Union of Concerned Scientists

Before the Senate Energy and Technology Committee
Testimony on Senate Bill 438
Prepared by Lead Midwest Energy Analyst Sam Gomberg
On behalf of the Union of Concerned Scientists

August 19, 2015

Chairman Nofs and Members of the Senate Energy and Technology Committee
100 North Capitol Avenue
Lansing, MI 48933

Chairman Nofs and Members of the Senate Energy and Technology Committee

Thank you for having me here today. My name is Sam Gomberg. I am the Lead Midwest Energy Analyst for The Union of Concerned Scientists - a science-based nonprofit organization with over 13,000 supporters in Michigan, including hundreds of scientists, economists, engineers and public health experts.

I'm here to testify in opposition to SB 438 because it repeals Michigan's energy optimization and renewable energy standards and because it inappropriately limits compensation for distributed generation resources. These legislative changes will cause Michigan to lose momentum and fall behind other Midwest states in the transition to an economy powered by cleaner, lower-risk, and more sustainable energy resources.

UCS has been engaged in the discussion about Michigan's energy future for several years. In addition to actively participating in the Governor's Energy Plan process in 2013 - submitting more than 100 pages of technical comments in response to the questions posed - we have also published multiple analyses over the past few years that are relevant to this discussion. For example, last year we released an analysis, using a model developed by the Department of Energy, titled *Charting Michigan's Renewable Energy Future*, that looked at the costs and benefits of ramping up Michigan's use of renewable energy to 30 percent or more by 2030.

This report is included in the packets that we provided. In sum, our findings are consistent with the wealth of other information published by the MPSC, independent consultants, and public interest organizations that show (1) the current renewable energy standard has successfully driven cost-effective investment in the state's renewable energy resources, (2) that there remains a vast untapped potential for Michigan to further develop its renewable energy resources, and (3) that renewable energy is a cost-effective, low-risk, and economically beneficial choice for Michigan consumers going forward.

In fact, our analysis found that Michigan can achieve 30 percent renewable energy by 2030 with virtually no additional cost to consumers while attracting nearly $10 billion in new capital investment to the state. This renewable energy development also brings additional tax revenue to the state and payments to local communities and landowners that host renewable energy facilities - all while driving down emissions and protecting Michigan's land, air, and water.

And achieving 30 percent renewable energy does not mean covering the state in wind turbines or solar panels, or cutting down Michigan's forests for bioenergy. For example, if we were to meet a full 30 percent of Michigan's energy demand with wind turbines alone, only 5 percent of Michigan's farmland would need to host wind farms. And 98 percent of that land would still be available for farming. Further, just tapping into the solar potential of Michigan's urban areas -- meaning rooftops and rural lands not suitable for other development, such as brownfields -- could provide about 25 percent of Michigan's energy demand. These greater levels of renewable energy investment would be a big step forward for Michigan but in fact would only begin to scratch the surface of Michigan's true renewable energy potential

I recognize several committee members have proposed to replace these standards with an integrated resource planning (IRP) process. And while I understand that we are not here today to talk about the proposal put forth in SB 437, I will take this opportunity to commend Senators Nofs and Proos for putting forth an IRP proposal that has clearly been given a lot of thought and effort to accommodate the various interests involved. I look forward to engaging in that discussion in the near future. However, an IRP process should be considered in the context of complementing, rather than replacing Michigan's renewable energy and energy optimization standards.

While an IRP process can drive significant investments in renewables and efficiency if it is carefully crafted and vigorously implemented, the state's renewable energy and energy optimization standards provide far more simplicity and certainty than an IRP process does. And when the evidence is so clear that renewables and efficiency carry with them significant benefits to the people of Michigan, I believe it is critical to preserve these standards rather than replace them with a less robust and more complex mechanism.

Across the country, renewable and efficiency standards are driving cost-effective investments in homegrown energy and local communities, and they are reducing our current over-reliance on fossil fuels, meaning a more sustainable, lower-risk, and cleaner electricity system. Failing to take this opportunity to extend and strengthen Michigan's standards will leave important benefits unrealized in Michigan. And abandoning these standards will make it harder for Michigan to comply with the new federal Clean Power Plan.

Just last week we released a report titled *States of Progress* that highlights how Michigan's current renewable energy and energy optimization standards, combined with announced coal plant retirements, have already moved Michigan more than 60 percent of the way towards compliance with the state's 2022 interim target under the EPA's final Clean Power Plan. As the state considers how best to meet the remainder of its requirements, strengthened standards can provide a straightforward pathway towards continued emission reductions.

By expanding state renewable energy and energy efficiency policies now, Michigan can also take full advantage of the Clean Energy Incentive Program that the EPA established under the final rule. Under the program, states can receive credit for early action by investing in energy efficiency in low-income communities or new wind and solar projects before the Clean Power Plan takes effect in 2022.

Finally, we cannot overlook the risk-mitigating benefits of diversifying the state's electricity portfolio with renewables and efficiency. I strongly agree with previous statements made by the MPSC and others that a more diverse electricity portfolio is a less risky portfolio. Unfortunately, the way Michigan's regulated utility system is designed, the vast majority of these risks falls on ratepayers and are therefore often overlooked or undervalued in the utility planning process. Standards are a good way to help protect against volatile fossil fuel prices, the impacts of future regulations, and the risks of future fuel availability. They also help insulate Michiganders from the public health, environmental and climate change risks associated with investing in the fossil fuel and nuclear resources that the traditional utility business model is built around.

For all of these reasons, I would encourage the Committee to reconsider extending and strengthening Michigan's renewable energy and energy optimization standards.

Another critical element of SB 438 that should be reconsidered is the valuation given to distributed generation, or "DG" resources. The reimbursement for DG resources laid out in SB 438 inappropriately damages the economics of these resources by ignoring the wide range of benefits these resources provide to the electricity system and the cost-savings they can provide for all ratepayers. We recommend removing these sections from SB 438 and instead setting up a process before the MPSC that includes input from stakeholders to determine the true value of DG resources to Michigan.

It is now widely accepted that DG resources provide significantly more benefits to the system and to ratepayers than simply the avoided cost of generation at centralized power plants. As such, DG resources should be valued significantly higher than what is reflected in SB 438. Both Maine and Minnesota have recently concluded proceedings before their utility commissions to determine the value of distributed solar. Both commissions concluded that the value of distributed solar was far higher than just the wholesale cost of electricity. The benefits of DG resources include reduced transmission congestion and, over time, the avoidance of transmission investments, reduced line losses because generation is in close proximity to load, voltage regulation benefits, market response to reduced demand, and - particularly in the case of solar resources - reduced demand for higher-priced peaking resources. Of course, when DG resources are made up of renewable energy technologies, there are also the public health and environmental benefits of avoided emissions.

To illustrate how DG resource can reduce costs for all ratepayers, consider the value as seen by a municipal utility from the cumulative effect of distributed solar PV installed within its service territory. The municipal utility is not a Transmission Owner, and obtains Network (or transmission) Services from an adjacent utility at the posted tariff rate. In PJM, these rates may range from $10,000 to $50,000 per megawatt-year. The cost of that service is paid to the transmission owner based on the municipal utility's demand at the time of the peak, multiplied by the published rate. When the peak load reduction of installed DG causes the municipal utility to have a 1 megawatt lower peak demand, the Network Service charge savings will be $10,000 to $50,000 per year. These savings are then passed on to all ratepayers served by that municipal utility.

Also, SB 438's setting of the price for energy paid at the day-ahead wholesale energy market price misses the opportunity to reflect the hourly price difference of energy and the value of resources that generate on-peak versus off-peak. Part of the value of solar as a mid-day resource is that it's able to generate electricity at times when prices are higher. Further, day ahead prices will not include the highest values that result from unexpected needs (such as during an unexpected outage or extreme heat event), so the decision to set compensation levels at the day-ahead wholesale price rather than "real-time" or actual energy market price inaccurately discounts the value of these resources.

It would be premature to speculate on what the outcome might be of MPSC proceedings to determine the true value of DG resources to Michigan's ratepayers. The range of costs and benefits studied by commissions in Maine and Minnesota highlight the complexity of this issue. But the results of those proceedings strongly suggest that the value of DG resources here in MI is significantly higher than the day-ahead wholesale cost of electricity. We would strongly encourage you to remove the DG resource compensation sections from SB

438 and instead direct the MPSC to initiate proceedings to determine compensation levels for DG resources in Michigan.

Thank you for the opportunity to provide this testimony. I am happy to answer any questions.

Sincerely,

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Documents accompanying this testimony:

1) *Charting Michigan's Renewable Energy Future: Accelerating the transition to clean, affordable, and reliable power*
2) *Michigan's Dependence on Imported Coal. Burning Coal Burning Cash: 2014 Update*
3) *Ripe for Retirement: The Case for Closing Michigan's Costliest Coal Plants*
4) *The Natural Gas Gamble: A Risky Bet on America's Clean Energy Future*
5) *States of Progress: Existing Commitments Put Most States in Strong Position to Meet the EPA's Final Clean Power Plan*
6) *Maine's Value of Solar Study: Key Findings*
7) Memo from Bill Grant, Deputy Commissioner of the MN Department of Commerce, regarding Minnesota's Value of Solar Tariff Methodology.

Subject: Value of Solar Tariff Methodology

To: Solar / Distributed Generation / Net Metering Stakeholders

From: Bill Grant, Deputy Commissioner
MN Department of Commerce, Division of Energy Resources

Date: 8/9/2013

Legislation passed in 2013 requires the Department of Commerce (Commerce) to establish a solar value methodology (Alternative tariff: MN Laws 2013, Chapter 85 HF 729, Article 9, Section 10).

Key points of the statute include (the full language is pasted below):

- As an alternative to net metering, investor-owned utilities may apply to the MN Public Utilities Commission (PUC) for a value of solar tariff that compensates customers through a credit (i.e., moves the netting from the meter to the bill) for the value to the utility, its customers, and society for operating distributed PV systems interconnected to the utility and operated by the customer primarily for meeting their own energy needs. The utility must demonstrate that the alternative tariff appropriately applies the methodology established by the Department and approved by the Commission;
- The Department of Commerce must establish the methodology and submit it to the PUC no later than January 31, 2014. The methodology must include the value of energy and its delivery, generation capacity, transmission capacity, transmission and distribution line losses, and environmental value. The credit will represent the present value of the future revenue streams of these components.

Please note the following draft schedule for upcoming stakeholder engagement regarding Value of Solar (VOS) methodology development:

September 17 (8:30am to 4pm) *Workshop*:

- **Overview – Objectives, Process, Schedule**, Commerce
- **Review of Solar PV Benefit and Cost Studies** Rocky Mountain Institute
- **Stakeholder Q&A**

September 20 – *Initial comments due on VOS methodology*
(send to: DG.Energy@state.mn.us)

These comments will be used to frame the Stakeholders Perspectives portion of the October 1 Stakeholder Workshop

October 1 (8:30am to 4pm) *Workshop*:

- **Proposed approach to methodology**, Commerce and Clean Power Research
- **Stakeholder perspectives**
- **Identification of key issues**, Facilitated discussion

October 15 (8:30am to 4pm) *Workshop*:

- **Discussion and resolution of key issues,** Facilitated discussion with stakeholders, Commerce and Clean Power Research

<u>November 19 (8:30am to 1pm) *Workshop*</u>:

- **Presentation of initial draft methodology,** Commerce and Clean Power Research
- **Stakeholder Q&A**

<u>December 10 – *Comments due on draft methodology*</u>
(send to DG.Energy@state.mn.us)

These comments will be used to inform the final draft VOS Methodology that the Department will submit to the PUC (by January 31, 2014).

Additional details on agenda and location will be provided in the coming weeks.

Please send any questions or comments on this process and schedule to DG.Energy@state.mn.us.

MN Laws 2013, Chapter 85 HF 729, Article 9, Section 10

Sec. 10. Minnesota Statutes 2012, section 216B.164, is amended by adding a subdivision to read:
Subd. 10. Alternative tariff; compensation for resource value.

(a) A public utility
may apply for commission approval for an alternative tariff that compensates customers through a bill credit mechanism for the value to the utility, its customers, and society for operating distributed solar photovoltaic resources interconnected to the utility system and operated by customers primarily for meeting their own energy needs.

(b) If approved, the alternative tariff shall apply to customers' interconnections occurring after the date of approval. The alternative tariff is in lieu of the applicable rate under subdivisions 3 and 3a.

(c) The commission shall after notice and opportunity for public comment approve the alternative tariff provided the utility has demonstrated the alternative tariff:

(1) appropriately applies the methodology established by the department and approved by the commission under this subdivision;

(2) includes a mechanism to allow recovery of the cost to serve customers receiving the alternative tariff rate;

(3) charges the customer for all electricity consumed by the customer at the applicable rate schedule for sales to that class of customer;

(4) credits the customer for all electricity generated by the solar photovoltaic device at the distributed solar value rate established under this subdivision;

(5) applies the charges and credits in clauses (3) and (4) to a monthly bill that includes a provision so that the unused portion of the credit in any month or billing period shall be carried forward and credited

against all charges. In the event that the customer has a positive balance after the 12-month cycle ending on the last day in February, that balance will be eliminated and the credit cycle will restart the following billing period beginning on March 1;

(6) complies with the size limits specified in subdivision 3a;

(7) complies with the interconnection requirements under section 216B.1611; and

(8) complies with the standby charge requirements in subdivision 3a, paragraph (b).

(d) A utility must provide to the customer the meter and any other equipment needed to provide service under the alternative tariff.

(e) The department must establish the distributed solar value methodology in paragraph (c), clause (1), no later than January 31, 2014. The department must submit the methodology to the commission for approval. The commission must approve, modify with the consent of the department, or disapprove the methodology within 60 days of its submission. When developing the distributed solar value methodology, the department shall consult stakeholders with experience and expertise in power systems, solar energy, and electric utility ratemaking regarding the proposed methodology, underlying assumptions, and preliminary data.

(f) The distributed solar value methodology established by the department must, at a minimum, account for the value of energy and its delivery, generation capacity, transmission capacity, transmission and distribution line losses, and environmental value. The department may, based on known and measurable evidence of the cost or benefit of solar operation to the utility, incorporate other values into the methodology, including credit for locally manufactured or assembled energy systems, systems installed at high-value locations on the distribution grid, or other factors.

(g) The credit for distributed solar value applied to alternative tariffs approved under this section shall represent the present value of the future revenue streams of the value components identified in paragraph (f).

(h) The utility shall recalculate the alternative tariff on an annual cycle, and shall file the recalculated alternative tariff with the commission for approval.

(i) Renewable energy credits for solar energy credited under this subdivision belong to the electric utility providing the credit.

(j) The commission may not authorize a utility to charge an alternative tariff rate that is lower than the utility's applicable retail rate until three years after the commission approves an alternative tariff for the utility.

(k) A utility must enter into a contract with an owner of a solar photovoltaic device receiving an alternative tariff rate under this section that has a term of at least 20 years, unless a shorter term is agreed to by the parties.

(l) An owner of a solar photovoltaic device receiving an alternative tariff rate under this section must be paid the same rate per kilowatt-hour generated each year for the term of the contract.

Maine's Value of Solar Study: Key Findings

In response to legislation passed in 2014, the Maine Public Utilities Commission (PUC) conducted a Maine-specific analysis of the quantitative value of distributed solar. They also developed a survey of implementation and policy options used in different states to increase the use of solar. NRCM offers the following summary of key findings and points from the final report.

Value of Solar Methods

- The PUC used several "value of solar" studies conducted elsewhere as a framework for their analysis. The PUC's consultants adjusted those models based on PUC and stakeholder input, then sought and generated Maine-specific data to use.
- The analysis included a detailed simulation to model amounts and times of generation (taking into account weather patterns, etc.) that solar in Maine would yield. They then matched that against demand on the grid, including during peak hours, to calculate the value of solar generation.
- The analysis followed specific legislative guidance. NRCM believes the PUC did a fair and careful job in its model, with the exception of the decision to *leave out* the value solar provides in reducing costs of the local distribution system over time. This value may be small but it is documented by CMP in other cases, and should have been included in the PUC report.
- The output of the analysis was a levelized value of solar that puts the energy and capacity production of solar over a 25 year period in present value cents/kwh.
- The study did not include economic or job creation benefits associated with increased development of solar.

Results of Analysis

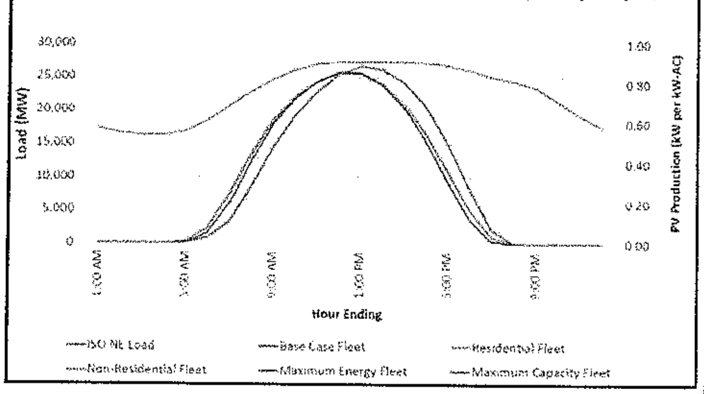
- **The value of distributed solar in Maine is 33.7 cents/kwh** (for CMP territory). This includes many avoided market costs as well as some societal benefits. In the next section is a brief explanation of each of the categories of costs or benefits shown at right.
- The study **confirmed that Maine solar is a good match with daily and seasonal demand for power**. On the annual system peak days from 2011-2013, peak hours were in late July from 9 am - 7 pm. On these days, modeled solar ramped up at 7-8 am and down at 6-7 pm.

25 Year Levelized

Energy Supply	Avoided Energy Cost	$0.081
	Avoided Gen. Capacity Cost	$0.040
	Avoided Res. Gen. Capacity Cost	$0.005
	Avoided NG Pipeline Cost	
	Solar Integration Cost	($0.005)
Transmission Delivery Service	Avoided Trans. Capacity Cost	$0.016
Distribution Delivery Service	Avoided Dist. Capacity Cost	
	Voltage Regulation	
Environmental	Net Social Cost of Carbon	$0.021
	Net Social Cost of SO_2	$0.062
	Net Social Cost of NO_x	$0.013
Other	Market Price Response	$0.066
	Avoided Fuel Price Uncertainty	$0.037

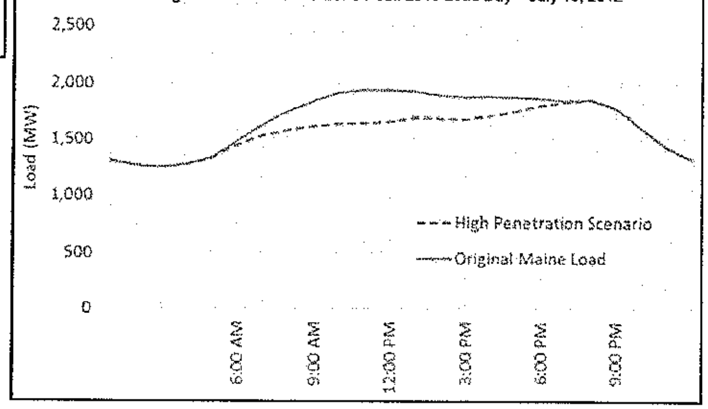
Total Value of solar = $0.337

Figure 15. Normalized Fleet Production vs. ISO NE Load on 2011 Peak Load Day – July 22, 2011



- The match between solar power and peak demand helps explain the value of solar in offsetting both transmission and generation capacity, both of which are rising cost drivers in New England.

Figure 20. Maine Load Zone Peak 2013 Load Day – July 16, 2012



- A simulated "high penetration" of solar capable of producing 5% of Maine's electricity needs would have reduced Maine's peak demand by 100-150 MW (5-8%) on each of the annual system peak days during the last three years, and shaved demand considerably during other hours on those days and many days like them.
- Significant value from solar comes from **reduced need to pay for additional expensive generation capacity**, which is already a growing portion of rates. Solar also **reduces the price for power supply, as well as price uncertainty.**
- The value of distributed solar is also augmented by reduced line losses. Less electricity needed to travel over transmission lines (because the solar is onsite) means less generation is required.

Quantified Values of Solar Included:

- **Avoided energy**: The market value of the electricity as a commodity, which is based on forecasted locational marginal prices for Maine.
- **Avoided generation capacity & reserve generation capacity costs**: A reduction in how much ratepayers have to pay for generation *capacity* to be available when we need it, i.e. the cost of the Forward Capacity Market.
- **Avoided natural gas pipeline cost**: A placeholder category representing the possibility that ratepayers will pay directly for new natural gas pipeline capacity
- **Solar integration cost**: The estimated increased cost of operating and spinning power generation reserves to account for variation in solar production.
- **Avoided transmission**: Reduction in the cost to ratepayers to upgrade and expand transmission systems over time
- **Avoided distribution**: Reduction in the cost to ratepayers to upgrade and expand local distribution systems over time; left as zero for now.
- **Avoided voltage regulation**: A placeholder for the benefit solar could provide in regulating voltage on the grid.

- **Avoided social costs of air emissions**: Avoided emissions of three key air pollutants, using federal studies or regional market prices. Carbon contributes to climate change, SO_2 and NOx are air pollutants that cause smog and respiratory illness.
- **Market price response benefit**: The reduction in power *supply* prices for all ratepayers by reducing the use of more expensive generation at peak times.
- **Avoided price uncertainty benefit**: The financial value of solar as a hedge against natural gas fuel price uncertainty.

Implementation & Policy Options

- The review of policy options used to encourage solar in various states was very comprehensive and not easily summarized.
- One key finding is that states with clear solar policies that use multiple approaches have higher rates of investment in solar. (p.12)
- The analysis found that *sequencing* types of policy approaches has yielded particularly effective results. This starts with policies to remove barriers and increases market access (like interconnection standards and net-metering). Next, policies are needed to help create markets and reduce investor uncertainty (such as Renewable Portfolio Standards.) Further stages are market expansion (such as rebate or tariff policies) and market transformation (such as grid modernization and financing.) (p. 13)
- All of the states surveyed as useful comparisons to Maine utilize net-metering, and all except Maine use some kind of grant or rebate. Many use a Solar REC component of their RPS. (All have an RPS except Vermont, which is still vertically integrated.) Many use long-term power purchase agreements (i.e. long-term contracts), as well as a variety of tariffs or performance incentives. (p. 117)

Union of Concerned Scientists

Michigan well on the path to comply with final Clean Power Plan

The Union of Concerned Scientists released a new analysis, States of Progress, shows that existing clean energy commitments will put most states, including Michigan, well on the path to meeting their Clean Power Plan 2022 emissions benchmarks and 2030 final target. These commitments include carbon caps, mandatory renewable energy and energy efficiency standards, announced coal retirements, and bringing on line nuclear power plants currently under construction.

Using the Clean Power Plan's rate-based approach for setting emissions goals, the analysis shows that:

- **31 states are already on track to be more than halfway toward meeting their 2022 Clean Power Plan benchmarks, with 21 states set to surpass it.** The 31 states are Alabama, Arizona, California, Colorado, Connecticut, Delaware, Georgia, Idaho, Illinois, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Washington, and Wisconsin.
- **20 states are already on track to be more than halfway toward meeting their 2030 Clean Power Plan target, with 16 states set to surpass their 2030 Clean Power Plan targets.** The 20 states are California, Connecticut, Delaware, Georgia, Maine, Maryland, Massachusetts, Minnesota, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Oregon, Rhode Island, South Carolina, Tennessee, Utah, and Washington.

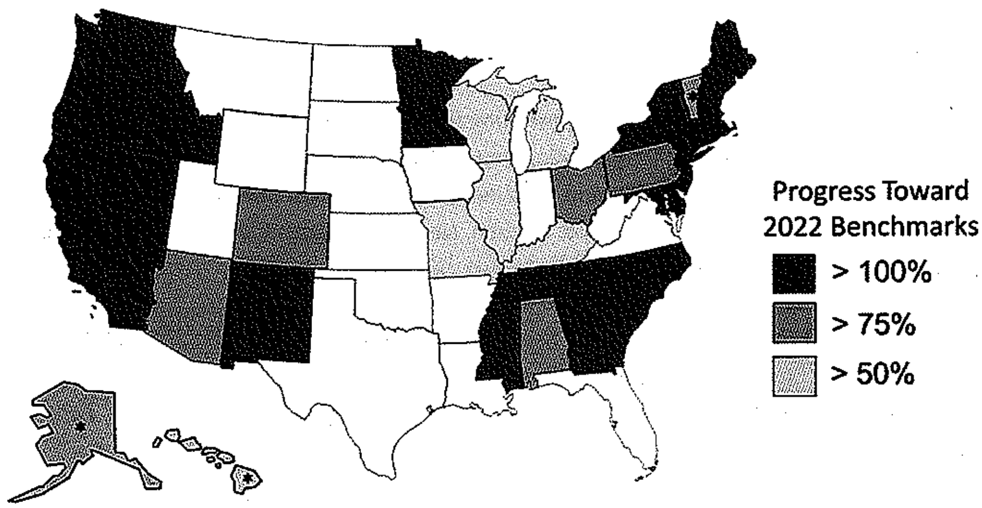
Michigan findings:

- Michigan is on track to be 63 percent of the way towards meeting its 2022 benchmark because of its renewable electricity and energy efficiency standards and announced coal plant closures.
  - The renewable electricity standard requires utilities to produce 10 percent of their electricity from renewables by 2015.
  - The energy efficiency standard requires utilities to reduce energy usage 1 percent a year in 2012 and every year thereafter.
  - In 2013, one coal generating unit in Michigan was shut down. By the end of 2020, another 12 coal units at five plants are scheduled to close, representing 5,242 gigawatt-hours of electricity generation or 10 percent of the state's coal-fired generation.
- Michigan, along with 30 other states, is leading the country, as these states have already taken steps to be more than halfway toward meeting their 2022 Clean Power Plan Benchmarks
- Michigan can meet its mandatory 2030 emissions reduction requirement a number of ways, including:
  - Creating a regional program that allows Midwest states to work together to reduce emissions cost-effectively. Michigan state regulators and utilities are considering this approach.
  - Taking advantage of the state's plentiful wind and solar potential by requiring utilities to provide more electricity from renewables. A UCS study found a 32 percent by 2030 standard would have minimal impact on ratepayers. Thanks to declining costs of renewable energy, DTE meets the current RES requirements with a $0.43 monthly surcharge and Consumers Energy has no monthly surcharge.

More states could reach compliance by joining together with other states in emissions trading programs.

Union of Concerned Scientists

31 States Will Be More Than Halfway Toward Meeting Their 2022 Benchmarks
(Rate-Based Compliance)



*Alaska, Hawaii, and Vermont have no obligations under the Clean Power Plan.

Our analysis

- We looked at four specific actions that states are taking (or have already taken) that will help them meet their emissions reduction requirements under the Clean Power Plan.
  - announced retirements of coal-fired power plants since 2012
  - incremental renewable energy demand from mandatory state Renewable Electricity Standards that comes on line after 2012
  - avoided generation from mandatory Energy Efficiency Resource Standards that occurs after 2012
  - the completion of nuclear power plants under construction as of 2012
- Our calculation assumes that zero-emitting resources like renewables and efficiency displace existing fossil-fired generation in direct proportion to each state's fossil steam and natural gas generation mix.
- We use future electricity sales based on the reference case from EIA's Annual Energy Outlook 2015.
- We include expected retirements of coal plants that have been announced through the end of July 2015 (SNL data).
- We reflect the projected impact of state RES and EERS policies as of July 24, 2015, based on LBNL and UCS calculations respectively.
- We did not include other types of mandatory state measures and programs, apart from EERSs, that could advance energy efficiency.
- We did not explicitly incorporate emissions trading which would allow states to take advantage of low-cost emissions reductions outside their borders, nor do we account for the potential emission reduction benefits from the EPA's proposed Clean Energy Incentive Program.

To learn more about the analysis, please visit www.ucsusa.org/statesofprogress or contact Courtney Hanson at chanson@ucsusa.org or (312) 578-1750, xt. 12.

Union of Concerned Scientists

Charting Michigan's Renewable Energy Future:

Accelerating the Transition to Clean, Affordable, and Reliable Power

Background

Using the *Regional Energy Deployment System* computer model developed by the U.S. Department of Energy, the Union of Concerned Scientists examined the impacts on consumers, the economy, and the environment of extending and strengthening Michigan's renewable electricity standard (RES). UCS studied three scenarios:

1. Increasing Michigan's RES to 32.5% by 2030;
2. Increasing Michigan's RES to 17.5% by 2020; and,
3. No extension or strengthening of Michigan's current 10% by 2015 RES (after leveling off in 2015, the current RES will not drive additional renewable energy development in Michigan).

Key Findings

32.5% by 2030 is Achievable at Virtually No Increase in Electricity Costs

- Michigan can affordably and reliably meet 32.5% of its electricity needs with in-state renewable energy resources by 2030 with just a 0.3% increase in electricity costs between 2014 and 2030.

Significant Benefits of Shifting from Fossil Fuels to Renewables

- A 32.5% RES would drive more than $9.5 billion in new capital investments from 2014 to 2030.
- Instead of spending ratepayer funds to burn more coal and natural gas, a stronger RES redirects these funds towards investment in new clean energy resources in Michigan.
- Shifting to renewables lowers Michigan's exposure to the economic, health, and environmental risks of over-relying on coal or natural gas.
- By 2030, renewable energy facilities would further boost Michigan's economy by adding nearly $570 million annually in maintenance payments and more than $21 million in lease payments to land owners.
- A more modest 17.5% by 2020 RES significantly reduces these benefits without reducing costs.

Sustained Development of Michigan's Renewable Energy Resources

- Michigan would add more than 550 megawatts (MW) of new renewable energy capacity per year, totaling nearly 9,400 MW by 2030, establishing Michigan as a national clean energy leader.

Reduced Carbon Dioxide Emissions

- A 32.5% RES would cut carbon dioxide emissions by more than 65 million tons from by 2030 – equivalent to the annual emissions of 15 typical (600 MW) coal plants – and put Michigan in a good position to cost-effectively comply with pending federal carbon regulations.

<u>Recommendation</u>: *Michigan should extend and strengthen its renewable energy standard to achieve at least 30% renewable energy by 2030. A 30% by 2030 RES is achievable, affordable and will provide significant benefits to Michiganders.*

Find the *Charting Michigan's Renewable Energy Future* report on UCS's website at: www.ucsusa.org.
For more information, contact Courtney Hanson at chanson@ucsusa.org or (312) 578-1750, xt. 12.

Union of Concerned Scientists

NOVEMBER 2012

Ripe for Retirement

The Case for Closing Michigan's Costliest Coal Plants

Michigan faces a once-in-a-generation opportunity to modernize its electric supply and transition to a cleaner energy future. Retiring old coal-fired power plants that are no longer economic to operate, and investing in new energy-saving technologies and clean, renewable sources of energy, offers important economic, public health, and environmental benefits to the state.

More than half of Michigan's electricity is generated by burning coal—a larger share than the national average of 42 percent (EIA 2012; MI PSC 2012). Michigan is also home to one of the oldest and least efficient coal power plant fleets in the nation: 87 percent of the state's coal capacity exceeds the 30-year design lifetime within which coal plants were engineered to operate. More than half of Michigan's coal plants are older than 40 years (built before 1970), and nearly a third began operation more than 50 years ago.

Most of the state's old coal plants lack essential modern pollution controls. The sulfur they emit causes acid rain. The mercury they release poisons waterways and fish and causes neurological damage in children (EPA 2012). The soot they emit causes lung disease and premature death, and triggers asthma attacks (EPA 2010a; NRC 2010). Air pollution from Michigan coal plants caused more than 650 deaths and almost 1,100 heart attacks in 2010 alone, according to one detailed study (CATF 2010). Another analysis estimated that air pollution from Michigan's oldest coal units[1]—those dating from before 1968—caused $5.4 billion in annual health damages (EH&E 2011).

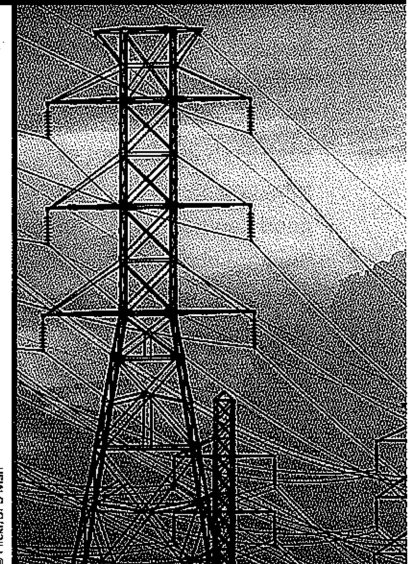
Many of Michigan's coal generators have reached the end of their useful life—it simply makes no economic sense to keep them running.

Coal-fired power plants are also Michigan's largest single source of heat-trapping carbon dioxide emissions, the primary contributor to global warming (EIA 2011a).

These well-documented environmental and public health impacts are reason enough to reduce dependence on coal in Michigan. With the availability of affordable renewable technologies, burning coal to produce power is not only the dirtier choice, but often the more expensive choice as well. Less widely appreciated is the fact that many of Michigan's coal generators have reached the end of their useful life—it simply makes no economic sense to keep them running.

Many Michigan Coal Plants Are Ripe for Retirement

A new analysis from the Union of Concerned Scientists (UCS), *Ripe for Retirement: The Case for Closing America's Costliest Coal Plants*,[2] examines and evaluates the economic viability of coal generators across the nation (including Michigan's fleet) compared with cleaner energy alternatives.[3] The report finds there are many uncompetitive coal generators in Michigan—and nationwide—that operators should consider closing. In an independent, peer-reviewed economic



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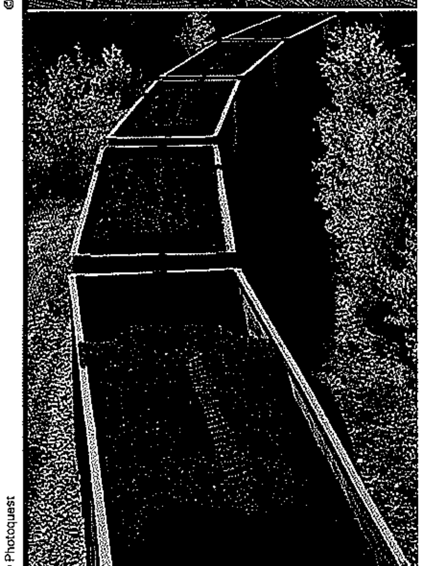

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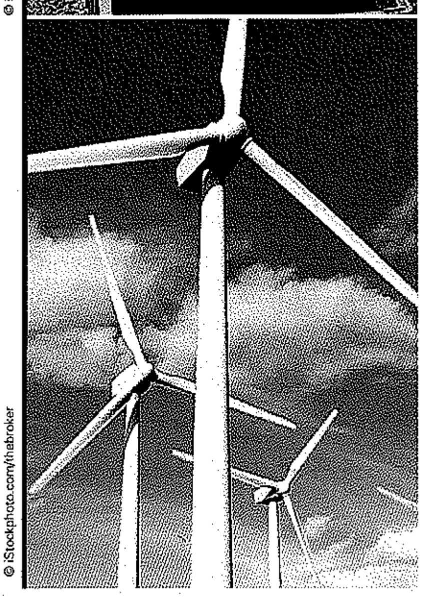

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[1] A power plant comprises one or more generating units or generators.

[2] *Ripe for Retirement: The Case for Closing America's Costliest Coal Plants* is available online at *www.ucsusa.org/ripeforretirement*. A fully referenced version of this fact sheet is also available online at *www.ucsusa.org/ripeforetirement/Michigan*.

[3] Coal-fired power plants may comprise one or more generating "units." A unit is the power production components of a power plant: a generator and the turbine and steam loop that drive it. Many power plants have multiple units that can operate independently. We refer to "units" and "generators" interchangeably. UCS analyzed each utility coal unit in Michigan.

analysis, UCS identified a range of 16 to 32 coal-fired generating units in Michigan—constituting 1,190 MW to 3,532 MW of power generation capacity—as ripe for retirement. These uneconomic coal units represent 10 to 29 percent of Michigan's total coal generation capacity. All are good candidates for closure because they are economically uncompetitive compared with cleaner, more affordable energy sources. Of all the states, Michigan ranks fifth in the amount of coal generating capacity identified as economically uncompetitive and thus ripe for retirement.[4]

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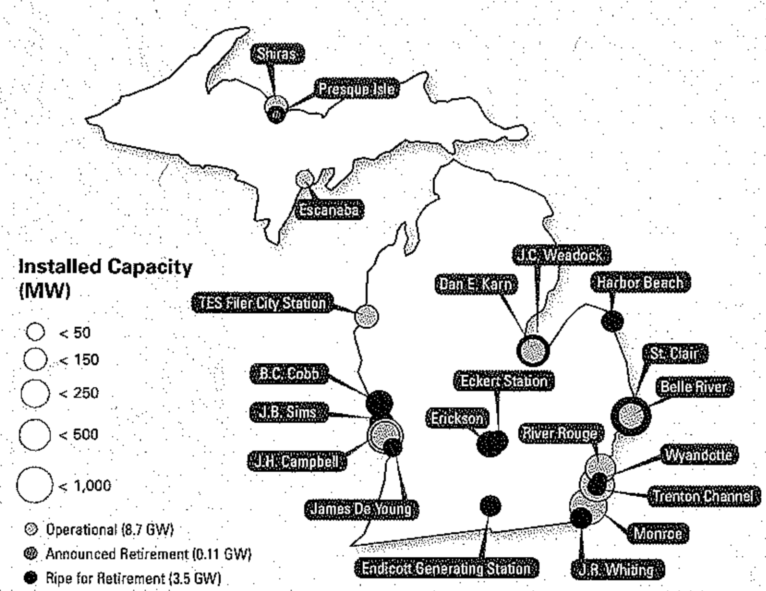
The retirement of old coal generators represents an opportunity to accelerate Michigan's transition to a cleaner energy future by shifting more of the electricity sector's investment dollars away from old coal plants and toward renewable energy resources, energy-saving technologies, an expanded and modernized electric grid and—to a more limited extent—natural gas power plants.

A fork in the road. Over the next several years, power companies in Michigan and across the nation must choose whether to make expensive upgrades to their oldest and dirtiest coal plants or retire them and instead invest in newer, cleaner technologies. *Ripe for Retirement* attempts to characterize which coal generators in Michigan are most economically vulnerable under current and possible near-term economic and regulatory conditions in the electric power market. Our analysis can help utilities, state and federal regulators, and banks decide whether it makes more economic sense to retire certain coal-fired generators and potentially replace them with cleaner energy alternatives, or to sink hundreds of millions—and in some cases billions—of dollars in additional capital into retrofitting them with modern pollution controls.

To evaluate the economic competitiveness of coal generators, we compared the cost of electricity from each of Michigan's coal-fired electricity generating units with the cost of electricity generated from an average natural gas power plant. Specifically, if a coal-fired generator—after installing any needed pollution controls—would be more expensive to operate than a typical cleaner-burning and more efficient natural gas combined-cycle (NGCC) plant, then we consider that coal generator ripe for retirement.

Michigan's Ripe-for-Retirement Coal Generators
(High Estimate by Size of Generators: 32 Generators Totaling 3,532 MW)



There are 20 coal-fired power plants in Michigan that house a total of 49 operating coal generators (excluding industrial and educational facilities and certain small units for which information was incomplete). This map shows the plants by capacity (in megawatts), and identifies those that have generating units already slated for retirement (green) or deemed ripe for retirement (red) compared with existing NGCC plants.

[4] State ranking is based on the high estimate case that compares the cost of producing electricity from coal-fired generators with the cost from existing natural gas combined-cycle power plants.

It is important to note that the analysis conducted for *Ripe for Retirement* is not an evaluation of the coal industry's compliance with federal clean air standards; instead, the report estimates the cost of modernizing the coal fleet to protect public health and the environment by installing the most effective pollution control technologies available.

While some owners are spending hundreds of millions of dollars per plant to add pollution controls, retrofitting old plants may not make sound economic sense. For example, in New Hampshire, the utility owning the Merrimack Station plant just spent $422 million adding pollution controls to two 1960s-era generators. However, in February 2012 the utility decided to idle Merrimack Station for months at a time because it costs substantially more to run the plant than to buy electricity from natural gas power plants elsewhere in New England (Loder 2012).

Coal is losing market share to cleaner energy sources. While coal plants are still the largest source of the nation's electricity, coal's dominance has been eroding for years, shrinking from 52 percent of electricity generation in 2000 to 45 percent in 2010, and is expected to drop to 40 percent in 2012 (EIA 2012a; EIA2012b). In Michigan, coal has slipped from 66 percent of generation as recently as 2009 to 54 percent in 2011 (EIA 2012a; EIA 2011a). One likely reason has been the rising cost per ton of delivered coal, which on a national level has increased every year since 2000. For Michigan utilities, the cost of delivered coal rose 34 percent just between 2010 and 2011 (EIA 2012a). Another factor making coal plants less competitive is the falling cost of alternative sources of energy such as natural gas and wind.

Coal produced 56 percent of Michigan's electricity in 2011, down from 66 percent in 2009, due to higher coal costs, lower natural gas prices, and increasing competition from renewable energy resources like wind power.

Still big polluters. While some plant owners are considering retrofitting old coal generating units with pollution controls that would dramatically improve air quality and save countless lives, those retrofitted generators would still emit enormous amounts of heat-trapping carbon dioxide (CO_2) (see the box). Coal plants are the nation's largest source of the carbon dioxide emissions causing climate change.

Much-needed reductions of CO_2 emissions can be achieved by replacing Michigan's ripe-for-retirement coal generators with cleaner alternatives such as wind and solar power that do not emit CO_2. Boosting production from existing natural gas power plants can cut smokestack emissions on an interim basis because burning natural gas emits about half the CO_2 of coal-fired

Coal's Ongoing Threat to the Climate

The U.S. National Academy of Sciences warns, **"The need for urgent action to address climate change is now indisputable"** (NAS 2009). Human activities, especially our burning of fossil fuels, are changing the climate, causing more extreme weather and posing a grave threat to human health, food and water supplies, global ecosystems, and national security.

Michigan's coal-fired power plants are the state's biggest source of carbon pollution by far, emitting more than all its transportation sources combined (Strait et al. 2008). Coal plants are the largest single source of carbon dioxide (CO_2) at the national level too, contributing one-third of energy-related CO_2 emissions (EIA 2011d).

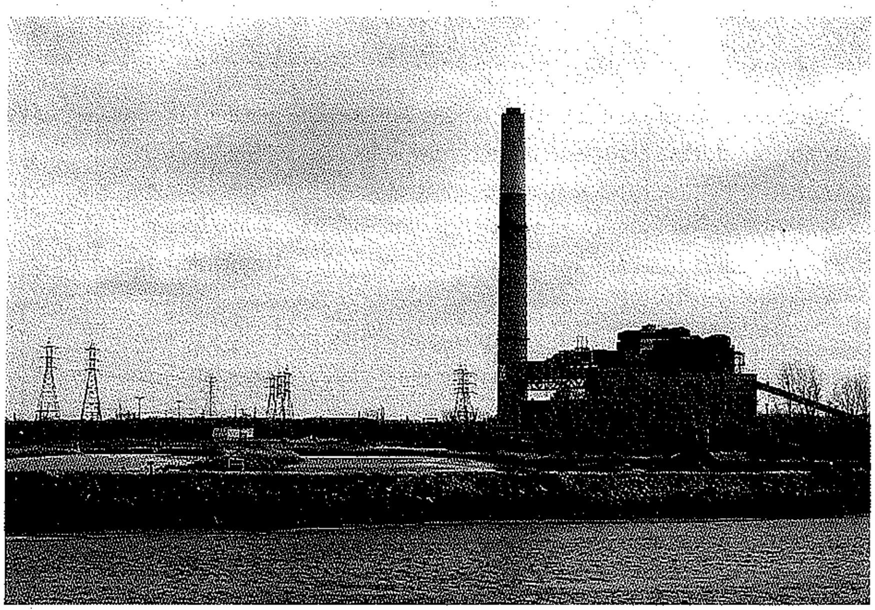
Deep cuts in CO_2 emissions from coal plants are therefore critical to slowing climate change. Carbon capture and storage (CCS)—a technology that might reduce the amount of CO_2 emissions released into the air by liquefying the CO_2 and storing it underground—is being investigated, but it is an energy-intensive process that also faces serious cost hurdles. A better use of this large capital expense could be made by investing it in cleaner, low- or no-carbon alternatives.

plants. Further reductions can be realized by reducing overall power demand through energy-efficient technologies.

Prudent foresight. Many owners of old coal plants around the country have already made the prudent choice to retire their generators. Since 2009, 288 coal-fired generators—about 12 percent of the U.S. coal fleet—have been scheduled for closure. The targeted retirees are among the oldest (with an average age of 50 years), dirtiest, and least-used coal generators. This wave of coal plant closures continues to grow as more and more power plant owners recognize that their old plants can no longer compete. Despite the age of Michigan's coal fleet and compelling economic arguments, the announced retirements in the state are so far quite modest.

State regulators and utilities should begin planning for coal retirements, with a particular focus on the coal generators designated as ripe for retirement in this analysis.

Big decisions ahead. Consumers Energy (CMS), Michigan's second-largest power provider, has announced it will suspend operations at three Michigan coal plants with units dating to the 1950s, though stopping short of officially scheduling their retirement (Consumers 2011). However, the owners of many other old and poorly controlled coal plants have yet to announce whether they will sink more money into them or finally retire them. These owners include Detroit Edison (DTE) (the state's largest power provider, it also owns 64 percent of Michigan's coal capacity), Wisconsin Energy, and several municipally owned utilities (including Lansing, Wyandotte, Holland, and the Michigan South Central Power Agency).



Courtesy of Sierra Club

Consumers Energy, Michigan's second-largest power provider, has announced that it will suspend operations at its B.C. Cobb plant, located at the eastern end of Muskegon Bay, in 2015, along with two other plants (J.R. Whiting and J.C. Weadock). The two currently operational coal generators at the B.C. Cobb plant, which have been identified as ripe for retirement in our analysis, began operations in 1956 and 1957.

Planning the path forward. State regulators and utilities—including municipal utilities that own some of the oldest, most costly coal units—should begin planning for coal retirements, with a particular focus on the coal generators designated as ripe for retirement in this analysis. Systematic planning will help ensure that Michigan maximizes the many benefits of modernizing its power system, while at the same time ensuring reliable and affordable electricity.

Stronger clean energy policies are needed. Michigan is reaping the early rewards of the energy efficiency and renewable electricity standards it adopted in 2008.[5] The state could greatly strengthen those standards, as other midwestern states have already done.

What Makes a Coal Generator Ripe for Retirement?

Our *Ripe for Retirement* analysis identifies the most economically marginal coal generators—those that should be candidates for closure rather than costly retrofits—by following a four-step methodology similar to the approach used by Synapse Energy Economics in its analysis of the economic merit

[5] Michigan law currently requires the state's utility companies to obtain 10 percent of their energy from renewable resources by 2015. Utilities are also required to reduce annual energy consumption 1.5 percent by 2015, through investments in energy efficiency programs.

of coal-fired power plants in the West (Fisher and Biewald 2011).[6,7]

We first calculated the current operating costs of each coal generator by adding the cost of the coal itself (including transportation) to operations and maintenance (O&M) costs, measured in dollars per megawatt-hour of power production. Next, we identified which coal generators are currently lacking key pollution control technologies to reduce emissions of sulfur dioxide, nitrogen oxides, particulate matter, mercury, and other toxic air pollution (further discussed below), and calculated the costs of installing such controls on each generator.

In the third step, we compared the costs of operating each coal generator with—and without—these pollution controls to the costs of readily available and cleaner alternatives, notably new and existing NGCC power plants and wind power. If a coal generator's total cost of power production is higher than at least one of these competing energy alternatives, we deem that generator ripe for retirement. This comparison allowed us to estimate a range of ripe-for-retirement generators in the operational fleet. The lower bound of that range is defined by comparing the costs of each coal generator with *new* NGCC plants, which are more expensive to operate because they are still recovering their capital and financing costs. The upper bound of that range is defined by comparing the costs of each coal generator with *existing* NGCC plants, which are less expensive to operate because their capital and financing costs have been largely recovered.

Natural gas serves as the bounds of our low and high estimates because, in many parts of the country, it is currently the most readily available low-cost power generation option capable of rapidly replacing coal-fired power plants in the near term, and many utilities are already taking steps to make this switch. However, we believe that retiring coal capacity could and should be replaced by a mix of alternatives including renewable energy technologies and reduced demand through energy efficiency.

A wholesale switch to natural gas is not a long-term solution to the climate problem: natural gas is cleaner-burning than coal but still leads to significant carbon dioxide emissions.

As the last step of our analysis, we examined the effect of several variables that could influence the economic competitiveness of the remaining operational coal fleet, including natural gas prices, the availability of federal tax credits for wind power, and a price on carbon emissions.

Natural gas prices. Because fluctuations in the price of natural gas have a substantial impact on the entire electric power industry, we also examined the effect that a lower and higher natural gas price forecast for both new and existing natural gas facilities would have on the economics of coal generators. Our core analysis assumes a 20-year, levelized national natural gas price of $4.88 per million British thermal units (MMBtu), based on the U.S. Energy Information Administration's (EIA's) reference case projections for the electricity sector in its *Annual Energy Outlook 2012* (EIA 2012c). Our low-price case assumes a 25 percent decrease in the EIA's reference case projections to $3.66/MMBtu, while the high-price case represents a 25 percent increase to $6.10/MMBtu.

Wind production tax credit (PTC). We also compared the cost of generating electric power from upgraded coal units with the cost of a new wind facility at a location with average wind resources, under two different scenarios. The federal PTC currently provides a 2.2-cent-per-kilowatt-hour benefit for the first 10 years of a wind power facility's operation. This policy, which has contributed to the significant growth of domestic wind power, is set to expire at the end of 2012. Our PTC scenario assumes the tax credit will be renewed, while our other scenario assumes it expires.

A price on carbon. Nationally and in Michigan, coal plants are one of the largest sources of the CO_2 emissions driving global warming. Our analysis examined the effect of putting a price on carbon as a generic proxy for a constraint on these emissions. We assume a carbon price of $15 per ton, which is consistent with more conservative price forecasts from several government, industry, and expert analyses (Johnston et al. 2011).

[6] A detailed discussion of our cost assumptions and methodology can be found in the full *Ripe for Retirement* report, available online at *www.ucsusa.org/ripeforretirement.*

[7] This analysis focuses on operational plants and excludes certain very small generators for which the data were incomplete (see Table 2); as a result some totals vary slightly from the Michigan totals presented in the full *Ripe for Retirement* report.

All of Michigan's ripe-for-retirement coal generators are good candidates for closure because they are old and economically uncompetitive compared with cleaner, more affordable energy sources.

Which Michigan Coal Units Are Ripe for Retirement?

UCS identified a range of 16 to 32 coal-fired generating units in Michigan as ripe for retirement in our core analysis (Table 1). These uneconomic coal units represent between 1,190 MW and 3,532 MW of coal generation capacity, or 10 to 29 percent of Michigan's total. The high estimate includes the coal capacity already scheduled to stop running (but not yet scheduled to be retired) in 2015. All ripe-for-retirement coal generators are good candidates for closure because they are old and economically uncompetitive compared with cleaner, more affordable energy sources. The *average* age of the coal units under the high estimate is 51 years, weighted by the size of the generator. Seventeen generators came online prior to 1960. Table 2 (pp. 8–9) lists generator-level information for each coal plant in Michigan, including age, ownership, and whether it has been designated as ripe for retirement in our analysis.

DTE and CMS, Michigan's two largest power companies, own the greatest share of the state's economically uncompetitive coal capacity under the high estimate: two-thirds of ripe-for-retirement coal units combined. DTE owns 1,364 MW of ripe-or-retirement units, or 38.6 percent, including two units at the Trenton Channel plant, five at the St. Clair plant, and one at the Harbor Beach facility. CMS owns 971 MW, or 27.5 percent, including the Whiting, Weadock, and Cobb plants where CMS has already decided to suspend operations. Lansing Board of Water & Light, the largest municipal utility in Michigan, ranks third with 530 MW of ripe-for-retirement coal capacity. Other power providers in Michigan that own and operate ripe-for-retirement coal generators include Wisconsin Energy, the Michigan South Central Power Agency, and municipal power authorities in Wyandotte, Holland, and Grand Haven.

Alternative scenarios. This analysis is sensitive to the price of natural gas. Under a higher natural gas price

Table 1. Ripe for Retirement Summary Results

Scenario		Capacity (MW) (% of Michigan coal fleet)	Number of Units	Generation (million MWh) (% of Michigan coal fleet)
Core cases	High estimate (existing NGCC)	3,532 (29%)	32	15.9 (24%)
	Low estimate (new NGCC)	1,190 (10%)	16	3.9 (6%)
Alternative Scenarios				
High gas prices	Existing NGCC	1,930 (16%)	21	7.3 (11%)
	New NGCC	832 (7%)	12	1.9 (3%)
Low gas prices	Existing NGCC	9,047 (74%)	44	46.3 (70%)
	New NGCC	3,099 (26%)	30	14.2 (21%)
Carbon price	Existing NGCC	6,491 (53%)	41	30.6 (46%)
	New NGCC	3,099 (26%)	30	14.2 (21%)
Wind	Without tax credits	887 (7%)	13	2.1 (3%)
	With tax credits	4,451 (37%)	35	19.7 (30%)

Under the two core scenarios—comparing upgraded coal units with existing and new NGCC plants—UCS identified a range of 16 to 32 coal-fired generating units in Michigan as ripe for retirement. These uneconomic coal units represent 1,190 MW to 3,532 MW of coal generation capacity, or 10 to 29 percent of Michigan's total. All are good candidates for closure because they are economically uncompetitive compared with cleaner, more affordable energy sources.

forecast, the amount of economically uncompetitive coal generating capacity decreases to a range of 832 to 1,930 MW (7 to 16 percent of the state's total coal capacity). Conversely, under lower natural gas prices, significantly more coal generating capacity meets our ripe-for-retirement threshold: 3,099 to 9,047 MW (26 to 74 percent).

Under our scenario with a conservatively low price on carbon, 26 percent of Michigan's coal generating capacity is economically uncompetitive compared with new NGCC plants. The amount increases to 53 percent when compared with existing NGCC plants. Of course, because natural gas is itself a fossil fuel and burning it still emits about half the CO_2 of a coal-fired plant, any price on carbon will also raise the cost of natural gas generation.

As Table 1 shows, wind power is cheaper than 13 of the upgraded coal units (887 MW) even if the federal PTC expires at the end of 2012. The amount of ripe-for-retirement coal capacity increases by five times (4,451 MW), however, if the PTC is extended.

Reducing Dangerous Air Emissions from Coal Plants

In Michigan, as in the nation as a whole, coal plants are a dominant source of many dangerous air pollutants. By retiring its dirtiest coal generators, Michigan could greatly reduce emissions of some of the pollutants that take the heaviest toll on public health. It could also reduce these emissions by adding pollution controls to those generators, but as this analysis shows, retrofits would cost more (and yield fewer benefits) for much of the state's coal fleet than replacing these plants with newer, cleaner options.

Eighty-three percent of Michigan's ripe-for-retirement coal generators lack all vital modern pollution controls. Retiring Michigan's dirtiest coal generators could greatly reduce dangerous air pollutants that take the heaviest toll on public health.

Sulfur dioxide (SO_2). Coal plants are the largest source of SO_2 emissions in the country and the state. Michigan coal plants emitted 254,000 tons of SO_2 in 2010—the sixth highest among all states (EIA 2012c). SO_2 causes acid rain that can directly harm the lungs, and it can also be converted into dangerous small particulates that, when inhaled, are a major cause of the hundreds of annual deaths from heart and lung disease linked to Michigan's coal plants (CATF 2010). Scrubbers—a pollution control technology available for decades and used by 6 in 10 coal plants nationwide—can cut SO_2 emissions by 95 to 99 percent (NESCAUM 2011).

Nitrogen oxides (NO_x). Coal plants in Michigan emitted 89,000 tons of NO_x in 2010—also the sixth highest among all states (EIA 2012c). NO_x contributes to the formation of smog, which exacerbates asthma, bronchitis, and other chronic lung conditions (Perera and Sanford 2011). Like SO_2, NO_x contributes to the formation of deadly particulates. The best technology to reduce NO_x is selective catalytic reduction (SCR), which can cut NO_x emissions by 90 percent, and is used by 4 in 10 coal plants nationwide (NESCAUM 2011).

Particulates. Coal plant smokestacks also emit particulates directly. Tightly woven baghouses, which can capture more than 99 percent of particulates, are used at about one-third of coal plants nationally (NESCAUM 2011).

Mercury. According to the U.S. Environmental Protection Agency's (EPA's) Toxic Release Inventory database, Michigan's coal plants are the source of 80 percent of the state's airborne mercury emissions (EPA 2011). Mercury is a potent neurotoxin that threatens the brain development of infants and children; it collects in bodies of water and builds up in the tissues of fish and the people who eat them. Nationally, hundreds of thousands of infants born each year may be exposed *in utero* to enough mercury to reduce their IQs (Trasande et al. 2005). For many coal plants, activated carbon injection (ACI) combined with other pollution controls can reduce mercury emissions by 90 percent or more (NESCAUM 2011).

Injuring public health. The Michigan coal generators designated as ripe for retirement lack modern pollution controls: of the 32 generators identified under the high estimate, 83 percent lack *all four* of the vital control technologies discussed above. Almost all the ripe-for-retirement generators—96 percent—lack scrubbers, and have taken no evident steps to install these life- and health-saving pollution controls. Table 2 shows the control status of each

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Table 2. Which Michigan Coal Units Are Ripe for Retirement?[a]

Coal Generator Age and Performance			Pollution Control Status (IP: in process of being added)[b]				Air Emissions (2009)[c]				Ripe-for-Retirement (R4R) Status by Scenario		
Units/Size in Megawatts (MW)	First Year Online	Capacity Factor (%)	SO_2 (scrubber)	NO_x (SCR)	Particulates (baghouse)	Mercury (ACI)	CO_2 (tons)	NO_x (tons)	SO_2 (tons)	Mercury (plant-wide) (lb)	Low Estimate	High Estimate	Carbon Price
Trenton Channel (Detroit Edison)													
7/120	1949	60	No	No	No	No	521,914	1,192	3,447		Operational	R4R	R4R
8/120	1950	20	No	No	No	No	315,110	683	2,086	185	R4R	R4R	R4R
9/536	1968	68	No	No	No	No	3,319,146	3,286	19,910		Operational	Operational	R4R
St. Clair (Detroit Edison)													
1/169	1953	52	No	No	No	No	823,040	1,474	2,382		Operational	R4R	R4R
2/156	1953	51	No	No	No	No	870,338	1,626	2,608		Operational	R4R	R4R
3/156	1954	52	No	No	No	No	909,502	1,772	2,630	280	Operational	R4R	R4R
4/169	1954	53	No	No	No	No	847,629	1,318	2,509		Operational	R4R	R4R
6/353	1961	51	No	No	No	No	1,482,251	1,193	7,457		Operational	R4R	R4R
7/545	1969	56	No	No	No	No	2,282,730	1,997	11,346		Operational	Operational	R4R
River Rouge (Detroit Edison)													
2/293	1957	78	No	No	No	No	1,741,140	1,462	7,481	153	Operational	Operational	R4R
3/358	1958	68	No	No	No	No	1,776,422	2,878	7,464		Operational	Operational	R4R
Harbor Beach (Detroit Edison)													
1/121	1968	14	No	No	No	No	172,034	460	1,044	N/A	R4R	R4R	R4R
Monroe (Detroit Edison)													
1/817	1971	66	IP	Yes	No	No	4,448,266	6,668	24,947		Operational	Operational	Operational
2/823	1973	70	IP	IP	No	No	4,852,354	8,205	27,230	848	Operational	Operational	Operational
3/823	1973	68	Yes	Yes	No	No	4,792,840	2,515	22,959		Operational	Operational	Operational
4/817	1974	74	Yes	Yes	No	No	5,282,599	2,987	10,762		Operational	Operational	Operational
Belle River (Detroit Edison)													
1/698	1984	85	No	No	No	No	4,929,799	5,324	13,595	328	Operational	Operational	Operational
2/698	1985	86	No	No	No	No	5,147,528	5,111	14,475		Operational	Operational	Operational
J.R. Whiting (Consumers Energy) [Suspension of operations by 2015 announced]													
1/106	1952	73	No	No	No	No	782,173	839	2,568		R4R	R4R	R4R
2/106	1952	72	No	No	No	No	790,438	892	2,540	85	R4R	R4R	R4R
3/133	1953	38	No	No	No	No	485,640	538	1,562		R4R	R4R	R4R
J.C. Weadock (Consumers Energy) [Suspension of operations by 2015 announced]													
7/156	1955	73	No	No	No	No	966,659	1,585	4,439	N/A[d]	Operational	R4R	R4R
8/156	1958	64	No	No	No	No	876,739	1,428	3,997		Operational	R4R	R4R
B.C. Cobb (Consumers Energy) [Suspension of operations by 2015 announced]													
4/156	1956	63	No	No	No	No	941,156	1,699	4,825	79	Operational	R4R	R4R
5/156	1957	60	No	No	No	No	943,695	886	4,805		Operational	R4R	R4R
Dan E. Karn (Consumers Energy)													
1/255	1959	43	IP	Yes	IP	IP	1,117,492	543	4,165	197[d]	Operational	Operational	R4R
2/260	1961	62	IP	Yes	Yes	IP	1,794,719	676	7,138		Operational	Operational	R4R

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J.H. Campbell (Consumers Energy)													
1/265	1962	81	No	No	IP	No	1,988,354	1,520	6,790	431	Operational	Operational	R4R
2/404	1967	46	IP	IP	IP	No	1,538,092	2,405	6,637		Operational	Operational	R4R
3/917	1980	87	IP	Yes	IP	No	7,198,924	4,571	18,370		Operational	Operational	Operational
Eckert Station (Lansing Board of Water and Light)													
1/44	1954	9	No	No	No	No	60,703	68	163	71	R4R	R4R	R4R
2/44	1958	15	No	No	No	No	72,074	101	198		R4R	R4R	R4R
3/47	1960	19	No	No	No	No	102,832	87	263		R4R	R4R	R4R
4/80	1964	41	No	No	No	No	331,548	328	846		R4R	R4R	R4R
5/80	1968	41	No	No	No	No	361,597	358	926		R4R	R4R	R4R
6/80	1970	38	No	No	No	No	330,784	325	831		R4R	R4R	R4R
Erickson (Lansing Board of Water and Light)													
1/155	1973	80	No	No	No	No	1,323,259	1,231	3,543	58	Operational	R4R	R4R
Wyandotte (Wyandotte Municipal Service Commission)													
5/22	1958	20	No	No	No	No	208,073	380	985	8	R4R	R4R	R4R
7/32	1986	47	No	No	No	No	173,574	168	284		R4R	R4R	R4R
James De Young (City of Holland)													
5/29	1969	30	No	No	No	No	115,646	227	654	3	R4R	R4R	R4R
Presque Isle (Wisconsin Electric)													
5/90	1974	55	No	No	Yes	No	481,778	887	1,966	30	Operational	R4R	R4R
6/90	1975	60	No	No	Yes	No	545,762	1,007	2,214		R4R	R4R	R4R
7/90	1978	71	No	No	Yes	Yes	653,175	1,203	1,549		Operational	R4R	R4R
8/90	1978	71	No	No	Yes	Yes	711,891	1,305	1,682		Operational	R4R	R4R
9/90	1979	77	No	No	Yes	Yes	750,525	1,375	1,773		Operational	R4R	R4R
Endicott Generating Station (Michigan South Central Power Agency)													
1/55	1982	56	Yes	No	No	No	478,052	424	1,242	14	R4R	R4R	R4R
J.B. Sims (City of Grand Haven)													
3/80	1983	43	Yes	No[e]	No	No	341,096	379	334	2	Operational	R4R	R4R
Shiras (City of Marquette)													
3/44	1983	74	Yes	No	Yes	No	345,696	247	63	18	Operational	Operational	R4R
TES Filer City Station (TES Filer City Station LP)													
1/70	1990	95	Yes	No	Yes	No	585,239	1,255	582	1	Operational	Operational	Operational

NOTES:

[a] Certain small Michigan coal units are not included in this table or in the aggregate values presented in the text because of a lack of complete data. These include two Escanaba units (totaling 23 MW), two units at James De Young (totaling 33.5 MW), one unit at Shiras (21 MW), and three units at White Pine (totaling 60 MW). Coal units that are nonoperational or operated by industrial facilities or educational facilities rather than by a public utility are also excluded.

[b] Pollution controls are considered in process of being added based on announcements by plant owners, regulatory filings, and communications with state regulators.

[c] Capacity factors and emissions of SO_2, NO_x, and CO_2 are from EIA 2009. Mercury emissions are for 2009 (EPA 2011).

[d] Mercury emissions from both Karn and Weadock are reported together (under Karn). For additional discussion of data sources and limitations, see *Ripe for Retirement* text and appendices.

[e] UCS did not add SCR costs to J.B. Sims because it already uses selective noncatalytic reduction (SNCR) for NO_x control.

continued from page 7

generating unit, and presents the unit's annual emissions of SO_2, NO_x, and CO_2. Mercury emissions are presented for the entire power plant.

The Added Benefits of Retiring Coal Plants

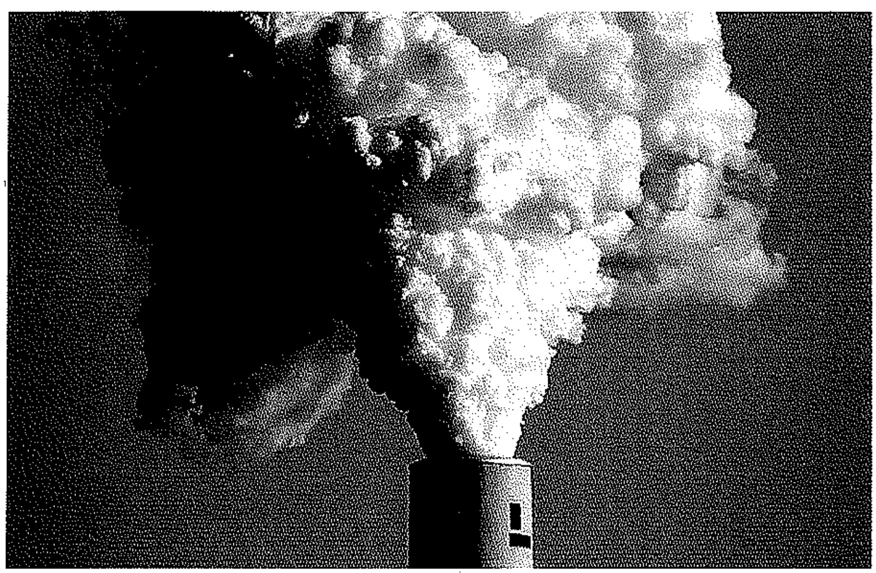
Carbon dioxide. While retrofitting old coal plants with the pollution controls discussed above can greatly reduce SO_2, NO_x, particulates, and mercury, no commercially available pollution control can reduce coal plants' enormous emissions of climate-changing CO_2. However, by retiring its old generators, Michigan can achieve even greater health benefits than retrofits alone could deliver, and realize deep cuts in CO_2 emissions.

By replacing 3,532 MW of coal generators with increased generation from wind power, other zero-emissions sources, and reduced power demand due to greater energy efficiency, CO_2 emissions would be cut by 18.7 million tons annually—equal to 26 percent of the CO_2 emissions from Michigan's total coal fleet. If the coal power is replaced with power from NGCC plants, the net CO_2 benefit would be significantly smaller, but would still be important because NGCC plants emit about 40 percent as much CO_2 as inefficient old coal plants. Adding a $15 per ton carbon price would alter the economics of both NGCC facilities and coal-fired generators, but would affect the coal units far more, providing greater incentive to retire them. Under this case, if all ripe-for-retirement coal generators were shut down, CO_2 emissions would be cut by up to 34.7 million tons annually, depending on the mix of technologies that replaced them.

Nothing in this analysis, however, should be construed as advocating a wholesale conversion to natural gas power generation. Natural gas (methane or CH_4) is still a fossil fuel, and burning it emits vast quantities of CO_2. Moreover, there are many unresolved questions about the amount of methane that leaks into the air that could reduce the climate benefit of natural gas, because methane is a far more potent heat-trapping gas than CO_2. In particular, the extraction of natural gas using "hydrofracking" technology and the transport of natural gas in pipelines create the potential for significant additional global warming emissions.

Cooling water. Retiring coal generators would also remove a major strain on local water bodies. A coal plant can withdraw hundreds of millions of gallons of water daily from adjacent lakes and rivers for cooling purposes. While most of that water is eventually returned, the simple act of removal kills fish and their larvae. Moreover, the waste heat in the returned water can also harm aquatic ecosystems (Averyt et al. 2011). Cooling towers can cut the total water a power plant withdraws by more than 90 percent. While about half of U.S. coal plants have cooling towers, only three of Michigan's coal plants do (EIA 2011e; Shuster 2010).

Ash. Burning coal creates vast quantities of ash that contains arsenic, selenium, cadmium, lead, mercury, and other hazardous chemicals that can leak into ground or surface water when disposed. Studies have found that the landfills at Michigan's Karn and Weadock plants have already leaked arsenic into Saginaw Bay (EIP and Earthjustice 2010). Retiring old coal generators reduces the costs and risks associated with this waste, including the risk that the facility could be required to switch to safer dry-ash handling systems.



Retiring coal generators would cut many harmful pollutants that damage public health and contribute to global warming. Replacing all 3,432 MW of ripe-for-retirement coal generators in Michigan with wind power and other zero-emissions sources would cut 18.7 million tons of CO_2 emissions annually—equal to 26 percent of the CO_2 emissions from Michigan's total coal fleet.

Ideally, an analysis of whether a coal generator is ripe for retirement would consider the costs of lower-impact cooling systems and ash handling. However, because of a lack of consistent data at the generator level, we did not include these costs in our analysis.

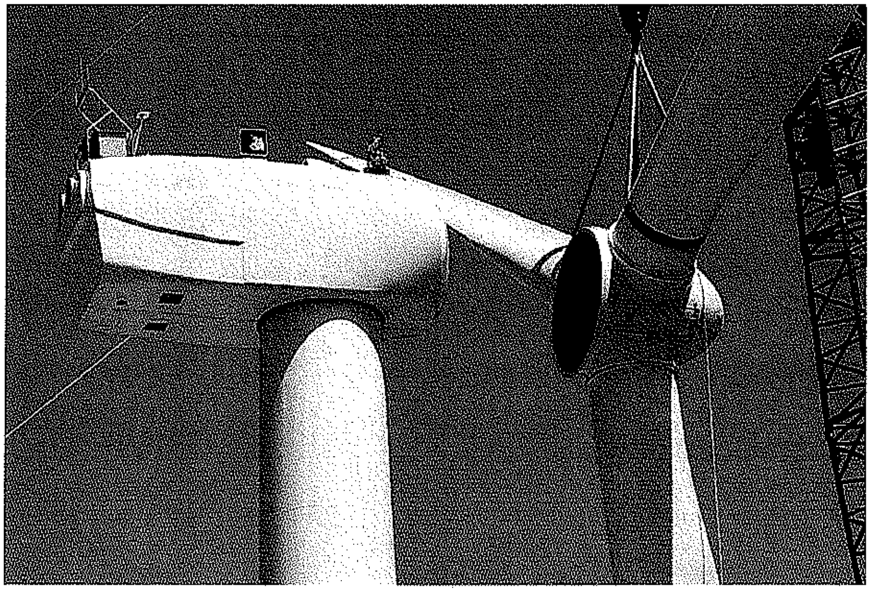
Maximizing the Benefits of Retiring Coal

Strengthening energy standards. Michigan is well poised to shift away from coal toward cleaner, more sustainable energy sources such as wind, solar, and biomass. Michigan also has a wealth of untapped potential for replacing coal-fired power by relying more strongly on energy-saving technologies that can reduce overall demand for electric power.

Michigan took an important first step in moving toward clean electricity in 2008 when it passed a law requiring utilities to use renewables to meet 10 percent of their electricity sales by 2015. State regulators have found not only that utilities are on track to meet this renewable electricity standard (RES) but that it has also spurred more than $100 million in new investments in Michigan. State regulators also reported that the cost of renewable power has been lower than expected, declining over time, and less than the cost of building new coal plants (Quackenbush, Isiogu, and White 2012).

The 2008 legislation also requires utilities to achieve 1 percent annual energy savings by 2012 through energy efficiency investments that cut energy usage and consumers' utility bills. Investing in energy-saving technologies is one of the quickest and most cost-effective ways to transition to a clean energy economy. Michigan regulators estimate that investing in energy savings will cost only 1.6 cents per kilowatt-hour (kWh) for the next few years based on utility filings (Quackenbush, Isiogu, and White 2012). By comparison, the cost of generating and delivering power is far higher (the average retail price of power in Michigan is 9.9 cents per kWh) (EIA 2012c).

To ensure a successful transition to sustainable energy, Michigan should also boost state clean energy incentives, adopt stronger energy efficiency codes for buildings, and implement better processes for planning, siting, and approving clean energy projects. In addition, elected officials should support expanded federal clean energy tax credits and other financial incentives, as well as more research and development funding.



Since 2008, clean energy investments in Michigan have exceeded $100 million, creating more than 10,000 jobs across the state. State regulators reported that the cost of renewable power in Michigan is declining over time and less than the cost of building new coal plants.

Creating clean energy jobs. Michigan has already become a hot spot for the clean energy sector. With the state's strong manufacturing base and highly trained workforce, it is well positioned to create even more jobs in fast-growing clean energy industries. Already, Hemlock Semiconductor and Dow Chemical are investing heavily in major new solar manufacturing facilities in the state, and many businesses are part of the growing renewable energy supply chain. For example, a recent analysis found that Michigan is home to 121 companies in the solar supply chain and 120 companies in the wind supply chain, providing more than 10,000 jobs in the state (Craig, Learner, and Gray 2011).

Accelerating the replacement of coal generators by investing in renewable power and energy efficiency would also let Michigan keep more of its energy dollars in the state. In 2010, Michigan imported all its coal, sending

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A new solar power manufacturing facility under construction in Midland, MI. Dow Chemical expects this facility will begin producing solar shingles in 2012 and will directly create 1,275 jobs (Dow 2011).

nearly $1.3 billion to other states (UCS 2012). From 2002 to 2010, its cumulative purchases of imported coal reached nearly $10.4 billion. Reducing Michigan's reliance on coal could put those dollars to work at home.

Public planning for coal retirements is needed. In many states, utilities must prepare detailed resource plans projecting long-range energy demand and analyzing alternatives for meeting it. The plan's choices and underlying cost/benefit assumptions are then reviewed in public hearings. Michigan utilities are not required to conduct such detailed, long-range public planning, but given the high-stakes decisions on coal plants that lie ahead, such a thorough, public process is needed. The state legislature should enact laws requiring its utilities to routinely undertake such planning.

Meanwhile, each utility that owns or operates a coal plant should prepare a coal retirement/retrofit strategy, clearly showing the long-term cost assumptions of each path and inviting public comment. These strategies should be prepared not only by investor-owned utilities such as DTE, but also by the municipal utilities (such as Lansing) that own some of the oldest, most economically marginal coal generators in Michigan. For retiring coal generators, utilities should develop an economic transition plan for both the affected workers and the broader community to help minimize any dislocation that may result from a plant closure.

Certainly, any utility expecting to charge ratepayers for the costs of retrofitting a plant should make an explicit case that retrofits make more economic and environmental sense than retirement. This case should consider the many financial risks associated with investing in coal (as detailed in both *Ripe for Retirement* and another recent report by UCS, *A Risky Proposition: The Financial Hazards of New Investments in Coal Plants* (Freese et al. 2011).

Regulators and citizens should demand a particularly rigorous demonstration of economic competitiveness and environmental benefit before any utility makes major new investments in any coal generator listed as ripe for retirement in this fact sheet.

Making the transition to a modern and sustainable energy system involves more than just adding new clean power sources to the grid—it also requires getting the dirtiest old power sources off the grid. Stronger clean energy policies and a long-term planning perspective will help Michigan maximize the environmental and economic benefits of a cleaner energy future, while maintaining reliable and affordable power for Michigan's families and businesses.

The fully referenced report and technical appendices are available online (in PDF format) at *www.ucsusa.org/ripeforretirement*.

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FACT SHEET

BURNING COAL, BURNING CASH: 2014 UPDATE

Michigan's Dependence on Imported Coal

The cost of importing coal is a drain on the economies of many states that rely heavily on coal-fired power. Thirty-seven states were net importers of coal from other states and nations in 2012. The scale of Michigan's annual coal import dependence is discussed here, along with ways to keep more of that money in-state through investments in energy efficiency and homegrown renewable energy.[1]

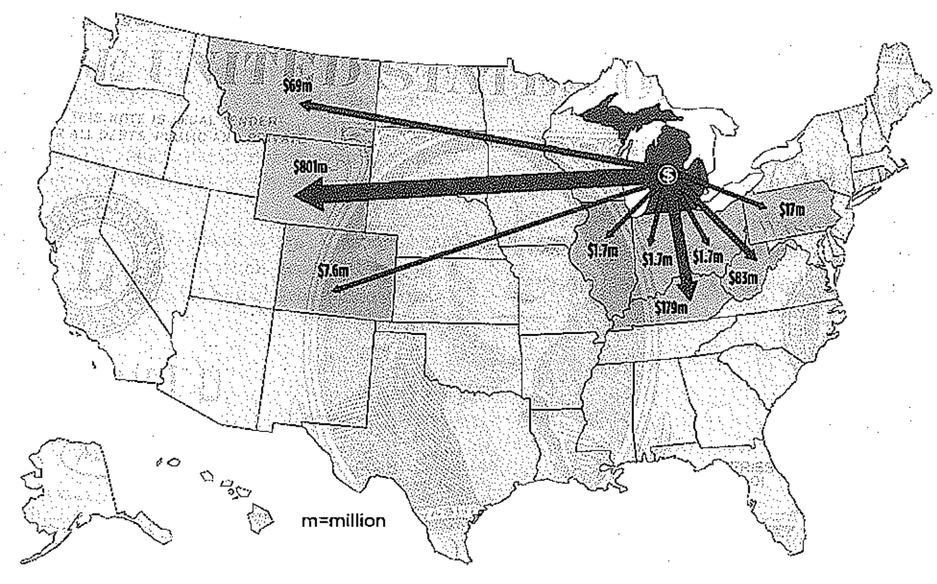
Despite having no in-state coal supplies, Michigan relied on coal for 49 percent of its in-state electricity generation in 2012 (EIA 2013). To supply that power, Michigan's power producers paid nearly **$1.2 billion** to import 21 million tons of coal from nine states, mainly from Wyoming. As a result, Michigan ranks sixth nationally, and first in the Midwest, for money spent on net coal imports.

DTE Energy, the state's largest power provider, sent $597 million out of Michigan to purchase coal in 2012—more than half the state's total. Consumers Energy, the state's second-largest utility, purchased $429 million in coal imports that year.

Michigan's dependence on coal generation has been declining as a result of flat power demand and the growth of cleaner, more affordable alternatives like natural gas and wind. From 2008 to 2012, natural gas generation in Michigan more than doubled from 8 percent to 20 percent as coal generation declined from 61 percent to 49 percent (EIA 2013). The tonnage of coal imported declined by 42 percent during this same period. Yet, coal expenditures dropped by just 14 percent as the average price paid for coal in Michigan increased by 47 percent from $37.67 per ton to $55.22 per ton.

While switching from coal to natural gas offers some near-term air quality and cost benefits, there is growing evidence that an overreliance on natural gas poses significant and complex risks to consumers, the economy, public health and safety, land and water resources, and the climate (Fleischman, Sattler, and Clemmer 2013). A better solution for consumers and the environment would be to replace more coal generation with renewable energy and energy efficiency.

FIGURE 1. Nearly $1.2 Billion Leaving Michigan to Pay for Imported Coal



The nearly $1.2 billion spent to import coal is a drain on Michigan's economy, which relies on coal for 49 percent of its power generation. Investments in homegrown renewable energy and energy efficiency can affordably help redirect funds into local economic development—funds that would otherwise leave the state.

Note: Based on 2012 data. Not all these funds will necessarily land in the state where the mining occurs. Mine owners may divert the profits to parent companies in other locations, for example. Amounts also include the cost of transportation.

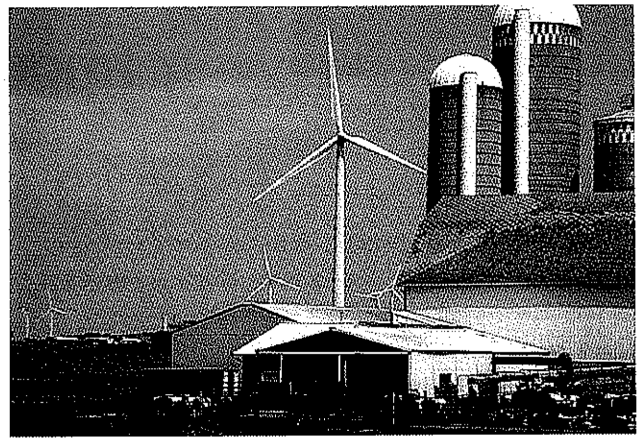
Clean Energy Can Boost Michigan's Energy Independence

Investing in homegrown renewable energy is a smart and responsible solution to reducing Michigan's dependence on imported coal and keeping more money in the local economy. Michigan has a wealth of renewable energy resources like wind, solar, and bioenergy; yet these resources supplied just 4.4 percent of the state's power in 2011. Utilities are on track to meet a requirement to produce 10 percent of the state's power needs from renewable energy by 2015 at lower costs than originally expected due largely to falling wind power prices (MI PSC 2013a). But Michigan can do much more.

A recent report from the Governor's staff found that Michigan could cost effectively achieve at least 30 percent renewable energy with in-state resources while maintaining reliability (Quackenbush and Bakal 2013). Increasing the renewable energy standard to this level would place Michigan among the national leaders (of the 28 other states with similar standards, 17 have targets of 20 percent or more) and build on the $1.8 billion that has already been invested in local renewable energy projects through 2012 (MI PSC 2013a).

Michigan also took an important step to tap into its tremendous energy efficiency potential in 2008 by requiring utilities to reduce electricity use, ramping up to an annual savings of 1 percent by 2012. The policy has been a success—in 2012, electric utilities exceeded their annual targets and achieved lifecycle savings of at least $936 million in energy costs, a savings of more than $4 for every dollar invested in energy efficiency (MI PSC 2013b).

Twenty-three other states have adopted similar power-saving targets, with several committing to annual savings of at least 2 percent. A 2013 analysis commissioned by Michigan's Public Service Commission found that utilities could cost effectively reduce electricity use by 1.7 percent per year over the next 10 years (or 17 percent total) (GDS Associates, Inc. 2013). This commitment could strengthen local economies, and save consumers up to $13 billion during that time. It could also further reduce money leaving Michigan to pay for coal imports.



Michigan's renewable energy and energy efficiency standards are effectively and affordably spurring in-state clean energy development, which can help reduce the state's dependence on imported coal while creating jobs and other economic and environmental benefits. Photo source: R. Baranowski/NREL

ENDNOTES

1 *This fact sheet is based on the findings from an update of* Burning Coal, Burning Cash: Ranking the States That Import the Most Coal, *a 2010 analysis by the Union of Concerned Scientists. More information about our methodology and assumptions, as well as other state profiles, can be viewed at www.ucsusa.org/bcbc2014update.*

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