NATIONAL RENEWABLE PORTFOLIO STANDARD: SMART POLICY OR MISGUIDED GESTURE?

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Synopsis: Concern over emissions and climate change has led over half of the states to enact "renewable portfolio standard" (RPS) legislation requiring regulated electric utilities to obtain some fraction of their power requirements from sources defined as "renewable." Legislation to institute a federal RPS may follow. In reality, RPS is a policy in search of a rationale, at odds with principles of efficient environmental regulation and poorly suited to promote other policies favored by its supporters. The actual record of state implementations has been largely symbolic. Very few states with binding RPS requirements are currently in compliance with their own programs, and a federal RPS will be subject to the same forces that have led to state-level failure. The recent history of renewables leads to a conclusion that existing and proposed mandates are better viewed as special interest legislation than as rational responses to climate change and fossil-fuel power plant emissions.

I. INTRODUCTION

Electricity from "renewable" sources is fast becoming a multipurpose remedy that will alleviate energy scarcities, abate air pollution, and mitigate climate change. As of July 2007, over half of the states had enacted "renewable portfolio standards" (RPS) requiring electric utilities to obtain portions of their power from sources legislatively defined as renewable.[1] On August 4, 2007, the U.S. House of Representatives voted in favor of a national RPS, but the Senate failed to pass a comparable provision.[2] Supporters of a national RPS have long viewed it as an environmental measure that can also slow the accumulation of greenhouse gases (GHG).[3] They have more recently argued that it is, among others, an industrial policy to create manufacturing jobs and revitalize declining regions, a market intervention that could lower energy prices, a stimulus to development of new technologies, an instrument for risk management, a trade policy initiative, and a weapon in the war on terrorism.[4]

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1. A map of the states and their percentage renewable obligations is kept current by the Database for State Incentives and Renewable Efficiency (DSIRE). DSIRE, RENEWABLES PORTFOLIO STANDARDS (2008), http://www.dsireusa.org/documents/SummaryMaps/RPS_Map.ppt. Most states can only impose these obligations on regulated corporate (investor-owned) utilities. Municipal and other governmental utilities are generally beyond the reach of state regulation, as are rural cooperatives. The former deliver 18% of the nation's electricity to ultimate users (retail customers), and the latter deliver 10%. AM. PUB. POWER ASS'N., U.S. ELECTRIC INDUSTRY STATISTICS (2004), http://www.appanet.org/files/PDFs/2006StatCharts.pdf.

2. H.R. 3221, 110th Cong. (2007), Subtitle H, § 9611. In 2005 the Senate enacted an RPS and the House did not.

3. Two important questions are beyond the scope of this article: (1) Should there be any climate policy at all, and (2) if so, what form should it take. Each is properly the subject of a separate specialized study whose conclusions will depend heavily on its underlying assumptions about atmospheric science. Regarding the desirability of climate policy, see NICHOLAS STERN, THE ECONOMICS OF CLIMATE CHANGE: THE STERN REVIEW (2007) http://www.hm-treasury.gov.uk/independent_review/stern_review_economics-climate_exchange/stern_review_report.cfm (favors extensive policy initiatives) and BJORN LOMBORG, COOL IT! THE SKEPTICAL ENVIRONMENTALIST'S GUIDE TO GLOBAL WARMING (Alfred A. Knopf 2007) (against such policies). For economists, the most important aspect of the second question is whether to enforce any such regulations through a market for traceable GHG emission permits (cap-and-trade) or a system of taxes. For a comparison of allowances and taxes, see Warwick McKibbin & Peter Wilcoxen, *The Role of Economics in Climate Change Policy*, 16 J. OF ECON. PERSP. 107, 107-129 (2002) [hereinafter McKibben and Wilcoxen].

4. Various of these rationales appear in CHRISTOPHER COOPER AND BENJAMIN SOVACOOL, NETWORK FOR NEW ENERGY CHOICES, RENEWING AMERICA: THE CASE FOR FEDERAL LEADERSHIP ON A NATIONAL RENEWABLE PORTFOLIO STANDARD (RPS) REPORT NO. 01-07 (2007) http://www.newenergychoices.org/dev/uploads/RPS%20Report_Cooper_Sovacool_FINAL_HILL.pdf [hereinafter Cooper and Sovacool]; NAT'L COMM'N ON ENERGY POLICY, ENERGY POLICY RECOMMENDATIONS TO THE PRESIDENT AND 110TH CONGRESS 23, 24 (2007) http://www.bipartisanpolicy.org/files/news/contentFiles/NCEP-Recom-final-single_4773e92b6f5c2.pdf [hereinafter NATIONAL COMMISSION ON ENERGY POLICY]; Alan Nogee et al, *Clean Energy Blueprint: Increasing Energy Security, Saving Money, and Protecting the Environment with Energy Efficiency and*

In reality, a national RPS is singularly ill-suited for any of these tasks. It will be an inefficient and inequitable environmental policy that reduces emissions at higher cost than necessary and is largely incompatible with existing air quality regulations. Some of the non-environmental rationales are elementary economic fallacies and others are at best conjectures. Worse yet, the record of state-level RPS compliance and enforcement strongly suggests that the effects of a federal program will be either minimal or perverse. Psychologically and politically satisfying, a national RPS is likely to obstruct the development of efficient policies. The range of public figures and distinguished commissions favoring a national RPS may indicate no more than an expectation that it will provide a new forum for interest-group politics.[5]

We begin with data on renewables which suggests that a federal RPS will bring little diversity in generation resources and few environmental benefits. The next sections examine advocates' claims for it, finding them inadequate at best. As environmental policy, an RPS is inefficient by every economic standard. It is a costly measure whose effects on emissions are uncertain, difficult to integrate with existing environmental regulation, and needlessly disruptive of generation investments intended to comply with anticipated emissions rules. Other purported consequences are also questionable. As macroeconomic or industrial policy, a national RPS cannot possibly "create" net increases in employment and rural areas that it will "revitalize" seldom need the help. Claims that it is necessary to stimulate reductions in production cost lose their force in a global economy, as do expectations that it will position the U.S. to dominate the world renewables market. Rather than facilitating risk management, standard renewables contracts only transfer it from utilities to captive customers. National security is better advanced through direct policies instead of compulsory investment in renewables.

We next examine the use of computer models to predict the effects of a national RPS. Fourteen years and numerous revisions after the introduction of the U.S. Department of Energy's National Energy Modeling System, its forecasting abilities are unimproved, particularly over long horizons relevant for renewables policy. Its outcomes are determined by its assumptions, some concealed in its mathematical structure and others chosen by the researcher. Since both long-term models and recent trends suggest that most renewables built over the near future will be wind turbines, we next examine their effects on reliability and operating costs. We go on to explore the seldom-discussed topic of compliance with state RPS programs, and find that advocates' selective reports of state-level success are generally incomplete or misleading. To better understand the compliance problem, we examine California, whose RPS has failed so thoroughly that in 2005, its utilities received the same percentage of power from renewables as they did in 1998. The political economy of California's regulation and utilities' compliance suggests similarly dim prospects

Renewable Energy, 22 BULL. OF SCI., TECH. AND SOC'Y. 100, 101-109 (2002); JOSEPH STANISLAW, ENERGY IN FLUX: THE 21ST CENTURY'S GREATEST CHALLENGE (2006) http://www.deloitte.com/dtt/cda/doc/content/us_er_energyinflux_stanislaw_05_01_2006%281%29.pdf; WORLDWATCH INST. AND CTR. FOR AMERICAN PROGRESS, AMERICAN ENERGY: THE RENEWABLE PATH TO ENERGY SECURITY (2006), http://images1.americanprogress.org/il80web20037/americanenergynow/AmericanEnergy.pdf [hereinafter WORLDWATCH INST. AND CTR. FOR AMERICAN PROGRESS].

5. *See* NATIONAL COMMISSION ON ENERGY POLICY, *supra* note 4, at 24.

for a federal RPS for many of the same reasons. A final section draws some conclusions.

II. RENEWABLES TODAY

A. Types of Renewables

RPS advocates generally define renewable power by exclusion, as generated in plants that do not burn fossil fuels such as natural gas or coal. Fossil fuels produce environmental pollutants and GHGs, and RPS advocates are also concerned about exhaustion of domestic supplies and security risks of imports. Politics also influences the definition. Precipitation renews all hydroelectric facilities, which also produce no emissions or GHGs. Nevertheless, no RPS state allows any over sixty megawatts (MW) capacity to qualify as renewable.[6] Nuclear power also produces no emissions or GHGs and uranium exhaustion is not at issue (waste management, however, is), but no state RPS calls nuclear facilities renewable and federal legislation puts them in a class of their own. Coal-producing Pennsylvania includes mine waste in one subset of its renewables, and sunny Nevada requires that a fraction of its renewable capacity be solar.[7] Setting these aside, there are four basic renewable technologies:

1. *Burning Biomass* creates high-pressure steam that turns a turbogenerator. Biomass includes waste from crops (stalks) and forests (bark and chips), and some states allow incinerated solid waste to qualify for RPS compliance. Advocates argue that it leaves no carbon "footprint" because replanted crops absorb roughly the amount of carbon produced by burning them.
2. *Wind Turbines* face oncoming winds and contain transmission assemblies that allow them to turn turbines.
3. *Geothermal* power uses underground heat sources, generally volcanic, to produce steam that turns a turbine.
4. *Solar Power* includes *Photovoltaic* energy created when sunlight strikes a chemically active surface, and *Thermal* energy from heat. The latter can be "active," with mirrors that concentrate sunlight to boil water, or "passive," in which direct sunlight heats water.

6. 2003 data on hydroelectric capacity appear in THOMAS PETERSIK, ENERGY INFO. ADMIN., STATE RENEWABLE ENERGY REQUIREMENTS AND GOALS: STATUS THROUGH 2003, U.S DEPT. OF ENERGY 2 (2004), http://www.eia.doe.gov/oiaf/analysispaper/rps/index.html. Nevada's Hoover Dam has a capacity of 2,080 MW and Washington's Grand Coulee Dam has 6,800 MW. *See* DEP'T OF THE INTERIOR, BUREAU OF RECLAMATION, LOWER COLORADO REGION HOOVER DAM, FREQUENTLY ASKED QUESTIONS http://www.usbr.gov/lc/hooverdam/faqs/powerfaq.html (last visited Jan. 29, 2008); DEP'T OF THE INTERIOR BUREAU OF RECLAMATION, GRAND COULEE POWERPLANT, http://www.usbr.gov/power/data/sites/grandcou/grandcou.html (last visited Jan. 29, 2008).

7. *See* DSIRE, *supra* note 1.

B. Sources of Electricity

Figure 1 shows the remarkably small share of renewables in U.S. generation.[8] Between 1991 and 2005, total power production grew by 1.95% annually. Figures 2a and 2b show that renewables grew more slowly, falling from 2.21 to 2.15% of the total. Coal-fired generation increased by 26.6% and despite regulatory concerns over emissions and GHGs, its share of production fell by only 2% points. No new nuclear plants were opened during the period, but improved operating procedures kept their share of production nearly constant. Hydropower's share fell as sites available for larger plants grew scarce and environmental intervenors succeeded in blocking projects. Gas-fired power grew, much of it produced in small and efficient generators built by competitive producers rather than utilities. Generation fueled by oil was a minor presence at the start and became less important over the period.

As a group, renewables have made little headway despite more stringent environmental regulations and increased public concern over fossil-fuel generation.[9] Figure 3 shows generation by type of renewable from 1991 through 2005. Production from wood and waste biomass remained roughly unchanged, as did output from geothermal plants. Figures 4a and 4b show that the total of these three sources fell from 95.3% to 78.9%, while solar power maintained its 0.6% share. Had wind generation not risen rapidly, renewable power would be below 2 percent of today's total. The fact that wind is the only renewable on a growth trend will have important consequences for a national RPS.

C. The Coming Costs

To meet their renewable quotas, utilities in today's RPS states must invest heavily and soon. In March 2005, they were deficient as a group by only 819 MW. To remain in compliance they must build 12,000 MW between 2006 and 2010, and 52,000 by 2020, at an estimated cost of $53.4 billion.[10] The amount exceeds Florida's total capacity and is 80% of California's.[11] Large utilities will bear a disproportionate share of the costs.[12] Wind will power most of the new plants, its capacity expected to increase 400% by 2020. The investment figures do not include transmission and related capital (e.g. substations). A 2007 California Energy Commission report estimated that the state's 33% 2020 renewable requirement requires $5.7 billion for 500 and 230 kilovolt lines alone, in addition to lower voltage lines, transformers, and new supplies of reactive

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8. Data in Figures 1 and 2 are from EIA, NET GENERATION BY ENERGY SOURCE: TOTAL (ALL SECTORS), http://www.eia.doe.gov/cneaf/electricity/epm/table1_1.html (last visited Jan. 29, 2008).

9. Data in Figures 3 and 4 are from EIA, NET GENERATION BY RENEWABLES: TOTAL (ALL SECTORS), http://www.eia.doe.gov/cneaf/electricity/epm/epmxlfile1_1_a.xls (last visited Ja. 29, 2008) (May 2007 and predecessors).

10. GLOBAL ENERGY DECISIONS, A DIFFERENT APPROACH: THE BOTTOM LINE ON RENEWABLES 9 (2005), http://www.globalenergy.com/BR05/BR05-renewables.pdf. [hereinafter GLOBAL ENERGY DECISIONS].

11. ENERGY INFORMATION ADMINISTRATION, STATE ELECTRICITY PROFILES (2007), http://www.eia.doe.gov/cneaf/electricity/st_profiles/e_profiles_sum.html.

12. The two largest investors will be Southern California Edison and Chicago's Commonwealth Edison, each spending between $3 and $4 billion. *See* GLOBAL ENERGY DECISIONS, *supra* note 10, at 9-11.

power.[13] For comparison, total U.S. spending by investor-owned utilities on all transmission, including replacements and upgrades in 2005, was $5.8 billion.[14]

III. A NATIONAL RPS AS ENVIRONMENTAL POLICY

A. *Efficient Environmental Regulation*

The logic of an RPS superficially resembles that of other environmental policies.[15] A bilateral transaction benefits both the buyer and seller, and if they are the only affected parties, both are better off and no one is worse off. If the transaction harms a third party (manufacturing or operating the traded good produces health-endangering pollutants), the buyer and seller do not bear its full cost, which equals production cost plus the "external cost" borne by the third party.[16] If the transactors only look to their private benefits, the exchange may be a net detriment to the society, i.e. them and the third party.[17] Maximizing the benefits net of the costs of pollution and its abatement may require policies whose effect is to reduce the concentration of the pollutant to a less harmful level. Economically efficient policy attains the target concentration at the smallest sacrifice in the value of other goods.[18] The target is itself a matter of choice. Higher concentrations are more harmful to health, but entail lower control costs that leave the economy's resources free to produce more of other valuable goods. The economically efficient concentration is the level that maximizes the net benefits, i.e. the difference between the value of improved health and the opportunity cost of abatement. The first step is to set an allowable concentration as the U.S. Environmental Protection Agency (EPA) does for "criteria pollutants" that include sulfur and nitrogen oxides. Conceptually, the agency compares the benefits of possible concentrations with the costs of

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13. INTERMITTENCY ANALYSIS PROJECT TEAM, INTERMITTENCY ANALYSIS PROJECT: FINAL REPORT, CEC-500-2007-081 26 (2007), http://www.energy.ca.gov/2007publications/CEC-500-2007-081/CEC-500-2007-081.PDF (prepared for California Energy Commission). These two voltages are the highest in general use.

14. EDISON ELECTRIC INSTITUTE, ACTUAL AND PLANNED TRANSMISSION INVESTMENT BY SHAREHOLDER-OWNED UTILITIES 2000-2009, http://www.eei.org/common/images/industry_issues/Energy_Data_Alert/bar_Transmission_Investment.jpg (last visited Jan. 29, 2008). Figures in the text only cover transmission owned by corporate utilities, which deliver approximately 72% of all power to final users.

15. The first RPS proposals were at the state level. *See* Richard Norgaard & Nancy Rader, *Efficiency and Sustainability in Restructured Electricity Markets: The Renewables Portfolio Standard*, 9 ELECTRICITY J. 37 (July 1996); Brent Haddad & Paul Jefferiss, *Forging Consensus on National Renewables Policy: The Renewables Portfolio Standard and the National Public Benefits Trust Fund*, 12 ELECTRICITY. J. 1, 68-80 (Mar. 1999).

16. "Health" here is a generic term for aspects of life that the pollution harms in economic terms. The full list of them is a matter of debate. "Full" cost is sometimes called "social" cost, and "external cost" is sometimes called an "externality."

17. Here we disregard the possibility that negotiating costs are low enough and rights are defined so that the three parties can bargain to an efficient outcome. Pollution and GHGs are classical cases in which large-numbers problems provide a rationale for intervention.

18. The text neglects numerous potentially relevant qualifications. These include the distribution of costs and benefits within the population ("environmental justice") and the population to be protected (America or the entire world? Both present and future generations?). Non-economists are sometimes uncomfortable with measuring costs and benefits at market prices, but they have suggested no quantifiable alternative.

attaining them and finds the concentration that maximizes the difference.[19] The costs include both the direct costs of abatement and the foregone output of other goods. Such a process is politically unappealing, since the EPA must assign dollar values to lives, health, and environmental amenities. The Supreme Court has ruled that the Clean Air Act does not allow the EPA to consider the costs of reduction, but in practice it has no choice but to do so.[20] The language of some environmental laws sets target concentrations at zero or requires that pollutants be reduced to levels that do not affect health.[21] The air will always contain tiny amounts of many pollutants produced in nature and they become detectable as monitoring technologies improve. Health effects are determined by statistical methods that invariably find small probabilities of harm. Any allowable concentration implies a value of life, even if politics prohibits explicit statements about it.[22] Inexactness and politics pervade the standard-setting process, but to a first approximation we see environmental regulators attempting to arrive at concentrations that maximize net benefits.[23]

After setting an allowable concentration, regulators must design institutions that minimize the costs of attaining that level. Economics provides several guidelines for efficient reduction:[24]

- *Consider all possible sources.* Regulating only a subset of sources cannot possibly lower the costs of achieving a given reduction in concentration.
- *Regulate the pollutant itself and not the process that produces it.* Regulating the design of equipment (small hydroelectric plants but not large ones) or its inputs (restrictions on usable fuels) is inferior to regulating output of the pollutant itself. Design standards needlessly restrict the range of possible abatement methods and may discourage innovative approaches to it. The desired end-product is a lower level of the pollutant rather than the dominance of a particular technology.
- *Match geography with costs and benefits*. National environmental laws nominally specify uniform standards, but the attainability of a target in practice requires particularized regulation. Specialized ozone regulations make sense for

19. For a summary of theory and practice in air quality management, see any environmental economics textbook, *e.g.* SCOTT CALLAN AND JANET THOMAS, ENVIRONMENTAL ECONOMICS & MANAGEMENT, 126-201 (Thomson 2007) [hereinafter CALLAN AND THOMAS]. For application to RPS, *see* W. David Montgomery, Presentation at Harvard Electricity Policy Group 39th Plenary Session, Renewable Portfolio Standards: A Solution in Search of a Problem? (May 20, 2005), http://www.ksg.harvard.edu/hepg/Papers/Montgomery%20Renewable%20 Portfolio%20Standards.pdf.

20. Whitman v. Am. Trucking Ass'ns, 531 U.S. 457 (2001).

21. The 1970 Clean Air Act specified that states eliminate all public health risks of air pollution by 1982. 42 U.S.C. § 7409(b)(1) (2000). The Clean Water Act of 1972 required that "discharge of pollutants into navigable waters be eliminated by 1985." Federal Water Pollution Control Act, 101(a)(1), 33 U.S.C. § 1251(a)(1) (2000).

22. In 2004, the EPA used a mean life value of $6.3 million. Ike Brannon, *What Is a Life Worth?,* 27 REGULATION 61, 63 (Winter 2004-2005).

23. More importantly, if the agency is not regulating to maximize net benefits, by what criteria is it actually setting its standards?

24. *See* CALLAN AND THOMAS, *supra* note 19, at 218-234.

Southern California's unique geography, but would not be worth the cost in rural Wyoming. The forthcoming Clean Air Interstate Rules for oxides of nitrogen and sulfur will be largely restricted to areas that are primarily responsible for emissions and contain most of the affected population.[25] Similarly, if GHGs are a worldwide problem, a worldwide control program is in order. A single state or national policy, standing alone, is primarily symbolic.

- *Provide incentives to minimize compliance costs*. This is the intent of cap-and-trade systems with government-issued allowances (rights to emit) that polluters may trade among themselves.[26] Holders whose abatement costs are low will make the required investments and profit from the sale of their allowances. The cap-and-trade market economizes on information. Without it, regulators could only achieve efficiency by collecting and processing masses of information that polluters will probably be reluctant to disclose. Exchangeable allowances encourage innovation because the inventor of a cheaper control technology lowers its own abatement costs and can sell or license it to others.[27]

B. RPS and Emissions

Whether state or national, as environmental policy, an RPS fails every criterion discussed above. States have generally adopted RPS without studying the costs and benefits of alternative quotas and target dates. Most appear to have been chosen for political reasons.[28] For as small an area as a state or region, an RPS may have advantages. It is easy to specify legislatively and the cost of compliance might be more easily concealed in utility bills than an outright tax on conventional power or subsidy to renewables. As a practical matter, it will be costly to set up and maintain a cap-and-trade system over a small region, and smallness lowers the potential benefits of its markets. At a national level, the possible advantages of an RPS decrease and those of markets increase.

An RPS inefficiently limits the types of generation to be used rather than constraining allowable emissions of pollutants and GHGs. Percentage

25. Sam Napolitano et al, *Clean Air Rules: A New Roadmap for the Power Sector*, PUB. UTIL. FORTNIGHTLY, June 2007, at 52-59.

26. Some special aspects of climate change could make a tax system more efficient than allowance trading. For example, there is great uncertainty about how many allowances must be created in order to achieve a desired degree of climate change mitigation. Uncertainty over future allowance amounts could disrupt markets and reduce their efficiency. Tax rates per ton of GHG emissions, by contrast, can in principle be adjusted more easily when new scientific information alters beliefs about the necessary reductions. *See* McKibbin and Wilcoxen, *supra* note 3.

27. Innovators may thus fare better under competing state RPSs, some of which accept their technologies, than under a federal one. Unless contracts are for lifetime fixed prices, new technologies threaten investments made to satisfy an RPS. Like utilities facing retail competition their owners might claim breach of an unwritten "compact." All major renewable technologies have trade associations that will work assiduously to protect their rents. Evidence of this can be seen in renewables advocates' lack of interest in treating demand management symmetrically with generation.

28. This may explain the relative popularity of round numbers for percentages and years. The use of large-scale simulations to evaluate costs and benefits of a national RPS is discussed below.

reductions in emissions over a region will not vary one-for-one with the percentage of power produced by renewables. Both the amounts emitted and their composition depend on the types of renewables built and the types of conventional generators they displace. As noted below, wind turbines will dominate renewable investments over at least the medium-term, but their intermittent availability means that they will largely displace gas-fired generation that can adjust output on short notice. Gas-fired plants emit fewer criteria pollutants and GHGs than coal-burning ones, so using intermittent renewables to satisfy an RPS will cut emissions by less than the RPS percentage. Unlike gas-fired generators, coal units will remain base-loaded and operating at almost all times. Among other renewables, geothermal and biomass plants can be base-loaded, but their growth prospects appear small.

An RPS violates the all-sources principle by restricting itself to a single industry. Instead of attacking pollutants, it attempts to do so indirectly by restricting the range of generating technologies and fuels. If a single RPS standard were adopted nationally, it would also violate the regionalization principle since the availability of renewable resources varies with geography. The benefits of a renewables quota will likewise depend both on them and on the region's legacy fleet of conventional generators. Absent a crediting system (whose difficulties are discussed below), a uniform national RPS will be a high-cost tool to achieve given reductions in pollutants and GHGs.

For efficient emissions control, the all-source principle recommends treating demand management and renewables symmetrically. A demand management program that permanently reduces load by a megawatt will have the same effect on emissions as investment in a megawatt of renewable generation. An efficient RPS, however, must contain dissimilar provisions for demand management and renewable generation. Under a 20% RPS a utility that cuts load by 1 MW reduces its obligation by only 0.2 MW, but an additional MW of renewable capacity counts fully for compliance. Renewable generation interest groups will generally be hostile to demand management, and currently only three states treat the two symmetrically. The California Energy Commission, normally a strong supporter of demand management, disfavors the inclusion of "non-generation" power sources in a federal RPS on grounds that "one of [its purposes] is to provide a market for renewable energy and ultimately reduce the cost of renewable technologies."[29]

C. Efficiency Through Time

The principles of efficiency extend to durable investments in generation and transmission. Intertemporal efficiency entails the choice of investments that produce a utility's planned output at the lowest cost, discounted to the present for comparability with alternative projects. Any chosen project must also account for expected future policy constraints such as more stringent air quality standards, and possibly GHG abatement or sequestration. Different investments will be optimal for differently situated utilities. Some might choose gas-fired units whose emissions are easier to control but whose fuel prices are less stable.

29. CALIFORNIA ENERGY COMM'N, RENEWABLES COMMITTEE RESPONSES TO QUESTIONS POSED BY REP. JOHN D. DINGELL IN MAY 24, 2007 LETTER FROM COMMITTEE ON ENERGY AND COMMERCE ON FEDERAL RPS 6 (2007), http://www.energy.ca.gov/papers/2007-06-18_CONGRESSMAN _DINGELL_LETTER.PDF.

Others might choose coal-burning technologies in the expectation that satisfactory abatement or sequestration technologies will be available at reasonable cost. Still others might invest in demand management. The utility's optimal choice will depend on expectations of the future and on the legacy generation the utility is bringing forward.

Renewables have been available as supply options for some time, but most utilities appear to have determined that they can meet their service obligations and remain in environmental compliance by investing in conventional plants and demand management. In states with RPS, utilities have generally chosen to make the required compliance investments in renewables, but not to build renewables beyond those amounts. A national RPS affects both those states with existing programs and those without. In the latter it forces the costly modification of supply plans that utilities expect will be in compliance with air quality and GHG regulations. The fact that renewables have lower emissions cannot by itself justify a requirement that they be built in lieu of conventional generation. Economic efficiency means production at least cost, where costs reflect the market values of all relevant resources. Whether lower allowable concentrations of pollutants or emissions of GHG are warranted is properly the subject of rulemakings like those that have set currently standards, rather than an *ad hoc* regulation like RPS.

IV. OTHER RATIONALES FOR A NATIONAL RPS

A. RPS as Macroeconomic Policy

A national RPS is primarily an environmental policy, but some advocates assert other benefits. They have calculated its effects on employment, using methods like those in government-commissioned studies estimating the jobs that, e.g. a new municipal stadium will create. This reasoning may have held during the great depression of the 1930s, when up to 1/3 of the workforce was unemployed. Today, most unemployment consists of transitions between assured jobs, short-term layoffs with high probabilities of return, and non-intensive job search by casual workers such as teenagers living at home, many of whom are hardly in hardship. Currently only 4.1% of high school graduates over twenty-five are unemployed, the median spell of unemployment lasts 8.2 weeks, and most of them receive unemployment compensation.[30] The workers who build a municipal stadium or a renewable generator come from other jobs, and are paid with funds that households and businesses would have spent elsewhere. Labor is reallocated to renewables, but the nation is unlikely to see a net increase in employment. Whatever the employment consequences of an RPS, energy and environmental policies should be judged by their effects on the problems they directly address.

Some advocates take job creation to such lengths that they endorse inefficient renewables over more efficient ones. One study notes that "the

30. Figures are for June 2007, from the Census Bureau's Current Population Survey. They can be found at the U.S. Bureau of Labor Statistics web site: http://data.bls.gov/cgi-bin/surveymost. In an average month 10% of all workers change employers, enter or leave the labor force, or enter or leave unemployment. Steven J. Davis et al., *The Flow Approach to Labor Markets: New Data Sources and Micro-Macro Links*, 20 J. OF ECON. PERSP. 3, 6, 10-11 (2006).

renewable energy sector generates more jobs per megawatt of power installed, per unit of energy produced, and per dollar of investment, than the fossil fuel-based energy sector."[31] It compares coal and solar units under an assumption that four megawatts of intermittent solar capacity are equivalent to one megawatt of coal-fired capacity. Building either takes the same labor input per megawatt, as would building a base-loadable MW of biomass capacity. The study's authors conclude in favor of solar because it creates four times as many construction jobs per effective megawatt as coal or biomass, and also requires more labor to operate. In effect the solar project attracts an unnecessarily large number of workers from more productive jobs and pays them from the higher bills of captive consumers.[32]

A variant of the job creation fallacy notes that renewables (particularly wind) are often distant from consumers of their power, so the economic stimulus that stems from their construction might revitalize declining rural areas.[33] Supporters of this view do not make clear why outmigration that has persisted for a century should be reversed, or why power consumers should bear the costs. Here too unemployment is a non-issue. Forty-nine of North Dakota's fifty-three counties lost population between 2000 and 2003, but the state enjoyed an unemployment rate half the national average.[34] Other advocates see a national RPS as a tool to encourage collective ownership of renewables by rural residents.[35] The Worldwatch Institute endorses this policy because "wealth remains in the local community," an odd posture for farmers who earn incomes by selling their output to urbanites.

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31. DANIEL KAMMEN ET AL, RENEWABLE AND APPROPRIATE ENERGY LABORATORY, UNIV. OF CAL., BERKELEY, PUTTING RENEWABLES TO WORK: HOW MANY JOBS CAN THE CLEAN ENERGY INDUSTRY GENERATE? 3-4 (2006), http://rael.berkeley.edu/files/2004/Kammen-Renewable-Jobs-2004.pdf. The document actually summarizes 13 other studies. Nine are from environmental or renewables groups and two from Ralph Nader organizations.

Similar reasoning appears in WORLDWATCH INST. AND CTR. FOR AM. PROGRESS, *supra* note 4, at 10; R.K. SCHWEIR & M. RIDDEL, NAT'L RENEWABLE ENERGY LAB., THE POTENTIAL ECONOMIC IMPACT OF CONSTRUCTING AND OPERATING SOLAR POWER FACILITIES IN NEVADA, NREL/SR-550-35037 (2004), http://www.nrel.gov/csp/pdfs/35037.pdf.

32. Since poorer consumers spend larger percentages of their incomes on power than wealthier ones, the RPS also acts as a regressive tax.

33. Among others, *see* U.S. DEPT. OF ENERGY, ST. WIND WORKING GROUP RESOURCE HANDBOOK, 100 (2003), http://www.eere.energy.gov/windandhydro/windpoweringamerica/filter_detail.asp?itemid=655&print (last visited Jan. 30, 2008) (referencing UNION OF CONCERNED SCIENTISTS, THE ECONOMIC DEVELOPMENT BENEFITS OF WIND POWER).

34. ECONOMIC RESEARCH SERVICE, U.S. DEPARTMENT OF AGRICULTURE, COUNTY LEVEL UNEMPLOYMENT AND MEDIAN HOUSEHOLD INCOME FOR THE UNITED STATES. http://www.ers.usda.gov/Data/Unemployment/RDList2.asp?ST=US (last visited Jan. 30, 2008).

35. MARK BOLINGER, LAWRENCE BERKELEY NAT'L. LAB COMMUNITY WIND POWER OWNERSHIP SCHEMES IN EUROPE AND THEIR RELEVANCE TO THE UNITED STATES (2001) http//:eetd.lbl.gov/ea/EMP/reports/48357.pdf; MARK BOLINGER AND RYAN WISER, LAWRENCE BERKELEY NAT'L LAB., UNIV. OF CAL. BERKELEY, A COMPARATIVE ANALYSIS OF BUSINESS STRUCTURES SUITABLE FOR FARMER-OWNED WIND POWER PROJECTS IN THE UNITED STATES (2004), http//:eetd.lbl.gov/ea/EMP/reports/56703.pdf.

B. RPS as Technology Policy and Foreign Policy

Some believe that a national RPS will help drive down the costs of renewables.[36] It is, for example, possible that large purchase orders will bring forth larger plants that capture economies of scale that have not been realized in today's relatively smaller ones. Renewables, however, have no obvious characteristics that would lead to economies in production exceeding those of similar manufactured goods, most of whose markets support at least several U.S. and foreign producers. Renewables can easily cross national boundaries in both directions, and a federal RPS will have little impact on already-competitive world markets.[37] The development of renewables has attracted technology investors, venture capitalists, and large firms (e.g. General Electric) with available internal funds.

Experience in production lowers costs, and a national RPS may add to experience in renewables. Since 2/3 of the population already lives in RPS states, it is not clear why adding the remainder will yield significant additional cost reductions. Competition also pressures producers to reduce costs, whether it comes from renewables or nonrenewables. Costs may fall with experience, but an inexperienced producer can also reduce them by observing and imitating competitors. Growing markets in intellectual property allow Americans to benefit from the research of others without a duplication of effort.[38] Any policy that directs increased investment to a particular industry can yield cost reductions that come with scale and experience, if they in fact exist. These savings, however, will come with any pro-renewables policy and are not in themselves a reason to favor a national RPS to increase their production.

Others hope that a national RPS can bring U.S. domination of the world's renewables markets. One advocate sees it as a necessary response to renewables-based export policies that are taking shape in Japan.[39] He believes Americans must emulate the cooperation between Japan's manufacturers and government planners, a vision of invincibility from the 1970s and 1980s that died with the recession and banking crisis of the 1990s.[40] Experience gives little reason to expect that such concerted policy formation can make either nation dominant. The U.S. will continue to export those in which it has a cost

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36. *See*, *e.g.* COOPER AND SOVACOOL, *supra* note 4, at 138.

37. The manufacture of wind turbines is highly internationalized. General Electric supplied turbines for 47% of domestic wind installations in 2006. Most of the remainder came from overseas sources, including Siemens (Germany, 23% of the total), Vestas (Denmark, 19%), and Mitsubishi (Japan, 5%). Some foreign manufacturers have opened U.S. plants, and some of GE's U.S. components were manufactured abroad. OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, U.S. DEP'T. OF ENERGY, ANNUAL REP. ON U.S. WIND POWER INSTALLATION, COST, AND PERFORMANCE TRENDS: 2006 6-7 (2007) http://www.nrel.gov/docs/fy07osti/41435.pdf.

38. The U.S. Department of Energy's projections for wind generators assume that performance will continue to improve whether or not it continues to sponsor research and development. One source of advance will be foreign manufacturers. *See* OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, U.S. DEP'T OF ENERGY, APPENDIX E – GPRA07 WIND TECHNOLOGIES PROGRAM DOCUMENTATION E-6 (2007), http://www1.eere.energy.gov/ba/pdfs/39684_app_E.pdf [hereinafter DOE/EERE].

39. STANISLAW, *supra* note 4, at 18.

40. That vision of the Japanese economy was almost entirely a fiction. YOSHIRO MIWA & J. MARK RAMSEYER, THE FABLE OF THE KEIRETSU: URBAN LEGENDS OF THE JAPANESE ECONOMY (University of Chicago Press 2006).

advantage and import those in which it does not.[41] International trade in renewables raises no security issues, since they are ordinary manufactures that no nation or group can credibly monopolize.

C. RPS as Risk Management Policy

1. Renewable Energy Credits

The geographic distribution of renewables is uneven, and the quality (e.g. wind speed) of a given renewable can differ among regions. Most federal RPS proposals include markets for Renewable Energy Credits (RECs) that allow utilities in resource-poor areas to achieve compliance if they purchase claims on the outputs of distant plants. Regulators must make certain that RECs are real, and that they have not been sold to multiple buyers. RECs may have fixed lifespans (one year) and secondary markets in them are possible. Credits, however, are not the same as power itself. Only certain renewables are dispatchable, and any source without dependable transmission to the buyer will require additional provisions for operating reserves. Some state programs do not even require interconnection between the utility and the source of credits.

The financial flows associated with RECs may stand in the way of an implementable national RPS. Some advocates see renewables everywhere, but over the medium term some utilities will be chronically deficient, regularly sending payments to others more fortunate.[42] The environmental effects of a crediting mechanism may also be inequitable. A renewable that improves air quality may benefit those in its vicinity, but not the customers of a utility that buys its RECs. They pay higher power bills to improve the environments of others, who can take the benefits with them because air quality is monetized in real estate markets. Homes in clean environments sell at premiums relative to similar ones elsewhere.[43] The empirical issue is whether the environmental

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41. Absent special circumstances, the Worldwatch Institute has little reason to be alarmed over a drop in the U.S. share of world solar collector production from 44% in 1996 to below 9% in 2005. The U.S. can only import renewables if it pays for them with the proceeds from exports or foreign investments. WORLDWATCH INST. AND CTR. FOR AM. PROGRESS, *supra* note 4, at 11.

42. Two RPS proponents suggest that the "elimination" of the Public Utility Holding Company Act in the Energy Policy Act of 2005 ends the inequality problem by removing restrictions on long-distance mergers of holding company utilities. Mergers will allow a renewable-rich operating company to "send" (actually, sell) power to a deficient one in the same organization. Benjamin Sovacool & Christopher Cooper, *Green Means 'Go?' – A Colorful Approach to a U.S. National Renewable Portfolio Standard,* 19 ELECTRICITY J. 22 (2006).

The scenario assumes a fortuitous pattern of mergers, disregards continuing oversight by the Federal Energy Regulatory Commission (FERC), and assumes that regulators in losing states will passively watch as customer bills increase. Recent attempts by low-cost Entergy Arkansas (supported by state regulators) to withdraw from the holding company's System Agreement may be illustrative. *See FERC Rejects Louisiana PSC's Request that Entergy Arkansas Not Be Allowed to Withdraw from Entergy System Agreement*, FOSTER ELEC. REPORT, June 6, 2007, at 8.

Sovacool and Cooper also fail to consider how states might protect their ratepayers from merger-related costs, and how they might continue to carry out their own environmental policies. Robert Gee, *After PUHCA Repeal - The State Response: Will the Industry be able to Meet Capital and Growth Expectations*, PUB. UTIL. FORTNIGHTLY REP., Mar. 2006, 43-48; Robert Burns & Michael Murphy, *Repeal of the Public Utility Holding Company Act of 1935: Implications and Options for State Commissions*, 19 ELECTRICITY J. 32, 32-42 (Oct. 2006).

43. Jeffrey Zabel & Katherine Kiel, *Estimating the Demand for Air Quality in Four U.S. Cities*, 76 LAND ECON., 174-194 (2000).

effects are localized or dispersed. Supporters of a national RPS argue that without it non-RPS states will "free ride" and get better air without paying for it.[44] If air quality is local, however, RECs allow people in renewable-rich areas to free ride on credits purchased by people whose air remains unimproved. Although experience is still sparse, it appears that RECs will not be usable as collateral for investments in renewables. The prices of state RECs have thus far been too volatile, and there are few reasons to expect that those sold under a federalized RPS will be different. When capacity is short they will be costly or unavailable, but when general compliance is achieved they will lose most of their value.[45]

2. Diversification and Risk

Holding a mix of financial assets reduces investment risk, relative to an undiversified portfolio with the same expected return. Since the late 1980s independent power producers have strongly favored small and efficient gas-fired generators, to such an extent that some believe the nation is excessively exposed to gas-related risks. Because volatile gas prices often set the price of electricity, it is possible that risk-averse consumers will benefit from a generation portfolio that includes renewables, even if adding them raises expected power costs.[46] A contract between a renewable producer and a regulated utility can reduce risk, shift risk, or conceal it. Most wind power agreements set a fixed price per kwh regardless of when it is produced. The utility gets a bargain (passed through in part to users) when gas-fired power is expensive and overpays when it is cheap. Since gas prices are volatile, and electricity market prices are heavily influenced by natural gas prices, long-term fixed-price contracts carry a substantial risk that they will vary significantly from market prices over the term of the contract.[47] If market price falls below the contract price, consumers lose because they are foreclosed from paying it, while if it is above the contract price they pay the same, but either way the utility's revenue is protected. The contract both shifts risk to captive customers and conceals its magnitude. Long-term fixed-price commodity contracts are almost unique to regulated utilities whose customers

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44. COOPER AND SOVACOOL, *supra* note 4, at 74.

45. Time series of several state credit prices appear in RYAN WISER, ET AL, LAWRENCE BERKELEY NAT'L. LAB., UNIV. OF CAL. BERKELEY, RENEWABLES PORTFOLIO STANDARDS: A FACTUAL INTRODUCTION TO EXPERIENCE FROM THE UNITED STATES 11 (2007), http://eetd.lbl.gov/ea/EMP/reports/62569.pdf.

46. Since investors in renewables do not capture the value to consumers of increased price stability, some argue that there is a case for subsidizing them, e.g. through the Production Tax Credit. MARK BOLINGER ET AL, LAWRENCE BERKELEY NAT'L. LAB. PUB., UNIV. OF CAL. BERKLEY, QUANTIFYING THE BENEFITS THAT WIND POWER PROVIDES AS A HEDGE AGAINST VOLATILE NATURAL GAS PRICES (2002), http://eetd.lbl.gov/EA/EMP/reports/50484.pdf.

The analogy between diversified investment portfolios and diversified generation is imperfect. Generators are indivisible, durable, specialized to different uses (base-load or peaking), and location-specific. They cannot be bought or sold on short notice, and short sales of units themselves are impossible (although their output can be committed). Utility shareholders can diversify against unpredictable returns but most consumers cannot similarly hedge unpredictable prices, leading to a potential conflict between the two. Philip Hanser & Frank Graves, *Utility Supply Portfolio Diversity Requirements*, 20 ELECTRICITY J. 22, 22-32 (June 2007).

47. Any general expectation of a rising trend can be built into the contract's price provisions.

usually have few alternative suppliers.[48] The economically relevant cost is the cost of power that is not produced by gas-fired units. In most summer-peaking territories winds are weakest at hours when wind generation would save the most gas expense, and strongest when it would save less.[49]

A fixed-price contract only benefits consumers who are highly risk-averse, willing to pay a premium for steadier prices that are higher on average than if generated by gas alone. It may be factually incorrect to assume such extreme consumer attitudes. Since the early 1970s automatic adjustments have passed volatile fuel prices through to consumers, with little outcry to replace them with stable rates. A number of utilities offer "level pay" plans, but they attract relatively few customers. Most Texas households can choose among suppliers offering different price adjustment provisions, contract lengths, base prices, and power sources (e.g. renewables). As of August 2007 a Houston household could choose among eighty-seven plans offered by twenty-four utilities and marketers.[50] Some of them offer price protection at premium rates, but the great majority do not. Data on enrollments in different types of plans are unavailable, but a significant number of sellers offer no fixed-price plans at all.

3. National Security

Any connection between an RPS and energy security is tenuous at best.[51] Virtually all international security concerns are oil-related, but oil produces only 3% of the nation's power, some in plants that can also burn gas.[52] Renewables primarily displace power generated by North American gas, whose price reflects conditions of demand, storage, and (over the longer run) policies that restrict or expand exploration for it. Claims that a national RPS will make powerplants more secure against terrorism appear overstated at best.[53] As shown below, most generation investments over the next twenty years will continue to be fossil-fueled or nuclear. An RPS is a costly and blunt tool for the protection of non-renewable powerplants.[54] Security is better addressed under a national infrastructure policy to harden them than under a policy that requires the construction of renewables. A national RPS will still require that "backbone" transmission be used as intensively as today, and there are few hard options for reducing its vulnerability. The industry, however, has long lived with problems like these. Because production and consumption must be equal every second,

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48. Robert J. Michaels, *Reducing Risk, Shifting Risk, and Concealing Risk: Why Are There Long-Term Gas Contracts*?, *in* NEW HORIZONS IN NATURAL GAS DEREGULATION 195-208 (Joseph Kalt & Jerry Ellig eds., 1996).

49. *See infra* Part V.C.2.

50. *See* PUB. UTIL. COMM'N OF TEX., TEX. ELEC. CHOICE, http://www.powertochoose.org/_content/_compare/compare.aspx (enter Houston zip code 77019). Consumer choice is only available to the 80% of Texas load located in the territories of the five utilities that make up the Electric Reliability Council of Texas.

51. The claim appears in COOPER & SOVACOOL *supra* note 4, at 13, 153; and WORLDWATCH INST. AND CTR. FOR AM. PROGRESS, *supra* note 4, at 6, 9. Arguments that the RPS will help the nation in its alleged quest for "energy independence" are generally no more than arguments against international trade. To the extent the concept has any substance at all it is probably best lumped with security.

52. *See infra* Figure 2B.

53. WORLDWATCH INST. AND CTR. FOR AM. PROGRESS, *supra* note 4, at 9, asserts this.

54. Since the 9/11/2001 attacks no such incidents have occurred. Whether this is due to good luck or effective security is not yet clear.

electric systems are designed for quick response to contingencies ranging from lightning strikes to boiler explosions. RPS advocates are correct when they assert that a 50 MW wind farm [or a 50 MW combustion turbine] is a less attractive target than a 500 MW coal-fired plant, but in most situations short of war either can be lost with little impact on reliability.

V. THE EFFECTS OF A NATIONAL RPS

A. Data and Assumptions

Since 1997 at least eighteen studies of a national RPS based on computer modeling have become public.[55] As with all models the conclusions will depend heavily on their explicit and implicit assumptions. The farther we are looking into the future, the greater is the range of plausible assumptions and the sensitivity of any predictions to them. An RPS will affect both renewable and conventional generation over a horizon measured in decades. Potentially critical assumptions for modeling a national RPS include:

1. Expectations of conventional (including nuclear) fuel prices will determine amounts invested in both conventional and renewable generation. Because significant percentages of both coal and gas production produce power, an RPS that replaces some of their generation could also affect their prices.
2. Prior to the 1970s energy prices and market growth were relatively stable. Prices have since become less predictable and demand has become more sensitive to them as more users face real-time pricing. The diffusion of new technologies, some of which increase demand (digital computers) and others that decrease it (conservation and load management) have added to its unpredictability and increased the difficulty of modeling its behavior.
3. New technologies for generation, transmission, and conservation will also determine future costs. The effects of a national RPS are sensitive to assumptions about relative cost trends in conventional and renewable generation. Some advocates expect an RPS itself will substantially reduce costs as experience in producing and operating them accumulates.[56]
4. Regulation and markets change constantly. The future mix of conventional and renewable generation may depend on whether investments are made by competitive producers responsible for their own risks or by utilities that can be confident of cost recovery in regulated rates.
5. The details of an RPS matter, in particular the resources defined as "renewable" and such aspects of their regulation as price caps and crediting.

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55. For a list, *see* Alan Nogee et al, *The Projected Impacts of a National Renewable Portfolio Standard*, 20 ELECTRICITY J. 33, 35 (May 2007).

56. All commonly used computer models include assumptions about future technological change in renewables, and their results are highly sensitive to these assumptions. *See infra* text accompanying note 65.

B. NEMS

With so many possible assumptions and types of markets, the dominance of a single model over much RPS research is odd. Most studies rely on the U.S. Energy Information Administration's (EIA) National Energy Modeling System (NEMS), which is also the source of the forecasts in EIA's *Annual Energy Outlook*.[57] NEMS is an exceedingly complex computer program consisting of thirteen "modules," each the work of different researchers, that estimates and forecasts hundreds of variables.[58] These include annual future prices and outputs for all forms of energy (including imported oil), consumption by various types of users, and macroeconomic variables such as gross domestic product and employment. Its outputs depend on literally thousands of assumptions, some at the discretion of users and others embodied in its hundreds of equations.[59] The detail and complexity effectively exclude non-specialists from using it and evaluating the quality of its results.

NEMS remains the consensus choice of RPS modelers despite its problematic performance, which has not markedly improved since its 1994 unveiling.[60] It appears to predict some important variables accurately, but the seeming preciseness conceals major forecast inaccuracies in their components.[61] NEMS is but one of many long-range forecasting models that have consistently failed. One authority claims that "[l]ong-range energy forecasters have missed every important shift of the past 2 generations," noting that from the 1960s through 1980s their models overestimated both U.S. and world energy

57. ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, ANNUAL ENERGY OUTLOOK 2007 WITH PROJECTIONS TO 2030 (2007), http://www.eia.doe.gov/oiaf/aeo/pdf/0383(2007).pdf [hereinafter ANNUAL ENERGY OUTLOOK 2007].

58. Documentation issued in 2006 and the first half of 2007 alone runs to over 3,500 pages. See the various module references at ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, REPORTS & PUB. – MODEL DOCUMENTATION, http://tonto.eia.doe.gov/reports/reports_kindD.asp?type=model%20documentation (last visited Jan. 31, 2008).

59. Using the 2004 version of NEMS to project the effects of a national RPS, Nogee et al., *supra* note 55, at 36-38 say that they "generally used more pessimistic assumptions about available renewable energy supply, but more optimistic assumptions about costs and performance." They apparently chose not to try reversing the optimism and pessimism. Researchers using the 1999 NEMS found that assumptions about future technology and costs are more important determinants of wind power deployment than assumptions about site availability. *See* JULIE OSBORN ET AL, LAWRENCE BERKELEY NAT'L LAB., UNIV. OF CAL. BERKELEY, A SENSITIVITY ANALYSIS OF THE TREATMENT OF WIND ENERGY IN THE AEO99 VERSION OF NEMS (2001), http://repositories.cdlib.org/cgi/viewcontent.cgi?article=2121&context=lbnl.

60. Without making their own evaluation, COOPER AND SOVACOOL, supra note 4, at 33 say that "NEMS is so rigorous it is used as a benchmark for models employed by the [Union of Concerned Scientists] and the Tellus Institute in their own projections of renewable energy production." In fact, Tellus simply ran NEMS as part of a 2002 UCS study, and neither organization appears to have its own model of an RPS. *See* Alan Nogee et. al., *Clean Energy Blueprint: Increasing Energy Security, Saving Money, and Protecting the Environment with Energy Efficiency and Renewable Energy*,, 22 BULL. OF SCI., TECH. AND SOC'Y. 100, 104 (April 2002).

61. In five-year forecasts between 1982 and 1988 the mean percentage error of NEMS for total energy consumption was an impressive 0.1%. NEMS, however, overestimated industrial use by an average of 5.9% and transportation by 4.5%. Extrapolation of simple trends often provided superior results. James Winebrake & Denys Sakva, *An Evaluation of Errors in U.S. Energy Forecasts: 1982 – 2003*, 34 ENERGY POL'Y 3475, 3482 (2006).

Likewise, a seemingly accurate forecast for energy intensity per dollar of gross domestic project is the product of substantial offsetting forecast errors for energy use and GDP. Brian O'Neill & Mausami Desai, *Accuracy of Past Projections of US Energy Consumption*, 33 ENERGY POL'Y 33 979-993 (2005).

consumption by factors ranging from 10 to 200%.[62] Futures traded on the New York Mercantile Exchange predict gas prices more accurately than the NEMS gas market module.[63]

Longer horizons are particularly important for RPS studies, but NEMS-based forecasts depend heavily on assumptions about the costs of future technologies. Sometimes results appear quite unreal, for reasons that non-specialists will have difficulty deducing. A 2007 EIA study for the U.S. Senate of a 15% RPS for 2030 illustrates the difficulties. The simple extension of existing trends (see Figure 1) would predict a continuing increase in wind generation and little change in biomass. NEMS, however, projects a 400% increase in wind-generated power and a 700% increase in production from biomass conversion, leaving their 2030 proportions of renewable power at 16 and 68%.[64] The reversal may (or may not) reflect assumptions about technological improvements that are hard to determine from publicly available data.[65] As currently formulated, NEMS does not incorporate some potentially useful information that might sharpen its predictions, such as readily available data on proposed generation that currently show thousands of megawatts of wind capacity and very small amounts of biomass.[66]

C. Some Scenarios

1. Business as Usual and Beyond

A logical first step asks what will happen if current policies remain in effect, known as a "business as usual" [BAU] scenario. The model's evolution

62. Vaclav Smil, *Perils of Long-Range Energy Forecasting: Reflections on Looking Far Ahead*, 65 TECH. FORECASTING AND SOC. CHANGE 251, 262 (2000).

63. GABRIELLE WONG-PARODI ET AL., LAWRENCE BERKELEY NAT'L LAB., UNIV. OF CAL. BERKELEY, NATURAL GAS PRICES FORECAST COMPARISON - AEO VS. NATURAL GAS MARKETS (2005), http://repositories.cdlib.org/cgi/viewcontent.cgi?article=2880&context=lbnl.

64. ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, IMPACTS OF A 15-PERCENT RENEWABLE PORTFOLIO STANDARD 9 (2007). Exemplifying sensitivity to technological and cost assumptions, Nogee et. al. use slightly different assumptions to get a NEMS estimate that a "20 percent by 2020" national RPS will yield 28.5% of production from biomass and 58.9% from wind. This study also predicts decreases in both power and gas prices in all regions. Nogee et. al., *supra* note 60, at 39, 41; Power Generation Resource Incentives and Diversity Standards Before the S. Comm. on Energy and Natural Resources 109th Congress (2005) (statement of Alan Nogee, Director, Clean Energy Program, Union of Concerned Scientists), http://energy.senate.gov/public/index.cfm?FuseAction=Hearings.Testimony&Hearing_ID=1403&Witness_ID=4034&SuppressLayouts=True.

65. It appears that the EIA projects substantially greater rates of cost reduction for biomass than for wind. *See* ENERGY INFO. ADMIN, DEP'T OF ENERGY, ASSUMPTIONS TO THE ANNUAL ENERGY OUTLOOK 2007, ELECTRICITY MARKET MODULE 76, 78 (2007), http://www.eia.doe.gov/oiaf/aeo/assumption/pdf/electricity.pdf#page=3. It is, however, known that "mature" technologies (as wind is becoming) have significantly slower rates of cost decrease than less mature ones. Karen Palmer & Dallas Burtraw, *Cost-Effectiveness of Renewable Energy Policies*, 27 ENERGY ECON. 873, 887 (2005) [hereinafter Palmer & Burtaw].

66. ENERGY INFO. ADMIN., U.S. DEP'T. OF ENERGY, PROPOSED U.S. ELECTRIC GENERATING UNITS BY YEAR, MONTH, COMPANY AND PLANT, SEPTEMBER 2007 – AUGUST 2008, http://www.eia.doe.gov/cneaf/electricity/epa/epat2p2.html (last visited Feb. 29, 2008).

under BAU can then be compared with scenarios of alternative policies.[67] BAU itself yields some unexpected conclusions: Gas-fired and nuclear power production will remain near today's levels for the next twenty years, and power from coal-fired units will satisfy most demand growth.[68] Renewables (excluding hydroelectric) will produce only 3.6% of the nation's electricity in 2030, up from 2.3% in 2006, and fossil fuels will produce approximately the same percentage that they do today.[69] Few changes in BAU assumptions predict over 4% renewable power in 2030. Even if all existing state RPS standards are attained, renewables will produce only 29% more power than is generated under BAU, still under 5% of the national total.[70]

Other conclusions are common to most NEMS-based RPS studies. The first general finding is that a national RPS will increase power prices by relatively little, generally under 5% per kwh.[71] The low figure is the net effect of higher costs for renewables and falling gas prices as they replace gas-fired generators.[72] The seeming accuracy sometimes reflects offsetting errors. Nearly all recent state-level studies underestimated both the actual costs of renewables and the magnitudes of recent gas price increases.[73] Some studies omit important costs of integrating renewables into the grid, and nearly all assume permanence of an on-again off-again federal production tax credit on wind energy. Oddly, almost all pre-2005 studies assumed no future carbon regulation that might by itself induce greater investment in renewables.[74] In general NEMS predicts that almost any policy that does not compel investment in renewables will have little impact on their percentage of future power output. Even a combination of

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67. The EIA maintains its legally required neutrality by assuming (unless otherwise requested) that existing legislation, regulation and policy remain unchanged. *See* Andy S. Kydes, *Impacts of a Renewable Portfolio Generation Standard on US Energy Markets*, 35 ENERGY POL'Y 809, 814 (2007).

68. NEMS also projects the amounts and dates of future additions to nuclear capacity.

69. ANNUAL ENERGY OUTLOOK 2007, *supra* note 57, at 86. The models assume no new environmental laws beyond passage of the Bush administration's Clear Skies Act in 2010.

70. *Id*. at 87. The low figure reflects the fact that many of the renewables put in place under business-as-usual are in RPS states.

71. For a comparison of 26 studies, see CLIFF CHEN, RYAN WISER AND MARK BOLINGER, LAWRENCE BERKELEY NAT'L LAB., UNIV. OF CAL. BERKELEY, IS IT WORTH IT? A COMPARATIVE ANALYSIS OF COST-BENEFIT PROJECTIONS FOR STATE RENEWABLES PORTFOLIO STANDARDS (2006), http://www.repositories.cdlib.org/lbnl/LBNL-60536 (prepared for U.S. Dep't. of Energy) [hereinafter CHEN]. Only eight found residential rate increases over 1% in the terminal year of the RPS and five found decreases.

72. In April 2007, 27.3% of gas deliveries went to generators. *See* ENERGY INFO. ADMIN., DEP'T OF ENERGY, NATURAL GAS CONSUMPTION BY END USE, http://tonto.eia.doe.gov/dnav/ng/ng_cons_sum_dcu_nus_m.htm (last visited Feb. 1, 2008).

One tabulation of sixteen studies showed gas prices falling by amounts that ranged from zero to $1.58 per million BTUs with a mean of 18.6 cents. Price changes per kilowatt-hour (KWh) of electricity ranged from an 0.18 cent drop (i.e. 1.8 mills) to a 0.21 cent increase. The average impact on gas excludes two extremely high figures from the Union of Concerned Scientists and the American Council for an Energy-Efficient Economy, both of which favor a national RPS. RYAN WISER ET AL, LAWRENCE BERKELEY NAT'L LAB., UNIV. OF CAL. BERKELEY, PUTTING DOWNWARD PRESSURE ON NATURAL GAS PRICES: THE IMPACT OF RENEWABLE ENERGY AND ENERGY EFFICIENCY 6 (2004), http://repositories.cdlib.org/lbnl/LBNL-54971/.

73. CHEN, *supra* note 71, at 6.

74. *Id*. at 7.

carbon taxes and production tax credits raises renewables' share of total production in 2025 by only one percentage point.[75]

2. RPS, Emissions, and Wind

One does not need NEMS to see that a national RPS will cut carbon emissions by less than its percentage requirement—a rough consensus is that a 10% increase in renewable output reduces them by only about 6%.[76] This occurs because intermittently available renewables such as wind turbines (which will make up most of the renewable fleet) must be backed by gas-fired generators whose outputs can quickly adjust to fluctuations in wind velocity. Coal-fired generators produce more GHG per kwh hour generated, but they will be base-loaded because their output cannot be altered on short notice. Some renewables such as biomass and geothermal can be base-loaded and will displace coal, but the wind turbines that will dominate renewable investment primarily displace cleaner conventional energy.[77]

Wind is the only renewable whose output has increased significantly since 1990. An indexed production tax credit (PTC), currently 1.9 cents per kwh, first became law in 1992, and in 1998 investment began its upward trend. The PTC has expired and been temporarily extended four times, and investment has fluctuated accordingly.[78] The Energy Policy Act of 2005 extended the PTC to certain other renewables, but investment in them has yet to respond. Wind is the least site-specific renewable, and some large consuming areas are in easy transmission range of windy ones.[79] Wind units often encounter less local resistance than fossil plants and other renewables, and they can be grouped into large "farms." Two obstacles may stand in the way of wind's continued growth. First, localized hostility is growing as units grow in size, visibility (some over 400 feet high), and audibility. Second, wind's costs have greatly increased in recent years. Costs per installed kilowatt steadily declined from the 1980s through the early 2000s. They then rose by 60% per installed kilowatt between

75. The 2005 study assumed a $6/ton carbon charge that rises to $8.50 in 2025, and an annual $4 billion production tax credit in effect from 2006 through 2009. ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, IMPACTS OF MODELED RECOMMENDATIONS OF THE NATIONAL COMMISSION ON ENERGY POLICY 33 (2005), http://www.energycommission.org/files/contentFiles/EIA%20Analysis%20of%20NCEP%20Recommendations_440cc3e92e86e.pdf.

76. ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, IMPACTS OF A 10-PERCENT RENEWABLE PORTFOLIO STANDARD 19 (2002), http://tonto.eia.doe.gov/ftproot/service/sroiaf(2002)03.pdf; Palmer and Burtraw, *supra* note 65, at 884. The EIA figures were derived from NEMS, and Palmer and Burtraw's from Resources for the Future's "Haiku" model.

Haiku exhibits another unexpected outcome: When nondispatchable renewables like wind rise to 20% of capacity they begin to back out nuclear units. There are high- and low-cost nuclear plants, and when renewables are a large enough part of generation utilities minimize their costs by closing inefficient nuclear units and keeping coal-fired units in operation, even under carbon taxes. *Id.* at 883.

77. One study finds another unexpected effect: when nondispatchable renewables rise to 20% of capacity they begin to back out nuclear rather than fossil-fueled units. Some nuclear plants have operating costs that are higher than others. When renewables are this prominent, total costs are minimized by closing less efficient nuclear units and keeping coal-fired ones in operation. *See id.*

78. New annual wind investments in the tax credit years of 2001, 2002, and 2005 were 1,697, 1,687, and 2,431 MW. In non-credit years of 2000, 2002, and 2004 they were 67, 446, and 389 MW. *See* DOE/EERE, *supra* note 38.

79. There are concerns that the best wind sites in some areas are already taken and that unless costs continue to fall a permanent PTC will be necessary to sustain investment. *See id*. at E-4.

2003 and 2006, 18% between 2005 and 2006 alone. The most important part of the increase was an increase in turbine costs, which are expected to remain high over the near future.[80]

Many national RPS scenarios predict that the preponderance of compliance investments will be wind. Operating experience has confirmed that the costs of adding small amounts of intermittent renewables to an existing grid are low.[81] Random fluctuations in wind require the same type of response as fluctuations in load or minor generator outages. There is also general agreement that if wind passes some threshold level it begins to raise operating costs. Outages of wind units are more highly correlated than those of conventional plants, i.e. if it is calm at one location in a control area it is also relatively likely to be calm at others. [82] The most complete U.S. study to date examined the cost to a utility (4,600 MW peak load) of maintaining industry operating standards with alternative amounts of wind capacity.[83] Assume that a wind unit will be paid the marginal cost per kwh of conventional generation it replaces, net of payments to the system operator for balancing and load-following services. If there is only a small amount of wind capacity the system incurs no extraordinary cost and the wind unit's owner receives an average $30 per MWh over the year. As wind becomes more prominent it displaces high cost gas-fired generation and lowers system marginal cost, which lowers the price all generators receive. The return to wind plant owners is lower because the purchase price for its power has fallen, and because additional wind capacity raises its integration cost per megawatt. 1,000 MW of wind on this system lowers its net payment per MWh to $15, and 2,000 MW drops it to $8. If most investments to meet an RPS are wind, they will not be viable if they must bear the actual operating costs they impose on the grid. [84]

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80. RYAN WISER & MARK BOLINGER, U.S. DEP'T. OF ENERGY, ANNUAL REPORT ON U.S. WIND POWER INSTALLATION, COST, AND PERFORMANCE TRENDS: 2006 15-16 (2007), http://www.nrel.gov/docs/fy07osti/41435.pdf.

81. See studies summarized in J. Charles Smith et al, Address at the American Wind Energy Ass'n Global WindPower Conference, Wind Power Impacts on Electric System Operating Costs: Summary and Perspective on Work to Date (Mar. 28-31, 2004), http://www.uwig.org/windpower2004.pdf.

82. *See* Edward Kahn, *Effective Load Carrying Capability of Wind Generation: Initial Results with Public Data*, 17 ELECTRICITY J. 85 (Dec. 2004); Michael Milligan & Kevin Porter, *The Capacity Value of Wind in the United States: Methods and Implementation*, 19 ELECTRICITY J. 91 (Mar. 2006). For an opposing view from Europe, *see* TIMUR GUL & TILL STENZEL, INT'L ENERGY AGENCY, VARIABILITY OF WIND POWER AND OTHER RENEWABLES: MANAGEMENT OPTIONS AND STRATEGIES 23 (2005), http://www.iea.org/Textbase/Papers/2005/variability.pdf.

83. *See* Eric Hirst & Jeffrey Hild, *The Value of Wind Energy as a Function of Wind Capacity*, 17 ELECTRICITY J. 11 (July 2004).

84. Geothermal and biomass are the only dispatchable renewables. Renewable advocates commonly cite Denmark's 20% of power obtained from wind as a counterexample, and some claim that backup capacity is almost unneeded. WORLDWATCH INST. AND CTR. FOR AM. PROGRESS, *supra* note 4, at 16. In reality Denmark operates within a unified hydroelectric-based Scandinavian grid and also has strong interconnections with Germany. Wind produces about 2% of the power in this multi-nation region, which serves as a sink when Denmark's winds are strong and a source of non-wind generation when they are not. Denmark must pay premium prices for imports when the wind is not blowing, and receives only discounted prices (sometimes zero) for most exported wind power. WORLD NUCLEAR ASS'N, NUCLEAR ENERGY IN DENMARK (2007), http://www.world-nuclear.org/info/inf99.html; CAL. ENERGY COMM'N, REVIEW OF INT'L EXPERIENCE INTEGRATING VARIABLE RENEWABLE GENERATION; APPENDIX A: DEN. (2007), http://www.energy.ca.gov/2007publications/CEC-500-2007-029/CEC-500-2007-029-APA.PDF.

Wind's usefulness to a grid operator is further lowered by the general inverse association between peak loads and wind velocities. In (most) regions, on-peak velocities are also lower in summer than winter. At the five highest load hours of 2006, wind units in California produced an average of 12.2% of their nominal capabilities.[85] Average California wind generation during on-peak hours (7 AM to 10 PM) in July 2006 was 495 MW (21% of capacity) and 464 MW in August.[86] Similarly, the average output of Texas 2,800 MW of wind generators is 16.8% of capacity, most of which occurs off-peak. For system planning purposes its grid operator currently sets a wind turbine's "effective capacity" at 8.7% of its nominal amount.[87]

A transmission line to an isolated wind producing area contributes less to reliability than one embedded in a network. The former will only be fully loaded when winds are strong, raising the cost per megawatt-hour actually carried. A new line in a network often provides an alternative path for power if another one goes out of service, but losing a radial link to an isolated renewable means that none of its power can reach users. There are no available estimates of additional investment required under a wind-dominated national RPS.[88] Some local data, however, are emerging. The 10,000 MW of renewables (nearly all wind) in Texas' 2025 RPS will require between $1.7 and $3.0 billion in new transmission.[89] As noted above, meeting California's 2020 standard will require $5.7 billion of new high-voltage and substantial amounts of others. In both cases, the investment includes both direct connections for the renewables and other construction needed to maintain reliability.

3. The Economics of Falling Gas Prices

NEMS-based studies of a national RPS generally predict falling gas prices as renewables displace gas units. In some runs, it falls by so much that total spending on gas and power is reduced. Some RPS advocates see this as a "free lunch" that provides environmental benefits without cost. They err by failing to account for the wealth lost by those who supply inputs into gas production (workers, capitalists, equipment makers, etc.). A buyer who spends a dollar less on gas is better off (i.e. has a dollar's worth of new opportunities that were unavailable before), but someone whose income comes from gas production has exactly a dollar less of opportunities. The result is a transfer among the population rather than a net gain in the nation's wealth.[90] The costs and (non-

85. CAL. PUB. UTILITIES COMM'N, 2006 RESOURCE ADEQUACY REPORT 34 (2007), http://www.cpuc.ca.gov/word_pdf/REPORT/65960.doc. By contrast, on all but one of the five peaks solar units were operating between 88 and 108% of capacity. *Id.* at 36.

86. CAL. ISO, 2007 SUMMER LOADS AND RESOURCES OPERATIONS ASSESSMENT 33-34 (2007), http://www.caiso.com/1b95/1b95abb649df4.pdf.

87. Lawrence Risman & Joan Ward, *Winds of Change Freshen Resource Adequacy*, PUBLIC UTILITIES FORTNIGHTLY 14–18 (May 2007); ELEC. RELIABILITY COUNCIL OF TEX. INDEP. SYSTEM OPERATOR, TRANSMISSION ISSUES ASSOCIATED WITH RENEWABLE ENERGY IN TEXAS 7 (2005), http://www.ercot.com/news/presentations/2006/RenewablesTransmissi.pdf (Informal White Paper for the Tex. Leg. 2005) [hereinafter ERCOT].

88. Note that the relevant comparison is between investments required to integrate renewable generation and those required for conventional plants.

89. ERCOT, *supra* note 87, at 10.

90. Assume for simplicity that a fixed amount of gas goes to market each month regardless of price, i.e. its supply curve is vertical. A national RPS shifts the demand curve for gas inward and reduces its price. The

environmental) benefits of a national RPS are created in the market(s) for electricity. The renewables the RPS brings forth will have production and capital costs that differ from those of conventional plants. Changes in the price and output of power will affect the well-being of producers and consumers. Owners of conventional generators will fare differently from owners of renewables, and exactly what happens to the former depends on the local generation mix.[91]

Even if the price of gas falls it is unlikely to stay low. If the gas market is competitive and near equilibrium just before the RPS takes effect, the highest-cost producer will just break even. An RPS shifts the demand curve for gas leftward, and hence its price falls. Producers that formerly broke even or made small profits will take losses and wish to exit from the market. When they can disinvest they will leave the industry and their former production will be subtracted from market supply. As the adjustment takes place, price will rise and gas consumers will enjoy smaller benefits.

VI. STATE RPS EXPERIENCES

A. Why Examine the States?

Any RPS must be an ambitious exercise in institutional design. States with RPS have had to formulate definitions of eligible renewables, put institutions in place to monitor compliance and crediting, and set penalties for noncompliance. A federal RPS will be further complicated by constraints that are imposed by the industry's dual regulatory system. The Federal Energy Regulatory Commission (FERC) has jurisdiction over "wholesale" exchanges of power and transmission, defined as those that are intended for ultimate resale to end-users. State commissions regulate "retail" rates charged to end-users and monitor the planning and prudence of utilities' generation and transmission investments. The FERC has no powers to compel or prohibit generation investments, and states are unlikely to shed their existing authority without a fight. States also have primary jurisdiction over the siting of new plants and lines.

Interactions between state and federal regulators under a national RPS will be complex, time-consuming, and costly to administer. Before committing to a federal RPS it may be useful to examine the actual organization and performance of state programs. Positive state results would be encouraging news for supporters of a federal regime. If the states have performed poorly or indifferently, advocates of a national RPS should explain why it will not produce similar results. State regulators require compliance reports from utilities and have varying amounts of discretion to impose penalties.[92] Some states have seen

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same volume per month changes hands, but the amount saved by the buyer of a unit equals the amount lost by its suppliers. The same reasoning holds for an upward-sloping supply curve. For a graphical demonstration see RYAN WISER ET AL, *supra* note 72, at 6.

91. Even if there are carbon taxes, efficient coal-fired plants in coal-dominated areas will remain profitable, and those in gas-dominated areas are likely to thrive. This unexpected result reflects the impact of added renewables and carbon taxes on market prices of power. For more on the effects of carbon taxes, see Victor Niemeyer, *The Change in Profit Climate*, PUB. UTIL. FORTNIGHTLY 20–26 (May 2007).

92. A few have set percentage "goals" with no penalties for noncompliance. They include North Dakota, Missouri, Virginia, and Vermont. *See* DSIRE, *supra* note 1.

little enforcement activity because RPS is not yet a binding constraint, and others are still formulating rules. Some legal definitions of compliance and crediting may not be clear, as is being demonstrated in California (see below). There are also escape provisions for noncompliant utilities. All but one RPS state has some type of price cap on renewables, and a utility is deemed in compliance (or exempt) if it cannot find any at or below that price.[93] Resource availability can also be a matter of definition. Minnesota exempts utilities that are under "economic and competitive pressure," and Pennsylvania does so if resources are not "reasonably available."[94]

B. Some State Experiences

The growing national RPS literature has given very little attention to the performance of state RPS programs, and what discussions exist are often vague or misleading. One RPS proposal describes the "impressive progress" of California, Nevada, and New York, which have in reality made little or none.[95] Seeking evidence of similar progress, the Worldwatch Institute notes that: "Several states are demonstrating just how quickly renewable energy can take hold with the right policies. California already gets 31 percent of its electricity from renewable resources; [and] 12 percent of this [i.e. 4 percent of the state total] comes from non-hydro sources."[96]

In reality Californians received approximately the same percentage of their power from nonhydro renewables in 2006 as they did in 1995, despite enactment of an RPS in 2002.[97] Most of the hydropower comes from large federal and utility-owned dams built before 1950, 23% from other states in 2006.[98] A report by Barry Rabe for the Pew Center on Global Climate Change also views state experiences favorably. "In a number of instances, RPSs have clearly played a central role in fostering rapid and significant expansion of the amount of

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93. The exception is Maine, 40% of whose current capacity is renewable under a 30% RPS. ENERGY ADVISORS, LLC, MAINE ENERGY POLICY: OVERVIEW AND OPPORTUNITIES FOR IMPROVEMENT 64 (2003), http://www.maineenergyinfo.com/docs/EnergyReportText.pdf.

Some states (e.g. Massachusetts) require that if actual generation is unavailable a utility pay its penalty into a research and development fund.

94. Karlynn S. Cory & Blair G. Swezey, *Renewable Portfolio Standards in the States: Balancing Goals and Rules*, 20 ELECTRCITY J. 21, 27 (May 2007).

95. Sovacool and Cooper, *supra* note 42, at 20. Most of California's and Nevada's progress (see below) was actually made before enactment of their programs.

New York's program is administered by the New York State Energy Resources and Development Authority (NYSERDA). In 2004 19.3% of the state's power came from renewables (including hydro). The RPS set a goal of 25% by 2013, largely funded by production subsidies. The program has two tiers, one consisting of large-scale projects that will sell into the New York Independent System Operator's markets, and the other (3% of the total) consisting of small resources that operate "behind the meter" supplying individual users. New first-tier plants were targeted to produce 1.1 million MWh in the initial year of 2006. Netting out contract failures and construction delays, actual output was 0.58 million, 52% of the target. *See* N.Y. ST. ENERGY RES. AND DEV. AUTH., NEW YORK STATE RENEWABLE PORTFOLIO STANDARD, PERFORMANCE REPORT PROGRAM PERIOD ENDING MARCH 2007 4-8 (2007), http://www.nyserda.org/rps/2006RPSPerformanceReport.pdf.

96. WORLDWATCH INST. AND CTR. FOR AMERICAN PROGRESS, *supra* note 4, at 7.

97. *See infra* pp. 128-33, for detailed discussion of California.

98. CALIFORNIA ENERGY COMM'N, 2006 GROSS SYSTEM ELECTRICITY PRODUCTION, http://www.energy.ca.gov/electricity/gross_system_power.html (last visited Jan. 19, 2008).

renewable energy provided in a state."[99] Apparently seeking to justify this claim, his report examines five states chosen for their representativeness and diversity:[100]

- *Texas* is the only state in full compliance with an RPS that has required substantial generation investment. In early 2007 it met its 2009 quota of 2,000 new renewable megawatts in territories that were open to retail competition. All utilities and competitive retailers are required to obtain a percentage of their supplies from renewables or obtain credits for them. Nearly all of the added capacity is wind. The RPS has since been extended to 5,000 MW of renewables by 2015 and a non-binding goal of 10,000 by 2025, at least 500 of which are to be non-wind. Texas has built its required renewables, but the Pew Report does not examine their actual contributions to power supply and reliability discussed above.
- *Massachusetts* required that 1% of all delivered power per year be from renewables between 1998 and 2002, after which the amount was to rise by 0.5% per year through 2009. Wind was expected to dominate compliance investments, but rural residents, environmentalists, and elected officials have successfully stopped or delayed most construction. Utilities used banked credits from 2002 to achieve compliance in 2003, fell 32.6% short in 2004, and 37.4% in 2005. They failed to comply despite a required payment to the state, currently $55.13 for each deficit MWh.[101]
- The Pew report asserts that *Nevada* could become the "next Texas," thanks to its geothermal capabilities and empty, windy deserts.[102] Its RPS requires annual progress to 20% by 2015, with 5% of renewables solar at that date.[103] Nevada's utilities have signed contracts with renewables providers that nominally

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99. BARRY RABE, PEW CTR. ON GLOBAL CLIMATE CHANGE, RACE TO THE TOP: THE EXPANDING ROLE OF U.S. RENEWABLE PORTFOLIO STANDARDS (2006) vi http://www.pewclimate.org/docUploads/RPSReportFinal.pdf [hereinafter RABE].

100. *Id.* at 10.

101. DIV. OF ENERGY RES. EXECUTIVE OFFICE OF ENERGY AND ENVTL. AFFAIRS, COMMONWEALTH OF MASSACHUSETTS RENEWABLE ENERGY PORTFOLIO STANDARD ANNUAL RPS COMPLIANCE REPORT FOR 2005 4, 9 (2007), http://www.mass.gov/doer/rps/rps-2005annual-rpt.pdf.

102. RABE, *supra* note 99, at 16. Nevada currently has no wind projects in operation.

103. Cooper and Sovacool's 2007 report also speaks well of Nevada's RPS. They note that at the time of enactment it:

> [S]et the target level *above* the state's existing level of renewable generation . . . Sierra Pacific and Nevada Power held their first solicitation for renewable energy in late 2001 and received 49 bids at very competitive prices for 4,300 MW of eligible power . . . By making its targets large enough, the statute successfully promoted new renewable energy development. Most recently, for instance, Nevada Power signed a 17 year power purchase agreement to build an 85.5 MW wind site . . . .

Cooper and Sovacool, *supra* note 4, at 137. Despite the availability of present-day data on compliance, Cooper and Sovacool's source is an unpublished 2002 study from the Lawrence Berkeley National Laboratory. It states that Nevada's 2001 bids were at "*reportedly* very competitive prices," (emphasis added) which is probably the most that can be said in light of confidentiality requirements. RYAN WISER & MARK BOLINGER, UNIV. OF CAL., LAWERENCE BERKELEY NAT'L. LAB., RENEWABLE PORTFOLIO STANDARDS: BACKGROUND AND ANALYSIS FOR N. Y. STATE (May 2, 2002), http://www.dps.state.ny.us/rps/rpsbackgroundpaper.pdf.

put the two of them taken together into compliance with its RPS.[104] Nevada Power met its 2006 requirement by purchasing 1.02 million kwh of credits from Sierra Pacific Power. As opposed to quantities under contract, the actual outputs of renewables are well below the utilities' quotas, currently 9%.[105] Both are also in deficit on their solar quotas.

- *Pennsylvania* enacted a two-tiered "Alternative Energy Portfolio Standard" in 2005. The first tier consists of non-hydro renewables and includes an 0.5% solar setaside. The second includes incinerated trash and waste coal. Tier 1 facilities are to generate 8% of the state's power by 2021, and Tier 2 10%.[106] Utilities are exempt from its provisions during their authorized periods for recovery of transition costs incurred in connection with restructuring. The alternative energy requirement began to run for three of them on Feb. 28, 2007, and the rest will begin on or before Jan. 1, 2011.[107] As of this writing, no data on compliance are publicly available.
- *Colorado* in 2004 became the first state to bypass its legislature and enact a 10% 2015 RPS (including a 4% solar setaside) by referendum.[108] In 2007 its legislature increased the requirement to 20% by 2020, with a 4% solar setaside. Unlike most other RPS states, its municipal and cooperative utilities must also comply, but at a lower level than investor-owned systems. Statewide compliance data are not currently available.[109]

The Pew Report expresses optimism over the future of these states' programs, but their actual records provide little reason for such a hopeful judgment. Only Texas is clearly in compliance with its own RPS, and its nearly 3,000 MW of wind capacity produced only 1.8% of its electricity in 2006, often

104. The two utilities are operating units of the same holding company, but are only weakly linked by transmission.

105. Using available reported data, Nevada Power appears to have obtained about 3% from renewables and Sierra Pacific 6%. *See* Original Filing, *Nev. Power Co.*, No. 07-04005 (Pub. Utilities Comm'n of Nev. Apr. 2, 2007), http://pucweb1.state.nv.us/pucn/ (follow "Dockets"; then follow "All Dockets"; then follow "View" for 07-04005; then follow "original filing").

106. Implementation Order, *Implementation of the Alternative Energy Portfolio Standards Act of 2004*, No. M-00051865 (Pa. Pub. Util. Comm'n. Mar. 23, 2005), http://www.puc.state.pa.us/PcDocs/534798.doc.

107. PA. PUB. UTIL. COMM'N, ELECTRIC POWER OUTLOOK FOR PENNSYLVANIA 2006-2011 9 (2007), http://www.puc.state.pa.us/General/publications_reports/pdf/EPO_2007.pdf.

108. Washington State passed a 15% 2020 requirement by referendum in November 2006.

109. A rough percentage can be derived by taking federal data on MWh generated from renewables, netting out those from hydroelectric facilities (all classified as renewable by the EIA), and expressing them as a percentage of total retail sales. By this calculation, 1.8% of Colorado's output in 2006 came from renewables. It is, however, subject to some biases: It does not account for renewable power imported into and exported from the state, and excludes an unknown quantity of hydroelectric production from small facilities (admissible under its RPS law) but not separable from other hydro in the source. *See* ENERY INFO. ADMIN., DEP'T OF ENERGY, STATE ELECTRICITY PROFILES 2006 (2007), http://www.eia.doe.gov/cneaf/electricity/st_profiles/sep2006.pdf; ENERGY INFO ADMIN., DEP'T OF ENERGY, RENEWABLE ENERGY CONSUMPTION AND ELECTRICITY PRELIMINARY 2006 STATISTICS (2007), http://www.eia.doe.gov/cneaf/solar.renewables/page/prelim_trends/rea_prereport.html.

at hours when it was of little value.[110] One of Nevada's two utilities is overcompliant and the other in deficit, but the exchange of credits between them has little meaning because of their weak interconnections. Massachusetts was out of compliance within a year after its requirements became binding, and environmental difficulties may render it dependent on external resources for the long term. No Pennsylvania utilities had to be in compliance with their state's RPS at the time of the Pew Report, and data from those currently subject to reporting requirements are not yet available. Likewise, Colorado's program appears too new to draw any firm conclusions about present-day compliance or future prospects for it.

C. California: Gestures and Strategies

1. How Large a Shortfall?

Recent events in California shed light on the forces that influence RPS design and attitudes toward enforcement and compliance. California's RPS began with a 2002 law that required the state's three major corporate utilities to obtain 20% renewable power by 2017, subsequently advanced to 2010. A 2005 resolution put the legislature on record as favoring an RPS of 33% by 2020. The laws require renewable power to rise by at least 1 percentage point per year. Figure 5 shows clearly that this has not happened, and that the 2010 goal will surely go unmet. Since the mid-1990s renewable power has remained at between 11 and 14% of the utilities' total supply.[111] In 2003 the California Public Utilities Commission (CPUC) estimated that compliance would require 4,200 MW of new renewables in operation by 2010. Between the 2002 inception of the RPS and January 2007, only 242 MW of renewables came on-line.[112] The percentage is currently on a downtrend. 14% of investor-owned utilities' power supplies were renewable in 2003, 13.7 in 2005, and a provisional total of 13.1% in 2006.[113]

Utilities claim to be in compliance with the RPS law on the basis of contracts entered into with developers, a position possibly inconsistent with legal language that compliance equates to actual production from renewable generators. As of January 2007 the three utilities had contracted for between 2,552 and 3,936 MW of renewables, most not yet under construction or even in the siting process.[114] The California Energy Commission estimates a cost of $1.2

110. The percentage was calculated by the method described in note 99 *supra* and may be subject to some of the same potential inaccuracies. Most Texas resources, however, are in a region that is only minimally interconnected with other regional grids.

111. CAL. ENERGY COMM'N, 2006 INTEGRATED ENERGY POLICY REPORT UPDATE 4 (2007), http://www.energy.ca.gov/2006publications/CEC-100-2006-001/CEC-100-2006-001-CMF.PDF. All CPUC-jurisdictional retailers must satisfy the RPS, but the state has yet to finalize a rule for non-utility providers who continue serving customers that left their utilities when bypass was legal in the 1990s.

112. *Id.* at 4.

113. CAL. ENERGY COMM'N, 2007 INTEGRATED ENERGY POLICY REPORT 165 (2007), http://www.energy.ca.gov/2007publications/CEC-100-2007-008/CEC-100-2007-008-CMF.PDF.

114. The range reflects the fact that some contracts have build-out options. They include a total of 800 MW of "Stirling engine" solar arrays for Southern California Edison and San Diego Gas & Electric, with another 950 MW of build-out options. Their desert footprints will total over ten square miles. The largest existing installations of this type have capacities of 150 kilowatts. Wind and solar power account for nearly all

billion for transmission necessary to carry all of the claimed 2010 compliance capacity.[115] Even if the contracts are valid measures of compliance, a 2006 study for the Commission estimates that 20 to 30% of them will fail.[116]

2. Why the Lack of Compliance?

Utilities' seeming noncompliance has many possible causes. Both electrical and non-electrical developers in California face high costs and protracted delays in obtaining permits for new construction and land-use changeovers. Electrical facilities probably face greater barriers than others because of their visual prominence, their possible emissions, and their other effects on environmental amenities and nearby real estate values. Permits are harder to obtain in wealthier and more densely populated areas, as well as those (e.g. coastal regions) that demonstrate heightened environmental concerns. The state's electrical regulatory policies have been in flux since the collapse of its restructuring experiment in 2001-2002, and the accompanying uncertainties have surely had an effect on generation investments by both utilities and non-utilities.

Penalties for non-compliance may also play a role in explaining the shortfall. California has yet to levy any penalties on utilities that are out of compliance or even to initiate regulatory dockets that could terminate in assessments. Even if the penalties are imposed with certainty, however, their dollar impact will probably be small. A utility whose renewables are out of compliance pays 5 cents for each deficit kwh, but its potential fine is capped at $25 million per year. It can avoid this fine if renewables are too expensive and the state has no funds to cover the difference between the actual price and a regulator-set cap.[117] Worst-case noncompliance leaves a utility with a maximum exposure of $25 million per year, and actual penalties could be as low as zero. Other aspects of the political climate may also explain a lack of compliance, but they are beyond our current scope. Having enacted seemingly stringent new standards, legislators may have little to gain politically by vigorously enforcing

of the remaining contracts, but transmission to some sites does not yet exist and may not be in place by 2010. *See California's Big Solar Plants on Track, Say Developer and Utilities*, POWER MARKET TODAY, July 5, 2007, at 4; Craig D. Rose, *Powerlink's Supply Called into Question*, SAN DIEGO UNION-TRIBUNE, July 11, 2007.

115. CAL. ENERGY COMM'N., INTERMITTENCY ANALYSIS PROJECT: FINAL REPORT 26 (2007), http://www.energy.ca.gov/2007publications/CEC-500-2007-081/CEC-500-2007-081.PDF. Total transmission investment (both new and replacement) by U.S. investor-owned utilities in 2005 was $5.8 billion. *See* EDISON ELECTRIC INST., *supra* note 14.

116. KEMA, INC., BUILDING A "MARGIN OF SAFETY" INTO RENEWABLE ENERGY PROCUREMENTS: A REVIEW OF EXPERIENCE WITH CONTRACT FAILURE (2006), http://www.energy.ca.gov/2006publications/CEC-300-2006-004/CEC-300-2006-004.PDF (prepared for Cal. Energy Comm'n). In KEMA's national sample of renewable contracts (which included failures), only half of the capacity was actually on track for timely completion.

117. The cap is known as a "market price referent," determined by the cost of an efficient gas-fired generator. The funds come from banked "public goods surcharges" that customers paid in the past. If they run out, the utility gains an exemption from its RPS. Opinion Conditionally Approving Procurement Plans for 2006 RPS Solicitations, Addressing TOD Benchmarking Methodology, and Closing Proceeding, *Order Instituting Rulemaking to Implement the California Renewables Portfolio Standard Program*, NO. 04-04-026, at 25 (Cal. Pub. Util. Comm'n 2006), http://www.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/56685.htm. *See also* RYAN WISER ET AL, LAWRENCE BERKELEY NAT'L. LAB. CALIFORNIA, UNIV. OF CAL. BERKELEY, RENEWABLE ENERGY POLICY AND IMPLEMENTATION ISSUES, (1996), http://eetd.lbl.gov/ea/ems/reports/39247.pdf.

them. At the same time, utilities and other interest groups may see the RPS as another arena in which to advance their own causes, possibly by maintaining less than full compliance with its standards.

E. The Federal Alternative

Currently no RPS states are actively contemplating the elimination of their requirements. Some appear likely to enact programs and still others are quite unlikely to do so. Absent a federal requirement this division between RPS and non-RPS states will persist, and RPS programs will remain heterogeneous. Some advocates argue that interstate differences taken by themselves suffice to justify imposition of a national program.[118] Even if we grant that RPS at some level of government is desirable on economic grounds (as this author does not), the case for a federal program is not an easy one. Probably the most common argument for centralization is that some states or regions will be free riders that benefit from the policies of others without bearing their costs. As seen above, however, there are reasons to doubt both the logic and the data that have been adduced as evidence of free riding that must be centrally controlled.[119] There are three other possible rationales for a national standard. First, a uniform RPS could be designed and implemented to produce more economic benefits than today's mix of state programs. Second, even an imperfect national RPS could save administrative costs and reduce barriers to trade that have resulted from heterogeneity among the states. Third, a federal RPS could reduce uncertainties that currently discourage investment in renewables. These reasons are also logically weak or empirically questionable.

Regarding the first rationale, RPSs may be generically inefficient institutions, but some can be more efficient than others. An RPS whose provisions recognize resources and institutions unique to a state may be superior to one that disregards them for the sake of uniformity. A state with abundant gas-fired generation will be better able to integrate intermittent renewables than one that is more dependent on coal or nuclear resources. One whose system is administered by a Regional Transmission Operator may have lower costs than one containing a number of separate control areas. Differences can also reflect preferences of electorates or elected officials. Arizona and Nevada have solar power setasides that reflect opportunities inherent in their climates, but New Jersey's similar requirement is more likely symbolic of local attitudes.

There are two broadly differing scholarly attitudes on state vs. federal regulation, which may of course depend on the activity being regulated. On one side are those who see the content of desirable regulation as clear from the outset, with little uncertainty about the markets to be regulated and the efficacy of a proposed regulatory mechanism. On this view, heterogeneous state regulatory provisions reflect either unimportant differences or errors that a uniform standard can rectify. The differences might even be evidence of a "race to the bottom" in which governments compete for the support of interest groups by producing regulations of low quality that fail to satisfy the public interest. The other attitude sees pervasive uncertainty in the regulatory process, where even with well-defined objectives the form and content of regulation are likely to

118. *See e.g.*, COOPER AND SOVACOOL, *supra* note 4, at 19, 74.

119. *See supra* Parts IV.B, IV.C.

be unknown in advance.[120] If so, competition among the states may improve regulation as they learn from each others' successes and failures.[121] This learning process is particularly valuable if policy must (for some reason) take such a hitherto untried form as an RPS. Some renewables advocates view the evolution of state RPS programs as evidence of a "race to the top," fostering innovations that facilitate efficiency and growth.[122] Allegations that the evolution of state RPS programs demonstrates a race to the bottom have yet to surface.

The second rationale for centralization is currently being proven unnecessary. Wholesale transactions in both conventional and renewable energy take place in growing regional markets under FERC jurisdiction. These markets can easily distinguish resources with different characteristics (e.g. intermittency) and already do allow contracts that price them efficiently. Proposals for a national RPS generally include design of a mechanism to trade and register credits, but existing markets and regional organizations are already taking on this job. A consortium of western states (both with and without RPS) has formed the Western Renewable Energy Generation Information System (WREGIS), administered at the headquarters of the Western Electricity Coordinating Council.[123] The WREGIS has been formed "to provide a single institution in the West that will issue, register and track renewable energy certificates for use in verification of compliance with state regulatory and voluntary market programs."[124]

It is hard to substantiate various claims that state RPS differences foreclose renewable and REC transactions that would have occurred under a national standard.[125] Even if a transaction between a particular buyer and seller is foreclosed, both may well have alternative counterparties in other states. Losing

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120. We do know that economic efficiency is an important determinant of choices between uniform and non-uniform laws. For data on the adoption and non-adoption of uniform laws proposed by the National Conference of Commissioners on Uniform State Laws, see Larry Ribstein & Bruce Kobayashi, *An Economic Analysis of Uniform State Laws*, 25 J. LEGAL STUD. 131 (1996).

121. This argument has appeared frequently in discussions of the evolution of U.S. state incorporation statutes. *See* Roberta Romano, *The Tenuous Case for Mandatory Corporate Laws*, 89 COLUM. L. REV. 1599 (1989).

122. See RABE, *supra* note 99, who wants to see more federal-state cooperation and interstate protocols to enhance trade in RECs, but does not endorse a federal RPS. *See also* Barry Rabe at the Pew Center on Global Climate Change, Race to the Top: The Expanding Role of U.S. Renewable Portfolio Standards (Jun 15, 2006), http://www.eande.tv/transcript/380 (E&E Television interview).

123. The formation of institutions like the WREGIS should be compared with metaphors of impossibility used by advocates of a national standard. Cooper and Sovacool assert that, "[i]f America's interstate highway system were structured like our renewable energy market, drivers would [be forced] to change engines, tire pressure, and fuel mixture every time they crossed state lines." COOPER & SOVACOOL *supra* note 4, at 25.

In reality state vehicle regulations differ substantially and have few discernible effects on commerce. All states regulate maximum truck weights, lengths, and numbers of axles (among others), consistent with differences in terrain, climate, and highway engineering. Weigh stations at state lines can economically check trucks and enforce compliance. There are far cheaper solutions to interstate differences than Sovacool and Cooper's hypothetical engine exchange, and state governments generally attempt to facilitate commerce rather than obstruct it.

124. *See* DEVON WALTON, DIRECTOR OF ENVIRONMENTAL MARKETS – APX INC., WREGIS, EXISTING REGISTRIES, AND RECS/GHG TRACKING AND TRADING (CPUC/CEC Workshop Sept. 2007), ftp://ftp.cpuc.ca.gov/puc/energy/electric/renewableenergy/APX_Thurs.ppt.

125. COOPER AND SOVACOOL, *supra* note 4, at 25-28.

the best transaction cuts the benefits of exchange, but only by the difference between the lost exchange and the next best one. The only barriers cited in Cooper and Sovacool's work favoring a federal standard involve differences in protocols among the three northeastern Regional Transmission Operators that would still exist under a national RPS. They reflect continuing problems at the "seams" between RTOs, differing technical standards, and differences in market institutions that cannot easily be harmonized. They are not the creations of state regulators. Interstate differences in defining renewables and RECs can appear formidable, but estimates of their actual effects have yet to be produced.[126]

The third rationale for centralization is that jurisdictional fragmentation can increase uncertainty. Investors will demand high returns if they do not have reasonable assurance that some degree of institutional stability will prevail. Operating under several state regulators increases uncertainty, but concerns about federal law have proven important in practice.[127] The source of uncertainty most often cited by RPS advocates is the federal Production Tax Credit on wind energy, whose presence has dramatically influenced investment.[128] It has been enacted, expired, and re-enacted four times. No state RPS law contains any comparable risks, and any legal change applies only to that state. Repeal or amendment of a federal law affects the entire nation.

The states' experiences suggest that a stable RPS program is only one element of a climate conducive to renewable investment. RPS laws in Texas and California have many analogous provisions, but Texas achieved early compliance while California has not even maintained a constant percentage of supply from renewables. The collapse of California's markets in 2001 brought legislation whose passage increased uncertainty, and its regulatory policies remain subject to almost-random change. The California Independent System Operator's new market institutions have yet to begin operation after nearly six years of experimentation and rule changes. Still more uncertainty will accompany implementation of the state's novel GHG policies. An RPS law leaves other institutions in place, and some of them may have greater impacts on investment than an RPS itself.

Finally, most advocates of a national RPS have said little about federal and state regulatory jurisdiction. State commissions determine both retail rates and

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126. Cooper and Sovacool describe Global Energy Decisions renewables study, and claim that its authors: "analyzed two national RPS scenarios, one without a nationwide REC system, and one with. They found that a national REC trading scheme would save utilities $14 billion compared to a RPS without uniform trading rules." COOPER AND SOVACOOL *supra* note 4, at 48 (one footnote omitted).

In reality $14 billion is the difference between two nonexistent situations: one that assumes absolutely no REC trading and one that assumes uniform market rules for all then-existing RPS states. This is not a "nationwide" system that imposes a single RPS on all states. In fact a national RPS would diminish these benefits. Resources in non-RPS states that utilities in RPS states currently purchase for credits would be off the market and used to satisfy their utilities' own national RPS requirements.

127. COOPER AND SOVACOOL, *supra* note 4, at 50-51. Their only non-legal citation on regulatory differences is to a PacifiCorp executive's 2005 congressional testimony expressing concern about state policies toward renewables. PacifiCorp operates in eight states, more than any other utility. As of 2007 it intended to install 2,000 MW of renewables by 2013, and its web site does not mention differences in state law. PacifiCorp Website, http://www.pacificorp.com/Navigation/Navigation551.html (last visited Jan. 30, 2008).

128. New annual wind investments in the tax credit years of 2001, 2002, and 2005 were 1,697, 1,687, and 2,431 MW. In non-credit years of 2000, 2002, and 2004 they were 67, 446, and 389 MW. *See* DOE/EERE, *supra* note 38, at E-4.

requirements for new generation and transmission to meet anticipated load growth. They will continue to have those powers under a national RPS, but federal compliance requirements may impose new constraints on them. The situation may mirror the concerns that state regulators have expressed about the Energy Policy Act of 2005's grant of federal "backstop" authority over the siting of certain transmission lines that states have not approved. Lengthy regulatory proceedings and court tests on transmission will surely occur in the near future. The same will happen for generation under a national RPS, perhaps even more confrontational because generation is a larger percentage of delivered power costs. The FERC cannot compel investment in generation, but the penalty provisions of a national RPS would coerce utilities into constructing generation (or arranging RECs) that state regulators might not approve. Many questions remain. May a utility be excused if it made a good-faith effort to gain state regulatory approval for a national RPS compliance investment but was refused? What if a proposed facility is not reachable because state regulators have blocked transmission to it? What if state-level intervenors introduce interminable litigation and regulatory proceedings to stop a compliance project? A national RPS threatens a larger displacement of state regulatory authority than any policy change since open access, and state regulators now know how to fight wars of attrition.

VII. CONCLUSIONS

A national RPS has appeared in legislation or proposed legislation eighteen times since 1997.[129] Its continuing appeal is more the result of its rhetorical force and political expediency than its likely consequences for electricity and the environment. RPS at any level reverses decades of hard-won progress in determining standards and developing institutions for the efficient control of criteria pollutants. It is also inefficient as GHG policy. It concentrates on using a certain technology rather than directly addressing emissions, and its alternatives in a comprehensive GHG policy have yet to be spelled out. Current trends suggest that wind power will constitute the great majority of compliance investments, but ensuring the reliability of a wind-dependent grid will require major transmission investments and continued reliance on conventional generation. Biomass and geothermal power have not yet passed the market test and solar power is a negligible presence, leaving wind to power any renewable future. Wind's intermittency implies that it will primarily displace gas-fired generation, while coal plants that pollute more heavily remain base-loaded. Among the few NEMS forecasts we can accept with confidence are its projections of substantial new investment in coal, gas, and possibly nuclear generation to keep up with even conservative estimates of load growth.

The seeming simplicity of a national RPS conceals design and implementation issues seldom mentioned by advocates. Like any other novel regulation it will entail detailed rulemakings, data collection, and procedures for enforcing compliance. Other environmental programs may have been coherently implemented, but this experience need not be dispositive for a national RPS. Whether it applies to states or utilities, its impacts will depend importantly on

129. COOPER AND SOVACOOL, *supra* note 4, at 17-18.

accidents of geography. Regions have vastly differing mixes of potential renewable resources, and areas with already high amounts of renewable generation will be less burdened than those without them.[130] Since most of the response to a national RPS will be investment in wind, advocates' expectations that source diversity will mitigate its distributional effects will probably not be fulfilled. Instead, some areas will be chronically burdened with REC payments that in effect make them pay for cleaner air that benefits the residents of distant regions. The relatively windless southeast will encounter such a fate, despite its array of coal-fired plants that are expected to remain in compliance with existing environmental regulations. One likely intent of an RPS is to advantage gas-dependent areas and disadvantage those that have fewer renewable opportunities and currently depend on coal.[131]

Advocates of a national RPS have also said little about the jurisdictional conflicts it will create between state and federal regulators. State regulators set cost-based retail rates and have authority over utilities' planning of generation and transmission additions, while the FERC has authority over wholesale transactions, even if the parties are in the same state. It is not easy to see how disagreements over investments made by utilities for compliance will be resolved. A requirement that state regulators include all of a utility's compliance investments (including RECs) in its rate base (on which it earns the allowed return) takes away an important part of their authority with no corresponding benefit. Allowing state regulators to disallow investments intended for compliance leaves the federal authorities with question of how to treat them. (Even if the legal answer is clear the political answer is not.) Federal regulators will be at least a shadow presence in state procurement proceedings, and probably an unappreciated one.[132] Most proposals for a federal RPS differ from existing state programs in having no price cap on renewables that will excuse a utility if renewable power is unavailable for less.[133] The political problems of reconciling state price caps with an uncapped federal program also remain unexplored.[134]

State regulators have substantial resources at their disposal to protect ratepayers from high renewables prices. In practice they exercise discretion in enforcing compliance, a task facilitated by price caps on renewables. Pervasive noncompliance makes clear that once a state RPS becomes law it can almost be forgotten. Excepting environmentalists and renewables producers, few organized interests benefit from tighter monitoring of compliance. The

130. Unlike some state programs, most federal RPS proposals intend to grandfather existing renewables into compliance rather than counting only post-RPS investments.

131. Cross-state regression analysis shows that existing RPS programs are "luxury goods," more likely to be enacted in high income states even if their power prices are already high. Greater dependence on coal significantly lowers the probability of a state RPS, even after accounting for income differences. Robert Michaels, *Where Renewables Come From – and Don't*, NEW POWER EXECUTIVE, Feb. 28, 2007, at 1.

132. A national RPS impacts both environmental and energy policy, but the House-passed measure fails to mention either the EPA or the FERC. Instead it lodges compliance and enforcement authority with the Department of Energy. The DOE lacks both the EPA's accumulated experience in environmental monitoring and the FERC's familiarity with power markets and their regulation.

133. *See, e.g.*, COOPER AND SOVACOOL, *supra* note 4, at 144.

134. For example, could a state argue that its cap is a "just and reasonable" rate under the standards of the Federal Power Act?

immediate interests of regulators and elected officials focus on the politically visible topic of rates rather than the largely invisible ones of air quality and climate change. Both have good reason to avoid accusations that RPS might be responsible for higher bills.[135] We should expect that the underlying structure of interests and incentives in a federal program will produce similar results. In one possible analogy, the idealistic and precise standards (zero pollution) of the original Clean Air and Clean Water Acts have been rendered problematic if not irrelevant by subsequent legislation, rulemakings, and compliance enforcement.

Proposals for a national RPS are the latest in a long series of grand attempts to reshape the energy sector in accordance with prevailing politics and prevailing conventional wisdom. The broad sweep of post-1970 electricity and gas legislation is not encouraging, its efforts to improve markets and efficiency largely overshadowed by provisions that redistribute economic rents. Its best consequences have been such unanticipated byproducts as the FERC's administrative decontrol of wellhead prices under the Natural Gas Policy Act and the growth of a competitive independent power industry under the Public Utility Regulatory Policies Act. A national RPS is an inefficient and inequitable response to emissions of pollutants and GHGs, a reassuring and ultimately dysfunctional distraction from real problems.

135. The question of when (if ever) regulators should allow utilities to include noncompliance penalties in rates remains for future study.

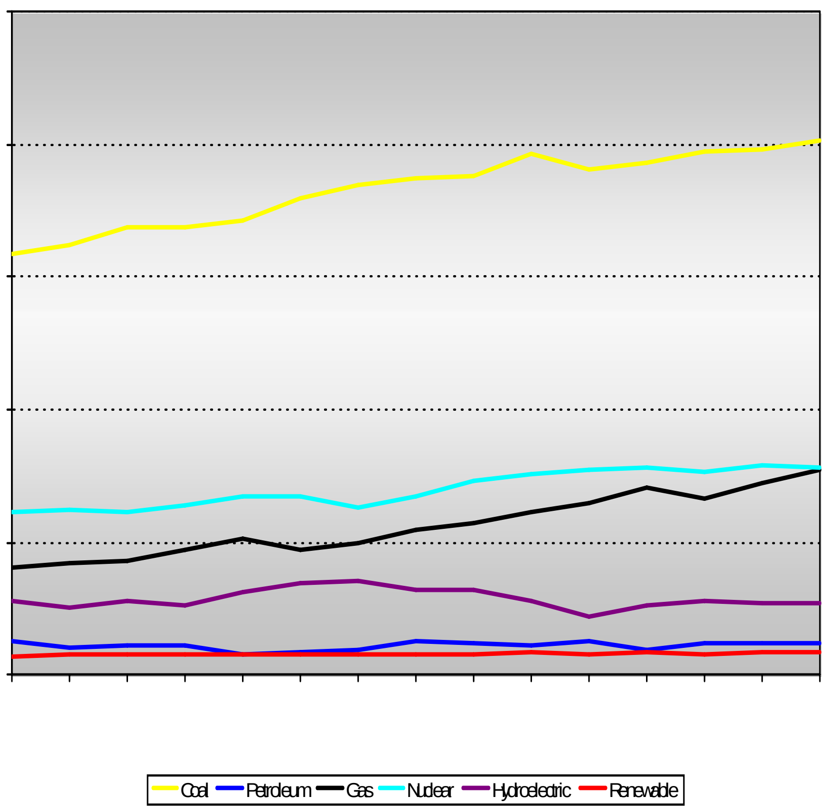

Figure 1. Source: EIA, NET GENERATION BY ENERGY SOURCE: TOTAL (ALL SECTORS), http://www.eia.doe.gov/cneaf/electricity/epm/table1_1.html (last visited Jan. 29, 2008).

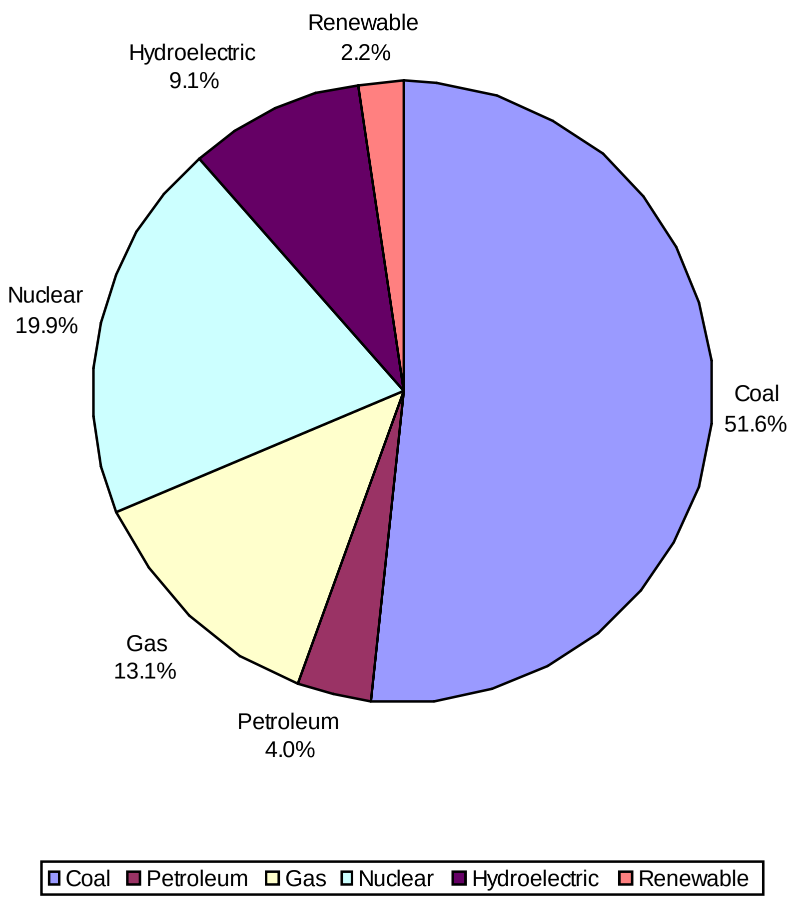

Figure 2A: Percentage of U.S. Power Generated by Source, 1991. Source: EIA, NET GENERATION BY ENERGY SOURCE: TOTAL (ALL SECTORS), http://www.eia.doe.gov/cneaf/electricity/epm/table1_1.html (last visited Jan. 29, 2008).

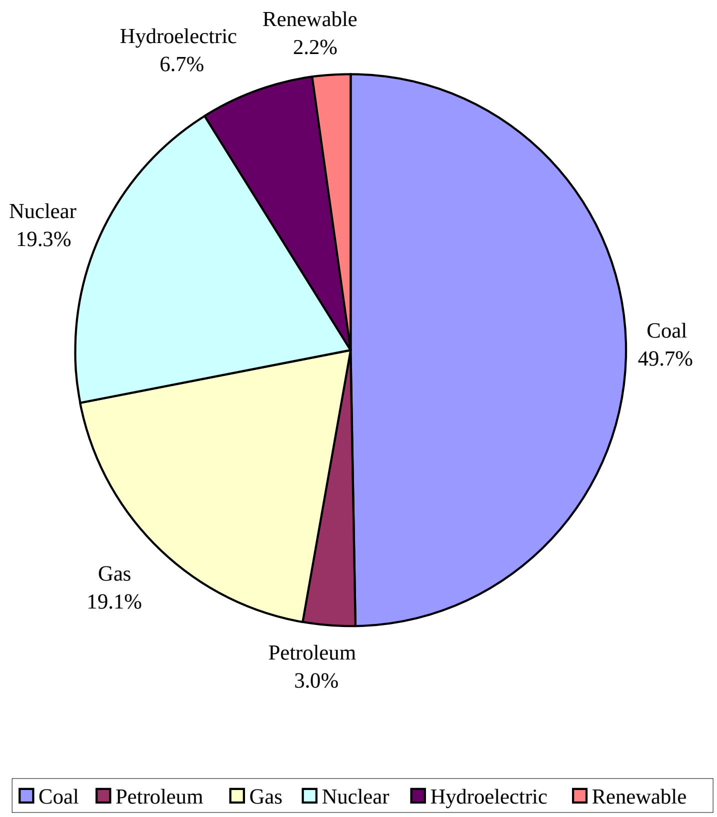

Figure 2B: Percentage of U.S. Power Generated by Source, 2005.
Source: EIA, NET GENERATION BY ENERGY SOURCE: TOTAL (ALL SECTORS), http://www.eia.doe.gov/cneaf/electricity/epm/table1_1.html (last visited Jan. 29, 2008).

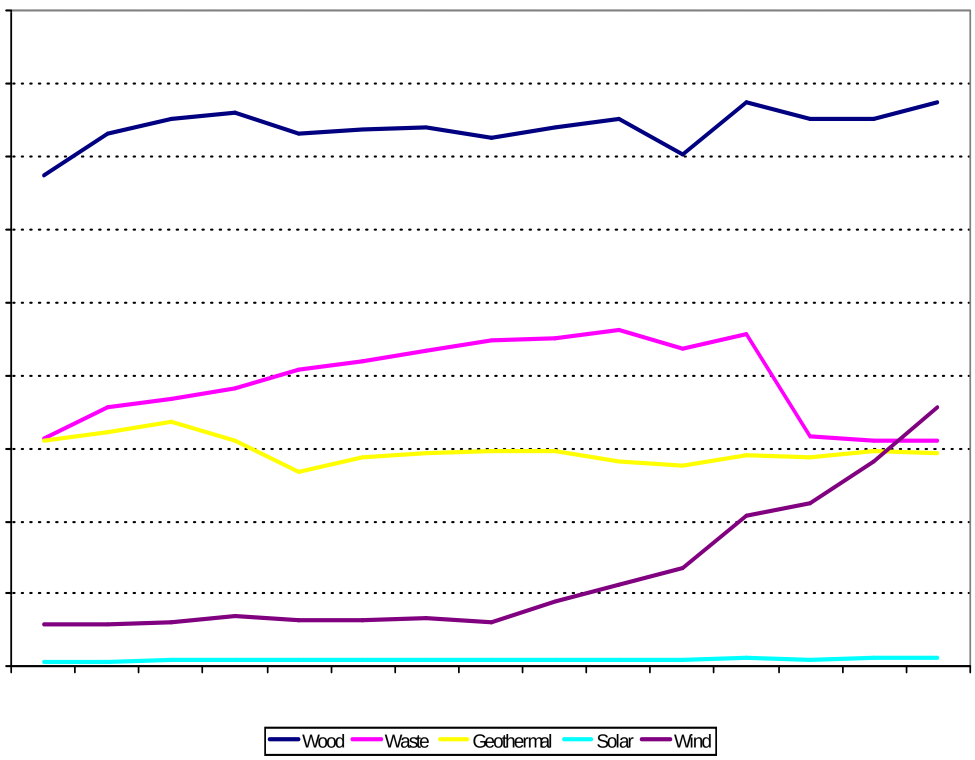

Figure 3: Electricity Generated by Various Renewable Sources, 1991-2005. *Source:* EIA, NET GENERATION BY RENEWABLES: TOTAL (ALL SECTORS), http://www.eia.doe.gov/cneaf/electricity/epm/epmxlfile1_1_a.xls (last visited Jan. 29, 2008) (May 2007 and predecessors).

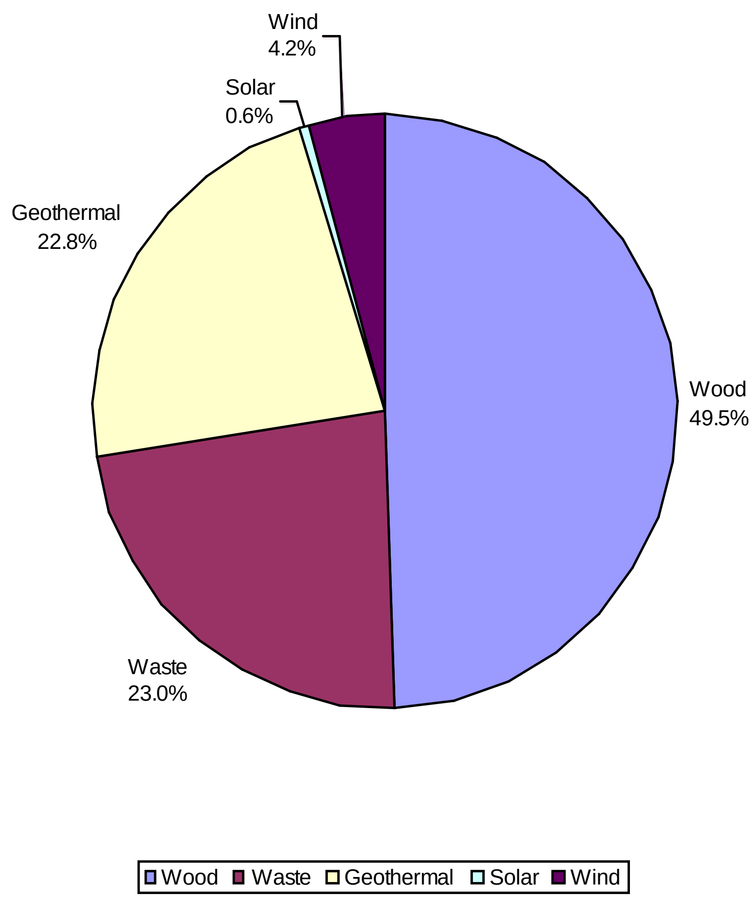

Figure 4A: Percentage of Renewable Generation by Source, 1991. Source: EIA, NET GENERATION BY RENEWABLES: TOTAL (ALL SECTORS), http://www.eia.doe.gov/cneaf/electricity/epm/epmxlfile1_1_a.xls (last visited Jan. 29, 2008) (May 2007 and predecessors).

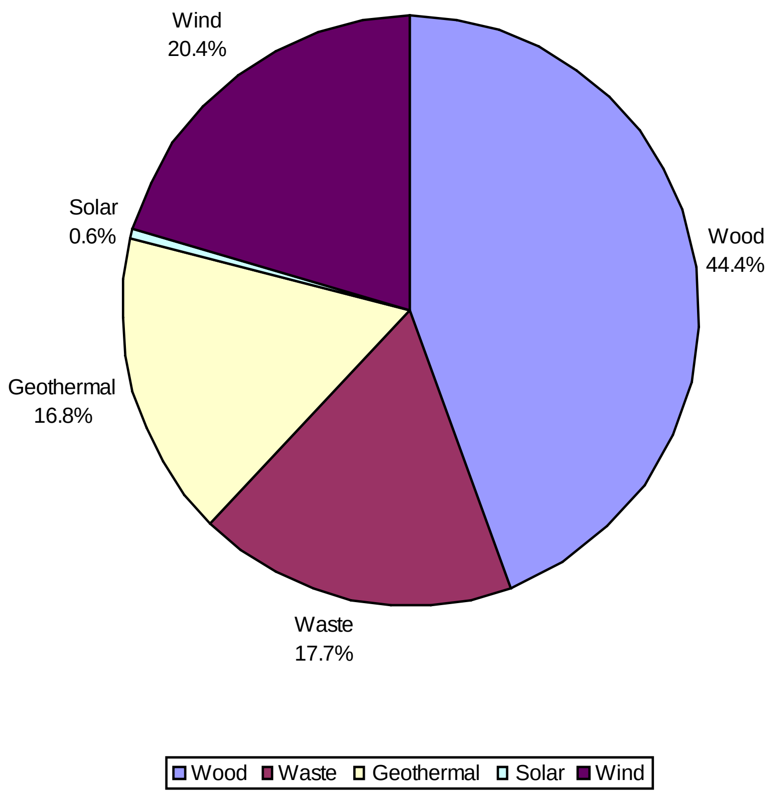

Figure 4B: Percentage of Renewable Generation by Source, 2005. *Source:* EIA, NET GENERATION BY RENEWABLES: TOTAL (ALL SECTORS), http://www.eia.doe.gov/cneaf/electricity/epm/epmxlfile1_1_a.xls (last visited Jan. 29, 2008) (May 2007 and predecessors).

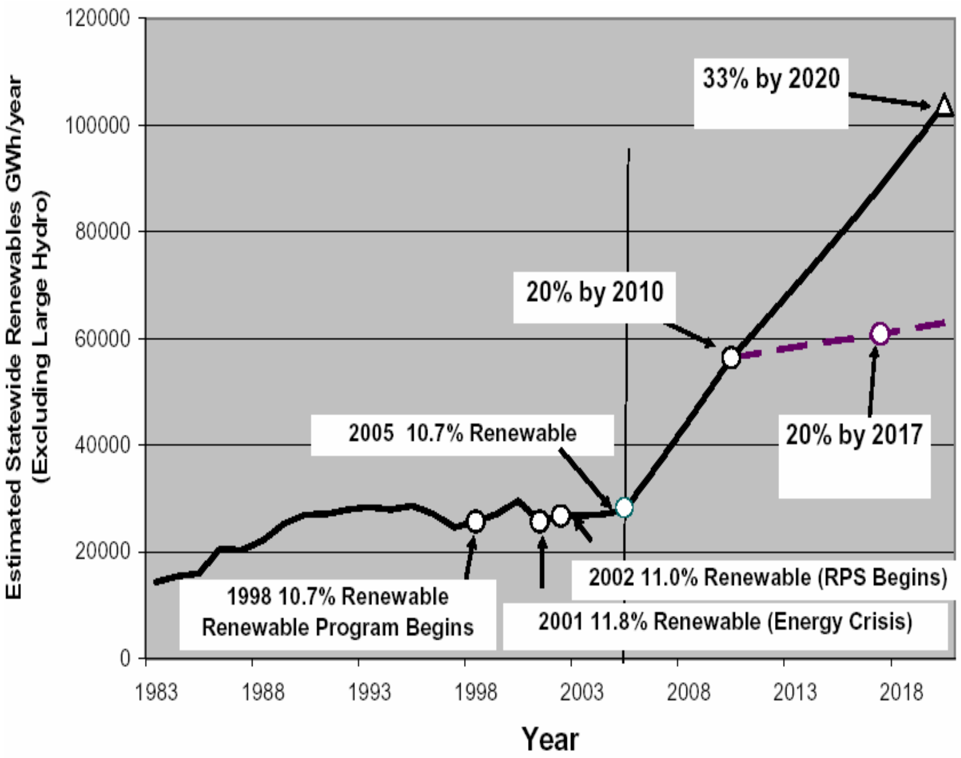

Figure 5: Utilities' Compliance with California RPS. Source: California Energy Commission, *Integrated Energy Policy Report, 2006 Update* (Jan. 2007), Report 100-2006-001-CMF, at 4.