Green Means 'Go?'—A Colorful Approach to a U.S. National Renewable Portfolio Standard

Opponents of renewable energy often suggest that mandating a national RPS would be technically impossible, costly, unfair to those states without renewable resources, and difficult to enforce. Contrary to these claims, the authors suggest that a properly designed RPS would actually lower electricity prices, empower states and local actors, and provide a host of important ancillary services to the electric utility industry and society at large.

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I. Introduction

Today lots of people are talking about renewable energy technologies and renewable portfolio standards (RPS)—laws mandating that suppliers provide a certain percentage of their electricity from renewable resources by a particular date. But real action is scant. Conferences and reports multiply. Advocates propose policies of various scopes. Academics pen countless articles. But fewer than half of the states in the U.S. have made any progress toward adopting effective RPS programs, and a vast majority of larger renewable energy projects continue to stall for lack of political, financial, and social commitment.

While no federal legislation requires the deployment of renewable energy, 22 states have passed their own RPS, launching an estimated $475 million in energy projects. The most aggressive are California, which requires that 33 percent of

its electricity come from renewable energy sources by 2020; New York, which mandates 25 percent by 2013; and Nevada, which seeks 20 percent by 2015.[1]

While these states have made impressive progress, the country's commitment to renewable energy remains lackluster. Excluding large hydroelectric stations, the U.S. Energy Information Administration (EIA) estimated that renewables provided a mere 2.2 percent of America's electricity supply in 2004, with roughly half of this capacity coming from dedicated biomass plants.[2] As Gunnar Birgisson and Erik Petersen recently concluded in *The Electricity Journal*, ''most existing mechanisms cannot be relied on to achieve long-term growth of renewable energy, either because of their own weaknesses or because of unpredictable variables.''[3] Paul Komor and Morgan Bazilian echoed similar sentiments when they remarked that ''there is little agreement on what policies are most effective in promoting renewables, or even what it means for a policy to be 'effective.'''[4]

Like blind men describing the different parts of an elephant, energy analysts continue to approach the issue of a national RPS in an entropic and narrow manner: some theorize about the concept, others talk about its economic benefits, still others ruminate about its environmental advantages. In an effort to provide a more holistic analysis, we hold that an advanced, properly designed national RPS would provide drastic and far-reaching benefits to the nation. We begin by documenting the common misconceptions that renewable resources—and thus a federally mandated RPS—are too costly, diffuse, complicated, intermittent, and ugly to play a large role in the American electric utility sector. We then propose a national RPS design that places special attention on coupling renewables with demand reduction and a national renewable energy credit market. Contrary to conventional wisdom, we conclude that a national RPS would likely lower electricity prices, empower states, and provide a host of important ancillary services to consumers, utilities, and society as a whole.

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II. Four Red Herrings and a Trout: Economic, Political, Social, Technical, and Aesthetic Arguments against a National RPS

To the casual observer, no shortage of arguments exists against the creation of a national RPS in the United States. Indeed, utilities complain that an RPS would be too expensive; energy analysts lament the difficulty of enforcement; system operators warn that a power grid comprised of intermittent renewable generators would constitute an immense technical challenge; politicians tout that it would be unfair to states lacking plentiful renewable resources, and citizens vocalize that they do not want to see renewable energy technologies near them.

A federally legislated RPS is typically rebuked on financial grounds. Brian O'Shaughnessy, President of Revere Copper Products, testified that if an RPS were implemented nationwide, ''the extra costs would have caused Revere to violate its banking covenants and driven us out of business ... Mandating renewable power with today's technology is like trying to go to the moon in the 1950s.''[5] Some utilities go so far as to issue vague threats that perceived regulatory costs would be passed on to consumers in the form of higher electricity prices. During Senate committee hearings in 2005, Kerry W. Bowers, a technology manager for Southern Company, told senators that ''not every renewable technology will be well suited to every region of the country ... [a renewable portfolio standard] would require us to use more costly renewable resources, increasing costs to our customers.''[6] And Claudia J. Banner, Senior Engineer for

Renewable Energy Planning at American Electric Power, recently stated that ''utilities are usually not receptive to mandated renewable portfolio standards, citing an increase in generation costs that could get passed back to the consumer, resulting in larger utility bills. Studies have shown that renewables are typically more expensive than traditional generation.''[7]

Similarly, energy lobbyists and analysts—including those from the Edison Electric Institute and the Alliance for Competitive Electricity—have suggested that a national RPS would be incredibly difficult to create, monitor, and enforce.[8] Janet L. Sawin from the Worldwatch Institute adds that many state RPS requirements suffer from design flaws, often applying only to a small segment of the market, stipulating uncertain purchase obligations and end dates, and establishing inconsistent penalties for non-compliance.[9]

Complications relating to intermittency, forecasting complexity, the need for supplemental generation, and grid interaction are perpetually listed as technical factors impeding the use of renewable resources nationwide. Utilities and system operators tend to classify renewable resources as ''non-dispatchable'' since they cannot be readily called upon to generate electricity on demand.[10] They also argue that connecting a large amount of renewable generators to the power grid would excessively complicate system management.

Such logistical matters are often compounded by a general belief among politicians that a nationwide RPS would unfairly penalize those states without robust renewable resources. Senator Pete V. Domenici (R.-N.M.) spoke against a generic RPS by stating that ''a federal program that would force ratepayers in one region to subsidize specially favored resources in another region would seem to be very difficult to accept.''[11] Similarly, in congressional debates over the creation of a possible federal RPS in 2005, Senator Saxby Chambliss (R.-Ga.) concluded that ''it imposes a one-size-fits-all mandate on the whole country without regard for whether the requirement is technologically or economically feasible.''[12]

Politicians generally believe that a nation-wide RPS would unfairly penalize those states without robust renewable resources.

Renewables also are frequently opposed for aesthetic, symbolic, and intimately personal reasons. Martin J. Pasqualetti, in his work on the opposition to the construction of wind turbines, notes that many forms of resistance to renewable energy systems have little to do with the technology itself. Rural residents, for example, often resent urban developers who wish to build energy projects in their midst. Others oppose new generators because they feel that they have been excluded from the policymaking, permitting, or siting process. In other cases, pastoral inhabitants want renewable energy projects for their own use—as a vehicle for economic development—and resent what seems like meddling by urban people intent on preserving the countryside for its scenic and recreational value.[13] And—most commonly—a pervasive ''not-in-my-backyard'' mentality pervades how most Americans view energy technologies. They resent that renewable energy systems have the potential to intrude upon what they believe to be beautiful landscapes (especially in regions such as Nantucket Sound, the Smoky Mountains, and highland regions of Appalachia).

III. Promising Possibilities Post-PUCHA

However, the revocation of the Public Utility Holding Company Act of 1935 (PUHCA)—a law that essentially created the vertically integrated public utility in which supply, generation, transmission, and distribution services are provided by a single entity for a specified franchise area—makes the call for a federally mandated RPS all the more timely.[14]

The Energy Policy Act of 2005 established a successor statute (PUHCA 2005) that essentially lifted the regulatory safeguards of the original act and replaced them with cursory oversight authority granted to the Federal Energy Regulatory Commission (FERC) and, to a lesser extent, state public utility commissioners.

The elimination of PUCHA removed the geographical restrictions that limited public utility holding companies to single, integrated systems.[15] Without PUHCA's requirements, an electricity company anywhere in the U.S. can acquire another electricity company anywhere else, effectively replacing state-based utility franchises with a network of interstate power players.[16] In May 2006, for example, MidAmerican Energy Holdings Company (with operations in Iowa, Illinois, and South Dakota) announced that it had purchased PacifiCorp, a subsidiary of ScottishPower servicing customers in Oregon, Utah, Idaho, Washington, Wyoming, and California.[17] Constellation Energy also merged with FLP Group in December 2005, creating the country's largest energy supplier—valued at $28 billion—serving almost 7 million natural gas and electricity customers throughout Maryland and Florida.[18] EPACT further accelerated the nationalization of the industry by establishing regional advisory bodies to promote interstate planning and cooperation, authorizing a greater number of interstate compacts, and permitting federal utilities such as the Tennessee Valley Authority to join regional transmission entities.[19]

Thus, the interstate electricity market created in the wake of PUHCA's repeal renders as nonsense the argument that a national RPS program would benefit some states at the cost of others. Deregulation of the utility holdings sector means that renewable electricity generated in one state benefits the same utility operating in another. Since a properly designed national RPS statute would make utilities, not individual states, subject to RPS goals, the burdens and benefits of a national program are likely to reflect the interstate nature of the emerging utility holdings sector.

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Establishing a national RPS could help fix inconsistencies caused by the current patchwork of state RPS mandates. In the wake of PUHCA's repeal, utilities are operating in an interstate electricity market still subject to individual state RPS mandates, varying and sometimes competing state net metering procedures, and differing state and regional renewable energy certificate tracking systems. Using individual states as a crucible for innovations in electricity generation and marketing may have made sense when PUHCA limited the size and geographic scope of utility holding companies. It makes little sense now.

IV. A Novel Approach to a National RPS: Linking Demand, Net Metering, and Credits

Besides unifying the country behind the noble goal of increasing renewable energy output, a cleverly designed national RPS program provides some unique advantages that no patchwork of state-based initiatives—no matter how ambitious—can match.

As Trent Berry and Mark Jaccard rightfully observe, setting a national RPS leaves policymakers with an almost infinite number of options in defining ''renewable'' resources, selecting a target size, establishing a target date, measuring energy production, and so on.[20] Our approach would require that by 2020 all regulated utilities meet 20 percent of net electricity demand from electricity generated by qualified renewable sources (generators harnessing electricity from sunlight, wind, falling water, sustainable biomass, waste, and geothermal sources). This method differs from most state-based RPS programs in a subtle but fundamental

way by setting the renewable energy goal as a function of electricity *demand* rather than electricity *generation*.

A demand-based approach to national RPS goals provides several advantages, both for regulated utilities and for renewable energy facilities. Calculating RPS goals as a function of electricity demand provides utilities with additional flexibility that traditional RPS architectures do not. Because the mandate is a function of demand, regulated utilities can turn to demand reduction strategies (like energy efficiency programs and expanded load management practices) to meet their regulatory burdens.

The creation of a national RPS also could help many states establish effective net metering policies—standards for measuring and crediting on-site, interconnected, small-scale renewable generation. In a triumph of tepidity, Congress rejected mandating federal net metering standards in the Energy Policy Act of 2005, settling instead to direct states to ''consider'' such standards. As legislative language, the word ''consider'' carries as much precision as words like ''gourmet'' or ''sustainable''.

Typically, regulated utilities have embraced the programs with the enthusiasm of a tax audit. Viewing most net metering mandates as revenue losers, many utilities have lobbied state legislatures for Draconian capacity caps on the amount of eligible renewable energy or for restrictions on the classes of eligible renewable generators. Others have devised complicated paperwork burdens or fee structures that have discouraged the generation of renewable energy from small-scale, distributed sources.[21]

The wide discrepancy in both the design and efficacy of individual state net metering statutes has created an uneven playing field both for utilities and for small-scale renewable generating facilities and has impeded the development of a coherent national renewable energy policy.[22] In states with poorly defined programs, utilities have used unreasonable safety concerns, limitations on energy ''banking,'' hidden standby charges, and unnecessary insurance and indemnification requirements to discourage distributed generation of renewable energy. In 2004, for example, Kentucky boasted an entire net metering regulatory program servicing a total of two customer-generators (which, shockingly, represents a decrease from 14 total customers in 2003).[23]

FERC might be directed to promulgate national net metering standards just as it has uniform interconnection standards for small generators.

By making the national RPS goal a function of demand, the program we have proposed puts the ultimate compliance level squarely in the hands of utilities, encouraging them to view on-site renewable generation as a demand reduction strategy that contributes to the attainment of their RPS mandates. If utilities viewed net metering programs correctly as demand-reduction strategies, it is likely that they would promote their expansion, including supporting higher capacity caps, expanding the number of eligible classes, and decreasing the unnecessary regulatory burdens that historically have discouraged small-scale production.

A federally mandated RPS could direct FERC to promulgate national net metering standards just as it has uniform interconnection standards for small generators.[24] Uniformity in net metering would provide an opportunity to craft a program from lessons learned in successful state-based programs and allow FERC essential oversight to prevent utilities from gaming the system to discourage small-scale renewable generation.

A uniform, national net metering program has several advantages over a network of 39 state-based regulatory arrangements.[25] By establishing a level terrain for small-scale renewable generation across states, a federal net metering program would allow market forces to dictate the geography of investments. A national program would also enable

certain technologies to flourish where they are most useful and encourage a greater diversity of generation across states. As well, a uniform national net metering policy provides a level of regulatory predictability that facilitates long-term planning that could be embraced by the growing number of utilities operating in states that have yet to ''consider'' net metering regulations. Even for utilities focused exclusively on the bottom line, the devil you know is better than the devil you don't.

Furthermore, we propose that FERC be given the authority to issue national renewable energy certificates (RECs) and develop a national REC tracking system. Unbundling the renewable nature of generation from the actual electricity generated provides critical flexibility for regulated utilities and ensures that market forces dictate renewable investment. For mixed-fuel facilities, we believe that allowing only the electricity generated from qualified renewable sources to count toward the value of a REC promotes efficient fuel combinations while protecting against fraud. A tracking system would also help certify that RECs represent actual renewable generation, facilitate the transfer of RECs between holders, and ensure that certificates are not double-counted.

State RPS mandates (and some voluntary initiatives) have encouraged the development of robust interstate and regional REC tracking systems.[26] For example, the New England Power Pool (NEPOOL), an operational REC tracking program, comprises six states: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. Regional tracking systems are also under development in the mid-Atlantic and western U.S. By early 2006, the non-profit Center for Resource Solutions formed the

North American Association of Issuing Bodies (NAAIB) to issue recommended ''best practices'' for certificate tracking and promote harmonization among the various tracking systems in North America.[27]

The emergence of the NAAIB suggests that a national REC tracking system may be inevitable. Moreover, just as the federal government ultimately intervened to regulate interstate electricity transmission,[28] such a REC tracking system will likely be subject to eventual federal oversight. It makes far more sense that such a system be the result of federal design earlier rather than circumstance later. Transparent and predictable rules established by a democratic body would likely avoid the fits and starts sure to plague a system that pieces together inconsistent and overlapping regional REC tracking systems.

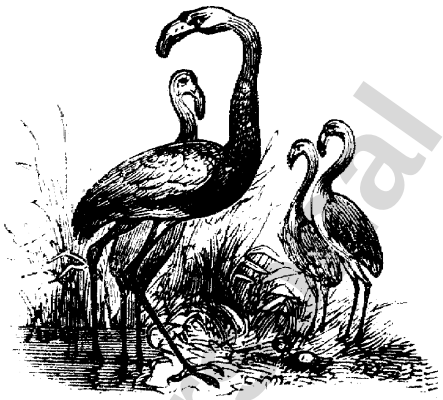
Early adoption of a uniform REC tracking system would allow both regulators and the regulated community to focus on the important work of exploring new ways to harness greater amounts of renewable energy, instead of wading through a mire of constantly evolving trading schemes. For example, some state RPS mandates have created uncertainty over who owns the RECs that result from power purchases mandated under the Public Utilities Regulatory Policies Act (PURPA).[29] Under section 210 of PURPA, Congress required local utilities to purchase power from co-generators and small, renewable power producers (known as ''qualifying facilities'') at a price set by state public utility commissioners. The price was not to exceed the utility's avoided costs, which the statute defined clumsily as ''the cost to the electric utility of the electric energy which, but for the purchase from such co-generator or small power producer, such utility would generate or purchase from another source.''[30]

Some PURPA-regulated utilities have argued that the renewable or environmental aspects of renewable generation are inseparable from the power purchase because they are the reason utilities are mandated to contract for the output in the first

place. Therefore, ownership of the RECs that derive from PURPA-mandated power purchases should transfer to the regulated facility purchasing the power. Many co-generators and renewable energy producers argue, on the other hand, that state RPS programs create certificates as commodities unbundled from the electricity produced, so it cannot be argued that ownership of RECs is automatically transferred with the sale of electricity, mandated or otherwise.

In 2003, to answer petitions brought by several PURPA qualifying facilities, FERC declared that avoided cost payments mandated by PURPA did not convey ownership of the RECs that may result from the renewable attributes of the electricity.[31] FERC ruled that it is up to the states to decide who own RECs, but that the avoided cost payments mandated by PURPA pay only for the capacity produced and do not convey the renewable aspects of its generation. On appeal, the U.S. Court of Appeals for the District of Columbia concluded that it lacked the jurisdiction to review the decision, leading to speculation that future suits may be pursued.

A national RPS program could resolve the issue in a particularly novel way by declaring that regulated utilities own RECs for renewable energy purchased from PURPA qualifying facilities or net metered generators *only* if the electricity is purchased at the retail rate, not the avoided cost. In their crudest form, RECs put a dollar amount on the value that the nation places in the generation of renewable energy. Their market value is largely dependent on the ability of regulated utilities to comply with RPS goals. Ideally, a national REC trading system would create a more sophisticated market in which the value of renewable energy generation is more realistically pegged to the retail value of electricity.



National RECs could further drive the cost of renewable resources down. Brent M. Haddad and Paul Jefferiss suggest that establishing a national RPS creates both a secondary commodity and a secondary market. That is, under a federal RPS, utilities would sell their renewable *power* at a market rate to their customers, but they would also sell their *renewable energy credits* nationally to retail suppliers anywhere. Haddad and Jefferiss predict that, after the creation of a national RPS, a ''vibrant market'' for renewable energy credits is ''likely to arise, driving their cost down, making renewable resource generators more competitive, and lowering the cost of our national commitment to renewable energy.''[32]

Under the system we have proposed, players in the renewable energy market would have to compare the market value of RECs with the difference between the retail rate of electricity and the avoided cost as required under PURPA. Renewable generators would decide whether to sell their energy (along with ownership of the REC) at the retail rate or sell it at avoided cost (and retain REC ownership). Such a national REC trading program would create downward pressure on the retail market for electricity as well as providing added economic incentives for energy services companies to invest in their own renewable capacity.

Regulated utilities that choose to purchase ownership of RECs by paying the retail rate for renewable generation would be subject to rate fluctuations themselves. If retail prices increase, so would the cost of purchasing renewable energy bundled with the adherent RECs. Therefore, mandating the option of purchasing REC ownership by paying the retail rate has the added benefit of increasing the likelihood that the electricity market will benefit ratepayers either by significantly decreasing the price of electricity (and, as a result, making renewables more cost-competitive) or by ensuring that regulated utilities invest in substantial new sources of renewable generation.

Lastly, economist David Berry has noted that a national market for renewable energy credits would provide the country with manifold advantages beyond state RPS programs. In jurisdictions where retail providers may not own renewable assets, credits enable providers to meet their portfolio requirements. Credits would give utilities the opportunity to still meet requirements if their supply of renewable energy unexpectedly falls short due to equipment failure, unexpected increases in demand, etc. RECs would also give utilities time to determine how best to meet RPS requirements and potentially defer investment decisions.

The gains from trading credits would make renewable energy systems more cost-competitive for suppliers, and could also minimize transmission costs, since they obviate the need for additional transmission when resources are located near population centers. Lastly, RECs would allow forms of renewable energy physically unable to be transmitted over the power grid—like solar thermal systems—to still contribute to meeting RPS targets.[33]

V. The Profuse Benefits of a National RPS

A closer examination of the evidence suggests that a properly designed national RPS would induce a number of wide ranging and positive changes in the electric utility sector: lower levelized costs of electricity resulting in cheaper bills to consumers; a depression of natural gas prices; a more distributed, modular, and efficient transmission and distribution grid; widely abundant fuel available in every state; drastically lower levels of pollution and emissions; and a host of other social benefits.

For instance, technological improvements in thermal

efficiency (the amount of raw energy converted to electricity), reductions in manufacturing cost, improved architectural designs, refined installation techniques, and better construction methods have coalesced to substantially reduce the cost of renewable energy over the past 30 years.[34] Photovoltaic electrical systems cost more than $60 per watt in 1976, but cost only around $3 per watt in 2004—a decline of 95 percent.[35] In 2005, the California Energy Commission (CEC) estimated that the average levelized cost (the total cost over the life of a generator divided by the numbers of kilowatt hours produced) of wind energy for the state was 3.5 cents per kWh, less than one-eighth the 1980s average price of 39 cents per kWh.[36] A similar study conducted by the Virginia Center for Coal and Energy Research concluded that renewable generators fueled by wind and landfill gases offered the *cheapest* forms of electricity—2.8 and 3.0 cents per kWh, respectively—when compared to all other generators including advanced coal, natural gas, and nuclear plants.[37]

Indeed, while every report is laden with its own assumptions, in 2001 the EIA estimated that a national RPS requiring 20 percent of renewable supply by 2020 would save consumers $580 million (in 1999 dollars); and a report by the Union of Concerned Scientists found that average electricity prices would likely decline between 13 and 17 percent under five different national RPS proposals.[38]

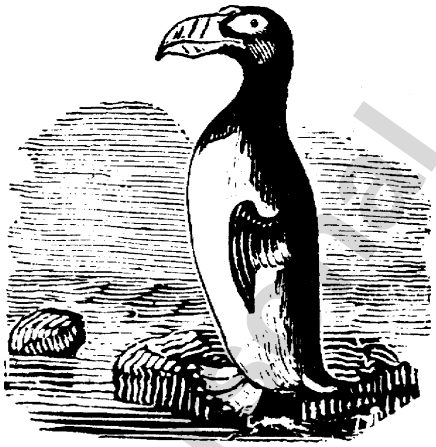
Given the mounting external costs associated with fossil fuel, utilities and system operators have come to rely on ''cleaner'' natural gas combined cycle generators because they are believed to be cheaper and faster to build than conventional coal plants. The result of this trend has been the addition of over 150 GW of gas-fired power generation between 1999 and 2004. The resulting surge in demand for natural gas comes at a time when domestic natural gas production has begun to plateau, driving prices skyward.[39,40] To cite two examples, the price of natural gas jumped from $0.62 per million cubic feet (mcf) in 1998 to $1.45 per mcf in

2001, and spiked again from around $2.10 per mcf in 2002 to more than $14 per mcf near the end of 2005.

Deployment of renewable energy technologies can reduce natural gas demand and thus put downward pressure on natural gas prices. A greater reliance on renewable resources would hedge against the price volatilities of natural gas by displacing gas-fired generators and provide wiggle room in a very tight natural gas market. A study undertaken by the Lawrence Berkeley National Laboratory found that increasing the amount of deployed renewable resources by only a small amount could depress wellhead natural gas prices between 0.8 and 2.0 percent. These numbers may not sound like much, but if renewable generation was implemented more widely, the study noted the net present value of natural gas savings could be as high as $74 billion between 2003 and 2020.[41]

Renewables could also help displace costly liquefied natural gas-fired ''peaking'' facilities that come online only during times of heavy demand. Distributed renewable resources offer policymakers a peak demand reduction strategy since, surreptitiously, many renewable sources—such as solar panels, for example—generate the most electricity at precisely the time demand is greatest.

When distributed, renewable resources can operate more efficiently than centralized fossil fuel generators since they tend to possess greater modularity, and can be installed in smaller increments with quicker construction times that enable forecasters to more accurately match projected supply and demand. Moreover, distributed generators, by producing power closer to the consumer, help avoid transmission losses and displace electricity normally produced by a large



coal- or natural-gas-fired turbine, backed up by a spinning reserve, and delivered through the power grid to the same location. And, lastly, because distributed technologies can be produced at smaller scale, they can be located almost anywhere and used for a variety of applications, enhancing the performance of centralized plants, distribution sub-stations, and transmission infrastructure.[42]

A greater reliance on renewable energy technologies would also help insulate the electric utility industry from fuel interruptions and shortages. Unlike coal, natural gas, uranium, and oil, renewable sources such as wind, solar, and biomass are available in every state.[43] One-thousand-times more solar energy reaches the surface of the earth each hour than the energy generated by all fossil fuels combined. The Midwest has been called the ''Saudi Arabia'' of wind, since it contains enough usable wind resources to produce all of the electricity used by the nation.[44] Many industrial and agricultural processes produce significant amounts of combustible byproducts, including tobacco residue, chicken carcasses, coffee-grounds, peach pits, sawdust, scrap wood, and rice-hulls that can be used in dedicated bioelectricity facilities.

And, in contrast to fossil-fueled generators, renewables lock in the production cost of electricity since they need not rely on volatile supplies of fuel. In the current era of restructuring, natural disasters, and price spikes, many manufacturers and utilities regard certainty as the most important factor in determining whether to invest in certain energy technologies. The more uncertainty there is about future fuel costs, the higher the risk premiums placed on investment returns. The capital intensity and long-term nature of such investments-generators are typically considered capital investments with decades-long lifetimes-only compounds the risk. Renewables enable power providers to offer more stable electricity rates since their levelized costs of electricity remain consistent to a greater degree.

The argument that a national RPS would be unfair to some states appears based on the

assumption that a 20 percent RPS by 2020 would force *each* state to build a massive amount of renewable resources. Such thinking is rightfully ridiculous: it would be akin to forcing Alaska to derive 20 percent of its electricity from nuclear plants, asking Nevada to derive 20 percent of its resources from hydropower, or attempting to make mayonnaise without milk and eggs. Instead, a national RPS would only require that the *entire nation* achieve 20 percent of its supply from renewable resources by 2020. Some states already possess competitive advantages over others in terms of coal, uranium, and oil. It is unlikely that requirements to harness renewable resources, which are far more diverse and plentiful, would unduly benefit some states over others.

And—if one considers a broader sense of equity—renewable energy resources create a more just society by minimizing the environmental consequences from fossil fuels. Such pollutants have long been noted as *unjust* because their impacts tend to be unevenly distributed geographically among the states, and socially among the young, poor, and elderly. Many studies have documented that almost every step in the process of converting fossil fuel into electricity—including mining, cooling, waste stream management, and emissions—damages human health and the environment.[45] As a result, Americans are experiencing a rise in respiratory illnesses (especially childhood asthma which has reached record highs) and the country's ecosystems continue to degrade. Particularly in the nation's ''non-attainment'' regions—locations so polluted that no pollution-emitting technologies can be used to generate power—renewable energy systems that emit no nitrous oxides, sulfur dioxides, particulate

matter, mercury, ozone, or carbon dioxide can be instrumental in preventing undercapacity.

Regarding the technical complexity of renewable energy systems, engineers and operators have made noteworthy progress overcoming barriers previously thought ''insurmountable.'' The National Association of Regulatory Utility Commissioners, the Federal Energy Regulatory Commission, and the Institute of Electrical and Electronics Engineers are all in the process of finalizing or have finalized interconnection standards for renewable generators.

Problems with intermittent renewable energy technologies long predicted by its detractors have failed to materialize in Denmark, Spain, and Germany, where aggressive renewable energy programs have been adopted. In these locations, system operators have overcome intermittence problems in four novel ways: diversifying locations, diversifying technologies, integrating with existing hydropower and demand response, and predicting wind patterns just as utilities already predict electricity demand and rainfall.[46] Utilities—especially those in the West such as Southern California Edison and Pacific Gas & Electric—have become much better at integrating renewable resources into their sophisticated integrated resource planning processes.[47] And system operators are becoming much better at day-ahead forecasting for intermittent renewable technologies like wind, where state-of-the-art forecasting capabilities are already in use throughout California and New York.[48]

In addition, a larger use of renewable energy systems could provide the nation with enhanced energy security. When distributed, such generators are far more resilient against terrorist attacks and severe weather events. Deploying small-scale renewable energy systems in targeted areas can create a more secure transmission and distribution grid by strengthening transformers, local taps, feeders, and switchgears, especially in congested areas or regions where the permitting of new transmission networks is difficult. A 1992 Pacific Gas and Electric Analysis

comparing 50 1-MW distributed photovoltaic plants versus one 50-MW central PV plant in Carissa Plains, Calif., found that the grid advantages (in forms of load savings and congestion) more than offset their generation disadvantages (in terms of high capital cost and interconnection).[49] A similar study conducted in New York concluded that modern wind plants with reactive power compensation can actually improve system stability following a major power system disturbance.[50]

The final, aesthetic matter represents a different and more difficult issue. Blaise Pascal commented in 1660 that ''there are two equally dangerous extremes—to shut reason out, and to let nothing else in.''[51] His thinking underscores, correctly, that human beings make decisions based on both rational and emotional grounds. Thus, attempting to tell an environmentalist opposed to placing a wind turbine on a beautiful ridgeline that their *reasons* are unsound ignores the entire ethical, spiritual, and emotional aspect of the issue.

Still, there are some strong ethical and aesthetic reasons in favor of renewable energy technologies. ''Out of sight'' does not mean ''out of hazard.'' Rodney Sobin from the Virginia Department of Environmental Quality recently stated that:

> Most Americans ... oppose wind turbines because they may ruin, in their mind, the view of a mountain top, but they never actually consider that the alternative to that turbine is more smokestacks, cooling towers, and even fly-ash and acid rain, which ultimately end up hurting the mountain much more. People don't campaign against birds hitting windows, cars, or cell phone towers, but they will campaign against birds hitting wind turbines. I think it demonstrates a lack of understanding of context and tradeoffs.[52]

A large fossil-fuel plant isolated from society may seem like its environmental impacts are segregated from society, but in reality burdens arise from the mining, transportation, and combustion of fuel. In the case of coal, these costs include artificial lakes built to provide cooling water, land disrupted to provide the thousands of tons of fuel burnt daily, millions of tons of ash and scrubber sludge, and the hundreds of tons of mined materials and ammonia required for pollution control equipment.[53] And renewables need not be inevitably located in pristine and beautiful landscapes. Wind projects in Pennsylvania, West Virginia, and elsewhere have been installed in dual-use areas on farms, pastures, woods, and coal fields where they do not interfere with other land uses.

VI. Conclusion

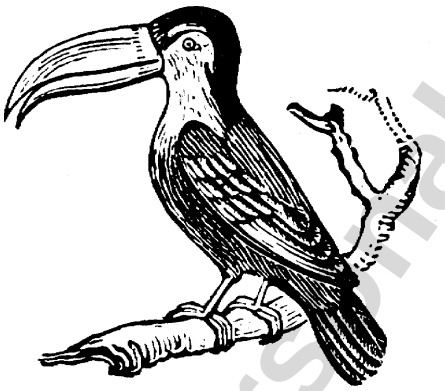
To be fair, a national RPS may not be a panacea to the country's renewable energy problems. Texas—which features the largest installed capacity of small-scale renewable energy (1,186 MW) in the country—had to implement a wide range of aggressive policies to achieve their market penetration of renewables. These included measures forcing electric companies to unbundle transmission, power generation,

The program we have proposed is not a perfect program. But is does not have to be.

and retail sales; eliminating the ability for utilities to levy stranded costs and other discriminatory practices against renewable technologies; forming interconnection rules that did not require extensive pre-interconnection studies; and mandating the use of real time pricing and net metering.[54] California—which has more installed renewable capacity than any other state—had to remove excessive utility tariffs, increase tax credits for renewable energy systems, and institute a large consumer awareness program before renewables were widely used.[55] In Europe—where production of wind capacity grew 40 percent between 1990 and 2000, and Austria, Finland, Norway, and Sweden all receive more than 20 percent of their electricity from renewable resources—aggressive tax incentives and rebates for consumers, rate-based incentives for utilities such as feed-in tariffs, and environmental taxes on carbon and other pollutants were needed to promote renewable energy technologies.[56]

Yet, for too long, the pursuit of a ''silver bullet'' national renewable energy strategy, embraced by all and burdensome to none, has kept the capacity of renewable generation ludicrously below its potential. The debate over a national RPS remains contentious even though many of the issues have been resolved by empirical data or can be avoided by structuring the program in a smart way. While many states have pursued aggressive strategies to expand renewable energy generation, the United States lacks a coherent and unified national renewable energy strategy. Current policies offer a ladder for those wishing to promote renewable energy, but the ladder is without rungs.

The program that we have proposed overcomes many of the



objections that have prevented the adoption of similar programs in the past. It is not a perfect program. But it does not have to be. A national RPS program is not like finding a life partner; it's okay to settle on less than perfection. Policymakers need not love every aspect of the program to acknowledge that its adoption would benefit our nation's electricity markets and make substantial progress toward a more coherent and secure national energy strategy.■

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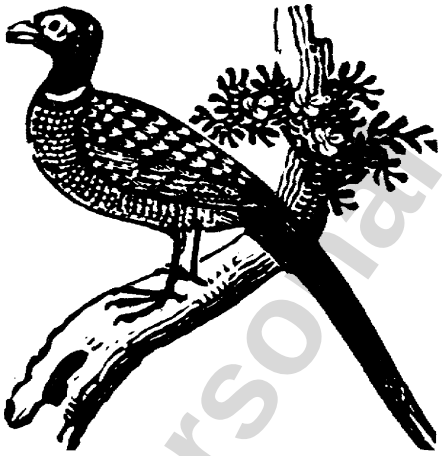

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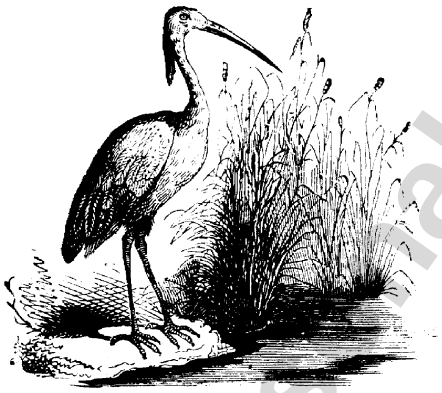

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