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Trade Policy Implications of Carbon Labels on Food¹

Shane Baddeley

*Former graduate student, School of Policy Studies,
Queen's University, Kingston, Ontario*

Peter Cheng

*Former graduate student, School of Policy Studies,
Queen's University, Kingston, Ontario*

Robert Wolfe

Professor, School of Policy Studies, Queen's University, Kingston, Ontario

Carbon labels providing information about the carbon footprints associated with food products might influence consumer purchases, which would have a differential effect on producers throughout global food chains. We first discuss why any labels work and then describe the mechanics of carbon labels. The novelty of the paper is an examination of the issues members of the WTO have raised about all types of labels since 1995. Although carbon labels are voluntary standards for now, their increasing use could become effectively mandatory. Difficulties for exporters will include the lack of an international standard and the challenge, especially for developing country exporters, of dealing with complex carbon footprint procedures.

Keywords: carbon footprint; labels, life cycle analysis, Technical Barriers to Trade, voluntary standards, World Trade Organization

Introduction

Reducing the greenhouse gas emissions that contribute to climate change is one of the fundamental challenges of our time. No single action will solve the problem: mitigation will require a host of small actions aimed at emissions wherever they occur. We can think of emissions by energy source (e.g., hydro, nuclear, coal, etc.), by function (e.g., transport, or heat), or by type of human activity. In rich countries, food and drink might account for an average of 9 percent of an individual's total carbon emissions.² The food system will inevitably have to play its part in efforts to reduce emissions, which means that the carbon associated with food will have to be priced, somehow. In the absence of a global carbon tax, efforts to price the carbon in food must take regulatory form.³ Given that moderately coercive regulatory tools affecting producers are not immediately available, and perhaps not feasible along complex global food chains, information in the form of a carbon label might influence consumers to purchase foods with lower associated emissions, thereby affecting carbon emissions. Whether such labels increase consumer interest in "food miles" or some other carbon-related factor, they will have a differential effect on producers throughout global food chains. This paper explores the potential impact of such labels on the trading system.

Labels are political.⁴ Some labels tell you that smoking causes cancer; others provide nutritional information in multiple languages; still others tell you in which country a product was made. Labels have many purposes besides branding. Their content is regulated, for example with respect to the listing of ingredients, to ensure that consumers are not misled about health and safety: people with allergies need to know if a food contains nuts. Any other information must be verifiable. It is illegal in Canada, for example, to claim health benefits for a product without scientific evidence. Some labels voluntarily include information about how the product was produced, such as kosher and halal products, because that helps certain consumers make important choices about what to eat. Other labels are based on a product's characteristics. Farmers who wish can label their produce "organic." Consumers are free to buy the product that says it is organic or kosher on the label, or the one that has no additional information on the label. In such cases where labelling is voluntary, the costs are borne by the consumers who wish to seek more information about their food and the producers who are willing to supply this information. When labels are mandatory, however, the costs are born by *all* producers, which can exclude smaller firms, or developing country producers, from a market.⁵

Carbon labels provide end-users with a product's carbon footprint throughout its entire life cycle. These generally voluntary and private labelling schemes indicate the amount of carbon emissions associated with the product from its production and processing stage, through transportation, intended use, and finally its disposal as waste.⁶ Carbon labels are proliferating from a variety of motivations, but producers have to respond whether a given label is imposed or approved by governments, required by retailers in response to consumer or activist pressure, or implemented by large firms as part of a corporate social responsibility program. The proliferation of carbon labels has the potential to create significant trade barriers, particularly in the food and agricultural sectors. Many studies have shown how technical standards and regulations can have a negative impact on agricultural trade. Exports from developing to OECD countries are vulnerable, especially when trying to enter the EU market, which has a plethora of standards and regulations for its food products.⁷ But the uncertainty caused by new standards is particularly hard on any new entrants to a market, whether new firms, or new products, or existing products being exported to new markets. This trade at the extensive margin is where the biggest gains in productivity are found, suggesting that poorly implemented carbon labels could have significant welfare effects.⁸ The design and operation of labelling schemes is therefore an issue for the trading system, whether or not labelling schemes have a sufficient impact on consumer behaviour to achieve a measurable reduction in carbon emissions.

This article brings together academic analysis of carbon labels with actual experience in the World Trade Organization. The first part of the article is largely based on the literature on labels in general, and on carbon labels in particular. We discuss why any labels work, including how consumers perceive labels. We then discuss the mechanics of carbon label schemes, and how they are seen by producers and governments. The novelty of the article is in the second part of the article, an examination of the kinds of concrete issues members of the WTO actually raise about labels. We examined all "specific trade concerns" involving labels of any kind that have arisen since 1995 in the WTO under the Agreement on Technical Barriers to Trade (TBT) and the Agreement on Sanitary and Phyto-sanitary Measures (SPS). We also looked at matters raised in the dispute settlement system that mention labels, and recent discussions about labels in WTO committees. Analysis of this actual experience with labels in general allows us to speculate on which characteristics of carbon labels will cause difficulties for the trading system. We begin by asking why labels might be chosen as a regulatory tool.

Information as a Policy Tool: Would a Carbon Label Work?

A carbon label is an information tool. Such tools are used to influence what people think, know, or believe when they engage in target behaviour. Governments use information to convince consumers either to avoid risky behaviour (anti-smoking campaigns) or to engage in positive consumption patterns (using nutrition labels). Information works well when users and providers of information share objectives, it works poorly when uniform compliance is important, and it does not work at all if nothing an information user is able to do will change the situation.⁹ And information does not work best alone. Combining information-based instruments (e.g., labels) with measures that more directly target an environmental externality (e.g., tax, or direct regulation) can make both instruments more effective.¹⁰ Labels as a particular kind of information tool are especially useful in cases of information asymmetry (when producers know more than consumers) and when the targets are dispersed.

Producers and governments can take two approaches to provide information: (1) a “consumer-centered-approach” gives consumers the information they say they need or (2) a “paternalistic approach” provides information thought to be beneficial.¹¹ Traditionally, product labels have focused on aspects such as measurements, ingredients and nutritional information, but new kinds of product labels have proliferated in the past few years because consumers demand more information related to their social and environmental concerns in order to make better-informed choices at the point of sale.¹² Labels also proliferate because campaigners (e.g., environmental NGOs) seek to support or pressure firms and consumers into sustainable practices.¹³ Providers of social or eco-labels rely on “moral suasion” to convince consumers that a particular product is consistent with his or her values,¹⁴ or that particular shopping decisions are socially responsible.¹⁵ In this sense a carbon footprint is analogous to what is described by economists as a “credence” attribute of a good, an aspect “that the consumer cannot evaluate accurately even after use due to insufficient information and/or the consumer’s lack of expert knowledge.”¹⁶ Labelling can be used as a signalling device to address such market failures, but has significant side effects when food supply chains cross international borders because of an information asymmetry problem: how can any user know that the food is properly labelled?¹⁷ And such labels only work if consumers are actually concerned about using the information the label provides.

How Consumers Perceive Labels

People do not respond to labels in the same way. Age, gender, and education alter who is potentially influenced by environmental labels, as shown in table 1.

Table 1 Who is Influenced by Labels?

Group	Influence	Reason
Male	Low	Men tend to pay less attention to eco-labels because they perceive it as not “masculine” and because in general they are not as socially/globally concerned. ¹⁸
Female	High	Women are more eco-conscious than men because they tend to be more socialized to help others. ¹⁹
Young	Moderate - high	Younger individuals are able to process more information, ²⁰ have less formed and more flexible buying habits, but have higher time valuations so may prefer to process less information. ²¹
Old	Low	Older consumers have difficulty attending to new food product information: they have well-established habits of looking for certain information. ²² They also attach more importance to the credibility of a label; they are therefore more skeptical. ²³
High education	High	Highly educated people are more likely to understand the implications of labels, but are critical of the perceived effectiveness of the product. ²⁴
Low education	Moderate	People with lower levels of education are vulnerable to less credible labels and to misinterpreting what labels represent. ²⁵
High/low income	Moderate	Income alone has little impact on label influence, ²⁶ especially if the label adds little or no additional cost to the product.

Whether a given consumer will actually respond to a label is also affected by other factors, from how they shop to perceptions of effective action, as shown in table 2. Consumers need to know about an issue, trust the label, and believe that a particular purchase choice is consequential. It matters who does the majority of the household shopping, particularly for food products. A survey based on supermarket shopping found that almost 75 percent of American households identified a female member as the primary shopper.²⁷ Men are usually considered to be secondary, “fill-in” shoppers. Children (8-12 years), because they are sometimes with the primary shopper, were also identified as being more than 10 percent responsible for a family’s shopping list.²⁸

Response to carbon labels will also be affected by perceptions of the importance of doing something about climate change. One poll found that 58 percent of Americans and 80 percent of Canadians believe that we have solid evidence of climate change. Of these individuals, more than 90 percent think climate change is a very serious or somewhat serious problem that must be addressed.²⁹

Table 2 Factors Affecting Response to Labels

Factor / trait	Explanation
Buying habits	Consumers have specific purchasing habits. Newly added information does not necessarily reach consumers not accustomed to looking for it.
Knowledge of issue and label	Consumers must be knowledgeable about the issue addressed by a label and the implications of choosing one product over another. They must also have prior knowledge of the label itself if they are to use it. ³⁰ The label must be recognizable, and its objectives clearly understood.
Trust of the label	A consumer will use a label only if s/he trusts its information. ³¹ Some people are trusting; others try to protect themselves against persuasion tactics by marketers. ³² Public and third-party labels are more trusted than ones provided by producers and retailers. The higher the prevalence of a label, the stronger the belief it is credible. ³³
Time pressure/distracted	Comparison shopping is under-utilized when a consumer is short on time or distracted in the market place. ³⁴ Simple and highly visible front-package labels get the most attention. ³⁵ Negative labels, such as health warnings on tobacco products (showing risk), hold an individual's attention longer than positive ones. ³⁶
Perceived consumer effectiveness	The consumer must think that a purchase decision matters in the marketplace; must value the cause and believe that the label is an effective means to their own environmental or social goals. ³⁷

Large majorities in most developed countries are aware of global warming and its risks, but this awareness seems to be much lower in developing countries. People in developing countries may have observed and adapted to the changes in their local climate, but lack a scientific explanation for what is happening. Simple awareness, however, does not motivate individuals to action or elicit a collective response. Climate change is often trumped by short-term concerns such as war, poverty, and the economy.³⁸ Nevertheless, a study by the Gallup Organization in 2009 across the EU found that 47 percent of respondents said that eco-labelling plays an important role in their purchasing decisions, and 72 percent of EU citizens thought carbon footprint labelling should be mandatory in the future.³⁹ An alternative consumer survey found that 56.3 percent of U.S. and 64.4 percent of UK respondents want companies to provide more information on climate impacts for their products.⁴⁰ The same study also found around half of the UK and U.S. respondents would rather do business with a company working to reduce its carbon footprint. Environmental factors rank third among attributes that influence consumer decisions, behind quality and price but before brand name, and carbon footprint is *not* the most important information an eco-label can contain. Recycling criteria and the use of environmentally friendly materials are attributes identified as more important.⁴¹

To summarize this section, carbon labels are most likely to influence the shopping behaviour of younger, better-educated women, the group that tends to do the majority of household grocery shopping, and least likely to influence older, less-educated men. Although many people are willing to take action on climate change, it may be one thing to be aware of and willing to do something but quite another to seek out this information and actually act on it.⁴² These conclusions suggest that carbon footprint information will not likely be a major driver for consumer purchasing decisions, but carbon labels will still play *some* role, most likely in comparison shopping when two products are of the same quality and price. Even a small shift in consumption behaviour could lead to significant emissions reductions due to the size of the consumer footprint.⁴³ More important for the trading system, if a large enough minority ask for such labels, producers will have to respond.

Carbon Labelling Schemes

Typical energy efficiency labels tend to focus on the emissions associated with the operation of a product.⁴⁴ That works well for refrigerators, but not for food. The first carbon labels described how a product traveled to get to the grocery shelf. At the start of 2007, UK retailers Tesco and Marks & Spencer announced they would label all airfreighted products in an attempt to reduce their carbon footprints and encourage consumers to make sustainable purchases.⁴⁵ Since then, carbon label schemes have proliferated worldwide with varying layouts, methodology and goals.

Producers use carbon labels either because they must, perhaps because of perceived consumer demand,⁴⁶ or because the label may in some way improve the firm's profitability. Perhaps the most significant motivation is to enhance product differentiation. A product that can claim to be more environmentally friendly than its competitors can capture much higher market share (provided quality and price do not differ).⁴⁷ Such labels can also be part of a corporate social responsibility (CSR) plan.⁴⁸ Consumers are increasingly making their purchasing decisions on the basis of a firm's role and contribution to society.⁴⁹ Government regulation is therefore not always the driving force behind a firm's positive social behaviour; investors, consumers, communities, and nongovernmental organizations all contribute to a firm's "social license to operate."⁵⁰ When businesses adopt the use of labelled products, not only is it seen as socially responsible, but also it results in good business practice for the future.

The need for a carbon label can affect a firm's production decisions independently of whether consumer purchasing decisions are influenced by the label. Significant benefits can be realized in the supply chain. Identifying greenhouse gas (GHG) "hotspots" when determining a product's carbon footprint can help a company run

more efficiently and ultimately save money on energy and resources.⁵¹ By assessing the carbon footprint of products now, producers will also be well prepared for any future government regulations.

Table 3 summarizes the main components of carbon label schemes, including compliance requirements, the operator/certifier, the product types being certified/labelled, the entity requiring the labels, the methodological basis, and whether this label is provided in collaboration with other stakeholders. As can be seen, each component has many variations. Few carbon labels are formally mandatory, yet, but many voluntary schemes are effectively mandatory for producers who want to sell in certain markets.

Table 3 Summary of the Various Components Involved in Carbon Labelling Schemes⁵²

Component	Examples / options
Compliance	Mandatory or voluntary
Operator/certifier	Government, public organization, OR private consultant, manufacturer, retailer, private not-for-profit
Product types certified	Food and drink, semi-durable and durable goods, services – can be single items to whole product lines.
Entity requiring the label	Product retailer, product manufacturer, government
Methodological basis	PAS 2050, ISO 14067, WRI-WBCSD, various other LCA schemes; all are npr PPMs
Partners/external funding	Government, environmental NGOs, civil society groups, etc.

Most carbon labels are essentially private standards. Some are first-party proprietary standards or own labels, some are second-party labels established by an association. Collaboration ensures the credibility of a label and may serve to lower costs for participating firms. In addition, firms may decide it is more advantageous to collaborate and protect their industry’s sustainability image as a whole rather than compete on a micro level.⁵³ Governments sometimes facilitate such standards. Finally, the most credible labels are established and certified by third parties external to an industry.⁵⁴

Four types of carbon labels are in current use.⁵⁵ A *low-carbon seal* is awarded to producers who are below a certain carbon efficiency threshold within a product category. While these seals are easy to understand, they do not allow consumers to

differentiate between products with the seal. A *carbon score*, in contrast, is provided based on an independent assessment of the product's carbon footprint. All labelled goods would have a score (usually the amount of carbon emitted by the product in grams) that is easily comparable across products and brands. Similarly, a *carbon rating* is a tiered approach much like the energy label in Europe (five-star system). Although these ratings allow comparisons between brands, consumers would need to know what the average product's score is in order to make appropriate purchasing decisions. Lastly, a *carbon neutral* label can indicate that a firm has assessed its total carbon emissions and has purchased complementary carbon offsets, which has the effect of symbolically negating any direct emissions that may be attributed to that firm.

As of 2009, 34 carbon footprinting schemes existed worldwide. The largest scheme is the Carbon Reduction Label operated by The Carbon Trust, a not-for-profit company set up by the UK government. Carbon Trust has labelled over 2,800 products since 2007 using the PAS 2050 standard.⁵⁶ The supermarket chain Tesco, for example, has used this company to label 20 of its products, with plans for expansion to all 70,000 of its products.⁵⁷ France initially proposed mandatory carbon labelling on all products by January 2011, but this initiative was replaced with a one-year, voluntary pilot program starting in July 2011 on an experimental basis. The intent is to find out how well the environmental information is received by consumers and how best the information requirements should be generalized for all products. The government will also consider whether small and medium enterprises (SMEs) are disadvantaged and whether labelling requirements bear most on the producer, retailer, or both.⁵⁸ Japan has had a similar trial program running since 2009 called the Carbon Footprint System managed by the government.⁵⁹ But private organizations make up the majority of carbon label suppliers. They can be found in many OECD countries, including the UK, the United States, France, Switzerland, Canada, Germany, and Sweden. In Canada, a not-for-profit organization called CarbonCounted has created its own carbon label and has begun working with companies such as Walmart and Loblaws. CarbonCounted uniquely allows companies to choose the standard they would like to use when footprinting their products and is regulated by a network of consulting partners.⁶⁰

No single organization coordinates all these bodies or ensures that their standards are in any way coherent or consistent.⁶¹ Indeed, no such body exists for environmental standards that is comparable to the well-established bodies that create standards for goods (e.g., the International Electrotechnical Commission) or food safety (e.g., the Codex Alimentarius Commission). The Global Eco-labelling Network (GEN) and the

International Social and Environmental Accreditation and Labelling Alliance (ISEAL Alliance) are attempting to fulfill this role.⁶² The ISEAL mandate is to help companies with CSR schemes to “conform with or surpass any requirements under WTO rules for recognition as legitimate standardization bodies.”⁶³ In addition, ISEAL’s code makes sure these companies remain accountable democratically, fulfill transparency requirements, and involve stakeholders.

When proliferating labels are increasingly used as marketing tools, confused consumers question the credibility of the labels.⁶⁴ Most individuals do not trust firms such as food processors and retailers to produce their own product labels, mainly because they view them as having a vested commercial interest or agenda.⁶⁵ Third-party certification for labels helps to bridge information asymmetries between producers and consumers. One survey found that 63 percent of U.S. and 76.8 percent of UK respondents thought it important for an independent party to verify any climate claims made by a producer.⁶⁶ A Canadian study found that 50 percent of people most trusted the federal government to provide legitimate information.⁶⁷ Consumers care that potential carbon labels be enforced by another private party or be produced by the government in order to prevent the “green washing”⁶⁸ of products.⁶⁹ (Negative feelings persist from highly prevalent green washing in the 1990s.⁷⁰) Firms seem to be responding to this new consumer demand: one study found that of those eco-labelling schemes that require certification before being issued, 64 percent mandate the use of a third-party certifier.⁷¹ But how credible are the third-party certifiers? What differentiates them from a firm that produces its own labels? Consumers may have no way of knowing if their purchase decisions have the intended impact. If producers and consumers insist on certifiers being transparent, then label certification schemes can maintain their legitimacy.⁷² If the concept becomes popular, however, governments may need to use regulatory tools to ensure the integrity of the labels.

Governments already have regulatory obligations with respect to the integrity of product labels. To take the Canadian example, the government already regulates labels under the Food and Drug Act and the associated Food and Drug Regulations. Officials can specify labelling requirements such as language (bilingual requirement for all mandatory information), quantity declaration (volume, weight, or count), and ingredients (in descending order of proportion by weight).⁷³ Health Canada is responsible for the establishment of policies and standards relating to the health, safety, and nutritional quality of food sold in Canada. The Canadian Food Inspection Agency is responsible for the administration of food labelling policies related to misrepresentation and fraud with respect to food labelling, packaging, advertising, and the administration of other food-related provisions such as the Consumer Packaging

and Labelling Act.⁷⁴ The government also acts through the multi-stakeholder Canadian General Standards Board, which is able to generate voluntary standards in a wide range of areas. The committee is composed of representatives of relevant interests including producers, consumers and other users, retailers, governments, educational institutions, technical, professional and trade societies, and research and testing organizations.⁷⁵

When the first carbon labels emerged based on the food-miles concept, exporters, especially in developing countries, were dismayed, believing that the largest effect of such labelling initiatives would be to encourage consumers to buy only goods produced within their communities. Supporters argued that restricting consumption to local goods is healthier since such goods require far fewer chemical preservatives to maintain freshness, but opponents countered that a ten-kilometre trip by car to the grocery store can add more to the emissions than air freight from a developing country.⁷⁶ Such debates can only be settled by undertaking an analysis of all the carbon associated with a food product, and not just the distance it travels to get to the consumer.

Life Cycle Assessment

A carbon label is intended to indicate the GHG emissions that can be attributed to a specific product. The so-called product carbon footprint (PCF) is usually based on a life cycle assessment (LCA). An LCA typically tries to assess the carbon used from “cradle to grave.”⁷⁷ The greenhouse gas emissions associated with the production, processing, transport, and storage of agricultural products include carbon dioxide (CO₂) emitted through the combustion of fossil energy at various stages in the life cycle of a product: in the production of agri-chemicals and soil amendments; by farm machinery during field preparation, planting, cultivation, and harvesting; by vehicles used to transport the intermediate and final products; by the factories that process the products; and in the production of electricity used to keep the products refrigerated, if necessary. They also include nitrous oxide (N₂O) released from the soil as a result of applying nitrogenous fertilizer; and changes in soil carbon resulting from farm practices that result in either a net release to the atmosphere (through oxidation) of carbon, or its sequestration (e.g., through storage by root biomass). Greenhouse gas emissions associated with products from livestock, especially from ruminant animals, include methane (CH₄) from enteric digestion and N₂O from decomposing manure.⁷⁸

The first methodology for determining a product’s life cycle carbon footprint, Publicly Available Standard (PAS) 2050, was introduced in 2008 by the British Standards Institute.⁷⁹ It covers a wide range of diverse products and remains the most detailed and comprehensive standard to date.⁸⁰ Also in 2008, the International *Estey Centre Journal of International Law and Trade Policy*

Organization for Standardization (ISO)⁸¹ announced its intent to add the “carbon footprint of products” to its ISO 14000 series of environmental management standards. The standard, to be available in November 2011, will have two parts: (1) ISO 14067-1, which will quantify the carbon footprint of a product as well as track its progress in GHG mitigation, and (2) ISO 14067-2, which will harmonize methodologies for carbon footprinting.⁸² Finally, in 2008, the World Resources Institute (WRI)⁸³ and the World Business Council on Sustainable Development (WBCSD)⁸⁴ started developing the Product and Supply Chain GHG Accounting and Reporting Standard. This standard again has two components: (1) product life cycle accounting and reporting and (2) corporate value chain (denoted “scope 3”) accounting and reporting, which measures indirect emissions other than brought-in energy. To avoid inconsistencies and promote further harmonization, the developers of the PAS, ISO, and WRI-WBCSD standards have agreed to keep each other informed of developments in their methodologies.⁸⁵

Smaller producers, and producers from developing countries, are worried about these emerging LCA standards because they are inherently imprecise and are shaped by the assumptions hidden in the life cycle data inventories and models on which they are based.⁸⁶ Most data sets use a mean value rather than a product-specific value, a method that can mask huge variance between appropriate maximum and minimum values. Take soft drink cans, for example, where whether the aluminum is recycled or thrown away has a huge impact on the LCA. Since a specific data set for every product is infeasible, nobody should think that any LCA is a scientifically precise number.⁸⁷

Developing countries have a number of reasons for concern:

- No scientific consensus exists on how to measure a product’s carbon footprint.
- Many developing countries are distant from developed-country markets, leading to higher carbon footprints due to additional transportation emissions. On the other hand, favourable production conditions elsewhere in the supply chain may offset the transport disadvantages.⁸⁸
- The land use conversion (LUC) concept puts developing countries at a big disadvantage. LUC refers to the emissions created by clearing natural land in order to create agricultural land and is considered in most agricultural product LCAs.⁸⁹ The LUC methodology can be especially disadvantageous for developing countries where data are weak or missing.⁹⁰ LUC is perceived as unfair because developed countries were able to create their agricultural land years ago, which thus has no impact on their current carbon footprint. Developing countries have contributed much less to total emissions, and therefore believe that they should

not be penalized by climate regulations established by already developed countries.⁹¹

- A number of tropical developing countries export goods derived from trees, but most LCAs do not allow them to claim or offset the benefit derived from the tree's ability to capture and sequester large amounts of carbon from the atmosphere.⁹²
- Emissions can vary by season and by location: a local apple will have a lower PCF when it is just picked than after it has spent months in storage; and products that have been produced using an identical process ought to have different PCFs if production of one used electricity from fossil sources and production of the other used electricity from renewable sources.⁹³
- Farming in some developing countries has low and variable crop yields. Carbon footprints are usually measured in per unit weight, meaning producers with lower crop yields than their competitors will have higher carbon footprints because they are essentially using more cropland and resources to produce the same amount of food.⁹⁴ Of course, carbon labels are *meant* to expose these kinds of inefficiencies that lead to high emissions, which may be a harsh reality producers in developing countries must face.
- The cost of an LCA can be very high for small or medium sized enterprises.⁹⁵ One company reported that conducting an LCA for a "typical" agricultural product can cost between €2,500 and €6,000 (around C\$3,500 to C\$8,500) to perform.⁹⁶
- Developing countries are also disadvantaged because the necessary data sets are either imprecise or uncertain, masking important differences and innovations across countries that would otherwise be important in an LCA. The data are better for rich countries and temperate products, and are limited in some regions, especially Africa.⁹⁷ In addition, the absence of accurate country-of-origin labels in blended products results in the use of the most conservative or "worst case scenario" data sets.

In sum, even a sophisticated LCA does not make a carbon label any less worrisome for distant suppliers than did the early food-miles labels. Carbon labels are inherently a problem for the trading system and therefore a matter for the WTO.

Are Carbon Labels Subject to WTO Disciplines?

Whether carbon labels are subject to WTO disciplines is a simple question that does not have a simple answer, as is evident in the substantial literature on standards in general and labels in particular, only some of which we cite. Much of the literature approaches the question through detailed analysis of WTO jurisprudence on related matters. WTO rules apply most obviously when a measure concerns the

physical characteristics of goods. “Like” goods should be treated in the same way, period. Government rules should not discriminate against foreigners. But a carbon label necessarily has a differential impact on goods based not on the thing itself, but on how it was produced, and the label is usually created by a private entity.

Given limited experience with carbon labels, but evident worries, we looked for evidence of any problem members of the WTO have experienced with labels since 1995. Rather than imagining what sort of problems carbon labels might cause, we undertook a detailed examination of the problems existing labels have already caused. This empirical data can then be used to make inferences about the types of problems that can be anticipated from carbon labelling in food.

Labels in general are covered by the WTO under the basic GATT principles and in various ways by the SPS Agreement and especially the TBT Agreement. The TBT Agreement covers the preparation, adoption, and application of (mandatory) technical regulations by governments, and of (voluntary) standards by standardizing bodies. It also covers the conformity assessment procedures that are established to assess compliance with these regulations and standards. Members must ensure that their regulations are consistent with the rules; they must also take “reasonable measures” to ensure that standardization bodies respect the principles of the Code of Good Practice for the Preparation, Adoption and Application of Standards annexed to the TBT Agreement.⁹⁸ The SPS Agreement covers measures that pertain to human, animal, or plant health. In both agreements the distinction between mandatory and voluntary measures is murky.⁹⁹

Transparency and surveillance are an essential part of the WTO.¹⁰⁰ Most agreements have provisions requiring notification of new measures and a procedure where members can ask questions of each other and seek to resolve difficulties. The most sophisticated such mechanisms are the “specific trade concerns” procedures established by Article 13.1 of the TBT Agreement specifying “the opportunity of consulting on any matters relating to the operation of this Agreement or the furtherance of its objectives” and the similar Article 12.2 of the SPS Agreement. When the procedures do not work, members have recourse to the dispute settlement system, but we found labelling issues in only three disputes since 1995, although they were mentioned tangentially in many more.

We have not attempted to analyze the many thousands of notifications that have been made under each agreement that in some way concern labels but we have looked at the hundreds of specific trade concerns have been raised in the committees.¹⁰¹ The records of these concerns and the associated discussions in the committees are a good source of information on how and where labels of all kinds are a source of conflict in

the trading system. The Secretariat provides detailed information on every specific trade concern in cumulative summary reports that are revised annually. These SPS and TBT reports are therefore an excellent source of information on standards and regulatory issues that have caused problems in the trading system. We used those reports to identify every labelling issue raised since 1995.¹⁰² We then found the document associated with each concern in the WTO database and searched the minutes of each TBT committee meeting from June 1995 to 2008 to find as much information as possible for each concern. All of the “specific trade concerns” with respect to labels that we found are listed in the technical annex. Those tables indicate whether labels appeared to be the primary or secondary cause of conflict in each specific trade concern.

We found that TBT has a much higher number of label concerns than SPS because it deals with a broader scope of standards. Table 4 shows the number of TBT- and SPS-specific trade concerns that were raised during this period and the number and percentage of those concerns that involved labels.

Table 4 TBT- and SPS-specific Trade Concerns Regarding Labels

Agreement	Total specific trade concerns	Those regarding labels	Proportion
TBT	258	53	21%
SPS	277	5	2%

The EU, which is known for its progressive marketplace labelling initiatives, unsurprisingly has been the subject of the highest number of concerns, followed by the United States, China, and Korea, as shown in table 5. Overall, 52 percent of the concerns were addressed to developed countries and 48 percent to developing countries.

Table 5 Number of Label Concerns per Member

Member	Number of concerns
European Union	10
United States	7
China	6
Korea	5
Mexico	4
India	3
Japan	3
Brazil	2
Columbia	2
Egypt	2
Israel	2
South Africa	2
Argentina	1
Canada	1
Chile	1
Hong Kong	1
Indonesia	1
Moldova	1
New Zealand	1
Peru	1
Thailand	1
Tunisia	1

These label concerns can be broken down into four different categories, as shown in table 6.

Table 6 Categories of Label Concerns

Type of label	Description	Number of concerns
General food	A label requiring specific food product information related to its content or production and process methods.	27
COOL	Country-of-origin-label – a label indicating where a product was produced	11
GMO	Genetically modified organism – a label indicating a food product is, or was made from, a bio-engineered organism.	10
General non-food product	A label designed for a non-food product that pertains to a specific attribute of that product such as its energy efficiency.	10

Concerns about labels on food products, the largest group, were roughly split between general issues and two highly contentious problems: country-of-origin labels (COOL), a major issue in the U.S. meat packing industry, where the concern was the additional costs to producers to comply with the COOL requirements, and labels on products that may or may not contain genetically modified organisms (GMOs), labelling which imposes additional costs on producers for compliance, from traceability to meeting different labelling schemes that may require additional capital/technical investments. Both measures are also thought to benefit local producers at the expense of foreigners. COOL is also the subject of two as-yet-unresolved dispute settlement cases involving labels (DS 384 and DS 386). The third labels-related dispute, US-Tuna II (Mexico) (DS 381), regarding dolphin-safe labels, was also first the subject of a specific trade concern.

The major factors contributing to the specific trade concerns articulated by members regarding labelling are shown in table 7. These factors include the absence of an international standard; the transparency of the approval process; scientific justification; the amount of time given to consider the notification; and the fact that the label imposed was mandatory.

Table 7 Factors Contributing to Specific Trade Concerns about Labels

Factors contributing to concerns	Description
International standard	Both agreements encourage the use of international standards, where available. Many concerns cited the absence of an international standard as a specific problem with the measure in question, which may well have exacerbated other problems.
Transparency of approval process	A large number of the concerns complained that the measure had been implemented without a transparent approval process. Transparency in this sense can refer to either the clarity of the approval criteria or the manner in which a specific label was developed.
Scientific justification	If a labelling scheme is designed to protect human, animal, or plant health and safety (SPS) it must be based on scientific principles and evidence. Labelling measures that fall under the TBT Agreement do not have to be scientifically justified as long as the measure does not create an unnecessary barrier to trade, but scientific support may help strengthen the case for any measures imposed under GATT Article XX. Other analysts separate this aspect into “appropriateness of measure” and “choice of measure.” ¹⁰³
Time to consider notification	Whether a member was given sufficient time to consider a notification about a new labelling requirement.
Labels imposed are mandatory	Whether the measure is voluntary or mandatory. Mandatory labels seem to provoke bigger concerns about non-discrimination and whether the measure is more trade-restrictive than necessary.

Implications of WTO Experience with Labels

Based on our analysis of WTO discussions of labels in general, we have identified four issues that could be relevant to carbon labels and the problems they might cause for the trading system, especially were they to become mandatory. First, no international standard is available for carbon labels. The majority of carbon label standards are established by private firms or NGOs.¹⁰⁴ Private standards may be more stringent and extensive, indeed may build on some framework of public regulation yet go beyond by being more prescriptive about how to achieve certain outcomes.¹⁰⁵ The problem with private standards is therefore twofold: private entities create these labels, and their use by firms creates *de facto* obligatory standards for the products they provide to their customers. For example, Walmart is the largest seller of groceries in the United States and is already implementing its own environmental standards for the products it carries.¹⁰⁶ A country banning a product because it does not have a carbon label is not much different from huge superstores like Walmart not stocking a certain product for the same reason. Despite this potential to create significant trade barriers, private standards are not subject to WTO discipline,¹⁰⁷ although members

should encourage all entities operating in their jurisdictions to comply with the Code of Good Practice annexed to the TBT Agreement.¹⁰⁸

The SPS Committee first took up the issue of private standards in 2007 in response to concerns raised by Saint Vincent and the Grenadines.¹⁰⁹ An ad hoc working group on private standards established under the SPS Committee met several times between 2008-2010, and 30 members have responded to a questionnaire asking for proposals on how issues in this area might be addressed. Responses to this questionnaire were compiled, summarized, and circulated among other members in preparation for the next step of preparing a document that identifies possible actions by the SPS Committee and/or members regarding private standards. Proposed actions for dealing with private standards can be broken into those that enjoy substantial support among members and those on which members have widely divergent views. Actions that are largely agreed upon include establishing a working definition of a private standard; providing regular information updates to international standard-setting bodies (e.g. Codex), sister organizations, and other WTO councils and committees (e.g. TBT Committee) about standards; and working with private entities to help effectively communicate trade concerns at the WTO level as well as the importance of good business practices.¹¹⁰

Six additional actions have been proposed in the SPS Committee, on which members have expressed significantly different opinions: (1) providing a forum for specific trade concerns relating to private standards, (2) developing guidelines on how Article 13 of the SPS Agreement should be interpreted with respect to these standards, (3) developing a transparency mechanism for private standards that includes increased opportunity to provide input on their development, (4) establishing a separate “Code of Good Practice” for private standards, (5) facilitating or developing ways in which members can liaise with standards-setting entities, and (6) clarifying if and how exactly the SPS Agreement applies to private standards.¹¹¹

The TBT Committee has tended to skirt the private standards issue in the past, most recently in 2009 when a workshop and meetings were held on the role of international standards. While some members thought it was appropriate to discuss this subject within the TBT, others disagreed, arguing that it was outside the committee’s mandate. Support is growing for more discussion in the TBT on private standards in general and using a forum similar to that created in the SPS. Members have specifically identified eco-labelling schemes as an important subject of discussion, possibly using questionnaires such as those used by the SPS Committee’s working group, to help identify key impacts on exports.¹¹²

The second problem carbon labels might pose for the trading system is transparency, given the complexity of carbon footprinting techniques and the various testing procedures and certification that will also be required. Even private standards require some conformity assessment procedure, but ensuring that procedures are accessible and non-discriminatory may be a challenge. Producers will have a difficult time conforming to the numerous regulations, testing procedures, and certification that labelling schemes demand.¹¹³

Third, the scientific justification for life cycle analysis may be problematic if a producer chooses not to use an international standard, especially given the differences of opinion on how LCAs should be conducted – the process “is as much art as science.”¹¹⁴ Given the lack of resources to do proper analysis in developing countries,¹¹⁵ funding and technical assistance may be needed to help countries meet these environmental standards while not sacrificing their development objectives.¹¹⁶ If producers are forced to conduct multiple LCAs and generate different carbon labels for the same product, small and medium enterprises will face serious market access barriers, especially firms in developing countries.

Fourth is the concern that a measure will unfairly discriminate against other members, a central concern in the current dolphin-safe labels case (DS381). Eco-labels can cover either product-related “process and production methods” (PPMs) or non-product-related characteristics (nprPPMs). Carbon labels are inherently nprPPMs.¹¹⁷ PPMs refer to the inputs, methods, and stages associated with creating a final product. Carbon labels are a PPM issue because they involve measuring a product’s associated carbon emissions based on how that product is made, rather than simply counting the physical carbon embodied in the product. A carbon label is therefore potentially inconsistent with the principles of Article 2.1 of the TBT Agreement, which states that “Members shall be accorded treatment no less favourable than that accorded to *like* products of national origin and to *like* products originating in any other country.” That is, products remain alike, for trade purposes, even if they were produced by different methods. If a process or method physically alters an end product, then that process could be the subject of a legitimate regulatory requirement. Mandatory labelling in food can be viewed as acceptable in cases where the product in question is changed in a way readily identifiable through inspection (e.g., testing, laboratory analysis) *or* consumption.¹¹⁸ In contrast, restrictions based on PPMs are generally not acceptable when the method results in no physical difference in the final product. Such cases are referred to as “non-product-related PPMs” because the end product is exactly the same regardless of how it is made.

We do not propose to summarize the extensive debate on nprPPMs, but we agree with the conclusion that

To the extent that voluntary standards are developed through processes with imperfect information and participation, the proliferation of the use of such standards represents a real and growing threat to those who do not, and often *cannot*, participate in their development – that is, developing country stakeholders. As the use of voluntary standards multiplies, developing country interests may be better served through the increased transparency and inclusivity brought forth by the clear and *intentional* treatment of PPM-related measures within the context of the international trading structure.¹¹⁹

Labels used for an environmental purpose have been under consideration in the Committee on Trade and the Environment (CTE) since the days of its predecessor committee in the GATT. The CTE received a formal mandate to address “labelling for environmental purposes” in paragraph 32 (iii) of the 2001 Doha Development Agenda that launched the Doha Round of multilateral trade negotiations, although little has happened. The committee has discussed the issue of carbon footprinting and labelling on five occasions since 2009. Table 8 summarizes the comments members made at the first four meetings on their concerns and important actions for the future. Disproportionate trade barriers for developing countries were by far the greatest *concern* expressed at the CTE, not surprisingly, as the high costs labelling imposes on developing countries have long been an issue at the WTO. Increasing the harmonization effort seems to be the most talked about *future action* for carbon labels. The exchange of information on eco-labelling and carbon footprinting schemes continued at the July 2011 CTE meeting, where members repeated familiar concerns. Bridges reported as well that Chile introduced a study suggesting that the production of processed food was the most carbon-intensive part of the life cycle and not its international transport.¹²⁰ With the Doha Round negotiations now moribund, these issues should receive much more attention in CTE work.

Table 8 Member Concerns in CTE on Carbon Labels¹²¹

Concerns	Members
Lack of uniform criteria or standard for LCA	Argentina, India, El Salvador
Affects developing countries and SMEs disproportionately	New Zealand, Argentina, India, El Salvador, Brazil, Cuba, Pakistan
Most are private standards (unpredictable/costly, <i>de facto</i> barriers, not in WTO jurisdiction)	Brazil, United States, Kenya
Non-product-related production and process methods (nprPPMs)	Argentina, Saudi Arabia
Motives behind labelling/usefulness of labelling	Cuba, United States
Lack of sharing experience across sectors	European Union, OECD
Most important future actions	Members
Harmonization effort (working with standards institutes and firms with methodology expertise)	New Zealand, Switzerland, Korea, Argentina, India, Saudi Arabia, Pakistan
Greater transparency	Korea, Argentina, India
Reducing costs for developing countries/technology and financial transfers	Argentina, India, Saudi Arabia, Cuba, Pakistan
Government monitoring of private standards	Turkey
More sharing experience	Brazil, Cuba, European Union, OECD

Conclusion

Carbon labelling on food offers a short-term, market-based compromise between government and business, encouraging consumer and producer behaviour towards low carbon sustainability, which both buys time to make more significant carbon reductions in the future and reduces long-term costs by building support for more efficient production practices now.¹²² If a significant proportion of companies implement an effective labelling scheme, governments could easily take over with little consumer backlash.¹²³ Private standards can serve as a gap filler or supplement to government action until regulation becomes politically viable,¹²⁴ although they have their own accountability challenges.¹²⁵ A label can easily start as (1) a means of product differentiation, then (2) a supply chain requirement, which can become (3) a *de facto* market standard, which governments may endorse for reasons of (4) public policy, eventually translating into (5) a technical regulation.

We can imagine three scenarios for the future of carbon labels. One, carbon labels prove to work extremely well in mitigating GHG emissions and countries decide to

adopt them as mandatory requirements both as a means of influencing consumer behaviour and as part of the operation of a border carbon adjustment (BCA)¹²⁶ scheme. Two, carbon labels on food are determined to do little to nothing for emissions reduction and members of the WTO choose to ban them altogether to reduce trade distortion. Third, and most probable, carbon labels are thought to do some good, but not enough to warrant them being mandatory, so they are left as they are now as voluntary standards. Voluntary standards are a favourable option for governments because they lower administration costs and impose less economic burden on producers than mandatory ones.¹²⁷ Since only a proportion of citizens actually care about the information a label provides,¹²⁸ producers can choose to use a label to attract these consumers, and price accordingly. Although governments may choose not to make carbon labels mandatory, they may increasingly require firms to assess and report on their emissions as part of a broader climate change strategy. If such measures are already required of them, more firms may consider labels as a worthwhile marketing advantage, as well as an effective way of meeting reporting obligations for the government.¹²⁹

Voluntary standards are nevertheless an issue for the WTO. The current dolphin-safe tuna dispute (DS381) shows the complexity in distinguishing between voluntary standards and mandatory technical regulations. It also shows the difficulty in justifying the objective served by a label, while proving that it is the least-trade restrictive means of achieving the objective. The challenge will be creating space for appropriate non-state regulation while ensuring that the basic principles of the trading system are respected.¹³⁰ We see a number of issues that must be addressed.

Lack of an International Standard

A robust international standard is always the best way of meeting an objective. When private power is so great that a particular label is effectively mandatory, it is all the more important to use an international standard. This issue was cited multiple times as a concern with labels. Producers must deal with multiple regulations, testing procedures and certification/accreditation requirements, each of which is expensive. Complicated accounting techniques lack transparency for smaller producers in developing countries. A related problem is insufficient and expensive data sets for LCAs. The environmental community ought to pursue initiatives to develop an integrated international standards process; WTO members ought to consider what kinds of linkages between public policy and voluntary standards are sufficient to render a carbon labelling organization as a “recognized standards body” and therefore subject to the TBT Code of Good Practice.¹³¹

Transparency and Equality of Labelling Process

Members frequently complain about the lack of clarity of some labelling standards and how this in turn restricts their products' market access. Carbon claims must not be deceptive, and the information provided for consumers must not leave out anything that is necessary to their purchasing decision. The problem is widespread in the WTO, and more effort is needed to improve both notification procedures and the use made of the data.¹³² If members agree on the principles under which carbon labels ought to be regulated (which can be done by an agreement on guidelines in the TBT Committee in the absence of new negotiations), then any private label authorized under such rules should be notified to the WTO. Members would then have an opportunity to discuss the notification in the TBT Committee, and the Secretariat would be asked to make the information on labelling schemes quickly available in a form useful to producers.

Production and Process Methods (PPMs)

Carbon footprint labels, rather than singling out a specific PPM to be used to the exclusion of others, leaves free choice as to the PPM that will be actually used – this leaves producers with the choice to either do nothing and simply display the emissions associated with their supply chain or determine which method is best to squeeze out carbon.¹³³ Many analysts conclude that nprPPMs are not necessarily inconsistent with the WTO, but clarity would be helpful. As natural phenomena, the trading system and carbon emissions do not respect each other, but the trade and climate change regimes will have to reach an accommodation. If we need to regulate emissions embodied in a product because of how it is made, then the trading system will have to cope, even if the measure is a nprPPM. Members would be well-advised to address this issue in the relevant committee rather than risk a non-negotiated resolution in an Appellate Body report.

Issues that ought to be discussed include technical and administrative feasibility (availability of certain technology and testing techniques, and logistics of coordinating footprint assessments); economic feasibility (costs associated with verification and certification systems and proving compliance with multiple sustainability standards); and legal feasibility (domestic and international law associated with competition and advertising).¹³⁴

Least-trade restrictive Measure

Are carbon labels an effective tool choice for addressing climate change? Carbon labels might actually work with certain types of consumers, but is the potential emissions reduction worth the bother? Labels are viewed as one of the least-trade

distorting instruments available compared to other measures, but do the environmental benefits outweigh the trade costs?

The last concern may be the most important, but addressing it will be hard without better analysis of the potential emissions reductions that may be achieved through the use of carbon labels on food. Although data are available on the emissions associated with the food and drink we buy, the amount that could be reduced through low-carbon consumption choices is still unclear. Despite the presence of food-miles labels and carbon labels on the market for many years, relatively little data are available on how consumers respond to these labels. It is one thing to show people *saying* in surveys they will use carbon labels and quite another to have evidence of people *actually* using them. One study found that only 25 percent of eco-labellers know of studies assessing the market-share trends of the products, services, and firms carrying their labels.¹³⁵ Carbon labels could be complicated to develop and implement fairly, with significant burdens on producers, especially in developing countries. If the only problem that carbon labels solve is relieving the bad conscience of rich western consumers, then they will be a disaster. Tackling climate change is too urgent to waste time and resources on anything that may prove to be a sideshow.

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Endnotes

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2. Bolwig and Gibbon, 2010: 7
3. Carbon can be priced with a tax, a cap and trade system, or though some mix of regulation and technology. See Stern, 2009.
4. Phillips and Wolfe, 2003
5. Nartova, 2009
6. Friends of Earth Europe, 2009: 8
7. Disdier et al., 2007: 337; Viju et al., 2011; Viju et al., 2010
8. Ciuriak et al., 2011: 7
9. Weiss, 2002: 218, 233-4
10. OECD, 2007: 25
11. Hadfield and Thomson, 1998: 564-565
12. Wandel, 1997: 212
13. De Boer, 2003: 261-2
14. Starobin and Weinthal, 2010: 1
15. Mohan, 2010: 35
16. Hobbs and Kerr, 2006: 80
17. Hobbs and Kerr, 2006: 87
18. Levi et al., 2006: 95;
19. Teisl et al., 2008: 153
20. Teisl et al., 2008: 143
21. Supermarket Strategic Alert, 2002: 1
22. Gaschler et al., 2010: 142
23. Teisl et al., 2008: 153
24. *Ibid*
25. *Ibid*
26. Teisl et al., 2008: 143
27. Supermarket Strategic Alert, 2002: 8
28. Supermarket Strategic Alert, 2002: 2-3
29. Borick et al., 2011: 3
30. D'Souza et al., 2006: 164
31. Thogersen, 2000: 292
32. Loibl et al., 2009: 51
33. Thogersen, 2000: 289, 307
34. Heroux et al., 1988

35. Wansink, 2003: 306
36. Grankvist, 2004: 217
37. Thogersen, 2000: 296
38. Leiserowitz, 2007: 3, 21
39. The Gallup Organization, 2009
40. Bolwig and Gibbon, 2010
41. The Gallup Organisation, 2009
42. Frantz and Mayer, 2009: 216
43. Vandenbergh et al., 2011: 6
44. Tamiotti et al., 2009: 121
45. Garside et al., 2007: 1
46. Bolwig and Gibbon, 2010: 2
47. Carpenter 2008: 3
48. Bernhagen et al., 2010
49. D'Souza et al., 2006
50. Vandenbergh, 2007: 940
51. Shah, 2008; De Boer, 2003: 258; Clay, 2010
52. Bolwig and Gibbon, 2010: 36-40
53. De Boer, 2003: 259
54. Cosebey et al., 2010: 37; Hobbs 2011: 143-5.
55. Carbon Label CA, 2011.
56. Bolwig and Gibbon, 2010: 21
57. Bridges, 2008
58. Moisé and Steenblick, 2011
59. Bolwig and Gibbon, 2010: 16-7
60. CarbonCounted, 2011
61. Cosbey et al., 2010: 37
62. Rotherham, 2007: 185
63. Bernstein and Hannah, 2008: 581.
64. Starobin and Weinthal, 2010: 4
65. Hobbs, 2003: 19
66. Bolwig and Gibbon, 2010
67. Hobbs, 2003: 18
68. A marketing technique used by businesses to mislead consumers into thinking a policy, product, or service is environmentally friendly when in reality it does very little or nothing to affect change.
69. Vandenbergh, 2007: 924
70. De Boer, 2003: 260
71. Global Ecolabel Monitor, 2010: 9
72. Starobin and Weinthal, 2010

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73. CFIA, 2011
 74. *Ibid*
 75. Canadian General Standards Board, 2004
 76. Shah, 2008; Nartova, 2009; Schmidt, 2009
 77. Bolwig and Gibbon, 2010: 10
 78. Steenblik and Moïsé, 2010: 1
 79. <http://shop.bsigroup.com/Navigate-by/Standards/Standards-LP/>
 80. Bolwig and Gibbon, 2010: 13
 81. <http://www.iso.org/iso/home.html>
 82. Bolwig and Gibbon, 2010: 10. The Society of Environmental Toxicology and Chemistry (SETAC) has an LCA Steering Committee that works with the ISO to help standardize LCAs in Europe.
 83. <http://www.wri.org/>
 84. <http://www.wbcd.org/templates/TemplateWBCSD5/layout.asp?MenuID=1>
 85. Bolwig and Gibbon, 2010: 15
 86. Steenblik and Moïsé, 2010; Moïsé and Steenblik, 2011
 87. Schmidt, 2009
 88. Brenton et al., 2009.
 89. Bolwig and Gibbon, 2010: 15
 90. Brenton et al., 2010b
 91. MacGregor, 2010: 1
 92. Brenton et al., 2010a: 2
 93. Brenton et al., 2009.
 94. Brenton et al., 2010a: 2
 95. Steenblik and Moïsé, 2010: 5
 96. Bolwig and Gibbon, 2010: 26
 97. Steenblik and Moïsé, 2010
 98. Tamiotti et al., 2009: 125
 99. Hobbs and Kerr, 2006
 100. Collins-Williams and Wolfe, 2010. On SPS and specific trade concerns, see Wolfe, 2005.
 101. For an analysis of the 1995-2001 period, including the notifications see OECD, 2003.
 102. This paper relies mostly on WTO, 2009c and WTO, 2010a.
 103. OECD, 2003: Box 4
 104. Bolwig and Gibbon, 2010: 1
 105. Henson and Humphrey, 2009
 106. Vandenbergh, 2007: 928
 107. Hobbs, 2010: 7
 108. Rotherham, 2007: 183
 109. WTO, 2007

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110. WTO, 2011a; WTO, 2010b
 111. WTO, 2010b
 112. WTO, 2009a
 113. Friends of Earth Europe, 2009:11
 114. Steenblik and Moïsé, 2010
 115. Brenton, 2010a: 2
 116. Cosbey et al., 2010: 60
 117. For an analysis of the developing country approach to nprPPMs see Bernstein and Hannah, 2008: 602-3. On the applicability of TBT, see Marceau and Trachtman, 2002; Vranes, 2010.
 118. Hobbs and Kerr, 2006: 96; Hobbs 2010: 137
 119. Potts, 2008: 5. See also Waide and Bernasconi-Osterwalder, 2008; Torney and Gueye, 2009.
 120. Bridges, 2011
 121. WTO, 2010c; WTO, 2009b; WTO, 2009c
 122. De Boer, 2003: 261; Vandenberg et al., 2011: 4
 123. Rotherham, 2007: 181
 124. Vandenberg, 2007: 965
 125. Hacjz and Wouters, 2011
 126. Border carbon adjustments (BCAs) refer to any number of fiscal measures in which an importing country will impose border measures on products exported to them from countries with less strict environmental policies. These measures may include charging a flat tariff or imposing a tax requirement on an imported product in order to relieve some or all of the cost disadvantage a similar domestic producer may face from the importing country's own environmental regulations (Viju, 2010; Holzer, 2010).
 127. Henriques and Sadorsky, 2008: 148
 128. Caswell, 1998: 156
 129. Jason Potts, private communication
 130. Bernstein and Hannah, 2008: 607
 131. Jason Potts, private communication
 132. Collins-Williams and Wolfe, 2010
 133. Moïsé and Steenblik, 2011
 134. Moïsé and Steenblik, 2011
 135. Global Ecolabel Monitor, 2010: 12