

# Direct and Indirect Impacts of Renewable Energy on End User Tariffs

ERRA Tariff/Pricing Committee

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Wyoming Public Service  
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# Considerations

- Costs
  - New Investments
    - Renewable Generation
    - Back Up Generation (Integration Costs)
    - Transmission
  - Comparison to Other Generation or Market Alternatives
  - Subsidies (Support Payments)
  - Rate Caps (Cost Impact Limitations)
- Benefits
  - Renewable Energy Credits (Sales Revenue)

# Illinois Power Agency Report on the Costs and Benefits of Renewable Resource Procurement (March 2012)

- Renewable Portfolio Requirements
  - 6% by June 2011; 7% by June 2012; 10% by June 2015; 25% by June 2025
  - Preference for renewable energy from Illinois, followed by preference for renewable energy from adjoining states
  - Cost Effectiveness Cap
    - Beginning in 2012, cannot cause amount customers pay to increase by more than 2.015% of the amount paid per kWh for year ended May 31, 2007 or the incremental amount per kWh paid for renewable resources in 2011
    - Caps have not limited purchases for 2009-2011 period.
  - 75% to come from wind
  - Solar Photovoltaics: 0.5% by June 2012 building up to 6% by June 2015
  - Distributed Renewable Generation mandate starting in 2013 (defined as connected at the distribution system level) -- start at 0.5% and increase to 1% by June 2015

# Illinois Power Agency Report on the Costs and Benefits of Renewable Resource Procurement (March 2012)

- Locational Marginal Price
  - For 2011, renewable energy reduced Illinois' average locational marginal price by \$1.30 per MWh from \$36.40 to \$35.10 per MWh

... The result is that construction of these renewable resources has a relatively small downward effect on capacity costs. However, when the sun is shining or the wind is blowing, the combined output of renewable generators benefits all customers by bringing down the market price of electric energy for all resources operating at that time. This is because wind and solar generation can effectively bid in at a zero variable fuel cost...

Illinois Power Agency Report

# Illinois Power Agency Report on the Costs and Benefits of Renewable Resource Procurement (March 2012)

- Commonwealth Edison Cost Comparison
  - Comparison
    - Actual average cost of the renewable energy credit (REC) procured in that year's procurement
    - The actual average cost of energy procured from conventional sources in that year's procurement
  - Average cost of renewable energy credit (without energy) June 2009 – May 2012 was \$0.00743
  - Average cost of conventional supply for June 2009 – May 2012 was \$0.03412 per kWh

# Illinois Power Agency Report on the Costs and Benefits of Renewable Resource Procurement (March 2012)

- Commonwealth Edison Rate Impacts
  - Percentage of Average Customer Bill with and without purchase of RECs
    - Based on the total amount paid for electric service including supply, transmission, distribution, surcharges, and add-on taxes

	Single Family Residence	Single Family with Electric Space Heating
June 2009 – May 2010		
Dollar Impact (\$)	\$18,582,034	\$438,849
Percentage (%)	0.69%	0.65%
June 2010 – May 2011		
Dollar Impact (\$)	\$6,593,738	\$86,042
Percentage (%)	0.21%	0.20%
June 2011 - May 2012		
Dollar Impact (\$)	\$1,479,872	\$36,246
Percentage (%)	0.05%	\$0.05%

# Illinois Power Agency Report on the Costs and Benefits of Renewable Resource Procurement (March 2012)

- Ameren Cost Comparison Cost Comparison
  - Comparison
    - The actual average cost of the renewable energy credit procured in that year's procurement
    - The actual average cost of energy and capacity procured from conventional sources in that year's procurement
  - Average cost of renewable energy credit (without energy) June 2009 – May 2012 was \$0.00623
  - Average cost of conventional supply for June 2009 – May 2012 was \$0.03378 per kWh

# Illinois Power Agency Report on the Costs and Benefits of Renewable Resource Procurement (March 2012)

- Ameren Rate Impacts – Residential
  - Percentage of Average Customer Bill with and without purchase of RECs
    - Based on the total amount paid for electric service including supply, transmission, distribution, surcharges, and add-on taxes

	Service Area 1	Service Area 2	Service Area 3
June 2009 – May 2010			
Dollar (\$)	\$2,398,953	\$1,264,776	\$3,504,771
Percentage (%)	0.70%	0.69%	0.61%
June 2010 – May 2011			
Dollar (\$)	\$847,848	\$456,896	\$1,248,348
Percentage (%)	0.22%	0.23%	0.19%
June 2011 – February 2012			
Dollar (\$)	\$170,449	\$94,818	\$255,827
Percentage (%)	0.06%	0.06%	0.05%



# Illinois Power Agency Report on the Costs and Benefits of Renewable Resource Procurement (March 2012)

- Ameren Rate Impacts – Small General Service (Commercial)
  - Percentage of Average Customer Bill with and without purchase of REC's
    - Based on the total amount paid for electric service including supply, transmission, distribution, surcharges, and add-on taxes

	Service Area 1	Service Area 2	Service Area 3
June 2009 – May 2010			
Dollar (\$)	\$852,750	\$351,942	\$1,127,579
Percentage (%)	0.63%	0.65%	0.58%
June 2010 – May 2011			
Dollar (\$)	\$230,026	\$100,738	\$307,786
Percentage (%)	0.21%	0.22%	0.19%
June 2011 – February 2012			
Dollar (\$)	\$42,353	\$19,213	\$56,506
Percentage (%)	0.06%	0.06%	0.05%

# Report on the Rate and Revenue Impacts of the Wisconsin Renewable Portfolio Standard (June 2012)

- Renewable Portfolio Requirements
  - Statewide: 6% renewable energy by 2010; 10% by 2015
  - By 2010, individual providers must increase its renewable energy percentage by at least 2% above the baseline
    - Baseline is average of 2001, 2002, 2003 renewable energy
  - Actual 2010 renewable energy = 7.37%
    - Most of the renewable (wind) projects reflected in this report were approved in 2007 and 2008
      - At the time of approval, market prices were higher, so price difference between market and renewable self generation was less than it is today

# Report on the Rate and Revenue Impacts of the Wisconsin Renewable Portfolio Standard (June 2012)

- Impact Analysis
  - Assumes that all new renewable energy once the law was enacted related to the required goals
    - Regulator has approved capital costs of approximately \$1.7 billion since 2007 for new utility owned renewable generation
      - \$500 million of this new investment will go into service after 2010 and therefore, is not included in this cost analysis report
  - Not include transmission upgrades
  - Not include potential revenue from sales of renewable energy credits

# Report on the Rate and Revenue Impacts of the Wisconsin Renewable Portfolio Standard (June 2012)

- New Generation Comparison
  - Levelized cost of energy from new renewable generators on a \$/MWh for 2008, 2009, 2010
    - Present value of the total cost of building and operating a generating resource over an assumed financial life, converted to equal annual payments
      - Real dollars to remove inflation impact
      - Capital Costs, Fuel Costs, Fixed and Variable Operating and Maintenance Costs, Financing Costs, Tax Credits
  - Compared to marginal cost of energy in Midwest regional market for 2008, 2009, 2010
  - Equals above (or below) market price
  - 3 year impact of \$209,693,463 or 1.09% of the revenue requirements
    - Statewide average rate impact of 1.09% for the three year period of 2008-2010

# Report on the Rate and Revenue Impacts of the Wisconsin Renewable Portfolio Standard (June 2012)

- New Generation Comparison (\$ per MWh)

	Levelized Cost for New Wind	On Peak Average Locational Marginal Pricing	Difference On Peak	Levelized Cost for New Wind	Off Peak Average Locational Marginal Pricing	Difference Off Peak
2008	\$77.28	\$68.64	\$8.64	\$77.28	\$33.23	\$44.05
2009	\$74.37	\$35.28	\$39.09	\$74.37	\$20.12	\$54.25
2010	\$74.82	\$39.60	\$35.22	\$74.82	\$23.77	\$51.05

# Report on the Rate and Revenue Impacts of the Wisconsin Renewable Portfolio Standard (June 2012)

- New Generation Comparison

	Total New Renewable Generation (MWh)	Total Production Cost (\$)	Market Cost (\$)	Difference (\$)
2008	781,620	\$60,401,792	\$38,970,429	\$21,431,363 \$27.42/MWh
2009	1,691,239	\$125,772,201	\$46,067,884	\$79,704,317 \$47.13/ MWh
2010	2,488,695	\$186,214,450	\$77,656,667	\$108,557,783 \$43.62/MWh
Total	4,961,554	\$372,388,443	\$162,694,980	\$209,693,463
Average/MWh		\$75.05	\$32.79	\$42.26

# Report on the Rate and Revenue Impacts of the Wisconsin Renewable Portfolio Standard (June 2012)

- Retail Sales Comparison
  - Retail sales from new renewable resources multiplied by levelized costs of energy
    - Sales from renewable resources for 2008, 2009, 2010 minus the amount of renewable energy sold at retail during 2006
  - Compared to marginal cost of energy in Midwest regional market for 2008, 2009, 2010
  - Renewable energy sold at retail above and beyond that which was already being sold in 2006 had a 3 year impact of \$190,882,754 or 1.00% of the revenue requirements
  - Statewide average rate impact of 1.00% for the three year period of 2008-2009

# Report on the Rate and Revenue Impacts of the Wisconsin Renewable Portfolio Standard (June 2012)

- Retail Sales Comparison

	Renewable Sales Above 2006 Levels (MWh)	Total Production Cost (\$)	Market Cost (\$)	Difference (\$)
2008	693,666	\$53,604,935	\$34,585,188	\$19,019,747
2009	1,393,954	\$103,664,055	\$37,970,105	\$65,693,950
2010	2,433,933	\$182,116,948	\$75,947,892	\$106,169,056
Total	4,521,554	\$339,385,938	\$148,503,184	\$190,882,754
Average /MWh		\$75.06	\$32.84	\$42.22



# Total Resource Cost – Supply Side Resource Options

(From PacifiCorp 2011 Integrated Resource Plan)

Cost in USD \$ per MWh in 2010 dollars (20 year levelized cost)

Type of Resource	Total Cost \$0/ton CO <sub>2</sub>	Total Cost with \$19/ton CO <sub>2</sub>
Pulverized Coal	\$61 - \$65	\$75 - \$78
Pulverized Coal with Carbon Capture and Sequestration	\$106 - \$113	\$108 - \$115
Integrated Gasification Combined Cycle with Carbon Capture and Sequestration	\$104 - \$114	\$105 - \$116
Single Cycle Natural Gas	\$119 - \$126	\$127 - \$134
Combined Cycle Natural Gas	\$65 - \$95	\$70 - \$102
Wind (with tax credit)	\$62 - \$82	\$62 - \$82
Geothermal (with tax credit)	\$68	\$68
Pumped Storage	\$162	\$180
Advanced Battery	\$167	\$183
Nuclear	\$89	\$89
Solar (with tax credit)	\$171 - \$234	\$171 - \$234
Biomass (with tax credit)	\$73	\$89

# Total Resource Cost -- Distributed Generation

(From PacifiCorp 2011 Integrated Resource Plan)

Cost in USD \$ per MWh in 2010 dollars (20 year levelized cost)

Type of Resource	Total Cost \$0/ton CO <sub>2</sub>
Reciprocating Engines	\$102 - \$105
Gas Turbine	\$68
Microturbine	\$119
Fuel Cell	\$124
Commercial Biomass (Anaerobic Digester)	\$52
Industrial Biomass	\$29
Rooftop Photovoltaic	\$312 - \$468
Solar Water Heaters	\$96 - \$144
Solar Attic Fans	\$1,644