

Meeting the Clean Power Plan in Minnesota

A Robust Pathway for Securing a Clean Energy Future

HIGHLIGHTS

The Clean Power Plan presents a historic opportunity to reduce global warming pollution from the U.S. electricity sector. The plan sets state-specific targets for cutting power plant carbon pollution, leading to a nationwide reduction of approximately 32 percent below 2005 levels by 2030. It also provides a valuable near-term opportunity to accelerate the transition to a clean energy future—already under way in Minnesota—by spurring investment in greater amounts of renewable energy and energy efficiency.

New analysis by the Union of Concerned Scientists shows that strengthening Minnesota’s clean energy policies, together with a robust carbon emissions trading program, provides a cost-effective pathway for the state to not only cut global warming emissions but also deliver significant health and economic benefits for all of its residents.

The Clean Power Plan (CPP), finalized in August 2015 by the U.S. Environmental Protection Agency (EPA), sets the nation’s first-ever limits on carbon dioxide (CO₂) emissions—the primary contributor to global warming—from power plants (see Box 1, p. 3). Each state is assigned its own annual goal for reducing such emissions, and Minnesota’s is 11.7 million tons, or 34 percent below 2012 levels, by 2030 (OAR 2015a).¹ The Land of 10,000 Lakes is well positioned to meet this target, given its current shift from coal generation and growing investments in renewable energy and energy efficiency.

New analysis by the Union of Concerned Scientists shows that an accelerated transition—based on stronger renewable energy and energy efficiency policies together with a vigorous carbon emissions trading program—constitutes a cost-effective pathway, or what we call a “Clean Path Case,” for Minnesota. This course toward a clean energy future will not only help cut global warming emissions but also reap significant health and economic benefits for all Minnesotans.

For example, our Clean Path Case will:

- Yield more than 4,500 megawatts (MW) of new wind and solar capacity in Minnesota by 2030, which could stimulate more than \$4.6 billion in total new capital investments²
- Reduce overall expenditures on electricity in every year through 2030, saving Minnesota \$745 million between 2016 and 2030



Typically known for its wind resources, Minnesota also has abundant solar potential, and utilities and cities around the state are increasingly investing in this clean, renewable energy resource. Accelerating the growth of renewable energy to help meet the state’s emissions reduction targets will also reduce electricity bills for residents and businesses.

- Lower the typical Minnesota household’s electricity bill by 7 percent in 2030 compared with a Reference Case, or an annual savings of more than \$50
- Generate \$205 million in average annual revenue during the 2022 to 2030 period from the sale of carbon allowances
- Prompt the investment of more than \$1 billion in energy efficiency improvements beyond the current energy efficiency resource standard (EERS)
- Provide some \$111 million in public health and economic benefits between 2022 and 2030 through reduced emissions of CO₂, sulfur dioxide (SO₂), and nitrogen oxides (NO_x) pollution

Minnesota’s Clean Energy Transition

Minnesota has made significant progress in diversifying its electricity-generation mix with renewable sources such as wind and solar. In 2014, more than 20 percent of the state’s generation came from renewables (EIA 2015a). However, Minnesota’s power sector continues to be dominated by carbon-intensive fossil fuels; in 2014, 49 percent of the state’s electricity generation came from coal power and nearly 7 percent from natural gas (EIA 2015a).

Though still accounting for almost half of the state’s electricity generation, the dominance of Minnesota’s aging and inefficient coal power plants, as in many other states, is in decline. Insufficient pollution controls to protect public

Minnesota’s potential for renewable energy—led primarily by solar and wind—could produce almost 180 times the state’s current electricity generation.

health, and serious economic competition from cleaner, lower-cost resources such as renewable energy and natural gas, are leading to coal plant retirements across the country (Cassar 2015). In Minnesota, two coal generators at Black Dog Station and four generators at the Silver Lake coal plant were retired in 2015. Looking ahead, all three units at the Taconite Harbor Energy Center will be permanently idled by the end of 2016, and two units at the Sherburne County (“Sherco”) plant will be retired—one in 2023 and the other in 2026—and replaced with a new natural gas plant and a 50 MW solar array at the site (MN Power 2015; SNL Financial 2015; Walton 2015).

As Minnesota moves away from coal, investments in the state’s renewable energy sources are increasing. Minnesota currently ranks ninth among the states for installed wind capacity, with more than 3,000 MW of capacity that generates more than 15 percent of Minnesota’s electricity (AWEA 2015).



Minnesota has developed more than 3,000 megawatts of wind capacity, ranking it ninth in the country. Increased renewable energy development will help the state meet Clean Power Plan targets while also generating economic benefits.

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BOX 1.

The Clean Power Plan

The CPP, developed by the EPA under the authority of the federal Clean Air Act, aims to reduce CO₂ emissions from the U.S. electricity sector—the nation’s largest contributor to such global warming emissions—by an estimated 32 percent below 2005 levels by 2030. The EPA set differing targets among the states, however, because each state has a unique mix of electricity generation resources—and also because local technological feasibility, cost, and emissions-reduction potential vary across the country.

The plan provides a number of options for cutting carbon emissions so that each state can develop a compliance strategy most suited to its own electricity-supply mix, resource availability, and policy objectives. These options include investing in renewable energy, energy efficiency, natural gas, or nuclear power, while shifting from coal-fired power. States are free to combine these carbon-reduction options in a flexible manner to meet their targets. States can also join together in multistate or regional agreements to find the lowest-cost options for reducing their CO₂ emissions, including through emissions trading programs.

The EPA has given states a choice between a rate-based emissions target (measured in pounds of CO₂ per megawatt-hour

of electricity generated) and a mass-based target (measured in short tons of CO₂ emitted by generating units). To avoid undermining the environmental integrity of the target, states must also address the potential for “leakage,” or emissions that might arise because of a shift from existing to new fossil fuel-fired power plants (which are not covered under the CPP). One way that the EPA suggests the states should address leakage is through the adoption of a mass-based target with a “new-source complement,” which represents an increase in a state’s emissions target based on an estimate of new power plants required to meet additional electricity demand after 2012. A mass-based target that includes CO₂ emissions from both new and existing power plants is the most straightforward way of bringing all power plants under an emissions cap and ensuring an accurate accounting of the emissions that contribute to climate change.

States must submit a final compliance plan, or an initial plan with a request for an extension of up to two years, by September 6, 2016. However, a February 2016 Supreme Court ruling put a stay on CPP implementation until legal challenges to the rule have been resolved. States may continue to develop their compliance plans in the interim.

Solar also has begun to take off. Xcel Energy—the state’s largest utility—recently announced plans to construct almost 700 MW of solar capacity by 2020 (Jossi 2015; Xcel 2015).

This development has largely been spurred by Minnesota’s renewable electricity standard (RES)—a requirement that Xcel Energy obtain 30 percent of its electricity sales from renewable energy sources by 2020 and that all other state utilities achieve 25 percent by 2025. Twenty-eight other states have also adopted RES policies, which have proven to be one of the most successful and cost-effective means for stimulating renewable energy growth in the United States (Heeter et al. 2014).

Despite Minnesota’s recent growth in renewable energy, much of the state’s potential remains untapped. According to the U.S. Department of Energy, that potential—led primarily by solar and wind—could produce more than 10,000 terawatt-hours of electricity, which is equivalent to almost 180 times the state’s current electricity generation (Brown et al. 2015).

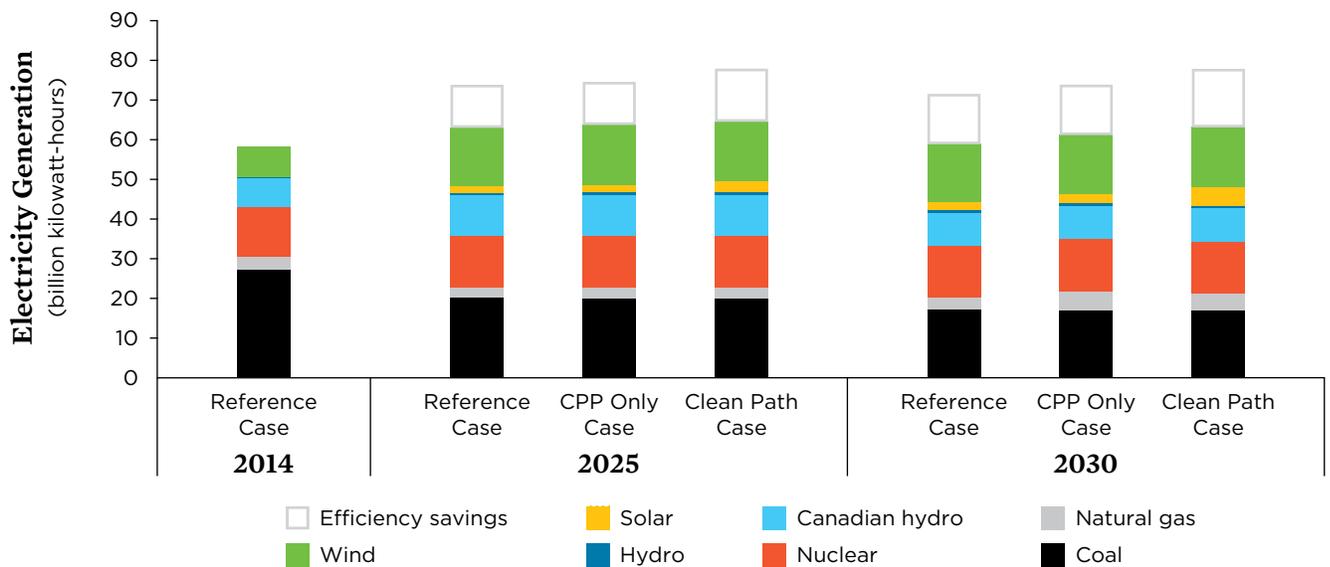
Minnesota has also promoted energy efficiency in homes, businesses, and industry as another effective and affordable strategy for shifting from carbon-intensive fossil fuels. The

state’s EERS, enacted in 2007, requires most utilities to achieve savings of 1.5 percent of average retail sales each year (Xcel Energy’s requirement is 2 percent) through energy conservation programs. Between 2008 and 2013, the societal net benefits of electricity and natural gas conservation programs in Minnesota were approximately \$3.3 billion (MN DOC 2015). Minnesota’s successful energy efficiency initiatives have earned it a ranking of 10th nationally and first in the Midwest by the American Council for an Energy Efficient Economy (Gilleo et al. 2015).

How Minnesota Can Meet Its Clean Power Plan Goals

Under the CPP, Minnesota’s 2030 target is for the total emissions of the state’s power sector (old and new power plants combined) to be 34 percent lower in that year than in the baseline year of 2012. In terms of mass, this overall target translates into a series of targets: 25.7 million tons per year on average in the interim period from 2022 through 2029, and 22.9 million tons in 2030 (OAR 2015b).

FIGURE 1. The Clean Path Case Diversifies Minnesota’s Electricity Mix



Compliance with the Clean Power Plan, complemented by renewable energy and energy efficiency policies—constituting the “Clean Path Case”—helps Minnesota accelerate its transition to a more diversified portfolio of clean energy sources.

Minnesota is well positioned to cost-effectively achieve, and even exceed, its overall target by investing in many of the CPP’s carbon-reduction options (as described in Box 1) and by participating with other states in a well-designed emissions trading program. Administering such a program by auctioning off emission allowances would also allow Minnesota to generate revenues that could be used to benefit all of its residents. Further, by complementing its CPP compliance plan with strengthened RES and EERS policies, Minnesota could accelerate its clean energy transition while increasing consumer, economic, and public health benefits.

The Union of Concerned Scientists examined the likely economic and environmental impacts of Minnesota’s compliance with the CPP by modeling the above combination of robust policies. We found that this approach, called the Complementary Clean Energy Compliance Pathway, or “Clean Path Case,” provides greater environmental, economic, and health benefits for the state, as compared with each of two other scenarios: a “Reference Case,” in which no new state or federal policies (including the CPP) are implemented beyond those in place as of October 2015; and a Clean Power Plan Compliance Pathway, or “CPP Only Case,” that includes interstate trading of allowances but no additional complementary renewable energy and energy efficiency

policies (see Box 2, p. 6, for more details on our methods and assumptions).

Clean Path Case Accelerates Minnesota’s Transition to Low-carbon Electricity

With the CPP and stronger renewable energy and energy efficiency policies to complement it, Minnesota can accelerate its shift toward cleaner, low-carbon energy sources and reduce costs for consumers. Indeed, even under the Reference Case scenario, Minnesota continues to reduce its dependence on coal-fired power generation, which is 37 percent lower in 2030 than in 2014 (Figure 1). Natural gas-fired power generation also decreases by 9 percent. Renewable energy generation—led by wind and solar power—increases to supply more than 27 percent of Minnesota’s energy sales by 2030 as power suppliers fulfill the state’s existing RES policy.³ Minnesota’s electricity imports under the Reference Case also decrease by 13 percent in 2030, compared with 2014, as in-state renewable energy and energy efficiency investments improve Minnesota’s energy independence.⁴

While the Reference Case shows how Minnesota’s leadership in clean energy continues to provide benefits

and drive clean energy investment through 2030, the CPP Only Case and the Clean Path Case result in a cleaner and more diversified generation mix with lower dependence on out-of-state sources. Under the CPP Only Case, renewable energy increases slightly, compared with the Reference Case, to 29 percent of electricity sales in 2030, while electricity imports are reduced by 25 percent compared with 2014.

Even greater clean energy deployment occurs under the Clean Path Case, spurred by the stronger RES and EERS policies combined with the CPP. By 2030, Minnesota's strengthened EERS results in energy efficiency savings equal to 22 percent of electricity sales, while in-state renewable energy sources supply nearly 34 percent of Minnesota's energy demand.⁵ And coal generation decreases by 38 percent compared with 2014. Further, primarily as a result of the increased renewable energy and energy efficiency investments, (along with a slight increase in in-state natural gas generation), Minnesota's net imports of electricity in 2030 under the Clean Path Case decline to 43 percent below 2014 levels.

To meet the strengthened RES and CPP requirements under the Clean Path Case, Minnesota builds more than 1,400 MW of new wind capacity and more than 3,000 MW of solar capacity beyond current levels by 2030, including almost 900 MW of rooftop solar on homes and businesses. By 2030, the Clean Path Case drives more than \$4.6 billion cumulatively⁶ in renewable energy investments in Minnesota, as well as more than \$1 billion in additional energy efficiency investments beyond the state's current EERS.



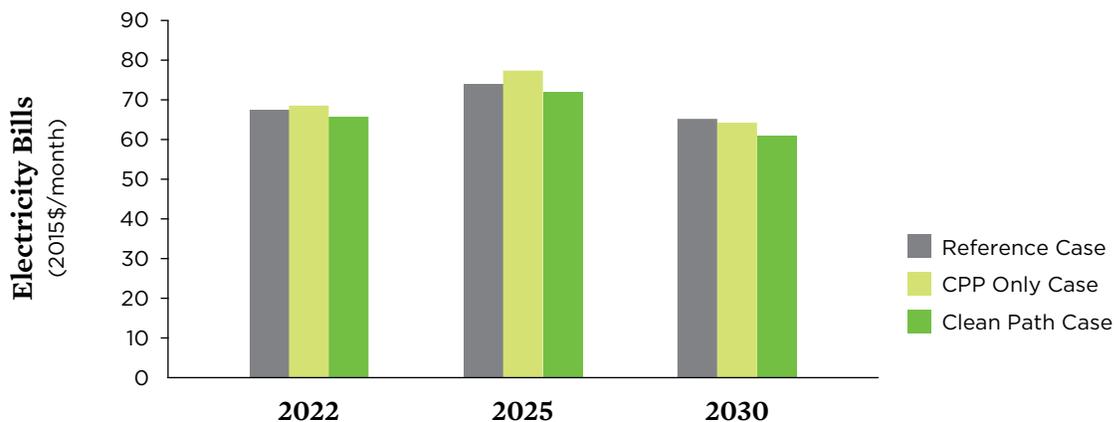
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The Cedar Street Armory in downtown St. Paul recently underwent renovations that not only increase the building's energy efficiency but also provide a better overall working environment for its users. Minnesota ranks 10th in the country for energy efficiency initiatives, and continuing this successful strategy will play an important role in meeting the state's Clean Power Plan emissions targets.

A Cleaner Energy Supply Is Affordable

The clean energy growth in Minnesota spurred by the Clean Path Case is not only achievable but also affordable. Driven primarily by cost savings associated with robust energy efficiency investments under the strengthened EERS, the Clean Path Case leads to significant consumer savings over both the Reference and the CPP Only Cases. Average monthly

FIGURE 2. Clean Energy Saves Minnesota Residents Money



As a result of Minnesota's greater investments in energy efficiency from a stronger EERS, the Clean Path Case leads to average consumer electricity bills that are lower than either the Reference Case or CPP Only Case. Energy efficiency helps consumers save electricity and money, and more renewable energy helps diversify the electricity mix and limit potential impacts from increases in natural gas prices.⁷

BOX 2.

Methodology

We used a modified version of the Regional Energy Deployment System (ReEDS)—a power-sector model developed by the National Renewable Energy Laboratory—to analyze various possible versions of Minnesota’s compliance pathway. ReEDS determines through simulation the electricity-supply mix that would meet electricity demand in the future (through 2050) throughout the contiguous United States at the lowest overall system cost while meeting reliability, environmental, and other legal requirements. The assumptions in our version of the model are based on information used by the Energy Information Administration for the *Annual Energy Outlook 2015* (EIA 2015b), supplemented by data from the recent Wind Vision and SunShot Vision studies (DOE 2015; DOE 2012). We also updated the model’s data for existing power plants to include recent retirements and plants under construction (see the technical appendix, online at www.ucsusa.org/CleanPowerPlanMinnesota, for more information).

For this analysis, we first modeled a Reference Case with no new state or federal policies beyond those in place as of October 2015. Our Reference Case also does not include CPP compliance, which was finalized in August 2015. We then compared the Reference Case with two policy cases, each of which achieves nationwide CPP compliance, and focused here on Minnesota-specific results. While the CPP offers “flexible” compliance options—i.e., a wide range of potential strategy mixes—for each state (see Box 1), for our analysis we investigated just these two sets of options for CPP compliance: a

Clean Power Plan Compliance Pathway—or “CPP Only”—Case; and a Complementary Clean Energy Compliance Pathway—or “Clean Path”—Case.

For the CPP Only Case, we modeled the CPP mass-based targets including both existing and new fossil fuel-fired power plants (see the discussion on leakage in Box 1). We assumed that each state has the option to meet its CPP target by trading carbon allowances with any other state. We also assumed that all states, as part of their compliance strategy, invest in energy efficiency at a level that achieves an electricity-sales decrease of at least 1 percent per year from 2022 to 2030.⁸

The Clean Path Case includes the same elements as the CPP Only Case, but in addition it complements CPP compliance with policies that explicitly support renewable energy and energy efficiency.⁹ For Minnesota, we assumed that the state strengthens and extends its mandatory EERS and RES such that:

- Energy efficiency savings equal to 2 percent of statewide electricity sales per year beginning in 2016 and each year thereafter
- Renewable energy ramping up to meet 40 percent of statewide electricity demand by 2030

Under the Clean Path Case, we also assume that other states with policies to support renewable energy and energy efficiency will continue them and that a few states will add policies or expand their existing requirements.

electricity bills for a typical household under the Clean Path Case are lower in every year of the study period. In 2030, average monthly electricity bills are 6.9 percent and 5.2 percent lower than the Reference and CPP Only cases, respectively. Compared with the Reference Case, this amounts to savings of \$54 for the average residential household in 2030 (Figure 2).

The Clean Path Case drives significant savings on overall electricity expenditures through 2030 compared with the Reference Case, saving Minnesota \$745 million even after accounting for the full cost (utility and participant) of achieving higher efficiency levels. These expenditures average 2 percent lower per year throughout the 2016 to 2030 period.

Our analysis also shows that a national mass-based emissions trading program with auctioned allowances would help Minnesota generate significant revenues. By setting a

Under the Clean Path Case, average monthly electricity bills are 6.9 percent lower than the Reference Case. This amounts to a savings of \$54 for the average residential household in 2030.

carbon cap and issuing allowances equal to its CPP targets, auctioning those allowances, and participating in an interstate carbon trading program, Minnesota could generate average annual revenues of \$205 million per year from 2022 to 2030 under the Clean Path Case. These revenues could be used to further reduce consumer electricity bills or be reinvested for the benefit of the state's residents. Investment options could include: additional deployment of renewable energy and energy efficiency resources; assistance to communities to address issues of environmental justice and equity; and worker training and other economic-transition support for communities adversely affected by the state's movement away from coal.

Public Health and Economic Benefits from Less Pollution

Under the Clean Path Case, electricity-related CO₂ emissions¹⁰ are projected to be 20 million tons in 2030, or 14 percent below Minnesota's CPP target. This outcome directly reflects the cleaner generation mix (see Figure 1) spurred by renewable energy and the reduced electricity demand resulting from stronger energy efficiency policies. Our analysis shows how Minnesota's history of leadership in clean energy gives it the flexibility to take advantage both of the power market (buying or selling electricity) and the carbon market (buying or selling carbon allowances) to react to changing circumstances. It also provides Minnesota with the capability to provide affordable electricity for consumers, and the means to exceed its responsibilities under the CPP.



With well-designed policies and careful planning and coordination, Minnesota can increase its clean energy resources, cost-effectively comply with the emissions reductions required by the Clean Power Plan, and reap important economic and public health benefits in the process.

The Clean Path Case also helps cut other conventional air pollutants, including SO₂ and NO_x, which leads to tangible health benefits. SO₂ and NO_x are contributors to smog and soot, which exacerbate asthma and other heart and lung diseases and can result in significant disability and premature death from such causes (EPA n.d.). CO₂ emissions contribute to global warming, which leads to sea level rise, to extreme weather such as heat waves, droughts, and heavy downpours, and to other climate impacts that can impair human health and safety.

Using the same methodology applied by the EPA in its impact assessment for the CPP, we estimated the monetary savings from reducing these pollutants.¹¹ Between 2022 (when CPP compliance obligations begin) and 2030, the health benefits of the avoided emissions of CO₂, SO₂, and NO_x under the Clean Path Case total \$111 million more than under the Reference Case.

Recommendations

Achieving the Clean Path Case's full range of benefits will require policy makers and regulators to work together with utilities, electricity generators, advocates, regional transmission organizations, and other stakeholders to develop a CPP compliance plan that prioritizes renewable energy and energy efficiency and generates benefits for Minnesota. Toward these ends, the Union of Concerned Scientists offers the following recommendations:

1. **The Minnesota Pollution Control Agency (MPCA) should consider a strong mass-based CPP compliance plan.** The MPCA has already begun a process for gathering comments and information to aid in the creation of a compliance plan that works for the state. In building this plan, the MPCA should prioritize renewable energy and energy efficiency, and it should strongly consider developing a mass-based emissions trading program that includes both new and existing sources and allows for interstate trading of carbon allowances. A mass-based approach offers a lower administrative burden, has a long history of successful implementation, and provides the greatest certainty for true achievement of an emissions target.
2. **The MPCA, Minnesota Public Utilities Commission, and Minnesota Department of Commerce should continue to coordinate closely with the Midcontinent Independent System Operator** (which coordinates the movement of electricity across 15 states in the Midwest and South) in order to ensure cost-effective market and transmission solutions that facilitate CPP compliance.

Prioritizing renewable energy and energy efficiency in Minnesota's CPP compliance plan will maximize the full range of benefits for all Minnesotans.

3. **The Minnesota legislature should enact strong clean-energy and carbon-market policies.** The legislature should extend and expand its current RES, which is set to level off at approximately 28 percent in 2025; and it should increase Minnesota's current EERS, in conformance with leading EERS states, to specify annual savings equal to 2 percent of electricity demand for all Minnesota utilities.
4. **The Minnesota legislature should authorize the state to auction carbon allowances as part of the emissions-trading program developed by the MPCA.** Revenues thus generated should be directed toward programs that benefit all residents, reduce carbon emissions, and promote equitable approaches to transitioning to a low-carbon economy.

With well-designed policies and careful planning and coordination, Minnesota could greatly enhance its clean energy resources, cost-effectively exceed the emissions reductions required by the Clean Power Plan, and reap important economic and public health benefits. And with a robust emissions trading program, Minnesota could generate significant carbon revenues that could be used to support high-quality jobs in renewable energy and energy efficiency, strengthen disadvantaged communities, make buildings and infrastructure more resilient, and boost economic development in regions dependent on the fossil-fuel economy. These benefits would help ensure a sound and prosperous future for all Minnesotans.

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ACKNOWLEDGMENTS

This fact sheet was made possible through generous funding for this work from the Wallace Genetic Foundation, Inc., the Common Sense Fund, the Merck Family Fund, the Joyce Foundation, the Energy Foundation, and UCS members.

The opinions expressed herein do not necessarily reflect those of the organizations that funded the work. The Union of Concerned Scientists bears sole responsibility for the report's contents.

ENDNOTES

1. "Tons" in this document refers to the U.S. short ton (2,000 pounds).
2. Unless otherwise indicated, all dollar amounts are expressed in 2015 dollars.
3. The remainder of Minnesota's RES (approximately 1 percent) is met with out-of-state renewable energy resources.
4. The generation mix, including the levels of imported and exported electricity, is the result of the model's calculations for meeting electricity demand in Minnesota and across the country at least cost, subject to reliability and other constraints based on our assumptions described in the technical appendix, online at www.ucsusa.org/CleanPowerPlanMinnesota.
5. The remainder of Minnesota's 40-percent-by-2030 RES is met with out-of-state renewable energy resources.
6. Assuming a 7 percent discount rate, based on recommendations outlined in OMB 2014.
7. Electricity costs are based on the monthly consumption of 810 kilowatt-hours (kWh) in 2014 for a typical residential nonelectric heating customer, declining over time as a result of energy efficiency investments. In the Clean Path Case, average monthly consumption is lower in 2030 (705 kWh compared with 727 kWh under both the Reference and CPP Only Cases) due to the implementation of the strengthened EERS. Electricity rates are also lower under this case.
8. The energy efficiency assumption is a proxy for state or utility action; it is needed because the ReEDS model does not include choices on energy efficiency. States with stronger mandatory energy-efficiency policies are assumed to continue meeting their respective targets.
9. The CPP also includes a Clean Energy Incentive Program (CEIP), which offers states incentives for early development of renewable energy and energy efficiency. A portion of the generation that meets the RPS and EERS requirements we modeled in the Clean Path Case may qualify for the CEIP, but we did not model the impact of the program or the benefits that early crediting would have on the cost-effectiveness of qualifying clean energy projects.
10. CO₂ emissions include those from resources that are excluded from the CPP, such as natural gas combustion turbines. In any case, excluded emissions constitute less than 1 percent of total CO₂ emissions.
11. The health benefits are calculated from the Benefit per Ton Estimates for SO₂ and NO_x reported in Tables 4-7, 4-8, and 4-9 in OAQPS 2015. See the technical appendix, online at www.ucsusa.org/CleanPowerPlanMinnesota, for values and additional information.

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