State energy factsheet: Minnesota

This report provides a fact-based overview of Minnesota’s power sector. It presents key metrics, highlights recent trends and discusses the state’s progress toward compliance under the EPA’s Clean Power Plan.

Findings

- Minnesota (MN) is a net importer of electricity; its retail electricity prices are below the US average; and its generation profile is more carbon-intensive than the US average (despite the fact that the state has substantial renewable energy capacity).

- Coal is the largest generation source, but natural gas is becoming more important in its power mix, providing 13% of electricity and accounting for 32% installed capacity in 2015, while coal is trending downwards. Coal-fired electricity generation fell from 52% in 2010 to 44% in 2015, and 396MW of coal plants retired in 2015.

- Meanwhile, renewable energy generation is trending upwards (it grew from 14% to 22% of annual generation from 2010 to 2015) on the back of strong state policy support. Between 2010 and 2015, MN built 1.5GW of utility-scale renewable capacity (mostly wind), and we estimate that the state’s investor-owned utilities (IOUs) will require 320MW of solar by 2020.

- MN is among the nation’s leaders in terms of energy efficiency: its energy efficiency mandates have driven state utilities to outspend many of their peers in neighboring states.

- MN has already made significant progress toward achieving its Clean Power Plan (CPP) targets for 2030, based on current and pipeline emission reduction activities.

Table 1: Key power system metrics, Minnesota versus US average, 2015

<table>
<thead>
<tr>
<th>Metric</th>
<th>Units</th>
<th>MN</th>
<th>US average</th>
<th>Comment</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total retail electricity sales</td>
<td>TWh</td>
<td>65</td>
<td>73</td>
<td>Below average electricity demand</td>
<td>23</td>
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<tr>
<td>Total generation</td>
<td>TWh</td>
<td>57</td>
<td>80</td>
<td>Below average in-state generation</td>
<td>27</td>
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<tr>
<td>Retail electricity sales per capita</td>
<td>MWh</td>
<td>11.9</td>
<td>11.6</td>
<td>Roughly average per capita demand</td>
<td>29</td>
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<tr>
<td>Retail electricity prices</td>
<td>¢/kWh</td>
<td>9.7</td>
<td>10.4</td>
<td>Below average electricity prices</td>
<td>23</td>
</tr>
<tr>
<td>Generation from gas</td>
<td>%</td>
<td>13</td>
<td>33</td>
<td>Below average reliance on gas for electricity</td>
<td>35</td>
</tr>
<tr>
<td>Generation from gas and renewables</td>
<td>%</td>
<td>35</td>
<td>47</td>
<td>Below average reliance on gas and renewables</td>
<td>33</td>
</tr>
<tr>
<td>Energy efficiency score*</td>
<td>ACEEE index</td>
<td>31</td>
<td>19</td>
<td>Above average on efficiency efforts</td>
<td>10</td>
</tr>
<tr>
<td>Utility energy efficiency budget*</td>
<td>% state revenue</td>
<td>2.1</td>
<td>1.6</td>
<td>Above average utility efficiency budget</td>
<td>12</td>
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<tr>
<td>CO2 emissions rate</td>
<td>tCO2/MWh</td>
<td>.54</td>
<td>.49</td>
<td>Dirtier than average generation profile</td>
<td>19</td>
</tr>
<tr>
<td>2030 CPP CO2 emissions reductions-mass goal</td>
<td>% cut from 2012</td>
<td>-35</td>
<td>-26</td>
<td>Above average ‘ask’ for CPP mass reduction goal</td>
<td>6</td>
</tr>
</tbody>
</table>

Source: Bloomberg New Energy Finance, US Energy Information Administration (EIA), US Census Bureau, ACEEE. Notes: ACEEE data is from 2014. US ranks are in descending order (1 being highest, 50 being lowest). For some metrics it is ‘good’ to have a high ranking (eg, energy efficiency score); for other metrics it is ‘good’ to have a low ranking (eg, retail electricity prices, CO2 emissions rate).
1. BIRD’S EYE VIEW OF MINNESOTA’S POWER SECTOR

Minnesota (MN) consumes more electricity than it produces (65 TWh of consumption versus 57 TWh of generation in 2015), making it a net importer of electricity from its neighbors. But MN is shrinking its generation gap: between 2010 and 2015, retail electricity sales fell off 4%, while generation increased 7% (Figure 1).

The retail price of electricity in MN was 9.7¢/kWh in 2015, 15% higher than in 2010 (in nominal terms), but close to the regional average (MISO). Both Minnesota and its neighbors pay below average rates for power in the US (Figure 2).

Gas is becoming more important in MN’s power mix: gas-fired plants provided 13% of electricity in 2015, up from just 8% in 2010 (Figure 3). Additionally, gas plants accounted for 32% of Minnesota’s fleet as of the end of 2015, up from 15% in 2000, owing to the addition of 4.4GW of gas capacity (and the retirement of 0.6GW of coal capacity) over that period (Figure 4).

Source: Bloomberg New Energy Finance, EIA
Notes: MISO is the electric power market in the Midwest, comprised of part or all of 16 states, including Minnesota.
At the same time, renewable energy generation is trending upwards: it grew from 14% to 22% of annual generation between 2010 and 2015, driven by wind. Coal generation is trending downwards (it fell from 52% to 44% over that period) (Figure 3), due to competition from low-priced natural gas as well as the retirement of 396MW of coal-fired capacity in 2015.

2. SUSTAINABLE ENERGY DEPLOYMENT

2.1. Natural gas

The amount of gas burned for power generation in MN grew at a CAGR of 8.7% from 2010-15 (a similar trend has occurred in neighboring states, as shown in Figure 5). Increased natural gas production flowing out of the Northeast has driven gas prices down nationwide (including MN, Figure 6), improving the economics of the state’s gas fleet.

![Figure 5: MN and neighboring states' natural gas consumption from the power sector, 2010-15 (Bcf/d)](image)

Historically, gas plants in MN have run primarily to meet peak electricity demand — as opposed to baseload demand — so their operations remained largely concentrated during the summer months, when hot temperatures call for high electricity use. However, low gas prices have allowed gas-fired generators to underprice coal even for baseload during certain periods in recent years. This trend, combined with impending coal retirements, will serve to reduce MN’s dependence on coal and will increase its reliance on other sources of electricity such as natural gas and renewables.

![Figure 6: MN natural gas price (citygate), 2010-Mar 2016 ($/MMBtu)](image)
2.2. Renewables

MN has a mandatory renewable energy standard that requires most of the state’s investor-owned utilities (IOUs)\(^1\) to obtain 25% of energy from renewable sources by 2025 (Table 2) plus an additional 1.5% from solar. In 2015, renewables provided 22% of electricity generation, and nearly all of this came from wind. Between 2010 and 2015, MN built 1.6GW of renewable capacity (1.5GW of wind, 56MW of biomass, 39MW of solar, and 10MW of hydro; Figure 7), bringing cumulative installed renewable capacity to 3.8GW in 2015 (Figure 8). Notably, MN is home to nine waste-to-energy facilities.

Figure 7: MN renewable capacity additions, 2010-15 (MW)

Source: Bloomberg New Energy Finance, EIA Note: includes BNEF data on distributed (ie, residential, commercial, and industrial) solar capacity.

Figure 8: MN cumulative renewable capacity, 2010-15 (GW)

Nearly 27MW of residential and commercial-scale (ie, distributed) solar capacity was installed in MN through 2015 (highlighted in Figure 9), in addition to 16MW of utility-scale solar. As noted previously, state policy requires IOUs to have 1.5% of electric sales from solar by 2020. To meet this, we estimate that the state’s IOUs will require 320MW of solar capacity, of which 10% (32MW) is required to be distributed solar.

The 2013 law that created the solar carve-out also established a framework to promote community solar, helping Minnesota to become the third-largest state by installed community solar capacity (10.7MW) as of March 2016. In its June 2016 compliance filing to the Public Utilities Commission, Xcel Energy (the state’s largest utility, which serves 45% of the retail base) listed a pipeline of 375MW worth of projects under design and construction through its Solar*Rewards Community Program.

Further renewables growth will also be spurred by utility-level policies: in October 2015, Xcel Energy updated its long-term resource plan with an emissions reduction target of 60% from 2005 levels by 2030. In addition, Xcel announced plans to source 63% of its electricity from carbon-free sources in 2030, including 8% from solar.

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\(^1\) Xcel Energy has an even more stringent mandate than other IOUs in the state: its target is effectively 31.5% by 2020. A minimum of 25% must be met by wind or solar (with solar capped at 1% of the 25% carve-out), plus the additional 1.5% solar carve-out. Other eligible technologies which may meet the remaining 5% include biomass, landfill gas, hydro facilities (<100MW), waste-to-energy, and livestock methane gas.
2.3. Energy efficiency

Minnesota is a leader in terms of its overall energy efficiency efforts. The American Council for an Energy Efficient Economy (ACEEE) gave the state its 10th highest score (31 out of 50) for its overall energy efficiency programs and policies in 2015. Figure 10 shows MN’s annual electricity revenues (black bars, left axis, $bn) and energy efficiency budget (green line, right axis, $m) from 2010 to 2014. The state dedicates noteworthy percentages of electricity revenues towards efficiency spending, although this has tapered in recent years. Figure 11 shows how MN stacks up versus nearby states in terms of efficiency spending. MN dedicated 2.1% of its state-wide revenues to efficiency in 2014, relatively high for the region.

![Figure 10: MN utility electricity revenues (left axis, $bn) and electricity efficiency budget (right axis, $m), 2010-14](image)

![Figure 11: States’ utility electricity efficiency budget as a fraction of state-wide electricity revenue, 2014 (%)](image)

Source: ACEEE

This efficiency spending helped pave the way for MN to achieve the savings required by its annual 1.5% energy efficiency resource standard (EERS). Annual electric savings from actions taken from 2008-13 under the state’s utilities’ Conservation Improvement Programs reached 4.2TWh in 2014, with a benefit-cost ratio of 4.01 in 2013 alone, according to a study commissioned by the Minnesota Department of Commerce.

3. CLEAN POWER PLAN

The US Environmental Protection Agency (EPA) released the finalized Clean Power Plan (CPP), its landmark power sector regulation, on 3 August 2015. Under the final CPP, Minnesota’s 2030 emissions rate goal is less stringent than what had been proposed in the earlier draft version of the Plan. The final rule requires the state to reach an emissions rate of 0.55tCO2/MWh by 2030, marking a 42% reduction from the 2012 baseline rate of 0.94tCO2/MWh. The draft rule had required the state to meet an emissions target of 0.40tCO2/MWh. Minnesota’s new interim goal, to be met on average during 2022-2029, is now 0.64tCO2/MWh – much less strict than the proposed 0.41tCO2/MWh. The state’s revised interim goal reflects EPA’s efforts to provide a ‘smoother glide path’ and eliminate the ‘cliff’ at the start of the program.
The final plan also provides mass targets, which states may choose as their compliance standards instead of emission rate goals. Minnesota’s 2030 mass goal is 20.6MtCO₂, reflecting a 35% decline from the 2012 baseline value of 31.5MtCO₂.

Given its current and scheduled emission reduction activities, Minnesota has already made significant progress toward meeting its final compliance goals, especially on the mass-based side. The state has already completed 28% of the reductions required to meet its 2030 mass target based on current and planned retirements from its fossil fleet. Under rate-based targets, Minnesota is 23% of the way towards achieving its 2030 target based solely on recent and pipeline fossil fuel plant retirements as well as renewables build.

4. OPPORTUNITIES

The Bloomberg New Energy Finance levelized cost of electricity (LCOE) analysis compares the cost of producing electricity from different technologies in the US (Figure 12). The red circles in the following chart show US averages (prior to the inclusion of policy — i.e., unsubsidized); the green triangles and squares show subsidized and unsubsidized Minnesota-specific LCOEs, respectively, for onshore wind and solar PV.

Figure 12: Unsubsidized levelized cost of electricity (LCOE) of select technologies in the US compared to subsidized and unsubsidized LCOE of onshore wind and solar PV in MN, H1 2016 ($/MWh)

Renewables

- MN has a broad scope of renewable technologies to consider. The LCOE analysis indicates that, in MN, wind is already economic after accounting for incentives, and it is approaching parity with combined-cycle natural gas plants even without incentives (i.e., unsubsidized).
- Solar PV (subsidized) is competitive with the high estimate of LCOEs natural gas combined-cycle turbines in MN, and small hydro is similarly attractive.

2 According to the Minnesota Renewable Energy Integration and Transmission Study (31 October 2014).
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- Other technologies like waste-to-energy, CHP (combined heat and power) and biomass could potentially do well in the state if these technologies received similar policy and price support as other renewables.

**Natural gas**

- The LCOE analysis also highlights the economic merit of natural gas CCGT, especially as increased natural gas production in the Northeast pushes down gas prices nationwide. MN imports most of its gas from its western neighbors (South and North Dakota) – and will continue to do so – but as Northeast production increasingly displaces other sources of demand for Canadian gas, more abundant – and potentially more stable – natural gas supplies could be on the horizon for MN.

**Energy efficiency**

- As MN’s cumulative energy savings goal grows (its 1.5% EERS compounds annually), electric utilities may have to expand existing customer programs and pilot new projects to meet goals.
- While MN leads many states on efficiency, it has even further room for improvement: for example, a study prepared for Xcel Energy, the state’s largest utility, places “technically” and “economically” achievable cumulative annual energy savings in MN at 10TWh and 7TWh per year by 2020, respectively.
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