

Meeting the Clean Power Plan in Michigan

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 Michigan—by spurring investment in greater amounts of renewable energy and energy efficiency.

New analysis by the Union of Concerned Scientists shows that strengthening Michigan's clean energy policies, together with a robust carbon emissions trading program, provides a sensible 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 Michigan's is 21.8 million tons, or 31 percent below 2012 levels, by 2030 (EPA 2015a).¹ Michigan 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 this transition—based on strong 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 Michigan. 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 Michiganders.

For example, we find that our Clean Path Case will:

- Yield 8,300 megawatts (MW) of new wind and solar capacity in Michigan by 2030, which could stimulate \$11 billion in total new capital investments²
- Prompt the investment of \$1.8 billion in energy efficiency improvements to benefit Michigan consumers



In 2014, Michigan ranked 14th nationally for cumulative installed wind capacity, with more than 1,500 MW online. Increased renewable energy development will help the state meet Clean Power Plan targets while also generating economic benefits.

- Generate \$428 million in average annual revenue during the 2022 to 2030 period from the sale of carbon allowances
- Provide some \$4.1 billion in public health and economic benefits between 2016 and 2030 through reduced emissions of CO₂, sulfur dioxide (SO₂), and nitrogen oxides (NO_x) pollution

Michigan's Clean Energy Transition

Michigan's power sector is currently dominated by carbon-intensive fossil fuels; in 2014, 54 percent of the state's electric-utility generation came from coal power and 6 percent from natural gas (EIA 2015a). Nuclear power provides most of the state's remaining generation (32 percent) while non-hydro renewable energy resources, such as wind, solar, and biomass, provide 6 percent (EIA 2015a).

Though still accounting for most of the state's electricity generation, the dominance of Michigan's aging and inefficient coal power plants, as in many other states, is in decline. Inefficient pollution controls to protect public 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). Ten coal generators at five different Michigan coal plants, totaling more than 1,200 MW of capacity, are expected to retire in 2016. Another 14 units, totaling nearly 850 MW, are expected to retire between 2017 and 2020 (Reindl 2015).

As Michigan moves away from coal, investment in the state's diverse mix of renewable energy resources has expanded. In 2014, Michigan ranked 14th nationally for cumulative installed wind capacity, with more than 1,500 MW online (AWEA 2015). Solar has also begun to take off in Michigan, with utilities, municipalities, and universities making commitments to invest in solar energy resources over the next several years (Gomberg 2015).

This development has largely been spurred by Michigan's renewable electricity standard (RES)—a requirement that utilities supply 10 percent of their power from renewable sources by 2015.³ Twenty-eight other states have also adopted RES policies, which have proven to be one of the most successful and cost-effective means for driving renewable energy development in the United States (Heeter et al. 2014).

Michigan has also promoted energy efficiency in homes, businesses, and industry as an effective and affordable strategy for transitioning from carbon-intensive fossil fuels. In 2014, efficiency investments in the state saved enough electricity—worth an estimated \$4.38 for every dollar invested—to power more than 170,000 Michigan homes (Quackenbush,



More than half of Michigan's power is generated from coal, but cleaner and less expensive renewable energy and natural gas will comprise a growing percentage of the state's electricity mix as aging, inefficient coal plants retire (including the Karn/Weadock Plant, above).

White, and Talberg 2014). This effort was largely spurred by Michigan's commitment, made in 2008, when it adopted an energy efficiency resource standard (EERS),⁴ which requires electricity providers to implement efficiency programs that reduce electricity demand 1 percent annually from 2012 on.

How Michigan Can Meet Its Clean Power Plan Goals

Under the CPP, Michigan's 2030 target for CO₂ emissions from its power sector (old and new power plants combined) is for total emissions to be 31 percent lower than in the baseline year of 2012. In terms of mass, this overall target translates into a series of targets: 53.7 million tons per year on average in the interim period from 2022 through 2029, and 48.1 million tons in 2030 (EPA 2015b).

Michigan is well positioned to cost-effectively achieve 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 Michigan 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, Michigan 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 Michigan's compliance with the CPP by modeling the above combination of robust policies. We found that this approach, called the

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 mega-

watt-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.

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 Michigan’s Transition to Low-carbon Electricity

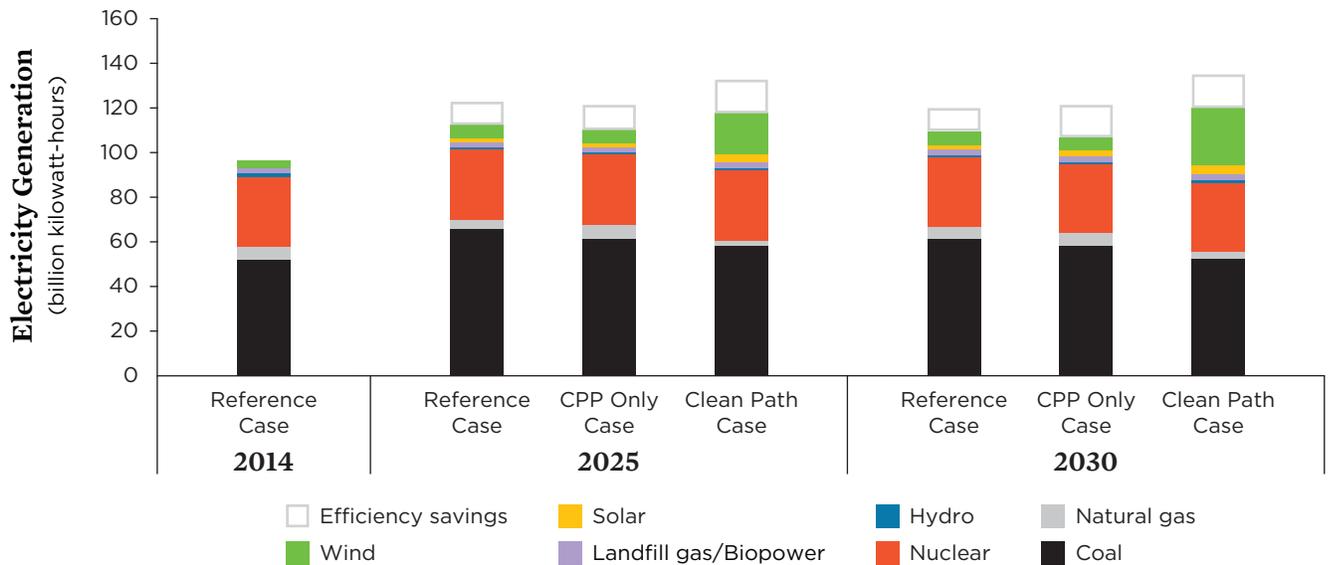
With the CPP and strong renewable energy and energy efficiency policies to complement it, Michigan can affordably comply with the CPP and accelerate its shift toward cleaner low-carbon energy resources. Under the Reference Case, which does not include the CPP, Michigan continues its overreliance on coal—increasing the state’s coal generation by 17 percent in 2030 compared with 2014⁵ while



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Utilities, municipalities, and universities across the state are making commitments to invest in solar energy resources over the next several years. Accelerating the growth of renewable energy to help meet the state’s emissions reduction targets will also provide important economic and health benefits.

FIGURE 1. The Clean Path Case Diversifies Michigan's Electricity Mix



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

natural gas-fired power generation decreases by 10 percent (Figure 1). But renewable energy generation rises to 10 percent of electricity sales by 2030 as power suppliers fulfill the state’s existing RES policy.⁶ The growth in renewable energy generation is primarily the result of solar photovoltaic (PV) deployment, with more than 1,700 MW of installed capacity by 2030. Energy efficiency deployment under the Reference Case, spurred by the state’s current EERS, is equivalent to 9 percent of electricity sales in 2030.

Under the CPP Only Case, Michigan’s coal generation also continues to increase, with a 2030 level that is 12 percent higher than in 2014. However, this increase is smaller than under the Reference Case. Renewable energy generation in 2030 accounts for about the same fraction as in the Reference Case, supplying some 10 percent of Michigan’s electricity demand, while savings in that year from energy efficiency investments are equivalent to 12 percent of total electricity sales.

Under the Clean Path Case, stronger RES and EERS policies combine with the CPP to spur significantly greater clean energy deployment than in either the Reference Case or the CPP Only Case. By 2030, energy efficiency savings are equivalent to 12.5 percent of total electricity sales, while renewable energy resources combine to supply 32 percent of

Michigan’s electricity demand; as a result, utilities successfully meet the strengthened RES. Compared with the CPP Only Case, generation totals from coal and natural gas plants in 2030 are 10 percent and 50 percent lower, respectively. Further, because of greater investment in renewable energy and energy efficiency, Michigan becomes a net exporter of electricity—in 2030 under the Clean Path Case, electricity exports are more than 14 times that of the CPP Only Case.



An efficiency specialist examines the systems at a multifamily building to identify cost-effective energy-saving measures. A CPP compliance plan that prioritizes efficiency efforts such as this can benefit all Michigan residents.

As Michigan sells nearly 12 percent of its in-state electricity generation to utilities elsewhere, a substantial source of new revenue for the state’s electric power industry is created.

To provide for wind and solar generation under the Clean Path Case, Michigan builds 5,190 MW of wind capacity and more than 930 MW of solar capacity above the corresponding amounts in the CPP Only Case (Figure 2) by 2030. This renewables development, cumulative through 2030, results in more than \$11.3 billion⁷ in additional clean energy investments—\$7.8 billion more than under the CPP Only Case. In addition, energy efficiency investments under the Clean Path Case are \$934 million greater by 2030 than in the CPP Only Case.

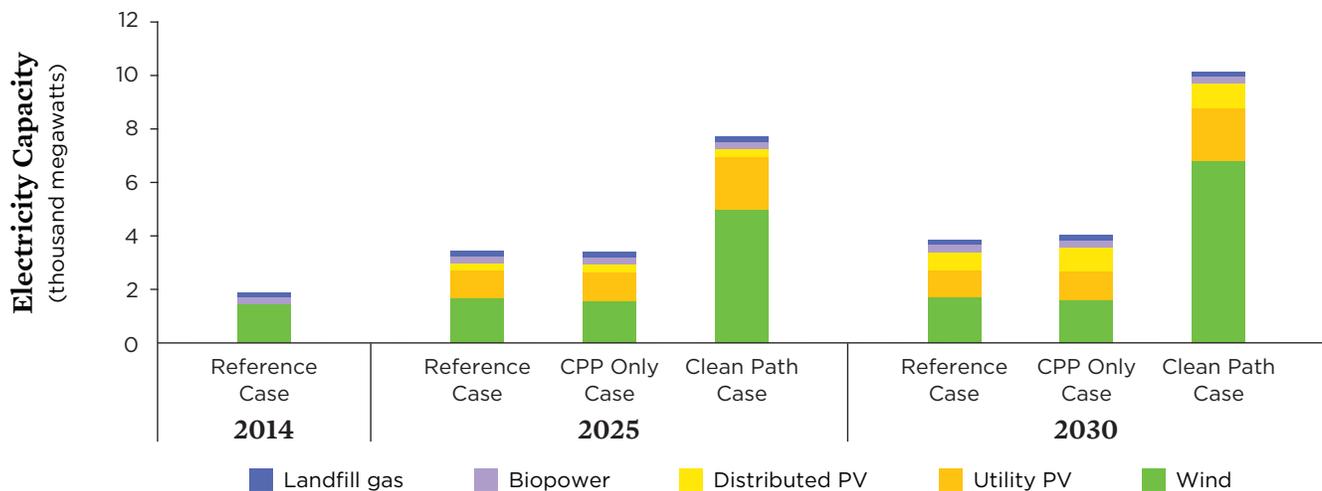
A Cleaner Power Supply Makes Economic Sense

The clean energy growth in Michigan spurred by the Clean Path Case is not only achievable but also is good for the economy. The Clean Path Case policies (which focus on new renewable energy projects, energy efficiency programs, and a price on carbon) do lead to modest customer cost increases when compared with the Reference Case, but the policies drive significantly greater environmental, economic and public health benefits at essentially the same cost as the CPP

only case. The average monthly electricity bill for a typical household under the Clean Path Case is 3.5 percent higher than in the Reference Case from 2016 to 2030, or a little less than \$3 per month. These modest cost increases are also virtually the same when comparing the CPP Only Case with the Reference Case.⁸

In our analysis of the three cases, we also examined some of the broader financial impacts on the electricity system in Michigan—including net impact on electricity bills for all customer classes, investments by participants in energy efficiency programs, and net costs for power generators and distributors. In 2022, there is a net cost of \$533 million, or 4.6 percent of total electricity system costs, to implement the policies outlined in the Clean Path Case (as compared with the Reference Case). In 2030, the net costs are \$521 million, or 4.3 percent. As in the residential example above, similar net electricity system costs are seen on average from 2016 to 2030 when comparing the CPP Only Case with the Reference Case. Consequently, the Clean Path Case spurs substantially more investments in local renewable energy and energy efficiency development than the CPP Only Case at approximately the same cost to the electricity system. This is because (a) the cost to operate most renewable energy facilities is much lower than that of fossil fuel plants, (b) energy-efficient buildings and appliances cost less to operate, and (c) more renewable energy and efficiency helps diversify the electricity

FIGURE 2. The Clean Path Case Drives Investment in Michigan’s Renewable Energy Resources



The Clean Path Case drives significant investments in Michigan’s non-hydro renewable energy resources, including by 2030 more than 5,000 MW of wind capacity and almost 1,000 MW of additional solar above the CPP Only Case. These resources account for more than 30 percent of Michigan electricity demand that year.

The Clean Path Case spurs substantially more investments in local renewable energy and energy efficiency development than the CPP Only Case at approximately the same cost to the electricity system.

mix and limit the potential impacts from increases in natural gas or coal prices.

Our analysis also shows that a national mass-based emissions trading program with auctioned allowances would help Michigan generate significant revenues that could be used to largely offset consumer electricity bill impacts or be reinvested for the benefit of the state's residents. By setting a carbon cap and issuing allowances equal to its CPP targets, auctioning those allowances, and participating in an

interstate carbon trading program, Michigan could generate average annual revenues of \$428 million per year from 2022 to 2030 under the Clean Path Case. Investment options for these revenues could include: additional deployment of renewable energy and energy efficiency resources; power-grid infrastructure improvements; assistance to communities for the purpose of environmental justice and equity; and worker training and other economic-transition support for communities adversely affected by the state's transition from coal.

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 Michigan'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/CleanPowerPlanMichigan, 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 Michigan-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 2030.⁹

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.¹⁰ For Michigan, we assumed that the state strengthens and extends its mandatory EERS and RES such that:

- Energy efficiency savings equal 1.5 percent of statewide electricity sales per year beginning in 2018 and each year thereafter
- Renewable energy ramps up to meet 30 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.

Public Health and Economic Benefits from Less Air Pollution

Michigan fully achieves its interim and final CO₂ emissions-reduction requirements, set by the CPP, through a combination of emissions reductions and purchase of carbon allowances, under both the Clean Path Case and the CPP Only Case. These two policy cases also help cut other air pollutants, including SO₂ and NO_x. In 2030, SO₂ and NO_x emissions under the CPP Only Case are more than 6 percent lower than in the Reference Case. These emissions are even lower under the Clean Path Case—a decrease of 16 percent in 2030 compared with the Reference Case—due to the deployment of more renewable energy and energy efficiency sources that results in greater displacement of power generation from polluting coal plants.

Reducing NO_x, SO₂, and CO₂ emissions leads to tangible health and economic benefits. NO_x and SO₂ 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 these causes (EPA n.d.). CO₂ emissions contribute to global warming, which leads to sea level rise, to extreme weather such as droughts, heat waves, 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. The combined carbon and health benefits of the avoided emissions of CO₂, SO₂, and NO_x under the CPP Only Case are valued at \$226 million on average each year from 2016 to 2030.¹¹ Under the Clean Path Case, average annual health and economic benefits increase to \$541 million during the same period. This annual benefit adds up to \$4.1 billion¹² cumulatively through 2030, which is greater than the total cumulative electric-system costs (\$3.9 billion) of complying with the Clean Path Case policies.

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 Michigan. Toward these ends, the Union of Concerned Scientists offers the following recommendations:

1. **The Michigan Agency for Energy (MAE) should develop a strong mass-based CPP compliance plan.**

The MAE has already begun a stakeholder process to gather public comments and information on how to build a compliance plan that works for the state. The MAE should prioritize renewable energy and energy efficiency in its compliance plan, and it should also develop 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 budget.

2. **The Michigan legislature should authorize the state to auction carbon allowances as part of the MAE's emissions trading program.** Revenues generated from the auctions should be directed toward programs that benefit all residents, reduce carbon emissions, and promote equitable approaches to transitioning to a low-carbon economy.
3. **The Michigan legislature should enact strong clean-energy policies.** The legislature should extend and expand its current RES, which leveled off at 10 percent in 2015. Similarly, Michigan's EERS should be increased in conformance with leading EERS states, which require utilities to reduce electricity use by 1.5 to 2 percent each year.

With well-designed policies and careful planning and coordination, Michigan could greatly enhance its clean energy resources, affordably comply with the emissions reductions required by the CPP, and reap important economic



With well-designed policies and careful planning and coordination, Michigan can greatly 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.

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

and public health benefits. And with a robust emissions trading program, Michigan could generate significant carbon revenues that could help 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 currently dependent on the fossil-fuel economy. These benefits would help ensure a sound and prosperous future for all Michiganders.

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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. Michigan's RES allows for the use both of banked historical credits and "incentive credits," which reward such things as the use of in-state labor and the deployment of solar. With these credits, achieving full compliance with the law requires only about 6 or 7 percent of the state's 2015 electricity to actually be met with renewable energy generated in 2015.
4. Known in Michigan as the "energy optimization standard."
5. The Reference Case does not account for the coal-unit retirements at Eckert Power Station and Presque Isle Power Plant, which were confirmed after the start of our analysis. As a result, statewide coal generation may be lower in 2030 than our projection indicates.
6. The generation mix, including the sources of imported and exported electricity, is the result of the model's calculations for meeting electricity demand in Michigan 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/CleanPowerPlanMichigan.
7. Assuming a 7 percent discount rate, based on recommendations outlined in OMB 2014.
8. Electricity costs in the Reference Case are based on the monthly consumption of 654 kilowatt-hours (kWh) for a typical residential nonelectric heating

customer in 2014 (EIA 2014), with consumption dropping to 623 kWh in 2030 because of existing efficiency programs. In the CPP Only Case and Clean Path Case, average monthly consumption is lower—reaching 599 kWh and 595 kWh, respectively—as a result of implementing strengthened energy efficiency policies.

9. The energy efficiency assumption is a proxy for state or utility action and is needed because ReEDs does not include choices on energy efficiency within the model. States with stronger mandatory energy-efficiency policies are assumed to continue meeting their respective targets.
10. 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 RES 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.
11. The health benefits are calculated from the Regional Particulate Matter (PM_{2.5}) Benefit per Ton Estimates reported in OAQPS 2015. See our technical appendix, online at www.ucsusa.org/CleanPowerPlanMichigan, for values and additional information.
12. This is the net present value from 2022 through 2030 using a 7 percent discount rate, based on recommendations outlined in OMB 2014.

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