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Race to the Top:

The Expanding Role of U.S. State Renewable Portfolio Standards

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Prepared for the Pew Center on Global Climate Change

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Contents

Foreword *Eileen Claussen, President, Pew Center on Global Climate Change*

Since the release of our 2002 report on state-level climate activity, *Greenhouse and Statehouse: The Evolving State Government Role in Climate Change,* the pace of innovation and adoption has quickened. States are taking a broad range of actions that reduce greenhouse gas emissions. One of the most widely-used policy tools is the creation of a renewable portfolio standard (RPS). These standards generally mandate that renewable energy provide an increasing share of state's electricity. As of mid 2006, 22 states and the District of Columbia have implemented an RPS.

In this Pew Center report, author Barry Rabe of the University of Michigan concentrates on this subset of the increasingly broad range of state climate policy initiatives. This work presents an overview of this policy tool, focusing on case studies of five states: Texas, Massachusetts, Nevada, Pennsylvania and Colorado. These cases reveal a number of themes with implications for other states considering adoption of an RPS, as well the implementation of a federal renewable portfolio standard.

RPS enactment and expansion appear to draw strong political support independent of party lines. States are enacting or expanding RPSs for multiple reasons, including economic development opportunities and a more reliable and diversified supply of electricity. Environmental factors, such as reduction of conventional pollutants or greenhouse gas emissions, are often seen as secondary drivers in many states. RPSs are already boosting renewable energy supplies in a cost-effective manner, and appear to hold considerable potential for more dramatic gains. They are driving the expansion of important homegrown industries. However, this report also identified a number of challenges that could potentially deter future development and successful implementation of this policy tool.

Many RPS programs remain in very early stages of implementation, and many states are facing serious implementation challenges. How should renewable energy be defined? How should individual states deal with intra-state and inter-state transmission capacity, an issue that calls for greater inter-state collaboration in policy development? Should special status be accorded specific, disadvantaged renewable sources, which might lead to a collision between competing special interests and end up by raising costs?

This report illustrates a classic case of federalism in energy and environmental policy. States adopting RPSs are providing actual data and real-world models, and the early successes of these states are changing the debate about what states can individually accomplish with their energy systems, how states can cooperate

regionally, and whether a federal RPS may be feasible. These states are also, however, pushing up against the limits of what states can do without federal support and coordination. Engagement between state and federal policy makers on this issue has been surprisingly limited, and is overdue. These policy experiments may prove a deciding factor in the energy path that the United States chooses to take, demonstrating that renewables can be a viable part of our energy future.

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Executive Summary

The role of American state governments in developing policies to reduce greenhouse gases continues to expand at a steady clip, measured both in the sheer number of policies and their potential impact on emissions. One of the most widely-used policy tools involves creation of a renewable portfolio standard (RPS). Such policies mandate that utilities operating within a state must provide a designated amount or percentage of power from renewable sources as a portion of their overall provision of electricity. This policy is not unique to the United States, as it is employed by a number of national governments as well as subnational entities that range from the state of South Australia to the province of Prince Edward Island. But they have proliferated among the American states at a rapid rate, having been adopted by 22 states and the District of Columbia as of mid 2006, with a strong likelihood of continued expansion in coming years. Well over half of the American public now lives in a state in which an RPS is in operation and at least one state has such a policy in every region of the nation except the Southeast.

This report builds on earlier Pew Center analyses of the evolving state role in climate policy development, placing a particular focus on the RPS experience to date. It presents an overview of this policy tool and examines key factors in both policy formation and implementation. This work considers the experience of all RPS states but devotes particular attention to five case studies that illustrate both common themes and points of divergence among individual state programs. The analysis concludes with an examination of RPS performance to date and some of the leading opportunities and challenges facing future development.

The continued proliferation of state RPSs and the decision in many states to establish second-generation policies illustrate that these policies tend to draw a fairly broad base of political support that often crosses partisan lines. States are compelled to enact or expand RPSs for multiple reasons, and greenhouse gas emissions may or may not be central factors in prompting adoption. Instead, states consistently anticipate significant economic development benefits from promoting renewables, particularly given the promise of developing home-grown energy sources that could lead to instate job creation. In turn, states are also attracted to RPSs by the prospect of greater reliability of electricity supply in coming decades and the prospect of reducing conventional air pollutants through a shift toward expanded use of renewables. Virtually all state RPSs make some use of flexible compliance mechanisms, including tradable renewable energy credits, although there is some inter-state variation in defining what constitutes a renewable energy source.

In recent years, important trends have emerged in RPS development. These include increasingly ambitious levels of renewable energy mandated over future periods, such as 25 percent of New York electricity by 2013 and 20 percent of Nevada electricity by 2015. In turn, many states have begun to differentiate between various sources of renewable electricity, providing special provisions to support certain forms of renewables that have lagged behind others due to high costs, and some are beginning to incorporate energy efficiency as a way to meet RPS goals. In a number of instances, RPSs have clearly played a central role in fostering rapid and significant expansion of the amount of renewable energy provided in a state.

Looking ahead, RPSs face a number of opportunities and challenges. As the number of state policies continues to grow, inevitable questions of cooperation across state boundaries arise. This may be particularly evident in those parts of the country, such as the Northeast and Southwest, in which *de facto* RPS regions are emerging through the independent actions of neighboring states. In turn, states increasingly face implementation challenges, including issues of siting new renewable energy facilities and, in some instances, expanding transmission capacity. Furthermore, there has been remarkably little engagement between state and federal policy makers on this issue and clearly a strong need for greater intergovernmental collaboration in thinking about sustaining the advances of individual state policies while consideration of a federal version of an RPS continues.

I. Introduction

One of the classic questions in American federalism concerns the role of state governments, particularly in those areas of public policy where the federal government has been unable or unwilling to engage. For generations, scholars have debated intensively whether states would be more likely to "race to the top" or "race to the bottom" in the absence of guiding federal commands. In areas of environmental protection not addressed by federal statute, for example, would states assume a leadership role and launch bold initiatives? Or would they set lower regulatory standards than their neighbors and quietly hope that environmental contamination might migrate to another jurisdiction?

In recent years, the area of global climate change has provided an unexpected test for this long-standing question. In November 2002, the Pew Center on Global Climate Change released a report that revealed an unexpectedly high level of state government engagement in developing policies to reduce greenhouse gases (Rabe 2002). This report highlighted very diverse policy experiments in multiple sectors and states, indicating a surprisingly robust level of state policy engagement that had received little attention from researchers and media analysts. This engagement, to be sure, did not involve all states and it was unclear whether this phenomenon was ephemeral or the beginning of a significant trend toward expanded state involvement. But it suggested the possibility that states might play a defining role in fashioning American climate researchers despite various Constitutional constraints placed on state actions (Kendall 2005; Scheberle 2004).

Subsequent developments corroborate the thesis that states are taking center stage in the formation and implementation of American policies that reduce greenhouse gas emissions. By any measure, the number of states involved in some form of climate policy has continued to grow and the inventory of state policies that address climate change continues to expand at a steady clip (Kriz 2005). Indeed, from Honolulu to Augusta, the saliency of climate-friendly policies continues to climb and increasingly results in legislative enactments, executive orders, and rule-making proceedings. Collectively, they address every sector of the American economy that generates greenhouse gases.

This report concentrates on one subset of this increasingly large basket of state policy initiatives: the promotion of renewable electricity generation. A transition from fossil fuels to such renewable sources as wind, geothermal, solar, biomass, and micro-hydro, among others, holds significant promise for reducing greenhouse gas emissions. States have attempted to foster this transition in numerous ways in recent years but a large and expanding number have embraced a policy tool known as a "renewable portfolio standard" (RPS). A state RPS

requires utilities operating within its boundaries to provide a specified amount or percentage of power from renewable sources as part of their total offering of electricity. Subsequent sections of this report will further define this policy and examine the various factors that have prompted so many states to adopt some version of it. The analysis will consider national trends but devote particular attention to five state case studies that illustrate both common themes and points of differentiation between states. This review will also include some analysis of early implementation experience and consideration of possible "next steps" in the evolution of this area of policy. In turn, as more states adopt or expand RPSs, a number of questions emerge concerning interstate collaboration in policy development as well as issues of state and federal relations.

II. The Proliferation of State Renewable Portfolio Standards

The employment of portfolio standards to promote expanded use of renewable energy is neither a new concept nor one that is exclusively American. It represents a blending of policy strategies with a combination of regulation and deference to market preferences that is a hallmark of more recent innovations in American environmental and energy policy (Mazmanian and Kraft 2000). For most states, establishing an RPS merely involves an incremental expansion of existing regulatory powers over electricity generation and distribution within their boundaries. Alongside their historic and pivotal roles in overseeing the regulation of electric utilities, market restructuring, approval and siting of new generating facilities, and electricity rate-setting and taxation, states have for decades sought ways to promote renewable energy sources as well as energy conservation (Teske 2004; Gormley 1983; Smeloff and Asmus 1997). Consequently, many state officials view portfolio standards as simply one additional mechanism to respond to public demand for an electricity supply that is as reliable, inexpensive, and environmentally friendly as possible.

Just as RPSs are increasingly common among U.S. states, they have also continued to emerge internationally, both at the national and subnational levels. In the European Union, the movement toward ratification of the Kyoto Protocol has not resulted in a uniform policy across the member nations on renewable energy (Rowlands 2005). Thus far, nations such as Italy, Poland, Sweden and the United Kingdom have authorized "tradeable certificate" programs that bear a striking resemblance to state RPSs and two regions within Belgium have followed suit (van der Linden, et al. 2005). Japan has also established its own version of an RPS and the Australian province of South Australia has approved a standard that is scheduled to reach 15 percent of total electricity supply from renewables by 2014 (Biello 2005). In Canada, Prince Edward Island has also set a 15 percent renewable standard, to be attained by 2010 (Marshall 2005). Like their American counterparts, these policies remain in fairly early stages of development but underscore the fact that American state policy formation runs parallel with international patterns (Rowlands 2003).

In 1991, Iowa became the first state to enact an RPS, followed in 1997 by comparable policies in Massachusetts, Minnesota, and Nevada. However, the process of policy diffusion has accelerated markedly in recent years, with ten states enacting RPS policies in 2004 and 2005 alone (see Table 1). By mid 2006, 22 states and the District of Columbia had created RPS programs. With the exception of the Southeast, every region in the United States had at least one RPS in operation at this point (See Figure 1). Many of the states with the largest populations—and levels of electricity consumption—had enacted RPSs, including California, Illinois, New York, Pennsylvania, and Texas. Indeed, any Presidential candidate in 2008 who was victorious only in states featuring an RPS would be elected handily by the Electoral College.

Table 1

State Renewable Portfolio Standards Key Design Features

State	Year Enacted	Date Revised	Governor Partisanship*	Legislature Control*	Preliminary Target	Final Target	Who's Covered	Credit Trading
Arizona	2001	2006	Rep	Split	0.2% by 2001	15% by 2025	Utility	No
California	2002	2005	Dem	Dem	13% by 2003	33% by 2020	Investor Owned Utility Municipal Utility	Yes
Colorado	2004		Rep	Rep	3% by 2007	10% by 2015	Utility Investor Owned Utility Rural Electric Cooperative	Yes
Connecticut	1999	2003	Rep	Dem	4% by 2004	10% by 2010	Utility	Yes
Delaware	2005		Dem	Split	1% by 2007	10% by 2019	Retail Electricity Supplier	Yes
District of Columbia	2005			Dem	4% by 2007	11% by 2022	Utility	Yes
Hawaii	2004		Rep	Dem	7% by 2003	20% by 2020	Utility	No
Illinois†	2005		Dem	Dem	2% by 2007	8% by 2013	Utility	No
Iowa	1991		Rep	Dem	none	105 MW	Utility	No
Maine	1999		Ind	Dem	none	30% by 2000	Utility	Yes
Maryland	2004		Rep	Dem	3.5% by 2006	7.5% by 2019	Electricity Supplier	Yes
Massachusetts	1997		Rep	Dem	1% new by 2003	4% new by 2009	Utility	Yes
Minnesota	1997		Rep	Dem	1,125 MW by 2010	1,250 MW by 2013	Xcel only	No
Montana	2005		Dem	Split**	5% by 2008	15% by 2015	Utility	Yes
Nevada	1997	2005	Rep	Split	6% by 2005	20% by 2015	Investor Owned Utility	Yes
New Jersey	2001	2004	Rep	Rep	6.5% by 2008	20% by 2020	Utility	Yes
New Mexico	2002	2004	Rep	Dem	5% by 2006	10% by 2011	Investor Owned Utility	Yes
New York	2004		Rep	Split	none	25% by 2013	Investor Owned Utility	Yes
Pennsylvania	2004		Dem	Rep	1.5% by 2007	18% by 2020	Utility	Yes
Rhode Island	2004		Rep	Dem	3% by 2007	16% by 2020	Electric Retailers	Yes
Texas	1999	2005	Rep	Rep	2,280 MW by 2007	5,880 MW by 2015	Retail Supplier	Yes
Vermont	2005		Rep	Dem	none	load growth by 2012	Retail Electricity Supplier	Yes
Wisconsin	1999	2006	Rep	Rep	none	10% by 2015	Utility	Yes

Sources: DSIRE, EIA, NGA, NCSL, Pew Center on Global Climate Change

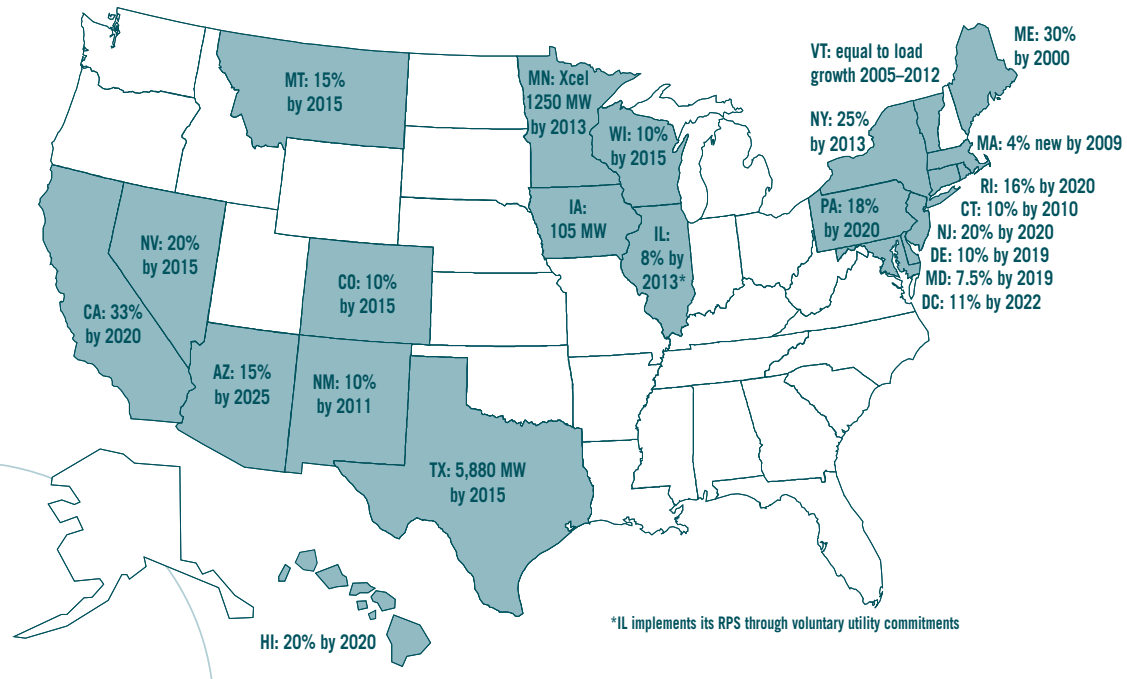
*Political Control at time of initial enactment

**Senate was controlled by Democrats, House was split 50-50.

†Illinois implements its RPS through voluntary utility commitments.

Figure 1

Renewable Portfolio Standards



Individual state RPSs differ from one another in detail but have many similar design features. All RPSs enacted to date establish some specification of a percentage or absolute amount of electricity generation or capacity that designated suppliers in a state are required to provide by a particular date. Each state program defines what constitutes a qualifying renewable electricity source (Table 2) and, over time, increases the percentage or amount of capacity or generation that must be provided from renewable sources to meet the standard. Most states also allow regulated parties to generate their own renewable supply or purchase credits from other suppliers. The so-called "renewable energy credit" (REC) system follows other market-based mechanisms that allow options for assuring compliance, enabling suppliers to meet regulatory requirements in the most inexpensive way feasible. In turn, each state RPS designates a lead governmental agency, most commonly the state public utility commission, to oversee most aspects of implementation.

Table 2

Qualifying Renewable Electricity Sources

State	Wind	Photo-voltaics	Solar Thermal	Biomass	Geo-thermal	Small Hydro-electric	Fuel Cells	Land Fill Gas	Tidal/ Ocean	Wave/ Thermal	Energy Efficiency
Arizona	✔	✔	✔	✔					✔		
California	✔	✔	✔	✔	✔		✔	✔	✔	✔	
Colorado	✔	✔		✔	✔	✔		✔	✔		
Connecticut	✔	✔	✔	✔			✔	✔	✔	✔	
Deleware	✔	✔	✔	✔	✔		✔	✔	✔	✔	
District of Columbia	✔	✔	✔	✔	✔		✔		✔	✔	
Hawaii	✔	✔	✔	✔	✔		✔	✔	✔	✔	✔
Illinois	✔	✔	✔	✔			✔		✔		
Iowa	✔	✔		✔			✔				
Maine	✔	✔	✔	✔			✔	✔	✔	✔	
Maryland	✔	✔	✔	✔	✔		✔	✔	✔	✔	
Massachusetts	✔	✔	✔	✔				✔	✔	✔	
Minnesota	✔			✔							
Montana	✔	✔	✔	✔	✔		✔	✔	✔		
Nevada	✔	✔	✔	✔	✔		✔		✔		✔
New Jersey	✔	✔		✔	✔		✔	✔	✔	✔	
New Mexico	✔	✔	✔	✔	✔		✔	✔	✔		
New York	✔	✔		✔			✔	✔	✔	✔	
Pennsylvania	✔	✔	✔	✔	✔		✔	✔	✔		✔
Rhode Island	✔	✔		✔	✔	✔		✔	✔	✔	
Texas	✔	✔	✔	✔	✔		✔		✔	✔	
Vermont	✔	✔	✔	✔			✔	✔	✔		
Wisconsin	✔	✔	✔	✔	✔		✔	✔	✔	✔	

Source: Database of State Incentives for Renewable Energy

A. Driving Political Forces

Many areas of state energy policy are enormously contentious, particularly those that propose significant changes in practice for privately held utilities that have traditionally dominated service delivery in a jurisdiction. These controversies have been evident in recent years in the battles in numerous state capitals over proposed restructuring (or deregulation) of electricity wholesale and retail rates (Brown 2001). Renewable portfolio standards indeed call for significant changes from past practice, but in most instances of adoption have received broad legislative support that frequently transcends partisan boundaries. This pattern is further reflected in those states that are considering "second generation" RPSs with heftier requirements, although conflict is increasingly evident in state debates over how high to set future targets and whether or not to give favored status to select renewable energy sources that are lagging behind others due to higher costs.

Among the 22 RPSs established to date, sixteen were enacted with a Republican governor, five with a Democrat, and one with an Independent. Hence, RPS bills have been signed into law by a diverse array of state executives including then-Governor George W. Bush (R-Texas), George Pataki (R-New York), and Edward Rendell (D-Pennsylvania). Legislative control at the point of enactment has been more evenly divided between parties. Regardless of partisan composition of state government, these policies have consistently drawn a rather broad coalition of support. In turn, one increasingly sees formal representation in the state legislative process from renewable energy developers who have established a foothold in the state and are eager to expand their role through RPS expansion (Rabe and Mundo 2007). In numerous states, such organizations are far more visible and influential in RPS deliberations than conventional environmental advocacy groups.

Perhaps one of the biggest factors facilitating such diverse support has been a commonly held perception that promotion of renewable energy through an RPS is in the economic interest of an individual state and thereby compatible with the predominant state goals of promoting economic development (Peterson 1995). Greenhouse gas reduction constitutes one important benefit from greater use of renewable energy and has been an important consideration in a number of the RPS cases. But in many instances, any climate benefits are deemed ancillary to a variety of economic advantages seen as accruing from an RPS. For states concerned about electricity supply and reliability, diversification through renewable promotion may be very desirable. For states frustrated with the unanticipated spike in natural gas prices over the past half-decade, the prospect of more predictable generation costs through renewables is increasingly attractive. For states struggling with environmental concerns such as conventional air emissions from coal-burning or nuclear waste management, renewables offer the promise of energy with far fewer undesirable externalities.

Many RPS states have emphasized particular economic development advantages as a rationale for action, particularly for wind energy. Electricity provided by wind sources in the United States expanded by more than 35 percent in 2005, surpassing 9,200 MW by the end of that year and continuing a dramatic rate of growth

in the past decade (American Wind Energy Association 2005). Much of this increase was stimulated by state RPS requirements and was facilitated by improved technological reliability, continued decline in the cost per unit of electricity generated, as well as the extension of the federal production tax credit for renewables. In turn, many states have been attracted to wind—and other renewables—due to their perceived job-generating potential. Whereas fuel accounts for much of the cost for conventional electricity, renewables use free or low-cost energy sources and thereby concentrate a far larger share of their total costs on labor. This labor benefit has fostered discussion in many state capitals about an anticipated "jobs multiplier" effect of renewables as opposed to conventional sources. Such development, of course, is particularly attractive if new sources generated in response to an RPS are developed within a state's boundaries and supplant fossil fuels that must be imported at considerable expense from other states or nations.

B. Design Trends

Consistent with the interstate diffusion of policy innovation in other areas, state RPSs maintain many common design features and yet are tailored to the particular realities of each individual state (Mossberger 2000). As one analyst has noted, "A tremendous variety of RPS designs exist in the field" (Frantzis 2003, 34). Nonetheless, certain trends have begun to emerge in recent years, particularly among those states that have more recently adopted an RPS or among those states with an established RPS that have amended and thereby modified the initial proposal. These themes will emerge more fully through the review of case studies and periodic reference to states not included in the full analysis.

First, states over time have increasingly tended to elevate the bar for the amount of electricity required by an RPS (see Table 1). While all maintain some phase-in policy over a specified period of time, the end target date tends to feature increasingly high levels of renewables. Many of the earlier programs set relatively low targets for renewables; the 1991 Iowa law set a standard that would reach approximately two percent by the end of that decade and Wisconsin's 1999 law established a 2.2 percent standard by 2011. More recent RPS enactment has tended toward more ambitious levels, consistently in double-digits and as high as 33 percent by 2020 in California and 25 percent by 2013 in New York. In many respects, this resembles a multi-state "race-to-the-top," whereby many states are committing to future renewable energy levels that seemed inconceivable a half-decade ago.

Second, state RPS programs are increasingly complemented by other state-launched initiatives to promote renewable energy as well as energy efficiency. Virtually every state has made some commitment to fostering renewable energy and, in some instances, these programs may create incentives for potential generators that will ease compliance with RPS standards. New Jersey, for example, has an RPS that reaches 6.5 percent renewable generation by 2008, and 20 percent by 2020. The state supplements its RPS with a "renewable energy fund" that is designed to encourage investment in renewables and is further supported by other incentive and

regulatory programs that mandate expanded use of renewables in government buildings (Rabe 2004). However, some states, such as Connecticut, have reallocated these funds away from their intended purposes toward other state policy goals amid state fiscal pressures. Such reallocations leave some question as to their long-term availability for renewable energy promotion.

Third, states historically shied away from favoring one renewable source over another in their RPSs but they have begun to modify that practice in recent years. Whereas early RPSs did not differentiate between sources, an increasing number have begun to place various renewables into differing classes or have mandated that a specific energy source comprise some percentage of the RPS. Approximately 80 percent of New Jersey's new renewable capacity, for example, must fall into Class I, which includes sources that have been deemed to have the least environmental impact. In turn, New Jersey's RPS features a "solar carve-out," which mandates that at least 90 megawatts of the new capacity in that class must come from solar sources by 2008, and 1500 megawatts by 2020. States have turned increasingly to such classification systems to differentiate between various types of renewables in an attempt to provide a boost to those technologies that remain relatively more expensive. The costs of solar-generated electricity, for example, have remained relatively high in comparison to wind and other sources, thereby leading to significant pressure from solar advocates for specialized treatment. These carve-outs raise some fundamental questions, given the emphasis in earlier stages of RPS development on being very specific about the level of renewable energy requirements but neutral on favoring one source over another. In some instances, this preferential treatment has begun to raise concern over who will assume responsibility for the heightened costs that will be incurred to meet these special provisions.

Fourth, as the number of states adopting an RPS and related pro-renewable programs have proliferated, they have increasingly begun to confront issues of inter-state collaboration. States have a clear incentive to attempt to retain any economic development and environmental benefits from promoting renewables (Rabe, Román, and Dobelis 2005). But with a few exceptions, such as Hawaii and Texas, most states share electricity generation transmission and distribution infrastructure and cannot ensure that all of the renewable electricity that they use will be generated in state. In some parts of the nation, such as the Southwest, a *de facto* "Regional RPS" operates, creating a new set of issues for these six states to consider (see Figure 1). To date, there has been relatively modest interaction on RPS development between neighboring states, reflecting the "home-grown" nature of individual RPS creation that is highly sensitive to political, economic, and technical considerations within each state. But issues such as inter-state recognition and trading of RECs, and translation of renewable energy expansion into greenhouse gas reduction credits in states that have RPSs and other climate policies in place are beginning to loom larger. Indeed, they are proving harder to seal hermetically within single-state boundaries and may necessitate new forms of inter-state collaboration. Looking ahead, greater intergovernmental collaboration presents significant opportunities and challenges for states eager to take the next steps in renewable energy development. Such activity could also cross

national boundaries, involving Canadian provinces and Mexican states and reflecting the reality that much North American energy movement flows north-south and is indifferent to national borders (Commission for Environmental Cooperation in North America 2002).

Fifth, many states have begun to move beyond RPS policy enactment into stages of implementation. This entails extensive rule-making provisions and, in some cases, revising legislation in response to early experience. In general, states have made considerable progress both in increasing the amounts of renewable energy mandated in their states and in establishing the policy infrastructure needed to assure a transparent and accountable policy system. One growing concern in a number of states involves siting processes, both for renewable energy facilities and transmission capacity to move renewable energy from its point of generation to its point of use. In some instances, the political issues of gaining public support for facility or transmission line siting may be the most important determinant of long-term RPS viability and development, indicating that state officials will need to be far more attentive to this issue than was originally anticipated in most state capitals.

III. State Experience with Renewable Portfolio Standards: Case Studies

From the growing body of state RPSs, five states were selected for more intensive analysis as case studies. The five cases—Texas, Massachusetts, Nevada, Pennsylvania, and Colorado—were chosen in order to maximize diversity among key criteria. Consequently, these cases are drawn from diverse geographical regions, represent different patterns of partisan political control at their time of enactment, and have divergent historic levels of commitment to adopting innovative environmental policy. Moreover, they represent different time periods for enactment and vary significantly in their degree of interstate engagement on energy development and policy collaboration.

The following cases are intended to provide a representative sample of current state experience with the RPS and do not constitute any effort to select or highlight "best practices" as currently provided by the 22 RPS states. Instead, they provide a glimpse into common patterns as well as divergence in current practice. Where implementation was sufficiently advanced, they also offer insight into early performance issues. Upon selection, the cases were developed through review of the entire legislative history leading to RPS development in each state, analysis of relevant reports and publications concerning that particular case, and interviews with individuals with diverse interests, all with the intent of providing a concise overview of each RPS and key issues in enactment and implementation to date. Each case introduces the background leading to RPS creation, basic design components, early operational results where available, and some of the challenges to full RPS implementation and possible expansion.

A. Texas: Another Gust in the Wind Rush

Given its historic role in fossil fuel development and use, Texas might appear to be an unlikely setting for a major RPS commitment to the development of renewable electricity. However, the RPS enacted in Austin in 1999 is widely viewed as having launched a new chapter in energy development in the Lone Star state, triggering a massive increase in the supply of renewables that is being provided at prices highly competitive with conventional sources. In fact, the program has proven so successful and so popular that the Texas Legislature overwhelmingly endorsed a major extension and expansion of the legislation, which was signed into law by Republican Governor Rick Perry on August 1, 2005 (Texas Senate Bill 2005, 20).

Electricity restructuring in the late 1990s opened a window of opportunity for Texas to reconsider all dimensions of its electricity generation and distribution system. Several factors converged to push an RPS

onto the state's political agenda. First, Texas had long led all other states in the consumption of electricity and was becoming increasingly concerned about long-term supply. Texas became a net importer of fossil fuels in the mid-1990s and its relative isolation on the American electricity grid gives it little ability to import power from other states or Mexico. Second, the state was encountering mounting environmental problems. Many of Texas' urban regions were designated as having some of the worst air quality in the nation. As a proxy measure for its conventional air contaminants, its greenhouse gas emissions were staggering; if it were an independent nation, Texas would rank seventh in the world, ahead of the United Kingdom, Canada, or France. Third, the state began to recognize that it was likely home to a potentially vast set of renewable resources, particularly enormous wind capacity in Western portions of the state. An extensive series of "deliberative opinion polls" conducted across the state demonstrated unexpectedly strong public consensus for a new commitment to renewables, expanding the base of political support for including an RPS within the state's 1999 electricity restructuring legislation (Rabe 2004, 49-62).

The first piece of legislation is widely regarded as a textbook model. It established a clear and effective "renewable energy credit" program, a transparent market transaction process, and an "alternative compliance mechanism" that provides options, albeit costly ones, for electricity suppliers unable to meet standard requirements. The Texas RPS focused on total renewable generation capacity and called for an increase from 1,280 MW in January 2003 to 2,880 MW by January 2009. This included approximately 880 MW of renewable, primarily older hydro facilities, which were in operation for many decades before enactment of the RPS. While the policy did not favor any particular source, it has had the effect of tapping into the state's massive wind capacity.

As of June 2005, 1,322 MW of new wind generation had been brought on line, supplemented by some additional capacity for solar, landfill gas, and micro-hydro (see Table 3). In January 2005, the Public Utility Commission of Texas concluded that "The construction of renewable energy facilities has proceeded significantly quicker than the timelines" set forth in the legislation (Public Utility Commission of Texas 2005, 3). This new capacity, alongside renewable projects under construction or advanced stages of the approval process, indicated that Texas would easily meet—and exceed—its 2009 standard. Moreover, this capacity has been introduced at rates that are highly competitive with conventional sources when the federal production tax credit (which stood at 1.8 cents per kWh in 2005) is included (Wiser, Porter, and Grace 2004, 14).

The success of the 1999 RPS and the rapid growth in costs for other major electricity sources in the state combined to put pressure on the Legislature to consider an RPS encore of sorts. A number of proposals received serious consideration in Austin during 2005; there was relatively little debate over the merits of an expansion and most controversy focused on how high to set the bar for the standard beyond 2009. A proposal with broad support in both chambers died in conference committee, due primarily to a prolonged battle

Table 3

Operational Texas Wind Power June 2005

Project	County	Size (MW)
Pre Senate Bill 7 (Sept. '99)		
Texas Wind Power Project	Culberson County	35.00
Fort Davis (retired end of '03)	Jeff Davis County	
Big Spring I	Howard County	34.32
Big Spring II (Westex Project)	Howard Conty	6.60
Southwest Mesa	Upton/ Crockett	74.90
Delaware Mountain	Culberson County	30.00
PRE SB 7 Total		**180.82 MW**
Post Senate Bill 7		
Woodware Mountain Wind Ranch	Pecos County	159.70
Indian Mesa	Pecos County	82.50
King Mountain Wind Ranch (1)	Upton County	76.70
King Mountain Wind Ranch (2)	Upton Conty	2.60
King Mountain Wind Ranch (3)	Upton County	200.00
Trent Mesa	Taylor County	150.00
Desert Sky Wind Farm	Pecos County	160.50
Hueco Mt. Wind Ranch at El Paso	Hudspeth County	1.32
Llano Estacado Wind Ranch at White Deer	Carson County	80.00
The Green Mountain Energy Wind Farm at Brazos	Scurry/ Borden Counties	160.00
Sweetwater Wind Project-Phase I	Nolan County	37.50
Vestas Prototype	Hansford County	3.00
King Mountian Addition	Upton County	3.00
Sweetwater Project-Phase 2	Nolan County	91.50
Callahan Divide	Taylor County	114.00
POST SB 7 TOTAL		**1322.32 MW**
OPERATIONAL TOTAL		**1503.14 MW**

Source: Texas Renewable Energy Industries Assocation, 2005

between key committee chairs over an unrelated telecommunications bill. But when Governor Perry used his Constitutional powers to call a special session of the Legislature in July 2005 to address school finance issues, RPS supporters decided to reintroduce the bill in this unusual context. When Perry agreed in mid-July to expand the session and include the RPS bill, the legislation moved very rapidly. It ultimately received overwhelming support in both chambers before going to the Governor's desk for signature on August 1.

The second RPS iteration did not tinker with the basic mechanics of the initial design. Instead, it elevated the levels of renewables required by 2007 and 2009 and specified continued expansion into the next decade. The legislation amended Section 39.905 of the Texas Utilities Code to require that "The cumulative installed renewable capacity in this state shall total 5,880 megawatts by January 1, 2015" (Texas Senate Bill 20, Section 3a, 2005). The legislation also introduced two "targets," although neither of these are necessarily binding

and will have to be more carefully defined through rule-making by the Public Utility Commission of Texas. One of these called upon the Commission to establish a target, after September 1, 2005, of "having at least 500 megawatts of capacity from a renewable energy technology other than a source using wind energy." The other created a non-binding target of 10,000 megawatts of installed renewable capacity by January 1, 2025.

A potentially more important section of the 2005 bill involves a series of mechanisms designed to improve transmission capacity. The unexpectedly rapid development of wind energy in remote sections of Western Texas placed significant demands on the relatively modest transmission systems that deliver electricity to areas of high demand. This constraint is linked with a larger challenge in Texas, and many other parts of the country, to upgrade and expand transmission capacity to assure more efficient electricity distribution. "So many projects came in so quickly that we were beginning to see about twice as much capacity as the system could handle, especially in peak wind periods," noted one state official. "We soon realized that the long extension cord from West Texas was going to get overloaded pretty quickly. But now, just as the PUC begins to look at transmission, we are also seeing developers realize that there are so many possible places for renewables in this state and they are increasingly aware of the need to link new generation with transmission access." Texas faces a particularly acute challenge and the new legislation calls upon the TPUC "to construct transmission capacity necessary" to deliver anticipated expansion of renewables. Implementation of this provision may be the single most important factor in determining effectiveness of the new RPS.

B. Massachusetts: One Component of a Broad Climate Strategy

Like Texas, Massachusetts developed its RPS in the late 1990s in conjunction with a large piece of legislation that authorized electricity restructuring in the state. The state also had some prior history with promoting renewable energy and retained significant concerns about electricity cost and supply reliability. But whereas Texas did not emphasize GHG benefits from its RPS and has not developed a series of related programs, Massachusetts has become consistently explicit and emphatic about the role of its RPS as part of a broad strategy to address climate change. It has continued to perceive a shift toward renewables as part of a long-term economic development strategy but places much more emphasis on anticipated environmental benefits, including greenhouse gas reduction.

The Massachusetts RPS focuses exclusively on new sources of renewable energy or expansion in generating capacity at existing renewable energy facilities, with the initial one percent level to represent sources brought on line between December 31, 1997 and January 1, 2003. Thereafter, renewables must be increased at a rate of 0.5 percent per year, reaching four percent by 2009. At this point, the legislation takes the unusual step of creating an open-ended increase of one percent per year, until such time as the Massachusetts Division of Energy Resources decides otherwise (Chapter 164 of the Acts of 1997). The 1997 authorizing legislation establishes a series of "alternative compliance payments" (ACPs) that began at $50 per MWh in 2003 and are

adjusted thereafter for inflation. These ACPs involve direct payments to the state "to maximize the commercial development of new renewable generation capacity" in cases where direct purchase of renewables is not a viable option (Massachusetts Office of Consumer Affairs and Business Regulation 2006, 4).

These payments are one of many sources of revenue that the Commonwealth has established to support the goals of the RPS and renewable energy development more generally. Like fourteen other states, Massachusetts has enacted a mandatory "public benefits" charge on all electricity bills to support renewable energy. By 2005, this reached $0.0005 per kilowatt hour and generates approximately $40 million per year for use on a range of renewable energy and energy efficiency projects that are funded by the Massachusetts Renewable Energy Trust. The Trust is a quasi-public entity and one component in a large infrastructure of state efforts to promote renewable energy. Collectively, these efforts provide a financial base of support for renewables that is not offered in Texas and some other states. Massachusetts continues to accentuate both the economic and environmental benefits from such action. As Robert Pratt, Director of the Trust, has noted: "Massachusetts has traditionally been a leader in technology because of its universities. As a result, we feel we should be the leader in [renewables]" (Fialka 2005).

At the same time, the RPS and related energy initiatives are only components of Massachusetts' broader effort to link greenhouse gas reduction with economic development. Massachusetts has been intensively involved in negotiations to establish a regional "cap-and-trade" program for carbon dioxide emissions from fossil fuel burning power plants. Although it has not formally joined the regional initiative thus far, Massachusetts is building on its pioneering efforts in 2001 to cap its own releases from these sources (DePalma 2005). It has also formally embraced California's standards to reduce greenhouse gas releases from motor vehicles and is an active participant in a compact linking the states of New England and provinces of Eastern Canada to achieve common reduction of greenhouse gas emissions. Each of these steps systematically link climate protection with economic development. As Governor Mitt Romney noted in introducing the 2004 Massachusetts Climate Protection Plan: "The same policies that protect the climate also promote energy efficiency, smart business practices, and improve the environment in which our citizens live and work" (Massachusetts Office of Commonwealth Development 2004, 3).

Initial implementation of the Massachusetts RPS has not triggered the exponential growth of renewable energy as in Texas, but has successfully met its initial requirements. A pair of comprehensive reports from the Massachusetts Division of Energy Resources have examined the first years of RPS compliance in 2003-04. They concluded that all parties covered by the RPS achieved compliance with sufficient RECs available in the market (Massachusetts Office of Consumer Affairs and Business Regulation 2005, 2006). Moreover, the reports noted that new renewable capacity was provided from landfill methane, biomass, anaerobic digester systems, wind, and photovoltaic sources. The Commonwealth initially relied on out-of-state renewable electricity to satisfy more than

half of its total requirements during the first two years of RPS operation. Former Secretary Doug Foy of the Office of Commonwealth Development estimates that "the first year of the program avoided emissions of 320,000 tons of carbon" (Massachusetts Office of Consumer Affairs and Business Regulation 2005a). All of this energy came from Northeastern sources, with the largest shares imported from Maine, New York, New Hampshire, Connecticut, and Rhode Island. Massachusetts officials recognize that there may be increasing regional demand for renewable energy, particularly given the fact that a number of other states in the region have their own RPSs and are beginning to compete for available renewable resources.

Consequently, Massachusetts has placed increasing emphasis on in-state renewable energy development. This is particularly attractive for economic development reasons but has already begun to pose serious challenges to successful implementation. Much of the initial projection for growth of renewables in Massachusetts presumed that it could follow the path of Texas and take expanded advantage of its wind supplies. However, its first major wind siting initiative is in serious jeopardy due to local political opposition. In 2004, Boston-based Cape Wind Associates proposed a $770 million project to develop a 420 MW wind farm on an off-shore installation in Nantucket Sound, drawn to the site by its outstanding wind resource. If implemented, this would involve the placement of approximately 130 wind turbines on a shoal and meet a significant portion of Massachusetts' RPS requirement in coming years. Local response has been largely negative, out of concern about the appearance of the turbines and their possible impact on tourism, recreational boating, and the property values of some of the most expensive real estate in the Northeast. Opponents include U.S. Senators from both political parties whose families hold property in the area and have attempted to amend various federal laws to thwart the proposed project (Badkhen 2004, 18).

Massachusetts officials acknowledge that the Cape Wind development is highly doubtful and has had a negative impact on other wind siting initiatives in the state. "There is currently no reason to believe that people who do not want wind on top of our mountains or in the Cape are going to change their minds," noted one senior state official. "We're not Texas and it will be interesting to see what kind of a laboratory we turn out to be." In response to the Cape Wind controversy, wind proponents have attempted substantial public outreach in exploring the possibility of developing a set of smaller wind sources. In turn, other renewable technologies are receiving greater attention from proponents and various state programs, reflected in a particularly strong emphasis by potential private developers and state officials in 2005 on possible expansion of biomass capacity in Massachusetts and neighboring states. Biomass, however, does not begin to match the scale of renewable energy that had been anticipated from Cape Wind, and has triggered its own set of controversies, such as contentious state hearings during 2005 on classification of energy produced by "retooled, older biomass plants." State officials are moving toward finalization of regulations for biomass eligibility but these will not resolve the considerable uncertainty regarding Massachusetts' ability to achieve its ascending RPS targets in the coming years.

C. Nevada: The Next Texas?

Unlike Texas and Massachusetts, Nevada ultimately decided not to pursue electricity restructuring, shaken by the experience of neighboring California. However, energy issues have retained high saliency in Nevada throughout the last decade. As the state's population and economy have expanded, so have electricity demand and concern about supply reliability. As the exploration of energy alternatives has intensified, Nevada officials have increasingly concluded that they may well possess an unusually diverse and plentiful set of renewable energy supplies. And as the federal government continues to press the case that all of the nation's high-level radioactive waste should be transferred to a repository in the southern part of the state at Yucca Mountain, a unifying theme in Nevada politics has been taking every conceivable step to demonstrate to the nation that there are viable alternatives to nuclear energy (Rabe 2003).

These factors have converged to make renewable energy, and RPS legislation, a staple in every Nevada legislative session since 1997. In four of the last five sessions (1997, 2001, 2003, 2005), Nevada has overwhelmingly passed RPS legislation. Building on a fairly modest start in 1997, Nevada has continually expanded its RPS and has increasingly come to depict itself as an emerging national leader in the generation of a wide range of renewable energy sources. In its most recent iteration, signed into law by Republican Governor Kenny Guinn in June 2005, Nevada elected to "up the bar" again. The state now mandates that 20 percent of Nevada's electricity come from renewable sources by 2015.

Few anticipated such an ambitious target in 1997 when the legislature enacted an RPS that called for a very modest set of incremental increases in renewable energy, reaching one percent by 2009 (Nevada Assembly Bill 366, 1997). The primary driver behind that legislation was an effort to promote a large solar facility near the Nevada Test Site, which is best known as a former weapons testing facility and has been proposed periodically as a transitional waste transfer site prior to the planned opening of Yucca Mountain. Indeed, the RPS called for "at least half" of the RPS-mandated energy to come from solar sources. The proposed project collapsed for financial reasons and yet the framework for RPS expansion was established.

Four years later, during the California electricity crisis that prompted that state to desperately attempt to increase imports of energy from its neighbors, the Nevada legislature repealed the earlier bill and replaced it with a far more expansive and ambitious RPS, including a markedly higher standard that reached 15 percent of electricity from renewable sources by 2013. (Nevada Senate Bill 372, 2001). Many important provisions were modeled after the RPS experience in Texas, including the renewable energy credit system and a provision to confine eligible electricity to that generated within state boundaries or imported through a dedicated transmission line. "We looked primarily to Texas as a state that had a large RPS and was fairly successful," noted one former state official. "We took some aspects of the Texas law and incorporated it to some degree into the Nevada bill. But we also realized that we had to tailor our RPS to our own resource situation." Unlike

Texas, Nevada decided to retain a solar carve-out, although reducing the level from solar to five percent from the higher level established in 1997. And whereas Texas quickly realized that it was likely to derive most of its renewables from one source (wind) in one part of the state (West Texas), Nevada prepared for a much more diverse set of energy sources (including geothermal, wind, solar, and biomass, among others) from virtually every corner of the state.

Over the next four years, however, Nevada would return its RPS to the legislative shop for further modification, reflecting broad consensus about the potential for renewable expansion and its possible impact on economic development. Senator Randolph Townsend (R-Washoe County), Chair of the Senate Committee on Commerce and Labor, proved to be a dominant figure in the laws enacted in 2001, 2003, and 2005. He retained a fairly broad body of support in both chambers and in the executive branch. As in Texas, the primary drivers behind the RPS continued to be energy diversification and economic development, although environmental benefits have become increasingly salient as concerns about air quality and nuclear waste storage persist. Anticipated greenhouse gas reductions have not figured prominently, although state officials have become increasingly aware of this issue as the anticipated levels of renewables have climbed.

Nevada's 2003 revisions provided a new boost for solar energy, through development of a REC bonus or "multiplier" for electricity that is generated from the sun as opposed to other sources. This multiplier provides a credit value of 2.4 (as opposed to 1.0) for each kilowatt hour of electricity provided by a solar photovoltaic system, as long as it was installed on a private residence and at least half of the electricity generated by the system was used on the premises. At the same time, the state decided to add electricity generated by the use of a "reverse polymerization" process on used tires, but set the credit at only 0.7 due to the amount of energy that must be used in this process (Nevada Assembly Bill 296, 2003). Two years later, Nevada literally transformed its renewable energy credits into "portfolio energy credits" by giving RPS credit to approved energy efficiency activities. According to the 2005 legislation, "a provider is entitled to one portfolio energy credit for each kilowatt-hour of electricity that the provider generates, acquires or saves from a portfolio energy system or efficiency measure" (Nevada Assembly Bill 385 Section 22, 2005). However, the total amount of credits that an electricity supplier can derive from energy efficiency is capped at 25 percent and at least half of any efficiency initiatives approved for credits must provide energy savings on residential sites. To date, only Nevada, Pennsylvania, and Hawaii have formally included energy efficiency in their RPSs, raising a number of complex implementation concerns.

The repeated modifications of the Nevada RPS have given the Public Utility Commission of Nevada (PUCN) a series of implementation challenges, involving a massive set of rule-making procedures that have continued into 2006. Thus far, one of the biggest challenges in implementation has been the financial woes of the state's two primary electricity suppliers, Sierra Pacific and Nevada Power. Their suspect credit has given pause to potential renewable energy investors who would need to enter into long-term contracts with

the utilities in order to meet RPS requirements. At the same time, the pace of PUCN approval of renewable energy suppliers for REC eligibility has intensified in recent years, including some significant new projects for geothermal, solar, and wind, leaving Nevada officials increasingly sanguine about the prospect of meeting each increase in the renewable standard (PUCN, 2005).

D. Pennsylvania: Green as Gold

Pennsylvania has also been drawn to renewable energy in large part for economic reasons but under somewhat different circumstances than states such as Texas and Nevada. The Commonwealth has suffered from a significant loss of jobs, particularly in the manufacturing sector, and recent governors and legislators have struggled mightily with the challenge of revitalizing the Pennsylvania economy. It has also suffered from a series of environmental problems that may have further impaired economic development, including an unusually large number of land tracts with extensive environmental contamination. At the same time, coal mining and its use in electricity have been Pennsylvania staples for generations, posing formidable challenges for any policies that might encroach on that resource.

In recent years, however, Pennsylvania has given new prominence to environmental protection and renewable energy. This has particularly been a hallmark of the administration of Democratic Governor Edward Rendell, who entered office in 2003 and has framed environmental and renewable concerns as essential for economic development and diversification. What has resulted is a flurry of new legislation and program initiatives, all designed to put Pennsylvania ahead of the curve in developing renewable energy sources and technologies, as well as environmental clean-up expertise, as part of a larger strategy to revitalize the Commonwealth's economy. This effort has included a series of tax incentives and renewable energy development programs, with the centerpiece being the enactment in November 2004 of the Pennsylvania Alternative Energy Portfolio Standards Act (Pennsylvania Senate Bill 1030 2004). Introduced with bipartisan support in both chambers of the Pennsylvania legislature, this legislation took effect in March 2005, followed by extensive rule-making directed by the Pennsylvania Public Utility Commission.

Pennsylvania had some prior experience with renewables, including 129 MW of wind power and a variety of hydro sources. It retains, of course, its strong historic linkage with coal, which was evident in its unique definition of what constitutes a qualifying source. Like several other states such as Connecticut and New Jersey, Pennsylvania divided its Alternative Energy Portfolio Standard (AEPS) into two distinct categories, with Tier I sources required to climb to a level of eight percent by 2020 and Tier II sources required to reach a level of 10 percent by that same year (see Table 4). Under Tier I, the legislation includes such familiar renewable sources as wind, geothermal, solar photovoltaic, low-impact hydro power, biologically-derived methane gas, biomass, and fuel cells. However, it also includes coal mine methane. Under Tier II, Pennsylvania joins Nevada and Hawaii in including energy efficiency but also adds more environmentally controversial sources such as waste coal, integrated coal gasification combined cycle, and incineration of municipal trash and poultry farm wastes.

Table 4

Schedule for Expanding Renewable Energy under the 2004 Pennsylvania Alternative Energy Portfolio Standards Act

		Tier I% (incl. Solar)	Tier II%	Solar PV%
Year 1:	6/1/06 - 5/31/07	1.50%	4.20%	0.0013%
Year 2:	6/1/07 - 5/31/08	1.50%	4.20%	0.0013%
Year 3:	6/1/08 - 5/31/09	2.00%	4.20%	0.0013%
Year 4:	6/1/09 - 5/31/10	2.50%	4.20%	0.0013%
Year 5:	6/1/10 - 5/31/11	3.00%	6.20%	0.0203%
Year 6:	6/1/11 - 5/31/12	3.50%	6.20%	0.0203%
Year 7:	6/1/12 - 5/31/13	4.00%	6.20%	0.0203%
Year 8:	6/1/13 - 5/31/14	4.50%	6.20%	0.0203%
Year 9:	6/1/14 - 5/31/15	5.00%	6.20%	0.0203%
Year 10:	6/1/15 - 5/31/16	5.50%	8.20%	0.2500%
Year 11:	6/1/16 - 5/31/17	6.00%	8.20%	0.2500%
Year 12:	6/1/17 - 5/31/18	6.50%	8.20%	0.2500%
Year 13:	6/1/18 - 5/31/19	7.00%	8.20%	0.2500%
Year 14:	6/1/19 - 5/31/20	7.50%	8.20%	0.2500%
Year 15:	6/1/20 - 5/31/21	8.00%	10.00%	0.5000%

Source: Pennsylvania Public Utility Commission, 2005

This expansive definition made the passage of the Pennsylvania legislation unusually controversial. A coalition of state-based environmental groups characterized the proposal as "the dirtiest RPS" in the nation and urged opposition, calling upon the legislature to narrow the definition of eligible energy sources. At the same time, supporters contended that the creation of Tier II essentially accepted energy sources that were already on line to be developed and that Tier I would foster considerable new renewable capacity in the state (Dujack 2005, 37). Overshadowed by the definitional controversies, the Pennsylvania AEPS does make specific commitments to solar energy and energy efficiency. It continues the trend in recent years toward boosting the prospects for solar through a designated percentage of Tier I energy that must be derived from solar sources (see Table 4). In turn, it preceded Nevada by several months in encouraging "the participation of demand side management and energy efficiency resources" as eligible for inclusion within an RPS, placing them alongside the more controversial items in Tier II (Pennsylvania Public Utility Commission 2005, 5). Many of the details of these provisions continue to be refined through rule-making procedures.

Initial rule-making indicates that defining the boundaries from which renewable energy can be counted toward the Pennsylvania standard will entail a major challenge. Much like other Eastern states, Pennsylvania has substantial cross-border exchange of energy. Most of the Commonwealth is located within one regional transmission organization (RTO), the PJM Interconnection that integrates Pennsylvania with electricity providers in Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Tennessee, Virginia, West Virginia, and the District of Columbia. However, portions of the state are located in other regional organizations, suggesting that a wide range of states could conceivably contribute renewable

energy to Pennsylvania. The RPS legislation establishes that eligible energy must be "derived only" from within Pennsylvania or "within the service territory of any regional transmission organization that manages the transmission system in any part of this Commonwealth" (Pennsylvania Senate Bill 1030, Section 4 2004). Debate has continued in Harrisburg through public hearings over just how to interpret that clause, weighing the constitutional requirement not to constrain the interstate movement of commerce against Pennsylvania's desire to capture economic and environmental benefits of renewable energy internally.

E. Colorado: Power to the People

For many years, the lone mechanism whereby states enacted RPSs and related state policies to reduce greenhouse gases involved the traditional channels of representative government. But the majority of American states have constitutional provisions that allow legislation to be enacted through majority vote of the electorate and they have used them increasingly in recent decades on a range of environmental and energy issues (Guber 2003). Consistent with that trend, in November 2004, Colorado became the first state to enact an RPS through "direct democracy" when Proposition 37 passed by a 54-to-46 percent margin. This led to extensive rule-making directed by the Colorado Public Utility Commission, with an Order released in December 2005 still subject to requests for rehearing. In 2007, covered suppliers will be required to generate three percent of their electricity from renewables, an increase from the current level of two percent, and steadily increase their renewable output to a level of 10 percent by 2015. The legislation also requires that at least four percent of renewables covered under the standard be derived from solar sources and establishes an explicit cost cap whereby any impact from the RPS cannot exceed 50 cents per residential customer per month.

After a coalition headed by utilities and coal mining interests blocked an RPS in three consecutive sessions of the Colorado legislature, the state seemed unlikely to adopt such a policy. Indeed, Colorado had been among those states most reluctant to take any steps related to greenhouse gas emissions during the previous decade (Rabe 2004). At the same time, proponents felt that there was a strong base of support for the RPS, since it had nearly passed the legislature on two prior occasions and preliminary polling showed solid public support. Consequently, supporters decided to go the route of an initiative, gathering more than 100,000 petition signatures that secured a place on the November ballot.

Opposition spent more than $2 million under the banner of an organization called Citizens for Sensible Energy Choices, investing heavily in a television advertising campaign that focused on concerns about potential costs. However, support was maintained through a campaign with bipartisan leadership, including co-chairs Lola Spradley, the Republican Speaker of the Colorado House, and Mark Udall, a Democratic member of the U.S. House of Representatives. The campaign enlisted a tapestry of supporters, representing numerous renewable energy developers, agriculture and ranching interests, public health and environmental protection constituencies, and various religious organizations. Proposition 37 also received endorsements from most of the state's major media outlets, including the *Denver Post (*Post 2004).

A number of anticipated environmental benefits were raised during the campaign but the most important driver behind the passage of Proposition 37 was projected economic development from expanding renewable capacity (Smith 2004). Considerable attention was focused on the state's first major wind farm, a 108-turbine facility in rural Prowers County. This farm has been warmly embraced in that part of the state, supplementing incomes of individual ranchers and farmers and boosting local property tax revenues by approximately one-third. As Rep. Spradley noted in a public endorsement of the RPS initiative, "Ranchers and farmers are going to harvest a bumper crop of renewable energy that can bring important economic development to rural Colorado" (Coloradans for Clean Energy 2004).

Just as new policies can diffuse across states through representative institutions, there is ample precedent for one state's use of direct democracy provisions to trigger replication elsewhere. The Colorado RPS has already attracted considerable national publicity due to its route of enactment and RPS proponents in states such as Oregon and Washington have begun to study the case as a possible model for their own future efforts. In turn, the Colorado ballot proposition may well have served as an impetus for Montana to accelerate its timetable for enacting its own RPS through more conventional means, just one month after the passage of Proposition 37.

IV. Challenges and Opportunities: The Next Round of RPS Development

A decade and a half after Iowa's enactment of the first state RPS, this policy has diffused to the point where more than one-half of the nation's citizens are covered by some version of a standard. The 22 states that currently operate an RPS represent nearly every region in the country, working from the same basic principles but tailoring their particular program to the special circumstances presented by each individual state. If anything, the trend toward proliferation and diversification has intensified in the last few years. More and more states are adopting RPS programs, a growing number have begun to give serious attention to an RPS, and existing RPSs are being revisited legislatively and increasingly expanded in scope and ambition.

Many of these programs remain in very early stages of implementation, reflecting the complexity of organizing renewable energy credit systems and other key features. But early indicators suggest that RPSs have considerable promise for boosting renewable energy supplies and doing so in a cost-effective manner. The basic structure of an RPS involves a blending of regulation and delegation of many choices to the marketplace that is clearly appealing to a diverse set of elected officials and organized interests. RPS enactment—and expansion—continues to occur in states with Republican, Democratic, and divided control of state political institutions.

States are clearly drawn to the RPS concept for multiple reasons. Economic development opportunities are paramount in all cases, as a growing set of states see significant job and investment opportunities in expanding their base of renewable energy. In turn, states envision advantages in creating a more reliable supply of electricity for coming years, a direct response to mounting concerns over both the price and availability of more conventional energy sources such as natural gas. Environmental factors, including reduction of conventional air emissions as well as greenhouse gases, figure differently in various cases but are clearly seen as a secondary driver in many states. Collectively, the evolving and expanding state experience with RPSs confirms the very real potential of policy development that simultaneously advances economic and environmental concerns.

Looking to the future, it appears reasonable to assume that additional states will enact RPSs in the coming years, just as existing RPS states continue to pursue implementation and revisit their goals. In anticipating the next generation of RPS development, a series of important challenges and opportunities appears to loom, concerning both continued policy development by individual states and increasingly salient interstate and intergovernmental factors.

First, a series of important issues has begun to emerge that may not have been fully anticipated at the point of enactment but could potentially deter successful implementation. Part of the initial attraction of the RPS concept was that while it did impose regulatory requirements specifying the amount of renewable energy that would be provided, it did not favor one source over another as long as it was deemed eligible. This meant that an initial regulatory intervention was followed by deference to the market, allowing different renewables to compete and demonstrate their ability to emerge as a viable alternative to traditional sources. The growing tendency to accord specialized status to more expensive renewable sources removes the level playing field originally intended in most states and, in some instances, may require significant financial subsidies from state sources or rate payers and thereby raise the cost of the policies. Moreover, the shift toward differential treatment has changed some of the recent debate over renewable energy policy in state capitals toward a collision between competing special interests, each seeking preferential treatment for its particular source (Rabe and Mundo 2007). Over time, one could envision a transformation whereby a well-intended effort to supplement select renewable sources altered RPSs into a complex formula with differential treatment for varied sources, thereby removing much of the flexibility of this policy tool and increasing the cost of implementation.

Second, much of the early planning for RPS targets assumed public support for renewable energy not only in general terms but also in presumed receptivity to siting facilities and related transmission capacity. In two of the five cases, one of the most important determinants of RPS success will involve siting issues. In Massachusetts, the formidable opposition to the Cape Wind project and the controversy surrounding development of biomass capacity raise the question of whether strong political support for renewables in abstract terms will actually translate into new renewable capacity that can be successfully sited. Without some breakthrough on siting issues within the state, Massachusetts could be forced to backtrack on its RPS targets. This problem may become increasingly common for those states with relatively concentrated and populated areas for outstanding renewable sources and it raises a new set of challenges for policy proponents. In Texas, perhaps the biggest potential impediment to achievement of its ambitious RPS goals is the construction of transmission capacity to move robust sources of wind power toward more populous areas. More generally, the development of both intra-state and inter-state transmission capacity remains a significant challenge, particularly in those regions of the country where there is substantial physical distance between the energy source and its potential consumers.

Third, the challenge of developing superior transmission capacity and RPS proliferation more broadly suggests an increasing likelihood that states may benefit from greater interaction and collaboration with each other. Case studies confirm that individual states are keen to maximize economic and environmental benefits from RPS implementation but they also highlight instances in which cross-state cooperation may be essential. This may include agreements for common definitions of renewables and related credits as well as shared efforts to promote regionally-based renewable resources with high potential. States will also need to guard

against "double counting," ensuring that renewable generation can only count toward RPS and greenhouse gas reduction requirements in one state. Such collaboration is most evident at present in the Northeast, where states are physically small and their economic and energy systems are closely connected. But interstate collaboration is also emerging as an issue in other regions, particularly the Southwest with its growing cluster of individual state RPSs. Indeed, one of the strongest cases against "bottom-up" policy design in a federal system involves those situations in which multiple states fail to work cooperatively and instead establish a patchwork quilt of provisions that preclude interstate cooperation. States need to begin to look beyond their own borders and seize multi-state or regional opportunities that would benefit all parties. One early model for such collaboration involves an 11-state effort convened by the Western Governors' Association in attempting to develop a common regional system for the issuance, tracking, and retirement of renewable energy credits. The so-called Western Renewable Energy Generation Information System (WREGIS) has been working in recent years to establish such a unified system for credit definition and oversight (Xenergy, Inc. 2003) and also includes authorities from western Canadian provinces and Mexican states.

Thus far, states are clearly learning lessons from one another, just as Nevada has closely monitored developments in Texas in refashioning its own RPS. Much of this cross-state interaction, however, occurs only sporadically and state officials across the continent acknowledge that they lack resources to carefully evaluate other programs and draw important lessons. Review of legislative testimony in all of the states examined as case studies suggests only occasional and often imprecise reference to the experience of other states. State budget woes in recent years have clearly eroded the capacity of some state agencies to maintain policy analysis expertise, attend conferences and workshops out of state, and monitor developments in neighboring states. In turn, pressures to maximize the capture of economic development benefits within state boundaries can serve to deter serious exploration of cross-state collaboration.

One area with considerable potential for inter-state collaboration is the development of a common metric for determining the greenhouse gas emissions impacts as various levels of renewable energy are brought on line in concert with RPS requirements. Of the five case studies, only Massachusetts has attempted to estimate in a systematic manner the greenhouse gas reduction achieved through RPS implementation (Massachusetts Office of Consumer Affairs and Business Regulation 2005, 2006). But Commonwealth officials acknowledge that this reflects only an initial estimate. "There are lots of debates over the assumptions that one uses and disagreement among stakeholders," noted one senior Massachusetts official. "I do not see a consensus here anytime soon." In contrast, other states have been reluctant to even venture a guess as to likely greenhouse gas impacts, noting methodological complexities and resource constraints in developing the needed analytical capacity. "The RPS is clearly having an impact on greenhouse gases but it is hard to get the model right," noted a senior Texas official. "If you add a big wind farm, where exactly is that off-setting generation? It is hard to track all of that and determine how much thermal source is being replaced." State officials generally concur

that the methodological issues can likely be resolved and would clearly welcome a mechanism to help establish a commonly accepted metric as RPSs promote higher levels of renewable energy. The appendix outlines the key issues for making these calculations, and a set of options that state officials might explore in working toward common methodology in this area.

Interstate collaboration could also take other forms, allowing neighboring RPS states to trade RECs and encourage integration between RPS implementation and other state policies designed to reduce greenhouse gases. One could also envision common efforts to build respective renewable sources through both informal and formal agreements between states. In recent years, multiple states have demonstrated new ways to work toward common cause in areas ranging from tax policy to vehicle registration to regional attainment of ozone standards, all with the intent of benefiting all participating states (Greenblatt 2005; Engel 2005; Zimmerman 2004). Renewable energy—and RPSs—may offer similar opportunities for states, much as other states are beginning to join common cause on other climate initiatives. In the case of cap-and-trade programs, for example, New York and seven other eastern states have concluded that it makes more sense to work together than separately, leading to the evolution of the Regional Greenhouse Gas Initiative (De Palma 2005). More broadly, states might also expand opportunities to work with other neighbors, such as Canadian provinces, in instances where considerable energy is already shared and similar policies are emerging between respective states and provinces.

Such collaborative precedents might fruitfully guide states away from steps that significantly constrain interstate movement of renewable energy and potentially violate the Commerce Clause of the U.S. Constitution. This is simply not an issue in those states with a strong recognition of cross-state interdependence. But it is conceivable that policies that are in some way designed to minimize the role of out-of-state renewables in meeting RPS targets could face a Constitutional challenge. Examples of such policies include those that confine acceptable imports to those that arrive via a dedicated transmission line, most notably Nevada and Texas. The Constitutional boundaries are not at all clear in this area, especially given the recent departure from the Supreme Court of Justices William Rehnquist and Sandra Day O'Connor, who held strong views on the power of states in relation to the federal government. To date, no legal challenges invoking the Commerce Clause have been brought against a state RPS but the very possibility of such a test further underscores the potential benefits of greater interstate collaboration to minimize the likelihood of such a confrontation.

Fourth, as the United States moves toward a *de facto* national RPS through a tapestry of state-based programs, it is important to find ways that the federal government can play a constructive and supportive role. President George W. Bush signed the Texas RPS into law in 1999 and two former cabinet-rank officers took similar steps when they served as governors of their respective states (New Jersey and Wisconsin). That statehouse experience has not, however, necessarily translated into constructive federal engagement and support for continued state experimentation with RPSs. Indeed, it is difficult to understate the antipathy

individuals responsible for different areas of RPS development and implementation at the state level express over their dealings with the federal government. This cuts across partisan and regional lines and reflects a deep state-based desire that, in the words of one official, "the feds not come in and mess up all the good stuff we've been trying to do."

Repeated fluctuation in the federal production tax credit for renewable energy has fostered a boom-and-bust cycle for renewable development in a number of states, leaving significant lags in the development of renewables during those periods in which the credit has been terminated or its status has remained uncertain. Officials in Texas and other states with large renewable targets contend that this fluctuation has been the single biggest impediment to even further expansion of renewable capacity. In this instance, most state officials welcome the recent extension of the credit in the 2005 Energy Act as one of the more constructive federal actions in many years.

States also remain concerned by their very limited inclusion in Congressional debates over various energy and climate initiatives. Most state officials interviewed for the case studies readily acknowledge they knew little or nothing about various federal RPS proposals that have been advanced in the U.S. Senate; they are adamant that states have taken the lead amid federal inertia and that the collective state experience with this policy tool should be studied carefully in guiding any future federal actions. In particular, state officials are opposed to any federal legislation that would preempt or constrain existing state policies and are very concerned about any steps that would penalize them for taking early actions. There appears to be particular concern among state officials about avoiding one of the unexpected consequences of the 1990 Clean Air Act Amendments. In that case, the level of sulfur dioxide allowance authorized for expanding renewable energy was set quite low (one ton of emissions for each 500 mWh of new renewables). The small number of allowances provided to incentivize renewable energy was not sufficient to make renewables competitive with the cheaper compliance options of switching to lower-sulfur coal or SO_2 scrubbers.

One constructive step that could be taken early in the next Congress would be a sequence of hearings designed to distill lessons from state practice that could guide future consideration of the design of a federal RPS. Such hearings might also explore models for a two-tier RPS system, with one tier that established a national framework and national REC trading process alongside another that allowed them to sustain renewable targets above any federal level through their own programs. These systems could be linked through allocating credits to states for early action. Terms for state entrance into a possible federal program have been a major focus in the creation of the Regional Greenhouse Gas Initiative. This experience and lessons from other forms of intergovernmental collaboration in environmental policy could also afford useful guidance for possible models of state and federal cooperation under a multi-tier RPS.

Despite persisting intergovernmental concerns, state officials generally recognize and welcome constructive forms of federal engagement. They perceive the federal production tax credit as an essential step to equalize the playing field with conventional sources that have long received a range of governmental subsidies. They also acknowledge the need for federal assistance in improving transmission capacity, particularly given the challenge of tapping renewable sources in remote areas and finding ways to transfer such electricity to high-demand areas. In turn, many state officials note that the federal government could also promote interstate learning about RPS experience and help with the development of common metrics to determine greenhouse gas impacts as well as foster cross-state collaboration.

It remains unclear whether the federal government might at some point draw larger lessons from the states and develop a nation-wide version of an RPS that thoughtfully and systematically builds on the best practices of state experience. At present, the American experience resembles that of other federated systems of government, such as the European Union and Australia. In all of these cases, RPSs continue to proliferate and mature, with the possibility of eventual incorporation into a policy that applies across jurisdictions. For now, states have moved to the cutting edge of this issue both domestically and internationally, having evolved in recent years from modest experimentation to the assumption of central roles in this area of climate policy development.

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Appendix

Translating Renewable Portfolio Standards into Avoided Greenhouse Gas Emissions

While states pursuing renewable portfolio standards consider greenhouse gas mitigation as only one of many co-benefits, they are often interested in projecting the greenhouse gas emissions avoided as the result of renewable portfolio standards. States are also interested in retrospectively examining the reductions they have achieved through the implementation of such a policy. This document aims to provide guidance to states attempting to calculate the greenhouse gas emissions that are avoided as the result of implementing a renewable portfolio standard. It lays out the key concepts and challenges when considering such estimates, and suggests some estimation methods.

Greenhouse Gas Emissions from the Electricity Sector

Coal and natural gas fueled generation account for the vast majority of greenhouse gas emissions from the electricity sector. Substituting renewable generation for fossil generation has two effects on electricity sector emissions. The first effect is the displacement of currently emitting generation by new non- (or lower-) emitting renewable generation. The second is the effect on the emissions from future conventional generation that would have been built if new renewable generation had not been built.

Electricity demand varies throughout the day, as do the types of generation available to meet that demand. The levels of greenhouse gas emissions consequently change as supply is adjusted to meet demand. The type of generation displaced by renewables is thus highly dependent on the generation load profile.[1] Determining when new generation will run and what type of generation it will displace are key components of an estimate, especially for load profiles with highly variable emissions. For this reason, methods of estimation that do not consider generation profiles and the resulting displaced conventional generation may differ significantly from actual performance. However, the considerable data required to produce estimates that are sensitive to the load profile may not be public.

[1] The load profile describes demand for electricity over time. When combined with the dispatch order, which describes the order in which different types of generation come online, these data tell an analyst how much generation of each type is demanded at any given time.

Options for Estimating Avoided Emissions

Renewable portfolio standards displace GHG emissions by substituting low- or zero-emission renewable generation for conventional fossil fuel generation. There are a number of competing methodologies for assessing the impact of renewables on electricity sector emissions. The basic process is consistent across methodologies. The first step is to develop a business-as-usual emissions scenario, predicting generation, new builds, and emissions over the period under consideration. The various methodologies described below take different approaches to estimating generation, new builds, and emissions. For predictive studies, states will have to model both the base case and the RPS case. For retrospective studies, the RPS case will require collecting data on actual past emissions, generation, and capacity investments, while developing a model of what these data would have been in the absence of an RPS.

In general, total avoided emissions equal the difference between emissions under the RPS and emissions under a hypothetical situation without the RPS that holds all other conditions constant. However, there is much uncertainty in these calculations. As an example, fuel prices—particularly natural gas prices—have a very large impact on marginal generation and investment. Varying natural gas prices under both the with- and without-RPS cases will provide a sensitivity analysis. Such explicit consideration of the areas of uncertainty can inform modeling efforts and their dissemination to policy-makers and the public. Due to these areas of uncertainty, a simpler, less expensive approach may provide an estimate of avoided emissions of comparable quality to the results of a very complex modeling method.

Avoided Emissions Methodologies

The methodological options below are listed by increasing levels of complexity, time, and cost. However, the most expensive methodologies may not provide an incremental level of certainty worth the increased level of resources, due to the uncertainties identified above. Many state governments may have to contract with independent consulting firms to complete these studies.

- Average emissions factor

Using an average emissions factor is the simplest method of calculating avoided emissions. This method involves calculating average emissions per kWh—based on portfolio mix—for the cases with and without an RPS policy and multiplying generation by the average emissions factor under each case. This method will provide a rough estimate, sufficient for many states' purposes.

- Marginal emissions factors

This method assesses avoided emissions based on the changes in emissions at the margin of the load profile as new renewable generation displaces existing generation. The marginal emissions factor method is

most useful for small projects that are not likely to significantly affect investment in new plants, and thus may not be able to adequately capture the impact of an RPS that has large impact on generation investment. This option also requires significant data collection, and some of the data may not be publicly available. This method is an improvement on the average emissions method, and does not require significantly higher costs.

- Marginal operating emissions plus avoided emissions from new builds

In addition to considering marginal emissions, this method considers a policy's impact on new investment. This method may prove useful for taking a first pass at an avoided emissions estimate for an RPS target that will affect construction of new generation. This option also requires fairly significant data collection and some load curve modeling. It offers the advantage of considering marginal emissions without a dispatch model.

- Energy or electricity sector modeling

These models are complex representations of the energy or electricity sector that calculate solutions to a given set of assumptions and policy interventions. These methods are the most involved, requiring at least a few months of work and at relatively high cost. Some of these models have been used to assess the impacts of proposed national RPS policies, and any of these models could—with some modification—assess a proposed or implemented state RPS. To complete such a modeling effort could require contracting with an outside consultancy or developing highly specialized inhouse capability, and would offer the highest resolution, flexibility, and degree of confidence.

Further Considerations

Policy-makers should bear in mind the areas of uncertainty in avoided emissions estimates when designing a renewable portfolio standard, especially if one of the goals is to reduce greenhouse gas emissions. The rules detailing applicable generation for RPS compliance provide important guidance for modeling avoided emissions. States that include only zero-emissions generation in their RPS will have lower uncertainty in projecting avoided emissions than states that allow emitting generation such as municipal solid waste generation, or fuel cells that require hydrogen production. Allowing emitting generation in an RPS complicates emissions projections because states will have to model investment choices for complying generation.

Calculating avoided emissions is easier at the utility or power pool level than at the state level; due to transmission interconnections between states, large amounts of electricity can flow between states. A further complication is the ability of some states to comply with their standards through the purchase of renewable energy credits (RECs) from other states without RPSs.

There are other metrics that may be used to examine the success of a renewable portfolio standard at avoiding GHG emissions. One likely candidate is carbon intensity: millions of metric tons of carbon dioxide equivalent per MWh. Specifically, a state could examine the intensity trend before and after the policy takes effect. A number of states have instituted resource portfolio disclosure requirements requiring electric providers to tell their customers the resource components used to generate their electricity.[2] Some of these reports include carbon, and could form the basis for GHG inventories and should be somewhat more accurate than average emissions factors.

[2] Arkansas, California, Colorado, Connecticut, Delaware, Florida, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, Nevada, New Jersey, New Mexico, New York, Ohio, Oregon, Texas, Vermont, and Washington have full disclosure requirements for electricity suppliers.

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