Policy capacity for the transition to a biofuels economy: a comparative study of the EU and USA

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Contributed Paper prepared for presentation at the 86th Annual Conference of the Agricultural Economics Society, University of Warwick, United Kingdom

16 - 18 April 2012

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Abstract

The scale of the ambition to decouple emissions growth from energy consumption in the economy runs counter to several decades of debates and literatures on the limits of government. Transport biofuels are an early and influential case of the policy capacity challenge in the transition to low-carbon economies. The case stands analytically for the policy-maker's dilemma of maintaining longer term policy goals as credible commitments, even though considerable flexibility and adaptability in policy-making is required to reach those far horizon goals in conditions of high technological and market uncertainty. In such terms, this paper compares US and EU biofuels policy processes, revealing an intertemporal choice which tests the capacity to account for the future benefits of a low carbon future in current policy processes; because if the pathway to their achievement is uncertain and politically contested in the implementation phase, then those future benefits may be heavily discounted, shortening policy-maker horizons and rendering the overall transition process politically vulnerable.

Keywords Biofuels, Policy Capacity, Policy Implementation, Policy Making

JEL code Q28, Q41, Q48

Introduction

The scale of the challenge to the policy capacity of the modern state of decoupling emissions growth from energy consumption in the economy is formidable. Indeed, the scale of the ambition runs counter to several decades of public administration debates and literatures on government overload, the shift from government to governance, the hollowed out state and government failure. The concept of policy capacity is variously defined, and enjoys currency because it encompasses two linked governance concerns; (i) the recognition of increasingly complex interdependence in the international economy imposing limits on conventional command-and-control governing strategies, and (ii) a prominent discourse about the development of steering capacity as an essential feature of effective, contemporary governing (Dror 2000).

Transport biofuels are an early and influential case of the policy capacity challenge in the transition to low-carbon economies. The case stands analytically for the policy-maker's dilemma of maintaining longer term policy goals as credible commitments, even though considerable flexibility and adaptability in policy-making is required to reach those far horizon goals in conditions of high technological and market uncertainty. In such terms, policy is an intertemporal choice which tests the capacity to account for the future benefits of a low carbon future in current policy processes; because if the pathway to their achievement is uncertain and politically contested in the implementation phase, then those future benefits may be heavily discounted, shortening policy-maker horizons and rendering the overall transition process politically vulnerable.

The first part of the paper investigates the recent literature on policy capacity in order to adumbrate five critical dimensions of policy capacity with respect to the challenge of governing the transition to a low carbon economy. The second part sets out liquid transport fuels as an important example of this challenge by providing a comparison of EU and US biofuels policy-making – both design and implementation - over the last decade, drawing on qualitative data from semi-structured interviews recently undertaken with leading policy actors in both jurisdictions.

The third part of the paper locates the EU and US processes on the policy capacity schema set out in part one. The dimensions of policy capacity offered in the present paper offer a means to identify and analyse key processes in biofuels policy-making in the EU and US, even if they fall short of a valid and reliable measurement of policy capacity. By investigating a policy sector that overlaps agriculture, energy and transport policy fields, this paper is able to offer distinctive public administration insights into the feasibility of environmental policy integration to achieve sustainability goals, widely advocated in the field of environmental studies (e.g. Dovers 2005; Buhrs 2009).

Policy capacity for the transition to a low carbon economy

The salience of the ambition to build policy capacity is related to the oft-invoked view that governments 'steer and do not row' in the contemporary international political economy. Wayne Parsons (2004, 44) develops a nautical version of the steering metaphor, arguing that map-making and navigating are core elements of the capacity to govern, 'the ability to chart the voyage, plot coordinates, set direction and take a long term view – in short, to navigate.' The academic literature on policy capacity offers subtle definitional variety. An indicative selection includes the ability of governments to make intelligent choices (Painter and Pierre 2005); to scan the horizon and set strategic directions (Howlett and Lindquist 2004); the faculty to weigh and assess the implications of policy alternatives (Bakvis 2000), as well as aptitude in making the effective use of appropriate knowledge in policy-making (Parsons 2004; Bakvis and Aucoin 2005).

Glyn Davis (2000) makes specific reference to the ability of governments to implement preferred choices of action as well as decide upon them; Parsons (2004) describes this dimension of policy capacity as the 'weaving' function of modern governments, the ability to weave together the multiplicity of organisations and interests to form a coherent policy fabric, which is robust enough to survive the politics of policy implementation.

We extract five specific dimensions from the literature on which to dissect analytically and specify policy capacity in terms of governing a transition to a low carbon economy. These are introduced here and will be employed in part three, in the analysis of the data available in the case of biofuels policy-making.

Value agreement capacity

This dimension refers to the role of governments in facilitating agreement about the values that motivate policy. This dimension contributes to policy capacity by enabling governments to introduce significant policy changes without risking societal backlash and electoral defeat. This feature of policy capacity is noted in the advocacy coalitions literature (Sabatier 1987; Sabatier and Jenkins-Smith 1993). However, as contributions in Adger and Jordan (2009) suggest, this may be an unrealistic standard in many areas of the governance of sustainability, which are marked by conflicting values and sharply divided public attitudes. Here the capacity of policy-makers is better understood in terms of managing the conflicts inevitably arising from the incommensurable values involved in the transition to a low carbon transport fuel mix.

Selection capacity

Following the literature, this dimension is the varying ability of governments to forge authoritative choices which commit relevant governmental and social actors, notably private enterprises in the case of biofuels, to implementing policy alternatives. As the environmental policy literature suggests, the goal of sustainability imposes a set of requirements across a wide set of cognate policy areas. This leaves governments with the challenge of coherent, joined-up policy making in a context where power may be diffuse, political consensus difficult to achieve and implementation requires strong co-ordination between multiple policy and market activities.

Operational capacity

A key proposition emerging from the network governance literature is that open and inclusive policy networks, although fluid in membership and often difficult to institutionalise, actually contribute to effective policymaking because they are able to absorb complexity and can be more resourceful and resilient in delivering outcomes than closed and exclusive networks (see, for example, Bovens, T'Hart and Peters 2001; Koppenjan and Klijn 2004). Policy-makers trying to effect a transition to a low carbon economy must deal with political, technological and market uncertainties that require they act within existing sector-specific networks, as well as across different networks that are being linked by novel biofuel policy agendas.

Foresight capacity

The ability of governments to look forward and anticipate is often doubted, and the attribution of myopia brought about by electoral timetables or media cycles is common. However, even amidst pervasive uncertainty, effective policy-making requires a capacity to identify ‘known unknowns’ in order to map a future path for policy. Foresight is a distinct dimension of policy capacity; for analytical purposes, there is a relevant difference between unconscious and conscious incompetence amongst governments. Understanding the capacity to anticipate potential political as well as private enterprise ‘hold up’ problems is important, independent of evidence of the ability to resolve them.

Reflection capacity

Even if the long-term policy goal (defined as part of a government’s Foresight Capacity) is fixed, Reflection – as a map-reading exercise – requires governments to monitor on an on-going basis where they have come from, where they are going, and how they might get there. This dimension encompasses the faculty for detecting problems with current policy settings (Deutsch 1963; Argyris and Schon 1978), as well as the ability to learn both cross-nationally and longitudinally in order to respond to evidence of failings. The capacity of policy-makers to avoid mere ‘muddling through’ behaviour when faced with existing policies identified as ineffective and/or unpopular (Klein 2009) is an important element of the steering mechanism available to governments. The extent to which the policy-making system as a whole has access to, and can utilise, institutions that allow current policies to be critically examined, to look back to recover historical lessons and scan the international horizon for alternative policy change options is constitutive of policy capacity.

Strategies governing the transition to a biofuels economy in the EU and US

In both the EU and US over the last decade, biofuels policy has been transformed from a relatively minor, niche aspect of energy policy into a central, economy-wide plank of future energy strategy in the transport sector. Despite their dissimilarities as political systems and the dissimilar constellation of political interests in sustainability policy, both jurisdictions arrived at a shared objective, at roughly the same time, of promoting a dramatic increase in the production and consumption of biofuels in the liquid transport fuel market. This section compares the processes of policy design in both jurisdictions that lead to this common objective; as well as their experiences in policy implementation. This includes the processes of error adaptation, learning, new political alliance formations, as well as shifts in the broader policy environment which have all contributed to test the policy capacity of the EU and US to implement biofuels policy.

Policy Design

The salient episodes in the two biofuels policy processes under scrutiny are the enactment of the US 2007 *Energy Independence and Security Act* (EISA) and the EU's 2009 *Renewable Energy Directive* (RED). Each of these builds on earlier policy initiatives reaching back to the 1970s and various responses to the extreme oil and commodity price volatility of that decade. However, for the subsequent twenty or so years, biofuels remained a niche concern in US and EU energy policy. It is the ambition to increase biofuels consumption in the US after the *Energy Policy Act* of 2005, and in the EU with the 2003 *Biofuels Directive*, that act as the proximate bases for the 2007 and 2009 policy adoptions.

Both EISA and RED impose mandates for the use of renewable fuels in transport well above current domestic production levels and above the levels set down in the earlier legislation. The EISA and RED also involve – in implementation – the development of sustainability criteria that need to be met before supplies can be counted as contributing towards the mandated figure. These mandates represent a significant part of expected liquid transport fuel consumption (most of the 10% renewable target in the EU by 2020, and 36 billion gallons in the US by 2022, representing 20-25% of forecast liquid transport fuel consumption).

In the US policy design, this 36 billion gallon mandate is divided explicitly between different types of biofuel, in the revised Renewable Fuel Standard (RFS2). 21 billion gallons are mandated to come from advanced biofuels (capable of delivering at least a 50% reduction in GHG emissions, as opposed to 20% for conventional (e.g. corn-based) ethanol).[1] Of those 21 billion gallons, at least 16 billion must come from cellulosic biofuels; and at least 1 billion must come from biomass-based diesel. The remaining 15 billion gallons can come from either conventional or advanced ethanol.

[1] In RFS2, 'advanced biofuels' are defined in terms of their GHG emissions reduction performance. In all other contexts, the term is used typically to describe all non-1G biofuels, derived from feedstocks other than those which compete as food or animal feed sources.

The general energy policy ambition to reduce reliance on oil has particular resonance in the transport sector, and is one of the reasons why biofuels attract attention as an early policy step towards a more sustainable economy. In both the US and EU, it is forecast to be a major source of future carbon emissions increases. Currently, the US transport sector accounts for around a third of total energy demand in the US and oil provides upwards of 95% of energy consumed in the sector; as it does in the EU. According to Boyan Kavalov (2004) EU transport, at that time, represented 50% of energy consumption imports, but this could rise to 70% by 2030, now expected to be the source of 90% of the projected increase in CO2 emissions to 2030.

Both the US and EU introduced two different types of policy to satisfy the incommensurable values in the policy process. Along with market, political and technological uncertainties, different values ranging from energy security to sustainability have been accommodated by adopting a policy design in which there was a demarcation between first generation (1G) and advanced biofuels. With 1G, the production technologies are known and available on a commercial scale, the feedstocks required to produce 1G biofuels are available (albeit subject to potentially significant constraints, discussed later), and the resulting biofuels can be used in existing vehicle engines (albeit subject to limits on the blending percentage for ethanol used in gasoline/petrol engines). Advanced biofuels address some of the negative impacts of 1G biofuels but, currently, there is a lack of commercial-scale production, even if the technologies exist in laboratories and on a demonstration scale.

Policy implementation

Although designed to promote domestic policy objectives, the biofuels policy environment has attracted the attention of non-domestic political actors in the implementation phase: international institutions like the OECD, international research institutes such as IFPRI with a focus on trade and development, and advocacy groups of non-state actors organised cross-nationally. This was manifest in the politics around the world food price spike in 2008 – and the resulting international opposition to biofuels – which came as biofuels production was accelerating (total world production of BF trebled between 2000 and 2007).

There were also specific market factors for expanding ethanol demand, related to MTBE Methyl Tertiary Butyl Ether (MTBE).[2] It is also worth noting that this take-off followed a period of oil price rises: from the start of 2003 to the middle of 2006, crude oil prices rose by 2.5 times, falling back to (just) double January 2003 levels at the start of 2007, rising to 4.5 times January 2003 levels by the middle of 2008. The higher the price of oil, the more likely biofuels are to be cost competitive, even without subsidies.

The international scrutiny of biofuels policies is related to their entanglement with many different societal values (security, environmental protection, economic

[2] MTBE and ethanol are both fuel oxygenates. 1990 amendments to the US Clean Air Act mandated oxygenates be used in areas with high air pollution levels. In 2005, concerns over groundwater pollution by MTBE led to the removal of MTBE liability protection; whilst, separately, the obligation to include oxygenates in gasoline was removed. Interviews revealed that, given this latter policy change and partly in response to lobbying from the corn and ethanol sectors, the Energy Policy Act introduced a Renewable Fuel Standard as a way to maintain policy support and a market for ethanol.

development, and rural communities). The unprecedented media scrutiny over the first seven months of 2008 to the possible role of biofuels in the global South's food security crisis brought international attention to biofuels policy in the US and EU; and shaped the implementation politics by directing attention to the impact of biofuel production on food security and the heightened incentives to convert lands in the developing south to biofuels production. This sits alongside environmental sustainability, with various attempts (from both inside and outside of government) to model the net energy benefit of biofuels over their life cycle versus conventional fossil fuels, including the direct and indirect land use impacts of biofuels on GHG emissions (see, for example, Searchinger, Heimlich, Houghton, Dong, Elobeid, Fabiosa, Tokgoz, Hayes and Yu 2008; Bouët, Dimaranan and Valin 2010; Edwards, Mulligan and Marelli 2010, the last comparing multiple models and their results).

Although these models are subject to controversy, their impact is to suggest to policy-makers that greater environmental gains will come from advanced biofuels whose GHG savings are larger, and which avoid the food-fuel trade-off (although the possible land-use change effects of producing some biomass sources remains contested). This reinforces the panaceaic properties assigned to advanced biofuels; they perform the function of separating incommensurable values in the policy process and assuaging opposition to (1G) biofuels by promising that any harmful effects will be dissipated by technological change in the advanced biofuels policy. This is an important element in the deliberate tolerance of ambiguity of policy goals, in combination with the conscious design of market and technological uncertainty into the policy process.

Assessment of policy capacity in the transition to a biofuels economy

Value agreement capacity

The development of biofuels policies in the EU and US has been underpinned by reference to common factors, albeit with varying emphasis reflecting different domestic political constituencies. The three dominant factors have been energy security, climate change mitigation and rural development. In the US, the greater emphasis initially was given to energy security, but in both the details of RFS2 and in the politics of the indirect land-use change (ILUC) debate, environmental concerns are manifest. A policy to reduce imports of Middle Eastern oil (noting also the tariffs on imported biofuels) has had particular resonance in the context of 9/11 and the subsequent military engagements in Afghanistan and Iraq. EU policy has long-referenced energy security but, with limited domestic production capacity relative to longer term mandates, the emphasis has been more on diversifying energy imports, in terms of both fuel types and source countries.

US policy has referenced climate change mitigation, for example in later State of the Union Addresses given by President Bush Jr; and recently has become more prominent in the policy discourse. In the EU, however, this has always had greater emphasis, especially given the role the EU has given itself as a global leader in climate change politics and policies (see, *inter alia*, Oberthür and Pallemaerts 2010; Wurzel and Connelly 2010). Rural development has also played a notable role in the EU and US. In the EU, when the Agriculture Directorate General established a bioenergy unit, it was located under Rural Development, aligning it with Pillar II of the CAP. In the US, however, the greater domestic production potential of biofuels feedstocks has resulted in biofuels policy been seen more overtly as an aspect of 'traditional' agricultural policy (several interviewees referred to the role of "big ag" in ethanol policy), given also the ability of 'big ag' to supply the feedstocks (principally corn) to facilitate diversifying energy supply away from imported fossil fuels and unfriendly regimes.[3]

The political tensions inherent in the value conflict between rural development, energy security and climate change mitigation have been exacerbated by a commercial environment characterised by market uncertainty (of the price of oil, commodity prices, etc.) alongside extreme technological uncertainty about the blend wall[4] for first generation ethanol (in the US) and the feasibility of industrial scale production of advanced biofuels (in the US and EU).

Mark Thacher and Martin Rein (2004) provide a typology of practical solutions to managing value conflicts in policy-making (see also Stewart 2009); the US and EU biofuels cases reveal a novel variant of the structural separation or firewalling strategy, where value conflict is mitigated through organisational design: different public organisations involved in a policy are guardians of different values. In the biofuel cases, the novelty exists in policy designed to separate conflicting values intertemporally. In both the US and EU, there are short to medium term goals of

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[3] Note also a stronger link in the EU between the concept of 'rural development' and the realities of smaller farmers, rather than the biggest producers.

[4] The scale of ethanol demand for blending with gasoline is limited by total gasoline demand and the maximum permitted blend percentage.

increasing the production of 1G biofuels, alongside longer term goals for advanced biofuels production.

Politically, the advanced biofuels policy element functions as a superordinate policy goal to describe the overall direction of travel (see also Foresight Capacity). This helps to persuade those concerned with values of food security and ecological sustainability to tolerate large increases in first generation biofuel production – which use known agricultural feedstocks, with associated land use changes and food production effects – as a necessary bridging step to an advanced biofuels economy. Reflecting this intertemporal aspect of policy, mandates increase certainty for those investing in advanced biofuels technologies; but also seek to commit future policy-makers to the values (and policies) determined in the present.

The two-part policy design enacted in both jurisdictions has had to evolve in implementation as a result of endogenous tensions associated with technological and market uncertainties as well as, since 2008, significant shifts in the broader policy environment. Neither the EU nor the US have solved the problem of reconciling the ambiguity of policy values by the 1G/advanced biofuels design separation. The novel requirements of environmental sustainability are firmly part of the 1G policy debate, rather than being confined to the advanced biofuels element. This is seen in both the EISA and RED, which set out how to calculate the net energy benefits of biofuels on a life cycle basis. The main uncertainty remaining is the modelling of land-use change effects, especially ILUC, which remains an intensely-debated aspect of biofuels production and policy. Relatedly, pressures grew on policy-makers and pro-biofuels advocacy coalitions from rising food prices in 2008, precipitating the emergence of large scale international opposition to biofuels production, as well as a strong 'food before fuel' campaign in the US.

The key design feature of policy in both jurisdictions in accommodating ambiguity in policy goals, through a sequence of temporal targets to guide the transition to mass biofuels consumption, alongside profound market and technological uncertainties about the feasibility of the targets (in the US case, as discussed further below, including 1G biofuels), has set the conditions for implementation politics. A central feature of policy in both jurisdictions has thus been that the demand side policy was enacted *without* coordination with supply availability and import security concerns. Sustainability and land-use change concerns were incorporated into the EISA, but in the EU whilst the RED outlined sustainability, the details were agreed and published over a year later; and the ILUC debate is ongoing in terms of how it might be reflected in policy. Both jurisdictions, however, have substantial hope invested in the development of an industrial-scale, commercially-viable advanced biofuels industry.

Selection Capacity

Recent work by Eric Patashnik (2008) on the political dynamics of major reforms offers insights into the factors which explain why some reforms stick and others are unpicked. In particular, reforms that endure through the implementation process typically destroy an existing policy subsystem and reconfigure the political dynamics. This insight is highly relevant to the ability to commit societal actors to a policy direction, or selection capacity in our terms. At least in terms of its political salience biofuels is a new policy domain in the EU and the US, and overlaps with several existing policy domains with their own particular networks and legacies. The policy capacity challenge is to be able to reorganise these in the direction of achieving long term mandates for biofuels use.

Following the 9/11 terrorist attacks President Bush, in every subsequent State of the Union Address, referred to the need for the US to reduce its dependence on imported oil. The 2005 Energy Policy Act, partly in response to changes in the policy on oxygenates in gasoline, introduced the RFS to create a usage target for ethanol. This was followed, two years later, by a greatly increased usage mandate in the EISA, introduced via RFS2. In the EU, 2001 saw the publication of proposals for what would become the 2003 Biofuels Directive. This had complex roots in ongoing policy discourses on sustainable development, the Lisbon Strategy and the embedding of environmental considerations into a range of common EU policies. Initial voluntary biofuels usage targets were replaced in 2009 with mandated, and much greater, usage targets via the RED. In both jurisdictions, however, expanded mandates were to be delivered over a longer timeframe. Mandates, as already noted, help increase investor certainty and seek to bind future policy-makers. This would be consistent with Parsons' notion of 'weaving', discussed above.

The conflict between interests/actors in the biofuels processes under scrutiny were not resolved in a single policy act, but rather have continued beyond adoption or enactment. The two-part biofuel policy design (1G/advanced) enacted in both the US and the EU was a strategic move to commit to - or 'select' - a path in a dynamic policy system rather than a one-off choice in some classic textbook way. The promise or foreshadowing of a radically changed policy environment, notably a mass market and international industry in biofuels, has provided policy logic in the system, and favours some interests or values over others. Nevertheless, this selection has not determined uniquely the subsequent policy path, which instead remains open and contingent to shifts in policy preferences which arise from political competition.

There are important intertemporal dimensions in both jurisdictions in terms of selection capacity. The strategy has been to agree policy objectives in the short term, and accommodate different and conflicting values involved in biofuels expansion by legislating guides to future policy change in the advanced biofuels sector. This adoption of two separate types of biofuels policy has precipitated a distinctive implementation situation. There is a superordinate goal of a substantial biofuel component in the liquid transport fuel market but there is only limited explicit policy guidance over the sources of future advanced biofuels. There also exist complementary superordinate constraints such as sustainability criteria which, as noted, are perceived to constrain conventional 1G biofuels more than advanced.

In the EU, additional 'credit' against renewables targets is available for advanced biofuels. In the US, the Renewable Fuel Standard (RFS) includes separate targets for different types of advanced biofuel, but this is accompanied by powers granted to the Environmental Protection Agency (EPA) to amend those targets year on year, in line with expected production. Uncertainty over what industry actors are willing and able to deliver raises the question of whether, and how, this acts as a constraint on the evolution of policy, in which actors are committed to a certain policy direction; a concern reinforced, in the US case, by the inclusion in the policy implementation process of this reverse gear.

Our analysis of the data collected shows that reformers' attention has waned in the US and in the EU, that the initial spirit of the reforms that held the reform coalition together has been contested by novel, unanticipated concerns in the implementation process. Notably, both the US and EU cases reveal that the discourse of sustainability, far from helping to integrate various policy objectives in the implementation phase in a common concern, can (i) add complexity to initial policy design, and increase the number of objectives, interests and players in policy implementation; (ii) be used as a key resource by institutionally-embedded actors in existing policy legacies to protect their autonomy against the ambitions for a coordinated implementation of the initial policy design. This is complicated further by the continued absence of significant commercial-scale production of advanced biofuels from the market (currently, about 99% of all biofuels globally are 1G, based on agricultural feedstocks).

Of course policy is always made under conditions of uncertainty, but the degree of market uncertainty and technological uncertainty that attends biofuels policy is central to selection capacity. For example, ethanol in the US is a valid outlet for its large-scale corn production, whilst ethanol and biodiesel are valid outlets for EU agricultural production, in the context of a decoupled CAP. These are 'market' reasons for this use of US/EU feedstocks that exist independently of 'policy' reasons. Policy is being implemented in conditions where various agricultural commodity markets are volatile, oil prices likewise, competition domestically and internationally is variable, in the context of a credit crunch for capital. Thus in trying to create appropriate incentives for a new biofuels industry, biofuels policy settings are not the only relevant factor.

Operational capacity

The design of biofuels policy in both jurisdictions requires flexibility and adaptation in operation, to ensure success in meeting the 10 year and longer targets. In the US, 1G ethanol is restricted by the blend wall. Advanced biofuels are limited by the lack of domestic commercial production – although that target could be met through imports of, for example, Brazilian sugarcane-based ethanol. The policy response to the blend wall has been to seek agreement on raising the ethanol blend percentage in gasoline; whilst, for advanced (cellulosic) biofuels, the current response is for the EPA to reduce the annual targets in RFS2, in line with estimated production each year. Meanwhile the Department of Energy (DoE) is offering increasing amounts of money to support research on different advanced biofuels, including the establishment of demonstration-scale plants. There are already several million FFVs on the road in the US, but interviews indicate this is in response to tax breaks and thus lower purchase prices; meanwhile availability of E85 remains limited and somewhat localised.

The EU mandate target of 10% of transport fuel from renewables in 2020 is somewhat more modest than the US target, perhaps half of the US figure, based on current projections for US gasoline demand for 2022 (although the environmental impact may offset this, given the greater GHG emissions reductions demanded in EU policy). Given also that the mandate does not distinguish between ethanol and biodiesel, nor between 1G and advanced biofuels, thus offering both flexibility in delivery and reducing potential ethanol blend wall concerns, the EU target appears, currently, to be more achievable. Countries' progress towards their individual targets, however, remains mixed at this stage (European Commission 2011).

Given the current status of debate in the US over the blend wall, a significant exportable surplus of ethanol is emerging from what was intended primarily as a domestic policy. Furthermore, Brazil has recently been importing ethanol, given poor recent cane harvests and price developments on the sugar market. Imports have come, in part, from the US, as a result of the domestic market constraints created by the blend wall.

In the EU, meanwhile, domestic production potential has meant its mandate would always require imports. Despite this, biofuels production in the two largest producing countries, Brazil and the US, is driven by domestic market concerns – production is not driven by potential export demand. Indeed, in the US exports of ethanol do not count towards the RFS2 mandate. It is beyond the scope of the present paper to analyse market developments in third countries where production may have been promoted specifically for export to the EU. At the time EU policy was being developed, however, the lack of policy coordination was such that the understanding that imports would be needed was not matched by knowledge of where those imports were to come from.

Beyond trade concerns, our data on the scope of the networks in which the EU and US are actively involved casts doubt on the extent to which domestic biofuels policies are subject to the influence of transnational politics. The principal inter-governmental biofuel body is the Global Bioenergy Partnership (GBEP). Interview data reveal very little transnational political impact on domestic policies in this forum. Instead, for example, it provides a forum for countries to ‘learn about’ each other’s jurisdictions, policies, the repertoires of instruments and methods, rather than representing epistemic communities in a Peter Haas (1992) sense. The domestic politics are so competitive it seems that this ‘soft’ power is attenuated and does not redistribute existing power in the policy system.

A notable difference between US and EU experience does arise, however, as a result of the different trade needs arising out of their domestic biofuel usage mandates. Our interview data from policy-makers in the US reveals very little evidence of a direct transmission belt from the ideas, strategies and activities of transnational political actors to domestic politics. In contrast EU policy, with its need for imports, has had to face a series of significant transnational issues. Given GHG emissions reductions is a central part of EU policy, there is a need to ensure the production of all biofuels feedstocks contributing to biofuels consumed in the EU avoids conflict with this goal. As a result, a system of policy measures is being developed regarding the production conditions of feedstocks, whilst remaining consistent with WTO rules on trade barriers.[5] There is strong evidence that EU sustainability criteria have been developed with WTO rules expressly in mind (Ackrill and Kay 2011). Moreover, transnational political engagement is expressly part of the guidance offered to countries in the WTO Technical Barriers to Trade Agreement (TBTA) when developing such criteria (*ibid*).

There are also various national and international Roundtables, in which a variety of economic and civil society actors work together in defining what sustainable biofuels

[5] US policy includes GHG emissions reductions thresholds, and sustainability criteria applicable to all feedstock production, from any source country. That said, the text distinguishes between, for example, federal and non-federal lands, suggesting a domestic orientation dominating in their initial design.

are or should be, what could/should private actors do to move in that direction, and how this can be certified and verified (Verdonk, Dieperink and Faaij 2007; Mol 2010; van den Hombergh 2008). Direct engagement between governments and Roundtables is key where the practical requirement of aligning certification schemes of the latter with importer government standards sets the biofuels trade policy agenda.

For example Bonsucro (formerly the Better Sugarcane Initiative) developed a general sugarcane production-standard, to which was added a small number of additional elements when developing an EU-compliant standard. Moreover, the Roundtables' certification function helps promote sustainability production independent of biofuels concerns. Products such as palm oil certified by the Roundtable on Sustainable Palm Oil (RSPO) are gaining market credibility in the eyes of industrial buyers and, ultimately, final consumers. This is helping spread the use of RSPO certification procedures globally.

The differences between EU and US engagement with such transnational actors reflect the different trade implications of biofuels mandates. In Brazil, meanwhile, the government's position has been to engage with the EU during the process establishing legislation on sustainability criteria. Brazil has avowedly not, however, supported or promoted domestic producers' involvement with certification schemes. It has remained neutral, a position from which (interview data reveal) it can best monitor policy implementation to ensure WTO-compliance in the policy-enactment phase. If it judges it necessary, it can then bring an action in the WTO without risking the credibility of the case: supporting Brazilian producers' involvement in a scheme could give the impression it was giving official approval to that scheme.

Overall, therefore, we have found evidence of transnational political networking activity by policy-makers, but in political terms the influence of this work is attenuated, certainly relative to domestic networks and their impact on domestic policies. Identifying a lack of operating capacity at the transnational scale, particularly in political terms in the form of inter-governmental influence, is an important finding.

One interpretation is that at the present stage of the development of biofuels policy, the construction of domestic operating capacity is of paramount importance. Moreover we may assume that, *a priori*, this is less challenging politically than constructing operational capacity on a transnational scale. As noted earlier, Value Agreement was undertaken by means of emphasising aspects of biofuels policy to which domestic constituencies would be most receptive.

In considering the co-ordinating mechanisms to implement the policy in each jurisdiction and how this has left both policy areas susceptible to fragmentation through sustainability concerns (which, in turn, have different meanings and scope in the EU and US), the initial policy design is brought into analytical focus. This included various policy objectives – implicitly and explicitly – such as rural development, energy security, and GHG emissions reduction that were managed intertemporally. This strategy required the bridge between the two stages, of 1G and advanced biofuels, to be credible for co-ordinated implementation. Without this, spillovers between the different temporal dimensions of the policy may arise and values conflict as their incidence is distributed among different policy legacies that might have an interest in biofuels policy.

It may be self-evident to assert that the lack of co-ordination in policy design is positively related to lack of co-ordination in policy implementation. Yet this truism sits at the heart of the implementation dilemma for both the US and the EU: the need to remain credible about long term goals alongside ambiguity about the reasons for those goals and necessary uncertainty about the steps to their achievement.

One policy issue that has been used by opponents of biofuels to challenge the policy goals, that raises questions about the internal consistency of domestic biofuels policies, and has exposed significant differences of opinion in different countries, is ILUC. The increased global demand for biofuels, so the argument goes, results in an expansion of croplands used to produce the feedstocks for ethanol or biodiesel production. What then happens is unclear (see below), but a possible causal chain of events could be as follows.

As farmers worldwide respond to the higher prices for crops now being diverted elsewhere into biofuels production, pristine lands are cleared and converted to new cropland to replace the crops for feed and food. Because natural lands, such as rainforests and grasslands, store and sequester carbon in their soil and biomass as plants grow each year, clearance of wilderness for new farmland (locally or globally) translates as a net increase in greenhouse gas emissions. ILUC is thus seen as the unintended consequence of biofuels demand on the GHG balance of a biofuel.

As several interviewees noted, in its causal complexity ILUC is difficult to imagine, never mind measure; indeed, direct observation and measurement are impossible.

Modelling is the only feasible approach, although determining the accuracy of such estimates is undermined by the unobservability of ILUC as a causal process, rather than a series of coincidental land-use changes in different regions and countries. This illustrates how policy-making within the discourse of sustainability is never a settled process because of its expansive quality; different and novel dimensions constantly emerge, compared to something more limited (but nonetheless grand) like GHG reduction, whilst understanding and modelling capacity of these aspects continues to develop.

Foresight Capacity

To adapt a distinction in James March (1978), policy-making always takes place in an environment of uncertainty about the consequences of action, but importantly also in an environment in which there is uncertainty about future preferences. The study of policy processes, over many decades, has served to query, empirically, the use of the assumption that policy preferences are stable over time, consistent, and exogenous to policy actions and their effects in modelling the policy process. Instead preferences are often vague, unstable and inconsistent.

With both the EISA and RED, there are explicit biofuels mandates (plus other targets, such as the US Corporate Average Fuel Economy, or CAFÉ, target for increasing average car fleet fuel efficiency). The EISA also contains explicit targets for the improved energy efficiency of Federal car fleets, as well as support for research into new technologies such as electric cars, advanced biofuels etc. In the EU, such measures are not contained in the RED, but in a range of thematic research programmes. In addition, there are other policy measures that are less explicit, yet continue to move energy usage and climate-change mitigation measures in a particular direction. This latter feature is not only a direct legislative effort, but also represents a contribution to a wider political discourse on energy and climate issues that continues to be contested.

Although the present paper is focused primarily on transport biofuels, it is important to note that both US and EU biofuels policies exists in a wider energy and climate context. That said, one difference is the nature of targets in those other policy areas. In the EU, the 20-20-20 targets represent targets for GHG emissions reductions, renewable energy in the EU energy mix, and a reduction in overall EU energy usage; of which heat and power are important contributors. In the US, however, the Senate removed a House plan to require that, by 2020, electricity utilities delivered a minimum 15% of electricity derived from renewable sources, with up to 4 percentage points able to come from efficiency savings (Sissine 2007, 2).

In the EU, the institutional structure allows the European Commission, not subject to electoral cycles, to engage in more challenging 'blue-sky' policy thinking. It is already, for example, undertaking discussions about possible goals for energy policy by 2050.[6] However even if, in policy terms, the EU is working towards more challenging targets, and even if the discussions of policy in 2050 are not fully delivered, in both jurisdictions the legislation and the surrounding discussion are seeking to take policy in a certain direction. Even if it is two steps forwards, one step back, as the House/Senate disagreement over renewable electricity illustrated, that is still a net step forwards in a particular desired direction.

[6] http://ec.europa.eu/energy/strategies/2011/roadmap_2050_en.htm (accessed 5 July 2011).

Reflection Capacity

Given the problems facing policy-makers, outlined at the start of the previous sub-section, there is then the question of the ability of policy-makers to reflect on policies as implemented. Can inconsistencies between policy-as-designed and policy-as-implemented be identified and corrected? Can lessons be learned from past experiences and/or from experiences in other countries? In terms of the biofuels cases, it is the credibility of government's commitment to longer term targets for biofuels use which lies at the heart of implementation politics; changes may be needed in order to maintain forward movement in the general direction of broad goals, even if they are implicit and unquantified. This requires a capacity for forward-looking Reflection.

Our data reveal that the feedback processes from policy design to subsequent policy changes are not straightforward; they are an uncertain and volatile mixture of positive and negative. There is evidence of policy layering (Streeck and Thelen 2005; Mahoney and Thelen 2010) in design; for example, biofuels policy clearly overlaps with, though it is much broader in scope than, the agricultural policy domain as it increases biomass demand i.e. for certain commodities as feedstocks, also ethanol production/refining generally in rural areas (biofuel feedstocks are typically bulk-losing commodities).

But policy layering in design needs to be complemented by analysis of its consequences in implementation. In particular, the interaction between different legacies and new interests can be observed in the lack of institutionalisation and co-ordination between the two parts of the design in the implementation phase. The biofuels cases are suggestive of the particular difficulties of joining up government in the new governance of sustainability. The two part policy designs that were enacted in the US and the EU immediately introduced a number of bureaucratic players in implementation. In the EU several Commission Directorates-General were involved: Energy (ENER), Mobility & Transport, Environment, Climate Action and Agriculture; in the US there was DoE, Department of Agriculture, EPA and State – let alone the other stakeholders and interested non-state actors involved in implementing policy. Furthermore, as noted, the emergence of new international organisations, such as GBEP, provide a forum for discussion between the major players in a more constructive and progressive manner than the traditional international intergovernmental organisation. Internally, however, the biofuels cases have revealed old interests have still been influential. With the RED, DG-ENER held the pen; whilst in the US, RFS2 was driven through by the Senate.

In both the EU and US, despite the use of policy mandates, we observe a biofuel policy bifurcation between an increasingly path-dependent 1G component and a still incoherent, uncertain and contested advanced component. In terms of technological uncertainty and policy implementation, the biofuels policy case is affected by uncertainty about parameters within existing technologies (e.g. blend walls, and viability of existing liquid transportation fuel infrastructure) as well as uncertainty about technological paradigm shifts to advanced biofuels. The potential consequences of this latter shift – something anticipated in existing policy design – for biofuels policy-making is so profound as to make its prospect something that adversely affects the institutionalisation of advanced biofuels policy.

The US corn-ethanol production target for 2015 is likely to be met, without significant adverse effects on domestic food prices, nor significant disruption to existing fuel distribution infrastructure. The growth in the biofuels market up to 2022, however, is designed to be in advanced, especially cellulosic, biofuels. In the US, the different mandates in a sense represent different biofuels policies. So, with the technological change hypothesis, with 1G biofuels policy there is less technological uncertainty and a more co-ordinated policy. Yet even here, technological uncertainties remain. The blend wall debate has led to a policy for E15 which, without indemnity insurance for gasoline suppliers, has delivered very little E15 to the market.

Furthermore, technological uncertainties also play a significant role on the demand side. Higher fuel prices have reduced vehicle miles and thus fuel demand, whilst CAFÉ regulations ensure average fuel efficiency across carmakers' fleets continues to rise. These developments make it harder to absorb even the targeted 15 billion gallons of conventional ethanol by 2015. Interviews reveal different options being discussed in response – so-called mid-level blends higher than E15; flex-fuel vehicles and E85 – all of which have technological implications, including infrastructure and engine-design limitations. This is against a backdrop where biofuels are increasingly unpopular; although at the time of writing, one source of discontent – the blenders' tax credit – is coming under increasing scrutiny.

If the authorities are this uncertain about existing technologies when they make policy related to 1G, what does that say about policies related to advanced biofuels? It is in the space for these and the huge mandates for a domestic industry not yet working (because technology is uncertain) that the co-ordination problems are yet greater. Of course, the co-ordination problems may well be fundamentally technical in nature rather than policy/political; but the concern of this paper is how technological uncertainty is related to policy coordination in implementation.

In the EU, the whole context of domestic production of biofuels means imports are more inevitable than in the US, whilst locating biofuels firmly in the climate change agenda has decoupled biofuels policy from agricultural policy. This meant there was less policy layering and the problems which that might pose for co-ordination in implementation, as the tense relationship between different layers prevents the emergence or design of institutions.

Conclusion

In this paper, we have developed a framework within which policy capacity can be analysed. Specifically, we have drawn on an in-depth empirical study of biofuels policies in the EU and US, as an early and influential case which tests the ability of states to move to a low carbon economy. We have identified five distinct elements within the process of policy-making, design, reform, implementation and evaluation.

Biofuels policies in the EU and US have developed significantly, at about the same time during the last decade. They responded to similar concerns – although across and within jurisdictions, the emphasis given to each individual factor has varied over time. As we have traced their development, significant differences and notable similarities have been observed. In the implementation phase, land use change, sustainability food security concerns (exogenous to policy designs in both jurisdictions) have pushed both US and EU policy in a convergent direction.

We are cautious of such clear-cut analysis, as the paper simultaneously argues that both jurisdictions are wrestling with the difficulty of co-ordination and struggling for clear direction in implementation; thus making the detection of any policy trajectory hazardous. Nevertheless, the intriguing point remains that the EU debates have always been located in a wider climate change (c.f. US) strategy; right back to the policy design phase. This is an important starting difference between the two cases. Indeed, we can go further and see separate policy frames at the design phase in US and EU in terms of deeper cultural values: EU desire to be 'green' diplomatic leader in the world during the time of the Bush administration and the assertion of deep and distinctive 'European' values; as does the energy security concern in the US tapping into older notions of isolationism and self-reliance. Yet, the continued contestation of biofuel policy in the implementation phase in both US and EU especially during 2008 can be observed in increasingly common problems of policy co-ordination, particularly in managing the 'bridge' between the two types of biofuel policy, with attendant consequences for politics of implementation.

The policy agendas in implementation look more similar in 2010 than they did in policy design phase 2006/7. For example, the tripod of climate change mitigation, energy security and rural development exists in policy narratives in both the US and the EU. There is convergence and coherence around those elements as regards 1G biofuel policy. Moreover, as our interview data from Brussels reveal – if someone challenges biofuels with reference to one leg of the tripod, the defence can be made that biofuels deliver the other two. The continued feasibility of such value-cycling will be tested in both jurisdictions in the near to medium future.

In the EU, the phased introduction of policy has seen the introduction of the RED in 2009, sustainability criteria in 2010, and discussion over land-use change in 2011. 2012 will see the first of a series of two-yearly reports on the implementation of the RED. Through this process, Reflection Capacity will be tested to ensure the member states, individually and collectively, reach the stated goals in 2020. That said, EU policy is sufficiently flexible that its biofuels target can be met, albeit mainly with 1G biofuels. In the US, the failure to develop significant production of advanced biofuels, especially cellulosic, represents a serious threat to the ability of the US industry to produce the desired volumes of biofuel types by 2022; whilst the blend wall and the limited availability of higher ethanol-blend gasoline and cars to use it represents a serious limit to market demand. Here, Reflection Capacity will be tested fundamentally – and may require a response which questions the entire biofuels policy capacity of the US.

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