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The Debate over Fixed Price Incentives for Renewable Electricity in Europe and the United States: Fallout and Future Directions

A White Paper

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Wilson Rickerson and Robert C. Grace

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About the Heinrich Böll Foundation

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About the authors

Wilson Rickerson, Rickerson Energy Strategies

Wilson Rickerson is a Boston-based energy consultant focusing on renewable energy policy and markets. He assists state and municipal governments with policy development, consults to businesses seeking to invest in the renewable energy industry, and helps organizations with energy program management and planning. He previously coordinated New York City's Million Solar Roofs initiative and worked with the Delaware Senate to draft the state renewables portfolio standard (RPS). He began his career with the Bundesverband WindEnergie, e.V. (BWE) in Berlin researching feed-in tariff policy. He holds a Masters in Energy and Environmental Policy from the University of Delaware and a B.A. in International Relations with a focus on Europe from the College of William & Mary.

Robert C. Grace, Sustainable Energy Advantage, LLC

As President of Sustainable Energy Advantage, Bob Grace specializes in technical and policy analysis of renewable energy markets, and in developing markets, business opportunities and infrastructure for bulk renewable electricity supply for clients in the public, private and non-profits sectors. Trained as an interdisciplinary analyst in energy and environment, he has accumulated a diverse experience base over 22 years in the electricity industry, the last 10 exclusively focusing on renewable energy. Bob previously headed up green power marketing activities of AllEnergy Marketing Company, and was a Principal Analyst specializing in wholesale power marketing, power supply planning and industry restructuring for New England Power Company. Bob holds a M.S. in Energy and Resources from the University of California, Berkeley, and a B.S. in Energy Studies from Brown University.

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1. Introduction

The diffusion of renewable energy policies around the world has prompted dialogue and debate on the comparative merits of different policy schemes. The most prevalent policies for supporting new renewable electricity are variations of the feed-in tariff[1] and the Renewables Portfolio Standard[2] (RPS). Feed-in tariffs offer a long-term, fixed price payment to renewable energy generators, whereas the RPS seeks to create price competition between renewable energy generators to meet defined targets at least cost, and typically define a maximum cost through a price cap instrument.

The European Union (EU) has substantial experience with both approaches. Feed-in tariffs have thus far driven rapid renewable energy capacity expansion in several European Union member nations while RPS polices have not. The perceived success of feed-in tariffs has inspired the adoption of similar laws by other countries, and feed-ins are currently world's most widespread national renewable energy policy. As of 2007, feed-in tariffs had been adopted by eighteen EU countries, Brazil, Indonesia, Israel, Korea, Nicaragua, Norway, Sri Lanka, Switzerland, and Turkey (REN21, 2006).

Experience with feed-in tariffs in the United States is limited, and US states have instead focused primarily on RPS policies. RPS policies require utilities (in integrated monopoly service territories) or generation service providers (in states with retail competition) to supply a minimum percentage of their electricity from renewable sources. RPS policies have diffused rapidly around the United States, but the momentum and impact of European feed-in tariffs is beginning to attract the interest of US policy makers. Commissioner John Geesman, of the California Energy Commission, recently stated that "Germany's renewable feed-in tariff has revolutionized the market for wind and solar energy…Those are things that California is directly looking at (Nicola, 2006)." Statements like Commissioner Geesman's raise questions as to whether feed-in tariffs could be an appropriate tool for the United States given the country's political and regulatory landscape.

In Europe there has been a lively debate between RPS and feed-in tariffs in anticipation of a harmonized EU-wide policy. In the US, debate between RPS and feed-in tariffs has been limited because feed-in tariffs have not generally been viewed as a feasible policy option. The goal of this paper is to examine whether feed-in tariffs (on their own or in hybrid) can be adapted to work in concert with existing and proposed US state-level policies and electricity market structures. The paper will review policy development in the US and Europe and discuss the implications of the European policy debate for US audiences. The paper will then review US concerns over feed-in tariffs, discuss US experience with feed-in tariffs to date, and explore future directions for US renewable energy policy.

1.1 The Evolution of RPS Policy in the United States

A major difference between the US and Europe is that US renewable energy policy has been driven by the states, and not the national government. In the absence of strong federal leadership, states have taken the lead on renewable energy policy in response to concerns over economic

[1] Also referred to as advanced renewable tariffs (ARTs), renewable energy feed-in tariffs (REFITs), FITs, fixed price tariffs, and standard offer contracts

[2] Referred to in Europe as quota obligations, renewable energy obligations, or tradable green certificate (TGC) systems

development, energy security, air pollution, and climate change (Kittler, 2003; Knigge and Bausch, 2006; Peterson and Rose, 2006; Rabe, 2004). Although states have developed a broad range of renewable energy incentives,[3] renewables portfolio standards have emerged as the primary state-level renewable energy policy tool. As of February 2007, twenty one states and Washington, DC had enacted mandatory renewables portfolio standards, and two states had adopted voluntary renewables portfolio goals (Figure 1 and Table 1).[4]

RPS policies were initially developed in the United States in the mid-1990s in response to the introduction of electricity market competition. It was argued that since renewable energy sources were not price competitive with conventional generation, they required policy to monetize their positive social and environmental benefits. RPS was viewed as a tool for preserving renewable energy support as other renewable energy policies lapsed during restructuring. Under RPS (as it was originally envisioned), utilities demonstrate compliance using a market-based system of tradable renewable energy credits (RECs) (AWEA, 1997). Every megawatt-hour of renewable energy produced is awarded a REC. Retail electric suppliers are then responsible for securing a quantity of RECs sufficient to meet their annual RPS compliance target.[5] This supply and demand creates a market in which RECs are bought, sold, and traded. The REC-based RPS, which was inspired by US emissions trading regimes, was viewed as philosophically compatible with the new era of retail electricity competition (Lauber, 2004). RPS supporters argued that price competition between renewable generators would result in low costs to society, while a steadily advancing schedule of compliance targets would encourage predictable renewable energy market growth (Rader and Norgaard, 1996).

[3] These policies include tax incentives, rebates, loan programs, public benefits funds, etc. A comprehensive catalogue of US state policy can be found at www.dsireusa.org

[4] National RPS bills have passed the US Senate on several occasions, but not the US House of Representatives. This paper focuses primarily on state-level RPS.

[5] The majority of the state compliance targets are expressed as a percentage of electricity supplied by a certain year, e.g. 10% by 2020. In Texas and Iowa, the targets are expressed as a targeted amount of capacity by a given year (although in Texas such targets are then converted to energy equivalents).

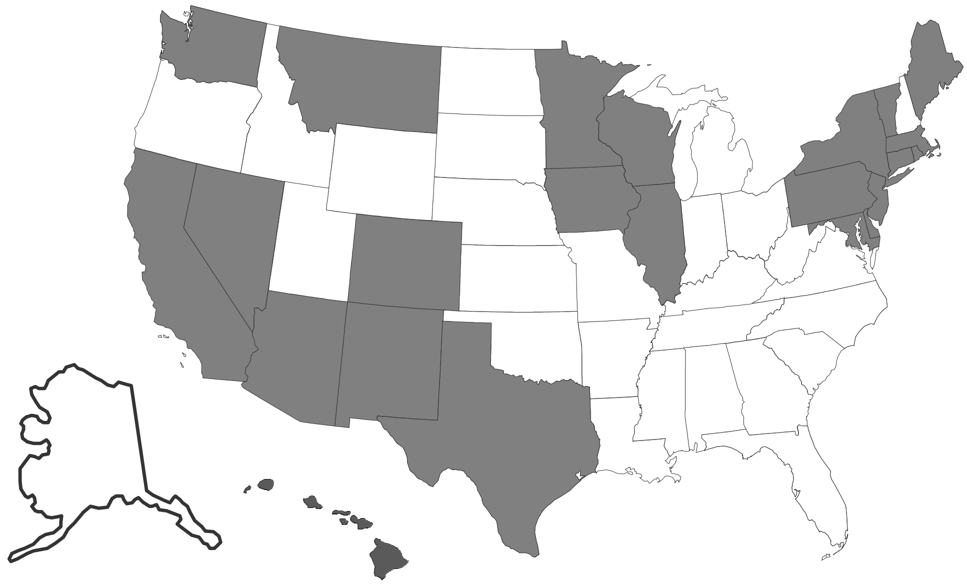

Figure 1. US states with RPS regulations
Source: DSIRE (2007)

Table 1. RPS targets by State

State	Target	State	Target
Arizona	15% by 2025	Montana	10% by 2015
California	20% by 2010 33% by 2020 (goal)	Nevada	20% by 2015
Colorado	10% by 2015	New Jersey	20% by 2020
Connecticut	10% by 2010	New Mexico	10% by 2011
Delaware	10% by 2019	New York	25% by 2013
Hawaii	20% by 2020	Pennsylvania	18% by 2020
Illinois (voluntary)	8% by 2012 15% by 2020 (goal)	Rhode Island	16% by 2019
Iowa	105 MW by 1999	Texas	5880 MW by 2015 10,000 MW by 2025 (goal)
Maryland	7.5% by 2019	Vermont (voluntary)	Incremental growth from 2005 to 2012 with 10% cap[6]
Maine	30% by 2000	Washington, DC	11% by 2022
Massachusetts	4% by 2009	Washington State	15% by 2020
Minnesota	30% by 2020 (Xcel) 25% by 2025 (all others)	Wisconsin	10% by 2015

Source: DSIRE (2007)

Although there have been several surveys of RPS best practices (Grace and Wiser, 2003; Rader and Hempling, 2001), no two RPS designs are the same and it is difficult to generalize about US RPS performance. RPS policies were initially intended for states that had restructured their electricity markets to allow for retail choice, but RPS regimes have been established in ten states that have not introduced (or have suspended) retail electricity competition.[7] Although many of

[6] Vermont's voluntary goal will become a mandatory standard in 2013 if current targets are not met
[7] California, Colorado, Hawaii, Iowa, Minnesota, Montana, Nevada, New Mexico, Washington, Wisconsin

the states tend to use some form of renewable energy credit, these credits are frequently bundled with electricity in long-term contracts with regulated utilities rather than traded in short-term markets. Some of these designs have functioned well, while others have yet to demonstrate success. Minnesota, Wisconsin, and Iowa, for example, have either met, or over-complied with, their RPS compliance schedules (Wiser et al., 2004), while Nevada has not met its targets because of problems with the creditworthiness of state utilities (Porter et al., 2004).

RPS performance has also been variable in states where electricity competition has been introduced. Some states in the Northeast have not performed as expected. Massachusetts has experienced high REC prices as a result of renewable energy supply lagging behind demand. Connecticut, meanwhile, has experienced erratic REC prices caused by repeated policy changes (e.g. Giovinetto, 2003). In Texas, however, long-term contracts have emerged in tandem with the short-term market for RECs. Although long-term contracts have reduced market liquidity and transparency, they have also improved investor confidence in the Texas RPS market (van der Linden et al., 2005). This confidence, in combination with Texas's excellent wind energy resource, has caused the wind energy market in Texas to explode. After over-complying with its initial RPS schedule (Langniss and Wiser, 2003), Texas expanded its target in 2005 to 5,880 MW of capacity by 2015. Texas has since surpassed California in terms of installed wind energy capacity and its RPS stands out as one of the most successful in the US.

The difficulty with RPS policy generalizations has been compounded by the fact that US RPS policies continue to evolve and change. Of the twenty-three mandatory and voluntary renewable energy targets in the United States, eleven have been significantly revised, eight have been newly created in the years since 2003 (Figure 2), and others have been subject to proposed modifications in each legislative cycle. In some states, targets were purposely started at low and easily attainable levels to allow for an easy ramp-up; some of these have yet to become "binding" at a level where new renewables would have to be brought on line to meet the targets. It is therefore still too early to effectively judge how many of these new or revised policies will perform.

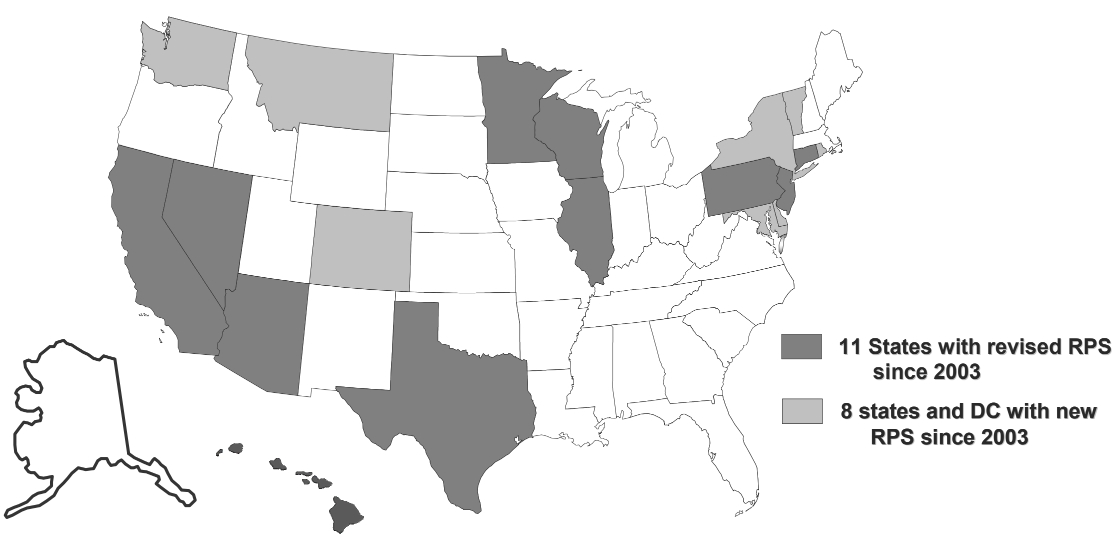

Figure 2. States that have established or revised RPS since 2003
Source: Rickerson (2005); DSIRE (2007)

1.2 The Feed-in Tariff in Europe

In contrast to the policy landscape in the US, the majority of European countries have adopted feed-in tariffs. While RPS policies typically seek to create electricity price competition, feed-in tariffs require utilities to purchase power from renewable energy generators at a fixed price. These fixed prices are structured either in the form of long-term payments based on generation cost[8] (as in Germany) or in the form of a fixed premium on top of the spot market price for electricity (as in Spain) (Ragwitz and Huber, 2005). Most of the laws also require utilities to interconnect all eligible renewable generation, thereby guaranteeing that renewable electricity can "feed in" to the grid. As of February, 2007, there were eighteen countries with feed-in tariffs in the European Union (Figure 3).

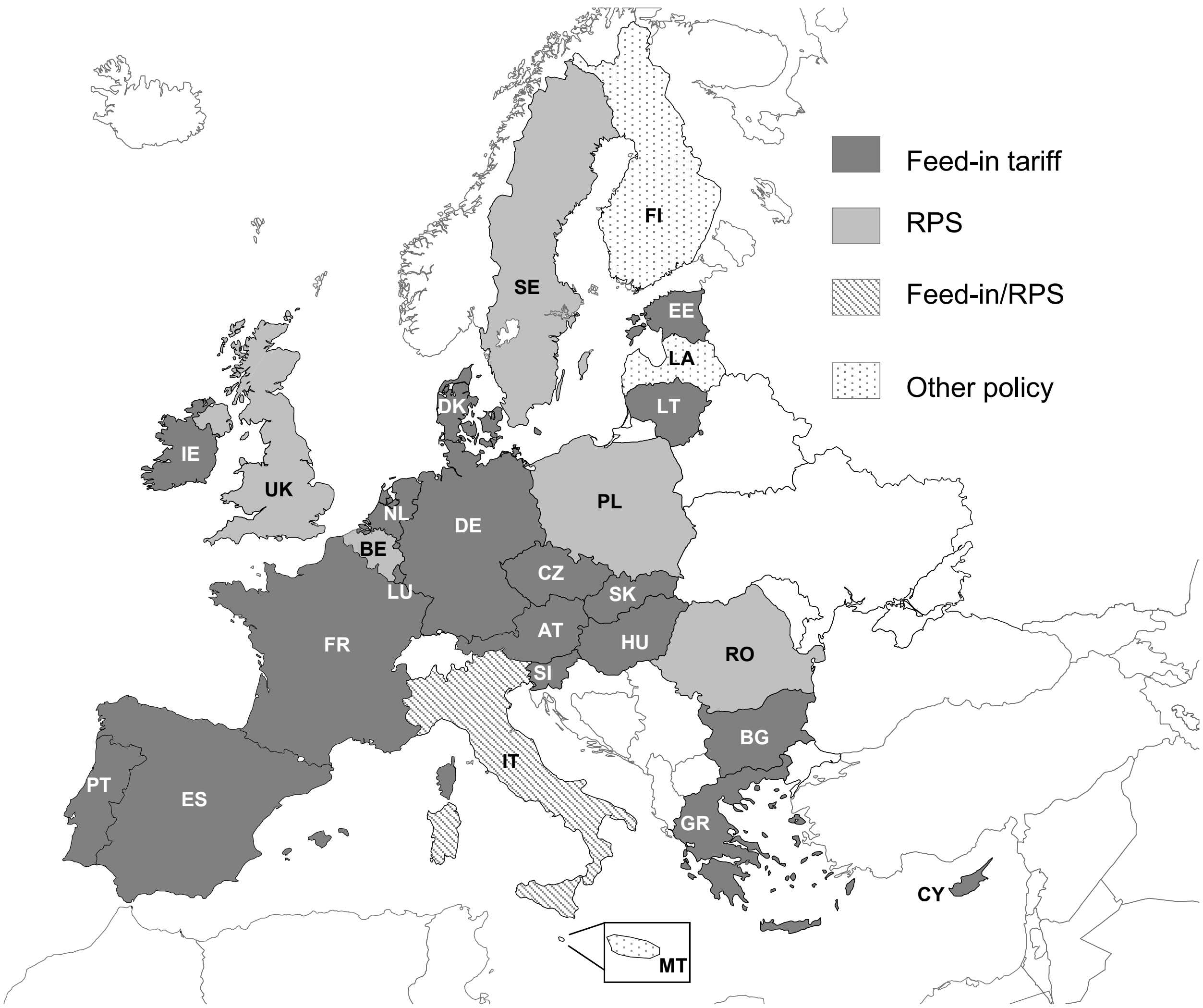

Figure 3. National renewable energy policies in the EU-25 countries
Source: Klein et al. (2007); Austrian Energy Agency (2007)

Like RPS, feed-in tariff designs vary widely and some of the laws (especially those of the newer EU member nations) are fairly new and untested. Several of the EU countries, namely Germany, Denmark, and Spain, however, have had feed-in tariff policies in place since the 1990s.[9] A recent

[8] Plus a reasonable profit

study of feed-in tariff best practices (Klein et al., 2007) concluded that successful feed-in tariffs have:

- Long-term guaranteed payments that adequately reflect generation costs and profit
- Incentive levels that decrease over time, i.e. "tariff digression"
- Incentive levels that are specific to certain renewable energy technologies (i.e. PV, wind, biomass, etc.)
- Incentive levels that tailored to achieve specific policy goals, i.e. development in different wind regimes, use of certain conversion technologies, etc., i.e. "stepped tariffs"

The German experience with feed-in tariff design has been cited as the basis for many of these best practices. Under the German Stromeinspeisungsgesetz (StrEG) (1991-2000), a fixed price for renewable energy was set at 90% of the retail electricity rate. This policy was patterned after a voluntary agreement between Danish utilities and the Danish Wind Turbine Association during the 1980s under which utilities purchased wind turbine output at 85% of the retail electricity rate (Krohn, 1998). When retail rates in Germany declined to a point that renewable energy development slowed under the StrEG, Germany introduced the Erneuerbare-Energien-Gesetz (EEG) (2000-present), under which a fixed price was established that was independent of retail rates.

Through the EEG, renewable generators receive a fixed payment for 20 years, but payment streams decline over time such that a generator beginning production in 2006 will receive a lower payment stream than a generator beginning production in 2005 (Table 2). This declining payment structure, which is subject to periodic review and adjustment, is intended to account for improved efficiencies from economies of scale and encourage cost reductions over time. The EEG also differentiates between technologies such that each renewable resource receives a different guaranteed price per kilowatt-hour (see Table 2).[10]

[10]Onsite renewable energy generators that take advantage of the feed-in tariff feed their entire output into the grid using a separate meter and do not offset retail electricity. For PV, the feed-in tariff rate is higher than the residential retail electricity rate (~18.6 eurocents in 2005 (Wenzel, 2007)) and is therefore an attractive option. For onsite biogas, on the other hand, the retail electricity rate is higher than the feed-in incentive level. In such cases, it is probable that the onsite generator will forgo the feed-in tariff and use system output to reduce retail electricity purchases instead.

Table 2. German fixed price payments by technology, with installed capacity, output (2005)

Resource	Limit	€cent/kWh	Decrease in incentive (% per annum)	MW (2005)	GWh (2005)
Hydropower	500 kW	9.67	0.00%	4,680	21,524
	5 MW	6.65			
Landfill gas, sewage gas, mine gas	500 kW	7.67	1.50%	2,192	13,444
	5 MW	6.65			
Biomass	150 kW	11.5	1.50%		
	500 kW	9.9			
	5 MW	8.9			
	20 MW	8.4			
Geothermal	5 MW	15	1.00%	0.2	0.2
	10 MW	14			
	20 MW	8.95			
	Above 20 MW	7.16			
Onshore wind	First five years	8.7	2%	26,500	18,428
	Up to 20 years	5.5			
Offshore wind	First twelve years	9.1	2%		
	Up to 20 years	6.19			
Photovoltaics	Ground mounted	45.7	5%	1,508	1,000
	Building mounted (30 kW)	57.4			
	Building mounted (<100 kW)	54.6			
	Building mounted (>100 kW)	54			

Source: Bundesministerium für Umwelt Naturschutz und Reaktorsicherheit (2004); Staiss et al. (2006)

The resource-specific feed-in tariffs are further differentiated by conversion technology, system size, installation type, and/or resource availability. Biomass and biogas technologies, for example, receive a higher payment than listed above if they use certain conversion technologies (i.e. Stirling engines, fuel cells, etc.) or employ combined heat and power. Solar installations receive a higher payment if the panels are building integrated. Wind energy generators receive a two-tiered incentive tied to the quality of their sites' wind resource. All onshore wind projects beginning operation in 2004 received 8.7 eurocents per kilowatt-hour (kWh) for the first five years of operation. After five years, the payment level at windy sites drops to 5.5 eurocents per kWh. For generators at less windy sites, the higher payment level is extended for longer periods of time depending on how weak their wind resource is. The structure of the wind payment is intended to encourage geographic distribution throughout Germany, rather than causing clustering at only the windiest sites.

As will be discussed in Section 2.1 below, well-designed feed-in tariffs have been highly successful in driving a large percentage of the new renewable energy capacity installed around the world since the 1990s.

2. Comparing Feed-in Tariffs and RPS

By the late 1990s, RPS in the US and in feed-in tariffs in Europe seemed to be evolving along parallel tracks. Some viewed this evolution as an extension of the philosophical divide between the laissez faire market orientation of the US and the command-and-control traditions of European social democracy (Lauber, 2004; Toke, 2005). By 2005, however, debate had erupted on both sides of the Atlantic as RPS policies began to make their way into Europe and as US policy advocates began to more seriously consider feed-in tariffs as an option. This section reviews the literature from the European debate between RPS and feed-in tariffs and discusses its applicability to the US.

2.1 The European Harmonization Debate

Although the majority of EU countries have adopted feed-in tariffs, it appeared as though RPS would diffuse fairly seamlessly into Europe in the 1990s. Market-based emissions trading regimes had already begun to diffuse from the US to Europe following the Kyoto Protocol negotiations (Oberthür and Tänzler, 2002). With the European drive toward electricity market liberalization (Jamasb and Pollitt, 2005), it seemed as though RPS would follow electricity competition into Europe, just as RPS had followed competition in the United States. A Commission of the European Communities (1999) report found that, given the shift toward electricity market competition, a move away from a "fixed price tariff towards one based on trade and competition is at some stage inevitable (p. 17)."

The 1999 Commission report was followed by a 2001 Directive from the European Parliament (EU, 2001) that established renewable energy targets for each member nation. The Directive stated that countries were free to choose policy mechanisms to achieve their targets. In 2005, however, the policies would be evaluated for effectiveness and a single harmonized policy would be adopted for Europe. The establishment of national targets and the push for harmonization shifted the energy policy dialogue in Europe from whether there should be renewable energy support to what kind of renewable energy support is best. Nations aligned behind different policy regimes and the debate became rapidly polarized.

Italy, Poland, Romania, Sweden, the United Kingdom, and parts of Belgium (Wallonia and Flanders) adopted renewable portfolio standards based on systems of tradable RECs.[11] This move toward RPS in Europe, combined with the push for harmonization, inspired a vigorous defense of feed-in tariffs. Between 2001 and 2006, academics (Butler and Neuhoff, 2004; Elliott, 2005), industry organizations (BWE, 2005; EPIA, 2005; Fouquet et al., 2005), and environmental organizations (Sawin, 2006) presented a broad range of economic, social, and environmental arguments in favor of feed-in tariffs. Although the debate between feed-ins and RPS is fairly wide-ranging, this section presents an abbreviated review of four primary points of contention stressed in the literature: cost, effectiveness, dynamic efficiency, and ownership structure.

[11] Italy's policy has since evolved into a hybrid policy with feed-in tariffs for PV. For an overview of Italy's policy history see: (Hirshman, 2006; Lorenzoni, 2003)

Investor confidence, price, and policy cost

One of the most heated arguments in Europe has been whether feed-in tariffs or RPS policies are more cost effective from a societal perspective. It is often argued in both Europe and in the US that fixed price policies are inherently more costly than RPS because they do not encourage renewable energy competition. In theory, competition between renewable energy generators under RPS places downward pressure on REC prices, just as electricity market competition between utilities places downward pressure on electricity prices (Menanteau et al., 2003; Rader and Hempling, 2001). The intent of REC trading is to create an efficient incentive that supports renewable energy capacity at a minimum cost to society.

The counter argument to this is that feed-in tariffs create a stable investment climate, while RPS policies do not. Investors regard well-designed feed-in tariffs as low risk policies because of the long-term stability of the fixed price payment. Under RPS, by contrast, investors face the risk of both a volatile electricity market and a volatile short-term renewable energy credit market (Mitchell et al., 2006). This price risk is further compounded by legislative and regulatory risks to RPS design or continuation. Ultimately, these risks raise the cost of capital used to finance renewable energy and raise the cost of renewable energy policies. The risk inherent in RPS markets can therefore make RPS more costly than feed-in tariffs.

In 2005, the Commission of the European Communities (CEC) released its report comparing the effectiveness and efficiency of different policies. The study found that risk did play an important role in policy efficiency. The incentive level payments for wind projects, for example, were typically higher in countries with RPS markets than they were in countries with feed-in tariffs. In other words, renewable energy credit market prices were higher than the government-determined fixed prices. Furthermore, wind energy generators typically received greater windfall profits under RPS than under feed-in tariffs (CEC, 2005). This analysis echoes a German government report's findings that feed-in tariffs are more efficient and less costly than REC trading (Ragwitz et al., 2005). The CEC concludes that the reason for the higher cost of RPS policies, "can be found in the higher risk premium requested by investors, the administrative costs and the still immature green certificate market (p. 28)."

More weight was lent to this argument by the United Kingdom Treasury's Stern Review on the economics of climate change. The Stern Review (2006) concludes that, compared to European RPS policies, "feed-in mechanisms achieve larger [renewable energy] deployment at lower costs. Central to this is the assurance of long-term price guarantees...uncertainty discourages investment and increases the cost of capital as the risks associated with the uncertain rewards require greater rewards (p. 366)."

Effectiveness

Another key criterion in the European policy debate is relative effectiveness. Feed-in tariffs have clearly been the most effective renewable energy policy in terms of installed capacity in Europe. Denmark, Germany, and Spain, for example, have used feed-in tariffs to install 31 gigawatts of wind energy capacity, equal to 53% of the global total, between 1990 and 2005 (GWEC, 2005).[12] In Germany, feed-in tariffs increased the amount of wind produced annually from 40 gigawatt-hours (GWh) in 1990, to 30,500 GWh by the end of 2006. Wind power's share of national electricity production has grown to 5%, surpassing hydropower output in 2005, and the German government has stated that it will meet its 2010 renewable electricity goal of 12.5% this year

[12]Denmark's feed-in tariff was repealed in 2000 and its renewable energy market has since stagnated

(Reuters, 2007; Staiss et al., 2006; Verband der Elektrizitätswirtschaft, 2007). Germany's feed-in tariff has also created the world's largest solar energy market, and analysts report that Spain's solar market is poised for similarly rapid growth (Maycock et al., 2006; Stirzaker, 2006).

Feed-in tariffs have also been judged to be the most effective using other benchmarks. The CEC (2005) defines effectiveness as the amount of renewable electricity produced each year as a share of national technical potential. Using this indicator, feed-in tariff nations are again clear leaders for wind power, hydropower, and solar electricity. The case for biomass is less clear cut as both the UK and the Netherlands have effectively developed their biomass resources using a mix of policies. The success of feed-in tariffs in encouraging new capacity and renewable electricity has also led analysts to conclude that feed-ins are more effective than other policies in reducing greenhouse gases and responding to climate change (Lauber, 2004; Lehmann and Niederle, 2006).

RPS policies in Europe, by contrast, have not succeeded in producing the explosive market growth seen in the leading feed-in tariff countries. Although critics assert that this lack of effectiveness is a direct result of the risk inherent in RPS policies, other design flaws have also contributed to underperformance. Under the Renewable Obligation (RO) in the UK, for example, an oligopoly of utilities purchase power from renewable energy generators that they directly or indirectly own. If RO targets are met, REC prices will crash. Utilities therefore have both the incentive and the market power to ensure that renewable energy markets are undersupplied (Toke, 2005).

Innovation and technology diversity

The 1999 CEC report states that RPS policies create more of an incentive for dynamic efficiency. Dynamic efficiency refers to the ability of a policy to support innovation and price reductions over time. The CEC also argued that feed-in tariffs were ineffective tools for dynamic efficiency because fixed prices cannot flexibly adapt to falling costs. In response to the 1999 report, a number of analysts have argued that feed-in tariffs are in fact more effective at encouraging dynamic efficiency than RPS policies.

One of the primary arguments for the dynamic efficiency of feed-in tariffs is that feed-in tariffs create market competition between technology manufacturers, rather than between renewable energy generators. Under feed-in tariffs, market price risk is non-existent and profitability depends on a project's ability to control costs (Menanteau et al., 2003). For fuel-free technologies like wind and solar power, the upfront equipment cost is one of the largest costs that projects incur. The feed-in tariff therefore places pressure on technology manufacturers to supply low-cost, reliable systems to project developers. Some have argued that the "market-based" equipment competition promoted by feed-in tariffs is actually more appropriate for capital-intensive renewable energy technologies than the "market-based" price competition created by RPS (Hvelplund, 2001; Wagner, 1999). A companion argument to this is that neither policy is more market-based than the other. Renewable capacity growth under both policies results from government mandate. Under RPS, government sets the amount of renewable energy and lets markets determine the price. Under feed-in tariffs, government sets the price and lets markets determine the quantity.

A second argument for the dynamic efficiency of feed-in tariffs is that they can be structured to support both near-term and emerging technologies. European RPS policies have not encouraged the development of less mature (and more expensive) technologies like photovoltaics. Countries like Germany, Austria, Luxembourg, and Spain, on the other hand, have successfully used feed-in tariffs to drive PV markets.

Some analysts have argued that the costs of feed-in tariffs for emerging technologies like PV outweigh the benefits from positive externalities (del Río and Gual, 2007). From a dynamic efficiency perspective, however, encouraging the development of emerging technologies in the short term can result in cost savings to society in the longer-term. Under RPS policies,[13] least-cost resources are developed first and more expensive technologies are developed once the least-cost resources are exhausted. Under feed-in tariffs, by contrast, longer-term technologies are typically targeted in parallel with near-market technologies. The longer-term technologies are therefore pushed more quickly down their experience curves.[14]

The long-term dynamic efficiency impacts of RPS and feed-ins were recently modeled using Green-X, a software tool developed by the EU to compare national renewable energy policies. The final report from the international Green-X team[15] concluded that the early cost reductions for emerging technologies under feed-ins resulted in lower overall societal costs compared to RPS (Huber et al., 2004). Similar findings were recently reported in a Green-X analysis for Ireland (Huber et al., 2007).

Ownership structure

Feed-in tariff proponents have repeatedly argued that feed-in tariffs inherently enable cooperative ownership models which in turn reduce NIMBYism, diffuse market power, and create a more distributed and democratic energy infrastructure (Hvelplund, 2001; Menanteau et al., 2003). While cooperative renewable energy projects have flourished under feed-in tariffs in Germany and Denmark, recent analysis has concluded that ownership structure is not dictated by policy type (Toke, 2005) and may have more to do with cultural factors, grid configuration, and population density (Bolinger, 2001). Nevertheless, it is true that feed-in tariffs can create more opportunities for risk averse market participants (e.g. small producers, cooperatives, etc.) than REC-based RPS systems can (van der Linden et al., 2005).

2.2 The Relevance of the European Debate to US RPS Policy

Based on the literature, feed-in tariffs enjoy broad-based support among the European energy policy community. As discussed above, the emerging consensus in Europe seems to be that feed-in tariffs are less risky and therefore less costly, more efficient, and more effective than RPS policies. In support of this conclusion, analysts cite the fact that countries with feed-in tariffs have succeeded in installing the majority of European renewable energy capacity, while promoting emerging technologies, encouraging domestic manufacturing, and creating jobs in the renewable energy sector (Fouquet et al., 2005; Menanteau et al., 2003).

Specific European conclusions about RPS, while provocative, are limited in their relevance to the US policy context. As in Europe, there are RPS policies in the US that rely on short-term, tradable REC markets. In such cases, European critiques could be a useful starting point for analyses of the impact of risk on policy cost and effectiveness. Broadly speaking, however,

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[13] Without resource tiers such as those established by some US RPS policies

[14] For a discussion on experience curves, see (Wene, 2000)

[15] Vienna University of Technology (AT), IT Power (UK), Kema (NL), Risø National Laboratory (DK), Spanish Council for Scientific Research (ES), Fraunhofer Institute for Systems and Innovation Research (DE), WIENSTROM GmbH (AT), EGL (CH), EREC (BE)

European generalizations about the inherent inferiority of RPS are not applicable to the US policy experience. First, the diversity of US RPS policy designs discussed in Section 1.1 makes generalizations difficult. European critiques of risk and cost, for example, are not easily transferable to those RPS markets in which long-term REC contract requirements can mute or eliminate price volatility. Second, the relative youth of US RPS policies has thus far made conclusions about their effectiveness premature.

Finally, the relevance of the European policy debate to US RPS policy is limited by the lack of political pressure for harmonization in the US. In the European Union, the push for harmonization has created an adversarial debate as to whether RPS *or* feed-in tariffs should be adopted. In the US, no such zero-sum policy debate exists. US states have the flexibility to view tradable credits and feed-in tariffs as complimentary mechanisms for achieving RPS targets, rather than mutually exclusive tools, and US states have successfully combined competing policies in the past (see Section 3.3). Moreover, given popular support for RPS policy in the US, it is unlikely that the US policy makers will respond favorably to calls for a dismantling of existing RPS infrastructure in favor of other policies. While some European criticisms of RPS may be applicable to specific US policies, an outright dismissal of RPS is neither useful nor warranted in the US.

Rather than focusing on the weaknesses of RPS as designed and implemented in Europe, it may be more helpful for US states to focus on strengths of feed-in tariffs and on how elements of feed-in tariffs can be synergistically integrated into the US RPS policy framework. This could mean either introducing fixed price elements into existing RPS policies, designing new RPS/fixed price hybrids for states without RPS, or establishing parallel policy mechanisms.

2.3 Arguments against Feed-in Tariffs in the US

Before the benefits of feed-in tariffs within the RPS framework can be discussed, an open question for US policy makers is whether feed-in tariffs are politically feasible in the US. As discussed above, the 2001 Directive in Europe created a debate as to which renewable energy policy was best. In the United States, the primary debate at the federal and state levels is whether to support renewable energy through policy at all. The US policy advocacy community has rallied around the concept of RPS as a response to business-as-usual energy policy, and there has been little formal dialogue about the comparative merits of feed-in tariffs and RPS. As a result, there is currently little organized advocacy for feed-in tariffs in the US. Despite this lack of formal dialogue, there are several informal schools of thought as to why feed-in tariffs may not be appropriate in the US. This section summarizes some of these anecdotal arguments, and provides the authors' viewpoint on their validity and implications.

Feed-in tariffs cannot work in the competitive environment

One criticism of feed-in tariffs is that they cannot function in tandem with a competitive retail electricity market.[16] The primary concern in this context is the lack of an obvious party to bear the electricity purchase obligation without destabilizing or skewing the competitive market landscape. Imposing an open-ended purchase obligation on competitive suppliers is not compatible with a market structure under which such suppliers contract to sell at fixed prices for varying terms to non-captive customers. Placing the obligation instead on just the regulated "provider of last resort", on the other hand, would not only burden a subset of customers

[16] This argument is mainly of concern to states that have introduced full retail electricity market competition

disproportionately with the cost premium of supporting renewable energy, but could also accelerate customer migration to competitive alternatives, stranding the costs with an ever-shrinking subset of customers. As Wiser et al. (2002) point out, "feed-in laws are only competitively neutral if applied to regulated elements of the industry or if a cost recovery and sharing mechanism is developed." In Europe, governments have developed mechanisms through which the costs of feed-in tariffs can be evenly redistributed (Muñoz et al., in press). In Germany, for example, regional transmission authorities evenly redistribute feed-in costs among national rate payers. In the US, Letendre (2006) suggests that a similar redistributive role could be played by regional transmission authorities or independent system operators.

Negative association of feed-in tariffs with PURPA

The Public Utility Regulatory Policies Act (PURPA) of 1978 required utilities to buy electricity from independent renewable energy and co-generation plants. Although PURPA has proven to be a controversial policy, there are important distinctions between both the specifics and the context of feed-in tariffs relative to the PURPA era experience. Prior to PURPA, utilities generated most of their electricity themselves or purchased electricity from other utilities. Under PURPA, the purchase price for non-utility generation was based on utilities' avoided cost.[17] The determination of avoided cost levels was left to individual the states, and avoided costs rates were frequently established based on escalating long-term estimates of future costs. Some states, like California and New York, established long-term contracts for independent power producers. California's Standard Offer No. 4 contract, which was based on utility price forecasts, offered an increasing schedule of fixed prices and attracted close to 1,700 MW of wind capacity between 1981 and 1994 (Gipe, 1995). The average price per kilowatt-hour paid by California utilities to non-utility renewable generators under PURPA was 12.79¢ per kilowatt-hour (Guey-Lee, 1999). By contrast, utility avoided costs plummeted to 2-3¢ per kWh in the 1990s as utilities increasingly switched from oil to then-inexpensive natural gas. With the decrease in avoided costs, PURPA earned a controversial reputation for being an expensive burden on utility rate payers.

Some analysts have described PURPA as a precursor to European feed-in tariffs (von Rottenburg and Mertens, 2006; Wiser et al., 2002) and this comparison resonates unpleasantly for many policy makers and energy industry regulators. Feed-in tariff supporters argue that what made PURPA so controversial was not solely the use of fixed price contracts, but the unique historical circumstances that precipitated the sharp decline in electricity prices. Invoking PURPA as a counter argument to feed-in tariffs is viewed as misleading because it ignores the shifts in electricity price trends, renewable energy generation costs, electricity industry structure, and policy maker attitudes toward renewable energy that have occurred in the last 15 years. There is more of an explicit acknowledgment today of the need to pay a premium for renewable energy over the cost of conventional alternatives. As a result, the existence of higher prices for renewable generators is not by itself a sign of policy failure. There are also important design distinctions between feed-ins and PURPA: PURPA was based on escalating forecasts of avoided cost, while fixed price payments are typically fixed over time and have built-in flexibility mechanisms. Feed-in tariffs are also not as open-ended as PURPA obligations in that they can be targeted to technologies and project sizes, which can limit the overall policy cost.

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[17] e.g. the cost that a utility would pay for generating its own power. Avoided costs under PURPA were administratively determined forecast. Today, the presence of competitive wholesale markets and the growing presence of liquid spot and forward markets enable a far more realistic benchmark for marginal or "avoided costs" than PURPA forecasts.

Too much political capital has been already been invested in RPS
A third argument against feed-in tariffs is that RPS has come too far for it to be undermined by counter-proposals for feed-in tariffs. This argument assumes, as analysts have assumed in Europe, that the two policies are mutually exclusive and that RPS would have to be repealed if feed-in tariffs were to be introduced. As was discussed above, this adversarial perspective is unnecessary in the US. US states are not currently under federal pressure to harmonize their renewable energy policies and can adopt a variety of different possible hybrid policy approaches. States have already shown a willingness to use different policy mechanisms to meet RPS targets. In New York State, for example, a state authority centrally procures renewable energy credits on a competitive basis under long-term contracts on behalf of the distribution utilities. This model was developed as an alternative to relying on competitive retail generation service providers with uncertain market share and limited creditworthiness to enter into long-term contracts. The New York renewable portfolio standard does not rely on the short-term REC market envisioned by early RPS theorists, but yet is still considered an RPS. Rather than viewing feed-in tariffs as a competing policy, states can view feed-in tariffs as another tool to be used for meeting existing or proposed RPS targets.

3. Feed-in tariffs in the United States?

The arguments and counter-arguments listed in the section above are illustrative of the political dialogue that is starting to take shape with regard to the feasibility of fixed price payments in the US. It is anticipated that this dialogue will expand and become more formalized in the coming years. One of the primary drivers for this increased scrutiny (and one of more compelling potential arguments in favor of US feed-in tariffs), is that several states have already put fixed price payments for renewable energy in place or are considering doing so. This section provides an overview of existing policies, reviews recent policy proposals, and discusses possible future policy directions.

3.1 Current Fixed Price Payments in the United States

This section provides brief summaries of six fixed price payment policies currently in place at the state-level.[18] None of these policies are referred to explicitly as "feed-in tariffs," and most of them differ dramatically from European policies in terms of in scope, size, and design. Nevertheless, these policies represent an exception to the rhetorical emphasis on "market-based" incentives in the US. A full discussion of the mechanics and impacts of these policies is beyond the scope of this report. The table below lists basic policy details such as contract length and payment level, and notes design details such as whether electricity is purchased by the utility under a power purchase agreement or whether the customer retains the right to offset retail electricity through net metering regulations. The table also notes whether RECs transfer to the contracting entity or whether they stay with the system owner. The relationship between net metering, RECs, and other incentives as they relate to feed-in tariffs is recommended for further research in Section 4. The table is loosely organized according to how closely the policies resemble European feed-in tariff designs, with those most similar listed first.[19]

[18] Although there have been no national feed-in tariff proposals, Toke (2005) suggests that the federal 1.9¢/kilowatt-hour production tax credit could be considered a "rich man's feed-in tariff" comparable to fixed premium policies like Spain's.
[19] The authors acknowledge that this comparison is subject to debate

Table 3. Current State-Level Fixed Price Payment Policies in the US

Program	States	Resource	$/kWh	Contract	Electricity	Restructured markets?	RECs	Notes
Community Based Energy Development (C-BED)	MN	wind	Up to 0.055 levelized over 20 years	20	100% purchased by utility	No	transfer	C-BED is a framework for negotiating contracts between qualifying community-owned projects and Utilities where the rate for energy is higher in the first 10 years of the project than the last 10 years. Utilities are not required to enter into contracts but must make a "good faith effort" to enter into contracts with qualifying projects. Contracts under the statute can be negotiated up to $0.055 per kWh.(Bailey and Morris, 2006).
WE Energies solar buy-back rate	WI	PV	0.225	10	100% purchased by utility	No	transfer	WE Energies, a Wisconsin utility, offers 10-year fixed price contracts of 22.5¢/kWh for 100% of the electricity and RECs, which it then blends into its green pricing program.
CVPS Cow Power	VT	Biogas	95% LMP + 0.04	-	100% purchased by utility	Yes	transfer	Central Vermont Public Service (CVPS) Corporation, a utility, offers farm biogas plants a fixed premium of 95% of locational marginal price (LMP) + 4¢/kWh to supply the Cow Power green power product. The CVPS purchases 100% of the electricity and RECs from the biogas facilities.
PNM Customer Solar Program	NM	PV	$0.13	through 2018	Net metering	No	transfer	In New Mexico, PV systems receive a triple RPS credit multiplier for their output. PNM, a New Mexico utility, is purchasing solar RECs from customers at a fixed price of 13¢/kWh through 2018 in order to meet RPS targets. Customers retain the right to net meter
Washington State Performance Incentive	WA	wind, PV, biogas	up to 0.54	through 2014	Net metering	No	stay	Washington State utilities receive tax credits to offer performance-based incentives to customer-sited wind, PV and biogas systems. The incentive levels increase if state-manufactured components are used. PV systems using in-state inverters and modules, for example, receive an incentive of as much as 54¢/kWh through 2014. Recipients of the incentive retain the right to net meter and to sell their RECs.
CEC Performance Based Incentive	CA	PV	0.50	3	Net metering	No	stay	California piloted a performance-based incentive for PV in which commercial customers were offered a three-year, 50¢/kWh incentive in lieu of the standard cash rebate. Recipients retain the right to net meter and the right to sell their RECs.[20] The program was funded through the CA public benefits fund

As can be seen in the table, none of these incentives is patterned directly on the European model in which fixed price payments are offered by utilities on an open-ended basis to both centralized and customer-sited resources. Almost all of these incentives have some kind of cap on system size and/or program size, many are funded by sources other than utilities, some of the incentives

[20] The California Public Utilities Commission released a proposed decision in December, 2006 that recipients of state incentives would retain ownership of their RECs.

are comparatively short-term, and none of them guarantee both interconnection and fixed prices. Nevertheless, these policies are significant as illustrative examples. First, they demonstrate the willingness of US policy makers to support renewable energy using fixed price or fixed premium payments. Second, these policies are in place in states with renewable portfolio standards or goals and demonstrate that fixed price incentives can operate in tandem with, or within, RPS regimes. Third, many of these incentives are being used to target policy goals (e.g. PV installations, residential ownership, community ownership, in-state manufacturing) that are not supported by the RPS market. Finally, it is noteworthy that almost all of these policies are in place in states with integrated monopoly electricity service. Taken individually, these policies appear relatively minor. Taken together, however, these policies provide a compelling policy precedent.

3.2 Proposed Feed-in Tariffs in the United States

In addition to the fixed price payments and incentives that are currently in place, fixed price policies are garnering increased attention among advocacy organizations and state policy-makers.

Although most of the largest environmental organizations in the US have RPS as a part of their platforms, a growing number of organizations are also endorsing feed-in tariffs. In 2002, the Sierra Club endorsed feed-in tariffs for North America as a response to climate change (Gipe, 2002). This endorsement has since been followed by other environmental groups in the US and Canada, including Greenpeace USA, the Institute for Local Self Reliance, the Earth Policy Institute, and Earth Action (Gipe, 2007). These endorsements represent a small, but symbolic shift away from the US advocacy community's exclusive focus on REC-based RPS advocacy.

Beyond these conceptual endorsements, there have been several initiatives during the past several years to introduce or explore fixed price incentives into the US policy arena, and some of these have explicitly acknowledged the European experience.

California

As mentioned in the introduction, California has made explicit mention of its intent to study the German experience and draw lessons from Germany's successes. One of the first signs of this commitment has been the establishment of a large-scale fixed price incentive for PV. In 2005, California announced the California Solar Initiative (CSI), which targets the installation of 3,000 MW of PV on one million buildings in California by 2017.

On March 16, 2006, the California Public Utilities Commission (CPUC) held a workshop to determine the structure of the incentives to be used under the CSI. As discussed in Section 3.1 above, California had piloted a performance-based incentive for large commercial systems in 2005. The motivation for the pilot PBI was that PV systems installed under California's upfront rebate program had not performed as expected. By converting the rebate from a capacity to an output-based payment, it was thought that project developers and owners would have a greater incentive to optimize system performance (Brasil et al., 2005). The intention of the 2006 workshop was to determine how performance-based incentives could be expanded under the CSI.

Although the stakeholders present at the workshop were generally supportive of a performance-based incentive, some raised concerns about the model. PV Now, a solar energy industry lobbying group, noted that policy structure needed to be differentiated from policy type and that policy makers should not assume that a PBI would work as well as Germany's feed-in tariff just because it was performance-based and not capacity-based. PV Now specifically pointed out that the California rebate would only be for five years, while Germany's feed-in tariff extends for twenty (Day and Wiedman, 2006). The California Solar Energy Industries Association, also pointed out that the success of Germany's solar market was related to the availability of low-cost financing and that the establishment of similar financing mechanisms in the US might reduce the value of the federal solar investment tax credit (Nelson, 2006). Pacific Gas and Electric (PG&E) Corporation (PG&E), a utility, stated that it "supports consideration of a feed-in tariff as a potential solution to the current tension surrounding the various subsidies supporting solar generation and its impact on non-participating customers. The various incentives including the CSI and net metering could be combined into a single incentive structure that declines over time (Litteneker and Walter, 2006: 7)."

The CPUC has since adopted a structure under which systems below 100 kW will receive a capacity-based rebate, while systems over 100 kW will receive a performance-based incentive. The PBI is based on the capacity rebate value and will be a 5-year, 39¢/kWh incentive for commercial systems and a 50¢/kWh payment for organizations that cannot take advantage of tax credits (CPUC, 2006). Contrary to the suggestion from PG&E, however, net metering, RECs, and PBIs have not been integrated into a single feed-in policy, and the PBI is more similar to existing state rebate programs than to European feed-in tariffs.

Although the CSI program does not rely on feed-in tariffs, California is also considering the adoption of feed-in tariffs as a mechanism to meet its goal of 33% renewable electricity by 2020 (Porter, 2006). The California Energy Commission's recent Integrated Energy Policy Report update concluded that the state "must accelerate its pace of renewable development" to meet its 2011-2020 goals (Doughman et al., 2006). The report noted that feed-in tariffs have been the most effective European policy, and recommended that the Legislature review whether bilateral, fixed-price contracts in California could have the same impact that feed-in tariffs have had in Europe.

<u>New Jersey</u>

The New Jersey RPS is multi-tiered, with a main target of 20% by 2020, and a solar-specific target of 2% by 2020. The New Jersey Clean Energy Program (NJCEP) (2007) projects that the solar target will result in the installation of 1,500 MW of PV. Between 2002 and 2006, New Jersey achieved triple digit solar market growth through a combination of state rebates and solar RECs, which traded at prices of over $290 per megawatt-hour (NJCEP, 2007). Although this model was highly successful, New Jersey is considering phasing out PV rebates and relying entirely on the solar RECs instead.

The New Jersey Clean Energy Program acknowledged the challenges associated with reliance on a market-based incentive and commissioned a series of white papers to explore strategies for limiting investment risk and credit price volatility (Winka, 2006). German feed-in tariffs were among the potential models referenced (Wobus et al., 2007), and the strategies proposed included setting price floors, raising the current price cap, extending REC life, setting prices through auction, and a combining RECs with fixed price incentives. Under the combined strategy, electric distribution companies would provide a fixed price payment through a tariff-regulated long-term contract to PV generators in tandem REC trading (Kling, 2006). Similar to a price floor, this fixed price tariff would provide some stability for investors while maintaining the market-based nature of the solar RPS.

New York

In 2003, the New York State Public Service Commission (PSC) initiated a proceeding to develop an RPS for the state. After a year and a half of administrative hearings with comments from over 150 active parties, the Commission established an RPS to increase the amount of renewable energy in the state from 19% to 25% by 2013. Unlike most other RPS policies on the East Coast, New York State elected to forgo a requirement placed on sellers of electricity using tradable RECs for compliance, in favor of a central procurement approach managed by the New York State Energy Research and Development Authority (NYSERDA). Investor-owned distribution utilities collect a surcharge on each kilowatt-hour of electricity sold within the state and transfer the revenues to a fund managed by NYSERDA. NYSERDA then uses the funds to provide incentives or payments to renewable energy generators in the state. The PSC established a main RPS tier for large, utility-scale renewable generators, and a customer-sited tier for small, "behind-the-meter" systems (PSC, 2004, 2006c).

A number of different procurement strategies have been discussed during the past several years, and NYSERDA has been granted some flexibility with regard to the approach it employs for the next few procurements. In the proposed implementation plan crafted by the New York State Department of Public Service (DPS) and NYSERDA, three long-term procurement mechanisms were suggested for consideration: auctions, requests for proposals, and standard offer contracts. Standard offer contracts are similar to feed-in tariffs in that they are defined as "administratively set prices" (Salgo, 2005). The proposed implementation plan concluded that standard offer contracts might be "a more effective procurement approach" for small generators because of the "simplicity of administration and less risk for the project applicant" (DPS & NYSERDA, 2004: p. 19).

Several of the active parties also supported the standard offer procurement method. The Renewable Energy Technology and Environmental Coalition, a group of state and national environmental advocacy and renewable resource technology organizations, supported a standard offer contract as the "most suitable" procurement mechanism "for the customer-sited tier (PSC, 2005: p. 24)." BQ Energy, Horizon Wind Energy, and Plug Power supported standard offers for projects 20 MW or less, Taylor Recycling Facility supported standard offers for projects under 1 MW, and the New York Independent System Operator expressed no objections to standard offers, but suggested that such contracts be limited to "projects connected to the distribution system and operated outside the NYISO wholesale market" (PSC, 2006a: p. 11). The Irish wind energy developer, Airtricity, advocated that a standard offer be available to all generators because it "significantly reduces financial uncertainty, and thus the cost of financing" (PSC, 2005: p. 17). Several parties opposed standard offers because they might over-compensate generators. Utilities argued that if standard offers were used in conjunction with auctions, market participants would know how much NYSERDA was willing to pay for generation and could adjust their bids accordingly.

The PSC ultimately ordered that NYSERDA develop an auction process using a declining clock format (PSC, 2006a), but indicated that DPS should evaluate whether the market was ready for such a model. DPS subsequently indicated in a July, 2006 notice to the PSC that a declining clock auction could not be developed in time for that year's solicitation. DPS also requested that NYSERDA be authorized to use requests for proposals and standard offer contracts for "small-scale solicitations" (DPS, 2006). The Commission approved the use of standard offers "as needed" for small-scale solicitations and, in doing so, disagreed that standard offers "would necessarily result in overpayments" (PSC, 2006b: p. 6). To date, however, NYSERDA has not offered standard offer contracts to generators.

Oregon

The Oregon Department of Energy's Oregon Wind Working Group (OWWG) hosted a meeting in April, 2006 on the feasibility of establishing fixed price incentives for small and medium renewable generators. The workshop reviewed European experience with feed-in tariffs and concluded that such policies could be effective for supporting distributed generation in Oregon. The OWWG recommended that feed-in tariffs should be explored, but noted that there could be a perceived conflict between feed-in and RPS proposals. The workshop concluded that RPS and feed-in tariffs, "each emphasize different kinds of market development" and that "An effort should be made to find ways to come up with a hybrid model that can take advantage of the best attributes of both approaches (De Winkel, 2006: 6)."

Wisconsin

In 2006, RENEW Wisconsin submitted testimony to the Public Service Commission supporting fixed price incentives for distributed, renewable generators. In the testimony, RENEW Wisconsin proposed "a standardized set of technology-specific rates, known informally as feed-in tariffs, that provides a fixed return for a pre-determined period of time not shorter than 10 years. The rates would be set in accordance with the expected production costs associated with each technology and as well the size of the installation (Vickerman, 2006)." The testimony also noted that "Feed-in tariffs have been the driving force behind the extraordinary penetration of solar, wind and biogas installations in nations like Germany and Spain." Citing the precedent of the WE Energies solar and biogas buy-back programs, RENEW Wisconsin proposed that feed-in tariffs be adopted by all of the state's utilities and is currently working with state stakeholders to develop a model tariff.

3.3 Future Directions for Feed-in Tariffs in the United States?

Given the existence of various fixed price incentives around the country and the dialogue about feed-in tariffs in 2004-2006, it seems as though feed-in tariffs are beginning to emerge as a viable policy tool in the United States. Given the differences in political, regulatory, and policy environments in the US and Europe, however, it seems unlikely that a full-scale feed-in tariff like Germany's will be adopted in the United States in the near future.

Judging from the current and proposed fixed price tariffs at the state level, it seems more likely that feed-in tariffs will continue to emerge as limited fixed price incentives or payments targeting specific policy goals. As discussed in Section 3.1, many of the existing fixed price tariffs target emerging technologies like PV, biogas, and small wind, or specific ownership models (i.e. customer-sited, residential, community-owned). The proposed fixed price payments in California, New Jersey, and Wisconsin also follow this model by explicitly targeting emerging technologies and distributed generation. The use of fixed price incentives to promote certain technologies and achieve specific policy goals is similar intent to the use of technology-specific feed-in tariffs in Europe.

The current discussions about incentive design in New Jersey and New York highlight the fact that some states are already using technology-specific tiers, or carve-outs, within the RPS to encourage technological diversity and/or new ownership models. Nine states have established goals for specific technologies and ownership models within their RPS targets (Table 4).

Table 4. State RPS resource tiers

State	Target	Resource
Arizona	4.5% by 2015	Distributed renewable energy (half must be residential)
Colorado	0.4% by 2015	Solar electric (half must be customer-stied)
Montana	75 MW by 2015	Community-owned renewable energy
Nevada	0.75% by 2013	Solar electric and solar thermal energy
New Jersey	2% by 2020	PV
New York State	0.1542% by 2013	Customer-sited PV, fuel cells, wind
Pennsylvania	0.5% by 2020	PV
Texas	500 MW by 2015	Non-wind renewables
Washington, DC	0.386% by 2021	PV

Source: Wiser (2006)

Several other states, including Delaware, New Mexico, and Maryland, have established credit multipliers for targeted technologies. As demonstrated in New Mexico with the PNM REC purchase program, and as proposed in New Jersey, technology-specific tiers or multipliers may be a logical first step for integrating fixed price payments into RPS.

This approach fits with the argument that feed-in tariffs and RPS can be used to target technologies at different stages of maturity and market penetration. In arguing for the development of hybrid compromise policies in Europe, for example, Midttun and Gautesen (2007) conclude that public benefits funds (PBFs) should be used to support technology in the research and development stage, feed-in tariffs should be used to support emerging energy technologies like PV,[21] and RPS markets should be used to promote competition between near-market renewable energy technologies. Rowlands (2005) has built a similar case for using feed-ins to support PV within RPS regimes in Canada.

US policy maker adopted a similar compromise approach to the debate between public benefit funds and RPS. During the period leading up to retail electricity competition in the 1990s, renewable energy advocates debated whether RPS or funds collected through ratepayer surcharges were more effective (Wiser et al., 1996). Although this debate began as an adversarial one (similar to the debate between RPS and feed-ins in Europe) it was ultimately determined that RPS and public benefits funds could co-exist and be used to support technologies at different stages of maturity (Haddad and Jefferiss, 1999). Several states (e.g. California, Connecticut, Massachusetts, New Jersey, New York, Rhode Island) have adopted this hybrid approach and introduced public benefits funds and RPS in tandem.

In addition to the use of fixed price incentives for emerging technologies and ownership models, it is possible that states (or utilities) may begin to use fixed price tariffs to contract for utility-scale renewable energy generators. As discussed above, long-term contracts for bundled RECs and electricity are already in use in several regulated states, and they have also emerged in Texas. NYSERDA, meanwhile, currently procures RECs for large-scale generators through long-term contracts in New York State. In Connecticut, the Project 100 Initiative offers 10-year, long-term

[21] This is a role currently played by PBFs in the US as well.

contracts for up to 100 MW of renewable energy projects. At the moment, all of these long-term contracts must be competed for or negotiated, rather than awarded automatically. Nevertheless, it is possible that states with long-term contracting already in place could shift to more transparent and standard long-term contracts similar to feed-in tariffs.

A third, but less likely, possibility for the entry of feed-in tariffs into the US policy arena could be the outright adoption of feed-in tariffs based on the European model. All of the current and proposed feed-in tariffs differ either in design, magnitude, funding source, and/or limitations from the policies currently employed in Europe. There have been some proposals for feed-in tariffs to achieve large-scale, open-ended market expansion (see: Letendre, 2006), but these have not yet been adopted as policy platforms by advocacy organizations or policy makers.

4. Areas for Further Research

This paper has reviewed the evolution of RPS and feed-in tariff policy in the US and Europe and has explored the feasibility of feed-in tariffs in the United States. Although there are no incentives patterned directly on European models in the United States, there is evidence of both interest from US state-level stakeholders in the European experience and a willingness to integrate fixed price payments into state renewable policy portfolios. In moving forward, future research should focus on how feed-in tariffs and fixed price payments can be structured to effectively and efficiently support renewable energy development in the United States. The US energy policy community could develop an analytical framework for state-level fixed price incentives that draws on best design practices from European feed-in tariffs, but takes US policy goals, market contexts, renewable resources,[22] and existing policy infrastructure into account. Such a framework could provide a basis for analyzing how fixed price payments might be integrated into existing RPS policies or created as stand-alone policies in both regulated and restructured electricity markets. Several specific potential areas for further research are detailed below.

Success Indicators and Conditions
It would be useful for US audiences to better understand what has led analysts to conclude that feed-in tariffs have been more “successful” and “effective” in Europe, and the degree to which such assessments apply to the US. Some European best practices may not transfer readily to the US context. Feed-in tariff proponents have argued, for example, that an advantage of feed-ins is that they can be structured to create incentives for renewable energy where the resource is comparatively weak (e.g. wind energy in Germany). This design criterion would most probably not be considered a best practice in US states with relatively strong renewable resources and low population densities. A recent European study used stakeholder surveys to isolate and identify which evaluation criteria were most important for judging renewable energy policies (Morthorst et al., 2005). A similar exercise could be carried out for US stakeholders.

A second step would be to identify the policy designs that can best meet the identified success criteria. There are “successful” and “unsuccessful” feed-in tariffs in Europe, just as there are “successful” and “unsuccessful” RPS policies in the US. It would valuable identify the design criteria shared by successful feed-in tariffs and RPS policies (i.e. long-term stability, administrative simplicity, etc.) and isolate factors beyond policy design that may have influenced success. Building off of the work of recent publications (e.g. Bechberger and Reiche, 2004;

[22] In particular, their location, scale, availability and cost.

Reiche, 2005), such an analysis could seek to correlate success indicators with a wider range of determinative factors. These might include physical factors like land-use patterns, population density, renewable energy resource, and electrical grid structure; and market context factors such as market structure, utility size and ownership, administrative barriers, the existence of creditworthy buyers able to enter into financeable long-term contracts, and the presence of an entity that can assume renewable energy purchase obligations without destabilizing competitive market structure or unfairly burdening specific subsets of customers.

Price setting, payment structure, and flexibility
Setting a fixed price payment must be done carefully. A low payment level will not promote renewable energy market growth, and a high payment level could result in politically untenable outcomes (e.g. free rider problems, exhausted budgets, windfall profits, etc.). In the past, US incentives like PURPA have been based on utility avoided cost projections. In Europe, most feed-in tariffs are based on a given technology's current generation cost plus a reasonable profit for the project owner. US policy makers should determine which of these approaches is most useful for accomplishing policy goals. As a starting point, there are at least two published methodologies on how feed-in tariffs can be set (Chabot et al., 2002; Muñoz et al., in press). In New York State, it was suggested that the outcomes from NYSERDA's competitive procurement could be used as a benchmark to set standard offer contract levels for distributed renewable generators (Salgo, 2005). These models could be reviewed and evaluated for their appropriateness to different political and regulatory contexts. Related considerations include whether the feed-in tariff should be a fixed payment or a fixed premium, whether these tariffs should be for energy bundled with RECs or just for RECs, and how to best build flexibility mechanisms into the tariff structure. In addition to a declining premium, for example, several European policies have a built-in review every few years to determine whether the tariff schedule should be adjusted given cost and market trends.

Policy interaction
In Europe, feed-in tariffs function in the same way for both utility-scale and customer-sited renewable resources: the utility purchases all of a generator's renewable electricity for a fixed payment. The policy landscape in the US is more complicated. At the utility-scale, renewable energy projects might be able to sell electricity under a power purchase agreement with a utility, generation company or wholesale marketer, sell RECs into the RPS or voluntary market, and receive a grant from the public benefits fund. Onsite generators, meanwhile, might sell RECs, receive rebates from the public benefits fund, and offset retail electricity consumption through net metering regulations. As can be seen from the policies listed in Table 3, there is currently no standard structure for fixed payments in the US. Some involve only REC purchases (PNM), some are for electricity and RECs (WE Energies, CVPS), and some are simply an incentive payment that does not impact electricity or RECs (CA & WA performance incentives). In order to facilitate the use of fixed payments in the US, a set of best practices for how fixed payments can (or should) interact with existing market and policy structures could be developed. If hybrid feed-in tariff/RPS policies are to be developed, for example, more research will need to be done on the mechanics of fixed price payments within the fixed schedule of RPS compliance targets.

There might also be opportunity for new policy proposals. As suggested by Litteneker & Walter (2006) on behalf of PG&E, there may be innovative new ways to combine fixed price payments with net metering, RECs, etc. Most states with net metering, for example, limit eligibility to renewable energy systems below a certain kilowatt capacity. States with RPS might consider allowing net metering for larger systems through the establishment of a premium, fixed price buyback payment that also involves a REC transfer to utilities for RPS compliance.

Related to the issue of policy interaction is how these policies should be funded. In Europe, utility ratepayers ultimately bear the burden of the fixed payments. In the US, the fixed payments could be funded either through utility ratepayers,[23] through tax policy, through voluntary markets, or through public benefits funds. The choice of funding source may inherently limit the size of the fixed payment programs. Budget-based programs, for example, might not have the funding sufficient to support open-ended fixed price commitments.

Canadian Policy

Although the European experience is useful for US states to explore, Canada could also be an interesting case study. Both Ontario and Prince Edward Island have recently established feed-in tariffs. Ontario's provides a 20-year, Can$0.11/kWh payment for wind, biomass, and small hydropower and a 20-year, Can$0.42/kWh payment for PV.[24] Systems must be smaller than ten megawatts to be eligible. Prince Edward Island, meanwhile, has a Can$0.0575/kWh payment for wind, biomass, and solar with a Can$0.02/kWh adder tied to the consumer price index.[25] Systems in Prince Edward Island must be larger than 100 kilowatts. In Saskatchewan, the Legislative Secretary for Renewable Energy Development and Conservation recently submitted a report to the Premier calling for a standard offer contract of at least Can$0.09/kWh for "high environmental performance renewable electricity projects (Prebble, 2006: p. 30)." The performance of these current and proposed policies would be instructive for US states to monitor.

Fixed price structure under different regulatory regimes

As discussed in Section 1.1, different states have different electricity market structures. Some states have introduced retail electricity market competition, and others remain fully regulated with vertically integrated utilities. Furthermore, some of these states have RPS policies and some do not. The introduction of fixed price payments into these different regulatory environments will face different barriers and require different policy approaches. As mentioned above, some sort of redistributive mechanism may be necessary in states with retail competition. An analysis of different possible approaches would be an interesting topic for further research. Related topics include how the US electricity market environment compares with that of Europe's and whether a national fixed price payment would be possible, or whether fixed payments are best left to the states.

Portfolio diversity benefits and risk

One of the motivating factors for many RPS policies has been the fact that RPS will lower electricity prices over the long-term. The reason for this is that the introduction of renewable energy into utility portfolios serves as a hedge against fossil fuel price volatility and decreases fossil fuel demand (Bolinger et al., 2004; Wiser et al., 2005). These dynamics have been reflected in RPS cost impact studies at both the national (US EIA, 2002, 2003) and state levels (Binz, 2004; Chen et al., 2003). To date, none of these studies have taken the risk premiums reported in Europe into account. In going forward, it would be interesting to analyze the

[23] In competitive retail markets, customers are both ratepayers of distribution utilities and customers of either competitive or regulated suppliers of generation service. These distinctions create a wider range of challenges or possibilities.

[24] US$0.35/kWh for PV and CAD 0.093/kWh for wind, biomass and small hydropower

[25] US$0.043 tariff with a US$0.013 adder

magnitude of REC price volatility premiums and whether they have played a significant role in any of the US RPS credit markets.

Conversely, recent analysis has concluded that long-term, fixed price payments for fuel-free energy sources like wind power can be viewed as effective portfolio management strategies (Biewald et al., 2003). Renewable energy contracts can hedge fuel price volatility, bridge inefficiencies in the long-term electric wholesale market, and reduce the green premium needed to support renewable energy project. In addition, in markets in which prices are set based on the bid price of marginal resources, renewables with low, or zero, fuel costs can suppress both electricity and fuel prices (Grace, 2007). These contracts can either be structured as physical hedges, through which both RECs and electricity are purchased under a long-term contract, or as financial hedges, through which only RECs are purchased and used as the basis for contracts-for-differences (Bolinger et al., 2003; Grace, 2007). It would be interesting to analyze the extent to which then feed-in tariffs using fixed payments or fixed premiums could fulfill portfolio management and hedge roles. It would also be interesting to see whether European countries have analyzed the impact of their most effective feed-in tariffs on fossil fuel price volatility and portfolio diversity.

Comparative RPS research

This paper focused primarily on the potential for feed-in tariffs in the United States based on lessons drawn from European experience. A second research focus could be on RPS in Europe as it compares to RPS in the US. Given the prevalence of RPS policy in the US, US audiences may find a more in-depth discussion of European criticisms of RPS valuable. European analysts have concluded that RPS has not been as effective in Europe as feed-in tariffs have been. The design of each European RPS policy differs (both from other European designs and from US designs), however, and most European analysts have not made an effort to distinguish between the design criteria of each and whether their flaws are intractable or could be resolved through amendment. Moreover, some of the comparisons between RPS and feed-in tariffs could be clarified. When comparing the 15-year record of the German feed-in tariff (under both the StrEG and the EEG), for example, against the more recently enacted European RPS laws, it might be useful to compare annual renewable capacity and energy increments over comparable timeframes.

Updated research on the lessons from US RPS experience for European policy makers might also be valuable for European audiences. As pointed out by Kurdziel (2004), "American support measures for renewable energies in every respect provide concrete examples, from the experiences of which Germany, too, can learn (p. 53)."

5. Conclusions

The European policy debate can provide policy makers around the world with useful insights into policy design and implementation. Given the progress that has been made in the US with state-level RPS, US states could effectively serve as laboratories for combining RPS and feed-in tariff policies in innovative and synergistic ways. There remain many questions as to how fixed price payments can best be integrated into US policy and regulatory frameworks, but these are questions that US policy makers seem increasingly interested in exploring. The goal of this White Paper is to serve as a useful starting point for the emerging dialog on feed-in tariffs and renewable portfolio standards in the United States and as a helpful reference for the policy community on both sides of the Atlantic.

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