



The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

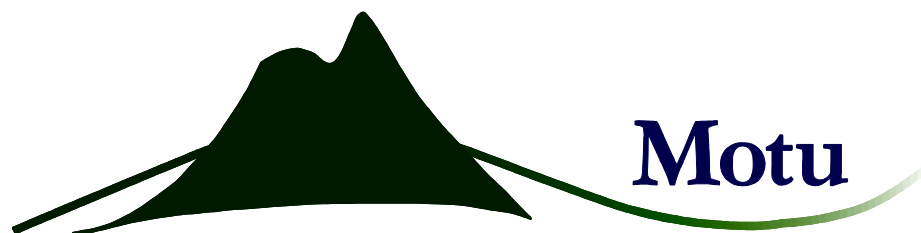
AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.



Roadmap for Implementing a Greenhouse Gas
Emissions Trading System in Chile:
Core Design Options and Policy Decision-Making Considerations
Report to the World Bank Partnership for Market Readiness
Consortium Lead:
Motu Economic and Public Policy Research

Motu Working Paper 12-14
December 2012

Originally published by the World Bank and available online at
<https://www.thepmr.org/content/chile-implementing-ghg-ets-design-options-and-decision-making-motu-2012>

Acknowledgments and Disclaimer

This report was authored by an international consortium led by Motu Economic and Public Policy Research. Consortium members comprise:

Country base	Firm	Key staff
New Zealand	Motu Economic and Public Policy Research	Suzi Kerr (Senior Fellow) Catherine Leining (consultant) Justine Sefton (consultant)
Chile	Centro de Cambio Global UC, Pontifica Universidad Catolica	Juan-Pablo Montero (Professor of Economics) Sebastian Vicuna (Executive Director)
	Cambio Climatico & Desarrollo Consultores	Eduardo Sanhueza (Executive Director)
	Grasty Quintana Majlis & Cía	Michael Grasty (Principal and Founding Partner)
United States	Environmental Defense Fund (EDF)	Ruben Lubowski (Chief Natural Resource Economist) Thomas Sterner (Visiting Chief Economist)
	Nicholas Institute for Environmental Policy Solutions	Billy Pizer (Faculty Fellow, Associate Professor of Public Policy and Environment) (<i>Participating in his personal capacity</i>)
United Kingdom	AEA Technology PLC	Chris Dodwell (Knowledge Leader, International Energy & Climate Change)
	Norton Rose LLB	Anthony Hobley (Partner and Global Head of Climate Change & Carbon Finance)

The Consortium also wishes to acknowledge the additional input and peer review provided by: Robert Milnes (AEA Technology, UK), Mark Johnson (AEA Technology, UK), Tim Baines (Norton Rose, UK), Andrés Pica Téllez (Centro de Cambio Global UC, Chile), Lucy Young (Grasty Quintana Majlis & Cía, Chile), Jessica Coria (University of Gothenburg, Sweden), Peter Sopher and Annie Petsonk (EDF, USA), Jos Cozijnsen (JC Consulting, The Netherlands), and David Antonioli and Will Ferretti (Verified Carbon Standard (VCS), USA). Pedro Piris-Cabezas (Consultant Researcher, EDF, USA) was the lead in conducting the preliminary modelling analysis in Appendix 6. Editorial support was provided by Susi Bailey, Gemma Freeman and Tui Head. However, the content remains the responsibility of the authors.

The opinions, findings, recommendations and conclusions expressed in this report are those of the authors and do not necessarily represent their institutions.

Lead Authors and Contact Details

Consortium lead Overall strategic direction	Suzi Kerr Motu Economic and Public Policy Research PO Box 24390, Wellington, New Zealand Email: suzi.kerr@motu.org.nz Telephone: +64 4 939 4250 Website: www.motu.org.nz
Project manager CHAPTER 1 – Introduction	Justine Sefton justine.sefton@gmail.com
CHAPTER 2 – Sector Coverage and Point of Obligation	Chris Dodwell chris.dodwell@aeat.co.uk
CHAPTER 3 – Setting the Level of Ambition in an ETS	Catherine Leining catherine@silverlinings.com
CHAPTER 4 – Linking and Offsets	Ruben Lubowski rlubowski@edf.org
CHAPTER 5 – Designing Emissions Trading Phases	Catherine Leining catherine@silverlinings.com
CHAPTER 6 – Allocation	Suzi Kerr suzi.kerr@motu.org.nz
CHAPTER 7 – ETS Research Needs	Juan-Pablo Montero jmontero@uc.cl
CHAPTER 8 – Recommendations for ETS Process and Meetings	Eduardo Sanhueza j.sanhueza@mi.cl
CHAPTER 9 – Roadmap for Government Decisions	Catherine Leining catherine@silverlinings.com

Contents

EXECUTIVE SUMMARY	1
Sector Coverage and Point of Obligation	2
Setting the Level of Ambition.....	4
Linking	5
Relationship between the ETS Cap, Linking and Price Stabilisation in Setting Ambition	7
Offsets	8
Designing ETS Phases.....	9
Phasing sectoral entry.....	10
Defining phases for ambition, price stabilisation, and linking.....	10
Allocation	13
Integrated Straw Man Option	14
Research Needs	15
Process Considerations	16
1 PROJECT OBJECTIVE AND SCOPE	18
1.1. What is an ETS?	19
1.2. Exploring an ETS for Chile	21
1.2.1. Drivers and objectives	21
1.2.2. General criteria for the design of an ETS	22
1.2.3. Key context and considerations for ETS scoping and design in Chile.....	23
1.2.4. Organisation of the report	31
1.2.5. Bringing it all together	31
1.3. References	33
2 SECTOR COVERAGE AND POINT OF OBLIGATION.....	35
2.1. Introduction.....	36
2.1.1. Overview and structure	36
2.1.2. Coverage of sectors and gases.....	37
2.1.3. Point of obligation	39
2.1.4. Forms of thresholds for excluding small emitters	43
2.1.5. Where to set the threshold for excluding small emitters.....	44
2.2. Lessons Learned from Other ETS.....	44
2.3. Chilean Context	50
2.3.1. Electricity	51
2.3.2. Industry	53
2.3.3. Transportation	56
2.3.4. Forestry	58
2.3.5. Waste	61
2.3.6. Agriculture	62

2.4.	Framework for Government Decisions.....	63
2.4.1.	Straw man options for Chile	63
2.4.2.	Priorities for further research	64
2.5.	References	65
3	SETTING THE LEVEL OF AMBITION	68
3.1.	Background on Setting the Ambition of an ETS.....	71
3.1.1.	General context for design of this component in an ETS.....	71
3.1.2.	Lessons learned from other ETS.....	72
3.2.	Options for Setting the Level of Ambition.....	76
3.2.1.	Objectives for setting the level of ambition	76
3.2.2.	Methodologies for setting the government cap on allocation.....	78
3.2.3.	Other mechanisms for controlling the level of emission reductions in an ETS.....	81
3.2.4.	Designing the cap in the context of Chile's ETS.....	83
3.3.	Framework for Government Decisions.....	87
3.4.	References	89
4	LINKING AND OFFSETS	91
4.1.	Background	94
4.1.1.	General context for design of this component in an ETS.....	94
4.1.2.	Lessons learned from other systems	96
4.2.	Linking to Other ETS and Overseas Credit Systems	101
4.2.1.	Coordination of scheme features without trading units	102
4.2.2.	One-way linkage: Buy only	104
4.2.3.	One-way linkage: Sell only	107
4.2.4.	Mutual recognition of units issued under linked schemes (buy-and-sell linkage)	111
4.3.	Offsets (Domestic and International).....	112
4.3.1.	Options for offsets.....	115
4.3.2.	Evaluation of options against key criteria in the Chilean context	119
4.4.	Framework for Government Decisions.....	121
4.5.	References	123
5	DESIGNING EMISSIONS TRADING PHASES.....	131
5.1.	Background on Defining Emissions Trading Phases	134
5.1.1.	General context for design of this component in an ETS.....	134
5.1.2.	Lessons learned from other ETS.....	135
5.2.	Elaborating Emissions Trading Phases	139
5.2.1.	Options for components to phase	139
5.2.2.	Phase options for Chile	143
5.2.3.	Evaluation of options against key criteria in the Chilean context	147
5.3.	Framework for Government Decisions.....	149
5.4.	References	152

6	ALLOCATION OF ALLOWANCES.....	153
6.1.	General Context for Design of Allocation in an ETS.....	154
6.2.	Experience from Existing or Proposed Schemes	157
6.2.1.	European Union	158
6.2.2.	New Zealand	160
6.2.3.	Australia	164
6.2.4.	Allowance allocation under United States ETS schemes	165
6.2.5.	Alberta, Canada.....	169
6.2.6.	Chilean experience with allocation within environmental markets	169
6.3.	Modalities for Allocation	171
6.3.1.	Auctioning	171
6.3.2.	Free allocation on the basis of historical data (grandparenting)	172
6.3.3.	Free allocation on the basis of performance benchmarks – output-based allocation.....	173
6.4.	Relationship between Initial Allocation Objectives, Choice of Modality and Level	174
6.4.1.	Achieving an equitable allocation of costs and windfall gains.....	174
6.4.2.	Reducing leakage to countries not covered by binding targets	178
6.4.3.	Managing a smooth transition to a long-term low-carbon economy.....	181
6.4.4.	Encouraging participation and compliance in the forestry and agriculture sectors.....	182
6.5.	Framework for Government Decisions.....	183
6.6.	References	185
7	ETS RESEARCH NEEDS	187
7.1.	Introduction.....	188
7.2.	Lessons from ETS Research in Other Countries.....	189
7.2.1.	European Union	189
7.2.2.	New Zealand	190
7.2.3.	United States	192
7.2.4.	Australia	193
7.3.	Identifying Research Needs	193
7.3.1.	Economic and fiscal impacts – political and market context	194
7.3.2.	Emissions and mitigation potential	197
7.3.3.	Economic and fiscal impacts.....	199
7.3.4.	Policy integration.....	200
7.4.	References	201
8	RECOMMENDATIONS FOR ETS PROCESS AND MEETINGS.....	205
8.1.	Introduction.....	206
8.1.1.	Lessons learned from relevant experience in Chile.....	207
8.2.	The ETS Policy Process in Other Countries	208
8.2.1.	European Union	208
8.2.2.	New Zealand	210
8.2.3.	Australia	212
8.2.4.	United States	214
8.3.	The Need for Education, Communication, and Building Support	216
8.3.1.	Capacity building for decision making on an ETS	216
8.3.2.	Capacity building for ETS implementation	217

8.4.	Participants in the Consensus Building and Learning Processes	217
8.4.1.	Policymakers.....	217
8.4.2.	Private and non-governmental sector.....	218
8.5.	Meetings with ETS Administrators (and Other Stakeholders) in Other Countries.....	219
8.6.	An Integrated Framework for ETS Government Processes	221
8.6.1.	Institutional requirements and legal infrastructure.....	221
8.6.2.	Government process considerations	222
8.7.	Government and Private Sector Networks	225
8.7.1.	Business and finance groups	225
8.7.2.	NGO/academic networks	225
8.7.3.	Regional governmental initiatives.....	225
8.8.	Proposed Next Steps	226
8.9.	References	232
9	ROADMAP FOR GOVERNMENT DECISIONS ON AN ETS	233
10	GLOSSARY OF TERMS	256
11	APPENDICES	265
11.1.	Appendix 1: PMR Chile Activity 2 Terms of Reference.....	266
11.2.	Appendix 2: Chile GHG Emission Trends	268
11.3.	Appendix 3: Sector Contribution to National GHG Emissions	270
11.4.	Appendix 4: GHG Emissions Across Energy Sector Supply Chain in Chile	271
11.5.	Appendix 5: Impact of Carbon Price on Electricity Generation Costs in Chile	273
11.6.	Appendix 6: Preliminary Economic Modelling of Alternative ETS Scenarios for Chile ..	277

Executive Summary

Motu and partners were contracted by the World Bank through its Partnership for Market Readiness (PMR) initiative to “Draft a proposal for the implementation in Chile of a Greenhouse Gas Emissions Trading System (ETS)”. The specific objective in the terms of reference is to “Propose a detailed roadmap, including its design elements, to inform decision-making for an advanced model of an ETS in Chile”. This is one of a set of four related reports commissioned to assist the Chilean government in preparing its “market readiness proposal” (MRP) for submission to the World Bank.

This report is the first step in a process that aims to clarify how an ETS could work in Chile and what the environmental, economic and social impacts would be. This process will allow the Chilean government and key stakeholders to assess, in a more informed way, whether an ETS would be desirable in Chile, as well as the optimal design of an ETS to achieve policy objectives and priorities. Given that Chile intends to move forward with a climate policy, an ETS presents several environmental, economic, and political advantages relative to other instruments, but also some challenges.

This report addresses each of the core components of an ETS: sector coverage; point of obligation for regulated sectors; the level of ambition; linking to other markets and use of (domestic and international) offsets; emissions trading phases; and allocation of units. Cost containment, price stabilisation and potential use of border carbon adjustments are not covered in detail in this report. Design options are analysed from a largely conceptual basis, but drawing on lessons learned in operating schemes and taking account of Chile’s national circumstances to the extent of available information, as well as highlighting critical points of divergence in scheme design depending on the underlying policy goals. The design options are brought together in a decision-making framework out of which we identify a smaller number of central options that appear to make the most sense for Chile. Each of the sections on core components identifies issues where Chile-specific research is needed to better inform key design decisions and technical implementation of the scheme ultimately chosen. Research needs for the next phase of policy development are discussed. We conclude with a high-level discussion of process going forward, both in terms of education and learning to enable an informed national debate, and in terms of developing broad (political, industry, and public) support for more serious consideration of an ETS as an option for Chile.

Chile could have several overlapping objectives for an ETS: cost-effectively contributing to global emission reductions; lowering the carbon-footprint of Chile’s exports in anticipation of potential trade restrictions against high-emitting countries and products; driving sustainable development including stimulation of new technology; profiting from sales of units to international buyers; generating co-benefits and avoiding perverse outcomes. The balance among objectives will affect design decisions so clarity about their relative weight and their implications for design is useful. There was a clear signal at the Durban climate change conference (2012) that at some point developing countries will be asked to have commitments. Chile will want to be prepared to respond to this.

Greenhouse gas (GHG) emissions trading systems evolved out of domestic cap-and-trade systems that control local pollutants. If there were a global GHG agreement with a cap, Chile would simply be one entity within the global cap-and-trade market. Absent a global GHG agreement with a cap, every ETS is a compromise between a system that contributes cost-effectively to global emissions, and a system that protects local interests in an unstable and uncertain world.

The greatest strength of emissions trading is that it encourages private actors to use their own knowledge and skill to find the best mitigation actions, including long-term investments. In a perfect world mitigation is done by the myriad of actors who can influence emissions, at the times and in the places where it is lowest cost. Even in an imperfect global market, if it is possible to link emissions markets across countries, linking facilitates cost-effective location of mitigation effort across countries by equalising prices across markets, and is likely to allow Chile to create a more ambitious system without imposing unacceptable costs on its economy as a whole. In the current imperfect world, with an uncertain long-term price and short-term prices that could be quite different from the long-term price, simply linking to the “international price” without further price stabilisation measures would impose risk and volatility on Chile and would not necessarily move it effectively toward a low-carbon economy.

Linking to other ETS (as a seller) may also not be feasible in the near term, since the international market rules post-2012 are still under negotiation in the United Nations Framework Convention on Climate Change (UNFCCC) and bilateral agreements outside this framework are still evolving; linking in order to sell units can be a complex process. However, an ETS can benefit Chile even before international ETS linking is possible. It could facilitate financing for a highly credible Nationally Appropriate Mitigation Action (NAMA) or through Reducing Emissions from Deforestation and Degradation (REDD+); send a regulatory and price signal that influences long-lived investment decisions and stimulates new technology development, thus placing Chile on a lower-emission sustainable development pathway; establish Chile as a leader; avoid any negative emissions-related trade repercussions from other countries; generate in-country revenue that can support government policy objectives; and produce additional environmental, economic, and social co-benefits. As international pressure builds for more ambitious global mitigation, Chile will be better prepared to contribute to international climate change agreements and compete effectively in a carbon-constrained global economy.

In a world with an agreed global cap-and-trade system, there would be much work involved in designing and negotiating that system, but the domestic implementation would then follow. In our present situation, design involves a series of compromises – essentially domestic negotiations – in terms of the domestic cap, international linking and price control and stabilisation and protection against leakage. The aims when making these compromises are to achieve credibility of emissions reduction effort, a level of carbon price that Chile is comfortable with, and an acceptable overall impact on the Chilean economy.

This tension from these compromises arises in each section below. Each offers one or more proposals for specific design decisions. Our final prototype draws on the design considerations specific to each section, and creates a package of coordinated compromises across issues. These are not recommendations but sensible options to consider as starting places for further analysis and discussion among government, researchers, and stakeholders.

Sector Coverage and Point of Obligation

- For any emissions trading system, the key question of who will be regulated under the scheme is the result of choices about the following issues:
 - the sectors and gases to be covered by the system
 - the point of obligation (i.e. the entity that will be subject to reporting and surrender requirements)
 - the criteria for excluding any entities (e.g. small entities or those in remote locations).

- In emissions trading systems developed to date, choices about coverage of sectors and gases, and the timing of their inclusion, have been influenced by a variety of overlapping factors including: the objectives of the scheme (e.g. to deliver economy-wide commitments cost effectively or to drive investment in specific sectors); the availability of data to infer emissions; the relative mitigation potential in each sector and the likely value of a price signal given existing regulation; and the political acceptability of including some sectors. The large number of entities that would need to be points of obligation to get significant mitigation benefits affects the attractiveness of including some sectors (e.g. forestry, agriculture and waste), although offsets can be thought of as another form of coverage for these. Emissions from bioenergy use will require appropriate coverage to provide right incentives for emissions reductions and avoid perverse incentives to deplete forests.
- The choice of point of obligation has been affected by similar factors, such as the desire for comprehensive coverage, sector-specific pricing dynamics, likely impact on behaviour, the ability to monitor emission reductions at each potential point, administrative feasibility, transaction costs and interaction with existing policies (including monitoring and reporting frameworks).
- The volume of carbon dioxide emissions from fossil fuels is determined (almost) entirely by the volume of fuel. This allows regulation of these emissions at any point along the fossil fuel supply chain. Emissions from other sources can be accurately monitored at only one point.
- The most significant choice relates to the coverage of the emissions of carbon dioxide from the energy sector. Under an “upstream” approach, comprehensive coverage could be achieved by regulating at the point of extraction or import of fossil fuels, resulting in the pass-through of an emission price to all consumers of energy in every sector. Alternatively, the point of obligation can be set at the point of where the fuels are burned and carbon dioxide is emitted (e.g. power station, industrial sites, and even vehicles).
- In order to allow ideas to be tested more thoroughly, we have suggested further exploration of the following options for coverage and regulated entity:

Sector	Point of obligation – option 1	Point of obligation – option 2
Non-transport energy	Upstream (i.e. point of production/import)	Major points of emission (e.g. power stations, industrial sites)
Transport	Upstream	
Non-energy industrial processes	Point of emission (e.g. industrial sites)	
Forestry	Landowner	
Non-CO ₂ agriculture	Farmer, processor	
Non-CO ₂ waste	Landfill operator	

- The coverage of the system could change over time as circumstances change. The system should be designed to accommodate changes.

Setting the Level of Ambition

- The government will need to decide on a level of ambition for emission reductions and prices in the ETS that is compatible with its national GHG mitigation and economic objectives, is politically acceptable domestically, and (as relevant) is acceptable to desired linking partners. In particular, the government needs to consider whether it wishes to control domestic emissions or contribute to global emission reductions through a combination of domestic effort and investment abroad, and whether it wishes to expose the economy to international market prices over time or maintain a divergent domestic price (lower or higher) to achieve its own policy agenda. The government can have a combination of objectives and decide which take precedence.
- The government's objectives for setting ETS ambition may vary with the evolution of the international carbon market. Key international drivers will include whether countries reach a collective agreement on ambition and on top-down rules governing ETS linking and the use of approved foreign offsets to meet international commitments. However, bilateral or regional linkages could continue to operate within a top-down system, and countries could choose a level of ambition for their domestic ETS that diverges from their international commitments for strategic reasons. The specific nature of Chile's linking opportunities may be a more significant external driver of Chile's domestic ETS ambition than whether the broader international market evolves top down or bottom up and whether countries reach a collective agreement on ambition.
- Strategically, Chile could stand to benefit from applying a higher level of ambition to its ETS. It would clearly demonstrate Chile's commitment to an ambitious outcome in the international negotiations and reinforce the environmental credibility of the ETS, which could facilitate linking. It could also be used to leverage increased foreign investment in mitigation activity in Chile. However, there would also be a risk that Chile could expose its economy to a disproportionate impact if other countries failed to follow Chile's lead. In this context, Chile could consider signalling a level of ambition for its ETS that was conditional on the level of international support (financial and otherwise) and the level of ambition adopted by prospective linking partners and other countries more broadly.
- Under an ETS, the core obligation is for ETS participants to surrender to the government a number of emission units (sometimes referred to as emission permits or allowances) equal to the quantity of emissions for which they are liable. As a first step in deciding ambition, the government needs to set a cap on the number of ETS units that it will allocate into the market. The cap chosen for the ETS must be clear and binding. The cap represents Chile's contribution to global emissions from the sectors covered under the ETS. While emissions by sources covered under the ETS can differ from the cap, based on decisions to hold units for the future or to buy and sell units internationally, the limits applied by the government to all of these activities will decide the overall level of ambition for emission reductions in the ETS.
- While a Chilean ETS could, by itself, be a major development and contribution to the global momentum for action, if Chile wants its ETS to generate a net global emission benefit relative to business-as-usual and make its units acceptable to external buyers, then the cap should be set at a level that requires some amount of uncredited domestic emission reduction below projected business-as-usual before

excess ETS units become available for international trading. Moreover, even if linking options are limited in the near term, Chile should aim to set its cap below business-as-usual to ensure that units are domestically scarce, reductions are real, and the system is credible to potential external buyers. The level of reduction below this depends on Chile's international objectives.

- The level of ambition of the government's cap on allocation can be based on a desired nationwide ambition level (top down) or through sector-by-sector analysis of the appropriate contribution (bottom up). Either way, the cap level can be evaluated relative to historical or projected emissions or on an emission intensity or cost basis, and can change in a defined way over time. The government may want to consider selecting multiple reference points, instead of a single point, to provide a broader perspective on the stringency of its ETS. The government's strategic goals, linking options, and the availability of data will influence the choice of cap.
- The pricing ambition of an ETS is defined by both the market price and the level of exposure of specific ETS participants to the market price. The government can use different price stabilisation mechanisms to contain or control the overall domestic emission prices relative to international market prices. The degree of emphasis on these controls will determine whether they operate inside or outside of the cap. The balance among ETS objectives and with concerns about the cost of rapid economic change will influence this choice.
- In the face of inherent uncertainty about future emissions and mitigation costs, a key design question faced by the government will be whether to allow the market to determine freely the price of units and the impact on Chilean consumers, or whether to limit the price range through price-ceiling and/or price-floor mechanisms that automatically adjust the cap. Such mechanisms limit uncertainty about prices and impacts, but create uncertainty about the cap and may affect the ability of Chile to sell units into another ETS.
- Whatever the chosen emission cap, the government should aim to provide market participants with near- to medium-term certainty about emission constraints and signal expectations for emission prices. In addition, it should send a clear signal regarding its commitment to increasingly stringent emission pricing over time, but allow adjustment as national circumstances evolve.

Linking

- The fluid international climate policy context creates challenges as well as diverse opportunities for Chile's ETS to interconnect with existing and emerging schemes at international, national, and subnational levels.
- The use of linking and offset credits from both domestic and international sources extends the coverage of an ETS to include more sources of mitigation that are valid for compliance within domestic regulations. This may be especially important for Chile and other relatively small economies if mitigation opportunities are limited and there is concern about market manipulation by one or more large players.
- Linking can benefit Chile by lowering costs or increasing profits, depending on whether the country is a net buyer or seller internationally, and by improving liquidity of the ETS. However, there will be winners and losers domestically even if the country gains overall. Also, linking can be a complex process and involves trade-

offsets in terms of exposure to international prices and loss of sovereign flexibility to determine and change scheme features once links are established.

- A direct link involves mutual recognition of emission allowances, and consequently direct buying or selling of units, from one ETS to another. Mutual recognition of units or credits from one system also creates an indirect linkage to any other system linked to that system, as with links in a chain.
- Linking as a seller increases demand, will probably raise price, and benefits net sellers (e.g. those with relatively low costs of reducing emissions and/or generous initial allocation), enabling profits from international sales and providing finance for mitigation beyond the cap. Addressing impacts of higher prices on domestic net buyers requires consideration together with other design elements, such as allocation, price stabilisation, and level of the cap. Linking as a seller requires the agreement of the international buyer, so is complex to negotiate.
- Linking as a buyer expands the supply of units and will probably lower prices, benefitting domestic net buyers by containing costs and improving liquidity. Limitations on the quantity of overseas units recognised for compliance is one way to address potential concerns over price levels and volatility.
- Linking as a seller has implications for other scheme features that should be considered in parallel during the design process so as to maintain and facilitate desired linkage options. For Chile to be able to sell its units or offsets internationally, another country's regulators will need to accept Chile's units or credits as valid for complying with their own scheme. This will probably require Chile's government to harmonise its ETS design features for environmental and economic integrity and comparability (e.g. measurement, reporting, and verification (MRV), type of cap, enforceability, certainty and predictability), as well as price protection (use of offsets, price floors/ceilings, banking/borrowing, third-party links), and reach agreement on an acceptable level of ambition for Chile's system and how this will change over time. The types of design features that can differ across linked ETS include sectoral coverage, points of obligation, and allocation. There will also be a process of political negotiation, including over other potential scheme features. Finalising such links may also need to wait until Chile's ETS has demonstrated its functioning. In the interim, the government may be able to generate international market as well as non-market financing for some reductions through NAMA, REDD+ and other crediting mechanisms negotiated within or outside the UNFCCC.
- Buy-only linkages may require only Chile's unilateral agreement, but the government may also similarly want to evaluate features of overseas units/credits before recognising their use so as to preserve integrity and comparability, as well as other linking options in the future.
- Preliminary economic modeling (in the Appendix) indicates that broadening the range of emission reduction beyond the energy and industry sectors to include forestry plus agriculture and waste, and/or purchases of low-cost international credits would play a key role in lowering costs and enabling Chile to meet its -20% reduction target relative to projected emissions for 2020, as well as potentially more ambitious reductions through 2030. Limiting the amount of international credits to 5% of total abatement only modestly affects estimated cost savings to the country.

- Whether the country of Chile as a whole would be a net buyer or seller depends on the level of ambition of the cap adopted for 2020 and potentially beyond, the sectors included in the market, the associated costs of reducing emissions internally and/or through international low-cost credits, and the level of its cap, as well as the international price. Modelling of scenarios with expanded forestry, agriculture and waste mitigation and -20% and -30% reduction targets relative to 2020 and 2030 projected emissions, respectively, indicates that Chile as a whole could break even on the total costs of its climate program if international sales are possible at prices of \$10-\$19 per tonne of carbon dioxide in 2015, rising at 5%.
- Coordinating specific (but not all) ETS features with other countries, without the necessity of trading any emission units/credits, can provide consistency for multinationals, level international competitiveness, and avoid border carbon adjustments and other trade measures from jurisdictions with more stringent climate regulations.

Relationship between the ETS Cap, Linking and Price Stabilisation in Setting Ambition

- The effects of the choice of cap depend heavily on how closely the ETS is linked to international markets and how the cap interacts with emission pricing stabilisation mechanisms.
- If the ETS has a link that allows sales and the external market price is higher than the marginal cost of reductions in a closed domestic system, ETS participants as a group will reduce their domestic emissions below the cap and sell the excess units abroad. The domestic market price will rise to meet the external market price; participants will likely not sell units domestically at a lower price than they can get abroad. This will increase impacts on emitters and consumers but increase the reward to those who mitigate or receive excess free allocation.
- Similarly, if the ETS has a link that allows Chile to buy units, then the cap will limit the net global emissions ETS participants are responsible for but will not limit their net domestic emissions. ETS participants will be able to increase their domestic emissions above the cap and purchase approved foreign units to help meet their obligations. If the international price is lower than in the closed domestic market, linking will lead to lower domestic emission prices and impacts on emitters and consumers, and lower rewards for those who mitigate.
- With international linking as both a potential buyer and seller, the stringency of the domestic cap will serve primarily as a distributional mechanism. If Chile is a net seller of units internationally, the cap is a key determinant of the balance between domestic mitigation funded from within Chile versus by foreign sources. If Chile is a net buyer, the cap balances the mitigation within and outside of Chile that is funded by Chileans.
- If the ETS is not linked internationally then the cap will limit the net domestic emissions contributed by ETS participants (with the possible addition of units from domestic offset/crediting mechanisms). Without additional measures, a domestic cap will set the price of units, although that price will be uncertain.

- The factors driving unit supply, demand and prices in Chile's market will be unpredictable over time, raising the risk that the ETS will lead to a higher or lower price than anticipated or desired.
- Without international linkages in particular, but even with them, if the government wants to protect entities against large changes in the emission price, it will need to use emission pricing stabilisation mechanisms. Price caps and different reserve designs can manage the risk of high emission prices, but can have implications for achievement of a fixed level of emissions. Fundamentally, the government needs to decide whether emissions quantity or emissions price will take precedence as the ultimate constraint on the ETS, with implications for the ability to demonstrate comparability and linkage with other schemes. Any price stabilisation mechanism also has implications for the use of banking.
- Setting an ETS emission constraint or creating an international linkage that leads to a higher price than that of major, unregulated trading partners could create a competitive disadvantage for Chile's emissions-intensive trade-exposed producers. In principle, this can be mitigated through other measures, but should remain an important consideration for the government.

Offsets

- In addition to linking as a buyer, domestic and international offsets expand flexibility to use mitigation from sources and sectors outside the emissions cap. Offsets can provide cost containment, price stabilisation, timing flexibility, and valuable co-benefits.
- Offset credits for voluntary reductions below a baseline inherently pose challenges for environmental integrity (whether emissions are actually reduced). However, by either lowering emission prices (in a closed or unlinked system) or by creating a new political constituency for the ETS among the offset sellers, they may allow the government to set a more ambitious cap, or, in the latter case, a higher price.
- Crediting systems require criteria for quantification, MRV, additionality, liability, and enforceability to ensure that offset credits can be exchanged with emission allowances issued under a cap while achieving equal or greater environmental benefits.
- There is a growing interest and international preference of some schemes for scaled-up (e.g. sectoral or jurisdictional) crediting approaches that offer potential to help simplify administration, generate other economic efficiencies of scale, and help address environmental concerns.
- A straw man for linking and offsets:
 - engage in both bottom-up and top-down international policy-development processes, including working groups of possible trading partners, to cooperate on design elements and policy preferences in real time
 - design ETS in parallel so as to preserve linkage options as much as possible while working to open opportunities as both a buyer and seller in international markets

- continue to allow international sales of CERs while additional ETS links are negotiated
- pursue other sources of both market and non-market financing for emission reductions within and outside ETS sectors (e.g. through NAMAs, REDD+, scaled-up crediting) while additional ETS links are negotiated
- provide testing and liquidity with limited short-term buying window (with potential for revisiting) for some existing foreign ETS as well as UNFCCC units, such as AAUs, Chilean Certified Emissions Reductions (CERs), and select types of CERs from smaller/poorer emitters consistent with other existing and proposed schemes (even if Chile's purchases are not formally recognised under UNFCCC)
- similarly, have a limited initial buying window for new types of domestic and international offsets with high-quality standards based on emerging models, and with focus on scaled-up approaches (e.g. for jurisdictional REDD+)
- use public funds from domestic and potential international sources (e.g. NAMAs) to test and develop offset methodologies and finance a pool of early credits that could eventually be sold domestically or internationally or used in other ways (e.g. as an insurance pool for future offsets or to fill a unit reserve for price stabilisation)
- evaluate benefits and costs of expanded links on a case-by-case basis.

Designing ETS Phases

- Launching an ETS in phases can help to ease the transition into facing an emission price, complying with new regulations, and participating in trading activity, for both participants and the government. However, it can also pose challenges and risks that need to be managed, particularly with regard to providing for a smooth transition between phases.
- Key strategic decisions for the government include:
 - how and when to sequence the entry of regulated sectors
 - at what rate to increase ambition
 - at what rate to reduce any government controls over unit supply and price
 - when to link to offset/crediting mechanisms and other ETS
 - what balance to strike between providing certainty and flexibility over future ETS settings.
- These decisions could be explicitly tied to pre-announced dates or could evolve in an ad hoc manner. The timing of these decisions in relation to other domestic and international processes is an additional concern.

Phasing sectoral entry

- For schemes covering multiple sectors, the primary options are to sequence the entry of sectors, either individually or in groups, or to provide for entry of all regulated sectors at the same time. Preliminary analysis of options in the Chilean context suggests that the stationary energy, transport, and emission-intensive industrial process sectors (e.g. cement, lime, and steel) may be the strongest candidates for early participation in an ETS.
- Enabling concurrent entry into the ETS of the stationary energy, transport, and selected industrial sectors would provide broad coverage of major emission sources that can be inter-related, supporting the government's national mitigation objectives, helping to address equity concerns, and generating revenue to support other policy objectives. It would create appropriate incentives for energy consumers and industrial producers to integrate their emission price response across multiple emitting activities. This would also help to increase the number of ETS market participants, which will be an issue for Chile to manage carefully.
- The forestry sector could be another strong candidate for early entry into the ETS. By crediting afforestation removals and imposing a liability for deforestation emissions under an ETS, the government could provide appropriately balanced emission pricing incentives to influence land-use decisions. An alternative is to introduce an offset/crediting mechanism in the forestry sector that links to the ETS or to overseas markets, or that is tied to other sources of finance (e.g. REDD+). Traditionally, such mechanisms seek to credit afforestation or avoided deforestation without imposing a deforestation liability. Their difficulty lies in defining business-as-usual baselines for measuring emission benefits and managing the risks of leakage and non-permanence. Comprehensive long-term inclusion of the forestry sector in an ETS can provide comparability with other sectors and reduce or avoid having to address these issues.
- Other sectors, such as waste, agriculture (fertilisers and livestock), and second-tier industrial producers (e.g. chemicals and producers of sulphur hexafluoride), have the potential to enter the ETS over time as direct points of obligation, but would be more complex to administer cost-effectively and their entry may not be feasible in the near term. Further research is needed in this area in Chile. Before entering the ETS, those sectors could link to the ETS through some form of offset/crediting mechanism, or be managed through other types of mitigation policies and measures. They could also participate in voluntary or mandatory reporting of their emissions well in advance of assuming ETS unit obligations.
- Before making decisions on the phasing of sectoral entry, the government needs to conduct further assessment of administrative feasibility and costs, mitigation price responsiveness, liquidity in the domestic market and potential for linking, and the overall magnitude and distribution of ETS cost impacts on the economy.

Defining phases for ambition, price stabilisation, and linking

- The ambition of the government's emission reduction and emission price targets under an ETS could be set to increase over time. Applying less stringent emission reduction targets and delaying full exposure to the international price of emissions in early phases of the scheme could help to ease the economic adjustment to emissions

pricing and reduce scheme impacts on Chile's export sectors before its trade competitors introduce comparable emission pricing measures. Avoiding increases in already high electricity prices is likely to be a critical issue in Chile. Addressing these through other regulatory reforms might be a precursor to allowing an ETS to raise electricity prices to reflect emissions.

- Decisions on ETS ambition across phases should be compatible with the government's broader GHG mitigation and economic transformation objectives, taking into account projected emissions, the mitigation potential of regulated sectors, the price elasticity of demand in different sectors, the prospects for linking, and the overall impacts of emission pricing on the economy.
- The government may wish to consider the following types of phases for introducing an ETS in Chile:
 - a preparatory phase to build institutional capacity
 - an early reporting phase (voluntary/mandatory)
 - a transitional phase with government control of emission price exposure (particularly if linking options are limited)
 - a transitional phase with international linking and government price stabilisation mechanisms
 - internationally linked emissions trading without government price intervention.
- The optimal nature and timing of transitional phases would likely be influenced by the development of the international carbon market, the availability of linking opportunities and the implications of these factors for unit supply/demand and the level and volatility of international emission prices. Chile may wish to conduct scenario analysis as a means of informing decisions on phase design.
- Allowing sufficient time for preparation (e.g. 2–4+ years) and early reporting (e.g. 1–3+ years) is of vital importance for data collection, capacity building, and institutional testing. Reporting can begin on a voluntary basis for different types of entities in all sectors, and become mandatory for points of obligation before they enter the ETS. Having good data will help to ensure that the cap and free allocation are set appropriately, and taking the time to develop and test the institutional infrastructure will help to reduce system risks. The implication is that it may not be feasible to launch trading under an ETS in Chile before 2017–2020 at the earliest.
- In a transitional phase with no or limited linking, options for controlling price exposure include:
 - operating a domestic-only ETS with a generous unit reserve and/or a price ceiling/floor operating outside the cap that would provide a price safety valve
 - operating a fixed-price scheme on a trading platform
 - linking the ETS as a seller to the international market indirectly with the government as an intermediary.
- A domestic-only ETS could mirror much of the government's preferred ETS design (e.g. sectoral coverage, points of obligation, MRV, and compliance). However, the

government would need to provide a price safety valve operating outside of the cap to manage price risk, and prohibit banking or international sale of fixed-price units to prevent arbitrage at government expense.

- The fixed-price option in particular would offer a high level of government price control, enabling the government to trial institutional arrangements with lower risk, test assumptions regarding market behaviour and mitigation potential at specific emission prices, and introduce emission pricing gradually before Chile is prepared to set a cap and link to other markets. Starting with a low price could reduce the potential for competitiveness impacts and leakage, and therefore the need for free allocation. Alternatively, the government could use this phase to trial its system for free allocation. To build trading experience among participants, the government could offer obligated participants the option not just to purchase fixed-price units but also to surrender units issued through free allocation and from approved offset/crediting mechanisms. The government could offer to buy back free allocation from recipients if buyers were limited in the domestic market. The fixed-price approach could operate differently from the ultimate ETS and produce a price disjunction in the transition to trading.
- Linking the ETS (as a seller) indirectly to international markets with the government as the intermediary could help to capture some benefits from selling units abroad without exposing the domestic economy to international prices. The revenue from foreign unit sales could be invested to provide transitional support to regulated sectors in the ETS or achieve other policy objectives. The government could also enter into other types of potential financing arrangements (e.g. NAMA finance) tied to emission reductions under the ETS without trading units that enable Chile's emission reductions to be offset by emissions elsewhere.
- Under an alternative transitional pathway, the government could consider starting with a “stand-alone” pilot trading phase (i.e. that is not the introductory phase of a broader or longer-term ETS, but is designed to build experience before designing a full ETS). This could be voluntary or mandatory, operate with narrow sectoral coverage, and have a generous cap providing for a government reserve and other price stabilisation mechanisms. A pilot trading phase offers the potential for learning by doing while operating at a smaller scale. However, it has trade-offs in terms of economic efficiency. It could increase the overall administrative burden by requiring the design of two sets of trading mechanisms, and operate in ways that are not representative of a fully operational ETS (e.g. because of limited linking opportunities or different point of obligation), thus teaching inappropriate “lessons”. It could also raise the risk of price disjunction when full trading starts.
- Even when the government is prepared to link its preferred ETS as a seller to international markets, it may still wish to operate transitional price stabilisation mechanisms that reduce uncertainty and risk. Whether the government participates in both types of transitional phases, and the appropriate length of such phases, would depend on market conditions and its objectives in generating international revenues and providing price control/containment. It would be appropriate for the government to review the ETS settings at the conclusion of the transitional period before introducing fully linked emission trading without government price mechanisms.
- The government may wish to adjust the type and level of financial support it provides to ETS participants and other affected stakeholders (e.g. free allocation,

subsidies, financing, tax benefits, etc.) across phases of the scheme, especially if the rationale for such support changes over time. For example, if mitigating competitiveness impacts is a key rationale for free allocation, then the government may wish to reduce free allocation as Chile's major trade competitors adopt comparable emission pricing regimes. If compensating for stranded assets is a key rationale for free allocation, then free allocation for this purpose might be high in the initial phase(s) and then may stop completely in later phases. As better data become available on the actual cost impacts of the ETS on participants, consumers, and other stakeholders, or on methods for benchmarking performance, then the government may wish to change how it calculates entitlements.

Allocation

- Allocation must be driven by objectives: equity, reduced leakage, smooth transition to a long-term low-carbon economy, and political acceptability and participation. Their relative weights will alter over time.
- Allocation can alter the distribution of burden across entities. It can also reduce the effective marginal cost of production. This can be used to address leakage from emissions-intensive trade-exposed mobile or expanding activities, and could also be used for distributional reasons – for example to minimise increases in the electricity price in the short term. The entities that might receive free allocation are not necessarily points of obligation.
- Allocation can be through auctions, grandparenting, or output-based allocation. Distribution of resources from auction proceeds can also be a substitute for direct allocation of units.
- High levels of free allocation are likely to be politically necessary in the early stages of the programme.
- With a given total cap on units, allocation by any combination of auctioning or grandparenting, in general, has no effect on the cost-effectiveness of ETS. Thus grandparenting can be used to achieve political acceptability with no long-term economic or emissions consequences.
- Auctions can be important for price discovery and liquidity, and can also address concerns about market power when the ETS is not linked to an international market.
- Output-based allocation is the only form of allocation that can directly address leakage.
- With the exception of output-based allocations, future allocations should not be influenced by firm behaviour, particularly emissions; this avoids perverse incentives to seek higher future allocations.
- Benchmarking/output-based allocation can be technically very complex. Its use should be strictly limited.
- Long-run allocation is only about equity. Allowances should be auctioned and the revenue used in ways that society chooses.
- Short- to medium-run allocation requires a complex balance across objectives that is made simpler if the phasing in of the system is gentle.

Integrated Straw Man Option

This option is not a recommendation but a set of design features that are consistent and that constitute a useful starting point for considering different features.

1. Sectoral coverage:
 - a. Start with stationary energy (upstream¹), transport (upstream), key industrial processes (cement, lime, and steel at the point of emission), and forestry (landowner)
 - b. Expand sectoral coverage over time to include (as feasible) waste (landfill operator), agriculture (fertiliser and livestock), and smaller industrial processes (e.g. chemicals and synthetic gases).
2. Pre-trading phases:
 - a. Preparation phase (e.g. 2013–2017) that includes research and data collection, engagement and capacity building, development of government institutions and registry, and beginning negotiation of linkages to sell.
 - b. A phase for voluntary, then mandatory, annual reporting for points of obligation before they enter the ETS, and extended voluntary annual reporting for other entities (e.g. 2015–2017+).
3. Allocation:
 - a. Grandparent enough free allocation to address equity and political issues – a fixed total amount spread over a number of years
 - b. Provide output-based allocation for emissions-intensive trade-exposed mobile or expanding sectors where “output” is relatively easily defined – this phases out over a fixed time frame
 - c. Provide auctioning throughout for liquidity and price discovery, and ramp up auctioning as free allocation is phased out.
4. Evolution of trading (e.g. 2018+):
 - a. ETS operation with government price control:
 - i. Negotiation of limited linking or contribution of external funds allows government to set a cap on allocation that is stringent enough to ensure a positive price
 - ii. Government initially reduces ETS participant exposure to real price by starting with a domestic cap with a price ceiling; the ETS is not directly linked to international markets; only the government can sell abroad
 - b. ETS operation with movement to international price but with government price stabilisation mechanisms to reduce price uncertainty; limited linking with international trading by ETS participants
 - c. Transition to unlimited international trading by ETS participants with no price stabilisation mechanism when external market is stable.

¹ A feasible alternative is to regulate stationary energy at the point of emission.

Research Needs

- The research process should be designed both to gain knowledge and also to build capability within Chile to understand the issues and contribute to the policy development.
- Key economic research can be grouped in two broad categories: background research; and research aimed at answering more specific questions for policy design.
- Background research should provide an opportunity for wide discussion among different stakeholders on how ETS has worked around the world, and the important role they are already playing and can play in the implementation of climate policy both domestically and internationally. This research includes:
 - i. understanding what is happening more widely in Latin America in terms of climate policy, and of implementation of ETS in particular
 - ii. lessons from previous ETS internationally, with particular attention to implementation, distributional effects, and design issues relevant to an emerging economy
 - iii. lessons on design, on the political process towards implementation, and on ex-post performance of environmental markets in Chile, namely, water markets, individual transferrable quotas for fisheries, and Santiago's particulate market and NO_x
 - iv. understanding how an ETS would interact with the rest of existing and future environmental legislation in the country.
- Targeted research consists of all research that provides stakeholders and policymakers with information (which in many cases builds upon existing studies) about the costs and benefits of implementing an ETS in the country (including distributional impacts). This includes:
 - i. improving understanding of the scale of mitigation opportunities (in both the different carbon-emitting sectors and in the forestry sector)
 - ii. understanding broad economic impacts of different ETS designs
 - iii. non-price barriers (e.g. information or regulatory barriers), especially in the electricity sector – this includes more generally to estimate the size of the energy efficiency gap in the country and to identify the kind of instruments that operate better, together with carbon prices, in improving efficiency
 - iv. understanding how market structure can affect the ability of Chilean firms to respond and pass on carbon prices and/or explain the existence or not of windfall profits (e.g. particularly in the electricity sector)
 - v. identifying emissions-intensive trade-exposed mobile or expanding activities and the likely scale of leakage from them
 - vi. identifying key stranded assets and mechanisms to address them
 - vii. understanding the distributional implications, especially the impacts on the poor, and the mechanisms that can be used to deal with undesirable outcomes and how they relate to existing schemes (e.g. subsidies for basic services).

- There are many technical and institutional implementation needs that are common to many ETS that will need specific answers in Chile. These are listed in each chapter.

Process Considerations

- While an increasing number of policy makers and stakeholders foresee that Chile will need to advance its climate change policies in conjunction with its broader agendas for sustainable development and economic transformation, it will be necessary to convince a much larger proportion of decision makers and stakeholders of the need to control Chile's GHG emission trajectory so that this anticipatory vision becomes a dominant logic.
- Chile needs to give careful consideration to the process of educating government policy makers, lawmakers, the private sector, the media and civil society about the merits of an ETS, the implications of particular design options and the institutional requirements. In parallel with general educational processes, it will be very important for the government to help build the capacity of regulated entities and other market participants to participate in emissions trading.
- Engagement with stakeholders across industry, academia and NGOs should occur both formally and informally throughout the process of ETS design, legislation and implementation. To facilitate the decision-making process and provide advice to the government, a broad multi-stakeholder group could be created consisting of governmental and opposition leaders, industry leaders, representatives from environmental non-governmental organizations, university professors and researchers working for think tanks.
- The process for ETS design in Chile should be led by Chilean experts, be tailored to national circumstances and build domestic capacity and understanding. Chile has a limited but rich experience in tradable permit schemes in other areas, and relevant lessons can be derived from these schemes that should be brought into ETS discussions. In addition, the government should consider the lessons learned by other countries and how Chile could build on them to optimise its own policy approach.
- For this purpose, it is recommended that government officials (and possibly other key stakeholders) meet with regulators, agencies and stakeholders in countries with an operational ETS; authorities in countries that are at the stage of considering the use of an ETS; and other constituencies participating actively in the global carbon market.
- The development and implementation of market instruments demands a clear regulatory framework that can provide signals to entities covered by the market instrument and assign clear responsibilities for the various functions. The regulatory framework must also provide a credible enforcement system (e.g. domestic penalties for non-compliance), and be accompanied by effective governance to ensure transparency and enhance stakeholder participation. As part of ETS design, the government should map out the long-term institutional requirements for implementing an ETS and evaluate which of these can be assigned to existing agencies and which could require the development of new administrative entities.

- In order to successfully overcome the technical and political hurdles to launching an ETS, the government will need to think strategically about how to organise its internal process for guiding the ETS through design, legislation and implementation. Particular challenges lie in coordinating complex decision making across multiple government agencies, engaging in a meaningful way with stakeholders, and preparing for the political legislative process. Creating interdepartmental working groups of officials could facilitate cross-government coordination.

1 Project Objective and Scope

Motu and partners were contracted by the World Bank through its Partnership for Market Readiness (PMR) initiative to “[d]raft a proposal for the implementation in Chile of a Greenhouse Gas Emissions Trading System (ETS)”. The specific objective in the Terms of Reference (see **Appendix 1**) is to “[p]ropose a detailed roadmap, including its design elements, to inform decision-making for an advanced model of an ETS in Chile”. This is one of a set of four related reports commissioned to assist the Chilean government in preparing its “market readiness proposal” (MRP) for submission to the World Bank later this year.

This report is the first step in a process that aims to clarify how an ETS could work in Chile and what the impacts would be environmentally, economically, and socially. This process will allow the Chilean government and key stakeholders to assess, in a more informed way, whether an ETS would be desirable in Chile as well as the optimal design of an ETS to achieve the government’s policy objectives and priorities (taking into account national circumstances).

The aim of this report is to enable the Chilean government to design an ETS that is *fit-for-purpose* and *tailored to Chile’s unique national circumstances*.

The report addresses each of the core components of an ETS: sector coverage; point of obligation for regulated sectors; the level of ambition; linking to other markets and use of (domestic and international) offsets; emissions trading phases; and allocation of units. Design options are analysed from a largely conceptual basis, but drawing on lessons learned in operating schemes and taking account of Chile’s national circumstances to the extent of available information as well as highlighting critical points of divergence in scheme design depending on the underlying policy goals.

The design options are brought together in a decision-making framework out of which we identify a smaller number of central options that appear to make the most sense for Chile. Each of the sections on core components identifies issues where Chile-specific research is needed to better inform key design decisions and technical implementation of the scheme ultimately chosen. Research needs for the next phase of policy development are discussed. We conclude with a high-level discussion of process going forward, both in terms of education and learning to enable an informed national debate, and in terms of developing broad (political, industry and public) support for more serious consideration of ETS as an option for Chile.

In this chapter, we first explain the concept of emissions trading and how it has evolved to tackle the global problem of climate change and the uncertainties of the current market. Then we suggest possible drivers and objectives for an ETS in Chile and outline key criteria to guide scheme design. Next we highlight key aspects of Chile’s national circumstances judged to be particularly relevant to the consideration and design on an ETS, including Chile’s previous experience with environmental markets. Finally, we explain the organisation of the report and conclude with a diagram showing how decisions on the different ETS design components and choices are linked.

This report should be read in conjunction with the related study conducted by PricewaterhouseCoopers (PwC) on Chile’s national circumstances.² However, it highlights key aspects of Chile’s national circumstances, drawn from that report and insights of our local team

² PricewaterhouseCoopers, 2012

members, that are judged to be particularly relevant to (and in some cases, determinative of) the question of whether an ETS is appropriate for Chile or to the merits of specific design options. Chapter 2 goes into more detail on the emissions profile and characteristics of different sectors in Chile.

1.1. What is an ETS?

Emissions trading is a policy instrument designed to address a market failure – i.e. the failure to factor certain “environmental externalities” into economic decision-making – through introducing a price of emissions into the market.³ An alternative is to impose an emissions tax. The key difference, according to basic economic theory, is this: an emissions trading scheme (ETS) fixes the quantity of emissions allowed but leaves the price to be set by the market, whereas an emissions tax fixes the price of emissions but leaves the emissions outcome uncertain.⁴

Greenhouse gas (GHG) emissions trading evolved out of domestic “cap-and-trade” systems designed to control local pollutants – notably, NO_x and SO_x trading schemes in the United States responding to the acid rain problem.

Under a standard cap-and-trade model, the government sets a fixed limit or cap on emissions⁵ applying to a certain group of emitters⁶ and issues tradable emission units (also referred to as “permits” or “allowances”) equivalent to the level of the cap (e.g. through free allocation or auctioning). The cap represents the aggregate level of pollution that may be released into the atmosphere in a given period.

Regulated firms under the scheme must surrender units equal to their total emissions each year, or face a penalty. Firms will determine the optimal compliance strategy for them – i.e. whether to reduce their emissions through the means available and sell any excess units on the market, or to purchase units representing lower-cost emissions made elsewhere. The price of units is determined by the relative supply and demand of units on the market.

The cap is lowered over time to reduce the overall level of pollution released. As the cap is ratcheted down and units become increasingly scarce, the price would typically increase, in turn driving investment into higher-cost mitigation options and technologies or causing shifts in production or behaviour.

This simple cap-and-trade model – as well as the dichotomy between certainty of quantity versus certainty of price – breaks down, however, when applied to the GHG problem against the current global political and market backdrop (especially when linking of schemes and international trading feature). This is illustrated by the emergence of various “hybrid” models of emissions trading.

³ Emissions trading is perhaps most well-known in the context of air pollution and carbon markets, but the concept has also been applied or adapted to other environmental goals – e.g. water, fisheries, biodiversity. The baseline-and-credit model of emissions trading is considered in the PMR Activity 3 report prepared by Climate Focus.

⁴ An evaluation of the relative merits of emissions taxes, trading and standards is beyond the scope of this report. However, it will be a critical starting point for any national debate on an ETS in Chile.

⁵ The defined category of emissions – in the present context – could be one or more of the 6 major GHG types. These are: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF₆).

⁶ Covering one or more sectors or segments of the economy or economy-wide.

In moving beyond a binary choice between quantity and price when linking an ETS to complex global markets, governments will need greater flexibility to be able to adjust the cap and settings of their ETS in order to manage the cost and risk to their economy and individual firms while contributing to global efforts to reduce emissions. Essentially, they need to strike a balance between the quantity of emissions they are prepared to take responsibility for, and the level of price (or degree of price volatility) to which they are willing to expose their domestic economy. Additional measures might be needed to compensate or shield some consumers from the pass-through of emission costs, particularly when emission pricing is uneven among trade competitors. In theory, such transitional settings should become unnecessary once a global cap or comparable emission pricing regimes are achieved.⁷

In a world with an agreed global cap-and-trade system, there would be much work involved in designing and negotiating that system, but the domestic implementation would then follow in alignment with the agreement. In the present situation, ETS design involves a series of compromises – essentially domestic and bilateral/regional negotiations – in terms of the domestic cap, international linking and price control and stabilisation. The aims when making these compromises are to achieve credibility of emissions reduction effort, a level of carbon price that Chile is comfortable with and an acceptable overall impact on the Chilean economy, environment and society.

Further complexity can arise where there are multiple policy objectives behind an ETS. Originally conceived as a mechanism for cost-effective mitigation of GHG emissions, some countries are seeking to use ETS as a tool to deliver a broader range of sustainable development or “green-growth” objectives (particularly around energy sector transformation) as well. While there is certainly a strong alignment between the two sets of goals, there can be some tension (e.g. in terms of what is a desirable domestic carbon price) which needs to be factored into detailed scheme design. Other policies and measures may be more appropriate to further non-GHG mitigation goals, or used to complement the carbon price signal. This will be different for every country.

The interplay between ETS and complementary policies is an emerging issue that is not yet well understood and should be given careful consideration. The EU has been grappling with the perverse consequences of the interaction between its carbon and energy policies, where the impact of energy efficiency and renewable energy incentives was to lower demand for ETS allowances and change the merit order of electricity supply, with dual impact on carbon and power prices. Some commentators use this to argue that EU ETS should be replaced with a carbon tax. Others say the problem really lies in the EU’s inability (politically) to adjust its cap or do so indirectly through measures to manage unit supply. Either way, there are lessons here for ETS design for a country pursuing both mitigation and energy transformation goals.

This tension from these compromises arises throughout this report. Each chapter offers one or more straw man proposals for specific design decisions. A final integrated straw man proposal, presented in the chapter on emission trading phases, draws on the design considerations specific to each section, and creates a package of coordinated compromises across issues. These are not recommendations but sensible options to consider as starting places for further analysis and discussion among government, researchers and stakeholders.

⁷ E.g. through an international agreement under the United Nations Framework Convention on Climate Change (UNFCCC) or through a network of bottom-up, fully linked and harmonised domestic ETS covering the bulk of global emissions with a comparable level of effort among countries.

An ETS provides a useful long-term policy architecture that fits where much of the world is heading. An ETS and a tax can be designed to deliver very similar domestic emission outcomes in the short term, but in the Chilean context an ETS should present more opportunities for cost-effective emission reductions and benefits from international unit sales in the longer term.

The greatest strength of emissions trading is that it encourages private actors to use their own knowledge and skill to find the best mitigation actions, including long-term investments, and incentivises innovation. In a perfect world mitigation is done by the myriad of actors who can influence emissions, and at the times and in the places where it is lowest cost. Even in an imperfect global market, if it is possible to link GHG markets across countries, linking facilitates cost-effective location of mitigation effort across countries by equalising prices across markets, and is likely to allow Chile to create a more ambitious system without imposing unacceptable costs on its economy as a whole. However, linking can pose risks as well, particularly when short-term prices and volatility in an immature market could prove quite different from those in the long term with broad and stable participation of major emitters in linked ETS.

Chile will need to consider carefully the range of opportunities from creating sell linkages and buy linkages to the international market, and what type of ETS design features may be needed to control or contain the associated risks while that market is still maturing.

1.2. Exploring an ETS for Chile

1.2.1. Drivers and objectives

The collective experience to date is that when it comes to designing an effective ETS, one size definitely does not fit all countries or sectors. While the leading design options for the core components of an ETS are well understood and valuable experience has been gained by the design and implementation of ETS in other countries, it will be essential to tailor the design of an ETS to accommodate Chile's specific national circumstances and to meet Chile's strategic policy, economic, environmental and social objectives and priorities. A blueprint from another country would be of limited value.

The fundamental questions for the Chilean government at the outset is: what are its high-level rationales for its climate change policy, what are its more specific policy objectives and priorities, and is an ETS a useful policy instrument to help achieve them? If it chooses to pursue the ETS option, then what is the best design to meet the government's policy goals and to avoid some of the pitfalls that have hampered other countries' schemes in this respect?

For example, Chile's rationales for implementing a comprehensive climate change policy package could include some or all of the following:

1. concern about climate change and reducing emissions
2. desire for domestic economic transformation (especially in the energy sector)
3. motivation to generate revenue from unit sales and leverage international climate finance
4. defence against international political, trade or consumer pressure.

Building on its rationales for action, Chile could identify a range of long-term policy objectives for an ETS, such as to:

1. support global mitigation through domestic action and linking to a stable global market
2. drive economic transformation and sustainable development through more efficient production and consumption, sustainable and secure energy supply, lower-emission infrastructure and land uses, and research and development
3. generate trade benefits, including profiting from the sale of units in international markets and new market opportunities, and building positive trade relations
4. generate additional economic, environmental, human health and social co-benefits and avoid perverse outcomes.

The Chilean government should consider opportunities to leverage existing and new sources of international climate finance to assist with ETS development and implementation – including the possibility of nesting an ETS within the UNFCCC’s Nationally Appropriate Mitigation Action (NAMA) framework. International support might be available, for example, to: partially finance the mitigation that needs to occur (in Chile or elsewhere) to meet the ETS cap; to provide a guaranteed buyer for ETS units (on a multilateral or bilateral basis) under current conditions of weak demand; to fund marginal mitigation cost curves and MRV capacity building; or to compensative or shield low-income consumers or trade-exposed industry from ETS costs. This, in turn, may give the government more confidence to set an ambitious cap and to get the ETS policy over-the-line at home.

The balance among objectives will affect design decisions so clarity about their relative weight and their implications for design is important. The final design will also depend on linking aspirations (and the expectations of potential linking partners), long-term expectations in terms of being a net buyer or seller, the government’s level of comfort in exposing the domestic economy to the international price of carbon, and national circumstances with a significant bearing on design options.

1.2.2. General criteria for the design of an ETS

The following (illustrative) criteria can be applied to guide the consideration and design of an ETS (and the selection of national climate change mitigation targets and policies more broadly), with more specific criteria suggested in other chapters for evaluation of options for key ETS design components:

1. *Environmental effectiveness.* Taking account of the relative significance of current and projected emissions, mitigation opportunities and costs, mitigation price responsiveness and the potential for emissions leakage (in the case of trade-exposed firms⁸ or as a result of definition of sector boundaries or qualifying thresholds).⁹
2. *Economic efficiency and competitiveness impacts:* Promoting efficient operation of the domestic market and facilitating effective linkages to international markets with low transaction costs. Striking the right balance between broad coverage of emissions and creating an incentive to abate emissions where there is most potential to do so as well as managing overall system administrative costs. Considering sectoral responses to emissions pricing, market size and liquidity and the distribution of costs and benefits.

⁸ I.e. production shifting to other countries with no or lower pricing/regulation of GHG emissions for that sector.

⁹ E.g. newer plants being built just below the qualifying threshold.

Taking into account the trade exposure of covered sectors and their ability to pass on the cost of emissions (both domestically and internationally, determining which firms are most at risk and considering options (such as free allocation of allowances) to mitigate competitiveness impacts.

3. *Equitable burden-sharing.* Understanding and managing the political dimension including: the perceived comparability of effort by other countries and burden across sectors; distribution of costs across the economy and society; impact on owners of and workers in trade-exposed firms and low-income households in particular; and delivery of co-benefits. Critical to generating broad-stakeholder buy-in, successful implementation, robustness of the architecture and acceptability of increases in stringency over time.
4. *Administrative feasibility and costs.* Minimising the MRV and transaction costs imposed on individual firms as well as the administrative costs for the regulatory body. Working within capability constraints (firms and government institutions) and developing capability where it is needed. More complex systems can be vulnerable to manipulation and are more costly and difficult to monitor.
5. *Regulatory and other barriers.* Identifying any significant non-price barriers that are not addressed, and considering the potential interactions between the ETS and other policies, regulations or measures, that could dampen the carbon price signal or lead to perverse outcomes.
6. *Other economic, environmental and social impacts, including co-benefits.* Considering the wider social and environmental implications of ETS design and climate change mitigation more broadly – e.g. on employment, health (air and water quality), research and innovation, energy and natural resource consumption and access to energy. Considering how scheme design could maximise benefits and minimise perverse outcomes at low cost. Monitoring impacts over time to provide positive news stories and allow quick response to perverse outcomes.
7. *Durability of the policy framework.* Providing predictable, stable long term policy (and avoiding sudden policy-driven shifts in price) to encourage low-carbon innovation, investment and technology deployment, while building in sufficient flexibility into the scheme design to respond to political and market conditions (resilience).

1.2.3. Key context and considerations for ETS scoping and design in Chile

Some key factors in the consideration and design of an ETS in Chile (elaborated in the individual chapters as relevant and are not exhaustive) include the following:¹⁰

Economic profile and emissions trends

Chile has a growing and fundamentally export-led economy that relies heavily on exports of copper, wood and cellulose, salmon, fruit and wine. It may be reluctant to adopt any carbon commitments if direct competitors do not adopt similar policies. Macroeconomic policy is stable and the country benefits from a strong financial sector.

¹⁰ Drawn from PwC (2012) and from in-country research and preliminary modelling undertaken by authors of this report.

Energy supply issues and dependence on fossil fuel imports pose a significant constraint on Chile's economic development over the longer term. Other challenges include the reduction of income inequality, diversification of the economy and the development of innovation.

Appendix 2 shows GHG emissions trends in Chile over the past decade. The country's emissions increased by 37% between 2000 and 2006. The energy and carbon intensity of the economy have shown only modest declines in recent years. Carbon intensity is pegged to the energy intensity of Chile's industry (currently high)¹¹ and variability of electricity generation mix (highly dependent on water levels and foreign natural gas supply). While per capita emissions are still significantly below the OECD average, they are growing much faster than in the rest of Latin America and Caribbean. The highest mitigation potential lies in the energy, industry and transportation sectors.

Sector profile

The energy sector (encompassing electricity and liquid transport fuels) will be central to realising Chile's GHG emission reduction, sustainable development and energy security goals. Chile faces real challenges in terms of ensuring clean, reliable, affordable and adequate energy supply to meet rising demand.

The energy sector is the biggest contributor to Chile's national GHG emissions (followed by agriculture, industrial processes and waste), accounting for 73% of the country's non-LULUCF emissions (see **Appendix 3**). Electricity production (36%); mining, manufacture and industry (23%); and transport (29%) make up most of the country's energy emissions. **Appendix 4** gives a detailed breakdown of the energy supply mix and carbon emissions across the energy supply chain in Chile.

Chile is highly dependent on fossil fuel imports for nearly 75% of its primary energy supply.¹² Coal, diesel and natural gas and hydropower dominate the electricity generation mix and the transport sector relies on oil. This makes Chile's energy system vulnerable to international commodity prices, supply disruptions and rainfall levels.

Chile has considerable renewable energy resources but only a fraction has been exploited so far. Diesel and coal have persisted as major electricity generation sources despite very high marginal costs of generation in Chile (hovering around US\$150/MWh since levels of US\$300/MWh in 2007 (when Chile lost its natural gas supply from Argentina), suggesting other barriers are at play. Modelling undertaken by the authors of this report suggests that only carbon prices above US\$50 per tonne of CO₂ can displace coal with natural gas and that the competitiveness of renewables is hardly improved, even with levels of US\$100 per tonne of CO₂ (see **Appendix 5**).

This could be interpreted by some stakeholders as evidence against the need for, or efficacy of, a carbon price applied to the energy sector. More likely, it indicates the need for additional government intervention to incentivise and overcome barriers to the development and large-scale commercial deployment of renewable energy in Chile. Absent that, there is a risk an

¹¹ The carbon footprint for salmon and wine depends largely on the emissions from the international transport component – responsibility for which is still undecided at the multilateral level. By contrast, the carbon footprint of the copper and wood and cellulose industries depends more on the quantity and kind of energy consumption at the production stage.

¹² Total primary energy supply (TPES) shares by source in 2010 were: crude oil 34.8%, coal 18.3%, natural gas 20.0%, hydroelectricity 7.6%, biomass 19.2%, and wind 0.1 (PwC, 2012).

ETS would simply alter rents without changing the composition of the generating matrix towards cleaner technologies.¹³ The government will need consider the interaction of any complementary measures with the ETS to avoid perverse outcomes.¹⁴

Common barriers reported by large-scale renewables developers include difficulties in the access and connection to transmission lines and securing long-term contracts and finance. Drastic spot-market price fluctuations, creating a lack of revenue predictability, are one important factor constraining investment in renewables.

The industries that form the backbone of Chile's economy (especially mining) are highly energy intensive and served primarily by the north/central grid systems which are more fossil fuel based and have less hydropower potential. There are plans to connect with the southern grid system but long transmission distances and environmental opposition limit the full development of the hydropower potential in that region. Energy demand in Chile is projected to keep rising (with electricity demand set to double by 2030), driven by industrial growth, with the largest incremental gains in road transport and copper mining.

The electricity market in Chile is largely deregulated. Electricity market regulation will be factor in the distribution of ETS-related costs. Investment costs are generally transferred in full to consumers with some exceptions (e.g. large industry, where contract terms are negotiated).

Ownership in the electricity generation sector is very concentrated among just a few big firms and some very small ones.¹⁵ In the transport liquid fuels sector, there is one importer and no local production. Industry is dominated by copper mining and also made up of a small number of actors. This is an advantage in terms of administration, both for the point of regulation and for any free allocation. It could however create problems of market power in the energy sector. By contrast, the transport, agriculture and waste sectors are atomised, with multiple small actors. This presents some challenges for inclusion in an ETS design; however other countries have found acceptable solutions to such challenges.

The effects of increasing energy costs (that could be associated with an ETS) in copper mining are not well understood. Some sector players fear that an ETS would damage their profitability, affecting their competitive advantage relative to producers in other copper mining countries (such as neighbouring Peru). This becomes a potential leakage source.

Forestry is a very significant sector for Chile, contributing a net sink of around 20–25% of total emissions, with some studies suggesting that there is still more mitigation potential. The number of actors is reasonably small. Forestry should form part of Chile's mitigation strategy (whether included in an ETS or through other policy instruments). Further research is needed in this area.

¹³ Arbitrage/wind-fall profits has become an issue in the ETS programme in NZ, with combined effect of price cap, no limits on use of international offsets for compliance and record-low carbon price. This is an issue being considered by the NZ government currently, as part of broader package of proposed amendments to the NZ ETS.

¹⁴ For example, it is understood that the government is considering a Price Stabilisation Fund to provide greater certainty to investors by guaranteeing a floor price for renewable energy projects and assuming the spot market price risk. The PSF could initially be funded with international climate assistance and domestic funds. The government would want to avoid the perverse impacts on carbon and energy prices that the EU has experienced due to interaction of its EU ETS and energy policy initiatives.

¹⁵ Chilean Ministerio de Energía, 2011

The table below presents a preliminary assessment of the number of actors accounting for 90% of emissions in each sector that potentially could be covered under an ETS in Chile.

Table 1.1: Potential actors covering at least 90% of emissions by sector¹⁶

Sector	Upstream actors	Midstream actors
Energy	oil derivatives: ~1 crude oil: ~1 natural gas: ~2 liquefied natural gas: ~2 gas works: ~10 methanol: ~10 coal: ~10 coal derivatives: ~10	refineries: ~1 gas plants (regasification): ~2 gas liquefaction plants: ~10 power plants (electricity): ~10 coke ovens: ~10
Industrial processes	~5 actors	
Forestry	Thousands of actors	
Agriculture	Thousands of actors	
Waste	Hundreds of actors	

Political, policy, and institutional landscape

Chile is a Party to the United Nations Framework Convention on Climate Change (UNFCCC). The post-2012 international climate change policy framework is still taking shape within the UNFCCC process. The Chilean government has communicated to the UNFCCC that it will take measures to achieve a 20% reduction below the “Business as Usual” emissions growth trajectory by 2020, as projected from year 2007, with a focus on energy efficiency, renewable energy and land use, land-use change and forestry. This is stated to be dependent on an appropriate level of international support. There was a clear signal at the Durban climate change conference in 2011 that at some point developing countries will be asked to have commitments. Chile will want to be prepared to respond to this.

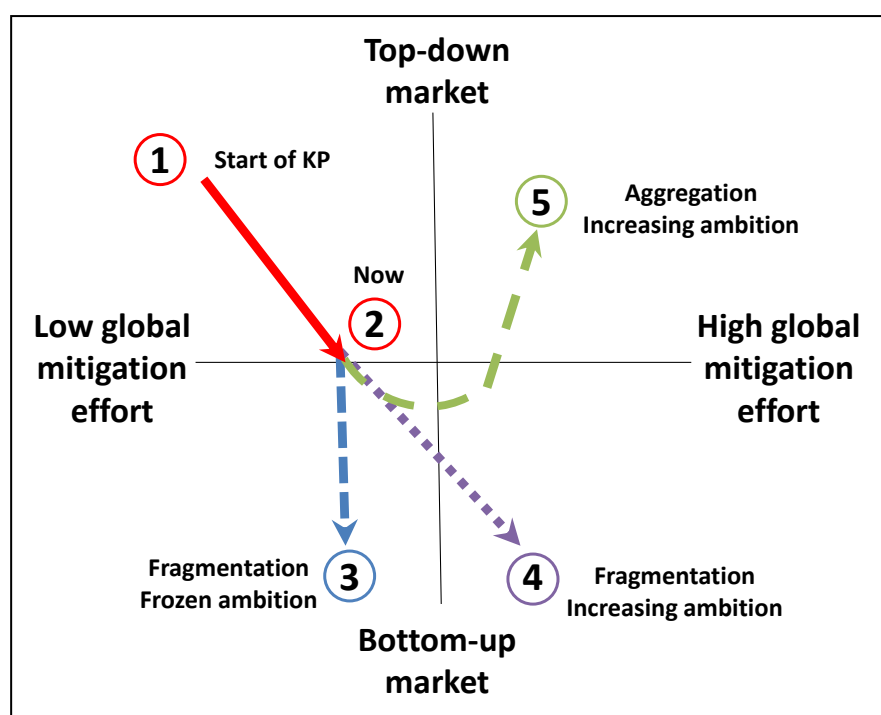
As part of a post-2102 climate agreement, Parties are discussing the use of existing and new, larger-scale market mechanisms to help meet countries’ mitigation targets and pledges, and are considering rules for helping to shape the future operation of the international carbon market. Parties are discussing how a top-down framework under the UNFCCC could interact with the bottom-up development of new market mechanisms and bilateral trading agreements between countries (with parallel efforts outside the negotiations on harmonised MRV and accounting rules). This opens up new market opportunities for developing countries that wish to participate in emissions trading. This also means that Chile currently faces significant uncertainty about what level of mitigation ambition other countries will adopt in the future, and how the

¹⁶ Chile Ministry of Energy (2012), Personal communication from the División de Prospectiva y Política Energética, July 2012.

international carbon market will evolve over time under top-down and bottom-up drivers to help countries deliver on that ambition. These factors will influence the overall prices and price volatility of the international carbon market as well as Chile's specific linking opportunities. They could also influence Chile's optimal balance between designing an ETS to meet domestic objectives versus to conform with international expectations, particularly with regard to meeting prerequisites for linking.

As Chile assesses its future options for the design of an ETS, it may wish to conduct market scenario analysis. Figure 1.1 illustrates how such scenarios could be formulated on the basis of the level of global ambition and the level of centralisation of the international carbon market. Scenario 1 depicts the start of the Kyoto Protocol, with a top-down model for market development under internationally agreed rules and a low level of global ambition. Scenario 2 depicts the present situation, where global ambition has increased somewhat and the market has become more fragmented. Future scenarios could include increasing fragmentation with no increase in ambition (Scenario 3), increasing fragmentation with increasing ambition (Scenario 4), or increasing ambition accompanied by a growing aggregation of ETS (Scenario 5), either through widespread linking or an international agreement on market rules.

Figure 1.1: Scenarios for the international carbon market



At a domestic level, the government has in place a National Climate Change Strategy and National Climate Change Action Plan, with initiatives underway to strengthen its inventory, MRV and institutional capacity, identify mitigation potential, develop emissions scenarios (projections) and formulate a mitigation strategy including Nationally Appropriate Mitigation Actions (NAMAs). There are also a number of recent sector-specific policies and targets, notably:

- The National Energy Strategy 2012–2030: fundamental pillars include increased energy efficiency, growth of non-conventional renewable energy, greater prevalence of water resources, less external dependence, interconnection of north and south

transmissions grids and creating a “public electricity highway” and a more competitive electricity market.

- Energy Efficiency Action Plan 2012–2020 (under development): aims to reduce final energy demand by 12% below BAU by 2020

The government has signalled its intention to design mechanisms that will encourage the adoption of clean and efficient technologies, and to study the possibility of incorporating tax instruments to reduce the negative externalities and promote the positive externalities and social benefits of projects, in order to redirect the electricity matrix.

An ETS would need to be integrated with these existing and proposed climate and energy policy initiatives in Chile.

The government has undertaken preliminary work on feasibility and scoping for an ETS in Chile, with assistance from the IEA, US EPA and the Government of New Zealand among others.¹⁷ The results of this research showed that Chile does have the essential fundamentals to establish an ETS in the country (i.e. appropriate and solid institutional and economic foundation, a dynamic private sector and a working legal framework) and that it will have to eventually link its ETS to other markets.

The government can also consider lessons from Chile’s previous experiments with market-based mechanisms (e.g. water markets created in the early 1980s and the offset market for particulates from large combustion plants created in Santiago in the early 1990s) as well as its experience as a leader and pioneer in the CDM market.

Comprehensive tax reform including green taxes is likely to be high on the agenda at the next Presidential election (in 2013). So far, there has been no mention of carbon pricing (whether tax or trading) by either the current administration or opposition parties.

Previous experience with environmental markets in Chile

Chile has used environmental markets to manage water, fisheries and air pollution. Here we briefly introduce each system. Details on the experience as it relates to specific design features are picked up in each of the later chapters.

Water markets

Water Resources Management (WRM) in Chile is widely known for its 1981 Water Code. Free-market mechanisms became under this code the economic philosophy in WRM, including the development of water markets and tradable water permits. The characteristics of the implementation of this water market are perhaps the most relevant local example to be studied in light of the implementation of an ETS. Key references are Dourojeanni and Jouravlev (1999), Bauer (2004) and Grafton (2011). A major flaw of the Chilean system is that the Water Code does not specifically address third party effects or environmental impacts; which are considered to be a great concern. The allocation of water rights has also been a significant concern.

¹⁷ Fernández Amunátegui and Searle, 2011

Fisheries

In 2001 an individual transferable quota (ITQ) system was introduced for all the most important industrial fisheries in Chile. Peña-Torres (2002 a and b) discusses the debate around the introduction. This system was put in place after years of declining stocks and over investment. Within this system, the Chilean southern industrial pelagic fishery has average catches of over 1.4 million tons a year, making it one of the largest fisheries in the world to be regulated by individual quotas. In this particular fishery under ITQs fleet size fell from 148 active boats in 2000 to 65 in 2002 as a direct consequence of the reform (Gómez-Lobo et al, 2011).

In recent years there have been concerns about declining stocks. This is not due to illegal fishing within the ITQ system; both large and small companies have been catching below their quotas. One explanation is that overfishing right beyond the 200 miles (Chile's exclusive economic zone) by international factory fishing ships has had a big effect on the stock of fish available. A second possible explanation is that there may have been a tendency to allocate more quotas than recommended by the scientific evidence. The current ITQ system expires in December. There has been debate about the new legislation that will replace it. Most debate is about how to allocate the new quotas, starting in 2013, whether based on historic catch or auction, and also about having expert panels deciding on the TAC every year (Montero, 2012).

Air pollution markets

Santiago, Chile was one of the first cities outside the OECD to implement a tradable permit program to control air pollution, primarily because Santiago is one of the most polluted cities in Latin America. During the early 1990s, it was officially declared a non-attainment zone for several atmospheric pollutants. In 1992, a cap-and-trade scheme was established by decree in Santiago to reduce emissions of particulate matter from large industrial and residential boilers.¹⁸

The first system focused on large boilers due to their easy identification and relative importance; at the time they accounted for more than 40% of total point-source emissions. Although the program became mandatory in 1994, it became active in 1997, giving the environmental authority additional time to collect information on emission sources.

Evaluation of the performance of Santiago's trading program was done at early stages of its implementation and more recently.

- Montero et al. (2002) found that the grandparenting used to allocate emissions permits initially created economic incentives for incumbent sources to more readily declare their historic emissions in order to claim permits.
- O'Ryan (2002) examines the impact of the introduction of natural gas in the applicability of the tradable permit program, concluding that this fuel increased the range of emissions potentially abated at a lower cost and reduced the efficiency gains from using a market-based instrument.
- Palacios and Chavez (2005) evaluated the performance of the program in terms of enforcement, concluding that the aggregate level of over compliance coexisted with frequent violations of regulations by some of the sources.

¹⁸ Montero et al, 2002; Palacios and Chavez, 2005; Coria and Sterner, 2010

Emissions trading for industrial processes

Two additional emissions trading programs were implemented in 2004 for particulate matter and NO_x pollution by large industrial processes. As in the large boiler program, existing sources were granted permits, but this time yearly caps on emissions were set with a target cap based on the 1997 emissions level. The formula allowed industrial processes to emit a maximum of 50% of the 1997 emissions of particulate matter and 67% of 1997 NO_x emissions, and it was anticipated that the targets be met by May 2007. (For NO_x, a second, more stringent target of 50% was imposed for 2010.) These new programs shared most of the features of the large boiler program, with one important exception: short-term offsetting was allowed. Thus, industrial processes in need of emission permits could “rent” emission permits from other industrial processes in the program for a minimum period of one year.

The main motivation behind short-term offsetting was to help start up a market by sending price signals, while giving new sources access to permits; initially there was an acute shortage of NO_x permits relative to demand. Calfucura et al. (2009) highlighted the effect of the lack of natural gas in explaining this shortage. The emissions cap was calculated based on 1997 data, just after many industrial processes switched to natural gas. However, in 2004, Argentina restricted exports of natural gas to Chile to deal with Argentina’s domestic shortages. Many industrial processes reverted to dirtier fuels, significantly increasing NO_x emissions; this led to non-compliance with the emissions cap.

Coria et. al (2010) conducted interviews and surveyed a sample of firms subject to emissions trading programs in Santiago. Most of the respondents reported that it was not very costly to attain the regulated level for particulate matter or NO_x. Moreover, though most firms said that SEREMI monitors firms on a continuous basis, they wanted SEREMI to increase its monitoring further. Coria et al. interpreted this as the result of a permit-based approach: As soon as regulations are transformed into pollution rights, they acquire some of the attributes of “property” and become valuable. Many sources realised that their permits become more valuable when monitoring is strong and the system in general is more stringent.

When interviewing firms, Coria et al. found that they did not have a generally negative attitude toward environmental regulations or environmental authorities. Furthermore, they did not seem reluctant to deal with environmental regulations. Hence, one could say that the regulation has gained legitimacy. The fact that firms want monitoring and the overall system to be more stringent is also very positive. This study also however identified some other shortcomings of the program.

In general, the air pollution trading programs have been characterised by a combination of failures affecting the attractiveness of trading: over-allocation of permits, high transaction costs, lack of clear penalties for sources in cases of violation, and several regulatory changes affecting the tenure over emission permits and hampering trade.¹⁹ The total amount of emission permits initially granted to incumbent sources has been decreased in two ways; the rate of offsetting has been raised twice and the program’s rules have led many sources to lose their emission permits because trade is only allowed within a specified period of time and unused permits have been withdrawn.

¹⁹ See also Coria and Sterner (2010).

1.2.4. Organisation of the report

The report has been structured to fulfil the World Bank's terms of reference for Activity 2 (*Study and design proposal of an Emissions Trading Scheme*) and support Chile in the preparation of its Market Readiness Proposal for an emissions trading scheme. The terms of reference originally requested inputs on research and meetings to be held with regulators and implementing agencies in countries with an existing ETS, and identified four core components of an ETS as the focus for analysis: (1) setting the point for regulated sectors, (2) emissions trading phases, (3) allocation of allowances, and (4) linking and offsets. This report re-orders some of these topics to support the flow of analysis. Notably, the second core component on emissions trading phases has been divided into separate discussions of setting the level of ambition in an ETS (covering the level of both emission reductions and prices) and designing emissions trading phases. The discussion of meetings to be held with regulators has been incorporated into a broader set of recommendations for the government's process of designing and implementing an ETS.

The report concludes with an integrated roadmap for the hierarchy of government decisions on the design of an ETS together with key strategic considerations. Note that for continuity, the content of the roadmap touches at a high level on analysis that is underway for other PMR Activities, notably Activity 1 (*MRV, compliance and registry*) and Activity 3 (*Study on market instruments: Scaled-up crediting and carbon pricing stabilisation mechanisms*), but these issues are not treated in depth in this report. The last part of the roadmap consists of straw man proposals for sector coverage and point of obligation, linking and offsets and allocation of allowances plus an integrated straw man proposal that shows how these might work in combination. These straw man proposals do not represent recommendations; instead, they are a useful starting point for considering different features. Further research, analysis and stakeholder engagement will be required in subsequent phases of work to support the development of recommendations for the design of an ETS in Chile.

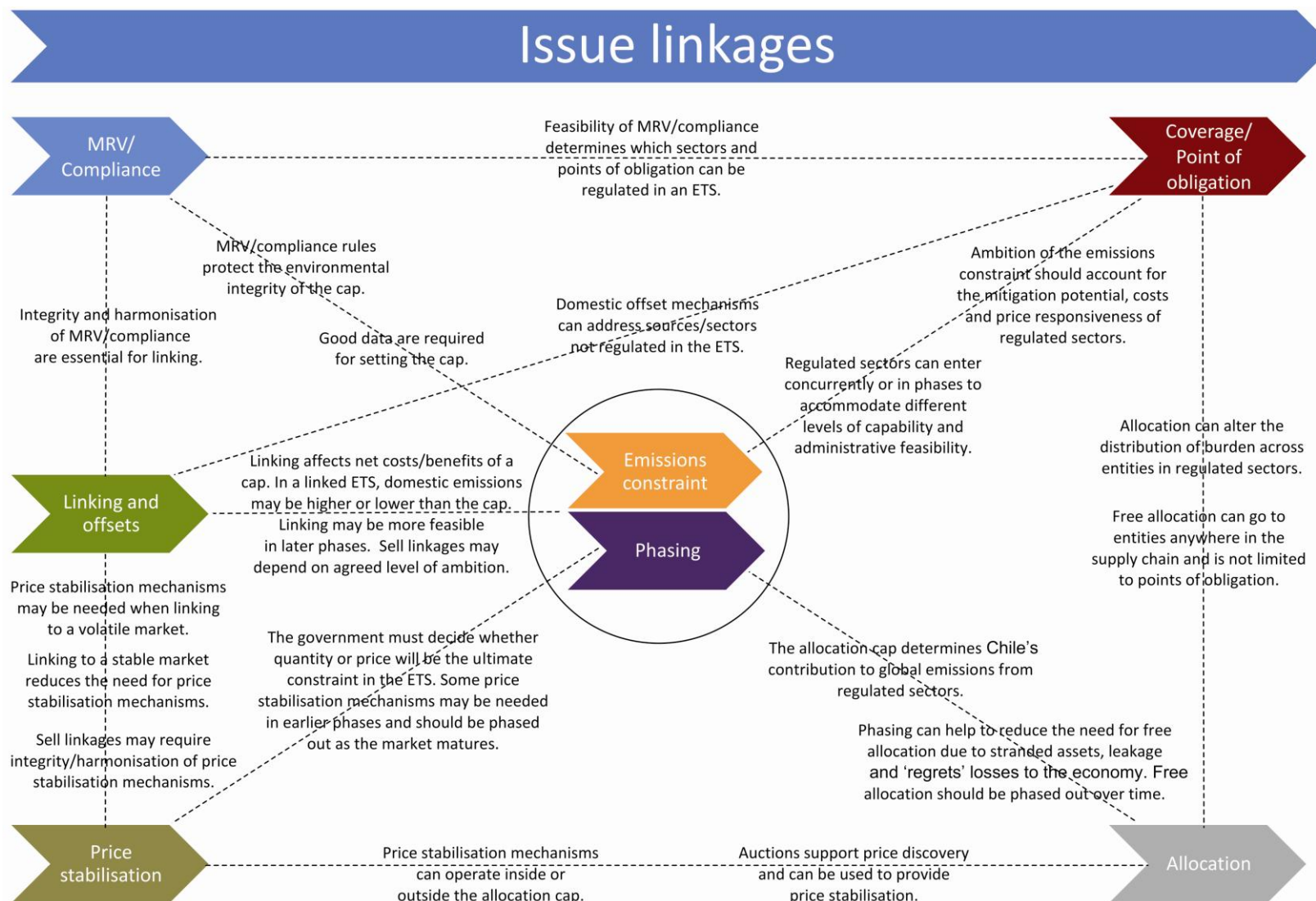
The report is organised as follows:

- Chapter 2 Sector Coverage and Point of Obligation
- Chapter 3 Setting the Level of Ambition
- Chapter 4 Linking and Offsets
- Chapter 5 Designing Emissions Trading Phases
- Chapter 6 Allocation
- Chapter 7 ETS Research Needs
- Chapter 8 Recommendations for ETS Process and Meetings
- Chapter 9 Roadmap for Government Decisions on an ETS

1.2.5. Bringing it all together

The design of an ETS is not a linear process. There are critical linkages and interdependencies across all of the core design components, and no one component can be designed in isolation. The following figure from the roadmap illustrates these linkages and interdependencies. It can serve as a useful point of reference for navigating through the report.

Figure 1.2: Issue linkages in ETS design



1.3. References

- Bauer, C. J. 2004. "Results of Chilean Water Markets: Empirical Research Since 1990," *Water Resources Research* 40:W09S06
- Calfucura, E., J. Coria and J.N. Sanchez. 2009. "Permisos Transables de Emisiones en Chile: Lecciones, Desafíos y Oportunidades para Países en Desarrollo," *El Trimestre Económico* 304:1027–1069
- Chile Ministry of Energy. 2012. Personal communication from the División de Prospectiva y Política Energética, July 2012.
- Chilean Ministerio de Energía. 2011. "Report of the Comisión Asesora de Desarrollo Eléctrico," Ministerio de Energía, Santiago, Chile. Available at <http://www.minenergia.cl/comision-asesora-para-el-desarrollo.html>
- Coria, J. and T. Sterner. 2010. "Tradable Permits in Developing Countries: Evidence from Air Pollution in Santiago, Chile," *Journal of Environment and Development* 19(2):145–170.
- Coria, J., Å. Löfgren and T. Sterner. 2010. "Trade or Not to Trade: An Analysis of Trading Schemes at the Firm Level", *Journal of Environmental Management* 91: 2126-2133.
- Dourojeanni, Axel, and Andrei Jouravlev. 1999. *Código de Aguas de Chile: entre la ideología y la realidad* Naciones Unidas, ECLAC /CEPAL, Santiago de Chile. Available online at: <http://girh.guamanpoma.org/biblioteca/lcl1263s.pdf>
- Fernández Amunátegui, Ignacio and Juan Pedro Searle. 2011. "Opciones y Análisis de Mecanismos de Mercado para la Reducción de Emisiones de Gases de Efecto Invernadero: Factibilidad de Implementación de un Sistema de Transacción de Emisiones en Chile", Informe Final para Ministerio de Energía, Santiago de Chile, Junio
- Gómez-Lobo, Andrés, Julio Peña-Torres & Patricio Barriá. 2011. "TTQ's in Chile: Measuring the Economic Benefits of Reform," *Environmental & Resource Economics, European Association of Environmental and Resource Economists*, 48:4, pp. 651–78.
- Grafton, R. Quentin, Gary Libecap, Samuel McGlennon, Clay Landry and Bob O'Brien. 2011. "An Integrated Assessment of Water Markets: A Cross-Country Comparison" *Review of Environmental Economic and Policy* 5(2): 219-239
- Montero, J.P., Sanchez, J.M. and R. Katz. 2002. "A Market-based Environmental Policy Experiment in Chile," *Journal of Law and Economics* 45:267–287.
- Montero, Juan Pablo. 2012. "Cuotas de pesca y libre competencia: consideraciones para la nueva ley de pesca", *Estudios Públicos* No. 127.
- O’Ryan, Raúl. 2002. "Emissions Trading in Santiago: Why Has it Not Worked, But Been Successful?," Unpublished document. Program for Environmental Economics and Management, Industrial Engineering Department, Universidad de Chile.
- Palacios, M., and C. Chavez. 2005. "Determinants of Compliance in the Emissions Compensation Program in Santiago, Chile," *Environment and Development Economics* 10:453–483.

- Peña-Torres, J. 2002a, “Debates sobre Cuotas Individuales Transferibles: ¿“Privatizando” el mar? ¿Subsidios? O ¿Muerte anunciada de la pesca extractiva en Chile?”, *Estudios Públicos*, N°86, Otoño (Fall), pp. 183-222.
- Peña-Torres, J. 2002b. “Individual Transferable Fishing Quotas in Chile: Recent History and Current Debates”, *Research Working Papers Series # I-139*, Department of Economics, Universidad Alberto Hurtado-ILADES, May.
- PricewaterhouseCoopers. 2012. “Draft Report Phase 1,” *Activity 4: Study on the Chilean National Situation*.

2 Sector Coverage and Point of Obligation

Key findings:

- For any emissions trading scheme, the key question of who will be regulated under the scheme is the result of choices about the following issues:
 - a. the sectors to be regulated and the greenhouse gases to be included;
 - b. the point of obligation (i.e. the entity that will be subject to reporting and surrender requirements); and
 - c. criteria for the exclusion of entities (e.g. small emitters or those in remote locations).
- In schemes developed to date, choices about coverage of sectors and gases have been influenced by a variety of overlapping factors, including the objectives of the scheme (e.g. to deliver economy-wide commitments or to drive investment in specific sectors), the availability of emissions data, the political acceptability of including some sectors, targeting sectors with greatest mitigation potential, and the costs and benefits of including small emitters.
- The choice of point of obligation has been affected by similar factors, such as the desire for comprehensive coverage, sector-specific pricing dynamics, likely impact on behaviour, the ability to monitor emission reductions at each potential point, administrative feasibility and transaction costs, and interaction with existing policies (including monitoring and reporting frameworks).
- The most significant choice relates to the coverage of the emissions of carbon dioxide from the energy sector. Under an ‘upstream’ approach, comprehensive coverage could be achieved by regulating at the point of extraction or import of fossil fuels, resulting in the pass-through of costs to all consumers of energy in every sector. Alternatively, the point of obligation can be set at the point at which the fuels are burned and carbon dioxide is emitted (e.g. power station, industrial sites, and even vehicles) or the point of consumption of electricity (e.g. industrial sites, businesses, and households).
- For Chile, these decisions will require careful consideration by the government and consultation with stakeholder groups. However, in order to allow ideas to be tested more thoroughly, we have suggested the following straw man options for coverage and regulated entity should be explored further:

Straw man for sectoral coverage and point of obligation

Sector	Point of obligation – option 1	Point of obligation – option 2
Non-transport energy	Upstream, i.e. point of production/import	Point of emission (e.g. power stations, industrial sites) but excluding smaller emitters such as households
Transport	Upstream	Upstream
Industrial processes	Point of emission (e.g. industrial sites)	Point of emission (e.g. industrial sites)
Non-CO ₂ agriculture	Farmer, processor	Farmer, processor
Non-CO ₂ waste	Landfill operator	Landfill operator
Forestry	Landowner	Landowner

- Emissions from bioenergy use will require appropriate coverage to provide the right incentives for emissions reductions and avoid perverse incentives to deplete forests.

2.1. Introduction

2.1.1. Overview and structure

This chapter examines the options available for addressing the key question of which entities will be regulated under an ETS in Chile. For any ETS, the key question of who will be regulated under the scheme is the result of choices about the following issues:

- the sectors to be regulated and the greenhouse gases (GHGs) to be included
- the point of obligation (i.e. the entity that will be subject to reporting and surrender requirements)
- criteria for the exclusion of entities (e.g. small emitters or those in remote locations).

Other trading schemes implemented or in the design phase elsewhere have taken a variety of approaches to tackling the three design questions set out above. In relation to the question of sectoral coverage, the approach taken has been informed by deliberate choices based on a number of factors. The International Energy Authority (IEA) summarised these as follows:²⁰

- the objectives of the scheme (e.g. to deliver cost-effective economy-wide commitments or to drive investment in specific sectors)
- the availability of emissions data for the sectors and gases to be included
- the costs and benefits of including small sectors and sources

²⁰ International Energy Agency, 2010

- targeting sectors with the greatest mitigation potential/ability to respond to price signals
- the desire to achieve least-cost mitigation by extending coverage as widely as possible
- the political acceptability of including some sectors, including the interaction with existing policies.

Given the intention to establish linkages with other trading schemes with a view to selling allowances, a further important consideration can be added to these, namely: the likely attitude of prospective buyers to the inclusion of specific sectors. Likewise, the choice of point of obligation has been affected by similar factors, such:

- the desire for comprehensive coverage
- sectoral pricing dynamics
- likely impact on behaviour
- the ability to monitor emission reductions at each potential point
- administrative feasibility and transaction costs
- interaction with existing policies (including monitoring and reporting frameworks).

This chapter begins with an overview of central issues relating to the coverage of sectors/gases and selection of points of obligation and thresholds for inclusion/exclusion. It then assesses lesson learned from other ETS, analyses the Chilean context for sectoral policy decisions on these issues, and presents an integrated straw man proposal as a basis for further discussion. It concludes with priorities for further research.

2.1.2. Coverage of sectors and gases

Put simply, an ETS can cover all or only part of a country's or region's emissions. In terms of economic theory, the principle advantage of broad coverage is that it increases the chance of realising the most cost-effective mitigation opportunities. This has been supported by numerous studies that have considered how non-price policies lead to higher costs. In addition, because an ETS provides certainty about the emissions outcome (i.e. global emissions from regulated sectors will be limited to the level of the cap), a "whole-economy" ETS can also provide certainty about the delivery of an absolute reduction target, whether as part of an international commitment or self-imposed. Examples of broad approaches to assist in meeting emission reduction objectives include the New Zealand ETS and the Californian ETS.

However, other ETS aim to play a complementary role alongside other policies with a view to delivering the economy-wide emissions targets collectively. Thus, in the EU, a decision was taken that the EU ETS would focus on certain sectors (principally energy and industry), while others (transport and residential) would be addressed by other policies, principally at the Member State level.²¹ Finally, some schemes have been established as a first step towards more comprehensive emissions trading (e.g. state- and provincial-level schemes in Canada, the US, and

²¹ This was also to comply with the legal principle of subsidiarity whereby the EU shall take action only where the objectives of the proposed action cannot be achieved by member states and can be better achieved by EU action.

Australia), with one of the major benefits intended to be the establishment of institutions including for the measurement, reporting, and verification (MRV) of emissions.

In addition to the objectives of the scheme, in 2010 the IEA and Organisation for Economic Co-operation and Development reviewed a series of further factors that have driven decisions on which sectors should be covered in a scheme (IEA, 2010) namely:

- *The availability of emissions data for the sectors and gases to be included.* In the EU ETS, coverage was initially limited to CO₂ emissions from large emitters in the power and industrial sectors, with an introductory phase that was designed to reflect the lack of initial data. By contrast, New Zealand's later start allowed it to be more confident of the systems it had put in place to measure emissions from other GHGs and more difficult sectors such as agriculture and forestry. It may be necessary to make a judgement on balancing the benefits to be gained from wider coverage against the increased costs of measurement.
- *The costs and benefits of including small sectors and sources.* The costs of including small sectors may outweigh the benefits of their inclusion (in particular where they are already declining – see, for example, agriculture in the EU). Further, schemes generally set a *de minimis* level to exclude smaller emitters (see further below).
- *Targeting sectors with the greatest mitigation potential and ability to respond to price signals.* A number of sectors have chosen to focus in their early stages at least only on the power sector or on power and industry. Part of the rationale for this is that these sectors are those expected to respond most quickly to an emissions price. Evidence for this can be seen from US Environmental Protection Agency (EPA) modelling²² on the impact of draft US legislation, which envisaged the greatest mitigation impact would be in the power sector due to the impact on future investment away from CO₂-intensive forms of generation.
- *The political acceptability of including some sectors.* There are numerous examples available of where political circumstances have trumped economic and practical arguments (e.g. exclusion of agricultural emissions from Australia's Carbon Pollution Reduction Scheme (CPRS), removal of transport emissions from draft US legislation). It must be accepted that this is likely to be a major factor in determining the scope of an ETS in Chile. Lessons may be learned from those countries that have been successful in introducing relatively broad systems and how they have handled engagement of industry stakeholders (see, for example, the joint work with industry in the UK on development of the UK ETS).
- *Interaction with existing policies.* Finally, the introduction of an ETS may be made easier if it goes with the grain of existing policies. In the EU, for example, the ETS directive shared many characteristics of the existing Integrated Pollution Prevention and Control legislation that already regulated many of the sectors concerned and made aspects of it more acceptable to national governments, regulators and regulated sources. Likewise, there was resistance for the inclusion of transport in the EU ETS because it might impact on Member State revenues from existing fuel excise duties.

²² U.S. Environmental Protection Agency, 2009

Another issue to consider is which of the GHGs should be included in the scheme. Some schemes are narrowly targeted and cover only emissions of carbon dioxide (CO₂) which is principally emitted by the combustion of fossil fuels. Others cover all six greenhouse gases regulated under the Kyoto Protocol, namely CO₂, methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆). Activities such as agriculture, coal mining, industrial production, refrigeration, and fossil fuel transportation produce wider GHGs as well as CO₂.

The principle advantages of a CO₂-only scheme are that it generally covers the major sources of emissions in a country or region while keeping monitoring and reporting requirements relatively simple. However, inclusion of a wider set of GHGs will not only ensure that a broader set of sectors and operations is subject to a carbon price but is also likely to provide greater opportunities for cost-effective reductions.

Although from an economic perspective the inclusion of these low-cost options is advantageous for the economy as a whole, it can lead to large transfers of resources to those sectors that can benefit from cheap mitigation technologies. For example, under the Clean Development Mechanism (CDM), projects targeting the destruction of HFCs reaped profits that far outweighed the cost of the end-of-pipe technologies deployed. In addition, some of the non-CO₂ GHGs are emitted in small quantities or used for limited applications and may therefore be managed more cost-effectively through direct regulation (e.g. EU regulation of fluorinated greenhouse gases (F-gases) in refrigerants and SF₆ in electrical transmission equipment). Similarly, other countries impose regulations requiring methane from landfills to be captured and used rather than including them in an ETS.

The key implementation issues potentially raised by the inclusion of non-CO₂ emissions that would need to be considered in Chile are:

- feasibility of undertaking MRV;
- understanding and uptake of mitigation potential;
- if emissions units include different GHGs to other schemes, MRV agreements will have to be developed to enable linking between schemes.

2.1.3. Point of obligation

This section discusses the options for where to place the point of obligation in a market based measure. The point of obligation refers to the entity – i.e. site or organisation – in a supply chain which would be responsible for compliance with any market-based measure for GHG emissions. The simplest example would be the point of emissions, such as an industrial site which uses boilers and perhaps also emits as part of its industrial process. However, often it is worth considering placing the obligation upstream of the point of emissions, for example with fuel suppliers. Theoretically, in both cases the emissions price would be felt at the same point in the supply chain, with fuel suppliers passing costs through to the emitters in the second case. Finally, it is also possible to place the point of obligation downstream of the point of emissions in order to encourage behavioural change in the demand of energy use. An example of where this may be useful would be to encourage energy efficiency in the commercial sector, requiring office users to pay for the emissions associated with their consumption of electricity.

Placing the obligation at the point of emissions requires the entity that burns the fuel or carries out activities resulting in release of process emissions to pay the emissions price. For example, in the cement sector the non-energy-related process emissions from manufacture of

cement at an industrial facility would be the responsibility of that site, not the limestone supplier which would be considered upstream of the point of emissions. Likewise, in respect of energy-related emissions, an industrial site burning natural gas in a boiler would be required to calculate the emissions from the combustion of natural gas, and pay an emissions price for those emissions. Standardised emission factors for burning various fuels are often used to ensure consistent reporting. Examples of this “point of emissions” approach are provided by the EU ETS and US Regional Greenhouse Gas Initiative.

Making the point of obligation upstream embodies an emissions price in the price of fossil fuels. For example, the price of coal would increase by an amount linked to its emissions when burned, based on standard emission factors. It follows that fossil fuels with higher emissions per unit of energy provided would be coupled with a higher emissions price, encouraging movement towards cleaner fuels. For industrial processes, upstream would relate to attaching an emissions price to materials used in manufacturing. For example, limestone bought for the cement industry would have an associated emissions value. Upstream regulation, however, is rarely seen as a good option for the industrial sector because of the difficulties in monitoring embedded emissions and sources of supply, and a point of emissions liability is more common. Existing schemes that obligate upstream for the energy sector are the NZ ETS and Californian ETS.

Relative to the other options, downstream regulation (i.e. downstream of the point at which emissions arise) is really only a possibility for the electricity supply sector, as for other sectors it is likely to be overly complex, impractical, and expensive to administer. For electricity supply, downstream regulation would involve a selective application of a carbon price to certain sectors, as opposed to the more far-reaching price signal that applies under the regulation of the power producers themselves. This is an advantage if the policy intent is to limit the carbon price to certain sectors, albeit the MRV costs of applying the approach could be high. If a broad and far-reaching price signal is intended, then the downstream approach is less desirable, although to a degree it would bring the benefits of consumer awareness that are discussed below in the context of point of emissions options. A major disadvantage of a downstream approach is that it fails to encourage carbon-reducing technology improvements. An example of a “downstream” scheme is the Carbon Reduction Commitment in the UK, which regulates large consumers of electricity in the public and commercial sectors. The remaining discussion focuses on the relative merits of upstream and point of emission approaches.

One of the primary advantages of the upstream approach is that it requires the regulation of far fewer numbers of entities (fuel suppliers) than alternative approaches (emitters and consumers). This can reduce the costs associated with capacity building, MRV, compliance system design and operation, and allowance trading.

Upstream approaches would place a price on carbon for all regulated fuels, which in its simplest form would then be felt by all consumers. This can be seen as a great advantage for a system designed to cap and reduce carbon emissions across all sectors of an economy and to use carbon pricing to influence the behaviour of very large numbers of small consumers, for example in the domestic, transport, or small commercial sectors. By contrast, an attempt to regulate these smaller entities directly by placing MRV and allowance purchase requirements on them could be extremely complex and costly.

In the case of industrial process emissions, an upstream system would need to regulate the suppliers of materials with the potential to emit greenhouse gases, which may be less visible to existing regulators than it is for fuel suppliers. Whilst upstream regulation of industrial process emissions is possible in some cases, it may be preferable to place the point of obligation for

industrial process emissions at the point of emission, even if other sectors in the ETS have an upstream obligation. This is the case with the system in New Zealand.

The most commonly perceived benefit of regulating at the point of emissions is that the imposed requirement for those in direct control of the emissions to measure and account for them creates a greater focus on emissions management and reduction. This is in comparison to a scenario where those in direct control of emissions are responding to an emission price passed through to them along the supply chain. This behavioural or cultural aspect requires further examination (see box below), but suggests a possible advantage of a point of emission approach over a pure upstream system even if the overall economic incentives to mitigate are the same in both cases. Under an upstream system a complementary regime of point of emissions monitoring and reporting could be imposed (possibly with a more relaxed level of required accuracy) to enhance behavioural change, although this would incur an additional administrative cost.

Under a new carbon pricing system, there are often calls to shelter trade-exposed industries from competitive disadvantage, despite there being consensus in the literature that only a small number of carbon-intensive sectors are genuinely at risk. This issue is most commonly addressed through free allocation of emissions allowances that will require some monitoring at the installation level. This could be emissions data or fuel, heat or outputs data as part of a benchmarking approach. In addition, benchmark determination may require installation-level monitoring in order to characterise the sector and its carbon intensity. In a system based on point of emissions, the monitoring required to inform free allocation decisions can align very closely with that required for compliance – when those who emit are provided with allowances – whereas in an upstream system it involves the monitoring of a different set of entities. However, depending on country-specific electricity pricing dynamics, free allocation may need to be directed separately to entities downstream of the generator regardless of whether the obligation lies at the point of fuel production/import or the point of emission from electricity generation.

Impact of point of obligation on behaviour:

- In economic theory, the point at which a price signal is imposed makes no difference on behaviour.
- Upstream regulation provides a way of realising wide emissions coverage without the administrative costs that would arise from requiring emissions reporting from a large number of small sources, for example as would especially be the case for transport and less energy-intensive business sectors. By enabling wide coverage it avoids the economic inefficiencies that would arise from narrow policy coverage. Specifically, it maximises the potential cost-effective mitigation opportunities and minimises the risk of emissions leakage by restricting the opportunities to switch from energy sources that are covered by an ETS to those that are not (e.g. if power generation were included in a system, then the simultaneous inclusion of domestic heating fuels would avoid the incentive to switch from one to the other in the domestic sector, but this coverage is practicable only by obligating domestic fuel supplies upstream).
- The counter arguments are that:
 - an upstream system will be felt by all consumers while it may be undesirable to impose additional costs on poorer households or small and medium enterprises (SMEs) in the first instance (although in an upstream system, direct compensation can be applied to disproportionately impacted consumers); and
 - there is evidence from the UK in particular that point of obligation has been as important in changing behaviour as price (e.g. through the involvement of boards in discussing the Climate Change Agreements (CCAs), the results of which have been significant energy and carbon reductions across a wide range of industries).
- There is also strong evidence that the management focus on energy savings through the target-setting approach helps to galvanise action. A 2004 Institute for European Environmental Policy study into early results of the CCAs, based on interviews with participants, stated: “The agreements also created ownership of energy issues in those businesses which entered into them; allowed businesses the flexibility of policy responses (trading possibility); and, at a practical level, facilitated dialogue between industry and government.”

Sources: AEA, 2011; Institute for European Environmental Policy, 2004

In summary, we have a mix of issues for which the balance of benefits depends on the policy intent and scope of the measure:

- For the regulation of highly numerous and small sources, such as in domestic, transport and small commercial sectors, the upstream approach appears most favourable. If it is a priority to avoid exposing portions of these sectors to carbon costs, then the upstream approach is distinctly disadvantageous, since the costs of

applying an upstream approach in a selective way, or compensating diffuse emitters, could be high.

- Similarly, if avoiding imposing a carbon price element within electricity prices for certain sectors of the economy is desired, then a downstream approach to accounting for electricity emissions is preferable, with target sectors being required to report and pay a corresponding carbon price. Under a broad and far-reaching approach though, regulation of electricity emissions at the point of generation is preferable.
- For trade-exposed sectors and those for which process emissions are significant, a “point of emission” approach can bring MRV efficiencies, since MRV associated with compliance, allocation, fuel and process emissions, and creating the behavioural change focus all lie with the same operator. (Note the possible exception discussed above for free allocation associated with electricity consumption.) Where – as in most cases – it is necessary to compensate industry through free allocation, the split requirements under an upstream approach seem to add additional complexity in relation to MRV for a concept intended primarily to deliver MRV savings. So for these sectors a midstream approach appears may have some advantages.
- For non-trade exposed sectors and those dominated by fuel emissions (rather than process emissions), there are significant MRV benefits from the upstream approach, with the potentially reduced focus on the actual emitter being the main, although unquantified, disadvantage. Further understanding of this behavioural aspect would be required to determine if it outweighs the MRV efficiencies of an upstream approach.

A consequence of the above discussion, however, is that differing approaches would be favourable under particular circumstances and for particular sectors, most likely resulting in a hybrid approach with different systems for different sectors.

2.1.4. Forms of thresholds for excluding small emitters

With any new policy it is necessary to define the criteria for inclusion, which for an emissions trading system will include the definition of one or more thresholds for activity at participant (i.e. site or organisation) level. This is important to provide clear boundaries for participation but also to allow for the exclusion of smaller sites or companies for which the administrative costs of participation may exceed emissions benefits.

Under an upstream approach, a threshold is required only if certain sectors or sizes of organisation are to be targeted as obligated entities. If the obligation is at the point of emissions or further downstream, then a threshold is more fundamental in order to define which sites or organisations participate in the scheme.

In the energy sector, an upstream threshold may apply to the quantity of fuel input, such as the tonnes of coal imported or extracted. Such a threshold could be used to exclude small-scale providers of firewood.

In a point of emission approach to the non-transport energy sector, the characteristics of the power generator may be used as a threshold for inclusion, such as the rated capacity of its equipment, its throughput, or its emissions. Rated capacity is often provided by the manufacturer, and should in theory be readily available information and is unlikely to change as

often as energy throughput or emissions. The EU ETS and US RGGI are examples of rated capacity thresholds.

Of course, the rated capacity does not reflect usage and so energy throughput and emissions may be more appropriate to incorporate the big emitters. Further, emissions are common across sectors – including afforestation and waste – and may be linked to government targets, making it easier to define thresholds and calculate their contribution to targets. One limitation of using emissions is the definition and updating of consistent emission factors across fuels. An example of a scheme that uses an emissions threshold is the Australian Carbon Pricing Mechanism and the Californian ETS.

In a downstream scheme focusing on energy consumption, a threshold may also be placed on organisations that consume energy. This provides an easy way of excluding small consumers, although it is administratively more burdensome to calculate because there are more consumers than producers of energy, and the number of participants satisfying the threshold is likely to fluctuate considerably over time. Schemes that use downstream energy consumption thresholds are the Tokyo Cap-and-Trade Program and the UK Carbon Reduction Commitment.

For other sectors specific criteria can be defined. For example, if industrial or agricultural emissions are to be regulated at the point of emission, certain trade-exposed products can simply be excluded entirely. Alternatively, the annual production rate at a plant or farm could be used as a threshold, such as tonnes of product per year. This could be used to exclude smaller operators from the scheme.

If industrial produce is to be obligated at the point of consumption, then benchmark levels of consumption of products could be established. However, because of the diverse nature of the uses for industrial produce this is not recommended.

2.1.5. Where to set the threshold for excluding small emitters

There is always a proportion of fixed costs for participants associated with the administration of compliance with a market-based measure, which will be disproportionate for small organisations. Further, the cumulative environmental impacts of such small organisations are likely to be insignificant in a region's total emissions, so regulation of this kind may not be worthwhile. On the other hand, broadening the scope invites greater cost-effective mitigation potential, which in sectors of many small operators could accumulate to be significant.

Thresholds may also create incentives for larger operators to outsource to smaller unregulated firms, which would lead to counterproductive leakage from the scheme. This is most likely where the size distribution of sectors shows few large producers and a long tail of small emitters, which is the case in some industries in Chile. It follows that it is important to consider a lower boundary for the size of target entity that would participate in a scheme.

2.2. Lessons Learned from Other ETS

A brief overview of the existing major ETS is provided in Table 2.1 below, followed by an assessment of the lessons for coverage and point of obligation that can be learned from the various schemes.

Table 2.1: Brief overview of coverage of existing schemes

Scheme	Geographic and sectoral coverage and phasing	Emissions coverage	Point of obligation and regulated entity	Rationale for approach
EU ETS	<ul style="list-style-type: none"> Covers 30 countries (27 EU member states plus Iceland, Liechtenstein, and Norway). Covers about 11,500 installations, which are owned by about 5,000 companies. The following sectors are included: power combustion, oil refining, coke and steel, cement and lime, glass, bricks and ceramics, pulp and paper, and miscellaneous. CO₂ emissions from aviation (domestic/intra-EU, and arriving and departing international flights) are covered from 2012. 	<ul style="list-style-type: none"> The EU ETS is collectively responsible for around 50% of EU CO₂ emissions and 40% (extended to 43% in Phase III) of total GHG emissions. In Phase 3 (2013–2020) CO₂ emissions from bulk organic chemicals, ammonia, and aluminium industries are to be included, as well as N₂O from certain production processes and PFCs from aluminium production. 	<ul style="list-style-type: none"> Point of emissions for all participants. Site-based scheme. 	<ul style="list-style-type: none"> Theory based on site-based energy managers having greatest influence over implementing projects to improve the efficiency of power generation and energy intensive industry. Approach similar to existing regulation, i.e. Integrated Pollution Prevention and Control regime. Smaller sectors (F-gases) covered by separate regulations. Political resistance to central regulation of other sectors (e.g. transport).
NZ ETS	<ul style="list-style-type: none"> From 1 January 2008, emissions from deforestation of pre-1990 forest land. From 1 January 2008, on voluntary opt-in basis, removals from post 1989 forest lands (and subsequent matching emissions on harvest, as applicable). 	<ul style="list-style-type: none"> Covers all Kyoto Protocol GHGs (CO₂, CH₄, N₂O, HFCs, PFCs, and SF₆) and all sectors, with staggered entry. 	<ul style="list-style-type: none"> Point of emission/removal at the landowner level for the forestry sector. Upstream at point of production/import of fuels in energy sector; option for large users to opt in as direct points of obligation. 	<ul style="list-style-type: none"> Principle that costs passed through to emitters in the price of fuels will lead to equal incentives to pricing at the point of emissions, but with broader coverage and lower administration burden due to fewer regulated entities upstream.

Scheme	Geographic and sectoral coverage and phasing	Emissions coverage	Point of obligation and regulated entity	Rationale for approach
	<ul style="list-style-type: none"> From 1 July 2010, emissions from stationary energy, liquid fossil fuels, fishing and industrial processes (non-synthetic gases) sectors. From 1 January 2013, emissions from waste and synthetic gases. As currently legislated, from 1 January 2015, biological emissions from agriculture sector; note the government has proposed to defer this pending a review in 2015. The government has also proposed to remove the NZ ETS obligation on the importation of synthetic GHGs in goods and motor vehicles and replace it with a levy. 		<ul style="list-style-type: none"> Point of emissions for process emissions in industry, allocated to eligible businesses, not sites. Point of emissions for waste at the landfill operator. As legislated, point of import/manufacture for SF₆; however, the government has proposed changing this to the user. As legislated, point of manufacture/import for fertiliser emissions unless moved to farmer level by Order in Council; and processor obligation for livestock emissions unless moved to farmer level by Order in Council. Note that the government has expressed a preference to move to a farmer-level obligation. 	<ul style="list-style-type: none"> Principle that the point of free allocation does not need to correspond to the point of obligation.
RGGI	<ul style="list-style-type: none"> Covers nine northeast states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont). Starts in 2013 for electric utilities and large industrial 	<ul style="list-style-type: none"> Covers CO₂ emissions from fossil fuel powered electricity generating plants ≥25MW During the first compliance period, which ran between 2009 and 2011, RGGI regulated 211 facilities. After New Jersey 	<ul style="list-style-type: none"> Point of emissions. Site based. 	<ul style="list-style-type: none"> Most important actor deemed to be the power generation sites in stimulating clean technology and recycling revenues into energy efficiency improvements for customers. Initial plans to include other

Scheme	Geographic and sectoral coverage and phasing	Emissions coverage	Point of obligation and regulated entity	Rationale for approach
	facilities.	withdrew from RGGI, the number of regulated facilities dropped to 171.		sectors, but competitiveness concerns narrowed it down to power generation only.
CalETS	<ul style="list-style-type: none"> Covers <i>c.</i> 350 businesses, representing 600 facilities in California. Cap-and-trade regulation to become effective on 1 January 2013. First compliance period (2013–2014) will cover electricity generating and industrial facilities exceeding 25,000 tonnes of CO₂e per year. Second compliance period (2015–2017) adds distributors of transportation, natural gas, and other fuels. Third compliance period (2018–2020) will include transportation fuels. 	<ul style="list-style-type: none"> Compliance obligation for GHG emissions to start on 1 January 2013. The initial 2013 allowance budget is 162.8 MMtCO₂e, and this budget will decrease by 2% for 2014. Beginning in 2015, when the cap expands to cover additional sectors, the allowance will increase by 235 MMtCO₂e, and will decrease by 12 MMtCO₂e/year through 2020. Over time will cover all major sources, representing 85% of California's GHG emissions. 	<ul style="list-style-type: none"> Upstream at liquid fuel supplier for transportation as of 2015. Point of emissions for all others. Businesses are obligated, not sites. 	<ul style="list-style-type: none"> Emissions reduction target covers all electricity consumption within the state; therefore the scheme had to obligate all fuels even from suppliers located outside the state.
AusCPM	<ul style="list-style-type: none"> Covers 500 large emitting facilities (i.e. over 25,000 tonnes CO₂e per annum). Accounts for <i>c.</i> 60% of Australia's GHG emissions. The following sectors are included: energy generation, 	<ul style="list-style-type: none"> Covers CO₂, CH₄, N₂O, and PFCs from aluminium smelting. Covers stationary energy (power generation), industrial processes, fugitive emissions (except decommissioned coal 	<ul style="list-style-type: none"> Point of emissions for electricity, site based. Upstream for gas at point of import, or business based for large gas suppliers if they volunteer to take on the liability. 	<ul style="list-style-type: none"> Very competitive power generation sector, so carbon price intended to present an opportunity for players to get ahead. Coal cannot be regulated upstream as it would be

Scheme	Geographic and sectoral coverage and phasing	Emissions coverage	Point of obligation and regulated entity	Rationale for approach
	<p>industrial processes, fugitive emissions processes (with the exception of decommissioned coal mines), non-legacy waste, and some parts of the transportation sector (domestic-based aviation, shipping, and rail emission are covered, but transportation fuels will not be covered).</p> <ul style="list-style-type: none"> • The Carbon Pricing Mechanism begins on 1 July 2012 as a fixed-price carbon “levy” (permits initially sold at Aus\$23/tonne CO₂ and increasing by 2.5% a year in real terms). • From 1 July 2015, transitions to a cap-and-trade scheme where market sets price (with a price ceiling and floor for the first three years of the flexible carbon price period). 	<p>mines), and emissions from “non-legacy waste”.</p>		<p>impossible to split domestic consumption from that exported.</p> <ul style="list-style-type: none"> • Gas chosen upstream to increase coverage.

Scheme	Geographic and sectoral coverage and phasing	Emissions coverage	Point of obligation and regulated entity	Rationale for approach
TokyoC&T	<ul style="list-style-type: none"> • Represents <i>c.</i> 1,000 commercial and institutional buildings and 300 industrial facilities (with annual energy consumption of at least 1,500 kl of crude oil equivalent). Office buildings comprise 80% of all covered facilities. • The ETS caps CO₂ from fuel consumption and electricity usage. • Launched in April 2012. 	<ul style="list-style-type: none"> • 20% of Tokyo's total CO₂ emissions. • Covers <i>c.</i> 40% commercial and industrial sector CO₂ emissions. 	<ul style="list-style-type: none"> • The point of obligation within the Tokyo ETS is at the facility level (ie. Commercial buildings/factories). 	<ul style="list-style-type: none"> • Limited regulator power: Tokyo Metropolitan Government had no powers to regulate electricity generators but was able to regulate energy consumption.

The EU ETS places the point of liability at the point of emission, i.e. the site of operations such as power generation facilities or cement manufacturers. Due to the large number of facilities under this scheme – spread across all Member States of Europe – administering the scheme has been costly. The inclusion of industrial sectors has proved to be particularly controversial due to the perceived risks of losing competitiveness with extra-EU firms. While this has been addressed by allocation of allowances for free based on benchmark levels of efficient performance, this process has been highly burdensome on EU-level and site-level administration. By including combustion installations above 20MW from all sectors rather than simply in the electricity generation sector, a long tail of small emitters was included in the scheme, resulting in large numbers of participants with relatively low emissions. However, this is now being addressed for 2013 by a *de minimis* threshold for inclusion in emissions terms. The Regional Greenhouse Gas Initiative (RGGI) in the US follows a similar approach by regulating energy generators, which is a relatively simple sector to regulate at the point of emission in a market with few players.

The New Zealand ETS uses an upstream approach for the energy sector, embedding a carbon price in fossil fuels burned, giving it very broad coverage. While some of the issues relating to direct regulation of industrial emitters have been avoided via this approach, some effort has been required to identify sectors that may be exposed to competitiveness risks as a result of pass-through costs by energy suppliers. Because of the difference in the composition of sectors compared with the EU, however, this has not been as burdensome as requiring all entities suffering from pass-through costs to monitor emissions as well as the upstream energy companies. For emissions from industrial processes, a point of emissions approach is used as these are large installations that have the data required to determine their emissions. It follows that the optimal approach for reducing administrative costs and providing the highest incentive for emissions reduction differs depending on the make-up of the sector and country. CalETS also uses upstream pricing of emissions potential in order to broaden coverage and reduce administrative burden.

The Australian carbon pricing mechanism uses a combination of approaches for different sectors. For example, whilst gas is regulated upstream, coal mining is not regulated because it is impossible to decouple coal burned domestically from that which is exported. Even within the gas sector, some larger suppliers will be monitored at the point of emissions because of their greater ability to manage emissions trading and effect change.

Tokyo focuses on energy demand, and therefore obligates downstream at the energy users. Whilst this may appear to be administratively burdensome because it targets the end user, thresholds ensure it is larger users only that are caught by the scheme, and data availability is already high amongst such users.

In summary, different approaches are required for different countries, sectors, and sometimes even subsectors. Depending on the size distribution of organisations or sites and other characteristics such as trade balance and economic importance, different options may be required in order to balance administration costs and emissions coverage. The following sections indicate the suitability of various approaches to the Chilean context.

2.3. Chilean Context

In this section, options for where and who could be obligated by a market-based measure in Chile have been discussed based on the principles above. Each sector is considered in turn, initiated with an overview of supply and demand factors, which is then followed by a discussion of its

mitigation potential, and the complements and conflicts with different options. The highest mitigation potential is available in the energy, industry, and transportation sectors (see PRM Activity 4 study for more details).

2.3.1. Electricity

Sector overview

In 2010, Chile generated around 60TWh of electricity, from a diverse mix of supplies. Hydro generation is dominant, with about 36% of generation, and of the remainder carbon-intensive fossil fuels play a major part. Coal generation amounts to 30%, natural gas 20%, and diesel fuels 12%. Coal is the dominant base-load technology, operating at over 80% capacity factor. Hydro capacity factors are around 50% and gas/oil provide flexible generation (Chile has invested in recent years in dual fuel – gas/diesel – capability). The system has undergone significant change in the last decade, and is projected to continue to develop. Generation was 40TWh in 2000 and is projected to grow at a rate of around 6% for the remainder of the decade, reaching 100TWh in 2020.²³ Of the new generation planned for that period, about half is coal, although a focus of new investment is to diversify base-load generation. There is a tension regarding this diversification, however, due to concerns over the cost of securing gas supplies – Chile rapidly expanded its gas imports from Argentina from the late 1990s to 2004, but then significantly curtailed this dependency following supply problems. The government is developing approaches to encourage the penetration of new renewables.

Industry provides the main demand for electricity, and is expected to continue to do so. Mining amounts to about 40% of demand, and other industry a further 30%. The remainder is split evenly between the residential sector and the commercial/public sectors.

Mitigation potential

Overall, the developing generation mix fuelled by high-demand growth suggests a good opportunity for emissions reductions against a business-as-usual scenario. Coal generation plays a major part, and will continue to do so, but there are opportunities to switch to greater use of gas within the existing mix, and increase the penetration of gas and renewables instead of coal as part of the new build programme. This high potential for mitigation is a strong case for including the electricity sector within a new carbon market mechanism.

More specifically, however, the sector is regionalised, with notably different generation mixes and growth rates in each system:

- The Central Interconnected System (SIC) supplies the central region and comprises 70% of the national generation. It supplies 90% of the population. The mix in this region is dominated by hydro generation, with diesel/gas comprising the majority of the remainder and coal only around 10%. This suggests a modest potential for mitigation in the short term, although most of Chile's projected demand growth is in this region.
- The Northern Interconnected System (SING) supplies primarily the mining industry. Its mix is dominated by diesel, natural gas, and coal. There are plans to link SIC with SING.

²³ International Energy Agency, 2012

- The electricity system of Aysén in the south of the country has less than 1% of Chilean-installed capacity. It comprises three separate systems and utilises hydro and oil generation.²⁴
- The electricity system of Magallanes in the far south also has less than 1% installed capacity. It comprises four separate subsystems using natural gas and, to a lesser extent, oil.

Taking account of the scale, levels of fragmentation, and connectiveness, together with the current mix and growth forecasts, the strongest case for carbon market-based measures lie for the SIC and SING systems. The energy-intensive industries that form the backbone of Chile's economy (especially mining) are served primarily by these grid systems, which are more fossil fuel based and have less hydropower potential. The Aysén and Magallanes are small, remote, isolated systems supplying primarily domestic customers, and the case for including these in a Chilean ETS is less strong. There are plans to connect with the southern grid system but long transmission distances and environmental opposition limit the full development of the hydropower potential in that region. However, there are opportunities for the deployment of other renewable generation within those regions (Aysén saw the first Chilean wind farm for example),²⁵ and therefore consideration could be given to introducing a crediting system linked to an ETS, to incentivise further renewable deployment in regions not covered by an ETS and take advantage of the lowest cost opportunities overall. The risk of perverse incentives or equity concerns from excluding the southern grid system from an ETS are considered low, given that it makes up such a small fraction of installed capacity and significant expansion of generating capacity (fossil or renewable) seems unlikely.

Complements and conflicts with options for inclusion

Chile operates a liberalised electricity market comprising many privately owned companies involved in generation, transmission, and distribution (supply). In 2009, there were 35 generating companies in SIC and six in SING, although there was a high degree of concentration, with 90% and 50% of installed capacity, respectively, being owned by just three companies.²⁶ Regarding distribution, 29 companies supply SIC customers and four supply customers in SING. Again, though, the market is highly concentrated within a small number of companies.

Under the 1982 Electricity Law, two types of customers were established, defined as those with a connected capacity of more or less than 2,000kW. The former are required to negotiate directly with the generation or distribution company, whereas the latter must accept a regulated tariff from their local distribution company.

As of 2007, there were 10 coal plants in operation, and by 2009 a further 10 under construction, due to finish by the present date. They are relatively small by international standards, with a capacity of 100–400MW. There are around six large hydro plants with capacities in the region 300–600MW. We have not identified data for the number of gas and diesel plant. In general, however, as indicated by the structure of market participants, generation assets are distributed amongst many companies and are relatively small.

²⁴ International Energy Agency, 2009

²⁵ Ibid.

²⁶ Ibid.

There are two possible approaches to the determination of the obligated entity with regards electricity-related emissions: to obligate generators or consumers. From the perspective of consumption, the only existing basis for regulation is the market distinction for free and regulated consumers. This is not an unreasonable threshold – at 2,000MW this would relate to an annual consumption of 6,000MWh at an average consumption level of 33% peak demand, the same level as is used at organisation level to define participants in the UK Carbon Reduction Commitment for private companies and public bodies.

However, the consumption approach is extremely complex, and the system lends itself well to point of emissions obligations. It is not clear to us whether each individual operating company is likely to own multiple assets (apart from the small number of dominant companies, which do), therefore the decision on whether it is best to obligate companies or sites is not clear. However, under the arguments set out above, obligation at site level would lead to economies of scale for operators of multiple sites anyway.

The make-up of the generating companies does lead to questions regarding thresholds for inclusion. The small number of dominant companies would have an advantage over smaller generators since they are likely to have greater capacity for market participation as well as economies for scale. The transaction costs for smaller generators would be higher. This suggests careful consideration of the threshold for inclusion, whilst also balancing the need for carbon market liquidity.

Concentrated ownership of electricity generation assets in the hands of just a few big firms plus some very small ones also raises potential issues of market liquidity and power. However, this would be mitigation by the inclusion of other sectors in an ETS (if the scheme covered just energy and transport sectors plus selected industrial processes to start with, for example, that amounts the majority of Chile's projected GHG emissions with a significant combined mitigation potential) and by linking to schemes in other countries the future. Further, it seems likely that the main power generators will institute some form of internal market for intra-company trade in order to incentivise improvement in energy efficiency and the most cost-effective means of generation across the company.

A further consideration is the policy intent with regards to creating a carbon price signal for domestic and SME customers. The stratification of the supply market would seem to offer an opportunity to influence this price signal, through the means by which regulated customer tariffs are set. By contrast, however, the pass-through of carbon costs to unregulated customers would be determined by the market. Thus by obligating generators it would be expected that the larger mines and industry that make up the majority of electricity consumption would also experience a carbon price signal.

2.3.2. Industry

Sector overview

Mining plays a major part in the Chilean economy, being the second largest contributor to GDP (17%),²⁷ and the largest in terms of export value (approximately 50%).²⁸ The dominant mineral

²⁷ Departamento de Estudios Sociedad de Fomento Fabril, 2011

²⁸ Departamento de Estudios Sociedad de Fomento Fabril, 2007

is copper, with gold and molybdenum also significant. The export value of all three has benefited from high market prices in recent years.²⁹

Within other industries, the largest contributor to GDP is the food, drink, and tobacco sector, at 26% of the total. Other industries include chemicals, petroleum products, rubber, plastics, manufacturing equipment, and pulp and paper. The major exports other than mining include salmon and trout, fruit, and wood pulp. Significant GHG-emitting industries, however, are iron and steel, cement, and lime. They are discussed below with data derived from the United States Geological Survey (USGS) minerals handbook for 2010:³⁰

- Crude steel production is around 1.5 million tonnes per annum. The main production is by CAP S.A (a subsidiary of which operates two plants) and two further plants operated by Gerdau AZA S.A.
- Annual cement production in Chile is around 4 million tonnes. The USGS identifies around 20 major limestone quarries, mines, and associated plants (it is not explicit about which are clinker-production plants). It lists five cement-production plants owned variously by Melón S.A., Cementos Bío Bío S.A., and Industria Nacional de Cemento S.A (INACESA).
- Lime production is around 800,000 tonnes, most of which comes from plants operated by INACESA, with other production from a plant operated by Soprocál Calerías e Industrias S.A.

The prime sector of interest from the perspective of ETS will therefore be the mining industry, especially copper, because of its size and its importance to exports (which could be impacted by uncompetitive price increases). Consideration should also be given to the inclusion of iron and steel, cement, and lime industries, as well as other research into further industries (USGS also identifies significant production of gypsum and nitrates, for example).

Mitigation potential

Energy use in the copper sector is dominated by electricity and diesel, which amount to around 75% of energy consumed in the sector. In recent years, copper production has remained fairly static, whereas annual electricity consumption has grown by 5–10% per annum.³¹ Wood fuel is also used within the industry. Thus, there are in principle good opportunities for reducing emissions from copper mining through decarbonisation of the electricity sector in the north (which is dominated by coal and diesel) and switching to lower carbon primary fuels at the mines. Liquefied natural gas (LNG) infrastructure has developed over the last five years, with two terminals. Mejillones in the far north is a joint venture between GDF Suez and the state copper mining firm Codelco. There is potential to expand this infrastructure to supply more gas to industry and mining in the region, or to develop indigenous supply through the exploitation of shale gas reserves.³²

²⁹ Seitz, 2011

³⁰ United States Geological Survey, 2012

³¹ Instituto Nacional de Estadísticas, 2011

³² Jasmamie, 2012

Complements and conflicts with options for inclusion

Mining in Chile is dominated by large companies. For example, Codelco is a state-owned company and is the world's largest copper producer and second-largest molybdenum producer. Its website lists eight large mining complexes.³³ A joint-venture company, Compañía Minera Dona Inés de Collahuasi SCM, operates the Collahuasi open-pit mine, the world's fourth largest mine. Antofagasta plc is one of the world's largest private copper mining firms, which operates four copper mines and has interests in transport and water distribution. Escondida is a joint-venture mining operation with major interests held by BHP Billiton and Rio Tinto. The industry involves major copper-smelting operations and the manufacture of copper products is an important part of Chilean industry.

ETS coverage of industry must focus on how to treat mining, and copper mining in particular. From the above descriptions the following conclusions can be drawn:

- Mining, of copper is a major sector in Chile, consuming large amounts of energy. For the sector as a whole, there are likely to be opportunities to improve carbon intensity, either by fuel switching or possibly through efficiency improvements. This suggests mining should be included in an ETS.
- By the fact that the electricity-intensity of copper production is constantly increasing, the ETS price signal must be strong enough to support infrastructure investment in new energy supply systems and mining technologies.
- The high use of electricity means that carbon pricing should be designed so that a common price is applied to the use of primary fuels and electricity. This would avoid creating incentives to switch from one to another, and hence avoid the risk of carbon leakage from the system.
- Taking the above into account, either upstream or midstream approaches could be appropriate for the sector. However, there are two further issues that warrant further consideration in making this decision.
- The sector is exposed to international competition, and energy supply cost issues are threatening investments³⁴. This makes a strong case for allocation of emission allowances to mine operators, which itself requires permitting and some monitoring. There may be greater efficiencies in obligating at midstream.
- It is not clear whether there are fugitive methane emissions associated with mining, or whether it would be practical for these to be covered by an ETS. If this is desired, then midstream regulation may be favoured again.
- Mining operations appear to be concentrated in major complexes. We have not been able to establish the extent of smaller operations. Further work to understand the structure of the industry is necessary. Major companies each operate up to about 10 facilities although some operate only single sites. Either site or company-based obligation would work for a midstream approach. However, considering the experience

³³ Codelco, 2012

³⁴ MercoPress, 2012

of the Indian Perform, Achieve and Trade (PAT) scheme for major industrial emitters³⁵, a company-based approach appears to provide more benefits by:

- Providing greater flexibility to the operators;
- Preventing redundancies and extra costs in bureaucratic requirements by the company; and
- Reducing the effort at the end of regulator and dispute resolution body as the number of entities they need to deal with will be reduced.
- Further consideration needs to be given to the treatment of other industries, in particular iron and steel, cement and lime, each of which is concentrated into a small number of production plants and suitable for inclusion in the ETS. The process nature of the emissions (as opposed to purely combustion emissions) suggests it may be better to place an obligation at the point of emissions.

2.3.3. Transportation

Sector overview

Chile's transport sector is growing rapidly; final energy consumption grew at an average rate of 5.2% during the last decade.³⁶ GHG emissions from the transport sector make a major contribution to the national total, up to 35%. Within the sector, road transport dominates, accounting for nearly 70% of its final energy consumption. Water transport is next, at about 20%, and air transport at around 10%. Rail makes a small contribution. Private vehicles account for almost 87% of vehicles in the country (in 2007).³⁷ Within the commercial sector, freight transport is dominated almost entirely by road-based truck transport.

The drivers for Chile's growth in transport emissions are expected to fuel further increases. Sustained economic growth has led to motorisation, frequency and length of trips, shifts toward private motor vehicle travel, and a growth in air travel.

Chile has no significant domestic motor manufacturing industry and vehicle emissions standards would be expected to be influenced by international standards, especially those applying in the US and Europe. The transport sector relies almost entirely on petroleum based fuels, with a dominance of gasoline over diesel. There are modest examples of electric vehicle use and there is electrification in metro systems.

Mitigation potential

Overall, the transport system is a major contribution to emissions and in particular road transport. There is potential for emission mitigation against a business-as-usual scenario through improved efficiency of road transport. Further work would be required to understand the feasibility

³⁵ Dube et al., 2011

³⁶ International Energy Agency, 2009

³⁷ Global Fuel Economy Initiative, 2011

of, and investments required to achieve, a move towards greater rail-freight and public transport usage to reduce emission from trucks and private motor vehicles. It is, nonetheless, a strong candidate for inclusion in an emission trading system.

The aviation sector is growing and may offer opportunities for mitigation through improved vehicle standards and routing practices. The sector provides a significant input to the Chilean economy. The International Air Transport Association (IATA) has examined the economic impact of higher charges for aviation and found that increases in costs of travel to Chile could have much greater negative impact on GDP than the corresponding value of additional revenues.³⁸ This is driven by the competitive nature of international passenger travel, especially tourism. This needs to be taken into account when considering the cost impact of including aviation within a Chilean ETS.

Whilst water-based transport is a significant part of the system, further analysis is required to determine the split by use type and the benefits that could arise from including this in an emission trading system. Chile gains significant export value from fish products and consideration needs to be given to the competitiveness impacts associated with increasing costs for the domestic fishing industry.

Rail transport plays a small part in Chile. Whilst inclusion would be desirable from the perspective of a fair and consistent carbon price, it may be preferable not to include rail where the practical costs of doing so would be high, and if rail were seen as an inherently lower carbon option than road vehicle transport.

The costs of including transport in an emission trading system need to be considered alongside the existing pricing measures associated with transport fuel and other policies to incentivise more efficient modes of transport. These include:

- incentives for the purchase of hybrid vehicles
- vehicle fuel efficiency labelling
- import taxes
- transport fuel taxes
- value added taxes.

For further information on the mitigation potential of the transportation sector, see the report on PMR Activity 4.

Complements and conflicts with options for inclusion

The inclusion of road vehicles in an emissions trading system would be most efficiently achieved by obligating upstream in the fuel-supply chain, either at the fuel supplier level or at import/refinery. This may also be the case for other modes of transport, although vehicle operator obligation is possible for aviation (as in the EU ETS) or for larger ships.

³⁸ IATA Economics, 2007

Chile is a large importer of oil and oil products, with production amounting to only about 2% of demand, although a much greater proportion of transport fuel products are refined domestically.³⁹ There are three refineries in Chile, operated by ENAP. Sales of liquid fuels are dominated (60%) by COPEC, especially for motor fuels. The Luksic group (previous Shell assets) has the second largest share (15%), with Terpel and Petrobas (both regional suppliers) making up most of the remainder.

Upstream obligation could therefore focus on the suppliers of domestically produced or imported transport fuels, noting that this would comprise a small number of market participants, one of which has a dominant position in the fuel supply marketplace.

2.3.4. Forestry

Sector overview

Chile has 16 million hectares of forest, of which 86% are natural and 14% are plantations. Due to high rates of planting exotic species, Chile is one of the few countries with a growing forestry sector. The main export products – white pine timber, eucalyptus pulp, and sawn timber – come from plantations.⁴⁰

In 2007, the annual timber harvest reached 52 million m³, of which 73% or 38 million m³ was used for industrial purposes and 27% or 14 million m³ for energy. Of the wood used in industry, 98% comes from plantations, whereas 44% of that used for energy still comes from natural forests; the rest is from plantations and waste from primary and secondary industry. The forestry sector is Chile's second-largest exporting industry, behind only large-scale mining.⁴¹

Mitigation potential

Carbon sequestration and release can be monitored at low cost (and medium accuracy) through satellite monitoring of forests and use of regional carbon tables by species. This could be supplemented by more detailed information provided by landowners where the benefits outweigh the cost of the information (e.g. for larger forestry blocks). The Intergovernmental Panel on Climate Change (IPCC) offer guidelines⁴² on different levels of quantification of emissions – similar to the EU ETS fallback approaches for industries without product benchmarks – which are provided below:

- Tier 1 uses default emission factors (indirect estimation of the emissions based on canopy cover reduction) for forest activities (“activity data”) that are collected nationally or globally.
- Tier 2 applies emission factors and activity data from country-specific data.

³⁹See summary of Chilean oil market in International Energy Agency (2012).

⁴⁰ Raga (2009)

⁴¹ Ibid.

⁴² Murdiyarso et al, 2008

- Tier 3 uses methods, models, and inventory measurement systems that are repeated over time, driven by high-resolution activity data and disaggregated subnationally at a finer scale.

It follows that a simplified, transparent approach could be possible, which would include the major sources of emissions.

However, information in Chile is quoted as uncertain because these methods differ to those of other sectors and there are inherently unpredictable elements such as the climate and forest fires. Further, because of the variability in the forestry sector, predictions on the remaining mitigation potential differ between sources.

There is overall agreement that forestry acts as a net carbon sink, counteracting Chile's emissions in other sectors. While forestry is expected to continue to act as a carbon sink, the mitigation potential is predicted to decline, with the University of Chile quoting a carbon sink of approximately 35 million tonnes of CO₂e in 2010 and 25 million tonnes of CO₂e in 2020.⁴³ This decline is a result of diminishing fertile lands available for plantations. Much of the country's more productive land, which had suffered from erosion and degradation in the past due to agricultural practices, has already been reforested: some 1.76 million hectares, or 84% of the planted land.⁴⁴

Complements and conflicts with options for inclusion

In the forestry sector, harvesting timber and forest fires are sources of emissions, whilst planting new trees and conversions and abandonment of land sequester carbon. The net effect of these factors in Chile is a carbon sink of approximately 36% of Chile's total emissions in 2006.⁴⁵

If only the sequestration potential of the Chilean forestry sector were included in an ETS large quantities of units/credits would be generated (depending on the criteria for generating new units/credits, and based on current projections), which may have an unpredictable effect on the emissions unit price. Conversely, forestry could be a net emitter under the scheme if only the deforestation activities were included. Without ensuring appropriate obligations, perverse incentives will be created for shifting between forest types, most detrimentally from plantations towards native species and illegal logging. If it is possible to include both afforestation and deforestation, balanced emission price incentives can apply both to discourage deforestation and encourage afforestation, and this can provide the right incentives to increase net carbon sequestration and avoid perverse outcomes.

Liability for deforestation emissions and credits for afforestation removals are best borne by landowners, because they control long-term land use and so can most easily ensure that an efficient decision is made at the end of a rotation. If existing forest owners were held liable for deforestation at the end of a rotation when their forestry right ends, they would be in an extremely weak bargaining position with the landowner. In addition, landowners are easier to identify and track than forest owners. The administrative feasibility of awarding credits for afforestation and managing liabilities for deforestation is relatively straightforward for the large landowners who dominate the

⁴³ University of Chile, 2009

⁴⁴ Raga, 2009

⁴⁵ Chilean Ministry of Environment, 2011

industry, but may be complicated for smaller operators planting or clearing trees. Some of these issues can be managed through establishing appropriate *de minimis* thresholds for inclusion.

Of the 52 million m³ of wood mentioned above that was produced in 2007, 73% was then manufactured by industry. Wood manufacture in Chile is an oligopolistic market: 80% of the pulp, paper, and wood is manufactured by 10% of the market players, the largest being ARAUCO, CMPC, and Masisa.⁴⁶ Further, these players also own the forest land that generates the wood as a consequence of the major privatisation of forests in Chile in the 1970s. Given that the majority of the forestry industry involves the same companies producing and manufacturing the wood, in a scheme that omits smaller operators the point of obligation is inconsequential.

The other 27% of wood produced, 14 million m³, is used for energy. Of this energy, a very small proportion is used for electricity generation, slightly more is used in industry boilers for heat, and the majority is used in the Commercial, Public and Residential (CPR) sector. By obligating the landowners, all of these energy uses and the manufacturing industries described above would be covered upstream of the wood's use as energy, rather than at the point of combustion. This may work if an upstream system is applied to other sectors as well. However, if electricity and industrial heat generation are obligated at the point of emissions, it is important to ensure the emissions from bioenergy use are appropriately accounted for to provide the right incentives, based on whether or not the emissions are covered upstream or at the landowner level.

If the forestry emissions are covered such that there is a liability for depletion of carbon stocks at the landowner level (or elsewhere along the wood distribution chain), the system would need to be designed to avoid double-counting where both forest owners pay upstream and electricity generators pay at the point of emission. Further, if industrial process emissions and on-site generation are obligated at point of emission, there would be a similar need to avoid double-counting between industry and landowners. Such double-counting could be avoided by simply excluding emissions from wood biomass from any liability faced at the point of combustion.

On the other hand, if emissions are not covered upstream in the forestry sector (or along the wood distribution chain), then it is important to ensure that the emissions from bioenergy use are covered at the point of combustion to avoid perverse results. The EU ETS and most existing ETS and proposed systems that do not cover the forest and land-use sector have made the mistake of covering fossil energy emissions but then not covering bioenergy emissions at the point of combustion (when they are also not being covered anywhere else). This has the potential to create perverse incentives to deplete forest stocks on the landscape for combustion as an unregulated energy source. Such "leakage" of emissions from a covered to an uncovered sector could significantly undermine national emissions reduction goals. If bioenergy emissions are covered at the point of combustion, a possibility is to design a complementary system of offset credits, accruing to either the producers or users of bioenergy feedstocks, which would create incentives for the production and use of more carbon-reducing bioenergy feedstocks. These credits would reward bioenergy production based on activities that build up carbon stocks (e.g. through afforestation or improved forest management) or that reduce emissions (e.g. from the removal of residues).

In summary, as in the NZ ETS, the most appropriate point of obligation for the forestry sector in Chile would most likely be the landowners. Special consideration may be needed across an

⁴⁶ LIGNUM, 2012

ETS to avoid double-counting of wood used as energy (and possibly to account properly for wood products), but in doing so it is important that perverse incentives are avoided.

2.3.5. Waste

Sector overview

The waste sector in Chile emitted 2.5 million tonnes of CO₂e in 2006, or 4% of the national total greenhouse gas emissions.⁴⁷ Emissions from waste are expected to increase to 5.4 million tonnes of CO₂e, but the percentage of the total is expected to decline slightly by 2020 to 3.5%.⁴⁸

The largest contributor to emissions from waste is municipal solid waste at 92%, which also has the best availability of data. This is because the method of disposal is landfill, which leads to high emissions of methane, a gas with a high GHG potential.

In terms of gases, methane contributes to 96% of the sector's emissions. Methane emissions are produced from municipal solid waste when landfilled, and are therefore proportional to the populations of various regions. In 2007, Region XIII, including Santiago the capital, contributed to 31% of emissions, with Region VIII (south of Santiago) at 18% and, to a lesser extent, Region V (immediately north of the capital) with 11% and Region II (to the north) with 8%.⁴⁹

Wastewater, hospital, and sewage waste treatment emissions contribute only minor proportions of the total emissions from waste.

In terms of size distribution, the waste sector is made up of hundreds of similarly sized organisations, in contrast to other sectors discussed, such as power generation and forestry.

Mitigation potential

Information on the mitigation potential in the waste sector in Chile is limited. That said, methane capture from landfill sites is well practised in the developed world and could be incentivised in Chile in the long term by a market-based measure.

Complements and conflicts with options for inclusion

In the waste sector, the most suitable point of obligation is the point of emissions, i.e. the landfill site. This is because the methane is produced by biodegradation of a multitude of waste products that could not be attributed accurately at any point further upstream. The landfill site owner is also in the best position to reduce emissions.

Data availability on emissions from the waste sector is reasonably reliable, and given the long-term nature of projects to capture landfill gas, early inclusion in a market-based measure would be preferable. With methane being the main focus, all greenhouse gases should be included in the scheme if waste is to be included.

⁴⁷ Chilean Ministry of Environment, 2011

⁴⁸ Chilean Ministry of Energy, 2011

⁴⁹ For the regions of Chile, see http://en.wikipedia.org/wiki/Regions_of_Chile.

2.3.6. Agriculture

Sector overview

The agricultural sector is made up of thousands of participants across crop and livestock farms. Emissions in 2006 were 13.8 million tonnes of CO₂e, or 23% of the country's total. Whilst emissions from agriculture are expected to increase to 30 million tonnes of CO₂e, the proportion will fall to 20% by 2020.⁵⁰ The increase in emissions is caused by higher intensity of agricultural practices, leading to an increased use of agrochemicals, including nitrogen fertilisers, and increasing pig, poultry and swine populations. Rice production is low emitting, and burning of agricultural residues is also a small contributor due to effective environmental standards.⁵¹

Regionally, agricultural emissions show two peaks corresponding to regions IX and X, indicating the strong impact of domestic livestock on emissions. Cattle contributes mainly towards methane emissions, while pigs contribute to nitrous oxide – the main source of greenhouse gas emissions. The main contributor to nitrous oxide however is cultivation of fertilised soils, at 56% of total greenhouse gas emissions.⁵²

Mitigation potential

There is little literature on the mitigation potential for agriculture in Chile. The main sources of emissions are nitrous oxides from fertiliser use and pig farming, and methane emissions from cattle farming. These sources are inextricably linked to output, meaning mitigation options would theoretically come from more sustainable farming practices.

Complements and conflicts with options for inclusion

Given behaviour change is the most promising option for emissions reduction, obligating at the point of the farm owner is most appropriate for the livestock emissions in the agricultural sector. This would require a large number of participants whom currently have incomplete data sets, for example livestock counts are undertaken only every 10 years.⁵³ This would suggest agriculture is not a sector to be included in the early stages of a market-based measure. To enable the inclusion of agriculture, all greenhouse gases should be included in the scheme from the start if possible.

Regulating emissions from fertilisers at the point of production/import could be more feasible to administer than a farmer-level obligation. In this instance, the fertiliser producers/importers would have to pay an emissions price for the nitrous oxide associated with the use of their products by farmers. Depending on the industry structure and farmers' ability to absorb cost increases, the emissions cost may be passed through to the farmers, encouraging more efficient application of fertiliser.

⁵⁰ Chilean Ministry of Energy, 2011

⁵¹ Chilean Ministry of Agriculture, 2010

⁵² Ibid.

⁵³ Ibid.

2.4. Framework for Government Decisions

2.4.1. Straw man options for Chile

For Chile, decisions on the design of a market-based measure will require careful consideration by the government and consultation with stakeholder groups. However, in order to allow ideas to be tested more thoroughly, we have suggested straw man options for coverage and regulated entity to be explored further.

For certain sectors, the point of obligation is the same in both straw man proposals – reasons are provided in the previous sections for corresponding sectors on why alternatives are not suitable in Chile.

The two sectors with differing points of obligation are non-transport energy and forestry. Regulating non-transport energy is complex, and both options provide benefits that can be explored in the use of the straw man proposals. The pros and cons of both options are discussed in detail in section 2.1.3 above.

Obligating the forestry sector at the manufacturer complements an upstream energy approach because it avoids double-counting of wood that is used for energy. If, however, non-transport energy is obligated at the point of emission – as in option 2 – use of wood as energy is likely to be excluded from the scheme as a small emissions source. Option 2 therefore allows for including these emissions with little administrative burden by obligating the forest owners. Wood used in manufacturing is still included because manufacturers own their forests.

Table 2.2: Straw man options

Sector	Point of obligation – option 1	Point of obligation – option 2	Emissions/entities
Non-transport energy (electricity generation and, potentially, iron and steel, cement, and lime as “tier 1” industries)	Upstream, i.e. point of production/import (potential limitation of electricity to SIC and SING)	Point of emission (e.g. power stations, industrial sites) but excluding smaller emitters such as households (potential limitation of electricity to SIC and SING)	Electricity (34%)/c. 30–40 generation and supply companies, with dominant players Tier 1 industries – c. five major production sites in each sector
Transport	Upstream		35% emissions/numerous emitting sources, energy breakdown: 70% road; 20% water; 10% air; insignificant rail
Industrial processes (i.e. process emissions, e.g. in “tier 1” industries)	Point of emission (e.g. industrial sites)		Tier 1 industries – c. five major production sites in each sector

Sector	Point of obligation – option 1	Point of obligation – option 2	Emissions/entities
Non-CO ₂ agriculture	Farmer (livestock), producer/importer (fertilisers)		
Non-CO ₂ waste	Landfill operator		
Forestry	Landowner		

2.4.2. Priorities for further research

Further research will be required in order to determine the final points of obligation and regulated entities that are appropriate for the sectors in Chile. The research should build on the principles highlighted in this report by providing evidence for the suitability of different options within sectors. Below is a summary of areas for further research identified in this project:

Specific data requirements

- information on the number of gas and diesel plants and their associated output
- capacity for renewable generation
- size distribution of the organizations within different sectors in order to determine the administration of upstream with allocation based on emissions versus midstream for both.

Strategic topics for consideration in Chile

All sectors:

- the level of price signal needed to support infrastructure investment in new energy supply systems and mining technologies.

Energy sector:

- evidence of the perceived benefit of site managers in effecting a greater level of change if targeted directly by a point of emissions carbon price. This is as opposed to a carbon cost passed through from upstream, which may be incurred by financial personnel. As part of this, whether each individual electricity company owns multiple assets and therefore whether it is best to obligate companies or sites.
- potential to expand the LNG infrastructure to supply more gas to industry and mining in the region, or to develop indigenous supply through the exploitation of shale gas reserves
- opportunities to improve carbon intensity, either by fuel switching or possibly through efficiency improvements in the copper sector.

Industry sector:

- industries in Chile strongly exposed to overseas trade and therefore highly sensitive to any competitive disadvantage
- the level of fugitive methane emissions associated with mining.

Transport sector:

- understanding the feasibility of, and investments required to achieve, a move towards greater rail-freight and public transport usage to reduce emission from trucks and private motor vehicles
- further analysis to determine the split by use type and the benefits that could arise from including water-based transport in an emission trading system. Chile gains significant export value from fish products and consideration needs to be given to the competitiveness impacts associated with increasing costs for the domestic fishing industry.

Forestry sector:

- current and future predictions for the carbon sequestration and release in the forestry sector.

Agriculture sector:

- structure of fertiliser producer and import markets and ability of farmers to absorb costs if the point of obligation for fertiliser emissions was placed upstream
- possibilities for improving frequency of livestock data collection, or using different methods.

Waste sector:

- research on mitigation potential of existing and new landfill sites.

2.5. References

- AEA. 2011. "Climate Change Agreements: Results of the Fifth Target Period", *Report for the Department of Energy and Climate Change*, Department of Energy and Climate Change, London, UK. Available at <http://www.decc.gov.uk/assets/decc/11/cutting-emissions/cca/3366-cca-5th-target.pdf>
- Chilean Ministry of Agriculture. 2010. "Complementos y Actualización del Inventario de Gases de Efecto Invernadero (GEI) para Chile en los Sectores de Agricultura, Uso del Suelo, Cambio de Uso del Suelo y Silvicultura, y Residuos Antrópicos", *Informe Final*. Available at http://www.sinia.cl/1292/articles-50188_recurso_2.pdf
- Chilean Ministry of Energy. 2011. *Opciones y Análisis de Mecanismos de Mercado para la Reducción de Emisiones de Gases de Efecto Invernadero: Factibilidad de Implementación de un Sistema de Transacción de Emisiones en Chile*. Santiago: Ministerios de Energía.

- Chilean Ministry of Environment. 2011. *Segunda Comunicación Nacional de Chile ante la Convención Marco de las Naciones Unidas Sobre Cambio Climático*, UNFCCC, Bonn, Germany. Available at http://unfccc.int/resource/docs/natc/snc_chile_spanish.pdf
- Codelco. 2012. “Operaciones”. Available at http://www.codelco.cl/prontus_codelco/site/edic/base/port/operaciones.html
- Departamento de Estudios Sociedad de Fomento Fabril. 2007. “Leading SOFOFA Activities”, SOFOFA, Santiago, Chile. available at http://www.sofofa.cl/english/figures_2008.pdf
- Departamento de Estudios Sociedad de Fomento Fabril. 2011. “Structure of Industry in Chile Statistics”, SOFOFA, Santiago, Chile. Available at <http://web.sofofa.cl/informacion-economica/indicadores-economicos/estructura-de-la-industria/>
- Dube, S., R Awasthi and V. Dhariwal. 2011. “Can the Learnings from International Examples Make the ‘Perform Achieve and Trade (PAT) Scheme’ Perform Better for India”, *Discussion Paper*, Emergent Ventures International, Haryana, India. Available at <http://www.emergent-ventures.com/docs/A%20Discussion%20Paper%20on%20India-s%20Perform%20%20Achieve%20and%20Trade%20%28PAT%29%20Scheme.pdf>
- Global Fuel Economy Initiative. 2011. “Cleaner, More Efficient Vehicles”, available at http://www.unep.org/transport/gfei/autotool/case_studies/samerica/chile/cs_sa_chile.asp#p14
- IATA Economics. 2007. *Economic Benefits from Air Transport in Chile*, Montreal and Geneva: IATA. Available at http://www.iata.org/whatwedo/Documents/economics/air_transport_chile.pdf
- Institute for European Environmental Policy. 2004. “Business Action on Climate Change: Where Next After Emissions Trading?”, *Working Paper and Literature Review*, Institution for European Environmental Policy, London. Available at <http://www.ieeplondon.org.uk/assets/241/wherenextafteremissionstradingworkingpaper.pdf>
- Instituto Nacional de Estadísticas. 2011. “Anáisis del Comportamiento del Consumo Eléctrico y la Actividad Minera”, available at http://www.ine.cl/canales/menu/publicaciones/estudios_y_documentos/estudios/mineria_y_consumo_electrico.pdf
- International Energy Agency. 2009. *Energy Policy Review: Chile*. Paris: OECD/IEA. Available at <http://www.iea.org/textbase/nppdf/free/2009/chile2009.pdf>
- International Energy Agency. 2010. “Reviewing Existing and Proposed Emissions Trading Systems”, OECD/IEA, Paris. Available at http://www.iea.org/Textbase/npsu/ets_paper2010.pdf
- International Energy Agency. 2012. “Oil and Gas Security: Chile”, OECD/IEA, Paris. Available at http://www.iea.org/publications/freepublications/publication/Chile_2012.pdf
- Jasamamie, Cecilia. 2012. “Shale Gas Most Likely Solution to Chilean Mining Industry’s Energy Supply Deficit: Report”, Mining.com report. Available at <http://www.mining.com/shale-gas-most-likely-solution-to-chiles-mining-industry-energy-supply-deficit-report/>

- LIGNUM. 2012. “Exportaciones 2011: Récord Histórico”, LIGNUM, Santiago, Chile. Available at <http://www.lignum.cl/exportaciones/2011/Diciembre.pdf>
- Mercopress. 2012. “High Cost and Scarcity of Electricity Threatens Chile’s Massive Investments in Copper Industry”, available at <http://en.mercopress.com/2012/04/25/high-cost-and-scarcity-of-electricity-threatens-chile-s-massive-investments-in-copper-industry>
- Murdiyarso, D., M. Skutsch, M. Guariguata, M. Kanninen, C. Luttrell, P. Verweij and O. Stella. Intergovernmental Panel on Climate Change. 2008. “Measuring and Monitoring Forest Degradation for REDD: Implications of Country Circumstances”, *Infobrief No. 16*, Center for International Forestry Research, Bogor, Indonesia. Available at http://www.cifor.org/publications/pdf_files/Infobrief/016-infobrief.pdf
- Raga, Fernando. 2009. “The Chilean Forestry Sector and Associated Risks”, *Trebol* 51, pp. 10–19. Available at <http://www.mapfre.com/mapfrere/docs/html/revistas/trebol/n51/docs/Revista-TREBOL-51-en.pdf>
- Seitz, Jackie. 2011. “Chile Exports Increase 30% in 2010, Led by Copper and Lumber Sales”, *Santiago Times*, 8 February 2011. Available at <http://en.mercopress.com/2011/02/08/chile-exports-increase-30-in-2010-led-by-copper-and-lumber-sales>
- U.S. Environmental Protection Agency. 2009. “Waxman-Markey Discussion Draft Preliminary Analysis: EPA Preliminary Analysis of the American Clean Energy and Security Act of 2009,” U.S. Environmental Protection Agency, Washington, D.C. Available at <http://www.epa.gov/climatechange/EPAactivities/economics/legislativeanalyses.html#waxmanMarkey>
- U.S. Geological Survey. 2012. *2010 Minerals Yearbook*, United States Geological Survey, Reston, VA. Available at <http://minerals.usgs.gov/minerals/pubs/country/2010/myb3-2010-ci.pdf>
- University of Chile. 2009. “Energy Consumption, Greenhouse Gas Emissions and Mitigation Options for Chile, 2007–2030”, Program for Environmental Economics and Management, Department of Industrial Engineering. Santiago, Chile. Available at <http://www.energycommunity.org/documents/Aplicacion%20de%20LEAP%20en%20Chile,%202010.pdf>

3 Setting the Level of Ambition

Key findings:

How is ambition determined in an ETS?

- The government will need to decide on a level of ambition for emission reductions and prices in the ETS that is compatible with its national GHG mitigation and economic objectives, is politically acceptable domestically, and (as relevant) is acceptable to desired linking partners. In particular, the government needs to consider whether it wishes to control domestic emissions or contribute to global emission reductions through a combination of domestic effort and investment abroad, and whether it wishes to expose the economy to international market prices over time or maintain a divergent domestic price (lower or higher) to achieve its own policy agenda. The government can have a combination of objectives and decide which take precedence.
- The government's objectives for setting ETS ambition may vary according to the evolution of the international carbon market. Key international drivers will include whether countries reach a collective agreement on ambition and on top-down rules governing ETS linking and the use of approved foreign offsets to meet international commitments. However, bilateral or regional linkages could continue to operate within a top-down system, and countries could choose a level of ambition for their domestic ETS that diverges from their international commitments for strategic reasons. The specific nature of Chile's linking opportunities may be a more significant external driver of Chile's domestic ETS ambition than whether the broader international market evolves top down or bottom up and whether countries reach a collective agreement on ambition.
- Strategically, Chile could stand to benefit from applying a higher level of ambition to its ETS. It would clearly demonstrate Chile's commitment to an ambitious outcome in the international negotiations and reinforce the environmental credibility of the ETS, which could facilitate linking. It could also be used to leverage increased foreign investment in mitigation activity in Chile. However, there would also be a risk that Chile could expose its economy to a disproportionate impact if other countries failed to follow Chile's lead. In this context, Chile could consider signalling a level of ambition for its ETS that was conditional on the level of international support (financial and otherwise) and the level of ambition adopted by prospective linking partners and other countries more broadly.
- Under an ETS, the core obligation is for ETS participants to surrender to the government a number of emission units (sometimes referred to as emission permits or allowances) equal to the quantity of emissions for which they are liable. As a first step in deciding ambition, the government needs to set a cap on the number of ETS units that it will allocate into the market. The cap chosen for the ETS must be clear and binding. The cap represents Chile's contribution to global emissions from the sectors covered under the ETS. While emissions by sources covered under the ETS can differ from the cap, based on decisions to hold units for the future or to buy and sell units internationally, the limits applied by the government to all of these activities will decide the overall level of ambition for emission reductions in the ETS.

- While a Chilean ETS could, by itself, be a major development and contribution to the global momentum for action, if Chile wants its ETS to generate a net global emission benefit relative to business-as-usual and make its units acceptable to external buyers, then the cap should be set at a level that requires some amount of uncredited domestic emission reduction below projected business-as-usual before excess ETS units become available for international trading. Moreover, even if linking options are limited in the near term, Chile should aim to set its cap below business-as-usual to ensure that units are domestically scarce, reductions are real, and the system is credible to potential external buyers. The level of reduction below this depends on Chile's international objectives.
- The level of ambition of the government's cap on allocation can be based on a desired nationwide ambition level (top down) or through sector-by-sector analysis of the appropriate contribution (bottom up). Either way, the cap level can be evaluated relative to historical or projected emissions or on an emission intensity or cost basis, and can change in a defined way over time. The government may want to consider selecting multiple reference points, instead of a single point, to provide a broader perspective on the stringency of its ETS. The government's strategic goals, linking options, and the availability of data will influence the choice of cap.
- The pricing ambition of an ETS is defined by both the market price and the level of exposure of specific ETS participants to the market price. The government can use different price stabilisation mechanisms to contain or control the overall domestic emission prices relative to international market prices. The degree of emphasis on these controls will determine whether they operate inside or outside of the cap. The balance among ETS objectives and with concerns about the cost of rapid economic change will influence this choice.
- In the face of inherent uncertainty about future emissions and mitigation costs, a key design question faced by the government will be whether to allow the market to determine freely the price of units and the impact on Chilean consumers, or whether to limit the price range through price-ceiling and/or price-floor mechanisms that automatically adjust the cap. Such mechanisms limit uncertainty about prices and impacts, but create uncertainty about the cap and may affect the ability of Chile to sell units into another ETS.
- Whatever the chosen emission cap, the government should aim to provide market participants with near- to medium-term certainty about emission constraints and signal expectations for emission prices. In addition, it should send a clear signal regarding its commitment to increasingly stringent emission pricing over time, but allow adjustment as national circumstances evolve.

Relationship between the ETS cap, linking, and price stabilisation in setting ambition

- The effects of the choice of cap depends heavily on how closely the ETS is linked to international markets and how the cap interacts with emission pricing stabilisation mechanisms.

- If the ETS has a link that allows sales and the external market price is higher than the cost of reductions in a closed domestic system, ETS participants as a group will reduce their domestic emissions below the cap and sell the excess units abroad. However, the domestic market price will rise to meet the external market price; participants will likely not sell units domestically at a lower price they can get abroad. This will increase domestic price impacts on emitters and consumers but increase the reward to those who mitigate or receive excess free allocation.
- Similarly, if the ETS has a link that allows Chile to buy units, then the cap will limit the net global emissions ETS participants are responsible for but will not limit their net domestic emissions. ETS participants will be able to increase their domestic emissions above the cap and purchase approved foreign units to help meet their obligations. If the international price is lower than the closed domestic market, linking will lead to lower domestic emission prices and impacts on emitters and consumers, and lower rewards for those who mitigate.
- With international linking as both a potential buyer and seller, the stringency of the domestic cap will serve primarily as a distributional mechanism. If Chile is a net seller of units internationally, the cap is a key determinant of the balance between domestic mitigation funded from within Chile versus by foreign sources. If Chile is a net buyer, the cap balances the mitigation within and outside of Chile that is funded by Chileans.
- If the ETS is not linked internationally then the cap will limit the net domestic emissions contributed by ETS participants (with the possible addition of units from domestic offset/crediting mechanisms). Without additional measures, a domestic cap will set the price of units, although that price will be uncertain.
- The factors driving unit supply, demand, and prices in Chile's market will be unpredictable over time, raising the risk that the ETS will lead to a higher or lower price than anticipated or desired.
- Without international linkages in particular, but even with them, if the government wants to protect entities against large changes in the emission price, it will need to use emission pricing stabilisation mechanisms. Price caps and different reserve designs can manage the risk of high emission prices, but can have implications for achievement of a fixed level of emissions. Fundamentally, the government needs to decide whether emissions quantity or emissions price will take precedence as the ultimate constraint on the ETS, with implications for the ability to demonstrate comparability and linkage with other schemes. Any price stabilisation mechanism also has implications for the use of banking.
- Setting an ETS emission constraint or creating an international linkage that leads to a higher price than that of major, unregulated trading partners could create a competitive disadvantage for Chile's emissions-intensive trade-exposed producers. In principle, this can be mitigated through other measures, but should remain an important consideration for the government.

3.1. Background on Setting the Ambition of an ETS

3.1.1. General context for design of this component in an ETS

This chapter examines options for setting the level of ambition of the emission reductions and emission prices to be achieved by an ETS in Chile. The process of setting ETS ambition can be one of the most challenging elements of scheme design. The ambition of the emission reductions for which Chile is willing to take responsibility will depend on the anticipated cost to the economy as a whole as well as the cost to specific groups. The ambition of the emission price Chile would like to introduce into its economy in the short and long term will depend on assessments of likely long-term emission prices, Chile's ability to adapt to a high emission price, and the strategic advantage of introducing a strong long-term price signal through a short-term price. The level of ambition needs to emerge from a political process. It will depend on domestic advocacy, international opportunities, and pressures both from countries and through markets.

An ETS can be designed to constrain domestic emissions and enhance forestry and other sinks to achieve a specified domestic target level of emissions cost effectively. Alternatively, an ETS can be designed to expose domestic emissions and sinks to the international price of emissions (via linking to other markets) without representing a limit by itself on domestic emissions. Under the second model, a "responsibility target" is set, whereby regulated entities are required to account for their emissions by redeeming the equivalent number of eligible units under the scheme (which may include domestic and international units), and excess units can be sold abroad. In a global marketplace with linked ETS under agreed caps, incentivising mitigation where it is at lowest cost and production where it is most emission-efficient (through purchase of international units to meet part of the domestic compliance obligations) may increase emissions in some countries while still producing a net reduction in global emissions for the benefit of all. The first model focuses primarily on ambition in terms of domestic emission reductions, while the second focuses on a price signal that drives production to the point where it is most efficient for global benefit.

The constraint on the level of domestic emissions allowed within an ETS over a specified period of time is determined by the following factors:

- the chosen cap on the government's allocation of units into the ETS, with any provisions that loosen or tighten the cap in response to concerns about costs
- the ability of ETS participants to bank and/or borrow units between years to help meet ETS obligations
- the ability of ETS participants to sell ETS units externally and/or to surrender external units (i.e. units from domestic or international offset/crediting mechanisms and/or linked ETS) to help meet ETS obligations.

The limits applied by the government to all of these activities will decide the overall level of ambition for emission reductions in the ETS. This is illustrated in Figure 3.1 below.

Figure 3.1: Total constraint on domestic emissions in an ETS

Total constraint on domestic emissions over a specified period	=	The cap on ETS units allocated by the government
		+ units purchased externally (offsets, linked ETS)
		+ ETS units banked from earlier periods
		+ ETS units borrowed from later periods
		– ETS units sold externally
		– ETS units banked for future use
		– ETS units borrowed from earlier periods
		± units from any price stabilisation system outside the cap

What is the cap on allocation?

Under an ETS, the core obligation is for ETS participants to surrender to the government a number of emission units equal to the quantity of emissions for which they are liable. As a first step in deciding ETS ambition, the government needs to set a cap on the number of ETS units that it will allocate into the market. The cap represents Chile’s targeted contribution to global emissions from the sectors covered under the ETS. If the actual domestic emissions from ETS sectors are higher than the cap, then the obligated entities in the ETS must purchase units from outside the ETS or surrender banked or borrowed units to cover the difference. If the actual domestic emissions from ETS sectors are below the cap, then excess units can be banked for future use or sold outside of the ETS.

Note that the use of the term “cap” has varied across schemes internationally. In the context of this report, following the Partnership for Market Readiness (PMR) convention, the term “cap” refers to the government’s total allocation of ETS units, whether through free allocation, auction or crediting of removals (e.g. from afforestation activities or carbon capture and storage). It does not refer to any limits placed on participants’ surrender of foreign units to help meet ETS obligations or sale of ETS units abroad, which contribute to the overall constraint on emissions in the domestic economy. Nor does it refer to the actual level of domestic emissions, which can be lower or higher than the cap on allocation.

The level of ambition of the government’s cap on allocation can be set using a top-down or bottom-up process, it can be measured relative to historical or projected emissions on an emissions intensity basis and/or on a cost basis, and it can change in a defined way over time. The government’s strategic goals, linking options, and the availability of data will influence the choice of cap.

3.1.2. Lessons learned from other ETS

The leading ETS have all applied different approaches to setting the level of emissions in their schemes, reflecting differences in their objectives and their national/local circumstances. Most schemes have sought to constrain emissions by limiting the allocation of ETS units and the sources and/or quantities of external units that can be used. In some cases, these constraints were designed

to operate in conjunction with price protection measures that can increase the allowed level of emissions.

Table 3.1: How other ETS have constrained emissions

ETS	Design constraints on the level of emissions
EU ETS	<ul style="list-style-type: none"> For Phases 1 and 2, the cap was set by Member States in their National Allocation Plans following criteria defined in the EU ETS Directive. Key criteria included consistency with Member States' Kyoto obligations, the potential to reduce emissions under the scheme, and non-discrimination against companies and sectors.⁵⁴ Banking was not allowed beyond Phase 1. In Phase 2, the cap equated to a 6.5% reduction of absolute emissions compared to 2005 levels. Banking, but not borrowing, was allowed between Phase 2 and Phase 3. Beyond the cap on allocation, each Member State set a limit on the surrender of imported Joint Implementation/Clean Development Mechanism (JI/CDM) credits, and unused entitlements could be transferred to the next phase.⁵⁵ For Phase 3, an EU-wide cap has been defined annually from 2013 to 2020. The stringency was guided by the EU emission reduction target for that period (20% reduction below 1990 levels by 2020) and the relative contribution from sectors regulated under the ETS. In 2013, the cap is the average level of allowances in the Phase 2 cap, adjusted for changes in the ETS coverage. In subsequent years, the cap is reduced at a linear rate of 1.74%.⁵⁶ This cap structure will produce a 21% reduction in the EU ETS sector emissions compared to 2005 by 2020.⁵⁷ Banking but not borrowing of EUAs is allowed between phases. Between 2008 and 2020, the EU ETS legislation provides for use of JI/CDM credits up to 50% of the overall reductions below 2005 levels made under the EU ETS.⁵⁸
NZ ETS	<ul style="list-style-type: none"> For 2008–2012, the NZ ETS operates within the Kyoto cap by requiring every NZU to be matched by a Kyoto unit at the end of the Protocol's true-up period. It does not have a separate domestic cap on allocation or emissions. From 2008 to 2012, free units have been allocated to forest owners on a per-hectare basis by land type, to eligible owners of fishing quota on an absolute basis, and to eligible industrial producers on an intensity basis using performance benchmarks. For price protection, participants can purchase unlimited units at a fixed price of NZ\$25 per tonne. No limit applies to the quantity of eligible foreign Kyoto units that can be surrendered to meet obligations, but some limits apply to sources. No limit applies to banking NZUs other than those purchased at fixed price, for which banking is prohibited. Borrowing is allowed only to the extent that participants can surrender freely allocated units issued prior to the compliance date for the previous year to help meet their obligations in the previous year. In 2012, the government has proposed legislative amendments to provide for auctioning post-2012, to introduce a domestic cap on allocation (including free

⁵⁴ Directive 2003/87/EC of the European Parliament and of the Council as of 13 October 2003, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:275:0032:0046:EN:PDF>

⁵⁵ Directive 2004/101/EC of the European Parliament and of the Council of 27 October 2004, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:338:0018:0023:EN:PDF>

⁵⁶ European Commission, 2011

⁵⁷ European Union, 2008

⁵⁸ European Commission, 2010

ETS	Design constraints on the level of emissions
	allocation and auction), and to remove the requirement to back NZUs with Kyoto units. It has not proposed to set a quantitative limit on the import of foreign units. ⁵⁹
AusCPM	<ul style="list-style-type: none"> • No cap on the quantity of emissions will apply during the initial fixed-price phase of the scheme (FY2012 to FY2014). The price will change from Aus\$23.00 per tonne in 2012/2013 to Aus\$24.15 in 2013/2014 and Aus\$25.40 in 2014/2015. • Starting with the first flexible-price phase (FY2015 to FY2018), the government will set annual caps for five-year periods, extending the cap by one year every year. The government will have regard to criteria including, among others, Australia's international obligations and national targets, and progress toward meeting those targets. A default cap guided by Australia's unconditional domestic target (to reduce its GHG emissions by 5% compared to 2000 levels by 2020) will apply in the event the Parliament cannot agree on a cap. For the first three years of this phase, a price ceiling will operate that could allow ETS emissions to exceed the cap.⁶⁰ Although the scheme initially contained a price floor, this will be removed and the price ceiling will be modified as part of a linking agreement with the EU ETS.⁶¹ Banking will be unlimited. Limited borrowing will be allowed such that a participant can surrender permits from the following vintage year to discharge up to 5% of its liability. Starting in the flexible-price phase, participants must meet at least 50% of their obligations with domestic units.⁶² • Participants can surrender Australian Carbon Credit Units (ACCUs) from the Carbon Farming Initiative (a domestic offsets programme targeted to farmers and land managers) to help meet their obligations. In the fixed-price period, liable entities may surrender eligible ACCUs totalling no more than 5% of their obligation. In the flexible-price period, there will be no limit on the surrender of ACCUs.⁶³
RGGI	<ul style="list-style-type: none"> • From 2009 to 2014, a fixed cap stabilises emissions. From 2015 to 2018, the cap declines by 2.5% per year for a total reduction of 10%.⁶⁴ Participants can meet 3.3% of their obligation using eligible offsets (this can increase to 5–10% under specified conditions).⁶⁵ Participants can bank units.
CalETS	<ul style="list-style-type: none"> • The cap is set in 2013 at about 2% below the emissions level forecast for 2012, and then declines about 2% in 2014 and about 3% annually from 2015 to 2020. Four percent of allowances will be held in reserve to contain costs. Banking is allowed, but

⁵⁹ New Zealand Ministry for the Environment, 2012

⁶⁰ Commonwealth of Australia, 2011

⁶¹ The Australian Department of Climate Change and Energy Efficiency reports, "The price ceiling under the Australian emissions trading scheme will be set with reference to European allowances as the major international unit. That is, the price ceiling will be [AUS]\$20 above the expected price for European allowances in the 2015-16 compliance year and will rise by 5% in real terms in the 2016-17 and 2017-18 compliance years." See Commonwealth of Australia (2012).

⁶² While liable entities in Australia will still be able to meet up to 50% of their liabilities through purchasing eligible international units, only 12.5% of their liabilities will be able to be met by Kyoto units (i.e. CERs, ERUs and RMUs). Ibid.

⁶³ Commonwealth of Australia, 2011

⁶⁴ Regional Greenhouse Gas Initiative, 2009

⁶⁵ Regional Greenhouse Gas Initiative, 2012

ETS	Design constraints on the level of emissions
	not borrowing. Eligible domestic offsets can be used to meet up to 8% of a participant's obligations. ⁶⁶
TokyoC&T	<ul style="list-style-type: none"> For the first compliance period (FY2010 to FY2014), the cap has been set to reduce base-year (2000) emissions by 6%. The cap stringency is guided by Tokyo's broader emission reduction target of 25% below the 2000 levels by 2020. A more stringent cap will be agreed for the second compliance period (FY2015 to FY2019) (expected to be a 17% reduction).⁶⁷ Banking is allowed, but not borrowing. Participants can use offsets to help meet their obligations. Eligible sources include credits from energy savings by small and medium installations outside of the ETS, Japanese renewable energy certificates and offsets from outside of Tokyo (with restrictions to be decided by the government).⁶⁸

Some of the key lessons learned from the setting of caps in other schemes are:

- Whether and how an ETS constrains emissions depends on the priority objectives of the scheme. For example, in the EU ETS, the key objectives were to help meet the EU-wide emission reduction target and to drive mitigation investment within the EU. Therefore, ETS prices were allowed to rise above international prices by limiting allocation, constraining the surrender of JI/CDM units, and providing no government price controls. In contrast, in the NZ ETS, the key objectives were to help the government comply with its international obligations at least cost and to introduce the international price of emissions gradually into the economy. Therefore, from 2008 to 2012, the scheme is designed to operate without a separate domestic cap or quantitative limit on the surrender of foreign units, and provides transitional price protection that allows emissions within the scheme to increase. However, at the international level, the government must take responsibility for all national emissions above its Kyoto assigned amount, so fewer reductions by NZ ETS participants will mean greater emission reductions by the government through domestic action outside the ETS or purchases of foreign units.
- From both technical and political standpoints, it can be a challenging and data-intensive process to set caps. This can involve developing reliable emission projections and mitigation cost curves for emissions by regulated sectors, deciding on the overall level of ambition, and determining appropriate levels of free allocation. Having primary ETS legislation provide criteria and a regulatory process for setting the cap, but not actually prescribing the cap itself, has been one tactic for managing this highly political and complex debate in several stages.
- Even with good data, cap setting involves a lot of uncertainty. Overallocation has proven problematic in some schemes, notably the EU ETS and RGGI. Mechanisms to

⁶⁶ California Environmental Protection Agency Air Resources Board, 2011

⁶⁷ Tokyo Metropolitan Government Bureau of the Environment, 2010

⁶⁸ Ibid.

review and adjust caps between or within phases can guard against overallocation but also can create greater uncertainty for ETS participants and the market more broadly.

- Within a domestic market, there will be winners and losers from both high and low emission prices. In the NZ ETS, falling emission prices over the past couple of years have discouraged new afforestation and reduced the value of free allocation to landowners while supporting the international competitiveness of energy-intensive export industries.
- As illustrated in the EU ETS and NZ ETS, setting constraints on linking to foreign units can produce a divergence between unit prices in the ETS and international unit prices. This may be desirable or not, depending on the objectives of the ETS.
- In developing ETS in multiple countries, there has been considerable domestic debate over enabling the use of foreign units to meet scheme obligations in order to improve market liquidity and reduce costs, and creating incentives for offshore wealth transfers at the expense of investments in domestic mitigation activities. Each government needs to find its own comfort level in managing this issue.
- To guide investment decisions, participants need to have certainty over long-term cap-setting processes and guidelines for the use of foreign units, banking, and borrowing. Significant changes in rules between phases can produce price volatility and undermine participants' confidence in the effective operation of the market. This is evident in the current operation of the EU ETS.
- In the early stages of their schemes, some governments have opted for greater price-protection measures within the scheme (e.g. the NZ ETS and AusCPM) at the expense of achieving greater levels of domestic emission reductions by scheme participants. This approach has shifted some of the burden and price risk of achieving national emission reduction targets from participants back to the government, but was essential for getting sufficient political and public support to proceed with implementation.

3.2. Options for Setting the Level of Ambition

3.2.1. Objectives for setting the level of ambition

Primary government objectives

How the government chooses to regulate ETS emission constraints and prices will depend on Chile's primary objectives in implementing the ETS. For example:

- If the primary objective were to *achieve a specific target level of domestic emissions or emission reductions*, then the design focus would be on domestic quantity constraints. The government would need to constrain both its own allocation (the ETS cap) and participants' sale of units abroad and surrender of external units to help meet its ETS obligations. It may also need to constrain banking and borrowing to achieve a strict domestic target during a specified time period. In this case, domestic quantity control would take precedence over price control.
- If the primary objective were to *achieve a "global responsibility target" with least-cost mitigation* through a combination of domestic effort and investment in foreign units, then the level of domestic effort as a percentage of total effort would be less important. Government

could exercise more flexibility regarding its level of allocation (the ETS cap), banking, borrowing, the sale of units overseas and the purchase of external units, and the operation of carbon price stabilisation mechanisms. In this case, quantity control of Chile's contribution at the global level would take precedence over price, but design features would achieve the quantity objective at least cost to the domestic economy.

- If the primary objective were to *enable the national economy to adapt to international emission prices*, then exposure to the international price signal would take precedence over domestic quantity constraints. It would matter less what level of domestic emissions or emission reductions was achieved, as long as international emission prices had been factored into domestic investment and production decisions. The government would reduce or eliminate the use of emission price stabilisation mechanisms to allow full exposure to international emission prices over time.
- If the primary objective were to *drive domestic mitigation investment or a technology step-change*, then the government would be most concerned about the stringency, certainty and durability of the emissions price signal. This would need to be controlled through constraints on allocation (the ETS cap), constraints on the sale of ETS units abroad and the surrender of external units, and perhaps through other kinds of price-control measures (e.g. a price floor or price ceiling). The government could use constraints on both quantity and price intentionally to engineer a divergence between the international and domestic prices to achieve its policy objectives.

The government's objectives for setting ETS ambition may vary according to the evolution of the international carbon market. Key international drivers will include whether countries reach a collective agreement on ambition and on top-down rules governing ETS linking and the use of approved foreign offsets to meet international commitments. However, bilateral or regional linkages could continue to operate within a top-down system, and countries could choose a level of ambition for their domestic ETS that diverges from their international commitments for strategic reasons. The specific nature of Chile's linking opportunities may be a more significant external driver of Chile's domestic ETS ambition than whether the broader international market evolves top down or bottom up and whether countries reach a collective agreement on ambition.

Strategically, Chile could stand to benefit from applying a higher level of ambition to its ETS. It would clearly demonstrate Chile's commitment to an ambitious outcome in the international negotiations and reinforce the environmental credibility of the ETS, which could facilitate linking. It could also be used to leverage increased foreign investment in mitigation activity in Chile. However, there would also be a risk that Chile could expose its economy to a disproportionate impact if other countries failed to follow Chile's lead. In this context, Chile could consider signalling a level of ambition for its ETS that was conditional on the level of international support (financial and otherwise) and the level of ambition adopted by prospective linking partners and other countries more broadly.

Additional objectives

The government may wish to define and prioritise additional objectives to be achieved by its approach to setting ambition. Examples include:

- providing for a smooth adjustment of the economy, including the impact on Chile's emissions-intensive trade-exposed producers

- supporting the operation of a stable and liquid domestic emissions trading market
- incentivising more efficient domestic production and consumption, lower-emission capital investment (especially in long-lived infrastructure), and lower-emission land uses to avoid locking Chile into an emission-intensive development pathway
- stimulating research, development, and commercialisation of new lower-emission technologies
- facilitating linking to other ETS with comparable integrity and stringency
- securing international trade benefits, including profiting from the sale of units in international markets, avoiding negative trade repercussions, and marketing low-emission products.

3.2.2. Methodologies for setting the government cap on allocation

Under the ETS established to date, each government has chosen to issue its own emissions unit (also referred to as a permit or allowance) as the primary trading currency. A standard unit has the value of one tonne (metric or short) of CO₂ or CO₂-equivalent (CO₂e) emissions. By capping the number of issued units, the government can limit the contribution to global emissions from regulated sectors under the scheme. As noted above, the government can issue capped units into the market through free allocation, auction, or crediting of removals. This section addresses methodologies for setting the government cap, including:

- setting the cap through top-down and bottom-up processes
- evaluating the cap's ambition
- modifying the cap over time
- defining the relationship between the cap and emission price stabilisation mechanisms.

Setting the cap through top-down and bottom-up processes

Under a top-down process, the government would set the level of the cap on an ETS-wide or sectoral basis according to its overall emission reduction objectives and sectoral coverage, and then allocate the units within the cap across the various means of disbursement to participants. To use a dessert analogy, the government would start with a fixed cake and then decide how to slice it. A top-down approach offers the benefits of more easily aligning the ETS cap with a national emissions target, and can be done with high-level emissions data, such as those from a national greenhouse gas inventory, instead of participant-level data (although the latter can certainly be considered if available).

Under a bottom-up process, the government would define free allocation and overall emission constraints at the level of participants (individually or aggregated at the subsector or sector level), and then define the overall cap as the sum of free allocation plus units to be issued at auction or for removals. Continuing the dessert analogy, the bottom-up cap would look like a layer cake built from the various types of allocation needs. A bottom-up approach offers the benefits of more precisely tailoring the cap to the mitigation potential and circumstances of individual participants, subsectors or sectors. However, it requires the availability of disaggregated data in these areas, which could result in the need for a phased approach to implementation. It also raises the risk that the sum

of the individual parts will not align with the government's national emission reduction target, although the government can always adjust the overall outcome of the bottom-up process to fit its broader objectives.

Evaluating the cap's ambition

Evaluating the cap relative to a reference point or scenario can be used as a measure of the ambition of emission reductions in comparison to that of other countries. In this context, the government could evaluate the stringency of its cap relative to:

- *The level of historical emissions, either in a base year or over a base period.* This approach has the benefit of using historical data that are fixed and certain. It may be less suitable if past emissions are not valid reference points for future emissions, which would be expected in a developing economy and possible in any economy. Referencing a historical base year or base period may become increasingly irrelevant over time as a measure of stringency and comparability of effort among participants, especially as new producers enter the market and existing producers change their operations.
- *An emissions projection for business as usual (BAU).* BAU projections for emissions and economic growth are vitally important sources of information as the government decides the stringency of its cap. Modelling a BAU projection can involve significant uncertainty and introduce risk in setting an appropriate cap. A BAU projection will always be counterfactual, so a government's assessment of emission reductions under the ETS relative to that projection will also always be counterfactual.
- *A performance benchmark for emissions intensity.* Benchmarking emissions intensity per unit of production (at the sectoral level) or GDP (at the economy-wide level) can be data intensive and complex to administer. If a bottom-up cap is set on a sector-by-sector basis, it can also be challenging to determine what type of benchmark is an appropriate measure for cap stringency (e.g. best available technology or best practice versus average historical performance).
- *A scenario with zero emission pricing.* One approach to measuring ambition focuses on the domestic emission price or economic impact (percentage change in GDP) that will result from the cap in combination with other ETS design features, such as linking and the use of emission price stabilisation mechanisms. While the price is uncertain in a traditional ETS, various cost-containment mechanisms can be used to target the price more precisely.

How the government chooses to express the ambition of its ETS targets will have implications for the technical and political judgement of the scheme's stringency and impact on sell-side linking opportunities (of course, many other sovereign design features will also impact on sell-side linking opportunities, and may be equally, if not more, important). The government may want to consider selecting multiple reference points, instead of a single point, to provide a broader perspective on the stringency of its ETS.

Modifying the cap over time

The government needs to make careful judgements about how to modify the cap over time. ETS markets operate on the basis of near- to medium-term supply and demand, which are driven by absolute covered emissions and the absolute number of emission units. To date, the major

implemented or proposed schemes with domestic caps have defined absolute caps that have been fixed for the length of a defined trading phase. Some have provided for a fixed annual rate of change extending well into the future, while others have provided for periodic review and adjustment of the cap. Some have included automatic adjustment mechanisms that can strengthen or loosen the cap in response to low or high prices. This approach of defining the cap and rules into the future offers market certainty over the supply of government units in each trading phase. However, this certainty can come at the expense of flexibility to accommodate changes in national circumstances within each phase, unless the government provides for such changes to occur or exercises its legislative power to change the cap. Experience with existing greenhouse gas and other environmental trading schemes has highlighted the importance of changing caps to reflect new information on costs and benefits under changing national circumstances; this is discussed further in Chapter 7. Investors will need to have a reasonable degree of policy certainty over cap setting in order to have confidence in market operation.

An absolute cap is set on the basis of assumptions about total unit supply and demand during each trading phase, and how this will impact on the economy. If reality diverges significantly from these assumptions, then the market can end up with a significant oversupply or undersupply of units relative to demand and fail to achieve government price objectives. This risk can be mitigated through different ETS design mechanisms that maintain the cap, such as use of unit reserves within the cap, banking and borrowing, and linking to offset/crediting mechanisms and other ETS. It is important to note that the use of an absolute cap does not preclude the use of output-based free allocation. An absolute cap can also be combined with a price-ceiling and/or price-floor mechanism that operates outside of the cap and allows emissions to fall above or below the cap.

One alternative approach to an absolute cap is the use of an intensity-based cap that is indexed to some variable, such as sectoral production levels or GDP. The cap would adjust automatically within each phase as emitters enter and exit the market, and as production increases or decreases in response to market demand. This approach could be data intensive. An intensity-based approach does not have to imply a loss of stringency; however, it does imply a loss of certainty over the total allocation (and hence total emissions) until final output numbers are available for the phase. The upside is greater flexibility – and presumed cost certainty – for the cap to change as national circumstances change. Predicting the complex relationship between total emissions and changes in GDP or production levels during times of economic growth and economic decline can be an important source of uncertainty and risk in this approach, particularly where past trends may not be indicative of future trends. In the current international market, an ETS with an intensity-based cap generally would not be considered an acceptable candidate for linking to the established schemes because of concerns about uncertainty and environmental integrity.

When setting the cap, the government will need to decide whether to define the cap on an annual or multi-year basis, how often to adjust the size of the cap, and how much signalling to provide about future adjustments. More frequent adjustment of the cap enables greater responsiveness to changes in national circumstances but provides less market certainty and is more complex to administer. More frequent adjustments may be appropriate if future economic and emissions performance is hard to predict with reasonable certainty. To signal the direction of future adjustments, the government could provide some form of longer-term “forecast band” signalling the direction and extent of the changes that could be made to the cap in subsequent phases. It could also identify key considerations for adjusting the cap, including changes to the emissions intensity of the national energy mix, the level of economic output, and prospects for linking to other ETS. This approach can help to establish a long-term price signal to guide investment decisions.

The government could provide for statutory periodic reviews of the cap, and could also choose to enable interim reviews of the ETS cap to be triggered under particular circumstances (e.g. to respond to extreme changes in national circumstances, unit supply and/or unit prices). Enabling predictable periodic review of the cap could be a very useful safeguard for ensuring the ETS remains fit for purpose over time while providing cap certainty between reviews. A periodic cap review should be conducted in the context of a broader ETS review so that other ETS settings could be adjusted consequentially if necessary. The use of triggered reviews comes with risks, since they could undermine market certainty and operate too slowly to respond effectively to unexpected developments. It may be preferable for the government to build in the capacity for short-term cap adjustments through the use of unit reserves within the cap or price ceilings/floors operating inside or outside of the cap; these would provide some level of certainty to the market about how the government would adjust the cap in response to unexpected developments, and how quickly the government would be able to act.

Existing ETS have used a variety of approaches for striking the balance between certainty and flexibility in setting a cap over time. For example:

- In Phase 3 of the EU ETS, an annual cap was set for each year within the phase, starting with a fixed number in the first year and reducing it by a linear amount each year to achieve the overall emission reduction target for the phase.
- Starting with the flexible-price phase of the AusCPM, annual caps will be set for five-year periods with a cap extension agreed in regulations for one year every year. Considerations are provided to guide this decision, and a default cap will apply if the Parliament cannot reach agreement.
- Both RGGI and the CalETS defined fixed annual caps up front for each year across multiple compliance periods (2009–2018 for RGGI, and 2013–2020 for the CalETS).
- The TokyoC&T defined caps on a five-year aggregate basis, naming a specific cap for the first compliance period (2010–2014) and an anticipated cap (to be confirmed) for the second compliance period (2015–2019).

3.2.3. Other mechanisms for controlling the level of emission reductions in an ETS

The overall constraint on emissions in an ETS is determined by the cap in conjunction with other scheme features, including regulating banking and borrowing, constraints on linking to foreign markets, using emission price stabilisation mechanisms, and modifying the obligation to surrender units.

Regulating banking and borrowing

Banking (and borrowing as appropriate) is an important tool for achieving cost-effectiveness over time. By allowing trading among regulated firms, a single-period ETS ensures a common price across covered emission sources, and therefore achieves emission reductions in that period at the lowest possible cost. Similarly, allowing trading across time via banking ensures a common (discounted) price across periods, and therefore achieves cumulative emission reductions at the lowest possible cost. Of course, rules for banking and borrowing can impact on emissions in a particular year or period of years, and therefore the government's ability to meet its mitigation targets from phase to phase. Allowing banking between phases can also help to guard against price

volatility between compliance periods, generate greater incentives for overcompliance and produce environmental benefits by deferring emissions. The potential downside of banking is the opportunity for unintended overallocation or units with questionable environmental integrity to be carried into future compliance periods, diluting their environmental effectiveness. Allowing the borrowing of units from future periods can help to guard against price volatility between compliance periods but can also represent an environmental liability by bringing emissions forward in time and raising the risk of future non-compliance. If borrowing is allowed, then it should be constrained to safeguard integrity.

Constraints on linking to foreign markets

The effects of the choice of cap depend heavily on how closely the ETS is linked to international markets. If the ETS is linked internationally as a seller, ETS participants can reduce their domestic emissions below the cap and sell the excess units abroad. This will tend to raise emission prices and impacts on consumers but increase the profit to sellers. Similarly, if the ETS is linked internationally as a buyer, then the cap will limit the net global emissions ETS participants are responsible for but will not limit their net domestic emissions. ETS participants will be able to increase their domestic emissions above the cap and purchase approved foreign units to help meet their obligations. This will tend to lower emission prices and impacts on consumers.

With international linking, the stringency of the domestic cap will serve primarily as a distributional mechanism. If Chile is a net seller of units internationally, the cap is a key determinant of the balance between domestic mitigation funded from within Chile versus mitigation funded by foreign sources. If Chile is a net buyer, the cap balances the mitigation within and outside of Chile that is funded by Chileans. If the ETS is not linked internationally, then the cap will limit the net domestic emissions contributed by ETS participants (with the possible addition of units from domestic offset/crediting mechanisms). Without additional measures, a domestic cap will set the price of units.

Defining the relationship between the cap and price stabilisation measures

In a pure ETS, the overall constraint on emissions relative to the supply of units sets the market price of emissions. If the government chooses to exert control or constraint over prices in the domestic market, then it may need to relinquish some control over emissions quantity. However, this depends on whether carbon price stabilisation mechanisms function within or outside of an established cap on emissions. For example, the government could set aside a unit reserve within the cap that would be available to supply units to the market once a price point was triggered. By setting a price ceiling and price floor at auction, the government can influence prices in the domestic market. When the reserve was exhausted, then the government would no longer be able to operate the mechanism. In this case, total emissions covered by government units would remain within the original cap. Alternatively, under an external price ceiling mechanism, once a price point was triggered the government could choose to issue additional units outside of the original cap in order to increase supply and lower prices. In this case, emissions covered by government units would exceed the original cap. Under an external price-floor mechanism, the government could buy back units from the market and cancel them. It is an important strategic call for the government to decide whether it wants to limit the emissions implications of any price-control or price-constraint mechanisms.

Modifying the obligation to surrender units

The core obligation under an ETS is for the participants with liabilities under the scheme to surrender to the government a number of emission units equivalent to their defined emissions liability. One emission unit corresponds to one tonne of CO₂ or CO₂-equivalent emissions. Under a progressive obligation, the government changes the ratio of units that must be surrendered relative to tonnes of emissions. For example, the government could transition from the surrender of one unit for every three tonnes of emissions toward a one-for-one ratio. This approach to moderating the exposure to emissions pricing at the margin would change the relationship between the units issued under the government's cap and the domestic emissions allowed by ETS participants. This concept is discussed further in section 5.2.1 on moderating exposure to emission pricing in the chapter on setting ETS phases.

3.2.4. Designing the cap in the context of Chile's ETS

The significance of the government's cap on allocation in Chile will depend heavily on whether the ETS is linked to international markets, and whether the government wants to restrict such linkages in order to control unit supply and price in the domestic market. As discussed above, if the ETS is linked internationally, ETS participants will have a greater incentive to reduce their domestic emissions below the cap if they have the option to sell the excess units abroad. Similarly, ETS participants will be able to increase their domestic emissions above the cap to the extent that they purchase approved foreign units to help meet their obligations. With international linking, the stringency of the domestic cap will serve as a distributional mechanism for the relative balance of investment in overseas versus domestic mitigation.

If the ETS is not linked internationally, then the cap will limit the net domestic emissions contributed by ETS participants. If the ETS is linked to domestic offset/crediting mechanisms, then emissions from ETS participants may increase within the regulated sectors relative to the cap, but on a national level will be in line with the cap's objectives. A domestic-only cap sets a significant constraint on domestic emissions and loses the important safety valve of international linkages for price protection, liquidity, and market demand in the event the assumptions used in setting the cap are proven wrong.

Another critically important consideration is the government's decision on the use of carbon pricing stabilisation mechanisms, such as unit reserves operating within the cap or price ceilings/floors operating outside the cap (i.e. whether the government will accept an increase in domestic emissions in order to reduce emission prices). Fundamentally, the government needs to decide whether emissions quantity or emissions price will take precedence as the ultimate constraint on the ETS. Operating carbon pricing stabilisation mechanisms inside the cap ensures that the emission reduction goals under the ETS will be achieved, but does set a limit on the use of such mechanisms. Operating carbon pricing stabilisation mechanisms outside of the cap may be more desirable in an unlinked market that is more susceptible to the risks of cap setting, but this could also pose an even greater barrier to future linking opportunities. Linking ETS tends to require agreement on the use of absolute caps that clearly define the ambition of each scheme, and either the harmonisation or removal of carbon pricing stabilisation mechanisms.

The government will need to decide on a level of ambition for emission reductions and prices in the ETS that is compatible with its national GHG mitigation and economic objectives, is politically acceptable domestically, and meets the criteria of desired sell-side linking partners. Significant research will be required on mitigation potential, costs and price responsiveness for

regulated sectors, and the broader impact of emission pricing on Chile's economy in order to determine how an ETS could contribute to the government's national emission reduction and economic transformation goals. However, it is possible to comment on some key considerations in setting the level of ambition for an ETS.

First, Chile can choose whether to contribute to lower global emissions, or to create a pool of emission reduction opportunities for others to buy without, by itself, reducing global emissions. The former requires the cap to be set at a level that requires some amount of domestic emission reduction below BAU absent crediting and international trading. Otherwise, when Chile's ETS units are sold offshore, they will enable emissions to increase in the country of purchase in equal measure to the further reductions in Chile. Choosing whether there will be autonomous reductions will be an important decision, with political implications for sell-side linking partners.

Second, setting an ETS emission constraint that leads to a price that is higher than that of major trading partners could create a competitive disadvantage for Chile's emissions-intensive trade-exposed producers. This can be mitigated through other measures, but should remain an important consideration for the government. Starting with a lower level of ambition and increasing it gradually as emission pricing is more widely adopted by Chile's trading partners could help to prevent economic regrets from the loss of domestic producers during the transitional period that would have remained viable in the long term. However, it is important to note that if Chile can sell into foreign markets, those markets can be expected to raise the domestic price irrespective of Chile's cap ambition.

Third, for an ETS to operate effectively, the unit demand (domestic or international) must exceed supply. The government will need to find ways to ensure unit scarcity in the domestic market without risking prices that are unacceptably high. The factors driving unit supply, demand and prices in Chile's market will be unpredictable over time, raising the risk that the ETS cap will be more or less stringent than anticipated. The government will need to decide if and how it wants to control unit supply and prices over time.

Across the spectrum of linking and price containment options operating alongside the cap to determine ETS ambition, the government could consider three options for further evaluation:

- *The government sets the domestic price of emissions.* At this end of the spectrum, the government would control domestic emission prices in the ETS through allocation. The ETS would not link directly to international markets, but the government could link to international markets, enabling the country as a whole to benefit from the sale of units generated by emission reductions under the ETS. Positioning the government as the intermediary between the ETS and the market would enable the government to shelter the ETS from higher international prices and to capture the rents from the sale of Chile's emission units overseas. If it was not feasible for the government to sell its surplus ETS units to linked schemes, then it could consider seeking alternative finance (e.g. Nationally Appropriate Mitigation Action) tied to those reductions as an incentive to set a more stringent cap.
- *The international market sets the domestic price of emissions.* At the other end of the spectrum, the ETS would have full buy-and-sell linkages to the international market, and the international market would set the domestic emission price. The government could also maintain buy-and-sell linkages with the international market.

- The domestic price of emissions moves toward international market prices, with government price stabilisation mechanisms to reduce uncertainty. Under this intermediate option, the international market would set the price through buy-and-sell linking with the ETS but government could operate emission price stabilisation mechanisms to help provide price certainty. For example, the government could operate a price floor/ceiling from a unit reserve within the cap, and could set quantitative constraints on linking in the buy and/or sell direction.

There is no precise science to setting the overall stringency of an ETS. Decision-making requires the integration of complex technical, economic, and political judgements. Table 3.2 presents some high-level evaluation of ETS design options for the level of ambition against key criteria.

Table 3.2: Evaluation of options for setting the level of ambition against key criteria

Key criteria	Evaluation of options for setting the level of emissions in the Chilean context
Environmental effectiveness	<ul style="list-style-type: none"> • ETS stringency should reflect consideration of: <ul style="list-style-type: none"> ○ the government's broader GHG mitigation objectives up to 2020 and beyond ○ the government's economic growth and other policy objectives ○ projected rates of emissions growth, mitigation opportunities, and mitigation costs for regulated sectors. • The ETS cap and its overall constraint on emissions could be more or less stringent than the national emission reduction target depending on the relative share of emissions, the projected emissions growth, and the mitigation potential/cost of the regulated sectors. • If Chile wants its ETS to generate a net global emission benefit, then the cap should be set at a level that requires some amount of uncredited domestic emission reduction below BAU before excess ETS units become available for international trading. Domestic emission reductions that are sold abroad as offsets will be negated by emissions in other schemes. • Signalling greater stringency in the longer term is valuable for guiding near-term investment decisions in long-lived infrastructure. By signalling future stringency, the long-term value of the scheme can be realised even if the short-term stringency is set relatively low. • If Chile wishes to link its ETS to other schemes, then the value to the atmosphere of each ETS unit needs to be comparable to that under the other schemes. This is influenced by how the cap is set and also by safeguards of environmental integrity, including measuring, reporting, and verifying standards and compliance measures.
Economic efficiency	<ul style="list-style-type: none"> • Setting an increasingly stringent cap in conjunction with decisions on linking and price stabilisation will produce a complex distribution of costs and benefits across the economy. These should be assessed carefully. • When determining constraints on domestic emissions and emission prices, the government should consider the trade-offs between using government controls to reduce uncertainty and risk versus enabling the most efficient

Key criteria	Evaluation of options for setting the level of emissions in the Chilean context
	<p>operation of a trading market.</p> <ul style="list-style-type: none"> • Whether the emission price in the Chilean market should diverge significantly from the international price will depend on the government's emission reduction and economic objectives as well as prospects for the effective functioning of the international carbon market. • Promoting investment in domestic mitigation by limiting the use of foreign units could increase the cost of compliance for participants, but generate other benefits of interest to the government. An important question is whether the government, or the market, is best placed to identify least-cost mitigation opportunities and decide the optimal balance between investment in domestic versus foreign mitigation. • Emissions pricing can influence when new projects with a significant mitigation impact (e.g. new renewable generation, co-generation, introduction of new industrial production technologies, carbon capture and storage, etc.) become commercially viable. Country-specific marginal abatement cost curves can be a valuable tool for identifying emission pricing thresholds that can trigger significant changes. • While moving toward a low-carbon economy may involve the closure of less efficient operations over time, the government may wish to soften this transition by moderating the initial stringency of the ETS.
Competitiveness impacts	<ul style="list-style-type: none"> • Setting an ETS emission constraint or creating an international linkage that leads to a higher price than that of major unregulated trading partners could create a competitive disadvantage for Chile's emissions-intensive trade-exposed producers. This can be mitigated through other measures, but should remain an important consideration for the government.
Equitable burden sharing	<ul style="list-style-type: none"> • When setting the stringency of ETS emission constraints for regulated sectors, individually and collectively, the government should carefully consider whether the burden sharing is equitable across regulated sectors and across regulated and non-regulated sectors. This will improve the political viability of the ETS. However, "equitable" does not imply "equal". It would be expected that ultimately some sectors will shoulder more of the cost of the emission reduction burden than others, and that those with lower-cost mitigation opportunities will benefit from the inflow of investment. Key considerations include the distribution of responsibility, mitigation potential, costs, and benefits.
Administrative feasibility and costs	<ul style="list-style-type: none"> • The approach used to set the cap and the overall constraint on emissions should be supported by adequate data on projected emissions, mitigation potential, mitigation and administrative costs, price pass-through, and trade exposure at the sectoral, subsectoral, and participant levels where possible.
Regulatory and other barriers	<ul style="list-style-type: none"> • Introducing a stringent emission constraint into regulated sectors could result in stranded assets, and in some legal systems could be interpreted as a case of government "takings" requiring compensation for affected parties. This issue should be evaluated in the context of Chile's legal and cultural environment.

Key criteria	Evaluation of options for setting the level of emissions in the Chilean context
	<ul style="list-style-type: none"> The government may wish to consider whether to delegate some level of policy design and/or decision-making over the cap and methods of allocation to an independent body with expert, government, business, and NGO representation.
Other impacts, including co-benefits	<ul style="list-style-type: none"> The stringency of the ETS will also affect the magnitude of its direct and indirect environmental, economic, and social impacts. If possible, these should be evaluated when setting the cap.

3.3. Framework for Government Decisions

The government's decision on setting an overall emission constraint in the ETS and the cap on government allocation within that constraint will require several stages of decision-making as illustrated in Table 3.3.

Table 3.3: Framework for government decisions on setting the level of emissions in the ETS

Stage	Decision-making activity
Objective setting	<ul style="list-style-type: none"> Setting primary government objectives regarding the balance between environmental and economic outcomes, such as: <ul style="list-style-type: none"> achieving a specific target level of domestic emissions or emission reductions achieving a "global responsibility target" with least-cost mitigation enabling the national economy to adapt to the international price of emissions driving domestic mitigation investment or a technology step-change. Setting secondary government objectives for the effective operation of the ETS.
Technical and economic analysis of mitigation potential and emission pricing impacts	<ul style="list-style-type: none"> Assessing the projected emissions, technical and economic mitigation potential, and price responsiveness of key ETS sectors, subsectors, and participants. Modelling the emissions and economic impacts of emission pricing and allocation scenarios with and without linkages to the international market.
Proposal of a preliminary ETS cap and overall emissions constraint in alignment with government objectives	<ul style="list-style-type: none"> Determining how regulated sectors in the ETS should contribute toward meeting the government's national mitigation and economic growth objectives through 2020 and beyond. Assessing equitable burden sharing of mitigation responsibility and costs across sectors. Issuing a preliminary proposal regarding the overall methodology and

Stage	Decision-making activity
	ambition for setting the cap on allocation and the overall constraint on emissions under the ETS, as the basis for further analysis.
Cap design and allocation across activities	<ul style="list-style-type: none"> • Using a top-down or bottom-up process for setting the government's cap depending on data availability and political considerations. • Identifying the range of government activities that need to be covered within the cap, including: free allocation, auctioning and crediting of removal activities, with consideration regarding the need for any unit reserve for the operation of emission price stabilisation mechanisms. • Refining the cap methodology and stringency in the context of rules for banking and borrowing, linking, and the use of emission price stabilisation mechanisms. • Deciding whether to define the cap on an annual or multi-year basis, how often to adjust the size of the cap, and how much certainty to provide about future adjustments. • Deciding whether an independent body should be created to administer the cap and allocation. • Deciding how the government will allocate capped units across free allocation, auctioning, crediting of removal activities, and unit reserves for the operation of emission price stabilisation mechanisms. • Developing a policy for the use of ETS revenue from auctioning.
Review and confirmation of overall emission constraint and cap	<ul style="list-style-type: none"> • Reviewing and adjusting the cap and the overall package of measures for constraining emissions in the ETS to ensure alignment with the government's environmental and economic objectives and effective operation of the domestic trading market

The government should give careful consideration to the governance of the process for setting cap stringency. Cap stringency will have significant economic, fiscal and environmental implications for Chile domestically and impact on its international relationships. For that reason it would be advisable for the government to make decisions on the cap using transparent legislative processes. However, the government could request independent advice on setting the cap to assist in effective decision making and help to build stakeholder support for the outcomes. The government's process for cap setting should also be coordinated with decisions on free allocation in order to ensure alignment and consistency. The government could consider whether to apply independent advice to decisions on free allocation as well. This is the approach used in the Australian CPM; an independent Climate Change Authority was established under legislation with the mandate to provide recommendations on future caps, provide advice on other aspects of the CPM's operation and conduct reviews of the CPM (and other parts of the accompanying policy package). The CPM legislation also provides for a separate review of the level of industry assistance

(i.e. free allocation) by the independent Productivity Commission. Any decisions to change the level of assistance could have implications for setting the cap.⁶⁹

Stakeholders across government, the private sector, academia, and the NGO community should be engaged throughout the process of setting the cap and defining the overall constraint on emissions. This is critical both to collect data and get their recommendations to inform decision-making, and to help secure their buy-in to the final outcome.

In summary, the government should not make the long-term environmental effectiveness and economic cost of its ETS dependent on its ability to predict a highly uncertain future by setting the domestic cap. Through the design of the cap in conjunction with rules on banking/borrowing, linking to other ETS, and using emission pricing stabilisation mechanisms, the government needs to be able to provide near-term certainty about the ambition of the emission reduction and economic objectives of the scheme, adjust the scheme's longer-term constraints on emissions in response to changing national circumstances, and send a clear signal regarding its commitment to increasingly stringent emission pricing over time.

3.4. References

- California Environmental Protection Agency Air Resources Board. 2011. *Overview of ARB Emissions Trading Program*. Available at http://www.arb.ca.gov/newsrel/2011/cap_trade_overview.pdf, accessed 26 October 2012.
- Commonwealth of Australia. 2012. *Linking and Australian Liable Entities*, Canberra: Department of Climate Change and Energy Efficiency, <http://www.cleanenergyfuture.gov.au/linking-and-australian-liable-entities/>, accessed 26 October 2012.
- Commonwealth of Australia. 2011. *Securing a Clean Energy Future: The Australian Government's Climate Change Plan*, Canberra: Department of Climate Change and Energy Efficiency. Available at <http://www.cleanenergyfuture.gov.au/wp-content/uploads/2011/07/Consolidated-Final.pdf>, accessed 26 October 2012.
- European Commission. 2011. "Cap," http://ec.europa.eu/clima/policies/ets/cap/index_en.htm
- European Commission. 2010. "Linking the EU ETS to other Emissions Trading Systems and Use of International Credits", http://ec.europa.eu/clima/policies/ets/linking/index_en.htm, accessed 26 October 2012.
- European Union. 2008. "Climate Change: Commission Welcomes Adoption of Europe's Climate and Energy Package," press release 17 December 2008, http://europa.eu/rapid/press-release_IP-08-1998_en.htm, accessed 26 October 2012.
- New Zealand Ministry for the Environment. 2012. "Government's Announced Changes to the ETS," <http://climatechange.govt.nz/emissions-trading-scheme/ets-amendments/index.html>, accessed 26 October 2012.

⁶⁹ Commonwealth of Australia, 2011

- Regional Greenhouse Gas Initiative. 2009. “The RGGI CO₂ Cap,” <http://www.rggi.org/design/overview/cap>, updated 18 November 2009, accessed 26 October 2012.
- Regional Greenhouse Gas Initiative. 2012. “About the Regional Greenhouse Gas Initiative (RGGI),” http://www.rggi.org/docs/Documents/RGGI_Fact_Sheet_2012_09_28.pdf, accessed 26 October 2012.
- Tokyo Metropolitan Government Bureau of the Environment. 2010. *Tokyo Cap-and-Trade Program: Japan’s First Mandatory Emissions Trading Scheme*, Tokyo: Bureau of Environment. Available at http://www.kankyo.metro.tokyo.jp/en/attachement/Tokyo-cap_and_trade_program-march_2010_TMG.pdf, accessed 26 October 2012.

4 Linking and Offsets

Key findings (linking):

- The fluid international climate policy context creates challenges as well as diverse opportunities for Chile's ETS to interconnect with existing and emerging schemes at international, national, and sub-national levels.
- The use of linking and offset credits from both domestic and international sources extends the coverage of an ETS to include more sources of mitigation that are valid for compliance within domestic regulations. This may be especially important for Chile and other relatively small economies if mitigation opportunities are limited and there concern about market manipulation by one or more large players.
- Linking can benefit Chile by lowering costs or increasing profits, depending on whether the country is a net buyer or seller internationally, and by improving liquidity of the ETS. However, there will be winners and losers domestically even if the country gains overall. Also, linking can be a complex process and involves trade-offs in terms of exposure to international prices and loss of sovereign flexibility to determine and change scheme features once links are established.
- A direct link involves mutual recognition of emission allowances, and consequently direct buying or selling of units, from one ETS to another. Mutual recognition of units or credits from one system also creates an indirect linkage to any other system linked to that system, as with links in a chain.
- Linking as a seller increases demand, will probably raise prices, and benefits net sellers (e.g. those with relatively low costs of reducing emissions and/or generous initial allocation), enabling profits from international sales and providing finance for mitigation above and beyond the cap.
- Addressing impacts of higher prices on domestic net buyers requires consideration together with other design elements, such as allocation, price stabilisation, and level of the cap. Linking as a seller requires the agreement of the international buyer, so is complex to negotiate.
- Linking as a buyer expands the supply of units and will probably lower prices, benefiting domestic net buyers by containing costs and improving liquidity. Limitations on the quantity of overseas units recognised for compliance is one way to address potential concerns over price levels and volatility
- Preliminary economic modeling indicates that broadening the range of emission reduction beyond energy and industry sectors to include forestry plus agriculture and waste, and/or purchases of low-cost international credits plays a key role in lowering costs and enabling Chile to meet its -20% reduction target relative to projected emissions for 2020, as well as potentially more ambitious reductions through 2030. Limiting the amount of international credits to 5% of total abatement only modestly affects estimated cost savings to the country.

- Linking as a seller has implications for other scheme features that should be considered in parallel during the design process so as to maintain and facilitate desired linkage options. For Chile to be able to sell its units or offsets internationally, another country's regulators will need to accept Chile's units or credits as valid for complying with their own scheme. This will probably require Chile's government to harmonise its ETS design features for environmental and economic integrity and comparability (e.g. measurement, reporting, and verification (MRV), type of cap, enforceability, certainty and predictability), as well as price protection (use of offsets, price floors/ceilings, banking/borrowing, third-party links), and to agree on an acceptable level of ambition for Chile's system and how this will change over time. The types of design features that can differ across linked ETS include sectoral coverage, points of obligation, and allocation. There will also be a process of political negotiation, including over other potential scheme features.
- Finalising sell linkages may also need to wait until Chile's ETS has demonstrated its functioning. In the interim, the government may be able to generate international market as well as non-market financing for some reductions through NAMA, REDD+ and other crediting mechanisms negotiated within or outside the UNFCCC.
- Buy-only linkages may require only Chile's unilateral agreement, but the government may also similarly want to evaluate features of overseas units/credits before recognising their use so as to preserve integrity and comparability, as well as other linking options in the future.
- Coordinating specific (but not all) ETS features with other countries, without the necessity of linking through trading of any emission units/credits, can provide consistency for multinationals, level international competitiveness, and avoid border carbon adjustments and other trade measures from jurisdictions with more stringent climate regulations.
- If both buying and selling of units is possible, some Chilean entities might sell units internationally while others might buy units, depending on whether costs of reducing emissions internally are lower/higher than the price at which the units could be sold/bought internationally. Different types of units might trade at different prices on international markets. As a result, it might also be profitable for Chilean entities buy some types of units and sell others on international markets.
- Whether the country of Chile as a whole would be a net buyer or seller depends on the level of ambition of the cap adopted for 2020 and potentially beyond, the sectors included in the market, the associated costs of reducing emissions internally and/or through international low-cost credits, the level of its cap, as well as the international price. Modelling of scenarios with expanded forestry, agriculture and waste mitigation and -20% and -30% reduction targets relative to 2020 and 2030 projected emissions, respectively, indicates that Chile as a whole could break even on the total costs of its climate program if international sales are possible at prices of \$10-\$19 per tonne of carbon dioxide in 2015, rising at 5%.

Key findings (offsets):

- In addition to linking as a buyer, domestic and international offsets expand flexibility to use mitigation from sources and sectors outside the emissions cap. Offsets can provide cost containment, price stabilisation, timing flexibility, and valuable co-benefits.
- Offset credits for voluntary reductions below a projected "business as usual" baseline inherently pose challenges for environmental integrity (whether emissions are actually reduced). However, by either lowering emission prices (especially in a closed or unlinked system) or by creating a new political constituency for the ETS among the offset sellers, they may allow the government to set a more ambitious cap.
- Crediting systems require criteria for quantification, MRV, additionality, liability, and enforceability to ensure that offset credits can be exchanged with emission allowances issued under a cap while achieving equal or greater environmental benefits.
- There is a growing interest and international preference of some schemes for scaled-up (e.g. sectoral or jurisdictional) crediting approaches that offer potential to simplify administration, generate other economic efficiencies of scale, and address environmental concerns.

A straw man proposal for linking and offsets:

- Engage in both bottom-up and top-down international policy-development processes, including working groups of possible trading partners, to cooperate on design elements and policy preferences in real time
- Pursue other sources of both market and non-market financing for emission reductions within and outside ETS sectors (e.g. through NAMAs, REDD+, scaled-up crediting) while additional ETS links are negotiated.
- Provide testing and liquidity by allowing a limited amount of purchases over a fixed short-term period of time (with potential for revisiting) for some existing foreign ETS as well as UNFCCC units, such as AAUs, Chilean Certified Emissions Reductions (CERs), and select types of CERs from smaller/poorer emitters consistent with other existing and proposed schemes (even if Chile's purchases are not formally recognised under UNFCCC).
- Similarly, have a time-limited initial buying period for a limited quantity of new types of domestic and international offsets with high-quality standards based on emerging models and with focus on scaled-up approaches (e.g. for jurisdictional REDD+).
- Use public and private funds from domestic and potential international sources (e.g. NAMAs) to test and develop offset methodologies and finance a pool of early credits that could eventually be sold domestically or internationally or used in other ways (e.g. as an insurance pool for future offsets or to fill a unit reserve for price stabilisation).
- Evaluate benefits and costs of expanded links on a case-by-case basis.
- Design ETS in parallel so as to preserve linkage options as much as possible while working to open opportunities as both a buyer and seller in international markets.
- Continue to allow international sales of CERs while additional ETS links are negotiated.

Notes on terminology:

The term “offsets”, or “offset credits”, is used differently in different contexts, but here it is used to describe credits for emissions reductions in sectors, subsectors, or other jurisdictions that are uncapped (not covered by a limit on total emissions) and that can be used to help comply with emissions control requirements in capped sectors within or outside that jurisdiction. Offset credits could be generated for emissions reductions by entities in a covered sector that is too small to meet an emissions threshold for inclusion in an ETS, or in a sector that is not covered under the ETS. Offsets thus differ from “units” or “allowances,” which are the permits for emissions by the covered entities subject to a cap that sets a limit on emission. The distinction is that offsets provide a mechanism for crediting reductions below a baseline in the context where there is no obligation to ensure emissions do not go above a baseline. Some offset credits for reductions below a baseline are issued on a project-specific basis, while other mechanisms can be for reductions at larger jurisdictional or sectoral scales.

There are also situations where a sector might be covered under a national or regional cap (e.g. under the Kyoto Protocol) but not covered under a domestic ETS, as with forests and agriculture under the EU ETS. In this case, a credit for reducing emissions in that sector would be called an “offset” from the perspective of a covered sector in that same country. However, that credit is a form of allowance, rather than an offset, from the perspective of an international buyer, as it is coming out from under a national cap.

4.1. Background

4.1.1. General context for design of this component in an ETS

Linking occurs when one ETS recognises units from a foreign system as valid currency for complying with its domestic requirements and, potentially, vice versa. Linking can benefit Chile by lowering costs or increasing profits, depending on whether the country is a net buyer or seller internationally, and by improving liquidity and competitiveness of the ETS. However, there can be winners or losers domestically, even if the country gains overall. Also, linking can be a complex process and involves trade-offs in terms of exposure to international prices and loss of sovereign flexibility to determine and change scheme features once links are established. While various ETS design features will affect the attractiveness of Chile’s system as a linkage partner, linking to other markets will also impact design issues relating to caps, competitiveness, and price stability. As a result, the government will want to consider issues relating to linking and offsets in parallel with other scheme features so as to maintain and facilitate desired linkage options as well as address the impacts of linking.⁷⁰

⁷⁰ For a review of conceptual issues and design interrelationships associated with linking ETS, see Jaffe & Stavins (2007).

Along with the use of offset credits from both domestic and international sources, linking extends the coverage of the linked systems to include more sources of mitigation. This expands flexibility to find the least-cost opportunities across the economic and geographic landscape. It also extends economic opportunities and incentives for reducing emissions and for low-emissions innovation. At the international level, a combination of linked domestic ETS would help harmonise the price of emissions across countries through the operation of the market, bringing down the costs of meeting emissions targets across the linked schemes. International linkage of ETS schemes is likely to be a far simpler approach to promote cost-effectiveness than attempting to align carbon taxes through political agreements internationally. The gains from trade across linked systems also results in lower costs for buyers of meeting a particular emissions target, as well as greater profits for sellers, which in principle can be reinvested in greater reductions. This means the benefits can be environmental as well as economic, with linking facilitating more ambitious policies to reduce emissions in both buying and selling countries and jurisdictions than if such trading were not possible.

Linking can also improve the functioning of the emissions market within a country. In large, economically diverse nations, the wide range of actors, emissions reduction possibilities, technology development and deployment opportunities, and differentials in marginal costs of control, mean that a wholly domestic ETS market could function well to reduce emissions, reduce cost, drive investment, and spur innovation – even if that market has no link to similar markets elsewhere. However, for a relatively small economy, such as Chile's, with fewer actors, less competition, and less diversity of covered sources, linking can bring important benefits in terms of managing costs, providing liquidity, extending incentives, and promoting competition. At the same time, linking and offsets will involve particular challenges to ensure the environmental equivalency of units across schemes, as well as other political challenges and policy trade-offs.

Linking will not require harmonisation and coordination over all ETS design elements, but the features that transfer across systems will require harmonisation and coordination for establishing market links. For regulators in another country or countries to recognise units from Chile's ETS, so that Chile can link as a seller to the international market, it is likely that the government of Chile will need to harmonise design features for environmental and economic integrity and comparability (e.g. measurement, reporting, and verification (MRV), type of cap, enforceability, certainty and predictability), as well as price protection (use of offsets, price floors/ceilings, banking/borrowing, third-party links), and agree on an acceptable level of ambition. There will also be a process of political negotiation, including over other potential scheme features. Other systems will evaluate these elements when determining whether to become buyers of units or offsets from Chile. On the other hand, Chile will also want to consider whether it wants to import these transferable elements into its system when deciding whether to be a buyer of overseas units or offsets.

How Chile's ETS will potentially link to foreign ETS and other crediting mechanisms outside of its domestic control raises critical considerations for the design of its system, with major implications for the supply and demand of units and the operation of the emissions market. There is a growing set of existing and emerging ETS that create opportunities for bilateral and multilateral discussions of linking among jurisdictions at national and subnational levels. The current state of international climate negotiations under the Durban Platform Agreement (DPA) has created a more fluid situation that provides broader opportunities than the Kyoto Protocol for a variety of system types to link together in market arrangements. However, international rules for these linkages have not yet been determined. It is possible that these rules will eventually emerge through a "top-down" process, or that the rules forged by market participants through "bottom-up" arrangements will

define the future architecture, if and when any agreement is reached via the United Nations Framework Convention on Climate Change (UNFCCC). It is also possible that a hybrid will emerge, where the UNFCCC provides an oversight function and individual trading rules are determined bilaterally or regionally rather than following the fully top-down model of the Kyoto Protocol. In any case, the bottom-up market developments are likely to provide important lessons and inform the top-down decision-making process. In this fluid international situation, the Chilean government may want to consider how to define its system so as to keep its options open. It may also want to consider the extent to which it wishes to engage act as an “early adopter” of new approaches and thereby help to define the rules of a new emerging architecture via its engagement through both UNFCCC and the linking options it chooses to structure and negotiate on bilateral and multilateral bases.

The first part of this chapter will discuss options for linking Chile’s ETS to systems in other countries/jurisdictions. The potential need to harmonise features with other ETS has implications for Chile’s decisions on a range of ETS design elements. This can be at the level of coordinating various climate policies rather than harmonising emissions trading in particular. Such policy linkages can have implications themselves, for example, in terms of climate-related international trade sanctions and unit/credit requirements by other countries. However, the main focus of this section will be on the implications of international linking as a means to expand the scope for Chile’s participation in international carbon markets as a potential buyer and/or seller of units or offset credits.

The second part of the chapter will turn to the issue of offset mechanisms, which are one of the ways in which Chile could connect with international markets. As described further in section 4.3, offsets are an option for reducing emissions from particular sources or broad sectors, such as agriculture and forestry, which may not be covered by an ETS, either domestically or internationally. Offsets can be an essential tool to reduce the costs of an ETS, but they raise particular challenges for ensuring environmental quality.

4.1.2. Lessons learned from other systems

Table 4.1 (at the end of this chapter) summarises the criteria for linkage and offsets from the major existing, planned, and proposed ETS systems. This section also discusses past experiences with linkages and offsets, and important lessons learned. Important lessons learned include:

- The difficulty of negotiating linking agreements, how long they take, and how hard it is to change scheme rules in individual countries after linking;
- The problems of trying to equate capped units with offset units measured relative to a counterfactual “business-as-usual” baseline;
- The problems with using both top-down (cumbersome and slow) and bottom-up (fragmented and inconsistent) international rules;
- The impacts of linking on prices (what it means to be a price taker versus a price maker, and how limits to offsets create divergence from international prices);
- The role of politics in deciding what type and level of linking to ETS and offsets are acceptable from an environmental and economic perspective (supplementarity, sending investments offshore, etc.);

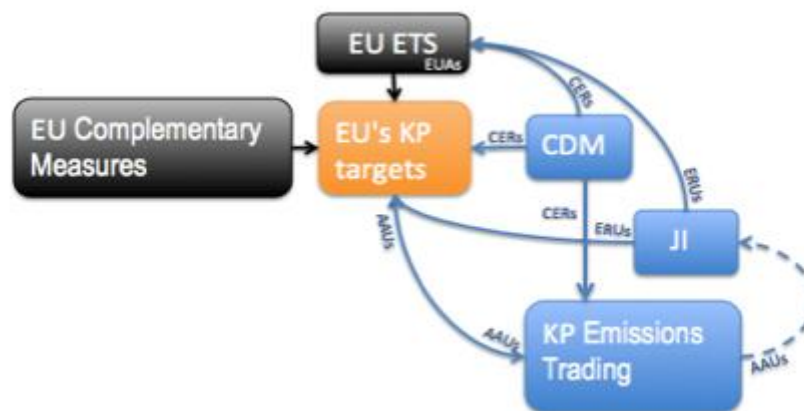
- The value to governments and to multinationals of harmonising features even when there is no mutual recognition of units. Some key issues and examples are discussed below.

Systems can link both directly and indirectly through mutual recognition of a third-party system. Figure 4.1 illustrates the direct and indirect links between the EU ETS and Kyoto Protocol system. Under the Kyoto Protocol, domestic actions to reduce emissions can be supplemented by way of three flexibility mechanisms. The Kyoto Protocol flexibility mechanisms are:

- *Emissions trading*. Countries are issued tradable Assigned Amount Units (AAUs) up to the country's Kyoto Protocol target. Those countries that have extra AAUs may sell them to countries whose emissions exceed their targets, creating a market of emissions allowances.
- *The Clean Development Mechanism (CDM)*. This project-based mechanism involves investment in projects that reduce emissions in developing countries and contribute to sustainable development. These projects generate Certified Emissions Reductions (CERs) that can be used for offsetting emissions in Annex I Parties to the Protocol.
- *Joint Implementation (JI)*. This project-based mechanism is similar to the CDM but is among Annex I parties. The offsets generated by these JI projects are denominated Emission Reduction Units (ERUs) that are created by the cancellation of the corresponding number of AAUs from within the selling country's budget.

The EU ETS was established by a Directive of the European Parliament and the Council of the European Union in October 2003, and amended by the “linking Directive” in October 2004 and the EU Energy and Climate Change Package of 2009. The linking Directive first regulated the linkage of the Kyoto Protocol project-based mechanisms, i.e. the CDM and the JI, to the EU ETS with the goal of increasing the diversity of low-cost compliance options within the EU ETS while safeguarding its environmental integrity. The implementation of the EU ETS has proceeded in phases, and currently covers around half of the EU's emissions of CO₂ and 40% of its total greenhouse gas emissions.⁷¹

Figure 4.1: Linkages under the EU ETS and Kyoto Protocol system



⁷¹ European Commission, 2009

There are benefits and drawbacks from top-down standardisation. The UNFCCC attempted to facilitate linking by defining common unit currencies, and by providing comprehensive rules for accounting, trading, and equating offset units with AAUs. However, the cumbersome system has not been able to adapt quickly enough to new circumstances, such as Kazakhstan or other developing countries wanting to trade or graduate into Annex B status, or countries making unilateral decisions that some of the accounting rules are not good enough and adding their own screens on approved units for linking. The rise of government-driven bilateral linking and offset mechanisms outside the UNFCCC is a key development.

To balance the benefits and challenges of both linking and offsets, some ETS systems have adopted limits on the number of different types of offsets and international credits that regulated entities can use for compliance purposes. Proposed policies have included further restrictions on the maximum quantities of domestic versus international offsets and other types of international credits, with distinctions based on the characteristics of the offsets/credits. This has been an evolving process, with improvements and learning by doing, as illustrated by the EU ETS.

During Phase I, the EU allowed for the use of Certified Emission Reductions (CERs) from CDM projects as offsets – even though the rules pertaining to the CDM were still in the process of being approved under the UNFCCC – but did not permit the use of Emission Reduction Units (ERUs) from JI projects. During Phase II, European member states have allowed in aggregate the use of around 1,400 million tonnes of CO₂e in CERs and ERUs. The use of CERs and ERUs has been allowed by each individual member state and calculated as a percentage of the allocation to each installation – 11% on average.⁷² Since that amount of CERs and ERUs for Phase II was over-dimensioned, the EU decided to allow operators to use such offsets during the period 2008–2020, encompassing Phase II and Phase III. The installations that were allowed fewer offsets than 11% of their allocation for 2008–2012 are now allowed to use up to 11%. As result, the total amount of credits increased to just above 1,600 million tonnes of CO₂e for 2008–2020. The offset use is constrained collectively to 50% of the required aggregate mitigation through 2020 relative to 2005. In an attempt to address the concerns relating to environmental integrity, value for money, and geographical distribution of offsets, Member States voted in January 2011 to ban CERs and ERUs from certain projects that destroy industrial gases from use in the EU ETS. Covered entities will be able to use these credits for compliance up to 2012 but not thereafter.

Buy-only links have been simpler to establish, as they may require only one country's approval, and can be a first step towards buy-and-sell links. Mutual recognition of units under linked systems has required close coordination and harmonisation along the ETS design process, with the EU and Norway being the only two-way link finalised to date between two national ETS schemes. In August 2012, Australia and the EU announced immediate agreement on a one-way link through which Australian entities will be able to use EU allowances for compliance at the end of the fixed price period in July 1, 2015. Australia and the EU also agreed to negotiate and finalize a full two-way link no later than July 1, 2018. The announcement stated that a final agreement will cover the following key issues:⁷³

- Measurement, reporting and verification arrangements

⁷² Leseur and Troignon, 2007

⁷³ European Commission and the Hon. Greg Combet AM MP, 2012

- types, quantities and other relevant aspects of third party units that can be accepted
- role of land-based domestic offsets
- implications, if any, for supporting the competitiveness of European and Australian industries, in particular sectors exposed to a risk of carbon leakage
- provisions for comparable market oversight.

Australia has also been formally pursuing linkage with New Zealand as of 2011 and engaging in conversations with China, California and Korea.

When the EU expanded to include Norway, Iceland, and Liechtenstein on 26 October 2007, it “highlighted that for nations or regions to join the EU’s scheme, their emissions trading systems must be mandatory, set absolute limits on emissions, have robust registry systems and have strict monitoring and compliance measures in place”.⁷⁴ Of the countries that joined the EU ETS in October 2007, Norway linked with the EU ETS because it already had an ETS of its own. The Norwegian ETS was designed to be compatible with the EU ETS, so many of the features of the two programmes are similar.⁷⁵ Like the EU ETS, the Norwegian ETS is split into three phases: Phase I (2005–2007), Phase II (2008–2012), and Phase III (2013–2020). The Norwegian ETS was amended in June 2007 and February 2009 to bring its features in line with Directive 2003/87/EC and thereby facilitate compatibility with the EU ETS during the Kyoto commitment period (Phase II, 2008–2012). The two programmes officially linked in Phase II, and they are expected to be fully harmonised by Phase III.⁷⁶

In Phase I, the Norwegian ETS included a one-way linkage with the EU ETS; Norwegian installations could purchase EU allowances for compliance, but not the other way around.⁷⁷ A bilateral linkage with the EU ETS was established in early 2009 when Norway’s revised national allocation plan, a document it was forced to craft as a member of the EU ETS,⁷⁸ was accepted by the European Commission. Since then, necessary amendments have been made to the Greenhouse Gas Emissions Trading Act, and the Norwegian ETS has been linked to the EU ETS with a few mutually accepted adaptations. For Phase II of the EU ETS, auctions are capped at 10% of overall allowances; however, for the same phase of the Norwegian ETS auctions account for 50% of

⁷⁴ Mace et al., 2008

⁷⁵ The Norwegian ETS is designed in a similar way to the EU ETS, and many of the flexibility guidelines for the two programmes are the same. Banking was not allowed between Phase I and Phase II, but unlimited allowances were permitted to carry over between Phase II and Phase III, and between years in Phase I. Borrowing is not technically allowed, but there is effectively year-ahead borrowing within trading periods. As is the case with the EU ETS, offsets from nuclear activity, sinks, and large-scale hydro power plants are not permitted within the Norwegian ETS. Failure to perform other mandatory duties also results in installation fines. For Phase II, the fine for excess emissions is €100/tCO₂e. In addition, the names of installations that fail to comply with their obligations are published as a shaming mechanism, and the following year the installation must submit allowances equivalent to the deficit in the previous year, on top of the initial cap. In Phase I, this fine was €40/tCO₂e.

⁷⁶ Holton, 2012

⁷⁷ Ranson and Stavins, 2012

⁷⁸ Due to its linkage with the EU ETS, Norway was required to submit a National Allocation Plan (NAP) for Phase II. This plan set the framework for allowance allocation. The NAP had to be approved by the EFTA Surveillance Authority (ESA) before Norwegian installations were officially allowed to transfer allowances from their accounts to accounts in the EU ETS.

allowance distribution. In addition, unlike the EU ETS, the Norwegian ETS does not designate any of its allowance reserve for new entrants. The Norwegian ETS was allowed to veer from EU ETS guidelines either when its system entailed stricter parameters than those of the EU, or when its national circumstances deemed inconsistency necessary.⁷⁹

Full integration of the two systems is likely to take place once Phase III begins.⁸⁰ This “full integration” basically means that the EU Commission will have complete power in determining the Norwegian cap for Phase III as its contribution to the single EU Phase III cap. Norway will no longer write its own allocation plan.

Switzerland, another European country that desires bilateral linkage with the EU ETS for Phase III, has not progressed as quickly as Norway. The Swiss and EU have already initiated discussions about linkage. This link is likely to become effective in 2014.⁸¹ The Swiss consider linking with the EU ETS desirable because a larger market provides for greater cost-effective reduction potential, liquidity, price stability, and flexibility in achieving targets. Furthermore, linkage would enable Swiss companies to participate in the same market as EU business partners.⁸² According to FOEN (2011), “the Swiss Federal Council has also proposed that the Swiss ETS be adapted in the context of the ongoing complete revision of the CO₂ Act with a view to attaining a high level of compatibility with the EU ETS”.⁸³ Hence, to achieve this desired link, Switzerland will need to amend domestic ETS legislation first.

Another example of a linkage process is the ongoing collaboration on mutual recognition of units between the US state of California and the Canadian province of Quebec, which will both place compliance obligations on large emitters of greenhouse gases under an ETS scheme beginning in January 2013.⁸⁴ The two jurisdictions, along with several other western US states and Canadian provinces, have been collaborating since 2007 through the Western Climate Initiative (WCI) on best practices and design principles for their ETS systems.⁸⁵

This information sharing has taken California and Quebec on a parallel track toward designing substantially similar programmes, so that now the two jurisdictions have the opportunity to “link”, or mutually recognise, compliance instruments issued by either programme. Any linkage between California and another jurisdiction requires the California Air Resources Board (CARB) to complete a full regulatory procedure to amend the California cap-and-trade regulation. This involves CARB staff developing a report that evaluates the stringency, quality, and overall design of the other programme, as well as potential economic and environmental impacts of the link and a 45-day public comment period. California’s governor and the CARB board must both approve the proposed linkage.⁸⁶ CARB has already presented their staff report on the Quebec linkage to their

⁷⁹ According to pewclimate.org, Norway is entitled to auction up to 50% of allowances because, prior to linking with the EU ETS, offshore oil companies were subject to a \$50/tCO₂e tax on emissions. If Norway had been forced to accept all of the EU ETS allowance allocation rules, then the regulations on these offshore oil companies would have eased. See Ellerman and Joskow, 2008.

⁸⁰ Holton, 2012

⁸¹ Ranson and Stavins, 2012

⁸² Switzerland Federal Office for the Environment, 2010

⁸³ Switzerland Federal Office for the Environment, 2011

⁸⁴ California Air Resources Board, 2012b (hereafter referred to as ISOR)

⁸⁵ Ibid., pp. 14–16; see also Western Climate Initiative, 2012.

⁸⁶ Senate Bill No. 1018, Ch. 5, § 12894, enacted 26 June 2012.

board and the public has provided comment. California is now waiting for Governor Brown to make his determination.⁸⁷

The CARB staff report confirmed that Quebec and California's programmes contained the same core elements, such as a cap, reliable mandatory reporting requirements, scientifically rigorous offset protocols, limits on borrowing, and strong penalty and enforcement mechanisms.⁸⁸ California and Quebec have also decided that if they link, they will conduct joint auctions and share a compliance instrument tracking system.⁸⁹ To help with the purely administrative and logistical tasks related to this endeavour, the two jurisdictions have set up a not-for-profit entity, WCI, Inc. This is similar to the entity set up by the Regional Greenhouse Gas Initiative and could provide a platform for other jurisdictions, such as those that initially participated in the WCI process, to link with California and Quebec in future years.⁹⁰

4.2. Linking to Other ETS and Overseas Credit Systems

There are three broad options for how Chile's ETS can interconnect with ETS and crediting mechanisms outside its direct national control:

- coordination of scheme features without trading units
- indirect linkages to other ETS established through mutual recognition of offsets or other third-party units
- direct linkages with sale of units between ETS schemes.

These options entail progressively greater degrees of linkage and can be considered as mutually independent options or as sequential phases. Linking of systems via trading can be direct or indirect. In addition, to the extent units are traded, Chile can be a buyer only, seller only, or both a buyer and a seller. Trading can be at the level of individual firms or regulated entities, and/or the government can participate in the market directly or as a possible intermediary between regulated entities and outside systems.

The benefits of having the individual entities trade directly with each other are more potential flexibility, innovation, and cost-effectiveness. At the same time, the government may have a valuable role as an intermediary that could help provide price stability as well as serve as an early buyer of units or credits that market actors may not be able to access. For example, in the proposed US Federal Waxman-Markey legislation, individual market participants could directly purchase international units from other participants. At the same time, the government administrator of the programme operated separate public funds to buy REDD credits, some of which would be retired to increase the ambition of the programme, and some of which would be bought for a cost containment reserve that would be sold to market participants at specified prices. The government may also wish to enter the market directly in order to buy or sell units related to overall national targets beyond those for the ETS sectors. For example, the EU ETS covers about half of the EU's economy and the Member States can buy or sell units to meet their overall national targets under the Kyoto Protocol.

⁸⁷ California Air Resources Board, 2012a

⁸⁸ ISOR, pp. 29–43.

⁸⁹ Ibid., pp. 20–29.

⁹⁰ Ibid., pp. 15–16.

A direct link involves directly buying or selling units from one ETS to another. In addition, recognition of units or credits from one system creates an indirect linkage to any other system linked to it. This is just as one link in a chain is linked to every other so that pulling on one link puts pressure on all the others. For example, if Chile were to become a buyer or seller of credits from an offsets system such as the CDM, it would indirectly become linked to any other ETS also buying credits from the CDM. This would mean that prices across all systems would be interconnected, with Chile's domestic price affected by the CER price, which in turn would depend on the demand from CERs for all the other ETS that accept those credits. Similarly, if Chile linked as a buyer or seller of credits to another ETS, Chile's prices would be affected by the demand and supply of credits from that ETS, which in turn would depend on that foreign system's links to other ETS and offset mechanisms, such that Chile would be indirectly linked to these systems as well.

The next section discusses the broad options available for linkages, beginning with harmonising ETS features without trading and following with a discussion of different trading linkages. In particular, the section examines how the advantages and disadvantages of trade linkages will vary depending on whether Chile links as a buyer or a seller, or both.

4.2.1. Coordination of scheme features without trading units

One option for “linking” Chile's ETS to ETS and other climate policies in other countries involves harmonising or otherwise coordinating over different scheme features, without the necessity of trading any units. Coordination of some features is likely to be a prerequisite or preparatory phase for achieving mutual recognition of ETS units, as discussed further below. Coordination of features can also be part of a policy to preserve options for future linkages. If these future linkages are anticipated, the approach of coordinating scheme features can also provide economic signals to market actors to begin preparing for international market participation. However, coordination of different policy features can also be considered a separate option for interconnecting with other schemes, without envisioning the potential for future transactions with external markets.

For example, emission reduction caps can be jointly negotiated as part of international climate agreements. National climate policy goals, including caps for a domestic ETS, can also be made explicitly contingent on actions by other countries and international progress, as the EU, Australia, New Zealand, and other countries have done. Such linkages of policy goals could help reach more ambitious international agreements but will create uncertainty for regulated entities over future policy requirements. Other non-ETS climate policies, such as taxes and standards, can also be harmonised and linked internationally, but these links are more challenging to establish.⁹¹

The option of harmonising or otherwise coordinating over different scheme features, without the need to trade any units, can yield several benefits, particularly if conducted jointly with close trading partners. First, it can provide consistency of obligations for multinational corporations, which is useful for close trading partners. Second, international harmonisation of caps and other policy goals could help reduce concerns over having an equal regulatory environment across countries, reducing competitiveness and leakage concerns, and facilitating the setting of more ambitious climate policies.

⁹¹ Metcalf and Weisbach (2012) pp. 110–129; Hahn and Stavins, 1999

While the economic effects of an ETS could have implications for trade and competitiveness in general, climate policies for one or more sectors in Chile may also have clear implications for trade issues, beyond carbon markets, as part of provisions in other ETS. In particular, the extent to which measures in Chile are deemed comparable or equivalent to the ETS of its trade partners may allow Chile to avoid border adjustments and other sanctions applied by these countries to “level the playing field” in terms of carbon regulation. For example, the proposed US Federal Waxman-Markey legislation included the option of a border carbon adjustment on imports of products from jurisdictions without comparable emissions pricing. In addition, as of 1 January 2012, the EU has already begun holding aircraft operators accountable for CO₂ emissions by establishing a special EU Emissions Trading System for aviation (sometimes referred to as the EU Aviation Directive). The EU law states that flights into the EU can be exempted from the ETS if the country of origin implements a measure with an environmental effect that is “at least equivalent” to that of the EU ETS. Chile may thus want to consider the extent to which an ETS or offsets programme would be considered an equivalent measure in the EU and the implications for the costs of its aviation sector.

Finally, as mentioned above, coordination of some features is likely to be a prerequisite or preparatory phase for achieving mutual recognition of ETS units and can also help preserve options for future linkages. At the same time, coordination of scheme features without trading means that Chile could preserve greater flexibility and control over the implementation and domestic impacts of climate policy, avoiding exposure to fluctuations and volatility in international markets. This therefore avoids some of the challenges, but also foregoes some of the benefits, of participating in international markets.

Coordination of scheme features without trading means that countries may be able to preserve greater flexibility and control over the implementation and domestic impacts of climate policy, avoiding exposure to fluctuations and volatility in international markets. For this reason, some have proposed a system of permits that would be traded only domestically by countries but would have the prices at which the government could sell permits and other key scheme features that would be coordinated across countries to achieve an efficient distribution of mitigation.⁹² While this is possible in theory, allowing markets to harmonise prices through trading is likely to be much easier in practice. In addition, coordinating ETS policies without international trading will not provide the benefits of greater liquidity and competition from thicker markets. This could be important to improve the functioning of the market. Most importantly, as discussed further below, such a policy will not offer Chile the potentially significant benefits in terms of either cost reduction from buying international permits or revenue from selling permits to international markets.

⁹² McKibbin and Wilcoxin, 2007

Table 4.2: Coordination of scheme features, without trading units

	Coordination of scheme features, without trading units
Advantages	<ul style="list-style-type: none"> • Does not require immediate market participation but can help manage competitiveness and international climate action. • Opens and preserves opportunities for participation in international emissions markets. • Provides consistency of obligations for multinational corporations, which is useful for close trading partners. • Can help establish equivalent regulatory measures and avoid possible trade repercussions (e.g. border taxes, allowance purchases to comply with EU aviation directive). • The government can retain greater control over the carbon price and other scheme design features. • May provide right early economic signals if future international linkages are anticipated.
Disadvantages	<ul style="list-style-type: none"> • Can delay or deny potential benefits of participation in international markets.
Existing schemes	<ul style="list-style-type: none"> • California and Quebec in initial phases of scheme design. • Pre-linking discussions between New Zealand and Australia.
Example of options in Chile	<ul style="list-style-type: none"> • Coordination of features with existing (EU, New Zealand) and planned ETS (e.g. Australia, California/Quebec, China, South Korea). • Coordination with other countries considering ETS, including through the PMR process and other fora (OECD, Asia-Pacific Partnership).
Potential implementation issues for Chile	<ul style="list-style-type: none"> • Will require consideration in parallel with other ETS design elements and dialogue process with relevant foreign jurisdictions.

4.2.2. One-way linkage: Buy only

Along with domestic offsets, a buy-only link is a way to expand the supply of credits regulated entities have access to. This means that Chile's ETS could pull units from the international market but the international market could not pull credits out of Chile's system. This will help Chilean entities who are net buyers of credits meet their compliance obligations at lower cost. Purchases of overseas allowances or credits could be conducted by individual firms and/or potentially by the government as an intermediary, as noted above.

Under no limitations on trading, an international buy-only link to a large market means that the international price will establish a ceiling on Chile's price. No Chilean entity will pay more domestically for a unit or offset domestically than it can get from purchasing a unit or offset from the overseas market. The opportunity to buy international units and offsets can be one of the most important cost containment features of the ETS design. The analyses of proposed climate policies in

the US identified the availability of domestic and international offset credits as the most critical policy variable affecting the overall costs of the programme – even more important than the availability of different energy technologies. Our preliminary analysis (see Appendix 6) shows that even relatively modest flexibility to buy credits from an international low-cost system, such as potentially REDD (Reduced Emissions from Deforestation and Degradation) credits from the states developing programmes with California, could provide sizeable cost reductions for Chile.

The other side of the equation is that domestic offset producers and other potential net sellers of units and credits will have to compete with sellers internationally and receive a lower price. If there are limits on the quantity of international units and offsets that can be used for compliance each year, domestic entities may not be able to source all their necessary units internationally and the Chilean price may not be pulled down all the way to the level of the international market from which Chile can buy. Thus, Chile's price could stay above the level of the international price if there are restrictions on the trading of units. This is the situation in the EU, where the domestic EUA price trades above the international CER price, as these units are not perfectly substitutable owing to the trading limits.

Increasing the supply of units within Chile can also solve some of the problems of a small market by promoting liquidity for those seeking to buy credits, potentially dampening volatility associated with a small number of players, and reducing the ability of domestic actors to exert market or monopoly power to raise prices in the emissions market. A buy-only link, however, would not do anything to improve liquidity for those domestic actors seeking to sell units and offsets. Thus, domestic firms might still be able to exert market power as buyers in the domestic market, lowering the price of domestic offsets, for example.

A buy linkage not only lowers the price internally, but also has implications for the quantity of emissions reductions achieved within Chile. Linking as a buyer means that entities within Chile would be able to buy external units rather than reducing emissions domestically. The government would thus want to consider the trade-off between cost-effectiveness and the desire to reduce emissions by a particular level within the country or to use the ETS to incentivise specific domestic clean energy or other mitigation activities. Such concerns, for example, have led to “supplementarity” provisions in the EU to limit the share of compliance that can come from international offsets and other external units.

As discussed below, recognition of allowances across different ETS is likely to require coordination and harmonisation of a variety of programme features, including mutual recognition of third-party units from either ETS or offsets. An interim step towards mutual recognition or an independent alternative could be buy-only linkages to another ETS or credit system (e.g. CDM, or emerging REDD programmes), or recognition and trading of mutually accepted units from third-party systems. The ability of Chile to link as a buyer could be politically simpler than linking as a seller of credits, since it reduces the need to demonstrate the environmental equivalence of units from Chile and could be step towards establishing a buy-and-sell link. However, decisions on imports of allowances/credits to Chile's ETS require strategic consideration of offset approaches and other features of the linked systems, so as not to foreclose other future linkage options

Ensuring the environmental quality of the units and offsets accepted in Chile's ETS will be important to the environmental performance of Chile's scheme as well as to the recognition and value of Chile's units in foreign markets. Before validating external units or offsets for use in its market, the government will want to be satisfied with the MRV and other environmental quality features of the units being traded, as well as with how they will affect market prices. It would also

want to consider how its acceptance of these units could affect other countries' willingness to buy units from Chile's system in the future.

Linking as a buyer also means that the international market will influence and possibly set the price in Chile. This means that Chile's ETS could become a price taker rather than a price maker – with the emissions price within Chile set by external versus internal forces. One link in a chain is linked to every other link. Similarly, linking either as a buyer or seller will also create both direct and indirect links (via other buyers of recognised third-party units). Linking to a chain of schemes means that each interlinked scheme can import market volatility and policy uncertainty as well as other potentially undesirable economic and environmental features into Chile's system, and vice versa, depending on the relative size of the markets. A possible concern is that a buy-only link to a system that allowed a large supply of low-cost units and credits would reduce price to a level inconsistent with the level of incentives desired domestically to drive mitigation in different sectors within the country. Of course, this concern could be addressed by tightening the cap, but that may not be politically possible.

The extent and impact of the indirect linkage created depends on the relative size of the ETS and third-party systems, the relative differences in marginal costs across the ETS and the third party system, and any restrictions on the trading of units within the schemes, as well as the possibilities to bank and save units for use in the future. An example of indirect linkage is the case of the EU and New Zealand ETS, both of which accept CERs from the CDM. Because the New Zealand ETS is relatively small compared to the EU's, and because New Zealand allows unlimited use of credits from the CDM within its ETS, these credits are perfectly substitutable for emission reductions within the country from the perspective of meeting the compliance needs of regulated entities. This means that the CDM price establishes an effective price ceiling within the New Zealand system and completely drives the price if it becomes low enough to become an attractive compliance option.

To balance the benefits and challenges of using overseas units and offsets, some ETS have adopted limits on the quantity as well as the sources/categories of different types of offsets and international credits that regulated entities can use. Jurisdictions may also choose to use the criteria for access to their market to incentivise certain types of overseas market developments. Proposed policies have included further restrictions on the maximum share of compliance obligations that can be met with non-domestic ETS units, including domestic offsets, international offsets and other types of international credits, with distinctions based on the characteristics and sources of the offsets/credits. Countries have also chosen to end market access for certain categories of credits, such as CERs from reductions in industrial gases (e.g. HFCs), as well as to plan explicitly in advance for a gradual phasing out and phasing in of different categories.

For example, California's ETS starting in 2013 allows linkages with other ETS but limits international offsets to those coming from "sectoral" programmes, including REDD+. It also limits total offset use to 8% of entities' total compliance obligation, with the share of this that can come from international sources rising over time. Similarly, the proposed US Federal Waxman-Markey legislation envisioned unrestricted trading with comparable ETS schemes but would have included absolute tonnage limits on the use of domestic and international offsets. It also had specific criteria for international credits, with the recognition of project-scale sources phasing out, and sectoral and national approaches for REDD and international offsets phasing in, over time based on countries' emissions and economic characteristics. In addition, the legislation included a trading ratio for the use of international offsets versus ETS units, demanding a higher number of offsets to be used against each unit of capped emissions (e.g. a covered entity must submit five tons of international offset credits for every four tons of capped emissions being offset). Such a ratio in theory can

protect environmental integrity, as stricter requirements are placed on the uncapped sectors, but it risks higher costs and reduced use of offsets. In practice, such a ratio can also actually reduce participation in offset programmes and lower the average environmental quality of each credit, and at the same time fewer credits are used overall.

The relative advantages/disadvantages of buy versus sell linkages are summarised in Table 4.3 and discussed further in the next section.

4.2.3. One-way linkage: Sell only

While a buy-only link only benefits net buyers of units domestically, a sell-only link would help net sellers by increasing demand for their units. Chile's potential ability to sell its units to other countries would mean that the external market could raise demand for its units, enabling profits from international sales that finance mitigation above and beyond the cap. However, it requires the agreement of the external buyer system, so may be complex to negotiate. Also, a sell-only linkage will raise costs for net buyers domestically and requires consideration alongside other design elements, such as allocation, price stabilisation, and level of the cap.

Under no limitations on trading, an international sell-only link to a large market means that the international price will establish a floor on Chile's price. No domestic actor would sell a unit or offset internally for less than it could gain by selling it overseas. As shown in our preliminary analysis, international sales could generate sufficient revenues to cover the costs of the programme and generate overall profits at the national level (Appendix 6). It could also help open export markets for low-carbon products. For example, in addition to reducing emissions, Chile could potentially market "low-carbon" agricultural products for export by "bundling" the products with emissions allowances or offsets that could be retired as part of the sale of the products.

The other side of the equation, however, is that domestic net buyers of units and credits will have to compete with international buyers and thus pay a higher price. This can have significant impacts for the distribution of costs and benefits under the programme. To an extent this can be anticipated, and could be addressed in advance through the allocation and other design elements to ensure equitable distribution of costs. If there are limits on the quantity of units that can be sold, domestic entities may not be able to sell all their units internationally and the Chilean price may not be pulled up all the way to the level of the international market.

In addition to increasing revenues for sellers of credits, a sell-only link will increase their liquidity. This would reduce concerns over domestic actors using market power on the buying side to keep prices low (i.e. monopsony power). A sell-only link, however, would not increase liquidity for those seeking to buy units or offset domestically. Thus, domestic entities that need to buy units or credits will have to compete with international buyers, and there may be concerns that large domestic actors could restrict supply on the selling side to keep prices higher than they would be in a competitive market. Competitive auctions of units by the government would be one way to reduce this concern.

Another potential downside of linking to a foreign system is the loss of sovereignty and government control over the ETS. Linking as a seller to a large market where costs were higher also means that Chile would likely become a price taker, with its price tracking international markets and introducing additional elements of volatility. In addition, in order for one nation's regulatory authorities to be satisfied that a tonne of another nation's emissions units or other credits could be tendered for compliance by regulated emitters in the nation's system, and vice versa, certain

elements are likely to be regarded by the nation's authorities as essential for environmental and economic credibility. Recognition of Chile's units by foreign ETS will probably require Chile to harmonise some, though not all, scheme features with those of the other schemes to which it is being linked. In general, the more ambitious, transparent, and well regulated an ETS scheme is, the more likely it can link in the future with other schemes and that it will be able to do so with a lesser degree of restrictions.

It is possible that two systems with equivalent standards of MRV, for example, might be able to reach agreement to link together, even if those standards are lower or different than those required for other linkages. Nevertheless, multiple emerging markets risk developing incompatible standards, impeding further linkages and jeopardising an eventual international system. Chile and other early adopter programmes will need to consider how, in the longer term, their schemes can integrate smoothly with existing emission markets, with each other, and with additional future programmes in ways that maximise their environmental and financial value. This will require that Chile's government and other jurisdictions developing ETS and crediting programmes to understand each other's needs and policy preferences in real time, as policies are developed and implemented.

Finally, while linking between systems is likely to be a complex process, involving the harmonisation of features and political negotiation, once Chile does link to another scheme this will constrain the government from unilaterally changing scheme features in the future. Furthermore, there will be high economic and political costs associated with de-linking from another system. For example, if domestic entities made investments in new equipment based on expectations of units or offsets sales given a high carbon price dependent on foreign demand, de-linking from the foreign market such that the price falls would risk leaving those assets stranded. De-linking as a buyer will also involve trade-offs with certain interests created by the linkage, but may be easier, as evidenced by the EU experience. However, this may have been dependent on the fact that ETS prices were low, supply was high, and regulated firms did not need those particular CERs for cost containment. Thus, the benefits and costs of linking as both a buyer and a seller should be evaluated carefully on a case-by-case basis.

ETS design elements that are likely to require harmonisation are those that relate to the basis for issuing allowances/credits, as these are the units that are transacted across systems. The environmental comparability of the units will be a principal consideration. Such elements also include the cost-containment features (use of offsets, price floors, price ceilings, banking, borrowing, allowance reserves). Linking will also entail agreement on the level of ambition of the schemes, including level and time frame of the cap and, potentially, procedures for re-evaluation.

The robustness of MRV and other environmental quality dimensions of the units and offsets accepted in Chile's ETS will also be particularly important for the environmental performance of the scheme, and for the recognition and value of Chile's units in foreign markets. In addition, existing schemes that have a hard cap on absolute emissions levels will probably be reluctant to link with systems that have intensity-based caps, given that one tonne of emissions reductions below the cap under one scheme is clearly not equivalent to one tonne of reductions in the other scheme. Similar concerns will apply for schemes with a hard price cap ("safety valve") provision that means the cap can be loosened if prices rise.⁹³

⁹³ See Petsonk (2009) for more discussion of design elements that could facilitate or hinder schemes' ability to "dock" into future emission markets.

Agreements on linkage are likely to involve an element of political negotiation, whether at the level of the UNFCCC or in the context of bilateral arrangements. In addition to issues of environmental and economic credibility, this will include an issue of distributional fairness. In particular, the relative ambition of the cap or the baseline (for offsets/crediting mechanisms) is likely to be a critical issue to determine each country's or jurisdiction's "fair share" in combating climate change, as well as ensuring a level playing field between trading competitors. A level of "own effort" is similarly a likely requirement for establishing baselines for crediting reductions under large-scale crediting systems, such as REDD.

Design elements about how allowances are distributed domestically, such as their allocation or the precise level of penalties for non-compliance, are not transferrable so are unlikely to raise technical issues for international linkage. In addition, it is not necessary for linked schemes to have comparable sectoral coverage as long as both countries have confidence in the comparable environmental integrity of the units. However, these concerns may still raise political issues even when technical aspects can be addressed, particularly among trading partners with competitiveness concerns over the relative stringency of regulations for particular sectors. Negotiating such links has not been a simple process to date and there are few actual examples, but it may become more streamlined in the future as more linkages develop.

Table 4.3: Comparison of buy versus sell linkages

	Buy linkages	Sell linkages
Advantages	<ul style="list-style-type: none"> • May be simpler to establish if only unilateral approval needed. • Do not require harmonisation of Chile's policy features. • Lower compliance costs for regulated entities (international market will lower and possibly set ceiling on domestic price). • Lower costs can enable more ambitious target. • Increases liquidity for domestic buyers. • Improve competitiveness by limiting possible market power of large domestic sellers. • Reduce volatility owing to small market. • Have a strategic role in developing international emission markets. 	<ul style="list-style-type: none"> • Raise demand for Chile's units/offsets and allow net profits from international sales. • Finance for domestic mitigation above and beyond the cap. • Can help cover costs of more ambitious national target. • Lower costs of buyers, potentially enabling stricter climate targets in other jurisdictions. • Greater liquidity for sellers of credits. • Improve competitiveness by limiting possible market power of large domestic buyers.
Disadvantages	<ul style="list-style-type: none"> • Reduced government control over Chile's price. • Imports volatility and policy uncertainty from connection to international markets. 	<ul style="list-style-type: none"> • Require the agreement of the buyer system so complex to negotiate. • Imports volatility and policy uncertainty from connection to international markets.

	Buy linkages	Sell linkages
	<ul style="list-style-type: none"> • Can complicate future links with other ETS depending on features of units/credits purchased. • Reduce mitigation occurring domestically. • No advantages from selling units. 	<ul style="list-style-type: none"> • Loss of sovereign flexibility to make unilateral changes to ETS design. • Will require close coordination and significant harmonisation of a variety of critical scheme features. • Higher prices/costs for domestic buyers, with potential competitiveness and distributional equity concerns. • No advantages from buying units.
Existing schemes	<ul style="list-style-type: none"> • Annex I countries purchase of CERs from developing countries. 	<ul style="list-style-type: none"> • EU and Norway have buy-and-sell linkage. • A full two-way linkage between the EU and Australia is not yet active, but it must commence no later than July 1, 2018. • New Zealand can sell units from the forestry sector (and will expand to allow sales from other sectors), while allowing purchases of some types of CERs, ERUs, and RMUs.
Example of options in Chile	<ul style="list-style-type: none"> • Unilateral linkage as buyer of (certain types of) CER and/or REDD credits (UNFCCC recognition will depend on rules). Can include quantitative as well as qualitative restrictions on purchases. • Linkage can be at firm/entity level or potentially via government trading or intermediation. • Linkage as buyer of credits from one or more national and/or subnational ETS systems. Can include quantitative as well as qualitative restrictions. 	<ul style="list-style-type: none"> • Sell-only or mutual recognition negotiation with one or more national/subnational ETS (California and Quebec, EU, Australia, New Zealand systems). • Linkage can be at firm/entity level or potentially via government trading or intermediation.
Potential implementation issues for Chile	<ul style="list-style-type: none"> • Will require consideration as package with other cost-containment issues (e.g. could be part of cost-containment unit reserve). • Could require dialogue and negotiation processes with relevant jurisdictions to assure desired quality of credits. • Will require strategic consideration of different offset approaches to ensure economic and environmental benefits. 	<ul style="list-style-type: none"> • Will require adjustments of allocation or other provisions for addressing competitiveness and distributional concerns. • Will probably require intense dialogue and negotiation processes with relevant jurisdictions as part of ETS design process. Inclusion of forestry and agriculture could be a key issue. • Will require strategic consideration of offset approaches and other scheme

	Buy linkages	Sell linkages
	<ul style="list-style-type: none"> Will require strategic consideration of offset approaches and other scheme features so as not to foreclose linkage options with other ETS. 	<p>features.</p> <ul style="list-style-type: none"> May intersect with other regional and global trade discussions. Probably not feasible in the short term while the system is being tested and adjusted.

4.2.4. Mutual recognition of units issued under linked schemes (buy-and-sell linkage)

In addition to limiting an ETS to just buying and selling to another scheme, a third possibility is full flexibility to buy or sell units depending on the most profitable opportunities in the market. As noted above, both buying and selling offer potential gains from trade, especially if links occur to markets with both higher and lower costs than those of Chile. Selling opportunities benefit those entities with marginal costs below the international market price that can thus gain a surplus by selling, while buying opportunities allow those with relatively higher costs to buy less costly overseas units. Even in a country that expects to be a net seller in aggregate and to benefit from high international prices, individual ETS participants may still be net buyers that are disadvantaged by high international prices. Thus, allowing flexibility to buy units and offsets from lower-cost jurisdictions would still provide benefits to some participants even as others are net sellers to overseas markets. A buy-and-sell arrangement would maximise flexibility and liquidity, but would allow Chile's price to either rise or fall based on international prices.

If both buying and selling of units is permitted, some Chilean entities would sell units internationally while others might buy units, depending on whether the costs of reducing emissions internally was lower/higher than the price at which the units could be sold/bought internationally. Whether the country of Chile as a whole would be a net buyer or seller depends on the level of ambition of the cap adopted for 2020 and potentially beyond. Chile's estimated opportunities to sell or buy credits internationally also depend on the range of sectors included in the market and associated costs of reducing emissions internally and/or through international low-cost credits, as well as the international price. As detailed in Appendix 6, economic modelling of scenarios with expanded forestry, agriculture and waste mitigation and 20% and 30% reduction targets relative to 2020 and 2030 emissions projections, respectively, indicate the country could earn enough profits from international sales to exactly cover all the costs of its climate program if international sales are possible at prices of \$10-\$19/tCO₂ in 2015, rising at 5%.

If all allowances and offsets are not perfectly exchangeable in a single international market due, for example, to restrictions on the quantities of offsets allowed for compliance in different schemes, different types of units might trade at different prices on international markets. As a result, it might also be profitable for Chilean entities buy some types of units and sell others on international markets. For example, Chile may be able to buy some lower cost international credits (e.g. from REDD) as well as sell allowances internationally for a higher price (see appendix 6 for more details).

4.3. Offsets (Domestic and International)

The flexibility to use offset credits for emissions reductions from uncapped sectors can be an important mechanism for cost-effectively reducing emissions under an ETS. Approaches for tapping mitigation from uncovered sources offer flexibility over ways to reduce emissions domestically and internationally, and have the potential to promote faster reductions and to reduce compliance costs of meeting emission reduction goals substantially without compromising environmental integrity. As detailed in Appendix 6, economic modelling indicates that broadening the range of emission reductions in Chile beyond energy and industry sectors to include forestry plus agriculture and waste, and/or purchases of low-cost international credits plays a key role in lowering costs and enabling Chile to meet its -20% reduction target relative to projected emissions for 2020, as well as potentially more ambitious reductions through 2030. Depending on the sectors covered by the ETS, therefore, extending the range of mitigation opportunities through offset programs, both domestic and international, could be critical for containing program costs. Limiting the amount of international credits to 5% of total abatement only modestly affects the estimated cost savings to the country.

While reducing costs to the regulated sectors, offsets can also stimulate technology innovation in the uncapped sectors, and provide economic and environmental co-benefits in addition to reducing greenhouse gases. For instance, activities to reduce emissions from agriculture can create economic development benefits for rural regions while reducing erosion, improving water quality, and protecting biological diversity.

This section will describe different options for including uncovered sources and sectors as offsets under Chile's ETS. Changes in emissions from uncovered sectors could be counted under a national accounting system, which encompasses emissions within and outside ETS sectors. Changes in emissions at the national level could potentially generate tradable units, as is the case with the AAUs of Annex 1 countries under the Kyoto Protocol. On the other hand, in addition to using emission allowances established under the cap, entities covered under the ETS could be allowed to reduce their compliance costs by compensating or offsetting some of their emissions through the use of approved offset credits from mitigation activities that remain uncapped under domestic or international climate policies. A combination of approaches is also possible, with some activities credited as offsets and others simply counted in national accounts.

Issues regarding offsets are a particularly important consideration for linking, with implications for both domestic and international linkages. Depending on which sectors and sources are covered by the ETS, decisions over opening the ETS to credits from domestic uncovered sectors and sources via offset mechanisms could have important implications for containing the costs of the programme, regardless of participation in international markets. In terms of international markets, Chile will need to consider participation as both a potential buyer and seller of offsets credits.

Offsets broaden the available options for complying with the requirements of an emissions cap by providing covered entities with greater flexibility to make greenhouse gas reductions wherever, however, and whenever they are most economical. For example, the forestry and agriculture sectors fall outside of the cap in the cases of the EU ETS, California's AB-32, and proposed US Federal policies, but still offer a range of opportunities to reduce emissions or increase carbon uptake (sequestration) at relatively low costs using existing technologies (e.g. by changing management practices, reducing deforestation, and afforestation/reforestation). Greater flexibility to use such options for meeting compliance obligations over the near term can be particularly valuable

as a “bridge” during a transition period when new energy and industrial technologies are still being developed. Such flexibility could also enable firms to invest in more research and development over the near term and then leapfrog to new technologies in the future, rather than sinking costs into long-lived capital investments in current technologies.

In addition to generating reductions from uncovered sources domestically, both the government and covered entities could also engage as a buyer of international offsets. International offsets are credits from reducing emissions in other countries that do not have their own emissions cap (or from specific uncapped sectors or activities in other countries), and thus are not eligible to trade allowances.

The United States Environmental Protection Agency’s economic analysis of the most recent Federal cap-and-trade proposal in the US Senate estimated that including domestic and international offsets (largely by credits for reducing emissions via tropical deforestation) would cut allowance prices by more than 50%.⁹⁴ While this analysis makes a number of probably highly unrealistic assumptions (e.g. that high-quality REDD credits would be available immediately from all tropical countries), it nonetheless suggests that allowing the use of offsets could have a larger effect on compliance costs than the deployment of key technologies such as carbon capture and storage or nuclear power.

Ensuring the environmental value and equivalency of offset credits is a particular challenge. The complexity arises from the fact that these credits come from voluntary activities where specific actors are rewarded for reductions according to some “baseline”, and where they have the choice to opt in or out of these programmes, without any penalties for emitting above the baseline, and where there is no overall constraint on emissions. In particular, there is a concern that participation may be selective and that some reductions may not be truly “additional” compared to what would have occurred otherwise, thus not representing a real reduction. There may also be significant leakage of emissions to other actors not participating within a country or region. This is in contrast to an ETS where all covered actors must participate and where total emissions under the cap must go down if a unit is sold to another jurisdiction.

When a particular set of activities is placed under a binding cap, total emissions are forced to go down from what they otherwise would have been, to the level of acceptable emissions established by the cap. As the cap goes down, each reduction in the units of allowances forces total emissions in the covered sectors to decline by this amount. Offsets, on the other hand, allow covered entities to increase their emissions in the covered sectors (as if they had more allowances) in exchange for reductions in uncapped sectors domestically or in other countries.

Depending on the specific offset category and the rigor and requirements of the GHG program, the environmental concerns with offsets can be reduced. The environmental “quality” of offsets is important to address so as to ensure that the domestic and global emission reductions goals for Chile’s ETS are still achieved, and ideally enhanced, in the case that the system accepts offsets from domestic and/or international sources. The environmental reliability and structural design of offsets programmes from Chile, and whether and how different offsets – both from within and outside of Chile – are included in Chile’s ETS, will also be critical design elements for the decisions of other ETS to buy offsets as well as emissions allowances from Chile.

⁹⁴ U.S. Environmental Protection Agency, 2010

There is a body of experience in developing standards and protocols for offsets from the voluntary carbon market, international programmes, and national, state and regional programmes. Several criteria must be consistently defined and satisfied to ensure that offset credits can be exchanged with emission allowances issued under a cap while achieving equal or greater environmental benefits. In general, to ensure the environmental quality of issued credits an offsets programme must produce credits that are:

- Real – truly reduce GHG emissions
- Additional – achieve reductions beyond an established baseline, such that the reductions at minimum would not have occurred otherwise under BAU
- Measurable – be subject to accurate measurement and monitoring
- Verifiable – by disinterested third parties
- Serialised and tracked on a registry – to allow demonstration of ownership and prevent double-counting
- Enforceable – in a court of law
- Permanent – in the sense that the offsets programme should ensure liability for reversals so as to guarantee reductions in emissions that persist at least as long as the reductions achieved under the emissions cap.

Effective standards and accounting rules and systems to achieve these criteria will be crucial to ensure the quality of offsets and safeguard emissions reduction goals. An offset system that achieves cost-effective reductions must also meet the environmental objectives while ensuring that administrative and transaction costs are kept at manageable levels. Developing offset programs to meet the above criteria entails infrastructural requirements that include:

- Rules and procedures to guide the development of methodologies and projects;
- A system for accrediting validators of projects and verifiers of emission reductions and removals, as well as ensuring proper oversight of auditor;
- A registry system;
- Professional staff to administer the program and/or provisions to engage qualified third parties (like California's Offset Project Registries) to support program administration.

Not all offsets or emission reduction crediting systems are created equal. There are distinctions for how crediting from uncovered sources can be structured to have major implications for the cost-effectiveness and environmental performance of the ETS, as well as the tradability of these credits in different countries' ETS. Offsets can be structured to tap additional sources of mitigation that provide large opportunities for emission reductions which can be important in reducing costs and generating valuable environmental and social co-benefits. However, depending on the structure of offset mechanisms, credited emission reductions from offsets could potentially have lower environmental value relative to emissions achieved under the capped sectors. Different offset system structures also run the risk of being too cumbersome and their transactions costs too high to be effective in delivering significant mitigation at reasonable cost, thus reducing all the potential benefits of offsets.

Offset programs may also be designed to be more efficient and effective. A trend towards the use of standardized offset methodologies, which predefine conditions for additionality or other criteria for crediting certain types of activities, offers potential to streamline procedures, enhance consistency, and reduce costs for individual projects.⁹⁵ There is also increasing interest in the ability of programmes to issue credits for reducing deforestation emissions and other activities that are based on accounting at a higher “sectoral” or geographic scale (e.g. at the level of a state or country), including “programmatic” approaches under the CDM as opposed to project-scale systems, such as the CDM to date. The EU, California, and proposed US Federal schemes have indicated a preference for trading with other ETS and from scaled-up crediting approaches, including REDD+, as opposed to project-scale offsets, except from poor countries or small emitters. In particular, the EU has moved towards accepting new CDM projects only from least developed countries (LDCs) after 2013 (this provision might not have a large impact as much of the supply of CERs will be covered with projects registered before 2012). This is also consistent with the UNFCCC concept of REDD+ crediting at national scales, with subnational crediting on an interim basis.

Scaled-up crediting offers potential to simplify administration, generate other economic efficiencies of scale, and help address environmental concerns. In particular, higher-scale systems account for leakage within the sector/jurisdiction and reduce concerns over additionality and permanence. These concerns may be acute for individual activities, but confidence over additionality and permanence will tend to be greater for a whole region or sector reducing below a baseline of historical emissions, for example, and for a jurisdiction with mechanisms to enforce liability against reversals.

While linking ETS usually requires a formal agreement at a political level over the recognition of a particular scheme’s units, it is possible – particularly in the context of offsets – that a system of “buyer liability” could emerge, as is currently being developed in California. This would mean that schemes would specify their criteria for recognising credits, but the individual participants would be responsible for replacing those credits if their environmental integrity is violated and they become invalid. Such a system would mean that buyers might be willing to pay a higher price for credits that are more secure and a lower price for credits that pose greater risks. In this way, the market itself would differentiate across different types of credits. A system of seller liability could also be established, but may be more difficult to enforce in an international context, especially outside of an international climate agreement. Regardless of the assignment of ultimate liability, it is important for offset crediting systems to have rules for ensuring that risk is managed and mitigated by the actors and jurisdictions developing the credits, and that these risks can be evaluated transparently.

4.3.1. Options for offsets

The international policy framework creates a dynamic landscape of challenges and opportunities, with a temporary extension of the Kyoto Protocol, and a new and as yet undefined international agreement scheduled to be negotiated under the Durban Platform by 2015 and due to become effective by 2020. Chile will need to decide the extent to which it wishes to limit itself to UNFCCC mechanisms for linking and offsets, and the extent to which it wishes to recognise and participate in mechanisms being developed from the “bottom up”. While UNFCCC mechanisms potentially offer more legitimacy and security of being recognised in the future, the UNFCCC

⁹⁵ Seagar and Ferretti, 2012

process has been slow and unwieldy to respond to market demands and changing conditions. As a result, schemes such as the EU's have made their own unilateral decisions about what types of units to recognise from the menu of choices provided by the UNFCCC. Other schemes, such as California's, are charting their own course in terms of negotiating mutual recognition of units with other schemes and developing domestic and international offset criteria, informed but not limited by UNFCCC decisions. In particular, California has decided to accept international offsets sourced only from sectoral programmes and has established a working group with the states of Acre in Brazil and Chiapas in Mexico to cooperate on developing criteria for generating compliance credits from REDD+. The existing and potential options for crediting offsets within and outside the UNFCCC are compared in Table 4.4 and discussed further below.

Table 4.4: Comparison of crediting mechanisms within and outside UNFCCC

	Operational UNFCCC crediting mechanisms	Potential new UNFCCC mechanisms (market and non-market)	Crediting approaches outside UNFCCC
Advantages	<ul style="list-style-type: none"> • Already developed set of approaches with track record, ongoing improvements, and legitimacy of UNFCCC. • Some existing market access. 	<ul style="list-style-type: none"> • Scaled-up approaches may provide greater environmental assurances and economic efficiency. • Legitimacy of UNFCCC process. • May provide greater market access as well as non-market finance. 	<ul style="list-style-type: none"> • Some ready to go immediately to credit early/prompt action • Greater flexibility • Can help inform UNFCCC developments • Jurisdictional and “nested” systems under development (e.g. for REDD+) can provide market access to private actors with benefits of scaled-up crediting. • Demonstrated mechanisms for facilitating the entry of agriculture and forestry credits into both voluntary and mandatory markets. • Greater development and use of standardized methods (e.g. California, Australia, CAR, VCS). • Developed standards for recognizing co-benefits associated with carbon projects (e.g. VCS/CCBA tagging, Gold Standard).
Disadvantages	<ul style="list-style-type: none"> • Currently no formal UNFCCC recognition and rules for a 	<ul style="list-style-type: none"> • Not yet operational and agreement could be slow. 	<ul style="list-style-type: none"> • Lacking UNFCCC stamp of approval.

	Operational UNFCCC crediting mechanisms	Potential new UNFCCC mechanisms (market and non-market)	Crediting approaches outside UNFCCC
	<p>developing country to purchase/trade Kyoto Protocol units or use the international trading log (ITL).</p> <ul style="list-style-type: none"> Challenges of project-scale approaches to credit reductions below counterfactual baseline. Poor record for forest and land sectors. Unclear what Kyoto Protocol elements will transfer to Durban. Linking acceptability may vary across schemes and could complicate some linkages. 	<ul style="list-style-type: none"> May not generate market based finance and depend on availability of public funding. 	<ul style="list-style-type: none"> Linking acceptability may vary across schemes and require harmonization of standards..
Existing schemes	<ul style="list-style-type: none"> CDM for developing countries and JI for Annex 1 countries. 	<ul style="list-style-type: none"> Proposed New Market Mechanisms Proposed REDD+ and financing, crediting, and trading of NAMAs. 	<ul style="list-style-type: none"> Approved offset protocols under California's AB32 and working group to develop REDD+ methodologies. Other voluntary market standards (e.g. ACR, CAR, VCS) The Australian Carbon Farming Initiative (CFI).
Example of options in Chile	<ul style="list-style-type: none"> Chile opens market to some types of CERs and Kyoto units (without current UNFCCC recognition). Chile sells CERs to markets that accept, with provisions to avoid double counting. New programmatic CDM approaches. 	<ul style="list-style-type: none"> Sectoral NAMA and/or national/subnational REDD+ program, building on UNFCCC guidance to date. 	<ul style="list-style-type: none"> VCS Jurisdictional and Nested REDD+ Initiative. The Santiago Climate Exchange (SCX) has been building a trading platform that would allow for early action offsets that could eventually be recognized by an official trading system.

	Operational UNFCCC crediting mechanisms	Potential new UNFCCC mechanisms (market and non-market)	Crediting approaches outside UNFCCC
Potential implementation issues for Chile	<ul style="list-style-type: none"> Administrative hurdles with CDM implementation. 	<ul style="list-style-type: none"> Could build on existing complementary measures. 	<ul style="list-style-type: none"> Could build on existing complementary measures.

Operational and new potential UNFCCC offset mechanisms

Current opportunities for Chile to engage in mechanisms under the UNFCCC are limited to selling CERs under the CDM, as it has already been doing, but near-term demand for these credits will be limited by the EU's current "oversupply" and decision to restrict eligible CERs to those from LDCs. To the extent that Chile establishes an ETS but has not yet linked as a seller of units to other schemes, it may still want to consider continuing to sell CERs internationally from both covered and uncovered sectors. If so, it will need to make sure that reductions credited internationally can also not generate additional credits domestically and thus be double-counted. As a buyer, Chile has the option of unilaterally accepting CERs and other Kyoto mechanism credits from other countries, though this kind of trading would not yet be recognised under any international agreement.

It is not yet known how CERs and Kyoto approaches will translate into an agreement under the Durban Platform or how approaches for REDD+ will evolve. There is also interest in developing a New Market Mechanism under the Durban Platform, which could potentially include REDD+ and other approaches, but there has not been any definition. Similarly, there are discussions over the potential to generate market and non-market finance through NAMAs, and various proposals are on the table.

Offset/crediting approaches outside the UNFCCC

A dynamic voluntary market for offsets has recently emerged to enable companies and individuals to reduce GHG emissions on a voluntary basis. As a newly emerging voluntary market operating in the absence of government oversight, it has seen a proliferation of different standards and concerns over the environmental validity of some of the produced credits. At the same time, the voluntary sphere has seen robust innovation and development of methodologies that could provide models for compliance markets, as well as new project types that might otherwise be ineligible in a compliance market. A purely voluntary market could continue to be used as a means for individuals as well as companies to purchase and retire reductions on the basis of personal or corporate social responsibility, in parallel to an offset market that companies can use for meeting mandatory obligations, though double counting concerns can arise in sectors covered by an emissions cap. Alongside both the UK and the EU ETS, individuals and corporations purchase and retire offsets on a voluntary basis.

Chile's government will need to consider whether it wishes to develop its own domestic offsets programme, based on its own criteria but outside of UNFCCC processes, which could be sold domestically. Voluntary market developments through the Santiago Climate Exchange (SCX), for example, could also begin to address requirements needed for a fully regulated system

(standardized methodologies, local auditing capacity, local registry services) and facilitate the transition. This may be especially important if the forestry sector is not covered by the ETS and given the difficulty that afforestation/reforestation projects have traditionally had under the CDM owing to concerns over permanence. It may also be possible to draw on voluntary market experiences and to develop different approaches to address permanence, based on buffer requirements for example, as California and Australia are doing even as the issue continues to evolve under the CDM. The government will similarly need to consider whether it wishes to negotiate its own links with other schemes, outside of a UNFCCC agreement, and whether it wishes to engage as both a buyer or seller of international offsets, such as the sectoral REDD frameworks being developed in California, before there are final decisions on all aspects of these issues under the UNFCCC.

Australia has kept options open for accepting UNFCCC and non-UNFCCC units into its ETS, which is scheduled to open to the international market in 2015 and could be the largest medium-term demander of CERs and other types of UNFCCC and “internationally recognised” units. However, the future of Australia’s scheme is still uncertain and the criteria for recognising international units have not been specified. Domestically, Australia is developing an agricultural and forestry offset system under its Carbon Farming Initiative (CFI). It has chosen to distinguish offsets based on Kyoto-recognised activities (which are currently recognised for domestic compliance) from non-Kyoto offsets (which are currently limited to the voluntary market but may be recognised in the future). This is potentially a way to maintain flexibility for linkage with other schemes, such as the EU ETS, which has generally been less receptive to credits from the agricultural and forest sectors. South Korea has indicated interest in linking but has not yet defined criteria. It has announced that it will not accept CERs into its scheme until 2020. It is also working on the development of a domestic system of forestry offsets.

4.3.2. Evaluation of options against key criteria in the Chilean context

Table 4.5 summarises the implications of different linkage options according to the key criteria for Chile’s decision-making.

Table 4.5: Evaluation of options for overseas linking against key criteria

Key criteria	Evaluation of options for linking to other ETS and overseas credit systems
Environmental effectiveness	<ul style="list-style-type: none"> • Decisions on linking with other ETS should be compatible with the government’s GHG mitigation objectives up to and beyond 2020, taking into account Chile’s goals for domestic and global mitigation via participation in international markets. • Harmonisation of scheme features with or without trading could affect global emissions reductions and help manage leakage across different countries. • Linking as a buyer and/or seller will involve consideration of all other design elements related to environmental integrity. Chile will want to consider the environmental value of the units that might potentially be imported into Chile’s system. Other countries buying units from Chile will similarly want to consider the environmental value of Chile’s units, including any other allowances/offsets that Chile imports. The considerations over linking are likely to involve negotiations over the stringency of the cap and baselines for crediting offsets.

Key criteria	Evaluation of options for linking to other ETS and overseas credit systems
	<ul style="list-style-type: none"> • Linking to international markets can potentially lower overall mitigation costs across linked schemes and even raise revenues that may increase the feasibility of more stringent caps and baselines, increasing environmental benefits. • Chile will want to consider the extent to which it would like to use access to its market as a tool to create incentives for emissions reductions in other jurisdictions that might link to its system.
Economic efficiency	<ul style="list-style-type: none"> • Decisions on linking with other ETS should be compatible with the government's goals for the economic incentives created under the ETS. • Linking will thus involve consideration of all other design elements related to the economic efficiency of the system. Chile will want to consider the economic features of the units that might potentially be imported into Chile's system. Other countries buying units from Chile will similarly want to consider the economic features of Chile's units. • Harmonisation of scheme features with or without trading could affect allowance purchase requirements and other trade sanctions established by trade partners. • Linking is an integral part of the package of provisions to address cost containment and price stability, as it will affect both the price and volatility. If Chile links to the larger existing or emerging ETS, it could become a price taker, linking to all the features of the international system. • Linking as both a buyer and seller will ensure the greatest gains from trade, both in terms of reducing net costs and maximising net benefits for the country as a whole. Linking as a buyer is likely to lower price and costs, while linking as a seller is likely to raise the price and lower the net costs (increase net benefits) after considering profits from sales. • Linking can also provide more liquidity and make the market more competitive, lowering some sources of volatility and exercise of market power. • Global economic efficiency will be maximised under well-designed linked systems based on agreed caps consistent with the long-run environmental goals that provide stability and certainty for investments. In practice, the extent to which the reality deviates from this ideal will be the basis for evaluating linkages. • There is a spectrum of options for limiting the exposure of Chilean firms to the international market as buyers (or potentially even as sellers). The benefits of these measures should be evaluated against the potential efficiency losses from reduced gains from trade.
Competitiveness impacts	<ul style="list-style-type: none"> • Linking will always lead to gains from trade in the aggregate for the economy but there may be individual winners and losers. Linking will thus have distributional and competitiveness effects. • Linkage can reduce costs for regulated entities in three ways: it can (but not always) lower costs of compliance by lowering price; it can lower net cost by increasing opportunities to earn net profits on permit/offset sales; and (with or without trading) it can lower costs by avoiding border carbon adjustments

Key criteria	Evaluation of options for linking to other ETS and overseas credit systems
	<p>or other penalties imposed by trade partners with carbon pricing systems.</p> <ul style="list-style-type: none"> • Linkage can increase competitiveness impacts by raising prices in Chile's ETS. Those who will still be net buyers at these higher prices will be affected more than if the price were lower. These impacts will need to be considered as part of policies to reduce negative impacts for competitiveness. • Linkage can also enhance competitiveness by increasing competition via the carbon market, creating greater incentives for innovation. • There could be many opportunities to increase competitiveness in terms of operating in a carbon constrained policy environment by opening new overseas markets for emissions reductions and taking advantage of lower cost opportunities through linkages.
Equitable burden sharing	<ul style="list-style-type: none"> • Linkage will always reduce net costs for the economy but there will be distributional impacts, as noted above. These will need to be considered in terms of adjusting the policies to deal with these impacts, notably allocation.
Administrative feasibility and costs	<ul style="list-style-type: none"> • Linking as a seller may require improving standards for monitoring, transparency, and enforcement that would tend to raise total administrative costs. • Linked jurisdictions might also consolidate some tasks, such as running joint auctions and tracking units (e.g. via WCI, Inc.), which could lower administration and logistics.
Regulatory and other barriers	<ul style="list-style-type: none"> • Chile will want to consider the cost of any carbon taxes or other climate regulations in addition to the cap when it links to other systems as a seller. This will influence how linking affects the distributional and competitiveness impacts on its firms.
Other impacts, including co-benefits	<ul style="list-style-type: none"> • Depending on whether Chile is a net buyer or seller of allowances/credits and whether it adjusts its cap in response to linking opportunities, the overall amount of reductions achieved in Chile could be increased or decreased. This could provide greater or lower co-benefits within Chile as well as in other jurisdictions linked to its system.

4.4. Framework for Government Decisions

Linking and offsets are likely to be central issues for the economic benefits and functioning of an ETS in Chile. Given the fluid state of international climate policies, Chile's decisions will ultimately be influenced by the relative timing of progress on Chile's ETS, international negotiations, and ETS development in different jurisdictions. However, the current state of uncertainty means that many options are still on the table, and the government can actively be engaged in promoting its policy preferences to enhance the benefits of its ETS and ensure market access to and from other jurisdictions.

A potential course for linking and offsets in Chile could be as follows:

- Engage in both bottom-up and top-down international policy-development processes, including working groups of possible trading partners to cooperate on design elements and policy preferences in real time.
- Design ETS in parallel so as to preserve linkage options as much as possible while working to develop opportunities as both a buyer and seller in international markets.
- Provide testing and liquidity with fixed buying period for limited amount of existing UNFCCC units, such as domestic and international CERs (even if not recognised by UNFCCC), and of domestic and international offsets with high-quality standards based on emerging models, with focus on scaled-up approaches (e.g. for jurisdictional REDD+).
- Use both public and private funds from domestic and potential international sources (e.g. NAMAs) to finance a reserve of early domestic offset credits and potentially other units while approaches are being tested and links negotiated.
- Allow banking of units and offsets, and sales of CERs, while additional ETS links are negotiated.
- Evaluate benefits and costs of expanded links on a case-by-case basis.

The design and implementation of an ETS in Chile will take time. While Chile might be able to buy and sell certain recognised units (e.g. CERs) from the beginning of the scheme, it will probably need to wait until the functioning of the ETS and the credits has been tested and proven before linking as a seller of ETS or new types of offsets. Along this process, however, Chile's government would probably be best served by being actively engaged in both bottom-up and top-down international policy development processes while, at the same time, progressing on its ETS design in such a way that it keeps options so as to ensure ample opportunities to engage as both a buyer and seller in future international emissions markets. This approach would argue for:

- Active engagement in UNFCCC to communicate policy preferences for market recognition of units under the new Durban Platform agreement
- Active engagement in bilateral and multilateral dialogues with other jurisdictions considering linking ETS and offsets around the world, including existing systems (EU, New Zealand) and systems being planned or considered in Latin America and Asia Pacific at national (e.g. Australia, China, Korea, Mexico, Brazil) and subnational levels (Quebec, Sao Paulo, Acre, Chiapas, Chinese provinces), to understand and communicate policy preferences. The Partnership for Market Readiness (PMR) as well as the Asia-Pacific Partnership could be some areas for multilateral discussion. Chile may also wish to follow a model such as California's in terms of developing working groups with other jurisdictions to collaborate on developing crediting approaches for mutual recognition.

The government may thus want to consider working in partnership with other jurisdictions to develop approaches to recognise ETS units as well as offsets from Chile so as to maximise the ultimate economic benefits of the scheme. The development of these linkages will have to be integrated with allocation, price stabilisation, and other approaches to ensure an equitable distribution of costs. At the same time as the government pursues dialogue through bottom-up and top-down channels, and in the absence of clearer policy signals, Chile may wish to begin with some

cautious testing by opening its ETS with limited windows for both buying and selling credits that could be expanded in the future.

In terms of buying, Chile could allow domestic offsets as well as international offsets, based on high-quality standards using current best practices, including provisions for scientific review, to ensure credits that are real, additional, measurable, verifiable, serialized and tracked on a registry, enforceable, and with liability for reversals. Chile should also seek to harmonize with emerging international criteria (e.g. for jurisdictional REDD+) being developed by other schemes. The government may want to devote special attention to the development of jurisdictional and sectoral approaches for offsets from uncovered sectors to address economic and environmental concerns, as well as maximise likely international demand for its units. The government could begin with a relatively small window for buying units to help provide liquidity and cost containment, while easing a transition into full trading and limiting potential problems with future links. The limit on purchases might potentially be adjustable based on whether additional liquidity and cost containment is needed. In terms of selling, the country could continue to sell CERs and also possibly allow buying of CERs (as well as other Kyoto units). However, it may want to limit purchases of CERs to specific quantities and sources, as other countries have done, for environmental integrity reasons, to help drive international processes, and also ensure the acceptance of these credits does not impede future linkages, depending on future international decisions.

While domestic offset approaches are being developed and both buy and sell linkages are being negotiated, the government could also consider allowing banking of early credits as well as using public financing – perhaps from unit auctions or other sources – to finance early action and establish a reserve of credits. All, or a portion, of these credits could later be used as a buffer or insurance source for future credits, sold into the market domestically to provide price control, or sold externally for revenue. Similarly, the government may want to explore international funding, perhaps in the context of a NAMA approach, which could help finance mitigation while market approaches are still being developed and negotiated with potential international buyers.

4.5. References

- California Air Resources Board. 2012a. “Notice of Public Hearing to Consider Amendments to California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms to Allow for the Use of Compliance Instruments Issued by Linked Jurisdictions,” Public Hearing: 28 June 2012
<http://www.arb.ca.gov/regact/2012/capandtrade12/ctlinkagenoticefinal.pdf>
- California Air Resources Board. 2012b. “Staff Report: Initial Statement of Reasons for Proposed Amendments to the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms to Allow for the Use of Compliance Instruments Issued by Linked Jurisdictions,” [referred to as ISOR], available at
<http://www.arb.ca.gov/regact/2012/capandtrade12/isormainfinal.pdf>
- Ellerman, A.D. and P.L. Joskow. 2008. “The European Union’s Emissions Trading System in Perspective,” report for Pew Center on Global Climate Change, available at
<http://www.pewclimate.org/docUploads/EU-ETS-In-Perspective-Report.pdf>
- European Commission and the Hon. Greg Combet AM MP. 2012. “Australia and European Commission agree on pathway towards fully linking emissions trading systems,” joint press

- release, 28 August 2012. Available at
<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/12/916>
- European Commission. 2009. *EU Action Against Climate Change: The EU Emissions Trading Scheme*, Luxembourg: Office for Official Publications of the European Communities.
- Hahn, Robert W., and Robert N. Stavins. 1999. *What Has the Kyoto Protocol Wrought? The Real Architecture of International Tradeable Permit Markets*. Washington, D.C.: The AEI Press
- Holton, Thea. 2012. "Actors, interests and values: the Norwegian emissions trading system from an institutional perspective," Master's thesis, Norwegian University of Life Sciences, Aas, Norway. Available at http://brage.bibsys.no/umb/handle/URN:NBN:no-bibsys_brage_20426.
- Jaffe, Judson, and Stavins, Robert. 2007. *Linking Tradable Permit Systems for Greenhouse Gas Emissions: Opportunities, Implications, and Challenges*, Geneva: Report for International Emissions Trading Association.
- Leseur, A. and R. Troignon. 2007. "Lessons from the 2006 Compliance," *Tendances Carbone* 16, available at <http://www.cdcclimat.com/Tendances-Carbone-no16-Lessons.html?lang=en>
- Mace, M.J., Ilona Millar, Christoph Schwarte, Jason Anderson, Derik Broekhoff, Robert Bradley, Catherine Bowyer and Robert Heilmayr. 2008. "Analysis of the Legal and Organisational Issues Arising in Linking the EU Emissions Trading Scheme to Other Existing and Emerging Emissions Trading Schemes: Final Report," study commissioned by the European Commission, Foundation for International Law and Development, London. Available at http://www.field.org.uk/files/Linking%20emission%20trading%20schemes_0.pdf
- McKibbin, Warwick J. and Peter Wilcoxin. 2007. "A Credible Foundation for Long-Term International Cooperation on Climate Change," in *Architectures for Agreement: Addressing Global Climate Change in the Post-Kyoto World* (Joseph Aldy & Robert Stavins, eds.). Cambridge University Press. Cambridge, UK.
- Metcalf, Gilbert E., and David Weisbach. 2012. "Linking Policies when Taste Differ: Global Climate Policy in a Heterogeneous World." *Review of Environmental Economics and Policy* 6(1): 110-129.
- Petsonk, Annie. 2009. "'Docking Stations': Designing a more welcoming architecture for a post-2012 framework to combat climate change." *Duke Journal of Comparative & International Law*. 19: 433-466.com
- Ranson, Matthew and Robert Stavins. 2012. "Post-Durban Climate Policy Architecture Based on Linkage of Cap-and-Trade Systems," HKS Working Paper, *Chicago Journal of International Law*.
- Seagar, Jerry and Will Ferretti. 2012. "Ensuring Consistency Across Standardized Methods—The Benefits of a Guiding Framework," in *Greenhouse Gas Market 2012 New Markets, New Mechanisms, New Opportunities*. (Anthony Mansell, ed.) International Emissions Trading Association (IETA), Geneva, Switzerland.
- Switzerland Federal Office for the Environment. 2010. "Linking the Emission Trading Systems Swiss–EU," available at
<http://www.bafu.admin.ch/emissionshandel/10923/index.html?lang=en>

- Switzerland Federal Office for the Environment. 2011. "First formal round of negotiations held with EU for linking of emissions trading systems," available at <http://www.bafu.admin.ch/dokumentation/medieninformation/00962/index.html?lang=en&msg-id=38021>
- U.S. Environmental Protection Agency. 2010. "EPA Analysis of the American Power Act in the 111th Congress," Office of Atmospheric Programs, Washington, DC. Available at http://www.epa.gov/climatechange/economics/pdfs/EPA_APA_Analysis_6-14-10.pdf
- Western Climate Initiative. 2012. "About the WCI," available at <http://www.westernclimateinitiative.org/about-the-wci>

Table 4.1. Linking and offsets criteria in different existing, planned, and proposed ETS schemes

Jurisdiction	Linking Rules and Actions	Offset Quantity Limitations	Types of Offsets Allowed
Alberta	<ul style="list-style-type: none"> • No linkages yet. • Output-based targets and its domestic offsets could raise issues for linkage. 	<ul style="list-style-type: none"> • Allows unlimited use of Alberta offsets for compliance. 	<ul style="list-style-type: none"> • Reductions must be: within Alberta; from actions taken on or after January 1, 2002; real, demonstrable, quantifiable, and measurable; from an action that is not required by law at the time of its initiation. • There are approved project protocols for: waste; agriculture; energy efficiency; and renewable energy.
Australia	<ul style="list-style-type: none"> • Linking is permitted with schemes that have comparable targets, design rules, and MRV; • Five years notice must be given prior to the enactment of linkage; • No linkage for the fixed price period (2012-15) • Australian entities may use EU allowances for compliance as of July 1, 2015 and there is agreement to negotiate details for a full two-way linkage to commence no later than July 1, 2018. • Ongoing discussions for establishing links with New Zealand, China, South Korea, and California. 	<ul style="list-style-type: none"> • No limits on domestic offsets. • Through 2020, up to 50% of the liability from covered entities can be achieved using international units. 	<ul style="list-style-type: none"> • After 2015, CERs, ERUs, and RMUs, as well as other internationally recognized units will be allowed but subject to government restrictions; AAUs are not allowed; neither temporary nor long-term CERs are allowed. • The Carbon Farming Initiative (CFI) credits land sector emission reductions and sequestration from Kyoto eligible activities, which can be used for compliance, and non-Kyoto activities available for voluntary market. • During the fixed price period, liable entities can use eligible CFI credits to meet 5% of their liability. No limits in the flexible price period.
California	<ul style="list-style-type: none"> • Linking allowed with other schemes with similarly stringent caps, acceptable MRV and enforcement, and harmonization of offsets, auction floor 	<ul style="list-style-type: none"> • Up to 8% of an entity's compliance obligation in each period can be met with domestic offsets and/or international sectoral offsets, 	<ul style="list-style-type: none"> • California's Air Resources Board (ARB) has currently accepted four domestic offset protocols, for: ozone depleting substance (ODS), livestock, urban forests, and US

Jurisdiction	Linking Rules and Actions	Offset Quantity Limitations	Types of Offsets Allowed
	<p>prices, unit reserves, and banking/borrowing.</p> <ul style="list-style-type: none"> Plans to link with Quebec by 2013. 	<p>including REDD.</p> <ul style="list-style-type: none"> International offsets further limited to 2% and 4% of an entity's compliance obligation in the second and third compliance periods, respectively. 	<p>forest projects.</p> <ul style="list-style-type: none"> Early Action Offsets (EAOs) will be accepted. Memoranda of Understanding (MOU) with Acre, Brazil and Chiapas, Mexico to develop REDD+ crediting criteria.
European Union	<ul style="list-style-type: none"> Linking considerations include control over evolving system; flexibility in adjusting caps and rules; transparency and public confidence; cost-effectiveness; certainty, formality, and enforceability; control over membership; demonstrated performance of the scheme to be linked with; flexibility to link with new schemes that may develop; and ability to sever linkage with minimum market and economic disruptions. Linkage with Norway's ETS finalized in early 2009 and plans to link soon with Swiss ETS. In 2013, ETS will include aviation, with all flights within, entering, or exiting EU subject to unit purchase requirements or equivalent measures. 	<ul style="list-style-type: none"> Offset usage for period 2008-2020 is constrained collectively to 50% of the required aggregate mitigation relative to 2005. In Phase II and III of the ETS, CERs and ERUs are allowed to comprise around 13.4% of the Phase II cap, equating to 1.6 billion credits in total. For Phases I and II, countries individually specified the offset percentage allowed, ranging between 0% (Estonia) and 20% (Spain and Lithuania). 	<ul style="list-style-type: none"> Flexibility mechanisms under the Kyoto Protocol, subject to some restrictions on CERs. CERs were allowed for Phase I and onwards, and ERUs were allowed for Phase II and onwards. As of 2013, CERs only accepted from pre-2012 CDM projects and new CDM projects that originate from Least Developed Countries (LDCs) and Alliance of Small Island States (AOSIS); As of May 2013 CERs from HFC and N₂O projects are not allowed under the EU ETS; Phase II (2008-12) credits are valid until March 31 2015, but post-2012 credits derived from pre-2012 activities are valid through 2020. Offsets from nuclear activities, sinks, and large-scale hydro projects are not permitted. The EU has decided to consider including REDD as an eligible offset if there is a new global agreement.

Jurisdiction	Linking Rules and Actions	Offset Quantity Limitations	Types of Offsets Allowed
New Zealand	<ul style="list-style-type: none"> • Open to potential linkages with international markets. • Discussions for establishing a two-way linkage with Australia officially began in 2011. • Flexibility mechanisms from the Kyoto Protocol subject to some restrictions. • Country can sell units overseas from the forestry sector and will expand to allow sales from other sectors when the fixed-price option is removed. 	<ul style="list-style-type: none"> • No quantity restrictions on domestic and international offsets. 	<ul style="list-style-type: none"> • ERUs and CERs from nuclear projects and CERs based on HFC-23 and N₂O industrial gas are ineligible. • New Zealand accepts Kyoto-compliant emissions reduction units purchased from abroad, which include approved AAUs, RMUs, ERUs, and CERs.
Norway	<ul style="list-style-type: none"> • ETS initially designed to link with EU ETS. • Linked with EU ETS beginning in 2009, and expected to fully harmonize with the EU ETS at the beginning of 2013. 	<ul style="list-style-type: none"> • 3 MtCO₂e, or 20% of the total quantity of allowances may derive from CERs and ERUs in Phase II (2008-2012). • Maximum allowed quantity of CERs and ERUs for an individual installation is 13% of surrendered allowances from previous year. 	<ul style="list-style-type: none"> • Eligible international offsets are CERs and ERUs. • Offsets from nuclear activity, sinks, and large-scale hydro power plants are not permitted.
Quebec	<ul style="list-style-type: none"> • Linking envisioned with other global carbon markets, especially within Western Climate Initiative (WCI). • Discussing linkage with California; Foresees linkage with other WCI Canadian provinces that commit to ETS. 	<ul style="list-style-type: none"> • No more than 8% of a company's total compliance obligation for each compliance period can be satisfied using offsets. • Role of international offsets still unclear. 	<ul style="list-style-type: none"> • Offset rules are still under development.

Jurisdiction	Linking Rules and Actions	Offset Quantity Limitations	Types of Offsets Allowed
RGGI	<ul style="list-style-type: none"> • Elements affecting potential linkage with other schemes include limited coverage, floor prices, domestic offsets, and weak targets. 	<ul style="list-style-type: none"> • No more than 3.3% of annual compliance obligation may be met via offset usage. If allowance prices increase to \$7 or \$10, allowable offset usage will increase to 5% and 10%, respectively. Offsets that originate outside RGGI states face a discount of one awarded RGGI allowance for every two CO₂-equivalent ton of certified reductions. 	<ul style="list-style-type: none"> • Performance standards and benchmarks determine additionality and eligibility. • Allows the following offset types: capture and destruction of CH₄ from landfills; SF₆ reductions from electricity transmission and distribution equipment; CO₂ sequestration through afforestation; CO₂ reductions through non-electric end use energy efficiency in buildings, and avoided CH₄ emissions through agricultural manure management operations. • If the \$10 trigger price is reached, then CERs and ERUs may be used.
South Korea	<ul style="list-style-type: none"> • Allows linking with other global carbon markets. 	<ul style="list-style-type: none"> • Proposal to postpone international offset usage until 2020. • Proposal to allow offsets to comprise up to 10% of companies' compliance obligation, up to half of which can be met with international offsets. • Domestic offset rules have yet to be determined. 	<ul style="list-style-type: none"> • UN offsets must be sourced from within South Korea. • Rules for Korean Certified Emissions Reductions (KCERs) are still to be determined.
Switzerland	<ul style="list-style-type: none"> • Ongoing discussions about linking with the EU ETS, likely for 2014. 	<ul style="list-style-type: none"> • Unlimited domestic offset usage, but international offsets are only allowed to meet up to 8% of companies' emissions targets. 	<ul style="list-style-type: none"> • ERUs, CERs, and RMUs are all valid types of international offsets. Temporary certificates from sink projects (tCERs and ICERs), such as afforestation and reforestation, are allowed, but they cannot be banked for future commitment periods. • AAUs are permitted from countries that have a similar ETS to Switzerland.

Jurisdiction	Linking Rules and Actions	Offset Quantity Limitations	Types of Offsets Allowed
Tokyo	<ul style="list-style-type: none"> • The Tokyo ETS was intended to spur national ETS legislation within Japan and would have been subsumed within the Japanese scheme. 	<ul style="list-style-type: none"> • Unlimited domestic offset usage; use of offsets generated from installations outside of Tokyo is limited to one-third of a company's obligations. • In the event of high allowance prices, Kyoto units may be allowed. 	<ul style="list-style-type: none"> • The Tokyo ETS allows offset credits both from uncapped small and medium enterprises within Tokyo, and from renewable energy certificates.
Proposed US Federal Waxman-Markey Legislation (American Clean Energy and Security Act of 2009; H.R. 2454)	<ul style="list-style-type: none"> • Links with international programmes imposing mandatory absolute limit on emissions at least as stringent. • Importers of energy-intensive products from nations whose sectors have not capped emissions or reduced their energy intensity to comparable levels required to submit special allowances to reflect the carbon emissions associated with the product's manufacture. Imports from least developed countries and those with minimal emissions exempted. 	<ul style="list-style-type: none"> • An aggregate amount of up to 2 billion tons CO₂e/year from domestic and/or international offsets allowed for compliance. • Up to 1 billion tons/year of international offsets allowed for compliance. The limit may be increased to 1.5 billion tons if it is determined that insufficient domestic offsets are available. • While international offsets can be traded at 1:1 through 2017, starting in 2018 emitters must surrender 5 international offsets for every 4 tons of U.S. compliance. 	<ul style="list-style-type: none"> • Domestic offset rules to be developed, including "term" credits for temporary reductions. • Three pathways for international offsets: • Project-scale credits issued by international body under UNFCCC (e.g. CERs) with equivalent integrity to domestic offset programme. After 2016, no project credits in countries/sectors with high emissions and incomes and sectors capped in the US. • REDD from national systems; large emitting states/provinces (for 5 years only); and projects from small emitting nations (for 5 years, extendable for an additional 8). • Sectoral credits for reductions below sufficiently stringent absolute baselines.

5 Designing Emissions Trading Phases

Key findings:

- Launching an ETS in phases can help to ease the transition into facing an emission price, complying with new regulations, and participating in trading activity, for both participants and the government. However, it can also pose challenges and risks that need to be managed, particularly with regard to providing for a smooth transition between phases.
- Key strategic decisions for the government include:
 - how and when to sequence the entry of regulated sectors
 - at what rate to increase ambition
 - at what rate to reduce any government controls over unit supply and price
 - when to link to offset/crediting mechanisms and other ETS
 - what balance to strike between providing certainty and flexibility over future ETS settings.
- These decisions could be explicitly tied to pre-announced dates or could evolve in an ad hoc manner. The timing of these decisions in relation to other domestic and international processes is an additional concern.

Phasing sector entry

- For schemes covering multiple sectors, the primary options are to sequence the entry of sectors, either individually or in groups, or to provide for entry of all regulated sectors at the same time. Preliminary analysis of options in the Chilean context suggests that the stationary energy, transport, and emission-intensive industrial process sectors (e.g. cement, lime, and steel) may be the strongest candidates for early participation in an ETS.
- Enabling concurrent entry into the ETS of the stationary energy, transport, and selected industrial sectors would provide broad coverage of major emission sources that can be inter-related, supporting the government's national mitigation objectives, helping to address equity concerns, and generating revenue to support other policy objectives. It would create appropriate incentives for energy consumers and industrial producers to integrate their emission price response across multiple emitting activities. This would also help to increase the number of ETS market participants, which will be an issue for Chile to manage carefully.
- The forestry sector could be another strong candidate for early entry into the ETS. By crediting afforestation removals and imposing a liability for deforestation emissions under an ETS, the government could provide appropriately balanced emission pricing incentives to influence land-use decisions. An alternative is to introduce an offset/crediting mechanism in the forestry sector that links to the ETS or to overseas markets, or that is tied to other sources of finance (e.g. REDD+). Traditionally, such mechanisms seek to credit afforestation or avoided deforestation without imposing a deforestation liability. Their difficulty lies in defining business-as-

usual baselines for measuring emission benefits and managing the risks of leakage and non-permanence. Comprehensive long-term inclusion of the forestry sector in an ETS can provide comparability with other sectors and reduce or avoid having to address these issues.

- Other sectors, such as waste, agriculture (fertilisers and livestock), and second-tier industrial producers (e.g. chemicals and producers of sulphur hexafluoride), have the potential to enter the ETS over time as direct points of obligation, but would be more complex to administer cost-effectively and their entry may not be feasible in the near term. Further research is needed in this area in Chile. Before entering the ETS, those sectors could link to the ETS through some form of offset/crediting mechanism, or be managed through other types of mitigation policies and measures. They could also participate in voluntary or mandatory reporting of their emissions well in advance of assuming ETS unit obligations.
- Before making decisions on the phasing of sectoral entry, the government needs to conduct further assessment of administrative feasibility and costs, mitigation price responsiveness, liquidity in the domestic market and the overall magnitude and distribution of ETS cost impacts on the economy.

Defining phases for ambition, price stabilisation, and linking

- The ambition of the government's emission reduction and emission price targets under an ETS could be set to increase over time. Applying less stringent emission reduction targets and delaying full exposure to the international price of emissions in early phases of the scheme could help to ease the economic adjustment to emissions pricing and reduce scheme impacts on Chile's export sectors before its trade competitors introduce comparable emission pricing measures. Avoiding increases in already high electricity prices is likely to be a critical issue in Chile. Addressing these through other regulatory reforms might be a precursor to allowing an ETS to raise electricity prices to reflect emissions.
- Decisions on ETS ambition across phases should be compatible with the government's broader GHG mitigation and economic transformation objectives, taking into account projected emissions, the mitigation potential of regulated sectors, the price elasticity of demand in different sectors, the prospects for linking, and the overall impacts of emission pricing on the economy.
- The government may wish to consider the following types of phases for introducing an ETS in Chile:
 - a preparatory phase to build institutional capacity
 - an early reporting phase (voluntary/mandatory)
 - a transitional phase with government control of emission price exposure (particularly if linking options are limited)
 - a transitional phase with international linking and government price stabilisation mechanisms
 - internationally linked emissions trading without government price intervention.
- The optimal nature and timing of transitional phases would likely be influenced by the development of the international carbon market, the availability of linking

opportunities and the implications of these factors for unit supply/demand and the level and volatility of international emission prices. Chile may wish to conduct scenario analysis as a means of informing decisions on phase design.

- Allowing sufficient time for preparation (e.g. 2–4+ years) and early reporting (e.g. 1–3+ years) is of vital importance for data collection, capacity building, and institutional testing. Reporting can begin on a voluntary basis for different types of entities in all sectors, and become mandatory for points of obligation before they enter the ETS.
- Having good data will help to ensure that the cap and free allocation are set appropriately, and taking the time to develop and test the institutional infrastructure will help to reduce system risks. The implication is that it may not be feasible to launch trading under an ETS in Chile before 2017–2020 at the earliest.
- In a transitional phase with no or limited linking, options for controlling price exposure include:
 - operating a domestic-only ETS with a generous unit reserve and/or a price ceiling/floor operating outside the cap that would provide a price safety valve
 - operating a fixed-price scheme on a trading platform
 - linking the ETS as a seller to the international market indirectly with the government as an intermediary.
- A domestic-only ETS could mirror much of the government's preferred ETS design (e.g. sectoral coverage, points of obligation, MRV, and compliance). However, the government would need to provide a price safety valve operating outside of the cap to manage price risk, and prohibit banking or international sale of fixed-price units to prevent arbitrage at government expense.
- The fixed-price option in particular would offer a high level of government price control, enabling the government to trial institutional arrangements with lower risk, test assumptions regarding market behaviour and mitigation potential at specific emission prices, and introduce emission pricing gradually before Chile is prepared to set a cap and link to other markets. Starting with a low price could reduce the potential for competitiveness impacts and leakage, and therefore the need for free allocation. Alternatively, the government could use this phase to trial its system for free allocation. To build trading experience among participants, the government could offer obligated participants the option not just to purchase fixed-price units but also to surrender units issued through free allocation and from approved offset/crediting mechanisms. The government could offer to buy back free allocation from recipients if buyers were limited in the domestic market. The fixed-price approach could operate quite differently from the ultimate ETS and produce a price disjunction in the transition to trading.
- Linking the ETS (as a seller) indirectly to international markets with the government as the intermediary could help to capture some benefits from selling units abroad without exposing the domestic economy to international prices. The revenue from foreign unit sales could be invested to provide transitional support to regulated sectors in the ETS or achieve other policy objectives. The government could also enter into other types of potential financing arrangements (e.g. NAMA finance) tied to emission reductions under the ETS without trading units that enable Chile's emission reductions to be offset by emissions elsewhere.

- Under an alternative transitional pathway, the government could consider starting with a “stand-alone” pilot trading phase (i.e. a phase that is not the introductory phase of a broader or longer-term ETS, but is designed to build experience before designing a full ETS). This could be voluntary or mandatory, operate with narrow sectoral coverage, and have a generous cap providing for a government reserve and other price stabilisation mechanisms. A pilot trading phase offers the potential for learning by doing while operating at a smaller scale. However, it has trade-offs in terms of economic efficiency. It could increase the overall administrative burden by requiring the design of two sets of trading mechanisms, and operate in ways that are not representative of a fully operational ETS (e.g. because of limited linking opportunities or different point of obligation), thus teaching inappropriate “lessons”. It could also raise the risk of price disjunction when full trading starts.
- Even when the government is prepared to link its preferred ETS as a seller to international markets, it may still wish to operate transitional price stabilisation mechanisms that reduce uncertainty and risk. Whether the government participates in both types of transitional phases, and the appropriate length of such phases, would depend on market conditions and its objectives in generating international revenues and providing price control/containment. It would be appropriate for the government to review the ETS settings at the conclusion of the transitional period before introducing fully linked emission trading without government price mechanisms.
- The government may wish to adjust the type and level of financial support it provides to ETS participants and other affected stakeholders (e.g. free allocation, subsidies, financing, tax benefits, etc.) across phases of the scheme, especially if the rationale for such support changes over time. For example, if mitigating competitiveness impacts is a key rationale for free allocation, then the government may wish to reduce free allocation as Chile’s major trade competitors adopt comparable emission pricing regimes, or conversely extend free allocation to the extent that uneven emission pricing and competitiveness impacts remain relevant issues. If compensating for stranded assets is a key rationale for free allocation, then free allocation for this purpose might be high in the initial phase(s) and then may stop completely in later phases. As better data become available on the actual cost impacts of the ETS on participants, consumers, and other stakeholders, or on methods for benchmarking performance, then the government may wish to change how it calculates entitlements.

5.1. Background on Defining Emissions Trading Phases

5.1.1. General context for design of this component in an ETS

Launching an ETS in phases can help to ease the transition into facing an emission price, complying with new regulations, and participating in trading activity for both participants and the government. Phasing can be applied to:

- the entry of regulated sectors into the ETS, accommodating different levels of preparedness to assume ETS obligations

- the ambition of emission reduction and emission price objectives for the ETS, enabling ETS participants, the government, and the economy to adapt more gradually to emission pricing
- the provision of financial support and operation of price protection mechanisms, helping to slow or reduce impacts from stranded assets and leakage of production overseas, and lower the exposure to price volatility, while the domestic and international markets are maturing
- linking to offset/crediting mechanisms and other ETS, allowing time to test and refine the domestic ETS design before entering into complex linking agreements.

Using a phased approach that starts gently but signals increasing stringency over time can avoid excessive costs from rapid transition, allow time for learning, and build public confidence in being able to manage ETS obligations and impacts. If the rules and stringency of each phase are announced in advance and are credible, then a system that is lenient in the short term can still send a long-term price signal that influences investment decisions in long-lived capital stock, helping to place a country on a lower-carbon development pathway.

However, phasing can also pose challenges and risks that need to be managed. These can include:

- raising equity concerns about the relative timing and stringency of ETS obligations and economic opportunities for different sectors
- creating disjunctions in participant obligations, supply, and demand across phases that disrupt the market or create perverse outcomes
- creating perverse incentives to bring emitting activities forward in time or stockpile materials before obligations apply or change
- introducing uncertainty about design settings and stringency for later phases.

The government needs to consider very carefully how it can use phasing to its advantage in engineering a smooth introduction of emissions trading into the Chilean economy. When evaluating phasing options, particularly important criteria include cost effectiveness, environmental effectiveness, administrative feasibility, equitable burden sharing, and political acceptability.

5.1.2. Lessons learned from other ETS

The leading ETS have used phased implementation in different ways. Some key characteristics are summarised below:

- The EU ETS started with Phase 1 from 2005 to 2007, implemented Phase 2 from 2008 to 2012 and will undertake Phase 3 from 2013 to 2020. Its coverage of sectors and gases, stringency of obligations, guidelines for the use of CDM units, and basis for free allocation across Member States have been adjusted for each phase. This reflected changes to the EU-wide emission reduction target and a shift in the administration of allocation from the Member States to the use of harmonised rules under an EU-wide cap. No banking was allowed between Phase 1 and Phase 2 to reduce risk to the government from high emissions in Phase 2, notably because Phase 2 was intended to support the EU's obligations under the first commitment

period of the Kyoto Protocol, which did not allow credit for pre-2008 action in developed countries.⁹⁶

- The NZ ETS is applying a phased approach to introducing different sectors over the period from 2008 to 2015+. Phased transitional measures apply for the stringency of unit obligations, reporting, compliance, price protection, free allocation, and the ability to sell NZUs abroad. For later entrants to the scheme, combinations of voluntary and/or mandatory reporting obligations apply before the commencement of unit surrender obligations.⁹⁷
- The AusCPM applies to all covered sectors from commencement, but begins with a three-year fixed-price period (FY2012 to FY2014), followed by a three-year flexible-price emissions trading period with price protection measures (FY2015 to FY2018), and then emissions trading without such measures (FY2019 onward).⁹⁸ The use of an initial fixed-price phase provides price certainty when the scheme first starts. The participants are currently experiencing the trade-off between certainty over the price and the divergence between the fixed Australian price and the currently lower international price of emissions. Under the linking agreement between Australia and the EU, participants in the AusCPM will be able to surrender EU ETS units starting in the flexible-price phase. Full two-way linking between the schemes will commence no later than July 2018.⁹⁹
- Under RGGI, the caps on allocation and participants' surrender obligations are defined for three-year "control periods" extending from 2009 to 2011, 2012 to 2014, and 2015 to 2018. The number of states participating in each phase has changed for political reasons.¹⁰⁰
- Under the CalETS, obligations start in 2013 for electric utilities and large industrial facilities, and 2015 for distributors of transportation, natural gas and other fuels. Obligations and allocation will be adjusted annually in subsequent years through 2050.¹⁰¹
- The TokyoC&T applies to the industrial and commercial sectors and uses five-year compliance periods, with the first operating from FY2010 to FY2014 and the second from FY2015 to FY2019. The scheme initially focuses on energy-related CO₂, but other gases may be added in the future.¹⁰²

Of the operating schemes, the EU ETS offers the longest period of experience with phasing. The phased introduction of sectors has worked effectively, enabling trading to start in the stationary energy and targeted industrial sectors and expand over time to include more complex industrial activities and aviation. The most significant pitfalls have related to over-allocation combined with banking across phases. The EU ETS experienced a notable disjunction between Phase 1 and Phase 2 because participants could not bank units between phases. The high level of allocation in Phase 1 relative to demand, and the lack of accurate information about baseline emissions so that the over-allocation was not recognised until late in the compliance

⁹⁶ European Commission, 2010

⁹⁷ New Zealand Ministry for the Environment, 2011

⁹⁸ Commonwealth of Australia, 2011

⁹⁹ Commonwealth of Australia, 2012

¹⁰⁰ Regional Greenhouse Gas Initiative, 2012

¹⁰¹ California Environmental Protection Agency Air Resources Board, 2011

¹⁰² Tokyo Metropolitan Government Bureau of the Environment, 2010

period, contributed to a price collapse at the end of that phase. However, the banking restriction also meant that the over-allocation in Phase 1 was not carried forward into Phase 2, where it could have affected the EU's compliance position under the first commitment period of the Kyoto Protocol.

Another important lesson from Phase 1 of the EU ETS was the windfall gains to electricity generators that received free allocation while passing emission costs to their customers. As a result, rules were changed so that free allocation to generators was reduced in Phase 2 and will be mostly phased out in Phase 3. However, over-allocation has also proven problematic in Phase 2 due to economic recession, contributing to low emission prices, and excess units will be carried over into Phase 3. Despite changes for Phase 3 to impose a tighter cap and introduce more sophisticated benchmarking as the basis for free allocation, regulators are facing difficult questions about how to address problems of unit over-supply. The policy uncertainty about Phase 3 is affecting Phase 2 trading activity across the EU ETS.

In the NZ ETS, the phased introduction of sectors has generally been effective, particularly where the scheme was developed and launched relatively quickly. The government was able to build on preliminary work to design a carbon tax (which was never implemented) on the energy and industrial sectors, but wanted to extend the ETS to all sectors of the economy to support equitable burden sharing (a politically charged issue during the design of the carbon tax). The government chose to start with not only immediate but also slightly retrospective deforestation obligations for the forestry sector, which faced perverse incentives to accelerate deforestation before emission pricing started. Deforestation emissions did fall significantly from the ETS start date in anticipation of the law, but had risen significantly in the three years beforehand. To create an incentive for new plantings and soften the blow for forestry sector, credits for afforestation were brought into the ETS at the same time. Landowners could opt in to receive units for removals from eligible afforestation activities provided they assumed corresponding liabilities for subsequent emissions. The stationary energy, industry, and transport sectors were given more time to prepare for trading obligations. The entry of the waste sector and synthetic (high global warming potential) industrial gases was deferred until 2013, and the agriculture sector was deferred until 2015 by amendment, to allow more time for the government and stakeholders to address technical issues and observe international developments. In 2012, the government proposed legislation to further defer the entry of the agriculture sector, pending the outcome of a review to be conducted in 2015 (discussed below).

One valuable lesson learned was the considerable amount of time needed by both the government and the ETS participants to prepare data and develop sector regulations for emissions accounting and free allocation. Because of the short time available for preparation, free allocation was confirmed and distributed to participants after ETS obligations had started in key sectors. The early experience with administering ETS obligations influenced government decisions on the post-2012 phase of the NZ ETS, as discussed further below.

Another lesson was the challenge of predicting how unit supply, demand, and price would evolve in the domestic market and impact on investment decisions. Initially, there was some concern that the NZ ETS would experience phasing problems around supply and demand because the forestry sector – which received significant free allocation and could also earn units from removals – entered into the scheme in advance of the sectors expected to be major unit purchasers. Banking, linkages to the international Kyoto market, and early sales to later ETS entrants helped to mitigate this problem. International linking has lowered emission prices in the New Zealand market relative to initial expectations because of the decline in international unit prices during 2011 and 2012. This has worked to the benefit of those with emission obligations but not those with units to sell from free allocation or afforestation. The NZ ETS has enabled

the domestic market to adapt to unpredictable changes and price emissions accordingly. While the government provided a price ceiling mechanism within its Kyoto cap as a transitional safeguard, it has not been needed to date.

A third valuable lesson is the importance of a periodic, comprehensive, independent review of ETS operations to build on lessons learned and adapt the scheme to new developments at the national and international level. Following a mandatory review of the NZ ETS by an independent panel in 2011, the government has announced its intention to amend the NZ ETS legislation and adjust some settings post-2012. The following key proposals will be considered by Parliament and are not approved at the time of writing. They illustrate the types of changes that could accompany different phases of an ETS.

- In consideration of the evolving UNFCCC policy framework and international carbon market post-2012, the government proposes to provide for auctioning and to introduce a new domestic cap that would cover both auctioning and free allocation. The cap would not include units issued for removals or units sold through the fixed-price option. The government will no longer require NZUs to be matched by Kyoto units held by the government.
- The government proposes to extend the progressive unit obligation¹⁰³ on the stationary energy, industrial, and transport sectors from 2012 until 2015. It also proposes to extend the fixed-price option of NZ\$25 per tonne CO₂e, coupled with the ban on exports of NZUs from non-forestry sectors indefinitely; originally, these were to end in 2012.
- The government proposes to defer the 2015 start date for biological emissions from agriculture pending a review in 2015. The government would also prefer to move from a processor-level to a farm-level point of obligation as soon as is practicable.
- Reflecting changes to the post-2012 Kyoto Protocol rules for forestry, the government proposes to provide flexibility to pre-1990 forest landowners to change to a more profitable land use without any deforestation liabilities, as long as a new forest is established elsewhere. It will claw back the previously agreed free allocation to landowners participating in “offsetting”.
- Because of the technical and administrative challenges associated with some sources of synthetic GHGs (scheduled to enter the NZ ETS in 2013), the government proposes to make a series of changes to different source categories, including shifting one point of obligation and removing the NZ ETS obligation on the importation of synthetic GHGs in goods and motor vehicles, and replacing it with a levy linked to the carbon price and transition measures.¹⁰⁴

The government rejected a proposal from the review panel to consider placing a quantitative restriction on the use of foreign units to meet NZ ETS obligations. This means that the domestic market will continue to reflect international prices. However, the government has chosen to exclude the surrender of CERs sourced from Clean Development Mechanism (CDM) projects involving the destruction of HFC-23 and N₂O from adipic acid production.

¹⁰³ The progressive obligation enables specific sectors to surrender one unit against every two tonnes of emissions as a transitional measure.

¹⁰⁴ For more information, see New Zealand Ministry for the Environment, 2012.

5.2. Elaborating Emissions Trading Phases

This section examines options for designing phases for an ETS in Chile. It starts by exploring how phasing could apply to the entry of regulated sectors; the level of ambition of emission reductions and prices; the provision of financial support, price stabilisation, and price exposure mechanisms; linking and other ETS rules. It then examines how the government could consider designing discrete phases of the scheme in Chile.

5.2.1. Options for components to phase

Entry of regulated sectors into the ETS

For schemes covering multiple sectors, the primary options are to sequence the entry of sectors, either individually or in groups, or to provide for entry of all regulated sectors at the same time. Key considerations are the relative level of preparedness of different sectors to assume ETS obligations, the increased potential for cost-effective mitigation through broader coverage, the provision of sufficient market liquidity, the potential for competitiveness impacts and perverse incentives, and the participation of enough buyers and sellers to avoid market-control behaviour. While linking an ETS to offset/crediting mechanisms or other ETS can help to provide liquidity and price protection in a small domestic market, these options raise complexities of their own and can take time to implement.

While cross-sector trading has important benefits, requiring all regulated sectors to enter an ETS at the same time may not be feasible for the participants or the government, particularly if some sectors are more complex or have variable levels of preparedness to assume ETS obligations, or if the government has to build its capacity gradually to administer the scheme. It could significantly delay the implementation of an ETS if the government and all regulated sectors have to be prepared to start at the same time. For this reason, many ETS (e.g. EU ETS, NZ ETS, CalETS, and TokyoC&T) have been implemented with the careful sequencing of individual or bundled sectors over time on the basis of which sectors are best prepared for trading and provide for adequate liquidity. In contrast, the AusCPM was launched with concurrent entry of all regulated sectors.

Sectors that enter the ETS in later phases could participate initially in a domestic sectoral crediting mechanism (SCM) that links to the ETS or to foreign markets. An SCM could serve as a more gentle transition into trading, particularly if it was voluntary and/or rewarded good performance without imposing the binding constraint of a cap. However, an SCM can involve significant technical and political difficulties around setting and administering sufficiently ambitious baselines, managing the potential for leakage and non-participation, avoiding double-counting, and managing the equity, uncertainty and risk considerations around deciding which individuals will actually receive units when crediting of individuals is dependent on the performance of the sector as a whole. Because units are received *ex post*, SCM participants cannot monetise units up front as they can under an ETS. It could also prove difficult to ensure a smooth transition from a sectoral crediting mechanism into trading. Careful consideration should be given to the politics and efficiency of the pathway to a long-term policy. These considerations are discussed more fully in the PMR report on Activity 3.¹⁰⁵

¹⁰⁵ Climate Focus, 2012

The ambition of emission reduction and emission price objectives for the ETS

The ambition of the government's emission reduction and emission price targets under an ETS could be set to increase over time. Applying less stringent emission reduction targets and delaying full exposure to the international price of emissions in early phases of the scheme could help to ease the economic adjustment to emissions pricing and reduce scheme impacts on Chile's export sectors before its trade competitors introduce comparable emission pricing measures. Signalling the increasing stringency of the ETS over time could send an important long-term price signal that influences investment decisions even if current emission prices are low. It is likely that it would be appropriate for the government to be able to adjust its ETS targets over time as the country's economic and emissions profiles evolve, its broader national emission reduction targets change, more countries adopt emission pricing, and the longer-term international climate change policy framework takes shape.

Decisions on ETS ambition across phases should be compatible with the government's broader GHG mitigation and economic transformation objectives, taking into account projected emissions, the mitigation potential of regulated sectors, the price elasticity of demand in different sectors, and the overall impacts of emission pricing on the economy. As discussed in Chapter 3, decisions on increasing ambition will need to encompass not only setting the level of the government's cap on allocation but also rules for banking and borrowing, linking to offset/crediting mechanisms and other ETS, and the use of emission price stabilisation mechanisms. Decisions on ambition should also reflect consideration of possible scenarios for the evolution of the international carbon market and any collective international agreement on the ambition of mitigation targets, both of which could influence the level and volatility of international market prices.

Linking to offset/crediting mechanisms and other ETS

How the Chile ETS might link to domestic and international offset/crediting mechanisms and other ETS can be expected to evolve across phases of an ETS. Linking can open markets for Chile's units and help to reduce the risks of imposing a hard emissions cap on the economy, but it can also introduce other price and policy risks. The UNFCCC rules for existing and new market mechanisms post-2012 are still under development. Bilateral agreements to link ETS can be very complex to negotiate, have important economic, environmental, and political consequences, and have sovereignty implications for future changes to domestic ETS. The government may not wish to negotiate ETS linking agreements with other countries until it has had an opportunity to test and refine its ETS design and better evaluate the strategic purpose of linking. Likewise, other countries may be unwilling to link to an ETS in Chile until their own schemes are fully established and they have full confidence in the ambition and integrity of Chile's scheme.

During the early phases of an ETS in Chile, and depending on how the international market develops, the government may have limited options for linking or may wish to constrain linking. For example, the government may wish to confine the eligible sources of units from offset/crediting mechanisms to safeguard environmental integrity. If domestic ETS compliance in Chile is likely to be problematic or if ambition is likely to be lower in early phases, the government may wish to consider direct buy-only linkages to other ETS with comparable or greater stringency; this approach offers price protection and liquidity to Chile without posing an integrity risk to the linking partner. Alternatively, the government could choose to enter into direct sell-only linkages to other schemes to create new markets for Chilean units; however, this would be expected to raise domestic emission prices to international prices. Imposing quantitative limits on direct linking could provide greater domestic price control.

As an alternative to linking the ETS directly to international markets, the government could serve as an intermediary between the ETS and international markets, enabling it to shelter the domestic ETS market from international prices while capturing the rents from selling ETS units abroad. Alternatively, the government could enter into other types of financing arrangements (e.g. NAMA finance) tied to emission reductions under the ETS without trading units that enable Chile's emission reductions to be offset by emissions elsewhere.

The provision of financial support, price stabilisation, and price exposure mechanisms

The government may wish to adjust the type and level of financial support it provides to ETS participants and other affected stakeholders (e.g. free allocation, subsidies, financing, tax benefits, etc.) across phases of the scheme, especially if the rationale for such support changes over time. For example, if mitigating competitiveness impacts is a key rationale for free allocation, then the government may wish to reduce free allocation as Chile's major trade competitors adopt comparable emission pricing regimes, or conversely extend free allocation to the extent that uneven emission pricing and competitiveness impacts remain relevant issues. If compensating for stranded assets is a key rationale for free allocation, then free allocation for this purpose might be high in the initial phase(s) and then may stop completely in later phases. As better data become available on the actual cost impacts of the ETS on participants, consumers, and other stakeholders, or on methods for benchmarking performance, then the government may wish to change how it calculates entitlements. There are important trade-offs between providing certainty about the level of financial support, and enabling the government to adjust such support as national circumstances evolve.

Across phases of the ETS, the government may also wish to change how it applies emission price stabilisation mechanisms like unit reserves operating within the cap and price ceilings and/or floors operating outside of the cap. Such mechanisms can help to reduce uncertainty and risk, and build confidence in the trading market. However, price stabilisation mechanisms operating outside of the cap can also reduce the environmental effectiveness and economic efficiency of the trading system. Fundamentally, the government needs to decide whether the constraint on the quantity or price of emissions will take precedence in the ETS.

A continuum of policy options lies between the two extremes of having the government and the market set the domestic price. For example, the government could allow the market to set the price but constrain prices by auctioning reserved units (inside the cap) with a price ceiling and/or floor. Over time, as the trading market matures or as the government seeks to link its ETS to other schemes that do not apply price stabilisation mechanisms, it may become less necessary or desirable for the government to use them. The government may also wish to adjust the design of complementary measures operating alongside the ETS that interact with emission pricing to help achieve policy objectives. More detailed options for applying emission price stabilisation mechanisms are discussed in the separate report on Partnership for Market Readiness (PMR) Activity 3.

The government can use other types of mechanisms to reduce participants' exposure to emission prices at the margin. One option is output-based allocation, which can be targeted to specific recipients and is discussed in depth in a chapter 6. Two other options that can be applied narrowly or broadly across an ETS are a fixed financial obligation instead of a unit surrender obligation or a progressive obligation.

- A *fixed financial obligation* could operate in the form of a carbon tax, where participants would pay a fixed fee per tonne of emissions to the government, or a fixed-price scheme operating on a trading platform, where participants could meet

their obligations by purchasing fixed-price units from the government or by trading freely allocated units (and domestic offsets, if available). Under both options, the government could control exposure to the emission price in the domestic market.

- Under a *progressive obligation*, one unit could be surrendered to meet obligations for more than one tonne of emissions. While the unit price would be set by the market and not the government, participants would face only a percentage of that price per tonne initially. Each unit would still have the value of one tonne for trading purposes; what would change is the surrender obligation. Over time, the ratio would change as a full obligation was imposed (e.g. from 1:3 to 1:2 to 1:1).

Reducing participants' exposure to emission pricing could help to provide for a softer economic adjustment to implementation of an ETS, but it would also provide a lower mitigation incentive and could be less economically efficient. The effectiveness of different approaches would depend in part on what the motivation is for moderating price exposure (e.g. to address competitiveness concerns), how the government sets the price, how long such measures remained in place, and how prices were passed through the supply chain. For example, if power generators price their electricity on long-run marginal costs, then they may charge their customers for the full long-term price of emissions from commencement even if they are exposed to only a fraction of that price in the near term, leading to windfall gains.

ETS rules, including for measurement, reporting, verification, and compliance

Across scheme phases, the government may wish to apply different rules governing the operation of the ETS in order to give ETS participants more time to build capacity, apply lessons learned and adapt the scheme to changing national and international circumstances. One area to consider is reporting rules. While mandatory reporting would apply to all ETS participants once unit obligations apply, the government could start with an initial period of voluntary reporting with optional third-party verification, and/or an advance period of mandatory reporting and verification. This could help to build the reporting capacity of ETS participants, upskill third-party verifiers and test the government's institutional capacity to process emissions reports. It could also assist the government with data collection to support the development of allocation plans.

Whether voluntary or mandatory, emissions reporting should be harmonised with other environmental and economic reporting where appropriate. A voluntary reporting phase may be less beneficial or appropriate in a country that already has effective mandatory environmental reporting processes in place; this was the case in the EU, Australia, US, and Tokyo schemes. Another downside of voluntary reporting is that it may not produce data of sufficient coverage and quality to meet the government's needs for allocation planning.

Even in early phases of an ETS in Chile, the government should not weaken rules for monitoring, reporting, and verification that could affect the perceived or actual environmental integrity and credibility of the scheme. In addition, the government needs to strike a careful balance between providing certainty and flexibility in changing the ETS rules over time. Changes to the ETS rules, especially those impacting on supply, demand and price protection, need to be made transparently and with considerable advance warning in order to avoid price shocks, enable a smooth transition between phases, and maintain domestic and international confidence in the operation of Chile's market. The government should also consider which types of rules should be designed to change across phases versus extend across phases.

5.2.2. Phase options for Chile

The government needs to decide how to phase the entry of regulated sectors into the ETS and how to phase the exposure of the economy to the international price of emissions over time. The process for phasing exposure to the international price could include:

- a preparatory phase
- an early reporting phase
- a transitional phase with government control of emission price exposure (particularly if linking options are limited)
- a transitional phase with international linking and government price stabilisation mechanisms
- internationally linked emissions trading without government price intervention.

Phasing the entry of sectors

Preliminary analysis of options in the Chilean context suggests that the stationary energy, transport, and emission-intensive industrial process sectors (e.g. cement, lime, and steel) may be the strongest candidates for early participation in an ETS. They are major contributors to the country's emission profile, they participate actively in markets, and methodologies for monitoring, reporting, and verifying emissions in those sectors are relatively well established at the international level. However, further work needs to be done on the mitigation price responsiveness of these sectors in Chile, and on whether there are any policy barriers in those sectors that would need to be removed for the effective introduction of an ETS price signal.

Other sectors, such as waste, forestry, agriculture (fertilisers and livestock), and second-tier industrial producers (e.g. chemicals and producers of sulphur hexafluoride), have the potential to enter the ETS over time as direct points of obligation, but would be more complex to administer cost-effectively and their entry may not be feasible in the near term. Further research is needed in this area in Chile. Before entering the ETS, those sectors could link to the ETS through some form of offset/crediting mechanism or be managed through other types of mitigation policies and measures. They could also participate in voluntary or mandatory reporting of their emissions well in advance of assuming ETS unit obligations.

Enabling concurrent entry into the ETS of the stationary energy, transport, and selected industrial sectors would provide broad coverage of major emission sources that can be inter-related, supporting the government's national mitigation objectives, helping to address equity concerns, and generating revenue to support other policy objectives. This would create appropriate incentives for energy consumers and industrial producers to integrate their emission price response across multiple emitting activities. Providing for incomplete or inconsistent pricing of emissions from different energy sources can create perverse incentives as regulated entities assess options for least-cost compliance.

Concurrent entry of multiple sectors would also help to increase the number of domestic ETS market participants, which will be an issue for Chile to manage carefully. The energy-sector emissions profile is dominated by oil derivatives and crude oil (accounting for 25.4% and 45.18% of energy emissions in 2009, respectively), followed by coal (21.9% of energy emissions in 2009). Table 1.1 shows that under an upstream obligation, approximately two actors account for at least 90% of emissions from oil derivatives and crude oil, and approximately 10 actors account for at least 90% of coal emissions. Placing the obligation at the midstream level could help to increase

the number of market participants, but not by a large number. The industrial process sector would add approximately 5 major actors.¹⁰⁶

However, while a relatively small number of domestic actors would be obligated to buy a large share of units, the total number of market participants would also encompass all of the recipients of free allocation (i.e. on the basis of stranded assets or indirect emissions from downstream energy consumption), as well as other parties voluntarily speculating in the market. Importantly, establishing international sell and/or buy linkages would help to diversify the market and support liquidity. The government could auction units domestically as a means of allocation, and could also step into the market as a buyer if necessary to support effective market operation before international linkages were feasible. As part of a future stage of ETS design, further analysis should be conducted on the liquidity and market-behaviour implications of the size of the Chilean market, and should take into consideration the experience from other environmental trading schemes, both domestic and international.

Before making decisions on the phasing of sectoral entry, the government needs to conduct further assessment of administrative feasibility and costs, mitigation price responsiveness, and the overall magnitude and distribution of ETS cost impacts on the economy. The assessment of administrative feasibility needs to include not only the preparedness of the obligated entities in those sectors, but also the preparedness of the government to administer those obligations and provide free allocation to appropriate recipients. Even if those sectors currently have different levels of preparedness to assume ETS obligations, allowing a sufficient period for preparation and capacity building by both participants and the government could enable these sectors to start concurrently. While differences in price responsiveness across sectors can be beneficial across an ETS, the government may also wish to consider whether this could create disproportionate impacts across sectors that could be a rationale for delaying their entry. Considerations could include the ability of trade-exposed producers to manage competitiveness impacts, and the price elasticity of demand in different sectors.

The government may also wish to consider the overall emission pricing impact of broader sectoral coverage on downstream consumers, on the demand for free allocation, and on government revenue from the ETS. For example, the government could choose to introduce emission pricing on stationary energy and major industrial processes first, and then add transport later after the initial economic adjustment by consumers. Conversely, if the government wanted to manage concerns around equity and the potential for perverse outcomes, it could choose broad coverage with a relatively low emission price and provide generous free allocation.

Preparatory phase

As the ETS moves from design into implementation, a substantial preparatory period is necessary to enable both government and ETS participants to build their capacity to participate in the scheme. This phase could take two to four years or longer, and include the following types of activities:

- ongoing research, analysis, and modelling
- data collection on points of obligation, emitters, and recipients of free allocation

¹⁰⁶ Chile Ministry of Energy, 2012

- development of ETS legislation/regulations, participant guidelines, and institutions, including the registry
- public education and ETS participant capacity building
- early discussions with prospective linking partners.

Early reporting phase

Unless there is a well-established reporting regime covering GHG emissions, the government may wish to provide for an early reporting phase that will enable the government, ETS participants, and third-party verifiers to build experience before unit obligations commence. This will also help the government to collect valuable information to support the development of allocation plans. This phase could take one to three years or longer, and include the following types of activities:

- voluntary and/or mandatory annual reporting by ETS points of obligation and other sector entities
- finalisation of allocation plans
- ongoing education, particularly focused on sectoral mitigation potential, engagement of the finance sector, and development of the domestic trading market.

Transitional phase with government control of emission price exposure

Depending on market conditions when the key sectors are ready to start emissions trading, the government may want to provide a transitional phase for controlled and gradual exposure of the economy to emission pricing instead of abrupt exposure to the full international price. This type of transitional phase may be particularly appropriate if the government has no, or limited, linking options and faces price risks from setting a hard constraint on domestic emissions, or if the international market has high or volatile prices. Options for controlling price exposure include:

- operating a domestic-only ETS with a generous unit reserve and/or a price ceiling or floor operating outside the cap that would provide a price safety valve
- operating a fixed-price scheme on a trading platform (as described earlier) linking the ETS to the international market indirectly, with the government as an intermediary.

A domestic-only ETS could mirror much of the government's preferred ETS design (e.g. sectoral coverage, points of obligation, MRV, compliance). However, the government would need to provide a price safety valve operating outside of the cap to manage price risk, and prohibit banking or international sales of fixed-price units to prevent arbitrage at government expense.

The fixed-price option in particular would offer a high level of government price control, enabling the government to trial institutional arrangements with lower risk, test assumptions regarding market behaviour and mitigation potential at specific emission prices, and introduce emission pricing gradually before Chile is prepared to set a cap and link to other markets. Starting with a low price could reduce the potential for competitiveness impacts and leakage, and therefore the need for free allocation. Alternatively, the government could use this phase to trial its system for free allocation. To build trading experience among participants, the government could offer obligated participants the option not just to purchase fixed-price units but also to surrender units issued through free allocation and from approved offset/crediting mechanisms.

The government could offer to buy back free allocation from recipients if buyers were limited in the domestic market. The fixed-price approach could operate quite differently from the ultimate ETS and produce a price disjunction in the transition to trading.

Linking the ETS indirectly to international markets with the government as the intermediary could help to capture the benefits from selling units abroad without exposing the domestic economy to international prices. The revenue from foreign unit sales could be invested to provide transitional support to regulated sectors in the ETS or achieve other policy objectives. As discussed earlier, the government could also enter into other types of financing arrangements (e.g. NAMA finance) tied to emission reductions under the ETS without trading units that enable Chile's emission reductions to be offset by emissions elsewhere.

Under an alternative transitional pathway, the government could consider starting with a “stand-alone” pilot trading scheme. This would not be the introductory phase of a broader or longer-term ETS, but instead would be a distinct scheme designed to build experience before designing a full ETS. This could be voluntary or mandatory, operate with narrow sectoral coverage, and have a generous cap providing for a government reserve and other price stabilisation mechanisms. A pilot trading scheme offers the potential to learn-by-doing at a smaller scale. However, it has trade-offs in terms of economic efficiency. It could increase the overall administrative burden by requiring the design of two sets of trading mechanisms, and operate in ways that are not representative of a fully operational ETS (e.g. because of limited participants and linking opportunities), thus teaching inappropriate “lessons”. Prohibiting banking after the end of the pilot phase could provide a disincentive for participants to over-comply and create a price shock before the start of the full trading scheme. However, this could also be a safeguard against carrying forward any over-allocation or loss of integrity experienced during the transitional phase. Even with banking, the transition from pilot trading to full trading could face the risk of a price disjunction. These are important considerations.

Transitional phase with international linking and government price stabilisation mechanisms

Even when the government is prepared to link its preferred ETS to international markets (e.g. via international offset/crediting mechanisms or other ETS), it may still wish to operate transitional price stabilisation mechanisms that reduce the uncertainty and risk to regulated sectors. One option would be a unit reserve operating within the cap that could be used to increase supply in the domestic market. The government could sell these units at a competitive auction and offer the further security of a price ceiling and floor. Another option would be to set quantitative limits on selling ETS units abroad and/or buying foreign units in order to maintain some divergence between international and domestic prices.

Whether the government participates in both types of transitional phases, and the appropriate length of such phases, would depend on market conditions and the government's objectives in providing price control/containment. As discussed in the context of ambition in section 3.2.2, the government could provide for statutory periodic reviews of phase design, and could also choose to enable interim reviews of phasing to be triggered under particular circumstances, such as new linking opportunities or relevant changes in the international carbon market. The government should carefully consider how to balance adaptability against providing regulatory certainty to build market confidence. At a minimum, it would be appropriate for the government to review the ETS settings at the conclusion of the transitional period before introducing fully linked emission trading without government price mechanisms.

Internationally linked emissions trading without government price intervention

A fully linked ETS would function with successive phases defined by fixed settings for key design features. A review and adjustment of settings could be conducted at the conclusion of each phase, in conjunction with linking partners where appropriate. Phases could last for three to ten years, and could be aligned with the government's domestic mitigation targets, other government regulatory cycles, and/or the stages of the international climate change negotiations. Key features could include:

- coverage of multiple sectors, with later entrants joining in tranches as they achieve sufficient capacity
- an annual cap on government allocation that is set for each phase and extended for one year each year, or that operates with a forecast band for the subsequent phase, to reduce uncertainty, provide a smooth transition between phases, and establish a long-term investment signal
- establishment of linking to domestic/overseas offset/crediting mechanisms in the short run and linking to ETS when feasible
- annual unit surrender and monitoring, reporting, and verification obligations for regulated entities
- punitive consequences for non-compliance
- the phasing out of output-based free allocation over time accompanied by the ramping up of government auction
- banking within and between phases
- borrowing either prohibited or constrained within and between phases
- review at the conclusion of each phase.

To set an appropriate balance between certainty and flexibility in the transition between phases, the government might want to signal which design features of the ETS would more likely be subject to assessment and adjustment in each review cycle, and signal parameters guiding how changes would be made.

5.2.3. Evaluation of options against key criteria in the Chilean context

Table 5.1 below presents a high-level evaluation of phase options against key criteria in the Chilean context.

Table 5.1: Evaluation of phase options against key criteria

Key criteria	Evaluation of phase options in the Chilean context
Environmental effectiveness	<ul style="list-style-type: none">• Decisions on sectoral coverage and stringency across phases should be compatible with the government's GHG mitigation and economic transformation objectives, taking into account projected emissions, the mitigation potential of regulated sectors, and the price elasticity of demand in different sectors.• If sectoral coverage and ETS prices are kept low in early phases, then the

Key criteria	Evaluation of phase options in the Chilean context
	<p>government will be more dependent on external, complementary measures to achieve its national mitigation objectives.</p> <ul style="list-style-type: none"> Starting with a low emission constraint/price but signalling increasing stringency over time may produce fewer emission reductions in the short term but, importantly, could still help to place Chile on a lower-emission development pathway by influencing investment decisions in long-lived capital stock.
Economic efficiency	<ul style="list-style-type: none"> Exposing participants to the full international price of emissions could produce an economically efficient outcome in the longer term but involve a more abrupt economic adjustment in the short term. To support more gradual adjustment, the government could use transitional phases providing price control and/or price containment. Phased introduction of different sectors into the ETS and phased use of linking and price stabilisation mechanisms should be organised in a way that supports the effective operation of the domestic market in the context of the evolving international market. As part of ETS design, the government should conduct further analysis of the liquidity implications of phasing sectoral coverage and linking to other ETS in the context of Chile's relatively small domestic market.
Competitiveness impacts	<ul style="list-style-type: none"> Competitiveness impacts are likely to be more significant in earlier phases of the ETS, before trade competitors implement comparable emission pricing mechanisms. Providing more generous free allocation and other transitional assistance in earlier phases could help to safeguard against competitiveness impacts leading to leakage of production and emissions abroad. Competitiveness impacts can be addressed by moderating impacts of the scheme on all participants or only a subset of participants. Providing targeted support to the most trade-exposed and emissions-intensive participants (e.g. through output-based free allocation) instead of weakening the entire scheme (e.g. through a progressive obligation) could help to improve the mitigation potential of the ETS as a whole.
Equitable burden sharing	<ul style="list-style-type: none"> Sectoral coverage has important equity implications. However, broad coverage of an ETS does not necessarily produce an equitable outcome because sectors can differ markedly in their preparedness for trading, mitigation potential, mitigation costs, and price elasticity of demand. Phasing can be used to address some of these concerns. The government needs to consider which sectors are best suited to participation in an ETS, when different sectors will have sufficient capacity to participate in trading, and what types of mitigation measures should apply to non-ETS sectors so that all sectors bear an appropriate level and timing of responsibility for helping to meet national emission reduction objectives.
Administrative feasibility and costs	<ul style="list-style-type: none"> Starting the ETS with a limited number of sectors and participants, and expanding it over time, could make it easier to administer while Chile's ETS institutions and processes are still being developed and tested. An alternative approach is to allow sufficient time for multiple sectors and the government to prepare fully for trading before implementing the ETS; the latter approach could reduce system risk. Developing a "stand-alone" pilot trading scheme in addition to an ETS could

Key criteria	Evaluation of phase options in the Chilean context
	increase the level of effort for the design and legislative processes, and could produce outcomes that are not representative of actual ETS operation.
Regulatory and other barriers	<ul style="list-style-type: none"> • The government needs to consider how the timing of ETS obligations will interact with other environmental and economic regulatory obligations for ETS participants, and how to manage any conflicts or barriers. For example, the government may need to provide for changes to property or tax law, or trading market regulations, to accommodate the ETS, and this could affect the timeline for implementing different phases of the ETS. • The government should seek to align the timing of scheme phases and scheme reviews with other relevant domestic regulatory cycles in key sectors, as well as its policy planning and budget cycles and phases in the international climate change negotiations. • The government may also wish to consider how scheme phases may be affected by national election cycles that impact on scheme review and legislative processes.
Other impacts, including co-benefits	<ul style="list-style-type: none"> • Directly and indirectly, the ETS may have a range of positive and negative impacts on the environment, economy, and society more broadly. The nature and timing of these impacts should be assessed as the phases of the ETS are developed, and measures should be put in place to monitor such impacts.

5.3. Framework for Government Decisions

Government decisions on phasing will need to be integrated with decisions on all of the major ETS design features. Key strategic decisions specific to phasing are:

- How does the government wish to align the timing of ETS phases with its national GHG mitigation and economic transformation objectives, its domestic regulatory processes, and the stages of the international climate change negotiations?
- How should the entry of regulated sectors be sequenced, reflecting their level of preparedness to assume ETS obligations and supporting equity, liquidity, and effective market operation?
- Under what conditions and how quickly would the government want to increase the level of ambition for emission reductions and prices and reduce the level of government price control/containment?
- Does the government want to operate a stand-alone pilot trading scheme, or move directly into trading through one or more strategically designed transitional phases?
- What balance does the government want between providing certainty to participants around design settings and flexibility to adjust those settings across phases as experience is gained and national circumstances evolve?

Table 5.2: Framework for government decisions on phases of the ETS

Stage	Decision-making activity
Assess preparatory needs	<ul style="list-style-type: none"> • Engaging with government departments and stakeholders to evaluate the level of preparedness of different sectors to assume ETS obligations and of key government departments to administer ETS functions, and the liquidity implications of phasing sectoral entry and linking. • Identifying data collection and research needs and developing implementation plans. • Identifying processes and timelines for developing ETS legislation/ regulations, participant guidelines, and institutions, including the registry. • Designing public education and capacity-building initiatives.
Design an early reporting phase	<ul style="list-style-type: none"> • Identifying which entities should be invited to participate in voluntary reporting and which should be required to participate in mandatory reporting, and when. • Designing ETS reporting requirements and guidelines.
Design the transitional phase(s) for introducing the ETS	<ul style="list-style-type: none"> • Identifying and evaluating the key drivers of transitional phase design features, including the size and characteristics of the domestic ETS market, the potential to link to offset/crediting mechanisms and other ETS in the near and longer term, the stability of the international market, and international climate change policy developments. • Choosing conditions and parameters for controlling exposure to the international price of emissions in the Chilean economy. • Selecting preferred policies for linking and government price control/ stabilisation mechanisms that will support the government's mitigation and economic transformation objectives. • Defining the conditions under which price-control/stabilisation mechanisms will be phased out and linking will be broadened over time. • Designing complementary measures that can support the government in achieving its policy objectives alongside transitional operation of the ETS.
Design the phase structure for the preferred long-term ETS	<ul style="list-style-type: none"> • Deciding the length and timing of trading phases for the fully operational ETS in relation to other domestic regulatory cycles and milestones in the international climate change negotiations. • Deciding how ETS ambition, linking and the provision of financial assistance will be adjusted across successive phases of the ETS.

The following is a straw man proposal illustrating how sectoral coverage, phasing, linking and allocation could interact. This option is not a recommendation but a set of design features that are consistent and that constitute a useful starting point for considering different features.

Table 5.3: Integrated straw man proposal for core design of an ETS

Design feature	Straw man proposal
Sectoral coverage and point of obligation	<ul style="list-style-type: none"> Start with: <ul style="list-style-type: none"> stationary energy (upstream obligation – fuel production/import¹⁰⁷) transport (upstream obligation – fuel production/import) industrial processes for cement, lime, and steel (obligation at point of emission) forestry (landowner obligation). Expand sectoral coverage over time to include (as feasible): <ul style="list-style-type: none"> waste (landfill operator obligation) agricultural fertilisers and livestock (farmer obligation) smaller industrial processes (e.g. chemicals and sulphur hexafluoride) (obligation at point of emission).
Preparation phase pre-trading (e.g. 2013–2017)	<ul style="list-style-type: none"> Conduct research and data collection. Develop ETS legislation/regulations, participant guidelines, and institutions, including the registry. Conduct public education and ETS participant capacity building. Hold early discussions with prospective linking partners.
Early reporting phase (e.g. 2015–2017+)	<ul style="list-style-type: none"> Implement voluntary then mandatory annual reporting for points of obligation before they enter the ETS. Offer voluntary annual reporting for other entities.
Allocation	<ul style="list-style-type: none"> Grandparent enough free allocation to address equity and political issues – this is a fixed total amount spread over a number of years. Provide output-based allocation for emissions-intensive trade-exposed mobile or expanding sectors where ‘output’ is relatively easily defined – this phases out over a fixed time frame. Provide auctioning throughout for liquidity and price discovery, and ramp up auctioning as free allocation is phased out.
Transitional phase: Government price control	<ul style="list-style-type: none"> Negotiate limited linking or contribution of external funds, allowing the government to set a cap on allocation that is stringent enough to ensure a positive price. Reduce ETS participant exposure to real price: <ul style="list-style-type: none"> start with a domestic cap with a narrow price floor and ceiling operating outside the cap to control price provide no direct linkage between the ETS and international markets; only the government can sell abroad

¹⁰⁷ A feasible alternative is to regulate stationary energy at the point of emission.

Design feature	Straw man proposal
Transitional phase: Government price stabilisation	<ul style="list-style-type: none"> • Provide limited direct linking between the ETS and international markets to move toward the international price. • Provide government price stabilisation mechanisms (e.g. unit reserve within the cap auctioned under a broader price floor and ceiling) to reduce price risk and uncertainty.
International trading with no government price intervention	<ul style="list-style-type: none"> • Transition to unlimited international trading by ETS participants with no government price stabilisation when the external market is stable.

5.4. References

- California Environmental Protection Agency Air Resources Board. 2011. *Overview of ARB Emissions Trading Program*. Available at http://www.arb.ca.gov/newsrel/2011/cap_trade_overview.pdf, accessed 26 October 2012.
- Chile Ministry of Energy. 2012. Personal communication from the División de Prospectiva y Política Energética, July 2012.
- Climate Focus. 2012. *Scaled-up Crediting Mechanism Options and Recommendations for Chile*. PMR Activity 3 Report to the World Bank. Amsterdam: Climate Focus.
- Commonwealth of Australia. 2011. *Securing a Clean Energy Future: The Australian Government's Climate Change Plan*, Canberra: Department of Climate Change and Energy Efficiency. Available at <http://www.cleanenergyfuture.gov.au/wp-content/uploads/2011/07/Consolidated-Final.pdf>
- Commonwealth of Australia. 2012. *Linking and Australian Liable Entities*, Canberra: Department of Climate Change and Energy Efficiency. Available at <http://www.cleanenergyfuture.gov.au/linking-and-australian-liable-entities/>
- European Commission. 2010. "The EU ETS, a System Based on the 'Cap and Trade' Principle," available at http://ec.europa.eu/clima/policies/ets/index_en.htm
- New Zealand Ministry for the Environment. 2011. "The NZ Emissions Trading Scheme," available at <http://www.climatechange.govt.nz/emissions-trading-scheme/about>
- New Zealand Ministry for the Environment. 2012. "Government's Announced Changes to the ETS", available at <http://climatechange.govt.nz/emissions-trading-scheme/ets-amendments/index.html>
- Regional Greenhouse Gas Initiative. 2012. "About the Regional Greenhouse Gas Initiative (RGGI)," http://www.rggi.org/docs/Documents/RGGI_Fact_Sheet_2012_09_28.pdf, accessed 26 October 2012.
- Tokyo Metropolitan Government Bureau of the Environment. 2010. *Tokyo Cap-and-Trade Program: Japan's First Mandatory Emissions Trading Scheme*, Tokyo: Bureau of Environment. Available at http://www.kankyo.metro.tokyo.jp/en/attachement/Tokyo-cap_and_trade_program-march_2010_TMG.pdf

6 Allocation of Allowances

Key findings:

- Allocation must be driven by objectives: equity, reduced leakage, smooth transition to a long-term low-carbon economy, and political acceptability and participation. Their relative weights will alter over time.
- Allocation can alter the distribution of burden across entities. It can also reduce the effective marginal cost of production. This can be used to address leakage from emissions-intensive trade-exposed mobile or expanding activities, and could also be used for distributional reasons – for example to minimise increases in the electricity price in the short term. The entities that might receive free allocation are not necessarily points of obligation.
- Allocation can be through auctions, grandfathering, or output-based allocation. Distribution of resources from auction proceeds can also be a substitute for direct allocation of units.
- High levels of free allocation are likely to be politically necessary in the early stages of the programme.
- With a given total cap on units, allocation by any combination of auctioning or grandfathering, in general, has no effect on the cost-effectiveness of ETS. Thus grandfathering can be used to achieve political acceptability with no long-term economic or emissions consequences.
- Auctions can be important for price discovery and liquidity, and can also address concerns about market power when the ETS is not linked to an international market.
- Output-based allocation is the only form of allocation that can directly address leakage.
- With the exception of output-based allocations, future allocations should not be influenced by firm behaviour, particularly emissions; this avoids perverse incentives to seek higher future allocations.
- Benchmarking/output-based allocation can be technically very complex. Its use should be strictly limited.
- Long-run allocation is only about equity. Allowances should be auctioned and the revenue used in ways that society chooses.
- Short- to medium-run allocation requires a complex balance across objectives, which is made simpler if the phasing in of the system is gentle.

6.1. General Context for Design of Allocation in an ETS

If Chile designed a system with a carbon price equivalent to US\$10 per ton of CO₂e, and covered the entire economy including forestry with a cap at 2006 levels, the total value of units in 2006 surrendered to match emissions would have been US\$785.9m, or around \$40 per capita, and growing fast. The number of units and the price level will be determined by choices about caps, phasing and linking. Initial allocation determines how this value is distributed and to what extent the carbon price affects marginal production costs (inclusive of emissions cost). Trading then determines who uses the allowances and hence who mitigates.

In this chapter we explore how and why units could be allocated to entities within Chile. We examine the range of both objectives and modalities for allocation in the Chilean context, and develop a framework for government decision-making on allocation across different sectors and phases of the ETS. This framework includes discussion of planning needs for different allocation modalities and potential trade-offs among the various approaches that could be adopted.

The common allocation modalities include auctioning (usually combined with use of some revenue to compensate consumers, fund research or complementary actions to reduce emissions or adapt to climate change, or as part of negotiations with key political groups), free allocation on the basis of historical emissions (grandparenting), free allocation on the basis of a performance benchmark and output levels, or a hybrid of different approaches. The choice of allocation modalities has critical implications for distribution of costs and benefits, can mitigate leakage (movement of activity and emissions to unregulated countries), could affect the efficiency of operation of the market in the short term, and has implications for administrative feasibility.

Under an ETS, emitters retain an incentive to reduce emissions regardless of whether their permits are allocated for free; they still face an opportunity cost from surrendering permits to the government for compliance; they could sell them for cash otherwise. The diverse ETS in operation demonstrate that it is not necessary for the parties receiving freely allocated permits to be the same as those bearing liabilities for their emissions; free allocation can be used to compensate or protect affected non-regulated parties; they then sell their allocation in the secondary market.

The optimal choice of allocation modality is driven largely by the objectives for free allocation, and these determinations also drive who receives allowances (or revenue from auctions), on what basis they receive them, how many they receive and for how long they receive them. In the long run consumers bear all costs so allocation is solely a question of wealth distribution. The short run is more complex.

One attractive feature of cap-and-trade systems compared to other regulations is that they offer the potential to separate issues of distribution from issues of efficient mitigation. With no transaction costs, a market equilibrium in a cap-and-trade system will be cost-effective and independent of the initial allocation of tradable rights.¹⁰⁸ This “independence property” allows politics and technical issues to be separated. In this chapter we explore the extent to which this holds in emissions trading markets within an incomplete global agreement, and with imperfect short-term markets, and the implications of this for short-term allocation of units.

¹⁰⁸ This is a corollary of the Coase Theorem (Coase, 1960). See Hahn and Stavins (2011) for a synthesis of evidence on the impacts of allocation on cost-effectiveness.

The rationale for free allocation is weakened in a system with a lower price, or a lower marginal cost. This can be achieved through a loose cap, through decisions on linking, or by “progressive allocation” (requiring surrender of fewer than one unit for each unit of emissions). Losses and windfall gains, leakage, pressure for rapid economic and institutional structural change, the value of additional participation and temptations to non-comply will all reduce with a lower price. The value of phasing toward a full price is discussed in Chapter 5.

Allocation decisions typically have complex technical and political elements with significant economic and distributional implications, and often require research to assess what direct and indirect costs industries in different sectors will bear under the scheme, and what costs will be passed through the supply chain, including to consumers. Different modalities and rationales may be appropriate for different sectors and may change across ETS phases.

We have identified four major objectives for allocating permits:

1. *Equity*: Achieve an equitable allocation of costs and any windfall gains
2. *Reduce leakage* of activities and hence emissions to countries not covered by binding targets
3. Manage a *smooth transition* to a long-term low-carbon economy
4. Encourage *participation and compliance* where the point of obligation must involve many small actors.

Existing emissions trading systems have put different weight on these objectives and achieved them in different ways. While balancing the trade-offs among objectives is ultimately a political judgement, it can be informed by analysis and data about the nature of the trade-offs and to identify the affected parties. How research can contribute to an informed allocation decision-making process is explored further in this paper but also synthesised in the separate chapter on research needs. Allocation decisions can also be informed by previous experience with emissions trading and other environmental markets – especially those in Chile (water, air pollutants, and fisheries).

We assess the attractiveness of each modality (and combinations of them) against these objectives in light of key considerations, including (but not limited to): political feasibility; improving the efficiency of the tax/revenue raising system; treatment of new entrants; administrative feasibility and avoidance of manipulation and corruption.

Figure 6.1 summarises the key relationships between objectives and modalities. It also identifies key considerations for each modality.

Figure 6.1: Summary of key matches between modality and objectives and key considerations for each modality

Allocation Objective	Modality			
		Auction / Require purchase	Grandparent	Output-based
	Equity			
	Reduce leakage			
	Smooth transition			
	Participation and compliance			
Key Considerations		Politically challenging:- concentrated costs - diffuse benefits Raises revenue	Requires good historical data Complex political process Risk of manipulation	Administratively complex Risk of manipulation and corruption

In this chapter we first summarise existing choices on allocation in leading national and regional ETS, ordered roughly by timing of implementation, and environmental markets in Chile and identify some key lessons that have come from international and local experience. We then explore each of the modalities, objectives and considerations in the unique Chilean context, taking into account how they might apply across different sectors and different phases of the scheme.

6.2. Experience from Existing or Proposed Schemes

Figure 6.2: Previous experience with allocation modalities in ETS and other environmental applications in Chile and internationally

	Modality used			
Scheme		Auction / purchase requirement	Grandparent	Output-based allocation
	EU ETS Phase I (2005-7)	Limited		
	EU ETS Phase II (2008-12)			
	New Zealand ETS	Liquid fuels and stationary energy	Fishing and deforestation only	Emissions- intensive, trade- exposed sectors
	Regional Greenhouse Gas Initiative, US	Auctioned to support technology programmes		
	American Clean Energy and Security Act (unsuccessful) Waxman-Markey	15% auctioned		Vulnerable sectors and electricity consumers
	California ETS	50% auctioned		Vulnerable sectors and electricity consumers
	Australian ETS			Emissions- intensive, trade- exposed sectors
	Alberta, Canada			Intensity-based system
	Chilean water markets	Small amount		
	Chilean air quality			
	Chilean fishing quota	In discussion		

6.2.1. European Union¹⁰⁹

One of the political approaches adopted by the European Commission to smooth the passage of the legislation establishing the EU ETS was to allow as much discretion as possible to Member States in how they implemented the system in their own country. A key aspect of this was the requirement for each Member States to develop a National Allocation Plan or NAP. As well as setting out the total number of allowances the Member State intended to issue (including justification for that total by reference to progress towards Kyoto Targets and interaction with other policies); the NAP also described the Member State's proposed approach to both free allocation and auctioning. It described the basis of the approach (e.g. based on historical emissions, sectoral projections) as well as the number of allowances to be issued to each obligated entity. The NAPs also included details on how new entrants and closures would be treated as well as how any auctioning of allowances would be carried out. Following consultation at the national level, these NAPs were then presented to the European Commission and other Member States and submitted to the Commission for approval.

Given the short timescales for the implementation of the EU ETS and the potential financial value involved in decisions on free allocation, it was hardly surprising that in most Member States the process of finalising the NAPs was controversial. Even in Member States where there was some practical experience of climate related policies, like the UK, industries were being briefed on the details of the ETS legislation at the same time as they were receiving requests for emissions data and being asked to develop monitoring and reporting plans.

However, by this stage the EU ETS framework and start date were locked in. One only has to imagine how this might have played out if the issue of caps and allocations had been developed as part of the EU legislative process and framework. It seems likely that the EU ETS would have commenced much later than 2005 and maybe not at all. In this light whilst it created some difficulties, locking in the framework and start date early can be seen as an astute strategic approach.

With no time to develop benchmarking approaches, the majority of Member States elected to use historical emissions as the principal method of allocation and most used unverified data provided by companies or sector associations to inform both the level of free allocation and the cap, leading to the well-publicised problems with over-allocation in EU ETS Phase 1. The allocation arrangements were also a source of controversy between Government departments with industry departments lobbying hard for higher allocations for industry and energy departments concerned about the impact of the scheme on energy security and pricing. This again led to upward pressure on free allocations and therefore caps. Both of these issues might have avoided if a better set of data on emissions from regulated entities had been held before decisions on allocations had to be made. In the UK, the situation was improved by the requirement that regulated entities had to have their emissions data verified by accredited bodies before submission but this was very much the exception to the rule.

For new installations, Member States were able to elect that they would provide no free allocation, which economic theory suggests is the best approach even where some allocation on historical emissions to incumbents on a purely historical basis has been allowed to smooth the

¹⁰⁹ Ellerman and Buchner (2007) is a critical reference on experience with allocation in the first phase of the European Emissions Trading System.

introduction of the scheme. Ellerman (2008) showed how the actual rules about grandfathered allocation to existing companies (who lose entitlements if they close – i.e. allocations are dependent on current activity as well as historical) relative to new entrants (who did not gain entitlements) could lead to perverse effects. However, again, industry departments argued strongly that “zero allocation” would be a barrier to new investment and that companies which had made investment decisions before the EU ETS was established, would suffer from stranded assets. And once the first Member State had made a decision to provide new entrants with free allowances, it was inevitable that others would follow the same route to avoid impacts on competition.

One positive thing which emerged from the new entrant rules was the need to develop benchmarking as an approach as obviously such new entrants had no historical emissions on which to base their allocation. It is important to note that benchmarking in the context of the EU ETS is still an “ex ante” system whereby allocations are determined on the basis of projections of future production rather than an “ex post” system where adjustment is made subsequently to allocations based on real production data. The European Commission has defended this approach strongly as part of its efforts to maintain regulatory certainty by resisting any adjustment to caps and allocations after they have been approved.

Equally, Member States were reluctant to make much use of auctioning in Phase 1 of the EU ETS again due to industry lobbying and concerns around impacts on competitiveness. Despite the fact that up to 5% of allowances could be auctioned, only four countries chose to auction any units.

As the scheme has moved into subsequent phases, the discovery that companies (in particular in the energy sector) were making significant windfall profits from their free allocations, led to a great deal of interest in revisiting the approach to both free allocation and auctioning. Some attempts were made to address this in Phase II of the scheme but the major impact was felt through the review of the ETS that took place in 2007 and the subsequent amendments to the EU legislation which came into effect for Phase III of the scheme. In particular the following changes will be made:

- Auctioning will progressively replace free allocation. Free allocation of emission allowances has been a key element for acceptance of the EU ETS in the pilot phase but comes at an efficiency loss and with equity concerns. Apart from a few transitional exemptions, the whole power sector will have to auction emission allowances. The European Commission expects that at least 50% of all allowances, corresponding to 1 billion tonnes of CO₂, will be auctioned in 2013, and this proportion will rise each year.
- Industrial installations will receive allowances on the basis of product-specific EU-wide benchmarks but must purchase at least 20% of allowances in 2013 rising to 70% in 2020 and 100% in 2027. Operators at risk of carbon leakage will receive allowances for free up to their benchmark. The benchmark is based on the average 10% most efficient installations in a given sector. Benchmark values are finalised and in the process of being approved by the European Parliament and Council.

Key experiences

Overall, the EU ETS has been relatively politically successful – not only was the original legislation developed in a way which allowed it to be fast-tracked through the EU legislative system but it has subsequently been significantly improved through revisions to that legislation. In particular, Member States have been willing to give up significant degrees of control over

decisions in return for common, harmonised approaches which avoid “prisoners’ dilemmas” and thereby will result a more efficient, less discriminatory system.

Because there was inadequate information about the scope of the system and total number of emissions regulated, Phase 1 was very challenging with prices spiking at the end of the first reporting year and then crashing once it emerged that the scheme as a whole suffered from massive over-allocation. This was also caused in part by the fact that Phase 1 concluded before Kyoto Protocol targets began to bite and therefore Member States had little or no incentive to require reductions from regulated entities. However, the risk of contamination into the second phase was limited by the prohibition on banking between periods. This also strengthened the hand of the EU Commission considerably in negotiating tougher caps for Phase II and III. Nonetheless, problems with over-allocation continued as a result of the massive reduction in EU industrial output driven by the global economic downturn. In the absence of the economic downturn the caps for Phase II and III would have been relatively robust. This does illustrate perhaps the potential value, particularly in an unlinked market, of a mechanism that links caps to general levels of economic activity.

The main administrative challenges initially encountered were largely due to the extremely short time period between the finalisation of legislation (October 2003) and the start of Phase 1 on 1 January 2005. Specific problems included: identification and permitting of the 10,000+ installations covered by the scheme (which were compounded by different approaches to sectoral definitions); gathering and verifying historical emissions; no time to develop alternatives to allocation based on historical emissions; difficulties in sharing best practices between Member States; lack of harmonisation generally.

A major difficulty felt by regulators across the EU was the information asymmetry between themselves and the regulated sectors. This related not only to emissions data but also left regulators and governments vulnerable to lobbying about the impacts of the scheme on activity. A good example was the pressure put on governments to allocate significant numbers of free allowances to energy companies despite the fact that those companies were in a position to pass through the majority, if not all, of their costs to consumers through increases in electricity prices.

While the issue of windfall profits for the electricity sector was largely addressed in the revised EU ETS legislation by reducing the allocations, free allocation to a broad range of industry sectors was preserved in the Phase III, despite the publication of a number of studies showing that carbon pricing was likely to affect trade only in a handful of sectors (e.g. iron and steel, cement). The main reason for this was political as the German government had reached an agreement with its industry association, the BDI, that it would support the other revisions to the scheme provided free allocation was preserved. However, in order to improve the equity of the allocation methodology and reduce perverse incentives to try to affect future allocations, it was agreed that benchmarking would replace historical emissions as the basis of allocation. Although still time consuming and administratively complex, it was possible to agree EU-wide rules because adequate time was provided and lessons could be learned from the new entrant approaches in earlier phases.

6.2.2. New Zealand

The New Zealand system was developed to meet New Zealand’s obligations under the Kyoto Protocol and followed Kyoto rules closely, including full use of flexibility mechanisms. Thus it did not have an explicit cap on allocation; the government instead committed to meet the economy-wide Kyoto target. Allocation within New Zealand’s system is also distinctive because

of concern about emissions-intensive trade-exposed industries, lack of compensation to the electricity or up-stream liquid fuels sectors, and allocation to actors that are not the point of obligation.

The system began with coverage of the forestry sector in 2008 and under legislation was designed ultimately to cover all sectors and GHGs.¹¹⁰ Like Chile, New Zealand is a small country with a very open economy and a political inclination against subsidisation of industry. Mitigating the potential for leakage and economic regret through loss of industry was a critical issue when designing the scheme. Many different tools were used to alter price and change the distribution of costs. The primary tool was free allocation targeted to specific recipients in specific sectors. This is discussed further below. As a broader measure covering the stationary energy, liquid fossil fuel and industrial process sectors, the government also applied a progressive obligation such that points of obligation would surrender one unit for every two tonnes of emissions. This effectively halves the emissions price faced and was intended to smooth adjustment for the economy as a whole. While this measure is in force, the level of free allocation to those sectors (discussed below) is pro-rated accordingly. Under legislation the progressive obligation was to expire at the end of 2012, but the government has proposed to extend this post-2012 without a specified end date. The progressive obligation does not apply to the forestry sector, where it was not considered to be appropriate or necessary to smooth the adjustment; many forestry participants were receiving units and planning to trade units offshore.

Energy-sector points of obligation and electricity generators

Free allocation was not provided to the upstream points of obligation in the stationary energy and liquid fossil fuels sector (which provides fuel for transport and some electricity and industry) because these producers were expected to pass on the costs. Likewise, electricity generators were not allocated free units. Many are government owned and because the electricity sector is deregulated they were all expected to pass costs on directly.¹¹¹

Non-industrial electricity consumers

One programme was directed at providing financial assistance to non-industrial electricity consumers. The 'Warm Up New Zealand: Heat Smart' programme provided an insulation fund initially proposed as a way to protect residential consumers from increased costs and a complementary instrument to reduce emissions. It was not strongly targeted at poorer consumers and had little impact on emissions (Grimes et al, 2012).

Industrial producers

Free allocation was provided to eligible trade-exposed, emissions-intensive industrial producers to mitigate emission cost impacts from stationary energy and industrial process emissions. Emission costs from liquid fossil fuels were excluded although the government signalled that it would follow Australia if it chose to include them in the future. In 2012, the government has now proposed to extend free allocation to cover emission costs from liquid fossil fuels used for stationary energy; this will be considered by Parliament.

¹¹⁰ The NZ ETS currently encompasses forestry, stationary energy, industrial processes and transport. Waste and synthetic gases will enter in 2013. The government has proposed to defer the entry of biological emissions from the agriculture sector pending a review in 2015.

¹¹¹ The considerable existing hydroelectric generation capacity was expected to receive windfall gains from higher electricity prices but these are largely government owned so this was not a critical issue. In Chile hydropower facilities are privately owned so windfall gains could be an issue.

Eligibility to receive free allocation is decided through a two-part process. First, eligible activities have to pass a trade exposure test which prohibits free allocation if (a) the activity is electricity generation, or (b) there is no international trade of the output of the activity across oceans, or (c) it is not economically viable to import or export the output of the activity. Second, they have to pass an emissions intensity test based on tonnes of emissions per 1 million New Zealand dollars of revenue. Under this test there are two thresholds for activities:

- a moderately emissions-intensive activity emits between 800 tonnes of CO₂e per 1 million New Zealand dollars of revenue and 1600 tonnes of CO₂e per 1 million New Zealand dollars of revenue
- a highly emissions-intensive activity emits more than 1600 tonnes of CO₂e per 1 million New Zealand dollars of revenue.

The threshold test will be applied to the average emission intensity for an activity across the whole industry carrying out that activity. New firms receive allocations on the same basis as existing ones.

For each eligible activity, an allocative baseline is defined consisting of a benchmark number of NZUs per unit of output. Free allocation is provided at 60% of the allocative baseline for a moderately emissions-intensive activity and 90% for a highly emissions-intensive activity, multiplied by the current year's output. This contrasts with European benchmarking and means that the emissions cost of an additional unit of output is very low; this mitigates the incentive to relocate production, 'leakage'. The reward for reducing emissions per unit of output is still the full value of an emissions unit (excluding the period of progressive obligation). As legislated, free allocation will phase-out at a rate of 1.3% from 2013 (calendar year). However, the government has proposed to suspend the phase-out until the progressive obligation has ended. Allocative baselines are based on either: (a) the average emissions and electricity use per unit output from the activity, based on data collected from those undertaking the activity in New Zealand in the financial years 2006/07, 2007/08 and 2008/09, or (b) information on equivalent emissions and electricity use per unit output from Australia. This latter was to enable alignment of New Zealand's industrial allocation regime with Australia's as appropriate.¹¹²

Fishing industry

An amount of 700,000 NZUs were set aside for fishing quota owners as compensation for any fall in value of fishing quota resulting from an increase in the cost of fuel under the NZ ETS. Units were allocated in a one-off distribution in 2010.¹¹³

Forestry sector

For the forestry sector, it was recognised that some landowners would face asset losses as a result of the deforestation liability for pre-1990 forest; however it was difficult to identify them. One identifiable group were Māori who had recently concluded Treaty of Waitangi settlements and received land with pre-1990 forest. This may be a relevant experience if Mapuche or other indigenous groups are adversely affected in Chile. The political solution to the deforestation liability for other foresters was to provide some compensation per hectare of forest on the basis of when they acquired the forest in relationship to the announcement of the government's intended forestry policy in 2002. The free allocation for forestry is being released in two large

¹¹² See <http://www.climatechange.govt.nz/emissions-trading-scheme/participating/industry/allocation/>.

¹¹³ See <http://www.climatechange.govt.nz/emissions-trading-scheme/participating/fishing/>.

tranches pre-2012 and post-2012 and was not targeted in any way toward those mostly likely to have lost land value. However, the government has proposed to claw back the second tranche of free allocation to forest owners that opt into a new forest offsetting mechanism that allows them to avoid the deforestation liability if they replant equivalent forest elsewhere.¹¹⁴

On the afforestation side, the NZ ETS provides units on an opt-in basis for afforestation removals on land that was not forested in 1989, in alignment with its obligations for the first commitment period under the Kyoto Protocol. In return, landowners have to accept liability for future reversal of those removals. This approach avoided the need to determine a baseline for eligible afforestation activity.

Agriculture sector

Under legislation, the agriculture sector would receive free allocation for biological emissions once it assumes obligations under the NZ ETS. This would initially start at 90 % of an allocative baseline on an output intensity basis and be phased out at 1.3% per year after the first year. The deferral of obligations for the agriculture sector has likewise deferred free allocation.¹¹⁵

Overall emission constraint

Under the original legislation, the NZ ETS capped the free allocation to the forestry and fishing sectors but did not cap the free allocation to the industry and agriculture sectors. Ultimately, the number of NZUs allocated by the government was covered within its Kyoto cap, which ensured their environmental value. Because the New Zealand system is linked to the Kyoto market as a buyer and no constraints are placed on the quantity of purchased units that can be used to meet ETS obligations, the number of units allocated by government does not limit the number of units in the system. Thus, auctions have not been needed to date to release units into the system. In 2012, the government has proposed to introduce auctions plus a cap that covers both free allocation and auctions (but excludes removals issued in the forestry and other sectors. Auctions are being considered as New Zealand increases its need to control the domestic market in response to evolving international negotiations and the significant fall in global carbon prices.

The overall impact of this package combined with the low international prices is extremely low marginal GHG prices. A very gradual transition may have been necessary, however, to politically enable the second mandatory national ETS in the world to be launched in a small trade-exposed country on an economy-wide basis in a region where no others faced an emission price at the time. Although emissions responses are likely to be low to date, the basic architecture of the system has been established and preserved through several challenges. Compensating for concentrated losses from the ban on deforestation was one of the most contentious issues – disproportionate to total cost. This was exacerbated by adherence to international rules that did not apply well to New Zealand conditions. On the other hand, the foresters who benefit from afforestation credits are now a strong vested interest who support strengthening of the policy.

The government found it very difficult to create performance benchmarks in the industry sector given the very small number of New Zealand firms in each sector and limited government capacity. This difficulty, combined with the desire to broadly align New Zealand with the evolving free allocation regime in Australia, led to the use of historical emissions rates for the

¹¹⁴ See <http://www.climatechange.govt.nz/emissions-trading-scheme/participating/forestry/allocation/>.

¹¹⁵ See <http://www.climatechange.govt.nz/emissions-trading-scheme/participating/agriculture/allocation/>.

determination of allocative baselines. Some firms found output-based allocation administratively challenging. Some have suggested that allowing firms to capitalise the free allocation and invest it in cleaner production technology would have achieved the same goal of avoiding leakage and been more effective than a flow of annual allocations.

6.2.3. Australia

The Australian system is very similar to New Zealand's in terms of free allocation; the two systems were developed with close communication. The Australian Government will introduce a carbon pricing mechanism from 1 July 2012. There will be two stages of the carbon pricing mechanism. From 1 July 2012 to 30 June 2015, the price for each tonne of carbon pollution will be fixed. Then, from 1 July 2015, the carbon pricing mechanism will transition to a 'cap and trade' emissions trading scheme. In this second 'flexible price' stage, the carbon price will be set by the market.

In contrast to the start of the EU ETS where the presumption was that EU Allowances would be grandfathered on the basis of historic emissions, the presumption in the Australian CPM is that carbon units should be bought or auctioned.

During the fixed price stage the number that can be bought will not be capped, and there is no binding Australian-wide target, but the price is fixed. The number of carbon units issued by the Government for compliance years in the flexible price stage will be limited by a pollution cap. A portion of these will be allocated for free as described below and the remainder auctioned.

Jobs and Competitiveness Program

To assist businesses with the transition to a carbon constrained economy the Australian Government created a Jobs and Competitiveness Program ("JCP") to help those entities undertaking activities that produce large amounts of greenhouse gas emissions and are highly exposed to international competition. These activities are known as emissions-intensive trade-exposed activities (EITE activities).

A key component of the JCP is the free allocation of carbon units to businesses to support jobs and competitiveness, and help affected industries make the transition to a clean energy future. The remaining carbon units will be sold by the Clean Energy Regulator (the Regulator) at auction.

Auctioning

The Clean Energy Act 2011 (the Act) specifies that the Regulator may issue carbon units through auctions. The Government's Clean Energy Future Plan sets out a number of policy decisions that relate to the design of auctions, including limiting the number of units that can be auctioned to a maximum of 15 million units for each vintage per year.

Free allocation pursuant to EITEs

The Clean Energy Regulations 2012 (Regulations) currently prescribe a list of 37 EITE activities which are covered by the Program. These activities are largely in the manufacturing industry and include activities such as steel, aluminium cement and zinc manufacturing. As in the EU and New Zealand, the power generation sector is not eligible for any free allocation and will have to purchase 100% of the carbon units it will need for compliance.

Entities that have “operational control” over facilities that undertake a prescribed EITE activity are able to apply to the Clean Energy Regulator for assistance under the Program. The Program provides assistance through the allocation of “free carbon units” early in the carbon price compliance period.

Similar to New Zealand, the number of free carbon units provided to an eligible entity is based on the level of production of a facility in the previous year, the average greenhouse gas emissions per unit of production for that EITE activity in the historic baseline period (as provided by the Regulations) and the classification of the EITE activity as either:

1. a ‘highly emissions-intensive activity’ – which will receive the highest assistance rate, starting at 94.5% of the industry average carbon cost in 2012-13; or
2. a ‘moderately emissions-intensive activity’ – which will receive the lower rate of assistance, starting at 66% of the industry average carbon cost in 2012-13.

These assistance rates will be reduced by 1.3% each year.

Application to add EITE activities

An entity can apply to the Department if it believes that an activity, which is not on the current list of EITE activities, should be added to the list of EITE activities, eligible for assistance under the Program.

An activity will be classified as “highly emission-intensive” if it produces over: 2,000 tonnes CO₂e per million dollars of revenue (or 6,000 tonnes CO₂e per million dollars of value-added); or moderately emission-intensive if between 1,000 and 1,999 tonnes CO₂e per million dollars of revenue (or between 3,000 and 5,999 tonnes CO₂e per million dollars of value-added).

An activity will be classified as “trade-exposed” if it meets both quantitative and qualitative tests. The quantitative test is a trade share (ratio of value of imports and exports to value of domestic production) greater than 10% in any one of the years 2004-05, 2005-06, 2006-07 or 2007-08. The qualitative test is a demonstrated lack of capacity to pass through costs due to the potential for international competition.

6.2.4. Allowance allocation under United States ETS schemes

The US experience brings two distinctive elements. The Regional Greenhouse Gas Initiative was based almost entirely on auctions and is interesting in terms of how the allowance revenues can be usefully used even under over-allocation. The California system and Waxman-Markey are interesting in terms of trying to blunt impacts on electricity prices.

Regional Greenhouse Gas Initiative (RGGI)

The first ETS for greenhouse gases in the United States, RGGI is a regional scheme covering emissions from electric power plants in the North-Eastern US, with nine states currently participating. Each state determines how units are allocated – either auctioned or freely allocated. In practice, approximately 99% of RGGI emission units are made available through central auctions that are conducted quarterly by RGGI, Inc. on behalf of the RGGI states. The remaining units are sold directly by specific states to qualifying sources. RGGI is unique in that it is the only ETS scheme that auctions virtually all units, instead of freely allocating them. Each auction has a reserve price under which no units will be sold. Currently, the auction reserve price is US\$1.93 per unit.

The format of a RGGI auctions is “single-round”, “sealed-bid”, “uniform-price”, in which each bidder may submit multiple confidential bids for a specific quantity of CO₂ units at a specific price. Any entity can participate in the auctions, given they meet qualification requirements – which includes provision of financial security. However, qualified single buyers or group of affiliated buyers may not purchase more than 25% of the units offered at a single auction.

Proceeds from the auctions are distributed to states, which determine how to use the funds. During the first compliance period, between 2009 and 2011, the proceeds from auctioned units equalled roughly US\$912 million. States have disbursed virtually all of these proceeds for various purposes, including energy efficiency measures, community-based renewable power projects, assistance to low-income customers to help pay their electricity bills, education and job training programmes, and contributions to a state’s general fund.

Of the freely allocated units, 25% must be allocated for a consumer benefit or strategic energy purpose, which includes: promotion of energy efficiency; direct mitigation of electricity ratepayer impacts; promotion of renewable or non-carbon-emitting energy technologies; reward or stimulation of investment in the development of innovative carbon emissions mitigation technologies with significant carbon reduction potential, and/or to fund administration of the RGGI programme. In practice, the majority of units are allocated toward consumer benefit or strategic energy purposes. In addition, states must recognise that, in order to provide regulatory certainty, state-specific rules for allocations should be completed as far in advance of the launch of the scheme as practicable.

Within a year of RGGI’s operation, emissions decreased faster than projected under the cap and it became apparent that the scheme was over-allocated (Hibbard et al 2011). Available allowances exceeded emissions due to the economic recession that has decreased output as well as RGGI’s success at reducing emissions, through pricing carbon and investing auction proceeds into energy efficiency and renewable energy. The history of RGGI auctions reflects this over-allocation. Recent auctions have been undersubscribed and traded at the floor price. Nevertheless, the programme can still be considered a success, with emissions declining, increased employment, lower fuel imports, and estimated net present value economic benefit of RGGI’s auction proceeds in excess of the cost of RGGI’s carbon price.

California

California’s Global Warming Solutions Act of 2006 caps economy-wide emissions with the goal of reducing back to 1990 levels by 2020.¹¹⁶ The California Air Resources Board (ARB) developed a “Scoping Plan” of about 70 measures to be developed and implemented. Amongst those 70 measures is an ETS scheme for utility power plants, large industrial emissions sources, and providers of transportation fuel and natural gas. The ETS compliance obligation is scheduled to begin 1 January 2013. In total between 2012 and 2020, ARB will make available up to 2.5 billion emission units, with roughly half auctioned and half given away for free. The amount of units that ARB puts into circulation is controlled by ARB over time to move the state towards AB32’s 2020 emissions target.

For auctions, allowance vintages from previous, current and future compliance years will be auctioned, with a unique auction for each vintage. In 2012, auctions will be held on 15 August

¹¹⁶ Two key references on the design of the system are Market Advisory Committee to the California Air Resources Board (2007) and Goulder (2007).

and 14 November but beginning in 2013 auctions will be held quarterly. After 2012, at auctions for previous and current years, one quarter of units for that year, as well as any unsold units from previous years, will be offered. For auctions for future year vintages – known as advance auctions – units will be withdrawn from the Auction Holding Account (AHA), which holds 10% of all units from budget years 2015–2020. After 2012, at advance auctions, one quarter of the units held in AHA for the compliance year three years subsequent to the current compliance year will be offered at auction.

Auction purchase limits prevent any covered entity from purchasing more than 15% of the units sold at any current or previous year auction, while non-covered entities are not allowed to purchase more than 4% of an auction's units. However, limits on advance auctions are less stringent, allowing a covered entity to purchase up to 25% of future vintage year units.

Proceeds from auctioned units will enter the Air Pollution Control Fund (APCF) and must be used to advance the objectives of AB32. In 2012 alone, proceeds from auctioned units are expected to equal one billion dollars. As the scheme progresses, both the portion of auctioned units and the scope of the cap increases result in an anticipated revenue of nearly \$12 billion dollars in 2020. Likely uses include rebates for low-income households, large-scale clean energy projects, university research and development, and/or incentives that encourage households and business to be more energy efficient.

The California ETS has a “hard” price floor on auction sales and a “soft” unit reserve mechanism to moderate price spikes. The price floor is set at US\$10 per ton for year 2012, and will grow at 5% per year. Units not sold at the price floor will be placed in a unit reserve. In addition, at the programme outset, approximately 4% of all units will be placed in the reserve. Units in the reserve will be available for sale to regulated entities at fixed prices ranging from US\$40 per ton to US\$50 per ton starting in 2012, and growing at 5% per year.

Two categories of covered entities will receive the majority of California's freely allocated units in 2013: vulnerable industries (including refiners) and electricity generators, including investor-owned and publicly owned utilities (IOUs and POUs, respectively). The units freely allocated to the electricity sector serve a specific purpose: they must be used for the benefit of electricity consumers. The number of free units allocated is determined differently for the electricity (utility), industrial and refinery sectors.

The utility sector point of obligation will be electricity generators, with those generators purchasing allowances at auction. Prior to auction, however, the allowances will be given to electricity deliverers for free. In turn, deliverers will put the allowances into the auction. Why take the extra step to create a “double auction”? A major concern pertained to the auction revenues. This approach gives the value of allowances to the companies that are compelled to deliver electricity, while preserving the efficiencies and incentives of an auction for polluters at the point of obligation. A similar approach will be used for providers of natural gas when added to the programme in Phase 2. Fuel providers will be the point of obligation in the transportation sector, and all of those allowances will be auctioned.

Given political and economic conditions, there was a need to develop a programme that prevents job loss (and emissions leakage) from, for example, compliance costs causing firms to slow production or to flee to states with lax environmental requirements. While the evidence does not support this concern – business relocation accounts for a smaller share of job losses and gains in California than in most other states – the cap-and-trade programme will allocate freely to trade-exposed, energy-intensive industries the majority of their allowances needed for compliance.

The allocation to industrial polluters is based on a four-part equation:

- output of the industrial operator (e.g., amount of cement produced)
- performance benchmark (e.g., greenhouse gas emissions rate per bag of cement produced)
- cap adjustment factor that declines to approach the 2020 cap goal
- assistance factor to enable a transition to low-carbon production and to prevent competitive disadvantages with imported products, and to prevent job loss to other jurisdictions.

The output-based allocation scheme potentially creates a small incentive to produce more in order to receive more allowances (though only for highly GHG-efficient producers), but maintains the incentive to mitigate emissions per unit of production, in contrast to an emissions-based allocation. The performance benchmark is based on 90% of the industry average in California, which results in a small shortfall of allowances for “average” firms that they can close by mitigating or purchasing allowances at auction. The assistance factor remains at 100% for the nine-year programme for highly trade exposed, energy intensive sectors, but it declines to 25% for light exposed, non-energy intensive sectors by the third three-year phase.

Waxman-Markey US Federal legislation (American Clean Energy and Security Act of 2009; House of Representatives bill 2454)

This legislation was unsuccessful but is included because of innovative aspects of design and because it did pass the US Congress suggesting that it had favourable political characteristics. The American Clean Energy and Security Act (ACESA) of 2009 would have provided that most emission units (85%) are initially freely allocated to regulated entities such as electric utility ratepayers and specific industries (such as the energy-intensive and trade-exposed industries that may be more vulnerable to regulation) rather than being auctioned (15%).

Specifically, 78% of allowance value would have gone to households (44%), small businesses (7%), and public purposes (27%), while 22% would have gone to industry. Value to households would have been distributed through three main channels. First, the allowance value allocated to the electricity sector would have gone to local distribution companies (LDCs), which are state-regulated entities from which consumers and businesses directly buy electricity. The bill mandated that the LDCs direct the value “exclusively for the benefits of retail ratepayers” i.e., to protect consumers from price increases. In this way, this provision would have helped to address regional disparities since the distribution of the value “follows the electrons” to where they are consumed. Second, ACESA would have reserved 15% of the value of units for low- and moderate-income households to help compensate them for the fact that they feel the impacts of regulation disproportionately. Finally, a substantial fraction of units in the later years of the scheme would have been returned to all households through a broad-based tax refund.

Overall, the vast majority of the free units would have been used for public purposes: smoothing the transition to a low-carbon economy for consumers and businesses, stimulating development and deployment of low-carbon technologies, and helping to adapt to climate change. In addition, the bill would have set aside 5% of the US unit pool for use in assisting tropical forest nations in preparing to participate in this programme and preserve existing forest stocks.

Some lessons learned include:

- The allowance allocation in ACESA illustrates one of the most powerful aspects of an ETS policy: the ability to target allowance value to the sectors or entities in the economy that are most vulnerable to the regulations, helping to protect them during the transition to a clean energy economy.
- Good data is essential to know whether particular sectors are over-allocated (there were issues with the industrial sector in particular).
- Having a mix of freely allocated allowances and auctioned allowances (directed towards various public programs such as energy efficiency) provided a good balance for the US Congress.
- Being able to show that a majority of allowance value will go back to households (rather than to industry) was politically important. The Waxman-Markey allocation structure allowed for this in multiple ways – in particular, the low income households allocation, the electricity allowances which went to local distribution companies since they would be required to use it to benefit consumers (also good to address regional disparities), and for the tax refund in later years of the programme. Second best was to be able to show that a portion goes to public purposes.

6.2.5. Alberta, Canada

Alberta, Canada has a narrow scheme focused on large emitters: oil sands and coal fired power. It is an intensity based system – therefore implicitly uses output-based allocation like New Zealand and Australia.

6.2.6. Chilean experience with allocation within environmental markets

Chile uses markets to manage water, individual tradable quota for fisheries and air pollutants from stationary sources in Santiago. Overall the experience has been positive. In both water and fisheries markets, all units were initially allocated by grandparenting. There is some discussion now of auctioning some of the ITQ for industrial buyers in the new law to be approved by the end of the 2012; water rights in the very few places that have not been claimed yet are to be auctioned off if more than one applicant claims for the same rights, according to the new reforms of the water code of 1981. The air pollutants market is a credit based mechanism rather than a cap-and-trade so they are grandparented by default.

Among the interesting features of the Chilean fisheries experience is the way the political economy of the reform was facilitated by the prior introduction of de facto individual quotas within the framework of fishery experimental activities. When the authorities closed the southern pelagic fishery because of biological problems between 1997 and 2000, they organized ‘experimental’ fishing expeditions in which participant boats were given the right to fish a certain amount of resources per expedition. This pseudo quota system allowed fishermen to experience directly the benefits of individual quotas and that was instrumental to the political agreement leading to the reform.¹¹⁷

¹¹⁷ See Gómez-Lobo et al., 2011

Allocation of water rights under the Water Code of 1981 and 2005 reforms

One of the most criticized aspects of the water market system established in Chile (Bauer, 2004) is the initial allocation of water rights. Articles 140 and following of the Water Code explain the establishment of water rights. If one person is the applicant, the national agency in charge of water management (DGA) is required to surrender allowances for free, as long as water is available. If two or more applicants request the same waters, the DGA cannot privilege to any other applicant, but must proceed to an auction among stakeholders. In 17 years of the Water Code, in less than 1% of the water rights applications have been required to proceed with the auctioning conditions (Dourojeanni and Jouravlev, 1999). Prior to the reforms of 2005 the Water Code did not require applicants to justify any future use of water. Nor it was necessary that the water rights holders actually used their rights or build the necessary infrastructure to do. It has been claimed by some authors (Dourojeanni and Jouravlev, 1999; Bauer, 2004) that these conditions have led to a large amount of water rights being hoarded by a small number of parties' especially prospective hydropower developers in the south of the country. In the reforms of 2005 these features change somehow with the introduction of a penalty for water rights not being used. It is not clear yet whether the penalties introduced have discouraged water right applications. Another issue was that agricultural users were allocated consumptive water rights while other users, for instance, power generation were allocated non-consumptive rights and there is some confusion as to which of these two rights holders has priority. Grafton et al (2011) provide an updated review.

Program of Control of Particulate Matter Emissions Coming from Stationary Sources

Santiago was one of the first cities outside the OECD to implement a tradable permit programs to control air pollutant like particulate matter and NO_x. When the programme was put in place in 1994, the inventory of emissions and sources was quite incomplete, it was work in progress. Grandfathering the "permits" helped the authority greatly in completing the process by creating incentives to unregistered sources to self-declare.¹¹⁸ Due to the lack of background information, the firms were only given permits "officially" and transactions started to be recorded in 1997.

Some firms lost permits because of regulatory changes. As the programme progressed, SEREMI came to realise that its initial allocation was too generous. They modified the quantity of allowed emissions to existing large boilers twice (in 2000 and 2005).

The system also includes an offset rate. A new source must buy more than one permit to offset each unit of pollution. Thus new entrants receive no free allocation and additionally face a higher price of pollution than existing firms. The high offset rate provides existing sources with perverse incentives to continue to operate while "taxing" newer and cleaner entrants. This might retard turnover of pollution sources, drive up the cost of environmental protection and even increase pollution levels. The offsetting rate made firms reluctant to trade since permits are depreciated progressively through trading. The offsetting rate was also modified. Initially, it was set at 1, but in 1998 it was increased to 1.2 and in 2000 to 1.5. By 2007, this led to a reduction in the stock of permits of 6.3%.¹¹⁹

¹¹⁸ Montero et al, 2002

¹¹⁹ Coria and Sterner, 2010.

Furthermore, in 1998, it was established that those large existing boilers that were not using their permits or those that wanted to exit the market had 2 and 3 years, respectively, to sell their permits before they became void. 15.8% of the total initial permits granted in 1997 have become void as a result of this.¹²⁰

6.3. Modalities for Allocation

Here we elaborate how each allocation modality functions. We defer discussion of how each modality addresses the objectives of free allocation to the following section and focus here on the practicalities (administrative feasibility; treatment of new entrants; and avoidance of manipulation and corruption), revenue-raising-efficiency effects and specific political characteristics of each. Most systems will use a combination of modalities to meet different objectives across sectors and time. Allocation choices may also have implications for linking – these are discussed in Chapter 4.

6.3.1. Auctioning

Auctions are a way to introduce units that are part of the ETS cap into the market or, in a linked system, one way to sell the government's excess units relative to their internationally agreed target. Auctions raise revenue that can be used either within the ETS for compensation, protection or complementary instruments, or for more general purposes (debt repayment or government spending). An auction can improve market liquidity, reduce market power and provide regular price signals.

Because GHG units are relatively homogenous, and are generally non-perishable (can be banked), and because an active secondary market in GHG units general develops quickly, a GHG unit auction is what is called a “common price” auction where all buyers are willing to pay the same price for units. If there is an active secondary market, or the market is linked closely to a larger external market, the price is set by those markets unless the auction is very large. This makes this a relatively simple auction design problem. If for phasing or linking reasons units are not homogenous (see discussion above), then auction design may be more important. The high level principles are: efficiency, simplicity, transparency and fairness. These are easily achieved in the context of carbon allowances with quite basic auctions utilizing a clearing price methodology. Such auction are used with most Treasury sales and wholesale electricity markets. Many governments have now used auction mechanisms to sell ETS units or units in other environmental markets with similar characteristics so this is a well understood problem.

Key features of successful use of auctions are: regular auctions at least initially to encourage learning and price discovery; focus on attracting large numbers of buyers in part by limiting distinctions among units as much as possible, to avoid market power; and avoiding barriers to secondary market development or linking to other markets. Cramton and Kerr (2002) and Betz et al. (2010) discuss detailed choice of auction mechanisms for GHG markets. An auction expert and someone with implementation experience should be involved in design and implementation of the auction but this is not a significant hurdle.

Thus auctions are generally a simple way to allocate units. The arguments for free allocation instead of auctions are largely political and distributional.

¹²⁰ Coria and Sterner, 2010

Auctions give revenue to government and impose the costs on those who purchase units. The ultimate cost bearers and beneficiaries depend on how the auction revenue (or revenue from selling excess units abroad) is used. Because the political process associated with allocating permits from a new system is generally different from the process associated with spending an equivalent amount of government funds, the beneficiaries are likely to be different. Many private sector actors are sceptical of government's incentives and ability to use funds effectively. They fear that the funds will be wasted and hence argue that all units should be allocated freely into the private sector. This is a general argument about tax but arises here in a very salient way. Where auctions have been successfully included, defining the use of the revenue has generally been part of the package. In some countries there are limits on the use of revenue, and the extent to which revenue raised through a program can be dedicated to a specific purpose ('hypothecation' or 'ear marking'). This would need to be clarified under Chilean law.

One potential use of funds has not only distributional effects but also tax-efficiency effects. Auction revenue can be used to lower taxes that distort economic activity and hence raise the efficiency of the government's revenue raising. If the alternative to auctioning is free allocation that is not related to current activity (e.g. grandparenting which simply transfers wealth – or sustains it – thus creating no efficiency benefit), moving to auctions raises extra revenue with no efficiency cost. Efficient revenue raising is an issue that has received more attention over time as emissions trading systems evolve. The importance of this and the relative value of different tax cuts relative to uses of government revenue are very specific to the tax structure and country involved.¹²¹ The allocation process, how much revenue could be raised, and how those revenues could be recycled back to the economy should perhaps be topics in a wider discussion of more comprehensive tax reform in Chile.

6.3.2. Free allocation on the basis of historical data (grandparenting)

The most common form of allocation in environmental markets is on the basis of historical emissions or output. One, or several years, are chosen as a baseline and allocation is a proportion of emissions/output measured in those years (or sometimes the best of a group of years). The allocation does not necessarily need to go to an entity that is a point of obligation.

Grandparenting can be done on the basis of either emissions or output multiplied by a performance benchmark. "Benchmarking is a principle of allocation whereby some index of historical activity or capacity is multiplied by a usually uniform emission-rate standard to determine allocations to individual installations."¹²² It attempts to reward firms that historically have had emissions-efficient processes and avoid rewarding emissions-inefficient firms. The US SO₂ market used output (British Thermal Units – BTUs) while the EU ETS used emissions. This difference is largely driven by the heterogeneity of products regulated under emissions trading relative to SO₂ among only electric utilities. Benchmarking is analytically extremely difficult with a large number of heterogeneous products and processes. Most states in the EU chose not to use emissions rather than benchmarks for grandparenting in Phase 1, for this reason and because of lack of precedent for benchmarking.

The grandparenting approach requires high quality data on historical emissions (and possibly output). It can result in lengthy appeals where data are poor or entities argue that there were special circumstances. Once it is complete however, it does not need to be repeated (and

¹²¹ Goulder et al, 1997

¹²² Ellerman and Buchner, 2007, p. 76

ideally is not repeated – to avoid incentives to inflate emissions in order to increase future free allocations).

Grandparenting to points of obligation has political appeal. It seems intuitive that costs fall on those who pay even though this is often, or even generally, not true. The points of obligation will be very conscious of the regulation and will tend to be large concentrated interests. Thus they will lobby actively. If Chile does not want to allocate in this way by default it will need to actively promote dialogue about alternatives.

Chilean institutions are strong by Latin American standards so administrative corruption (i.e. misapplying agreed rules) in the process of grandparenting may not be such a threat. However Chile is a very unequal country with a strong political elite, so powerful vested interests may be able to influence the design of grandparenting rules in their favour (manipulation or political corruption). Most Chilean industries are also quite concentrated, with a few large firms. This would argue for a carefully planned political process to frame the issue carefully, inform affected groups of their interests (and those of others) and create a balanced process.

Generally allocation of units under a grandparented system is done on a rolling basis for a certain number of years ahead. The rules for them are announced further in advance than actual allocation so firms can anticipate future units. Grandparented allocations typically phase out over time. In some systems, e.g. the European Union in Phase 1, units are withheld from firms that close. This creates an allocation system that is a mixture between grandparenting and output-based allocation (discussed below). It can lead to perverse results as inefficient existing firms will persist and potentially crowd out efficient new firms.¹²³

More generally, if free allocation is conditional on activity or updated on the basis of emissions, it will have incentive effects. It is critical to avoid incentives to increase emissions in order to influence future allocation. Thus allocation should be based on data from a period before entities (seriously) anticipate the system. However, this can be problematic if the system takes a long time to develop. Especially in a rapidly developing economy, emissions from several years earlier may be a very poor proxy for stranded assets or the relative adjustment needs at the time when the system is introduced.

Under a pure grandparented system, new entrants to an industry do not receive units. However, this is often felt to be “unfair” or to create competitive disadvantage for new firms. This leads us to allocation modalities that depend on current as well as historical activity and information.

6.3.3. Free allocation on the basis of performance benchmarks – output-based allocation

If new entrants are to be allocated units it cannot be on the basis of their historical emissions. Benchmarks and capacity are usually used to define allocations. If there is a total cap on allocation of units – for example in a system that is not linked, or linked in a limited way – then the government needs to plan how they will provide these units. This has generally been done by holding back a “new entrants reserve” but given that the number and scale of new entrants is unknown, this will not necessarily meet demand. The alternative is for the government to purchase and provide allowances as needed.

¹²³ Ellerman, 2008

Output-based allocation goes one step further than closure rules and new entrant provisions. Instead of using an historical basis for allocation, allocation depends on current or previous year output multiplied by an emissions factor. This factor could be a benchmark for the sector or simply a fraction of past emissions per unit of output. The latter approach avoids the need for benchmarks, but “output” still needs to be defined in a meaningful way so that firms with heterogeneous output cannot lower their emissions by changing their mix of output, thus spuriously generating a surplus of units. The definition of output needs to be able to be associated with a subset of historical emissions within the installation or with a benchmark to create the emission factors. Emissions factors based on historical emissions are probably easier to create than benchmarks but output is still challenging to define so this is administratively challenging.

The same issues with corruption and manipulation that apply to grandparenting will arise here. Output-based allocation reduces the pressure of regulation so is politically attractive to high emitting sources. By reducing pressure to reduce output (discussed below) it can also protect existing jobs so can be attractive also to workers in emissions intensive sectors and the unions that represent them.

6.4. Relationship between Initial Allocation Objectives, Choice of Modality and Level

Given the understanding from the previous section about the modalities available, we here elaborate on the major objectives, discuss how they can be addressed using one or more of the modalities and explore how these choices may play out in the specific Chilean context across sectors and phases and drawing on the experience discussed above. The four major objectives to be considered when allocating units are equity, reduced leakage, smooth transition, and participation and compliance. Finally we propose a prototype to focus future research.

6.4.1. Achieving an equitable allocation of costs and windfall gains

We first draw lessons from the theoretical and empirical literature on how costs are passed through supply chains and from the owners of companies to consumers or workers including assessing available information on the likely distribution of costs within Chile drawing on local data. The incidence of these costs can be altered through the free allocation of units. There are many valid views on what would be a fair sharing of costs – and hence allocation of units. We discuss each of these views and explore to what extent they are consonant with or in conflict with other valid views. We then discuss how each view on fair sharing would influence the allocation of units.

Who bears costs under an ETS?

The costs of an ETS do not fall entirely, or even mostly, on those who directly pay the costs. Firms that do not have monopoly power make little profit so are unable to absorb costs. They pass costs on as higher prices to their customers or as lower wages to employees. Even to the extent that they do absorb cost rather than passing it on, “firms” do not bear the costs, the owners of the firms do.

Consumers ultimately bear the costs. How these costs are spread across people depends on the emissions footprint of each product (after firms through the supply chain have undertaken mitigation) and the consumption patterns of consumers (after they have responded to changes in the costs of products). Impacts on consumers are likely to be of particular concern to the extent that poor people are affected and if costs are concentrated on specific groups.

Changes in consumption patterns and changes in production as a result of an emissions price will mean that some previous investments will be less valuable than they were. In some cases, the losses could be significant. An obvious example is that a coal mine that sells domestically is less valuable because demand for coal falls. The owners of firms with these “stranded assets” lose equity. This could however also affect workers. Workers in a region that depends heavily on activities that contract with an emissions price, and workers with specific skills that are associated with high emissions activities and cannot easily be used elsewhere will face lower wages. This is a loss of “human capital”. If regulation is anticipated and slowly phased in, assets will have depreciated before the regulation causes them to drop in value. The value of stranded assets may not be as great as thought. Fifteen percent of allowances were estimated to be enough to fully compensate for stranded assets as a result of the proposed federal emissions trading system in the United States.¹²⁴ New entrants to an industry, by definition do not have stranded assets. They invested with good knowledge of the regulation and its likely impact on the value of the assets they were purchasing.

Another situation where firms do bear costs is where they are trade exposed within a competitive international market and hence unable to pass costs on to their customers. In this case they either face the risk of closure and leakage, or, if they are immobile, the value of their asset falls. The latter is particularly relevant for resource based industries such as copper, fisheries or agriculture.

In the very short run, while prices and consumption/production patterns adjust, and long term contracts have not been renegotiated, costs may not be smoothly passed on and the distribution of costs will be different. A key example of this in Chile is likely to arise in the electricity sector. The high prices of electricity since Chile lost the supply of natural gas from Argentina might have led to a change in generation mix toward renewables but this has not occurred. The high prices seem mostly to have led to rents to existing generators. This may have been due to long term contracts or regulatory and political features that inhibit renewable energy. This needs more analysis. An ETS will operate more effectively in tandem with an effective electricity market and the distribution of costs could be quite different.

Good information on where costs will ultimately fall is useful to inform allocation discussions and avoid some groups getting unintended gains by claiming larger costs or needs than is really justified. The analysis required involves detailed studies of price pass through in critical sectors (e.g. electricity generation), and general equilibrium modelling to identify impacts across sectors and impacts on workers relative to owners of capital. Understanding of potential trade impacts and the market power of Chilean producers in international markets will be critical for some products (e.g. copper). Understanding labour mobility between affected and less affected sectors and between regions that are likely to be seriously impacted relative to others may identify vulnerable communities and groups of workers. Then within each group, household expenditure survey data can identify vulnerable consumers; information on ownership structures and labour within sectors will help identify the owners of stranded assets.¹²⁵

Distributional effects in transport

Transport is a sector that is frequently excluded from ETS. Many developing country regimes (ranging from Ghana to Iran, Indonesia or Nigeria) have been seriously worried by the

¹²⁴ Goulder et al, 2009

¹²⁵ All power generation in Chile is in private hands. A large part of mining production (a third in the case of copper) is in state hands through Codelco.

force developed by fuel price protests and even been forced to repeal decisions concerning fuel prices or taxes. Here we assess the logic behind this and the empirical evidence on the equity impacts of inclusion of transport with some evidence specific to Chile.

A key argument against fuel taxes is that they are unfair to the poor. It might seem that a low price is always better than a high price and oil importing countries remember the spikes in oil price in 1973–74, 1979 and more recently as painful. But a gas price that is due to a high tax is very different from a high import price. Attractive goods are always scarce; this is painfully evident to the poor in low-income societies. But the conclusion is not to subsidise everything: government typically has a long list of desirable spending: vaccines, elementary health, elementary schooling, research, clean water, sewage, roads, law and order, police, and defence.

Clearly it is better for the poor if the state taxes goods consumed disproportionately by the rich (“progressive taxes”). If the poorest groups spend not only less – but a smaller proportion of their income – on a certain good than the richer groups in society – then we can safely say that taxing that particular good is better for the poor than raising funds for the state by taxing other goods with a less progressive profile. Sterner (2012) finds that fuel taxes tend to be more progressive, the lower is the income of the country.

Table 6.1: Fuel tax progressivity for a number of countries studied in Sterner 2012

Regressive	Weak regressive	Neutral	Weak progressive	Progressive
<-0.1	[-0.1, -0.02]	[-0.02, 0.02]	[0.02, 0.1]	>0.1
USA	Italy, Mexico	Czech Rep. France, Germany, UK, Iran, Spain	Brazil, Costa Rica, India, Serbia, Sweden	China, Chile, Ethiopia, Ghana, Kenya, Peru, South Africa, Tanzania

a) Kakwani coefficients calculated defining the tax burden as the share of paid fuel tax in total expenditures except for the US and Mexico where the income approach is used since expenditure data were unavailable.

In the 14 poorer countries, which are a definite majority both by number and even more so by population, we find that a fuel tax would be progressive. In the case of Chile Sterner did not have much data and no particular chapter was written but we had data on cost shares and found the Kakwani index to be above 0.1, i.e. a tax would be quite strongly progressive. This would clearly be worth a more detailed follow up study focusing on the differences between different fuels, countryside versus cities and maybe including sophisticated indirect effects.

The distribution effects studied are a combination of direct distribution effects based on private consumption of fuels and indirect use such as in public transport. The former is almost always a progressive effect. The indirect effects on public transport however vary significantly across countries. Public transport is often used more intensely by the poor or by middle classes and so the distributional effect of fuel taxes through this route is more likely to be regressive, though in some very low-income countries even public transport is too expensive for the very poor.

The measures above do not include all indirect effects nor do they include adaptation mechanisms, nor do they include the distributional effects of environmental damage. Both the latter factors would tend to give more progressivity. Finally they do not of course consider the use of the funds collected.

Sterner concludes that it is some middle income groups that are most affected. He argues that these are politically influential and that the argument about the poor is window dressing – they are not affected and have no power anyway – but are convenient to use as an argument.

Equity principles (potentially competing) and their implications

There is no one accepted definition of equity. Different stakeholders will tend to see the issue from their perspective. We offer four principles to consider. These summarise arguments brought up in many discussions with a wide range of stakeholders and from the literature.

- a. “Polluters” should pay.
- b. Those who benefit from climate mitigation should pay – in particular they should not receive windfall gains.
- c. Those with higher incomes and wealth should pay more, and pay a higher percentage of their income, than those with less.
- d. Property rights should be protected against “takings”; owners of stranded assets should be compensated for their losses.

The polluter-pays principle is often misapplied as an equity principle when it was originally intended to be an efficiency principle.¹²⁶ “Polluters” in a pejorative sense could be thought of as those who are responsible for pollution. Using this as an equity principle presupposes that those made to bear cost know they are doing damage and that they have the ability to avoid it. The people who happen to own or work in high emissions industries are not necessarily “polluters”. Those who persist in using high emitting technologies and processes as new technologies become technically and economically feasible and those who choose to consume high emissions products when there are alternatives might more easily be defined as polluters.

In terms of equity, grandparenting and output-based allocation are generally motivated by principle (d). Those who lose value are either owners of capital (who are generally higher income) or those with skills highly specific to a vulnerable industry or located in regions that are economically dependent on vulnerable industries.

If output-based allocation is used to address trade exposure leading to leakage (see below) there will be fewer stranded assets and the argument for equity-based free allocation will be more limited. If output-based allocation is not used in a trade exposed sector (possibly because they are not vulnerable to leakage because they are immobile), the sector could end up with large stranded assets. It is not clear that the owners of these assets should be singled out as “polluters” (a) when their consumers could be regarded as equally responsible for the emissions. Copper and horticultural products could be examples of this in Chile.

Creating a level playing field for new entrants is another issue that often arises. Although new entrants have no stranded assets to justify a need for compensation, if there are imperfect capital markets and non-competitive sectors, incumbents that receive free allocations may have an inefficient competitive advantage over new entrants. This potential problem arises because of imperfections in capital markets. Those with stronger balance sheets have an advantage over those with less access to capital. Whether the financially stronger players are incumbents or new entrants is sector specific. New entrants could be struggling start ups or multinationals

¹²⁶ “The polluter-pays principle is not a principle of equity; it is designed not to punish polluters but to set appropriate signals in place in the economic system so that environmental costs are incorporated in the decision-making process and hence arrive at sustainable development that is environment-friendly.” OECD, 1992

establishing operations in a new country. This is not a problem specific to ETS either; it is a fundamental problem associated with capital markets. Giving free lump sum allocations to new entrants would be equivalent to giving start-ups grants and suffers from the same problems of identifying good new start-ups to support. A better argument, discussed below, for supporting new entrants is that they may be making investments that are most vulnerable to leakage.

Auctions generate revenue that can address equity principle (c) through expenditure or changes to taxation. For example, inclusion of the transport sector in the ETS almost certainly improve equity defined under (c) and even more so if revenue is used to make a progressive reduction in taxes or fund a government programme that benefits the poor. It is hard to deliberately focus costs on those who benefit (b) except by not supporting them if they happen to have high costs. The political process may naturally tend however to compensate those who do not want the policy.

6.4.2. Reducing leakage to countries not covered by binding targets

In a world where not every country faces the same climate change policy, there is a risk that an ETS leads to relocation of production solely because of the uneven nature of regulation. In Chile's context, this means that when a Chilean Emissions Trading Scheme (ETS) is implemented, the resulting increase in production costs for some products may mean that some exported products are no longer competitive, or that products imported from countries with less stringent climate policies are substituted for domestic products. This may cause certain production activities to relocate to countries with weaker climate policies, leading to job losses and to no "real" decrease in global greenhouse gas (GHG) emissions.

New investments are at the greatest risk from leakage because while an existing plant needs only to cover operating and maintenance costs to make it worthwhile continuing, a new investment must also make a positive return on capital. However new investments involve only potential jobs, whereas loss of existing capacity leads to identifiable job losses.

Politically, the critical issue will probably be the number of jobs lost when activity moves. Reducing emissions will always involve shifting jobs from one sector to another and this is never costless – an argument for a smooth transition and support for workers and communities facing large adjustments. However, jobs that are lost solely because of leakage are hard to justify. Although, if emission reductions are valuable to Chile (for intrinsic reasons or because they can be sold), the economy as a whole may benefit once the adjustment has occurred, the short-term social cost can be high. This needs to be set against the potentially high cost of protecting jobs for the indefinite future.

Some also argue that regulating before other countries could adversely affect the long term structure of the economy; strategic industries could be lost. If a Chilean firm is unable to reopen a plant once a global agreement is in place, even though if the plant had remained operating still in Chile it would now be profitable, a short term difference in regulation will have long-term effects. Society will particularly regret this if the fall in production had effects on workers and communities that the firm did not take into account in its decision-making. The decision to leave (not come) may be optimal for the firm but sub-optimal for society. Others, however, will argue the opposite, that early climate regulation will give Chile a strategic advantage in clean technology.

If the Chilean system operates under an emissions cap, either domestically or in an internationally linked system, any Chilean emission reductions associated with leakage will be matched by increased emissions elsewhere under the cap. From a narrow economic point of view, the leakage makes it easier to achieve the cap so could be perversely attractive. However,

the increase in emissions in the unregulated country to which the production leaks is hence entirely an addition to global emissions. This does not depend on the competitor's production being more emissions intensive than Chile, though this would of course aggravate the environmental damage. If leakage is large, it could completely offset the contribution Chile is making to the global effort through an autonomous reduction.

Both the loss of production and jobs to other countries and the smaller decrease in global GHG emissions are important for Chile; they undermine the political acceptability and integrity of the efforts being made by Chileans to address climate change. Concerns around leakage will likely diminish over time as more countries implement climate change policy; policy should reflect that.

Assessing the likely scale of leakage is extremely difficult, particularly in a small country where each sector involves very few players (and possibly few potential investors). Investment and relocation of production decisions are mostly long term, so influenced not only by current regulatory differences, but also expectations about relative stringency of climate policy across countries in the medium term. Many other factors also drive them. It is even hard to identify leakage after the fact. Many insights into the likely scale of leakage are drawn from empirical studies of response to other environmental regulatory differences across countries. These lessons may however not translate well because they may be based on more stable regulations aimed at domestic policies. Climate change policy is evolving rapidly and differences in regulatory pressure across countries may be hard to predict. Current policy is often a good indicator of future policies but in the case of climate change, many firms are already anticipating stronger policies. Thus investment leakage may be less than expected because it may be against firms' long-term interests as well as society's.¹²⁷

In Chile two sectors that might be vulnerable are copper, and pulp and paper; cement (especially clinker) and steel may also be of concern. Copper may be a sector where the issue could be largely addressed through a sectoral agreement with the US, Peru and China (given that Australian production is already covered by their ETS – though with output-based allocation that may need to be adjusted). More analysis would also be need to see to what extent an impact on profit in this sector would lead to movement of production (and future investment) as opposed to a fall in the value of the existing resource. This may be largely a stranded asset rather than a leakage issue.

Implications of leakage motivation for allocation modalities

The best solution to leakage is to extend the scope of climate regulation across countries. Thus, in the development of climate policy, and particularly ETS because it directly affects effective marginal production costs, it is valuable to engage actively with those in competitor countries and encourage them to move as quickly as possible. If Chile can create a system that works, this will set an attractive example for other similar countries to follow.

Assuming the cause of the uneven regulatory playing field cannot be rectified – Chile has decided to regulate emissions, Peru has not – the question remains whether a government should adopt policies that minimise the overall size of leakage. This question is analogous to the question of how a country should respond to foreign tariffs and subsidies. While the international trade literature does not have a clear answer on this question, the traditional economic response is that in most circumstances a small country should not impose tariffs or

¹²⁷ Kerr and Coleman, 2008

subsidies at home in response to tariffs or subsidies imposed abroad as this lowers aggregate welfare. The basic insight of this literature is that any attempt to protect the domestic industry from a foreign subsidy will generate greater costs on domestic consumers or taxpayers than benefits to the affected industry. (If Peruvian taxpayers were to pay for a subsidy to provide Chilean consumers with cheap goods, at the cost of putting a Chilean firm out of business, then so be it.)¹²⁸ The normal Chilean position has been that policies to protect a Chilean firm or industry from “unfair” foreign competition have a greater cost to society as a whole than the benefit that accrues to the affected sector. Good evidence of this thinking is that Chile opened up its borders to foreign competition much earlier and to a degree unlike any other country in the region.

The situation with an ETS is slightly different because of concern about emissions. In these circumstances, a subsidy to the domestic industry may be welfare enhancing, for the reduction in global emissions from subsidising the domestic industry would offset the net welfare costs from the subsidy.

Leakage can be reduced through the design of the ETS. There are two options to consider. One is to allocate emission units each year to firms with GHG intensive products that are trade exposed and mobile (could easily be produced elsewhere) based on the quantity of these products they produce. The number of units allocated per unit of production would allow a certain GHG “intensity” with no penalty. This allocation approach encourages firms to reduce the emissions intensity of their production but reduces the pressure on them to reduce (or not expand) production and thus reduces leakage. It also, however, reduces the incentive for domestic consumers of the product to change consumption patterns.

This is relatively easy to do in the electricity sector where output is clearly defined, but electricity is unlikely to be vulnerable to leakage in Chile. Other sectors are more difficult to address but these challenges have now been faced by several other countries and standard methodologies for defining output, and setting allocation rates for each unit of output have been developed. It is not necessary for the emissions rate to represent best practice or some other industry-wide performance standard. The emissions rate chosen does not affect the incentive to reduce emissions per unit of output; it does however affect the degree of protection of output.

In the copper sector, only 10 mine sites represent more than 70% of production, so with a sufficiently high threshold for free allocation, output-based allocation should be administratively feasible. In the pulp and paper sector, only two companies, with 10 plants between them, represent 80% of the value produced in the sector, so again output-based free allocation would be administratively feasible.

The other is called a “border carbon adjustment”, which rebates emission units for emission intensive trade exposed goods that are exported from Chile, while imposing emissions obligations (e.g. a tax, or an obligation to hold units) on emission intensive goods imported from countries with weak climate policies. This approach also protects the production of GHG intensive goods that are trade exposed while maintaining a domestic price signal to reduce both GHG emissions per unit of production and domestic consumption of goods associated with high GHG emissions. It has different impacts on taxpayers relative to the first option. It raises significant legal and trade policy issues and hence has not been used by any country yet.

¹²⁸ This position can be subject to many qualifications. For example, a large country may gain from imposing a tariff on an imported good if the tariff is absorbed by the producer and there is no retaliation. There are also circumstances when a subsidy may give a first-mover advantage to a firm that enables it to capture large monopoly profits when it becomes the dominant global player (strategic trade theory).

6.4.3. Managing a smooth transition to a long-term low-carbon economy

There are many reasons to gradually transition to a long-term low-carbon economy. Suppose for a moment that emissions prices were certain and stable, which of course they are not. It will take time for actors to adopt new technologies. If they all tried to adopt rapidly there would be supply side constraints and the cost would be very high. As adoption progresses, technology will be refined through application and firms will learn how to install and use it; its attractiveness will grow. Some firms will be early movers possibly because they are highly skilled and have good access to capital, or because their applications of the technology are the most valuable. Others will have existing capital that they want to use until it is obsolete, they may have poor management skills, organisational structures that make rapid change difficult, or lack of access to capital. Because innovation is a continuous process, some firms will choose to wait for an even better technology rather than use the new technology available today. This all means that mitigation may be slow initially.

Lack of certainty about international policy, and from the point of view of investors about domestic policy too, exacerbates this slowness. Carbon prices are uncertain and unstable. Investing on the basis of a regulation that is likely to be changed is risky. This uncertainty leads to under-investment. This means that the period of adjustment is likely to be long.

Responses to emissions trading are also likely to take time to evolve. Emissions trading is a new institution and requires new processes, unfamiliar decisions and establishment of new relationships. Fear of making mistakes is likely to make companies cautious about trading in the short term. Those who can sell units may be less likely to engage rapidly in trading than those who need to buy; the former have a choice. If there is a fixed cap, this unwillingness to sell excess units could affect liquidity and even market price. In the short run, allocation may influence emission reductions and even innovation. Survey evidence from the EU system suggests that those received free allocations were less likely to innovate than other, very similar, firms who did not.¹²⁹ In the long term, the allocation of units may not affect where emissions reductions occur (except output-based allocation) but in the short run they may have a real effect.¹³⁰

Managing a smooth transition ideally involves developing a long-term vision of Chile's comparative advantage in a low-carbon world. In contrast to existing ETS in developed countries, given that Chile is still growing rapidly, this may be more a matter of guiding new investments rather than focusing primarily on avoiding loss of existing industries. The trade-off between the costs of protecting or encouraging industry that is costly to Chile in the short term must be weighed against the long-run benefits of establishing or protecting industry now that will be valuable in the long term. Chile, as a small country, may also face issues with poor access to capital markets which may make these issues more stark and discrete – for example, New Zealand has needed to make decisions in the face of the potential (threatened) loss of large discrete investments that may no longer be available when conditions change in future. Evaluating this will require assessment of the long-run comparative advantage of Chile and the extent to which that differs from the current economic structure and direction of growth.

Some systems have chosen to focus incentives most where mitigation opportunities are greatest, and where the political implications are less severe. If it is difficult to protect small trade-exposed firms that might have high electricity consumption, or vulnerable consumers,

¹²⁹ Martin et al., 2011

¹³⁰ Hahn and Stavins (2011) summarise evidence on this.

deferring the rise in electricity price implied by ETS could be attractive. In Chile, because electricity prices may be artificially high, this could be worth considering at least temporarily.

Implications of smooth transition for allocation modalities

A desire to smooth the transition into an ETS can be addressed through gradual phasing in of the programme (as discussed in Chapter 5). Beyond this, output-based allocation can be used to reduce prices of specific products, e.g. electricity, temporarily. Regular auctions to provide price discovery and liquidity for all actors will address problems with the development of markets; alternatively, if auctions are not a political option, units could be grandparented to points of obligation that are likely to have difficulty with trading in the very short term. High levels of initial free allocation are reassuring to firms facing uncertain cost increases and likely to smooth the political transition.

6.4.4. Encouraging participation and compliance in the forestry and agriculture sectors

Difficulties with monitoring, verification and reporting, and compliance challenges associated with involving large numbers of small actors have led most countries to exclude forestry and agricultural emissions from their ETS. In some cases they are partially included through domestic offset systems (Australia and California). Offset systems, for many sources, have severe problems relating to leakage outside of projects and lack of additionality (payment for reductions that would have happened anyway). Offsets are also administratively complex, especially when a crediting baseline must be established for each project.

A middle ground is to create a standard system for reporting and compliance in the same way that you would for an ETS but make participation voluntary. Efficiency of this system requires high levels of participation. Such a system must be easily understood and baselines based on easily available data. Generous baselines, which are equivalent to free allocation that could be above business as usual, ensure that (nearly) all entities would find it financially attractive to participate. Generous baselines also allow simpler monitoring that aims at lack of bias rather than precision because errors in monitoring that make participation more or less attractive will not determine participation. This is administratively cheaper and less vulnerable to corruption. It does however imply high levels of free allocation and windfall gains to some actors. This is how reforestation is included in the New Zealand emissions trading system.

An alternative model for small sources where compliance is challenging is to make the system compulsory but make allocation generous enough that most entities voluntarily comply and put pressure on others to comply. Voluntary compliance is the basis of successful tax systems that depend on self-reporting and random audit. Once entities are involved in the system the free allocation may be able to be phased out without triggering massive non-compliance.

In Chile, as discussed above there is evidence of the impact of allocation on compliance. Grandfathering accelerated the completion of the inventory of emissions in the particulates market in Santiago (Montero et al, 2002). Companies also reported that once the system was running and they saw the pollution permits as “property rights”, they wanted the regulatory agency to monitor more stringently.

A judgment needs to be made on the trade-off between the cost of (overly) generous allocation and Chile’s ability to take advantage of low-cost mitigation options. This trade-off will depend on the nature of the actors involved, the ability to predict emissions and the scale of

mitigation options. The acceptability for this approach will depend on who reaps any windfall gains.

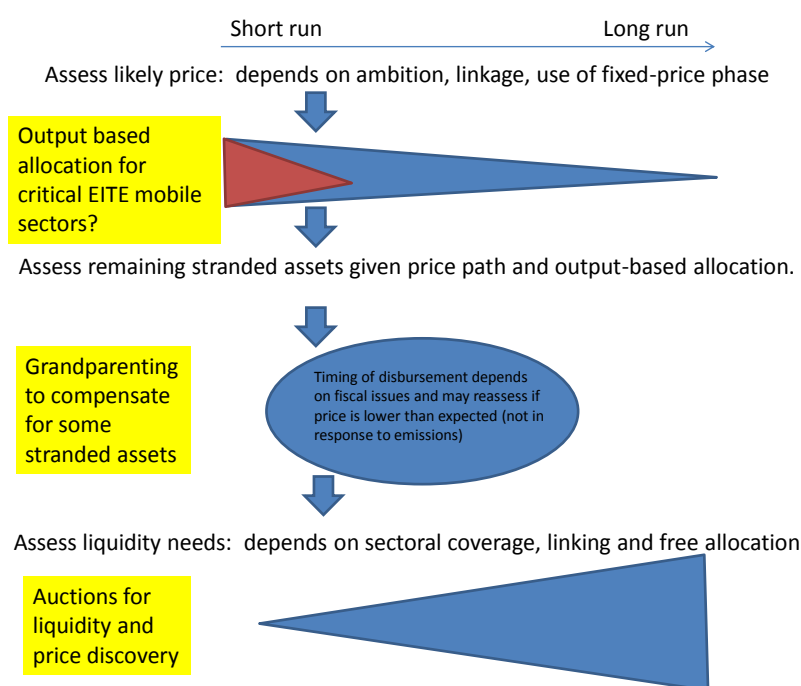
6.5. Framework for Government Decisions

Based on the analysis of both objectives and modalities for free allocation conducted above, we now develop a framework for decision making on allocation for each regulated industry and scheme phase that will identify options, criteria and considerations. This framework will help to guide the government as it determines which industries will receive units for free, on what basis they will receive them, how many they will receive and for how long they will continue to receive them.

Once objectives for allocation are clarified, in each sector and each phase, the likely weight of different objectives needs to be assessed. Here we propose one possible approach at a broad level. We start with long-run allocation because it is simpler; where “long run” implies a (near) complete global agreement and (largely) complete economic adjustment (including labour markets). We then suggest one approach to balancing the more complex short-term considerations. Our suggested approach is summarised in Table 6.2.

In the long run, all emissions costs are borne by the consumers of products with a positive emissions footprint. Equity and revenue raising efficiency considerations dominate. There is no risk of leakage or regret, transition is complete and there is no reason to use allocation to alter marginal price pressures. The only rationale for allocation is equity, yet there are no remaining stranded assets (all have been depreciated or been compensated for (land)) and key political hurdles have been overcome (though ongoing support is always needed) so it is (almost) purely an issue of allocation of wealth. Long-run allocation is question of how best to release units for private use and how to allocate the value of those units. Units should be auctioned to a combination of domestic and international buyers. There will need to be political agreement on how to use the resulting revenue.

Figure 6.3: Decision-making process for short-run allocation of units



The short run is more complex. While climate agreements are globally incomplete, leakage and the risk of regret is likely to be a stronger issue. Any new regulation requires a phase-in period to avoid excessive adjustment costs; more generous allocation – biased toward existing activities (either output-based or grandparenting) – is one way to achieve this. Political feasibility is critical and may depend on fairness considerations but may be driven by strong vested interests.

The only allocation tool to address leakage and regret is output-based allocation, yet this is complex, imperfect and vulnerable to manipulation. If phasing is gradual and linked to development of the wider global effort, and/or if economic transition is a broad enough issue to justify overall price control, the extra value of targeted protection for energy intensive trade exposed sectors may be low relative to the cost. It may be preferable to address their stranded assets issues instead – possibly in such a way that the resources provided are used as capital to facilitate a transition to low emissions technology or to replace products with lower emitting alternatives. If output-based allocation is used it should have a fixed rate of phase out irrespective of international regulation to reflect the high cost of protection that means Chile will not want to protect these sectors indefinitely. At the same time there should be a mechanism to accelerate the phase-out in response to the introduction of climate regulation in competitor countries.

A transition from one form of allocation to another, possibly toward more auctioning with use of revenue to benefit disadvantaged groups, is likely to be desirable. To the extent possible, this transition path should be determined early in the scheme to avoid investment uncertainty and the incentive to behave strategically (e.g. by increasing emissions or avoiding mitigation) to influence future free allocations. Ideally allocation rules are defined in such a way that they are able to adapt to new information without being completely renegotiated. There are international models of both success and failure in this regard that can be used here.

Table 6.2: A suggested approach to allocation

Phase	Modality			
		Auction/required purchase	Grandparent	Output-based allocation
	Short run	Use auctions for liquidity and price discovery	To compensate for stranded assets:	Strongly emissions intensive trade exposed sectors only
	<ul style="list-style-type: none">• Incomplete global agreement• Economic transition	Require liquid fuel sector and energy generators to purchase units	<ul style="list-style-type: none">• human capital (workers)• physical capital Small points of obligation	Set gradual phase out of protection
Long run	Auction all units			

6.6. References

- Bauer, C. J. 2004. "Results of Chilean Water Markets: Empirical Research Since 1990," *Water Resources Research* 40:W09S06.
- Betz, Regina, Stefan Seifert, Peter Cramton and Suzi Kerr. 2010. "Auctioning Greenhouse Gas Emissions Permits in Australia," *Australian Journal of Agricultural and Resource Economics* Special Issue: Climate Change 54:2, pp. 219–238
- Coase, Ronald H. 1960. "The Problem of Social Cost," *Journal of Law and Economics* 3:1, pp. 1–44
- Coria, J., Å. Löfgren and T. Sterner. 2010. "To Trade or Not to Trade: An Analysis of Trading Schemes at the Firm Level", *Journal of Environmental Management* 91: 2126–33.
- Coria, J., and T. Sterner. 2010. "Tradable Permits in Developing Countries: Evidence from Air Pollution in Santiago, Chile", *Journal of Environment and Development* 19:2, pp. 145–70
- Cramton, Peter and Suzi Kerr. 2002. "Tradeable Carbon Permit Auctions: How and Why to Auction Not Grandfather," *Energy Policy* 30:333–45.
- Dourojeanni, Axel, and Andrei Jouravlev. 1999. *Código de Aguas de Chile: entre la ideología y la realidad Naciones Unidas*, ECLAC /CEPAL, Santiago de Chile. Available online at: <http://girh.guamanpoma.org/biblioteca/lcl1263s.pdf>
- Ellerman, A.D. 2008. "New Entrant and Closure Provisions: How Do They Distort?," *The Energy Journal* 29, Special Issue 1, pp. 63–76
- Ellerman, A.D. and Barbara K. Buchner. 2007. "The European Union Emissions Trading Scheme: Origins, Allocation, and Early Results," *Review of Environmental Economics and Policy* 1(1):66–87. Available at <http://reep.oxfordjournals.org/content/1/1/66.abstract>
- Gómez-Lobo, Andrés, Julio Peña-Torres and Patricio Barriá. 2011. "ITQ's in Chile: Measuring the Economic Benefits of Reform," *Environmental & Resource Economics, European Association of Environmental and Resource Economists*, 48:4, pp. 651–78.
- Goulder, Lawrence. 2007. "California's Bold New Climate Policy." *Economists' Voice* 4(3), pp. 1–6.
- Goulder, Lawrence H., Marc A.C. Hafstead and Michael S. Dworsky. 2009. "Impacts of Alternative Emissions Allowance Allocation Methods under a Federal Cap-and-Trade Program," *NBER Working Paper No. 15293*, National Bureau of Economic Research, Cambridge MA.
- Goulder, Lawrence H., Ian W.H. Parry, and Dallas Burtraw. 1997. "Revenue-Raising vs. Other Approaches to Environmental Protection: The Critical Significance of Pre-Existing Tax Distortions," *RAND Journal of Economics* 28:4, pp. 708–31
- Grafton, R. Quentin, Gary Libecap, Samuel McGlennon, Clay Landry and Bob O'Brien. 2011. "An Integrated Assessment of Water Markets: A Cross-Country Comparison", *Review of Environmental Economic and Policy* 5:2, pp. 219–39
- Grimes, Arthur, Tim Denne, Philippa Howden-Chapman, Richard Arnold, Lucy Telfar-Barnard, Nicholas Preval and Chris Young. 2012. "Cost Benefit Analysis of the Warm Up New Zealand: Heat Smart Programme," *Report to the Ministry of Economic Development, MED*, Wellington.

- Hahn, Robert W. and Robert N. Stavins. 2011. "The Effect of Allowance Allocations on Cap-and-Trade System Performance," *Journal of Law and Economics* 54:4, Markets, Firms, and Property Rights: A Celebration of the Research of Ronald Coase [November 2011]:S267–S294.
- Hibbard, Paul J., Susan F. Tierney, Andrea M. Okie, and Pavel G. Darling. 2011. "The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States", *Review of the Use of RGGI Auction Proceeds from the First Three-Year Compliance Period*, Analysis Group, United States. Available at http://www.analysisgroup.com/uploadedfiles/publishing/articles/economic_impact_rggi_report.pdf
- Kerr, Suzi and Andrew Coleman. 2008. "Economic regrets," Motu manuscript presented to Cluster B of the Climate Change Leadership Forum, 22 May. Available at http://www.motu.org.nz/publications/detail/economic_regrets
- Market Advisory Committee to the California Air Resources Board. 2007. "Chapter 2," *Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California*, Recommendations of the Market Advisory Committee to the California Air Resources Board, June 2007.
- Martin, Ralf, Mirabelle Muûls and Ulrich Wagner. 2011. "Climate Change, Investment and Carbon Markets and Prices – Evidence from Manager Interviews," *Carbon Pricing for Low-Carbon Investment Project*. London and Madrid: London School of Economics/Imperial College/Universidad Carlos III de Madrid.
- Montero, Juan-Pablo, Jose Miguel Sanchez and Ricardo Katz. 2002. "A Market-Based Environmental Policy Experiment in Chile," *Journal of Law and Economics* 45:1, pp. 267–87.
- OECD. 1992. "The Polluter-Pays Principle: OECD Analyses and Recommendations," *OCDE/GD(92)81*, OECD, Paris. Available at: [http://search.oecd.org/officialdocuments/displaydocumentpdf/?cote=OCDE/GD\(92\)81&docLanguage=En](http://search.oecd.org/officialdocuments/displaydocumentpdf/?cote=OCDE/GD(92)81&docLanguage=En)
- Stern, Thomas (ed.). 2012. *Fuel Taxes and the Poor: The Distributional Effects of Gasoline Taxation and their Implications for Climate Policy*. Oxford and New York: RFF Press, Resources for the Future.

7 ETS Research Needs

Key findings:

- The research process should be designed both to gain knowledge and also to build capability within Chile to understand the issues and contribute to the policy development.
- Key economic research can be grouped in two broad categories: background research; and research aimed at answering more specific questions for policy design.
- Background research should provide an opportunity for wide discussion among different stakeholders on how ETS has worked around the world, and the important role they are already playing and can play in the implementation of climate policy both domestically and internationally. This research includes: (i) understanding what is happening more widely in Latin America in terms of climate policy, and of implementation of ETS in particular; (ii) lessons from previous ETS internationally, with particular attention to implementation, distributional effects, and design issues relevant to an emerging economy; (iii) lessons on design, on the political process towards implementation, and on ex-post performance of environmental markets in Chile, namely, water markets, individual transferrable quotas for fisheries, and Santiago's particulate market and NO_x; and (iv) understanding how an ETS would interact with the rest of existing and future environmental legislation in the country.
- Targeted research consists of all research that provides stakeholders and policymakers with information (which in many cases builds upon existing studies) about the costs and benefits of implementing an ETS in the country (including distributional impacts). This includes:
 - i. improving understanding of the scale of mitigation opportunities (in both the different carbon-emitting sectors and in the forestry sector)
 - ii. understanding broad economic impacts of different ETS designs
 - iii. non-price barriers (e.g. information or regulatory barriers), especially in the electricity sector – this includes more generally to estimate the size of the energy efficiency gap in the country and to identify the kind of instruments that operate better, together with carbon prices, in improving efficiency
 - iv. understanding how market structure can affect the ability of Chilean firms to respond and pass on carbon prices and/or explain the existence or not of windfall profits (e.g. particularly in the electricity sector)
 - v. identifying emissions-intensive trade-exposed mobile or expanding activities and the likely scale of leakage from them
 - vi. identifying key stranded assets and mechanisms to address them
 - vii. understanding the distributional implications, especially the impacts on the poor, and the mechanisms that can be used to deal with undesirable outcomes and how they relate to existing schemes (e.g. subsidies for basic services).
- There are many technical and institutional implementation needs that are common to many ETS that will need specific answers in Chile. These are listed in each chapter.

7.1. Introduction

This chapter provides an overview of research needs for designing an ETS in Chile, and discussion of process considerations around how the research can be designed and undertaken through a transparent and inclusive multi-stakeholder process that builds on the existing foundation of knowledge and practical experience. This chapter focuses on high-level, strategic, and cross-cutting research topics, and identifies some lessons learned from other countries that have been early leaders in ETS development. Further research will be needed to support the technical information needs of ETS implementation for specific core design features and sectors. Those types of research needs are identified in other chapters throughout the report as appropriate.

When developing an ETS, the research agenda must not only produce valuable technical information for policymakers but also help in the process of educating society towards making more informative decisions in the area of climate change and energy use. The best example of this need is the increasing opposition faced by different kinds of power generation projects (e.g, Hydroaysen in the very south, Castilla in the north, etc.) at the moment in the country. It is quite likely that a large part of this opposition is driven by a lack of information that a well-crafted research agenda should help alleviate.

Understood this way, this ETS research process should also look for opportunities for collaboration with neighbouring countries that face similar decisions in the near future. In the past Argentina has been very aggressive in proposing a binding (but generous) carbon cap for its entire economy in expectations that it can become an active seller of carbon permits in the international markets.¹³¹ The proposal never prospered. This collaboration is also important for understanding emission leakage and trade effects within the region if some countries adopt binding commitments and ETS programmes while others do not.

Ideally, one would like to organise research projects in groups according to their goals and expected outcomes. There is research that can contribute the most to the process of capacity and awareness building, while other research is more targeted to answer specific questions. If the ultimate goal is to build political support for the implementation of an ETS, there is clearly some research that is more effective than others, for example, documenting that ETS can work reasonably well when well designed. Like elsewhere, there will always be groups in the country opposed to the idea of emissions trading, and they will look for evidence everywhere to show that these markets many not work as expected and that alternative instruments can work better. Yet others will be looking for subsidies and would go after “evidence” showing that they work better than ETS in terms of price signal for the development of cleaner technologies.

For setting a national research agenda supporting design and implementation of an ETS, it is important to have in mind a multi-agent process that can permit an ongoing dialogue between researchers, government, and stakeholders to disseminate existing knowledge and gradually frame new questions as issues arise and people better understand what they need to know. As the experiences from other countries show, stakeholder engagement is very important when designing models and making key assumptions as inputs to modelling. This type of process provides better policy research and also, again, builds a community within Chile with deep understanding of the issues. This could involve quarterly or biannual workshops with a consistent core of knowledgeable people.

¹³¹ Conte Grand and D’Elia, 2011

7.2. Lessons from ETS Research in Other Countries

Before going into identifying the research needs it is worth emphasising, based on evidence from some countries where ETS have been implemented, the importance of research in getting them implemented and how it was conducted (e.g. use of more than one study to answer a particular question). This section focuses on lessons learned from the European Union, New Zealand, the United States and Australia.

7.2.1. European Union

Below are some of the key areas of research undertaken to inform the initial design of the EU ETS and its revisions.

- *Assessment of the National Allocation Plans for Phase II of the EU ETS*¹³². This study provides lessons on how to monitor progress against a cap and how to set realistic business as usual scenarios. This is valuable in trying to understand whether or not the supply and demand for emissions allowance units will be proportionate and associated implications for the emissions unit price.
- *PRIMES modeling of the economic effects of emissions trading to reduce greenhouse gases*¹³³. This study showed that economy wide emissions trading would be the cheapest way for Europe to meet its obligations under the Kyoto Protocol. Several policy ideas are considered including sectoral and wider economy emissions trading systems. PRIMES is an energy modeling system that simulates a market equilibrium for energy supply and demand in the EU.
- *Cumulative impacts of energy and climate change policies on carbon leakage*¹³⁴. This study provides a useful summary of the literature on carbon leakage, competitiveness and measures used to limit associated negative effects. It covers the wealth of literature on this topic with more than 50 detailed papers from experts such as Climate Strategies and the Carbon Trust.
- *Methodology for the free allocation of emission allowances in the EU ETS post 2012*. Sector-by-sector reviews of the benchmarking methodology, how to create benchmarking criteria and the methodology for free allocation based on benchmarks. This study comprises a main report and 13 sector specific papers¹³⁵.
- *Review of the impact of the EU ETS and plans for its development*. The Department for Energy and Climate Change in the UK published various independent review documents on the EU ETS. The National Audit Office paper provides a comprehensive review, including information on the performance of auctioning in the first two phases of the EU ETS¹³⁶.
- *Review of MRV approaches across Member States*¹³⁷. This study shows the various approaches used in Europe for measurement, reporting and verification. It does not

¹³² Ecofys, 2006

¹³³ E3M Lab et al, 2000

¹³⁴ U.K. Department for Business Innovation and Skills, 2012

¹³⁵ Ecofys, 2009

¹³⁶ U.K. Department of Energy and Climate Change, 2006–08

¹³⁷ AEA Energy and Environment, 2009

only focus on the EU ETS, but draws on lessons from other policies which require MRV of pollutants or quantification of the effects of policies.

The European Commission (EC) has a thorough and well-practiced process for conducting research projects. It requires that public consultations are undertaken for three months, and the ideas of stakeholder working groups are balanced against the views of highly experienced trade persons, academics and consultants. While this level of collaboration is to the credit of the EC, industry lobbying has been accused of causing over-allocation in the EU ETS.

The UK is supportive of the EC's approaches and policy direction on climate change. It was one of the few Member States to support the unsuccessful proposal for a move from 20% to 30% on the EU emissions reduction target for 2020. This, coupled with high standards for transparency and accountability, means the UK regularly provides independent reviews of the EU ETS and plays a large role in supporting its research and development. For example, the UK provided the template on which the EU standard monitoring and reporting process was based.

Successes of the research in the EU and UK can be credited in part to close working with the public, stakeholders and independent experts. There is also a great interest in climate policy from all affected ministries, which provides valuable political debate – the UK BIS study referenced above is a good example of such wider participation. Finally, a great emphasis is placed on data and transparency, encouraging detailed and substantive work.

7.2.2. New Zealand

When designing the carbon tax and the NZ ETS, the most useful pieces of research were:

- *Computable General Equilibrium (CGE) modelling of the impact of emission pricing on the New Zealand economy with and without international linkages.* When developing the NZ ETS, this research was conducted by different economic firms and then through a direct collaboration by two leading firms. That helped to support the contestability of the findings. The value of the studies was particularly in the direction and relativity of pricing impacts with and without linking. It also was useful in showing the types of impacts that emission pricing could have on economic output as a whole and on consumers. It was important to understand the limitations of such models and how they could be used to help inform sound policy decisions. One important drawback of the models used was that they did not integrate the forestry sector. However, some qualitative assessment of forestry-sector implications was included in the major reports of findings.
- *Assessment of the impact of emission pricing on power generation investments in New Zealand.* This work had started in preparation for the proposed carbon tax. Creating incentives for new renewable generation rather than new thermal generation was one of the key mitigation opportunities for New Zealand. The government needed to understand how investment decisions in the power generation sector would respond to an emission price.
- *Studies on projected deforestation, afforestation, and harvesting rates in New Zealand and the relative impact of emission pricing.* This work had been underway in New Zealand for several years prior to designing the NZ ETS. Setting a cap on the government's responsibility for the national deforestation liability had been part of the government's 2002 climate change policy package and it needed to project how the

land use, land-use change, and forestry (LULUCF) sector would contribute to achieving New Zealand's commitments under the Kyoto Protocol.

- *Mitigation potential and trade exposure of New Zealand's large emissions-intensive and trade-exposed industries.* This work had been started under the government's previous policy proposal to offer Negotiated Greenhouse Agreements to large trade-exposed emitters that provided an exemption from the carbon tax in return for agreement to a binding mitigation pathway. This work had applied a "World's Best Practice" approach and had found that several of New Zealand's industrial producers had relatively limited mitigation potential given the national circumstances.

Within the research sector, from 2002 there was a sustained series of meetings and collaborative projects among researchers from different institutions to encourage comparative work and deepen mutual understanding on what was known and what was not. Many of the participants in this process were actively involved in providing advice directly to government and technical input to multi-stakeholder processes. The prior communication among researchers allowed them to present consistent messages – including the message that some things were highly uncertain – and avoid the appearance of disagreements among experts where none really existed.

The government also commissioned work on marginal mitigation cost curves across all sectors for New Zealand. This work proved less useful because some of the findings were contested, particularly in the agriculture sector.

The government conducted a study on other potential environmental impacts of the NZ ETS (e.g. air quality, water quality, land use, and so on).¹³⁸ The authors identified some substantial co-benefits but also some potential areas for perverse outcomes (e.g. potential loss of indigenous biodiversity from establishment of fast-growing pine plantations, and increased pressure on natural character and some landscapes, and potential land use and resource conflicts generally, arising from both afforestation and the accelerated development of renewable energy sources, notably hydro and wind, but also possibly marine energy). The authors recommended putting in place a system to monitor direct and indirect impacts of the NZ ETS after implementation and to include this in the scope of government reviews of the NZ ETS.

As a result of a multi-stakeholder process, the government collaborated with the private sector and jointly commissioned independent consultants to explore the likely leakage from several large firms (who agreed to cooperate). While these were only case studies, they highlighted some key issues and provided a complement to the CGE analysis, which did not give good guidance on the impacts on the one to two firms actually in each sector in New Zealand.

One important lesson learned was the value of sharing commissioned research with stakeholders and the general public, and involving stakeholders in testing some of the key assumptions used as model inputs. In some cases, the government chose to withhold research findings from public release because of the commercial sensitivity of data collected from businesses and also because of possible implications for other areas of government negotiations, both domestic and international. This caused some friction with stakeholders.

¹³⁸ Sinner et al, 2008

7.2.3. United States

The US process has been heavily influenced by the government modelling capacity at US Energy Information Administration (EIA) and the US Environmental Protection Agency (EPA). Having multiple agencies/research groups with separate modelling and analysis was important. In California, which is going ahead with ETS, there was less diversity of modelling (basically done by just the California Air Resources Board), but this entity was sufficiently well respected. This may be more analogous to Chile. In that sense, the government of Chile should find ways to learn the most from the California experience; the recently established programme for mutual collaboration on research and technology transfer – with its particular emphasis on energy and water-related sectors – should serve as a platform for that.

It is important to emphasise that in either case, at the federal and state levels, the research process was much more than just estimating marginal mitigation cost (MAC) curves: it provided information on energy price impacts, sectoral impacts, trade impacts, and macroeconomic impacts. Moreover, the provision of research by respected and relatively independent government analysts, in the case of EIA, is particularly influential. Most of the serious debates have started with requests to EIA to model various features and options. A perpetual challenge is not just modelling theoretical issues but trying to add the policy realism so as to consider precise features of proposed legislation. The ability to run various scenarios examining particular pieces of the policy was important. This was useful not just during the stage of evaluating the legislation, but also at the stage of stakeholders trying to reach agreement through the US Climate Action Partnership (US-CAP), a coalition of businesses and NGOs that developed a blueprint for what became the House bill at the federal level. All this suggests, again, that Chile should invest in internal capacity to model or oversee modelling exercises beyond simple MAC analysis.

In addition to this capacity, several other reports have been influential. The inter-agency report on competitiveness was perhaps the most important,¹³⁹ as it focused on the most controversial issue. There were also important studies of distributional impacts, by region and income and other demographics. Politically, one of the big issues was jobs. Most economic models are not able to address employment shifts at a granular level credibly. Other types of analyses were needed to build the case (in California as well as other states) that “green” jobs would provide real benefits and counterbalance the loss of “dirty” jobs.

In the wake of the financial crisis, it was also important to examine the role of market oversight in the allowance market.¹⁴⁰ Finally, a number of studies have generally contributed to the arguments for pricing CO₂. There was a government report on the social cost of carbon,¹⁴¹ as well as National Research Council reports on energy externalities and energy consequences of the tax code.¹⁴²

It is also interesting to understand why the Federal approaches to implement an ETS have failed but the State of California has succeeded. One possible explanation is that there is much stronger regional support for action than at the Federal level. The Federal argument could not be won simply based on the case of low costs of the policy. There were not sufficiently strong arguments for the costs of inaction and the reason to act urgently, especially during a

¹³⁹ U.S. Environmental Protection Agency, 2009

¹⁴⁰ Interagency Working Group for the Study on Oversight of Carbon Markets, 2011

¹⁴¹ U.S. Department of Energy Building Technologies Program, 2010

¹⁴² National Academy of Sciences, 2010; Board on Science, Technology, and Economic Policy, 2012

recession. In addition, the economic analyses fell short in making a positive case for benefits to the agriculture/rural sector, which was politically important. The US Department of Agriculture (USDA) was not as far along in modelling some of the important issues on agriculture offsets, for example. Yet for some, the single most important factor for failing to pass ETS legislation at the Federal level was the absence of someone in the Senate to provide skilled legislative leadership, unlike in the House. Cap-and-trade legislation is extremely complex, with a very wide range of interests and stakeholders. It requires a very skilled legislator or group of legislators to get things done.

7.2.4. Australia

Scientific and economic research played an important role in the development of the Australian Carbon Pricing Mechanisms and the preceding ETS proposals.

In the lead-up to the 2007 general election in Australia, the Australian Labor Party (ALP) commissioned a major study to be prepared by the respected economist Professor Ross Garnaut, detailing the scientific consensus on climate change and the most appropriate policy mechanisms for Australia to apply to meet the challenge of climate change by reducing Australia's emissions. The "Garnaut Climate Change Review" was handed down in early 2008, after the ALP had won the 2007 election, which recommended the implementation of an emissions trading scheme model. This led to the initial proposal for a Carbon Pollution Reduction Scheme (CPRS), which was defeated in Parliament.

In late September 2010, the Federal Labor Government announced the establishment of a Multi-Party Climate Change Committee (MPCCC). The goal of the MPCCC was to explore options and reach agreement on the design of a carbon pricing mechanism (CPM). In addition the Government created two informal stakeholder groups to feed in comments. One was made up of CEOs from selected major businesses and the second by CEOs from the major NGOs. The MPCCC and the associated process was fed with a number of keynote reports and studies, including:

- the Garnaut Review 2011, wherein Professor Ross Garnaut was commissioned to update his 2008 Climate Change Review covering a wide range of issues such as climate change science, economics impacts, assessment of action in the rest of the world, and land sector mitigation
- the Productivity Commission's Carbon Research Report – the commission was instructed by the Government to examine the state and existence of carbon pricing internationally to allow the MPCCC to consider the level of action being taken by Australia's major trading partners.

Having this kind of comprehensive research available to support ETS policy development was an important contributor to final passage of the legislation.

7.3. Identifying Research Needs

This section examines specific research needs for designing an ETS in the Chilean context. These fall into the categories of:

- political and market context
- emissions and mitigation potential.

7.3.1. Economic and fiscal impacts – political and market context

Understanding climate policy in the region

A first research project, labelled as “Climate Policy in Latin America: Where do we stand”, would bring together researchers from a few countries in Latin America, at least those that have already adhered to MAPS (i.e. Brazil, Chile, Colombia, and Peru), to prepare a survey article and conduct a series of conferences on where the region stands in terms of climate change policy. This research should discuss what governments in different countries are doing and explain why some countries are moving faster than others. It should also provide some normative directions, for example, in explaining whether regional agreements may be more effective than individual actions. The analysis should also touch on the prospects for the introduction of market-based instruments, in particular, ETS. Based on the recent work by Caffera (2011), where he documents the scant use of market-based instruments for controlling domestic pollution in the region, the prospects are not good. But such evidence may be misleading if countries also see in a greenhouse gas ETS the opportunity that at some point in the future their domestic ETS can be linked to an international carbon market.

There have been some studies in the region. For example, Felicani Robles and Peskett (2010) discuss current proposals in Mexico to establish a national register of carbon emission that can then serve as the basis for the creation of a “carbon market”. They also discuss the legal and implementation challenges of considering carbon credits from the forestry sector. Also in Mexico, Ibararán et al (2011) study whether it is feasible for the country to achieve the 50% reduction in GHG by 2050 that it has announced. Using a CGE model, they conclude that is not only extremely costly but also very regressive. However, they do not consider the possibility of selling carbon permits into an international market. Vergara et al (2010), on the other hand, look at the potential of wind power in Colombia. They conclude that although capital costs are expected to decrease and wind energy is highly complementary to Colombia’s hydro regime, they see its expansion potential as limited because of different entry barriers. The analysis ends with a discussion of policies that could reverse that. Finally, Chagas (2010) discusses a bill that was debated in the Brazilian Lower House to reduce emissions from reforestation and degradation (REDD) via the use of public funding and market-based mechanisms. The bill proposed the creation of two different REDD units: UREDDs, which would be non-tradable and would entitle the holder to receive benefits from national and international non-market funding (basically grants); and CREDDs, which would be tradable rights to be used both domestically and internationally. The author considers that the REDD bill is a step forward in regulation of carbon forest activities in Brazil, even though Parliament discussion has not ended and therefore important aspects remain to be determined.

These studies and others¹⁴³ show that climate change policy, in at least some countries in Latin America, is beginning to take shape. It would be useful to carry out a more systematic analysis of all this evidence to see how things stand and where they are going, in particular in terms of the prospects for ETS implementation.

Lessons from other ETS

The only way to gain political support for an ETS is to understand what has worked and what has not in the schemes implemented to date. Although command and control continues to be the most prevalent instrument for pollution control, the use of market-based instruments, and

¹⁴³ Pagiola, 2008; Locatelli et al, 2011; and Johnson et al, 2010

particularly of ETS (or cap and trade), is gaining support, partly driven by the climate change problem. Policymakers in countries that are planning to implement an ETS, whether for carbon or local pollutants such as particulates or NO_x, naturally look at previous experiences for lessons on design and implementation. In fact, the government of Chile is soon to send legislation on an ETS for congressional discussion once again (there was a previous attempt a few years ago that failed). According to the 1994 Law of the Environment in Chile,¹⁴⁴ the implementation of any ETS in the country, whether for carbon or for local pollutants, requires first the approval of legislation framing the use of tradable permits. In drafting the legislation, policymakers in the Ministry of the Environment just recently came up with different questions on design and implementation (listed below). These questions should serve as the basis for a second set of research questions that can be labelled as: “What we know and don’t know about the implementation and performance of pollution markets around the world: evidence from 20 or more years of experience with particular attention to emerging economies and to carbon market implementation”.

It would be important to engage, either through conferences and interviews, or perhaps more directly, people from government and industry to identify relevant questions and see what existing programmes can tell us. Here is the list of questions/issues posed (however, perhaps the first question on the list could be whether there are any ETS experiences in the developing world and what we make of them):

1. Is it common to use price floors and price ceilings to stabilise permit prices? What are cases in which they have been used and how?
2. How often should the cap be revised, if ever? What are the conditions that need to be satisfied for the revision? How is the new cap set? As explained by Schamlensee and Stavins (2012) for the US sulphur dioxide (SO₂) trading programme, failing to change caps as new information on costs and/or benefits flows in may be fatal, i.e. cause the programme to self-destruct. Perhaps here one can draw lessons from ITQ in fisheries that allow for caps to change from year to year.
3. Have transaction costs been important and what should be done about them? There are schemes in which transaction costs have been relatively low (e.g. the US SO₂ trading programme) but others where this is not the case (e.g. RECLAIM in California). It should be explained why and how to reduce transaction costs if possible. One instrument is the use of auctions that can send strong price signals.
4. What has been the experience with enforcement, monitoring and compliance? Is compliance less likely under ETS because there are more incentives for cheating to sell permits? Is it still a good idea to use ETS when monitoring is less than perfect? Has this been used somewhere? Actually it has, in the credit-based programme in Santiago.¹⁴⁵ Should sanctions for non-compliance be attached to permit prices?
5. When should schemes use banking and/or borrowing, and when should this not occur? Should different exchange rates be used when borrowing from the future? Can banking create hot spots intertemporally? The US SO₂ programme, for example, shows that banking is typically used very smoothly and is unlikely to create hot spots.¹⁴⁶ What does the RECLAIM programme say?

¹⁴⁴ Ley No. 19300 de 1994: Ley de Bases del Medio Ambiente

¹⁴⁵ Montero, 2005

¹⁴⁶ Ellerman and Montero, 2007

6. Is voluntary participation by sources not originally affected by the programme always a good idea? How should the programme be designed? With *ex ante* allocations that can be revised *ex post*? We have evidence from the US SO₂ programme (substitution provision) but also from the EU ETS with the CDM. What can we learn from there?
7. How should permits initially be allocated – for free or by auctioning? What is the experience? What are the political economy explanations of using one or the other, or a combination of both?
8. Has market power been a relevant consideration in these types of markets? How has it been dealt with and by whom (e.g. by the same competition authorities in charge of promoting competition in other markets)? According to Ellerman and Montero (2007) and Liski and Montero (2011), for example, market power has been an issue in the US SO₂ programme.
9. Are there experiences in which an ETS has been complemented by other instruments either to promote innovation (subsidies) or to deal with local pollution (hot spots)? What is the experience in the NO_x budget programme in the Northeastern US to avoid hot spots in time or spatially?
10. What are important issues of implementation, such as compiling the inventory of sources (how lengthy a process it can be) and who should pay for the administration of the system? The same participants? Perhaps with the same small fee per transaction? What is the experience elsewhere?
11. It is also important to discuss the political processes involved in the implementation of the different ETS and how research (e.g. about estimation of costs and benefits) has played an important role. Schmalensee and Stavins (2012), for example, argue that the implementation of the US SO₂ emissions trading programme, including the decision about the cap and the phase-in scheme, were independent of benefit estimates. In fact, they find the *ex post* benefits to be well above the costs. In other words, it would be important to discuss whether a substantial amount of research is required to gain political support for the implementation of ETS, and the kind of research that is most effective in building such support.

It is worth emphasising that part of the value of conducting this research by local researchers is to build local capacity. A lot has been written on this already, especially in the US and Europe, but it has not been analysed in the specific context of what lessons are relevant to Chile. And part of this capacity building should be employed in transferring the research findings to other Partnership for Market Readiness (PMR) countries that are also exploring market mechanisms. The process of carrying out this research will build a larger group of people with in-depth knowledge of ETS. These people will be critical for making on-going decisions that are consistent with the fundamental purpose, for explaining the concepts to others, and for creating confidence within Chile that this is not something imposed by outsiders.

Chile's experience with ETS-like policies

Chile is unique in the region in regard to the use of market-based instruments for the management of natural resources, namely water, fisheries, and air quality. The Water Code of 1981 established a decentralised management system for water allocation in all river basins in the country based on the principle of free trade of water rights. These rights were allocated for free based on historic use or simply given away when claimed if previously unused. New reforms to the code, recently passed, have established the use of auctions for allocating any new water rights in the few places left where water has not been fully claimed. There has been some important

amount of work looking at the performance of these water markets in the different basins in terms of presence of transaction costs, price dispersion, exercise of market power, etc.; ultimately, looking at whether the existing allocations have been reasonably efficient or not.¹⁴⁷ ITQs in fisheries are a more recent introduction (in 2001), and their performance has also been studied in different dimensions. For example, Gomez-Lobo et al. (2011) document the large benefit associated to the reduction in fleet size. Finally, we have an experience with credit-based systems for controlling particulates in Santiago. As documented by Montero et al. (2002), although transaction costs were high, monitoring imperfect, and enforcement insufficient, the programme still delivered some benefits by providing firms with flexibility to save on mitigation costs. As explained above, there are no new initiatives of this sort because of the absence of legislation approving the use of this instrument in the more standard version of cap and trade, which would be needed for the implementation of an ETS for emissions trading.

All this research has been conducted separately, so there is an opportunity for a group of researchers from the three areas to look at them together to provide a more comprehensive analysis of aspects such as:

- Was it politically challenging to allocate permits for free?
- Were the distributional effects important?
- Did the initial allocation affect the *ex post* allocation? Have there been important innovations?
- Are some programmes more challenging to administer than others?

This would be a third research area and could be labelled as: “Chile’s experience with market-based instruments for the management of natural resources – water, fisheries and air quality – and lessons for future market design and implementation”.

7.3.2. Emissions and mitigation potential

Chile’s benefit in implementing an ETS for emissions trading at an early stage depends fundamentally on how cheaply it can generate tradable emission units to be sold in the international market. This requires not only considering different allocation scenarios when linking its domestic market to the international one, but also having good studies of the cost of emission reductions and sequestration in the country. There are some (engineering) studies for the energy sector showing large potential for emission reductions at virtually no cost or even at a negative cost.¹⁴⁸ But once that potential is removed, mitigation costs can rise sharply. This uncertainty in the estimates of reducing emissions is common to all energy sectors, including power generation and transportation.

The forestry sector is not different in that the information required to estimate sequestration costs is quite uncertain as well, especially in regard to factors related to the land base and its opportunity costs, and the carbon inventories and flows. There are just a few studies addressing forest carbon sequestration costs, and in these the costs have been estimated using different assumptions and data. For example, Mosnaim (2001) estimated sequestration costs of US\$6.2–224 tonnes of CO₂e for forestry depending mainly on the geographical region and the land type (agricultural or forest). A more recent study from the Centro de Cambio Global-UC

¹⁴⁷ For example, Bauer (2004).

¹⁴⁸ For example, Mosnaim (2001).

(CCG-UC) in 2010 estimated forest carbon sequestration costs of US\$10–56 tonnes of CO₂e depending on the time frame involved and the scenario (expected optimistic, pessimistic) considered and with very different sequestration potentials.¹⁴⁹ More recently, Portillo and Quiroga (2012) find that the sequestration potential is much lower than previously thought.

The variability of sequestration costs agrees with what is found for other countries. Just to quote an example, Stavins and Richards (2005) estimated sequestration costs for forests in the US of US\$7.5–22.5 tonnes of CO₂e for a programme sequestering 300 million tonnes of annual carbon sequestration and US\$9–27 tonnes of CO₂e for a programme sequestering 500 million tonnes of annual carbon. They reported this range depends upon underlying biological and economic assumptions as well as the analytical methods employed. Another, more comprehensive study was carried out by Richards and Stokes (2004).

There is an evident research need for updating and expanding what we know in terms of both abating carbon in all sectors of the economy (e.g. power generation, industry, transportation) and sequestering carbon in the forestry sector. In particular, would it be possible to generate a carbon supply curve from the forestry sector similar to the one in Stavins (1999) or Lubowski et al (2006) for the US? This analysis also includes constructing scenarios of counterfactual paths for all these sectors under different scenarios and time spans. All this research can be grouped under “Chile’s potential for abating and sequestering carbon at low cost and their implications for ETS design”.

It is worth noting that the Mitigation Action Plans & Scenarios (MAPS) initiative (www.mapschile.cl) is currently preparing similar research requests (i.e. construction of counterfactual emission paths and estimation of mitigation and sequestration costs) to be allocated to research groups in the country through a competitive bidding process. A natural question is whether the research proposed here should feed into MAPS work or be conducted separately for contestability. As proven in other countries (in New Zealand in particular), it is very desirable to have more than one study. Note that implicit in the estimation of mitigation potential is the issue of how responsive to prices the different sectors are. If the low response is due to factors other than adjustment possibilities such as information asymmetries and inattention, this opens up a new set of questions about the need for additional instruments to help deal with them. We return to these issues below.

Having information on mitigation and sequestration costs, the research should move into issues of ETS design dealing with phases and with setting the cap. The additional research requires answering questions such as:

1. What is the “central scenario” for a business-as-usual (BAU) emission trajectory for Chile through 2020 and beyond? What is the range of possible scenarios? What are the particularly significant sources of uncertainty with regard to the chosen BAU scenario(s)?
2. In case it becomes unfeasible to have full coverage, what is the mitigation potential, cost, and price responsiveness of the key sectors and subsectors that are strong candidates for trading?
3. What is the impact of emission pricing on the Chilean economy with and without international linking (buy only, sell only, buy and sell)? Can this be analysed in the

¹⁴⁹ CCG-UC, 2011

short-term adjustment (or transition) period as well as in a longer-term equilibrium state?

4. What are scenarios for unit supply, demand, and price in the Chilean market under the leading emission scenario?
5. Are there particular emission price trigger points for step-change investments in new technologies and land uses? Can this analysis be done at the sector level? Or at least for the level of aggregation that is likely to be covered?
6. What are the electricity prices (including carbon prices, if any) that can make investment in renewable energy (wind, solar, geothermal) profitable from the perspective of a private investor? Are there other barriers, other than prices, that may prevent those “profitable” investments from materializing? Is there a way in which we can learn about those barriers?
7. Can we obtain an estimate of the response from industrial and residential customers to the sharp increase in electricity prices in 2005 and after? How disaggregated are the data on consumption, both cross-sectorally and intertemporally? Did the increase in prices affect industrial customers differently depending on whether they are in the south (SIC system) or in the north (SING system)? Do we observe different responses from industrial customers in the same industry?

There are two additional questions, which are more theoretical, that are important to address in order to understand mitigation potentials and the cost and benefits of linking a domestic ETS to international markets:

1. What are options to design more dynamic opt-in programs in which countries (or sectors of countries) can voluntarily accept binding commitments that allows them to sell credit into international markets? The existing literature takes a static view of the problem. A more dynamic view is required to respond to the situation where a country wants to take a short-term commitment or eventually wants to opt-out. How might these opt-in contracts look in dynamic frameworks that combine adverse selection and genuine uncertainty?
2. What are options to design more creative “public-private partnerships” between the government and the private sector that can remove, to the extent possible, the policy uncertainty associated with future changes to government policy? Unlike in other sectors (e.g., highways, ports) here the risk of “policy” expropriation seems greater because the government has more control over the demand for carbon permits (and not over the demand for transportation on a road).

7.3.3. Economic and fiscal impacts

The introduction of an ETS that puts a price on emissions will have a range of different impacts throughout the economy, and many will be highly dependent on whether the ETS is linked to the international market or not. As part of a fifth research area, which can be named as “Economic impacts of ETS and measures that can be developed to deal with them”, we can identify a series of topics that should be researched using different tools (e.g. partial equilibrium models, CGE models, econometric analysis, surveys, RTC, etc.):

- Modelling the economic impacts of emissions pricing in Chile, including the distribution of those impacts across producers and consumers and their impact on key commodity prices. It is important to have some idea of potential winners and

losers; in particular, of the size and ownership of key stranded assets: physical and human (workers with specific non-mobile skills). In that regard:

- Are there groups of people who will suffer large individual losses?
- How quickly will the assets depreciate? If the system is phased in slowly will most of these assets have depreciated before a high price enters?
- *Trade exposure of emissions-intensive industries in Chile (copper mining in particular).* What does the evidence tell us in terms of how exposed those industries could be? Can we use some empirical evidence for this, particularly exposure coming from shocks in inputs (e.g. low electricity prices starting in 1997 with the introduction of natural gas in the power generation sector; sharp increase in electricity prices with the shortage of natural gas since 2007; increasing water scarcity in the northern regions, etc.)? More specifically, this research should include data collection and analysis on the relative trade exposure/sensitivity of different sectors and subsectors as to answer the following:
 - Which GHG-intensive sectors are exposed to international competition?
 - Which of these are mobile, or anticipating significant new investment?
 - What is the employment rate per unit of GHG in the emissions-intensive trade-exposed mobile/expanding sectors?
 - Are these sectors strategic for future development? Would they be sustained or grow at a high emissions price (i.e. is Chile efficient at this activity on a global scale and will the activity itself persist)?
 - What is the ability of these sectors to pass on the price of emissions or to absorb this cost?
 - What is the ability of these sectors to reduce their emissions in response to an emissions price?
- The ability of non-trade-exposed industries to pass the cost of emissions through the chain of production and consumption and how that much depends on the market structure. It is important to think on how to structure some econometric tests that can make use of the “natural experiments” mentioned above.
- Projected revenue and costs to the government under the ETS and analysis of how best to recycle revenues back to the economy in case permits are allocated through auctioning.

7.3.4. Policy integration

Is an emission price enough to correct for the externality associated with emissions? There has been plenty of discussion as to whether an emission price, in the form of taxes or as a result of a cap-and-trade programme, should be complemented with other instruments. One of the reasons for this claim is that agents downstream, whether firms or consumers, may not respond to prices, i.e., be inattentive to prices; in other words, there is an energy-efficiency gap. If such a gap exists and agents are relatively homogenous in terms of how responsive they are to prices, it may be preferential to supplement the emission price with subsidies for investments in more energy-efficient technologies.

The J-PAL office in Latin America¹⁵⁰ is now looking at the possibility of carrying out an Randomised Controlled Trial (RCT) study in Chile to evaluate residential consumers' responses to information programmes that can help them to make more informed decisions about electricity consumption and purchases in more efficient energy appliances.

It would most interesting, because of the larger potential for energy savings and because there seem to be few of such studies in the literature, to carry out a similar RCT study but for small companies, or the so-called PYMES (*pequeñas y medianas empresas* – small and medium firms) for different sectors in the economy.

It has been also argued that since it is hard to get reductions from the transportation sector with just an emission price (i.e. with higher gasoline prices), it is necessary to supplement the carbon price with additional instruments such as stricter standards on new vehicles, driving restrictions upon older (more inefficient) vehicles, subsidies for public transportations, etc. It would important to carry out different studies. An econometric study using historical data on gasoline prices can document how unresponsive the transport sector actually is. A second study, based mostly on numerical simulations, can shed light on how to combine the different instruments and help identify which ones can be more effective.

7.4. References

- AEA Energy and Environment. 2009. *Streamlining Climate Change and Air Quality Reporting – Final Report*. European Commission, Brussels. Available at http://ec.europa.eu/clima/policies/g-gas/docs/streamlining_cc_apreporting_en.pdf
- Bauer, C. J. 2004. “Results of Chilean Water Markets: Empirical Research Since 1990,” *Water Resources Research* 40:W09S06
- Board on Science, Technology, and Economic Policy. 2012. “Effects of Provisions in the Internal Revenue Code on Greenhouse Gas Emissions”, available at <http://sites.nationalacademies.org/PGA/step/CarbonAudit/index.htm>
- Caffera, M. 2011. “The Use of Economic Instruments for Pollution Control in Latin America: Lessons for Future Policy Design,” *Environment and Development Economics* 16: Special Issue 3, pp. 247–73.
- CCG-UC. 2011. “Análisis de Opciones Futuras de Mitigación de GEI para Chile Asociadas a Programas de Fomento en el Sector Silvoagropecuario (Analysis of Future Mitigation Options Associated to Subsidy Programs in Agriculture for Chile)”, Final Project Report, Centro de Cambio Global, Santiago, Chile.
- Chagas, Thiago. 2010. “Carbon Rights in Brazil,” *World Bank Report N° 65866*. The World Bank.
- Conte Grand, Mariana, and Vanessa D’Elia. 2011. “A Reassessment of Argentina’s GHG Proposed Target,” *Working Paper No. 444*, CEMA University, Argentina.
- E3M Lab, P. Capros and L. Mantzos. 2000. “The Economic Effects of EU-Wide Industry-Level Emission Trading to Reduce Greenhouse Gases,” *Background to the Green Paper on greenhouse gas emissions trading within the European Union*, European Commission:

¹⁵⁰ Part of the global Poverty Action Lab (J-PAL) network.

- Environment, Brussels. Available at http://ec.europa.eu/environment/archives/docum/0087_en.htm
- Ecofys. 2006. "Initial Assessment of National Allocation Plans for Phase II of the EU Emission Trading Scheme," available at http://www.ecofys.com/files/files/ecofys_summary_initialnap2_assessment.pdf
- Ecofys. 2009. "Methodology for the Free Allocation of Emission Allowances in the EU ETS Post 2012", available at http://ec.europa.eu/clima/policies/ets/benchmarking/docs/bm_study-project_approach_and_general_issues_en.pdf
- Ellerman, D. and J.-P. Montero. 2007. "The Efficiency and Robustness of Allowance Banking in the U.S. Acid Rain Program," *The Energy Journal* 28:4, pp. 47–72
- Feliciani Robles, F., and L. Peskett. 2010. "Carbon Rights in Mexico," *World Bank Report N° 65877*. World Bank, Washington D.C..
- Gómez-Lobo, Andrés, Julio Peña-Torres & Patricio Barriá. 2011. "TTQ's in Chile: Measuring the Economic Benefits of Reform," *Environmental & Resource Economics, European Association of Environmental and Resource Economists*, 48:4, pp. 651–78.
- Ibarrarán, M., R. Boyd and L. Moreno. 2011. "Costly Commitments: Climate Change Policy in Mexico," *Latin American Policy*, 2:2 pp. 222–33.
- Interagency Working Group for the Study on Oversight of Carbon Markets. 2011. "Report on the Oversight of Existing and Prospective Carbon Markets," U.S. Commodity Futures Trading Commission, Washington, D. C. Available at http://www.cftc.gov/ucm/groups/public/@swaps/documents/file/dfstudy_carbon_011811.pdf
- Johnson, T., C. Alatorre, Z. Romo and F. Liu. 2010. *Low Carbon Development for Mexico*. Washington, D.C.: the World Bank.
- Liski, Matti, and Juan-Pablo Montero. 2011. "Market Power in an Exhaustible Resource Market: The Case of Storable Pollution Permits", *The Economic Journal* 121:551, pp. 116–44.
- Locatelli, B., V. Evans, A. Wardell, A. Andrade and R. Vignola. 2011. "Forests and Climate Change in Latin America: Linking Adaptation and Mitigation," *Forests*, 2:1, pp. 431–50
- Lubowski, Ruben N., Andrew J. Plantinga and Robert N Stavins. 2006. "Land-use Change and Carbon Sinks: Economic Estimation of the Carbon Sequestration Supply Function," *Journal of Environmental Economics and Management* 51:2, pp. 135–52.
- Montero, J.-P. 2005. "Pollution Markets with Imperfectly Observed Emissions," *RAND Journal of Economics*, 36:3 pp. 645–660.
- Montero, Juan-Pablo, Jose Miguel Sanchez and Ricardo Katz. 2002. "A Market-Based Environmental Policy Experiment in Chile," *Journal of Law and Economics* 45:1, pp. 267–87.
- Mosnaim, A. 2001. "Estimating CO₂ Abatement and Sequestration Potentials for Chile," *Energy Policy* 29:8, pp. 631–40.

- National Academy of Sciences. 2010. *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use*. Washington, D.C.: National Academies Press. Available at http://www.nap.edu/catalog.php?record_id=12794
- Pagiola, Stefano. 2008. "Payments for Environmental Services in Costa Rica," *Ecological Economics*, 65:4, pp. 712–24
- Portillo, R. and M. Quiroga. 2012. *Costo de Captura de Carbono: Una Aplicación para Chile Utilizando el Censo Agrícola*, mimeo, University of Concepción, Chile.
- Richards, K.R. and C. Stokes. 2004. "A Review of Forest Carbon Sequestration Cost Studies: A Dozen Years of Research," *Climatic Change* 63:1–2, pp. 1–48.
- Schamlensee, Richard, and Robert Stavins. 2012. "The SO₂ Allowance Trading System: The Ironic History of a Grand Policy Experiment," *NBER Working Paper No. 18306*, National Bureau of Economic Research, Cambridge, Massachusetts
- Sinner, Jim, Judy Lawrence, Roland Sapsford and Paul Blaschke. 2008. *Scoping Report for an Environmental Assessment of the NZ Emissions Trading Scheme and Closely Related Measures*, Cawthron Institute, Nelson, New Zealand. Available at <http://www.cawthron.org.nz/news/downloads/Scoping%20Report%20for%20an%20Environmental%20Assessment%20of%20the%20NZ%20ETS%20and%20Closely%20Related%20Measures.pdf>
- Stavins, R. and K.R. Richards. 2005. *The Cost of U.S. Forest-Based Carbon Sequestration*. Pew Center on Global Climate Change, Arlington, VA.
- Stavins, Robert N. 1999. "The Costs of Carbon Sequestration: A Revealed-Preference Approach," *American Economic Review* 89:4, pp. 994–1009.
- U.K. Department for Business Innovation and Skills. 2012. "Cumulative Impacts of Energy and Climate Change Policies on Carbon Leakage," BIS, London. Available at <http://www.bis.gov.uk/assets/biscore/business-sectors/docs/c/12-581-cumulative-impacts-policies-on-carbon-leakage.pdf>
- U.K. Department of Energy and Climate Change. 2006–08. "EU ETS Publications and Research," available at http://www.decc.gov.uk/en/content/cms/emissions/eu_ets/publications/publications.aspx
- U.S. Department of Energy Building Technologies Program. 2010. "Appendix 15A: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866", *Small Electric Motors Final Rule Technical Support*. Washington, D.C.: U. S. Department of Energy. Available at http://www1.eere.energy.gov/buildings/appliance_standards/commercial/sem_finalrule_tsd.html
- U.S. Environmental Protection Agency. 2009. *The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries*. Washington, DC: US Environmental Protection Agency. Available at <http://www.epa.gov/climatechange/EPAactivities/economics/legislativeanalyses.html#interagencyReport>

Vergara, W., A. Deeb, N. Toba, P. Crampton and I. Leino. 2010. "Wind Energy in Colombia,"
World Bank Report N°55842. The World Bank, Washington, D.C.

8 Recommendations for ETS Process and Meetings

Key findings:

- While an increasing number of policy makers and stakeholders foresee that Chile will need to advance its climate change policies in conjunction with its broader agendas for sustainable development and economic transformation, it will be necessary to convince a much larger proportion of decision makers and stakeholders of the need to control Chile's GHG emission trajectory so that this anticipatory vision becomes a dominant logic.
- Chile needs to give careful consideration to the process of educating government policy makers, lawmakers, the private sector, the media and civil society about the merits of an ETS, the implications of particular design options and the institutional requirements. In parallel with general educational processes, it will be very important for the government to help build the capacity of regulated entities and other market participants to participate in emissions trading.
- Engagement with stakeholders across industry, academia and NGOs should occur both formally and informally throughout the process of ETS design, legislation and implementation. To facilitate the decision-making process and provide advice to the government, a broad multi-stakeholder group could be created consisting of governmental and opposition leaders, industry leaders, representatives from environmental non-governmental organizations, university professors and researchers working for think tanks.
- The process for ETS design in Chile should be led by Chilean experts, be tailored to national circumstances and build domestic capacity and understanding. Chile has a limited but rich experience in tradable permit schemes in other areas, and relevant lessons can be derived from these schemes that should be brought into ETS discussions. In addition, the government should consider the lessons learned by other countries and how Chile could build on them to optimise its own policy approach.
- For this purpose, it is recommended that government officials (and possibly other key stakeholders) meet with regulators, agencies and stakeholders in countries with an operational ETS; authorities in countries that are at the stage of considering the use of an ETS; and other constituencies participating actively in the global carbon market.
- The development and implementation of market instruments demands a clear regulatory framework that can provide signals to entities covered by the market instrument and assign clear responsibilities for the various functions. The regulatory framework must also provide a credible enforcement system (e.g., domestic penalties for non-compliance), and be accompanied by effective governance to ensure transparency and enhance stakeholder participation. As part of ETS design, the government should map out the long-term institutional requirements for implementing an ETS and evaluate which of these can be assigned to existing agencies and which could require the development of new administrative entities.

- In order to successfully overcome the technical and political hurdles to launching an ETS, the government will need to think strategically about how to organise its internal process for guiding the ETS through design, legislation and implementation. Particular challenges lie in coordinating complex decision making across multiple government agencies, engaging in a meaningful way with stakeholders, and preparing for the political legislative process. Creating interdepartmental working groups of officials could facilitate cross-government coordination.

8.1. Introduction

The purpose of this chapter is to provide some additional high-level considerations for the government around its process for ETS design and to allow the project team to share some of its insights on the valuable lessons learned from other governments around ETS design process issues. In addition to examining processes within government for decision making, institutional design and coordination, the chapter examines ways for the government to engage effectively with a range of stakeholder groups and the general public in order to improve ETS design and build broad understanding of and support for an ETS.

It is well known that processes that have led to the establishment of ETS around the world have lasted for years and have faced many technical and political difficulties along the pathway to passage of legislation. It is worth bearing in mind the valuable lessons from these experiences when figuring out what process to follow in Chile to consider an ETS as an integral part of its broader policy framework for energy development and economic transformation. Of course, an important reservation is that the process in Chile will be unique due to the country's own particularities and situation, namely its economic structure, developing economic plans, greenhouse gas (GHG) emission profile and international commitments on the control of these emissions, among other considerations. With these considerations in mind, this chapter will elaborate on these teachings and propose some recommendations to facilitate a process that, in any case, Chile will have to experience in the context of its unique circumstances. Ultimately, the Chilean process from its very beginning will be different with respect to the historical experiences registered to date.

This chapter will not present a comprehensive process roadmap, but a series of reflections on how the Chilean government may be able to chart a smoother and more successful course by avoiding some of the process pitfalls that have affected ETS development in other countries. The discussion is organised as follows:

- Experience from Chile with the process of developing other environmental markets
- Experience from other countries with the process of developing ETS.
- The need for education, communication and building support (political, business and public)
- Participants in and design of the educational process
- Design of a multi-stakeholder process to build support
- An integrated framework for ETS government process
- Government and private sector networks.

8.1.1. Lessons learned from relevant experience in Chile

Chile has a limited but rich experience in tradable permit schemes, and relevant lessons from these schemes should be brought into discussions on the tailored design of an ETS for GHG emission control. This local experience is valuable to complement international experience that comes from quite different contexts. It will capture local circumstances and give more confidence to decision makers, lawmakers and the public in general.

However, these experiences are not widely publicised in Chile. Therefore, a key line of action will be to diffuse these experiences and lessons widely, not only to avoid starting the discussion on an ETS for Chile from scratch, but also to introduce the notion that the government is not speaking about a novel and strange market instrument invented in other contexts, but rather about its use in Chile for a new purpose: the required adjustment of Chile's national GHG emission trend to the new worldwide paradigms of behaviour on this matter. Chapter 1 provides short descriptions of three key areas where market instruments have been used in Chile: water; fisheries and air pollution. Other chapters discuss lessons from that experience for specific design features such as allocation. The discussion below highlights some of Chile's experience and lessons learned with respect to the process used to develop and implement the air pollution regulations. More could be learned from water and fisheries.

Air pollution

Santiago, Chile was one of the first cities outside the OECD to implement a tradable permit program to control air pollution, primarily because Santiago is one of the most polluted cities in Latin America. During the early 1990s, it was officially declared a non-attainment zone for several atmospheric pollutants. In 1992, a cap-and-trade scheme was established by decree in Santiago to reduce emissions of particulate matter from large industrial and residential boilers.¹⁵¹ At that time, there was no environmental agency, so a new governmental office was created to manage this program. The "Program to Control Emissions coming from Stationary Sources" (PROCEFF), under the Ministry of Health, was given the responsibility of allocating permits and keeping an up-to-date record of permits, as well as monitoring and enforcing emissions caps. Within a short time, the first general environmental laws were passed, and in 1994 the National Environmental Commission (CONAMA) was created to coordinate all governmental offices involved with environmental jurisdiction and to design new policies to deal with pollution problems. Since then, CONAMA promoted implementation of additional trading programmes for other stationary sources and pollutants. The actual implementation and management of these programmes did however remain under SEREMI.

The system focused on large boilers due to their easy identification and relative importance; at the time they accounted for more than 40% of total point-source emissions. Although the program became mandatory in 1994, it became active in 1997, giving the environmental authority additional time to collect information on emission sources.

The environmental law regarding the tradable permit program rests mainly on two pieces of legislation: Supreme Decree 4 (SD4) (passed in 1992) and Supreme Decree 16 (SD16) (passed in 1998). Palacios and Chavez (2005) evaluated the performance of the program in terms of enforcement, concluding that the aggregate level of over compliance coexisted with frequent

¹⁵¹ Montero et al, 2002; Palacios and Chavez, 2005; Coria and Sterner, 2010.

violations of regulations by some of the sources.¹⁵² Other process and institutional issues are that the total amount of emission permits initially granted to incumbent sources has been decreased twice; the rate of offsetting has been raised twice while the program's rules have led many sources to lose their emission permits. These changes have created uncertainty which will have reduced the effectiveness of the scheme.

Within a short time after the launching of PROCEFF, the first environmental framework law was passed in Chile, and in 1994 the National Environmental Commission (CONAMA) was created to coordinate all governmental offices involved in environmental matters in the various Ministries and to design new policies to deal with pollution problems. Since 1994, CONAMA has promoted the implementation of additional trading programs for other stationary sources and pollutants. However, the current implementation and management of these programs remained under the Ministry of Health.

The fact that institutions and current regulations evolved so quickly, in some cases simultaneously or even superseding legal bases, may have complicated the implementation, affecting mainly the enforcement dimension of the schemes. However when interviewing firms involved in the air pollutant trading programs, Coria et al. (2010) found that they did not have a generally negative attitude toward environmental regulations or environmental authorities suggesting some success with the process of implementation. Furthermore, they did not seem reluctant to deal with environmental regulations. Hence, one could say that the regulation has gained legitimacy. The fact that firms want monitoring and the overall system to be more stringent is also very positive. Overall, an important lesson from the implementation of environmental markets in Chile is that institutions matter, i.e., sufficient administrative authority, resources, and information to manage environmental markets effectively is a key to their success.

8.2. The ETS Policy Process in Other Countries

This section provides some experiences and lessons regarding the process to establish and implement an ETS from several countries that have already been through the process: European Union, New Zealand, Australia and the US.

8.2.1. European Union

Before setting out the process for the European Union (EU), it is important to provide some context. Firstly it has to be understood that the EU is a very unique supra-national entity which is able to pass legislation which is binding on the Member States (MS) in those areas where it has competence i.e. where the Sovereign MS have ceded legislative making power to the legislation making bodies of the EU. Crucially, the MS have ceded power to legislate on environmental matters. However, the rules of the EU make passing tax legislation significantly more challenging. This has clear implications for the choice of an ETS as opposed to a carbon tax at EU level. A further key part of this context is what can be described as a “democratic deficit” at the EU level or, put another way, the institutions are by the nature of the EU somewhat insulated from the kinds of political pressure or vagaries which are very apparent in, for example, Canberra or Washington DC.

At the end of the 1990s and very early 2000s there was a clear consensus on and acceptance of the need to take action on climate change across both the political spectrum and civil society. The business community felt pretty certain that the EU would act to curb GHG

¹⁵² Palacios and Chavez, 2005

emissions. The EU potentially had the means to do so through existing command-and-control legislation, the Integrated Pollution Prevention and Control Directive. Carbon dioxide could have been added as a prescribed pollutant and then point source industrial installations would have had caps imposed on their emissions within their existing pollution permits.

Business therefore saw the choice as being between GHG emissions being regulated by one of: (i) command-and-control emissions limits; (ii) a carbon tax; or (iii) a market based approach, i.e. emissions trading. They did not see the lack of regulation as a possibility.

In this context the business community in the United Kingdom (UK) decided to take a proactive approach. No discussion of the process and stakeholder engagement in the EU in the lead up to the conception, design and implementation of the EU ETS would be complete without a summary of the process in the UK leading to the creation of the UK Emissions Trading Group (UK ETG) and the resulting pilot UK ETS.

The UK Emissions Trading Group and UK ETS

The UK ETG was formed in 1999 on the instigation of the ACBE & Confederation of British Industry (with UK Government support) with just 30 founder members as an informal body. It was funded by and staffed with secondees from British Industry. The whole rationale for the UK ETG was to design and present to the UK Government proposals for and design of a five-year voluntary UK GHG ETS. The UK ETG did this through a series of Working Groups made up largely of representatives from industry, business and professional services firms. Government observers were involved and engaged during the whole process.

The process was successful and culminated in a voluntary UK ETS which commenced in April 2002 and lasted for five years. Industry facilities which “opted in” were incentivised by a share in £250 million of Government money. The amount paid per tonne of emissions reductions was determined by an auction process at the beginning of the scheme.

Around the same time it became clear that the EU was moving to regulate GHG emissions across the whole of the EU so as to meet its Kyoto Protocol targets and to incentivise a move to low-emissions alternatives. British business decided that it needed to influence this process and as a result of the UK ETG process it had the infrastructure in the form of the UK ETG, and expertise and credibility from designing the UK ETG, to influence the choice of regulatory tool. It pushed for emissions trading and influenced the design of the resulting EU ETS. Again, there was a large degree of coherence between the UK business community represented through the ETG and the UK Government.

The UK ETG, working closely with the UK Government, particularly the Foreign and Commonwealth Office (FCO) and Department of Trade & Industry (in the form of UK Trade & Investment (UKTI)) organised a series of seminars, workshops and briefings right across Europe between 2001 and 2003, which were extremely influential on the debate in each EU Member State.

Only one other Member State’s business community became organised at a relatively early stage and this was Germany. German business was not initially as supportive of emissions trading as their British counterparts. There were some very robust discussions initially between the UK and German business communities.

The EU process

The development, design and implementation of the EU ETS is one of the success stories of EU environmental law making. The EU ETS Directive was conceptualised, designed

and implemented in record-breaking time. The EU Green Paper setting out the concept was published in March 2000. By October 2001 the EU Commission had already adopted a proposal for a Directive on EU-wide GHG emissions – effectively the first concrete step in the legislative process where the draft legislation is fed into the EU legislative machinery. After an incredibly quick legislative review process, the final directive was published in July 2003 and became law in October 2003. It was to start on the 1st January 2005, allowing little over a year for implementation.

How was this achieved so quickly? Some EU insiders who were heavily involved in the legislative process argue that there was a deliberate strategy to prepare a framework law which left all the more difficult and controversial elements of emissions trading such as caps, allocation, etc. to be developed later and at the MS level. So, while not perfect, it allowed an EU ETS to come into being much earlier than would otherwise have been the case.

To begin with there had been a long history in the EU of trying to pass a tax on carbon, in fact since 1992. This was consistently blocked by the UK. So industry knew it had a choice between a command-and-control approach or emissions trading. Industry that understood the issues (largely in the UK) was determined to see emissions trading implemented, as opposed to command and control.

Ironically, the EU tried to block the inclusion of market mechanisms such as emissions trading in the Kyoto Protocol in 1997. But by 2000, as it became clear what the fiscal consequences of the EU's targets would be without emissions trading, and with other policy instruments failing to deliver reductions, the European Commission published a Green Paper on emissions trading in March 2000. This led to a consultation process which heavily involved industry and, to a lesser extent, NGOs. The Commission followed this up with a multi-stakeholder working group as a part of the European Climate Change Programme. The working group met 10 times between July 2000 and May 2001 culminating in a strong call for the EU to implement an EU wide GHG trading regime "as soon as practicable". This working group achieved a high degree of consensus. This was all the more impressive, considering the wide range of interests of different MS (with, for example, some 30 representatives from the UK), industry and environmental pressure groups.

In October 2001 the European Commission advanced the debate to a new level by adopting a proposal for a Directive on EU-wide trading in GHG permits. The proposal's main points survived all further debates:

- mandatory introduction of trading in GHG permits in all EU Member States as of 2005;
- coverage of power and heat generation, iron and steel, oil refining, pulp and paper, cement and other building materials;
- coverage of CO₂ emissions only;
- from 2001 the writing was clearly on the wall that EU industry would face a price on carbon. After an astonishingly quick resolution of differences with the EU Parliament, the Directive was published in July 2003 and became law in October 2003.

8.2.2. New Zealand

An ETS was first seriously considered as a domestic policy option for New Zealand in the mid-1990s. Many of the basic issues were identified then and many of those involved in the

initial design have been involved in the process throughout, providing continuous capability development and a community of people who are knowledgeable, and know and trust each other.

For many years, the New Zealand climate change policy process got stuck in a cyclical debate about tax versus trading as the preferred policy. What finally tipped the balance was: (a) the movement of other countries (particularly Australia) in the direction of domestic emissions trading, (b) the ongoing use of emissions trading as a flexibility mechanism under the Kyoto Protocol and in the development of a post-2012 international agreement, (c) concern that many large emitters would be exempted from the tax, through negotiated agreements, creating imbalance between large and small firms and making the tax coverage so low as to be ineffective, and (c) the potential economic benefits to New Zealand of establishing a domestic ETS with international linkages. Where New Zealand is a small economy with growing emissions and limited cost-effective domestic mitigation potential, the opportunity to link with other countries through emissions trading at both the government and private-sector levels was seen as a critical strategy for meeting New Zealand's international climate change obligations, at least from a cost viewpoint. It was also important for the government to design a durable policy framework for devolving emissions liability from the government to the emitters who have the means to reduce emissions and the consumers who have the means to change their demand for emission-intensive products.

Outside of government, once the government had announced its intention to proceed with an ETS, a group of academics set up a private-sector dialogue group. This group met four times, including a weekend retreat. The aim of the group was to develop mutual understanding of what an ETS is, what it would mean for different sectors, and how it could be made effective. It brought together key people from each sector, many of whom have been key players in the policy development every since. The meetings involved presentations on key design issues by a series of researchers (who also learned through the process). These presentations were summarised in short papers and released gradually to the media by way of one-page media releases as the ETS became a public issue.

Once the government decided to proceed with the design of the NZ ETS, it launched two initiatives to facilitate the process. First, it created an interdepartmental Emissions Trading Group (ETG), co-managed through the Ministry for the Environment and the Treasury. The ETG was staffed by government officials on secondment from all of the major government departments that needed to be involved in core design decisions (Ministry for the Environment, Ministry of Economic Development (which covered energy), Ministry of Agriculture and Forestry, Ministry of Transport, and the Treasury), and some expert consultants. Consultation was held across all government departments as appropriate throughout the process, but establishing the ETG as a separate and dedicated entity with direct linkages to the key departments helped to focus and leverage departmental resources and speed decision making.

Second, the government created a Climate Change Leadership Forum (CCLF) with 33 members, including government chief executives; private-sector participants from the agriculture, electricity, forestry and industrial sectors; representatives of the science, environmental and local government sectors; and three Māori representatives. Key Ministers regularly participated in sessions at CCLF meetings to provide updates and hear recommendations. To quote an overview, "The purpose of the Forum was to facilitate communication between the government and the broader community as policy decisions were taken on the proposed design of a New Zealand ETS. The Forum provided an opportunity for community and business leaders to air their differing views on emissions trading and wider climate change policy as well as an opportunity to provide advice to help shape the design

features of the ETS.” The CCLF met for a year while the New Zealand ETS was under development, helped to provide stakeholder input into design decisions, and served as a credible champion for the development of an effective ETS and the communication of its benefits to other stakeholders.¹⁵³ Some participants were sceptical about the value of the large group forum because it was too large for in-depth discussion and the agenda was largely controlled by government officials who ran the secretariat. The private-sector representatives were extremely senior (CEO level), which had some advantages and disadvantages. They did not have much expertise and did not have time to engage intensively with the process. The more detailed discussions occurred within a subgroup that was generally attended by less senior private-sector representatives.

The government also engaged with stakeholders informally throughout the ETS design process and conducted several rounds of formal public consultation on the policy. Before deciding to proceed with an ETS, the government consulted on post-2012 climate change policy directions for New Zealand and the competing alternatives of an emission tax, an ETS, and traditional command-and-control regulation. Once the government prepared its initial policy proposal, it conducted extensive public consultation on this proposal before proceeding with drafting legislation. Further public consultation occurred during the legislative Select Committee process. After the legislation was passed, the government consulted with affected parties on the design of sectoral regulations, including allocation plans.

The ETS legislation was passed shortly before a national election that brought a change of government. Because there was sufficient cross-party political and stakeholder support for the ETS, the ETS underwent review and revision under the new government, but was not removed. This experience points clearly to the importance of stakeholder engagement, public education and the development of cross-party political support for an ETS to make it a viable policy instrument across election cycles.

One issue that arose several times was the need for the private sector to have meaningful participation in, and a partnership approach to, the engagement processes so they felt it was a truly two-way process. Genuine engagement requires the private sector to commit real resources and also for government to cede some real control and not exclude those with differing views.

The environmental NGO community was actively involved with a variety of roles. Advocacy for the interests of the poor, or of sectors that were not heavily directly affected, was weak.

8.2.3. Australia

In the lead-up to the 2007 general election in Australia, the Australian Labor Party (ALP) commissioned a major study to be prepared by the respected economist Professor Ross Garnaut, detailing the scientific consensus on climate change and the most appropriate policy mechanisms for Australia to apply to meet the challenge of climate change by reducing Australia’s emissions. The “Garnaut Climate Change Review” was handed down in early 2008, after the ALP won the 2007 election, which recommended the implementation of an ETS model. The ALP then developed the 500 page “Carbon Pollution Reduction Scheme Green Paper” (the Green Paper) released in July 2008, setting out the case for action on climate change and the policy options that the government intended to follow. The principal policy option was the Carbon Pollution

¹⁵³ For more information, see <http://www.climatechange.govt.nz/emissions-trading-scheme/building/groups/climate-change-leadership-forum>

Reduction Scheme (CPRS), an ETS linked to the international market, beginning with a one-year fixed-price period. Following community and stakeholder consultation on the Green Paper, the government refined the policy and released the “CPRS White Paper” in December 2008. This paper, which also attracted community consultation, formed the basis of legislation to implement the CPRS put before Parliament in 2009. The CPRS legislation was defeated three times in the Upper House of the Australian Parliament and subsequently deferred indefinitely.

In contrast to the EU, the Australian process for development of the CPRS and the Carbon Pricing Mechanism (CPM) (the ETS that has now been legislated) and associated stakeholder engagement was conducted under the full spotlight of media interest and a strongly polarised political landscape.

Following the general election in August 2010, which resulted in neither major political party securing a clear majority, the ALP managed to form a minority government by entering into agreements with a number of independent MPs and the Australian Greens on certain major policies issues and reforms to parliamentary processes. One of these policy issues was to secure legislation on mitigating climate change including the implementation of a price on carbon. As part of these agreements, the Australian Greens and independent MPs agreed to provide voting support on the floor of the Parliament.

In late September 2010, the Federal Labor Government announced the establishment of a Multi-Party Climate Change Committee (MPCCC). The goal of the MPCCC was to explore options and reach agreement on the design of a carbon pricing mechanism (CPM). The MPCCC included members from the ALP, Australian Greens and two independent MPs. The Opposition Liberal/National coalition was invited to participate, but declined to be involved.

In effect it was a clever strategy in a very politicised environment by the Labor Government to create a political forum for it to thrash out the political deal with its partners the Australian Greens and independents outside of Parliament, so when the Labor Government took it to Parliament, it would have the numbers in the Lower House (House of Representatives) to pass the legislation, thereby avoiding long drawn-out debates with its political allies which the Opposition would have been able to exploit.

The MPCCC was advised by a panel of four independent experts and supported by a Secretaries’ Group comprising Secretaries of Departments involved in implementing climate change policy. The MPCCC started from the position that a carbon price is a necessary economic reform required to reduce carbon pollution, to encourage investment in low-emissions technologies and complement other measures including renewable energy and energy efficiency. It also provided advice on and assisted in building community consensus for action on climate change. The MPCCC consulted, negotiated and reported to the Cabinet on agreed options through the Minister for Climate Change and Energy Efficiency. In addition the Government created two informal stakeholder groups to feed in comments. One was made up of CEOs from selected major businesses and the second by CEOs from the major NGOs.

In February 2011, the MPCCC proposed a Climate Change Framework, comprising an initial fixed-price trading scheme starting on 1 July 2012 followed by a full-scale trading scheme to follow three to five years later. The proposal was couched in terms of possibilities rather than commitments and both independent MPs went on record as saying they supported it as a basis for discussion only. But most commentators agreed this was to protect them politically and the proposal represented a political deal on the major points.

The MPCCC continued to meet regularly where the detail was thrashed out and it culminated in a much more detailed announcement in July 2011 with the release of the Clean

Energy Future policy plan. Stakeholders and community members were invited to comment upon the plan and over 300 submissions were received by government.

The MPCCC and the associated process was supplied with a number of keynote reports and studies, including:

- The Garnaut Review 2011 – wherein Professor Ross Garnaut was commissioned to update his 2008 Climate Change Review covering a wide range of issues such as climate change science, economics impacts, assessment of action in the rest of the World, and land sector mitigation
- The Productivity Commission's Carbon Research Report – the Commission was instructed by the Government to examine the state and existence of carbon pricing internationally to allow the MPCCC to consider the level of action being taken by Australia's major trading partners.

Following the release of the policy detail in July 2011, the government released a tranche of draft legislation designed to implement the plan, termed the Clean Energy Future legislative package. Submissions from stakeholders and community members were also called for at this stage; however, the time allowed for the making of submissions was very limited. The government also conducted a range of informal special interest group consultations with, for example, expert legal participants and specific industry group participants.

The Clean Energy Future Package was passed through both houses of the Australian Parliament in November 2011, followed by the rapid development of regulations to support the legislation, each tranche of regulations attracting stakeholder consultation.

8.2.4. United States

The GHG emissions trading process in the US has been characterised by the leadership of sub-national emissions trading initiatives in the absence of agreement to federal legislation. This contrasts with earlier experiences with market-based approaches to environmental regulation. The federal government successfully implemented emissions trading for SO₂ under the US Acid Rain Program in Title IV of the 1990 Clean Air Act, and for NO_x to manage ground-level ozone (smog). While the US Congress did start to consider federal emissions trading legislation a decade ago (e.g. the 2003 Climate Stewardship Act), the actual success with implementing ETS to date has occurred at the regional/state levels.

The first mandatory ETS in the US was the Regional Greenhouse Gas Initiative (RGGI), which was agreed in 2003 and initially involved ten Northeastern states (New Jersey has since withdrawn). It operates as a series of linked state-level cap-and-trade programs based on the same model rule. The scope of the ETS is limited to the power sector, but participants can surrender limited domestic offsets from other specified sectors. The first compliance period started in 2009.

In 2006, the State of California passed legislation to establish a mandatory state-level cap-and-trade program with a focus on the energy sector and linkages to other sectors through offsets. This has faced considerable opposition by some interest groups, but court challenges have been overcome and have not blocked the implementation of the scheme. The California legislation was a key anchor point for the development of the Western Climate Initiative, which has involved discussions on emissions trading across seven US states and four Canadian provinces since 2007. The WCI has not advanced beyond the discussion point.

Multiple attempts at federal climate change legislation have failed to deliver an ETS. In 2009, the passage of the American Clean Energy and Security Act by the US House of Representatives was a landmark achievement, but it did not gain approval by the US Senate. There has been much discussion on why the federal approaches have failed and California has succeeded. A cap-and-trade legislative reform process is extremely complex, with a very wide range of interests and stakeholders. The legislation touches on so many areas and involved many different Senate committees which made it especially difficult to orchestrate procedurally. It requires a very skilled and effective legislator to lead the process and find a compromise in the Senate.

At a high level, there was probably much stronger regional support for action than federal. It was also not a main priority for the White House given the then-difficult economic climate, and so many other competing issues. There was a lot of discussion of the costs of the policy but not a lot of discussion of the benefits. Opponents were effective at creating confusion over climate science. An open question is whether a broader coalition of interests beyond environmentalists (e.g. youth groups, defence community, religious groups) could have been engaged to effectively provide a constituency for action driving politicians from the bottom up. Related to this is the point that time ran out on the legislative calendar to be able to craft a solution given that other issues were put first in line (health care, financial reform). Also, the legislation that came out of the House was very long (over 1400 pages) which made it difficult for people to fully understand and easier for opponents to mischaracterise.

Some of the lessons learned from the US experience to date are:

- Having multiple agencies or research groups with separate modelling and analysis was important during the federal legislative process. In California, there was less diversity of modelling (basically just the California Air Resources Board), but they were sufficiently well respected, so that was enough. This may be more analogous to Chile.
- A perpetual challenge is not just modelling theoretical issues but trying to add the policy realism so as to consider precise features of proposed legislation. The ability to run various scenarios examining particular pieces of the policy was important. This was useful not just during the stage of evaluating the federal legislation but also at the stage of stakeholders trying to reach agreement through the US-CAP,¹⁵⁴ a coalition of businesses and NGOs that developed a blueprint for what became the House bill.
- Politically one of the big issues has been jobs. Most economic models are not able to credibly address employment shifts at a granular level. Other types of analyses were needed to build the case (in California as well as other states) that “green” jobs would provide real benefits and counterbalance the loss of dirty jobs.
- In the recent attempts at federal legislation, the economic analyses fell short in making a positive case for benefits to the agriculture/rural sector, which was politically important. The US Department of Agriculture (USDA) was not as far along in modelling some of the important issues on agriculture offsets, for example.

¹⁵⁴ The US Climate Action Partnership (US CAP) was a very interesting model where private sector and environmental group stakeholders worked together to reach a workable policy and advocate for a flexible market based approach at a time when there seemed to be a likelihood of climate policy.

- The federal argument could not be won simply based on the case of low costs of the policy. There were not sufficiently strong arguments for the costs of inaction and the reason to act urgently, especially during a recession.

8.3. The Need for Education, Communication, and Building Support

8.3.1. Capacity building for decision making on an ETS

Chile is committed to the goals of the United Nations Framework Convention on Climate Change, is a Party to the Kyoto Protocol, and has made an international pledge of reducing its GHG emissions growth rate by 20% below business-as-usual (BAU) levels by 2020 compared to 2007 (a goal that is conditional upon significant international economic/technological support). However, Chile's currently low, by OECD standards, per capita GHG emissions, and Chile's status as a developing and non-Annex I country, on the other, suggest that in the near future the country will not adopt a mandatory domestic policy for controlling its level of GHG emissions solely for climate change reasons. This situation might change significantly in a rapidly evolving world as both industrialised and developing countries take more ambitious action to de-carbonise their economies. There is growing international pressure for countries to adopt economic incentives to promote new generations of technologies that will need to be deployed on a massive scale to support preferred stabilization pathways. Climate change considerations and the carbon footprint of production may also take on greater significance in countries' trade policies, particularly if the adoption of ambitious policies is uneven across trade competitors.

While an increasing number of policy makers and stakeholders foresee that the country will need to advance its climate change policies in conjunction with its broader agendas for sustainable development and economic transformation, it will be necessary to convince a much larger group of decision-makers and stakeholders, both governmental and non-governmental, of the need to control Chile's GHG emission trajectory so that this anticipatory vision becomes a dominant logic.

Chilean governmental authorities have identified market instruments as an important tool to meet GHG mitigation objectives and, upon learning of the initiative, expressed their great interest in being part of the Partnership for Market Readiness (PMR). Chile's early interest was manifested in the participation of its Minister of Energy in the official launching ceremony of the PMR in Cancun in December 2010. However, Chile is still in the category of Implementing Country Participants in the PMR that have not yet reached a policy decision on which market instrument to pursue.

Policymakers have paid increasing attention to market-based policy instruments over the last decades. Tradable emission permits have been at the centre of this discussion due to the theoretical promise of cost-effectiveness and because they have been used successfully in the United States to reduce sulphur dioxide (SO₂) and nitrogen oxides (NO_x).

Moreover, this interest increased significantly after the positive experience of the EU in the use of this kind of instrument for reducing its GHG emissions to levels compatible with its obligations under the Kyoto Protocol and the more recent adoption of the model by a number of other countries (e.g. New Zealand, Australia, Tokyo within Japan and jurisdictions in the US). However critical open questions remain, including how an ETS would be structured if one were used in Chile and whether an ETS would be chosen as part of the set of policies. This report directly addresses only the first question, and aims only to help inform discussions on the second question.

No ETS has been implemented or even fully designed in Latin America. Similarly, none of the previously designed ETS were for countries at Chile's stage of development. This means that Chile needs to embark on a learning process where government, private sector and academics need to jointly learn. No one group has all the knowledge or will have all the creative ideas needed to design something that builds on knowledge and experience but adapts to the new circumstances.

The combination of consensus building around climate change policy and learning around an ETS must engage with a wide audience and a broad set of issues. Regarding the audience, policymakers, lawmakers, the private sector (stakeholders), civil society and media should be active participants. Regarding the issues to be covered, the process should deal with a wide range of issues starting with the importance of regulating GHG emissions and including the value of using ETS for this purpose, the best-suited architecture for an ETS in Chile, and the institutional arrangements and legal infrastructure required to implement the scheme.

8.3.2. Capacity building for ETS implementation

It will also be very important for the government to help build the capacity of regulated entities and other market participants to participate in emissions trading. This can be supported through the use of early voluntary reporting as a distinct phase of the ETS to help regulated entities build their MRV capacity and the initiation of programs to help businesses, regardless whether or not they will be directly regulated, prepare a GHG inventory, assess their mitigation options, and calculate the impacts of emissions trading on their activities. When the program is close to implementation, practical training and certification initiatives for third-party verifiers and prospective brokers would be valuable. In addition to the capacity building benefits of such activities, they can also help to identify mitigation opportunities and institutional needs to improve ETS implementation.

8.4. Participants in the Consensus Building and Learning Processes

8.4.1. Policymakers

Recognising that the government plays a crucial role in proposing bills and driving them through the Chilean legislative procedures, certainly there is an urgent need to build understanding and support among governmental authorities regarding the development of an ETS. Hence, beyond the Ministries where that conviction already exists, namely Energy and Environment, it is necessary to identify and train champions in other Ministries with political responsibilities pertaining to other sectors that are proposed to be covered in an ETS. In addition, it will be a requisite to have the support of champions in the ministries of Economy and Finance, who always have the last word in matters that have an economic or financial impact.

Beyond the political will shown by the government in initiating a legislative process to establish an ETS, in order to pass ETS legislation, it will be necessary to achieve a legislative majority in both the Chamber of Deputies and the Senate. Therefore, in the consensus process, attention should be focused upon building a broad, cross-party support for the passage of legislation on an ETS.

They may not be directly involved in the learning process, because of the large time commitment to one issue, but are a key audience for the insights that emerge.

8.4.2. Private and non-governmental sector

Given the power and influence of the private sector in the Chilean economy, it is critical to identify and involve private actors at the outset of the project. In particular, the process will need certain champions and visionaries who will be instrumental to support and actively lobby for the law reform bill to create the ETS (*proyecto de ley*) from its commencement, through the congressional processes and to the final passage and implementation of legislation. Ideally, these people will have good relationships across the political spectrum, since governments change every four years and the process to create the emissions trading scheme will need to endure across successive administrations.

In addition, to facilitate the decision making process, a broader multi-stakeholder group could be created to include the following private actors, along with governmental and opposition leaders:

- Leaders in key industries and facilities across all sectors or subsectors that potentially would be regulated under or impacted by the ETS, such as power generation, industrial production, mining, transport, forestry, agriculture, waste, etc. In this regard, it will be particularly important to involve the highest executives in the trade/industry associations that represent these industries or facilities. Involving less senior staff who can develop a deep understanding of the issues and provide detailed technical input will also be important.
- Non-governmental and academic groups
 - Environmental non-governmental organisations (NGOs), such as The Nature Conservancy, WWF, Chile Sustentable and other local NGOs specifically focused on climate change policy processes.
 - University professors – specifically, to understand how different ETS features will affect the incentive effects and distributional implications of the policy; to provide input and comment upon the law reform bill that is drafted; and provide expert technical input on emissions accounting. To ensure broad support for the project, it is essential to identify and consult with professors from distinct renowned universities.

It is also recommended that researchers working for think tanks, such as Centro de Estudios de la Realidad Contemporánea, Centro de Estudios Públicos, Cieplan, Fundación Chile, Libertad y Desarrollo, and Océanos Azules, among others, be involved in this multi-stakeholder group. The Chilean experience shows that these institutions play an important role in the thought evolution of Chilean politicians. The idea here is to design a strong ETS, well adapted to Chilean conditions, and to build broad, cross-party support for the passing of legislation on an ETS.

Finally, it is recommended that the work of this multi-stakeholder group should be augmented by other particularly important actors in the process of forming public opinion. In this regard, it will be key to educate the media about these issues (especially technical and economic policy issues) up front in order to improve the quality of reporting on the policy development process.

8.5. Meetings with ETS Administrators (and Other Stakeholders) in Other Countries

In the design of an ETS, three types of issues require special attention:

- policy setting – e.g. deciding what sectors to include and with what points of obligation, what the cap should be, what methods of allocation should be employed, what methods should be adopted for monitoring, reporting and verification (MRV), what forms of compensation should be offered to firms and households disproportionately (and unacceptably) impacted by increases in the cost of energy and other commodities, and how any revenues (e.g. from government auctions of allowances) should be distributed. These are not just one-off issues to be addressed at the start-up of a scheme. The initial scheme settings that deal with these issues may require programmed periodic review.
- operational – e.g. implementing the MRV framework with points of obligation, establishing and operating the emissions trading registry, establishing, implementing and enforcing the compliance regime and managing the disbursement of any compensation.
- market oversight – e.g. implementing provisions to avoid abuse of market power and fraud within the carbon market – preferentially compatible to, or integrated in the provisions set up for other commodity and financial markets.

This report provides a framework for further analysis of options as the government develops its proposal for an ETS tailored to the national circumstances of Chile. A detailed and participatory analysis of the government's proposal will constitute an important line of action in this process. This exercise should integrate the general national experience in tradable permit schemes, as mentioned above, but should also integrate the international experience on the process.

Some decision makers and private sector representatives question the value of international experience for the design of policies in developing countries, mainly when they refer to environmental issues, arguing that they correspond to economic realities far distant from the national circumstances. Looking beyond the rhetoric, there certainly is merit in a policy design process that is led by Chilean experts, is tailored to national circumstances and builds domestic capacity and understanding. However, it would be short-sighted to overlook the lessons learned by other countries and consider how Chile could build on them to optimise its own policy approach.

For this purpose, it is recommended that the government (and possibly other key Chilean stakeholders) meet with regulators, agencies and stakeholders in countries with an ETS; authorities in countries that are at the stage of considering the use of this instrument; and other constituencies that have arisen in the framework of the development of the global carbon market. Such meetings could be used to obtain valuable information about lessons learned from the design of other ETS to date, identify opportunities for such countries to help build Chile's capacity to implement an ETS, discuss the use of offsets mechanisms, and explore other opportunities for harmonizing or linking ETS in the longer term. The latter can be particularly important, since some ETS design features can complicate or preclude linking, and multinational firms can benefit from harmonised ETS requirements across their markets. Early discussions with other governments with mutual interests in linking and harmonisation could help to advance and keep opportunities open and prevent barriers to taking such action in the future.

Meetings are likely to be phased and may be iterative depending upon the stages of Chile's decision making process. They could be bilateral or multilateral and could include meetings with private sector and other stakeholder groups.

Meetings with countries with an ETS

The government and other key Chilean stakeholders may wish to meet with government representatives and key stakeholder groups in the following countries that have implemented an ETS to date:

- European Union (both key Member States and the European Commission)
- New Zealand
- Australia
- Japan (both federal and municipal)
- United States (both federal and state/regional).

In-country meetings should include a broad range of relevant government departments (e.g. environment, energy, transport, agriculture, forestry, trade, foreign affairs and treasury). They could also include elected representatives and stakeholders in key industries, academia and NGOs.

While the meetings could address the full range of core ETS design issues (e.g. sectoral coverage and points of obligation, caps, phasing, allocation, use of offsets and linking), the government may also wish to focus on each country's unique design features that could offer valuable experience for Chile. For example:

- The European Union offers experience with regulating emissions at the point of emission rather than upstream, aligning phased caps with longer-term emission reduction targets, controlling the import of offset units, linking to the ETS of other countries, and expanding coverage to include aviation. The United Kingdom also has experience with additional domestic ETS that could be of interest to Chile.
- New Zealand offers experience with economy-wide sectoral coverage (encompassing the stationary energy, transport, industrial process, forestry, agriculture and waste sectors), using upstream points of obligation in the energy sector, buy-and-sell linking to the international market, the use of a transitional price ceiling, and tailored approaches to free allocation to avoid windfall gains to recipients while safeguarding the competitiveness of its emissions-intensive trade-exposed producers.
- Australia offers experience with the use of an introductory fixed-price phase, a hybrid approach to the point of regulation in the stationary energy sector, the operation of a parallel levy structure for transport emissions which are outside the AusCPM, linking to domestic offsets through the Carbon Farming Initiative and recycling ETS revenue as part of a comprehensive climate change and energy package to mitigate ETS impacts and accomplish other climate-change-related objectives. Australia also has experience with earlier sub-national trading initiatives.
- Japan offers experience with voluntary ETS initiatives at the federal level, and the use of a mandatory municipal-level ETS in Tokyo that uniquely targets commercial and institutional buildings and industrial facilities.

- The United States offers practical experience with the operation of a multi-state power-sector ETS in the Northeast (RGGI), which applies a universal-auction model, and the implementation of the state-level ETS in California, which focuses on the energy sector, includes links to approved domestic offsets, and is part of the Western Climate Initiative across several US states and Canadian provinces. At the federal level, the United States developed comprehensive legislative proposals for an ETS which did not pass but offer valuable experience with setting a long-term cap, linking to other ETS, accepting different types of domestic and international offsets and considering the trade implications of uneven emission pricing regimes in other countries.

It will be of particular interest to discuss how these schemes have approached or are considering approaching the issue of linking to existing and emerging ETS, and explore prospects for Chile to link its ETS to these markets in the longer term. As part of its policy design process, the Chilean government will have to consider very carefully the trade-offs between tailoring its ETS to fit national circumstances and enabling sufficient harmonisation of key features (e.g. those affecting the level of ambition, the integrity of units and price control measures) with other ETS to support linking internationally in the longer term.

Meetings with countries considering an ETS

At present, other countries are considering the use of an ETS; these include Brazil, China, Colombia, Mexico, Republic of Korea and Canadian provinces. Brazil, China, Colombia and Mexico are also implementing country participants in the PMR. These countries will all face many of the same challenges and difficulties that Chile will have to overcome in its road to implement an ETS. It is evident that all of these countries could benefit from a regular interchange of experiences and lessons learned in these processes. In particular it might be valuable to create a government and stakeholder network within Latin America. Therefore, in principle, it seems worthwhile from every standpoint for Chilean representatives to visit some of these countries as part of the educational process being proposed. Further work will be needed to assess the current status of these initiatives and build a list of countries and appropriate agendas for such meetings.

8.6. An Integrated Framework for ETS Government Processes

8.6.1. Institutional requirements and legal infrastructure

Cap-and-trade schemes need to be established in some form of legal framework. Like any market commodity, carbon derives its value through scarcity and this relies on rules requiring emitters to match their emissions to their allowances and face penalties if they do not. Moreover, allowances have a value and initial allocation of them can represent wealth transfers between private sector players and between the private sector and governments.

The development and implementation of market instruments demands a clear regulatory framework that can provide signals to entities covered by the market instrument, as well as assign clear responsibilities for the functioning of the market instrument. The regulatory framework must also provide a credible enforcement system (e.g. domestic penalties for non-compliance), and be accompanied by effective governance to ensure transparency and enhance stakeholder participation.

An important role of the instrument's institutional set-up will be to provide confidence to market participants (and stakeholders) that emissions are adequately monitored, reported and

verified and that appropriate action is taken in cases of non-compliance – in accordance with the overall regulatory framework. Key regulatory activities can include, for example: (i) assigning responsibility for collecting emissions data; (ii) verifying GHG emissions and activity data; (iii) issuing allowances or credits; (iv) tracking the movement of units as a result of trading; and (v) assessing and enforcing compliance. There is normally a separation of institutions between policy and operations. In particular, the processes of cap setting and allocation should be strictly separated. The units (and emissions) registry is a critical institutional function and is central to the operational integrity of the scheme. The way in which verification is handled reflects other aspects of the legal systems in the specific jurisdictions. The infrastructure for trading in the primary and secondary markets (e.g. standard contracts, trading platforms) is usually left to the private sector, but should be subjected to commodity and financial market oversight. The implementation of cap-and-trade schemes requires a range of complementary provisions with regard to taxation and accounting standards, as well as early measures to educate the respective regulated entities.

In Chile, the implementation of an ETS will require a new law to be approved by Congress; experience suggests this will not be a rapid process. For example:

- The Bill on Carbon Credits (*Proyecto de Ley de Bonos de Descontaminación*) was presented in 2003 and is basically sleeping before Congress.
- The Bill on the Creation of the *Derecho Real de Conservación* (Conservation Easement) was presented in 2008 and only recently was granted urgency and approved by the Chamber of Deputies. This bill still needs to be approved by Congress.

Again, a wide, participative and thorough discussion of all these elements, based upon the recommendations set forth in this report, can also constitute an important educational tool, particularly for law-makers. This activity would be enriched and complemented by the opportunity to meet with regulators, agencies and stakeholders in countries with ETS.

8.6.2. Government process considerations

In order to successfully overcome the technical and political hurdles to launching an ETS, the government will need to think strategically about how to organise its internal process for designing an ETS and guiding it through legislation and implementation. The particular challenges lie in coordinating communication, analysis and complex decision making across multiple government agencies during ETS design; engaging in a meaningful way with stakeholders throughout the process in order to tap their expertise and gain their support for the final outcome; and preparing for the political process of passing legislation. An outstanding technical design cannot compensate for failure to plan an effective process for getting the ETS across the finish line.

As part of this exercise, the government should map out the long-term institutional requirements for implementing an ETS, and evaluate which of these can be assigned to existing agencies and which could require the development of new administrative entities. This will be a useful way of identifying which government agencies will need to be involved early in the design process. The list of core government functions for implementing an ETS could include:

- ETS oversight and coordination
- major and minor ETS policy decisions
- issuance of regulations

- cap setting
- allocation planning
- issuance of units
- information collection and reporting
- registry administration
- compliance administration
- appeals process
- ETS review.

The various ETS established in the world have assigned responsibilities on these issues to different existing institutions and/or created particular instances for dealing with some specific issues. Table 8.1 is illustrative in this respect.

Table 8.1: Comparison of countries' institutional structures for ETS¹⁵⁵

	AETS	Californian ETS	EU ETS	NZ ETS
Major policy direction	Government, oversight by Parliament	Government and CARB, with oversight by legislature	EC, oversight by European Parliament and European Council	Government, oversight by Parliament
Scheme monitoring and policy advice	Climate Change Authority and Productivity Commission	Market Monitor, Market Surveillance Committee	EC	NZ ETS Review Panel (first review)
Scheme cap and allowance allocations	Clean Energy Regulator	CARB	EC, with input from European Parliament and European Council	(No caps) Government Minister for Climate Change Issues
Monitoring, reporting and verification	Clean Energy Regulator	CARB	Member States, EC oversight	Environment Protection Authority
Auctioning and allocation	Clean Energy Regulator	CARB (and potentially private registry operators)	Member States, EC oversight	(No auctions), issuance by Registrar under Ministerial direction

¹⁵⁵ Greenacre, 2012

	AETS	Californian ETS	EU ETS	NZ ETS
Market oversight	Australian Securities and Investment Commission, and Australian Competition and Consumer Commission	CARB, Market Surveillance Committee, Commodity Futures Trading Commission	European Securities and Markets Authority and national bodies	Ministry of Economic Development
Registry management	Australian National Registry of Emission Units (Clean Energy Regulator)	CARB	Union Registry	New Zealand Emissions Unit Register (Registrar)
Enforcement of scheme rules	Clean Energy Regulator, subject to judicial review	CARB, subject to judicial review	Member States, subject to judicial review	Environment Protection Authority

Once the government decides in principle to proceed with an ETS, the stages of the government's decision making process could include:

- the initial proposal of ETS objectives and criteria
- identification of ETS design options
- research and analysis
- development of the government's proposal for ETS design
- impact assessment of the government's proposal
- formal consultation on the government's proposal
- review of consultation responses
- final government policy decisions on ETS design
- legislation
- preparation
- implementation.

To assist in government communication and decision making, the government could consider creating interdepartmental working groups of officials at different levels (e.g. agency heads versus technical staff) that could meet regularly, or as in New Zealand even be co-located, throughout the policy design process. This will help to build the government's internal capacity to undertake final decisions in an efficient manner.

As discussed above, engagement with stakeholder groups across industry, academia and NGOs should occur both formally and informally throughout the process of ETS design, legislation and implementation. Stakeholders will have valuable information that the government

will need in order to design the ETS and implementing regulations. They will also have important perspectives which should be considered, and could help to improve ETS design. To facilitate regular stakeholder engagement, the government could create stakeholder working groups with diverse membership, including influential business and thought leaders and sectoral experts. Multiple rounds of formal public consultation will also be critical to improving ETS design and securing public and political support for the mechanism.

8.7. Government and Private Sector Networks

Listed below are some organisations that could assist the Chilean government with gathering information or road-test thinking on both optimal design and process.

8.7.1. Business and finance groups

- Carbon Market Investment Association (<http://www.cmia.net>)
- Investors Group on Climate Change (Aus/NZ) (<http://www.igcc.org.au>)
- Institutional Investors Group on Climate Change (Europe) (<http://www.iigcc.org>)
- Investor Network on Climate Risk (US) (<http://www.ceres.org/incr>)
- International Emissions Trading Association (IETA) (<http://www.ceres.org/incr>)
- International Carbon Action Partnership (ICAP) (<http://icapcarbonaction.com>)

8.7.2. NGO/academic networks

- Centro Andino para la Economía en el Medio Ambiente (<http://www.andeancenter.com/>)
- Climate and Development Knowledge Network (CDKN) (<http://cdkn.org>)
- Climate Action Network (<http://www.climateactionnetwork.org>)
- ClimateWorks (<http://www.climateworks.org>)
- Climate Policy Initiative (<http://climatepolicyinitiative.org>)
- Harvard Project on Climate Agreements (http://belfercenter.ksg.harvard.edu/project/56/harvard_project_on_climate_agreements.html)

8.7.3. Regional governmental initiatives

The Asia-Pacific Carbon Markets Roundtable (regional political/policy dialogue) brings together senior officials from developed and developing countries in the Asia-Pacific region that are considering, developing or implementing market-based schemes for GHG emission reductions at national or sub-national level. As well as enabling exchange of knowledge and experience, the group is exploring the feasibility of an Asia-Pacific market of linked schemes post-2012. Building upon this Asia-Pacific experience, it could be valuable try to create a similar group in the Latin American region that, in addition to being a forum for the exchange of experiences and lessons between countries, could provide a space to identify regional opportunities in policy development.

8.8. Proposed Next Steps

This section identifies (what we consider to be) the research and other activities essential to support Chile’s decision whether to proceed with an ETS, and, if so, the detailed design, and to begin the necessary data collection. This corresponds to the “Preparatory” phase and the beginning of the “Early Reporting” phase in our ETS Roadmap (see Chapter 9). It also gives an indication of the broad sequencing of activities.

As shown in Figure 8.1, the overall ETS process can be divided into “policy development” (involving research and stakeholder education and engagement) and “institutional development” (encompassing technical and legal infrastructure, institutional arrangements and readiness). Tables 8.2 and 8.3 elaborate on the sequencing of activities across this process. We have assumed the following objectives:

- filling the technical gaps in knowledge to help Chile to make a decision on ETS/ETS design
- launching a national conversation on Chile’s preferred climate policy package (including the ETS option and the purposes for which Chile might pursue an ETS – i.e. explore the “why?” question)
- building technical, institutional and organisational capacity to implement an ETS.

For each type of activity, we have suggested the activities that should start immediately (some of these will be ongoing) and the activities that could be started later. We are not suggesting a rigid, linear process but rather a succession of building blocks.

The policy development process, in particular, will be highly iterative. Key policy questions at each stage will shape, and be shaped by, research and stakeholder engagement outcomes. There will be some foundation or “no regrets” activities that ought to be conducted regardless. We also took a stab at identifying first-order policy questions at the start of the process for Chile. These will have a significant bearing on the research and engagement agenda that follows. It is hard to be precise beyond this first stage, as future steps will depend how the policy process unfolds in Chile. The different aspects of institutional development should take place in parallel on a related but not necessarily identical timetable.

Figure 8.1: An iterative process for ETS design

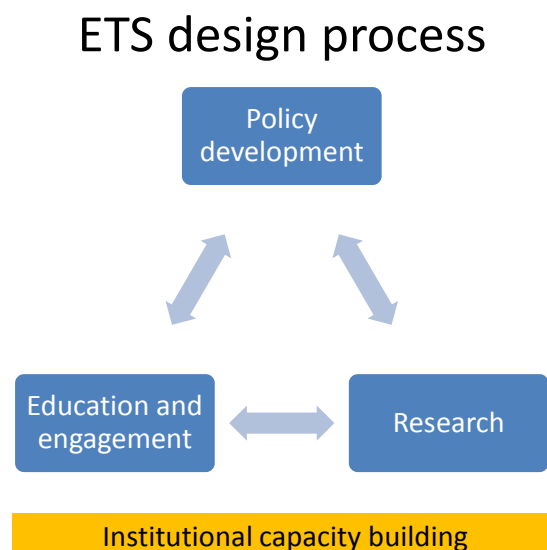


Table 8.2: Preparation and early reporting phases – policy development process

	First steps “Scoping and research”	Next steps “Design, refine and road-test”	Later stages “Refine, consult and decide”
Key policy issues	<ul style="list-style-type: none"> • Chile’s ETS objectives • High-level/”in principle” design parameters: <ul style="list-style-type: none"> ○ Does Chile want to sell units on the international market? ○ Does the government want to control domestic prices? ○ What point of obligation should apply in the stationary energy sector? 	<ul style="list-style-type: none"> • Detailed consideration of core design components: <ul style="list-style-type: none"> ○ Coverage ○ Points of obligation ○ Ambition ○ Linking ○ Price stabilisation ○ Phasing • High level design parameters: <ul style="list-style-type: none"> ○ Chile’s objectives for allocation of units 	<ul style="list-style-type: none"> • Detailed consideration of core design components: <ul style="list-style-type: none"> ○ Allocation ○ Compliance
Research	<ul style="list-style-type: none"> • Lessons from experience and emerging economy issues (see detail below in Table 8.4) • Sectoral market structures and emissions profiles (see detail below) 	<ul style="list-style-type: none"> • Specific issues that arise from stakeholder engagement or on individual design components • Assessment of Economic Impacts Research (see detail below) • Study on linking opportunities and implications for ambition and harmonisation of ETS design features • Domestic offsets value/feasibility • Complementary measures to address non-price barriers and facilitate low-carbon investment (Activity 3) 	<ul style="list-style-type: none"> • Cost/benefit analysis of the government’s preferred ETS design proposal

	First steps “Scoping and research”	Next steps “Design, refine and road-test”	Later stages “Refine, consult and decide”
Education and engagement	<ul style="list-style-type: none"> • Government communications strategy for domestic stakeholders • Multi-media public education and engagement campaign on Chile’s climate change objectives and preferred policies, including the option of an ETS (what is an ETS and why the government is considering) • Establishment of a Latin American regional dialogue on ETS development • Engagement in other relevant international ETS-related policy processes 	<ul style="list-style-type: none"> • Establish multi-stakeholder and technical advisory bodies/processes as needed • Bilateral meetings with emitters (survey) • Meetings of government, regulators and stakeholders with their counterparts in countries with or considering an ETS (on design, lessons learned and linking opportunities) • Meetings with other ETS constituencies (e.g. international emissions trading and industry associations, brokerages, etc.) 	<ul style="list-style-type: none"> • Formal consultation on the government’s comprehensive proposal for an ETS (preferred design) • Bilateral emitter engagement via Early Reporting (data collection) process

Table 8.3: Preparation and early reporting phase – institutional development

	First steps	Next steps	Later stages
Technical and legal infrastructure		<ul style="list-style-type: none"> • Establishment of new institutions (if any) • Delegation of governance responsibilities • Legislative needs and gaps assessment (to proceed with policy development process – c.f. ETS implementing legislation) <i>(Preparing for Early Reporting phase a priority)</i>	<ul style="list-style-type: none"> • Draft implementing legislation • Compliance regime • Verification guidance and accreditation
Institutional arrangements	<ul style="list-style-type: none"> • Plan for coordinating PMR activities across government 	<ul style="list-style-type: none"> • Plan for coordinating the government's decision-making process for an ETS and establishment of any coordination bodies/processes • Plan for institutional arrangements for ETS rule-making, administration, MRV and market oversight • Registry development 	
Readiness	<ul style="list-style-type: none"> • Assessment of sector and institutional readiness and capacity building/training needs 	<ul style="list-style-type: none"> • Developing measurement and reporting protocols for Early Reporting Phase (emitters) – e.g. begin with survey • Institutional capacity building for ETS implementation • Sectoral capacity building in MRV for ETS participation 	<ul style="list-style-type: none"> • Implementation of Early Reporting (data collection) phase <i>(likely to be separately funded?)</i> • Sector capacity building for ETS trading

Table 8.4: Needed and existing research programmes

	Useful research	Existing work streams
Lessons from experience and emerging country issues	<ul style="list-style-type: none"> • Lessons learned from other countries on ETS objectives, design, political and policy process and implementation (including meetings with countries with or considering an ETS – see below) • Relevant lessons from domestic experience of other types of market mechanisms • Specific ETS design issues for emerging economies • Latest thinking on price control/stabilisation measures? • Regional developments on climate policy and ETS 	
Sectoral market structures and emissions profiles	<ul style="list-style-type: none"> • Sectoral price responsiveness (price pass-through, elasticity of demand and supply, price impact/triggers on low-carbon investment decisions, non-price barriers (especially in the electricity sector) • Targeted forestry sector research: Study on factors influencing forest carbon sequestration costs, such as land base and forest yield but also environmental, social and economic dimensions influencing the feasibility and the potential implementation of ETS in this sector. • Market structure (actors, supply chain, potential participants) and regulation for sectors 	
	<ul style="list-style-type: none"> • National GHG inventory 	<ul style="list-style-type: none"> • Done periodically by Environment Ministry
	<ul style="list-style-type: none"> • Emissions baseline and BAU projections by sector/sub-sector 	<ul style="list-style-type: none"> • Being done under MAPS (MAPS budget for this item quite low so outputs could be deficient for some sectors)

	Useful research	Existing work streams
	<ul style="list-style-type: none"> • Technical mitigation potential/options and marginal abatement cost (MAC) curves by sector/sub-sector 	<ul style="list-style-type: none"> • Being done under MAPS
Assessment of economic impacts research	<ul style="list-style-type: none"> • CGE modelling to assess the emissions, economic/fiscal and distributional impacts of different ETS design options (with and without international linking and under sell-only, buy-only, and buy-sell linkages). • Drawing on scenario analysis for: <ul style="list-style-type: none"> ○ Evolution of global carbon markets (out to 2020 and beyond) ○ Different ETS design options under different global carbon market scenarios (in terms of supply/demand/price, net seller or net buyer, linking prospects etc.) ○ Counterfactual pathway (i.e. no ETS) • Identifying EITE producers and entities with stranded assets. Assessing competitiveness and leakage risk. 	<ul style="list-style-type: none"> • Some CGE modelling being done under MAPS

8.9. References

- Calfura, E., Coria, J. and J.N. Sanchez. 2009. "Permisos Transables de Emisiones en Chile: Lecciones, Desafíos y Oportunidades para Países en Desarrollo," *El Trimestre Económico* 304, pp. 1027–69.
- Coria, J. and T. Sterner. 2010. "Tradable Permits in Developing Countries: Evidence from Air Pollution in Santiago, Chile," *Journal of Environment & Development* 19:2, pp. 145–70.
- Coria, J., Löfgren, A. and T. Sterner. 2010. "To Trade or Not to Trade: Firm-level Analysis of Emission Trading in Santiago, Chile," *Journal of Environmental Management* 91:2126–2133.
- Greenacre, S. 2012. "ETS Institutional Arrangements." Presentation at the World Bank Partnership for Market Readiness Technical Workshop *Domestic Emissions Trading*, Shenzhen, China, 13 March 2012.
- Montero, J.P., Sanchez, J.M. and R. Katz. 2002. "A Market-based Environmental Policy Experiment in Chile," *Journal of Law and Economics* 45:267–287.
- O’Ryan, Raúl, 2002. "Emissions Trading in Santiago: Why Has it Not Worked, But Been Successful?," Unpublished document. Program for Environmental Economics and Management, Industrial Engineering Department, Universidad de Chile.
- Palacios, M., and C. Chavez. 2005. "Determinants of Compliance in the Emissions Compensation Program in Santiago, Chile," *Environment and Development Economics* 10:453–483.

9 Roadmap for Government Decisions on an ETS

As noted in the introduction to this report, the design of an ETS is not a linear process. There are critical linkages and interdependencies across all of the core design components, and no one component can be designed in isolation. This chapter presents an integrated roadmap for the hierarchy of government decisions on the core components of an ETS. It starts with an overview of issue linkages and summarises a range of possible objectives and criteria for an ETS in Chile. It then travels through design choices for each of the core components addressed in this report (sectoral coverage and point of obligation, emissions constraint, linking and offsets, phasing and allocation), identifying key considerations as appropriate. For continuity of analysis, it touches on two components covered under separate reports from other PMR Activities: price stabilisation and MRV/compliance/registries). It lays out some considerations for the assignment of institutional responsibilities and the design of an effective government process for guiding the ETS from design to legislation and implementation with the engagement of key stakeholders throughout. It highlights key government strategic judgments for each of core components.

The last part of the roadmap addresses the integration of decisions on design and government institutions and processes. It presents straw man proposals for sector coverage and point of obligation, linking and offsets and allocation of allowances plus an integrated straw man proposal that shows how these might work in combination. These straw man proposals do not represent recommendations; instead, they are a useful starting point for considering different features as a package. Further research, analysis and stakeholder engagement will be required in subsequent phases of work to support the development of recommendations for the design of an ETS in Chile. The final two graphics depict an iterative and integrated process for conducting policy development, research, education and engagement alongside the development of institutions and infrastructure.

10 Glossary of Terms

A

Account: Each page in the Registry shows the history of one account. Each regulated facility under the ETS and each entity that has ever owned any tradable units will have an account in the registry. The only other account in the registry is the retirement account.

Additional: When used with respect to GHG offset projects, “additional” means reductions, avoidance, or sequestration that result in a lower level of net greenhouse gas emissions or atmospheric concentrations than would occur in the absence of an offset project.

Additionality principle: The principle that a project should only be able to earn credits if the greenhouse gas emission reductions produced by the project are additional to what would have happened in the absence of the carbon credit component.

Afforestation and reforestation (A/R) projects: Projects involving the growing of forest on land that has not been forested for a period of at least 50 years (afforestation) or on non-forested land (reforestation) through planting, seeding, and/or the promotion of natural seed sources.

Allocation: The distribution of allowances to participants under an emissions trading scheme or other entities. Allocation can be done for free or by selling the allowances (see “Auctioning”). Principles for free allocation include grandfathering, benchmarking, and projections.

Allowance: Synonymous with “unit”.

Annex B countries: Annex B countries are the 39 emissions-capped countries listed in Annex B of the Kyoto Protocol. In practice, Annex I of the United Nations Framework Convention on Climate Change (see below) and Annex B of the Kyoto Protocol are often used interchangeably.

Annex I countries: The industrialised OECD countries and countries with economies in transition listed in Annex I of the UNFCCC. Belarus and Turkey are listed in Annex I but not in Annex B; and Croatia, Liechtenstein, Monaco, and Slovenia are listed in Annex B but not in Annex I. In practice, however, Annex I of the UNFCCC and Annex B of the Kyoto Protocol are often used interchangeably.

Assigned Amount (AA) and Assigned Amount Units (AAUs): The Assigned Amount is the total volume of greenhouse gases that each Annex B country is allowed to emit during the first commitment period (see explanation below) of the Kyoto Protocol. An Assigned Amount Unit (AAU) is a tradable unit of one tonne of CO₂e.

Auctioning: Common term used for the sale of allowances, as opposed to allocating them for free (see also “Allocation”).

B

Banking: The transfer of allowances or credits from one compliance period to the next. Parties to the Kyoto Protocol may bank as many Assigned Amount Units they wish as long as they follow commitment period reserve rules, Certified Emissions Reductions corresponding to 2.5% of their targets, and Emissions Reduction Units corresponding to 2.5% of their targets, to use them in subsequent commitment periods. The EU ETS allows unlimited banking from the

second compliance period (2008–2012) onwards, but did not permit banking from the first to later periods. Also known as carry-over or hoarding.

Baseline and baseline scenario: The baseline represents forecasted emissions under a business-as-usual scenario (see below), often referred to as the “baseline scenario”, i.e. expected emissions if the emission reduction activities were not implemented.

Benchmarking: An allocation method in which allowances are distributed based on output (e.g. one allowance per MWh generated), or on intensity standards in the industry, based on best-performing companies.

Border carbon adjustment: A trade measure in which jurisdictions with climate policies would impose a charge on imported goods to level the playing field in terms of the emissions costs associated with domestic and foreign producers facing climate policies of differing stringencies.

Borrowing: A mechanism under a cap-and-trade system that allows entities to use allowances designated for a future compliance period to meet current compliance period requirements.

Bottom up: Establishing smaller systems (national and subnational ETS) with the goal of connecting these to create a more comprehensive, larger system (global ETS).

Burden sharing: Sharing the burden of climate protection.

Business-as-usual (BAU): A business-as-usual scenario is a policy-neutral reference case of future emissions, i.e. projections of future emission levels in the absence of changes in current policies, economics, and technology.

C

Cap: A regulated, specified maximum total of emissions of greenhouse gases from the total of capped facilities in an emissions trading system in a specific year.

Cap and trade: A design for emissions trading systems under which total emissions are limited or “capped”. Tradable emission allowances corresponding to the total allowed emission volume are allocated to participants for free or through auctioning. It contrasts with baseline-and-credit approaches, where only deviations from a baseline are tradable. Examples are the EU ETS, RGGI, international emissions trading under the Kyoto Protocol, and the proposed emissions trading scheme in Australia (Carbon Pollution Reduction Scheme).

Carbon capture and storage (CCS): Process consisting of the separation of carbon dioxide from industrial and energy-related sources, transport to a storage location and long-term isolation from the atmosphere. Carbon dioxide may be stored underground in old oil and gas fields, non-commercial coal fields, and saline aquifers. It may also be injected into the ocean. Also known as carbon capture and geological storage (CCGS).

Carbon dioxide equivalent (CO₂e): A measurement unit used to indicate the global warming potential of greenhouse gases. Carbon dioxide is the reference gas against which other greenhouse gases are measured. See “Global Warming Potential” for conversion rates.

Carbon neutrality: The practice of purchasing and retiring emission credits or allowances corresponding to the amount of greenhouse gas emissions from, for instance, an activity, company, or country.

Carbon sink: Natural or human-made systems that absorb carbon dioxide from the atmosphere and store them. Forests are the most common form of sink, in addition to soils, peat, permafrost, ocean water, and carbonate deposits in the deep ocean.

Carbon stock: The quantity of carbon contained in a biological reservoir or system that has the capacity to accumulate or release carbon.

Carbon tax: A price that covered entities must pay for emitting a unit of carbon.

Certified Emissions Reductions (CERs): Carbon credits generated through the Clean Development Mechanism (see below). It can be used to meet an Annex B party's emission commitment or as a unit of trade in greenhouse gas emissions trading systems.

Clean Development Mechanism (CDM): A mechanism for project-based emission reduction activities in developing countries (non-Annex B countries). Certified Emissions Reductions (see above) are generated from projects that lead to certifiable emissions reductions that would otherwise not occur.

Cogeneration: The sequential production of useful mechanical energy and useful thermal energy in the same engine.

Command and control: An alternative to emissions trading and the traditional method of environmental regulation. The government specifies the exact emission limit for each facility, and prosecutes the facility owner if the facility exceeds that limit.

Compliance: The act, specific to cap-and-trade schemes, of surrendering the required amount of allowances, or some combination of allowances and offsets, to cover an entity's emissions. Achievement by a party in meeting its quantified emission limitation and reduction commitments under the Kyoto Protocol.

Coverage: The scope of the system; the sectors and gases included in an ETS.

Credit: Most commonly used in relation to emission reductions that have been achieved in excess of required amounts – either under the cap and trade ETS or through an additional abatement activity.

D

Degradation (of forests): Negative changes in a forest area that limit its productive capacity.

Direct emissions: Whereby greenhouse gases are emitted directly from the exhaust stacks of a facility.

Direct linkage: When one or both of two systems allow regulated entities to meet their compliance obligations by surrendering allowances or credits obtained from the other system. *Two-way direct linkage* occurs when two cap-and-trade systems choose to recognise each other's allowances. *One-way direct linkage* occurs when a cap-and-trade system recognises credits from an emissions-reduction system or from another cap-and-trade system without reciprocation.

Domestic Offset Credit: An offset credit deriving from a project within the jurisdiction of a given ETS.

Double-counting: A potential problem with Joint Implementation projects in sectors covered by the EU ETS.

Downstream cap: A “downstream” cap-and-trade system is one in which the entities emitting carbon dioxide are required to surrender allowances (see also “Upstream cap”).

E

Early action: Verified, additional, and permanent mitigation action that occurred prior to the implementation of an ETS. In some emissions trading schemes, early action may earn certain entities allowances.

Emission: The release of a greenhouse gases into the ambient air.

Emissions factor: A commonly accepted numerical value for the emissions released by combustion of a specific quantity of a specific fuel, e.g. combustion of one litre of gasoline releases 2.36kg of carbon dioxide into the atmosphere.

Emissions Intensive Trade Exposed (EITE): A firm that generates a disproportionately high quantity of emissions and is heavily reliant on exporting its product. Legislation designed for carbon mitigation impacts these firms’ business models, and hence competitiveness, in a relatively potent manner, so ETS cost-containment mechanisms often target EITE firms in order to ease their burdens.

Emissions Reduction Unit (ERU): Permits achieved through a Joint Implementation project.

Emissions threshold: The amount of emissions a facility must produce in order to be covered by the ETS.

Emissions trading: Broadly speaking, this is a market-based system that gives the flexibility to select cost-effective solutions to achieve established environmental goals. It also encourages compliance and financial managers to pursue cost-effective emissions reduction strategies that provide incentives to emitters to develop the means by which greenhouse gas emissions can be reduced at least cost.

Energy efficiency: Usable energy per unit of fuel.

F

First commitment period: Under the Kyoto Protocol, the first compliance period from 1 January 2008 to 31 December 2012.

Flexibility Mechanism: Under the Kyoto Protocol, a collective term for International Emissions Trading, the Clean Development Mechanism, and Joint Implementation.

Fossil fuel: Natural gas, petroleum, or coal, or any form of solid, liquid, or gaseous fuel derived from such material, including consumer products that are derived from such materials and are combusted.

Fugitive emissions: Emission from leaks, valves, joints, or other small openings in pipes, ducts, or other equipment, or from vents.

Fungibility: Regarding ETS, fungibility refers to the interchangeability, or relative value, the different types of allowances have within one system. For example, a hypothetical ETS might force covered entities that achieve compliance via international offsets to retire five tonnes of verified carbon equivalent reductions for every four tonnes of carbon equivalent reduced domestically.

G

Global Warming Potential (GWP): The impact a greenhouse gas has on global warming. By definition, carbon dioxide (CO₂) is used as reference case, hence it always has the GWP of 1. GWP changes with time, and the Intergovernmental Panel on Climate Change has suggested using 100-year GWPs for comparison purposes. Below is a list of 100-year GWPs used in the Kyoto Protocol for the six Kyoto gases:

Carbon dioxide (CO ₂)	GWP: 1
Methane (CH ₄)	GWP: 21
Nitrous oxide (N ₂ O)	GWP: 310
Hydrofluorocarbons (HFCs)	GWP: 150 – 11 700
Perfluorocarbons (PFCs)	GWP: 6,500 – 9 200
Sulphur hexafluoride (SF ₆)	GWP: 23,900

Grandfathering: Synonymous with “grandparenting” (see below).

Grandparenting: A method for allocation of emissions credits/allowances to companies or other legal entities, usually free of charge, on the basis of their historic emissions. Grandfathering has been the main allocation method in Phase 1 and Phase 2 of the EU ETS.

Greenhouse gases (GHGs): Trace gases that control energy flows in the Earth’s atmosphere by absorbing infra-red radiation. Some GHGs occur naturally in the atmosphere, while others result from human activities. There are six GHGs covered under the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆). CO₂ is the most important GHG released by human activities.

H

HFC-23: About 98% of HFC-23 gas emissions are created as a by-product in the production of HCFC-22 and are generally vented to the atmosphere. HCFC-22 is used mostly as a refrigerant for stationary refrigeration and air conditioning.

Hoarding: Net banking of permits by the private sector, that is, permits purchased in excess of current acquittal liability may be held as an asset on a firm’s balance sheet.

Hydrofluorocarbons (HFCs): One of the six greenhouse gases, controlled in the Kyoto Protocol. They are produced commercially and are largely used in refrigeration and insulating foam.

I

Indirect linkage: Occurs when two systems link directly to a common third party.

International Offset Credit: An offset issued by a foreign entity.

Inventory: A country report, under the Kyoto Protocol, on anthropogenic greenhouse gas emissions and removals delivered on a regular basis according to the Intergovernmental Panel on Climate Change guidelines.

J

Joint Implementation (JI): One of the three flexible mechanisms under the Kyoto Protocol, for transfer of emissions permits from one Annex B country to another. JI generates Emissions Reduction Units on the basis of emission reduction projects leading to quantifiable emissions reductions.

K

Kyoto Protocol: The Kyoto Protocol originated at the Third Conference of the Parties (COP-3) of the United Nations Framework Convention on Climate Change in Kyoto, Japan, in December 1997. It specifies emission obligations for the Annex B countries and defines the three so-called Kyoto flexible mechanisms: Joint Implementation, Clean Development Mechanism, and emissions trading. It entered into force on 16 February 2005.

L

Land use, land-use change, and forestry (LULUCF): The land-use, land-use change, and forestry (LULUCF) sector was included under the Kyoto Protocol to take into consideration certain human-induced activities that remove greenhouse gases from the atmosphere, also known as carbon “sinks”. These activities are referred to in Article 3, paragraphs 3 and 4, of the Kyoto Protocol, as defined in Paragraph 1 of the annex to decision 16/CMP.1, as follows: afforestation, reforestation, deforestation (the direct human-induced conversion of forested land to non-forested land), revegetation, forest management, cropland management, grazing land management.

Leakage: Carbon leakage occurs when production of goods is moved to countries with less strict climate policy than the original country (e.g. from the EU to India or China).

Least developed countries (LDCs): Countries that, according to the United Nations, exhibit the lowest indicators of socioeconomic development, and have the lowest Human Health Index ratings of all countries in the world.

Linkage: Connecting Emissions Trading Systems, either directly or indirectly, so as to expand potential mitigation options.

M

Marginal abatement cost (MAC): The cost of reducing emissions by one additional unit. Aggregated marginal costs over a number of projects or activities define the marginal abatement cost curve.

Measurable: Subject to accurate measurement and monitoring.

Mitigation: Reducing the quantity of greenhouse gases in the atmosphere. Reduction in the quantity or intensity of greenhouse gas emissions.

Monitoring: The collection and archiving of all relevant data necessary for determining the baseline, measuring anthropogenic emissions by sources of greenhouse gases within the boundary of a project activity and leakage, as applicable.

Measurement, reporting, and verification (MRV): [definition to come].

N

National Allocation Plan (NAP): Plan from a Member State for how to distribute EU allowances across installations taking part in the EU ETS in that given country.

Nationally Appropriate Mitigation Activity (NAMA): Refers to a set of policies that countries undertake as part of a commitment to reduce greenhouse gases. The term recognises that different countries may take different nationally appropriate action on the basis of equity and in accordance with common but differentiated responsibilities and respective capabilities.

O

Offsets: A credit for emissions reductions from a domestic or international source outside the coverage of the cap.

P

Permanence: Ensures liability for reversals so as to ensure reductions in emissions that persist at least as long as the reductions achieved under the emissions cap.

Permit: Synonymous with “unit”.

Perfluorocarbons (PFCs): One of the six greenhouse gases controlled by the Kyoto Protocol. PFCs are a by-product of aluminium smelting and are a replacement for chlorofluorocarbons in manufacturing semiconductors.

Point of obligation: The set of entities within covered sectors that are responsible for obtaining required allowances. In broad terms, the point of obligation can be upstream, midstream, or downstream.

Point of regulation: Synonymous with “point of obligation”.

Price cap: A cap set on the price of traded emissions allowances. Also known as a safety valve.

Price ceiling: A sales price a good (i.e. emissions allowance) is not allowed to exceed.

Price collar: Essentially a combination of price triggers – one designed for when prices are unexpectedly high, and one when they are unexpectedly low – that defines the range of allowance prices, thereby providing a level of certainty to regulated entities.

Price floor: A sales price that a good (i.e. emissions allowance) is not allowed to fall below.

R

Real reductions: Truly reducing greenhouse gas emissions.

Reduced emissions from deforestation and degradation (REDD): Mitigation action that seeks to preserve existing carbon stocks in forests (typically tropical rainforests), peat lands, etc. The

approach would be additional to project-based efforts such as the Clean Development Mechanism. Issues to be solved are permanence, leakage, monitoring, and baselines.

Registry: A database that shows who owns what emissions allowances. Account balances can be viewed and transactions initiated online. It combines functionality of a land registry with that of banking alone. The registry is not a trading platform; it does not support the statement of sale and purchase orders or prices.

Removal Units (RMUs): A unit relating to land use, land-use change, and forestry activities, equal to one metric tonne of carbon dioxide equivalent. RMUs cannot be banked for use in any subsequent commitment period, but can be converted into Assigned Amount Units within a national registry.

Reversal: Intentional or unintentional loss of sequestered greenhouse gases to the atmosphere.

S

Safety valve: A mechanism that prevents prices from rising above a price ceiling by, for example, enabling the government to issue more allowances if the price reaches a pre-set trigger level.

Secondary market: The second transaction or trading of Certified Emissions Reductions related to Clean Development Mechanism projects or Emission Reduction Units from Joint Implementation projects.

Sequestration: The separation, isolation, or removal of greenhouse gases from the atmosphere.

Sinks: The removal of greenhouse gases from the atmosphere through land management and forestry activities that may be subtracted from a country's allowable level of emissions.

Stationary source: Any integrated operation comprising any plant, building, structure, or stationary equipment, including support buildings and equipment, that is located within one or more contiguous or adjacent properties, is under common control or the same person or persons, and emits or may emit a greenhouse gas.

T

Target: A national goal of emissions in a specific year, including regulated and non-regulated sectors.

Top Down: Establishing a rule or policy at an overarching jurisdictional level (i.e. UN policy for global ETS), thereby galvanising similar action at lower-level jurisdictions (i.e. regional, national, provincial, city, etc.) that fall underneath this higher level jurisdiction.

Trading period: Period of time for which ETS emissions certificates are issued.

U

Unit: Legally defined unit (e.g. EUAs, AAUs, RGAs, NZUs, and others) that entitles the holder to emit one tonne of carbon dioxide equivalent or another quantity of greenhouses gases. Also known as emission allowance or emission permit.

United Nations Framework Convention on Climate Change (UNFCCC): The UNFCCC was established 1992 at the Rio Earth Summit. It is the overall framework guiding the international climate negotiations. Its main objective is “stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (man-made) interference with the climate system”.

Upstream cap: An “upstream” cap-and-trade system is one in which the entities supplying or importing carbon-rich fuels into the market would be required to surrender allowances (see also “Downstream cap”). The proposed Australian Carbon Pollution Reduction Scheme uses an upstream approach for transportation and some other emission categories.

V

Verification: The process of formal confirmation by a recognised independent third party that inventories and carbon reduction claimed by participants in carbon trading schemes are in conformity with reality and established rules. Under the Clean Development Mechanism, verification is performed by designated operational entities (DOEs).

Vintage year: The calendar year for which an emission allowance is established, except the vintage year for a strategic reserve allowance, which is the year in which such allowance is purchased at auction.

Voluntary carbon market: The sum of all transactions of carbon credits in non-compliance markets. The generation of non-compliance credits – or voluntary offset credit supply – comprises the reduction of greenhouse gas emissions for the purpose of selling them to voluntary end users and not to compliance buyers. Voluntary markets for emissions reductions include generation and transaction of carbon credits in non-compliance markets. The voluntary market permits the use of credits such as verified emission reductions (VERs), non-verified emission reductions (ERs), and prospective emission reductions (PERs), as well as the non-compliance use of CERs, ERUs, EUAs and other credits and allowances generated for the compliance market.

References

- Kunzemann, Thilo. 2010. “Emissions Trading – A Glossary”, Allianz. Available at <http://www.knowledge.allianz.com/search.cfm?63/emissions-trading-a-glossary>
- Local Government Association of Queensland. 2010. “Carbon Accounting and Emissions Trading: Glossary and Facts for Local Governments.” Available at http://lgaq.asn.au/c/document_library/get_file?p_l_id=418589&folderId=95601&name=DLFE-3021.pdf
- Point Carbon. 2012. “Carbon A–Z – Glossary of Keywords.” Available at <http://www.pointcarbon.com/1.266906>
- Ranson, Matthew and Robert Stavins. 2012. “Post-Durban Climate Policy Architecture Based on Linkage of Cap-and-Trade Systems,” HKS Working Paper, *Chicago Journal of International Law*.
- US House of Representatives. 2009. American Clean Energy and Security Act of 2009 (H.R. 2454). <http://thomas.loc.gov/cgi-bin/bdquery/z?d111:H.R.2454.>

11 Appendices

Appendix 1: PMR Chile Activity 2 Terms of Reference

Appendix 2: Chile GHG Emissions Trends

Appendix 3: Sector Contribution to National GHG Emissions

Appendix 4: Carbon Emissions Across Energy Sector Supply Chain in Chile

Appendix 5: Impact of Carbon Price on Electricity Generation Costs in Chile

Appendix 6: Preliminary Economic Modelling of Alternative ETS Scenarios for Chile

11.1. Appendix 1: PMR Chile Activity 2 Terms of Reference

Partnership for Market Readiness (PMR)

CHILE

Activity 2: Study and design proposal of an Emissions Trading System

General objective

Draft a proposal for the implementation in Chile of a Greenhouse Gas Emissions Trading System (ETS).

Specific objective

Propose a detailed roadmap, including its design elements, to inform decision-making for an advanced model of an ETS in Chile.

Activities

Based on existing and operating schemes and the input from the other studies, write a proposal of the work, including the research and meetings to be held with regulators and implementing agencies in countries with an existing ETS. The first part of this study will focus on the research of the core components of an ETS, including:

1. **Setting the point for regulated sectors:** Establish a framework to enable informed decision-making on the coverage in an ETS. The framework should include a list of criteria and indicators against which different sectors could be assessed to inform decisions on the determination of regulated and non-regulated sectors for an ETS in the country. This criteria framework should include a sectoral and structural cost-benefit analysis for the implementation of this type of regulation, as well as other types of quantitative and qualitative criteria, such as trade exposure, growth expectations, ability to pass-on cost of emissions, regulatory (or other) barriers and industry's mitigation opportunities and costs, among others.
2. **Emissions trading phases:** Outline the key steps/criteria and considerations for the elaboration of a system of phases in which different industries would enter the system at different times. This proposal needs to specify, for example, the level of reductions at each phase, the industries involved and the rationale behind these criteria.¹⁵⁶
3. **Allocation of allowances:** Establish a framework with criteria and considerations that could be used for the assignment of permits according to the different phases. Examine different allocation modalities (auctioning, grandfathering or a hybrid) for each industry and each phase, and identify pros and cons, providing an appropriate justification. Given the importance of this item in the success of implementing an ETS in Chile, special attention will be paid to the steps needed for appropriate planning of different permit assignment model. Finally, identify key issues that need to be addressed in decisions on the allocation of allowances and identify potential trade-offs that need to be made when making a decision on allocation.¹⁵⁷

¹⁵⁶ Close work with stakeholders is needed here, especially with industry associations and other government agencies.

¹⁵⁷ The experience of most countries and regions that have previously implemented ETSs describe this item as the most politically sensitive and discussed throughout the process of approving these kinds of systems.

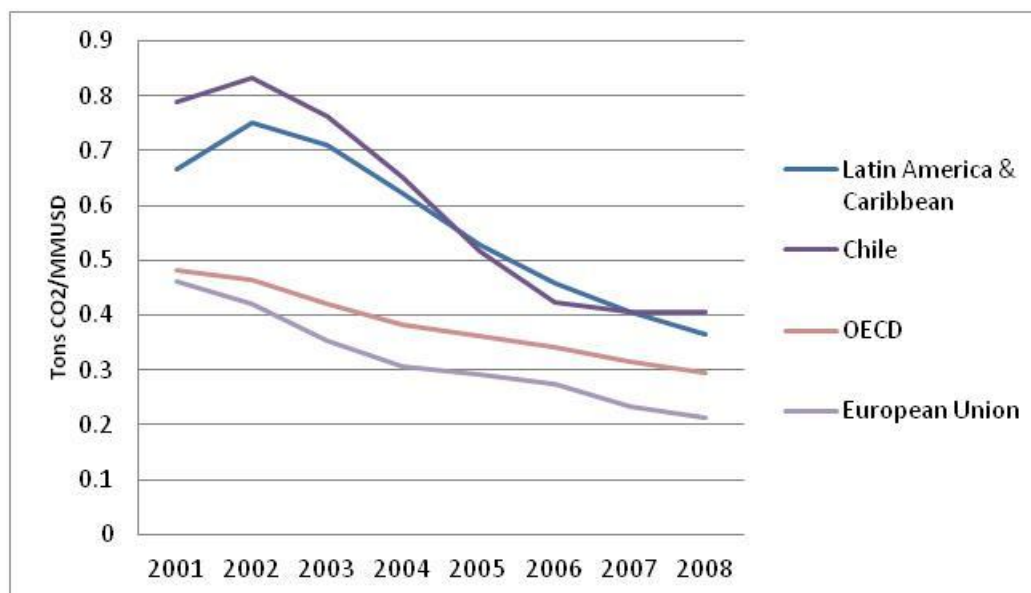
4. **Linking and offsets:** Relying on an established registry and complying with the elements of a solid, stringent and transparent MRV system, a tentative array of linking options for the Chilean market will be presented primarily based on existing and potential offset options with the aim of contributing to enhancing cost-efficiency and environmental effectiveness. Also, the consultant to identify the key requirements and considerations to inform decision on linking and offsets.

End products / deliverables:

A proposal for an ETS in Chile that includes a list with all the core components, a list of regulated sectors, entry phases with suggested periods, an appropriate system to allocate allowances and a plan for linking and offset options.

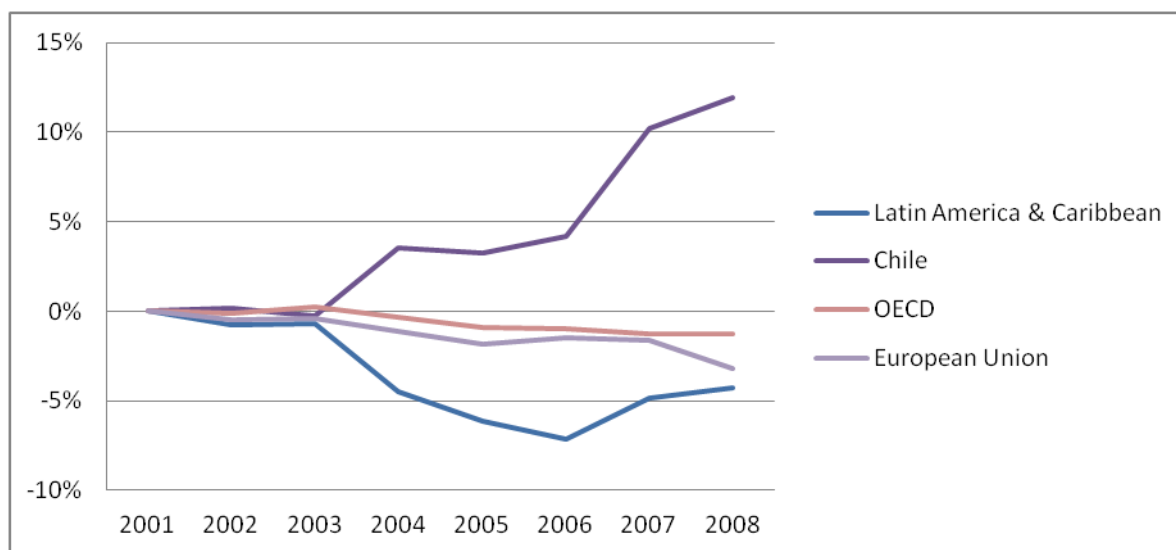
11.2. Appendix 2: Chile GHG Emission Trends

Figure 1 - CO₂ Intensity: Tonnes of CO₂/GDP



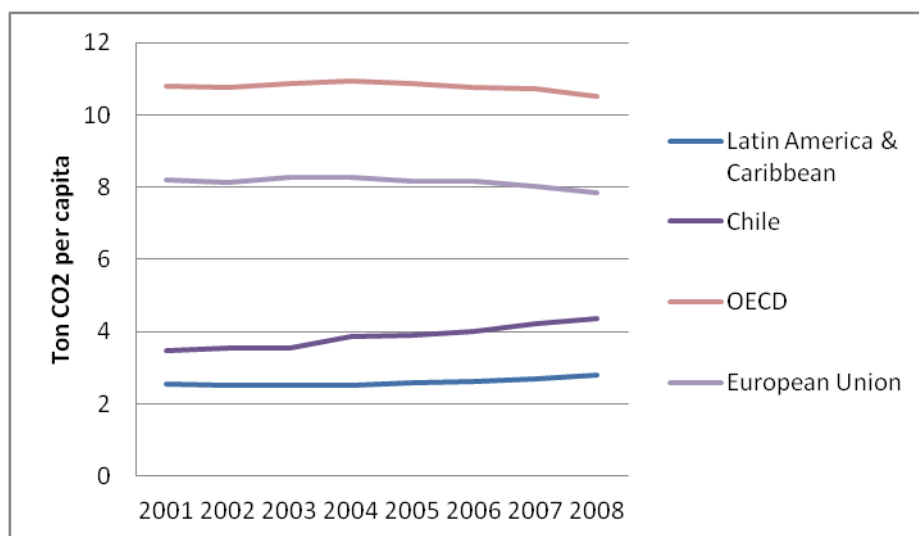
Source: Self-elaboration using data from the World Bank (2012)

Figure 2 - Percentage change in total CO₂ emissions relative to 2001 emissions



Source: Self-elaboration using data from the World Bank (2012)

Figure 3 - CO₂ emissions per capita



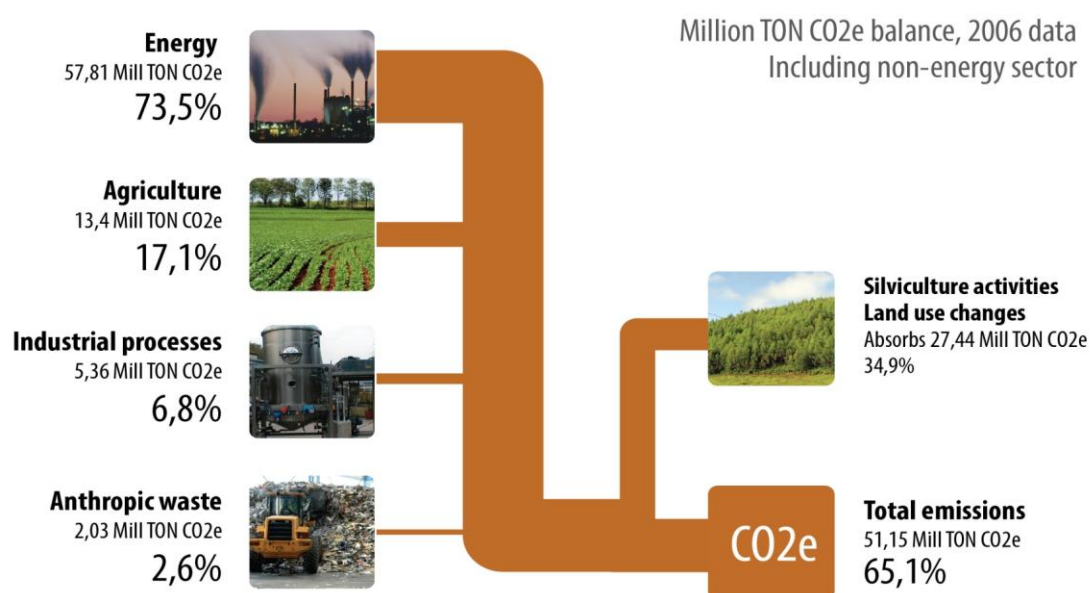
Source: Self-elaboration using data from the World Bank (2012)

Reference

World Bank. 2012. *The World Bank Open Data*. Available at <http://data.worldbank.org>, accessed July 2012.

11.3. Appendix 3: Sector Contribution to National GHG Emissions

Figure 1: Total emissions by sector (2006)



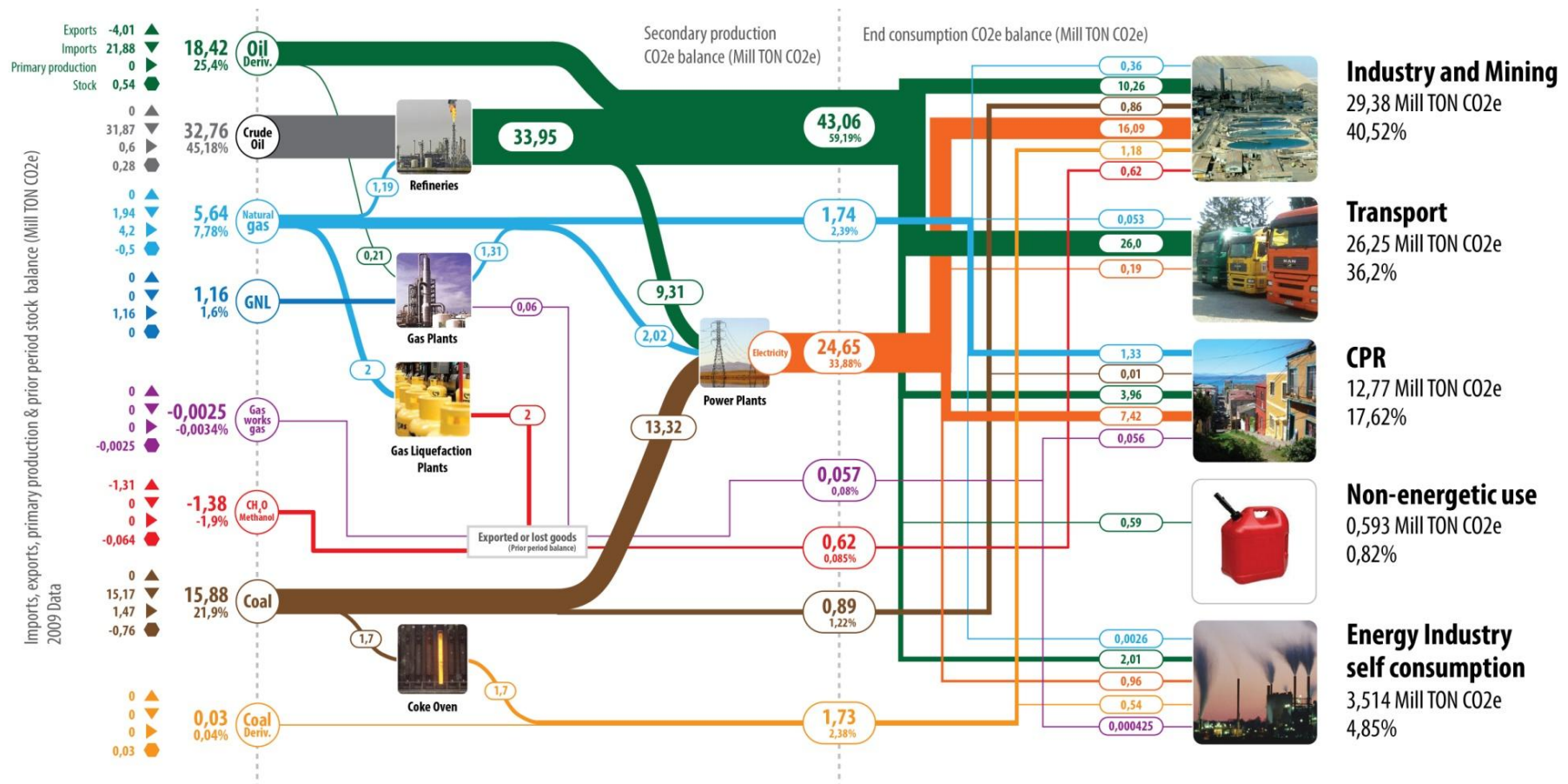
Source: Self-elaboration using data from Ministerio del Medio Ambiente (2011)

Reference

Chilean Ministry of Environment. 2011. *Segunda Comunicación Nacional de Chile ante la Convención Marco de las Naciones Unidas Sobre Cambio Climático*, UNFCCC, Bonn, Germany. Available at http://unfccc.int/resource/docs/natc/snc_chile_spanish.pdf

11.4. Appendix 4: GHG Emissions Across Energy Sector Supply Chain in Chile

Figure 1 - Carbon trace of the 2009 CO₂ emissions (Energy Sector) from supply to Consumers



Source: Self-elaboration using data from Eggleston et al (2006) and CNE (2011)

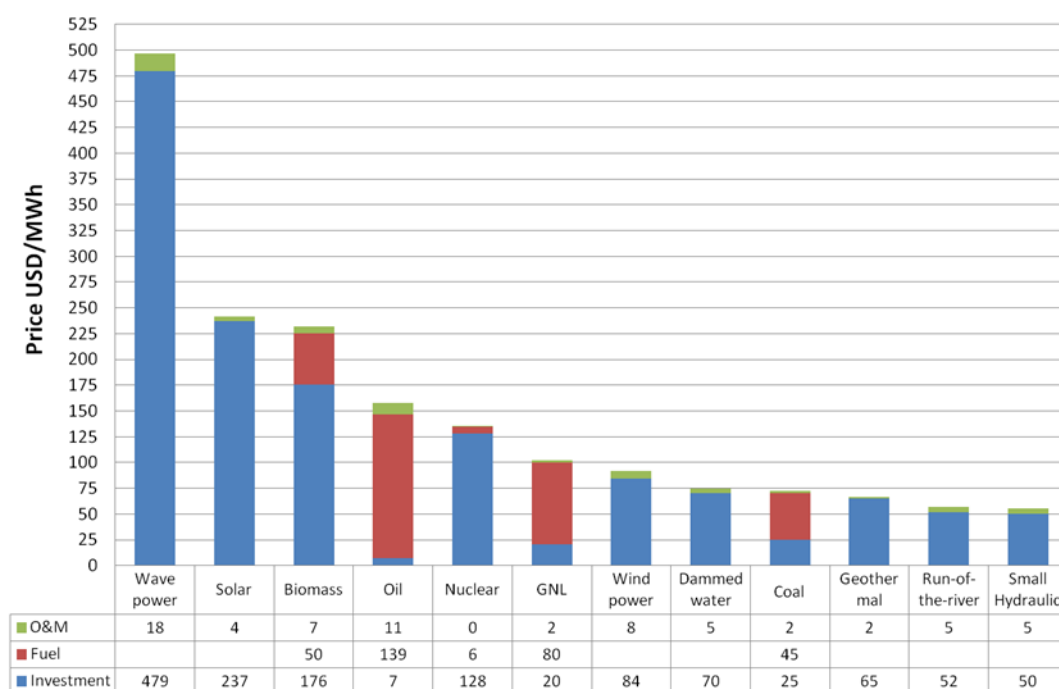
References

- Eggleston, S., L. Buendia, K. Miwa, T. Ngara and K. Tanabe. 2006. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Hayama, Japan: Institute for Global Environment Strategies.
- Comisión Nacional de Energía. 2011. *Balance Nacional de Energías 2009*. Santiago, Chile: CNE.

11.5. Appendix 5: Impact of Carbon Price on Electricity Generation Costs in Chile

Absent other instruments such as quotas on renewable energy or subsidies, an important research question is whether a carbon price is high enough to promote the introduction of cleaner technologies in Chile that can displace more conventional and dirtier technologies (carbon, coal and diesel). Figure 1 shows our analysis of the levelised costs of electricity (LCE) for different technologies in Chile, without a carbon price.

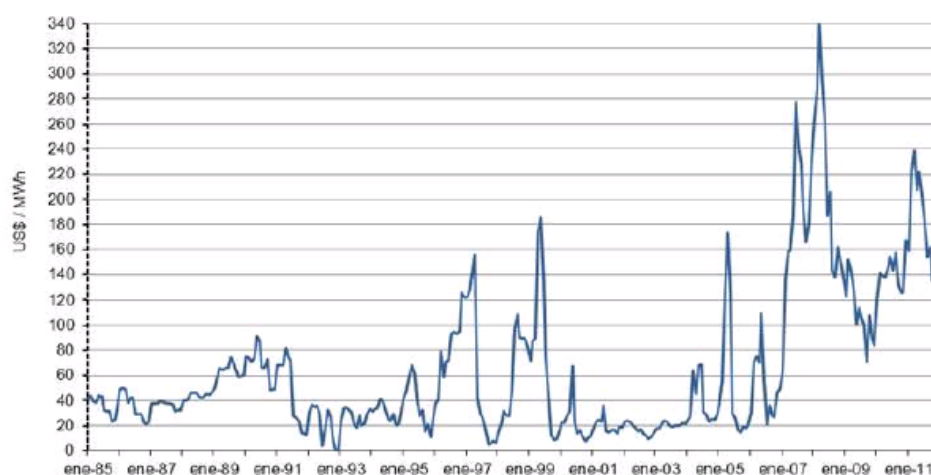
Figure 1 - Energy generation costs without CO₂e price



Source: Self-elaboration using data from Borregaard and Katz (2009)

As Figure 2 illustrates, the current marginal costs of generation in Chile have risen from levels of US\$60/MWh (with the exception of some dry years) to levels of US\$300/MWh in 2007. This happened in part because Chile lost the supply of natural gas from Argentina. Considering that more than 30% of the electricity is generated with this fuel, the cost of electricity generation changed dramatically from the switch from cheap Argentinean gas to expensive diesel. Since this crisis, Chile has not been able to reduce generation costs below levels of US\$150/MWh and most of the variability of this cost is related to the price of crude oil; even the introduction of coal-fired power plants has not been effective at reducing the costs of electricity in Chile. Although it might be expected that with high electricity prices renewable energy sources like wind, geothermal and hydro would enter the system, this has not happened and only coal-fired generation has increased.

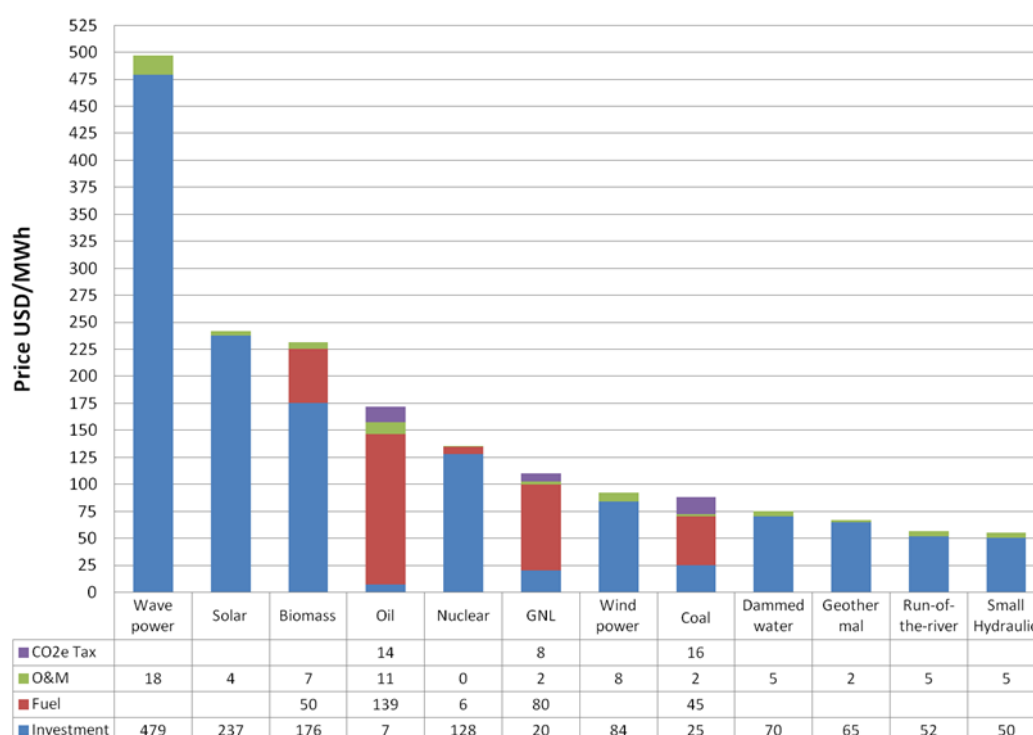
Figure 2 - SIC marginal costs
(Central interconnected system of electricity transmission)



Source: Chilean Ministry of Energy (2011)

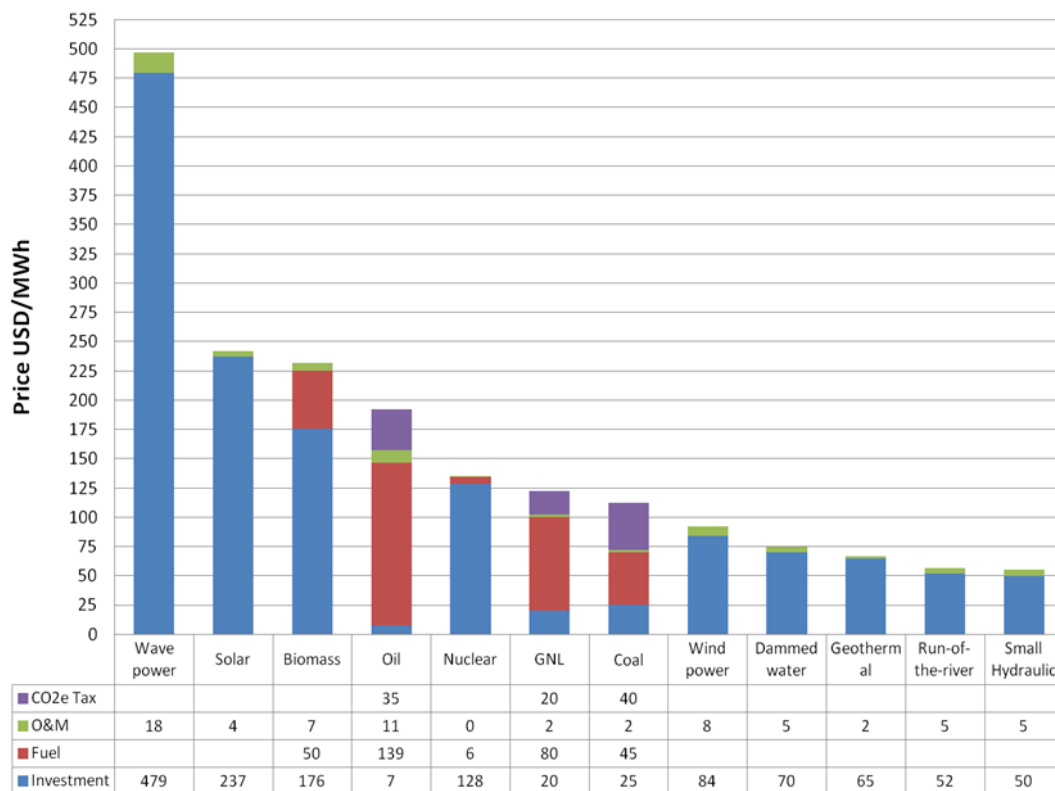
If we concentrate only on the substitution between coal and natural gas, the graph in Figure 3 indicates that only carbon prices above 50 US\$/tonne CO₂ will displace coal. The competitiveness of renewable energy hardly changes, even with levels of 100 US\$/tonne CO₂. This calls into question why the cost of LNG is so high in Chile. This is in part due to existence of long-term LNG contracts above current spot prices, because these contracts were made at the beginning of 2008, when natural gas was at a maximum historical price.

Figure 3 - Energy generation costs with CO₂e price of 20 US\$/tonne CO₂e



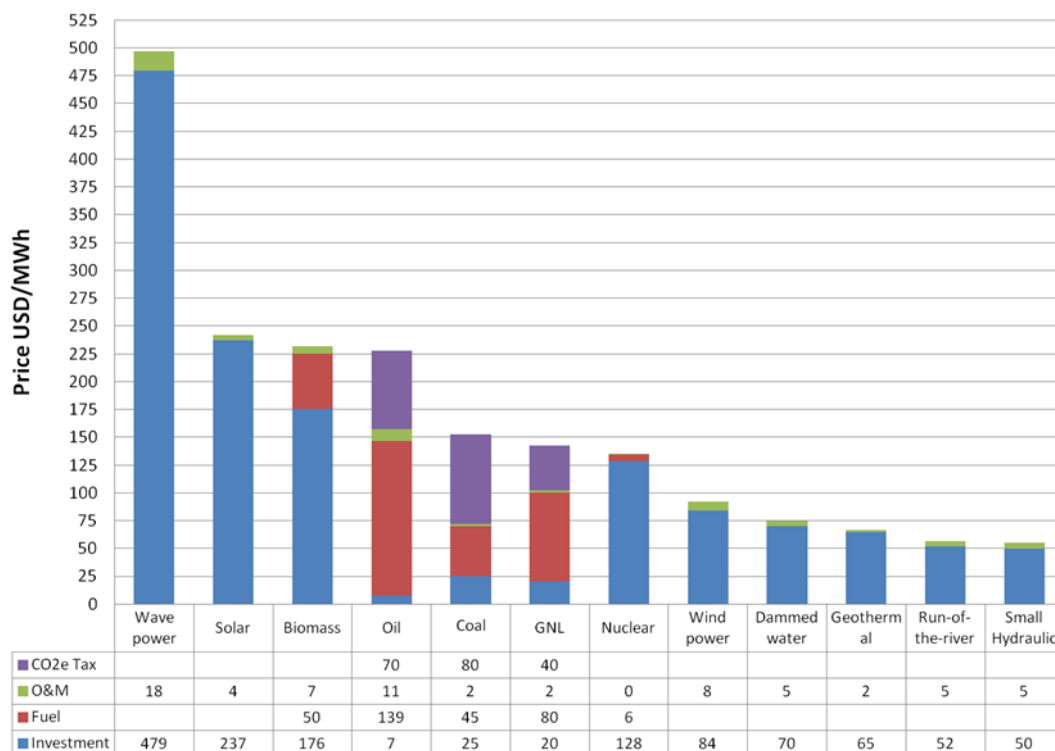
Source: Self-elaboration using data from Borregaard and Katz (2009)

Figure 4 - Energy generation costs with CO₂e price of 50 US\$/tonne CO₂e



Source: Self-elaboration using data from Borregaard and Katz (2009)

Figure 5 - Energy generation costs with CO₂e price of 100 US\$/tonne CO₂e



Source: Self-elaboration using data from Borregaard and Katz (2009)

References

- Borregaard, N, and R Katz. 2009. *Opciones para la Matriz Energética Eléctrica: Insumos para la Discusión*, Chile: Fundación Futuro Latinoamericano.
- Chilean Ministerio de Energía. 2011. “Report of the Comisión Asesora de Desarrollo Eléctrico,” Ministerio de Energía, Santiago, Chile. Available at <http://www.minenergia.cl/comision-asesora-para-el-desarrollo.html>

11.6. Appendix 6: Preliminary Economic Modelling of Alternative ETS Scenarios for Chile

Executive Summary¹⁵⁸

Chile has pledged within the framework of the Copenhagen Accord of 2009 to take nationally appropriate mitigation actions in order to achieve a 20% deviation below the business-as-usual (BAU) emissions growth trajectory by 2020, as projected from the year 2007. Energy efficiency, renewable energy and land-use and forestry measures will be the main focus of Chile's nationally appropriate mitigation actions. To accomplish this objective, Chile plans on rely on a relevant level of international support.¹⁵⁹

This preliminary study considers the effects of achieving this goal by means of a carbon market in Chile based on the most recent and detailed analysis commissioned by Chile's government to project emissions and estimate emission reduction costs.¹⁶⁰ This analysis conducted by POCH and Centro de Cambio Global at Pontificia Universidad Católica de Chile (2010) considers two different business-as-usual (BAU) emissions growth scenarios for the country: AZUL and NEGRO with moderate and higher emissions projections, respectively. For each scenario, the study provides a range of mitigation potential based on the penetration of the mitigation technology options. The summary discussion below and figures 1-10 focus on the more moderate growth AZUL scenarios. Results from higher emissions scenarios, including alternative modelling by the University of Chile (2009), are reported in tables 1-8.¹⁶¹

Preliminary modelling of the effects of achieving that goal by means of a carbon market in Chile shows that:

- 1) Under a cost-effective policy, such as emissions trading, including the energy sector and major industrial processes of the Chilean economy (but excluding agriculture, waste, and forestry), Chile could achieve about half of the 97 million tons required to meet our modeled target for 2015-2020 (reducing emissions in a straight line from 2015 down to -20% below business-as-usual emissions in 2020). Given a policy to linearly reduce emissions over 2015-2020, Chile could reduce emissions by -7.5% relative to BAU in 2020 and around 44 million tons of emissions over 2015-2020 with actions in just the domestic energy and industry sectors.¹⁶² Achieving these goals relies on inter-temporal flexibility, the possibility of 'banking' excess reductions for use in meeting obligations in future years (figure 1). The estimated net present value costs of achieving this policy are USD\$10 million dollars (and a

¹⁵⁸ Analysis conducted by Pedro Piris-Cabezas and Ruben Lubowski, Environmental Defense Fund. For correspondence, please contact: rlubowski@edf.org.

¹⁵⁹ Chile's submission to the UNFCCC Secretariat (August 23, 2010), available at:

http://unfccc.int/files/meetings/cop_15/copenhagen_accord/application/pdf/chilecphaccord_app2.pdf

¹⁶⁰ POCH and Centro de Cambio Global at Pontificia Universidad Católica de Chile: "Análisis de Opciones Futuras de Mitigación de Gases de Efecto Invernadero para Chile en el Sector Energía" (2010), a report commissioned by la Comisión Nacional del Medio Ambiente (CONAMA) and Comisión Nacional de Energía (CNE).

¹⁶¹ We considered alternative emission reduction cost estimates for the mining, industrial, energy, transport, residential, public services and commercial sectors from the University of Chile's 2009 study commissioned by public utility Endesa Latinoamérica: "Energy Consumption, Greenhouse Gas Emissions and Mitigation Options for Chile, 2007-2030."

¹⁶² Greater percentage and absolute reductions are achievable under the higher business-as-usual emissions scenarios, but only the scenario from UC/ENDESA includes enough reduction potential to achieve a linear reduction to the -20% target relative to the projection for 2020 through actions in the domestic energy and industry sectors alone.

marginal cost or carbon price of \$5.3/tCO₂e in 2015, rising at 5% per year). Costs fall to just \$2 million with maximum technology penetration (with a price of just \$0.2/CO₂e in 2015). These estimated costs do not take into account substantial estimated savings from the mitigation activities with negative costs (i.e. positive benefits), which throughout this preliminary analysis are, to be conservative, assumed to have zero costs. About two thirds of the reductions are from the power sector, with the remainder roughly split between industry and transport (figure 2).

- 2) In the hypothetical case that the country adopts a longer-term policy horizon, with a credible and anticipated target of -15% below BAU for 2030, Chile's energy and industry sectors could reduce 215 million tons of emissions by 2030, close to the maximum total potential based on the estimated marginal cost curves for those sectors (figure 3). These reductions would have an estimated net present value cost of \$1.4 billion (with a marginal price of \$53/tCO₂e in 2015, rising at 5% per year). These costs fall to just \$0.1 billion (\$29/tCO₂e in 2015) with maximum technology penetration.
- 3) Broadening the range of mitigation options from other sectors lowers costs and enables larger scale reductions. For the scenario that reduces BAU emissions by -7.5% in 2020 and -15% in 2030, a cost-effective approach for including forestry and agriculture would lower Chile's estimated costs by 85% (58%) based on a conservative estimate of forestry/agriculture mitigation potential and normal (maximum) technology penetration (table 3.1).¹⁶³ This would lower costs to \$217 (\$56) million and the carbon price to \$7.6 (\$3.9) per ton of CO₂e in 2015 (rising at 5%). Based on these scenarios and normal (maximum) technology penetration, Chile would achieve about 78% (94%) of the targeted reductions from the energy/industry sectors and 22% (6%) from forestry/agriculture (an average of about 3 million tons/year from 2015 to 2030) (figure 5).¹⁶⁴
 - Alternative cost curves for the waste, agriculture and forestry sectors generate higher potential reductions of 1, 5 and 15 million tons of CO₂e/year, respectively, for a cost of \$6/tCO₂e.¹⁶⁵ Given such higher estimates from forestry/agriculture and the inclusion of mitigation from the waste sector, Chile could achieve a more ambitious target of -20% and -30% relative to projections for 2020 and 2030, respectively (figure 6). This translates to reductions of 505 million tons of emissions by 2030, or

¹⁶³ The marginal abatement cost (MAC) curves for agriculture and forestry sectors are based on the 2011 report by Centro de Cambio Global de la Pontificia Universidad Católica de Chile (CCG-UC): "Análisis de Opciones Futuras de Mitigación de GEI para Chile asociadas a Programas de Fomento del Sector Silvoagropecuario," commissioned by la Comisión Nacional del Medio Ambiente (CONAMA). Although this analysis focuses on both the forestry sector and the agriculture, virtually all the mitigation potential from this set of MAC curves resides in the forestry sector. The CCG-UC report estimates forestry sector mitigation potential that is additional to that estimated by Infor/ODEPA (2010) for the implementation of Law 20.283 of 2008 about native forest recovery and the promotion of the forestry sector. Infor/ODEPA (2010): "Potencial de mitigación del cambio climático asociado a la Ley sobre la recuperación del bosque nativo y fomento forestal", available at:

http://www.odepa.gob.cl/odepaweb/servicios-informacion/publica/Estudio_mitigacion_cambio_climatico.pdf. Absent reliable MAC curves for the waste sector, we consider that the sector does not generate any abatement in this scenario.

¹⁶⁴ For the prices in this scenario, there is almost no forestry and agriculture abatement until 2020 and an average of about 5 million tons/ year over 2021–2030.

¹⁶⁵ The figures for waste and agriculture are a fraction of the historical annual emissions. The estimate for forestry is based on the "low penetration" scenario in Mosnaim (2001) based on estimates from Noe (1999). See: Mosnaim, Ariel. 2001. "Estimating CO₂ abatement and sequestration potentials in Chile." *Energy Policy* 29: 631-640; and Noe, D (1999). "Costos y potenciales de captura de carbono para el sector forestal en Chile. Ingeniería Industrial. Pontificia Universidad Católica de Chile. Santiago, Chile.

more than double the reductions in the case of -15% in 2030. Chile's estimated costs through 2030 would amount to \$649 (\$499) million (and the carbon price to \$7.6 (\$4.0) per tCO₂e in 2015 under normal (maximum) technology penetration. Under these scenarios, Chile would achieve about 33-40% of the targeted reductions from the energy/industry sectors and 60-67% from agriculture, waste and forestry. If the country could also use early emissions reductions from 2013-2014 to meet its target, compliance the costs would fall to \$470-\$596 million and the carbon price to \$3.5-\$4.3/tCO₂e in 2015 (table 3.2).

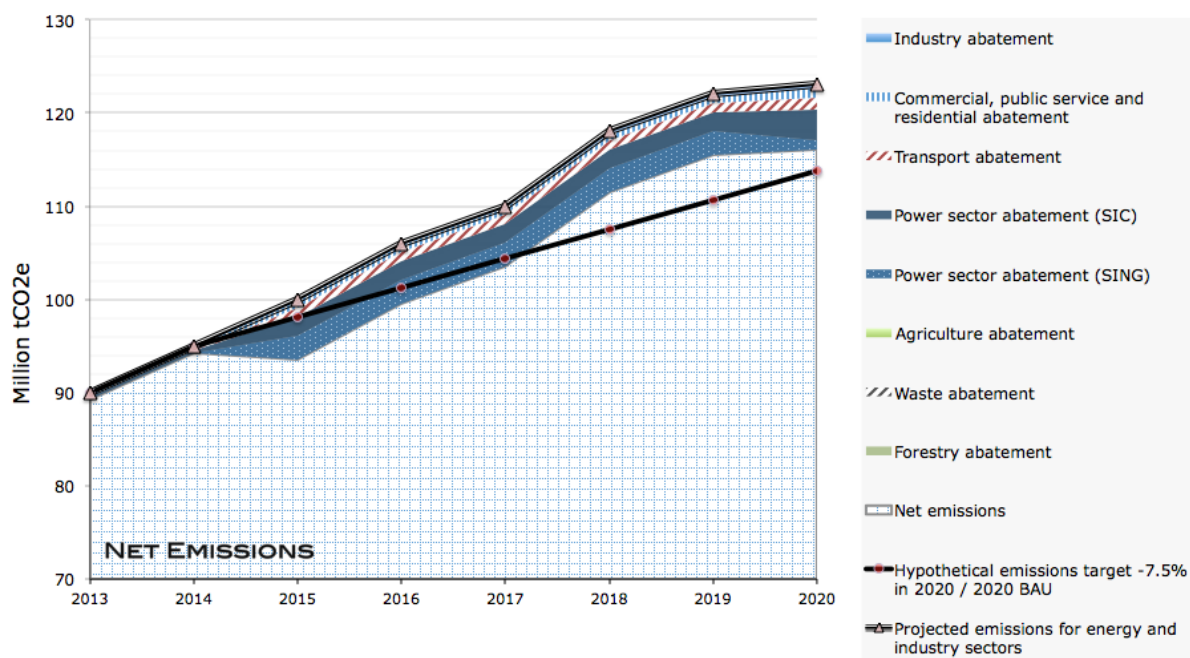
- The alternative forestry, agriculture, and waste estimates also enable an even more ambitious emissions reduction scenario that would keep emissions constant after 2025. In such a scenario, Chile's costs through 2030 would be \$1.3 (\$0.7) billion (with a carbon price of \$38.1 (\$5.0) per ton in 2015) under normal (maximum) technology penetration. Chile would achieve cumulative reductions of 569 million tons, including early action reductions from 2013-2014 (figure 8 and table 5). Under this scenario, Chile would achieve about one third (34-36%) of its targeted reductions from the energy/industry sectors and two thirds (64-66%) from agriculture, waste and forestry.
- 4) Linking Chile's emissions trading system to the international carbon market(s) could generate international revenues to help cover or even exceed domestic costs. For the scenario with targeted reductions of -20% in 2020 and -30% in 2030, an international carbon price of \$19.1 (\$10.5) per tCO₂ in 2015, rising at 5% per year, would generate sufficient international revenues to cover program costs based on normal (maximum) technology penetration. International revenues from selling reductions of 44 (88) million tCO₂ beyond the country's 2015-2030 targets would fund all the costs of the program so the country would "break even" on its total emission reduction costs (table 4).
- For an international carbon price of \$10/tCO₂e in 2015 (rising 5% per year), Chile could sell around 44 (84) million tCO₂e depending on normal (maximum) technology penetration, helping to significantly cover aggregate program costs. Given normal (maximum) technology penetration, this increases reductions by 9% (17%) and generates international revenues that lower the aggregate net costs by 42% (93%) through 2030 to \$374 (\$35) million for the case of early action from 2013-2014 (table 4).
 - If the international carbon market price were \$20/tCO₂e in 2015 (rising 5% per year), the revenues from selling 45 (84) million tons internationally would more than cover the program costs and yield a net benefit of \$24 (\$742) million over and above the total costs of the program given normal (maximum) technology penetration and early action from 2013-2014 (table 4).
- 5) Rather than relying on additional domestic emissions reductions from forestry or other sectors, Chile could also contain costs by including flexibility to purchase credits from international markets, including through potential bilateral arrangements. For example, for marginal costs on the order of \$1/ton, Brazil's state of Acre could generate an estimated 168 million tons of deforestation emissions reductions, based on a conservative proposed baseline in its state plan for 2006-2020. Chile could also buy certified emissions reductions (CERs) from the clean development mechanism (CDM), currently trading at about \$3/tCO₂e.

- For the case of the more stringent target that levels emissions over 2025-2030, if Chile had flexibility to meet its targets through unlimited purchases of international credits at the current price of CERs of \$3.2/ton of CO₂, total costs through 2030 would be about \$808 (\$564) million, including 108 (67) million international credits purchased, based on normal (maximum) technology penetration (table 7). This translates to a cost reduction of 37% (20%) through the purchase of international credits equal to 19% (12%) of total reductions. The carbon price would be \$3.5 in 2015, rising at 5%.
- 6) Constraining the amount of international credits to 5% of total abatement would only modestly affect cost savings to the country as a whole and raise the carbon price. Chile's costs through 2030 would fall by 38% (4%) and be about \$802 (\$677) million with a carbon price of \$3.9 (\$3.5) per ton in 2015, rising at 5% in the case of normal (maximum) technology penetration.¹⁶⁶ The cumulative reductions achieved are 569 million tCO₂e, including 87 million CERs and/or other international credits (table 8). If allowance sales are possible internationally, the country as a whole may buy lower cost credits as well as sell international allowances at a higher price.
- If Chile could sell its allowances at an international carbon allowance price of \$10/tCO₂e in 2015, rising 5% per year, Chile would purchase 87 million tons of credits to help meet its target and then sell around 65 (106) million tCO₂e of reductions at the higher international allowance price. This would generate international revenues that would lower net costs by 65% (84%), with a net present value of costs of \$450 (\$112) million through 2030 given normal (maximum) technology penetration.
 - If the international allowance price were \$20/tCO₂e in 2015 (rising 5% per year), the revenues from selling 67 million tons internationally would reduce net program costs by 81% in the case of normal technology penetration, for a net cost of \$151 million dollars. In the case of maximum technology penetration, international sales of 106 million are enough to more than cover total program costs, yielding a net aggregate benefit of \$873 million over and above the total program costs.

¹⁶⁶ Costs to the country as a whole are actually slightly less when international purchases are restricted in this scenario as the cost of international credits is the full international price while domestic mitigation costs are only the area under the cost curve. This is because profits earned by foreign sellers are considered a cost from the country's perspective while profits earned from internal allowance trades by any domestic sellers are just considered a transfer among domestic actors, rather than an overall cost to the country.

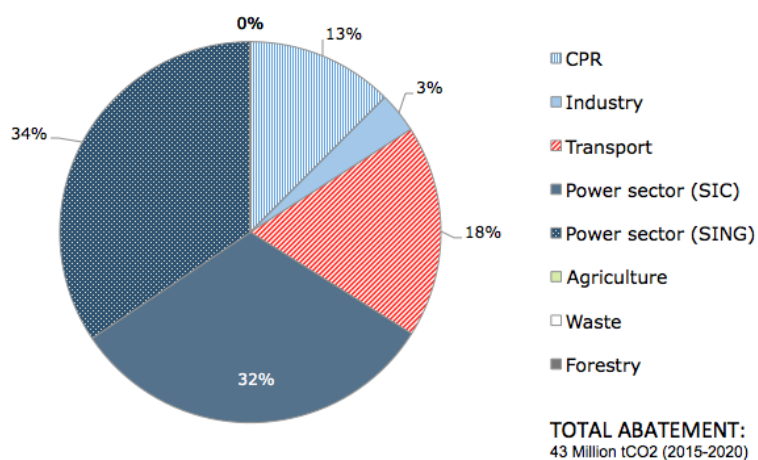
FIGURES

Figure 1: Potential emissions and reductions from Chile to meet hypothetical reduction target domestically through 2020 via energy/industry sectors alone, with banking of reductions



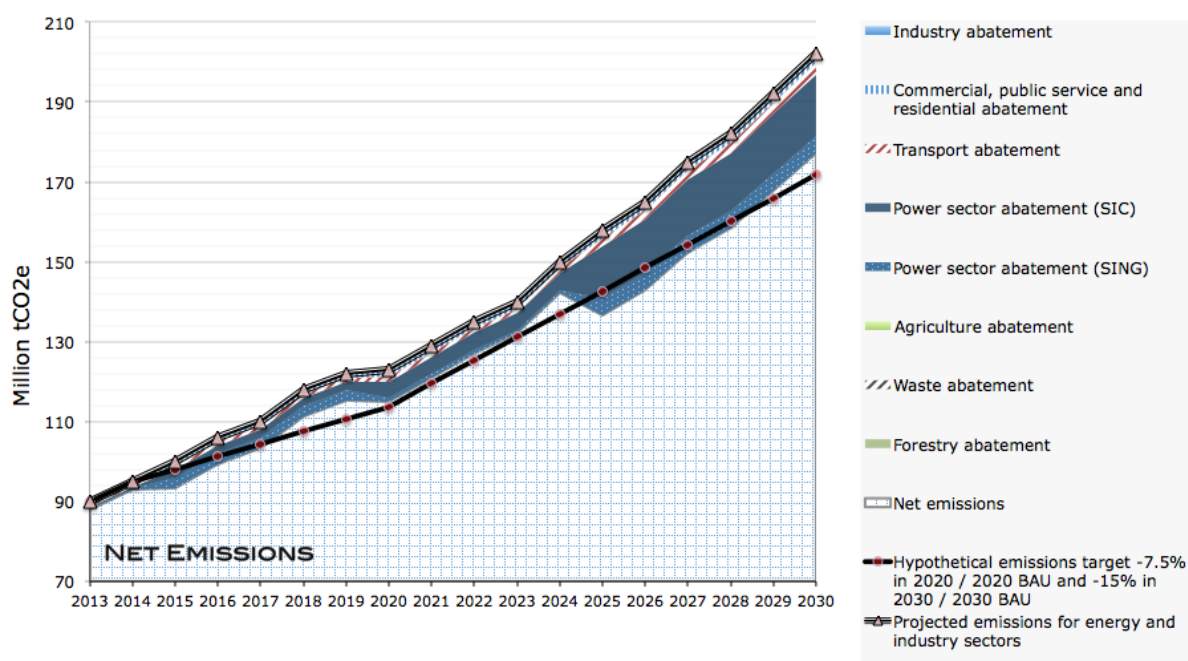
Note: Based on AZUL moderate emissions growth scenario from POCH-UC (2010).

Figure 2: Least-cost composition of emissions reductions from Chile to meet hypothetical reduction target domestically through 2020 via energy/industry sectors alone, with banking of reductions



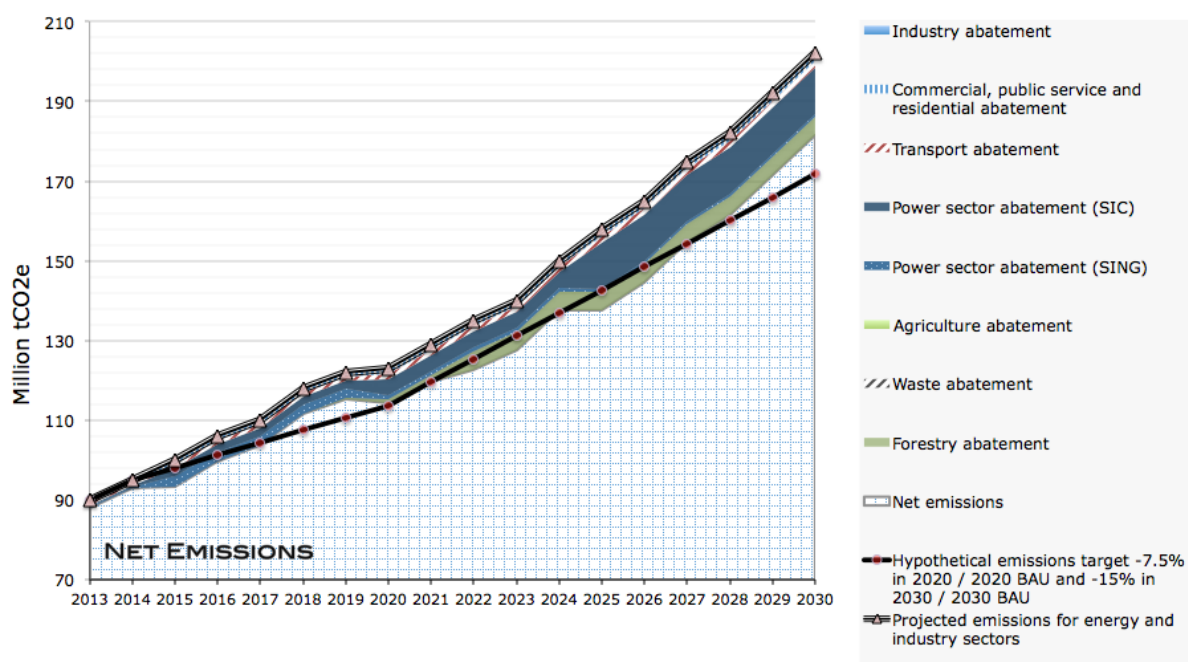
Note: These estimates correspond to the scenario shown in figure 1.

Figure 3: Potential emissions and reductions from Chile to meet hypothetical reduction target domestically through 2030 via energy/industry sectors alone, with banking of reductions



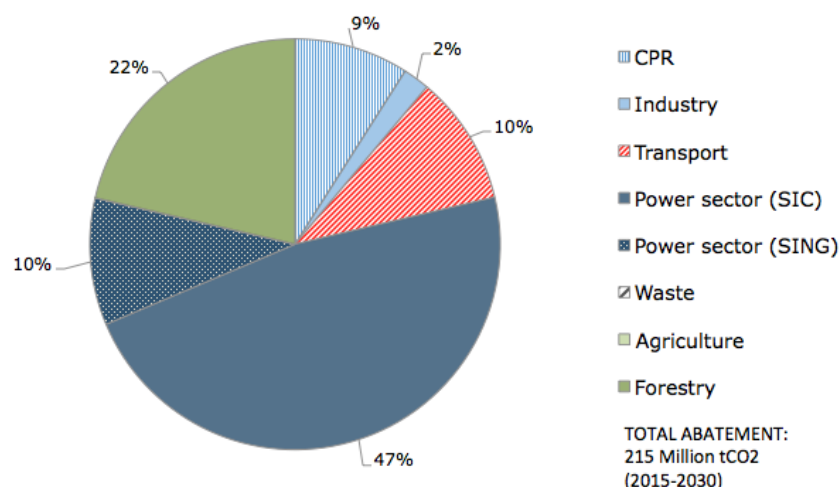
Note: Based on AZUL moderate emissions growth scenario from POCH-UC (2010).

Figure 4: Potential emissions and reductions from Chile to meet hypothetical reduction target domestically through 2030 with energy/industry sectors plus forestry and agriculture, with banking of reductions



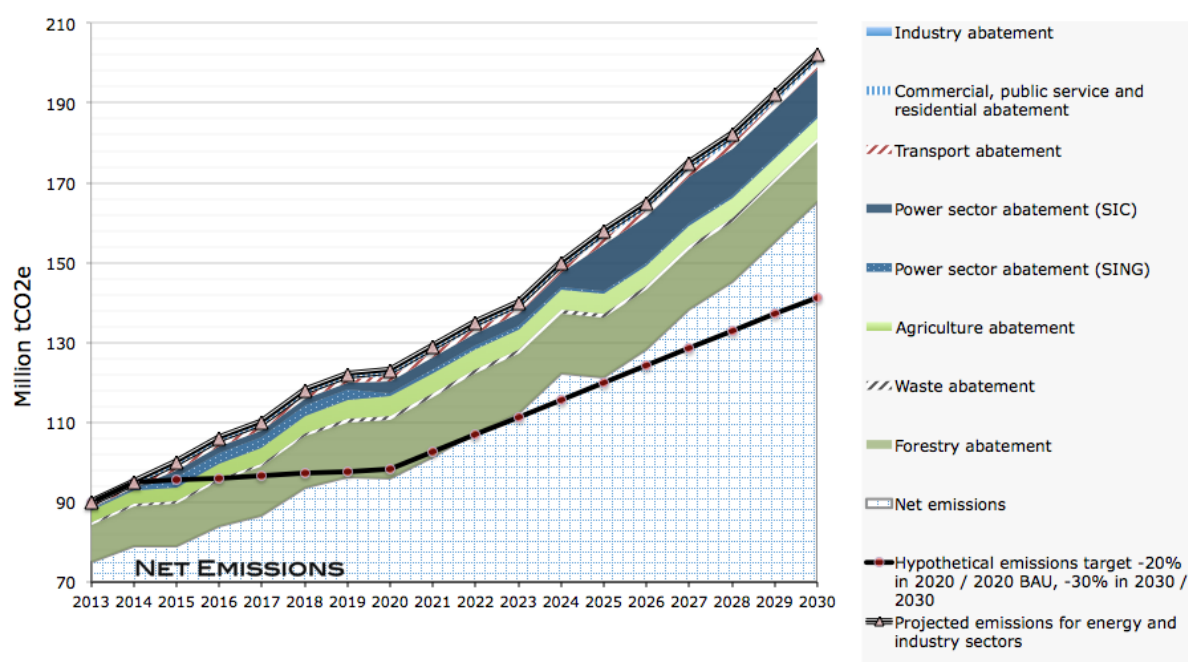
Note: Based on AZUL moderate emissions growth scenario from POCH-UC (2010) and forestry and agriculture mitigation of about 3 million tCO₂e/year based on estimates from CCG-UC (2010).

Figure 5: Least-cost composition of emissions reductions from Chile to meet hypothetical reduction target domestically through 2020 with energy/industry sectors plus forestry and agriculture, with banking of reductions



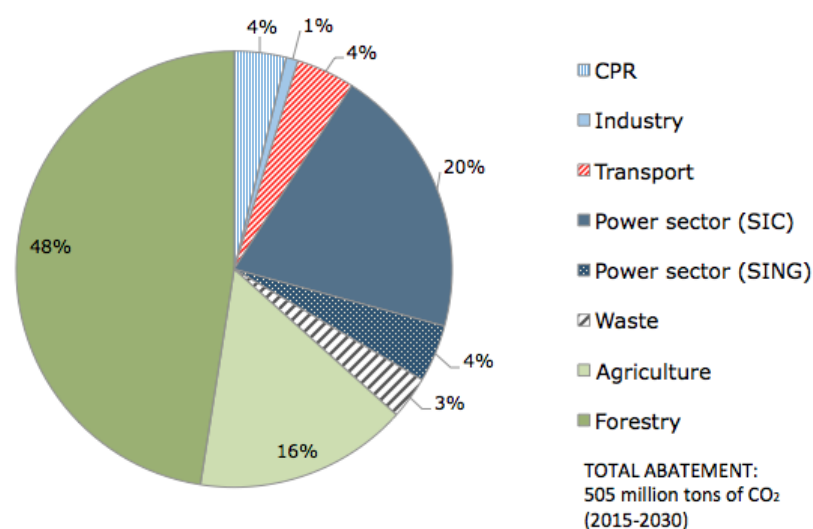
Note: These estimates correspond to the scenario shown in figure 4.

Figure 6: Potential emissions and reductions from Chile to meet hypothetical reduction target through 2030 with energy/industry sectors plus alternative waste, agriculture, and forestry potential estimates, with banking of reductions and early action from 2013–2014



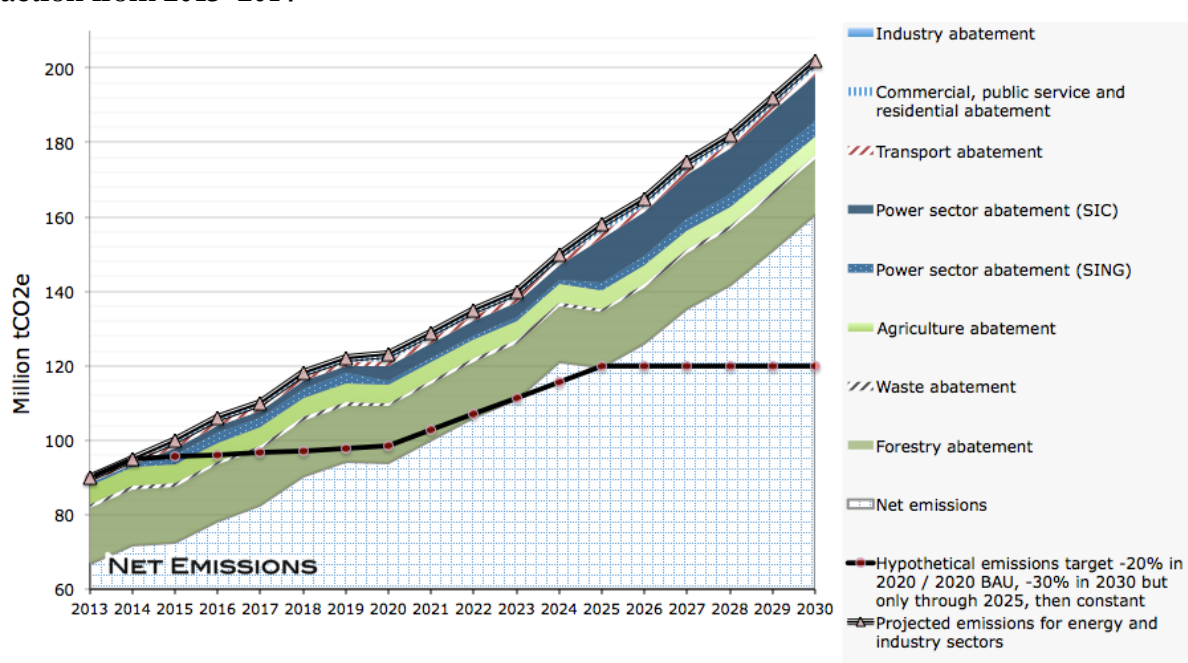
Note: Based on AZUL moderate emissions growth scenario from POCH-UC (2010), a hypothetical target of -20% in 2020 and -30% in 2030 relative to BAU, and alternative cost curves for the waste, agriculture and forestry sectors with potential reductions of 1, 5 and 15 million tCO₂e/year, respectively.

Figure 7: Least-cost composition of emissions reductions from Chile to meet hypothetical reduction target domestically through 2030 via energy/industry/waste/agriculture/forestry sectors alone, with banking of reductions



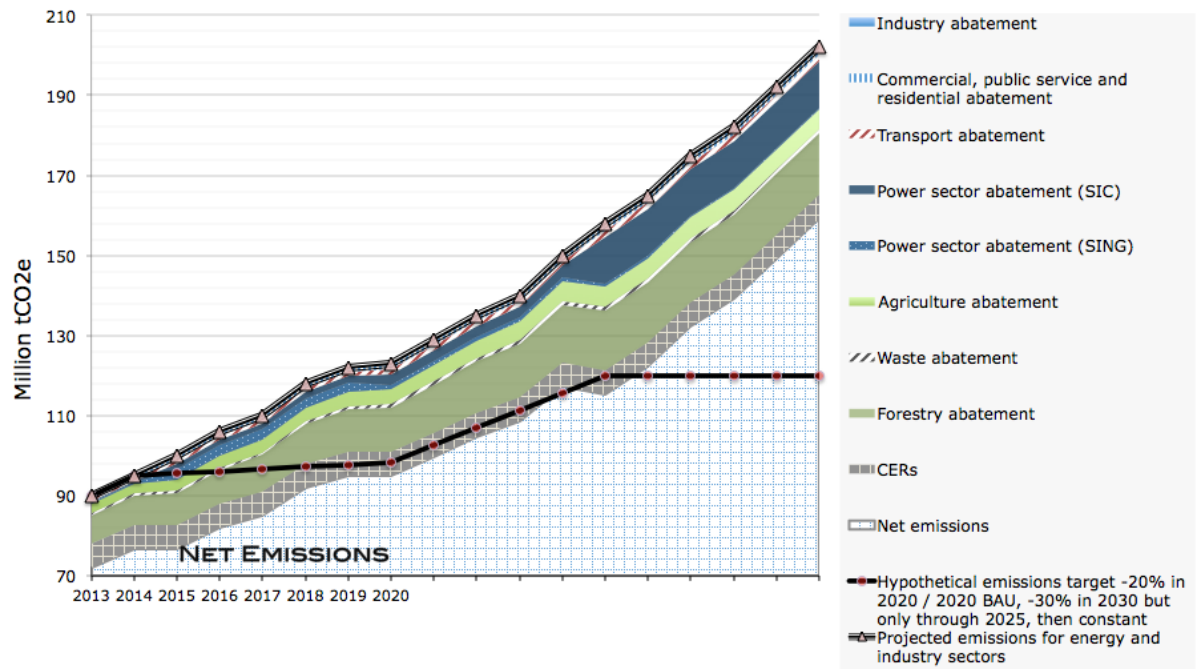
Note: These estimates correspond to the scenario shown in figure 6.

Figure 8: Potential emissions and reductions from Chile to meet more stringent hypothetical reduction target through 2030 with energy/industry sectors plus alternative waste, agriculture, and forestry potential estimates, with banking of reductions and early action from 2013–2014



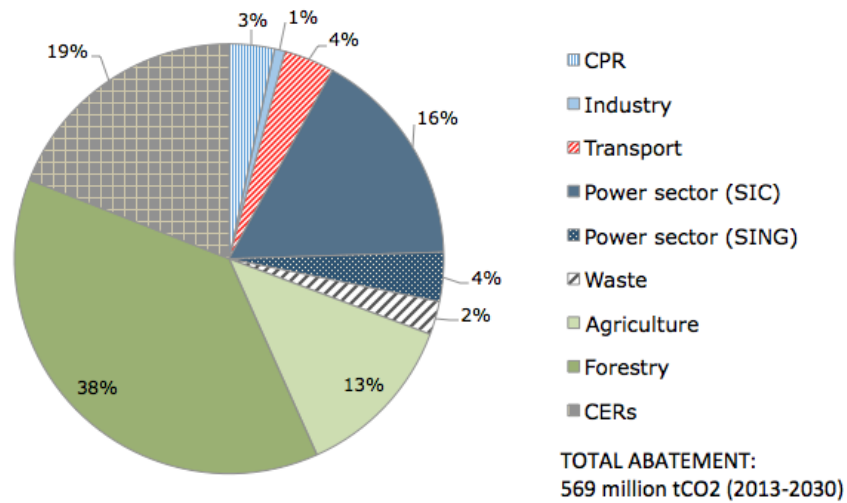
Note: Based on AZUL moderate emissions growth scenario from POCH-UC (2010) and a hypothetical target as in figure 6 through 2025 and then keeping emissions constant over 2025–2030.

Figure 9: Potential emissions and reductions from Chile to meet more stringent hypothetical reduction target through 2030 with energy/industry sectors plus alternative waste, agriculture, and forestry potential estimates and unlimited purchases of CERs or other low-cost international credits, with banking of reductions and early action from 2013-2014



Note: Based on AZUL moderate emissions growth scenario from POCH-UC (2010) and a hypothetical target as in figure 6 through 2025 and then keeping emissions constant over 2025-2030.

Figure 10: Least-cost composition of emissions reductions from Chile to meet hypothetical reduction target domestically through 2030 via energy/industry/waste/agriculture/forestry sectors and unlimited CERs, with banking of reductions



Note: These correspond to the scenario shown in figure 9.

TABLES

Table 1: Targets, abatement, price and costs for a policy with a 2020 time horizon: comparative analysis

	<i>Target relative to BAU in 2020*</i>	<i>Abatement (2015- 2020) (million tCO_{2e})</i>	<i>2015 Price (USD\$/tCO_{2e})</i>	<i>Total Cost (NPV million USD\$)</i>
AZUL normal	-7.50%	43.5	5.2	10
AZUL maximum	-7.50%	43.5	0.2	2
NEGRO normal	-11%	70	14.1	95
NEGRO maximum	-11%	70	0	0
UC (ENDESA)	-20%	107	16	70

*The AZUL and NEGRO scenarios have alternative targets for 2020 because there are not enough mitigation options to achieve the -20% target. Under AZUL and NEGRO we adopt the more ambitious targets achievable at reasonable prices for the "normal" cases.

Table 2: 2030 time horizon flexibility

	<i>Target relative to BAU in 2020 and 2030</i>	<i>Abatement (2015-2030) (million tCO_{2e})</i>	<i>2015 Price (USD\$/tCO_{2e})</i>	<i>Total Cost (NPV million USD\$)</i>
AZUL normal	-7.5% and -15%	215	52.5	1,430
AZUL maximum	-7.5% and -15%	215	29.4	134
NEGRO normal	-11% and -18%	347	50.4	789
NEGRO maximum	-11% and -18%	347	10.1	177
UC (ENDESA)	-20% and -30%	658	33	2,400

*The AZUL and NEGRO scenarios have alternative targets for 2020 because there are not enough mitigation options to achieve the -20% target. Under AZUL and NEGRO we adopt the more ambitious targets achievable at reasonable prices for the "normal" cases.

Table 3.1: Scenarios with inclusion of agriculture and forestry sectors

	<i>Target relative to BAU in 2020 and 2030*</i>	<i>Abatement (2015- 2030) (million tCO₂e)</i>	<i>2015 Price (USD\$/tCO₂e)</i>	<i>Cost (NPV million USD\$)</i>
AZUL normal	-7.5% and -15%	215	7.6	217
AZUL maximum	-7.5% and -15%	215	3.9	56
NEGRO normal	-11% and -18%	347	9.3	325
NEGRO maximum	-11% and -18%	347	4.3	89
UC (ENDESA)	-20% and -30%	658	19.3	1,349

*The AZUL and NEGRO scenarios have alternative targets for 2020 because there are not enough mitigation options to achieve the -20% target. Under AZUL and NEGRO we adopt the more ambitious targets achievable at reasonable prices for the "normal" cases.

Note: Based on estimates from CCG-UC (2011) described in text.

Table 3.2: Alternative agriculture and forestry MAC curves and waste sector, with and without early action before 2015

	<i>Target relative to BAU in 2020 and 2030</i>	<i>Abatement (2015-2030) (million tCO₂e)</i>	<i>2015 Price (USD\$/tCO₂e)</i>	<i>Cost (NPV million USD\$)</i>
	With (and without) early action			
AZUL normal	-20% and -30%	505	4.3 (7.6)	596 (649)
AZUL maximum	-20% and -30%	505	3.5 (4.0)	470 (499)
NEGRO normal	-20% and -30%	618	4.3 (7.2)	581 (631)
NEGRO maximum	-20% and -30%	618	3.5 (3.9)	444 (472)
UC (ENDESA)	-20% and -30%	658	2.0 (2.1)	155 (200)

Note: Based on alternative agriculture and forest MACs described in footnote 163.

Table 4: Scenarios with international linking at \$10 and \$20 prices in 2015

	<i>Allow- ances sold int. (million tCO₂e)</i>	<i>Price (USD\$/ tCO₂e)</i>	<i>Cost (NPV million USD\$)</i>	<i>Allow- ances sold int. (million tCO₂e)</i>	<i>2015 Price (USD\$/ tCO₂e)</i>	<i>Cost (NPV million USD\$)</i>	<i>Allow- ances sold int. (million tCO₂e)</i>	<i>Price (USD\$/ tCO₂e)</i>	<i>Cost (NPV million USD\$)</i>
AZUL normal	44	19.1	0	43	10	374	45	20	-24
AZUL maximum	84	10.5	0	84	10	35	84	20	-742
NEGRO normal	92	13.9	0	62	10	322	99	20	-548
NEGRO maximum	97	9.2	0	106	10	-88	143	20	-1357
UC (ENDESA)	144	4.2	0	200	10	-995	267	20	-3,250

Note: Based on alternative agriculture and forest MACs described in text and target of -20% in 2020 and -30% in 2030 as shown in figure 6.

Table 5: Sensitivity analysis: International link with tighter targets for 2025-2030*

	<i>Abatement (2015-2030) (million tCO₂e)</i>	<i>2015 Price (USD\$/ tCO₂e)</i>	<i>Cost (NPV million USD\$)</i>	<i>Agriculture, waste and forestry (%)</i>	<i>International 2015 Price (USD\$/ tCO₂e)</i>	<i>Allowances sold int. (million tCO₂e)</i>	<i>Cost (NPV million USD\$)</i>
	<i>Domestic reductions only</i>				<i>International link</i>		
AZUL normal	569	38.1	1,292	66%	-	-	-
AZUL maximum	569	5.0	708	64%	20	19	425
NEGRO normal	734	64.9	1,928	51%	-	-	-
NEGRO maximum	734	10.9	962	51%	20	26	752
UC (ENDESA)	770	3.1	379	49%	20	221	-2,283

* Same target as tables 3.2 and 4 through 2025 and then emissions constant over 2025-2030, as shown in figure 8.

Note: Based on alternative agriculture and forest MACs described in footnote 163.

Table 6: Scenario with unlimited purchases of international credits (e.g. CERs) through 2030

	<i>Abatement (2015-2030) (million tCO_{2e})</i>	<i>Price (USD\$/tCO_{2e})</i>	<i>Cost (NPV million USD\$)</i>	<i>Credits purchased (million tCO_{2e})</i>
AZUL normal	569	3.5	808	108
AZUL maximum	569	3.5	564	67
NEGRO normal	734	3.5	788	159
NEGRO maximum	734	3.5	668	114
UC (ENDESA)	770	3.1	379	0

Note: Based on more stringent target after 2025 as in table 6 and alternative agriculture and forest MACs described in footnote 163. International credits are assumed available at current CER price of \$3.2/tCO_{2e}, rising at 5% per year.

Table 7: Scenario with purchases of international credits (e.g. CERs) constrained to 5% of the total compliance obligation (87 million tons through 2030)

	<i>Domestic abatement (2015-2030) (million tCO_{2e})</i>	<i>Credits purchased (million tCO_{2e})</i>	<i>Price (USD\$/tCO_{2e})</i>	<i>Cost (NPV million USD\$)</i>	<i>Abatement (2015-2030) (million tCO_{2e})</i>	<i>Credits purchased (million tCO_{2e})</i>	<i>Price (USD\$/tCO_{2e})</i>	<i>Cost (NPV million USD\$)</i>	<i>Price (USD\$/tCO_{2e})</i>	<i>Cost (NPV million USD\$)</i>
	<i>International credit purchases only</i>				<i>International credit purchases as well as international allowance sales</i>					
AZUL normal	482	87	3.9	802	482	87	10	450	20	151
AZUL maximum	499	70	3.5	677	482	87	10	112	20	-873
NEGRO normal	647	87	4.7	958	647	87	10	793	20	66
NEGRO maximum	647	87	3.7	811	647	87	10	384	20	-744

Note: Based on more stringent target after 2025 as in tables 6 and 7 and alternative agriculture and forest MACs described in footnote 163. International credits are assumed available at current CER price of \$3.2/tCO_{2e}, rising at 5% per year.