State energy factsheet: Minnesota

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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

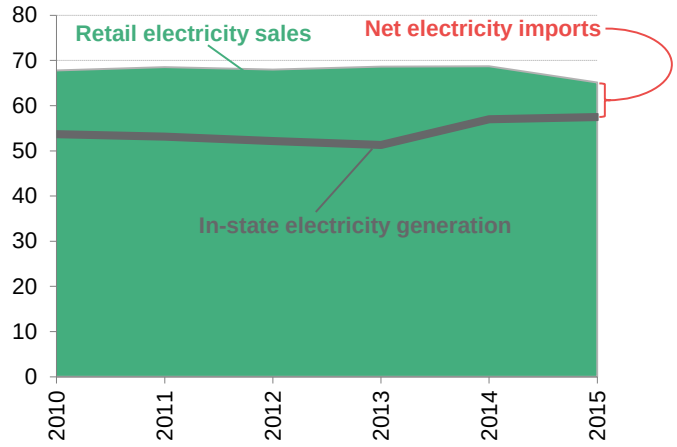
Metric	Units	MN	US average	Comment	Rank
Total retail electricity sales	TWh	65	73	***Below average*** electricity demand	23
Total generation	TWh	57	80	***Below average*** in-state generation	27
Retail electricity sales per capita	MWh	11.9	11.6	***Roughly average*** per capita demand	29
Retail electricity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

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 (ie, 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

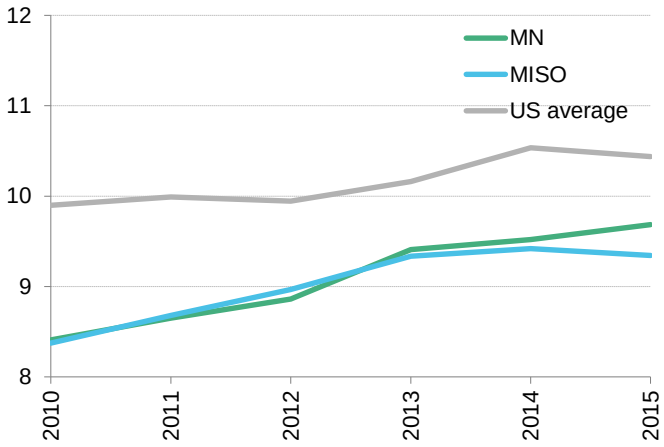
Minnesota (MN) consumes more electricity than it produces (65TWh of consumption versus 57TWh of generation in 2015), making it a net importer of electricity from its neighbors. But MN is shrinking its generation gap: between 2010 and 2015, retail electricity sales fell off 4%, while generation increased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

Figure 1: MN electricity sales and generation, 2010-15 (TWh)



Source: Bloomberg New Energy Finance, EIA

Figure 2: MN electricity prices relative to regional (MISO) and US averages, 2010-15 (¢/kWh)

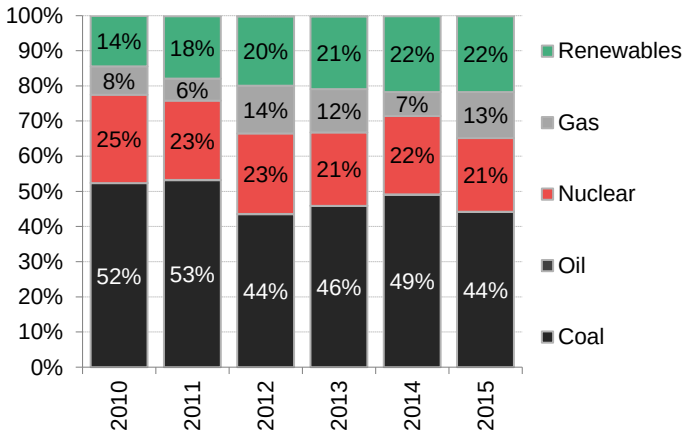


Source: Bloomberg New Energy Finance, EIA Notes: MISO is the electric power market in the Midwest, comprised of part or all of 16 states, including Minnesota.

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).

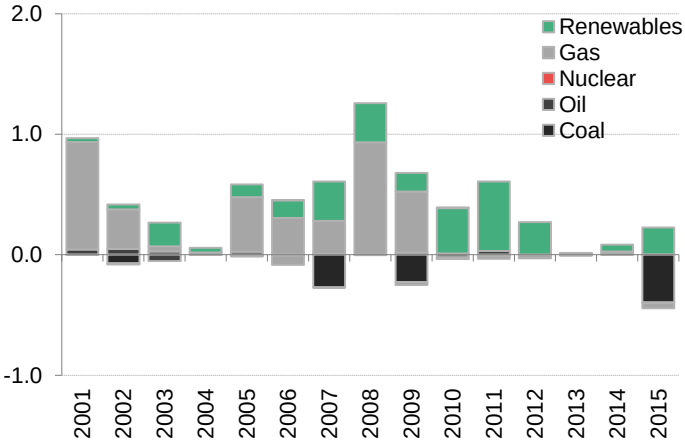
Gas is becoming more important in MN's power mix: gas-fired plants provided 13% of electricity in 2015, up from just 8% in 2010 (Figure 3). Additionally, gas plants accounted for 32% of Minnesota's fleet as of the end of 2015, up from 15% in 2000, owing to the addition of 4.4GW of gas capacity (and the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

Figure 3: MN electricity generation mix by technology, 2010-15 (%)



Source: Bloomberg New Energy Finance, EIA

Figure 4: MN capacity additions (build, above x-axis) and retirements (below x-axis), 2001-15 (GW)



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 (Bcfd)

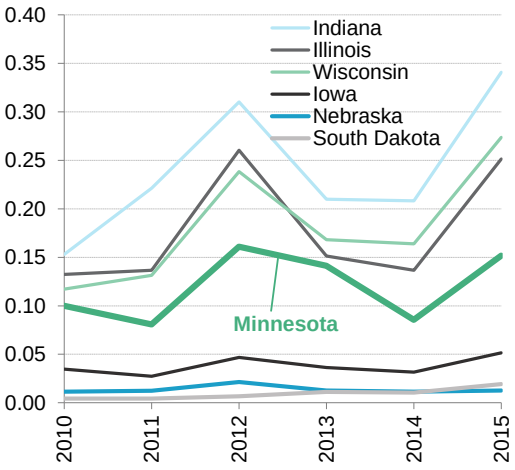
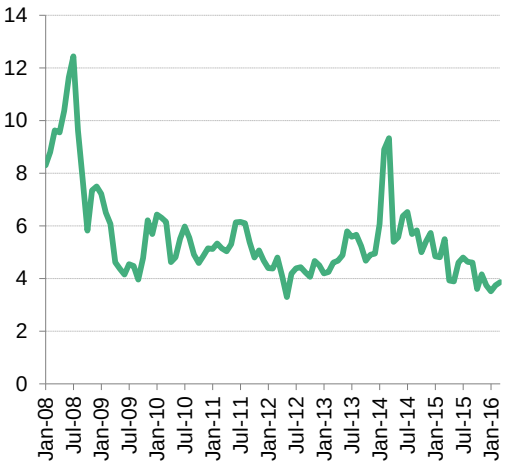


Figure 6: MN natural gas price (citygate), 2010-Mar 2016 ($/MMBtu)



Source: Bloomberg New Energy Finance, EIA

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.

Table 2: MN policies relevant to sustainable energy sectors

Renewables
Renewable energy standard (RES)
Requires all electric utilities to obtain 25% of electricity from renewable sources by 2025 (30% by 2020 for Xcel Energy)
Solar energy standard
Requires IOUs to have 1.5% of retail electric sales from solar by 2020 (in addition to RES target); also, statewide goal of 10% solar by 2030.
Net metering
Provides customers with net excess generation (NEG) from eligible systems <40kW with a monthly credit on their bill equal to the retail rate; systems 40kW-1,000kW receive avoided cost rate
Value of solar tariff (VOST)
Alternative offered to net metering, compensates customers for net value of solar PV on the distribution system
Energy efficiency
Energy efficiency resource standard (EERS)
Yearly energy savings goal for utilities of 1.5% of average retail sales beginning in 2010 (no statutory end date)
Property assessed clean energy (PACE)
Authorizes certain MN local governments to provide property owners with upfront capital for energy efficiency improvements, which is in turn repaid through additional charges on homeowner property taxes

Source: Bloomberg New Energy Finance, DSIRE, Minnesota Department of Commerce

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.

MN has over 3GW of utility-scale wind installed

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

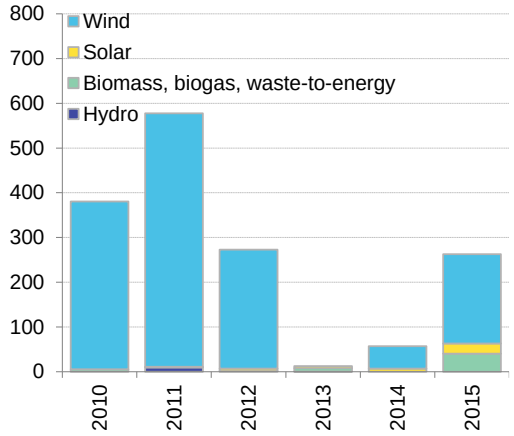
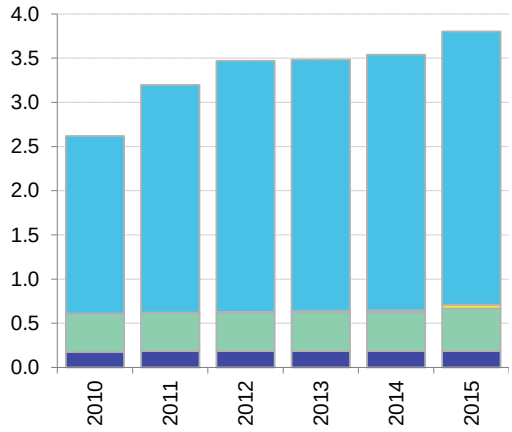
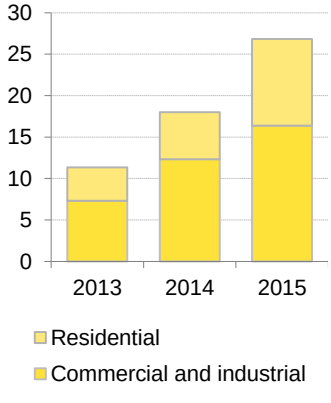


Figure 8: MN cumulative renewable capacity, 2010-15 (GW)



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

Figure 9: MN cumulative installed residential and commercial solar capacity, 2013-15 (MW)



Source: Bloomberg New Energy Finance

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.

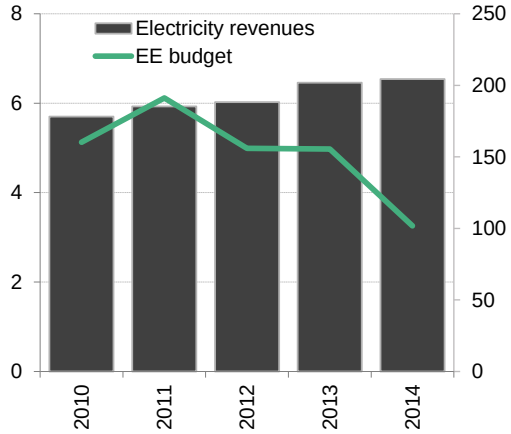
Further renewables growth will also be spurred by utility-level policies: in October 2015, Xcel Energy updated its long-term resource plan with an emissions reduction target of 60% from 2005 levels by 2030. In addition, Xcel announced plans to source 63% of its electricity from carbon-free sources in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

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

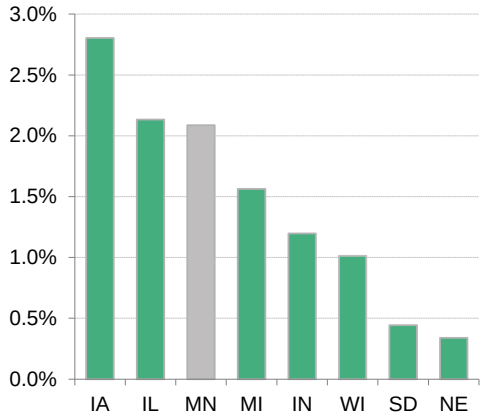
Minnesota is a leader in terms of its overall energy efficiency efforts. The American Council for an Energy Efficient Economy (ACEEE) gave the state its 10th highest score (31 out of 50) for its overall energy efficiency programs and policies in 2015. Figure 10 shows MN's annual electricity revenues (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



Source: ACEEE

Figure 11: States' utility electricity efficiency budgets as a fraction of state-wide electricity revenue, 2014 (%)



Source: ACEEE

MN spends more than some neighbors on energy efficiency and ranks 12th in the US for registered energy efficiency patents

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.

Minnesota has already made significant progress toward achieving both its rate-based and mass-based CPP goals for 2030.

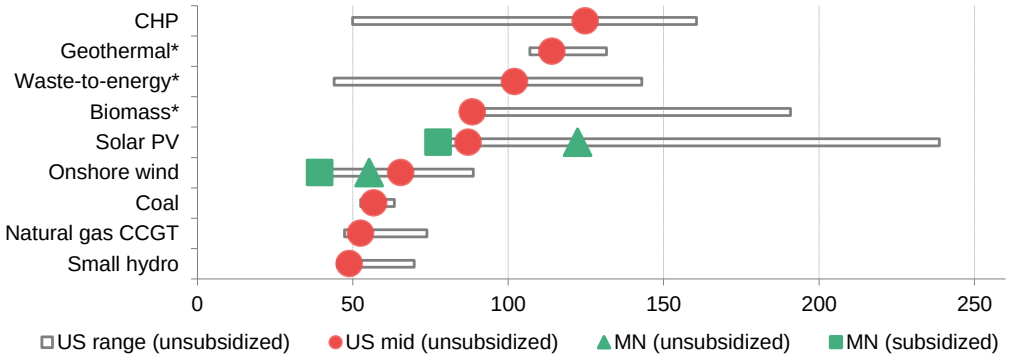
Given its current and scheduled emission reduction activities, Minnesota has already made significant progress toward meeting its final compliance goals, especially on the mass-based side. The state has already completed 28% of the reductions required to meet its 2030 mass target based on current and 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 – ie, 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)

Wind and solar PV are already, or on the verge of being, economically viable in Minnesota



*Source: Bloomberg New Energy Finance Notes: *LCOE for waste-to-energy in this report is a global estimate; biomass and geothermal are Americas region estimates; all other LCOEs in Figure 12 are either US or MN-specific. Variations in MN versus US average result from variations in capacity factor, capex and financing rates. Bars indicate the range of unsubsidized LCOE for each technology in the US. Key policies such as the $23/MWh Production Tax Credit (PTC) and accelerated depreciated (MACRS) bring down unsubsidized LCOEs to subsidized levels. LCOE for combined heat and power (CHP) is for reciprocating engines with CHP. LCOE for small hydro assumes 56% capacity factor, but this can vary significantly depending on annual rainfall conditions.*

A state study suggests MN can increase its 2030 RES to 40% without sacrificing reliability[2]

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 (ie, 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).

- 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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