

A Study Evaluating the Impacts of Increasing Wisconsin's Renewable Portfolio Standard

Final report prepared by the University of Wisconsin – Madison
for the
Wisconsin Department of Administration, Division of Energy
Renewable Energy Assistance Program Technical Assistance Grant Number 83041
University of Wisconsin – Madison Account 133-FJ56
Wisconsin Agricultural Experiment Station project number WIS04737

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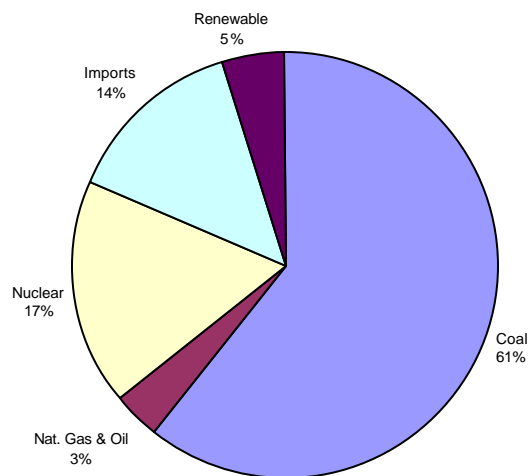
Key Findings

1. Wisconsin has adequate reserves of developable renewable sources of electric power to make increasing the present Renewable Portfolio Standard (RPS) a reasonable objective.
2. Wisconsin utilities already have sufficient generating capacity and banked renewable resource credits in place to ensure that they will meet the targets of the present Renewable Portfolio Standard.
3. The feasibility of adding the additional generating capacity from renewable sources needed to meet the requirements of the increased RPS levels modeled is reasonably certain. It also seems fairly certain that increased generation from wind turbines will be the most economical way to meet most of this requirement.
4. Out of state sources of renewable energy are allowable to meet the standard in its present form. These sources are also the most economical way to provide most of the generation needed to meet an increased Wisconsin standard.
5. The greatest uncertainties regarding future costs to consumers of an increased standard are future fuel prices, transmission constraints, and federal tax credit projections. These factors cause projected costs to the average residential consumer to vary widely, depending on the scenario chosen, from a net cost to a net saving, but within a rather small range (not greater than fifty cents per month one way or the other for the average consumer.)
6. There are advocacy positions both for and against increasing the standard. This study provides unbiased facts and projections and analyzes them by an open and unbiased model. However, the uncertainties regarding future costs reflected above imply that policy decisions will be based not only on facts, but on the will to lead Wisconsin's energy policy either toward or away from increased emphasis on renewable sources

Executive Summary

Wisconsin utilities sold about 66 billion kilowatt-hours of electrical power in 2001¹, and this is expected to increase by about 2% annually. To produce this power, 105 trillion BTU's of energy were used to produce electrical power generated outside of Wisconsin and imported, and 632 trillion BTU's were consumed to produce electricity generated within Wisconsin. Coal, almost all of which comes by rail from western states, was the dominant fuel for electricity generation in the state, providing 61% of the electricity used. About 22 million tons of coal was imported to Wisconsin for electrical power generation in 2001; 93% of this was low-sulfur western coal, 87% came from Wyoming. About five percent of the electric power was provided by renewable energy, when all hydroelectric power is considered.

Fig. 1. Wisconsin Electricity Supplied, by fuel type, 2001



Seventeen percent of use was from nuclear plants, and when combined with the 5% from renewable sources, Wisconsin electric power generation provided 22 percent of emissions-free electricity. Although nuclear power is emission free, there are significant regulatory and public opinion barriers to increasing capacity from nuclear plants, and addition of nuclear capacity was not considered in this study. Wisconsin's present generating capacity is 13,200 megawatts (MW), and this is essentially equal to demand. The 14% of our supply which is imported accommodates the need for reserve capacity, plant shut down and maintenance, peak demand, and geographic imbalances between supply and demand. Increasing supply to meet requirements in future years will require the construction of new generating capacity. Recently, the preferred fuel for new plants has been gas. Gas fueled plants are more efficient and economical to build than other generating options, but can be expensive to operate and are dependent on volatile fuel prices. Gas plants also are emitters of carbon dioxide, so they are not emissions free.

As mentioned, renewable sources of energy provide 5% of Wisconsin's electrical generating capacity, and are the only class of non-emitting sources that can reasonably be projected to expand. (It is understood that biomass-fired generation has emissions, but this is compensated by carbon dioxide absorbed from the atmosphere when the bio-fuel is grown.) Wisconsin has in place a Renewable Portfolio Standard², which mandates that a specified percentage (initially 0.5%, rising to 2.2% in 2012) of electricity sales must be from renewable sources. One way of ensuring that future capacity additions and generation will emphasize renewable sources would be to increase the mandated percentages in the Renewable Portfolio Standard

This study considered the economic impact to Wisconsin of four scenarios for future RPS standards. These are:

- No increase or the existing standard: 2.2% by 2012, including a maximum of 0.6% from pre-1998 hydro, and Xcel energy excluded from the calculations. (Xcel is exempt from the existing standard because it obtains more than 10% of its energy from renewable sources.)
- The existing standard doubled: 4.4% by 2012
- 10% by 2013 with all other rules the same with the exception that Xcel Energy is included in the calculations.
- 10% by 2013 with rules the same as above, except all hydro would be counted. (This is therefore somewhat less aggressive than the other 10% option)

Of these options, the third is the most aggressive. For this option and the fourth, we conducted a sensitivity analysis of the effect of two contingencies: The first was that there would be no transmission capacity to import renewable-sourced power, so all new renewable power would have to be sited in Wisconsin. The second was that the production tax credit (PTC) on construction of new wind and closed loop biomass renewable generation capacity would be extended for the effective life of the study (2020) and expanded to include other renewable energy sources, based on bi-partisan proposals in the national energy bills currently before Congress. The worst case, in terms of costs that would be passed on to the consumer, would be no imports and no extension of the PTC. Under this case, the cost of electrical power to the average Wisconsin household would rise about 51 cents per month. If imports were not constrained, this cost would drop to about 30 cents per month, and if the PTC were extended for the entire study period, consumers would be saving 16 cents per month by 2013.

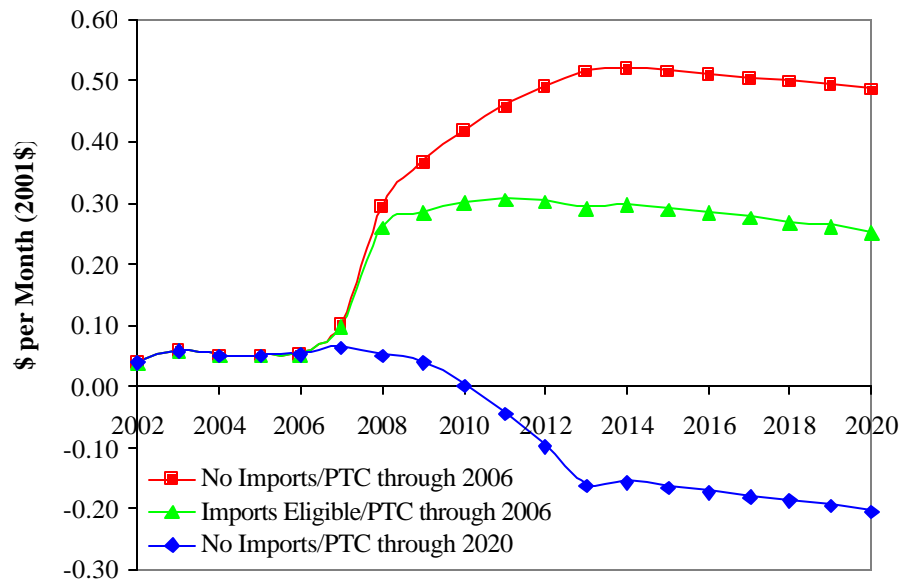


Figure 2. Change in Typical Household Electricity Bill, 10% by 2013 RPS with Xcel³

What benefits would be gained in exchange for this expense? Ten percent of generation in 2013 would represent 8.6 trillion kWh generated by renewable sources. To provide this, 2,200 MW of new renewable generating capacity would have been installed. Most (1,600 MW) of this will be in the form of wind turbines. All of these would be in Wisconsin under the (most severe) no imports scenario, but 1,300 MW would be outside of Wisconsin if imports were not constrained. Similarly, power from biomass would be partially sourced from outside of the state if not constrained by transmission limitations. Wherever generation was located, the carbon dioxide reduction would be over seven million tons per year. The generation in Wisconsin would represent investment and operations contributing to Wisconsin's economy rather than going to imported fuels. Additional sources of renewable electric power would reduce Wisconsin's exposure to fuel price volatility, and would increase the reliability of our electricity supply.

Policy makers considering increasing the Renewable Portfolio Standard must weigh the potential environmental, economic and reliability benefits against the potential costs. This study provides projections of those factors under a variety of scenarios to assist in weighing policy options. However, technology forecasting, fuel price forecasting, and prediction of federal policy, such as the future of the Production Tax Credit for renewables, are all risky. A revision to the RPS made with the best balance of costs and benefits will still need to be monitored to ensure that the underlying assumptions remain reasonable. Policy will have to be supportive of the infrastructure (particularly generation and transmission) needed to implement the standard. Finally, it would be prudent to monitor and advocate for federal energy policy that supports the mandated objectives of the Wisconsin RPS.

Introduction

The purpose of this study is to provide policy makers with a realistic forecast of the economically available supplies, costs, and carbon dioxide reductions that could result from various requirements to increase electricity generated from renewable energy sources.

Wisconsin is heavily reliant on coal, other fossil fuels, and nuclear power to produce 95 percent of the electricity generated in the state in 2001. Furthermore Wisconsin is also currently a net importer of electricity from other states. Wisconsin's reliance on fossil fuel and electricity imports results in a number of negative impacts to the economy and health of the state:

1. The spending of energy dollars out of state results in losses of income and the multiplier effects of subsequent spending, reducing potential community wealth and government tax revenues.
2. Over-reliance on imported energy limits Wisconsin's ability to manage the risk of supply interruptions
3. Potential fossil fuel price escalation and volatility presents financial risks to Wisconsin's economy.
4. Reliance on fossil fuels brings with it the potential to adversely affect both the physical beauty and the health of the environment.

New electric capacity will be required in the future, both to accommodate growth in demand, and to replace older generating plants. Traditionally coal and, increasingly, natural gas fired plants are the default choices for new capacity, but there is growing interest in examining the economic viability of clean domestic renewable energy from wind, solar, and biomass energy sources such as energy crops and agricultural wastes.

These in-state supply options could expand profits for local industry and agriculture, keep energy dollars in state for local economic development, enhance the state and local tax base and provide insurance against future fossil fuel price inflation and supply interruptions. They also hold promise for a cleaner and safer environment.

Renewable Portfolio Standards

Renewable Portfolio Standards (RPS) are legal requirements that a certain amount of an electric company's generation be derived from renewable resources. Typically, they are enacted as state law, but they can be enacted by any jurisdiction having authority over utility operations. For example, the city of Fort Collins, Colorado has enacted a standard. The fundamental requirement of most Renewable Portfolio Standards is that a certain percentage of a company's electricity sales be generated by renewable sources. The measurement used is typically megawatt-hours sold (MWH), as opposed to electric generating capacity, measured in megawatts (MW). Because energy generated is measured rather than capacity, renewable sources must not only be built, but must be used so that the energy they generate displaces energy from conventionally fueled plants.

The detailed structure of RPS legislation varies markedly from state to state. A summary is available on the DSIRE web site, from which this introduction was taken.⁴

As of April 24, 2003, some version of Renewable Portfolio Standard was in force in 16 States:

State	Renewable Target	Year target is reached
Arizona	1.1%	2007
California	20%	2017
Fort Collins, CO	15%	2017
Connecticut	13%	2009
Hawaii	9% ¹	2010
Illinois	15% ¹	2020
Iowa	105 MW ²	1991
Maine	30%	1999
Massachusetts	4% ³	2009
Minnesota	10%	2015
Nevada	15%	2013
New Jersey	6.5%	2012
New Mexico	10%	2011
Pennsylvania	2%	2001
Texas	2,000 MW ⁴	2009
Wisconsin	2.2%	2012

1. Goal, not requirement
2. Effective capacity
3. Increases 1% per year after 2009
4. Nameplate capacity

The standards shown in the table can not be compared directly, as there is neither uniform language nor content of the various standards. For example Maine's standard, which seems very aggressive, should be viewed in the context that Maine already derives 50% of its electric energy from renewable sources. Minnesota's standard only applies to one utility – Xcel Energy; the rest of the utilities in Minnesota only have to make a “good faith effort” according to the law.

Wisconsin's Renewable Portfolio Standard

Wisconsin's Renewable Portfolio Standard (RPS) was created by 1999 Wisconsin Act 9, and is incorporated in Wisconsin Statutes at 196.378.² Wisconsin utilities are currently in compliance with this standard, and should meet the projected requirements through 2009 with no additional renewable capacity. In fact, the Wisconsin RPS allows renewable generation in excess of the requirement in any given year to be “banked.” Because of banking in the early years, Wisconsin utilities had enough renewable generation in 2002 to meet their requirements for renewable power through 2011 without constructing any new renewable capacity.

The statute requires each electric provider to provide its retail customers a specified percentage of its total retail electric sales from renewable energy. Renewable energy is defined as that derived from: fuel cells using renewable fuel, tide or wave action, solar thermal electric or photovoltaic, wind, geothermal, biomass, or hydroelectric resources of less than 60 megawatts. The required percentage increases over time, beginning at 0.5% by December 31, 2001 and increasing to 2.2% by December 31, 2012. Retail sales are the defining element, and the renewable power does not need to have been generated in Wisconsin, nor does it need to have been generated in facilities owned by the provider.

Hydroelectric power from a facility that was in service before January 1, 1998, (“Excludable Renewable Energy”) may not be used to meet more than 0.6% of any particular supplier's requirement in determining compliance with Wisconsin's RPS. Generation within the 0.6% limit is referred to as “Eligible Excludable Renewable Energy”.

A provider supplying excess renewable energy in any particular year accumulates “Renewable Resource Credits” equivalent to the excess. These credits may be sold to other providers needing to overcome a shortfall, or they may be “banked” for an unlimited period of time and used for compliance in future years. Because the Credits are tradable at a price negotiated between buyer and seller, the value of a Renewable Resource Credit is a proxy for the cost premium of renewable energy over conventional energy. Since utilities are entitled to recover from their ratepayers the cost of providing renewable energy to meet the minimum requirements, the cost of a Renewable Resource Credit is also a proxy for the cost to utilities of providing their customers with sufficient renewable energy to comply with the Renewable Portfolio Standard.

Renewable Resource Credits are denominated in units of electrical power, e.g. MWH, rather than in dollars. The generally accepted expectation is that the cost premium of renewable over conventionally generated power will decrease over time. For this reason, the present value of a banked Renewable Resource Credit tends to trend below its acquisition cost over time, and the utility owning the credit will tend to use it as soon as possible. This characteristic of Renewable Resource Credits incentivizes utilities to delay bringing new renewable generating capacity on-line as long as possible.

Reexamination of Wisconsin's Renewable Portfolio Standard

Both former Governor McCallum and Governor Doyle have made clear their interest in continuing the encouragement of renewable energy which began with the establishment of Wisconsin's present Renewable Portfolio Standard. An obvious potential mechanism for achieving this goal is to increase the levels of renewable power supply mandated by the Renewable Portfolio Standard. Responsible consideration of this course of action demands that projections of the potential economic costs and environmental benefits of an increase in the standard be calculated and considered.

To produce these projections, a mathematical model of the interrelationship between costs and availability of alternative conventional and renewable power sources, the level of renewable energy mandated by an increased standard, and the effects of the increased standard on costs and CO₂ emissions was constructed. The model is complex because of the many variables being simultaneously managed, but the actual calculations are straightforward, and the outcome of any change in inputs is as would be expected. With there being no hidden protocols within the model, the major factor that influences the rationality of the results of the modeling study is the reasonableness of the inputs used. In order to obtain broad input and consensus for the inputs and assumptions, a Stakeholder group was formed to review and comment on the modeling process.

The Stakeholder Review Process

The model, assumptions, and scenarios that were developed for this analysis went through an extensive review process by a group of diverse "Stakeholders." These stakeholders included representatives from the Wisconsin Utilities Association and most of its member utilities, the Municipal Electric Utilities of Wisconsin, Wisconsin Public Power Inc., consumer and environmental public interest groups, Wisconsin industry groups, the Public Service Commission, the Department of Administration, the modeling team, and the University of Wisconsin. The model assumptions were circulated to the stakeholders, discussed at Stakeholder meetings, and revised in many cases based on stakeholder input. After three iterations of this process, the assumptions were finalized.

Similarly, all of the Stakeholders were shown the model's function and sensitivity to assumption changes, and comments on the model were received. Those stakeholders who chose to execute a confidentiality agreement with the model's owners were given working copies of the model to explore. Stakeholder comments on the functionality of the model were considered and modifications made where appropriate before the final runs were performed.

The results presented in this report are not consensus results in the sense that we have not obtained unanimity of stakeholder approval on the assumptions or on the RPS scenarios tested. We have, on the other hand considered and responded to all stakeholder comments and, in that sense, the comments and suggestions of the stakeholder group have influenced our results. With the flexibility of the model, there is virtually no limit on the number of scenarios to be tested, nor on the number of input parameters that can be tested. For the purposes of this study, we selected the most likely input assumptions combined with the present Wisconsin RPS standard as the "Base case", and then tested other possible future RPS scenarios holding all other assumptions constant. This approach gives a relatively simplistic view of the effects of potential revisions to the RPS standard; policy makers should understand that different assumptions might lead to different outcomes. For example, assumptions about future costs of fossil fuels, Federal tax credits, and availability of transmission capacity to deliver renewable energy all affect the cost determined by the model for increasing the required renewable component of Wisconsin's energy supply.

The Study

The Methodology, Assumptions, Scenarios, and Results are presented in a companion paper³. The results are, in turn, the product of a modeling program used for evaluation of RPS proposals in a number of states. This program is described in more detail in the Study. A copy of the model was provided to the Division of Energy, so that details leading to the results in the Study can be verified. Several reasonable scenarios were modeled, but additional scenarios could be added with the assistance of the modeling team.

Conclusions

1. Wisconsin has adequate reserves of developable renewable sources of electric power to make an increase in the present Renewable Portfolio Standard a reasonable objective. For example, the potentially developable onshore wind in Wisconsin is estimated to be 6,300 MW. Under the most aggressive scenario we modeled, 1,600 MW of wind capacity would need to be brought on line in Wisconsin.
2. Wisconsin utilities already have sufficient generating capacity and banked renewable resource credits in place to ensure that they will meet the targets of the present Renewable Portfolio Standard.
3. The projected additional generating capacity from renewable sources needed to meet the requirements of the increased RPS levels modeled is reasonably certain, and it seems fairly certain that increased generation from wind turbines will be the most economical way to meet most of this requirement. The U.S. Department of Energy projects the 20 year levelized costs of onshore wind projects to be 3-4.5 cents per kilowatt-hour (kWh) by 2010, and 2.5 to 4 cents per kWh by 2020.⁵
4. Out of state sources of renewable energy are allowable to meet the standard in its present form, and these sources are the most economical way to meet a majority of an increased Wisconsin demand. For example, under our most aggressive scenario, the model projects 1,300 MW of imported wind capacity of a total capacity of 1,681 MW.
5. The study also found that Wisconsin could meet a higher standard with in-state renewable resources at a relatively modest additional cost to consumers
6. The greatest uncertainties regarding future costs to consumers of an increased standard are future fossil fuel prices, transmission constraints, and federal tax credit productions. These factors cause projected costs to the average residential consumer to swing widely, from a net cost to a net saving, but within rather constrained limits (not greater than fifty cents per month one way or the other for the average consumer.)

Acknowledgements: Paul Helgeson, Wisconsin Public Service Commission, and Don Wichert, Wisconsin Department of Administration, Division of Energy, were of invaluable assistance in facilitating discussion and in seeking stakeholder inputs as well as serving as knowledge and background resources.

Endnotes

¹ Wisconsin Energy Statistics 2002. Wisconsin Department of Administration, Division of Energy. 2002

² Wisconsin Statutes 196.378, accessed at <http://folio.legis.state.wi.us>, April 30, 2003

³ A study to Evaluate the Impacts of Increasing Wisconsin's Renewable Portfolio Standard. Steve Clemmer, Bob Grace, and Karlynn Cory. July 8, 2003

⁴ Database of State Incentives for Renewable Energy. <http://www.dsireusa.org>. Accessed May 1, 2003

⁵ DOE Office of Power Technologies, Government Performance Review Act (GPR) Act (GPR), 2003 and FY03 U.S. DOE Wind Program Internal Planning Documents, Summer 2001