

Report on the  
Rate and Revenue Impacts  
of the  
Wisconsin Renewable Portfolio Standard  
Docket 5-GF-220

Public Service Commission of Wisconsin

June 15, 2012

## **Introduction**

Wisconsin Stat. § 196.378 (4r) requires the Public Service Commission (Commission) to biannually submit a report which evaluates the impact of the Renewable Portfolio Standard (RPS), Wis. Stat. § 196.378, on the rates and revenue requirements of electric providers and compare that impact with the impact that would have occurred if renewable energy practices of electric providers were subject to market forces in the absence of the requirements of Wis. Stat. § 196.378. This memorandum is designed to fulfill the reporting obligation to the governor and legislature and includes information regarding the impact of the RPS for calendar years 2008 through 2010. Complete information regarding calendar year 2011 will not become available until late in 2012, too late to include in this report.

Commission staff selected a Microsoft Excel spreadsheet methodology to calculate the costs of renewable generation used to satisfy the RPS, and determine rate and revenue impact estimates. Separate line items for the major projects placed into utility service and Purchase Power Agreements (PPA) from Independent Power Producers (IPP) are provided. Several caveats and assumptions were needed in compiling this report.

Many factors influence an electric provider's decision to invest in constructing or purchasing electricity from a given resource. The analysis in this report assumes that Wisconsin electric providers would not have invested in any renewable energy beyond what they already had procured as of the time the RPS was enacted. Because electric providers were investing in renewable energy before the RPS existed, it seems highly likely that some level of additional investment in renewable energy would have occurred even without the RPS, making the assumptions used in this report conservative. Wisconsin electric providers might have invested in renewable energy even without the Wisconsin RPS for various reasons, including:

- To establish a diverse mix of energy sources;
- To learn about different renewable energy technologies;
- To hedge against the impact of future environmental or climate legislation that could restrict the use of conventional resources;
- To address customer desire for electricity from renewable resources;
- To reduce vulnerability to potentially large changes in fuel prices associated with conventional resources.

Because of the difficulty in determining what Wisconsin electric providers would have done if the RPS had not been enacted, it is reasonable for purposes of evaluating this two-year period to assume no new facilities would have been installed beyond what was in place at the time the RPS was passed.

Additionally, this report does not attempt to quantify any secondary costs or benefits that have occurred as a result of investments made to satisfy the RPS. Benefits not addressed include those related to jobs, manufacturing, supply chain, the environment, health, the electric system, and payments to local landowners and local governments. Costs not addressed include those related to the electric system (including transmission upgrades) and the effects of higher electricity prices.

## **Executive Summary**

In order to meet RPS requirements, electric providers have undertaken several utility-owned projects, most significantly wind projects. When evaluating a proposal by an electric provider for a new facility, the Commission evaluates the proposals under Wis. Stat. § 196.49, the Certificate of Authority statute; Wis. Stat. § 196.491, the Certificate of Public Convenience and Necessity statute; Wis. Stat. §§ 1.12 and 196.025 regarding energy priorities; and Wis. Admin. Code ch. PSC 4, the Wisconsin Environmental Policy Act. As of the date of this report, the Commission has approved capital costs amounting to approximately \$1.7 billion since 2007 for

new utility-owned renewable facilities.<sup>1</sup> Approximately \$500 million of this accounts for facilities that went into service after 2010<sup>2</sup>, or have not yet been constructed,<sup>3</sup> and are therefore not included in this analysis of the 2008 to 2010 period. Only costs associated with those utility-owned facilities that went into service from 2006 up through the end of 2010 are included in the analysis in this report.<sup>4</sup> Because the costs associated with utility-owned facilities are recovered over time and not all at once, these capital costs are levelized for purposes of this analysis.<sup>5</sup> In addition, electric providers have entered into PPAs with IPPs, and some electric providers have purchased additional Renewable Resource Credits (RRC) from other Wisconsin electric providers. All of the new renewable construction and purchases included in the economic analysis in this report relate to wind energy generation facilities. This report uses two perspectives to look at new renewable electricity since the RPS was enacted—one perspective based on the amount of electricity generated from new renewable facilities, and the other perspective based on the amount of electricity from renewable resources sold at retail to Wisconsin customers beyond that which was sold to customers before the RPS was enacted.

The first perspective looks at new utility-owned renewable facilities and facilities that are newly selling power to Wisconsin electric providers since the current RPS obligations were

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<sup>1</sup> This *does not* include facilities that are not utility-owned. This number *does* include Bent Tree, which was only partially in service in 2010 and which did not affect rates in 2010. The Commission is currently reviewing an application for a Certificate of Public Convenience and Necessity (CPCN) to construct the Highland Wind Farm. This application has not been approved, and the project is not proposed to be owned by a Wisconsin electric provider, nor does it have a contract to sell power to a Wisconsin electric provider as of the time this report was drafted. No other CPCN applications for construction of renewable facilities are currently pending. Wisconsin Electric Power Company has submitted a proposal as part of its currently pending rate case to construct 5 MW of utility-owned solar electric generation. None of these costs are included here; no Wisconsin electric provider has received any kind of approval for these costs from the Commission as of the date of this report.

<sup>2</sup> Glacier Hills Wind Park, in service in 2011.

<sup>3</sup> Rothschild biomass plant, anticipated to be in service in 2013.

<sup>4</sup> Includes Blue Sky Green Field, Top of Iowa III, Cedar Ridge, Crane Creek, and Bent Tree. See Table 2 for detailed list of facilities.

<sup>5</sup> See pages 9-10 for an explanation of levelized cost. Production and costs from Bent Tree during 2010 are included in this analysis even though costs associated with Bent Tree were not included in rates in 2010.

enacted in 2006.<sup>6</sup> Commission staff determined the levelized costs of energy for these facilities in dollars per megawatt-hour (MWh), and then considered those costs incurred for each MWh of energy these facilities generated during the years 2008, 2009, and 2010. These costs in turn were compared to the marginal cost of energy in the Midwest regional energy market for the years 2008, 2009, and 2010, to determine what cost, if any, the new renewable facilities were above the market price of electricity for these years. The second perspective uses the same market prices to compare against the average cost of renewable energy applied to retail sales of electricity from renewable resources that Wisconsin electric providers reported selling to Wisconsin customers. The amount of new renewable energy sold at retail is determined by comparing sales from renewable resources as reported in RPS compliance reports for the years 2008, 2009, and 2010, and subtracting out the amount of renewable energy sold at retail during 2006. The same levelized costs of energy estimated in the generation perspective were applied to these incremental sales levels.

Using the first approach, generation from these new renewable facilities has had a three year total revenue impact of \$209,693,463, which represents 1.09 percent of the revenue requirements of Wisconsin utilities for that three year period; this can also be viewed as a statewide average rate impact for that three year period of 1.09 percent.<sup>7</sup>

Using the second approach, renewable energy sold at retail above and beyond that which was already being sold at retail during 2006 has a three-year total revenue impact of \$190,882,754, which represents 1.00 percent of the revenue requirements of Wisconsin utilities, or a 1.00 percent statewide average rate impact. Table 1 presents these perspectives.

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<sup>6</sup> The statutory requirement to evaluate the impacts of Wis. Stat. § 196.378, herein referred to as the RPS or RPS requirements, was created at the time the electric provider's current RPS obligations were enacted in 2005 Wisconsin Act 141 and took effect April 1, 2006.

<sup>7</sup> Includes costs associated with those new facilities or new PPAs producing electricity in 2008, 2009, and 2010; utility-owned facilities included are Blue Sky Green Field, Top of Iowa III, Cedar Ridge, Crane Creek, Bent Tree (only partially in service in 2010); PPAs included are from Top of Iowa II, Forward Energy, Endeavor II, Barton I, Barton II, Crystal Lake, Butler Ridge, Winnebago, St. Leon. See Tables 2 and 3 for additional information.

**Table 1 Revenue and Rate Impacts**

<b>Analysis Perspective</b>	<b>Revenue Requirement (\$)</b>	<b>Percent Impact (%)</b>
New Renewable Generation	\$209.7 Million	1.09%
New Renewable Sales	\$190.9 Million	1.00%

Note that both of these approaches treat the value of a renewable MWh the same as a MWh of electricity from other sources, which does not account for any additional value that could have been realized for the associated renewable energy credits. For example, in a no RPS scenario, Wisconsin electric providers could have procured electricity from renewable facilities and sold the associated credits to voluntary renewable energy purchasers, or to electric providers in other states that must meet another state’s RPS. No monetary value is estimated or included in this analysis to account for potential revenue from renewable energy credit sales.

**Reporting Requirement under Wis. Stat. § 196.378 (4r)**

The reporting requirements in Wis. Stat. § 196.378 (4r) are as follows:

No later than July 1 of each even-numbered year, the commission shall submit a report to the governor and chief clerk of each house of the legislature for distribution to the legislature under s. 13.172(2) that evaluates the impact of the requirements of this section on the rates and revenue requirements of electric providers and compares that impact with the impact that would have occurred if renewable energy practices of electric providers were subject to market forces in the absence of the requirements of this section.

A report was last issued in 2006. Wisconsin’s RPS law sets a goal for retail electric providers to produce 6 percent of the state’s electricity from renewable resources by the year 2010, and 10 percent by 2015. Each electric provider has an individual baseline requirement, and all electric providers are required to increase the renewable percentage above their baseline by 2 percent in 2010, and by another 4 percent in 2015. Each year by April 15, Wisconsin utilities and

cooperatives are required to report to the Commission their progress in meeting their renewable milestones the previous year. The electric providers' 2010 RPS compliance filings indicate:<sup>8</sup>

- All 118 Wisconsin electric providers met their RPS requirement for 2010;
- In 2010, 7.37 percent of the electricity sold by the state's utilities and cooperatives was generated from renewable resources eligible for the RPS, up from 6.29 percent in 2009, and 4.90 percent in 2008; and
- Wisconsin electric providers collectively have already achieved approximately three-quarters of the level of renewable energy that the state will need to reach its 10 percent goal in 2015, however, not all utilities are equally far along towards meeting their future requirements.

### **Short-term versus Long-term Analysis**

In accordance with Wis. Stat. § 196.378 (4r), this report is designed to take a short-term look at RPS impacts over the past few years. However, the renewable energy projects addressed in this report will generate electricity for many more years into the future. For this reason, the Commission prospectively evaluates proposed projects for cost-effectiveness over the course of their projected useful life, not just their first few years, using a much broader, longer-term analysis. The Commission uses Electric Generation Expansion Analysis System (EGEAS) analysis to estimate the cost impacts for major construction projects over a longer time period—typically 30 years. As part of the Commission's analysis, it is necessary to project future market conditions in order to evaluate the cost impacts over the life of a proposed project. The majority of utility-owned renewable energy projects that are included in this report were approved by the Commission in 2007 and 2008. At the time these renewable projects were approved, the cost of the projects above market prices over the life of the proposed projects was projected to be less than what this report indicates, for several reasons, including:

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<sup>8</sup> See docket 5-GF-206. Information about CY 2011 RPS compliance was due to be filed with the Commission by April 15, 2012, and is available in docket 5-GF-214; however, it has not yet been evaluated by the Commission as of the date of this report.

- Energy growth has not met projections made at the time individual renewable construction projects or PPAs were put under contract, and energy growth actually has reduced in recent years. Conservation efforts by utilities and individuals also contributed to lower demand than originally forecast.
- As a result of lower demand, the need for new generation to meet load is almost nonexistent. RPS requirements, however, require an investment in renewable energy sources.
- As a result of lower demand, market prices or the marginal cost of energy is lower than projected at the time renewable projects were installed.
- Greenhouse gas regulation, which in recent years appeared likely to occur at the federal level, did not occur during the years analyzed for this report.

Both the analysis done at the time a project is proposed and the analysis in this report consist of comparing the levelized costs of renewable energy projects to market prices for electricity. Many factors influence the market price of electricity, including fuel prices, operation and maintenance costs, outages, construction costs, weather conditions, and regulations such as limits on pollution emissions, and a discussion of those factors is beyond the scope of this report.

## Analysis – Generation Perspective

### *Utility-Owned Renewable Resources*

A summary of utility-owned generation approved by the Commission from 2007 through 2011 is provided in Table 2.

**Table 2**            **New Utility-Owned Renewables**

Utility <sup>9</sup> (Project)	Location	Docket	Year Approved	Year Installed	Capacity	Type
WEPCO (Blue Sky Green Field)	Calumet County, WI	6630-CE-294	2007	2008	145 MW	Wind
MGE (Top of Iowa III)	Worth County, IA	3270-CE-126	2007	2008	30 MW	Wind
WP&L (Cedar Ridge)	Fond du Lac County, WI	6680-CE-171	2007	2008	68 MW	Wind
WPSC (Crane Creek)	Howard County, IA	6690-CE-194	2008	2009	99 MW	Wind
WP&L (Bent Tree) <sup>10</sup>	Freeborn County, MN	6680-CE-173	2009	2010/11	201 MW	Wind
WEPCO (Glacier Hills) <sup>11</sup>	Columbia County, WI	6630-CE-302	2010	2011	207 MW	Wind
WEPCO (Rothschild) <sup>12</sup>	Marathon County, WI	6630-CE-305	2011	2013	50 MW	Biomass

<sup>9</sup> Acronyms as follows: Wisconsin Electric Power Company (WEPCO), Madison Gas and Electric Company (MGE), Wisconsin Power and Light Company (WP&L), and Wisconsin Public Service Corporation (WPSC).

<sup>10</sup> Bent Tree is included in the analysis; however, the costs associated with Bent Tree from generation during 2010 did not impact rates and revenue requirements in 2010.

<sup>11</sup> Glacier Hills listed for informational purposes only; costs not included in analysis. Glacier Hills did not impact rates and revenue requirements through 2010.



***PPAs and/or RRCs Purchased by Utilities***

Electric providers have entered into a variety of renewable energy PPAs since the current RPS requirement was adopted by the legislature, and the most significant are listed in Table 3.

**Table 3 New Utility-Purchased Renewables**

<b>Project (Utility)</b>	<b>Location</b>	<b>Year<sup>13</sup></b>	<b>Capacity</b>	<b>Type</b>
Top Of Iowa II (WPPI)	Worth County, IA	2007	50 MW	Wind
Forward Energy LLC (WPSC, WP&L, MGE, WPPI) <sup>14</sup>	Dodge/Fond du Lac Co, WI	2008	129 MW	Wind
Top of Iowa II (MGE)	Worth County, IA	2008	30 MW	Wind
Endeavor II (MGE)	Dickinson County, IA	2008	50 MW	Wind
Winnebago (DPC) <sup>15</sup>	Forest City, IA	2008	20 MW	Wind
St. Leon (WPS)	Manitoba, Canada	2009 <sup>16</sup>	35 MW <sup>17</sup>	Wind
Barton I (WPPI)	Worth County, IA	2009	30 MW	Wind
Barton II (WEPCO)	Worth County, IA	2009	50 MW	Wind
Crystal Lake (WP&L)	Hancock, IA	2009	200 MW	Wind
Butler Ridge (WPPI)	Dodge County, WI	2009	54 MW	Wind

***Renewable Projects Not Included in the Generation Perspective Analysis***

Methane digesters at municipal solid waste facilities, anaerobic digesters at large dairy farms, and small installations of wind and solar have also come online since the RPS was adopted by the legislature. While production from some of these small scale projects is used for RPS compliance, most if not all of these projects sell electricity to their electric provider pursuant to a tariff that is voluntarily offered by the electric provider. It is not possible to conclude that electric providers would not have offered these voluntary tariffs if the RPS had not been enacted, and in fact, many of these tariffs are used by electric providers to supply voluntary green pricing program subscriptions rather than mandatory RPS obligations. Any rate or revenue requirement impact of

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<sup>12</sup> Rothschild listed for informational purposes only; costs not included in analysis. Rothschild did not impact rates and revenue requirements through 2010.

<sup>13</sup> Year installed unless otherwise noted.

<sup>14</sup> Invenergy, LLC received siting approval for Forward from the Commission in docket 9300-CE-100.

<sup>15</sup> DPC = Dairyland Power Cooperative.

<sup>16</sup> Installed in 2005-2006; PPA with WPS began in 2009.

<sup>17</sup> Total installed capacity of the St. Leon facility is 103.9 MW; WPSC is purchasing approximately one third of the output.

these small projects is not directly attributable to the RPS requirement and was therefore not included in that portion of the analysis that analyzes costs from the generation perspective. All renewable electricity sold at retail from 2008 through 2010 above the levels sold during 2006 is accounted for in that portion of the analysis from the retail sales perspective, therefore, that perspective should capture all of these smaller facilities that generated energy for the RPS.

Additionally, some electric providers are subject to RPS requirements in other states which have a greater influence on the electric providers' need for renewable energy than the Wisconsin RPS. Where electric providers are subject to requirements in other states that result in the electric provider acquiring more renewable energy than the Wisconsin RPS requires, such other states' requirements were considered "market forces" outside of the Wisconsin RPS, and therefore any new renewable energy procured by those electric providers was not included in that portion of the analysis that analyzes costs from the generation perspective. Specifically, renewable generation from Northern States Power Company-Wisconsin (NSPW) was excluded from the analysis. The interchange agreement between NSPW and Northern States Power Company-Minnesota requires NSPW to be allocated a higher percentage of renewables than Wisconsin law requires; therefore, the Wisconsin RPS is not the driving factor for renewable energy acquired by NSPW. Again, because all renewable electricity sold at retail from 2008 through 2010, above the levels sold during 2006, is accounted for in the retail sales perspective, that perspective should capture all portions of renewable facilities used for Wisconsin's RPS, including those for which other states' requirements are the driver.

### ***Levelized Cost of Electricity***

The levelized cost of electricity (LCOE or levelized cost) represents the present value of the total cost of building and operating a generating resource over an assumed financial life and

duty cycle, converted to equal annual payments and expressed in terms of real dollars to remove the impact of inflation. Levelized cost reflects overnight capital cost,<sup>18</sup> fuel cost, fixed and variable operation and maintenance costs, financing costs, and assumed utilization rate for each plant type and state or federal tax credits. Levelized cost is often cited as a convenient summary measure of the overall competitiveness of different generating technologies and can be expressed in dollars per MWh (\$/MWh). Commission staff calculated the estimated LCOE for each of the major renewable projects. Commission staff then utilized actual or estimated MWh of generation for each project for the years 2008, 2009 and 2010 to calculate costs based on the MWhs produced for those years.

Because actual generation varies by facility and by year, the costs vary from facility to facility and from year to year. For projects under a PPA, the costs reflect the terms negotiated between an IPP and the electric provider. Capital costs greatly affect the impacts of wind levelized costs for utility-owned projects. Capital costs for utility-owned projects were gathered through Commission dockets; PPA costs were obtained from utility annual reports where available. The table below presents the weighted average wholesale LCOE estimated for these new wind facilities by year.

**Table 4**                      **Average LCOE for New Renewable (Wind) Facilities**

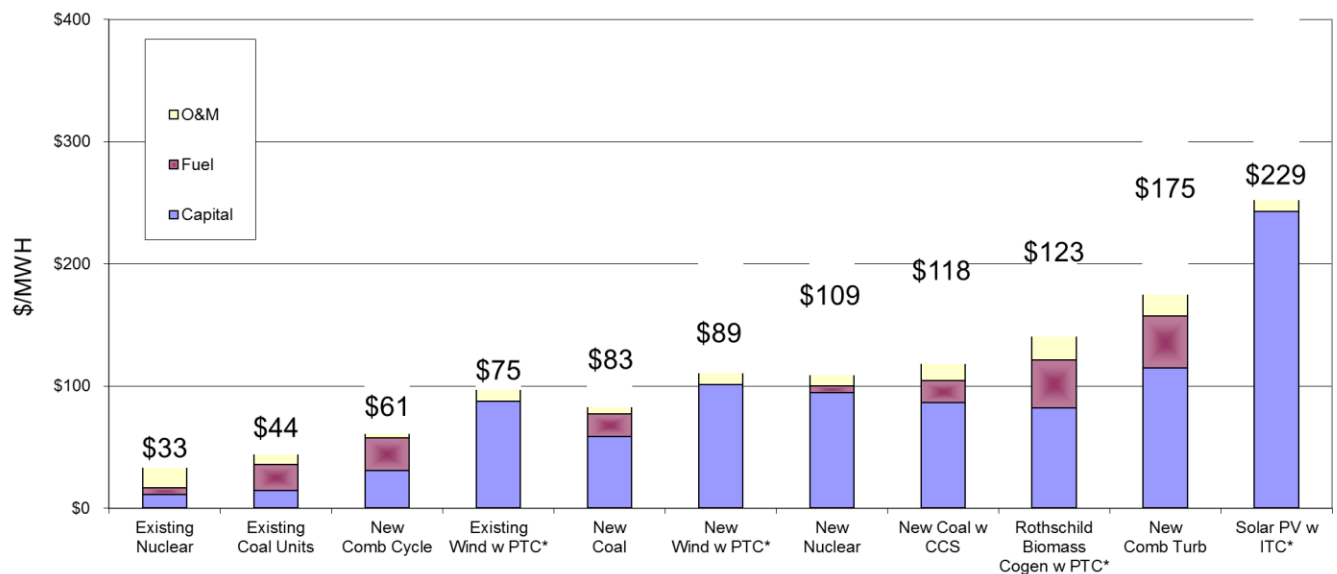
<b>Year</b>	<b>Average LCOE for Renewable Facilities (\$/MWh)</b>
2008	\$77.28
2009	\$74.37
2010	\$74.82

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<sup>18</sup> “Overnight capital cost” refers to the cost of constructing a plant assuming the entire process from planning through completion could be accomplished in a single day (“overnight”). Overnight capital cost does not take into account the impact of any financing considerations; it typically does include costs associated with development and transmission connections.

For comparison, information on the estimated LCOE for various other generation options is included in Figure A below. While wind facilities do not have a fuel cost, fuel is a material component of the LCOE of many other resources. Just as with wind facilities, capital costs play a large role in estimating LCOE at any given time. Because most existing units have little book value, the capital cost portion of the LCOE below for existing units is relatively low. Actual levelized costs from existing units will vary. Major cost components of the LCOEs below are broken out by category. These figures are based on large, utility scale projects and are not intended to represent small scale customer installations.

**Figure A Levelized Cost of Various Generation Options<sup>19</sup>**



\* Includes value of Production Tax Credit (wind, biomass) or Investment Tax Credit (solar)

<sup>19</sup> Figure created for this report by Commission staff for informational purposes. Impacts of any particular unit on other units and on the utility's entire system would be evaluated in a utility's Integrated Resource Plan. New unit capital cost is based on Commission staff's estimate of new construction costs in 2011 dollars. Fuel cost assumptions include: \$2/MMBtu for coal, \$3/MMBtu for wood, \$4/MMBtu for natural gas. Capacity factors estimated as follows: Existing Nuclear – 85.4%, Existing Coal – 71.3%, New Combined-Cycle – 80%, New Coal – 85%, New Wind – 35%, New Nuclear – 90%, Rothschild Biomass – 70.7%, New Combustion Turbine – 10%, Solar PV – 18%; no capacity factor was assumed for Existing Wind because actual generation information was used to estimate the LCOE, see Table 4. New Wind LCOE is estimated at \$111/MWh, however a federal tax credit of \$22/MWh reduces the value to that shown at \$89/MWh; a different tax credit affects the depicted Rothschild and Solar PV costs.

**Analysis – Sales Perspective**

The analysis from the generation perspective described above calculated the total amount of renewable electricity generation that electric providers purchased from new non-utility renewable facilities and that which was generated by new utility-owned renewable facilities, listed in Tables 2 and 3. However, the generation from these facilities over the three-year period does not equal the total retail sales of electricity from renewable facilities, above 2006 levels, as reported in electric provider RPS compliance reports over this same period.

Table 5 shows the percentages of sales of electricity from renewables sold to Wisconsin retail customers from 2006 to 2010. The percent from renewables has increased each year over this time period. These sales include electricity produced by facilities within and outside of Wisconsin.

**Table 5                    Percent of Sales to Wisconsin Retail Customers from Renewable Sources<sup>20</sup>**

Year	Sales from Renewables as % of Sales from All Resources
2006	3.78
2007	3.84
2008	4.90
2009	6.06
2010	7.37

Table 6 shows the percentages of generation produced from renewables located within Wisconsin from 2006 to 2010. The percent from renewables located in Wisconsin has increased each year over this time period.

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<sup>20</sup> Data from RPS Compliance Reports. This does not include sales from voluntary utility green pricing programs for the years 2009 and 2010; information on sales through voluntary green pricing programs was not separately provided in RPS compliance filings for prior years.

**Table 6** Percent of Generation from Renewables Located in Wisconsin<sup>21</sup>

Year	Generation from Wisconsin Renewables as % of Generation from All Wisconsin Resources
2006	3.49
2007	3.56
2008	4.60
2009	5.57
2010	6.45

These sales levels include all independently-owned utilities, municipal electric utilities, and electric cooperatives in Wisconsin, and incorporate all renewable generation, not just large projects. Electric providers have in fact reported selling less incremental RPS renewable energy at retail to Wisconsin customers than was produced by the new large renewable facilities added after the RPS was enacted.<sup>22</sup>

Generation from these new facilities exceeded electric providers' reported total retail sales of electricity from renewable resources above 2006 levels for every year analyzed. Generation from the new facilities listed in Tables 2 and 3 exceeded what all Wisconsin electric providers reported as retail sales from renewable resources above their 2006 levels by almost 88,000 MWh in 2008, 297,000 MWh in 2009, and 55,000 MWh in 2010. Commission staff believes that electric providers may be selling some portion of the output of these new renewable facilities to other participants in the Midwest regional energy market, and that this may account for the discrepancy. Note, whether one uses the amount of energy *generated* by new renewable facilities or the amount of renewable energy *sold* at retail as reported by electric providers, there is not a significant difference in the rate and revenue impacts of the analysis. However, information about the rate and

<sup>21</sup> Data from PSC Production Database. Does not include generation from facilities that do not qualify for the RPS.

<sup>22</sup> "No RPS" scenario assumes that the amount of retail sales of electricity from renewable resources that occurred in 2006 is held constant for all future years. This scenario was compared to the actual retail sales of electricity from renewable resources as reported by electric providers annually in RPS compliance dockets. See PSC dockets 5-GF-163 (CY 2006), 5-GF-173 (CY 2007), 5-GF-184 (CY 2008), 5-GF-194 (CY 2009) and 5-GF-206 (CY 2010).

revenue impacts using the amount of renewable energy sold at retail is provided here, since Commission staff cannot confirm that all of the energy generated by these new facilities included in the analysis was actually used for the Wisconsin RPS.

**Results**

Using the amount of renewable energy generated by the new (post-2006) facilities included in this analysis, the amount of renewable energy and associated production costs are as follows:

**Table 7 New Renewables (Wind) and Cost – Generation Perspective**

Year	Total New Renewable Generation (MWh)	Total Production Cost (\$)
2008	781,620	\$60,401,792
2009	1,691,239	\$125,772,201
2010	2,488,695	\$186,214,450
<b>Total</b>	<b>4,961,554 MWh</b>	<b>\$372,388,443</b>

Applying the average production cost of new renewable projects included in this analysis to the amount of renewable energy that was reported as sold at retail to Wisconsin customers provides an additional perspective. Using this approach, the amount of electricity from renewable energy, sold above 2006 retail sales levels, and associated production costs are as listed in Table 8.

**Table 8 New Renewables (Wind) and Cost – Sales Perspective**

Year	Total New Renewable Sales (MWh)	Total Production Cost (\$)
2008	693,666	\$53,604,935
2009	1,393,954	\$103,664,055
2010	2,433,933	\$182,116,948
<b>Total</b>	<b>4,521,554 MWh</b>	<b>\$339,385,938</b>

**Market Forces**

Market forces were determined by tabulating Midwest Independent Transmission System Operator, Inc. Day Ahead Locational Marginal Pricing (LMP) for both on- and off-peak times of day for each year. Lower market prices during and after 2009 compared to prices in 2008 significantly impact the value of renewable energy relative to the market. The weighted average

LMP prices for Wisconsin utilities used in this analysis are reflected in Table 9. The difference between average LCOE from wind facilities and average LMPs are listed in Table 10.

**Table 9 Weighted Average LMPs**

Year	On-Peak (\$/MWh)	Off-Peak (\$/MWh)
2008	\$68.64	\$33.23
2009	\$35.28	\$20.12
2010	\$39.60	\$23.77

**Table 10 Average LCOE for New Renewables Minus Weighted Average LMPs**

Year	On-Peak (\$/MWh)	Off-Peak (\$/MWh)
2008	\$8.64	\$44.05
2009	\$39.09	\$54.25
2010	\$35.22	\$51.05

This analysis uses the assumption that if Wisconsin electric providers did not procure generation from the renewable facilities listed above to meet the RPS, they would have bought this same amount of generation at LMP market prices.<sup>23</sup>

**Net Cost – Generation Perspective**

In 2008, the market cost of buying 781,620 MWh of electricity is estimated at \$39 million.<sup>24</sup> Procuring this same amount of electricity from the new renewable resources described in this report is estimated to have resulted in a net cost of \$21.4 million. In 2009, the market cost of purchasing 1.69 million MWh of electricity is estimated at \$46.1 million. Using new renewable resource generation instead of market purchases is estimated to have amounted to a net cost of \$79.7 million for 2009. For 2010, the market cost associated with 2.49 million MWh of electricity is estimated at \$77.7 million. The net cost of procuring new renewable

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<sup>23</sup> For another example of this type of analysis, see electric provider filings in Minnesota Public Utilities Commission docket 11-852. Available at <<http://www.puc.state.mn.us>>. It should be noted that Wisconsin utilities use a combination of market purchases and utility-owned generation to meet their needs. The LMP analysis does not account for the capital costs associated with utility-owned projects.

<sup>24</sup> Amount of electricity is rounded to two decimal places. Cost is rounded to one decimal place.



energy in place of such market purchases is estimated to have been \$108.6 million for 2010. The total net cost for renewable generation acquired by electric providers to comply with the requirements of the RPS during 2008, 2009 and 2010 is \$209.7 million dollars.<sup>25</sup> These net costs are presented in Table 11 below.

**Table 11 RPS Renewable Generation and Costs Above Market**

<b>Year</b>	<b>Total New Renewable Generation (MWh)</b>	<b>Total Production Cost Above Market (\$)</b>
2008	781,620	\$21,431,363
2009	1,691,239	\$79,704,317
2010	2,488,695	\$108,557,783
<b>Total</b>	<b>4,961,554 MWh</b>	<b>\$209,693,463</b>

**Net Cost – Sales Perspective**

Using the same LCOE for renewable energy in Table 4 against LMP market prices in Table 9 above, total retail sales of electricity from renewable resources above 2006 levels resulted in the sales levels and associated incremental costs listed in Table 12 below.

**Table 12 RPS Renewable Sales Above 2006 Levels and Costs Above Market**

<b>Year</b>	<b>Total Renewable Sales Above 2006 Levels (MWh)</b>	<b>Total Production Cost Above Market (\$)</b>
2008	693,666	\$19,019,747
2009	1,393,954	\$65,693,950
2010	2,433,933	\$106,169,056
<b>Total</b>	<b>4,521,554 MWh</b>	<b>\$190,882,754</b>

**Revenue Requirement and Rate Impact**

Revenue requirement impacts in this report are based on statewide actual revenue collected by all Wisconsin electric providers as reported to the U.S. Energy Information Administration (EIA). EIA Form 826 shows that electric providers collected an estimated \$19.25 billion in revenue from Wisconsin retail customers over the three-year period. Actual revenue impacts vary from year to year, depending on market prices, actual renewable energy production, and when

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<sup>25</sup> Calculated using unrounded numbers; result reported to one decimal place.

individual renewable energy projects are placed into service. Because revenue requirements are recovered through rates, the revenue requirement can also be viewed as an average rate impact from a statewide perspective for that period. Using the two perspectives provided in this report, the statewide revenue requirement and average rate impacts for the years 2008-2010 from new renewable energy since the RPS was enacted are estimated as follows:

**Table 13 Revenue and Rate Impacts Overall 2008-2010**

<b>Analysis Perspective</b>	<b>Revenue Requirement (\$)</b>	<b>Percent Impact (%)</b>
New Renewable Generation	\$209.7 Million	1.09%
New Renewable Sales	\$190.9 Million	1.00%

**Other Considerations**

Regional electricity market forces alone do not capture the need for new renewable generation under the RPS. Utilities provided EGEAS analysis for all of the major renewable energy projects constructed requiring the review and approval of the Commission. As indicated above, the forecasts for future carbon dioxide (CO<sub>2</sub>) regulation and energy growth used in these analyses are now less than were being estimated when the Commission reviewed these proposed projects.

During the time period reflected in this report, CO<sub>2</sub> monetization was part of any evaluation of new generation alternatives. CO<sub>2</sub> monetization results in the largest change in Present Value Revenue Requirements (PVRR) of any of the variables typically analyzed. Assuming CO<sub>2</sub> monetization in any economic evaluation results in lower rate impacts from renewables compared to existing market power or other forms of generation. Because this analysis is historical and CO<sub>2</sub> monetization did not occur in the years analyzed, the analysis does not incorporate any effects related to CO<sub>2</sub> monetization.

Energy growth estimates typically have the second largest effect on PVRR of the variables typically analyzed in EGEAS expansion planning. When the projects installed in 2008 and later were being planned (during 2006 and 2007), energy usage was expected to grow in future years, and such growth improved the projected cost-effectiveness of individual projects. However, from 2008 through 2010 actual energy growth was negligible or declining. As a result, future needs of Wisconsin utilities for additional sources of electricity generation to meet energy demands have been pushed back, making such projects now appear less costs-effective in recent years than they were anticipated to be when the projects were originally planned.

### **Conclusion**

Many factors influence an electric provider's decision to invest in constructing or purchasing electricity from a renewable generation resource. One major factor is, presumably, the state's RPS. Compared to conventional generation resources, Wisconsin ratepayers, from 2008 through 2010, paid nearly \$210 million in new renewable generation or, from another perspective, approximately \$191 million in new renewable sales.

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