

A climate for collaboration

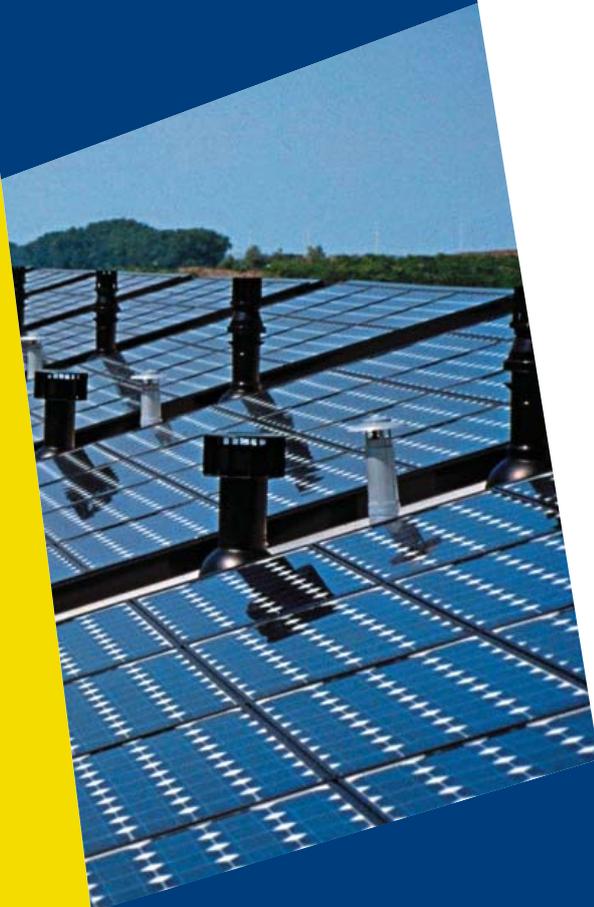
Analysis of US and EU lessons and opportunities in energy and climate policy

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Abstract

This paper aims to improve mutual understanding between the EU and US with regard to climate change and energy policy, suggesting specific opportunities for transatlantic cooperation in this area. A background on the environmental, legislative, and economic contexts of the EU and US as they relate to climate policy sets the context. This is followed by an overview of how cap & trade, renewable energy, and sustainable transportation policies have taken shape in the EU and the US. Some observations and lessons learnt within each of these areas are highlighted. Building on these insights, recommendations are made regarding the carbon market, possibilities for new technologies to bridge the valley of death, and best practices and standards.

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Executive Summary

After having followed notably different policy paths over the past decade, the perspectives on climate and energy policies of the US and the EU are now converging. This opens up new opportunities for cooperation in climate change and energy policy analysis and implementation. Constructive collaboration requires mutual understanding of the starting points, gaps and strengths within the US and EU systems. In contribution to achieving such understanding, this work presents a comparative evaluation of three policy areas related to climate change mitigation: cap and trade, renewable energy, and sustainable transportation. A review of the EU and US policies elucidates where both economies can benefit from each other's experience.

Climate policy in the US has, thus far, been primarily limited to local, state, and regional efforts. For example, the northeast Regional Greenhouse Gas Initiative caps CO₂ emissions of electricity generating sources and distributes allowances through auctioning. The EU, however, began with a centralised system: the European Union Emissions Trading Scheme (EU ETS), which in its initial phases used a free allocation system to distribute allowances and has since tightened its rules to implement more ambitious caps and auctioning of allowances. Reciprocal learning could increase efficiency of the mechanisms in both jurisdictions.

The Renewable Portfolio Standard (RPS) is a commonly employed mechanism to encourage renewable energy development within the US states. Within the EU, renewable energy support mechanisms vary considerably by Member State (MS). Germany has a feed-in tariff, the Dutch have a feed-in premium, and the UK an obligation system, all of which aim to contribute to the EU objective of achieving 20% of gross final energy consumption through renewable energy. All these systems have specific merits and drawbacks, and are effective in different fields. There is much scope for mutual learning on best practices although this must be carefully considered within the specific context in order to ensure effectiveness and compatibility with other policies.

In sustainable transport, both the US and the EU are currently implementing a low-carbon fuel standard - the US following California's example and in the EU moving from a voluntary to an obligatory system. The US standard requires the emissions per energy content of the fuel to be reduced and considers the overall life cycle emissions, while the EU CO₂ emission standard focuses on increasing carbon efficiency of vehicles, as high fuel prices in the EU already render a relatively fuel-efficient vehicle fleet.

Based on the overview of EU and US climate policies, lessons learned and observations, we offer recommendations on opportunities for coordination in the following areas: the carbon market, innovation for low-carbon technology in the demonstration phase and common policy best practices and standards.

Facilitating a dialogue between relevant policymakers, industry and policy researchers across the EU and US could assist in optimising emissions trading and its effectiveness on both sides of the Atlantic and globally through streamlining offsetting mechanisms. Sharing experiences and conducting collaborative research into the mechanisms to support technologies through to commercialization could be of great benefit. Policymakers and researchers could further converge on best practices for policies in various sectors. For sectors not covered by a cap-and-trade system, setting uniform technology standards could help level the playing field and increase cooperation, with global spill-over benefits.

1. Introduction

The climate and energy policies of the United States of America and the European Union have recently been converging, after having followed notably different paths in the first decade of the 21st century. While the EU adopted the Kyoto Protocol and embraced a domestic cap-and-trade system, the US focused on developing low-carbon technology and energy security policy. Recently US House of Representatives has adopted a cap-and-trade bill, and the EU is supporting technology-specific climate and energy policies. These developments open up new opportunities for cooperation in climate change policy analysis and implementation. At the same time, lack of knowledge on each other's starting points, policy drivers and systems still leads to misunderstanding on climate and energy policy with policymakers, researchers and other stakeholders on both sides of the Atlantic.

After years of minimal cooperation and information exchange between the US and EU, opportunities for sharing climate and energy policy experiences are ample. This paper identifies a selection based on a high-level review of policies in energy and climate. The convergence in perspectives and policies provides significant opportunities, not only to share best practices, but also to view how to catalyze the transformation to a clean-energy economy. Moreover transatlantic cooperation in the field of energy and climate could create momentum for clean producers, potentially even leading to a tipping point in the global market.

A deepening of cooperation between the US and the EU requires mutual trust, and understanding of current policies, challenges and successes. Through providing such understanding among policymakers, industry and other stakeholders in both economies, opportunities for transatlantic cooperation on climate change and energy policy emerge. This paper sets out by discussing the environmental, legislative, and economic contexts of the EU and US as related to climate. This context is essential to understanding how cap-and-trade, renewable energy and sustainable transportation policies have taken shape in the EU and the US, as described in Chapter 3.¹ For each of these policies, a barrier analysis and discussion is provided. Chapter 4 builds off this improved understanding to list observations and possible lessons learned. The paper concludes with recommendations on topics where EU and US interests align, and where further cooperation could prove beneficial.

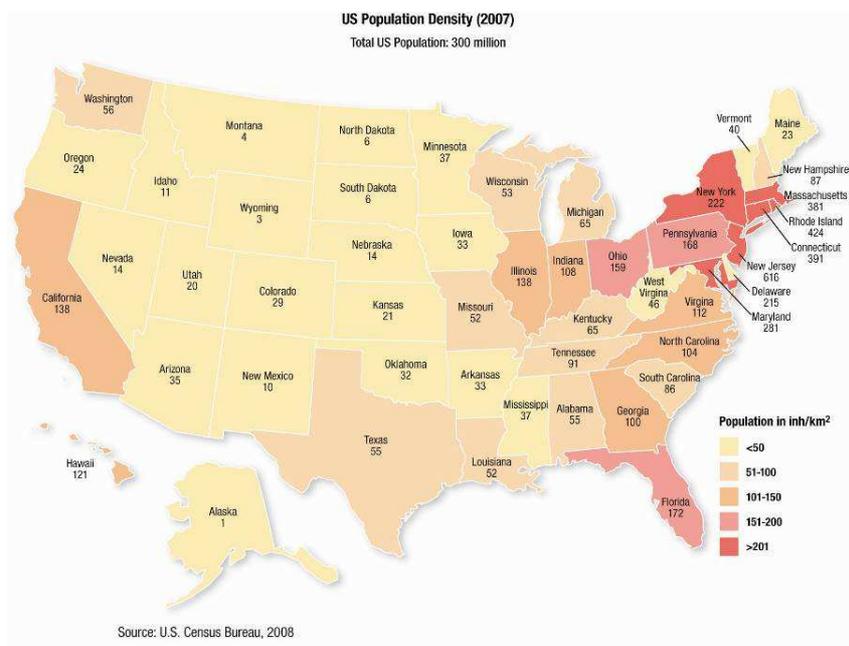
¹ Cap and trade, renewable energy and sustainable transport were selected for consideration here because they are major areas of policy concern in current discussions surrounding climate change mitigation. Energy efficiency is acknowledged as an additional sector with enormous potential to contribute to climate change mitigation at a minimal cost, however due to the scope of policies involved and the limited resources available to the authors, it was not included in this study.

2. Setting the context to climate change policy: US and EU Key climate and energy parameters

2.1 Economic and energy data

The energy system of a country is not only shaped by policies, parameters like population densities, economic status, electricity sources and per capita emissions also matter. A review of such data provides a reference point from which coordination on climate policy can begin.

As the maps here show, the EU is characterized by higher population densities. The area of the US is more than double that of the EU². This is relevant to the discussion here on several levels. Population density is one indicator of the amount of land potentially available for renewable energy development or the population potentially displaced or affected due to changing climate conditions; on the other hand larger area indicates larger distances for transportation and for distribution infrastructure.



² Note: The maps presented in this report are not to scale.

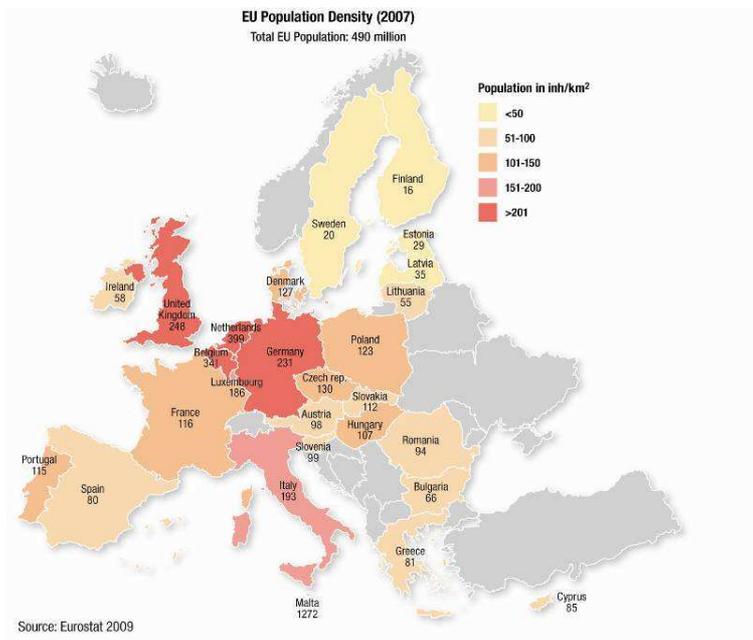


Figure 2.1 *US and EU Population Densities*

Note: Countries in grey are not part of the EU and are only shown for graphical purposes.

There are a variety of economic factors that affect the motivation of government at all levels to pursue climate policies, including the real and external costs of environmental emissions, electricity prices, local resource availability, gross income levels, and broader economic climate. Comparisons of the gross domestic product per capita indicate that, while the economic conditions within the two regions are similar, the US overall has a higher GDP per capita than in the EU, particularly as compared to eastern Europe.

In the US, states with an abundance of coal, nuclear, or hydroelectric power, may have less incentive to invest in local non-hydro renewable energy (RE) resources than states that must import electricity or fuels at a high cost (EIA a, EIA b). States with higher gross state products have more resources that can be funneled to climate change mitigation programs, including renewable energy development. Many states now cite the anticipated manufacturing and job creation as a major driver in dedicating limited state resources to the renewable energy and energy efficiency sectors. Programs to assist the US workforce transition from energy-intensive activities to clean-energy jobs could, thus, prove to be a valued aspect of any proposed climate change policy.

A recent study concludes that the American Recovery and Reinvestment Act, a stimulus package emphasizing job creation and clean energy production, combined with the House climate legislation, would generate public and private investments in clean energy of \$150 billion/year, yielding a net gain of 1.7 million jobs annually (Pollin et al. 2009). New jobs created through these investments stem from building retrofits that require, for example, electricians, installers, carpenters, construction equipment operators, procurement specialists, and engineers.

In the EU, the energy intensity of the entire economy varies by a factor of almost ten between Ireland and Denmark (103 kgoe/1000€GDP³ and 105 kgoe/1000 €GDP in 2007) and Bulgaria (1016 kgoe /1000€GDP), which joined the EU in 2007. The number of employees in the energy sector has decreased since the mid 1990s (EMCC 2008). The decrease was mainly in lower skilled personnel.

³ 1 kgoe= 6.84barrels of oil equivalent=39 623Btu (mean).

The necessity for higher skilled employees is expected to rise in future as the large energy companies are becoming more efficient and the RE sector expands. Also improving general infrastructure necessary to develop a clean energy economy is expected to contribute more jobs (EMCC 2008).

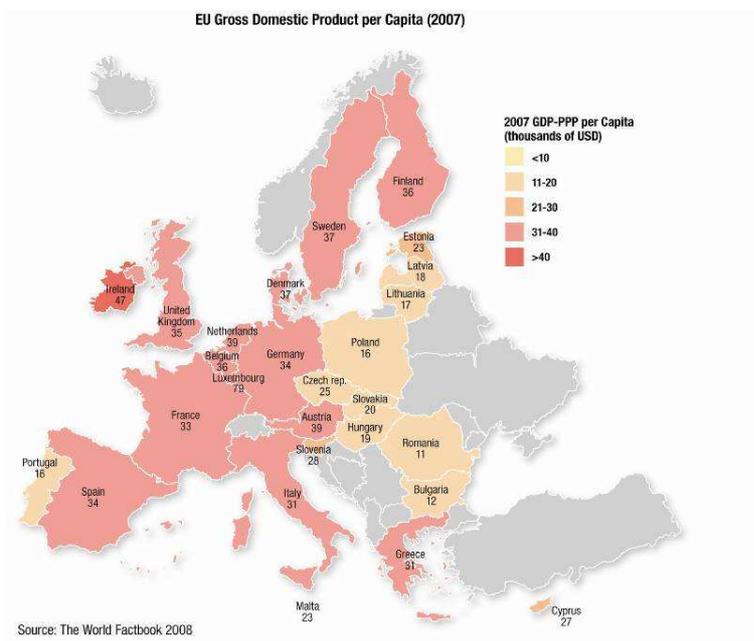
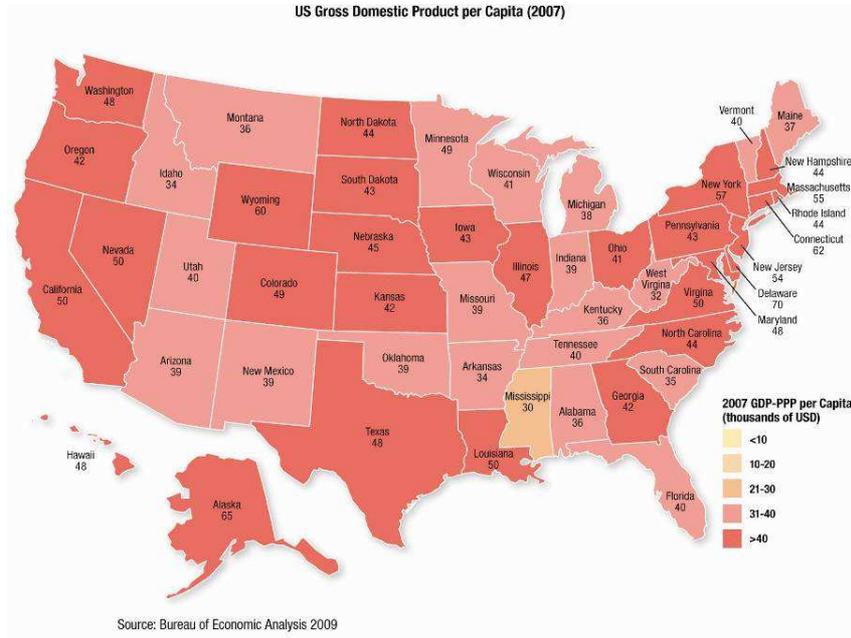
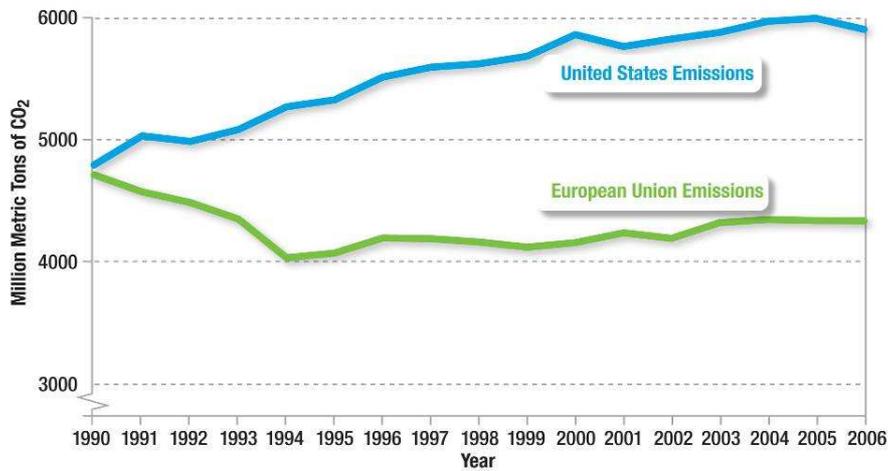


Figure 2.2 US and EU GDP per Capita

Note: Countries in grey are not part of the EU and are only shown for graphical purposes.

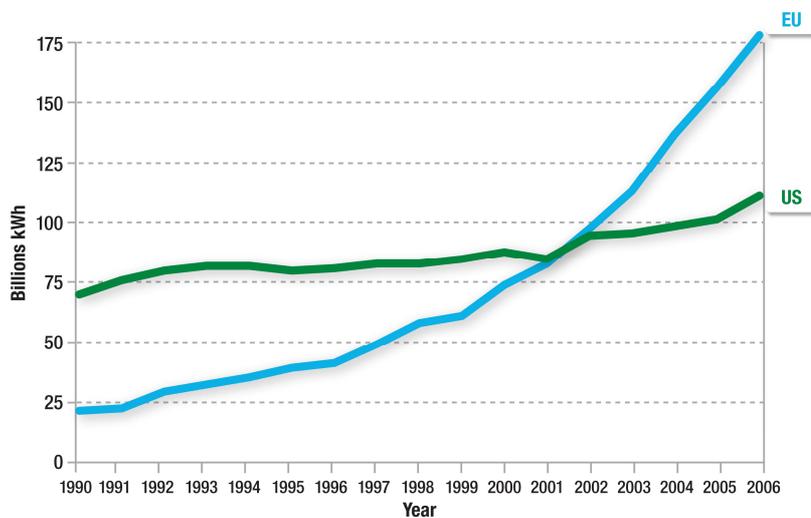
Emission trends over the period 1990-2006 show an immediate divergence between the US and EU, with US emissions rising steadily over the following sixteen years and EU emissions falling until the mid-1990s, after which they stabilized.



The historical data for EU includes all 27 countries that are currently in the EU, where available.
 Source: EIA, International Energy Annual 2006

Figure 2.3 US and EU CO₂ emission trends

The emission trend lines are in part explained by the economic restructuring in Eastern Europe and the increased use of gas after market liberalization beginning in 1990. The EU's trend line is consistent with the Kyoto target. As shown in the figure below, the consumption of renewable energy within the US has grown more slowly.



Source: EIA, International Energy Annual 2006
 *Includes: geothermal, wind, solar wave tidal, fuel cell, biomass, and waste
 The historical data for EU includes all 27 countries that are currently in the EU, where available.

Figure 2.4 US and EU electricity consumption from non-hydroelectric renewable sources

As demonstrated by the charts below, the total US electricity consumption (at 4138 TWh in 2007) is somewhat larger than the EU-27 (3185 TWh), with a greater percentage of US electricity produced with coal. The EU produces a greater share of electricity from other sources, such as hydroelectric, nuclear, and renewable resources.

Text Box 1 *Climate-related Lobbying in the US*

As climate policy has progressed at the national level, so too has the breadth of lobbying interests. A recent study reports that 770 companies and interest groups hired 2340 lobbyists to influence federal climate change legislation over the previous year (Lavelle 2009). Dominating lobbying interests are the sectors most directly affected by climate legislation - coal, utilities, manufacturers, and oil and gas. But the list of other lobbying groups, both for and against the emerging climate legislation, continues to proliferate, sometimes from unexpected quarters. Apart from environmental interests and the RE and biofuel sectors, active lobbying comes from labor groups that are concerned that jobs will move to countries without carbon caps, cities and public transit authorities that seek funding from the auctioning of carbon permits, and financial institutions that are eager to influence the structure of carbon trading (Ibid).

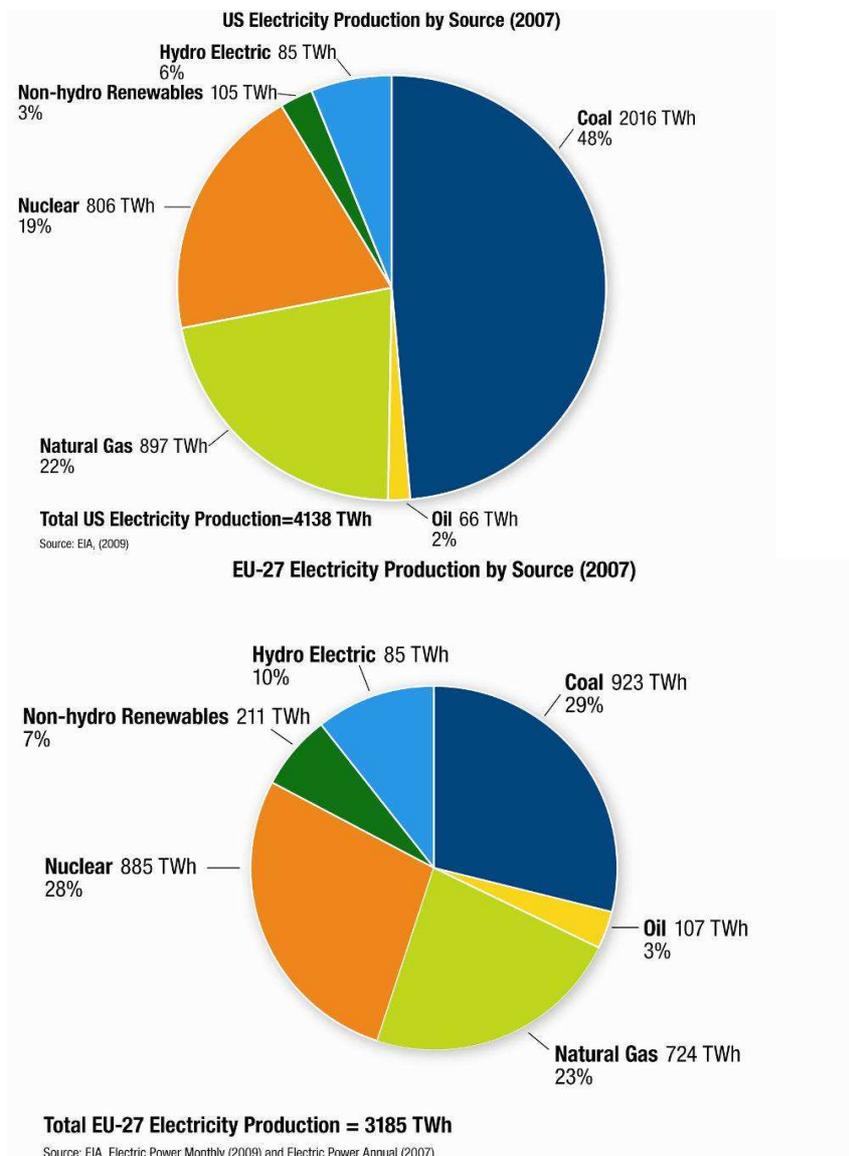


Figure 2.5 *US and EU Electricity Production, by Source*

2.2 Policy factors

2.2.1 Climate policy formulation within the US governmental structure

The formulation of climate policy in the US is subject to two primary dynamics - those between the three branches of the federal government, and those between the federal government and the states. On the federal level, the executive branch has the power to control emissions through its jurisdiction over such areas as fuel economy, national appliance standards, and regulation of national carbon markets. In particular, the executive branch's Environmental Protection Agency (EPA) has broad authority to set regulations that reduce carbon emissions under the Clean Air Act.

Although implementing climate policy at a federal level has the advantage of scope, achieving legislation at this level has proven challenging. States have been able to customize climate policies to their own political and economic contexts more easily, as evidenced by the current existence of thirty-three state-level climate plans. These state policies are in stark contrast to those at the federal level, where there exists a suite of climate-related policies, but no comprehensive plan signed into law. Because climate policy is now being formulated at both the federal and state levels, there are inevitable tensions - as well as opportunities for cooperation - between these two spheres.

Certain policies, when implemented at the federal level, prevent the implementation of more aggressive policies by states. Appliance and fuel economy standards, for example, are federally mandated to minimize the burden to manufacturers, and cannot be altered by states. States wishing to implement robust climate plans can find such federal standards restricting. Other federal initiatives, e.g., tax incentives and technical assistance, can work in harmony with similar state-level programs.

Text Box 2 Government Structure in the US - An Overview

The US federal government is composed of three branches: executive, legislative and judicial. Each branch has its own powers and areas of influence. The executive branch includes the power afforded to the President, who is responsible for the execution, enforcement and administration of federal agencies and legislation. The legislative branch consists of the two chambers of Congress: the Senate and the House of Representatives. Proposed legislation is introduced into either the Senate or House and is first debated by the appropriate committee(s). If approved by the committee, it is voted on by the full chamber. Once similar legislation is approved in both chambers, it is sent to a joint committee of the House and Senate, which writes compromise legislation. This legislation is returned to each chamber for a final vote.

Once both the House and the Senate approve identical bills, it is sent to the President, who has the power to either veto it or sign it into law. Congress can override a presidential veto, but this requires a two-thirds vote by a quorum of both the House and Senate. The executive branch then implements the legislation. If the bill is challenged to be in violation of the constitution, the case is brought to court, where the judicial branch interprets its constitutionality.

The state government process is largely parallel to the federal process, with the Governor serving as head of the executive branch, and a state legislature that typically consists of two chambers. The division of jurisdiction between federal and state levels is stipulated in the state's constitution and interpreted through the judicial branch. The need to continually interpret this division as applied to new and complex challenges, like climate change, is a source of many judicial and political disputes.

There are also key areas of climate change policy currently outside the federal government's domain, e.g., building codes and power generation - two of the strongest determinants of carbon emissions. As the federal government moves toward a comprehensive climate plan, however, states may lose some of their control over such sectors - a source of tension for many states. For example, although states currently hold jurisdiction over whether and where new transmission lines are constructed, federal preemption laws mean that they could lose some or all of this control if a federal policy regarding transmission line expansion is made (NREL 2009).

One important benefit of diversity in state climate-related policies to date has been the development of best practices that inform national level climate policy (Doris 2009). However, state activity in climate policy has not significantly shaped international climate policy. Representation in international climate discussions occurs at the federal level, and states have historically had limited ability to influence US participation or positioning in international climate agreements.

2.2.2 Climate policy formulation within the European Union structure

The confederation character of the European Union has opportunities and challenges for climate change and energy policy. For climate change, it is considered an opportunity to coordinate and legislate climate policy. The EU Emissions Trading Scheme (ETS) would not have had the same impact within single Member States (MS). Also, at UNFCCC Conferences of Parties, the EU negotiates as one country, with the Member State that holds the EU presidency representing other Member States and affiliated countries, such as Norway and Switzerland.

For some areas, however, coordination is more difficult. Decisions in the Council have to be made by consensus between 27 MS with sometimes very different interests. This makes it difficult to overcome the interests of single states, even when they are small, and to agree on proposals quickly. In addition, the complexity of the procedures can lead to months or years between the proposal and the implementation of a measure. The ETS took four years between the first proposal and the start of the scheme, and this was considered a very fast procedure. In the field of energy security of supply, there is no coherent EU policy.

Text Box 3 The European Union Governmental Structure - An Overview

The European Union is a confederation of countries that began with the treaty of Rome in 1957, the foundation of what was then called the European Economic Community (EEC). It now has 27 Member States, of which 12 share a common single currency. The legislation is divided into two main parts: the primary legislation or the founding treaties of the EU, and the secondary legislation made up of Directives and other formal regulations. Environmental legislation is usually laid down in Directives. Directives need to be transformed into national legislation for the directive to take effect in each state. This can result in differences in implementation and enforcement of climate and energy policies. Partial or late implementation is subject to a fine by the European Court of Justice.

The EU has three main bodies that make decisions:

- (i) The Council of the EU: The Council consists of relevant ministers of the Member States and shares legislative power with the European Parliament. The presidency of the Council rotates between Member States (MS) in periods of six months.
- (ii) The European Parliament is an elected body with 736 members and 20 committees that prepare the plenary sessions. It is based in Brussels and also meets in Stras-

bourg. It has three ways to participate in the legislative procedure:

- through the ‘cooperation procedure’ it makes comments on directives and regulations proposed by the Commission, which must be considered;
- the ‘assent procedure’ gives the Parliament the power to assent to international agreements negotiated by the Commission;
- the ‘co-decision procedure’, in which Parliament shares power and develops policies interactively with the Council. Through this power it can also override Council decisions.

(iii) The European Commission (EC) ‘manages and runs’ the EU and is the only institution allowed to make official new policy proposals. Each Directorate General of the EC is headed by a Commissioner, who is appointed for five years - the same period as the European Parliament. It ensures that regulations and directives adopted by the Council and Parliament are being implemented by MS into national legislation and that the timetable for implementation is followed. The EC is based in Brussels.

Text Box 4 *Climate-related lobbying in the EU*

The European Commission estimates that around 15 000 lobbyists are active in Brussels, providing information to and attempting to influence the European Commission and the European Parliament (Euractiv, 2009). All major companies, trade associations, and NGOs have offices in Brussels - some 2 600 of them - and many think tanks and other special interest groups also have a presence. In 2005, after criticism on the lack of transparency in influencing processes, the responsible European Commissioner launched a ‘Transparency Initiative,’ with, e.g., a voluntary registry and information of beneficiaries of European funds. Lobbyists in Brussels cannot exercise much power during elections; there are no known cases of special interest groups funding election campaigns.

2.2.3 Energy security issues for the EU and US

Energy security is an often-used term, yet one for which there is no agreed definition. In fact, the phrase has different implications in the EU and US. This is because different energy security issues manifest themselves in the two regions, largely due to the differences in fuel source dependencies.

The EU dependence on Russia for natural gas to produce heat and electricity causes wide concern for future energy security. Energy security became a central point of EU policy in 1996 with the Green Paper presented by the European Commission, “Towards a European strategy for energy security and supply.” Strong voices, e.g., through the above-mentioned Green Paper and follow-up documents, call for more collaboration in the field of energy security, and many political parties are in favour of the concept.

However, contrary to the climate policy arena, energy security policy in the EU has, thus far, made little headway. Although the EU is a large market that could have a strong influence on energy suppliers, these suppliers still successfully employ a ‘divide-and-rule’ tactic, to their own benefit. The EU has not been able to overcome the market failures that incentivize free-ridership, and has fallen short of kindling energy security cooperation (Gerrits 2008).

The EU directive on renewable energies is explicitly intended to address security of energy supply, as well as to promote technological development and innovation and providing opportunities for employment and regional development, especially in rural and isolated areas. These points are not mentioned explicitly in the national RE policies, but act as drivers for designing specific RE support strategies.

In the US, energy security has a slightly different implication than in the EU. The term ‘energy independence’ is more commonly used in the political context, to refer to either reducing dependence on foreign oil through increased domestic drilling (by the political right) or the need for development of renewable energy resources (by the political left). Since the US is not dependent on imported natural gas for electricity production needs, as is the EU, it does not face the same challenges with regards to energy security. Despite the different natures of the challenges of energy security, the basic issue (and terminology) is shared.

3. Overview and discussion of US and EU energy and climate policies

3.1 Introduction

This chapter presents a high-level evaluation of EU and US climate-related policies against a list of recognized barriers to development of climate change mitigation technologies and programs. This comparative evaluation is done for three policy areas related to climate change mitigation: cap & trade, renewable energy, and sustainable transportation.

First, barriers to the adoption of RE and sustainable transportation were identified through a literature search. We then matched these barriers against major policies in the US and EU, to provide an overview of the range of policy responses and to identify barriers that require further attention. Table 3.6 and Table 3.10 present the results of this process.

This discussion of US and EU policies do not distinguish jurisdiction (i.e., federal and state, EU and Member States). All policies are considered relevant to the study, even if they are implemented in a limited region. The eventual aim of the study, implemented in chapter 5, is to identify opportunities for collaboration and information exchange, not to evaluate the thoroughness or effectiveness of climate change mitigation efforts. The Appendix includes a more detailed description of policies and notes, for reference, level of jurisdiction.

3.2 Cap and trade policy

Policies that reduce carbon emissions are critical to mitigating climate change. Policies should be robust in the sense that they don't cause more emissions elsewhere. Cap and trade policies are seen as a cost-effective instrument to reduce emissions.

The structure and implementation of the underlying policies is critical to the efficacy of the emission-reduction policy. This is particularly true when there is only a single policy tool. The climate policy section of this paper provides an overview of how cap-and-trade policies have taken shape in the US and the EU, as well as an initial assessment of the strengths and weaknesses of these policies.

3.2.1 US cap and trade policy

The US is gaining interest in cap-and-trade programs to reduce greenhouse gas emissions, and the House of Representatives has passed its first legislation mandating cap-and-trade - the American Clean Energy and Security Act (H.R. 2454), commonly referred to as the Waxman-Markey bill. While a federal cap and trade policy is still many steps away from being finalized, the process has drawn much national and international attention, thus warranting discussion here.

Unwilling to wait for federal action, many states have already implemented climate policies tailored to state needs. The first cap and trade effort in the US, and the one that is furthest along in its development, is the Northeast Regional Greenhouse Gas Initiative, detailed below. In addition, the Western Climate Initiative has released the design of its cap and trade program, which is scheduled to commence in 2012 and includes transportation fuels, in addition to electrical sources. The Midwest-

ern Greenhouse Gas Reduction Accord also aims to develop a regional cap and trade system. In contrast to the EU cap-and-trade policy, none of the active or proposed US systems include industries (such as iron and steel).

US Federal Cap and Trade Policy

The Waxman-Markey bill (H.R. 2454) was released in a draft form in March 2009 and passed by the US House of Representatives on 26 June by a vote of 219 to 212. The bill comprises five titles, the third of which would create a national cap and trade scheme that would reduce greenhouse gas emissions from major sources by 17% by 2020 and 83% by 2050, relative to 2005 levels.

The Senate has drafted a comparable bill on energy and climate change, called the American Clean Energy Leadership Act (ACELA), which passed the Senate Energy & Natural Resources Committee on 17 June 2009. However, it is unlikely that the full Senate will address cap-and-trade legislation before 2010.

If the Senate passes a climate change bill, then the House and Senate versions will have to be reconciled, which will likely result in further changes and compromises to their current forms. If reconciliation can be achieved, the joint legislation will be sent to both chambers (the House of Representatives and the Senate) for a final vote, before being sent to the President for signing into law. Given the complexity of this process and the likelihood of alterations in the provisions of the bills, it is impossible at this point to predict the outcome or the strength of any future federal climate change legislation.

Northeast Regional Greenhouse Gas Initiative (RGGI)

The first cap and trade effort in the US, and the one that is furthest along in its development, is the Northeast Regional Greenhouse Gas Initiative (RGGI, pronounced 'reggie'). RGGI went into effect on January 1, 2009, capping CO₂ emissions from electricity generating sources of 25 MW or larger. The first phase stabilizes emissions through 2014. Beginning in 2015 the goal is to reduce regional emissions by 2.5% each year, for a total of a 10% reduction by 2018. If successful, the program may expand to cap other emissions from other sources.

The RGGI Memorandum of Understanding (MOU) was signed by 10 states: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. In addition, the District of Columbia, Pennsylvania, Ontario, Quebec, the Eastern Canadian Provinces, and New Brunswick are observers to the process (RGGI MOU 2005).

All 10 RGGI states committed to auction the vast majority of their carbon allowances. This decision was in response to experience with the EU ETS that indicates that providing a free allocation of carbon allowances to generators reduces the incentive to invest in low CO₂ technologies and provides significant windfall profits (Point Carbon 2008). The first three auctions, held quarterly in September 2008, January 2009, and March 2009, raised a total of \$262.3 million for the states. Subsequent auctions in June and September 2009 were 30% lower (RGGI 2009), likely due to an excess of available allowances, the effects of the economic recession and low natural gas prices.

The RGGI MOU commits states to invest 25% of revenue from carbon credits to energy efficiency, support renewable energy innovation and deployment, reduce greenhouse gas emissions, and help consumers control energy costs. Revenues from the RGGI auctions will be an important source of funding for the ambitious goals a number of Northeast states have set for the implementation of measures and technologies to enhance energy savings and emissions reductions (Union of Concerned Scientists 2009). The commitment to energy efficiency is one mechanism being used by the participating states to reduce the problem of 'leakage' (the transfer of emissions to outside of the

RGGI region). Other policies being considered to reduce leakage are those that cap carbon emissions related to electricity use or directly address these emissions through, e.g. emissions portfolio standards. The baseline needed to effectively monitor potential leakage has been developed using data from the New England Independent System Operator (RGGI 2008).

After a three-year compliance period, each facility must have a sufficient number of allowances to cover the emissions during the compliance period. CO₂ offset allowances may be used to satisfy up to 3.3% of a regulated power plant's compliance obligation, although this may be expanded to 5 and 10 percent if certain CO₂ allowance price thresholds are reached. Entities with a surplus of allowances may either bank them for future use or sell them, with unlimited banking of allowances possible. Verification and reporting within the program is controlled through the required use of state-accredited, independent verifiers. A comprehensive review of the RGGI program will be conducted in 2012 (RGGI MOU 2005).

Table 3.1 *RGGI policy overview*

Overall aim	Voluntary efforts by state governments to reduce CO ₂ prompted the formation of RGGI to develop a formal CO ₂ trading program.
Target and timeframe	Emission permit auctioning began in September 2008, and the first three-year compliance period began on January 1, 2009. The first program phase stabilizes emissions through 2014, while the second phase will reduce emissions 10% by 2018.
Responsible body	RGGI Staff Working Group acts as the enforcing entity; the environmental and state regulatory agencies within the participating states are the promulgating agencies.
Means of enforcement	Compliance enforcement is the responsibility of each signatory state. Verification is required by independent third-parties meeting accreditation standards.
Sectoral coverage	All fossil fuel-fired electric generating units serving a generator 25 MW or greater are required to comply with the CO ₂ Budget Trading Program. All power plants in the participating states are allowed to purchase CO ₂ allowances to offset emissions from generation activities.
Other provisions	The starting point of the cap is 4% above the average 2000-2004 annual emissions.
Amount of allocations	Power sector CO ₂ emissions are capped at 188 million short tons per year through 2014. The cap will then be reduced by 2.5 percent in each of the four years 2015 through 2018, for a total reduction of 10 percent.

3.2.2 EU Emission Trading Scheme (EU ETS)

The EU Emissions Trading Scheme is a domestic cap and trade scheme, covering almost half of EU CO₂ emissions, and is the centerpiece of EU climate policymaking. The scheme aims to cost-effectively reduce and control emissions in the industrial and power generating sectors. The first phase of the EU ETS started in 2005 as a trial for the establishment of the system. Phase II, beginning in 2008, is expected to help the EU-15 achieve its Kyoto target of 8% reductions below 1990; while phase III should help achieve its unilateral commitment to 20% emission reductions below 1990 by 2020. In addition, there are plans to incorporate new sectors and gases in phase III, in particular aviation. Beginning with phase II the scheme allows the use of credits generated through the flexible mechanisms of the Kyoto Protocol, Joint Implementation (JI), and Clean Development

Mechanism (CDM) - thus creating a link to the global carbon market. Each MS allocates allowances, for free in phases I and II and partially through auction in phase III. To provide a framework for allocation, phases I and II require the use of National Allocation Plans (NAP), which must be approved by the Commission. Phase III includes an EU-wide cap and centralized allocation rules, so no NAPs are necessary. The free allocations in the early phases are used to encourage broad public acceptance. Now that the scheme is operational, auctions will be used to a greater degree in order to stimulate the adoption of clean energy technologies.

Table 3.2 *EU ETS policy overview*

Overall aim	“to promote reductions of greenhouse gas emissions in a cost-effective and economically efficient manner” (Directive 2009/29/EC)
Target and timeframe	Phase I (2005-2007): cap setting decentralized process between Commission and Member State governments; approximately 2150 MtCO ₂ /year Phase II (2008-2012): cap setting decentralized process between Commission and Member State governments; on average a cap of 2080 MtCO ₂ /year Phase III (2013-2020): cap for 2020 is 1720 MtCO ₂ (decline of 1.74% p.a.)
Responsible body	European Commission, appropriate competent authority for implementation of rules of Directive (2003/87/EC)
Means of enforcement	EU wide penalties
Sectoral coverage	Power: all electric thermal power plants above 20MW installed capacity Industry: Installations from the following sub-sectors: (1) iron and steel, (2) cookeries, refineries and cracker, (3) cement and lime producing plants, (4) glass, bricks and ceramic plants, and (5) paper and pulp factories
Other provisions	Total allowed CDM/JI over 2008-2020 1610MtCO ₂
Amount of allocations	1.9 billion tonnes CO ₂ allocated in 2008 (CITL)

The trial phase (phase I) provided insightful lessons on the operation of an ETS, and led to more centralized allocation procedures in subsequent phases, particularly for phase III (Convery 2008, Ellerman 2008). Industries participating in the scheme need to take into consideration the price of carbon in their decision making. The extent of emissions reductions depends highly on the number of allowances and the resulting CO₂ price. In 2008 emissions in participating sectors of the EU ETS were reduced by about 3%, compared to the previous year, after a reduction in allowances of 6.5% for the second trading period; thus with the start of phase II the scheme has started to make a difference (Europa 2009).

The cost effectiveness of the ETS is difficult to estimate. In principle, a well-constructed carbon market supports least-cost actions to reduce emissions. However, phase I showed significant price volatility, which resulted from several factors, e.g., energy prices, economic conditions, information, and, in the first phase only, the impossibility to bank emissions for subsequent phases. The last factor, dependent on how the scheme is established, reduced the efficiency of the scheme, as it shortened the decision horizon (Convery 2008). All factors contributed to distrust in the market. One of the measures to address this problem in phases II and III is banking of credits between phases, which should theoretically contribute to price stability (Lewis 2008).

Beyond emissions reductions, ETS also supports three other policy goals: innovation, air pollution, and energy security. Innovation relates to the EU ‘Lisbon agenda’ of making the EU economy more sustainable and competitive. Side-effects include the increased use of energy efficiency, innovation, and technological development (Para 28, Directive 2009/29/EC). Many ETS-related measures also reduce non CO₂ air pollution, e.g., particulates from industrial plants due to improved efficiency. Energy security as a co-benefit is debatable. On the one hand, the ETS supports higher energy efficiency. On the other hand, it supports fuel switching from coal to gas, which is generally not considered compatible with energy security concerns.

In conclusion, the ETS needs to be robust enough for investors to estimate the consequences of inaction. So far price volatility has caused insecurity for investors. It is expected that this will improve in the phases II and III of the scheme, particularly because of better market information, stronger long-term targets and banking of allowances. The ETS has also shown to be able to respond to new developments such as the integration of the Norwegian trading scheme in 2008 and of Romania and Bulgaria, when they became EU member states in 2007.

3.3 Renewable energy policy

Renewable energy technologies are an answer to environmental pollution, energy security, health impacts and local economic impacts. Significant market barriers prevent renewable energy technologies from competing with traditional energy sources in the current market structure, since externalities are not included in the market price. This effectively gives RE a competitive disadvantage.

The role of policy is to account for the benefits of renewable energy that are not captured by the market and to reduce the barriers to technological development and deployment. Policies play this role by, for example, placing a price on pollution, providing subsidies to encourage the adoption of early-stage technologies, or offering low-cost financing options for these technologies. Gaps and barriers occur at various stages on the road to market, thus a variety of policies must be used to address each of these issues. The section below provides an overview of the variety of policies being implemented in the US and the EU to support renewable energy and indicates which market barriers they address. It provides examples of key policies, and describes contextual factors that affect implementation. This overview is in support of identifying areas of potential transatlantic collaboration in Chapter 4.

3.3.1 Policy discussion: US state-level Renewable Portfolio Standards

The US does not have a federal RE electricity standard in place, although various federal tax incentives exist to spur investment in renewable energy. However the individual States do implement RE policies. The policy drivers range from environmental considerations, energy security needs, and various economic benefits, including job creation and industrial development. Renewable portfolio standards (RPS) and goals are currently a high profile and widely implemented policy at the state level in the US.

A renewable portfolio *standard* is a mandate requiring certain electricity retailers to provide a minimum specified share of their total electricity sales from qualifying renewable power generation. Utilities may be allowed to meet part or the entire requirement through the purchase of renewable energy certificates (REC), which represent renewable power generated by other renewable power producers. Renewable portfolio *goals* are similar to RPS policies in that they set a target percentage

of RE, but unlike the RPS, are not legally binding. The term ‘set-aside’ or ‘carve-out’ refers to a provision within an RPS that requires utilities to satisfy a portion of the required renewable power using a specific resource, typically solar energy (DSIRE 2009, Doris et al. 2009).

Table 3.3 *US state-level Renewable Portfolio Standards - policy overview*

Overall aim	Ensure minimum level of renewable energy production
Target and timeframe	Varies by State, see Figure 3.1
Responsible body	State governments

As of June 2009, twenty-nine states and the District of Columbia have renewable portfolio standards. Five additional states and the territory of Guam have non-binding renewable portfolio goals. Although the state of Iowa began an RPS in 1983, most of the state RPS policies have been established within the last 10 years (Doris et al. 2009). States having implemented this policy by June 2009 are illustrated in the figure below.

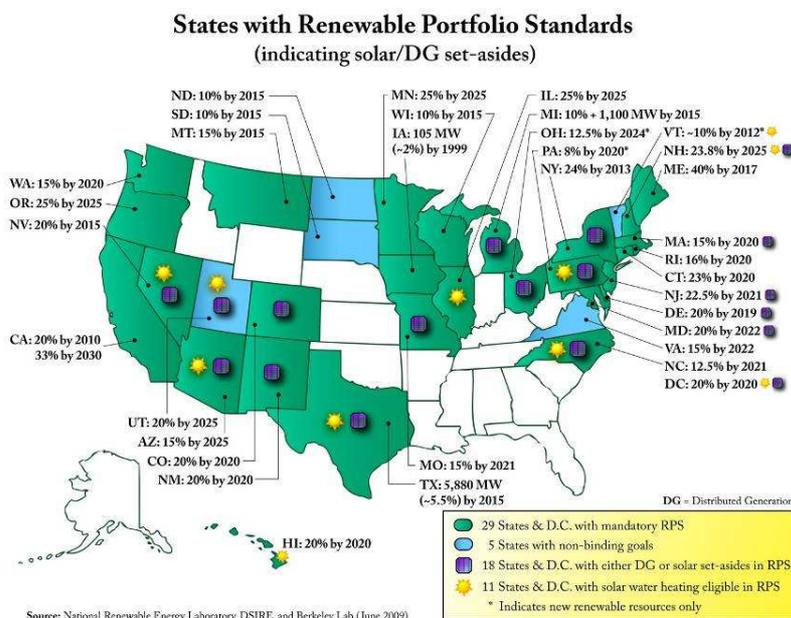


Figure 3.1 *US States with Renewable Portfolio Standards*

An RPS can work in any regulatory structure, from traditional cost-of-service regulation to competitive restructuring, and can be designed to function within a wide variety of circumstances. Varying resource availability and technology costs in different regions affect what design elements should be selected, however some overarching best practice elements have been identified. These include the establishment of REC trading and tracking, financial penalties for non-compliance, encouraging long-term financing through contract duration requirements, central procurement, credit protection policies and/or RE fund support, and a defined reporting and policy review process. In addition, allowing for a portion of the commitment to be met through out-of-state projects, and including set-asides for distributed generation or solar projects are considered to be best-practice design elements.

An RPS is best suited to states that know where the most cost-effective renewable resources are, and have a holistic strategy for getting those resources to market. If a state does not have its own

abundant, accessible, low-cost resources, achieving the ideal will require either the use of RECs or additional policies to ensure that the regional transmission system is sufficiently robust to move renewable power from resource-rich areas to the state's load centers. Creating a robust system may depend on the existence - or the creation - of multistate institutions to coordinate transmission planning and expansion. Thus, an RPS is more likely to be effective when accompanied by complementary policies, such as resource assessments, transmission expansion, and regional collaboration.

When estimating the economic impact of an RPS, there are two important considerations: (1) whether the policy allows for the eligibility of out-of-state renewable resources, and (2) to what degree in-state resources are used for manufacturing of materials and the construction and operation of new RE facilities. These factors influence how much of the economic impact of the RPS will occur locally vs. non-locally. When designing an RPS, there may be a tension between local economic growth and minimizing ratepayer impacts if the most cost-effective renewable resources are in a neighboring state or country. Extending RPS eligibility to non-local resources can reduce ratepayer impacts, but allows another state to realize the local economic development benefits associated with those resources (Hurlbut 2008).

Some US states have responded to the risk of ratepayer impacts resulting from RPS implementation by including provisions to prevent costs from escalating excessively. Important issues that must be decided when setting the price cap include how often it is triggered, the effect on investment and development risk, and the magnitude of renewable energy's incremental cost relative to the price of other fuels (Hurlbut, 2008).

Text Box 5 Supporting Renewable Energy programs through public benefit charges

Some US governments and utilities fund renewable energy programs through a public benefit charge (PBC), which is typically collected as a \$/kWh surcharge added to utility customer bills. The funds collected through the surcharge can be distributed to a variety of renewable energy programs to support renewable energy development, such as research programs, low-cost financing, demonstration projects, or public education efforts.

In the United States, seventeen states plus the District of Columbia have public benefits funds ranging from several million to several hundred million USD. Because these monies are collected through utility bills rather than the general budget, funding has remained stable despite severe cuts in public spending in 2009.

3.3.2 Policy discussion: EU renewable energy policy

The EU Energy and Climate package includes a target to increase RE use to 20% of the EU's gross final energy consumption⁴ by 2020. The target is distributed differentially among Member States, based on national income and RE potential. This agreement takes into account previously installed capacity and the potential for expanding the share of RE.⁵ For example the RE share in Germany will have to increase from 5.8% in 2005 to 18% in 2020, that of the Netherlands from 2.4% to 14% and that of the UK from 1.3% to 15%. Sweden, which already has high RE production from hydro-power, must increase the percentage from 39.8% to 49%. As part of the legislation, each MS must develop and submit a national RE action plan to the European Commission by 30 June 2010, con-

⁴ Gross final energy consumption includes the direct use of renewable fuels (e.g. biofuels) plus energy produced from renewable fuels (e.g. wind, hydro).

⁵ The shares in 2005 and the 2020 targets can be found in Annex I of the EU Directive 2009/28/EC.

taining the share of RE in 2020 for each of the following sectors: transport,⁶ electricity, and heating and cooling. The overall amount of incentives devoted to renewable energy in the EU has not been researched.

Table 3.4 *EU Renewable Energy directive - policy overview*

Overall aim	Reduction of GHG emissions
Target and timeframe	20% RE of gross final consumption of energy by 2020
Responsible body	Commission, national governments

Most MS have implemented some form of incentive to promote national RE production. In general, three main support schemes are used to promote renewable energy: feed-in tariffs and premiums (Germany, Spain, Netherlands), tendering procedures (Netherlands selectively and formerly in Ireland) and obligation systems (UK, Belgium). Feed-in tariffs determine a fixed tariff for every kWh fed into the electricity grid. The tariff can change depending on the generation technology. In a system with feed-in premiums the electricity is sold on the electricity market and the producer is provided the difference between the market price and a predetermined tariff. In a tendering procedure generation capacities are tendered by electricity suppliers who consent to specific contractual agreements. Obligation or quota systems specify how much of the electricity supply needs to come from RE sources, similarly to the RPS. The obligation can be for the utility or for the end consumer. Below, the support schemes in Germany, the Netherlands and the UK are discussed in more detail.

Germany's 'Erneuerbaren Energien Gesetz' (EEG- Renewable Energy Law) aims to source 30% of its electricity from RE in 2020 (EEG 2009). The system provides tariffs of varying levels for each technology. The system does not cap the amount of RE that are eligible to receive these tariffs. The Dutch "Subsidieregeling Duurzame Energy" (SDE - Subsidy regulations for sustainable energy) is used to increase the share of RE to 20% in 2020, but the resources currently devoted to the system are considered to be insufficient to achieve the proposed target. It is estimated that renewable electricity will achieve only a 12% share under current legislation and subsidies (Dril, 2009). The support scheme (based on Renewable Obligation Certificates - ROC) in the UK obliges electricity suppliers to source a certain amount of electricity from RE resources. If a supplier cannot meet its obligation it must pay a predetermined amount into a buy-out fund (UK 2009).

Table 3.5 *EEG, SDE, and ROC - policy overview*

	Germany: EEG	Netherlands: SDE	UK: ROCs
Overall aim	Increase sustainability of the energy system		
Target and timeframe	30% renewable electricity by 2020 14% of heat use	20% of RE in 2020	15.4% of RE in 2020
Responsible body	Ministry of Environment	Ministry of Economic Affairs	Department for Energy and Climate Change
Input	Paid by electricity suppliers who pass it on to consumers	Government budget; recently changed to energy tax funding	Paid by electricity suppliers who pass it on to consumers

⁶ Also see the discussion regarding biofuels, in this chapter.

Shares of RE in each of the three countries energy mix have risen recently. Business as usual scenarios forecast that there will be 12-14% RE across the EU in 2020; thus expenditures on policies that support RE have to greatly increase for countries to achieve the 20% target (Coenraads et al. 2008). The 2004 version of the German EEG set an intermediate target of 12.5% of renewable electricity production for 2010. It is likely that this target will be achieved, as RE covered 14.2% of final electricity production in 2007 (BMU 2008). Germany has the highest installed capacity of both wind and PV in Europe, mainly due to favorable financial conditions offered through the support scheme. Both technologies are not yet commercially competitive, but it has led the country to be one of the leading producers of PV and wind (EurObserv'ER 2008). The positive employment consequences of this have contributed to broad political and societal support for the EEG.

Prior to the feed-in system, the Netherlands had a tax incentive for RE consumption. Even so, imported RE certificates were less expensive than building additional RE capacity within the Netherlands, and the country experienced a gradual reduction in national RE investments. Subsequently a feed-in tariff was established but the lack of a predefined ceiling on program funds resulted in all applications for feed-in tariff funding being accepted. This led to excessive costs and the eventual freezing of the program in 2006. The current Dutch SDE came into effect in April 2007, its effectiveness still cannot be assessed. . Although it provides more stability, the numerous changes and non-economic barriers still stifle development, and the SDE does not appear to be sufficient to overcome them.

The ROC system in the UK achieved an increase of renewable electricity from 1.8% in 2002 to 5.3% in 2008 (excluding hydro) (UK 2009). Despite this growth, in 2004 the system was evaluated as having low effectiveness (under 5%) and high added costs (just below 0.06 €/Wh) (Ragwitz et al. 2007). A new review has been ongoing since September 2007, with no results yet. Consultations are taking place (summer 2009) to investigate the impacts of including a feed-in tariff to subsidize small-scale decentralized clean electricity production. This would be in addition to the Renewable Obligations, which primarily supports large-scale renewable electricity projects (UK 2009).

The costs of the three systems also vary. The EEG costs cannot be estimated a priori as there is no way of knowing how much electricity will be fed into the grid from a specific energy source. The additional costs are largely paid for by consumers. In the Netherlands the premiums of the SDE are paid for by the government and cover the difference between the electricity price obtained at the market and a predetermined tariff. An overall budget ceiling is determined by the government. In the British system the costs are carried through the system to the end user.

Each of the three systems offers different levels of financial risk to investors. The feed-in systems implemented in Germany and Netherlands offer high security for the investors, as they secure revenues over long time periods - generally 10 to 20 years depending on the technologies. In the German system consumers pay the higher costs due to feed-in tariffs. This provides more financial stability for investors than the Dutch system, where the subsidies are funded by the government, and are thus subject to changes in political priorities on a yearly basis. The tariffs for new installations decrease over time, due to expected improvement in technology.

The system in the UK subjects investments to greater risks because contracts have shorter terms. The government has tried to stabilize the system by ensuring that the system will be in place until 2027. The system is being considered for extension through 2037 (UK 2009). There are consultations in progress to decide how to encourage stability of the price of the ROCs (Ibid.).

3.3.3 Barriers to the development of RE and the policies to address them

Table 3.6, below, lists some commonly discussed barriers to renewable energy development down the left-hand column, along with policies used by the US and EU along the top. The table indicates the barriers that each policy is designed to address, which may differ between the US and the EU for similar policies. The table is not designed to indicate the effectiveness of the policies at addressing the barriers, only the intended effect of the policy. In some cases, other barriers may also be addressed to a lesser extent or in a secondary way. The table only indicates the primary barrier(s) a policy intends to address. Each policy is more fully described in the annex.

The purpose of the table is to: (1) allow for a comparison of EU and US policies, and (2) provide a visual method of exploring the extent to which barriers to renewable energy development are being addressed in the two regions. This provides an opportunity to identify areas in which knowledge can be exchanged and collaboration may be beneficial. If one region addresses a particular barrier more completely, this may be an opportunity for learning. This table should be considered a work-in-progress, rather than a completed product. It is hoped that this work can be refined and expanded on through future efforts.

One notable gap evidenced by the table is the lack of policies to address permitting barriers. The US has resource access laws, which ensure that building owners who want to install renewable energy systems have necessary access to renewable resources (typically solar). There is, however, a shortage of policies that address the broader permitting issues affecting larger-scale renewable energy projects. This is discussed further in Chapter 4.

Table 3.6 *Barriers to RE development and policies that address them*

Barriers to Renewable Electricity Development	US Renewable Electricity Policies													EU Renewable electricity policies													
	Contractor Licencing	Equipment Standardisation	Feed-in tariff (production incentive)	Generation Disclosure	Grid Access Standards	Investment subsidies (incl. rebates) and loans	Line Extension Analysis	Mandatory Green Power Option	Netmetering	Public Benefits Fund	Public Procurement	R&D funding (Grants)	Renewable Portfolio Standard (Renewable Electricity Standard)	Resource Access Laws [7]	Tax Incentives	Equipment Standardisation	Feed-in tariffs or premiums	Generation Disclosure	Grid Access Standards	Information campaign	Investment subsidies and loans	Public procurement	Quota systems or other obligations	R&D funding	Tax incentives	Tendering schemes	
Market Inertia and Risk Adversity																											
Perception of high risk	x	x	x			x					x		x		x	x			x	x		x	x				
Lack of market maturity			x			x				x		x			x	x				x			x	x	x	x	
Established companies have the power to guard their positions					x			x	x	x			x					x									
Cost Barriers																											
High capital costs			x			x	x					x			x		x				x			x	x		
Price Distortions from existing subsidies and unequal tax burdens between renewables and conventional sources[1]			x						x						x		x						x	x	x	x	
Lack of economies of scale			x										x			x							x				x
Technological availability						x						x									x			x			
Knowledge Limitations																											
Additional technological advancements needed (for generation, grid, and storage technologies)						x				x[5]		x									x			x			
Lack of public understanding of technologies (leads to decreased public acceptance)					x		x	x		x[6]		x								x			x				
Lack of information on products, resources and opportunities	x	x		x			x	x		x[6]		x				x		x		x							
Lack of performance validation and experience	x	x				x					x					x					x		x				
Institutional Structures																											
Permitting barriers														x													
Regulations are based on industry tradition and may restrict new technologies			x			x		x								x	x		x								x
Lack of industry coordination and leadership	x	x																									
Failure of market to value the public benefits of RE[2]			x			x	x	x	x	x					x						x				x		x
Public acceptance issues	x	x					x	x			x					x					x						

Note: [1] e.g. Conventional generating technologies receive subsidies for research and development; [2] This affects the areas of R&D, environment/health/public safety, employment/economic development/price stability; [3] This includes barriers such as a lack of clearly defined roles or responsibilities, lack of industry or market coordination or communication or a lack of institutional leadership; [4] RE projects face high financing costs and lack of access to capital due to the small size of many of the projects, the newness of the companies, the perceived risks, and high capital cost of the projects; [5] If the public benefit funds are directed toward research and development activities; [6] If the public benefit funds are directed toward public information and education efforts; [7] Residential Renewable Resource Access

3.4 Sustainable transportation policy

Like policies that promote renewable energy, those that promote sustainable transportation vary greatly. They include mandatory regulations, such as vehicle standards, to policies encouraging voluntary reductions in fuel consumption, such as vehicle labeling and congestion pricing. This sustainable transportation section provides an overview of the sector from a policy standpoint, including an analysis of fuel and emission standards for vehicles within the EU and US. The focus here is on personal vehicles and light duty trucks for road transport.

3.4.1 Policy discussion: US sustainable transport policies

Federal CAFÉ standard

One of the oldest and most well recognized transportation policies in the US is the Corporate Average Fuel Economy (CAFÉ) standard. In 1975, in response to the 1973-74 oil embargo, the Energy Policy Conservation Act established fuel economy standards for passenger cars and light trucks. The standard sets the fuel economy (expressed in miles per gallon of fuel) for fleets of passenger vehicles manufactured in the US during any given year. Vehicles with a gross vehicle weight rating of 8,500 pounds or less are subject to the standard, which is currently set at 27.5 mpg for passenger cars. The National Highway Traffic Safety Administration is responsible for enforcing and amending these standards, as well as administering all aspects of the regulation, including considering petitions for exemptions and issues of domestic production by foreign manufacturers (Title 49 US Code 2006).

Federal CO₂ emission standard for passenger cars and light-duty trucks

In 2009, the US EPA, in response to the Supreme Court ruling that ruled greenhouse gases are air pollutants under the Clean Air Act, proposed a CO₂ emission standard for passenger vehicles and light-duty trucks, effective for model year 2012. Vehicles and trucks have differing standards based on their size, but the standard stipulates that by 2016, the fleet-wide average of vehicles and light-duty trucks combined can emit no more than 250 g CO₂/mile (155 g CO₂/km). The standard allows this emission target to be met in part through credits, e.g., through the use of biofuels and improved efficiencies in the air conditioning systems. The standard assumes that overall CO₂ targets can be achieved through more widespread use of existing technologies. The EPA estimates that this regulation, in conjunction with strengthened fuel-efficiency standards through the Department of Transportation's National Highway Traffic Safety Administration, will reduce US CO₂ emissions by 950 million metric tons between 2012-2016 (EPA 2009).

Federal Renewable Fuels Standard

The federal renewable fuels standard (RFS), originally adopted in 2005, requires that certain amounts of renewable fuels be blended into gasoline. In 2007, the program increased the volume of renewable fuels required from 9 billion gallons in 2008 to 36 billion gallons by 2022. Twenty-one billion gallons of these fuels must be "advanced" lower carbon biofuels, while the remaining 15 billion gallons can be corn ethanol (EISA 2007). The Environmental Protection Agency is responsible for implementing the regulations (EPA 2009).

Table 3.7 *US federal sustainable transport standards- policy overview*

	CAFE	CO ₂ emission standard	RFS
Overall aim	Increase the sustainability of the transport system		
Target and timeframe	27.5 mpg for passenger cars built since 1990	fleet-wide average of less than 250 g CO ₂ /mile (155 g CO ₂ /km)	36 billion gallons of renewable fuel by 2022
Responsible body	National Highway Traffic Safety Administration	Environmental Protection Agency	Environmental Protection Agency
Means of enforcement	Penalties paid by manufacturers for each tenth of a mile per gallon under target for each model year	EPA may test to ensure vehicle fleet compliance; manufacturers required to remediate in the case of noncompliance	Obligated parties subject to report auditing, violators subject to penalties

State-level Low Carbon Fuel Standards

Designed to supplement the federal renewable fuels standard, California Governor Schwarzenegger issued an Executive Order in 2007 establishing a Low Carbon Fuel Standard (LCFS) for transportation fuels. California's transportation - 96% of which is fossil-fuel based, produces 40% of the state's greenhouse gases (Crane et al. 2007). The LCFS requires fuel providers to reduce the carbon intensity of California's transportation fuels, beginning with modest reductions in 2011, and growing to 10 % reduction by 2020 (ARB 2007, ARB 2009). The LCFS establishes certainty of demand for low-carbon fuels, without favoring one fuel over another.

LCFS requires fuel providers (e.g., producers, importers, refiners) to limit the life-cycle⁷ CO₂ emissions associated with each fuel sold (gram CO_{2eq}/BTU), the calculation of which includes indirect sources of carbon emissions, e.g., based on cultivation practices and fuel transportation. Fuel providers can meet their target through a variety of mechanisms:

- different biofuel mixes, e.g., selling more E85 concentrations, using cellulosic ethanol, and increasing biofuel concentrations in conventional fuel from the standard 5.7% to 10% by volume
- low-carbon hydrogen for fuel-cell cars
- buying credits from electric utilities that fuel electric vehicles
- buying credits from providers who exceeded minimum performance standards
- using banked credits from previous years

Critical to the success of LCFS in achieving net CO₂ reductions is the inclusion of indirect land use changes in calculating the fuels' life-cycle carbon intensity. When cultivated land that is used for fuel instead of food, e.g., for corn ethanol, induces uncultivated land elsewhere to be converted to agriculture, e.g., for corn, the loss of rich carbon-sinks in forests and soil causes net increases in carbon emissions - potentially the most significant factor in a fuel's life-cycle assessment (see e.g., Searchinger et al. 2008, Farrell et al. 2007). The LCFS supports the growth of next-generation, low-carbon biofuels - e.g., from switch grass or algae, which do not require cultivated land - by including land-use changes in its calculations. The LCFS, however, does not include assessments of wider sustainability impacts, e.g., on food prices, biodiversity, fertilizer-based pollution, social impacts, and water consumption.

⁷ Also known as well-to-wheels.

Table 3.8 California's *Low Carbon Fuel Standard-policy overview*

Overall aim	Reduction of CO ₂ emissions
Target and timeframe	10% reduction in lifecycle CO ₂ emissions by 2020
Responsible body	Coordination carried out by the California Environmental Protection Agency, in coordination with the University of California, the California Energy Commission and other state agencies.
Means of enforcement	A LCFS Compliance and Reporting Tool, managed by the California Air Resources Board, will be used for reporting and tracking credits and penalties.

3.4.2 Policy discussion: EU sustainable transport policies

In 2005, the transport sector was responsible for 22% of total EU GHG emissions. The emissions in the EU are projected to grow from 767MtCO₂-eq in 1990 to 1091 MtCO₂-eq in 2020, maintaining the same growth rate as between 1990 and 2005 (EEA, 2008). As part of the Energy and Climate package, in April 2009 two legally binding EU policies were approved for the transport sector: (1) regulation instituting legally binding standards for CO₂ emissions from passenger cars (EC 2009a) and (2) the RE directive, which contains regulations for biofuels (EC 2009b).

CO₂ emission standard for passenger cars

In 2007, the European Commission and car manufacturers agreed on a voluntary emission standard, for tailpipe emissions of 130gCO₂/km⁸ for the average passenger car fleet in 2012. In 2007 and 2008, however, various studies showed (e.g., EEA, 2008) that there was a severe lack of progress and that the target was essentially out of reach. The Commission, through the Climate and Energy Package, then delayed the target year to allow the industry to reach the target, but made it legally binding and enforceable.

Table 3.9 *CO₂ standards for passenger vehicles - policy overview*

Overall aim	Reduction of CO ₂ emissions
Target and timeframe	120 gCO ₂ /km by 2015, 95 gCO ₂ /km by 2020 ⁹
Responsible body	European Commission ¹⁰
Means of enforcement	European Commission imposes excess emission premiums

The new, binding CO₂ emission standard for passenger cars obliges all car manufacturers to produce fleets with an average carbon efficiency of 120 gCO₂/km by 2015. The target of 120 gCO₂/km is to be achieved in two ways: by improvements in the engine technology (to reach 130 gCO₂/km) and more efficient vehicle features such as more efficient tyres or air-conditioning systems to achieve the additional 10 gCO₂/km. The manufacturers of light duty vehicles need to adapt their fleet in three steps: in 2012, 65% of the fleet must comply with the target, 75% in 2012 and 80% in 2014. There are penalties for non compliance. Between 2012 and 2018 the penalties will be € per newly registered car for the first gram above the limit, € for the second gram and 95€ for the third gram. Starting in 2019 it will be € from the first gram. Exclusion of niche manufacturers can occur under certain conditions.

⁸ 130gCO₂/km is equivalent to 209.215gCO₂/mile.

⁹ Subject to revision no later than 2013 (AEA 2009); 120gCO₂/km=193.12gCO₂/mile and 95gCO₂/km = 152.9gCO₂/mile. All values refer to tailpipe emissions.

¹⁰ Excess emissions premium shall be considered as revenue for the general budget of the European Union (Article 9, para. 4, REGULATION (EC) No 443/2009 (EC 2009a)).

The process of agreeing on a CO₂ emission target showed that the initial voluntary agreement was insufficient, and that the European Commission had to take aggressive steps to make the industry comply. Due to the obligation, it is expected that the target will be met in the average fleet in the EU, but would need to be strengthened to eventually achieve 100% fleet compliance after 2014 (Hoen et al., 2009). It can be expected that car companies will also manufacture more CO₂-efficient cars outside of the EU.

Biofuel target

The EU, as part of its Directive on the use of RE, adopted a target of 10% renewable fuels in the 2020 fuel mix for the entire transport energy consumption. This target can also be met through the use of electric vehicles. Previously, the 2003 biofuels directive had given indicative targets for biofuels of 2% and 5.75% by 2005 and 2010, respectively, but these were not enforced. Many MS are not on track to achieve them (Pelkmans et al., 2008). Biofuels are an attractive climate policy option as they require less radical change to infrastructure than, e.g., hydrogen or electric vehicles, and can be accommodated at high percentages in new cars through slight modifications to the engine. The German example - a country on track to achieve high shares of biofuels - is discussed in detail below.

Biofuels in Germany

At the moment, biofuels in the transport sector are not competitive with regular petrol, and therefore require subsidies or obligations to increase their market share. Germany addressed this problem by implementing a bundle of measures to achieve the targets established in the Biofuels Directive, including: standards, mandates for distributors, and tax exemptions. The German policies primarily affected biodiesel; bioethanol use grew, but did not achieve the expected growth (Pelkmans et al. 2008).

So far, the share increased from 1.21% in 2003 to 6.7% in 2007, and therefore seems on track for the 10% target in 2020. The cooperation of the German car manufacturers proved important for the increased use of biodiesel (Pelkmans et al. 2008). That cooperation was in turn due to the public pressure on manufacturers to extend their guarantees to biodiesel in pure and blended form, as biodiesel was for several years cheaper than fossil diesel.

Initially biofuels were exempt from taxation¹¹. From 2006 onwards, the government decided to re-introduce a tax on biofuels for consumers to start aligning it with the taxes on fossil fuels, and enforced a mandate for distributors, with high (>0.50 €/litre) penalties for non-compliance. Consumers were initially attracted to biofuels due to their relative low-cost compared to conventional diesel, which is more heavily taxed. However, with the reduction of tax exemptions, biodiesel has again become more expensive, and the use of biodiesel B100 is projected to decrease (Pelkmans et al. 2008), endangering the compliance of Germany with the biofuel targets.

In addition to reducing GHG emissions, if sustainability criteria are met, the use of biofuels also increases energy security. Approx. 92% of German biodiesel is produced in Germany, (Pelkmans et al. 2008), boosting employment in rural and economically disadvantaged areas, primarily in the eastern part of the country (e.structure 2009).

The change in quotas and tax exemptions for biofuels and resultant decrease in use (Biofuels Barometer 2008) show that biofuel prices have not yet decreased enough to be competitive with conventional fuels. The EU policy framework adds some robustness to the German policy, but continuous policy support remains a condition for success.

¹¹ The minimum excise duty for diesel adopted by the Council in Directive 2003/96/EC on October 27, 2003 is 302 €/000 litres, equivalent to approx. 768 US\$/1000gallon (exchange rate 1€=1.4874 US\$, 27th October 2009) (EC 2009c).

3.4.3 Barriers to the development of sustainable transportation and the policies to address them

Table 3.10, below, shows the major barriers to developing a sustainable transportation system, and the policies in use across the US and EU designed to address these barriers, which may differ between the US and the EU for similar policies. As with Table 3.3, this effort is a work in progress, and should not be considered exhaustive. It is an attempt to provide a quick visual comparison of the policy efforts being used in the two regions, and identify potential opportunities for knowledge exchange and collaboration.

The table indicates that there are numerous policies in both the EU and US that aim to address public awareness of sustainable transportation. This would imply that, if these policies are effective, that public awareness should no longer be a significant barrier to increasing transportation sustainability. Whether this assumption is true, or not, is potentially an interesting question, as is understanding which other barriers have not been sufficiently addressed and identifying an effective portfolio of policies that effectively support each other.

Table 3.10 *Barriers to sustainable transportation and policies that address them*

Barriers to Sustainable Transport Development	US Transport Policies										EU Transport Policies										
	Driving regulations (e.g., speed limits, anti-idling rules)	Fuel standards (e.g. low carbon fuel standards)	Land use planning and infrastructure for alternative transport	Non-financial incentives (HOV [2])	Public education and labeling	Public procurement mandates	R&D	Road Pricing (e.g., congestion pricing, parking fees)	Tax incentives	Technical assistance (e.g. assistance fleet conversion)	Vehicle Emission/Efficiency Standards	Biofuel targets (EU level): obligations (MS level)	Driving regulations (Ecodriving)	Fuel standards (quality standards for fuels and biofuels)	Public education and labeling (e.g. Promoting public transportation)	Public procurement mandate	R&D	Road pricing (congestion charge, motorway tolls, environmental areas in city centres)	Subsidies/tenders for fuel infrastructure	Tax incentives (Exemptions)	Vehicle Emission/Efficiency Standards (120g/km)
Need for technological advances and reduced costs		x				x	x				x		x		x	x				x	
Limited infrastructure for alternative transportation		x	x			x									x				x		
Difficulties in obtaining early-stage market involvement		x				x		x		x [1]	x		x		x					x	x [1]
Limited experience bringing products to market		x	x			x		x		x					x					x	x [1]
Established companies have the power to guard their positions		x																			
Uncertainties in lifecycle environmental benefits		x									x		x								
Low public and commercial acceptance and/or awareness	x		x	x	x	x		x	x			x		x	x				x		
Infrastructure that favors vehicle travel (free roads & parking, segregated zoning)			x														x				

Note: [1] with very strict targets; [2] High Occupancy Vehicle.

4. Emerging opportunities for transatlantic cooperation

What are the opportunities for policy cooperation and knowledge sharing between the US and the EU? A series of observations and lessons based on the case studies in chapter 3 are presented below. Recommendations for actions and opportunities, based on these observations, are then presented in Chapter 5.

4.1 Cap and trade: lessons and observations

The United States and the European Union both employ, to varying extents, emissions trading as a policy instrument to address climate change. The EU has implemented the EU Emissions Trading Scheme in a top-down manner. Emissions trading in the US began with emissions trading for sulphur oxide and continued with state-based and voluntary markets, which are currently in the process of being integrated into a nation-wide accounting system.

Facilitating a dialogue between relevant policymakers, industry and policy researchers across the European Union and the United States could assist in optimising emissions trading mechanisms and enhance its effectiveness on both sides of the Atlantic. Opportunities for mutually beneficial exchange between the US and the EU with regards to emissions trading are apparent as the EU top-down and US bottom-up approaches both contain important lessons that should be shared. While the EU ETS is relatively fixed, policy development within the US is in a dynamic state. Failures and successes in the EU have been referred to in the US debate, but more attention could be given to the EU lessons learned. Furthermore, reviews of the EU ETS will take place, and some alterations are still possible.

Some elements in particular can be observed in the case studies that might be important for future developments and analyses. First, both the RGGI and the EU ETS initially had problems with insufficient information about the emissions of single emitters. In both cases, this caused prices to rise at the beginning of the first trading period and then to fall steadily after it became evident that allowances were less scarce. When developing new systems or modifications, it is important to take into account that there may be initial lack of information and that price fluctuations may result from this.

Second, a difference in scope can be seen between the two systems, both geographically and sectorally speaking. The RGGI has a smaller geographic scope than the EU ETS which may result in leakage of emissions outside the system boundaries. The EU ETS is much larger and therefore has fewer problems with leakage to neighboring areas; there are also provisions to discourage industries from leaving the area. Further, the EU ETS already includes most major emitting sectors and accounts for approximately 46% of overall EU emissions. The RGGI is expected to be expanded to other sectors if the current system proves to be successful.

A third consideration to be made for both the RGGI and the EU ETS is the offsetting mechanisms used. The RGGI includes the possibility to buy domestic allowances from specified non-power sectors to offset emissions from generating electricity. The federal US system may develop an own offsetting system. The EU ETS avoided significant transaction costs by allowing offsetting through the existing global carbon market as offsetting takes place primarily through the CDM Kyoto mechanism.

4.2 Renewable energy policies: lessons and observations

A variety of instruments is used in the US and EU to support and increase the growth of RE including: Renewable Portfolio Standards (RPS) in the US, the Renewable Obligation Certificate (ROC) system in the UK, feed-in tariffs and premiums in a number of EU Member States, and the EU wide target of 20% of gross final energy consumption in 2020. The case studies indicate that policy and budget robustness as well as a long-term perspective for investors are important characteristics of effective policies, since these characteristics contribute to investment certainty for developers. In connection, it can be observed that a budget neutral policy (one that does not depend on annual government budget decisions or funding) is more likely to provide investor certainty. Where additional costs are passed on to the consumers, electricity prices may increase, but the RE support system is more stable. Furthermore, it is beneficial if there is broad political support¹² for RE and the policy chosen to support it. If this is not the case a change in government may result in an alteration of rules and regulations regarding RE support, thus increasing investor uncertainty.

Another important factor supporting RE is the development of new low-carbon technologies, from the initial stages of technological development through to commercialization, with each phase being crucial to ultimate success. Although each technology faces its own unique challenges, common elements can be identified across technologies and across country boundaries. For example, in both the EU and the US, technologies in the demonstration phase often face a ‘valley of death’ between the R&D stage and market commercialization. Technology developers still have much to learn about the conditions necessary to overcoming the associated barriers and successfully bringing technologies to the market. Toward this goal, the US has provided access to capital for demonstrations, while the EU has given developers long-term signals, largely through RE policies and targets, high fossil fuel taxes and climate policies. Both may be necessary for successful market introduction of a new technology.

In addition to the elements above, there are other aspects of RE development where establishing collaborative investigation could be beneficial. Examples include developing a better understanding of policy interactions and how contextual factors affect policy effectiveness. Despite geographical distances, the EU and US experience many common barriers to RE development, such as land use conflicts and public acceptance issues, for which sharing experiences could prove useful.

4.3 Vehicle standards and low emitting fuels

The transport sector is currently excluded from emissions trading. However, a variety of policies have been implemented in this sector, from which valuable lessons can be learned and applied elsewhere. Both the US and the EU have or are implementing some form of vehicle efficiency standards.

Setting uniform technology standards could help level the playing field and increase trust and cooperation for sectors such as transport, which not covered by a cap-and-trade system. As shown in chapter 3, there has been convergence within the two jurisdictions towards establishing vehicle emission standards, in the form of limits to average fleet emissions. In the US this is being implemented through the Clean Air Act, whereas in the EU it is done through the directive on CO₂ emission standards for passenger vehicles. Having comparable standards in sectors where trade issues come into play is particularly important to enhance the mutual trust between the EU and US that is essential for cooperation and create a level-playing field.

This may also be the case for fuels. In chapter 3, two different approaches to reduce emission through fuel regulation were introduced. In California, low carbon fuel standards (LCFS) have

¹² In the context of the US, this would be called bipartisan.

been set to limit the amount of emissions per energy content of the fuel. The emissions are calculated taking into account the entire life cycle, including changes in land use. In this way, the life cycle analysis method remains neutral as possible. On the other hand, the EU has directly promoted renewable fuels through an RE fuel target. Criteria for the quality and sustainability of the biofuels, in particular, were set to avoid negative environmental impacts of biofuel production. As with the vehicle efficiency, a standard has been set for fuels. In the case of biofuels, there is a global debate on the contribution of biofuels to climate change mitigation and how they can be deployed more sustainably.

5. Not-to-miss opportunities for transatlantic cooperation

Collaboration on climate change is not only in the individual domestic interests of the US and EU. Together, they can provide the critical mass and the momentum to change the energy system globally, and thus have an impact that goes beyond their own jurisdictions. What are the opportunities that would make the greatest difference? Based on the commonalities and differences in US and EU domestic circumstances and the lessons and observations reviewed in the previous chapters, we arrive at specific recommended areas of collaboration.

5.1 The carbon market

Given the EU and US steps towards emissions trading as a policy instrument to address climate change, the possibility of linking a federal carbon-trading instrument in the US with the EU ETS could now be explored, with an initial focus on design compatibility issues for the new US system as well as longer-term possibilities for international expansion. A common carbon market between the US and the EU would create momentum and send a strong signal to countries not yet engaged in carbon trading, but would also need to overcome barriers and choices that the EU and the US have made in the past.

In addition to linking the US and EU carbon markets, the respective offset markets could be coordinated. The EU ETS currently uses credits from the Kyoto Protocol's Clean Development Mechanism, whereas the United States is likely to set up its own offset scheme. Using a combined offset market is an option, but rules and regulations would need to be aligned to ensure comparable conditions. If the EU and the US operated jointly in this field, it would lower barriers for credit suppliers, especially those in developing countries, to bring their offsets to the market.

5.2 Bridging the valley of death together

The US and the EU are both highly innovative economies. Well over half of global energy R&D is spent in the US and the EU. Sharing experiences and conducting collaborative research to support technologies through to commercialization could be beneficial. Understanding the conditions in which development and commercialization occur is essential to the successful deployment of new technologies. Although each technology faces its own unique challenges, common elements can be identified across technologies and across country boundaries.

Technologies in the demonstration phase often face a "valley of death". Technology developers still have much to learn about the conditions necessary to successfully bring technologies to the market, and financiers need to be convinced in the absence of actual data. The US has been relatively successful in providing access to capital for innovators, but the longer-term signal has not yet been well proven. The EU has given developers firmer long-term signals, largely through renewable energy policies and targets, high fossil fuel taxes and climate policy. These provide incentives to invest in low-carbon technology, but have not been sufficient to pull large-scale technologies with high capital costs through the valley of death. Collaboration could involve joint R&D and demonstration, but also easier access to each other's markets.

5.3 Best practices and standards

In sectors and technologies that are excluded from emissions trading, or for which market instruments have proven to be less effective, other policy mechanisms can be useful in overcoming

ing barriers. The policies that are used vary greatly across the US and EU at all levels of governance. The transport sector, for instance, has a variety of policies from which valuable lessons can be learned and applied elsewhere. Exchanging experiences on policy-lessons learned would be a no-risk activity with potentially high-benefits.

Setting uniform technology standards could help level the playing field and increase trust and cooperation. To enhance the mutual trust between the EU and US in trade-sensitive sectors, a level-playing field is required. Emissions trading can help, but agreements between the US and EU regarding emission or technology standards for new appliances or personal vehicles sold or produced within their jurisdictions may create a tipping point for producers, leading to a change in the global market for those products.

Standards can also be applied further upstream. In the case of biofuels, there is a global debate on the contribution of biofuels to climate change mitigation and how biofuels can be deployed more sustainably. The US and the EU collectively are an interesting market for biofuels. Agreement on standards for sustainable biofuels and on the creation of markets for such biofuels could foster international markets, create a global biofuel commodity and help developing countries produce biofuels in a way that is less harmful to food provision, local communities and ecosystems. Another potential area for best practice and standards is in testing and certification of wind turbines or quality control systems.

While some best practices would be easily transferable, others will need to be altered according to differences between the regulatory systems in the EU and the US, as well as those between the EU Member States and US States. This is an area with much potential, but little previous exploration.

Acronyms

ACELA	American Clean Energy Leadership Act
CDM	Clean Development Mechanism
EC	European Commission
EEG	Erneuerbaren Energien Gesetz (Renewable Energy Law)
EPA	Environmental Protection Agency
ETS	Emissions Trading Scheme
GHG	Greenhouse Gas
HOV	High Occupancy Vehicle
JI	Joint Implementation
LCFS	Low Carbon Fuel Standard
MS	Member State (EU)
MOU	Memorandum Of Understanding
NAP	National Allocation Plan
PBC	Public Benefit Charge
PBF	Public Benefit Fund
RE	Renewable Energy
REC	Renewable Energy Certificate
RGGI	Regional Greenhouse Gas Initiative
ROC	Renewable Obligation Certificate
RPS	Renewable Portfolio Standard
SDE	Subsidieregeling Duurzame Energy (Subsidy regulations for sustainable energy)
SBC	Systems Benefit Charge
UNFCCC	United Nations Framework Convention on Climate Change

References

- AEA (2009): *Assessment with respect to long term CO₂ emission targets for passenger cars and vans*. Report to European Commission. July 2009.
- Alter-motive (2009): <http://www.alter-motive.org/>, Accessed 1 October 2009.
- American Solar Energy Society, Robert H. Bezdek, Green Collar Jobs in the US and Colorado: Economic Drivers for the 21st Century, January 2009. Available at: <http://www.greenforall.org/resources/ases-green-collar-jobs-report-forecasts-37-million-jobs-from-renewable-energy-and-energy-efficiency-in-u.s.-by-2030>
- ARB (2007): Air Resource Board's Low Carbon Fuel Standard Program pursuant to the California Assembly Bill AB 32 and the Governor's Executive Order S-01-07. <http://www.arb.ca.gov/fuels/lcfs/lcfs.htm>
- ARB (2009): California's Low Carbon Fuel Standard: An update on the California Air Resources Board's LCFS Program. October 2009. Available at: <http://www.arb.ca.gov/fuels/lcfs/lcfs.htm>
- Biofuels Barometer (2008): SYSTÈMES SOLAIRES le journal des énergies renouvelables N° 185 - 2008. EurObserv'ER June 2008
- BMU (2008): Erneuerbare Energien in Zahlen: nationale und internationale Entwicklung. Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), June 2008.
- CITL (2008): Compliance Data (Extracted from CITL 26/08/2009) <http://ec.europa.eu/environment/climat/emission/pdf/vesu2008public.xls>
- Coenraads et al. (2008): PROGRESS promotion and growth of renewable energy sources and systems, Utrecht 2008.
- Convery, F., Ellerman, D., De Perthuis, C. (2008): The European Carbon Market in Action: Lessons from the First Trading Period Interim Report. MIT Joint Program on the Science and Policy of Global Change Report No. 162, June 2008.
- Crane, D. and B. Prusnek (2007): *The Role of a Low Carbon Fuel Standard in Reducing Greenhouse Gas Emissions and Protecting Our Economy*. Office of the Governor, State of California. Retrieved 16 September, 2009, from <http://gov.ca.gov/index.php?fact-sheet/5155/>. 8 January
- Doris, E, J. McLaren Loring, V. Healey and S. Hockett. (2009): State of the States 2009: Renewable Energy Development and the Role of Policy. NREL Draft Report.
- Dril et al. (2009): *Verkenning Schoon en Zuinig*, ECN-E--09-022
- [DSIRE] (2009): Database of State Incentives for Renewables and Efficiency. [DSIRE: Glossary](#) online. Accessed July 28, 2009.
- e.structure (2009): Erneuerbare Energien sorgen im Osten für Aufwind. E.structure, Strukturpolitik und neue Länder. Nr. 001- Sonderausgabe Europa. Die Bundesregierung. <http://www.bundesregierung.de/Content/DE/Magazine/emags/estructure/005SonderausgabeEuropa/thema02-erneuerbare-energien-sorgen-im-osten-fuer-aufwind.html>. Accessed August 2009.
- EEA (2008): *Climate for a transport change*, EEA Report 1/2008.
- EIA (2005): http://www.eia.doe.gov/cneaf/electricity/page/fact_sheets/restructuring.html. Accessed October 6, 2009
- EIA (2005a): Information on state-by-state electricity costs is available on Energy Information Administration website: <http://www.eia.doe.gov/fuelelectric.html>. Accessed September, 2009.

- EIA (2005b): The Energy Information Administration maintains information on state coal-production: <http://www.eia.doe.gov/cneaf/coal/statepro/imagemap/usaimagemap.htm>. Accessed September, 2009.
- EISA (2007): H.R. 6--110th Congress: Energy Independence and Security Act of 2007. (2007).
- Ellerman, A.D., Joskow, P.L. (2008): The European Union's Emissions Trading System in perspective. Pew Centre on Global Climate Change, May 2008.
- EMCC (2008): Trends and drivers of change in the European energy sector: Mapping report. European Monitoring Centre on Change, European Foundation for the Improvement of Living and Working Conditions, 2008.
- Energy.eu (2009): Europe's Energy Portal - The Power of Renewable Energy. <http://www.energy.eu/#renewable>. Accessed October 2009.
- EPA (2009): *EPA and NHTSA Propose Historic National Program to Reduce Greenhouse Gases and Improve Fuel Economy for Cars and Trucks.* <http://www.epa.gov/oms/climate/regulations/420f09047.htm>. (Also see: <http://www.epa.gov/EPA-AIR/2009/September/Day-28/a22516b.htm>)
- EPA (2009): *Renewable Fuel Standard Program.* <http://www.epa.gov/OMSWWW/renewablefuels/> Access date: 24 November 2009.
- EurObserv'ER (2008): *The state of renewable energies in Europe.* 8th EurObserv'ER Report, 2008.
- Europa (2009): Press release: Reference: IP/09/794. Brussels, 15/05/2009. <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/794>
- European Commission (EC 2009a): Regulation (EC) No 443/2009 of the European parliament and of the council of 23 April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated. Regulation (EC) No. 443/2009
- European Commission (EC 2009b): Directive 2009/28/EC of the European parliament and of the council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently. Directive 2009/28/EC
- European Commission (EC 2009c): Excise duty tables Part II - Energy products and Electricity. European Commission, Directorate General Taxation and Customs Union Tax Policy. REF 1.029 July 2009. repealing Directives 2001/77/EC and 2003/30/EC. approach to reduce CO₂ emissions from light-duty vehicles
- Farrell, A. E., D. Sperling, et al. (2007): *A Low-Carbon Fuel Standard for California Part 2: Policy Analysis*, Office of the Governor and the Air Resources Board.
- Gerrits A. (ed.), M. Bader, M. de Haas, J. de Jong and A. Gerrits (2008): *The European Union and Russia: Perception and Interest in the Shaping of Relations.* Netherlands Institute of International Relations Clingendael, November 2008.
- Hoen, A. , K. Geurs, H. de Wilde, C. Hanschke, M. Uyterlinde, (2009): *CO₂ emission reduction in transport: Confronting medium-term and long-term options for achieving climate targets in the Netherlands.* Netherlands Environmental Assessment Agency (PBL), July 2009.
- Hurlbut, D. (2008): *State Clean Energy Practices: Renewable Portfolio Standards.* 23 pp.; NREL Report No. TP-670-43512.
- Lavelle, Marianne. (2009): *The Climate Change Lobby Explosion.* Center for Public Integrity. February 24. http://www.publicintegrity.org/investigations/climate_change/articles/entry/1171/ Accessed 23 July 2009.
- Lewis, M.-C. (2008): *The ETS review: a first reaction.* Deutsche Bank, Global Market Researches, January 2008.
- Network for New Energy Choices (2008): *Freeing the Grid: Best and Worst Practices in State Net-Metering Policies and Interconnection Standards 2008.*

- NREL (2009): http://www.nrel.gov/features/20091002_transmission.html
- Optres (2009): <http://www.optres.fhg.de/> Accessed 1 October 2009.
- Pelkmans, L., L. Govaerts, K. Kessels (2008): *Inventory of biofuel policy measures and their impact on the market* (Report D2.1 of ELOBIO subtasks 2.1-2.2). VITO - Flemish Institute for Technological Research, September 2008.
- Point Carbon (2008): *EU ETS Phase II - The potential and scale of windfall profits in the power sector*. A report for WWF by Point Carbon Advisory Services, March 2008.
- Political Economy Research Institute, University of Massachusetts, Amherst; Robert Pollin and Jeannette Wiks-Lim, *Job Opportunities for the Green Economy: A State-by-State Picture of Occupations that Gain from Green Investments*, June 2008. Available at: <http://www.greenforall.org/resources/a-state-by-state-picture-of-occupations-that-gain>
- Pollin, Robert et al. (2009): *The Economic Benefits of Investing in Clean Energy*. Center for American Progress. June.
http://www.americanprogress.org/issues/2009/06/pdf/peri_report.pdf Accessed 23 July 2009.
- Ragwitz, M. et al (2007): *OPTRES Assessment and optimisation of renewable energy support schemes in the European electricity market*. Intelligent Energy Europe 2007
- NREL (2005):Renewables Portfolio Standard Overview. Wind and Hydropower Technologies Program (Fact Sheet). (2005). 2 pp.; NREL Report No. FS-500-37627; DOE/GO-102005-2073.
- Res2020 (2009): <http://www.res2020.eu/> Accessed 1 October 2009.
- RGGI (2009): <http://www.rggi.org/co2-auctions/results>, Accessed 3 October 2009.
- RGGI (2008): Potential Emissions Leakage and the Regional Greenhouse Gas Initiative. Final report of the RGGI emissions leakage multi-state staff working group to the RGGI agency heads. March, 2008.
- RGGI MOU (2005): *Regional Greenhouse Gas Initiative Memorandum of Understanding*. December 2005
- RPS (2009): *Recommended Principles and Best Practices for State Renewable Portfolio Standard*. By the State and Federal RPS Collaborative.
- Searchinger T. et al. (2008): *Use of US Croplands for Biofuels Increases Greenhouse Gases through Emissions from Land-use Change*. Science, 319, 1238-1240
- Title 49 United States Code, Subtitle VI. Chapter 329-Automotive Fuel Economy. June 2006. Available at: <http://www.nhtsa.dot.gov/Cars/rules/CAFE/legislation.htm#>
- UK (2009): The UK Renewable Energy Strategy, HM Government July 2009.
- Union of Concerned Scientists. Cap and Invest: How a cap-and-trade program can reduce energy costs, create jobs and improve energy security. Accessed 3 October 2009: http://www.ucsusa.org/global_warming/solutions/big_picture_solutions/cap-and-invest.html
- Wiser & Barbose (2008): Renewable Portfolio standards in the US: a status report with data through 2007. p. 16.

Appendix A Glossary

A.1 Renewable electricity policies

Contractor Licensing (region: US)

Specific licensing for contractors who want to install renewable energy systems is available, guaranteeing that the contractors have the experience and knowledge necessary to ensure proper installation and maintenance (DSIRE 2009). Requirements for certification vary by state, but generally include defined minimum experience and an examination.

Equipment Certification (region: EU/US)

Equipment certification policy requires that renewable energy equipment meets set standards, which ensures the quality of the equipment sold to consumers and reduces the problems associated with inferior equipment - issues that can result in a negative view of renewable energy technologies. Equipment requirements can be regulator-designed or modeled off nationally recognized standards (DSIRE 2009).

Feed-in tariff (production incentive)/ Feed-in premiums (region: EU/US)

Feed-in tariffs determine a fixed tariff for every kWh fed into the electricity grid. The tariff can change depending on the generation technology. In a system with feed-in premiums the electricity is sold on the electricity market and the producer is provided the difference between the market price and a predetermined tariff.

Generation Disclosure (region: EU/US)

Disclosure policies require utilities to provide customers with information about their electricity supply. This information, which is often included on the monthly bill, can include an explanation of fuel mix percentages and information on the related emissions. In states where the electricity market has been restructured, generation disclosure provides customers with valuable information that allows them to make informed choices on the electricity and provider they choose. Additionally, there may be a requirement that the utility company provide certification that any renewable energy sources that they use are certified as renewable. The Green-e certification, offered by the Center for Resource Solutions, is one example of a verifiable certification that can be used by utility companies (DSIRE 2009).

Grid Access Standards (region: EU/US)

Grid access policy sets minimum conditions regarding the interconnection of renewable energy projects to the electricity grid. These standards reduce uncertainty, time, and costs associated with negotiations between the producer and the utility or grid operator and facilitate the interconnection of renewable energy projects with the grid.

Information Campaigns (region: EU)

In the EU, information campaigns regarding renewable energy, energy efficiency are often mandated as articles of policies related to a specific subject.

Investment subsidies (incl. rebates) and loans (region: EU/US)

Investment subsidies promote the installation of renewable energy systems by decreasing the overall costs of project financing. Rebate programs are common mechanisms used to promote solar energy technologies, however they can be used for any technology. Loan programs, including low-interest or zero-interest loans, provide financing for the purchase of systems or equipment.

Line extension Analysis (region: US)

When an electric customer requests service for a home or facility that is not currently serviced by the electric grid, typically the customer is required to pay a distance-based fee for the cost of extending power lines to the home or facility. Frequently, it is more economical to use an on-site renewable energy system to supply a prospective customer's electricity needs. Certain states require utilities to provide information about renewable energy options when the customer requests a line extension (DSIRE 2009).

Mandatory Green Power Option (region: US)

Several states require specific classes of electric utilities to offer customers the option of purchasing electricity generated from renewable resources. Typically, utilities offer green power generated from renewable resources owned by the utility or purchased under contract. They may also buy renewable energy credits (RECs) from a renewable energy provider certified by a state public utilities commission (DSIRE 2009).

Netmetering (region: US)

The billing arrangement by which customers realize savings from their systems, where 1-kWh generated by the customer has the exact same value as 1-kWh consumed by the customer (NNEC 2008). For electric customers who generate their own electricity, net metering allows for the flow of electricity both to and from the customer. Typically, this process is accomplished through a single, bi-directional meter. During times when a customer's generation exceeds the customer's use, net-metering allows for electricity to flow from the customer back to the grid, offsetting electricity consumed by the customer at a different time. In effect, the customer uses excess generation to offset electricity that the customer otherwise would have to purchase at the utility's full retail rate (DSIRE 2009).

Public Benefits Fund (PBF) /Systems Benefit Charge (SBC) (region: US)

Public benefit funds (PBF) are state-level programs typically developed during electric utility restructuring by some states in the late 1990s to ensure continued support for renewable energy resources, energy efficiency initiatives and low-income energy programs. These funds are most commonly supported through a small surcharge on electricity consumption. PBFs commonly support rebate programs for renewable energy systems, loan programs, research and development, and energy education programs (DSIRE 2009). Key elements of a clean energy fund include the funding source, the entity that administers the fund, and the model for allocating the funds. Three basic funding models are used to allocate funding (EPA 2007):

1. The investment model uses state loans and equity to provide initial investment in clean energy companies and projects.
2. The project development model directly promotes clean energy project installation by providing production incentives and grants or rebates.
3. The industry development model uses business development grants, marketing support programs, research and development grants, resource assessments, technical assistance, consumer education, and demonstration projects to facilitate market transformation.

Public Procurement (region US/EU)

Public procurement policy requires government owned facilities to use a specific product, e.g. in the US seventy-five percent of new light-duty vehicles acquired by certain federal fleets must be AFVs (alternative fuel vehicles), including hybrid electric vehicles, fuel cell vehicles, and advanced lean burn vehicles.

R&D funding (US also Grants) (region US/EU)

Funding to public or private entities to carry out research and development projects.

Renewable Portfolio Standard (Renewable Electricity Standard) (region: US)

Renewable portfolio standards (RPS) require utilities to own or acquire renewable energy or RECs to account for a certain percentage of their retail electricity sales, or a certain amount of

generating capacity, within a specified timeframe. Renewable portfolio goals are similar to RPS policies, but renewable portfolio goals are not legally binding. The term ‘set-aside’ or ‘carve-out’ refers to a provision within an RPS that requires utilities to use a specific renewable resource, typically solar energy, to account for a certain percentage of their retail electricity sales, or a certain amount of generating capacity, within a specified timeframe (DSIRE 2009).

Resource Access Laws (region: US)

Renewable energy access laws typically apply to solar and wind resources. Solar and wind access laws are designed to protect a consumer’s right to install and operate a solar or wind energy system at a home or business. Some solar access laws also ensure a system owner’s access to sunlight. In some states, access rights prohibit homeowners associations, neighborhood covenants or local ordinances from restricting a homeowner’s right to use solar energy. Easements, the most common form of solar access law, allow for the rights to existing access to a renewable resource on the part of one property owner to be secured from an owner whose property could be developed in such a way as to restrict that resource. An easement is usually transferred with the property title (DSIRE 2009).

Tax Incentives (region US/EU)

There are multiple types of tax incentives for which renewable energy systems may be eligible. The five primary categories of tax incentives that apply to renewable energy development are corporate, industry recruitment and support, personal, property, and sales tax incentives. The main objective is to reduce the relative cost difference between renewable energy systems and their not renewable alternative.

A.2 Sustainable transport policies

Biofuel targets (EU level): obligations (MS level) (region EU)

Mandated targets for the percentage of biofuel in the overall fuel mix.

Driving regulations (region US/EU)

Both regions implement regulations to reduce the emissions from the transport sector, examples include speed limits and anti-idling rules in the US and eco-driving in the EU.

Fuel standards (region US/EU)

The US and the EU mandate fuel standards. In the US there are low carbon fuel standards and in the EU there are quality standards for all fuels, and for biofuels in particular.

Land use planning and infrastructure for alternative transport (region US)

This category of policies includes zoning (e.g., mixed-use and high-density zoning), infrastructure for vehicle alternatives (e.g., bicycle parking and lanes), and transportation plans that prioritize walking and public transportation.

Non-financial incentives (HOV) (region US)

Many state and local governments offer non-financial incentives to drivers of low-emissions vehicles, such as access to parking and high-occupancy vehicle lanes.

Public education and labeling (region US/EU)

This policy mandates public education programs and/or appliance labeling in order to improve public knowledge regarding the sustainability or energy efficiency of products or services.

Public procurement mandates (region US/EU)

The requirement that government owned facilities must use a specific product, e.g. in the US seventy-five percent of new light-duty vehicles acquired by certain federal fleets must be AFVs

(alternative fuel vehicles), including hybrid electric vehicles, fuel cell vehicles, and advanced lean burn vehicles.

R&D (region US/EU)

Funding to public or private entities to carry out research and development projects.

Road Pricing (region US/EU)

Road pricing are mechanisms that serve as disincentives for using personal vehicles, including congestion pricing or charges, parking fees, motorway tolls and environmental areas in city centres.

Subsidies/tenders for fuel infrastructure (region US/EU)

Subsidies to developers and businesses that expand the infrastructure for alternative fuels.

Tax incentives (region US/EU)

Tax incentives are used to give incentives to more sustainable transport, by reducing the cost of a less sustainable alternative.

Technical assistance (e.g. assistance fleet conversion) (region US/EU)

Support for government programs, e.g. for the US:

- Air Pollution Control Program, which assists state, local, and tribal agencies in planning, developing, establishing, improving, and maintaining adequate programs to prevent and control air pollution and implement national air quality standards.
- Alternative Transportation in Parks and Public Lands Program, which provides funds to support planning and capital expenses for alternative transportation systems in parks.
- Congestion Mitigation and Air Quality (CMAQ) Improvement Program, which provides funding to states' departments of transportation, municipal planning organizations, and transit agencies for projects and programs that reduce transportation-related emissions in air quality non-attainment and maintenance areas.
- Clean Cities, which promotes the energy, economic, and environmental security of the United States by supporting local initiatives to adopt practices that reduce the use of petroleum in the transportation sector.
- Clean School Bus USA, which reduces children's exposure to harmful diesel exhaust through a public-private partnership that limits school bus idling, implements pollution reduction technologies, improves route logistics, and switches to clean fuels.

Support for industry, e.g. for the US:

- SmartWay Transport Partnership, which assists the ground freight industry in quantifying emissions and creating a plan to reduce fuel consumption.
- Voluntary Airport Low Emission (VALE) Program, which reduces ground level emissions at commercial service airports located in designated ozone and carbon monoxide air quality nonattainment and maintenance areas.

Vehicle Emission/Efficiency Standards (region US/EU)

Standards imposed on vehicles to improve their efficiency or reduce their fuel consumption.

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This paper aims to improve mutual understanding between the EU and US with regard to climate change policy, suggesting specific opportunities for transatlantic cooperation in this arena. A background on the environmental, legislative, and economic contexts of the EU and US as they relate to climate policy sets the context. This is followed by an overview of how cap & trade, renewable energy, and sustainable transportation policies have taken shape in the EU and the US. Some observations and lessons learnt within each of these areas are highlighted. Building on these insights, recommendations are made regarding the carbon market, possibilities for new technologies to bridge the valley of death, and best practices and standards.

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