

A Green Energy Alternative for Michigan

Executive Summary	2
-------------------------	---

1. Introduction.....	10
----------------------	----

2. Grappling with Energy in Michigan.....	12
2.1. Michigan’s Changing Demand	14
2.2. Steps to a New Direction Michigan Energy.....	15
2.3. Michigan’s Energy Plan.....	16
2.4. Implications of a Fossil Plan for Michigan.....	18
2.4.1. Power Plant Construction and Operation Cost Risks.....	18
2.4.2. Risk of Air Pollutant Emissions Costs.....	18
2.4.3. Costs of Greenhouse-Gas Emissions	19

3. Michigan’s Green Potential	22
3.1. Energy-Efficiency in Michigan	24
3.1.1. Energy-Efficiency Potential.....	24
3.1.2. Demand Response Potential.....	26
3.1.3. Combined-Heat-and-Power Potential.....	26
3.2. Michigan’s Potential for Renewable Energy.....	29
3.2.1. Biomass Potential.....	29
3.2.2. Landfill-Gas and Municipal-Solid-Waste Potential.....	30
3.2.3. Solar Photovoltaic Potential	30
3.2.4. Onshore Wind Potential.....	31
3.2.5. Offshore Wind Potential.....	32
3.3. Jobs from Energy Efficiency and Renewable Energy.....	33

4. A Robust Energy Alternative for a Resilient Michigan	36
4.1. Michigan’s Alternative—Reducing Reliance on Fossil Fuels.....	38
4.2. Planning For a Clean Efficient Future	41
4.2.1. New Assumptions Based on New Experience.....	41
4.2.2. An Integrated Resource Plan.....	41
4.3. Energy Efficiency: Capturing the Potential	42
4.3.1. Increasing Generation at Michigan’s Existing Gas-fired Power Plants ..	42
4.3.2. Efficiency: Getting the Most out of Electricity	43
4.4. Tapping Into Renewables.....	46
4.4.1. Renewable-Portfolio Standards.....	46
4.4.2. Renewable-Energy Payments.....	48
4.4.3. Distributed Renewable Resources.....	49
4.4.4. Pricing Renewable Energy.....	50
4.4.5. Program Synergies.....	50
4.4.6. Appropriate Biomass	50
4.4.7. Catalog and Claim Renewable Energy.....	50
4.4.8. Passive Solar and Solar Thermal	50
4.5. Recent Congressional Action on Renewable Energy and Energy Efficiency: The Economic Outlook	51

5. Conclusions.....	52
---------------------	----





Executive Summary:

A Real 21st Century Energy Future for Michigan

Michigan's Electric Industry and the PSC Plan

Michigan's electricity currently comes primarily from large baseload coal and nuclear generating stations with some additional generation from natural gas-fired plants. For example, in 2005, approximately 58% of the power generated in the state was produced at coal-fired power plants. By comparison, only about 3% of the power generated in the state was from hydroelectric and other renewable facilities. See *Figure ES-1*.

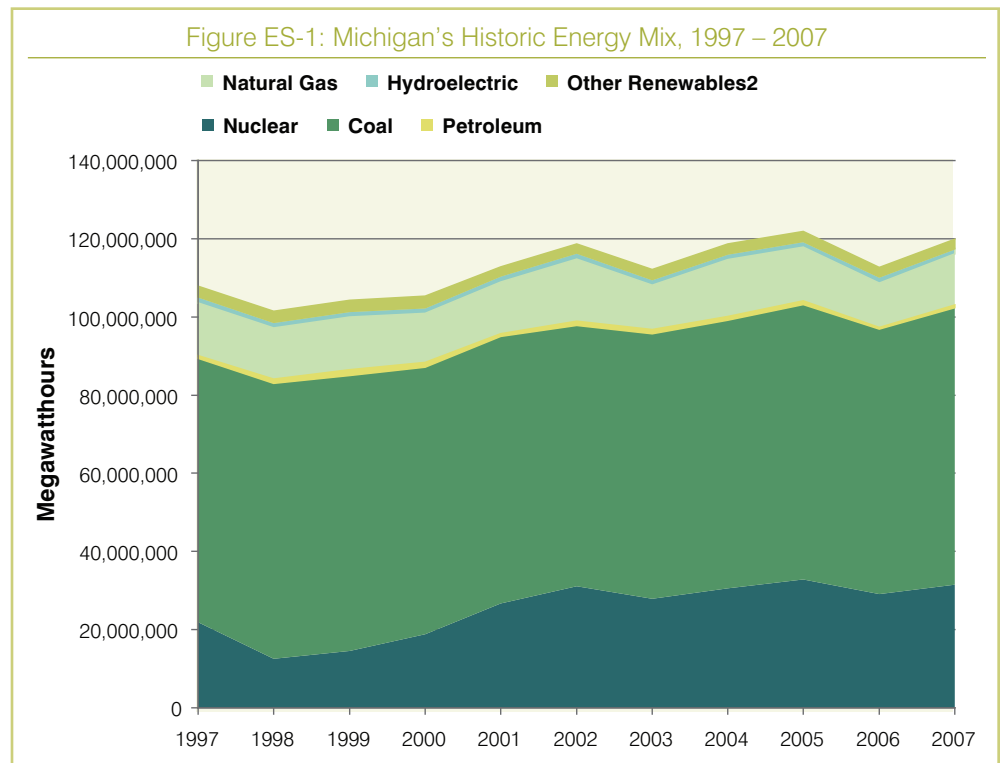
In determining how to respond to current circumstances and anticipated electricity usage, Michigan policy-makers must consider carefully whether to perpetuate Michigan's historic heavily fossil-fired energy mix or to accelerate diversification and innovation.

The 21st Century Electric Energy Plan projected that by 2020 the state would require 10% to 17% more electric energy than 2008. The Plan maintained the status quo by adding new coal-fired central station generation to meet this expected growth in energy usage. Renewables were increased somewhat, and the Plan also anticipated that energy efficiency could reduce demand slightly.

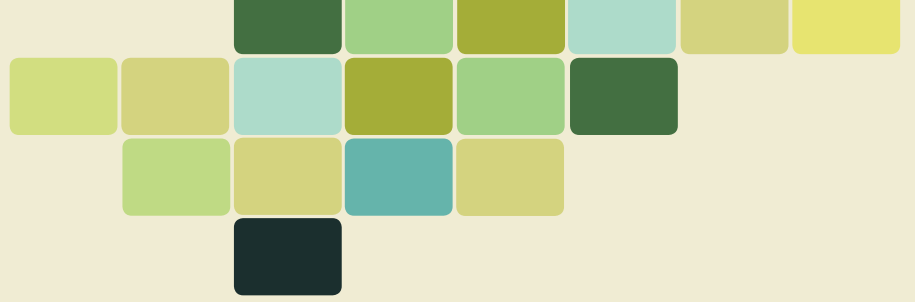
However, contrary to the increase that was projected in the 21st Century Electric Energy Plan, electricity sales decreased, by 3.4% in 2008 and are expected to decline by an additional 6.7% in 2009.

In fact, rather than projecting any significant growth in sales or loads, the two largest electric utilities in the state, Consumers Energy and Detroit Edison Company, are now forecasting that consumption will be flat through 2016 and that customer loads actually will decline from 2007 to 2013 (0.3% and 0.8%, respectively). For example, Consumers Energy is forecasting a 2019 summer peak of 8,356 MW compared to a 2008 peak of 8,799 MW. Detroit Edison is forecasting a 2013 summer peak of 11,529 MW, compared to a 2007 peak of 12,229 MW.¹ The bases for these forecasts are declining population, saturation of the residential air-conditioning market, and adverse economic conditions.² Together with forecasts from the Indiana Michigan Power Company,³ the combined forecasted demand from these three major utilities is 1.7% lower in 2013 than 2007.

Due to shifts in consumption patterns, Michigan's generation no longer corresponds to its demand. The large baseload units are ill-matched to the fluctuating load-shape of Michigan's demand today. New baseload units would not resolve this problem. The appropriate response is to shave peak demand with efficiency and demand-response programs, and to meet new supply needs with small and nimble resources that can follow load, such as CHP, renewables, and natural-gas. Michigan has all the resources it needs to do this without any new coal—indeed, even assuming significant retirements of coal capacity. In preferred alternative scenarios, energy efficiency, and renewables—chiefly wind—replace coal at less cost and more reliability.



¹ <http://efile.mpsc.cis.state.mi.us/efile/docs/15677/0001.pdf> Case U-15677, Exhibit A-8, Witness S. L. Seifman, September 2008. ² Consumers Energy load forecasting, presentation to Michigan Load Consortium, November 18, 2008. ³ MPSC. U-15676. Sept. 30, 2008. Ex. IM-1



21st Century Choices

Michigan is at the cusp of important decisions regarding its energy future. Already, the state has taken some important steps in shaping that energy future. It has begun to acknowledge the importance of long-term and sustained commitments to efficiency and renewable energy by establishing binding targets for renewable-resources, and mandating comprehensive energy planning for utilities.⁴ Michigan also has a climate action plan, and a requirement for the Department of Environmental Quality to consider the need for and all feasible and prudent alternatives to the construction of any new coal-fired power plant.

Any new plan must of course satisfy these requirements, and respond to other major factors. Michigan, as well as the nation, is suffering a significant economic downturn with large impacts on jobs, business, electrical demand, and citizens' ability to absorb cost increases. The electricity customer base is shifting towards residential customers and away from industry. And finally, the United States is on the verge of enacting limits on greenhouse gas emissions that will affect the economics of all resources in the electric industry.

Designing a plan that is responsive to all of these factors is challenging. The 21st Century Electric Energy Plan was a good first step when it was prepared. Unfortunately, the Plan was based on analyses that are now outdated and it does not meet the challenge or position Michigan well for the future. In the absence of an updated plan, the state is at the risk of moving in exactly the wrong direction. Michigan is facing a flood of power plant proposals, well in excess of even what was envisioned in the 21st Century Electric Energy Plan. These proposals would lock Michigan's ratepayers into expensive and escalating coal plant construction costs, high operating costs that ship money out of state through coal purchases, and years of costly greenhouse gas emissions.

- The six new coal plants that are being proposed in Michigan to meet future demand could cost state ratepayers in excess of \$12 to 14 billion. Due to long lead times, no new coal plant could be in service before 2015 or 2016, at the earliest; no new nuclear power plants could be in service before 2020, if then. A plant must operate for decades in order to fully recover its capital costs.
- Each new plant would export tens or even hundreds of millions of dollars each year out of state in fuel costs since Michigan has no indigenous coal. Fuel costs are the largest operating costs for coal-fired plants.
- If they generate at expected levels, the six proposed coal plants would emit an estimated 19 million tons of CO₂ each year for an estimated 60 year operating life. That would mean an additional 1.2 billion tons of CO₂ being emitted into the atmosphere.

- Federal regulation of greenhouse gas emissions is inevitable. The new coal plants being proposed for Michigan would expose the state's ratepayers to the cost of CO₂ emissions allowances amounting to between \$260 and \$800 million annually in their early years of operation, and to between \$760 million and 2.3 billion annually in later years.⁵

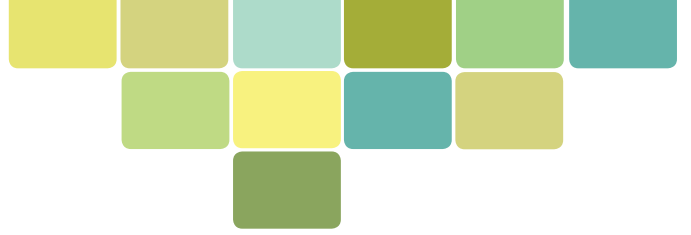
Chapter 2 discusses in detail the many disadvantages of investment in new large coal plants now. By comparison, investments in energy efficiency and demand response, examined in Chapter 3, will produce real and cumulative benefits in both the short term and the long term, regardless of Michigan's energy demand. They entail less financial risk, are modular and scalable, and emit no greenhouse gases. Plant owners and ratepayers face a much smaller risk of having to pay for too much capacity or for outdated technology with these smaller, more flexible, and quicker resources, compared to an investment in one large power plant based on a single technology such as coal.

Policymakers need not ignore sound energy planning in the face of economic crisis. Indeed the most competitive economies in the 21st Century will be those that are innovative and efficient in energy and resources use. Michigan needs a plan that uses current resources effectively, adds new clean modular resources to create greater flexibility, avoids expensive greenhouse gas emissions, and offers jobs. Fortunately, the State has the means to create such a plan through developing its available resources in energy efficiency and renewable energy.



⁴ Act 295 will set a renewable-portfolio standard, essentially renewable-energy targets for utilities. Renewable-portfolio standards are the prevailing mechanism to support new renewable energy in the U.S. Act 286 requires integrated resource planning, the comprehensive least-cost energy-planning discipline that is used in other states; it is discussed further in Section 4.2.

⁵ See Appendix A.



Michigan's Large Clean Energy Potential

Michigan has substantially more energy efficiency and renewable resource potential than is included in the 21st Century Electric Energy Plan:

- The potential for a 7,000 MW reduction in loads during peak demand periods through energy efficiency and demand response technologies.⁶ This nearly 30% reduction would save nearly 19,000 GWh of energy annually—approximately 17% of the state's total energy consumption in 2008. The levelized cost of these savings would be only 2.9 cents per kilowatt-hour, far lower than the cost of generating power at any of the proposed coal-fired power plants.
- The potential for 6,500 MW of combined heat and power facilities beyond the PSC's estimate of 4,580 MW already online in the state.⁷ We estimate that approximately 1,950 MW, or 30% of that potential, could be built over the next decade.
- The potential for more than 76,000 MW of potential renewable resources such as wind, biomass and solar, of which approximately 9,000 MW can be economically developed by 2025. These resources would generate over 27,000 GWh energy annually, or more than one third of today's demand.

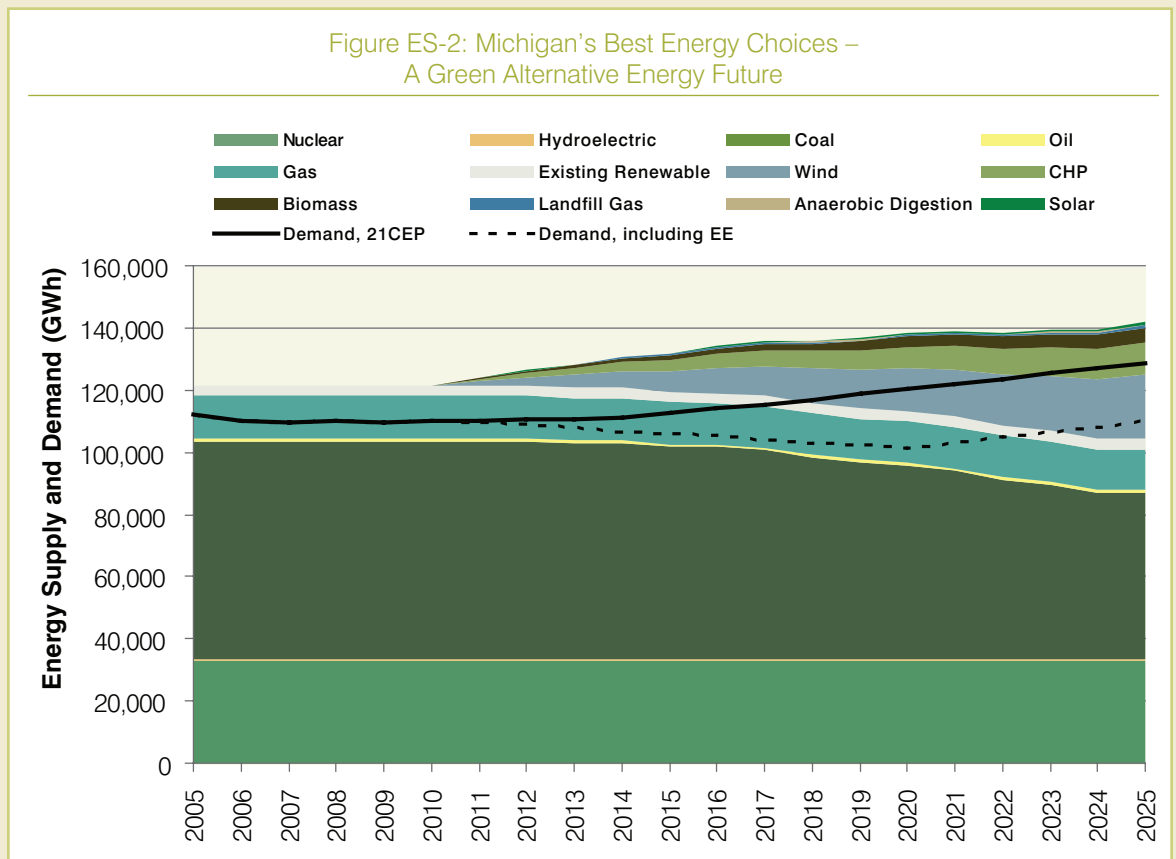


⁶ Estimate for 2019 relative to baseline. ⁷ Combined heat and power uses the waste heat from energy production or industrial processes for such end-use purposes as hot water or steam.

An Alternative Green Energy Future for Michigan

Michigan can implement rigorous cost-saving energy-efficiency mechanisms, develop new renewable-energy resources, and employ thousands of skilled workers in a new green-energy economy by developing a long-term plan with a broad portfolio of options. Other states serve as models to build upon. Chapter 4 describes policy options.

Here, we present an alternative to the coal-dependent 21st Century Electric Energy Plan through which Michigan could meet its power needs, retire inefficient and polluting fossil generators, and achieve a 20% renewable-portfolio standard by 2020 (about twice the levels required under Act 295). See *Figure ES-2*.





Jobs from Energy Efficiency and Renewable Energy

Since the late 1990s, there have been a series of assessments of the employment opportunities that could be generated by the renewable-energy and energy-efficiency industries. These assessments almost uniformly have concluded that investments in renewables and efficiency provide a significant net employment benefit relative to energy supply from traditional fossil resources. In particular, because the individual units of renewable energy projects are smaller (e.g. wind turbines versus a single large coal plant) and are increasingly produced and installed locally rather than by out-of-state contractors, more employment benefits accrue in-state. Energy-efficiency programs rely on large numbers of installers, contractors, and laborers, work that cannot be outsourced, confers local economic benefits, and provides local jobs.

For example a study of the economic impact of the implementation of a Renewable Portfolio Standard and an Energy Efficiency Program in the State of Michigan, produced by NextEnergy Center for the Michigan Department of Environmental Quality, found that:

- Energy efficiency programs will cause a significant improvement in Michigan's economy.
- Renewable portfolio standards (RPS) will cause a moderate improvement in Michigan's economy.
- Combining an energy efficiency program with an RPS will cause the largest improvement in Michigan's economy.
- Together, energy efficiency programs combined with an RPS will significantly reduce Michigan's CO₂ emissions.
- Manufacturing renewable energy components will improve Michigan's economy.⁸

The study found that a Moderate RPS combined with a Moderate energy efficiency program would create approximately 19,000 more jobs within the study period than a base case that added new coal-fired power plants.⁹ This scenario assumed that the components for new wind facilities would be produced in Michigan. The Moderate RPS combined with a Moderate energy efficiency program would create over 17,000 jobs during the study period even if the wind components were manufactured out of state.

We have concluded that the NextEnergy Study for the Michigan Department of Environmental Quality significantly understates the number of new jobs that could be created by an aggressive RPS and aggressive energy efficiency investments because it understates the potential for achievable cost-effective energy efficiency and renewable resources in the state. Thus, we recommend more aggressive investments in energy efficiency that would create significantly more new jobs. The same is true for renewable resources. The investments to build and operate the new wind, biomass, photovoltaic, landfill gas, and digestion facilities that would generate this additional renewable energy would create substantially more jobs than building new coal-fired power plants.

Conclusion

This report discusses policies and measures that are cost-effective and have measurable benefits. As Chapter 4 explains, achieving the above energy potential will require sustained and consistent commitment. Though dire economic conditions increase the lure of quick fixes to pull the state from its current gloom, recovery will be slower, weaker, and more fragile if Michigan does not reduce its dependence on fossil fuels. A clean energy portfolio promotes economic recovery within the state in three ways:

- creating jobs in the manufacture and/or installation of wind turbines and solar cells, and implementation of efficiency improvements to homes, businesses and other buildings;
- retaining energy dollars in-state that would otherwise be used to purchase energy resources and services out-of-state; and
- leading to lower future energy costs, thereby promoting the general economic health of Michigan businesses and citizens.

Michigan's future can be very bright; the current period of reduced electricity consumption offers breathing room to build intelligent new energy infrastructure that will reduce energy demand and provide new, clean energy even as the economy recovers. Michigan's best option for the 21st Century is to develop its strong energy efficiency and renewables potential rather than build new large central generating stations. Both options keep the lights on—but only one offers clean energy, Michigan jobs, and resilience in the face of changing circumstances.

1. Introduction





Michigan is planning for its electricity future. In 2007 the Michigan Public Service Commission issued an electricity plan titled “The 21st Century Electric Energy Plan.” The plan projected steady growth in electricity demand and anticipated a need for significant investment in baseload coal-fired generation. Such a plan might work in an era of steady demand growth, predictably low costs for coal-fired electric generation, and little concern over air emissions and global warming. However, that is not today’s world. The 21st Century Electric Energy Plan is ill-suited to the broader context framed by the national economic downturn and developing federal energy policy, and is already outdated due to changing circumstances in Michigan. Instead of propelling Michigan forward, implementing this plan will set Michigan back and saddle citizens with high costs.

The citizens of Michigan deserve better—they deserve a plan that will be robust under a wide variety and combination of futures, that is responsive to Michigan’s emerging policies, that reflects awareness of federal policy on carbon emissions, and that will minimize financial risk for Michigan’s citizens and businesses.

An alternative plan, built upon promoting efficient energy use and adding renewable energy, will be more resilient under changing economic circumstances in a carbon-constrained world. Michigan has plentiful energy efficiency and renewable resources that are ready to develop; in combination with more efficient use of existing natural gas-fired generating capacity, these will serve as the foundation of a solid and cost-effective electricity future. A critical benefit of such an approach would be the additional jobs for skilled workers that can emerge from growth of the energy efficiency and renewables industries in Michigan.



2. Grappling with Energy in Michigan





Michigan today faces a changing and uncertain world. The electricity consumer base is shifting, electrical demand is down and the federal government is preparing to regulate carbon emissions. Michigan citizens, business, and institutions are tightening their belts through this difficult economic period.

As shown in Figure 2.1, below, Michigan’s electricity currently comes primarily from large baseload coal and nuclear generating stations with some additional generation from natural gas-fired units. In 2005, about 58% of the power generated in the state was produced at coal-fired plants. By comparison, only about 3% of the power generated in the state was from hydroelectric or other renewable facilities. Michigan imports 100% of the coal burned at its power plants, and nearly all of the fuel oil for in-state generators.

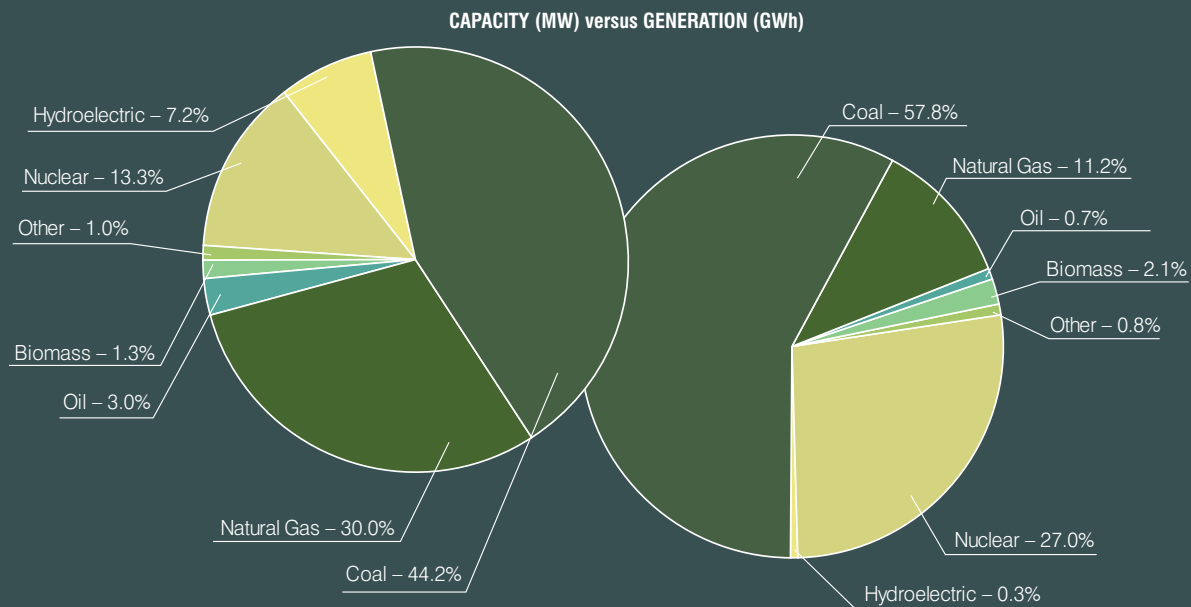


Figure 2.1: Fuel Mix of Capability and Generation in 2005

SECTION 2.1.

Michigan's Changing Demand

The current economic recession has had a major impact on the use of electricity in Michigan. Total electric sales in the state decreased by 3.8% in 2008 and are expected to decline another 6.7% in 2009.¹⁰ Consumers Energy anticipates a 4.5% decline in sales in 2009.¹¹ Detroit Edison projects only a 1% decline in sales.¹²

According to the Michigan Energy Appraisal released in June 2009 by Michigan Public Service Commission and the Michigan Department of Energy, Labor & Economic Growth:

Industrial electric sales are projected to decline steeply due to the sharp downturn in the economy. This is based on the Michigan Industrial Production Index which is a measure of industrial capacity utilization and production. Global Insights shows a decline in the Michigan Industrial Production Index of 6.5% in 2008 compared to 2007, and for 2009 is projecting a severe contraction of 14.7%.¹³

The declines in sales in 2008 and 2009 also reflect long-term trends as well as the current economic recession. Overall, from 1995 to 2008, Michigan industrial demand plummeted by 13.8%.¹⁴ For example, as shown in Table 2.1 below, the number of industrial customers in Consumers Energy's service territory declined by 5% between 1995

and 2007, as did industrial sales. Although the number of industrial customers in Detroit Edison's service territory increased by 11% between 1995 and 2007, the total annual sales for this larger number of customers decreased by 6%. Sales per customer also declined during this same period, by 7.5% for Consumers Energy and by 17.5% for Detroit Edison. Industrial customers typically operate for 16 or even 24 hours a day and, once processes are started, electrical loads tend to be constant.

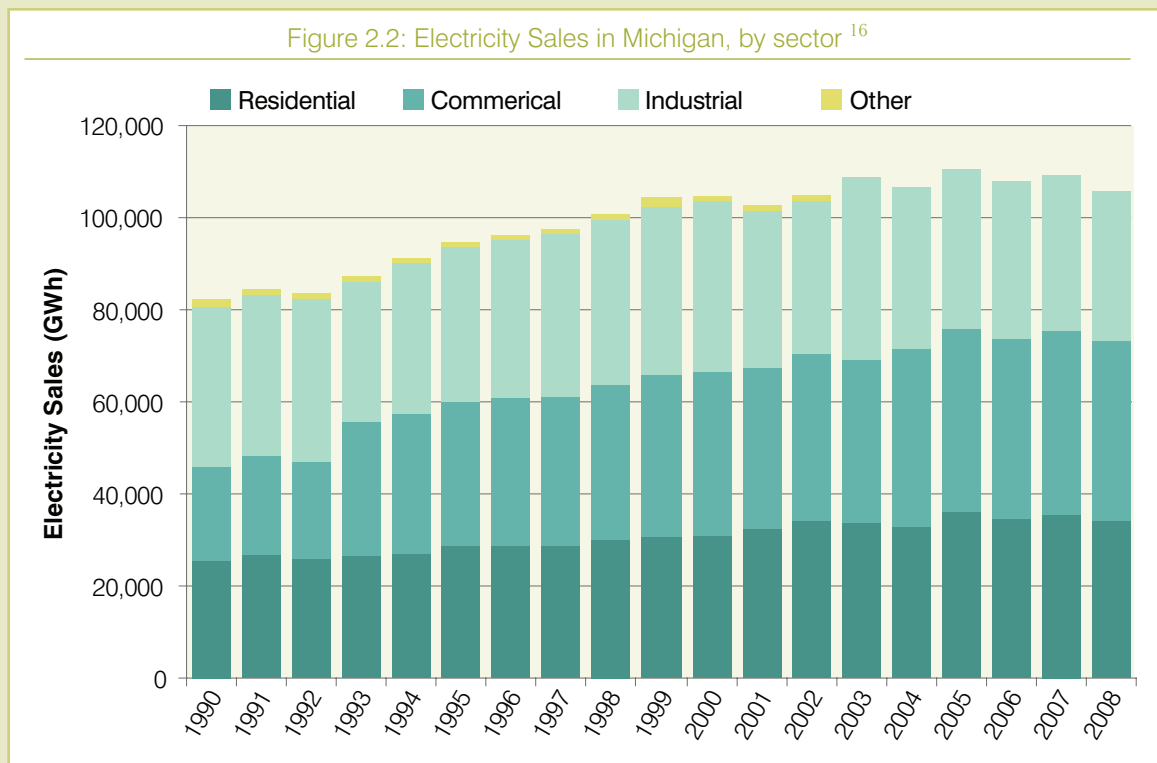
Table 2.1:
Changing Industrial Demand for Michigan Utilities¹⁵

	CONSUMER'S ENERGY		DETROIT EDISON	
	Customers	Sales (MWh)	Customers	Sales (MWh)
1995	9,106	12,688,148	955	14,092,083
2007	8,621	11,153,047	1,051	13,337,832

As shown in Figure 2.2, below, overall electricity sales in Michigan essentially have been flat since 2002.

This evidence suggests that the sustained growth in overall electricity consumption in Michigan, that was experienced during the 1990s, is not likely to be seen again for the foreseeable future.

Figure 2.2: Electricity Sales in Michigan, by sector¹⁶



¹⁰ Michigan Energy Appraisal, Semiw **11** Id, at page 2. ¹² Id, at page 2. ¹³ Id, at page 2. ¹⁴ Source data: US DOE, Energy Information Administration (EIA). "Retail Sales of Electricity by State by Sector by Provider, 1990-2007" and EIA Electric Power Monthly "Table 5.4.B. Retail Sales of Electricity to Ultimate Customers by End-Use Sector, by State, Year-to-Date through December 2008 and 2007" ¹⁵ Source: Statistical Data of Retail Sales, Electric Utilities in Michigan, 1995-2007. ¹⁶ U.S. DOE, EIA. January 29, 2009. Electric Power Annual 2007-State Data Tables. Data available at: <http://www.eia.doe.gov/cneal/electricity/epa/salesstate.xls>

SECTION 2.2.

Steps to a New Direction for Michigan Energy

Michigan is at the cusp of important decisions regarding its energy future. Already, the State has taken some important steps in shaping that energy future. In the past few years, Michigan has put some important policy components in place to guide the future of the electric industry.

- Act 286 (Acts of 2008) requires the state’s utilities to develop an integrated resource plan
- Act 295 (Acts of 2008) establishes a 10% Renewable Energy Portfolio Standard and directives for “energy optimization.”
- Executive Directive 2009-02 requires the Department of Environmental Quality to consider the need for and all feasible and prudent alternatives to the construction of any new coal-fired power plant.¹⁷
- In March 2009, the Michigan Department of Environmental Quality issued the Climate Action Plan that had been developed by the Michigan Climate Action Council.¹⁸ This plan proposed goals for the state that would reduce greenhouse gas emissions to 20% below 2005 levels by 2020 and to 80% below 2005 levels by 2050.



¹⁷ Act 295 establishes a 10% renewable portfolio standard by 2016. ED 2009-02 requires the Department of Environmental Quality to consider all prudent alternatives to the construction of any proposed new coal-fired power plant, and to deny the permit if alternatives are feasible. Alternatives include reducing consumption through energy efficiency and reduction of peak demand, and construction of renewable-energy facilities. The Directive also requires a determination of need.

¹⁸ Michigan Department of Environmental Quality, Michigan Climate Action Council Climate Action Plan, March 2009, available at <http://www.miclimatchange.us/>.

SECTION 2.3.

Michigan's Energy Plan

In January 2007 the Michigan Public Service Commission issued “Michigan’s 21st Century Electric Energy Plan” in response to Governor Granholm’s Executive Directive 2006-02. The plan examined Michigan’s electric needs over the next 20 years and proposed a series of policy solutions designed both to protect environmental quality through the use of renewable energy and energy efficiency, and assist electric utilities in providing electricity sufficient to meet growing demand. The Commission forecasted demand growth for the state by compiling forecasts of annual energy requirements and peak demands that have been prepared by each utility in Michigan. Based on the individual utility forecasts, the Commission estimated that demand would grow at an annual average rate of 1.3% from 2006 to 2025. This was a critical assumption that underlay all of the modeling that was presented in the plan.¹⁹ See figure 2.3.

In addition to sustained growth in demand, the 21st Century Electric Energy Plan (“The Plan”) forecast a shortfall of supply resources to meet that increased demand. As a result, the Plan called for new baseload generation in Michigan by 2015.²⁰ However, where the Plan called for a mix of resources, and only a limited amount of new power generation, utilities and merchant generators responded with proposals to build eight new power plants, with a total of 3,670 MW of new generation, all using coal (usually as the primary fuel). Two of these proposals have since been cancelled. The remaining six coal plants being proposed for Michigan are listed in Table 2.2 below:

Table 2.2: Proposed Michigan Coal Plants ²¹		
Plant Description	Proposed Capacity	Plant Status (as of July 2009)
Wolverine/ Wolverine Power Co-operative	600 MW circulating fluidized bed	Draft air permit and MACT determination issued by MDEQ.
Lansing/ Lansing Board of Water and Light	250 MW (70% coal, 30% biomass)	Proposed for operation by 2018.
Board of Holland Public Works	78 MW	Draft air permit and MACT determination issued by MDEQ
Bay City/ Consumers Energy	830 MW supercritical	Draft air permit and MACT determination issued by MDEQ. Proposed to be operational by 2017.
Alma/ M&M Energy	750 MW IGCC	M&M announcement. Tax credit applications filed with town and state. No permit application filed.
Filer Township /Tondu	Expansion of existing 75 MW to 250 MW IGCC	Local announcement
Total	2683 MW	

As it turned out, even the moderate amount of new coal-fired power generation anticipated in the 21st Century Electric Energy Plan is unnecessary. Assumptions about future loads, energy sales, costs and environmental regulations are among the most critical components in planning assessments such as the 21st Century Electric Energy Plan. They affect modeling results, and thus have a significant impact on policy recommendations. Unfortunately, the 21st Century Electric Energy Plan suffered from a number of critical assumptions that have proven incorrect. Most particularly, the Plan:

- Overestimated load growth and, consequently, the need for new generating facilities
- Underestimated coal plant construction and operation costs
- Did not adequately take into account the costs of inevitable greenhouse gas emission regulations

The events of the past two-and-a-half years have rendered the Plan inappropriate as a tool or reference for guiding Michigan’s energy future. Coal plant construction costs have soared since 2007 and, instead of increasing, as the Plan projected, electricity consumption has declined. For example, as noted earlier, electricity sales decreased by 3.4% in 2008 and are expected to decline by an additional 6.7% in 2009.

Rather than projecting any significant growth in sales or loads, the two largest electric utilities in the state, Consumers Energy and Detroit Edison Company, are now forecasting that consumption will be flat through 2016 and that customer loads actually will decline from 2007 to 2013 (0.3% and 0.8%, respectively).²² See Figure 2.4. For example, Consumers is forecasting a 2019 summer peak of 8,356 MW compared to a 2008 peak of 8,799 MW.²³ Detroit Edison is forecasting a 2013 summer peak of 11,529 MW, compared to a 2007 peak of 12,229 MW.²⁴ The bases for these forecasts are declining population, saturation of the residential air-conditioning market, and adverse economic conditions.²⁵ Together with forecasts from the Indiana Michigan Power Company,²⁶ the combined forecasted demand from these three major utilities is 1.7% lower in 2013 than 2007. These forecasts were released in the third quarter of 2008. See figure 2.4.

Michigan should not rely on the 21st Century Plan as a basis for future energy planning, and especially not for implementing Act 295 and Governor Granholm’s Executive Directive 2009-02. Appendix A contains a detailed critique of the 21st Century Energy Plan.

¹⁹ “Michigan’s 21st Century Electric Energy Plan.” Submitted to the Honorable Jennifer M. Granholm, Governor of Michigan, by J. Peter Lark, Chairman, Michigan Public Service Commission. January 2007. p. 9 ²⁰ The 21st Century Energy Plan found that “...in the absence of any energy efficiency programming, Michigan would need no fewer than four new 500 MW baseload units by 2015 to meet forecasted demand. With energy efficiency programming, the modeal decreased the forecasted need to two new baseload units on a staggered basis, and with the addition of the RPS, this projection has been decreased further to one new unit by 2015.” (at page 32) Moreover, the Plan found that “By displacing traditional fossil fuel energy, the energy efficiency program alone could save Michigan \$3 billion in electricity costs over the next 20 years.” (at page 33) ²¹ Sources: <http://www.sierraclub.org/environmentallaw/coal> and Erik Shuster, “Tracking New Coal Fired Power Plants”, National Energy Technology Laboratory, Office of Analysis and Planning, U.S. Department of Energy, June 30, 2008.

Figure 2.3: Forecast energy consumption and supply in the 21st Century Electric Energy Plan (GWh)

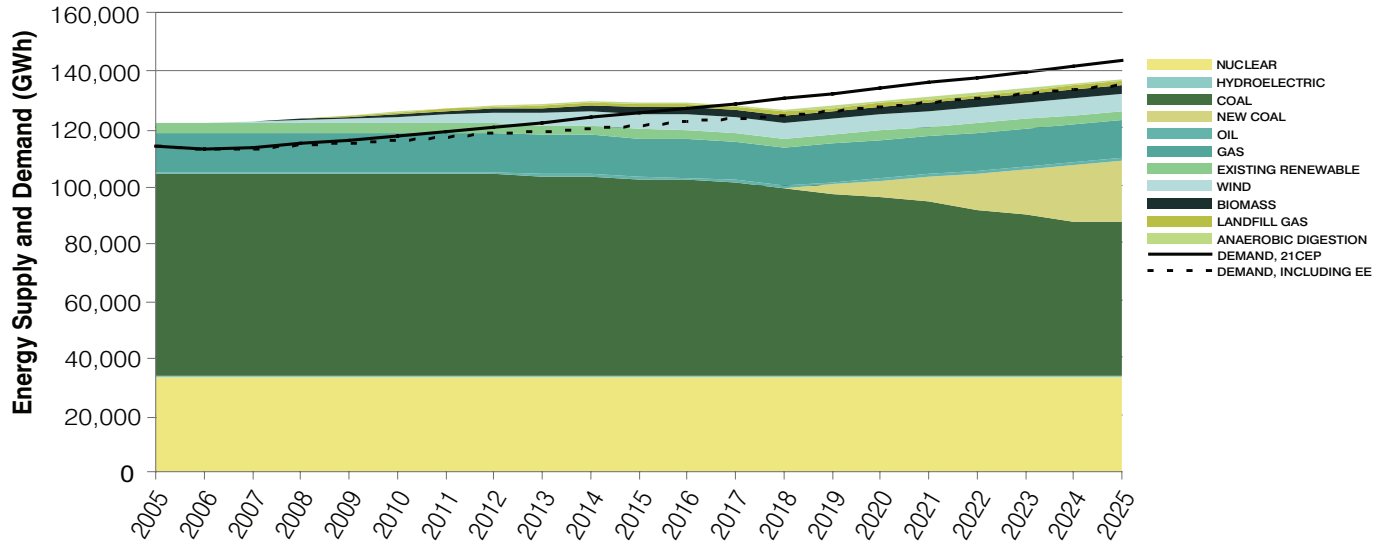
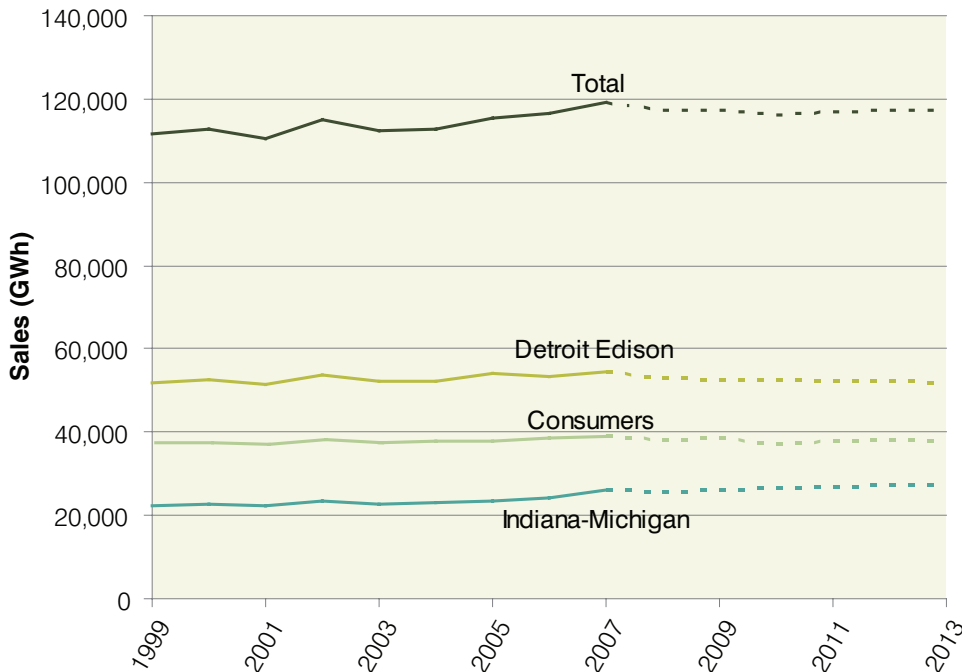


Figure 2.4: Michigan Utilities Forecast Declining Demand from 2008 to 2013



22 MPSC. U-15645. Nov. 14, 2008. Ex. A-79; MPSC. U-15677. Sept. 30, 2008. Ex. A-8. 23 <http://efile.mpsc.cis.state.mi.us/efile/docs/15645/0003.pdf> Case U-15645, Exhibit A-79, Witness L. D. Warriner, November 2008. 24 <http://efile.mpsc.cis.state.mi.us/efile/docs/15677/0001.pdf> Case U-15677, Exhibit A-8, Witness S. L. Seifman, September 2008. 25 Consumers Energy load forecasting, presentation to Michigan Load Consortium, November 18, 2008. 26 MPSC. U-15676. Sept. 30, 2008. Ex. IM-1



SECTION 2.4.

Implications of a Fossil Plan for Michigan

Michigan faces current and future risks if it continues to pursue carbon- and emissions-intensive energy consumption. Continued heavy reliance on coal-fired electricity will expose the state to more-severe economic pain in the near and long-term future.

2.4.1. Power Plant Construction and Operation Cost Risks

Investing in long-lived coal-fired power plants at this time entails increasing risks and unpredictable costs. These current and future risks include the following:

- **RISING AND VOLATILE FUEL PRICES.** Oil, coal, and natural gas prices fluctuated wildly during 2008, and their current trough should not lull people into thinking the low prices will last. Once the recent global energy demand growth resumes in developing countries, prices will again increase.
- **ESCALATING LABOR AND ENGINEERING COSTS.** Coal-power-plant-construction costs have risen dramatically in recent years with terms like “staggering” and “skyrocketing” used to describe these cost increases.²⁷ Coal-fired power plants that had cost \$1,500 per kilowatt in 2005-06 are now projected to cost in excess of \$3,500 per kilowatt, excluding financing costs, by the utilities who would build them. This would mean a cost of more than \$2 – 2.5 billion for a single 600-MW coal plant when financing costs are included. These cost increases have been driven by a worldwide competition for power-plant design and construction resources, commodities, equipment, and manufacturing capacity. Prices for products that require energy to extract them, such as copper, tungsten, and nickel, were the most volatile.²⁸

Cost increases have plagued almost every proposed coal plant project in the United States in recent years. For example:

- The estimated cost of Consumers’ proposed Karn-Weadock coal plant has increased by 32% since the Company filed its original Balanced Energy Initiative in 2007.²⁹ The total cost of the plant, including financing costs, is now expected to be more than \$3 billion.
- In Southern Ohio, the estimated cost of a 960 MW coal plant proposed by American Municipal Power–Ohio rose rapidly from \$1.2 billion to \$3.2 billion between October 2005 and October 2008.
- Duke Energy Carolina’s Cliffside Project costs increased by 80% in one year between the summer of 2006 and 2007.

- Wisconsin Power & Light’s now-cancelled Nelson Dewey 3 coal plant increased by approximately 47% from February 2006 to September 2008.

Even plants that are far along in the design, procurement, and construction process face rising costs. For example:

- Duke Energy Indiana announced an 18% increase in the projected cost of its Edwardsport IGCC coal plant project between spring 2007 and April 2008, to reflect increased costs experienced during the actual procurement of plant equipment and materials.
- The projected cost of Kansas City Power and Light’s Iatan 2 power plant was increased by 15% in early 2008 even though the plant was well underway and scheduled to be completed in 2010. The company announced that costs may rise yet again after engineering reviews are completed.

More than 90 proposed coal plants have been cancelled, significantly delayed, or rejected by state regulatory commissions and officials since the early years of this decade. Many of these cancellations, delays and rejections have been due to the uncertainty and risks associated with rising construction costs and federal regulation of greenhouse gas emissions. Although some projects have been approved, state regulatory commissions in North Carolina, Florida, Virginia, Oklahoma, Washington State, Oregon, Wisconsin and Kansas have rejected proposed coal-fired power plants.

2.4.2. Risk of Air Pollutant Emissions Costs

Fossil-fuel-burning power plants emit numerous harmful air pollutants, including oxides of nitrogen (NO_x), sulfur dioxide (SO₂), fine particulates, and mercury. NO_x emissions are precursors to the formation of ground-level ozone.

Data from 2006 indicate that Michigan has several counties that measured 8-hour ozone concentrations above the EPA standard of 75 parts per billion. States are required to submit plans to show how they will achieve and maintain compliance with this new standard by 2011, a goal that will be more difficult to achieve if new coal-fired power plants are built. The EPA issued its final designations for fine particulates in August 2008. Seven counties in southeastern and two counties in southwestern Michigan have been designated non-attainment for fine particulate, meaning that emissions will need to be reduced through additional regulations and control measures in order to comply.³⁰

²⁷ Final order in Public Service Commission of Wisconsin Case No. 6680-CE-170, Dec. 11 2008, re Wisconsin Power and Light coal-plant application. Press coverage of the rejected plant used “staggering” and “skyrocketing” costs in their headlines. ²⁸ Synapse Energy Economics, “Don’t Get Burned: The Risks of Investing in New Coal-Fired Facilities”, February 26, 2008. ²⁹ The new cost estimate was presented to the Commission in Case No. U-15800 in a January 15, 2009 report from HDR/Cummins & Bernard, at page 12. ³⁰ <http://www.epa.gov/pmdesignations/2006standards/final/region5.htm> (Accessed February 6 2009)



In 2007, electric power plants in Michigan produced 121.6 terawatt-hours of electricity, 3% of the U.S. total. Over 59% of this electricity was derived from coal.³¹ Consequently, the state also produced 117,458 tons of NO_x and 353,360 tons of SO₂. Michigan's electric generating plants emitted 3,765 pounds of mercury in 2005.³² These emissions made Michigan the 11th and 8th greatest producer of NO_x and SO₂, respectively, and the 9th greatest producer of mercury from electricity generation.

Increased NO_x, SO₂, particulate matter, and other emissions from one or more of the six coal-fired power plants proposed will affect the state's ability to attain and maintain compliance with the ozone and fine particulate standards.

2.4.3. Costs of Greenhouse-Gas Emissions

Fossil-burning power plants all release significant greenhouse gases, primarily in the form of carbon dioxide (CO₂). The emissions are a currently unavoidable byproduct of combustion. Current state, regional, and national efforts to reduce emissions of greenhouse gasses depend on either reducing the amount of fossil fuels combusted

or finding methods of permanently sequestering CO₂ underground. Attaining these goals will be made much more difficult and costly if new coal-fired power plants are built.

In 2007, electric power plants in Michigan emitted 79,090,202 metric tons of CO₂, making it the 11th greatest emitter in the U.S. 89% of those emissions were from coal-fired power plants.³³

Leaders in both the U.S. House and Senate are pursuing plans for aggressive legislative action on climate change during this session. To date, the most substantive legislative proposal is the Waxman-Markey proposal that was recently approved by the House of Representatives (June 26, 2009). This bill would mandate a cap on emissions to achieve the following greenhouse gas reduction targets:

2020 – 83% of 2005 emission levels

2050 – 17% of 2005 emission levels

³¹ U.S. EIA, *State Electricity Profiles, Table A.1. Selected Electric Industry Summary Statistics by State, 2007*; ³² U.S. EPA, *eGRID, 2007*. ³³ U.S. EIA, *State Historical Tables for 2007, released January 29, 2009*.

Figure 2.5, at right, shows the emissions trajectories under the proposed Waxman-Markey legislation. These trajectories aim for emissions reductions of 83% from 2005 levels by 2050, similar to the plan recently announced by the Obama Administration.

While Congress debates climate change legislation, the EPA is poised to take the next step towards regulating greenhouse gases under the Clean Air Act. In 2007, the U.S. Supreme Court determined that carbon dioxide is an “air pollutant” under the Clean Air Act, and that EPA has the authority to regulate it.³⁴ The EPA has now circulated its draft finding, for public comment, that greenhouse gas emissions endanger public health and welfare.³⁵ The Obama Administration has stated its preference for a legislative solution to addressing climate change; however, EPA’s regulatory authority provides an alternate option should Congress fail to act.

The Obama Administration indicated in its recently released Federal budget that it would seek to establish a cap-and-trade system to reduce greenhouse gas emissions to 14% below 2005 levels by 2020 and to 83% below 2005 levels by 2050. This plan would require emissions reductions that approximate the steepest reductions shown in Figure 2.5, at right.

Climate-protection legislation and rulemaking details are clearly not final. However, they will certainly result in a cost associated with greenhouse gas emissions—costs that will be higher for carbon-intensive energy. Increasing greenhouse gas emissions now, for example through the construction of new fossil-fuel fired power plants, will increase the overall costs of compliance with a cap on greenhouse gas emissions, and will certainly increase the costs of compliance in those areas already heavily reliant on fossil fuels for electricity.

Indeed, based on Synapse’s projected range of future CO₂ emissions allowances costs, greenhouse gas emissions from the six proposed plants in Michigan could cost ratepayers between \$260 and \$800 million annually in the early years of a federal climate program.³⁶ It is likely that such a program would be in place before the plants in question are even in operation. In later years, ratepayers could be exposed to costs ranging from \$760 million to \$2.3 billion per year for the cost of allowances.

None of the coal plants proposed in Michigan include any commitment to capture, sequester, or otherwise limit their emissions of CO₂. Indeed, it is widely acknowledged that post-combustion carbon-capture technology is not commercially viable, which raises questions about how much such systems would cost. By contrast, air emissions such as SO₂ and NO_x are currently reducible by

commercially available scrubbers and other technologies and practices; their regulatory requirements and costs are well-mapped. To date, no utility or private generator has committed to using a full-scale post-combustion carbon-capture system, although the regulatory basis for requiring such technologies is clear.³⁷

Though the details of federal greenhouse gas restrictions remain under debate, there is bipartisan consensus that federal limits will be placed on CO₂ and other greenhouse gas emissions. Given the plans that have been announced in recent months, and the proposals that were introduced in the previous Congress, the general trend towards strong federal action to address climate change is clear; over time the proposals are becoming more stringent as evidence of climate change accumulates and as the political support for serious governmental action grows.

Figure 2.6, at right, shows Michigan’s recent statewide CO₂ emissions, and the emission levels that would be consistent with the national caps in the Waxman-Markey legislation. As can be seen, substantial overall reductions in the state’s CO₂ emissions will be required during the coming decades in order to be consistent with the reduced nationwide emissions caps.

Significant reductions in Michigan’s CO₂ emissions will be required over the coming decades, as have been recommended in the recently issued Climate Action Plan. It would be a mistake to ignore the inevitability of these reductions in long-term decisions concerning electric resources.

³⁴ In this case, Massachusetts and 11 other states sued the US EPA for failing to regulate greenhouse gas emissions from the transportation sector. The Court found that EPA has the authority and the obligation to regulate greenhouse gas emissions. The court found that EPA’s refusal to do so or to provide a reasonable explanation of why it could not regulate was arbitrary, capricious and otherwise not in accordance with law. The Supreme Court also found that the “harms associated with climate change are serious and well recognized.” ³⁵ “White House begins review of EPA endangerment proposal,” Greenwire, March 23, 2009.

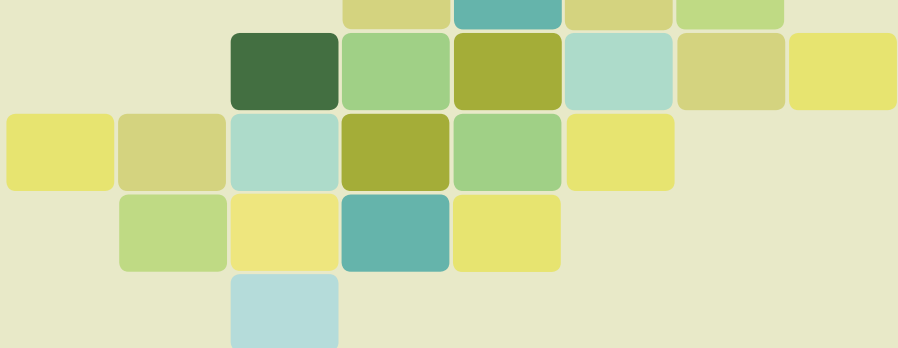


Figure 2.5: Emissions reductions that would be required under the Waxman-Market climate change legislation introduced in the current 111th U.S. Congress

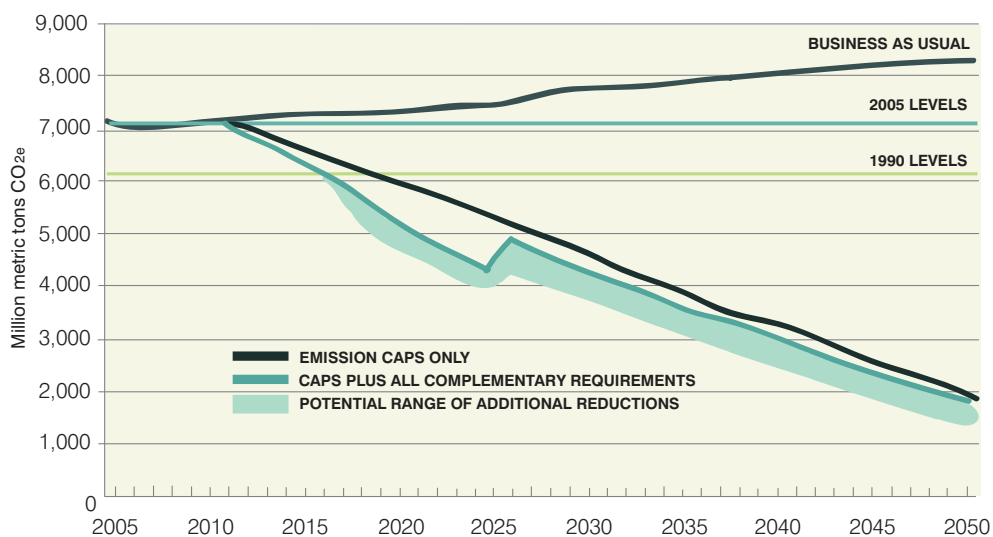
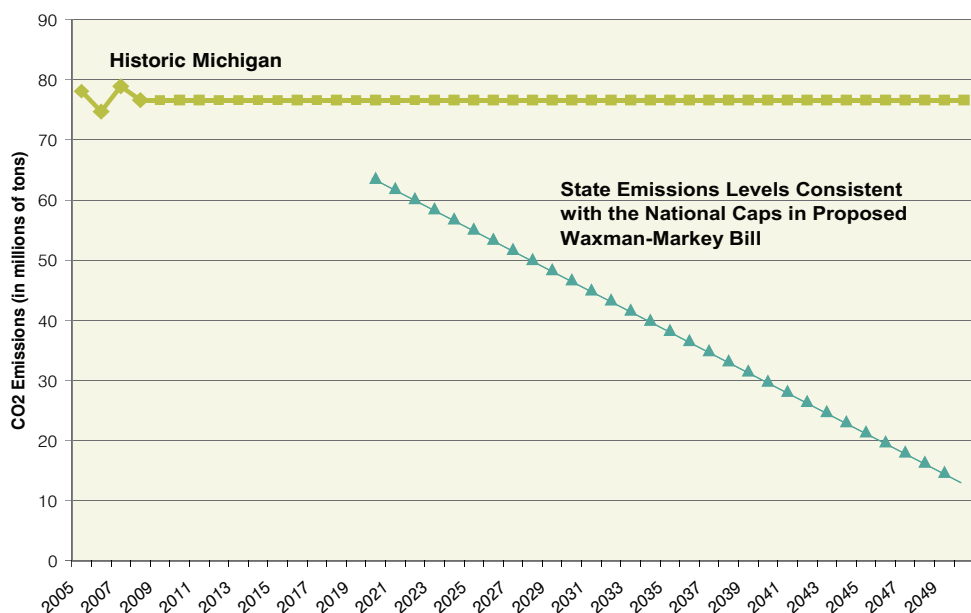
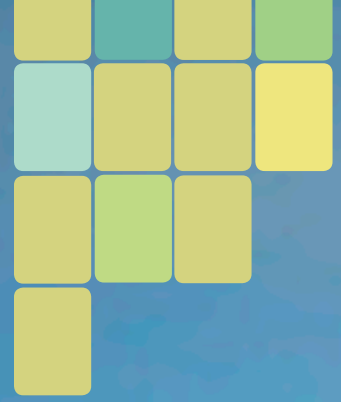


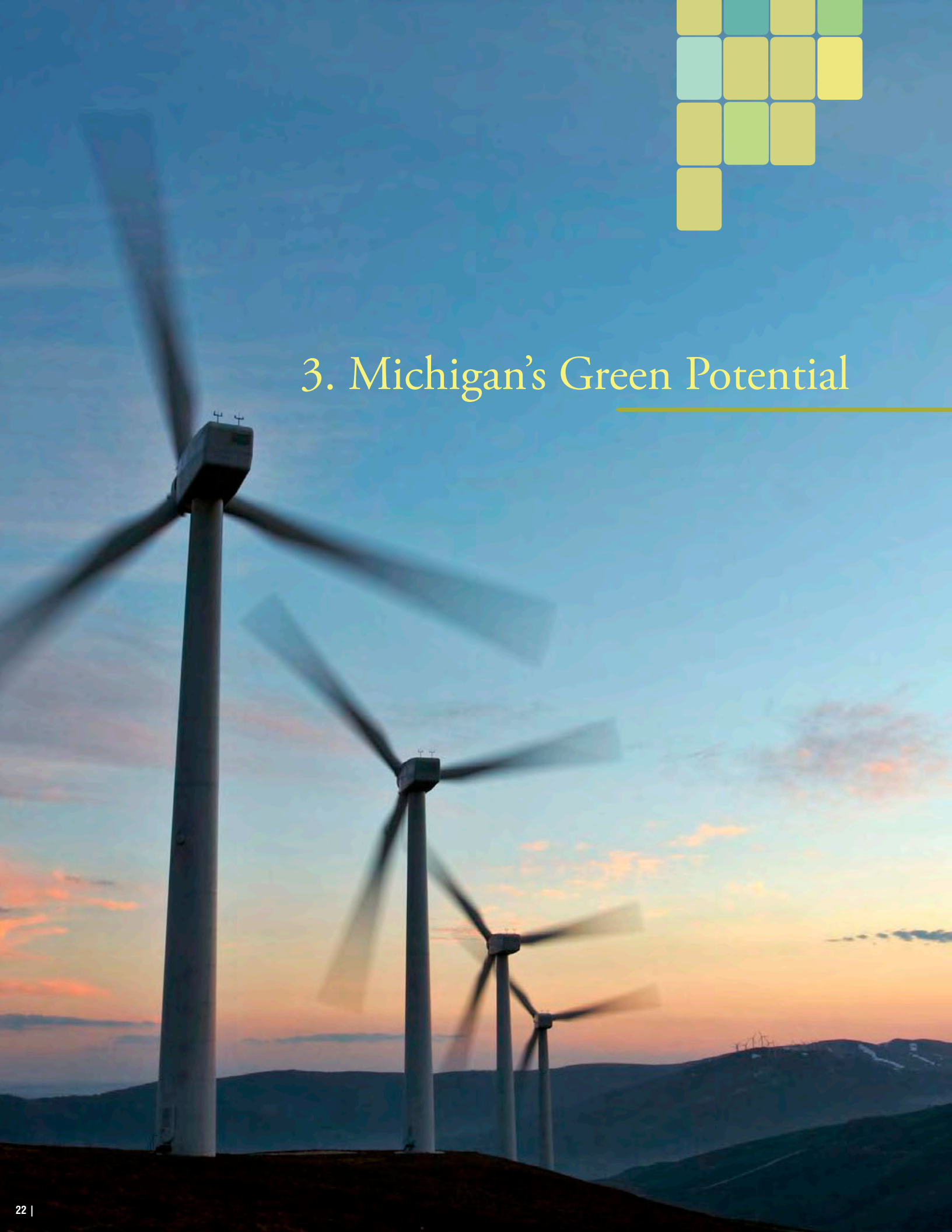
Figure 2.6: Michigan's Historic and Future CO₂ Emissions compared to the Emission Levels that would be consistent with the National CO₂ Caps in the proposed Waxman-Markey Legislation



36 The six plants under consideration have a combined capacity of 2680 MW. These plants will emit roughly 19 million tons of carbon dioxide (CO₂) each year for an expected 60 year service life (at an 85% capacity factor. 37 The Michigan DEQ will likely require new plants to demonstrate best available control technology for CO₂ as part of their technology evaluation.



3. Michigan's Green Potential





Michigan can stabilize electricity rates, improve energy security, and provide new jobs, with cheaper, faster, cleaner energy choices. This chapter explores the technical and economic potential in Michigan for increasing energy efficiency, shifting electrical demand to use existing resources better, recycling waste heat with combined heat and power (CHP), and developing abundant, accessible renewable energy opportunities.

Table 3.1 summarizes our estimates of the achievable³⁸ energy efficiency, demand response, CHP, and renewable energy potential in Michigan.

Technology	Capacity (MW)	Energy (GWh)
Energy Efficiency	5,403	18,868
Demand Response	1,967	—
Combined Heat and Power	1,949	10,414
Biomass, Landfill Gas, and Digestion	922	5,813
Solar Photovoltaics	952	701
Wind	7,155	20,559

Energy efficiency offers considerable potential for development in Michigan over the next decade. The lack of sustained energy-efficiency programs places Michigan near the bottom of states in an annual ranking completed by ACEEE.³⁹ For 2008, Michigan ranked in a tie for 38th place, receiving only six points out of a possible fifty.

The state has also not fully taken advantage of its substantial renewable resources, although recently two large wind farms have been built in the Thumb region.⁴⁰ Similarly the state could address peak electricity consumption by shifting load off-peak with targeted demand-response programs, reducing the need for excess capacity and expensive peaking generation.

Exploiting the potential from energy efficiency alone will avoid the need to build large new centralized generating plants. Adding the quantities of cost-effective energy and capacity that could be provided by combined heat and power and renewable energy will provide additional reliability and security. Finally, demand-response programs can avoid the need to dispatch inefficient and costly generation that also emits large quantities of greenhouse gas emissions and other air pollutants.

To develop the estimates for the potential quantities of energy and capacity that could be provided by efficiency and renewable resources, we reviewed current literature and recent energy potential studies. We focused first on studies that were completed for or by entities in Michigan, or which have Michigan-specific data. If such studies were not available, we used regional or national level studies for which Michigan data were either provided or broken out.

³⁸ "Achievable" is a generic term used to indicate that even under an aggressive policy to pursue energy efficiency and renewable energy, only a fraction of the feasible and economic resources will be pursued. In this report, the term achievable indicates that the total feasible or economic potential has been discounted by 70-80%, detailed in the subsections below. ³⁹ Maggie Eldridge et al. 2008. "The 2008 State Energy Efficiency Scorecard." Washington, D.C.: American Council for an Energy Efficient Economy. ⁴⁰ Harvest Wind Farm has 32 turbines (52.8 MW) operating in Pigeon, (<http://www.pigeonmichigan.com/node/33>). Forty-six turbines (69 MW) are nearly operational. (http://blog.mlive.com/watershedwatch/2008/07/construction_starts_on_thumbs.html). Other wind farms are in the Midwest Independent System Operator queue although financing might not be secured.



SECTION 3.1.

Energy-Efficiency in Michigan

Energy efficiency is Michigan’s biggest and best energy resource. The 5,355 MW of achievable potential identified in this section would be significantly less expensive to achieve than building new power plants and offer the potential to create a substantial number of new jobs.⁴¹

Efficiency is load-following by nature, in that efficiency measures automatically “dispatch” their benefits at times of energy use. By this measure efficiency is superior to supply, even were their costs the same. However, efficiency costs less, avoiding carbon, pollution, fuel costs, transmission-and-distribution investment, and costly new power plants. For this reason, all of the achievable potential identified in this report is less expensive than the supply it avoids; this efficiency includes the cheapest new energy resources available to Michigan today.

3.1.1. Energy-Efficiency Potential

We estimate that by 2019, energy efficiency can meet 16% of Michigan’s electricity needs per megawatt hour and 20% of capacity needs per megawatt. These savings are achievable at the levelized cost of 2.9¢ per kilowatt-hour with a total benefit/cost ratio of 2.22 to 1 for all programs.

The foundation for our estimate is a comprehensive analysis prepared in 2002 for the American Council for an Energy-Efficient Economy (“2002 Study”).⁴² We have updated the inputs and parameters from the 2002 Study with 2008 statistics (“2008 Results”). We have built our estimate of the energy-efficiency potential for Michigan from the bottom-up.⁴³ We started with a list of end uses, selected measures appropriate for those end uses that would save energy, and then estimated the number of units that could be cost effectively installed and that would be accepted by the customer. This process, and some of the special considerations that inform best-practices program designs, are reviewed in Appendices D and E.⁴⁴

As shown in Figure 3.1, right, the achievable cost-effective energy-efficiency potential is large in Michigan. In fact, the opportunity for energy efficiency is even better than it was in 2002. Since 2002, Michigan’s industrial sector has shrunk significantly and the rate of new home construction declined; consequently, fewer savings are available in those sectors. However, in the intervening years, there have been improvements in energy-efficiency technology and the potential for efficiency in residential sector retrofits has grown.

As shown in Table 3.2, within ten years energy efficiency could avoid the need for 5,355 MW of generating capacity and 18,867,657 MWh of energy.

Table 3.2:
Comparison of Economic Achievable Potential,
2002 versus 2008

	MWh Savings in 10 Years		MW Savings in 10 Years	
	2002 Study	2008 Results	2002 Study	2008 Results
Residential				
New Construction	411,444	136,595	145	49
Replacement	2,265,303	2,334,497	801	1,259
Retrofit	1,301,756	3,964,595	414	997
SUBTOTAL	3,978,503	6,435,687	1,215	2,256
Commercial				
New Construction	1,124,255	1,342,854	587	690
Retrofit	7,427,386	8,871,559	1,574	1,849
SUBTOTAL	8,551,641	10,214,413	2,161	2,539
Industrial				
	2,885,231	2,217,557	729	560
TOTAL	15,415,375	18,867,657	4,105	5,355

⁴¹ Section 3.3 explores the potential of energy-efficiency programs to create new jobs in Michigan. ⁴² ACEEE. 2002. “Examining The Potential For Energy Efficiency In Michigan: Help For The Economy And The Environment.” 2002. Washington, D.C. ⁴³ For a complete description of potential-study methodology, see the National Action Plan for Energy Efficiency (NAPEE) “Guide to Conducting Energy Efficiency Potential Studies” ⁴⁴ The EPA guide “Advancing State Clean Energy Funds: Options for Administration and Funding” (May 2008) contains a more-detailed, yet still brief, description of program design concepts in Chapter Six of that document for those seeking more information. http://www.epa.gov/cleanenergy/documents/clean_energy_fund_manual.pdf, accessed 12/2/08

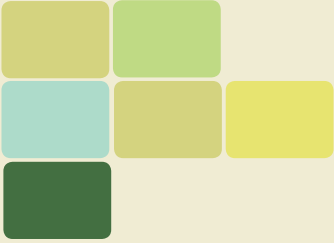
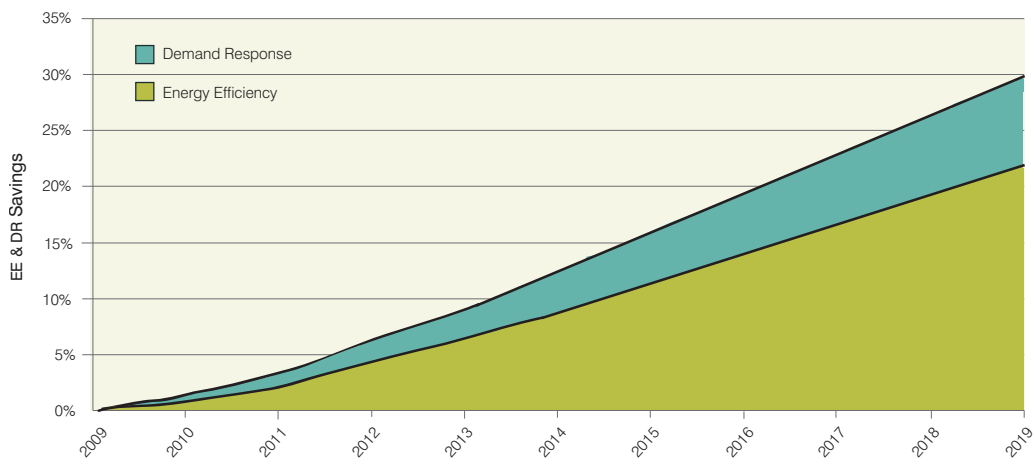


Figure 3.1: Economically Achievable Energy Efficiency (EE) and Demand Response (DR) in Michigan (Capacity, MW) as a Percentage of the 2008 Forecast



3.1.2. Demand Response Potential

Demand Response (DR) is the generic name for a variety of mechanisms that reduce demand at specific times of peak load. Programs can include direct load control (in which the utility or a third party can unilaterally cut load), rate and information structures that allow customers to curtail load voluntarily on an event basis, and contractual fixed-time arrangements, among others. Appendix C describes DR programs in greater detail. Utilities in this country have used demand-response resources for decades, peaking in 1996. The U.S. Department of Energy estimates that in 1996, national DR capacity was 33,598 MW at 407 utilities, or roughly 4% of national peak load. By 2004, this capacity had declined to approximately 3% of U.S. peak load at 273 utilities.

3.1.2.1. Existing and Potential Demand Response

According to the 21st Century Energy Plan (Appendix 2, p. 115), Detroit Edison had approximately 284,000 residential and small commercial customers with air conditioning connected to direct load control, providing a peak reduction of 255 MW. The Plan (p. 120) estimated that direct load control for air conditioning could reduce the statewide system peak demand by 397 MW, 569 MW, and 764 MW in 2007, 2015, and 2025 respectively. This estimate was based on expansion of Detroit Edison's program and implementation of a comparable program at Consumers Energy.

Since the plan's publication, Consumers Energy has determined it can achieve a peak reduction of 242 MW by 2015, a reduction 12.5% greater, and ten years earlier, than the plan had projected for the utility.⁴⁵ Clearly, there is a tremendous potential for demand response in Michigan.

Michigan can achieve substantially more demand response by exploiting the full range of demand-response resources available from commercial, institutional and industrial customers. These customers typically have large loads and a greater administrative and financial capacity to implement demand response than residential and small customers. Though a Michigan study is not available, there are several studies that inform our estimate of DR potential in Michigan. A 2008 assessment of DR for Seattle City Light found that "the market for Commercial and Industrial potential, based on industry expert 'rules of thumb,' is between 5% and 10% of total peak load." The Seattle study conservatively uses a market penetration rate of between 0.05% and 3% to estimate potential in the first few years of a program.⁴⁶

Technological advances such as automated control strategies and two-way communication between the utility and the customer have significantly boosted the power and reach of DR. For example, a 2003/2004 pilot program in the Southern California Edison service territory showed a 14% reduction in load for small commercial customers.⁴⁷

A 2005 International Energy Agency study established the following achievable benchmarks for demand-response programs based on an extensive survey.⁴⁸ The data collected only supported benchmarks for a limited set of DR program types.

Achievable Benchmarks from Existing DR Programs		
DR Program Type	Customer Class	Benchmark (% of class peak)
Direct Load Control	Residential	10%
Interruptible Rates	Commercial/Industrial	10%
Demand Bidding/Buyback	Commercial/Industrial	8% – 9%

Two studies published by ACEEE in 2007 found even greater potential load reduction from demand-response resources.

Achievable Demand Response Achievable Potential as a % of State-Wide Peak Load		
State	2013	2023
Florida ⁴⁹	9 %	15 %
Texas	4.1%	12.5 %

We conclude based on our review of the above research that Michigan can, and should, expect to achieve peak-load reductions from demand response of about 1,970 MW, or 8% of demand, by 2025.

3.1.3. Combined-Heat-and-Power Potential

Combined heat and power (CHP), also known as cogeneration, is a term that refers to generators that harvest excess heat during energy production and deliver the heat for end-uses such as hot water or steam. CHP can also be used in industrial processes that use waste heat to generate electricity. The systems can be sized from generators smaller than 100 kW to large cogeneration facilities of many megawatts that provide district-wide heating and cooling. CHP in large industrial facilities provides on-site generation and often significant cost savings for power procurement and heat generation.

Combined heat and power is considered an effective cost-saving measure for medium-to-large commercial operations such as hotels, professional buildings, shopping plazas, and entertainment venues. Because CHP provides both power and heating (and sometimes cooling) and is located at the same site as load, it typically provides energy services to customers very efficiently and can reduce total greenhouse-gas emissions if deployed appropriately.

⁴⁵ Direct Testimony of Consumers Power Witness Teri L. Van Sumeren in Case No. U-15290. May 2007. p. 5. ⁴⁶ Seattle City Light staff. "Seattle City Light 2008 Integrated Resource Plan" Appendix E. Seattle City Light. 18 September 2008. p. E-1. <http://www.seattle.gov/light/news/issues/irp/docs/2008IRPfinal.pdf> ⁴⁷ U.S. DOE Staff. 2007. "Benefits of Demand Response in Electricity Markets and Recommendations for Achieving Them: A Report to the U.S. Congress Pursuant to Section 1252 of the Energy Policy Act of 2005." Washington, DC: U.S. DOE. In that study energy savings for customers with peak load of less than 20 kW were attributed entirely to enabling technology while for customers with loads between 20 kW and 200 kW these technologies were responsible for 80% of savings.



The potential for combined heat and power in Michigan, and indeed the U.S., is largely untapped. Michigan has substantial CHP potential, both in terms of energy resources (fuels) and locations due to its active industrial sector where significant on-site combined heat and power could save state businesses significant energy costs. Our estimate of potential CHP is based on both state-specific estimates and secondary national and regional sources, adjusted for Michigan-specific circumstances to the extent possible.

The Michigan Public Service Commission has estimated that there are 4,580 MW of CHP currently online. Of this, 2,419 MW are served from two large co-generation plants (Midland Cogeneration Venture and Dearborn Industrial Generation), and another 990 MW is generated at other utility-owned boilers. 493 MW are generated at universities and paper-processing facilities.⁵⁰

We find an additional 6,498 MW of CHP potential in Michigan. While all of these 6,498 MW are economic (i.e., are more cost-effective than grid-based central generation), the adoption rate may be slowed by policy barriers and momentum. Therefore, we assume that the achievable potential is 30% of the economic potential, or 1,949 MW. See Appendix F for details on our estimate of the potential for CHP in Michigan.

Table 3.3:
Estimated CHP Potential in Michigan by Sector

Sector	Economic Potential (MW)	Achievable Potential (MW)
Industrial	2,724	817
Commercial	2,874	862
Residential	900	270
TOTAL	6,498	1,949

This CHP capacity would have an annual output of 10,414 GWh.

⁴⁸ Gunn, Randy. *International Energy Agency Demand Side Management Programme Task XIII: Demand Response Resources Estimating Demand Response Market Potential*. Paris: International Energy Agency, 2005. ⁴⁹ Elliot, R. Neal, Maggie Eldridge, Anna M. Shipley, John "Skip" Laitner, Steven Nadel, Phillip Fairey, Robin Vieira, Jeff Sonne, Alison Silverstein, Bruce Hedman, Ken Darrow. *Energy Efficiency and Renewal Energy to Meet Florida's Growing Energy Demands*. Washington, DC: American Council for an Energy-Efficient Economy, 2007. ⁵⁰ Michigan Public Service Commission. 2006. "Michigan Capacity Need Forum: Staff Report to the Michigan Public Utilities Commission" vol. 2 (of 2 vols.). www.dleg.state.mi.us/mpsc/electric/capacity/cnf/cnf_reportvol2_1-3-06.pdf.

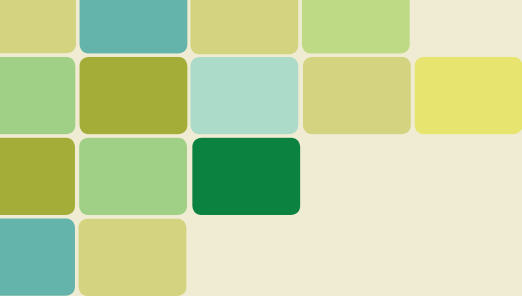


Table 3.4:
Renewable Energy Technical Potential and Achievable Potential in Michigan

Technology	Technical Potential ⁵² (MW)	Achievable Potential		
		Nameplate Capacity (MW)	Peak Capacity (MW)	Annual Energy (GWh)
Biomass, Forestry	248	174	174	1,067
Biomass, Urban Waste	204	143	143	874
Biomass, Agricultural	667	466	466	2,861
Landfill Gas	148	103	130	728
Anaerobic Digestion	51	36	36	283
Solar, Photovoltaic – Residential	18,121	326	183	428
Solar, Photovoltaic – Commercial	14,232	626	351	823
Wind, Onshore	16,565	1,988	398	4,717
Wind, Offshore	25,837	5,167	1,033	15,842
TOTAL	76,073	9,029	2,914	27,623

⁵¹ This analysis will show an achievable nameplate capacity of 9,028 MW, generating 27,623 GWh per year, by 2025. Michigan currently is estimated to consume about 114,492 GWh of energy in 2008 according to the 21st Century Electric Energy Plan. ⁵² In the case of biomass, landfill gas, and anaerobic digestion, these figures represent the economic potential, or the energy potential of infrastructure which could be built at a lower cost than central generation. However, because there are typically policy barriers and momentum to overcome, we estimate that the achievable potential is still significantly less than even the economic potential. ⁵³ Simpkins, D. 2006. Clean Energy from Wood Residues in Michigan. Michigan Biomass Energy Program. June, 2006. Combusting biomass is renewable in most aspects, if the entire lifecycle of an operation is considered. Growing plants pull

SECTION 3.2.

Michigan’s Potential for Renewable Energy

Historically, Michigan has been considered a moderately attractive state for developing renewable energy resources. The state has large tracts of moderate onshore and offshore wind and large agricultural and forestry sectors capable of providing significant crop and mill residue for biomass-based energy.

We have found that Michigan has more than 76,000 MW of potential renewable resources, which could readily be tapped with today’s technology (see Table 3.4). Even if only a moderate fraction of this potential is economically feasible in the near future, Michigan could still produce 9,029 MW of new renewable or alternative energy in the near future—representing more than 24% of its current demand.⁵¹

3.2.1. Biomass Potential

The term “biomass” encompasses a variety of energy generating options, most of which entail the combustion of woody or agricultural waste products. Wood-based products offer several waste streams for electricity generation:⁵³

- **Forest residues:** In forestry, small-stemmed trees and branches are not typically used, and up to 50% of the mass of a tree can possibly be harvested for energy use.⁵⁴
- **Primary residues:** Moisture-laden chips, sawdust, and bark generated during the milling process. Depending on the characteristics of a mill, up to 40% of wood entering a mill may end up as primary residue.
- **Secondary residues:** Dried chips, sawdust, and fibers generated during the manufacture of consumer goods. Up to 30% of milled wood is not utilized in products and is available as a high quality fuel. In Michigan, 98% of these residues are used for other purposes, such as energy or fiber.
- **Urban wood residue:** Urban wood includes all other wood in municipal and commercial waste streams. This can include disposal of consumer goods, tree trimmings, lumber, pallets, and construction and demolition debris.

Similarly, in agriculture significant biomass often remains after extraction of consumable materials. Corn stover (leaves and stalks) and wheat straw are abundantly available in Michigan, and can be harvested for either biofuel production or direct combustion. While the technology is rapidly advancing, cellulosic ethanol production is not currently commercially available and is not considered in this study.

A 2003 report prepared for the USDA, DOE, and NREL estimated the following biomass power potential for Michigan *See Table 3.5, below.*⁵⁵

- **248 MW of potential forest and mill residue:** Mills tend to be located in relatively close proximity to the source forests. Since the same machinery, companies and decentralized mills would be the organizations harvesting and collecting forest and mill residue, there would be significant value in co-locating small biomass power plants nearby, saving transportation costs and emissions. One promising area is using biomass to fire combined heat and power (CHP) facilities, providing electricity to the grid, and district steam heat to industries (i.e. the mills) nearby. The EPA describes several such cutting-edge economic and deployable technologies.⁵⁶
- **203 MW of potential urban wood waste:** Within a municipality a small number of commercial or public entities are commonly responsible for the collection and disposal of all of these wastes. Co-locating either municipal electricity generating stations or CHP facilities near processing or disposal facilities will reduce logistical and transportation costs.
- **666 MW of agricultural waste:** Agricultural waste is generated at the farm level, and is generally not collected or transported along with the agricultural product. However, if the cost of and emissions from collection and transportation is low enough, it could be feasible to have distributed generation stations throughout a rural area which fire biomass or biogas derived from the anaerobic digestion of agricultural biomass.

Table 3.5:
Energy Potential from Biomass in Michigan

Biomass Source	Michigan Energy Potential (MW)
Forest Residue	236.6
Primary Mill Residue	11.7
Forest and Mill Residue	248.3
Construction and Demolition	93.6
Yard Trimmings	58.7
Other Wood Waste ⁵⁷	51.3
Urban Wood Waste	203.6
Corn Stover	429.9
Wheat Straw	236.6
Agricultural Waste	666.5

CO₂ from the atmosphere, which is released again during combustion. If the biomass needs to be transported or processed, any fossil fuels count against the renewable component of biomass use. **54** Removing debris from a harvested forest may reduce the fertility of soils and the productivity of the forest. **55** Antares Group, Inc. (2003, September). Assessment of Power Production at Rural Utilities Using Forest Thinnings and Commercially Available Biomass Power Technologies. Prepared for the U.S. Department of Agriculture, U.S. Department of Energy, and National Renewable Energy Laboratory. **56** U.S. EPA. 2007. Biomass Combined Heat and Power Catalog of Technologies. U.S. EPA Combined Heat and Power Partnership. **57** Discarded wood products and residues from commercial entities and non-mill manufacture.



These estimates are economic potentials based on availability and accessibility of biomass resources at competitive supply costs. However, the estimates do not take into account the cost of nor the feasibility of developing such resources. The potential is determined with the following assumptions:⁵⁸

- Available biomass supplies are not currently used for other productive uses. This means power generation from such resources will not compete for materials already used productively.
- Each residue type has a specific assumed heat content.
- Biomass plants operate at a heat rate of 10,500 Btu/kWh.
- Biomass plants have a capacity factor of 70%.

This potential is real, but there are political barriers, inertia, and other factors that prevent new energy sources from being developed quickly. We estimate the achievable potential that could be realistically developed over the next decade is, conservatively, 70% of this potential. Therefore, the achievable potentials for the above three biomass-based technologies are approximately 174, 143, and 466 MW, respectively. At 70% capacity factor, these technologies would produce 1,067, 874, and 2,861 GWh, respectively.

3.2.2. Landfill-Gas and Municipal-Solid-Waste Potential

Anaerobic fermentation by bacteria in landfills produces methane gas. This gas can be harvested for energy or heat production. The EPA tracks landfills that use landfill gas for energy and those which have the capacity to produce energy. Roughly calculating from the estimated waste in place from existing landfill gas projects and potential projects in Michigan, we estimate 34 MW of capacity available at a rate of 1.85 MW per million tons of waste entrained.⁵⁹

However, the EPA database is not as comprehensive as a study conducted exclusively for Michigan. The Michigan Public Service Commission found a total of 148 MW of new or expanded landfill-gas capacity available at Michigan landfills.⁶⁰ We use this value as the technical potential because we believe this number more-accurately reflects the current status of landfill gas potential.

Political barriers, momentum, and site-specific considerations lead us to reduce this technical potential by 30%, for an achievable potential of 103 MW. Once built, landfill-gas generators operate nearly continuously at 90% capacity factors. Thus, we can expect that, fully utilized, new or expanded landfill gas sites could generate 728 GWh per year.

Anaerobic digesters operate similarly to the concept of landfill gas, but are optimized to process slurry animal wastes. At cattle, dairy, swine, and poultry operations, waste collected in lagoons is capped by a digester dome that restricts the oxygen available to the system and captures the methane. The methane is then combusted for energy.

The Commission estimated a total of 51 MW of new anaerobic-digestion capacity available in Michigan. Similarly to landfill gas operations, we filter this value by 30% to estimate an achievable potential of 36 MW. Anaerobic digesters operate continuously, at a 90% capacity factor; thus Michigan could produce 283 GWh of power from this resource.

3.2.3. Solar Photovoltaic Potential

Michigan's solar-resource potential lies primarily in distributed photovoltaic (PV) systems mounted on commercial and residential properties. PV systems can operate effectively in both direct and diffuse radiation. While Michigan's high latitude and frequent cloud cover pose some obstacles, other states and countries with similar conditions have not been deterred from pursuing a significant solar portfolio standard. Pennsylvania now has a state renewable-portfolio standard that will require more than 600 MW of solar capacity in the state by 2025.⁶¹ Germany, which has poorer solar radiation

⁵⁸ Antares Group, Inc. *op. cit.* ⁵⁹ Landfills throughout the U.S. have a range of energy production per waste in place. We assume that Michigan is climatically well suited to methane production, and new facilities would be built for maximum efficiency. The 1.85 MW per million tons is the 95th =ile of all landfill gas projects in the U.S., with rates as high as 10.3 MW per million tons. ⁶⁰ Michigan Public Service Commission, *op. cit.*, p. F-9 ⁶¹ Wisser, R. and M Bollinger. 2005. *Projecting the Impact of State Portfolio Standards on Solar Installations*. CEC. ⁶² "Off Grid. 2007. "Germany Tops World Solar League." 10 Oct 2007. <http://www.off-grid.net/2007/10/10/germany-tops-world-solar-league/> (accessed January 28, 2008).



than Michigan, is currently the world leader in installed solar-PV capacity and had approximately 3,800 MW of grid-connected solar-PV capacity installed as of 2007.⁶²

A 2004 report by Navigant Consulting Inc. estimated that Michigan and surrounding states (Wisconsin, Illinois, Indiana, and Ohio) have a joint total technical potential of 104,000 MW of distributed capacity on rooftop surfaces in 2010, and 146,000 MW of capacity in 2025. Michigan’s share will likely be about 2,350 MW in 2025. It is unlikely that every available roof surface would be used for PV, considering its currently high capital cost. However, Navigant estimated that if prices fall or are subsidized to \$1–1.25 per watt in 2010 and if various barriers against PV installations are removed, Michigan could expect to see 283 MW of solar PV demand in 2010. This report was completed in 2004 and it is now 2009; it is not likely that Michigan could develop 283 MW of PV in one year. However, if Michigan started today, it could ramp up its PV resources to achieve this 283 MW—or more—by 2015.⁶³

Navigant also estimates market potential, the subset of technically potential PV that would be demanded at a given price, taking government subsidies into account. We assume the current installed price is about \$7 to \$8 per Watt and the installed PV cost per watt could be lowered in the range of \$2 to \$4 on average in 2010 through 2025 with strong state and federal support and subsidies. Given this price range and the payback year of 9 to 16 years for Michigan provided in the report, we estimated a range of 0.8% to 6.5% cumulative market penetration (of total technical potential) in 2025 for Michigan, using Navigant’s payback curve. Applying this penetration range, we concluded that Michigan could achieve roughly 470 to 1,400 MW of solar PV by 2025 (with the average of 935 MW) if the effective installed cost per watt for consumers is lowered to the range of \$2 to \$4 per watt. See Table 3.6.⁶⁴

Table 3.6:
Solar PV Technical Potential vs. Expected Demand in 2025 (MW of installed capacity)

	Residential	Commercial	TOTAL
Technical Potential	18,121	14,232	32,353
Demand at \$ 2.00 – 2.50 / W	507	925	1,432
Demand at \$ 3.00 – 3.75 / W	145	327	472
Average Expected Demand	326	626	952

Estimates for the peak contribution of solar PV use an “effective load-carrying capability” factor (ELCC), which represents a percentage of capacity reasonably expected during peak periods. According to Perez et al. 2006, the ELCC for Michigan ranges from about 47% to 65% for the penetration of 2 to 5% depending on the type of PV application (i.e., two-axis tracking, horizontal, and south 30° tilt).⁶⁵ Assuming the average ELCC of 56%, we estimated the peak contribution of PV to be about 530 MW in 2025. In addition, we estimated the power generation to be about 1250 GWh based a 15 % capacity factor (relative to the “Average Expected Demand” figure). See Table 3.7.

Table 3.7:
Expected Demand and Generation based on Average Expected Demand

	Residential	Commercial	TOTAL
Expected Peak Demand (MW)	183	351	533
Expected Generation (GWh)	428	823	1251

3.2.4. Onshore Wind Potential

Michigan has moderate onshore wind resources. At 50-meter hub-heights, much of the Lower Peninsula is categorized as Class 2 (wind speeds average 13.2 mph). However, a 2005 report for the National Renewable Energy Laboratory (NREL report of 2005) estimated that, with exclusions, 15,734 MW of Class 3 and 831 MW of Class 4+ wind was available for development assuming 50-meter hubs. Hub heights now regularly exceed the 50-meter height assumed in this study, reaching faster and steadier winds at 80-meter elevations.⁶⁶

The NREL study takes into account exclusions for certain areas: those near urban centers, federal park, forest, and military land are excluded all or in part. We accept the exclusions. Our total technical-

⁶³ Chaudhari, M. L. Frantzis, TE Hoff. 2004. PV Grid Connected Market Potential under a Cost Breakthrough Scenario. Navigant Consulting. <http://www.ef.org/documents/EF-Final-Final2.pdf> ⁶⁴ Navigant estimates market potential based on its estimate or assumption for a customer payback curve and a technology adoption curve called S-curve. The market potential varies based on the level of assumed effective installed PV prices in 2010 with government subsidies. The price ranges from \$1 to \$5 per Watt installed. The lower prices assume state and federal government’s strong policy support and subsidies. ⁶⁵ Richard Perez et al. 2006. “Update: Effective Load-Carrying Capability of Photovoltaics in the United States” NREL conference paper in June 2006. ⁶⁶ Heimiller, D. 2005. National Renewable Energy Laboratory, March 2005. The total resource excludes parks, protected lands, steep slopes, airports, urban areas and associated 3 km buffers, and small resource areas. The study assumes that 5 MW of turbines could be installed per sq. km.

potential estimate is the combined Class 3 and 4 NREL potential (about 16.5 GW). Since Class 4 sites are economically attractive, we estimate an achievable potential of 50% of the Class-4-wind and only 10% of the Class-3-wind sites. The assumptions and results are shown in Table 3.8, based on capacity factors derived from an Arizona study.⁶⁷

Table 3.8:
Onshore Wind Potential in Michigan

	Total Potential (including exclusions) MW	Achievable Potential	Peak Capacity @ 20% ELCC	Total Energy GWh @ 35% capacity factor
1 km exclusion 30 m depth	110,570	22,114	4,422	67,801 GWh
5 km exclusion 30 m depth	25,837	5,167	1,033	15,842 GWh

3.2.5. Offshore Wind Potential

Until recently, offshore wind has been considered less feasible in the United States than onshore wind. Offshore wind requires more-complex construction in shallow water, and is only in conceptual development for deep water (greater-than-60-meter depths). Also, offshore wind uses primarily public domain lands (subsurface), and has been cited by wind opponents as endangering marine and avian wildlife, naval and shipping operations, and potentially aircraft operations as well. Despite these considerations, shallow-water offshore wind development has continued apace in Western Europe, now providing more than 668 MW in the United Kingdom.⁶⁸

Offshore conditions are nearly ideal for harnessing wind power. Offshore winds are stronger, more steady and predictable, and typically closer to load centers than land-based windy regions. It has been known for more than a decade that offshore winds on the Great Lakes could provide a rich energy resource, but until recently, the potential has been largely unexplored.

Copious, economically competitive wind energy is available offshore on the Great Lakes according to a groundbreaking 2008 report by the Michigan State University Land Policy Institute found that 321,936 MW (or 359,755 MW nameplate) of wind could be installed on the Great Lakes within State jurisdiction.⁶⁹ The rigorous geographic analysis found that 22,000 to 94,000 MW of capacity could physically be tapped with today's technologies, depending on siting choices. The study relied upon April 2008 data released by AWS Truewind.⁷⁰ The study assumes that offshore wind farms comprise 3.6-MW turbines spaced at 1-km (0.6-mile) distances. Offshore turbines of this size are already used in Arklow, Scotland.⁷¹

With wind resources close to existing transmission lines and metropolitan areas (load centers), the competitive renewable energy in Michigan may be significantly better than even windy states to the west.⁷²

Two-thirds of the offshore wind potential is in waters deeper than 60 meters that are currently not accessible. Of this, about 10% is within one kilometer of the shoreline, and could encounter political resistance by shoreline residents. Outside of the one-kilometer buffer and at appropriate depth, there are still 110,570 MW (nameplate) available. Assuming stiffer political resistance requiring a 5 km buffer to the shoreline and interest in developing only very shallow regions (shallower than 30 meters), 25,837 MW (nameplate) of potential are still available from offshore wind, or nearly one and a half times the amount of wind currently developed in the U.S.⁷³

Table 3.9:
Offshore Wind Energy Potential in Michigan

	Total Potential (including exclusions) MW	Achievable Potential	Peak Capacity @ 20% ELCC	Total Energy GWh @ 35% capacity factor
1 km exclusion 30 m depth	110,570	22,114	4,422	67,801 GWh
5 km exclusion 30 m depth	25,837	5,167	1,033	15,842 GWh

Environmental, practical, and economic considerations will influence the amount of offshore wind that can be developed. Other studies have assumed 33% and 67% reductions in developed area based on other considerations.⁷⁴ Conservatively assuming that only 20% of this easily available resource is developed in the near future at the parameters defined by the Land Policy Institute, we estimate 5,167 MW of nameplate wind power.⁷⁵ Wind power is an intermittent resource, changing with wind velocities. Therefore, it does not consistently produce during peak periods. An adjustment factor is used to estimate how much credit should be given to wind power to produce during peak periods. In this case, we use an effective load-carrying capacity (ELCC) of 20% to estimate peak power potential. With a 35% capacity factor, offshore wind could produce 15,842 GWh per year. See Table 3.9

An emerging study from NREL suggests that if the U.S. moves towards a goal of 20% wind-generated electricity by 2030, the Reliability First electrical region could see an economic impact of \$79 billion over 20 years, 161,500 manufacturing jobs (FTE), and 571,800 operations jobs over 20 years (FTE).⁷⁶

⁶⁷ Acker T.L., Williams S.K., Duque E.P.N., Brummels G., Buechler J. 2007. Wind resource assessment in the state of Arizona: Inventory, capacity factor, and cost. *Renewable Energy* 32(9), pp. 1453-1466. ⁶⁸ British Wind Energy Association. *Real Power 12* (April-June 2008). ⁶⁹ Adelaja, S. and C. McKeown. 2008. *Michigan's Offshore Wind Potential*. Michigan State Land Policy Institute. September 30, 2008. ⁷⁰ AWS Truewind, 2008, *Wind Resource of the Great Lakes*, AWS Truewind Published Maps, April 2008. These are the same maps referred to by the Michigan Department of Energy, Labor and Growth http://www.michigan.gov/dleg/0,1607,7-154-25676_25774-101765-,00.html. ⁷¹ Adelaja, S. and C. McKeown. 2008. *Michigan's Offshore Wind Potential*. Michigan State Land Policy Institute. September 30, 2008; Flowers, L. 2008 *Wind Energy Update*. National Renewable Energy Laboratory. June, 2008. The LPI study calculated available power by multiplying mean wind speeds by expected power output of a 3.6 MW turbine. A more-traditional measure of capacity is in nameplate capacity (MW), which is presented in this study. Although it is unlikely that a wind resource would ever generate at full nameplate capacity (requiring all turbines to move at maximum output), the measure is a useful metric. Total



SECTION 3.3.

Jobs from Energy Efficiency and Renewable Energy

Since the late 1990s, there have been a series of assessments of the employment opportunities that could be generated by the renewable-energy and energy-efficiency industries. These assessments almost uniformly have concluded that investments in renewables and efficiency provide a significant net employment benefit relative to energy supply from traditional fossil resources. In particular, because the individual units of renewable energy projects are smaller (e.g. wind turbines versus a single large coal plant) and are increasingly produced and installed locally rather than by out-of-state contractors, more employment benefits accrue in-state. Energy-efficiency programs rely on large numbers of installers, contractors, and laborers, work that cannot be outsourced, confers local economic benefits, and provides local jobs.

Several studies have been undertaken to estimate the economic impact of implementing Renewable Portfolio Standard and an Energy Efficiency Program in Michigan. The first study was produced by NextEnergy Center for the Michigan Department of Environmental Quality.⁷⁷ This study found that:

- Energy efficiency programs will cause a significant improvement in Michigan's economy.

- Renewable portfolio standards (RPS) will cause a moderate improvement in Michigan's economy.
- Combining an energy efficiency program with an RPS will cause the largest improvement in Michigan's economy.
- Together, energy efficiency programs combined with an RPS will significantly reduce Michigan's CO₂ emissions.
- Manufacturing renewable energy components will improve Michigan's economy.⁷⁸

The study also found that the jobs impact of an RPS "are likely to be positive over the life cycle of renewable power generation plants (versus fossil generation plants)."⁷⁹

The NextEnergy Study found that a Moderate RPS combined with a Moderate energy efficiency program would create approximately 19,000 more jobs within the study period than a base case that added new coal-fired power plants.⁸⁰ This scenario assumed that the components for new wind facilities would be produced in Michigan. The Moderate RPS combined with a Moderate energy efficiency program would create over 17,000 during the study period even if the wind components were manufactured out of state.

power output (in MWh) is found by multiplying the capacity by the capacity factor, or average percent of capacity obtained in a year. Power available for peak load is found by multiplying by the effective load carrying capability (ELCC) rate, or percentage of capacity reasonably expected during peak periods. **72** A load center is an area in which there is significant energy demand (load). Typically cities and metropolitan areas are considered load centers. **73** U.S. Total: 16,971 MW as of April, 2008. Flowers, L. op. cit. **74** Dvorak, M.J., Jacobson, M.Z., and Archer, C.L. (2007). "California Offshore Wind Energy Potential" Proceedings from Windpower 2007. American Wind Energy Association Windpower 2007 Conference & Exhibition, June 36, 2007, Los Angeles. AWEA; Musial, W. (2005). "Offshore Wind Energy Potential for the United States". May 19, 2005. Evergreen, Col. Paper Presented to: The Wind Powering America Annual State Summit. **75** This is an extremely conservative estimate: the NREL study (Heimiller, 2005) found 26,571 MW of offshore nameplate wind potential with significant exclusions, more than five times our conservative assumption. Wind towers can only occur in a 10-km zone between 10 and 20 km offshore, and only ___ of this area could be developed. This estimate did not consider depth or environmental exclusions. **76** Flowers, L. op. cit. This region comprises Michigan, Indiana, Ohio, West Virginia, Pennsylvania, Maryland, Delaware, and New Jersey. **77** A Study of Economic Impacts from the Implementation of a Renewable Portfolio Standard and an Energy Efficiency Program in Michigan, NextEnergy Center for the Michigan Department of Environmental Quality, April 2007. **78** Pages v through xi. **79** Page xi. **80** Page 37.



We have concluded that the NextEnergy Study significantly understates the number of new jobs that could be created by an aggressive RPS and aggressive energy efficiency investments because it understates the potential for achievable cost-effective energy efficiency and renewable resources in the state. For example, the NextEnergy Study assumed in its High Penetration EE2 Case, that only 1,853 MW of peak reduction could be achieved by 2018.⁸¹ As discussed in Section 3.1.1 above, we believe that an aggressive energy efficiency program could reduce peak demand by 5,355 MW by that same year, or almost triple what NextEnergy assumed. Thus, we recommend more aggressive investments in energy efficiency that would create significantly more new jobs.

The same is true for renewable resources. NextEnergy assumes that as late as 2025, renewable resources in Michigan would only provide approximately 21,631 GWh of energy.⁸² Again, we have concluded that in-state renewable resources could provide significantly more energy—perhaps a total of as much as 27,000 GWh.⁸³ The investments to build and operate the new wind, biomass, photovoltaic, landfill gas, and digestion facilities that would generate this additional renewable energy would create more jobs than the NextEnergy Study suggests.

The American Council for an Energy-Efficient Economy (ACEEE) also has studied the economic impacts of the 21st Century Electric Plan, finding that a combination of efficiency and renewable technologies could provide economic benefits within Michigan.⁸⁴ The ACEEE also examined whether a more aggressive “clean energy” scenario could provide additional economic benefits in terms of net growth in jobs in the state. Table 3.10, below, shows the results of the ACEEE study for two scenarios, the first with a goal of achieving 15% energy efficiency savings over the period from 2008 to 2023 with 7% of the remaining energy demand coming from renewables, and a “doubling efficiency” scenario. This “doubling efficiency” scenario doubled investment in efficiency and renewables, resulting in energy savings of 23.6% by 2020 and renewable generation held constant at 7%.

In both scenarios the number of jobs created increases substantially between 2008 and 2013 as initial investment expenditures cause programs to take hold and increase in scale. In later years, renewable investments level off and a small number of investments drive efficiency gains, leading to a decline in the number of net jobs. Nonetheless, in the “doubling efficiency” scenario net job gains in 2018 are almost equal to the number of jobs created in the NextEnergy study’s scenario with maximum job growth—a scenario that includes wind component manufacturing facilities. Job impact under a doubling of investment scenario leads to the creation of 5,000 more Michigan jobs than the maximum scenario in the Michigan 21st Century Energy Plan. Therefore, “the big conclusion from this alternative scenario is that the savings and economic impacts tend to be more robust in outcome—and that greater levels of energy efficiency investment produce greater gains in net employment...in Michigan.”

Fossil-fired generation, by contrast, is typically capital-intensive but not labor-intensive. While clean energy investments create 16.7 jobs for every \$1 million in spending, investments in fossil fuel technologies generate only 5.3 jobs for every \$1 million in spending. And relative to fossil fuel spending, investments in clean energy create 2.6 times more jobs for people with college degrees or above, 3 times more jobs for people with some college, and 3.6 times more jobs for people with high school degrees or less.⁸⁶

Increased levels of investment dollars have been made available to states by the federal government through the American Recovery and Reinvestment Act of 2009 (ARRA), which has numerous provisions designed to provide funding for efficiency and renewable energy projects in the US. Under the ARRA, Michigan was allocated approximately \$243 million for the Weatherization Assistance Program, designed to help low-income households to permanently increase energy efficiency in their homes. Approximately \$76 million went to Michigan under the Energy Efficiency and Conservation Block Program, and funds may be allocated to state, county, city, and tribal governments to be used for various energy efficiency measures

Table 3.10.
Job Impact from Michigan PSC Scenario
and a Clean Energy Alternative⁸⁵

		2008	2013	2018	2023
Michigan PSC Scenario	GWh saved	657	4,323	9,132	12,417
	Jobs Created	3,411	8,112	3,170	3,888
“Doubling Efficiency”	GWh saved	1,314	8,646	18,264	24,834
	Jobs Created	3,262	9,203	5,371	7,506

⁸¹ Page 14. ⁸² Page 16. ⁸³ See Table 3.1 above. ⁸⁴ John A. “Skip” Laitner and Martin G. Kushler. *More Jobs and Greater Total Wage Income: The Economic Benefits of an Efficiency-Led Clean Energy Strategy to Meet Growing Electricity Needs in Michigan*. 2007. Page iv. ⁸⁵ *Ibid.* Pages 10, 12. ⁸⁶ Robert Pollin, James Heintz, and Heidi Garrett-Peltier. *Clean-Energy Investments Create Jobs in Michigan*. Political Economy Research Institute. Prepared for the Center for American Progress. June 2009.



as well as the installation of renewable energy systems on government buildings. Finally, more than \$82 million was allocated to Michigan through the State Energy Program. The state has determined that it will focus this funding on the following three-year goals:

- Reducing energy consumption in public buildings by 20% by 2012;
- Establishing green communities;
- Creating markets for renewable energy systems; and
- Creating sustainable jobs in energy efficiency and renewable energy sectors.⁸⁷

Michigan has stated its commitment to the creation of jobs through the implementation of energy efficiency and renewable energy programs; however, carrying out the 21st Century Energy Plan would achieve only a fraction of the job creation that is possible through these initiatives. Studies have shown that increased levels of efficiency and renewables could create even more jobs in Michigan—jobs that residents who were formerly employed in the state’s ailing manufacturing sectors could perform with little or no additional training. From an employment point of view, directing funds toward fossil fuel technologies would be misguided, when investments in clean energy creates three times the number of jobs as investment

in coal. Funding should be directed instead toward additional gains in energy efficiency and renewable generation, including those funds recently made available through the ARRA. Finally, if the Waxman-Markey climate bill is passed by the US Senate, research has shown that there would be a net increase of \$4.8 billion dollars of investment revenue in Michigan, creating 54,000 jobs in energy efficiency and renewable energy programs.⁸⁸ As employment opportunities shift away from the automobile industry and toward clean and efficiency energy technologies, so Michigan should also adjust. The state needs to set goals now for increased efficiency and renewables in order to prepare itself to take full advantage of these funding opportunities and regain its role as a major employer of workers in key industrial sectors.

⁸⁷ United States Department of Energy. *Obama Administration Announces More Than \$32 Million for Energy Projects in Michigan*. Press Release, June 22, 2009. Available at: <http://www.energy.gov/7483.htm>. ⁸⁸ *Id.*

4. A Robust Energy Plan for a Resilient Michigan





Michigan, like many other states, is navigating difficult challenges, and is at the cusp of important decisions regarding its energy future. Already, the state has taken some important steps in shaping that energy future; it has begun to acknowledge the importance of long-term and sustained commitments to efficiency and renewable energy by establishing binding targets for renewable-resources, and mandating comprehensive energy planning for utilities.⁸⁹ Michigan also has a climate action plan, and a requirement for the Department of Environmental Quality to consider the need for and all feasible and prudent alternatives to the construction of any new coal-fired power plant.

Any new plan must of course satisfy these requirements, and respond to other major factors. Michigan, as well as the nation, is suffering a significant economic downturn with large impacts on jobs, business, electrical demand, and citizens' ability to absorb cost increases. The electricity customer base is shifting towards residential customers and away from industry. And finally, the United States is on the verge of enacting limits on greenhouse gas emissions that will affect the economics of all resources in the electric industry.

Designing a plan that is responsive to all of these factors is challenging. Unfortunately, the 21st Century Electric Energy Plan does not meet the challenge or position Michigan well for the future. The Plan would lock Michigan's ratepayers into expensive and escalating coal plant construction costs, high operating costs that ship money out of state through coal purchases, and years of costly greenhouse gas emissions.

Policymakers need not ignore sound energy planning in the face of economic crisis. Indeed the most competitive economies in the 21st Century will be those that are innovative and efficient in energy and resources use. Michigan needs a plan that uses current resources efficiently, taps energy efficient technologies for all customers, adds new clean modular resources to create greater flexibility, does not lock the state into expensive greenhouse gas emissions, and offers jobs. Fortunately, it has the means to create such a plan through developing its available resources in energy efficiency and renewable energy.

Michigan has an opportunity to implement rigorous cost-saving energy-efficiency mechanisms, develop new renewable energy resources, and employ thousands of skilled workers in a new green-energy economy. While a cleaner, more cost-effective, job-producing energy sector is appealing under any circumstances, the allure is even greater in the midst of an economic downturn. Actions by other states provide models for Michigan to build upon in moving towards cost-effective energy efficiency, wide-ranging renewable energy, and the use of long-term planning with a broad portfolio of options.

⁸⁹ Act 295 will set a renewable-portfolio standard, essentially renewable-energy targets for utilities. Renewable-portfolio standards are the prevailing mechanism to support new renewable energy in the U.S.; they are discussed in detail in Section 4.4.1. Act 286 requires integrated resource planning, the comprehensive least-cost energy-planning discipline that is used in other states; it is discussed further in Section 4.2.



SECTION 4.1.

Michigan's Alternative – Reducing Reliance on Fossil Fuels

Michigan's residents and businesses spend billions of dollars each year to import 100% of the coal, and virtually 100% of the oil, used by in-state generators. These dollars are exported out of state and are not returned. Decreasing the amount of imported fuel would keep more of those dollars in the state. Michigan consumers spend \$18 billion dollars per year on energy.⁹⁰ Reducing that result by only 10% would achieve the energy benefits expected over a 20-year period by the Public Service Commission in the 21st Century Electric Energy Plan. Such a modest reduction would also avoid the need to build a coal plant that would impose more than \$2 billion in plant capital costs to the same ratepayers over its expected life.

Due to shifts in consumption patterns, Michigan's generation no longer corresponds to its demand. The large baseload units are ill-matched to the fluctuating load-shape of Michigan's demand today. New baseload units would not resolve this problem. The appropriate response is to shave peak with efficiency and demand-response programs, and to meet new supply needs with small and nimble resources that can follow load, such as CHP, renewables, and natural-gas. Michigan has all the resources it needs to do this without any new coal—indeed, even assuming significant retirements of coal capacity. In the preferred scenario, energy efficiency, and renewables—chiefly wind—replace coal at less cost and more reliability.

Michigan's energy consumption has been flat for the past several years and decreasing in 2008. This reality contrasts with the projections for continued 1.2% load growth ad infinitum, as assumed by the 21st Century Electric Energy Plan. According to the electricity load forecast included in the 21st Century Electric Energy Plan under the "base case" conditions, energy efficiency plays only a modest role in reducing demand.

In the green alternative (Figure 4.1), we find that load growth is unlikely in the next several years, considering Michigan's current economic condition and the recent utility forecasts that project no growth in consumption and loads through at least 2016.⁹¹ We forecast an aggressive (yet still highly economic) energy-efficiency case, and

include the alternative-energy options identified above in Chapter 3.⁹² New wind (onshore and offshore) and CHP provide much of the energy available and new biomass, landfill gas, and small solar installations add a margin above that. Excess renewable energy could displace existing coal in Michigan. Renewable energy that qualifies for a renewable energy credit can be sold at a premium.

Capacity in the 21st Century Plan exceeds demand by a wide margin. For the most part, this is due to the low capacity factors of Michigan coal plants, which provide significant capacity but very low generation. The modest efficiency proposed in that plan reduces demand only slightly. *See Figure 4.2.*

In the green alternative, capacity also exceeds peak demand through the entire period. More-aggressive energy efficiency reduces peak demand significantly, and additional demand response cuts peak requirements even further, making better use of existing capacity.⁹³ New renewable energy comes online in this alternative as of 2010 and ramps towards the achievable potential. Wind has a very low capacity credit (it is not always synchronous with load) and thus does not provide much peak capacity to the system. However, the green portfolio still meets, and indeed far exceeds, capacity needs. *See Figure 4.3, page 40.*

It is important to note that *the green alternative is not an energy plan.* Developing a plan requires in-depth modeling to estimate which resources can be built, at what rate, and what cost. The green alternative is presented to inform future planning efforts and illustrate the opportunities for an efficient and competitive energy economy in Michigan.

Michigan can realize a portfolio of renewable energy and CHP that is much more extensive than that assumed in the 21st Century Plan. *See Figure 4.3.* If, as in other jurisdictions, small-scale onsite CHP is included in any renewable-portfolio standard, Michigan can easily achieve a 20% renewable portfolio standard by 2020, and nearly 30% by 2025. This would put Michigan on track with other leading states.

⁹⁰ Midwest Energy Efficiency Alliance. 2006. "Comments on 21 CEP/CNF Update Strawman Proposals" filed with Michigan PSC. August 25 2006, p. 4. ⁹¹ <http://efile.mpsc.cis.state.mi.us/efile/docs/15645/0003.pdf> Case U-15645, Exhibit A-79, Witness L. D. Warriner, November 2008 (for Consumers Energy). ⁹² This analysis did not calculate new energy efficiency past 2019. Instead, we conservatively estimate that targets achieved by 2019 remain. It is far more likely, however, that new efficiency measures would continue to draw down or flatline growth after this time. ⁹³ Again, an analysis was not conducted for efficiency or demand-response past 2019, and the levels for these resources are conservatively held constant from 2019 to 2025.

Figure 4.1: Energy Demand and Supply in the Green Alternative Scenario, with New Renewable and Energy-Efficiency Programs

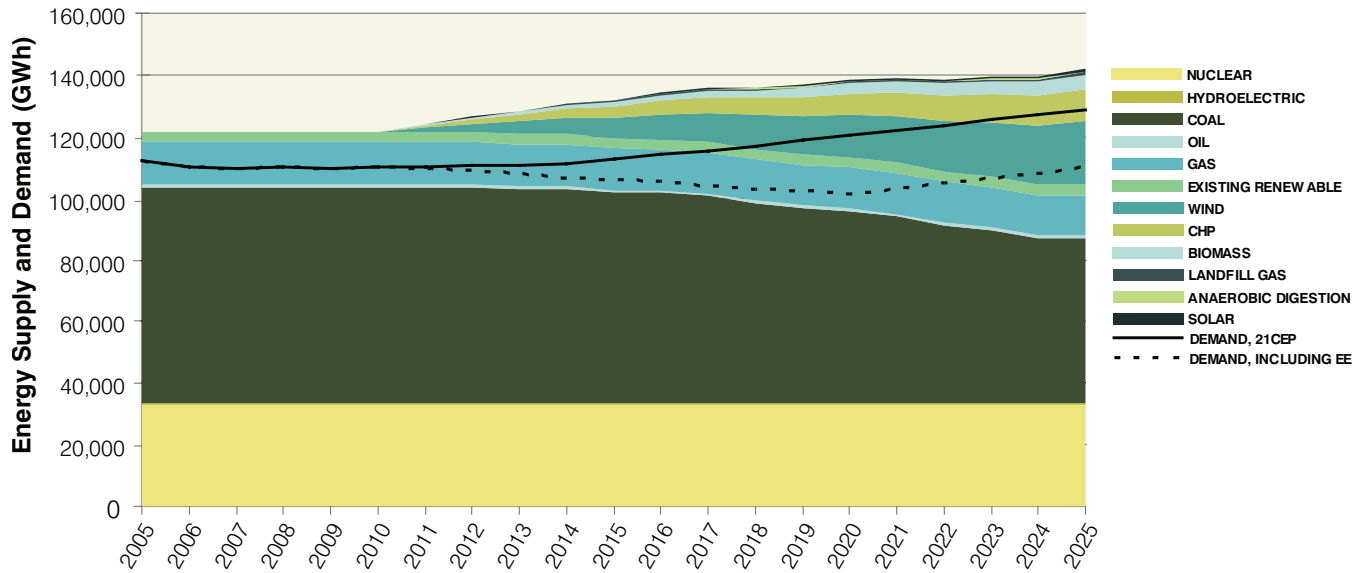


Figure 4.2: Peak Capacity in the 21st Century Energy Plan

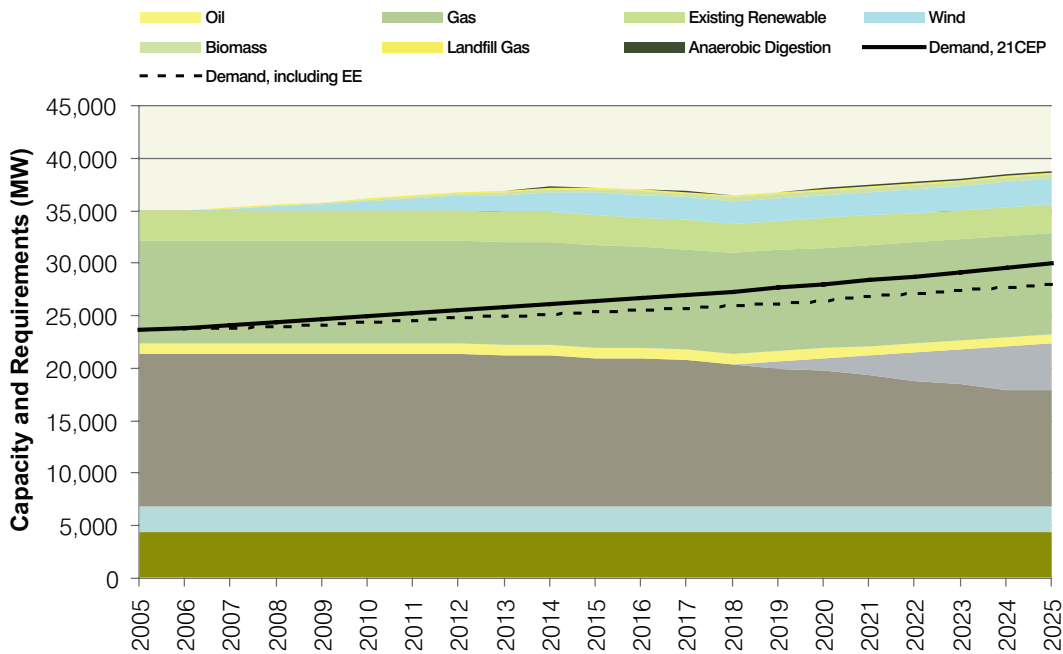


Figure 4.3: Peak Capacity in the Green Alternative

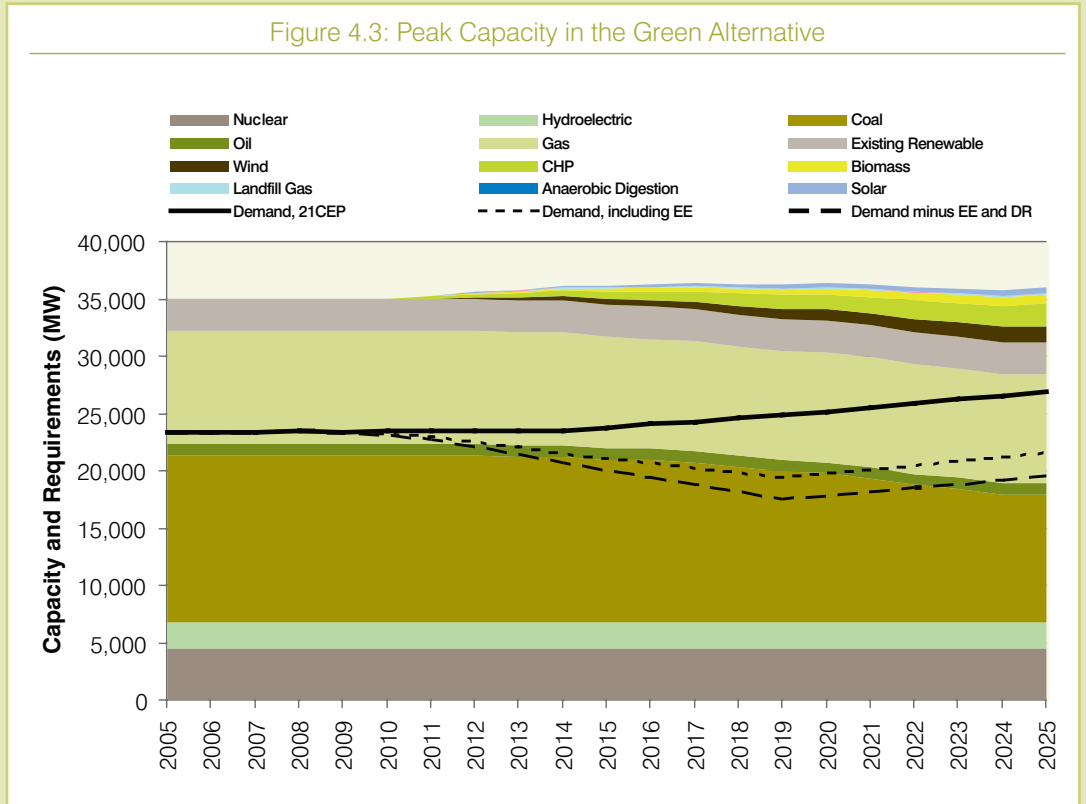
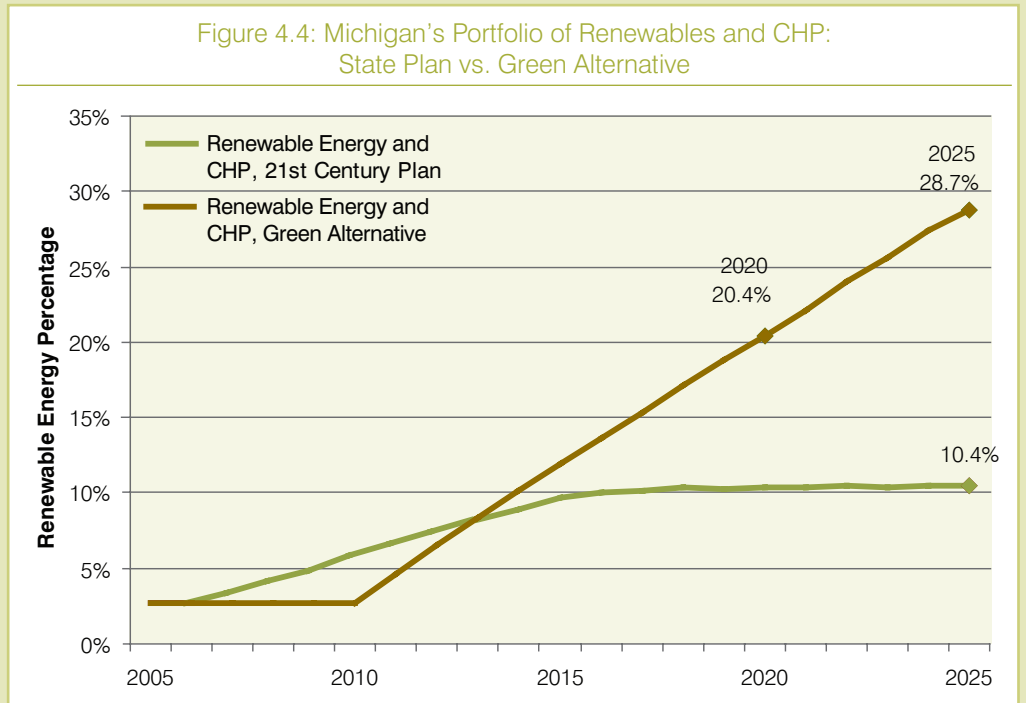


Figure 4.4: Michigan's Portfolio of Renewables and CHP: State Plan vs. Green Alternative





SECTION 4.2.

Planning For a Clean Efficient Future

Michigan has an historic opportunity to improve energy reliability, forestall sharp increases in electric costs, develop its demand-side and renewable resources, create local jobs, and to reduce its environmental footprint. The state will miss these opportunities if it acts based on inaccurate assumptions and low expectations. The framework for Michigan to claim its clean, least-cost future is an integrated resource plan that examines both supply-side resource alternatives (that is, generating units) and demand-side options (energy efficiency) using rigorous economic tests. In other jurisdictions such long-term plans are key energy blueprints. Michigan's new Act 286 (Acts of 2008) requiring such a plan is a good first step, but legislators should refine the law's requirements further, drawing on the rich experience of integrated resource planning in other U.S. states.

4.2.1. New Assumptions Based on New Experience

Shifting to a new planning paradigm requires several changes in planning methods. In developing energy plans in Michigan:

- Energy-efficiency programs should be analyzed under low, medium, and high annual penetration savings scenarios of 1%, 1.5% and 2% of load respectively;
- Michigan should develop its energy-efficiency programs based on savings achievable with a budget based on funding at a level of at least 3mils/kWh;⁹⁴
- All readily available technology and current methodologies for peak load response should be considered with the goal of capping then reducing peak load in the near term;
- A revised estimate of the economic potential for CHP, including both large and small industrial, commercial, and residential sectors;
- Michigan should use up-to-date values for capital, fixed, and operating costs for fossil fuel generation, including escalation rates that reflect the volatility of these components (sample data are provided in the end notes for this paper);
- New assumptions about wind-capacity credits should be based on protocols suggested by NREL and take advantage of recent work in Minnesota that more-precisely characterizes this resource;⁹⁵
- Michigan should incorporate into its planning a reasonable range of expected prices of carbon-dioxide emissions to help forecast the additional costs for fossil-fuel-fired generators.

4.2.2. An Integrated Resource Plan

Along with Act 295 the Michigan legislature also passed Act 286 during 2008. This Act requires the state's utilities to develop integrated-resource plans (IRP). These are long-term plans for acquiring energy resources (including efficiency) that are developed using rigorous economic tests for economic efficiency.

The Act's provisions do not apply to municipal and rural cooperatives, and don't specify a true IRP that treats all demand-side and supply-side resources equally. The language is also over-vague about how utilities are to conduct load forecasts, stating only that forecasts should be done under "various reasonable scenarios," which leaves it to the utilities to define what this means. Section 9, subsection 11 of Act 286 provides specific requirements.

Several states require a portfolio approach to integrated resource planning.⁹⁶ An important provision is the requirement that all cost-effective energy efficiency be procured first, before investments in supply-side resources are considered. Connecticut's 2007 Public Act 07-242 is one of many examples that could inform Michigan as it refines and strengthens Act 286. Appendix G provides detailed language from the relevant sections of the Connecticut law.

A good integrated-resource plan incorporates the following principles:

- All resources are considered on a level playing field. This means that energy efficiency and demand response, transmission and distribution resources, and all types of generation resources are considered on an equal basis;
- The planning process should result in an integrated resource portfolio with the mix that will provide adequate and reliable service at the lowest life-cycle cost. Life-cycle-cost comparisons should be made using either the Total Resource Cost Test or the Societal Test.⁹⁷

Applying the IRP principles and attributes to Michigan would yield the following benefits to Michigan's ratepayers and industries:

- Using realistic capital and operating cost assumptions will help to protect ratepayers from surprises in the form of future rate increases and unexpected fuel adjustment charges.

⁹⁴ The 3 mils/kWh is a baseline level. Several states have funding above this. Vermont recently approved rates that fund energy efficiency at up to 6.7 mils/kWh: Memo from Susan Hudson, Clerk of Vermont Public Service Board to Electric Distribution Utilities, October 31, 2008. ⁹⁵ Modeling Utility-Scale Wind Plants, National Renewable Energy Laboratory; March 2002; NREL/TP-500-29701; Michael Milligan; EnerNex Corporation, Final Report, Minnesota Wind Integration Study, November 30, 2006. Prepared for the Minnesota Public Service Commission. ⁹⁶ Among the states that have passed legislation requiring all cost-effective energy efficiency measures to be procured first are: Connecticut, Maine, Massachusetts, Rhode Island, and Vermont. California also has energy efficiency first in their loading order for new resources. ⁹⁷ Adopted from testimony of William Steinhurst, Synapse Energy Economics, before the Mississippi Public Service Commission, docket No. 2008-AD-158, June 10, 2008, on behalf of the Sierra Club.



SECTION 4.3.

Energy Efficiency: Capturing the Potential

- Michigan's current flat demand creates the perfect opportunity to develop new renewable and energy-efficiency resources that can offset the rate of the current growth. As Michigan's economy improves, the trajectory of savings from renewables and energy efficiency will also grow sufficient to achieve greater savings without the need to construct new generation.
- Michigan can be strategic about which of the old plants to replace, and how. Michigan's aging fleet of existing generation will require replacement, but new generation should be appropriately matched to load. It should also be based upon a diversity of fuels, including natural gas, solar, wind, and a network of smaller distributed generation, such as combined heat and power. Having a mix of large and small plants permits a nimble response to unexpected outages and demand, in addition to placing the generation closer to its demand. There is no absolute need to replace an existing coal plant with another coal plant.
- Michigan can harness its industrial base and skilled workforce to implement a plan that integrates energy efficiency, combined heat and power, renewable energy, and efficient distribution and transmission.
- Michigan can anticipate and prepare for current and future regulations to reduce greenhouse gas emissions.

Michigan can strive for efficiency both in how existing resources, such as power plants, are used, and in how electricity is used to meet requirements for energy services. This section explores both. Michigan does not need to build significant new capacity in order to meet demand. The next section explores the means of meeting demand with existing resources. The subsequent section explores policies and programs to increase energy efficiency in consumers' use of electricity.

4.3.1. Increasing Generation at Michigan's Existing Gas-fired Power Plants

Michigan has more than 11,000 MW of natural gas-fired generating capacity: 6,270 MW of combustion turbines (CT) and 5,200 MW of combined cycle (CC) facilities. Combustion turbines are generally used to meet loads during peak hours. Combined cycle units are frequently used as baseload facilities that are operated as much as needed and as is economically justified.

These gas-fired plants have operated at very low capacity factors in recent years. Eight gas-fired combined cycle units operated at an average 21.3% capacity factor in 2007, well below the 60% to 70% average annual capacity factors that can be expected at a combined cycle generating facility. An additional 17,500 GWh of electricity could be generated at the existing combined cycle facilities in the state if their average capacity factor were increased from 21% to 60%.



If additional generating capacity proves necessary, existing CT units can be repowered into more efficient combined cycle facilities by adding heat recovery steam generators. This is a common practice in the electric industry. In this way, new relatively low-cost generating capacity can be added to the system in a comparatively short period of time.

Michigan's changing customer base (from industrial to residential), coupled with Michigan's current economic conditions that have decreased electricity demand across all sectors during 2008, suggest the following:

- Michigan's loss of industrial base over the last decade has shifted how in-state generators are used. Units constructed as baseload units are now being operated as load-following or even peaking units. See, for example, the peaks and valleys of coal baseload units, Appendix I, Figure I.1.
- Existing industrial customers appear to be cutting their operations from three shifts to one or two shifts per day or have smaller overall demand. This is highlighted especially by Detroit Edison's customer base. The number of customers increased, but their combined load has decreased significantly.
- The increased residential demand also contributes to smaller generating-capacity factors. Residential use has two distinct peaks, one in the early morning, as people get ready for work and another in the late afternoon and evening, as people return home. Michigan's in-state natural gas supplies mean that relatively few homes are heated by electricity, so the demand peaks are more likely driven by summer air conditioning load, appliance and electronics use, and lighting.

Generation should synchronize with Michigan's electricity demand. Lower industrial demand and increased residential demand means new large baseload generation cannot be justified. Financing for such plants would also be difficult due to uncertainty that a new plant would operate at sufficiently high capacity factors to recover the investment over a time period satisfactory to financiers.

New supply-side resources for Michigan should be smaller and capable of increasing and decreasing their generation to follow load and/or of being dispatched quickly to provide service during peak-demand hours. New generation should also be located closer to centers of demand. The types of generation that can satisfy these conditions are as follows:

- Combined heat and power, particularly for industrial and commercial customers where there is a complementary need for process heat or heating and cooling of work spaces;
- Renewable resources, such as wind, solar and biomass;
- Natural-gas-fired turbines or combined cycle units. This option could use Michigan's native natural-gas supplies, and would decrease the need to import coal and oil from other states and countries.

4.3.2. Efficiency: Getting the Most out of Electricity

Achieving efficiency requires planning and targeted programs to overcome natural market barriers. These barriers cause rational economic actors to make individual choices that lead, perversely, to greater costs. Tenants for instance may reasonably refrain from efficiency investments to property they do not own and may vacate at any time, even though they pay the resulting energy bills; meanwhile the property owner would see little benefit from investments that cut tenants' energy bills.

Market barriers may involve asymmetrical distribution of benefits or risk, lack of information or time, or other factors. Good efficiency-program design bridges such barriers and aligns the individual economic interests with the potential for the greatest savings. The best efficiency programs capture all the cost-effective efficiency opportunities at the least possible cost; this goal is at the heart of the practice of integrated resource planning. There is a solid body of experience and precedent in this field from jurisdictions throughout the country.

Our estimates of potential energy savings from the full range of demand-side measures (energy efficiency, combined heat and power, and demand response) can be achievable and cost-effective. They are not guaranteed to be both under all circumstances. These resources must be acquired through a portfolio of programs.

The green alternative shows the potential for Michigan to satisfy a significant fraction of its future demand through energy efficiency and improved deployment of combined heat and power. By 2020, efficiency measures could satisfy 22% of Michigan's peak capacity needs. Demand response could provide an additional 8%.

These same policies could also provide a substantial and cumulative fraction of Michigan's energy needs. Demand-side measures could provide 16% of these needs by 2020. Combined heat and power could add an additional 6%.



Starting with an almost blank slate, Michigan has the opportunity to develop an outstanding portfolio. It can benefit from the experience of others in the areas of portfolio and program design, implementation, and evaluation. Several organizations, including ACEEE and the California Public Utilities Commission, support independent evaluations of best practices that are available on the Internet.⁹⁸

4.3.2.1. Programs

The purpose of energy-efficiency programs is to acquire economic efficiency resources at the least cost. Some of the special considerations that inform best-practices program designs, are reviewed in Appendix D.⁹⁹

Our recommendations for programs follow the same structure as our estimates of energy efficiency potential. The ACEEE's 2002 study of residential potential, the foundation of our estimate of energy efficiency potential, is based on three markets, defined as new construction, products, and retrofit.¹⁰⁰ The commercial-sector potential is based on three markets as well, new construction, remodel/replace, and retrofit. A portfolio of model programs to capture energy-efficiency potential segments the markets at finer level of detail to focus resources on hard-to-reach and special circumstances. The programs are grouped into two sectors, residential and commercial/industrial.

Residential Programs

- **RESIDENTIAL NEW CONSTRUCTION** Based on the national Energy Star Homes Program, this program promotes the construction of energy-efficient new homes.
- **EFFICIENT PRODUCT** This program promotes the stocking, promotion, and sales of efficient lighting, appliances and other consumer products through close collaboration with retailer and manufacturers. The Energy Star designation would be the minimum threshold for most equipment.

- **HEATING VENTILATION & AIR CONDITIONING AND DOMESTIC HOT WATER** This submarket, due to the large installed base and multiple market barriers, is best served by a targeted program that promotes high-quality installation and maintenance of efficient cooling, heating, ventilation, and domestic hot-water equipment.
- **EXISTING HOMES** Comprehensive energy savings for existing homes owned or occupied by non-low-income residents are acquired through direct installation of efficiency measures, energy audit-directed comprehensive energy improvements, and supplemental services including low-cost financing.
- **LOW INCOME** Coordinating with the Michigan Weatherization Assistance Program, this program provides the same level of services as the "Existing Homes" program at no cost to participants.

Commercial Programs

- **COMMERCIAL DIRECT INSTALL** This program offers "turn-key" or "sign-on-the-dotted-line" efficiency services targeted at the small-to-medium C&I customer that is traditionally hard to reach due to numerous barriers.
- **COMMERCIAL EXISTING BUILDINGS** Large customers are served through enhanced account management in a solution-provider system in which small customers are eligible for prescriptive and custom incentives. The program seeks to acquire comprehensive cost-effective energy savings at each facility.
- **COMMERCIAL NEW CONSTRUCTION** The solution-provider approach is used for large customers and projects while small-to-medium projects are eligible for prescriptive incentives for beyond-code performance.

Similarly, Michigan can achieve a higher degree of savings by adopting the latest version of the ASHRAE Standard, phasing in requirements to go beyond the Standard as outlined in Appendix

⁹⁸ See, for example, the ACEEE web site and <http://www.eebestpractices.com/index.asp>. ⁹⁹ The EPA guide "Advancing State Clean Energy Funds: Options for Administration and Funding" (May 2008) contains a more-detailed, yet still brief, description of program design concepts in Chapter Six of that document for those seeking more information. http://www.epa.gov/cleanenergy/documents/clean_energy_fund_manual.pdf, accessed 12/2/08

¹⁰⁰ ACEEE. 2002. "Examining The Potential For Energy Efficiency In Michigan: Help For The Economy And The Environment." 2002. Washington, D.C.: ACEEE.



E, automatically updating the Standards to require higher levels of efficiency over time, and adopting the goals of the Architecture 2030 Challenge;¹⁰¹

The absence of significant energy-efficiency programming from Michigan for more than a decade likely results in both pent-up demand and a dearth of capacity to serve that demand. Experience in other areas shows that programming can be rapidly, efficiently, and effectively expanded under these conditions; Michigan's plan should have high expectations of near-term accomplishments

Appendix E provides more-detailed descriptions of each program including a summary of market barriers and the means of overcoming them, the target market and approaches, targeted end uses, technologies, and incentives.

4.3.2.2. Program Integration and Administration

Certain elements of energy efficiency program delivery pertain to a wide range of programs. For example:

- **STATE-WIDE COORDINATION** Infrastructure requirements that transcend utility service territories, such as HERS certification and upstream efforts noted in the sections to follow, are most effectively accomplished through a coordinated statewide effort.
- **MARKET BARRIERS** Efficiency measures typically face barriers of increased first costs, lack of knowledge as to their benefits, and split incentives. A split incentive occurs when the party making the initial investment decision is not responsible for ongoing operation and maintenance costs. For example, a builder may install the least expensive heating system to reduce the total purchase cost of a new home leading to greater lifetime operation costs for the homeowner.
- **FINANCIAL INCENTIVES** In many cases the incentives are first offered to end-users and then moved upstream to retailers, distributors, and manufacturers over time.

An integrated service-delivery system is critical to meeting the needs of customers and the goals of energy efficiency, other cross-cutting issues include ensuring that programs build capacity for market-based delivery, and emphasizing program simplicity and ease of access.

There is overlap among many programs. For example, the solution-provider approach is applied in both the new-construction and existing-building markets. Incentives are available to both residential and commercial customers for purchasing energy efficient products. Programs almost universally seek to build capacity for market-based,

or unsubsidized, efficiency service delivery. Another important element in these program designs is simplicity and ease of access. Experience has shown that customers, and other market actors, respond favorably to clear consistent messages from reliable sources. The efficiency program should strive to be that source and provide that message.

Michigan has already taken a step in this direction. Act 295 (2008) requires energy providers to undertake “energy optimization programs.” Administration of these programs shall be “practical and effective” and “may be administered, at the provider’s option, by the provider, alone or jointly with other providers, by a state agency, or by an appropriate experienced nonprofit organization selected after a competitive bid process.” However, the wide latitude of administrative structures contemplated in the new statute may not sufficiently support the most efficient or effective energy optimization.

The EPA report noted earlier describes three basic administrative approaches for energy efficiency and related programs,¹⁰² as follows:

- **UTILITY** Delivered by utilities, usually distribution-only utilities in restructured markets or integrated utilities in a fully regulated markets
- **STATE** Delivered by an existing or newly created state entity, typically relying on contractors to perform many functions.
- **THIRD PARTY** Delivered by an independent entity whose sole purpose is to administer energy-efficiency programs.

These distinctions are conceptually useful, but in practice there is overlap. For example, utilities increasingly rely on contract staff for all aspects of efficiency programming. And Vermont, the home to the nation’s first energy efficiency utility, is administering an energy-efficiency fund through a state office. No administrative model is clearly superior on all counts.

Regardless of the administrative model or models adopted, Michigan cannot realize the full benefit of the potential for efficiency resource if (1) customers are confused by a variety of program offerings, (2) retailers have to keep track of differing incentives for the customers of different utilities, or (3) manufacturers face a different set of equipment efficiency requirements in different utility service territories. The multiplicity of administrative structures the law permits may allow some administrative inefficiency. It must not be permitted to create a cumbersome, artificially segmented market place.

¹⁰¹ See <http://www.architecture2030.org/> (accessed September 11, 2008), then click on “Meeting the 2030 Challenge Through Building Codes” to obtain the recommended actions. ¹⁰² http://www.epa.gov/cleanenergy/documents/clean_energy_fund_manual.pdf, accessed 12/2/08



SECTION 4.4.

Tapping Into Renewables

Michigan has the potential for renewable-resource development well in excess of the levels required by Public Act 295. Its significant onshore and offshore wind resources, plus strategically placed solar and biomass, can make Michigan a leader among its neighboring states. Implementation of the steps below will help develop the state's renewable energy resources strategically and cost-effectively.

There are a variety of policies to promote renewable development in states and countries today. Some of the major policies include (1) quota based policies such as renewable portfolio standards, (2) price-based policies such as renewable energy payments (also called feed-in tariffs), (3) renewable rebates and incentives to reduce upfront capital costs, and (4) renewable rebates and incentives to reward performance.

Table 4.1, at right, contains a high-level definition of each of these policies, an overview of the pros and cons of each of these policies, and a list of the states and countries that have implemented each policy.

Renewable-energy payments have driven most of the renewable installations in Europe, while renewable-portfolio standards are the predominant policy to develop renewables in the U.S. Based on European success with renewable-energy payments, and on some difficulties U.S. states are experiencing in promoting renewables under renewable portfolio standards, much of the current interest and debate is focused on the comparative success of each of these two policies in developing renewable resources. Furthermore, while rebates and incentives can be provided with or without renewable portfolio standards, states that offer rebates and incentives without a renewable portfolio standard have not seen significant development of renewable energy projects. However, rebates and incentives have become vital instruments to promote renewables alongside renewable portfolio standards. As a result, we focus on renewable energy payments and renewable portfolio standards.

A wide variety of renewable-energy payments and renewable-portfolio standards have evolved over time. Here, we broadly define renewable energy payments as a fixed tariff-based policy and renewable portfolio standards as a quota-based policy that allows the market to set prices. We further define each of these two policies using best practice to date (i.e., designs that are driving the greatest amount of renewable energy) as described below. This section also describes a number of other programs to increase penetration of renewables in a state's resource mix.

4.4.1. Renewable-Portfolio Standards

Renewable-portfolio standards require utilities to procure a certain percentage of their total resource portfolio from renewable energy sources. They are essentially renewable-energy quotas for utilities that allow market forces to set the prices for renewable energy. They have been implemented by more than 30 states and are currently the most-common policy in the United States to promote renewable energy. U.S. states have had extensive experience with, and strong political support for, renewable portfolio standards. The amount of renewable energy required by the standard generally increases over time. Renewable-portfolio standards usually accompany policies that require utilities to prioritize interconnection of renewable generation.

Michigan's Public Act 295 (Acts of 2008) requires each electric provider, including municipally owned utilities, to describe how it will meet requirements for a 10% RPS by the end of 2015. The Act has the following positive provisions that will help establish the framework for a long-term commitment to renewable energy resources:

- **A GRADUAL INCREASE OF THE AMOUNT OF ENERGY THAT SHOULD BE PROVIDED BY RENEWABLE RESOURCES**, starting from 0.3% per year in 2008-09 to 1% per year in 2012, and higher rates of savings in later years.
- **SPECIFIC PROCUREMENT REQUIREMENTS FOR LARGE UTILITIES**. Those serving more than one million customers must procure 200 MW of renewable energy by December 31, 2013, and 500 MW by December 31, 2015. For utilities serving more than two million customers, the requirements are to procure 300 MW and 600 MW, respectively.
- **CREATION OF A WIND-ENERGY BOARD** to study and recommend sites to construct wind turbines;
- **STATEWIDE NET METERING**.

Act 295 is the first step towards a greener and more-efficient Michigan economy. It begins to align future supply needs with changing demand (by addressing peak load growth and lower-to-flat growth in base demand) and to increase reliance on renewables. However, Michigan can do much better than the modest levels anticipated by Act 295.

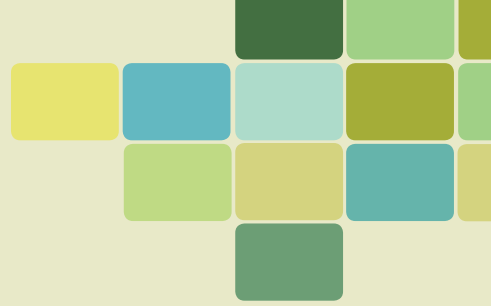



Table 4.1:
Overview of Policies to Promote Renewable Energy Development ¹⁰³

Definition	Pros and Cons	Currently In Use
RENEWABLE-PORTFOLIO STANDARDS (RPS)		
A requirement that utilities procure a certain amount or percentage of their load from renewable resources and to allow market mechanisms to determine prices. A best practice RPS should incorporate fixed long-term contracts via RFPs and should have multiple markets for different technologies.	Provides certainty with regard to quantity, but pricing can vary from year to year or from project to project	Mandatory: AZ, CA, CO, CT, DC, DE, HI, IA, IL, MA, MD, ME, MI, MN, MT, NC, NH, NJ, NM, NV, NY, OH, OR, PA, RI, TX, WA, WI, Belgium, Italy, Poland, Romania, Sweden, United Kingdom Voluntary: MO, ND, SD, UT, VA, VT
RENEWABLE-ENERGY PAYMENTS (REP; KNOWN IN EUROPE AS FEED-IN TARIFFS)		
A set of fixed, long-term incentive payments made to renewable-energy generators	Provides certainty with regard to pricing, but quantity developed depends largely on adequate pricing	In Place: CA, WA, WI, Ontario, Austria, Bulgaria, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Luxembourg, Netherlands, Portugal, Slovenia, Slovakia, Spain, Switzerland ¹⁰⁴ Proposed: HI, IL, MI, MN, RI
RENEWABLE REBATES AND INCENTIVES TO BUY DOWN CAPITAL COSTS		
A single payment made by the federal government, state governments, or utilities to renewable energy generators to buy down the upfront cost of a new renewable installation	Reduces costs relative to benefits, but renewal of policy is uncertain from year to year	Many states and countries
PERFORMANCE-BASED RENEWABLE REBATES AND INCENTIVES		
A series of payments made by the federal government, state governments, or utilities to reimburse renewable-energy generators the upfront costs of a renewable installation by providing rewards per kWh produced.	Reduces costs relative to benefits, but provides no assistance with upfront costs and renewal of policy is uncertain from year to year	Many states and countries

¹⁰³ Renewable Portfolio Standards, rebates, grants and tax incentives from www.dsireusa.org ¹⁰⁴ Klein, Arne, Benjamin Pfluger, Anne Held, Mario Ragwitz, Gustav Resch, and Thomas Faber. 2008. "Evaluation of Different Feed-In Tariff Design Options-Best Practices Paper for the International Feed-In Cooperative" 2nd Ed. Germany: Energy Economics Group & Fraunhofer Institute Systems and Innovation Research.



Renewable-portfolio standards typically require electricity retailers or other load-serving entities to include a certain quantity of renewable resources in their energy supply portfolios.¹⁰⁵ Some renewable-portfolio-standard designs allow utilities to meet the standard using renewable energy certificates (RECs). Under this system, one entity, usually a Regional Transmission Operator, issues certificates to each generator in its territory for each MWh of energy generated. The certificate contains a variety of information such as the generating source and the emissions characteristics of the source. Where RECs are used, load-serving entities can meet their annual requirements through (1) REC purchase (i.e., purchasing certificates that show they are from a renewable generator), (2) purchase of both the power and RECs from a renewable generator or (3) generation of renewable energy on their own and use of the resulting RECs.

Aside from the quantity of renewable energy required, the key difference among early renewable-portfolio-standard policies was the type and vintage of generation that qualified. For example, some states accept power from renewable generators operating prior to the RPS, and some do not. Some accept power from municipal solid waste combustion, and some do not. Some early renewable-portfolio standards had just one requirement, which could be met by power from any eligible renewable resource. Others had two requirements, one that could be met by existing generators and a second that could only be met by generation that came online after the effective date of the standard. These early designs only promoted development of the most cost-effective resources, often wind.¹⁰⁶ Recent RPS requirements have separate goals by resource class—often for distributed generation and solar PV—each of which must be met in addition to the overall percentage goal.¹⁰⁷

Certain states have acknowledged some shortcomings of renewable portfolio standards. New Jersey was one of the first states to note challenges associated with the development of renewable energy under renewable-portfolio standards, such as the persistence of investment risk and price volatility.¹⁰⁸ Also, without specific set-asides for more expensive technologies, development has not occurred at a rapid rate.

In states with retail electric competition, the price of power, including any required renewable-energy certificates, is often determined by centralized auctions or requests for proposals that extend for no more than three years. In those states, load-serving entities tend to secure short-term contracts for power and renewable energy credits, which results in significant uncertainty for renewable energy developers concerning the longer-term profitability of projects. To address that concern, some states (e.g., Connecticut and Massachusetts) now require long-term contracts (i.e., 10 – 15 years) for renewable-energy certificates or renewable power under their renewable-portfolio-standard rules.¹⁰⁹ In states that still have Public Utility Regulatory

Policies Act requirements, contracts for renewable energy under renewable portfolio standards are already longer-term.¹¹⁰

The best renewable-portfolio standards have fixed-price and long-term contract requirements to create a healthy investment environment for renewable-energy developers. It is also considered best practice to have as many different resource classes or markets as there are types of technologies and projects to be promoted, so as to realize benefits from technological diversity. The level of diversity that is actually implemented is guided by state policy objectives and often constrained by practicality.

4.4.2. Renewable-Energy Payments

“Renewable-energy payments” are fixed payments that electricity companies make to renewable-energy generators based on technology-specific generation costs and a reasonable profit. These payments are funded through a consumption charge on consumers’ electric bills. Renewable-energy payments provide set prices for renewable generation and leave market forces to determine the appropriate quantity of resources at those prices. Payments are guaranteed over a long time period (i.e., 10 to 20 years) to provide price certainty and market stability and thus reduce the initial investment risk for renewable energy developers. Best-practice policy-designs for renewable-energy payments have payment levels that are specific to the resource type, with further price differentiation by size, application, and vintage.¹¹¹

Like renewable-portfolio standards, renewable-energy payments generally accompany policies that require utilities to prioritize interconnection of renewable generation. Renewable-energy payments can stand alone or be used in conjunction with a renewable-portfolio standard that requires a certain amount of renewable energy be procured as part of a state’s total resource portfolio. Germany’s renewable-energy-payments program is frequently referred to as a best practice; other European countries such as Italy are adopting it for solar PV, and it has been proposed in many U.S. states.¹¹² Germany’s best-practice design provides payments that

- adequately reflect generation costs and profit;
- are guaranteed for a long period of time (i.e., 10 or more years);
- are sustained over time once the generator is approved for admission into the program;
- decline each year for new generators that are being admitted into the program to automatically adjust for economies of scale, learning and technological breakthroughs (referred to as tariff digression);
- differ by renewable technology (often depending on the stage of development that the technology is in);

¹⁰⁵ Most renewable-portfolio standards apply only to investor-owned utilities or retail energy suppliers, while some apply to other type of utilities such as municipal and cooperative utilities as well. ¹⁰⁶ Texas’ renewable portfolio standard largely promoted wind power resources because it was the most cost effective renewable energy resource. See Wiser, Ryan, & Langniss, Ole 2001. *The Renewables Portfolio Standard in Texas: An Early Assessment*, Lawrence Berkeley National Laboratory LBNL-49107, available at <http://eetd.lbl.gov/ea/EMS/reports/49107.pdf> ¹⁰⁷ See http://www.dsireusa.org/documents/SummaryMaps/RPS_Map.ppt ¹⁰⁸ *An Analysis of Potential Ratepayer Impact of Alternatives for Transitioning the New Jersey Solar Market from Rebates to Market-Based Incentives*. Final Report. August 6, 2007. Summit Blue Consulting. Prepared for the New Jersey Board of Public Utilities. ¹⁰⁹ Connecticut Public Act No. 03-135, Sec. 4(j)(2); Massachusetts Senate Bill No. 2768, *An Act Relative to Green Communities*, approved by the Senate on June 24, 2008. ¹¹⁰ Holt, E. and Bird, L. 2005. *Emerging Markets for Renewable Energy Certificates: Opportunities and Challenges*, NREL/TP-620-37388; National Renewable Energy Laboratory; Wiser, R, Porter, K., and Grace, R. 2004. *Evaluating Experience with Renewable Portfolio Standards in*



- are differentiated within each renewable technology in order to most-closely match payments with actual generator costs that differ by size and application.

Some countries, such as Spain and Slovenia, offer renewable-energy generators an alternate calculation for their fixed payments—a premium on top of the spot market price for electricity. However, we do not view this as approach as best practice because it could (1) enable windfall profits to generators by increasing the gap between payments and actual generation costs and (2) increase investor risk by exposing project payments to volatile and uncertain energy markets, thereby increasing the risk premium of the projects.

Europe has developed renewable-energy payments (known in Europe as feed-in tariffs) over the past two decades. As of early 2007, approximately 70% of the countries in the European Union had some form of renewable energy payment. In comparison, approximately 20% had adopted renewable-portfolio standards. Italy is the only European country to have both a renewable-portfolio standard and renewable-energy payments.¹¹³

Conversely, renewable-energy payments are still rare in the United States. As of September 2008, California has the most comprehensive set of renewable-energy payments. The policy addresses all technologies, but only small sizes. Washington and Wisconsin have renewable-energy payments in place for a few technologies, including solar PV. Like California, Washington's and Wisconsin's policies only address small-sized generators. Hawaii, Rhode Island, Michigan, Illinois and Minnesota are reviewing renewable-energy-payments proposals for solar PV, but do not yet have policies in place.

Germany's success with renewable-energy payments has garnered interest from U.S. states and European countries that had previously

adopted renewable-portfolio standards and from states and countries that have adopted neither to date. U.S. states recently have begun to explore integrating renewable-energy payments with their renewable-portfolio standards. This can be accomplished by (1) using renewable-energy payments to achieve renewable-portfolio-standard goals or (2) using renewable-portfolio standards to set targets for some resources and renewable-energy payments to drive development of other resources outside of the renewable-portfolio-standard framework.

4.4.3. Distributed Renewable Resources

Michigan should develop its renewable-energy resources strategically to align with state electricity demand and location of loads, and in conjunction with replacement of existing inefficient coal-fired generation. Since 1995, industrial load has decreased while residential loads have increased. The latter loads are smaller and more distributed, with distinct peaks and valleys. To meet this demand, Michigan does not need new large centralized baseload units. Generation that is more distributed and smaller will align best with those criteria, operate at higher capacity factors, and have an improved chance of being financed, built and operated. Focusing renewable energy development on a distributed basis is also one of the policy recommendations included in Michigan's climate change action plan.¹¹⁴

the United States: Ernest Orland Lawrence Berkeley National Laboratory. 111 Klein et al. op. cit. The term 'application' describes a more-detailed classification system for the various implementations of a particular technology. Two major applications of wind are onshore and offshore. Likewise, three major applications of solar PV are stand-alone, roof-mounted, and building-integrated. The term 'vintage' refers to the year in which the new generator comes on line. 112 Klein et al. op. cit. 113 Wilson Rickerson and Robert C. Grace. 2007. "The Debate over Fixed Price Incentives for Renewable Electricity in Europe and the United States: Fallout and Future Directions." Whitepaper prepared for the Heinrich Böll Foundation. Feb 2007. Found at: http://www.boell.org/docs/Rickerson_Grace_FINAL.pdf 114 <http://www.miclimatchange.us> See Energy Supply policy options to increase the percentage of renewable distributed resources



4.4.4. Pricing Renewable Energy

Six Michigan utilities have offered their customers some form of “Green Power” at a premium over standard-offer service.¹¹⁵

In 2005, utilities reported that an average of 6.5% and a median of 5.1% of customers dropped out of green pricing programs. This finding is somewhat surprising in a year in which customers throughout the country faced higher electricity and energy prices. Although the reason for the increase in customer retention is not clear, this finding suggests that customers “stick” and maintain participation in green power programs despite other energy cost increases.¹¹⁶

Charging customers a premium above the rates paid by standard-offer customers sends a mixed message. Most customers who choose to purchase renewable energy first are among the early adopters and understand that some forms of renewable energy have a cost premium, such as solar PV. However, linking these same customers to the volatility of fossil-fuel prices, and to short-term and spot-market contracts, is in effect using them to subsidize others’ poor planning and lack of prudence.

The experience of Xcel Energy of Colorado suggests an alternative to increase the number of renewable-energy customers and their persistence. Xcel based renewable-energy rates on market prices. With new wind more cost-effective than new natural gas or coal, Xcel’s renewable rates were lower than those of standard-offer service. Xcel quickly reached its initial customer goal as many standard-offer customers switched when they saw the lower bills for the RE customers.

4.4.5. Program Synergies

Renewable energy programs should be implemented in tandem with effective programs to promote energy efficiency. Building a wind turbine to provide load for an inefficient commercial or industrial building, or installing solar PV on a poorly insulated home, oversizes the system needed to actually satisfy the customer’s load. Reducing the energy demand first, by installing all cost-effective energy-efficiency measures, allows a smaller, more cost-effective system to be installed that will be aligned better with the needs and demands of building and owner. Program managers and account executives should have a clear and well-coordinated line of communications and support.

4.4.6. Appropriate Biomass

Michigan has significant biomass potential from its forest-products industry. Developing this resource could have multiple benefits, including less material placed in landfills or incinerated. Smaller-scale biomass plants would also synchronize supply better with periods of demand. The biomass used should be sustainably harvested or else be diverted material that otherwise would have been incinerated without energy recovery or being placed in a landfill. Biomass supply should be close to the generating plant to minimize transportation costs, and to keep the scale of the plant balanced with the amount of annual supply (or less). This will also ensure stability for fuel prices.

As enacted, Act 295 allows mixing biomass with coal to meet RPS requirements. However, we recommend that this provision be changed to disallow co-firing. This report has emphasized the need for smaller distributed generation. Large-scale generation that burns biomass mixed with coal dilutes the RPS and can cause demand for biomass to exceed the amount of available supply. This can drive up fuel prices and lead to unsustainable timber harvest practices.

4.4.7. Catalog and Claim Renewable Energy

Several studies of potential energy-efficiency and combined-heat-and-power resources in Michigan are detailed in earlier chapters. Parallel studies for renewable energy were not available.¹¹⁷ A comprehensive inventory would enable planners to consider each of the different renewable resources, wind, solar, biomass, in one place. Michigan could then develop these resources strategically, prioritizing them by cost, feasibility, co-benefits, and ability to displace existing inefficient fossil resources.

4.4.8. Passive Solar and Solar Thermal

Despite Michigan’s grey climate, solar resources are feasible and cost-effective. Germany, with a similar climate and more-northerly latitudes, has exploited its solar resources dramatically. Natural lighting also entails worker-productivity benefits and greater building-resale values.¹¹⁸

Michigan should revise state and local building codes to require new and modified structures to be sited to take advantage of the lower angle fall through winter solar gain (to reduce heating loads and to provide for daylighting), and to avoid the high angle spring through summer sun (to reduce cooling loads).

¹¹⁵ Bird, Lori and Blair Sweezy. National Renewable Energy Laboratory. “Green Power Marketing in the United States: A Status Report” (Ninth Edition). November 2006; “Green Pricing Utility Programs by State” <http://apps3.eere.energy.gov/greenpower/markets/pricing.shtml?page=1> accessed March 10 2009. ¹¹⁶ Bird and Sweezy 2006 op. cit. ¹¹⁷ An in-state study for wind potential was used to derive the quantity of energy and capacity that could be provided for that resource. One study was also located to assess the woody biomass potential that could be derived from Michigan’s forest products industry. Other studies were nationally focused, and data for Michigan were broken out or assigned based on regional or national factors. ¹¹⁸ “The Benefits of Daylight Through Windows”, Peter Boyce, Claudia Hunter and Owen Howlett, Rensselaer Polytechnic Institute, Lighting Research Center, September 12, 2003. See also “Windows and Offices: A Study of Office Worker Performance and the Indoor Environment”; Hescong Mahone Group, Inc; Fair Oaks, California. Prepared for California Energy Commission, October 2003

SECTION 4.5.

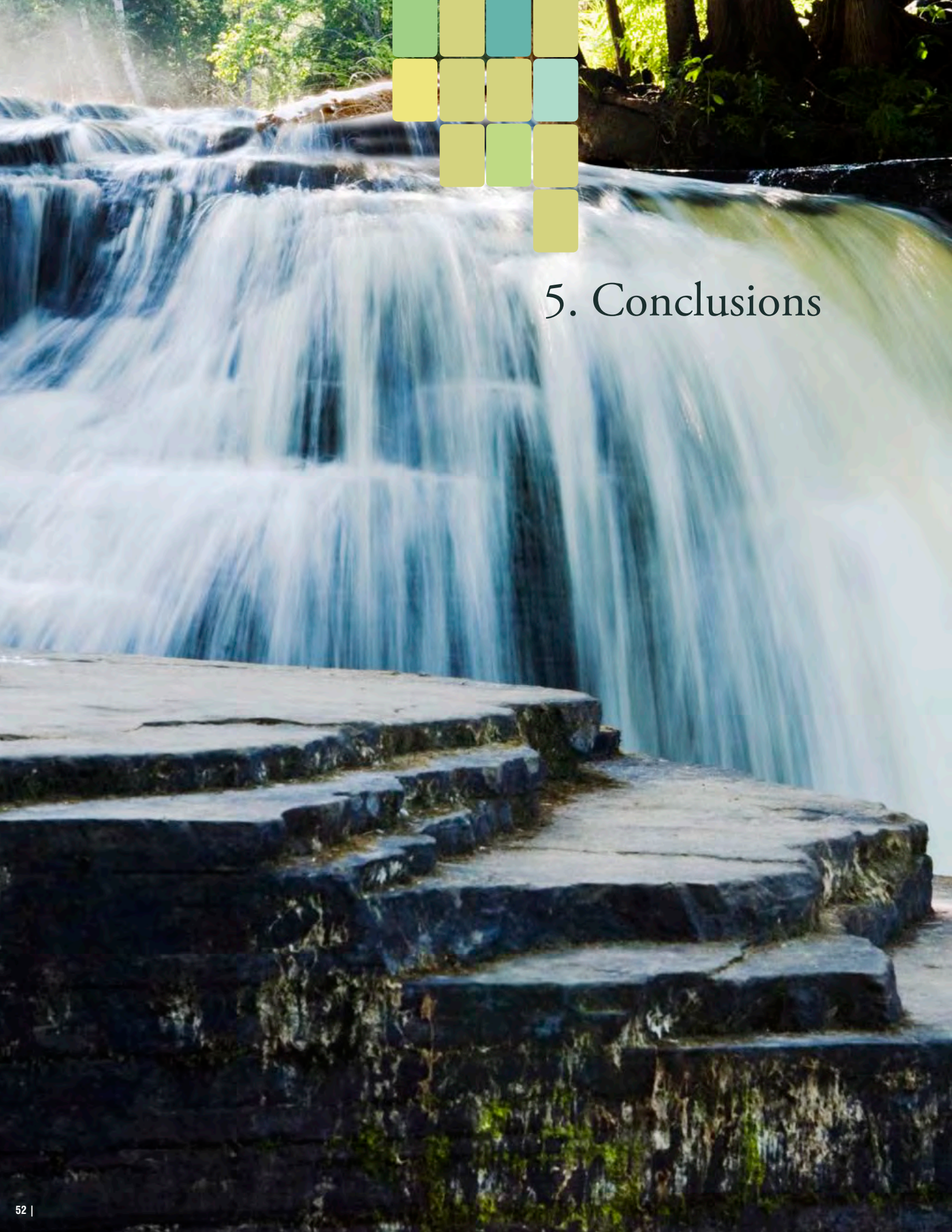
Recent Congressional Action on Renewable Energy and Energy Efficiency: The Economic Outlook

Congressional actions to rescue credit markets and stimulate the U.S. economy contained several provisions that will help increase the amount of renewable energy development. While the provisions are national in scope, specific elements, such as those for wind, will help areas with more-favorable wind resources, such as Michigan. The following are some of the key highlights of the Emergency Economic Stabilization Act of 2008:

- For solar, the bailout extended the 30% tax credit for residential and commercial solar installations. It eliminated the \$2,000 cap on that tax credit for solar electric panels installed after the end of this year, and allowed utilities to benefit from these tax credits.
- Wind-industry subsidies (production tax credits) were extended for one year, which doesn't disrupt ongoing wind projects but falls short of the long-term footing the industry was seeking. For wind turbines of less than 100 kW, the federal government will now give a tax credit of as much as \$4,000 for the next eight years.
- The existing production-tax credits for large-scale geothermal and biomass projects are extended for two years. Residential geothermal heat pumps have a \$2,000 tax credit, and credits for marine power systems are also extended, for eight years.
- Buyers of new plug-in hybrid vehicles get a tax credit between \$2,500 and \$7,500, depending on the capacity of the battery. Larger vehicles, such as trucks, are eligible for larger credits.
- The law extends the alternative fuels tax credit and extends for one year the existing \$1/gallon credit for biodiesel and renewable diesel production.

For energy efficiency, the law includes rebates for appliances and bonds available to building operators that decrease building energy usage by at least 20%.





5. Conclusions

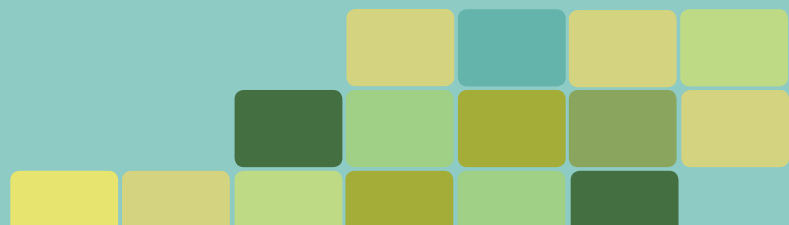


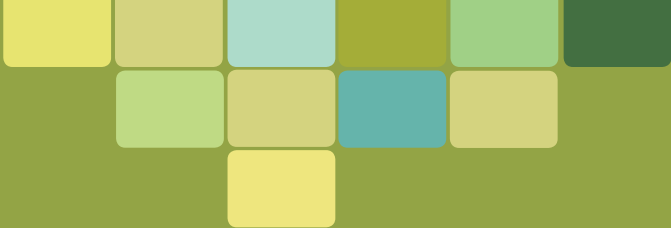
Michigan has important critical decisions to make regarding the future of its electric sector. Those decisions will shape Michigan's future in important ways. Building even one new coal or nuclear plant requires significant investment, and assurances that the plant will operate for decades in order to fully recover its capital costs. It also takes many years to design, license, and build new coal and nuclear power plants. Relying on coal and nuclear power would mean committing to spend tens of billions of dollars on new plants that won't produce any electricity for years. No new coal plant could be in service before at least 2014. No new nuclear power plants could be in service before 2020, if then. Constructing coal or nuclear plants also exposes Michigan ratepayers to the costs of operating these plants for decades. Fuel costs are the largest operating costs for these plants, and for each new coal plant, Michigan will ship tens to hundreds of millions of dollars out of state each year to pay for fuel (depending on the size of the plant).

Large coal plants run most efficiently at load conditions close to or at their design capacities. Power plants are designed, ordered, and built to meet particular specifications and load requirements. A 500-MW boiler cannot easily be reconfigured to one that is 250 MW if demand changes after the plant was designed. Many larger power plants also require extensive custom on-site work. A new coal or nuclear plant must be 100% completed before it can deliver one kWh of generating output. Building part of a plant doesn't help Michigan's energy needs, and, if the plant is not constructed after it is approved, Michigan's ratepayers could still be required to pay for hundreds of millions or even billions of dollars in stranded costs.

In contrast, investments in energy efficiency can be more modular and will produce real and cumulative benefits in the short and long terms, regardless of Michigan's energy demand. If only a fraction of planned energy-efficiency investments can be made, Michigan's ratepayers will still receive benefits. Renewable resources share similar traits with energy efficiency. If only a fraction of planned wind turbines can be financed, some of the wind power will still be generated. In addition, energy efficiency and renewable energy bear less financial risk due to smaller unit size and lead times, and the use of technologies that are modular and scalable. Owners' and ratepayers' exposure to risk from too much capacity or outdated technology is limited with efficiency and renewables. That stands in contrast to investments in a few large facilities based on one technology such as coal. Planning to meet Michigan's energy needs through energy efficiency, renewable energy, and combined heat and power also helps to ensure that energy performance improves faster than demand grows, avoiding the need to construct new fossil or nuclear generation and their associated costs and risks.

Michigan's dire economic conditions may increase the lure of familiar resources to help the state emerge from its current gloom. Recovery, however, will take longer and be weaker and more fragile if Michigan does not reduce its dependence on fossil fuels that suck money out of the state and entail unknown costs of carbon regulation that will likely grow over time. The policies and measures discussed in this report are cost-effective and have real, measurable, and quantifiable benefits. Achieving the potential that we estimate will require sustained and consistent commitment. These are realistic goals, but policy-makers and the public need to appreciate that success

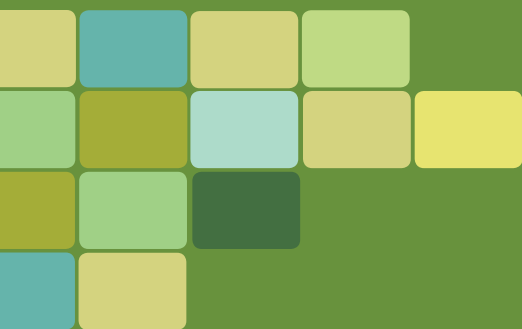




cannot be achieved overnight. Requiring utilities to consider the most cost-effective resources first will make reliable and affordable electric service for Michigan's ratepayers an engine of economic growth for many decades to come.

Moving towards an energy efficient economy and producing more renewable energy produces net job growth, and in many cases, net local job growth. The substitution of wind power for coal may cause relative losses in O&M personnel, but provides opportunities for new manufacturing, or re-tooling of existing manufacturing facilities for a green economy.

A third of the jobs produced by building and operating coal plants are out-of-state, and would not benefit the Michigan economy directly. By contrast, small photovoltaic installations over large areas provide significant job opportunities both in photovoltaic manufacture and for installation and maintenance workers. Building new wind provides many in-state jobs, and if there is a great-enough demand, could even create an in-state manufacturing sector for turbines, drawing on existing Michigan expertise. CHP and energy efficiency promote job growth by stimulating manufacturing sectors, and frees up consumer resources to spend on other sectors, further spurring job creation.



Michigan's future can be very bright. The state can take advantage of this period of lower electricity consumption to grow more efficient and maintain that lower consumption even as the economy recovers. The state should build upon the incremental steps already passed, such as those in Act 295 and Governor Granholm's Executive Directive 2009-02, that invest in energy efficiency and renewable-energy. Michigan has the potential to achieve much more than the modest steps required under the new law. Exploiting the latent energy-efficiency potential and developing even a fraction of the wind potential in the state will avoid the need to construct any of the new and expensive coal-fired power plants that are being proposed. Pursuing a more-efficient economy also better positions Michigan to respond to expected federal legislation that will require reductions in greenhouse gases, and regulations that will further reduce emissions of oxides of nitrogen, sulfur oxides, and fine particulate. Doing so also reduces the risk, and exposure to the future costs, that will be associated with the implementation of each of these environmental programs.



This report was funded by Natural Resources Defense Council
and the Energy Foundation

REPORT AUTHORS

Synapse Energy Economics

Jeremy Fisher
Christopher James
Lucy Johnston
David Schlissel
Rachel Wilson

Optimal Energy

Thomas Franks

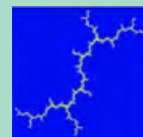
FOR MORE INFORMATION CONTACT:

Shannon Fisk

Natural Resources Defense Council
312-663-9900
www.nrdc.org

David Schlissel

Synapse Energy Economics
617-661-3248 ext 224
dschlissel@synapse-energy.com



Synapse
Energy Economics, Inc.