# Increasing the Texas Renewable Energy Standard: Economic and Employment Benefits

**Jeff Deyette**
**Steve Clemmer**

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Jeff Deyette is an analyst in the UCS Clean Energy Program. Steve Clemmer is the program's research director.

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# Executive Summary

A growing number of states have taken steps to increase their use of renewable energy sources like wind, solar, and bioenergy. Eighteen states, including Texas and the District of Columbia, have enacted renewable energy standards—also known as Renewable Portfolio Standards (RPS)—that require electric companies to increase their use of renewable energy. Fifteen states have created renewable energy funds, which provide financial resources for renewable energy development. Five states have revisited initial standards and have subsequently raised or accelerated them.

In 1999, Texas enacted its RPS—requiring 2,000 megawatts (MW) of new renewable energy capacity by 2009—as part of legislation that restructured the state's electricity market. Today, the Texas RPS is one of the most effective and successful in the nation. The state is ahead of its annual requirement schedule with nearly 1,200 MW of new renewable energy already installed.

Given the success of the existing law and the state's vast renewable energy potential, at least two proposals have been made to increase the state's standard. The Texas Renewable Energy Industries Association (TREIA) and a coalition of Texas environmental organizations are advocating for a long-term 20 percent by 2020 RPS, with one percent of the requirement set aside for distributed resources like solar energy and farm-based technologies.[1] The Texas Energy Planning Council (TEPC) is recommending a more modest increase of the standard to 5,000 MW by 2015 (500 MW from non-wind renewable resources), with a goal of 10,000 MW by 2025. We project that the TEPC proposal would yield approximately 8 percent renewable energy in 2025.

The Union of Concerned Scientists (UCS) analyzed the costs and benefits of increasing the current Texas RPS based on the proposals made by TREIA and the TEPC, using the Energy Information Administration's (EIA) National Energy Modeling System (NEMS). Under the more likely scenario that primarily utilizes renewable energy technology cost projections from the Department of Energy's national laboratories, we found that both the 20 percent proposal and the 10,000 MW proposal would result in significant new benefits for Texas' economy and environment (Table ES1). Under the 20 percent proposal, economic development and environmental benefits would be much greater because it stimulates more renewable energy development—a total of 17,820 MW by 2025.

**Table ES1. Comparison of Benefits*, Texas RPS Proposals (More Likely Scenario)**

| | 20 Percent by 2020 RPS | 10,000 MW by 2025 RPS |
|---|---|---|
| **Consumer Benefits** | | |
| Electric Bill Savings | $4.6 billion | $5 billion |
| Natural Gas Bill Savings | $1 billion | $0.5 billion |
| Total Energy Bill Savings | $5.6 billion | $5.5 billion |
| **Economic Benefits** | | |
| New jobs created | 38,290 | 19,950 |
| New capital investment | $9.4 billion | $4.7 billion |
| Biomass energy revenues | $542 million | $197 million |
| School tax revenues | $1.1 billion | $628 million |
| Wind power land lease royalties | $154 million | $111 million |
| **Environmental Benefits** | | |
| Power plants annual $CO_2$ emission savings | 20 MMT | 5 MMT |

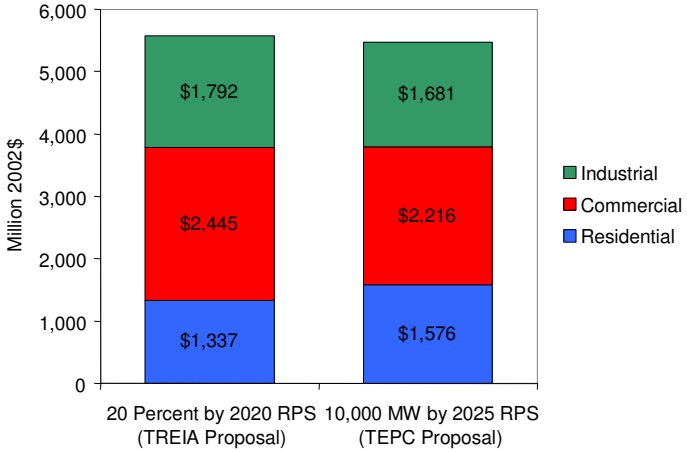
* Results are in cumulative net present value 2002$ using a seven percent real discount rate. Job results are for the year 2025.

[1] TREIA is also recommending a shorter-term expansion of the current RPS to be adopted by the Texas Legislature in 2005, requiring 10,000 MW of renewable energy capacity (500 MW from distributed renewable resources) by 2015. This shorter-term goal is not analyzed in this report.

**Renewable Energy Saves Consumers Money.** New renewable energy generation would create much needed competition with natural gas power plants, leading to reduced gas demand and lower natural gas and electricity prices. Under the 20 percent standard, average consumer electricity prices would remain virtually unchanged through 2012, with prices beginning to decline thereafter. By 2025, average electricity prices would be nine percent lower under the 20 percent standard compared with business as usual. Average annual natural gas prices would be as much as three percent lower than business as usual during the forecast period.

Lower natural gas and electricity prices lead to a reduction in the overall cost of energy for consumers. By 2025, total consumer energy bills (natural gas and electric) would be nearly $5.6 billion lower under the 20 percent standard. All sectors of the economy would benefit, with residential, commercial, and industrial customers' total savings reaching $1.3 billion, $2.4 billion, and $1.8 billion, respectively (Figure ES1).

**Figure ES1. Cumulative Consumer Energy Bill Savings, Comparison of Proposals by Sector, 2005-2025[a]**



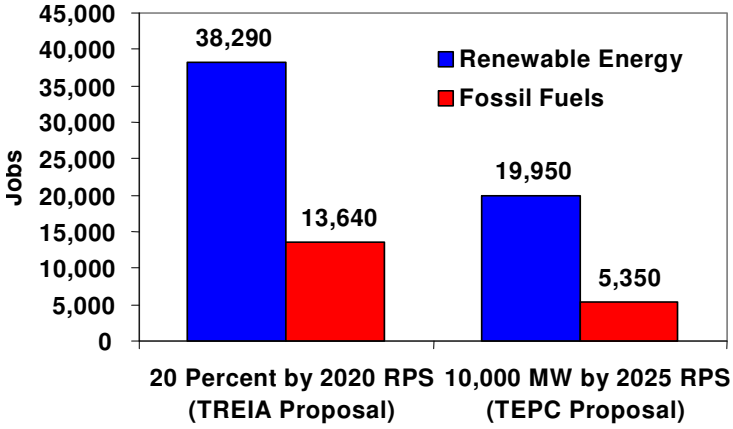

[a]Net present value 2002$ using a seven percent real discount rate.

New renewable energy generation would also lead to slightly lower natural gas and electricity prices under the 10,000 MW proposal. By 2025, consumers would see cumulative energy bill savings of nearly $5.5 billion compared with business as usual, with savings reaching residential, commercial, and industrial customers.

If natural gas prices exhibit either short-term price spikes or long-term sustained increases beyond those currently projected by the EIA, or if the federal production tax credit for wind and other renewable resources is extended beyond 2005, consumer savings would be greater under both policy proposals than reported here.

**Renewable Energy Creates Jobs and Boosts the Economy.** By 2025, the 20 percent RPS would create 38,290 new jobs in manufacturing, construction, operation, maintenance, and other industries. In fact, the amount of renewable energy needed to meet the requirement would create 2.8 times more jobs than fossil fuels—a net increase of 24,650 jobs by 2025 (Figure ES2). These jobs would generate an additional $950 million in income and $440 million in gross state product for Texas' economy.

**Figure ES2. Renewable Energy vs. Fossil Fuel Jobs, Comparison of Proposals (2025)**



Rural Texas would also receive a tremendous boost from increasing the current renewable energy standard. Many of the jobs identified above would be created in rural areas where most of the facilities would be located. By 2025, the 20 percent standard would provide:

- $9.4 billion in new capital investment
- $1.1 billion in new property tax revenues for local school districts, and $750 million in additional new property tax revenues for other local public services
- $542 million in additional revenues to farmers, rural landowners, and other biomass energy producers
- $154 million in income to farmers, ranchers, and rural landowners from wind power land leases[2]

The 10,000 MW proposal leads to significantly less development of renewable energy capacity compared with the 20 percent by 2020 standard, resulting in fewer jobs and other economic benefits (See Table ES1 for comparison).

**Renewable Energy Diversifies the Electricity Mix.** Currently, Texas relies heavily on fossil fuels and nuclear power for most of its electricity. This reliance on fossil fuels—particularly natural gas and coal—for electricity generation will increase if Texas continues on its current path. Increasing the existing state RPS would stimulate additional renewable energy development and help diversify the electricity mix. Under the 20 percent proposal, Texas would increase its total homegrown renewable power to more than 17,800 MW by 2025[3]—producing enough electricity to meet the needs of 4.9 million average-sized homes.[4] Texas' strong wind resources would power the majority of this development, with bioenergy and solar resources also making significant contributions to the mix. For much of the 20-year forecast period, renewable energy primarily displaces natural gas generation. In the later years, renewable energy also helps to displace new coal generation.

Under the 10,000 MW proposal, wind power would constitute the majority of development, while nearly all of the 500 MW of non-wind capacity would come from bioenergy by 2015. The 10,000 MW proposal would lead to about 8 percent of statewide electricity sales from renewable energy by 2025. It would also help to displace fossil fuel generation, primarily from natural gas.

**Renewable Energy Improves the Environment.** Increasing renewable energy use will reduce the amount of air pollution from coal-, oil-, and natural gas-fired power plants, resulting in better air quality and fewer pollution-related illnesses. Carbon dioxide ($CO_2$) emissions, which trap heat in the atmosphere and cause global warming, would also be reduced. The 20 percent RPS will reduce about 20 million metric tons (MMT) of power plant $CO_2$ emissions per year by 2025—a reduction of 7.4 percent below business-as-usual levels. This reduction is equivalent to taking 2.5 million cars off the road or planting 4.8 million acres of trees—an area the size of New Jersey. The 10,000 MW proposal would reduce annual $CO_2$ emissions from power plants by 5 MMT—a reduction of 1.7 percent below business-as-usual levels. Increasing the RPS will also reduce the impact on water and land resources through extraction, transport, and use of fossil fuels, and conserve resources for future generations.

[2] Results are in cumulative net present value 2002$ using a seven percent real discount rate.
[3] This development includes residential solar water heating systems that offset an estimated 390 MW of peak generating capacity.
[4] Based on EIA Electric Sales & Revenue Report 2002 data for residential sector of 1,140 kWh/month.

**Consumers Still Benefit With EIA's Conservative Renewables Assumptions.** Even with EIA's more pessimistic assumptions for renewable energy technology costs, increasing the current RPS under both policy proposals would provide significant benefits for Texas (Table ES2). In fact, our results show that—with a few key exceptions—many of the benefits are comparable with those from our more likely scenario under both proposals. One of the more important differences is that while wind resources still power the majority of the renewable energy development under the less likely scenario, EIA's higher cost assumptions for wind power lead to considerably more generation from new bioenergy facilities under both policy proposals.

Because bioenergy power plants require more jobs to construct and operate than wind power facilities, the additional bioenergy development results in greater job creation under the 20 percent standard for our less likely scenario compared with the more likely scenario. The increased use of bioenergy, combined with less total renewable energy generation in the business as usual case for our less likely scenario compared with our more likely scenario, also leads to larger net reductions in $CO_2$ emissions from power plants under both policy proposals. Bioenergy facilities can directly displace more generation from natural gas and coal plants—which are the greatest source of global warming emissions in the country.

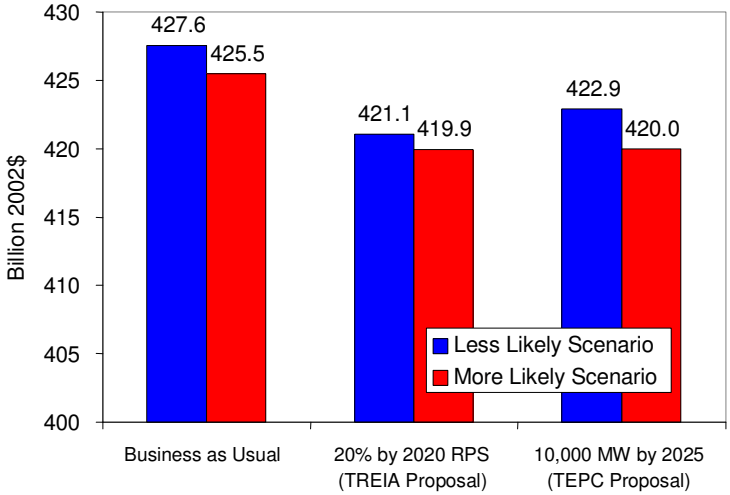
In our less likely scenario, the increased use of renewable energy would still stimulate competition with natural gas facilities under both policy proposals, resulting in significant savings for energy consumers. Cumulative energy bill savings through 2025 under the 20 percent proposal would be $6.5 billion, when compared with its respective business-as-usual case. These net savings are greater than those achieved for the 20 percent proposal in our more likely scenario. However, cumulative consumer energy bills through 2025 are still the lowest under the 20 percent proposal when using our more likely set of assumptions (Figure ES3).

**Table ES2. Comparison of Benefits*, Texas RPS Proposals (Less Likely Scenario)**

| | 20 Percent by 2020 RPS | 10,000 MW by 2025 RPS |
|---|---|---|
| **Consumer Benefits** | | |
| Electric Bill Savings | $5.9 billion | $4.5 billion |
| Natural Gas Bill Savings | $0.6 billion | $0.2 billion |
| Total Energy Bill Savings | $6.5 billion | $4.7 billion |
| **Economic Benefits** | | |
| New jobs created | 45,470 | 17,060 |
| New capital investment | $9.7 billion | $4.0 billion |
| Biomass energy revenues | $1.5 million | $433 million |
| School tax revenues | $1.2 billion | $534 million |
| Wind power land lease royalties | $133 million | $98 million |
| **Environmental Benefits** | | |
| Power plants annual $CO_2$ emission savings | 27 MMT | 9 MMT |

* Results are in cumulative net present value 2002$ using a seven percent real discount rate. Job results are for the year 2025.

**Figure ES3. Cumulative Energy Bills* Comparison, 2005-2025**




*Excludes Transportation.

# Introduction

A growing number of states have taken steps to increase the use of renewable electricity sources like wind, solar, geothermal, and bioenergy. To date, 18 states—including Texas—and the District of Columbia have enacted renewable energy standards (also known as Renewable Portfolio Standards or RPS) that require electric companies to gradually increase the amount of renewable energy in their electricity mix. Fifteen states have created renewable energy funds, which provide financial resources for renewable energy development.

Texas enacted its RPS in 1999 as part of legislation that restructured the state's electricity market. Signed by then Governor George W. Bush, the Texas standard required utilities to purchase 2,000 megawatts (MW) of new renewable energy capacity (2,880 MW total) by 2009. Given the state's large electricity demand, the standard is equivalent to approximately 2.7 percent of total electricity sales by electric suppliers required to meet the standard in 2009. Still, in adopting their RPS, Texas created the largest market for new renewable energy development in the United States at that time.

Today, the Texas RPS is one of the most effective and successful in the nation. Nearly 1,200 MW of new renewable energy capacity has already been installed, which puts the state well ahead of its intermediate 2005 target of 850 MW. However, Texas can no longer stake claim to having the largest renewable energy requirement. Since 1999, California, New York, and Pennsylvania have all enacted policies that support the generation of more new renewable energy than the current Texas standard. More importantly, a dozen states have adopted renewable standards that exceed the Texas RPS on a percent of state electricity sales basis.

Given the success of the existing law and the state's vast renewable energy potential, at least two proposals have been made to increase the state's RPS. The Texas Renewable Energy Industries Association (TREIA) and a coalition of Texas environmental organizations are advocating that renewable energy provide at least 20 percent of the state's total electricity use by 2020, with one percent of the total renewable energy requirement obligated to solar energy resources only.[5] In its state energy plan for 2005, the Texas Energy Planning Council (TEPC) recommends that the existing RPS be increased to 5,000 MW by 2015, with at least 500 MW of the total coming from non-wind renewable energy technologies. The TEPC also recommends that the state establish a voluntary renewable energy target of 10,000 MW by 2025.[6]

The Union of Concerned Scientists (UCS) analyzed the costs and benefits of increasing the current Texas RPS based on the proposals made by TREIA and the TEPC. We use the National Energy Modeling System (NEMS), developed and maintained by the U.S. Department of Energy's Energy Information Administration (EIA), to examine the impact of the RPS proposals on electricity and natural gas prices and consumer energy bills. Additionally, we analyze the impact of the RPS on the electric generation mix, renewable energy development, investment, employment, income, and emissions of carbon dioxide—the heat-trapping gas that contributes to global warming.

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[5] TREIA is also recommending a shorter-term expansion of the current RPS be adopted by the Texas Legislature in 2005, requiring 10,000 MW of renewable energy capacity (500 MW from distributed renewable resources) by 2015. This shorter-term goal is not analyzed in this report.

[6] Texas Energy Planning Council. *Texas Energy Plan 2005: Energy Security for a Bright Tomorrow*. December 2004. Available online at http://www.rrc.state.tx.us/tepc/finalenergyplan.pdf.

In this analysis, we examine the range of costs and benefits for each RPS proposal under two scenarios for renewable energy technology cost assumptions. The "more likely" scenario primarily utilizes projections from the Department of Energy's national labs that conduct research and development of renewable energy technologies. The other, or "less likely", scenario utilizes more pessimistic projections on renewable energy costs and performance from EIA.[7] UCS has reviewed these assumptions extensively with federal and state government analysts, independent consultants, and renewable energy developers and businesses. A number of EIA assumptions appear highly unrealistic, with current technology performance already exceeding EIA's projections in a few cases. We believe that renewable energy costs and performance are likely to be much closer to the first, but present the results of the more pessimistic scenario as well, in order to simulate a worst case.

In this report, we first provide an overview of the RPS as a policy tool, and the experience that states have had with it to date. We then review the provisions in the current Texas RPS, and its impact to date on the state's economy. We also provide a detailed description of the two proposals to increase the existing standard, and how they compare to programs in other states. Next, we present our modeling methods and major assumptions for the analysis followed by detailed results that compare the RPS proposals and highlight their impact on consumer energy bills, jobs, rural economic development, and the environment. Finally, we sum up our results of increasing the current RPS on the energy future of Texas.

## Renewable Energy Standards: Policy Overview

An RPS is a market-based policy mechanism that requires electric utilities to gradually increase the amount of renewable energy resources in their electricity supplies. Though they can vary in design, an RPS generally establishes annual requirements for each utility covered by the program to meet a certain percentage of their electricity sales using renewable power.

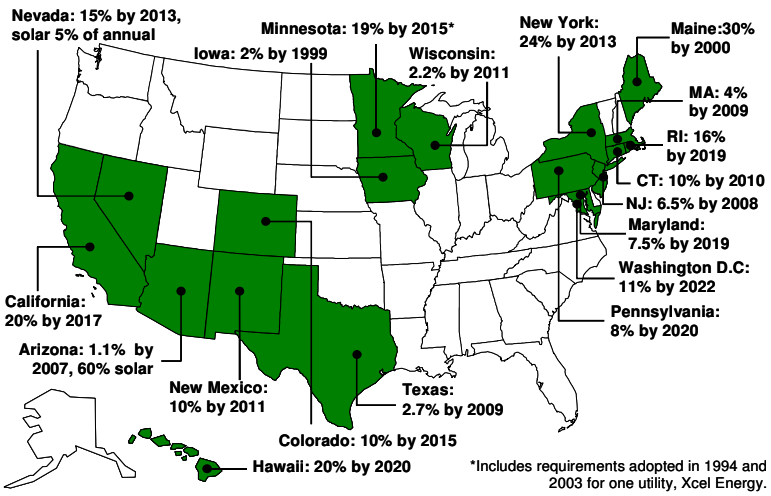
A growing number of states are choosing the RPS as their primary tool for promoting renewable energy. To date, 18 states and the District of Columbia have implemented minimum renewable energy standards (Figure 1).[8] On Election Day 2004, Colorado voters passed the first-ever renewable energy standard ballot initiative requiring the state's utilities to generate 10 percent of their electricity supply from renewable energy sources by 2015. In September 2004, New York created the second-largest new renewable energy market in the country (behind California) when the state Public Service Commission adopted a 24 percent by 2013 RPS. Hawaii, Maryland, Pennsylvania, Rhode Island, and Washington D.C. also enacted minimum renewable electricity standards in 2004. The majority of these 18 states enacted their standard legislatively, with just under half being included as part of legislation deregulating electricity generation. Several states—including Minnesota, Nevada, New Mexico, New Jersey, and most recently Pennsylvania—have revisited and significantly increased or accelerated their standards.

[7] For one technology, distributed solar photovoltaics, EIA projects slightly lower costs. To bracket the likely range of results, we have combined the more optimistic assumptions in one scenario and the more pessimistic assumptions in the other scenario.

[8] For detailed information on state renewable energy standard programs and other state policies to promote renewable energy, see UCS website, http://www.ucsusa.org/clean_energy/renewable_energy/page.cfm?pageID=114.

UCS projects that existing state renewable energy standards will result in the development of 25,550 MW of new renewable power by 2017 (Figure 2). This represents enough clean power to meet the electricity needs of 16.9 million typical homes. The standards in California, New York, Pennsylvania, and Texas make up the four largest markets for new renewable energy growth in the United States.

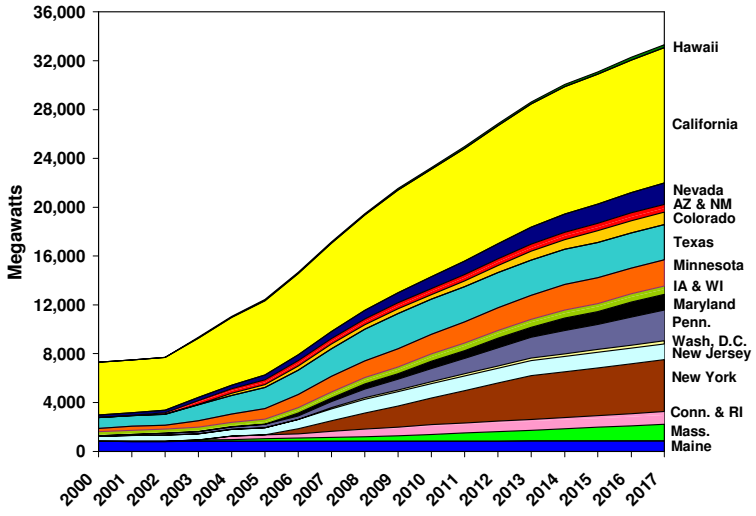
**Figure 1. Renewable Energy Standards**




While most standards have been enacted too recently to fully evaluate their effectiveness, a number of studies have found that renewable energy standards are and will continue to be the primary driver of new renewable energy generation in the United States.[9] In fact, nearly three-quarters of the wind facilities installed between 1998 and 2003 (3,570 MW) are located in states with an RPS.[10] In Minnesota, Xcel Energy has acquired about 600 MW of wind and bioenergy power as a direct result of its requirement. Wisconsin utilities have secured enough renewable resources to meet their targets through 2011, and Iowa has met and exceeded its relatively low renewable energy requirement. In some ways, the most successful RPS so far may belong to Texas (see discussion below).

Technological advances and increasing market share have led to significant decreases in the cost of renewable energy technologies over the past two decades. In areas with the best resources, wind energy can often compete on a lowest-cost resource basis with fossil fuel technologies on a long-term basis. However, there continue to be numerous market barriers—such as access to transmission lines and low-cost financing—that drive up the cost and hamper the development of renewable energy, as well as company decision-making based only on short-term rather than long-term costs. The RPS is designed to

**Figure 2. Renewable Energy Expected From State Standards***




* Projected development assuming states achieve annual targets.

[9] See UCS website, http://www.ucsusa.org/clean_energy/renewable_energy/page.cfm?pageID=1517.

[10] Not all of this capacity is directly attributable to state renewable energy standards. Some of the wind capacity was installed in a few states before the standard was adopted or because of other renewable energy policies and voluntary initiatives, however, this development often provided an impetus for the state to later adopt a renewable standard.

overcome these barriers and reduce costs for new renewable energy technologies so they can eventually compete with fossil fuel generators on a level playing field.

One relatively common mechanism for complying with the standard is a renewable energy credit (REC) trading program. Under a REC program, a renewable energy facility earns one credit for every kilowatt-hour (kWh) or megawatt-hour (MWh) of electricity that is generated in a given year. These RECs can then be bought and sold by utilities with annual renewable requirements—much like the Clean Air Act emission allowance trading system, which permits lower-cost, market-based compliance with air pollution regulations. This market-based approach instills competition among renewable energy generators and creates an ongoing incentive to drive down costs. A REC trading market provides compliance flexibility while ensuring the greatest amount of renewable power is delivered for the lowest price.

## The Texas RPS: A Model for Success

In June 1999, the Texas legislature became the eighth state to enact an RPS when it did so as part of major legislation that restructured the state's electricity market. At the time it was passed, the Texas RPS created the largest market for new renewable energy development in the country. And in the more than five years since it was adopted, many have regarded the Texas standard as one of the nation's most successful. In this section, we review the major provisions of the current Texas RPS, the installed capacity and related economic impacts that have resulted to date, and the key reasons behind the success.

### An Overview of the Texas RPS

The Texas RPS requires that 2,000 MW of new renewable electricity capacity be installed by 2009, and that an additional 880 MW of existing renewable energy capacity (mostly hydropower) in the state be preserved. The RPS establishes intermediate targets for new renewable energy capacity leading up to 2009, including 400 MW by 2003, 850 MW by 2005, and 1,400 MW by 2007. The 2,000 MW requirement stays in place from 2009 through 2019. In its regulations for implementing the RPS, the Texas Public Utility Commission (PUC) converted these capacity requirements into generation requirements using an average capacity factor for all renewable energy facilities. The PUC has set the capacity factor at 35 percent since the start of the RPS, but it can be adjusted by the PUC every two years based on actual performance of the installed renewable energy projects.

All retail electric suppliers that participate in the competitive market—equal to about 80 percent of the state's total electricity use—are required to meet the RPS targets. The overall target is allocated to suppliers based on their relative proportion of total covered electricity sales. This level of renewable energy development is equivalent to about 2.7 percent of the obligated electric suppliers' total projected sales in 2009.

Eligible renewable energy resources are defined in the Texas RPS as: solar, wind, geothermal, bioenergy (energy crops, forest and agricultural residues, animal waste products), landfill gas, wave, tidal, hydro, and renewable energy generation offset technologies (solar water heating, geothermal heat pumps). New renewable energy facilities are defined as those commissioned after September 1, 1999, and all renewable energy plants smaller than 2 MW—regardless of installation date. To be eligible to meet the RPS, a renewable energy facility must also be located within—or deliver its electricity into—the Texas power grid.

Texas' RPS program was the first in the country to verify and track compliance using a system of tradable RECs. In May 2001, the Electric Reliability Council of Texas' (ERCOT) Independent Systems Operator launched a web-based system to administer the REC trading program. Under this program, an eligible renewable energy facility earns one credit for every MWh of electricity that is generated. These RECs can then be bought, sold, or traded by retail electric suppliers in Texas with annual target requirements. RECs can be issued, registered, traded, and retired—all on ERCOT's online platform. At the end of each annual compliance cycle, a period of three months is provided so that obligated electric suppliers have time to ensure that they have acquired the required number of RECs. A credit generated in a given year can be used during that compliance period, or it can be banked for up to two additional years.

The Texas PUC is in charge of regulating and enforcing RPS compliance. If a retail electric supplier fails to meet its annual requirement, the PUC has the authority to administer strong penalties. A fine of $50 or 200 percent of the average market value of a REC during the compliance period—whichever is less—is levied for each MWh of an obligated supplier's requirement that is not met.

## The Texas Wind Power Boom

When the Texas Legislature enacted the RPS in 1999, one of its primary goals was to encourage the development of new renewable energy projects that would provide significant economic development opportunities in rural areas, and improve the state's environment.[11] In evaluating the policy's performance to date, there is strong evidence demonstrating that this goal is being achieved.

The first year of compliance for the RPS was 2002, but the Texas wind power boom did not wait that long to get underway. In 2001, Texas set a national record by installing more wind power than had been installed in the entire United States in any previous year. Today, nearly 1,200 MW of renewable energy have been installed. The vast majority of the development has been wind power, but some landfill gas, bioenergy, solar, and hydro projects have also been completed. An additional 500 MW of wind power projects are projected to come online in 2005, with many more proposals in various stages of development.

Several factors have contributed to the dominance of wind power in the early years of the Texas RPS. First, wind power is currently the most cost-competitive resource eligible to meet the RPS. Technological advances and market growth have helped reduce wind power costs so that areas with the strongest resources can now compete with new natural gas plants. Second, Texas possesses some of the best and most economical wind resources in the country, which makes it more difficult for other technologies to compete at this time. Third, the federal production tax credit (PTC) for wind power was set to expire at the end of 2001, and at that time there was great uncertainty about its future.[12] Developers and retail electric suppliers took advantage of early compliance provisions in the RPS—and the expiring PTC—to build several large-scale wind projects under long-term contracts.

[11] Section 39.904 of the Public Utility Regulatory Act (PURA).

[12] The PTC was extended in February 2002 through the end of 2003. In September 2004, it was extended again—and expanded to include other renewable energy sources—through the end of 2005. For more information, see http://www.ucsusa.org/clean_energy/renewable_energy/page.cfm?pageID=121.

The rush to develop wind power has created significant economic benefits for all Texans, but particularly those in rural communities. The 912 MW of wind installed in 2001 alone represented approximately $1 billion of capital investment. A recent report by the Texas Sustainable Energy and Economic Development Coalition and Texas Public Citizen quantified the economic benefits for the wind development that had been installed in Texas through 2001 (a total of approximately 1,100 MW). The report estimates that these wind projects are providing:

- $11.6 million in property tax revenues to school districts in ten counties;
- $2.5 million in land lease payments to rural land owners, or about $2,000 per turbine per year for a 25 year period;
- 2,500 direct wind-related jobs with a payroll of $75 million in many sectors including manufacturing, construction, and services;
- 2,900 indirect jobs in businesses such as equipment manufacturers and wholesalers, transportation companies, and financers that provide goods and services to the wind industry.[13]

### The Building Blocks for Success

A variety of factors have contributed to the early success of the Texas RPS. The success of the RPS is due, in part, to the availability of good renewable energy resources in the state, the continued economic incentives provided by the federal PTC, and favorable siting processes. In addition, the RPS has received strong political support and regulatory commitment from the outset, which is necessary to provide developers and retail electric suppliers with the confidence to make long-term investments in renewable energy projects.

The design and implementation of a renewable energy standard is also critical for the policy to operate efficiently and cost-effectively. The inclusion of the following key provisions in the Texas RPS legislation has contributed to its overall success:

- New renewable energy requirements that are predictable and large enough to trigger market growth in the state;
- A system of tradable RECs to track and verify compliance and other mechanisms—such as early compliance and limited banking and borrowing of RECs—to ensure the flexibility needed to meet the annual requirements; and
- Credible and significant financial penalties for retail providers that do not comply with the annual requirements.[14]

## Increasing the Texas RPS

On many fronts, the current version of the Texas RPS has been an unqualified success. The annual requirements are being met cost-effectively and well ahead of schedule. The renewable energy development that has occurred to date is providing significant economic benefits, primarily to rural communities. The RPS is providing much needed competition for natural gas power plants in

[13] Texas SEED Coalition and Texas Public Citizen. *Renewable Resources: The New Texas Energy Powerhouse*. September 2002.
[14] Wiser, R., K. Porter and R. Grace. *Evaluating Experience with Renewables Portfolio Standards in the United States*. March 2004. Wiser, R. and O. Langniss. *The Renewables Portfolio Standard in Texas: An Early Assessment*. November 2001.

Texas, which have seen fuel prices more than double over the past five years. The RPS has also improved the environment by reducing air emissions from fossil fuel power plants and reducing the demand for scarce water resources. As a result of these achievements, many renewable energy supporters are calling for the Texas legislature to increase the current requirements. In this section, we discuss the need for increasing the existing RPS requirements, and then describe the two proposals we analyzed, including a comparison of these proposals to programs in other states.

### Making The Case

When the RPS was enacted in 1999, the 2,000 MW by 2009 requirement was significant compared to other state commitments, but many considered it to be modest by Texas' own measures. The state has by far the largest electricity consumption in the United States, and enough renewable energy technical potential to meet its current electricity demand nearly eight times over. The original requirements were set at levels that started out low and gradually increased at a gradual pace to allow the RPS and the tradable REC compliance program enough time to be implemented effectively. Now that the operating and compliance systems are in place—with several years of experience behind them—the RPS can confidently be set at a higher level that better reflects the size of the state's electricity market and renewable energy potential.

Today, Texas is well ahead of its requirement schedule. Past experience has demonstrated that renewable energy developers are capable of installing projects at higher levels, and with a much faster pace than previously determined. By the end of 2005—if projections for new wind capacity are realized—renewable energy development in the state will be quickly approaching the 2009 target of 2,000 MW. A higher requirement will be needed to stimulate further development, while generating additional rural economic development and helping Texas-based businesses maintain their competitive advantage in the renewable energy industry. It would also help increase the diversity of the Texas generation mix and provide residential and business consumers with additional protection against higher natural gas prices.

Limited transmission capacity is a significant barrier to new renewable energy development in Texas that prevents the vast wind resources in the western part of the state and the Panhandle from reaching primary load centers. New wind development in these areas could be subjected to long periods of curtailment until transmission capacity can be increased by building new lines or upgrading existing lines. The state is actively taking steps to strengthen its transmission system, so it is likely that the current constraints will be addressed in the near term. If the existing renewable energy requirements were increased, it would send a positive signal in support of the transmission improvements currently underway, and would provide planners with greater certainty in assessing—and proactively addressing—longer-term transmission needs.

### The TREIA 20 Percent by 2020 Proposal

TREIA and a coalition of Texas environmental organizations are proposing to increase the existing Texas RPS requirements so that renewable energy provides 10 percent of the state's total electricity consumption by 2015, and rises to 20 percent by 2020. The proposal also requires that at least five percent of the annual renewable energy supply—or one percent of the total 2020 requirement—come from solar energy resource technologies (including solar photovoltaics, solar thermal, and solar water heating). TREIA is also recommending a shorter-term expansion of the current RPS be adopted by the Texas Legislature in 2005, requiring 10,000 MW of renewable energy capacity (500 MW from distributed renewable resources) by 2015. This shorter-term goal is not specifically analyzed in this report.

Converting from a capacity-based requirement to one based on generation would eliminate the need for the PUC to determine generation obligations by setting an average capacity value for all renewable energy facilities. It would also provide an incentive to maximize production from renewable energy facilities and create a more level playing field for all renewable energy technologies. Otherwise, the structure of the existing RPS—including obligated retail electric suppliers, eligible renewable energy resources, REC trading compliance, and penalties for non-compliance—would remain the same under the TREIA proposal.

If enacted, the 20 percent by 2020 requirement would move Texas up into the top tier among the 18 states that currently have RPS programs (Table 1). In terms of actual megawatts of capacity needed to meet the requirements in the TREIA proposal, Texas would once again be able to stake its claim to the top spot, as it did when the existing RPS was adopted in 1999.

Several other states have included similar provisions in their standards to support solar energy and/or customer-sited renewable generation. Like the TREIA proposal, Arizona, Nevada, New Jersey, New York, Pennsylvania, and Washington, DC all have separate requirements for solar energy technologies. The standards in Arizona, Nevada, and New Mexico give multiple credits for solar and other types of renewable energy generation.

**Table 1. State Renewable Energy Standards Comparison**

| State | Renewable Requirement (% sales) |
|---|---|
| Maine | 30% by 2000 |
| New York | 24% by 2013 |
| California | 20% by 2017 |
| ***Texas (TREIA)*** | ***20% by 2020*** |
| Hawaii | 20% by 2020 |
| Minnesota | 19% by 2015* |
| Rhode Island | 16% by 2019 |
| Nevada | 15% by 2013 |
| Washington, DC | 11% by 2022 |
| Connecticut | 10% by 2010 |
| New Mexico | 10% by 2011 |
| Colorado | 10% by 2015 |
| ***Texas (TEPC)*** | ***~9% by 2025*** ** |
| Pennsylvania | 8% by 2020 |
| Maryland | 7.5% by 2019 |
| New Jersey | 6.5% by 2008 |
| Massachusetts | 4% by 2009 |
| ***Texas (Current)*** | ***~2.7% by 2009*** ** |
| Wisconsin | 2.2% by 2011 |
| Iowa | ~2% by 2000** |
| Arizona | 1.1% by 2007 |

* Minnesota's standard is for Xcel Energy only, and it includes the utility's 1994 capacity-based and 2003 generation-based requirements.
** The Iowa RPS and current Texas RPS, as well as the TEPC proposal are capacity-based, requiring 105 average MW, 2,880 MW, and 10,000 MW respectively.

## The TEPC 10,000 MW by 2025 Proposal

In December 2004, the TEPC released its 2005 state energy plan. In this plan, the TEPC acknowledges that Texas has far more renewable energy potential than is reflected by the existing RPS. As a result, it recommends that the existing RPS be increased to 5,000 MW by 2015, with a longer-term target set at 10,000 MW by 2025. The state energy plan also recognizes that the vast majority of the near-term renewable energy development in Texas will come from wind power. In an effort to support other renewable energy technologies, the proposal calls for at least 500 MW of the total requirement to come from non-wind renewable energy sources. As with the TREIA proposal, the structure of the RPS under the TEPC recommendations would remain the same as in the existing standard.

The TEPC energy plan also makes recommendations for improving transmission infrastructure in the state. One recommendation would direct the PUC to identify "competitive wind and renewable zones" and determine transmission needs in an effort to bring renewable electricity from these zones into load centers. The TEPC also proposes a "Renew Texas" plan that would create a dedicated fund to support improvements in transmission infrastructure for renewable energy

projects. The "Renew Texas" plan would generate revenue by collecting a small fee (with caps and based on kWh usage) from all customer classes on their monthly bills. Wind projects benefiting from the infrastructure improvements would also be required to contribute to the Renew Texas fund to support the development of other renewable energy resources.

Assuming that the entire 10,000 MW by 2025 target is achieved, Texas would rank in the middle of the pack when compared to other state RPS programs on a percent of sales basis. However, like the TREIA proposal, the TEPC plan would move Texas into the top spot compared to other states based on total new renewable energy capacity supported. As discussed above, several other states have included provisions in their standards to support solar energy and/or customer-sited renewable generation. However, no other state RPS program has yet created a separate requirement exclusively for non-wind renewable energy technologies. Fifteen states have created renewable energy funds, which—similarly to the "Renew Texas" proposal—provide financial resources for renewable energy development.

## Methods and Assumptions

We used nationally recognized models and adopted conservative assumptions to estimate the costs and benefits of increasing the Texas RPS. The following describes the models and key assumptions we used to project the energy and macroeconomic impacts.

### Modeling Energy Impacts

We used the EIA's National Energy Modeling System (NEMS) to quantify the direct costs and benefits of the Texas RPS. EIA uses the NEMS model to conduct the official long-term forecasts of U.S. energy supply, demand, prices, and expenditures and to estimate the impacts of energy policy proposals.[15] We recently used this modified version of the NEMS model to estimate the impacts of a national renewable energy standard on the United States and several individual states, and of the Colorado renewable energy standard ballot initiative.[16] The Tellus Institute, a Boston-based consulting group with extensive experience running the NEMS model, completed the NEMS runs of the Texas RPS for UCS.

We started with the version of the model that EIA used to produce *Annual Energy Outlook 2004* (AEO 2004)—the EIA's most recent long-term energy forecast at the time we initiated this study. The business as usual (BAU) forecast used in our analysis is identical to EIA's reference case forecast for AEO 2004, except for the following changes. First, we modified NEMS to incorporate more conservative estimates of the market potential for wind, geothermal, and bioenergy resources to account for siting, transmission, penetration, and other potential constraints in some regions of the country. These changes resulted in a reduction of up to 60 percent of the conventional geothermal potential in the West. We also reduced the available bioenergy supply by reducing urban residues by 5 percent to ensure that contaminated materials are excluded, and reducing forest residues by 50 percent to provide an extra margin against relying on unsustainable sources, even

[15] For complete documentation of the NEMS model, see http://www.eia.doe.gov/bookshelf/docs.html.
[16] Union of Concerned Scientists. *Renewing America's Economy*. September 2004. Available online at: http://www.ucsusa.org/clean_energy/renewable_energy/page.cfm?pageID=1505. Deyette, J. and S. Clemmer. *The Colorado Renewable Energy Standard Ballot Initiative: Impacts on Jobs and the Economy*. October 2004. Available online at: http://www.ucsusa.org/clean_energy/renewable_energy/page.cfm?pageID=1536.

though EIA's estimate already excluded road less areas, steep slopes, and more than half the remaining residues.

We also reduced the wind potential that is assumed to be available for development by 50 percent in the West, Plains, and New England. However, we increased the wind resource potential that could be developed in the ERCOT electricity reliability region in Texas by 12,700 MW based on an extrapolation of an updated wind resource assessment completed by the National Renewable Energy Laboratory for the western part of the state. We also assumed that up to 4,000 MW of wind capacity could be developed in the Panhandle, and up to 1,000 MW in west Texas would be delivered to demand centers in ERCOT via new transmission lines. The cost of these new lines was also included as indicated below.

Second, we modified several EIA assumptions that artificially constrain the growth and raise the projected cost of renewable energy technologies. As a starting point, we incorporated changes made to NEMS by the U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) to examine the impact of their renewable energy research and development (R&D) programs for the FY05 Government Performance and Results Act (GPRA) and by EIA for the "DOE Goals" case in AEO 2004.[17] In addition, we supplemented this information with input from renewable energy experts and developers, utilities, and recent studies.

Based on this information, the key model changes that have an impact on this analysis include:

- We changed EIA's designation of wind as a commercial technology to "evolutionary" status to allow for a greater reduction in capital costs as installed capacity increases based on the GPRA projections.

- We increased capital costs for wind power by up to 50 percent as the penetration of wind increases to 30 percent of a region's electricity generation. This includes a cost increase of up to 20 percent for integrating wind into the broader electricity system based on a recent analysis for PacifiCorp's Integrated Resource Plan and a cost increase of up to 30 percent for additional siting and transmission costs. This is a conservative approach as the PacifiCorp results showed the highest impacts of the nine studies considered in a recent NREL report,[18] and within ERCOT, transmission is a shared asset whose cost is supported by all load. (EIA assumes, without substantiation, cost increases up to 200 percent).[19]

- We adopted changes EIA made to wind power in *AEO 2005* including increasing initial capital costs to $1,100/kW, increasing capacity factors as the penetration of wind increases, and lowering costs for connecting wind projects to the existing transmission system.

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[17] GPRA assumptions are online at *www.eere.energy.gov/office_eere/gpra_estimates_fy05.html*. EIA assumptions for the DOE Goals case can be found in Assumptions to Annual Energy Outlook 2004, pp 135-137. These assumptions are an update to assumptions originally made in NEMS by the Interlaboratory Working Group of the five national energy laboratories in *Scenarios for a Clean Energy Future*.

[18] National Renewable Energy Laboratory. *Wind Power Impacts on Electric Power System Operating Costs: Summary and Perspective on Work to Date*. NREL/CP-500-35946. March, 2004.

[19] For a description of the other changes we made to the model that impacts other states and regions see: http://www.ucsusa.org/clean_energy/renewable_energy/page.cfm?pageID=1504.

## Modeling Macroeconomic Impacts

We used the Impact Analysis for Planning (IMPLAN) model and specific data on Texas' economy to estimate the macroeconomic impacts (employment, income, and gross state product) of the Texas RPS. IMPLAN is an input-output (I-O) model that identifies interactions between all sectors of the economy. I-O models 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 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 energy modeling described above.[20] There were four main steps in completing the macroeconomic analysis:

- First, we estimated total expenditures for installing, manufacturing, operating, and maintaining renewable energy technologies that are projected to be developed to meet the Texas RPS and for coal and natural gas power plants that would have otherwise been developed without the standard.
- Second, the expenditures are broken down and allocated to the industries that would directly supply the equipment, labor, and services for renewable and conventional energy technologies.
- Third, these detailed expenditures are multiplied by the estimated local share of equipment, labor, and services that can be supplied by Texas businesses and matched to the appropriate sectors in the IMPLAN model to calculate the direct and indirect macroeconomic impacts in Texas.
- Finally, we calculated the macroeconomic impacts of changes in consumer energy bills in Texas.

We also adopted several key assumptions for the macroeconomic analysis. The expenditure breakdown for the construction and operation and maintenance of renewable and conventional power plants was based on data from actual projects collected from a variety of sources, including state and federal agencies, renewable energy developers and utilities. The expenditure breakdown and local share data on wind projects—the technology that benefits most under the RPS—was based on inputs used in the National Renewable Energy Laboratory's (NREL) Jobs and Economic Development Impacts (JEDI) Model.[21]

We used data from the IMPLAN model to estimate the local share of expenditures for specific industries, with a few key exceptions. Increasing the Texas RPS to the levels analyzed in this study would create a large market for renewable energy in the state that would help attract businesses that manufacture technologies and components and provide services. As discussed above, implementation of the current standard has already resulted in an estimated 2,500 direct jobs from Texas businesses supplying wind towers, blades, and development, construction, and transportation

[20] The analytical approach used in this analysis is similar to that used by Geller, DeCicco, and Laitner, *Energy Efficiency and Job Creation*, American Council for an Energy Efficient Economy, 1992.
[21] For more information about the JEDI model, see http://www.eere.energy.gov/windpoweringamerica/jedi.html.

services.[22] Based on this, we made the following assumptions about the share of expenditures and manufacturing that could be supplied by local businesses:

- 100 percent of the towers and blades for wind turbines
- 33 percent of other wind turbine components and solar photovoltaic panels
- 100 percent of solar water heating collectors
- 100 percent of natural gas fuel expenditures and 52 percent of coal fuel expenditures based on data from EIA.[23]

We also completed a sensitivity analysis that assumed 100 percent of other wind turbine components and solar photovoltaic panels are manufactured in the state. We do not include any jobs or economic development from Texas manufacturers exporting equipment to other states or countries. If Texas is able to attract renewable energy manufacturers to produce equipment for facilities in the state and for export, the jobs and income from the standard would increase significantly.

## Major Assumptions of the Texas RPS proposals

The following describes our main assumptions in modeling the implementation details of the two RPS proposals.

**Renewable Energy Targets.** We assume that the utilities covered under the standard will generate or purchase the minimum amount of renewable energy needed to meet the proposed targets through 2025.

**Solar requirement.** We also assume that the TREIA target for solar will be met, with 70 percent coming from distributed solar technologies and 30 percent from large central station solar photovoltaics (PV) and thermal technologies. In addition, we assume that 50 percent of the distributed solar will be met with PV and 50 percent from solar water heaters installed on homes and businesses based on the projected economics for these technologies.

We used the NEMS model to determine the incentives that would be needed to meet the targets for large-scale solar. The costs of meeting the targets for distributed solar PV and solar water heating were estimated in an offline analysis. For distributed solar PV, we assumed that retail electricity providers would offer rebates that are sufficient to stimulate enough consumer investment to meet the solar requirement. We assumed that this will initially require rebates of approximately $4 to $5 per watt for residential systems and $2.50 to $3.50 per watt for commercial systems, declining to $2 per watt over the next 10 years as the cost of PV is projected fall. For comparison, Austin Energy is currently offering rebates of $5 per watt and $6.25 per watt for PV equipment manufactured in Austin to residential and commercial customers.[24] In addition, we assumed that electricity

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[22] Texas SEED Coalition and Texas Public Citizen. *Renewable Resources: The New Texas Energy Powerhouse*. September 2002.

[23] Energy Information Administration. *Natural Gas Production & Use by Texas*, available online at http://www.eia.doe.gov/emeu/states/ngsales/ngsales_tx.html. Energy Information Administration. *Texas Coal Statistics*, available online at http://www.eia.doe.gov/cneaf/coal/statepro/imagemap/tx1p1.html.

[24] The rebate is capped at 80 percent of the invoiced cost or a maximum of $15,000 for a residential system and a maximum of $100,000 for a commercial system, whichever is less. Source: Austin Energy, http://www.austinenergy.com/Energy Efficiency/Programs/Rebates/Solar Rebates/.

providers would treat the rebate programs as capital investments that are recovered from all retail customers and allowed to earn an authorized rate of return.

For residential solar water heating, we used cost and performance assumptions developed by DOE for the GPRA analysis, EIA for the AEO 2004 version of the NEMS model, and NREL for a recent a study that used an extended version of NEMS.[25] Based on these studies, we assumed installed costs would decline from $2,800 per system today to $1000 in 2025 as market penetration of the technology increased due to the renewable standard. We also assumed that solar would provide 50 percent of total water heating electricity use of 2,536 kWh[26] and that each system would displace 0.42 kW of peak capacity.[27] We also calculated savings on consumer energy bills by multiplying projected residential electricity prices in Texas from the NEMS model by the electricity displaced by solar water heating.

**Electricity Demand Growth.** We assume that electricity demand increases at over 2 percent per year initially declining to about 1.4 percent per year in 2025 based on EIA projections for ERCOT in the AEO 2004 reference case.

**Transmission Investments.** As discussed above, we included investments in new transmission lines and upgrades to support new wind development projected under the proposals. We assume that approximately 500 MW of wind could be added each year through 2009 without major new investments in bulk transmission. Beginning in 2010, we assume major new investments in bulk transfer capacity (345 kV lines) and associated equipment would be brought into service to support wind facilities in West Texas and the Panhandle and that transmission capacity ramps-up over time to support new wind development through 2025. We also assume that only a portion of the total investment costs will be paid for by wind projects, as other sources of generation will use these lines as well.

## Scenarios

We modeled two main scenarios in this analysis to estimate the potential range of costs and benefits that could result from the two proposals to increase the Texas RPS. The scenario that examines the most likely impacts of the standard uses cost and performance assumptions for renewable energy technologies developed by the National Renewable Energy Laboratory and the DOE for use in the GPRA analysis and by EIA for the "DOE Goals Case" in AEO 2004.[28] In addition, we used EIA's projections in the NEMS model for distributed solar PV. We believe these assumptions better reflect improvements in renewable energy technologies that are likely to occur through continued R&D, industry expansion, and increases in installed capacity. We also modeled a less likely scenario that uses EIA's more pessimistic cost and performance assumptions for large-scale wind,

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[25] See footnote 18 and Robert M. Margolis and Francis Wood, "The Role for Solar in the Long-Term Outlook of Electric Power Generation in the U.S," Paper presented at the 24th USAEE/IAEE North American Conference, Washington D.C., July 8-10, 2004.

[26] EIA. *2001 Residential Energy Consumption Survey: Household Energy Consumption and Expenditures Tables*. Table CE4-11c. Available online at http://www.eia.doe.gov/emeu/recs/recs2001/ce_pdf/waterheat/ce4-11c_so_region2001.pdf.

[27] Frontier Associates, LLC. *Deemed Savings, Installation & Efficiency Standards*. February, 2002. p. 39. Available online at: http://www.puc.state.tx.us/electric/projects/22241/DeemedSavings_final.pdf.

[28] See footnote 9. The renewable energy cost and performance assumptions were originally developed by the Electric Power Research Institute (EPRI) and recently updated by the National Renewable Energy Laboratory (NREL) in the *Power Technologies Databook* 2003 and in the GPRA analysis.

bioenergy, geothermal, and solar technologies, and slightly higher cost projections for distributed solar from the GPRA analysis.

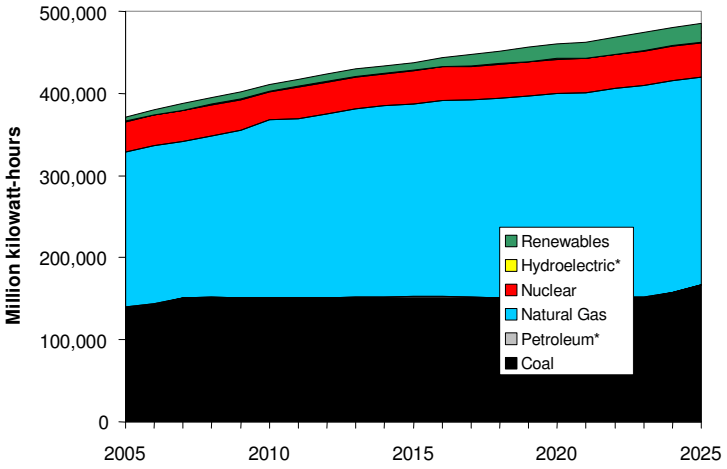
For both scenarios, we assume that the federal production tax credit for wind and closed loop biomass is extended only through 2005 and is expanded to include solar, geothermal, and other biomass resources, as specified in current law. If the PTC is extended beyond 2005, which we think is likely, the cost of meeting the proposed increases in the Texas RPS would be significantly lower than estimated in this report.

# Results

Below we present the results from our analysis for the Texas Renewable Energy Industries Association (TREIA) and the Texas Energy Planning Council (TEPC) proposals under two renewable energy technology cost scenarios. We begin with our "most likely" scenario, using the renewable energy technology cost projections from NREL and DOE as described above. For this scenario, we first identify the impact of TREIA's 20 percent by 2020 renewable standard on Texas' electricity mix, energy consumers, jobs and economic development, and the environment. We then present the results from the TEPC proposal, focusing on these same impacts. Finally, we present the findings for both proposals from our "less likely" scenario, which uses EIA's more pessimistic renewable energy technology cost projections as described above.

## Results from the TREIA 20 Percent by 2020 Proposal

**Figure 3. Texas' Electric Generation Mix under Business as Usual, 2005-2025**



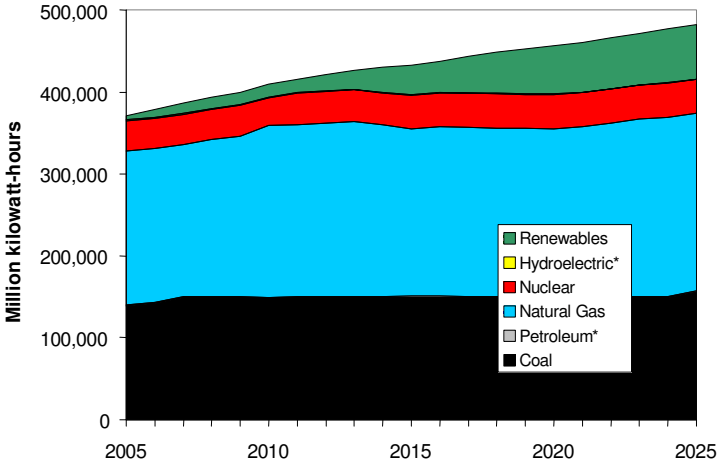

*Hydroelectric and Petroleum are not visible in the graphic. Combined, they account for less than 0.5 percent of the total generation mix.

**Renewable Energy Diversifies the Electricity Mix.** Under a business as usual scenario, Texas increases its dependence on fossil fuels to meet a steady growth in electricity use through 2025 (Figure 3). Nearly all of the increase in electricity generation would come from natural gas, which would increase by one-third over current levels over the 20-year period. Coal generation would remain relatively flat throughout much of the forecast period. However, coal generation would be nearly 25 percent higher than current levels in 2025, as high natural gas prices makes new coal generation cost competitive in both the initial and late years of the forecast.[29] As a result of Texas' current RPS and continuing improvements in renewable technologies, non-hydro renewable generation would increase under business as usual to 5,600 MW or 4.8 percent of total electricity generation by 2025. Wind power would provide nearly all of the new renewable energy capacity.

[29] Two new coal power plants have been proposed in Texas (near San Antonio and Waco), totaling 1,550 MW in capacity. They are currently in the permitting process.

Under the 20 percent by 2020 standard, Texas would increase its total homegrown renewable power to more than 17,800 megawatts (MW) by 2025.[30] Texas' strong wind resources would power the majority of this development, with bioenergy and solar resources also contributing to the mix. This level of development would produce enough electricity to meet the needs of 4.9 million average-sized Texas homes.[31]

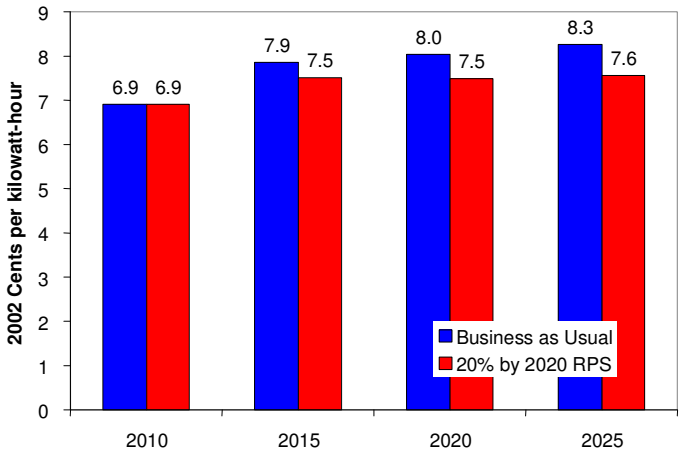
**Figure 4. Texas' Electric Generation Mix under a 20 Percent by 2020 RPS, 2005-2025**




*Hydroelectric and Petroleum are not visible in the graphic. Combined, they account for less than 0.5 percent of the total generation mix.

Wind, bioenergy, and solar resources meet a much larger share of Texas' electricity needs under the 20 percent standard (Figure 4). For much of the forecast, renewable energy displaces natural gas generation, which is 14 percent lower than business as usual by 2025. In the later years, renewable energy also displaces the need for new coal generation under business as usual. However, both natural gas and coal generation would still increase by 17 percent and 16 percent, respectively, compared with today's levels under the 20 percent standard.

**Figure 5. Average Electricity Prices, 20 percent by 2020 RPS**




**Renewable Energy Saves Energy Consumers Money.** New renewable energy generation stimulated by the 20 percent RPS would create much needed competition with natural gas power plants, leading to reduced gas demand and lower natural gas and electricity prices. Under the 20 percent standard, average annual natural gas prices would be up to three percent lower than business as usual, with an average price reduction of five cents per million British thermal units (MMBtu) over the 20-year forecast period. Lower natural gas prices benefit a host of Texas consumers, including families and businesses that use gas to heat their homes and buildings, industrial consumers that use gas to run their facilities and as a feedstock, and power plants that use natural gas to generate electricity. Lower natural gas prices would also lower fertilizer prices for farmers.

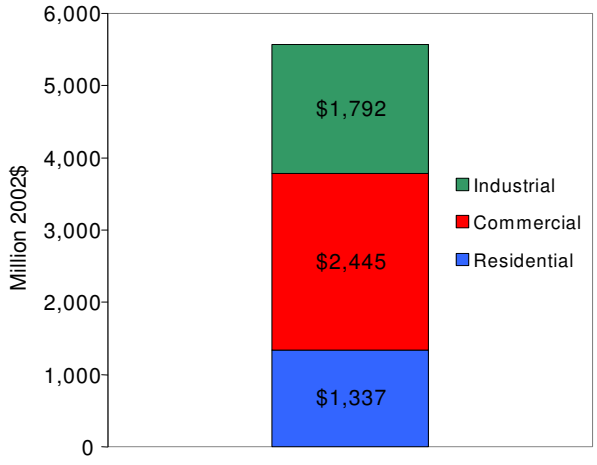
[30] This includes residential solar water heating systems that will offset an estimated 390 MW of peak generating capacity.

[31] Based on EIA Electric Sales & Revenue Report 2002 data for residential sector of 1,140 kWh/month.

In addition to reducing gas prices, renewable energy facilities would also directly displace electricity generated from more expensive natural gas power plants. As a result, average consumer electricity prices under the 20 percent standard would remain virtually the same as business as usual through 2012, with prices beginning to decline thereafter (Figure 5). By 2025, average electricity prices would be nine percent—or 0.7 cents per kilowatt-hour—lower under the 20 percent standard compared to business usual.[32]

Lower natural gas and electricity prices lead to a reduction in the overall cost of energy for consumers. By 2025, total consumer energy (natural gas and electric) bills would be nearly $5.6 billion lower under the 20 percent standard. All sectors of the economy would benefit, with residential, commercial, and industrial customers' total savings reaching $1.3 billion, $2.4 billion, and $1.8 billion, respectively (Figure 6).

**Figure 6. Cumulative Consumer Energy Bill Savings, by Sector, 2005-2025 (20 percent by 2020 RPS)[a]**




[a]Net present value 2002$ using a seven percent real discount rate.

In a regulated electricity market, these savings normally would be passed on to consumers through the regulated rate-setting process. However, the electric market in Texas is competitive. As a result, electric suppliers would have the option of keeping the savings from the reduced energy costs, or passing the savings on to consumers. By holding on to the savings, an electric supplier could increase their profit margins, but they would also run the risk of losing customers to a competitor that chooses to pass the savings on via lower prices. In a properly functioning market—where electric suppliers are competing for every customer—it is probable that the energy bill savings resulting from the increased use of renewable energy would be passed on to the energy consumer.

If natural gas prices exhibit either short-term price spikes or long-term sustained increases beyond those currently projected by EIA, consumer savings would be greater than reported here. Studies have found that the natural gas futures market does anticipate higher gas prices than EIA projects for at least the next 10 years.[33] And EIA has raised its long-term gas price forecast in each of the last eight years.[34]

**Renewable Energy Creates Jobs and Boosts the Economy.** As described above, renewable energy development has already demonstrated that it can create new high-paying jobs and other economic benefits in Texas. Increasing the renewable energy standard to 20 percent by 2020 would

[32] In a competitive market, wholesale "spot market" electricity prices are set by the highest cost plant on the margin needed to meet demand during a given time period. This marginal price is based on the variable operating and fuel costs of the plant. Since wind projects have low operating and no fuel costs, the generation from these projects is typically used when it's available. This exerts downward pressure on the wholesale price of electricity by displacing higher cost generation on the margin.

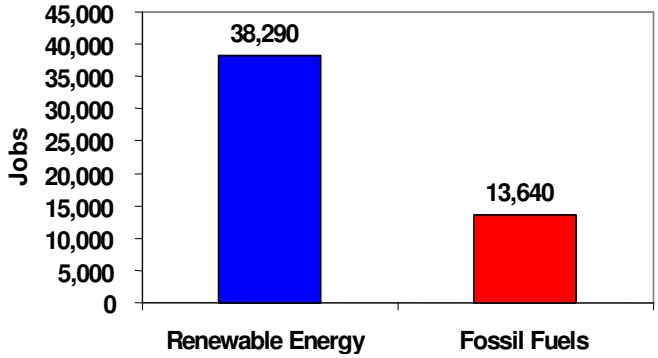
[33] Bolinger, M., R.H. Wiser, and W. Golove. *Accounting for Fuel Price Risk: Using Forward Natural Gas Prices Instead of Gas Price Forecasts to Compare Renewable to Natural Gas-Fired Generation*. August 2003.

[34] See UCS, *Renewable Energy Can Help Ease the Natural Gas Crunch* at http://www.ucsusa.org/clean_energy/renewable_energy/page.cfm?pageID=1370.

build on these current successes and significantly increase jobs and economic development benefits. By 2025, the 20 percent standard would create 38,290 new jobs in manufacturing, construction, operation, maintenance, and other industries. In fact, the amount of renewable energy needed to meet the requirement would create 2.8 times more jobs than fossil fuels—a net increase of 24,650 jobs by 2025 (Figure 7). This increase in jobs would generate an additional $950 million in income and $440 million in gross state product for Texas' economy.

These job results reflect the conservative assumption that 33 percent of the manufacturing for the wind and solar photovoltaic technologies installed in Texas is produced by businesses located in the state. If Texas was able to attract additional renewable energy manufacturers to produce all of the equipment for wind and solar PV facilities in the state, an additional 1,100 new permanent high paying jobs would be created in Texas by 2025. The results do not reflect any jobs or economic benefits from Texas manufacturers exporting equipment to other states or countries, which could be significant.

**Figure 7. Renewable Energy vs. Fossil Fuel Jobs, 2025 (20 percent by 2020 RPS)**




Rural economies across Texas would also receive a tremendous boost from increasing the current RPS. Many of the jobs identified above would be created in rural areas where most of the facilities would be located. By 2025, the 20 percent standard would provide:

- $9.4 billion in new capital investment for renewable energy facilities
- $1.1 billion in new property tax revenues for local school districts
- $750 million in additional new property tax revenues for other local public services, depending on the level of tax abatements offered by a community
- $542 million in additional revenues to farmers, rural landowners, and other biomass energy producers
- $154 million in income to farmers, ranchers, and rural landowners from wind power land leases[35]

The new capital investment in renewable energy facilities includes investments in new transmission lines and upgrades to existing lines that will be needed to ensure that the generation from the new wind power development can be delivered to load centers. Under the 20 percent standard, our analysis includes nearly $1.8 billion ($676 million net present value) in transmission investments through 2020 to support 13,840 MW of total installed wind capacity in Texas.

This level of investment is consistent with recent transmission cost studies conducted by the Lower Colorado River Authority (LCRA) and the Electric Reliability Council of Texas (ERCOT). LCRA found that the capital costs for the transmission to support 10,000 MW of wind power in the ERCOT control area by 2015 would range from $1.8 billion to $2.2 billion, depending on the size of the transmission line. ERCOT estimates that transmission investments needed to support

[35] Results are in cumulative net present value 2002$ using a seven percent real discount rate. Job results are for the year 2025.

5,000 MW (3,800 MW new) of wind power in West Texas would cost about $1.0 billion—or approximately $260 million per 1,000 MW of new wind capacity.[36] It is also important to note that new and upgraded transmission lines will likely be used by other types of new and existing electric generation, not just wind power. While within ERCOT, transmission is regarded as a system-wide asset supported by all load, the prudence of the public policy to invest in additional transmission lines can be evaluated by simply including those costs as an "adjusted" capital cost of the wind power projects. As a result, our analysis conservatively assumes that wind projects would pay nearly 70 percent of the overall investment costs.

**Renewable Energy Improves the Environment.** Increasing renewable energy use will reduce the amount of air pollution from power plants that threaten the people of Texas' health by burning coal, oil, and natural gas. Carbon dioxide ($CO_2$) emissions, which trap heat in the atmosphere and cause global warming, would also be reduced. A 20 percent by 2020 standard will reduce about 20 million metric tons (MMT) of power plant $CO_2$ emissions per year by 2025—a reduction of 7.4 percent below business-as-usual levels. This reduction is equivalent to taking 2.5 million cars off the road or planting 4.8 million acres of trees—an area the size of New Jersey. In addition, the renewable energy standard will reduce harmful water and land impacts from extracting, transporting, and using fossil fuels and conserve resources for future generations.

The decrease in emissions of $CO_2$ and other pollutants also reduces the financial exposure of Texas utilities and customers to future costs of regulating those emissions. Recently, Wayne Brunetti, CEO of Minnesota-based Xcel Energy, said that the United States will likely impose $CO_2$ emission regulations "in one form or another" on the power industry in the near future.[37] Other CEOs from major utilities and Fortune 500 companies are beginning to agree with this conclusion.[38] Such regulation will result in higher costs for fossil fuel in the form of added controls, emission allowance permits, or emission taxes.

In California, a recent Public Utilities Commission decision requires the state's utilities to assume a greenhouse gas emissions adder cost of $8 to $25 per ton of $CO_2$ in evaluating new long-term resource commitments and in developing their next long-term plans.[39] Other utilities, like PacifiCorp in the northwest, are assuming $CO_2$ costs of $8 per ton, or approximately 0.3 cents per kWh in higher natural gas generation costs and 0.7 cents per kWh in higher coal plant costs in their long-range planning. These avoided costs in the RPS scenario are not explicitly considered in this analysis.

**National Benefits from Increasing the Texas RPS.** The level of new renewable energy development resulting from the 20 percent by 2020 standard would have an impact that reaches beyond the borders of Texas. First, Texas has the highest electricity use of any state in the country, representing more than nine percent of total current U.S. electricity use. As a result, the effect that

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[36] "Preliminary Report on Transmission Impact of 5,000 MW of Wind Generation on ERCOT's Grid," PowerPoint presentation by ERCOT Transmission Services, December 15, 2004. The low end of the cost range for both studies is based on adding 345 kV lines, while the high end of the range is based on adding 765 kV lines. ERCOT claims there may be additional benefits from the 765 kV alternative that were not evaluated in the study.

[37] Dow Jones, February 4, 2004.

[38] National Environmental Trust. *Cleaning Up Air Pollution From America's Power Plants: The Facts*. 2002. Available online at: http://cta.policy.net/fact/4pbook.pdf.

[39] California Public Utilities Commission. *Decision 04-12-048 on the CPUC's Policy to Reduce Customers' Exposure to the Financial Risk Associated with Greenhouse Gas Emissions*. Proceeding R.04-04-003 December 16, 2004.

increased renewable energy generation has on reducing natural gas demand in Texas, also results in slightly lower natural gas prices for the rest of the country.

Second, the 20 percent standard in Texas would significantly increase the level of total installed renewable energy capacity in the United States, particularly wind and solar capacity. Under the 20 percent standard, 13,840 MW of wind power would be installed in Texas by 2025—more than two times the total installed wind capacity in the United States today. Nearly 1,000 MW of distributed and central station solar PV would also be installed in Texas by 2025 under the 20 percent standard—more than three times the installed solar PV capacity in the United States today. Meeting the demand for renewable energy in Texas will help lower the cost of renewable energy technologies by increasing production volumes and efficiencies in manufacturing of equipment, creating greater economies of scale in construction and maintenance of facilities, and providing investment capital that could stimulate additional technological breakthroughs.

Lower capital and operating costs will help make renewable energy technologies more competitive with fossil fuels over time and throughout the United States—leading to additional development outside of Texas. The increased renewable energy generation that occurs outside Texas helps to lower gas and electricity prices further, creating national savings for energy consumers. By 2025, cumulative national energy bills under the Texas 20 percent by 2020 standard would be $16.8 billion lower than business as usual, with these savings reaching all sectors of the economy.

### Results from the TEPC 10,000 MW by 2025 Proposal[40]

Under the TEPC's 10,000 MW by 2025 RPS proposal, Texas would still see significant increases in renewable energy and its associated benefits compared to the existing standard, but many of these benefits would be considerably less than under the more aggressive 20 percent standard. Under the 10,000 MW standard, Texas could produce enough electricity to meet the needs of 2.6 million average-sized Texas homes or about eight percent of total electricity use in Texas by 2025. As with the 20 percent standard, Texas' strong wind resources would power the majority of this development, with bioenergy meeting nearly the entire non-wind renewable energy goal of 500 MW by 2015. Without a specific set-aside requirement, solar resources are unable to compete with wind or bioenergy resources, and therefore account for a much smaller portion of the total renewable energy mix in this case.

New renewable energy generation would also lead to lower gas demand and slightly lower natural gas and electricity prices under the 10,000 MW target. Average annual natural gas prices would be as much as 2.2 percent lower than business as usual, with an average price reduction of 3 cents per MMBtu from 2005 to 2025. Average electricity prices would be lower in every year of the forecast under the 10,000 MW standard. By 2025, average electricity prices would be 5.2 percent—or 0.43 cents per kWh—lower under the RPS compared with business as usual.

Reduced natural gas and electricity prices resulting from increased renewable energy generation leads to lower total consumer energy bills. By 2025, consumers would see cumulative energy bill

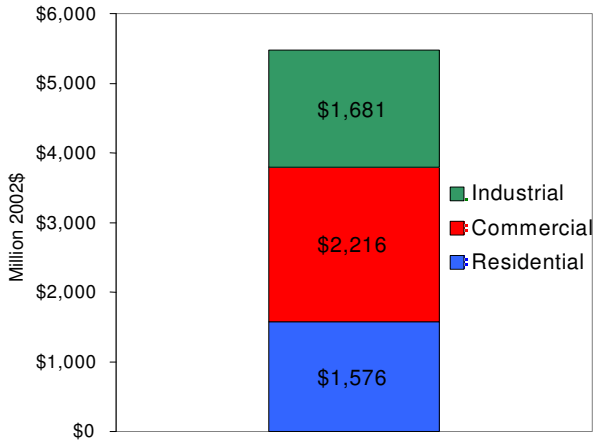
[40] As described earlier, the TEPC proposal calls for increasing the Texas RPS from the current level of 2,000 MW of new renewable energy capacity to 5,000 MW by 2015, with a goal of reaching 10,000 MW by 2025. Our analysis assumes that the larger 10,000 MW by 2025 target is achieved under the same compliance and enforcement mechanisms that would govern the lesser requirement. If the TEPC's 10,000 MW goal remains strictly voluntary and is under achieved, the benefits would be less than the results presented in this report.

savings of nearly $5.5 billion under the 10,000 MW standard compared to business as usual, with savings in the residential, commercial, and industrial customer classes (Figure 8).

The cumulative impact on consumer energy bills under the 10,000 MW target is similar to the 20 percent by 2020 standard proposal. However, on an annual basis, the impact on consumer energy bills between the two proposals varies, and in some years the difference is significant.

Two additional factors should be considered when comparing the impact on energy consumers. First, compliance costs are higher under the 20 percent standard. Achieving the solar energy requirement under the 20 percent standard increases compliance costs and reduces some of the consumer savings attained by developing the less expensive wind and biomass resources under the 10,000 MW target. Higher levels of wind generation under the 20 percent standard also result in higher transmission and ancillary service costs. And with less renewable energy generation required than under the 20 percent standard, the 10,000 MW target does not have as great an effect on reducing natural gas and electricity prices.

**Figure 8. Cumulative Consumer Energy Bill Savings, by Sector, 2005-2025 (10,000 MW by 2025 RPS)[a]**

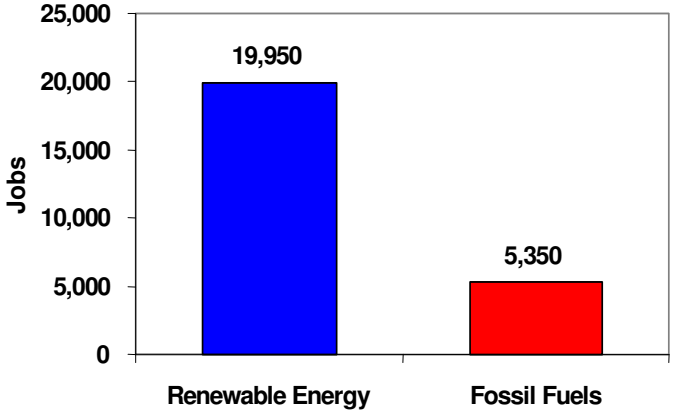



[a]Net present value 2002$ using a seven percent real discount rate.

Second, under the 20 percent RPS proposal, the annual renewable energy generation requirements ramp up more quickly and to higher levels than the 10,000 MW standard in the latter years of the forecast. As a result, the energy bill savings from the additional renewable energy development are also greater on an annual basis under the 20 percent standard in these latter years. If the forecast period were extended beyond 2025, the annual impact on reducing consumer energy bills under the 20 percent standard would likely continue to exceed those savings achieved under the 10,000 MW target, leading to greater long-term cumulative savings.

Because the 10,000 MW target leads to considerably less renewable energy development than under the 20 percent standard, the jobs and economic development benefits are also lower. However, these benefits are still significantly greater than what would be achieved under business as usual. By 2025, increasing the Texas standard to 10,000 MW would create 19,950 new jobs—3.7 times more than fossil fuels for a net increase of 14,600 jobs (Figure 9). The Texas economy would also gain an additional $600 million in income and $60 million in gross state product under

**Figure 9. Renewable Energy vs. Fossil Fuel Jobs, 2025 (10,000 MW by 2025 RPS)**



the 10,000 MW target. If the state were able to attract additional renewable energy manufacturers to produce all of the equipment for facilities in the state, the 10,000 MW standard would create 550 more jobs and $50 million in additional income by 2025.

By 2025, the 10,000 MW standard would provide the following economic benefits, primarily to communities in rural regions of Texas where most of the renewable energy resources are located:

- $4.7 billion in new capital investment for renewable energy facilities, including $179 million ($523 million undiscounted) in investments for new transmission lines and upgrades to existing lines
- $628 million in new property tax revenues for local school districts
- $420 million in additional new property tax revenues for other local public services, depending on the level of tax abatements offered by a community
- $197 million in additional revenues to farmers, rural landowners, and other biomass energy producers
- $111 million in income to farmers, ranchers, and rural landowners from wind power land leases

The 10,000 MW RPS would also provide important benefits to the environment, though to a lesser degree than would occur under the more aggressive 20 percent renewable standard proposal. By 2025, the 10,000 MW standard would reduce power plant $CO_2$ emissions by about 5 MMT per year—a reduction of 1.7 percent below business-as-usual levels.

### Results from our Less Likely Scenario

Even with more pessimistic assumptions for renewable energy technology costs, increasing the current Texas standard would provide significant benefits for the state's economy and environment. Using EIA's assumptions, our results show that many of these benefits are in fact comparable to those described above for each of the two policy proposals (Table 2). There are, however, some key differences between the two sets of results, which we discuss in this section.

Using EIA's assumptions, the renewable energy requirements would still be met under both renewable energy standard proposals. Texas' strong wind resources would also continue to power the majority of this development. However, the higher cost assumptions for wind power result in the building of considerably more bioenergy facilities as part of the renewable energy mix. Since bioenergy facilities operate at a higher capacity factor compared to wind and solar technologies, and can be used as base load power plants, less total renewable energy capacity is needed to produce the same amount of renewable generation for both proposals than was modeled under the more likely scenarios. Solar resources continue to play an important role under the 20 percent standard (due to the solar technology set-aside requirement), while making a much smaller contribution to the renewable energy mix under the 10,000 MW standard.

The increased use of renewable energy would still stimulate competition with natural gas facilities under both of the less likely scenarios, resulting in lower gas and electricity prices, and significant savings for energy consumers. In fact, under our less likely scenario, cumulative energy bill savings through 2025 for the 20 percent standard would actually be greater ($6.5 billion vs. $5.6 billion) compared to its respective business as usual case than under our more likely scenario.

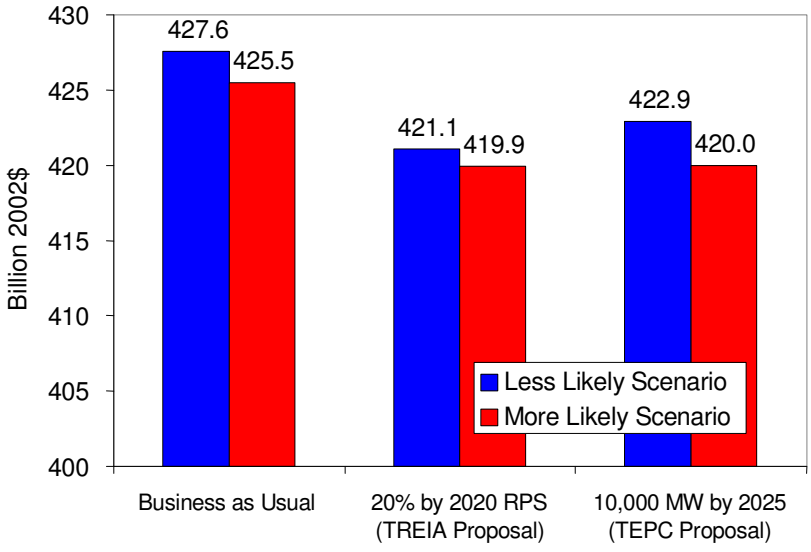
## Table 2. Comparison of Benefits, Texas RPS Proposals

| | 20 Percent by 2020 RPS (TREIA Proposal) | | 10,000 MW by 2025 RPS (TEPC Proposal) | |
|---|---|---|---|---|
| | More Likely Scenario | Less Likely Scenario | More Likely Scenario | Less Likely Scenario |
| New jobs created | 38,290 | 45,470 | 19,950 | 17,060 |
| New capital investment | $9.4 billion | $9.7 billion | $4.7 billion | $4.0 billion |
| Consumer energy bill savings | $5.6 billion | $6.5 billion | $5.5 billion | $4.7 billion |
| Biomass energy revenues | $542 million | $1.5 billion | $197 million | $433 million |
| School tax revenues | $1.1 billion | $1.2 billion | $628 million | $534 million |
| Wind power land lease royalties | $154 million | $133 million | $111 million | $98 million |
| Power plants annual $CO_2$ emission savings | 20 MMT | 27 MMT | 5 MMT | 9 MMT |

At first, this seems counterintuitive given that our more likely scenario assumes lower costs for renewable energy technologies. However, consumer savings are calculated by subtracting cumulative energy bills under the renewable standards from the business as usual case for the respective scenarios. With lower technology cost assumptions, more renewable energy is built in the business as usual case used in our more likely scenario compared with our less likely scenario. This leads to lower total consumer energy bills in the business as usual case for the more likely scenario (Figure 10). Thus, while consumer savings are higher under the less likely scenario, overall consumer energy bills are lower in the most likely scenario. Figure 10 illustrates that cumulative consumer energy bills are the lowest under the 20 percent by 2020 standard in our more likely scenario.

The number of jobs created under the 20 percent standard is also projected to be greater under the less likely scenario. The difference is primarily a result of the additional new bioenergy facilities that would be developed, and the slightly higher consumer energy bill savings experienced under the less likely scenario. Bioenergy facilities require more jobs to construct and operate than wind power facilities, and the additional consumer energy bill savings is re-invested into the economy—leading to more induced jobs.

**Figure 10. Cumulative Energy Bills* Comparison, 2005-2025**




*Excludes Transportation.

Net reductions in $CO_2$ emission from power plants would also be greater under the less likely scenarios. The increased use of bioenergy helps to directly displace more generation from natural gas facilities as well as from coal power plants, which are the greatest source of global warming emissions in the country. In addition, less renewable energy is developed under the business as usual case in the less likely scenario compared with the more likely scenario. As a result, the level of fossil fuel displacement and $CO_2$ reductions realized under the less likely scenario for both policy proposals is also higher. The 20 percent and 10,000 MW standards would reduce about 27 MMT and 9 MTT of power plant $CO_2$ emissions per year by 2025—a reduction of nearly 10 percent and 3.4 percent below business-as-usual levels respectively.

## Conclusions

In many ways, the current Texas RPS has been a great success. Since the RPS was passed in 1999, Texas has installed more new renewable energy capacity than any other state. This development has strengthened the renewable energy industry in Texas and elsewhere, creating new jobs and investments, and has provided important new revenues and other benefits to rural communities. It has also helped to improve the state's environment by reducing polluting air emissions and conserving valuable water resources. Yet, Texas' vast renewable energy resources remain largely untapped, and—despite the new competition from renewable energy—the electric power industry continues to increase its dependency on natural gas and other fossil fuels, leaving consumers vulnerable to volatile energy prices. In addition, over the past few years, Texas has lost ground to a number of other states that have adopted higher renewable energy standards.

As a result of these early achievements, and mindful of the energy challenges that face Texas in the future, at least two leading organizations are calling for an increase in the current renewable energy standard. The Texas Renewable Energy Industries Association is advocating for a 20 percent by 2020 standard, with one percent of the requirement set aside for solar energy technologies. The Texas Energy Planning Council is recommending a more modest increase of the requirement to 5,000 MW (500 MW of non-wind renewable energy capacity) by 2015, with a goal of 10,000 MW by 2025. Adopting either of these targets would help Texas maintain its national leadership in developing renewable energy.

Our analysis shows that by increasing and extending its current renewable energy requirements, Texas can build on its successes and generate significant economic and environmental benefits for the state. While both proposals would benefit Texas, the benefits under the 20 percent standard would be significantly greater. By diversifying Texas' electricity mix, increasing the RPS to 20 percent by 2020 would help stabilize electricity and natural gas prices, while saving consumers money on their natural gas bills. An increased RPS would create jobs and provide important economic development benefits for rural communities. It would provide environmental and public health benefits by reducing air pollution, $CO_2$ emissions, and harmful water and land impacts from extracting and burning fossil fuels, while conserving resources for future generations. Finally, it would provide insurance against rising energy prices and future regulations on carbon emissions.