Union of Concerned Scientists
Citizens and Scientists for Environmental Solutions

The Honorable John D. Dingell
U.S. House of Representatives
2328 Rayburn House Office Building
Washington, DC 20515

The Honorable Rick Boucher
U.S. House of Representatives
2187 Rayburn House Office Building
Washington, DC 20515

Dear Chairman Dingell and Chairman Boucher,

Thank you for your invitation to our President, Kevin Knobloch, to submit responses to your questions of May 24 on portfolio standards legislation. On behalf of Mr. Knobloch, I submit the attached responses.

The Union of Concerned Scientists is the nation's leading science-based non-profit working on environmental and security issues. Our Clean Energy Program participated in the initial development of the renewable portfolio standard concept in the 1990s. We have worked with states and state-based coalitions during the process of enactment and implementation of renewable electricity standards in most of the 23 states and the District of Columbia where they have been adopted to date. We have testified on federal RPS bills before the Senate Energy Committee and the House Subcommittee on Energy and Air Quality. And we have conducted numerous analyses of the costs and benefits of both state and federal proposals.

We hope that our responses are helpful to you in your deliberations. We would be happy to provide any additional information on the subject.

Sincerely,

Alan J. Nogee

Alan Nogee
Director, Clean Energy Program

1. **Purpose of Portfolio Standards Proposals**
    a. **Do you believe that adopting one or more Federal "portfolio-standard" requirements applied to sources of retail electricity, mandating that a given percentage of the power sold at retail come from particular sources, is an advisable Federal policy? Why or why not?**

Answer. Yes.

Why a portfolio standard? A portfolio standard can be an effective market-friendly mechanism for increasing the use of some technologies that face market barriers or failures that limit their penetration below levels that may be cost-effective for the economy as a whole over the long run. The portfolio standard was invented as a mechanism to ensure the sustained orderly development of renewable energy technologies that provide multiple societal benefits, and which show a promise of becoming cost-effective with increasing economies of scale. It is designed to harness competitive market forces to reduce renewable energy costs and to capture their benefits at least cost to the economy.[1]

Renewable portfolio standards, also known as Renewable Electricity Standards (RES) have proven themselves popular and effective in state "laboratories," with a growing number of studies concluding they are now a primary driver, along with the federal production tax credit, of new renewable energy development in the United States (Attachment A). Twenty-three states plus the District of Columbia have adopted Renewable Electricity Standards. Perhaps more importantly, 15 states have demonstrated such satisfaction with the policy they have already revisited and raised or accelerated initial standards (Attachment B).

By ensuring a steadily growing market, renewable standards provide the revenue stream and the market predictability to enable developers to finance projects, as well as encourage forward investment in manufacturing facilities and other infrastructure development, at low costs.

Why a federal standard? The need for a federal standard is illustrated by the fact that the U.S. Energy Information Administration (EIA) calculates that under business as usual, renewable energy will grow to supply only 4.1 percent of electricity use by 2030. Yet EIA's own analyses, discussed further in section (e) below, show that the US could increase its use of renewable energy to at least a 15 percent level with essentially no impact on energy bills (e.g., a 1/20th of one percent increase), and potential energy bill savings. Other analyses have found that renewable standards up to at least 20 percent could reduce energy bills.

A federal standard can provide many benefits for the nation, including increasing energy security, fuel diversity, price stability, jobs, farm and ranch income, tax revenues, technology development, customer choices, and reduced environmental impacts, water consumption, and resource depletion, as well as reduced compliance costs with current and future environmental regulations.

These benefits cannot be fully captured through either voluntary actions or state-based requirements, because a significant portion of the benefits are not realized by individuals or states who take action, but by the country as a whole. Therefore, relying on individual and state action will lead to underinvestment in renewable energy. The national benefits of renewable energy can only be fully realized by federal action:

- *Greater energy security*. Achieving greater energy independence and reducing our energy imports clearly benefits the entire country, and is increasingly recognized as a critical national need. While little oil is used for electricity in most states, increasing renewable energy use can reduce the nation's fast-growing dependence on imported natural gas, much of which is projected to come from politically unstable or unfriendly countries. Domestically-produced renewable energy keeps energy revenues circulating in the domestic economy, adding to national income and employment, rather than going to enrich foreign energy suppliers.

- *Increasing fuel diversity and hedging against fossil fuel price spikes and price increases*. Diversifying fuel sources increases energy security by reducing energy portfolio risk, just as diversifying investments reduces investment portfolio risk. Diversifying with renewables, which use little or no fuel, or fuel that's price is not correlated with fossil fuel prices, reduces the risk of fuel price spikes or long-term increases. It also reduces the risk of fuel supply interruptions or shortages, whether from market or natural forces or from manipulation by companies or other countries. Because the American economy is so dependent on energy, this price stability reduces the pressure on manufacturers to relocate overseas to escape high and unstable prices, and reduces the risk of fuel price spikes rippling through the entire economy. Nine of the last ten national recessions were preceded by energy price spikes.[2]

- *Reducing natural gas prices*. Studies by The U.S. Energy Information Administration, UCS, Lawrence Berkeley National Laboratory and the American Council for an Energy Efficient Economy have all found that increasing renewable energy nationally can also reduce the price of natural gas, by reducing the demand for gas relative to supply.[3] A 2004 analysis found that a 20 percent renewable electricity standard could reduce gas prices by as much as 9 percent. This benefit accrues to all natural gas customers in the U.S., regardless of whether their electric utilities or states are increasing renewable energy, so any action or policy short of federal policy will not capture all the potential benefits.

- *Strengthening the rural economy*. Because many renewable energy sources are located in rural areas, increasing renewable energy use will also help build rural economies. A stronger rural economy, with good jobs to help retain youth from increasingly migrating to cities, builds a stronger America.

- *Reducing environmental compliance costs*. Similarly, we have a national market in sulfur dioxide allowances, regional markets in nitrogen oxide allowances, and are likely to have a national market in carbon dioxide allowances in the future. By displacing fossil fuel generation, increasing renewable energy reduces the need for additional pollution controls or other emission reduction costs needed to meet regional or national caps, and therefore benefits all participants in those regional or national markets.

- *Conserving scarce resources*. By promoting development of resources that are non-depletable, renewable standards conserve natural resources for future generations. Over the long run, fossil fuels may have higher value for other purposes, such as chemical feedstocks. New technology will likely enable them to be utilized more efficiently, and with lower emissions. By conserving these resources, future generations will have more options. Renewable electricity standards will also reduce the risk of an early peak in the production of fossil fuels, which would accelerate depletion, scarcity and price increases. Because use little or no water resources, renewable energy sources also conserve increasingly scarce water supplies.

- *Creating a low-cost national market*. By creating a national market in tradable Renewable Energy Credits, a federal standard would further reduce the cost of renewable energy, which has already declined by as much as 80-90 percent for wind and solar technologies in the last three decades. Companies would be able to buy the least-cost renewable energy credits in any state in a large and liquid market. Aggregating demand from all states would rapidly create the economies of scale needed to reduce renewable energy costs. Lower renewable energy costs will not only mean greater net benefits in the future, but more energy choices available to individuals, businesses and utilities.

- *Strengthening US competitiveness*. And finally, creating a strong, thriving renewable energy industry would enable the U.S. to compete effectively in a growing international renewable energy marketplace that has already exceeded $55 billion in 2006 and is projected to exceed $220 billion by 2016.[4]

We have strong national policies for fossil and nuclear fuels. Where renewable energy can contribute so many benefits to the national economy and environment, we must not rely on the states alone to be the primary drivers of renewable energy development.

b. Is it appropriate for Government to impose generation-source conditions or energy savings requirements on load-serving utilities in order to serve public-policy purposes such as promotion of renewable energy production, energy efficiency, and reduction of carbon emissions? Why or why not?

Answer. Yes. As mentioned in the response to question 1a, portfolio standards were designed to capture the public benefits of renewable energy at least cost. As described above, carbon emission reductions are one very important among many of the public benefits that would be realized through a federal renewable standard.

Twelve states have enacted Energy Efficiency Resource Standards (EERS). Importantly, in all but one of those cases, the efficiency technologies have either their own entirely separate standard, or compete together in a tier separately from new renewable energy technologies. As of now, there is very limited experience with the effectiveness of EERS's, and no experience with direct competition between efficiency and renewable technologies in the same tier.

Western states are considering load-based standards for carbon emission reductions, but no such programs have yet been enacted. Load-based standards have also been identified as an option for preventing leakage in the Northeast Regional Greenhouse Gas Initiative (RGGI). No decision on leakage prevention or mitigation options within RGGI have yet been made.

c. If you favor such a policy, how would you define its specific purpose?

Answer. The purpose of a federal renewable electricity standard is to increase the use of renewable electricity by US electricity suppliers and customers, by creating a national market for renewable energy credits, in order to realize national benefits of increasing energy security, fuel diversity, price stability, fossil fuel price decreases, strengthen rural economies, reduce environmental impacts and compliance costs, and conserve natural resources.

d. If Congress were to adopt an economy-wide policy mandating reductions in emissions of greenhouse gases, including the electricity industry, would such a portfolio standard policy remain necessary or advisable?

Answer. Yes. A federal renewable electricity standard and other energy policies are essential complements to economy-wide policy to reduce greenhouse gases. An economy-wide greenhouse gas policy will place a price on carbon emissions, most likely either through cap-and-trade or a carbon tax or both. Placing a price on using the atmosphere as a carbon dump is essential for creating appropriate price signals to reduce greenhouse gas emissions.

However, there are numerous market barriers and failures in the electricity, buildings, industrial and transportation sectors to deploying new low-carbon and zero-carbon technologies necessary to reduce greenhouse gas emissions economy-wide. Examples of such market barriers include a lack of information by energy decision-makers, especially about advanced technologies; uncertainty and risk of new technologies perceived by consumers, businesses, utilities and investors; a lack of access to capital, or higher priority needs for investing scarce capital; short payback horizons imposed by the need to report high quarterly earnings; high transaction costs; split incentives between owners of buildings and renters, and others.

Examples of market failures include the failure of the market to put a price on carbon emissions, but also on many other fossil fuel impacts, and the co-benefits of low-emission or zero-emission technologies, including: reduced cost of compliance with cap and trade regulations for those not making the zero-emission investments, reduced emissions of uncapped pollutants, include toxic metals; reduced impacts of fuel extraction, processing, transport, and waste disposal; reduced consumption of water; reduced depletion of increasingly scarce fossil resources, and the risks of a near-term peak oil and gas use; and others.

Renewable energy technologies face distortions in tax and spending policy. Studies have established that federal and state tax and spending policies tend to favor fossil-fuel technologies over renewable energy. A 2003 study by the Renewable Energy Policy Project showed that between 1943 and 1999, the nuclear industry received over $145 billion in federal subsidies vs. $4.4 billion for solar energy and $1.3 billion for wind energy. Another study by the non-partisan Congressional Joint Committee on Taxation projected that the oil and gas industries would receive an estimated $11 billion in tax incentives for exploration and production activities between 1999 and 2003. In addition to these subsidies, conventional generating technologies enjoy a lower tax burden. Fuel expenditures can be deducted from taxable income, but few renewable technologies benefit from this deduction, since most do not use market-supplied fuels. Income and property taxes are higher for renewable energy, which require large capital investments but have low fuel and operating expenses.

These market failures and barriers mean that higher prices are needed to induce investment in new technology through price signals alone than if these barriers and failures did not exist. They produce low price elasticity – low consumer response to higher energy prices. Addressing and overcoming the market barriers and failures directly can thus reduce the cost of compliance with cap and trade or other emissions policies.

Analyses by EIA and others have explicitly found that it is less expensive to meet emission caps with an RPS than without one. A 2001 EIA analysis of a four-pollutant bill sponsored by Senator James Jeffords found that an RPS would reduce the cost of compliance by $95 billion net present value.[5]

e. What analysis has been done of any portfolio standards requirement you endorse to demonstrate:

i. Its economic costs to consumers, nationally, and in various regions, in electricity rates?

Answer. Since 1997, at least 20 studies have been completed on various RPS scenarios. These studies have analyzed an RPS as a stand-alone policy and an RPS combined with additional renewable energy, energy efficiency, and emissions reduction policies, using several different computer models and a range of assumptions. UCS and EIA completed many of the studies, using different versions of EIA's NEMS model and different assumptions for renewable energy potential, cost, performance and other factors. We reviewed these studies in an article for a recent issue of the Electricity Journal. (Attachment C). Despite using very different assumptions, the studies show that a federal RPS in the 10-20 percent by 2020 range can reap significant national environmental and economic benefits for either a very small cost, or a potential savings to consumers, nationally, and in all regions.

In 2004, for example, UCS conducted an analysis using the Annual Energy Outlook 2004 (AEO 2004) version of NEMS. Specifically, we analyzed a 20 percent by 2020 RPS and the federal production tax credits (PTC) for renewable energy supported by the Senate energy bill conference committee in November 2003, as well as a 10 percent by 2020 RPS. This proposal was modeled under two scenarios: one with EIA's assumptions and one with modifications made by UCS to certain assumptions for renewable energy technologies.

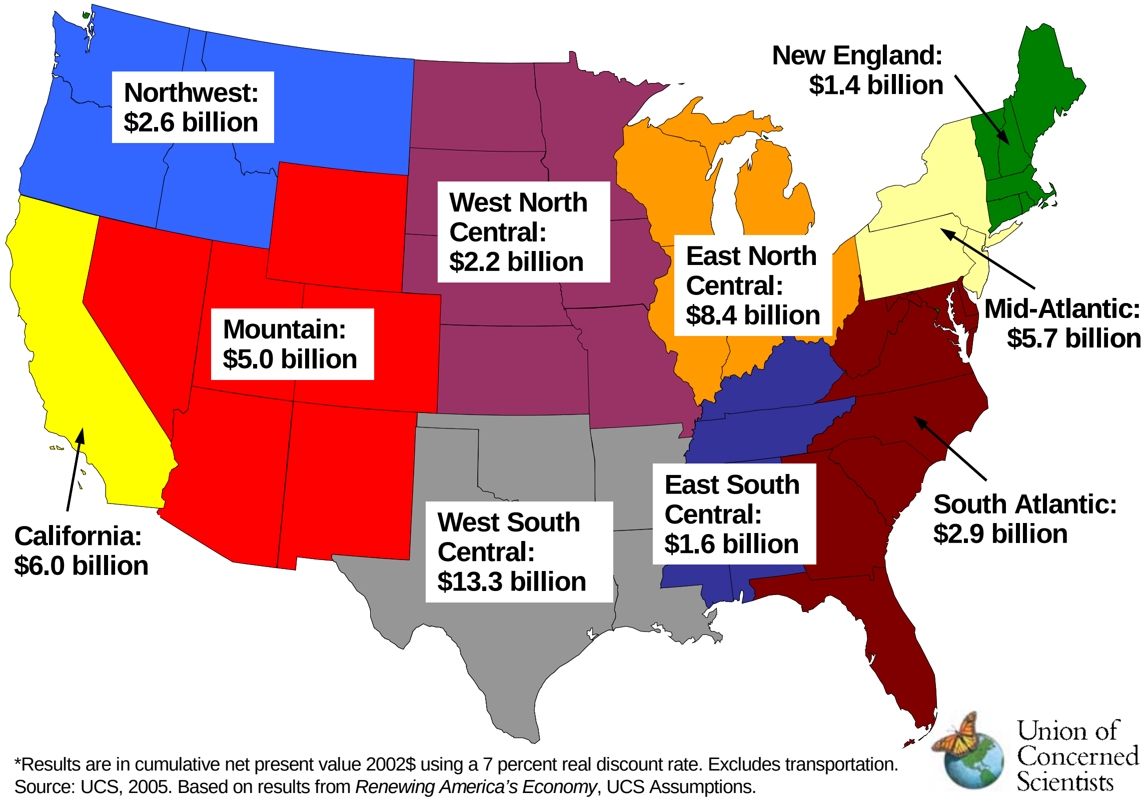
Both the UCS and EIA analyses show that a national RPS can save consumers money in several ways. First, by reducing the demand for fossil fuels, and creating new competitors for the dominant fuel sources, renewable energy helps reduce the price of fossil fuels and restrain the ability of fossil fuel prices to increase in the future. Natural gas therefore costs less for electricity generation, as well as for other purposes, benefiting both electricity consumers and other natural gas consumers. Second, some renewable resources, especially wind energy at good sites, are now less expensive than building new natural gas- or coal-fired power plants over the expected lifetimes of the plants, and reduce projected generation costs. And third, a national RPS reduces the cost of renewable energy technologies, by creating competition among renewable sources and projects to meet the requirements, and by creating economies of scale in manufacturing, installation, operations, and maintenance. Most importantly, projected savings are robust enough to be found in all of the recent RPS scenarios, at both the 10 percent and 20 percent levels, and despite large differences in projected renewable energy costs and performance in the EIA and UCS assumptions.

Using UCS assumptions for renewable energy technologies, the 2004 analyses found that average consumer natural gas prices would be lower than business as usual in nearly every year of the forecast under the 20 percent RPS, with an average annual reduction of 1.5 percent. In addition, average consumer electricity prices would be lower than business as usual in every year of the forecast, with an average annual reduction of 1.8 percent. As a result, the 20 percent RPS would save consumers $49.1 billion on their electricity and natural gas bills by 2020. All sectors of the economy would benefit, with commercial, industrial, and residential customers' total savings reaching $19.1 billion, $17.4 billion, and $12.6 billion, respectively.

With UCS running NEMS using EIA's assumptions unmodified, the results showed that a 20 percent RPS would still reduce gas and electricity prices. Cumulative savings to electricity customers under a 20 percent RPS totaled $15.4 billion by 2020, with cumulative savings to gas consumers of an additional $11.6 billion, for a total savings of more than $27 billion.

A 10 percent renewable standard would save less money than the 20 percent scenario. In the UCS scenario, consumers would save almost $28.2 billion on their electricity and natural gas bills by 2020, with the savings continuing to grow to $37.7 billion by 2025. EIA's own analysis in 2005 for Senator Bingaman found that the 10 percent RPS would save consumers $22.6 billion by 2025.

Cumulative Energy Bill Savings* by U.S. Census Region, (20 percent by 2020 RPS)



*Results are in cumulative net present value 2002$ using a 7 percent real discount rate. Excludes transportation.
Source: UCS, 2005. Based on results from *Renewing America's Economy*, UCS Assumptions.

The 2004 national RPS scenarios using either UCS or EIA assumptions also found that energy bills would be reduced in every region of the country, including the Southeast, where some people have suggested there is limited low-cost renewable energy potential. This is primarily due to the lower natural gas prices for electricity generation and other direct gas consumers that all regions would see. In addition, all regions do have some renewable energy resources, and would likely see an increase in using local resources for generation that would often displace the need for importing fossil fuel. Furthermore, the national credit trading market created by a national RPS would allow utilities in all regions to purchase RECs for the same price, providing utilities with negotiating leverage over local renewable generators. We are in the process of updating this analysis for 2007.

Since the *Electricity Journal* article was published, at least three new federal RPS analyses have been conducted. UCS has examined 20 percent and 15 percent by 2020 standards using the Annual Energy Outlook (AEO) 2007 version of EIA's NEMS model with no change in assumptions about technology costs and performance, and found cumulative net present value savings of 10.8 billion and 16.4 billion, respectively, by 2030. While our 15 percent by 2020 analysis showed savings in every region of the country, except for very small increases in the two Southeast regions, we expect that our upcoming analysis using revised technology cost and performance assumptions will show savings in all regions of the country and higher savings overall. EIA itself recently published an analysis of Senator Jeff Bingaman's 15 percent by 2020 amendment, and found net costs of $18 billion by 2030. While these results appear very different at first glance, they actually represent very small differences, with UCS's results a savings of 0.3 percent in cumulative electricity and gas bills over the period, and EIA's results a 0.3 percent cost.

The differences are primarily a result of slightly different calculations of the amount of renewable energy required after various exemptions and deductions of resources from the baseline; EIA's use of a 1.9 cent per kWh alternative compliance payment (ACP) vs. UCS use of a 2.0 cent/kWh ACP (in the current bill), and EIA's use of a 2030 sunset (in the current bill) vs. UCS assumption of no sunset. The primary lesson from comparing these analyses is that inclusion of a sunset, and a lower alternative compliance payment, paradoxically increases the cost of the RPS. That is because projects coming on-line in 2020, for example, have only ten years to pay off capital costs under a 2030 sunset, raising the price they must charge to recover their fixed costs, and leading to greater use of ACP instead.

UCS is currently in the process of conducting new analyses using revised technology cost and performance assumptions that better reflect price increases affecting all energy resources in the last several years, as well as national lab and other projections for future renewable energy costs and performance.

ii. Its benefits in greenhouse gas emission reductions?

Answer. In the most recent UCS analysis, a 20 percent RPS reduced carbon dioxide emissions by 310 million metric tons per year in 2020, a 69 percent reduction in the growth of projected power plant carbon dioxide emissions, and an 11 percent reduction in overall US power plant carbon dioxide emissions. UCS found that a 15 percent RPS would reduce power plant carbon dioxide emissions by 199 million metric tons in 2020. Because EIA projected slightly more renewable energy generation, after considering RPS exemptions and deductions from the baseline, they found that a 15 percent RPS would reduce 2020 carbon dioxide emissions by 172 million metric tons.

iii. Its implications for electricity reliability, security, and grid management?

Answer. Some people have expressed concerns about the variable output of renewable sources like solar and wind, and believe that an RPS would affect the reliability of our energy system. However, the electric system is designed to handle unexpected swings in energy supply and demand, such as significant changes in consumer demand or even the failure of a large power plant or transmission line. Solar energy is also generally most plentiful when it is most needed—when air-conditioners are causing high electricity demand. There are several areas in Europe, including parts of Spain, Germany, and Denmark, where wind power already supplies over 20 percent of the electricity with no adverse effects on the reliability of the system. In addition, several important renewable energy sources, such as geothermal, biomass, and landfill gas systems can operate around the clock. Studies by the EIA and the Union of Concerned Scientists show these nonintermittent, dispatchable renewable energy plants would generate about half of the nation's nonhydro renewable energy under a 10 percent RPS in 2020. Renewable energy can increase the reliability of the overall system, by diversifying our resource base and using supplies that are not vulnerable to periodic shortages or other supply interruptions.

A summary of studies have found that the impacts and costs for large scale wind generation on the power grid are relatively low at penetration rates that are expected over the next several years. For example, a 2007 study prepared for the California Energy Commission shows that nine utility studies in the U.S. have found a modest cost increase of less than 0.5 cents per kWh for integrating wind up to 29 percent of system capacity.[6] In addition, a 2006 study completed for the Minnesota Public Utilities Commission found that the additional costs of integrating 5,700 MW of wind—or 25 percent of Minnesota electricity sales—would be between 0.3 and 0.41 cents per kWh.[7]

iv. Its implications for jobs and economic development?

Answer. In the 2004 UCS analysis using UCS assumptions, we projected that by 2020 the 20 percent RPS would generate more than 355,000 jobs in manufacturing, construction, operation, maintenance, and other industries—nearly twice as many as fossil fuels, representing a net increase of 157,480 jobs Renewable energy would also provide an additional $8.2 billion in income and $10.2 billion in gross domestic product in the U.S. economy in 2020. We are in the process of updating this analysis.

Renewable energy technologies tend to create more jobs than fossil fuel technologies because they are more labor-intensive. A large share of the expenditures for renewable energy is spent onmanufacturing equipment, and installing and maintaining it. With biomass, money is also spent on fuel, but usually from sources that are within 50 miles of a biomass plant, because it is too expensive to transport it for long distances. Therefore, renewable energy facilities avoid the need to export cash to import fuel from other states, regions, or countries— keeping money circulating in the local economy, and creating more local jobs.

Many of the new jobs would be located in rural areas where the renewable energy generating facilities would be sited. However, a national RPS can also benefit manufacturing states, even those with less abundant renewable resources, by providing them the opportunity to manufacture and assemble components for renewable energy facilities. Developing a strong manufacturing base can also create enormous export opportunities, given the rapidly growing commitment of the rest of the world to expand use of renewable energy.

Analysis by the Renewable Energy Policy Project (REPP) found that the economic benefits are not localized to the states that have the most renewable energy resources. REPP examined the capability of the manufacturing industries in each state to supply components for wind and solar facilities. They found that the top 20 states for wind component manufacturing would be California Ohio, Texas, Michigan, Illinois, Indiana, Pennsylvania, Wisconsin, New York, South Carolina, North Carolina, Tennessee, Alabama, Georgia, Virginia, Florida, Missouri, Massachusetts, Minnesota, and New Jersey. The top 20 states for solar manufacturing would be California, Texas, Arizona, New York, Pennsylvania, Massachusetts, Illinois, Ohio, Oregon, Florida, North Carolina, New Jersey, Colorado, Washington, Virginia, Indiana, Michigan, Minnesota, New Mexico, and Missouri.[8]

A national RPS can help improve the U.S. economy in other ways. Renewable energy can greatly benefit struggling rural economies, by providing new income for farmers, ranchers, and landowners from biomass energy production, wind power lease payments, and local ownership.

Property tax revenues from renewable energy facilities can also help local communities pay for schools and vital public services. Our 2004 analysis, which is currently being updated, found that a 20 percent by 2020 RPS would produce $15 billion in biomass energy payments, $1.2 billion in wind power land lease payments, and $5 billion in local tax revenues.

v. Its implications for utility capital investment?

Our 2004 analysis found that a 20 percent by 2020 RPS would produce $72.6 billion in new capital investment.

vi. Other relevant factors?

A federal RPS has sometimes been mischaracterized as a program that overwhelmingly supports only wind energy technology. It is correct that in UCS analyses, wind energy sometimes constitutes as much as two-thirds of renewable energy developed to meet the standard. On the other hand, in EIA analyses, biomass has generally been the largest beneficiary, with over half of all renewable generation produced by the standard.

The fact that the variation in predominant technologies is much larger than the variation in resulting costs, despite very different assumptions, reflects the robustness of the broad economic conclusions, the sensitivity of the model to small changes in assumptions reflecting the relative competitiveness of the resources and technologies, and the fact that wind, biomass in some regions and applications, and geothermal in some regions, are all relatively competitive. Ultimately, the competition to among renewable energy sources that is stimulated by a national RPS will pressure all developers to reduce costs and determine the technology winners. Which renewable energy technologies will actually emerge as the biggest winners is much harder to predict.

2. **Portfolio Inclusions and Exclusions**
   a. **What is the principle that should determine inclusion or exclusion of any energy source from an adopted portfolio standard? (i.e., excludes all fossil-fired generation, includes all generation that emits no GHG, excludes all generation below given energy-conversion efficiency, etc.)**

Answer. A Renewable Portfolio Standard should include only renewable energy resources that being the constellation of benefits reviewed in section 1a above, including increasing fuel diversity.

Over the long-term, the most important economic benefit of the RPS is that it would diversify the fuel sources in our energy portfolio, reducing consumer and industrial energy bills by creating new competitors to the coal, gas and nuclear resources that currently constitute about 90 percent of our fuel sources for electricity. Developing advanced technologies that use existing fuels is also important, but does not contribute to the objective of diversifying energy sources.

Any new or minimally used fuel whose price is independent of existing fuels would help accomplish that objective. The more that new competitors are available to be rapidly deployed, the less vulnerable our economy is to potential energy supply shortages or interruptions, price spikes, price increases or price manipulation as a result of our current dependence on a limited supply of a limited number of fuels. Renewable resources—including wind, solar, biomass, geothermal, tidal, and wave power—are especially valuable in this respect because they are also domestic, non-interruptible, and nondepletable; because they do not present attractive targets for terrorists; because they avoid the risk of high future environmental and safety regulatory costs; and because they each have the potential for significant expansion as competitors to existing fuels.

Generally speaking, portfolio standards are designed to accommodate resources that provide a broad range of benefits, can be provided competitively using different technologies from different suppliers, are commercially available and likely to become cost-effective as a result of increased economies of scale, and are available in relatively small increments compared to the overall standard. Renewable energy technologies and energy efficiency technologies are thus a good fit with portfolio standards. Advanced technologies for large fossil fuel and nuclear power plants are not.

b. What generation sources for retail electricity supplies (including efficiency offsets) should be included and should be excluded from any mandatory portfolio requirement that is adopted? Please provide your reasons for excluding any sources.

Answer. As discussed above, renewable resources—including wind, solar, biomass, geothermal, and incremental hydro—should be included in the RPS.

Customer-sited renewable generation, such as fuel cells using renewable fuels and photovoltaic systems, should continue to be eligible in a federal RPS, and continue to be eligible for triple credits, as enacted twice by the Senate.

While IGCC, advanced nuclear generation, and low emission non-renewable customer sited generation should be encouraged, other mechanisms should be used to encourage these technologies, and they should not be included as eligible resources in an RPS, for the reasons discussed below.

Improving the efficiency, the environmental performance, and the safety of technologies that utilize currently dominant fuels is also a very important objective, but accomplishing that objective cannot satisfy the critical national need to develop new competitors to current fuels. Because both objectives—developing new fuel sources, and developing advanced technologies using dominant fuels—are important, one policy, such as the RPS, should not be used to create a zero-sum game where achieving one objective competes with achieving the other objective.

Proposals that would maintain or increase even other subsidies for the dominant resources, and potentially phase out the production tax credit for renewables, compound the concern that including other technologies in the RPS could limit or preclude its effectiveness in developing new competitors. Nuclear generation, for example, continues to receive significant subsidies for fuel enrichment, insurance, security, and waste disposal, as well as the new subsidies included in the Energy Policy Act of 2005. A Cato Institute paper found that the insurance subsidy alone conferred by the Price-Anderson Act is worth as much as $3.4 billion per year to the nuclear industry.[1]

Improving energy efficiency is also a critical national objective, but one that should not compete with or displace the need to develop new supply-side competitors to coal, nuclear and gas. The U.S. needs both improved energy efficiency and new supply options. There are many very inexpensive efficiency options that are not being implemented because of market barriers in the electricity industry. Sound energy policy should ensure that those cost-effective efficiency options are implemented without putting them in competition with and compromising the objective of developing new supply options.

The RPS is designed to help emerging renewable technologies cross over the so-called “valley of death” between R&D and commercial deployment. The RPS lets the market place determine winners and losers by creating a national market with competition among new commercially ready technologies to gain critical field installation and operating experience and achieve initial economies of scale, the RPS helps drive down the costs of the technologies to enable them to increasingly compete with established fuels.

To the extent that Congress wants to utilize competition to meet a standard to further the objectives of developing new renewable energy sources, improve end-use efficiency, or developing advanced technology to utilize today’s dominant energy sources, it should create entirely separate standards to meet each of the three objectives. In that way, similar technologies will compete with each other to achieve each of the three objectives, without trading one important objective for another.

Before considering such a competitive mechanism for advanced technologies using today’s dominant energy sources, however, we recommend that Congress consider:

- While there are now a number of states that have demonstrated successfully that a renewable standard can work, there is not yet one working state example of an advanced technology standard. Pennsylvania’s standard, with a separate tier for nonrenewable advanced technologies, is still in the regulatory development phase.
- The RPS creates competition among renewable projects and options because many small projects can compete to fulfill a relatively small piece of the overall load. As Commissioner Richard Morgan pointed out in his oral Senate testimony in 2005, it is not clear whether such a mechanism would work effectively with much larger projects. Larger projects would create lumpy additions to utility rates, and are not likely to be financeable using a market-based mechanism such as tradable credits, especially for initial deployment of new technologies.

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[1] Heyes, Anthony. "Determining the Price of Price-Anderson." Regulation, Winter 2002-2003. Available at: <http://www.cato.org/pubs/regulation/regv25n4/v25n4-8.pdf>

- We are not aware of any analyses that would help determine appropriate percentages, costs and benefits, or cost cap levels for a standard for advanced technologies.
- To be on a level environmental playing field with renewables, which have very low or zero net carbon emissions, IGCC would have to be coupled with carbon capture and storage.
- An early deployment mechanism, like a portfolio standard, is not a substitute for R&D. Carbon capture and storage still requires significant R&D to determine if it can be effective and economical. Advanced nuclear technologies require considerable R&D to resolve safety, security, waste disposal and economic issues before they are ready to consider for deployment.
- Nothing will foreclose future nuclear options faster and surer than another nuclear accident. The highest nuclear funding priority should be increasing the Nuclear Regulatory Commission’s budget for inspection and enforcement.

c. To the extent that multiple renewable energy sources and efficiency or other sources are eligible for inclusion, should any tiers among them or separate sub-requirements be adopted?

Answer. As noted above, we do not support adding non-renewable technologies to a national RPS. Eligible resources should only include renewable resources, as in the previous renewable portfolio standards that were approved by the Senate. We continue to support providing multiple credits to renewable facilities sited in customer facilities. Such distributed generation projects face additional market barriers not faced by bulk power renewables, and generally require more support to be implemented. To the extent they were to be included in a standard, however, it would be critical to include them in a separate tier.

A number of states have found it valuable to create a separate tier for solar or small distributed generation resources. (See Attachment D). As these technologies have somewhat higher costs than bulk renewables, they do not compete well in one tier in an RPS.

d. Should there be any distinction between existing and new sources of generation eligible for inclusion in the portfolio? If so, what would be the threshold date for eligibility?

A number of states have also found it valuable to create a separate tier for existing renewable energy generation. Generally, it is much less expensive to continue operation of an existing unit than it is to build a new one. By creating a separate tier for existing renewables, they compete against each other to maintain existing levels of renewable generation, with lower credit prices than commanded by new projects. In such a system, it is advisable to allow new renewables to compete in both tiers. An existing renewable energy project should be displaceable by a new project if the new project can operate more economically. The threshold for eligibility as a new renewable energy facility should be after enactment of the bill, or a period shortly before that.

e. Would the electricity equivalent of useful thermal energy from eligible sources be credited against the requirement? Why or why not?

Thermal energy production should count toward energy saved in an energy efficiency standard, as opposed to qualifying as a renewable resource in a renewable electricity standard.

f. To the extent energy efficiency is included:

i. How would the required savings be measured and verified?

UCS has not examined this area yet.

ii. Against what base consumption period (historic or projected)?

UCS has not examined this area yet.

3. **Percentage Requirement and Timing**

a. What target percentage of total retail power deliveries should achieved by the required portfolio?

Answer. 20 percent.

b. What is the target year for reaching the ultimate mandated portfolio percentage?

Answer. 2020

c. Should there be a straight-line, accelerating, or other form of "ramp-up" to the ultimate target percentage?

Answer. Straight line, after a briefly delayed start for regulatory implementation.

d. Should there be any "off-ramps" or other built-in automatic changes in requirements as a function of contingencies? If so, what should they be? (e.g., price or cost thresholds, contingencies for natural or climate conditions, lack of adequate transmission, etc.)

Answer. We do not believe that any off-ramps are necessary, especially if the RPS includes a well-designed system for alternative compliance payments "off-ramps" for contingency situations should not be necessary. The use of the alternative compliance payments for subsequent renewable energy generation makes up for the delay in reaching the targeted levels as a result of the contingencies.

4. **Relationship to State Portfolio Standards and Utility Regulation**

a. Should an adopted Federal portfolio standard set:

i. **A minimum standard, allowing States to set or maintain higher targets?**

Answer. Yes. A federal standard should also explicitly allow states with higher standards to retire any renewable energy credits used for state compliance, rather than allowing them to be resold to either in-state or out-of-state companies. In that way, states that desire to do so can ensure that incremental renewable generation caused by its higher state standard adds to the floor established by the federal standard.

ii. **A preemptive standard, prohibiting States to set higher or different targets?**

Answer. No.

iii. **Merely a mandate for a standard, allowing States to set their own targets at any level?**

Answer. No.

iv. **Merely a given percentage target, allowing States to elect generation or efficiency sources eligible to meet it?**

Answer. No.

v. **A standard applying only to States without prior portfolio requirements, grandfathering all prior standard programs?**

Answer. No.

b. **Can and should State regulatory agencies be required to pass through the costs of complying with Federal portfolio standards requirements in retail rates?**

Answer. Companies should be allowed to recover all prudently incurred expenditures for compliance with a federal RPS. Federal law should respect the states' authority to establish retail rates, cost recovery rules and prudency tests for state RPS policies, even if REC purchases under these policies also may count towards the federal RPS. State regulators are responsible for determining the prudence of utility electricity purchase decisions, and allowing them to do so for compliance with federal RPS law, as with all other federal law, is important for ensuring that companies pursue least cost strategies for federal RPS compliance.

5. **Utility Coverage**

   a. **Should any retail sellers of electricity be exempt from the portfolio requirement? (e.g., municipal utilities, rural cooperatives, utilities selling less than a minimum volume of power, unregulated marketers in States with competitive retail markets, etc.)**

Answer. No. It is not necessary to exempt any company on the basis of size or other criteria, because the national credit trading market and the alternative compliance payment provide simple, flexible, low cost means of compliance for any company. The standard should apply to all retail suppliers, regulated and unregulated alike.

   b. **Should any standard apply to wholesale power markets or sales?**

Answer. No. Renewable electricity standards in all 23 states plus the District of Columbia apply to retail electricity sales. A federal standard on retail sales would allow for optimal integration and coordination of state and federal policy. By placing the renewable standard on retail suppliers, the standard is placed on the companies that are responsible for assembling a portfolio of energy resources to serve their customers. The retail standard thus appropriately targets the entity with the responsibility to make energy purchase decisions, and incentivizes them to make optimal decisions to meet the standard. Since it is the retail companies that must assess the value of renewable energy options to their customers, a retail standard helps those companies learn how to value renewable energy appropriately, and helps mainstreams renewable energy.

   c. **Should there be any basis for discretionary exemptions of certain States or utilities?**

Answer. No. The RPS provides national benefits that accrue to all states and companies, so all states and companies should participate.

6. **Administration and Enforcement**

   a. **Should a Federal Government entity enforce the requirement and decide on any exemptions?**

      i. **If so, which one? (e.g., the Environmental Protection Agency? The Department of Energy? The Federal Energy Regulatory Commission? A newly created office or entity?)**

Answer. We would recommend that either the Department of Energy or the Federal Energy Regulatory Commission should enforce the requirement, with FERC preferred.

      ii. **If not, should enforcement be delegated to the States or to regional transmission or electric-system-operation entities?**

Answer. No.

b. How should Federal and State enforcement be coordinated in States with their own portfolio requirements?

Answer. Federal legislation should create a floor on which the states can build. Compliance with state standards either through renewable energy generation or by payment to a state compliance or alternative compliance mechanism should count toward the federal standard, on the basis of the amount of renewable energy ultimately generated by use of such compliance payments. A federal standard should not preempt the ability of states to establish their own RPS policies, which may differ from a Federal RPS, though state RPS policies should not relieve retail electric suppliers of responsibility to satisfy Federal requirements. As mentioned above, states should be able to ensure retirement of allowances used for compliance with state RPS's that are higher than the federal standard.

Renewable energy credits should be issued strictly on the basis of one credit for each megawatt-hour of eligible renewable energy generated, and should coordinate with and build on existing state and regional certificate tracking systems to ensure national tracking for Federal RECs and to address double-counting concerns.

Consumers wishing to voluntarily purchase renewable energy or RECs as "green power" in excess of minimum requirements should be ensured that such voluntary demand is additional to the Federal RPS.

c. What penalties should apply for failure of utilities to meet the percentage mandate?

Answer. An Alternative Compliance Payment should be enforced at 5 cents/kWh for every kWh short of the mandate, escalated by inflation. The Government should recycle the funds from alternative compliance into the development of renewable facilities, either through purchasing credits in the market to resell as needed, or by auctioning funds to potential developers, or by distributing the money to state renewable energy funds in the state served by the supplier.

A higher civil penalty should be imposed for failure to comply.

7. **Credits and Trading**

a. Should tradable credits for qualifying generation be utilized as the mechanism for establishing compliance?

Answer. Yes.

b. Should credit trading be permitted or required on a national basis in order to achieve least-cost compliance with the portfolio standards?

Answer. Yes, subject to the authority of a state to retire credits used to meet higher state standards than the federal standard.

c. Should there be a cap on credit values to limit costs?

Answer. Such a cap is not needed. If imposed, it should be at least 5 cents per kWh, adjusted for inflation.

d. As between a utility purchaser and a qualifying power generator, to whom should the portfolio standard credits be initially allocated?

Answer. States should determine REC ownership (state and Federal) based on state law. Where states and existing contracts are silent on this issue, we believe that credits associated with historic purchases of QF power should go to the purchasing utility.

e. What relationship, if any, should portfolio standard credits have to other State and Federal credit trading programs for S02, greenhouse gases, or biofuels?

Answer. There does not need to be a relationship defined within State or Federal RPS credit trading programs with respect to $S0_2$, greenhouse gases, or biofuels. Cap and trade programs, however, should reduce the number of allowances distributed or auctioned by the amount of GHGs reduced from any voluntary purchases of renewable energy credits above any RPS standards, to ensure that such purchases create additional GHG benefits.

f. What requirements, if any, would there be concerning the length of contracts for qualifying generation and ownership of credit rights?

The vast majority of renewable energy projects are financed on the basis of long-term contracts for their output. Longer contracts generally reduce financing costs and permit lower renewable energy prices. A number of states have found that requiring compliance of at least a part of the RPS through long-term contracts of at least ten years can help reduce compliance costs.

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Union of Concerned Scientists | fact sheet
Citizens and Scientists for Environmental Solutions

Experts Agree: Renewable Electricity Standards are a Key Driver of New Renewable Energy Development

More and more renewable energy experts are recognizing that renewable electricity standards are a key driver of new renewable energy in the United States. A renewable electricity standard—also known as a renewable portfolio standard or RPS—is a cost-effective, market-based policy that requires electric utilities to gradually increase their use of renewable energy resources such as wind, solar, and bioenergy. Currently, 21 states and the District of Columbia have enacted renewable standards, which UCS projects will result in the development of more than 46,000 megawatts (MW) of new renewable energy by 2020. If our country's leaders implemented a national 20 percent by 2020 renewable standard, then we could increase our total renewable energy capacity to 180,000 MW, while providing significant economic and environmental benefits.

Here is what just some of the experts have to say about the renewable electricity standard:

- "RPS also will be the most important driver for new renewables in the United States and Canada over the next ten years." This was a key finding in "The Changing Face of Renewable Energy," an October 2003 study prepared by Navigant Consulting on behalf of a group of U.S. and Canadian energy and utility companies. For more information, http://www.navigantconsulting.com/.

- "Renewable portfolio standards or purchase mandates are the most powerful tool that a state can use to promote wind energy." Lori Bird, et al. from the National Renewable Energy Laboratory released "Policies and Market Factors Driving Wind Power Development in the United States." The report explores the factors that have been driving utility-scale U.S. wind energy development, and found that state-level renewable electricity standards appear to be the most effective policy. To view this report, http://www.nrel.gov/docs/fy03osti/34599.pdf.

- "In 2001, 75 percent of the wind power developed in the United States was within those states with renewable energy requirements." Statement by Lawrence Berkeley National Laboratory's (LBL) Ryan Wiser in a January 9, 2004, article in *The Olympian*.

- "The option that elicits the highest [willingness to pay] in the [contingent valuation] survey is the RPS: collective payment, with private provision." In August 2003, LBL's Ryan Wiser released "Using Contingent Valuation to Explore Willingness to Pay for Renewable Energy: A Comparison of Collective and Voluntary Payment Vehicles." The report found that U.S. households express a higher willingness to pay for collective efforts to support renewable energy—especially policies such as renewable electricity standards—over voluntary efforts such as green marketing or pricing. To view the report, http://eetd.lbl.gov/ea/EMS/reports/53239.pdf.

- State-level renewable electricity standards, along with the federal production tax credit for wind, will be the primary drivers of new renewable energy growth in the United States through 2015. This was a key finding in Platts Research & Consulting's July 2003 report, *Renewable Power Outlook 2003*. To purchase the report, http://www.platts.com/.

- "Renewable portfolio standards have emerged as an effective and popular tool for promoting renewable energy." In *Renewable Energy and State Economies*, a May 2003 report by the Council of State Governments, Barry Hopkins listed the RPS as one of the two most effective and popular options (along with public benefits funds) for stimulating renewable energy growth and providing important economic opportunities for states.

- Existing and new renewable electricity standards are key components to achieving a "50 gigawatt" U.S. renewable energy growth scenario. Presentation made by Steven Taub, Director of Cambridge Energy Research Associates' Emerging Generation Technologies Group, at the Second Annual Conference of the American Council For Renewable Energy in July 2003. For more information, http://www.solaraccess.com/news/story?storyid=4716 (free registration required).

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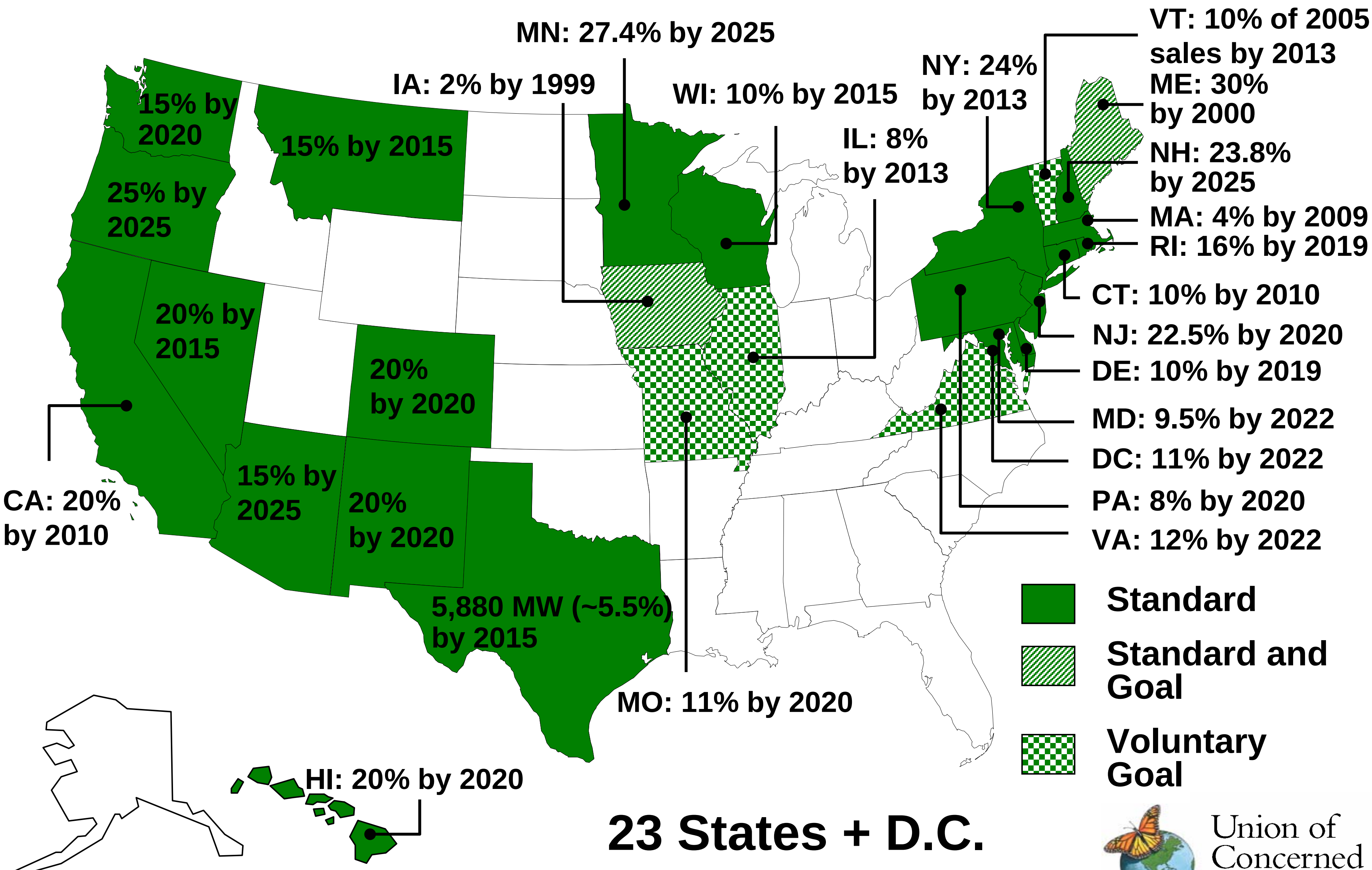
Renewable Electricity Standards



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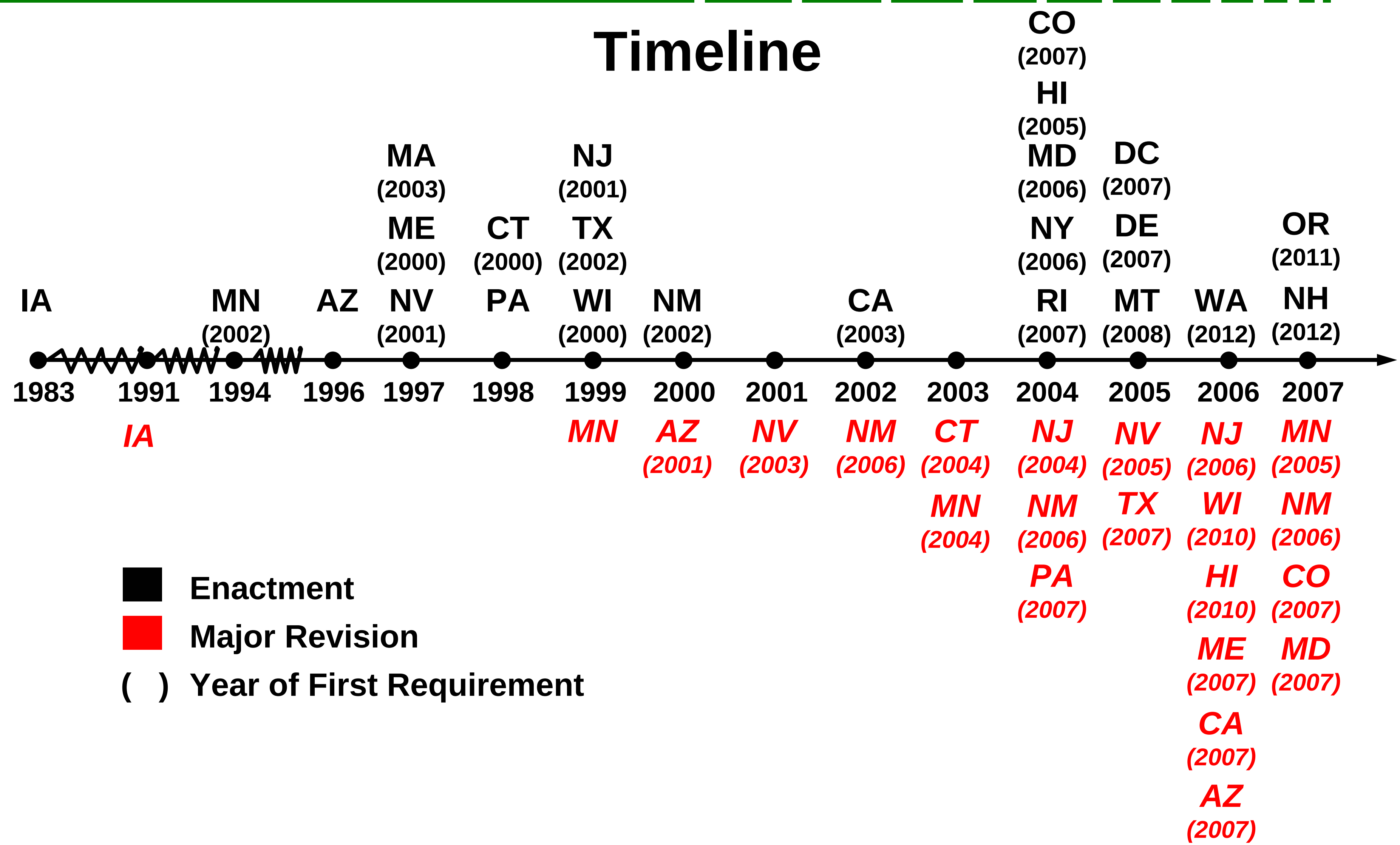
Timeline



Attachment C

The Projected Impacts of a National Renewable Portfolio Standard

A review of analyses by the Union of Concerned Scientists and the U.S. Department of Energy's Energy Information Administration using the same model, but with different assumptions, reveals a common conclusion that a national renewable portfolio standards is achievable, and would provide important economic and environmental benefits.

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I. Introduction

The renewable portfolio standard (RPS)—which requires electricity providers to gradually increase the amount of renewable energy sources such as wind, solar, bioenergy, and geothermal in their power supplies—has emerged as a popular tool for reducing market barriers and stimulating new clean energy markets. As of February 2007, 21 states and the District of Columbia had adopted an RPS,[1] and at least eight more states were actively considering legislation. A number of analyses have concluded that state RPS are a primary driver of new renewable energy development in the United States.[2]

In Congress, lawmakers from both chambers and both parties have introduced numerous national RPS proposals since 1997. Championed in large part by Sen. Jeff Bingaman (D.-N.M.), the Senate has passed a national RPS as part of comprehensive energy legislation three times since 2002, most recently in 2005. However, each time it has failed to become law.

Since 1997, the Union of Concerned Scientists (UCS) and the U.S. Department of Energy's (DOE) Energy Information Administration (EIA) have completed several studies that examine the costs and benefits of various national RPS proposals. Both organizations use EIA's National Energy Modeling System (NEMS), but with several different assumptions for renewable energy technologies. Therefore, comparing the results reveals the robustness of common conclusions about the likely economic and environmental benefits of a national RPS, as well as the impact of various uncertainties on the magnitude of the benefits.

We review results on electric and natural gas prices, consumer energy bills, the electricity generation mix, renewable energy development, carbon emissions, jobs, and economic development benefits for both 20 percent and 10 percent by 2020 national RPS scenarios. In addition, we discuss several additional benefits from increased renewable energy use, as well as the implications that various RPS design details can have on projected benefits. First, we review the drivers and history of national RPS policy, and describe the model and assumptions used to conduct the analyses.

II. Drivers of National RPS Policy

To date, state governments have dominated RPS activity in the U.S. While Iowa (1983) and Minnesota (1994) were the first states to place minimum requirements for renewable energy on their electricity providers, the RPS gained significant momentum among the states during the push for electricity deregulation in the mid-1990s as a means to capture the public benefits of renewable energy and help reduce their costs in a way that was compatible with newly competitive electricity markets.[3] The California energy crisis of 2000–01 dampened state-level interest in deregulation, but the RPS has continued to increase in popularity as nearly half of state RPS policies have been adopted since 2002. New drivers have emerged, including recognition that increased renewable energy use can diversify energy supplies and reduce natural gas demand and prices; provide new jobs, and other economic development benefits; and reduce global warming and other emissions.[4] It is precisely these benefits that have served as a primary driver for a national RPS in recent years.

Early successes in states like Texas, Minnesota, Iowa, and Wisconsin have demonstrated that the policy can be effective.

Interest in elevating the RPS to a national policy has also been driven by several other factors. For example, the size of the new renewable energy market created under existing state RPS policies would be far outweighed by a national RPS. UCS estimates that state standards, if entirely successful, would support more than 46,000 MW of new renewable power—equal to about 6 percent of total U.S. electric sales—by 2020.[5] By contrast, a 20 percent by 2020 national RPS would support as much as four times the development of renewable energy capacity (see Section V). Because all national RPS proposals to date have established a national floor, with states allowed to continue to set higher standards, a combination of state and federal standards would create the most development.

In addition, early successes in states like Texas, Minnesota, Iowa, and Wisconsin, along with the continuing growth of new state RPS adoption and expansion have demonstrated that the policy can be effective.[6] State governments are often the laboratories for national policy. If a policy is successful in one state—as with California's standards for energy-efficient appliances—it is usually replicated and expanded by others until it is ultimately considered at the national level. Furthermore, renewable energy provides important benefits to all consumers, not just those in states required to use it. Leveling the

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playing field by requiring all states and electricity providers to share in the cost of renewable energy investment is fair, as well as publicly and politically popular.

Finally, a national RPS would establish uniform rules for the most efficient trading of renewable energy credits (RECs). This uniformity could further reduce renewable energy technology costs by creating economies of scale and a national market for the most cost-effective resources; inducing renewable energy development in the regions of the country where they are the most cost-effective; and reducing transaction costs, by enabling suppliers to buy credits and avoid having to negotiate many small contracts with individual renewable energy projects.

III. History of Federal RPS Proposals

At the federal level, Sen. Dale Bumpers (D.-Ark.) introduced the first national RPS, which called for 12 percent renewable electricity by 2013, in January 1997. By 1999, at least six RPS proposals had been introduced, spanning both major political parties as well as both chambers of Congress and the Administration.[7]

Serious consideration of a national RPS did not begin until December 2001, when Sens. Tom Daschle (D.-S.D.), at the time Majority Leader, and Jeff Bingaman introduced comprehensive energy legislation (S. 1766) that included a 10 percent by 2020 RPS. In the spring of 2002, an amendment by Sen. John Kyle (R.-Ariz.) to strip the RPS provision from the energy bill on the Senate floor failed by a 40–58 vote. An amendment offered by Sen. James Jeffords (I.-Vt.) that would have increased the annual requirement to 20 percent by 2020 also failed by a 29–70 vote.

A national RPS would establish uniform rules for the most efficient trading of renewable energy credits.

Though passed by the Senate, the House failed to support the 10 percent RPS in its version of the energy bill. Ultimately, a conference committee made up of House and Senate members could not agree on final language and the energy bill died at the end of the 107th Congress.

A similar scenario played out in 2003, and again in 2005, as Congress continued its attempt to pass comprehensive energy legislation. In July 2005, as in 2002, conferees voted to strip the Senate's 10 percent RPS provision out of the conference report. This time, however, Congress passed the conference report, and President Bush signed the Energy Policy Act of 2005 into law, ending any chance of RPS passage for the rest of the 109th Congress.

As the 110th Congress has begun, there appears to be strong interest among both House and Senate leadership to consider RPS legislation.[8] Five RPS proposals have been introduced as of March 2007—three in the House of Representatives and two in the Senate. All five bills call for a 20 percent by 2020 RPS, including H.R. 969 introduced by Reps. Tom Udall (D.-N.M.), Todd Platts (R.-Penn.), and 13 other co-sponsors. In addition, Sen. Bingaman-current chairman of the Senate Energy and Natural Resources Committee-has indicated an interest in proposing a 15 percent by 2020 RPS.

IV. Federal RPS Analyses

Since 1997, at least 18 studies have been completed on various RPS scenarios. These studies have analyzed an RPS as a stand-alone policy and an RPS combined with additional renewable energy, energy efficiency, and emissions reduction policies, using several different computer models and a range of assumptions.[9] UCS and EIA completed many of the studies, using different versions of EIA's NEMS model and different assumptions for renewable energy potential, cost, performance and other factors.

In this article, we focus primarily on the findings from four of the most recent RPS scenarios examined by UCS and EIA. Three of the RPS scenarios are based on a 2004 UCS analysis using the *Annual Energy Outlook 2004* (AEO 2004) version of NEMS. Specifically, we analyzed a 20 percent by 2020 RPS and the federal production tax credits (PTC) for renewable energy supported by the Senate energy bill conference committee in November 2003.[10] This proposal was modeled under two scenarios: one with EIA's assumptions and one with modifications made by UCS to certain assumptions for renewable energy technologies. In the third scenario, we analyze a 10 percent by 2020 national RPS and PTC passed by the U.S. Senate in July 2003 as part of a comprehensive energy bill (HR 6), using the same modifications to renewable energy technology assumptions as in the 20 percent RPS scenario.[11]

The fourth RPS scenario is an EIA analysis of the 10 percent by 2020 national RPS that was passed by the U.S. Senate in July 2005.[12] Conducted at the request of Sen. Bingaman, this analysis uses the version of NEMS that produced AEO 2005.

These four scenarios provide a range of potential impacts for the RPS proposals expected to garner consideration in the 110th Congress. Below we describe NEMS, including a comparison of EIA and UCS assumptions, as well as the macroeconomic model used in the UCS analyses to project jobs and income.

A. The National Energy Modeling System

NEMS is an energy-economy computer modeling system designed by EIA, and used to provide long-term forecasts of U.S. energy markets. The model consists of 13 separate modules: four supply modules (oil and gas, natural gas transmission and distribution, coal, and renewable fuels); four end-use demand modules (residential, commercial, transportation, and industrial); two conversion modules (electricity and petroleum refineries); one macroeconomic activity module; one international energy activity module; and one module that integrates all the other modules. Each module contains a set of assumptions and data that are updated annually. To reflect the broad range of energy market characteristics across the United States, NEMS uses data from various regional inputs.[13]

> *Four scenarios provide a range of potential impacts for the RPS proposals expected to garner consideration in the 110th Congress.*

EIA primarily uses NEMS to develop baseline and sensitivity forecasts that are published in the AEO each year. EIA also uses NEMS to respond to requests for special studies of various energy policy scenarios by Congress and the Administration.[14]

B. Comparison of EIA and UCS assumptions

UCS made several modifications to the assumptions for renewable energy potential, cost, and performance in the AEO 2004 version of NEMS.[15] Compared to EIA, we generally used more pessimistic assumptions about available renewable energy supply, but more optimistic assumptions about costs and performance. We first modified NEMS to incorporate more conservative estimates of the market potential for wind, geothermal, and biomass resources to account for siting, transmission, penetration, and other potential constraints in certain regions of the country. In both the business as usual and policy runs, we:

- Reduced the developable wind potential by up to 50 percent in the Northeast, Plains, and West regions;
- Reduced the amount of conventional geothermal resource available for development by 60 percent on average based on a study conducted for the California Energy Commission and input from geothermal developers;
- Reduced the amount of forest residues by 50 percent from the biomass supply to

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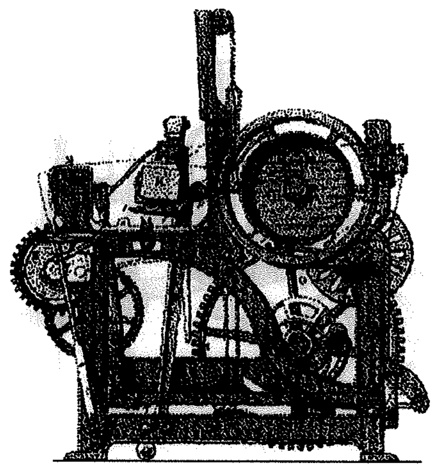
provide an extra margin against relying on unsustainable sources, even though EIA's estimate already excluded road-less areas, steep slopes, and more than half the remaining residues; and

• Excluded an additional 5 percent of construction and demolition debris from the biomass supply—on top of the 75 percent exclusion included in the estimate used by EIA—to provide an extra margin against relying on contaminated materials.

We also modified several EIA assumptions that constrain the growth and raise the projected cost of renewable energy technologies that are not applied to conventional technologies. EIA's projections of renewable energy technology costs and performance have been more pessimistic than projections made by DOE's national energy laboratories—such as the 2000 Interlaboratory Working Group study[16]—the Electric Power Research Institute, and other renewable energy analysts. As a starting point, we incorporated changes made to the AEO 2004 version of NEMS by DOE's Office of Energy Efficiency and Renewable Energy (EERE). We also supplemented this information with input from renewable energy experts and developers and other studies.

For geothermal energy, we included 3,400 MW of potential development by 2025 from advanced technologies (Enhanced Geothermal Systems) based on data from the Government Performance Review Act (GPRA) analysis. For wind energy, we:

• Changed EIA's designation of wind as a commercial technology that assumed capital costs would remain steady over time to "evolutionary" status to allow for a greater reduction in capital costs as installed capacity increases based on the fiscal year 2005 GPRA projections and historical trends;



• Assumed wind could provide up to 30 percent of a region's electricity (EIA assumed 20 percent), based on actual experience in regions of Germany, Denmark, and Spain that have already achieved penetrations of over 20 percent.

• Increased capital costs by up to 50 percent as the penetration of wind increases to 30 percent of a region's electricity. This includes a 20 percent cost increase for integrating wind into the broader electricity system based on an analysis for PacifiCorp and a 30 percent increase for additional siting and transmission costs based on estimates from wind developers, utilities, and other studies. (EIA applied a cost penalty of 200 percent to 90 percent of total wind potential without adequate substantiation);

• Added over 12,700 MW of wind potential in Texas based on updated data from the National Renewable Energy Lab (NREL) and over 4,100 MW of wind potential in the Mid-Atlantic based on plans by developers.

For the policy cases only, we assume continued R&D investments combined with increases in installed renewable energy capacity that result from the RPS will lower costs and improve performance to the levels similar to those projected by DOE/EERE for wind, solar and biomass and EIA's "DOE Goals" case for geothermal. For example, EIA's projections for wind power in good wind regimes are 1–2 cents/kilowatt-hour higher than the DOE/EERE projections. The assumptions used in the UCS analyses are closer to, but slightly more conservative than, the DOE/EERE projections.

We also left a number of conservative EIA assumptions unchanged in our analysis. EIA's 2004 projection of natural gas wellhead prices were approximately $3.50–$4.50 per thousand cubic feet (Mcf, 2002$) between 2005 and 2025. They assumed that state RPS and renewable energy funds would only add 3,100 MW of new renewable capacity after 2001

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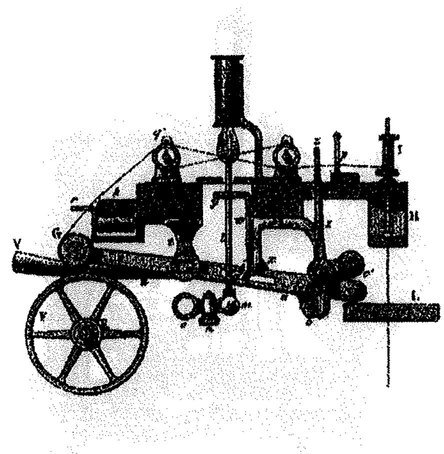
whereas UCS projections at that time showed that state standards could add over 23,000 MW of new renewables.[17] EIA generally underestimates cost reductions occurring from growth in the international market for renewable energy. In addition, EIA's model does not yet include potential from several renewable energy resources and technologies that could contribute to and lower the cost of the RPS over the forecast period, such as class 3 wind resources, offshore wind, higher yield energy crops, incremental hydro generation at existing dams, ocean and wave energy, and hot dry rock. All other EIA assumptions, such as load forecasts, fuel prices, thermal plant performance and cost assumptions, etc., were left unmodified.

C. Evaluating macroeconomic impacts

UCS used the IMPLAN (IMpact Analysis for PLANning) model to estimate the macroeconomic impacts (employment, income, and gross state product) for two of the national RPS scenarios. IMPLAN is an input/output (I/O) model that can show how expenditures for installing, manufacturing, operating, and maintaining renewable energy technologies and related equipment not only directly benefit the industries engaged in these activities, but also indirectly benefit businesses that provide inputs (i.e., goods and services) to these industries. I/O models can also show the benefits of workers re-spending the income earned from these direct and indirect activities and the impact of changes in consumer energy bills. The macroeconomic analysis was completed by MRG & Associates using a well-established analytical approach



and the inputs and results of the NEMS runs.[18]

V. Results

Below we review results from the four RPS scenarios. We begin with the impacts where we can compare UCS and EIA results, including electricity and natural gas prices, consumer energy bills, electricity generation, renewable energy development, and carbon emissions. Next, we present results from UCS assumptions-only scenarios on jobs, income, and economic development. Finally, we discuss additional benefits from increased renewable energy use, and the implications that design details have on national RPS benefits.

A. Natural gas and electricity prices, and consumer energy bills

Both the UCS and EIA analyses show that a national RPS can save consumers money in several ways. First, by reducing the demand for fossil fuels, and creating new competitors for the dominant fuel sources, renewable energy helps reduce the price of fossil fuels and restrain the ability of fossil fuel prices to increase in the future. Natural gas therefore costs less for electricity generation, as well as for other purposes, benefiting both electricity consumers and other natural gas consumers. Second, some renewable resources, especially wind energy at good sites, are now less expensive than building new natural gas- or coal-fired power plants over the expected lifetimes of the plants, and reduce projected generation costs. And third, a national RPS reduces the cost of renewable energy technologies, by creating competition among renewable sources and projects to meet the requirements, and by creating economies of scale in manufacturing, installation, operations, and maintenance. Most importantly, projected savings are robust enough to be found in all of the recent RPS scenarios, at both the 10 percent and 20 percent levels, and despite large differences in projected renewable energy costs and performance in the EIA and UCS assumptions.

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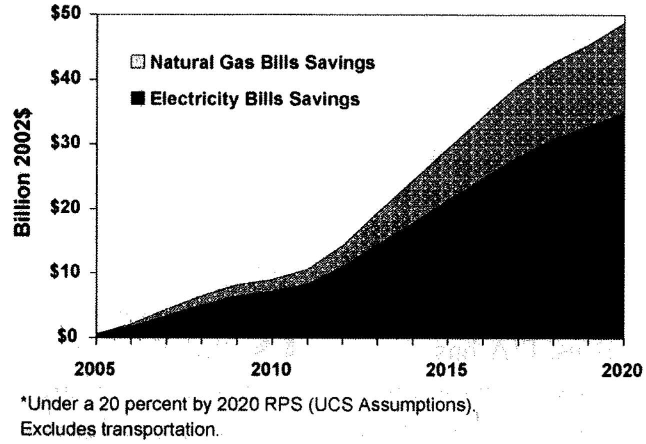

Figure 1: Cumulative Natural Gas and Electricity Bill Savings*

Using UCS assumptions for renewable energy technologies, average consumer natural gas prices would be lower than business as usual in nearly every year of the forecast under the 20 percent RPS, with an average annual reduction of 1.5 percent. In addition, average consumer electricity prices would be lower than business as usual in every year of the forecast, with an average annual reduction of 1.8 percent. As a result, the 20 percent RPS would save consumers $49.1 billion on their electricity and natural gas bills by 2020 (**Figure 1**).[19] All sectors of the economy would benefit, with commercial, industrial, and residential customers' total savings reaching $19.1 billion, $17.4 billion, and $12.6 billion, respectively.

With UCS running NEMS using EIA's assumptions unmodified, the results showed that a 20 percent RPS would still reduce gas and electricity prices. Cumulative savings to electricity customers under a 20 percent RPS totaled $15.4 billion by 2020, with cumulative savings to gas consumers of an additional $11.6 billion, for a total savings of more than $27 billion.

A 10 percent renewable standard would save less money than the 20 percent scenario. In the UCS scenario, consumers would save almost $28.2 billion on their electricity and natural gas bills by 2020, with the savings continuing to grow to $37.7 billion by 2025. EIA's own analysis found that the 10 percent RPS would save consumers $22.6 billion by 2025.[20]

National RPS scenarios using either UCS or EIA assumptions also show that energy bills would be reduced in every region of the country, including the Southeast, where some people have suggested there is limited low-cost renewable energy potential (**Table 1**). This is primarily due to the lower natural gas prices for electricity generation and other direct gas consumers that all regions would see. In addition, all regions do have some renewable energy resources, and would likely see an increase in using local resources for generation that would often displace the need for importing fossil fuel. Furthermore, the national credit trading market created by a national RPS would allow utilities in all regions to purchase RECs for the same price, providing utilities with

Table 1: Cumulative Energy Bill Savings by U.S. Census Region, 2005–2020, Comparison of National RPS Proposals* **(billion $)**

	20 Percent RPS		10 Percent RPS
Census Region	UCS Assumptions ($)	EIA Assumptions ($)	UCS Assumptions ($)
New England	1.4	0.7	0.8
Mid-Atlantic	5.7	2.0	3.1
East North Central	8.4	5.3	4.7
West North Central	2.2	1.2	1.1
South Atlantic	2.9	0.1	3.3
East South Central	1.6	0.9	1.3
West South Central	13.3	8.1	6.9
Mountain	5.0	3.1	2.1
Northwest	2.6	1.7	1.3
California	6.0	4.2	3.3

* Results are in cumulative net present value 2002$ using a seven percent real discount rate. Excludes transportation. UCS did not obtain regional data for EIA's analysis.

negotiating leverage over local renewable generators.

The strong relationship between renewable energy generation, and natural gas demand and prices is further supported by a 2005 Lawrence Berkeley National Laboratory (LBL) study, which reviewed 13 analyses using different computer models and assumptions. The analyses all confirmed that renewable energy (and energy efficiency) could reduce gas demand and put downward pressure on natural gas prices and bills by displacing gas-fired electricity generation. The report also found that the higher the level of renewable energy penetration, the more gas is saved, and the more gas prices are reduced. Furthermore, LBL's study shows how these results are broadly consistent with economic theory, with results from other energy models, and with limited empirical evidence.[21]

Because of this relationship, long-term natural gas prices have a significant effect on the impact of a national RPS. As gas price forecasts have increased, analyses have shown that a national RPS is more cost-effective. For example, a 2001 EIA analysis—using wellhead natural gas prices that averaged \$3.28 per Mcf (2002\$) over the forecast period—projected that a 20 percent national RPS would result in cumulative consumer energy bill costs of \$14 billion by 2020.[22] By comparison, the 20 percent RPS scenario (EIA assumptions) from 2004, which showed consumer savings of \$27 billion, used a natural gas price forecast that averaged \$3.97 per Mcf (2002\$). While EIA changed a number of the assumptions used in NEMS between 2001 and 2004, most of the difference in energy bill impacts is due to the increase in natural gas prices. EIA has consistently increased its long-term natural gas price projection each year since 1997 to conform to new data. In the recently released AEO 2007, wellhead gas prices average \$5.06 per Mcf (2002\$) over the forecast period.[23]

B. Electricity generation

Under the business as usual scenario (AEO 2004), the United States increases its dependence on coal and natural gas in order to meet a projected 30 percent increase in demand for electricity from 2005 to 2020 (**Figure 2**). Non-hydro renewable energy use nearly doubles between 2005 and 2020, mostly as a result of existing state RPS policies and the increasing ability of wind power to be cost competitive with conventional energy sources. However, the total contribution from non-hydro renewable energy increases from 2.4 percent to just 3.5 percent during that same period.[24]

Renewable energy diversifies the energy portfolio by meeting a much larger portion of U.S. electricity demand under a 20 percent national RPS (UCS assumptions). By 2020, non-hydro renewable energy accounts for 15.5 percent of total electric power generation (**Figure 3**).[25] In the earlier years of the forecast, the increased renewable energy generation displaces more natural gas. In the latter years, as coal generation begins to compete with more expensive natural gas, renewable energy generation displaces more coal. However, new growth in both coal and natural gas are still needed under the RPS to meet the projected increase in energy demand by consumers. By 2020, nearly two-thirds of the increase in coal generation projected under

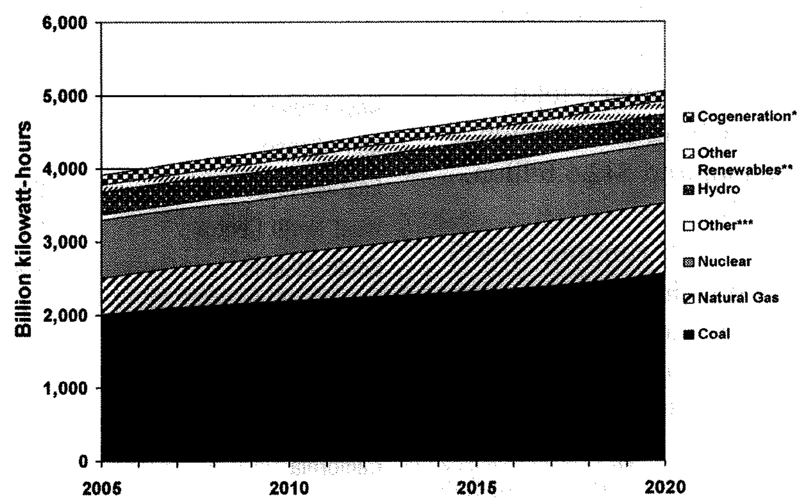

Figure 2: Electricity Generation under Business-as-Usual (UCS Assumptions)

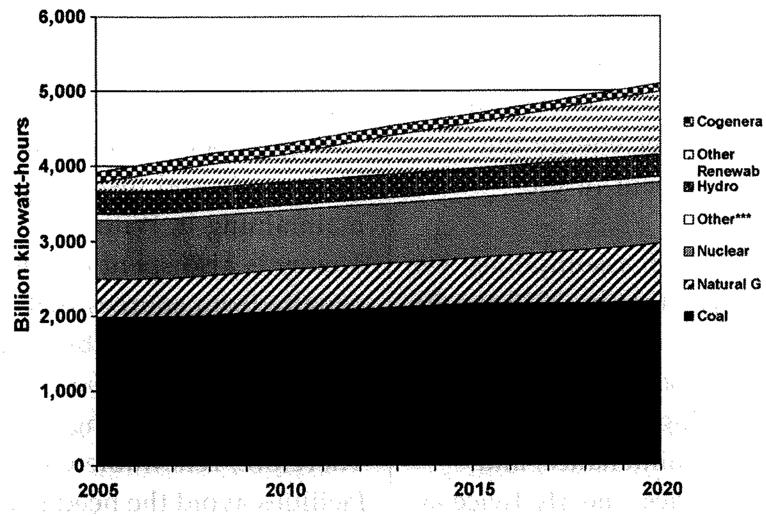

Figure 3: Electricity Generation under 20 Percent by 2020 RPS (UCS Assumptions)

business as usual is displaced as a result of the new renewable energy generation.

The impact on the U.S. electric power mix of a 20 percent by 2020 RPS using EIA's assumptions is generally consistent with these trends. Under a 10 percent RPS, renewable energy generation still increases significantly compared with business as usual—providing important resource diversity benefits—but at lower levels than the 20 percent RPS.

C. Renewable energy development

Table 2 illustrates that the mix of renewable energy generation under various national RPS scenarios is much more sensitive to the difference in assumptions between UCS and EIA than the projected consumer benefits. Using UCS assumptions, wind power provides the majority of renewable energy generation under the 20 percent RPS, with significant contributions also coming from biomass and geothermal resources. Under this scenario, total U.S. non-hydro renewable power capacity increases from about 20,000 MW in 2005 to 180,000 MW by 2020.

Using EIA assumptions, however, results in significantly more generation from biomass energy. This is primarily due to the more pessimistic cost and performance assumptions that EIA uses for wind power. Because wind power is more expensive under EIA's assumptions, generation from biomass integrated gasification combined cycle plants becomes cost-competitive more quickly, and is deployed by the model to meet a larger portion of the annual targets. Greater generation from biomass, which has a higher capacity factor than wind power, also results in less total renewable energy capacity being developed. Under EIA assumptions, total non-hydro renewable power capacity increases to 150,000 MW by 2020.

The difference in renewable energy generation mix between scenarios that use UCS and EIA assumptions also holds true under a 10 percent national RPS. The UCS scenario found that wind power would account for the majority of the generation resulting from the 109,000 MW of renewable eneergy capacity developed by 2020. Biomass, geothermal, landfill gas, and solar resources continue to play important, but lesser roles. Under EIA's 10 percent RPS analysis, biomass actually accounts for a majority of the renewable energy mix by 2020. Ultimately, the competition between renewable energy resources that is stimulated by a national RPS will pressure developers to reduce costs and determine the technology winners.

Table 2: Renewable Energy Generation Mix, 2020

	20 Percent by 2020 RPS		10 Percent by 2020 RPS	
Technology	UCS Assumptions	EIA Assumptions	UCS Assumptions	EIA Assumptions
Biomass	28.5%	44.6%	16.2%	52.7%
Geothermal	9.9%	8.3%	14.3%	8.5%
Landfill gas	2.3%	2.5%	3.0%	2.8%
Solar	0.4%	0.4%	0.6%	1.6%
Wind	58.9%	44.2%	65.9%	34.4%

D. Carbon emissions

Increased renewable energy use would reduce CO_2 emissions from power plants. Using UCS assumptions, the 20 percent national RPS is projected to reduce CO_2 emissions by 434 million metric tons (MMT) per year by 2020—15 percent below business as usual levels or a 59 percent reduction in the projected growth in emissions. This reduction is equivalent to taking nearly 71 million cars off the road. Using EIA assumptions, a 20 percent RPS would produce slightly greater CO_2 reductions of 468 MMT by 2020, as the increased use of biomass sources displaces higher amounts of coal generation.

Under a 10 percent RPS, UCS and EIA analyses show that CO_2 emissions would be reduced 166 MMT to 215 MMT nationally by 2020—a reduction of up to 7.2 percent below business as usual levels. As with the 20 percent scenarios, the use of EIA's assumptions results in greater emission reductions due to higher levels of biomass energy production.

E. Jobs, income, and other economic benefits

Investment in renewable energy can create high-paying jobs in the U.S. For example, direct jobs are created in manufacturing renewable energy technologies, as well as in installing and operating them. Jobs are also created when renewable energy workers spend their additional income on other goods and services and when consumer energy bill savings are spent in the economy.

Using UCS assumptions, we project that by 2020 the 20 percent RPS would generate more than 355,000 jobs in manufacturing, construction, operation, maintenance, and other industries—nearly twice as many as fossil fuels, representing a net increase of 157,480 jobs (**Figure 4**). Renewable energy would also provide an additional $8.2 billion in income and $10.2 billion in gross domestic product in the U.S. economy in 2020.

A 10 percent national RPS would create significant, but fewer jobs. Under the 10 percent scenario using UCS assumptions, more than 190,000 jobs would be created by 2020—a net increase of 91,220 jobs when compared with fossil fuels. In addition, $5.1 billion in income and $5.9 billion in gross domestic product would be pumped into the U.S. economy in 2020.

Renewable energy technologies tend to create more jobs than fossil fuel technologies because they are more labor-intensive. A large share of the expenditures for renewable energy is spent on manufacturing equipment, and installing and maintaining it. With biomass, money is also spent on fuel, but usually from sources that are within 50 miles of a biomass plant, because it is too expensive to transport it for long distances. Therefore, renewable energy facilities avoid the need to export cash to import fuel from other states, regions, or countries—keeping money circulating in the local economy, and creating more local jobs.

Many of the new jobs would be located in rural areas where the renewable energy generating facilities would be sited. However, a national RPS can also benefit manufacturing states, even those with less abundant renewable resources, by providing them the opportunity to manufacture and assemble components for renewable energy facilities. Developing a strong manufacturing base can also create enormous export opportunities, given the rapidly growing commitment of the rest

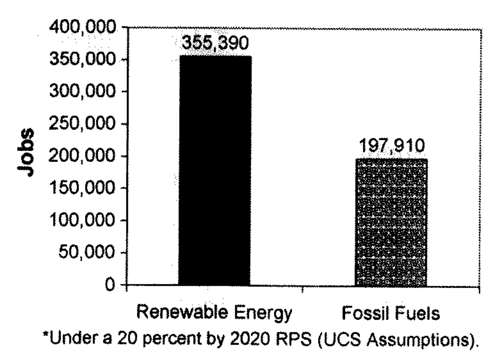

Figure 4: Job Creation, Renewable Energy* vs. Fossil Fuels, 2020

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Table 3: Economic Development Benefits*, Comparison of National RPS Scenarios

	UCS Assumptions	
	20% by 2020 RPS ($)	10% by 2020 RPS ($)
New capital investment	72.6 billion	41.5 billion
Biomass energy payments	15 billion	4.9 billion
Property tax revenues	5 billion	2.8 billion
Wind power land lease payments	1.2 billion	0.8 billion

* Results are presented in cumulative net present value 2002$ using a seven percent real discount rate.

of the world to expand use of renewable energy.

A national RPS can help improve the U.S. economy in other ways. Renewable energy can greatly benefit struggling rural economies, by providing new income for farmers, ranchers, and landowners from biomass energy production, wind power lease payments, and local ownership. Property tax revenues from renewable energy facilities can also help local communities pay for schools and vital public services. **Table 3** compares the economic development benefits of the 20 percent by 2020 and 10 percent by 2020 national RPS scenarios analyzed using UCS assumptions.

VI. Additional Benefits of a National RPS

Below, we offer several additional benefits that could result from the increased use of renewable energy under a national RPS. These benefits are presented qualitatively, as they were not evaluated as part of any of the UCS or EIA analyses discussed in this article.

A. National security

In response to high gas prices, and the declining productivity of North American gas wells, EIA projects imports of liquefied natural gas (LNG) to increase more than seven-fold over the next 20 years.[26] This trend threatens to push the U.S. down the same troubled road of rising dependence on imported gas that has been followed for oil. By reducing the demand for natural gas, renewable energy can reduce imports.

Lacking long fuel supply chains, renewable energy facilities are also not vulnerable to supply shortages or disruptions, price spikes, price increases, or price manipulation. And because they do not use volatile fuel or produce dangerous wastes, renewable energy facilities (except large hydropower dams) do not present inviting targets for sabotage or attack.

B. Reduced exposure to natural gas price risk

Typically, contracts for natural gas generation are variably priced, which leaves utilities and their customers exposed to periods of price volatility such as that which has plagued the U.S. gas industry since 2000. By contrast, generation from renewable energy systems is normally sold under fixed-price contracts. Increasing the amount of renewable energy included in a utilities' energy portfolio can provide an important hedge against this gas price risk.

Furthermore, the value of this reduced exposure is often underestimated. LBL analyzed the cost of hedging natural gas price risk through traditional methods (e.g., futures, swaps) compared with forecasts of spot natural gas prices. They found that, at least from 2001–05, forward gas prices (two to 10 years) have been considerably higher than most natural gas spot price forecasts, including EIA's baseline forecasts used in NEMS. Therefore, resource portfolio planning or other policy evaluations based on these forecasts have been biased in favor of natural gas generation. To more accurately capture the value of long-term price stability provided by renewable energy technologies, LBL recommends a comparison of the cost of fixed-price renewable generation to the guaranteed cost of new natural gas-fired generation that have been locked in through forward markets.[27]

C. Reduced risks from future carbon reduction policies

As discussed above, a national RPS would reduce CO_2 emissions

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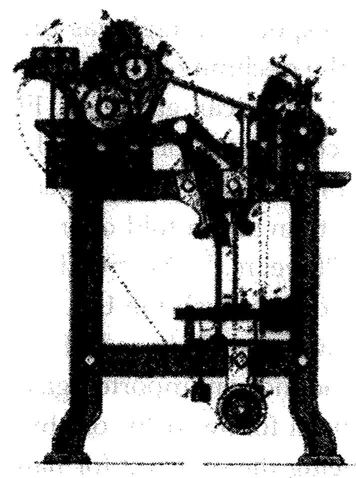
from power plants. And because a national RPS would also save money for electricity and gas consumers, these are highly cost-effective carbon reductions. They represent insurance against the risk that electric providers—the largest source of CO_2 emissions in the U.S. economy—will have to eventually reduce those emissions.

Congressional leaders have expressed a strong interest in adopting a mandatory carbon reduction policy, and even most utility executives believe that they will have to implement carbon reductions. Yet in response to higher natural gas prices and increasing energy demand in recent years, more than 150 new coal-fired power plants have been proposed throughout the U.S.—none of which include plans to capture and store their carbon emissions.[28] As a result, these plants will expose their owners, power purchasers, and customers to the risk of future price increases from CO_2 regulation or installing equipment to reduce emissions that could be avoided by investing in renewable energy instead. Indeed, under an economy-wide cap-and-trade approach, the carbon reductions from increasing renewable energy could save money. A 2001 analysis by EIA of a bill proposing to cap four power plant pollutants, including CO_2, found that the addition of a 20 percent RPS to the cap-and-trade scenario reduced cumulative compliance costs $72 billion by 2020.[29]

D. Environmental and public health benefits

Electricity use has a significant impact on the environment and public health. Electricity accounts for less than 3 percent



of U.S. economic activity, yet the burning of coal, oil, and natural gas for power currently accounts for more than 26 percent of smog-producing nitrogen oxide emissions, one-third of toxic mercury emissions, and 64 percent of acid rain-causing SO_2 emissions. Increased renewable energy use can help reduce these harmful emissions, or reduce the cost of complying with pollutant reduction requirements. And by reducing the need to extract, transport, and consume fossil fuels, a national RPS would limit the damage done to our water and land and conserve natural resources for future generations.

VII. Design Details Matter

RPS design and implementation can be quite complex, and analyses demonstrate that the details can make a big difference in its effectiveness and overall costs and benefits. For example, a 2003 EIA analysis looked at the impact of a lower RPS cost cap. EIA's analysis from the previous year examined a 10 percent RPS with a REC price cap of 3 cents per kWh, indexed to inflation. EIA's 2003 analysis assumed a cost cap of 1.5 cents without inflation adjustment, limiting REC prices in 2025 to only 0.8 cents in real dollars. Ironically, EIA found that reducing the cost cap increases the cost of the RPS and decreases the benefits.[30] As inflation lowers the value of the cost cap, more utilities pay the non-compliance penalty rather than develop more renewable energy. The result is less renewable energy, less natural gas savings, and fewer economic and environmental benefits.

Other design details can also impact the benefits of an RPS. A 2002 EIA study found that removing a sunset provision would lower REC prices, and lead to full compliance with the annual targets. Removing the sunset provision also changed the RPS from having a slight increase in electricity costs of 0.1 cents per kWh to slightly reduced electricity prices.[31] In addition, specific renewable energy resource tiers or REC multipliers—such as for solar or distributed generation

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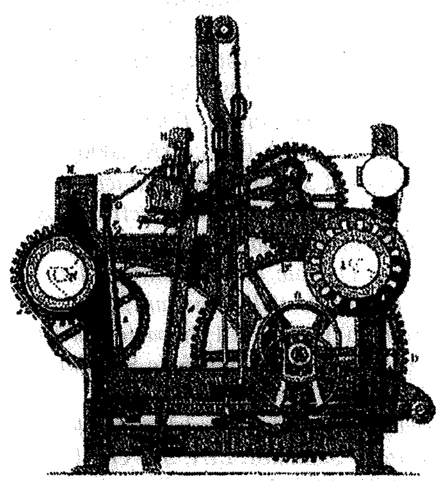
technologies—are designed to promote diversity and increase grid reliability while giving a boost to emerging technologies. The tradeoff is that the cost of compliance can be higher with a resource tier,[32] and the amount of renewable energy generation required can be less with REC multipliers.[33] Vintage requirements for eligible technologies can also play a large role in determining the amount of new development needed to meet the annual targets. Allowing generation from existing facilities to count towards compliance provides flexibility and rewards early adopters, but it also undermines a primary goal of the RPS—additionality of renewable energy generation—and can reduce the economic and environmental benefits.

Finally, the inclusion of non-renewable energy technologies—such as nuclear or advanced coal technologies—can undermine another primary goal of the RPS: fuel source diversity. Coal, natural gas, and nuclear power currently constitute about 90 percent of our fuel sources for electricity. The RPS is designed to create new competition with these conventional fuel sources. The more that new competitors are available to be rapidly deployed, the less vulnerable the U.S. economy is to potential energy supply shortages or interruptions, price volatility, or price manipulation as a result of the United States' current dependence on a limited supply of a limited number of fuels. Renewable resources are especially valuable in this respect because they are domestic, non-interruptible, non-depletable, and have potential for significant expansion as competitors to existing fuels. Because both objectives—developing new fuel sources, and developing advanced technologies using dominant fuels—are important, a



national RPS should not be used to create a zero-sum game where achieving one objective competes with achieving the other.

Similarly, improving energy efficiency is an essential national objective, and enacting energy efficiency resource standards could provide benefits similar to an RPS. The objective of increasing efficiency should not compete with or displace the objective of developing diverse, clean energy supply options, however.

VIII. Conclusions

The RPS has emerged as a popular and effective tool used by a growing number of states to reduce market barriers and stimulate new renewable energy development. Driven in part by early successes in the states, and recognition of the many benefits that significantly increasing renewable energy use can provide the entire nation, advocates have been calling for a national RPS for nearly a decade. A national RPS has passed three times in the U.S. Senate from 2002 to 2005, but has failed to become law. Leadership in the 110th Congress has indicated interest in continuing the national RPS debate as part of an effort to increase America's energy independence and reduce global warming emissions.

For several years EIA and UCS have been conducting analyses to project the costs and benefits of various RPS proposals. The analyses demonstrate that under a wide range of assumptions, a 20 percent national RPS is achievable, and would save consumers money by reducing natural gas and electricity prices. The analyses also show that a national RPS would diversify the electricity system, promote local economic development, improve the nation's energy security and reliability, and achieve important reductions in global warming emissions. Even under a 10 percent RPS, both UCS and EIA analyses show Americans would see all of these benefits, but at lower levels than what would occur under a 20 percent RPS.■

Endnotes:

1. Other sources, such as the North Carolina Solar Center's Database of

State Incentives for Renewables and Efficiency, also count two states that have voluntary renewable energy goals—Illinois and Vermont—as having an RPS.

2. *Experts Agree: Renewable Electricity Standards Are a Key Driver of New Renewable Energy Development*, Union of Concerned Scientists, 2007, Cambridge, Mass, available at http://www.ucsusa.org/clean_energy/clean_energy_policies/experts-agree-renewable-electricity-standards-are-a-key-driver-of-new-renewable-energy.html.

3. N. Rader and S. Hempling, *The Renewables Portfolio Standard: A Practical Guide*, Prepared for National Association of Regulatory Utility Commissioners, Feb. 2001.

4. See, for example, the preamble language from RPS legislation that has passed in several states over the past few years, including: California SB 1078 (Renewables Portfolio Standard Program), available at http://www.leginfo.ca.gov/pub/01-02/bill/sen/sb_1051-1100/sb_1078_bill_20020912_chaptered.pdf; Colorado Ballot Initiative 37 (Renewable Energy Standard), available at http://www.state.co.us/gov_dir/leg_dir/lcsstaff/2004/ballot/2004BluebookforInternet.PDF; and Rhode Island H 7375 (Renewable Energy Standard Act), available at http://www.rilin.state.ri.us/Billtext/BillText04/HouseText04/H7375Aaa.pdf.

5. *Renewable Electricity Standards at Work in the States*, Union of Concerned Scientists, 2007.

6. Id.

7. S. Clemmer, A. Nogee, M. Brower and P. Jefferiss, *A Powerful Opportunity: Making Renewable Electricity the Standard*, Union of Concerned Scientists, 1999.

8. D. Goode, *Senate Democrats Look to Co-Opt Bush on Energy Agenda*, Congress Daily, Jan. 18, 2007; B. Geman, *Bingaman to Spearhead Fight for 15 percent RPS by 2020*, E&E Daily, Jan. 23, 2007.

9. A. Bailie, S. Bernow, B. Castelli, P. O'Connor and J. Romm, *The Path to Carbon Dioxide-Free Power: Switching to Clean Energy in the Utility Sector*, Tellus Institute, Boston, 2003; A. Bailie, S. Bernow, W. Dougherty and M. Lazarus, *Analysis of the Climate Stewardship Act*, Tellus Institute, 2003; S. Clemmer, A. Nogee, M. Brower and P. Jefferiss, *A Powerful Opportunity: Making Renewable Electricity the Standard*, Union of Concerned Scientists, 1999; S. Clemmer, D. Donovan, A. Nogee and J. Deyette, *Clean Energy Blueprint: A Smarter National Energy Policy for Today and the Future*, Union of Concerned Scientists, 2001; Energy Information Administration (EIA), *Analysis of S. 687, the Electric System Public Benefits Protection Act of 1997*, SR/OIAF/98-01, EIA, 1998; *Annual Energy Outlook 2000*, DOE/EIA-0383, EIA, 2000; *Analysis of Strategies for Reducing Multiple Emissions from Electric Power Plants: Sulfur Dioxide, Nitrogen Oxides, Carbon Dioxide, and Mercury and a Renewable Portfolio Standard*, EIA, SR/OIAF/2001-03, 2001; *Impacts of a 10-Percent Renewable Portfolio Standard*, EIA, SR/OIAF/2002-03, 2002; *Analysis of a 10-Percent Renewable Portfolio Standard, EIA*, SR/OIAF/2003-01, 2003; Letter to Senator Bingaman, EIA, June 15, 2005; *Energy Innovations: A Prosperous Path to a Clean Environment*, Alliance to Save Energy, American Council for an Energy-Efficient Economy, Natural Resources Defense Council, Tellus Institute, and UCS, Washington, DC, 1997; *Scenarios for a Clean Energy Future*, Interlaboratory Working Group, Lawrence Berkeley National Laboratory, LBNL-44029, 2000; K. Palmer and D. Burtraw, *Electricity, Renewables, and Climate Change: Searching for a Cost-Effective Policy*, Resources for the Future, 2004; *Renewing Where We Live*, Union of Concerned Scientists, Feb. 2002 ed.; *Renewing Where We Live*, Union of Concerned Scientists, Sept. 2002 ed.; *Renewing Where We Live*, Sept. 2003 ed.; "Renewable Energy Can Help Ease the Natural Gas Crunch," Press release, Union of Concerned Scientists, 2004; *Renewing America's Economy: A 20 Percent National Renewable Energy Standard Will Create Jobs and Save Consumers Money*, Union of Concerned Scientists.

10. UCS, *Renewing America's Economy*, *supra* note 9; *Renewable Energy Can Help Ease the Natural Gas Crunch*, UCS, 2004. This analysis assumed the federal production tax credits for renewable energy would be extended through Dec. 31, 2006, and expanded to include other resources, as supported in the Senate energy bill.

11. UCS, *Renewing America's Economy*, *supra* note 9. The NEMS runs for each of these three scenarios were performed for UCS by the Tellus Institute—a Boston-based consulting group with extensive experience operating NEMS—using EIA's Annual Energy Outlook (AEO) 2004 version of the model.

12. EIA, Bingaman letter, *supra* note 9.

13. *The National Energy Modeling System: An Overview 2003*, EIA, DOE/EIA-0581, 2003.

14. For more information about NEMS' capabilities, structure, and assumptions visit http://www.eia.doe.gov/oiaf/forecasting.html.

15. For a complete description of the UCS modifications to the AEO 2004 version of NEMS, see *Differences Between UCS and EIA Assumptions Using National Energy Modeling System (AEO 2004 Version)*, available at http://www.ucsusa.org/clean_energy/clean_energy_policies/nems-differences-between-ucs-and-eia-assumptions-aeo-2004-version.html. Because NEMS is revised annually, EIA may have made modifications in subsequent model versions that are not described in this article.

16. Interlaboratory Working Group, *Scenarios*, *supra* note 9.

17. UCS' projection assumed that all states would eventually meet their RPS targets, whereas EIA did not.

18. The analytical approach is similar to that used by H. Geller, J. DeCicco and S. Laitner, *Energy Efficiency and Job Creation*, American Council for an Energy-Efficient Economy, 1992.

19. Results are presented in cumulative net present value

2002$ using a 7 percent real discount rate.

20. Results are cumulative (2005–25) net present value 2003$ using a 7 percent real discount rate.

21. R. Wiser, M. Bolinger and M. St. Clair, *Easing the Natural Gas Crisis: Reducing Natural Gas Prices through Increased Deployment of Renewable Energy and Energy Efficiency*, Lawrence Berkeley National Laboratory, LBNL-56756, 2005.

22. EIA, *Analysis of Strategies for Reducing Multiple Emissions, supra* note 9.

23. *Annual Energy Outlook 2007: With Projections to 2030*, EIA, DOE/EIA-0383, 2007.

24. The trend of increased electricity demand being met by fossil fuels, with only modest gains in total contribution from renewable energy sources, is generally consistent with EIA's Annual Energy Outlook (AEO) 2007. The one key difference is that new growth in fossil fuel generation is dominated by coal in AEO 2007 due primarily to higher natural gas prices.

25. The national RPS is based on a percent of electricity sales, not a percent of generation. In addition, electricity sales from small utilities and hydroelectric facilities were excluded from the national RPS proposal that was analyzed.

26. *Annual Energy Outlook 2007, supra* note 23.

27. M. Bolinger, R. Wiser and W. Golove, *Accounting for Fuel Price Risk: Using Forward Natural Gas Prices Instead of Gas Price Forecasts to Compare Renewable to Natural Gas-Fired Generation*, Lawrence Berkeley National Laboratory, LBNL-53587, 2003; and M. Bolinger and R. Wiser, 2005. *Memorandum: Comparison of AEO 2006 Natural Gas Price Forecast to NYMEX Futures Prices*, Lawrence Berkeley National Laboratory, 2005.

28. *Tracking New Coal-Fired Power Plants: Coal's Resurgence in Electric Power Generation*, U.S. Department of Energy, National Energy Technology Laboratory, 2007, available at http://www.netl.doe.gov/coal/refshelf/ncp.pdf.

29. EIA, *Analysis of Strategies for Reducing Multiple Emissions, supra* note 9.

30. EIA, *Analysis of a 10-Percent Renewable Portfolio Standard, supra* note 9, and *Addendum to Analysis of a 10-Percent Renewable Portfolio Standard*, EIA.

31. EIA, *Impacts of a 10-Percent Renewable Portfolio Standard, supra* note 9.

32. C. Chen, R. Wiser and M. Bolinger, *Weighing the Costs and Benefits of Renewables Portfolio Standards: A Comparative Analysis of State-Level Policy Impact Projections*, Lawrence Berkeley National Laboratory, LBNL-61580, 2007.

33. EIA, Bingaman letter, *supra* note 9.

Vintage requirements for eligible technologies can also play a large role in determining the amount of new development needed.

[illegible] EIA

31. [illegible] Impacts of a 10 Percent Renewable Portfolio Standard, supra note 9

32. [illegible] Chen, R. Wiser and M. Bolinger, Weighing the Costs and Benefits of State Renewables Portfolio Standards: A Comparative Analysis of State-Level Policy Impact Projections, [illegible] Berkeley National Laboratory, [illegible]

33. [illegible]

[illegible] Wiser and [illegible] Hedging [illegible] Fuel Price Risk [illegible] Natural Gas [illegible] Natural Gas-Fired [illegible] Lawrence Berkeley [illegible] Laboratory, LBNL [illegible] Bolinger and R. Wiser, [illegible] Comparison of AEO [illegible]

[illegible]

22. EIA, Analyses of Strategies for Reducing Multiple Emissions, supra note [illegible]

23. Annual Energy Outlook 2007 With Projections to 2030, EIA, DOE/EIA-0383, 2007

24. The [illegible] electricity demand [illegible] fossil fuels, with [illegible] renewable [illegible] EIA [illegible]

Union of Concerned Scientists

Solar incentives in state renewable electricity standards