Appendix A. Rising Energy Demand in a Falling Economy? A Critique of the 21st Century Electric Energy Plan

Michigan's economy has been struggling for several years, and the recent downturn has hit the State's manufacturing base particularly hard. With the future of the auto industry uncertain, Michigan industries are bracing for hard times. Generally, changes in electricity consumption are very closely tied to changes in the economy. When the economy grows, new businesses and residents demand more energy; when the economy falters, electricity demand becomes flat or even declines. Economic growth in Michigan has been flat or declining since the year 2000, and this is reflected in the electrical demand over that time.

The compound annual growth rate for Michigan's real Gross Domestic Product (GDP) stayed flat at 0.0 percent from 2000 to 2006, contracted at a rate of 0.3 percent between 2004 and 2006, and contracted further to a rate of 0.5 percent in 2006.

Michigan's economy has also performed at lower levels than surrounding states and for the U.S. as a whole. The GDP of the United States grew at a rate of 3.4 percent in 2006. Ohio, which was the individual state with the next most sluggish growth, had a GDP that grew at a compound annual rate of 1.6 percent. In 2007, Michigan was described as being "stuck in a one-state recession" and was "rapidly becoming a relatively poor state."[1] Michigan's unemployment rate was 8.7 percent in September, compared to the U.S. average of 6.1 percent.[2] November data show that the unemployment rate has risen even higher to 9.3 percent, now tied with Rhode Island for the highest in the country.[3]

Michigan's economy has traditionally been heavily reliant upon the automobile industry. Forty years ago this industry accounted for 25 percent of the state's GDP, but in 2006 it accounted for only 6 percent.[4] The auto industry, including the car makers and suppliers are struggling with low demand for new vehicles in the economic downturn; on February 3rd 2009, GM announced a 49 percent drop in sales.[5] Federal bailouts are attempting to help stabilize the industry, but the near-term economic outlook bodes poorly. Although numbers are not yet available at the time of this writing, we expect that electricity demand in Michigan will have fallen significantly in the face of the downturn.

A "green stimulus" package is being discussed both by Congress and the Obama administration. In addition to funds to encourage more fuel-efficient cars, funds would be

[1] ComericA Bank. "Michigan Brief." June 11, 2007.

[2] U.S. Federal Reserve. http://www.chicagofed.org/economic_research_and_data/midwest_economy_data.cfm

[3] Saulny, Susan and Monica Davey. *New Economic Fears Arise in Michigan*. The New York Times. November 23, 2008.

[4] ComericA Bank. "Michigan Brief." June 11, 2007.

[5] Reuters. February 3, 2009. "GM sales plunge 49 percent"

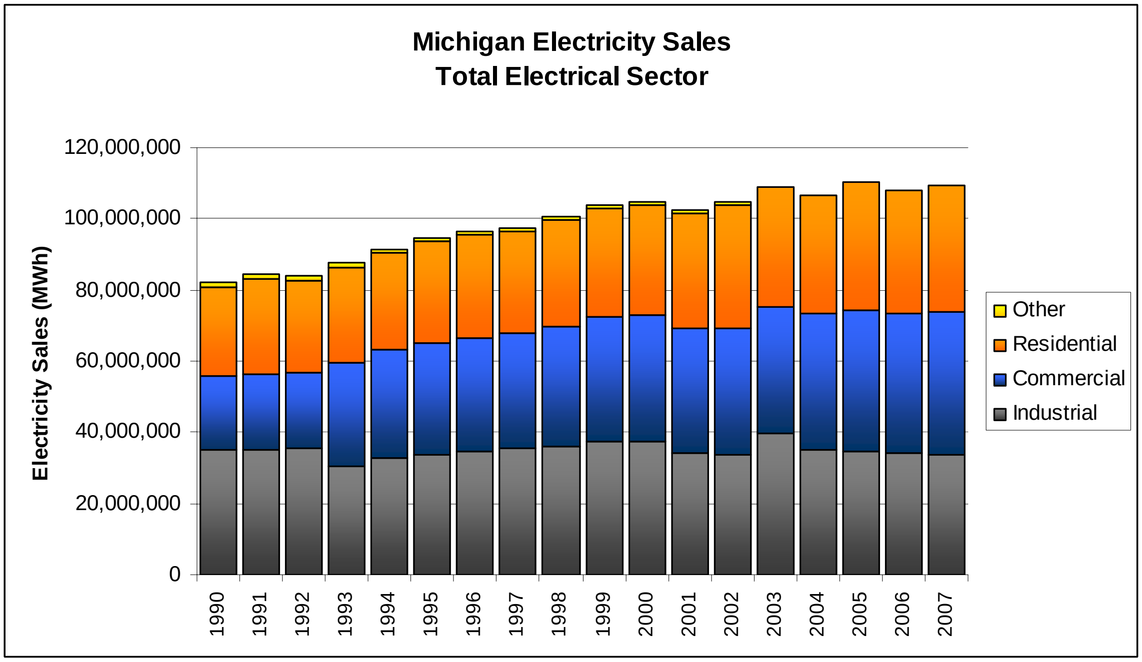
provided to invest in more energy efficient technologies, renewable generation and infrastructure. States which have “shovel ready” projects are likely to receive funding first.[6] Michigan needs to move quickly to adopt the provisions contained in Senate Bill 213, to begin to ramp up its investments in energy-efficiency and renewable-energy technologies, to better position itself to take advantage of the expected federal stimulus.

Michigan’s Energy Supply and Demand Outlook

One of the best indicators of electricity demand is the size of the economy. Manufacturing and industrial sectors require energy to operate factories and agricultural operations and the commercial sector requires energy for retail, business, and public buildings. As an economy grows, energy demand per capita grows in the absence of aggressive energy-efficiency or conservation measures. New industrial and retail enterprises require additional energy, and residential customers demand additional energy to run appliances and electronics. Conversely, when the economy shrinks, sectors decline, or industries either fold or leave the state, energy demand decreases. Following the economy, electricity consumption has been nearly flat since 2000, with increased demand from the residential sector offset by decreased demand from the industrial sector (see Figure A.1). The flat level of electricity consumption since 2000 is especially striking since Michigan did not operate any energy efficiency programs during this period. If like other states Michigan had funded such programs, electricity consumption would have been reduced further. The 21st Century Energy Plan outlined an aggressive forecast of Michigan’s future energy consumption despite data, available at the time, which reflected otherwise.

6 Shovel ready refers to projects which are already planned, and for which human and industrial capacity is readily available. Such projects may have been on hold for lack of funding, but have cleared most other hurdles.

Figure A.1: Electricity Sales in Michigan, by Sector[7]



In 2008, Michigan's electricity sales are expected to have decreased by 1.4% due to a reduction in electricity demand in all sectors. The decline in industrial sector demand continues a trend that since 1995 has decreased demand by 6-12%[8]. According to EIA estimates, industrial load in 2007 fell by nearly 15% to 33.6 GWh from a 2003 high of 39.8 GWh. These actual sales figures are a stark contrast to two earlier reports that were prepared for the Michigan Public Service Commission. The Capacity Need Forum, published January 2006, forecast electricity demand to *increase* 1.9% annually.[9] One year later, the 21st Century Electric Energy Plan forecast electricity demand to increase 1.2% annually[10]. Given that Michigan was already in a recession, and that the fundamentals that caused it were known, these forecasts seem misleading, and overstated future electricity demand.

The Michigan 21st Century Plan: An Outdated Vision

The 21st Century Electric Energy Plan led the PSC to call for new baseload generation by 2015. Utilities and merchant generators responded to this call with proposals for eight new coal-fired power plants. Two of these proposals have been cancelled. Table A.1., below, lists the remaining coal plants that are in various stages of consideration for proposed construction and operation.

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7 U.S. DOE, EIA. Electric Power Annual 2007—State Data Tables. http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html

8 Statistical Data of Retail Sales, Electric Utilities in Michigan, 1995-2006. Actual sales data obtained from the Michigan Public Service Commission.

9 Capacity Need Forum, Staff Report to the Michigan Public Service Commission, January 2006, Section ES-3 Major Findings.

10 21st Century Electric Energy Plan, January 2007.

Table A.1: Proposed Michigan Coal Plants[11]

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**	

Following the 21st Century Energy Plan, Consumers Energy, a utility serving a large portion of Michigan's Lower Peninsula, released a plan it has called the Balanced Energy Initiative (BEI).[12] In the BEI, Consumers has proposed a 930 MW (gross) supercritical coal-fired facility, costing what appears to be in excess of $3 billion and beginning operation in 2017.[13] As of this writing, this proposed plant is one of the furthest along in the approval process.

Consumers also includes its recently purchased Zeeland natural gas-fired plant and new wind and energy efficiency as part of the BEI.

As Synapse has explained in its July 7, 2009 *Comments on Consumers Energy's Electric Generation Alternatives Analysis for the BEI*, ("EGAA") Consumers BEI is heavily biased in favor of new coal in a number of ways:

- Consumers ignores the availability of a substantial amount of under-utilized gas-fired combined cycle and gas turbine capacity that could provide much, if not all, of the energy that would be generated at the proposed Karn-Weadock coal plant.

- Consumers increases the apparent need for the Karn-Weadock plant in 2017 by assuming that it will not be able to achieve more than 0.5 percent annual incremental energy efficiency savings after the year 2015.

- Consumers assumes in the EGAA that it will not add any additional renewable resources after 2018.

11 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.

12 *Balanced Energy Initiative Electric Generation Alternatives Analysis*, June 2009..

13 Eggert, David. "New coal-fired power plants opposed in Mid-Michigan." Associated Press. April 16, 2008. Available at: http://www.mlive.com/environment/index.ssf/2008/04/new_coalfired_power_plants_opp.html

- The only way that Consumers can show a need in 2017 in the EGAA for its proposed Karn-Weadock plant is by suggesting that it will retire approximately 950 MW of existing coal capacity by 2018 even though it has not made any firm commitment to actually retire any or all of that capacity. In fact, an increasing amount of the Company's aging coal-fired generating plants can be retired over time without building the proposed Karn-Weadock plant.

- Consumers understates its continuing heavy dependence on coal-fired generation in future years by (a) presenting capacity mix information in MW instead of MWh and (b) by suggesting that the Company will retire approximately 950 MW of existing coal capacity by 2018 when it has not made any firm commitment to actually retire that capacity.

- A comprehensive system for federal regulation of carbon dioxide (CO_2) and other greenhouse gas emissions is inevitable. It is generally expected that this federal regulation will require steep reductions in greenhouse gas emissions. This inevitable regulation of greenhouse gas emissions by the federal government will require the State of Michigan to reduce its current heavy dependence on coal-fired power plants.

- Consumers' claim that the plant will be "carbon capture ready" has no real substantive meaning but, instead, essentially suggests only that space has been set aside to accommodate currently unknown equipment for capturing CO_2 that would otherwise be emitted into the atmosphere.

- Ratepayers will face significant financial risk associated with the decision to lock in high levels of carbon emissions for the coming decades at a time when those emissions will be costly.

- The estimated cost of the proposed Karn-Weadock coal plant has increased by 32 percent since the Company filed its original Balanced Energy Initiative in 2007. The plant's cost may increase further before it is completed.

- Consumers does not consider the risks associated with different supply and demand side plans. In fact, other than considering levelized costs for resources with and without CO_2 costs, the EGAA did not consider uncertainty for any of the key input parameters.

- Consumers' levelized cost analyses did not adequately consider portfolios of alternatives to the proposed Karn-Weadock coal plant that would include existing and/or new gas, more wind, and additional cost-effective energy efficiency.
- Consumers used unreasonably high natural gas prices biases the levelized cost analyses in the EGAA in favor of coal.

- Consumers used high coal plant and extremely low natural gas plant capacity factors biases the levelized cost analyses in the EGAA in favor of coal.
- Consumers unrealistic assumed that all of the alternatives considered were in service as of the beginning of 2009.

- Consumers used very high wind costs biases the levelized cost analyses in the EGAA in favor of coal.

A number of the most important assumptions underlying the 21st Century Energy Plan already are significantly outdated: for example, the assumption that demand will continue to grow quickly in Michigan over the next decade. As noted above, the Plan predicted a continuous growth rate of 1.2 percent in demand each year over the next two decades, a growth rate more in keeping with expanding economies in good economic times. Recently released forecasts from the two largest Michigan utilities, Consumers Energy and Detroit Edison Company both show marked declines in total demand from 2007 to 2013 (−0.3% and−0.8%, respectively).[14] Together with forecasts from the Indiana Michigan Power Company,[15] the combined forecasted demand from these three major utilities shows a drop in demand of 1.7% by 2013 from 2007 (see Figure A.2). These forecasts were released in the third quarter of 2008.

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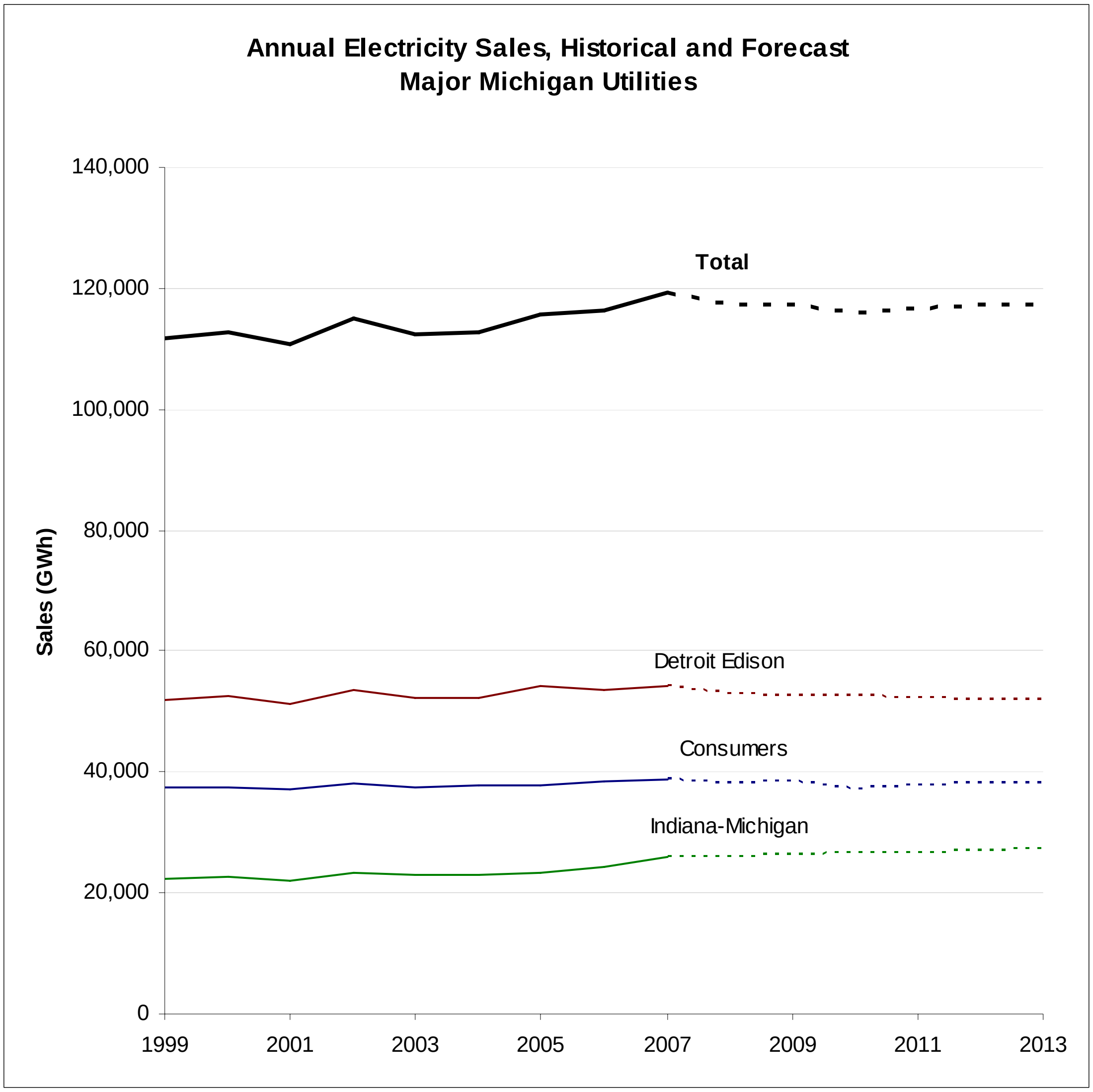
14 MPSC. U-15645. Nov. 14, 2008. Ex. A-79; MPSC. U-15677. Sept. 30, 2008. Ex. A-8

15 MPSC. U-15676. Sept. 30, 2008. Ex. IM-1

Figure A.2: Michigan Utilities forecast declining demand from 2008 to 2013. See text for sources.



Risks of Coal: The Business-As-Usual Energy Plan

Michigan should clearly understand the current and future risks that the state will be exposed to if it continues to pursue carbon and emissions-intensive energy consumption. Resuming that path only because it is easy and familiar will only expose the state to more severe economic pain in the near and long-term future. Michigan's automotive manufacturers are well aware of the connections between their products and national and global economies. Many of the same connections exist for the factors related to energy consumption.

Increasing Fuel Prices

While the recent collapse of oil prices to below $50 per barrel may provide a temporary relief to vehicle-owners, ratepayers and decision-makers, it is important to recall the factors that lead to the rapid run-up in oil prices, nearly $150 per barrel earlier in 2008, and the plummet during the late summer and fall of 2008.

- Global demand for energy is driven by emerging economies such as India and China. China estimates that a minimum 8% annual growth in GDP is needed to help transform its economy from rural agrarian to urban industrial and to avoid labor protests and unrest.

- Many researchers believe that in most major oil fields, peak production has already passed. At least half of all recoverable oil has already occurred, and that portion is considered to be the "easy and cheap" portion.

- Oil refining capacity is constrained, with aging infrastructure.

- Americans decreased their fuel consumption during 2008 due to $4 per gallon gasoline prices. This drop in consumption lead to a collapse in oil prices, and gasoline is currently selling for less than $2 per gallon (Lundberg). However, since no new refining capacity has been constructed, there is limited headroom in supplies and a resumption of increased consumption will likely drive up prices again. Such prices may rise significantly regardless of actual U.S. consumption, driven by increased consumption in emerging economies.

Coal prices are currently bounded by access from major coal-producing states to U.S. electrical facilities, access to the coast for international export, and the cost of transportation to end users. China was a net importer of coal during 2007, receiving supplies from U.S. domestic sources in the Powder River Basin and Kentucky. The cost of delivered coal is strongly tied to the cost of petroleum for transportation, and less to the demand for coal from overseas consumers. This association remains true as oil prices rose to over $140 per barrel during 2008 and then dropped. Central Appalachian coal rose to about $140 per ton in July 2008 and dropped to about $60 per ton.[16]

Increasing Equipment Construction and Material Costs

In the past few years, materials costs for many industrial processes, including new energy facilities, have escalated significantly. Prices for metals rose by over 100%, and those for cement climbed by 30%. Labor and engineering costs also rose significantly. Prices for products that require energy to extract them, such as copper, tungsten, and nickel, were the most volatile.[17]

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16 *http://www.eia.doe.gov/cneaf/coal/page/nymex/nymex_chart.pdf* (Accessed February 6, 2009)

17 Synapse Energy Economics, "Don't Get Burned: The Risks of Investing in New Coal-Fired Facilities", February 26, 2008.

Coal power plant construction costs have risen dramatically in recent years with terms like "staggering" and "skyrocketing" being used to describe these cost increases.[18] Coal-fired power plants that were estimated to cost $1,500 per kilowatt in 2005-06 are now projected to cost in excess of $3,500 per kilowatt, excluding financing costs. This would mean a cost of well over $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.

The increases in construction costs at proposed coal-fired power plants are due, in large part, to a significant increase in the worldwide demand for power plant design and construction resources, commodities and equipment. This worldwide competition is driven mainly by huge demands for power plants in China and India, by a rapidly increasing demand for power plants and power plant pollution control modifications in the United States required to meet SO_2 and NO_x emissions standards, and by the competition for resources from the petroleum refining industry.

The limited capacity of EPC firms and equipment manufacturers also has contributed to rising power plant construction costs. This has meant fewer bidders for work, higher prices, earlier payment schedules and longer delivery times. The demand for and cost of both on-site construction labor and skilled manufacturing labor also have escalated significantly in recent years.

Almost every proposed coal plant project in the United States has experienced significant cost increases in recent years. For example:

- The estimated cost of Consumers' proposed Karn-Weadock coal plant has increased by 32 percent since the Company filed its original Balanced Energy Initiative in 2007.[19]

- 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.

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18 Available at *http://psc.wi.gov/%5Cpdffiles%5CNews%20Releases%5C2008%5C11%20November%5CNED%20Decision.pdf,* Public Service Commission of Wisconsin, November 11, 2008, decision on Wisconsin Power and Light application. Press coverage of the rejected plant used "staggering" and "skyrocketing" costs in their headlines.

19 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.

Even plants that are far along in the design, procurement and construction process are not immune to rising costs. For example:

- Duke Energy Indiana announced an 18% estimated cost increase in the 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.

- Kansas City Power and Light Iatan 2 power plant is currently experiencing cost overruns of 15%, even though the plant is well underway and scheduled to be completed in 2010. The company announced that costs may rise yet again after engineering reviews.

It is true that the prices of the commodities used to build power plants have decreased since the middle of last year (2008) and there is some anecdotal evidence that the costs of some short-term construction projects have dropped. However, there has been no evidence that these recent decreases in commodity prices actually have led to lower projected construction costs for long-term construction projects such as new coal plants. In fact, the Engineering News-Record, a respected industry source, has recently reported that both its Building Cost and Construction Cost Indices actually rose between March 2008 and March 2009, as did a power plant-specific construction cost index.20

Project Financing is Difficult to Obtain

While the increase in construction costs has caused many proponents of coal-fired generating plants to have to revise their projections upward, obtaining financing for construction is also proving to be difficult. Multiple firms which provide market liquidity have either recently closed (e.g. Lehman Brothers) or have merged with other firms (e.g. Goldman Sachs).

Criteria Pollutant Emissions, Air Quality and Health

Fossil-fuel burning power plants emit numerous harmful air pollutants, including oxides of nitrogen (NO_x), sulfur dioxide (SO_2), fine particulates, and mercury. NO_x emissions are precursors to the formation of ground-level ozone. Ground-level ozone is a known lung and airway irritant, aggravates asthma, and damages ecosystems and crops. Both NO_x and SO_2 are leading causes of acid rain, and lead to the formation of fine particulates (a known carcinogen), and impair visibility. Coal power plants are the most significant source of NOx and SOx, and comprise Michigan's largest source of airborne mercury, a neurotoxin that bioaccumulates in aquatic food chains.

At elevated concentrations, sulfur dioxide (SO_2) "directly impairs human health,"[21] by causing and exacerbating respiratory conditions, such as asthma, and cardiovascular

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[20] March 23, 2009, at pages 32, 37 and 38.

[21] *American Lung Ass'n v. EPA*, 134 F.3d 388, 389 (D.C. Cir. 1999). *See generally* U.S. EPA, *National Ambient Air Quality Standards for Sulfur Oxides (Sulfur Dioxide)–Final Decision*, 61 Fed. Reg. 25,566, 25,570–25,576 (May 22, 1996).

illness. Emissions of oxides of nitrogen (NO_x) can "adversely affect human health, vegetation, materials, and visibility" by combining with VOC and sunlight to form ground level ozone, which is also known as smog.[22]. Ozone pollution can lead to throat irritation, aggravation of asthma, bronchitis, heart disease, and emphysema, and lung tissue damage.[23] Ozone can also make plants more susceptible to disease and insect pests by reducing plant's ability to produce and store food. NO_x and SO_2 also combine with other pollutants to form acid rain, which acidifies lakes and streams, destroys crops and other vegetations, and can impact areas hundreds of miles away from the pollution source.[24]

Particulate matter also poses a significant threat to public health. Particulate matter comes in a variety of sizes, of which the two of most concern here are particles between 2.5 and 10 micrometers in diameter ("PM 10"), and particles less than 2.5 micrometers in diameter ("PM 2.5" or "fine particulate matter"). Short term exposure to PM 10 has been associated with hospital admissions for cardiopulmonary disease, increased respiratory symptoms, and possibly premature mortality.[25] PM 2.5, meanwhile, can cause coughing and shortness of breath, aggravation of respiratory conditions such as asthma and bronchitis, increased susceptibility to respiratory infections, and heart attacks or even premature death in people with heart and lung disease.[26] Both types of particulate matter also impair visibility and negatively impact vegetation and ecosystems.[27]

The Consumers coal plant would also emit significant amounts of mercury and other hazardous air pollutants (HAP). These pollutants have been identified as hazardous because the U.S. Congress and U.S. EPA have determined that they may pose a threat of adverse human health or environmental effects through ambient concentrations, bioaccumulation, deposition, or other vectors of exposure.[28] For example, mercury is a highly toxic and persistent pollutant that deposits into rivers, lakes, and streams, and then bioaccumulates in the food chain.[29] Fetuses or young children that are exposed to elevated mercury levels may experience developmental disabilities, including cerebral palsy, reduced neurological test scores, and delays and deficits in learning abilities.[30] Other HAPs emitted by coal-fired power plants–such as arsenic, cadmium, chromium,

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22 U.S. EPA, *National Ambient Air Quality Standards for Nitrogen Dioxide: Final Decision*, 61 Fed. Reg. 52,852-01, 52,853 (Oct. 8, 1996)

23 *American Trucking Ass'ns, Inc. v. Environmental Protection Agency*, 283 F.3d 355, 359 (D.C. Cir. 2002).

24 *Clean Air Market Group v. Pataki*, 194 F. Supp. 2d 147, 152 (N.D.N.Y. 2002)

25 U.S. EPA, *National Ambient Air Quality Standards for Particulate Matter*, 71 Fed. Reg. 61144-01, 61145 (Oct. 17, 2006).

26 *Id.*; *American Trucking*, 283 F.3d at 359; *In re: So. Mont. Elec. Generation & Transmission Coop.-Highwood Generating Station Air Quality Permit No. 3423-00*, Case No. BER 2007-07 AQ, at p. 23 ¶¶ 6-12 (Mont. Bd. Env. Rev. May 30, 2008).

27 *National Ambient Air Quality Standards for Particulate Matter*, 71 Fed. Reg. at 61145.

28 42 U.S.C. § 7412(b)(2

29 U.S. EPA, *Regulatory Finding on the Emission of Hazardous Air Pollutants From Electric Utility Steam Generating Units*, 65 Fed. Reg. 79,825, 79,828 (Dec. 20, 2000)

30 *Id*. at 78,929.

nickel, dioxins, hydrogen chloride, and hydrogen fluoride–may have carcinogenic or other health effects.[31]
As part of the Clean Air Act, the EPA has promulgated standards for criteria pollutants of ozone and fine particulates ambient air quality standards at levels designed to protect public health and the environment.

For criteria pollutants, Michigan has nine counties that exceeded the 0.08 parts per million standard (8-hour average) for ground-level ozone. EPA has since enacted a new, standard that, while still not adequate, is set at a more protective standard level of 75 parts per billion (ppb). Based on 2006 data, Michigan has several counties which measured 8-hour ozone concentrations above 75 ppb. States are required to submit plans to show how they will achieve and maintain compliance with this new standard by 2011, a goal made more difficult with new coal-fired power plants on the horizon.

Michigan demonstrated attainment with the current EPA fine particulate standard of 65 micrograms per cubic meter (ug/m^3).[32] Recently, EPA promulgated a new standard of 35 ug/m^3. States were required to submit plans to EPA by December 18, 2007, to show they will achieve and maintain compliance with this standard. Based on 2006 data, Michigan has several monitors, particularly in southeast Michigan, which have monitored fine particulate concentrations above 35 ug/m^3 33. EPA issued its final PM2.5 designations 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.[34]

In 2005, electric power plants in Michigan produced 121.6 terawatt-hours of electricity, or 3% of the U.S. total. Nearly 58% of this electricity was derived from coal-fired plants, producing 126,585 tons of NOx and 390,491 tons of SO_2. These emissions made Michigan the 11th highest producer of these pollutants and the 9th highest producer of mercury from electricity generation. Michigan's generators emitted 3765 pounds of mercury in 2005.[35]

Increased SOx and NOx emissions from one or more of the eight coal-fired power plants proposed will affect the state's ability to attain and maintain compliance with the ozone and fine particulate standards.

Greenhouse Gas Emissions from Coal-Fired Generators

Fossil-burning power plants all release significant greenhouse gases, primarily in the form of carbon dioxide (CO_2). The emissions are a currently unavoidable byproduct of

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31 *Id.* at 79,827
32 Fine particulate 24-hour standard
33 Michigan Department of Environmental Quality, Air Quality Division, 2006 Annual Report, prepared November 2007 (the most recent available as of December 2008)
34 *http://www.epa.gov/pmdesignations/2006standards/final/region5.htm* (Accessed February 6, 2009)
35 U.S. EPA. eGRID, 2007.

combustion. Current state, regional, and national efforts to reduce emissions of greenhouse gasses depend on some combination of reducing the amount of fossil fuels combusted or finding methods of permanently sequestering CO_2 underground. Attaining these goals is made more difficult if new coal-fired power plants are built. In addition, the costs of attaining a climate stabilization goal are much higher as more emissions need to be mitigated.

In 2005, electric power plants in Michigan emitted 80,885,000 metric tons of CO_2, making it the 12th highest emitter in the country. Coal combustion in Michigan is already responsible for 74,484,000 metric tons, or over 91% of the State's electricity-based greenhouse gas emissions.[36]

Greenhouse Gas Costs: Anticipating National Emissions Regulations

Corporate, government, and financial leaders anticipate imminent greenhouse gas regulation in the U.S., and that greenhouse gas emission restrictions will pose substantial challenges and create significant new costs for the owners of coal-fired power plants. For example, in its January 28, 2008 assessment of the *Top 10 U.S. Electric Utility Credit Issues for 2008 and Beyond*, Standard & Poor's noted that "the single biggest challenge regulated electric utilities will tackle is the discharge of carbon dioxide (CO_2) into the air"[37]

Standard & Poor's subsequently issued a report on *The Credit Cost of Going Green for U.S. Utilities* in March 2008, in which it concluded that:

> The debate is over. Not the one concerning climate change, but the one about whether the U.S. will act to limit greenhouse gas emissions to address the possibility that human activities are harming the planet. By now it's a foregone conclusion that the U.S. will pass laws that call for significant reductions in carbon dioxide (CO_2). The only uncertainty is the details of how much and by when….So for electric utilities, the credit question is not so much whether higher costs related to controlling emissions are coming, but rather when and how high they'll actually go.[38]

More recently, in its January 2009 Electric Industry Outlook, Moody's Investors Services also has warned that:

> The prospect for new environmental legislation—particularly concerning carbon dioxide—represents the biggest emerging issue for electric utilities, given the volume of carbon dioxide emissions and the unknown form and substance of potential CO_2 legislation.[39]

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36 U.S. EPA. eGRID, 2007.

37 *To 10 U.S. Electric Utility Credit Issues for 2008 and Beyond*, Standard & Poor's, January 28, 2008, at page 2.

38 *The Credit Cost of Going Green*, Standard & Poor's, March 2008, at page 15.

39 *Moody's Global Infrastructure – Industry Outlook: "U.S. Investor-Owned Electric Utilities;"* Moody's Investors Services. January 2009.

Moody's also emphasized that the credit risk for utilities arises from the uncertain costs and format of emissions regulation, acceleration of potential climate change legislation, as well as the possibility that rate regulators will balk at rising costs when consumers reach their tolerance level for cost increases, particularly in light of recessionary pressures.

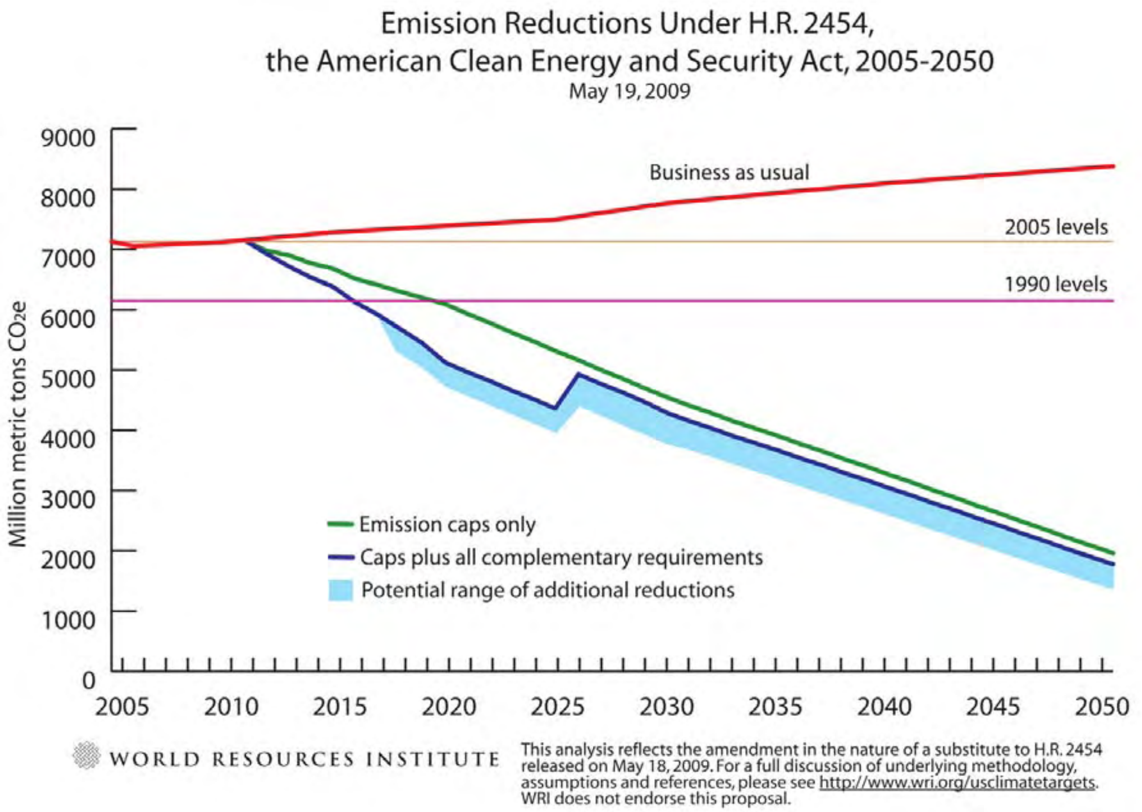
Regulation of greenhouse gases is inevitable and will increase the cost of running power plants that emit CO_2, particularly those that are coal-fired due to the high carbon content of coal. There are two likely avenues for federal regulation of greenhouse gases. Congress could pass legislation or the U.S. Environmental Protection Agency could adopt regulations to limit greenhouse gas emissions. Both paths are currently under active consideration.

Leaders in both the 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 that was recently approved by the House of Representatives. This bill would mandate the following greenhouse gas reduction targets:

- 2020 – 83 percent of 2005 emission levels
- 2050 – 17 percent of 2005 emission levels

Figure A.3, below, shows the emissions trajectories that would be mandated under the proposed Waxman-Markey legislation. These trajectories aim for emissions reductions of 83 percent from 2005 levels by 2050, similar to the plan recently announced by the Obama Administration.

Figure A.3: Emissions reductions that would be required under the Waxman-Market climate change legislation introduced in the current 111th U.S. Congress.



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.[40] The EPA has now circulated its draft finding, for public comment, that greenhouse gas emissions endanger public health and welfare.[41] 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 percent below 2005 levels by 2020 and to 83 percent below 2005 levels by 2050. This plan would require emissions reductions that approximate the steepest reductions shown in Figure 1. The Edison Electric Institute (EEI) recently issued "Global Climate Change

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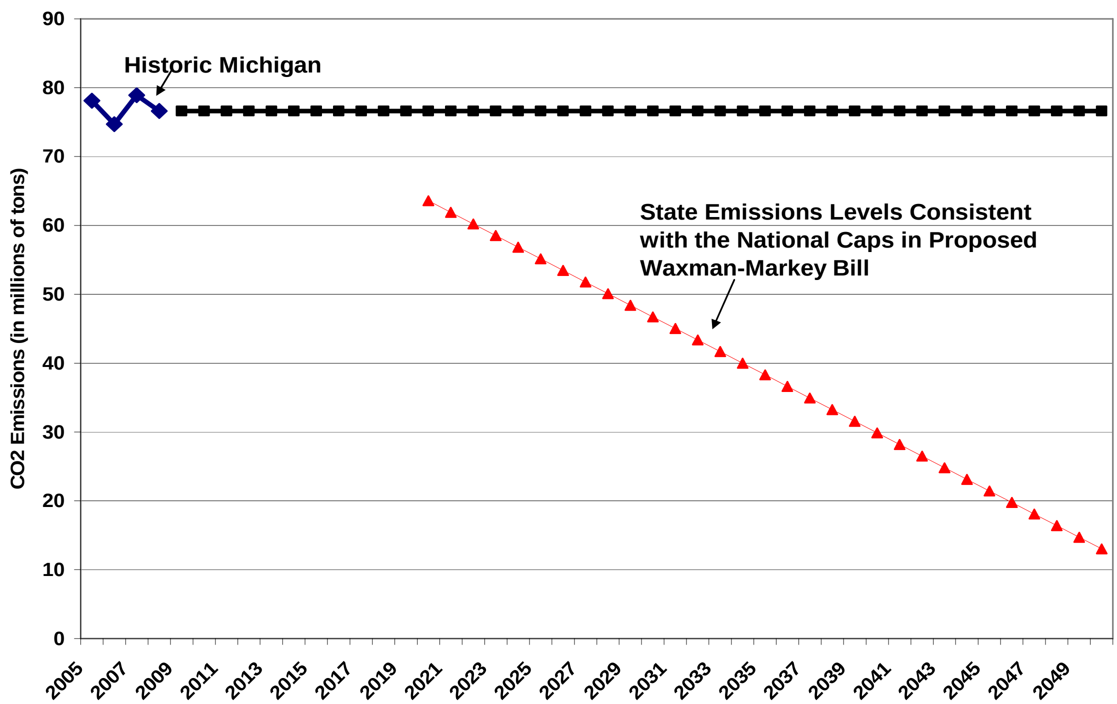
40 In this case, Massachusetts and 11 other states sued the US EPA for failing to regulate greenhouse gas emissions from the transportation sector. The Court found that EPA has the authority and the obligation to regulation greenhouse gas emissions. The court found that EPA's refusal to do so or to provide 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."

41 "White House begins review of EPA endangerment proposal," Greenwire, March 23, 2009.

Points of Agreement" that included an agreement that long-term targets (i.e. 2050) should be 80 percent reduction below current levels.[42] 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; and it would be a mistake to ignore it in long-term decisions concerning electric resources. 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 A.4, below, shows Michigan's recent statewide CO_2 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 CO_2 emissions will be required during the coming decades in order to be consistent with the reduced nationwide emissions caps.

Figure A.4: The State of Michigan's Historic and Future CO_2 Emissions compared to the Emission Levels that Would Be Consistent with the National CO_2 Caps in the proposed Waxman-Markey Legislation.



If Michigan replaces old coal units with new coal plants, it will have to purchase substantial amounts of expensive allowances or offsets to meet the declining federal caps. On the other hand, if the state gradually replaces old coal with cost-effective energy efficiency, renewables, and, to the minimum amount necessary, gas, it would put itself into a position of possibly being able to sell allowances into the national market to the benefit of ratepayers and the economy.

42 Edison Electric Institute, "EEI Global Climate Change Points of Agreement," January 14, 2009

Unlike with other air emissions such as SO_2 and NOx, none of the coal plants proposed in Michigan include any commitment to capture, sequester, or otherwise limit their emissions of CO_2. To date, no utility or private generator has committed to using a full-scale post-combustion carbon capture system, which raises questions as to how much such system would cost.

Changing Direction: Canceled Coal Plants

In 2007 and 2008 more than twenty proposed coal projects have been cancelled and more than three dozen others have been delayed. State regulatory Commissions in North Carolina, Florida, Virginia, Oklahoma, Washington State, Oregon, and Wisconsin, and the Secretary of Health and Environment of Kansas have rejected proposed coal-fired power plants, permits, or purchase agreements.

The following are examples of rejected or canceled coal power plants in the last two years:

- Kansas, December 2006. Westar Energy deferrers site selection for a 600 MW coal-fired power plant citing "sharply higher equipment and construction cost estimates" of 20-40% in just 18 months. [43]

- Florida, July 2007. The Public Service Commission denies approval for the 1,960 MW Glades Power Project on concerns of construction, fuel, and environmental costs. [44]

- Oklahoma, July 2007. Tenaska Energy cancels plans to build a coal-fired facility because of rising material, construction, and fuel costs. [45]

- Minnesota, August 2007. The Public Utilities Commission refuses to approve an agreement under which Xcel Energy would have purchased power from a proposed coal facility.[46]

- Minnesota, September 2007. Great River Energy Generation & Transmission Cooperative withdraws from the Big Stone II projects citing uncertainty in environmental requirements and new technologies, as well as increasing costs.[47]

- Kansas, October 2007. The Department of Health and Environment rejects an application to build 1,400 MW of coal-firing at an existing facility on concerns of the harmful effects of greenhouse gasses on climate. [48, 49]

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43 Available at http://www.westarenergy.com/corp_com/corpcomm.nsf/F6BE1277A768F0E4862572690055581C/$file/122806%20coal%20plant%20final2.pdf.

44 Order No. PSC-07-0557-FOF-EI, Docket No. 070098-EI, July 2, 2007.

45 Available at www.swtimes.com/articles/2007/07/09/news/news02.prt.

46 Order in Docket No. E-6472/M-05-1993, dated August 30, 2007, at pages 16-19.

47 See www.greatriverenergy.com/press/news/091707_big_stone_ii.html.

- Utah, November 2007. Rocky Mountain Power–PacifiCorp cancels two proposed coal plants citing uncertain future greenhouse gas compliance costs, and stated that it would no longer pursue new coal fired generators. [50, 51]

- Virginia, April 2008. The State Corporation Commission rejects a proposed coal plant on the basis of uncertain costs, technologies, and future federal mandates. The commission noted that siting the plant "represents an extraordinary risk that we cannot allow the ratepayers of Virginia in [Appalachian Power Company's] service territory to assume."[52]

- Missouri, March 2008. Associated Electric Cooperative indefinitely delays plans to build a 660 MW coal plant due to "significantly increased" costs, difficulty obtaining financing, and greenhouse gas regulatory uncertainty. [53]

- Texas, July 2008. Although approving the Turk coal plant, the Public Utilities Commission limits the construction costs and future greenhouse gas emissions allowance costs which the Southwestern Electric Power Company could recover from ratepayers.[54]

- Wisconsin, November 2008. The Public Service Commission rejects a Wisconsin Power & Light plant citing the cost in comparison to alternatives such as natural gas and power purchases, as well as uncertain carbon regulations.[55,56]

- In February 2009, NV Energy, Inc. announced the postponement, due to increasing environmental and economic uncertainties, of its plans to construct a

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48 In a prepared statement explaining the basis for this decision, Rod Bremby, Kansas's secretary of health and environment noted that "I believe it would be irresponsible to ignore emerging information about the contribution of carbon dioxide and other greenhouse gases to climate change and the potential harm to our environment and health if we do nothing."

49 See www.kansascity.com/105/story/323833.html.

50 In a letter to the Public Service Commission of Utah, dated 11/28/2007, RMP explained that "Within the last few months, it has become apparent that Congress will enact some restriction upon carbon emissions, but the project cost impact upon new coal generation is currently within such a wide range as to make meaningful risk assessment futile…. While the Company is not excluding new coal generation ownership from its 20 year options, absent some change in conditions, it cannot be determined at this time whether new coal generation will satisfy the least cost, least risk standards that would enable us to consider it as a viable option within our ten year plans."

51 http://www.psc.utah.gov/elec/05docs/0503547/55486NoticeWithdrawal.doc.

52 Final Order of the Virginia State Corporation Commission, in Case PUB 2007-00068, April 14, 2008.

53 http://www.aeci.org/NR20080303.aspx.

54 August 12, 2008 Order in Texas Public Utility Commission Docket No. 33891, at page 6.

55 The Wisconsin commission's decision included the following: "Concerns over construction costs and uncertainty over the costs of complying with future possible carbon dioxide regulations were all contributing factors to the denial."

56 *PSC Rejects Wisconsin Power & Light's Proposed Coal Plant*, issued by the Public Service Commission of Wisconsin on November 11, 2008.

coal-fired power plant in East Nevada. The company has said that it will not proceed with construction of the coal plant until the technologies that will capture and store greenhouse gasses are commercially feasible, which it believes is not likely before the end of the next decade.57

- Then in early March 2009, Alliant Energy cancelled its plan to build a proposed 649 MW coal-fired plant in Marshalltown, Iowa. According to Alliant, the decision to cancel the project was based on a combination of factors including "the current economic and financial climate; increasing environmental, legislative and regulatory uncertainty regarding regulation of future greenhouse gas emissions" and the terms placed on the proposed power plant by regulators.58

- On April 9, 2009, the Board of Tri-State Generation & Transmission, which supplies wholesale power to 18 electric distribution cooperatives in Colorado and 26 in Wyoming, New Mexico and Nebraska, voted to shift its focus from building 2 or 3 proposed coal plants to natural gas, renewable energy and efficiency.59

- In mid-May 2009, four Electric Membership Corporations withdrew from the proposed Plant Washington coal project in Georgia, citing high costs and concerns about the uncertainties surrounding federal climate legislation.

The Rural Utilities Service of the U.S. Department of Agriculture announced in early March 2008 that it was suspending the program through which it makes loans to rural cooperatives to build new coal-fired power plants. In a letter to Congress, the Administrator of Utility Programs for the Department of Agriculture indicated that loans for new base load generation plants would not be made until the department and the federal Office of Management and Budget could more appropriately characterize the risks associated with the construction of such plants.

Michigan Proposed Coal Plants: Concerns for Ratepayers and Legislators

There are several issues which should raise red flags for Michigan ratepayers and legislators. Amongst these are costs for coal power plants well under those seen in other states, anticipated national carbon and climate legislation, and mischaracterized estimates of demand requirements in Michigan. These include underestimated coal and natural gas construction costs, and a failure to anticipate greenhouse gas legislation and recent rulings on greenhouse gas emissions.

[57] NV Energy Press Release, dated February 9, 2009.

[58] http://www.alliantenergy.com/Newsroom/RecentPressReleases/023120.

[59] "Tri-State changes course, says it will develop gas, renewables over coal," Denver Business Journal, April 11, 2009. Available at http://www.bizjournals.com/denver/stories/2009/04/06/daily99.html.

Underestimated Coal Plant Costs

Since the fall of 2008, commodity prices have retreated, but the basic underlying factors that caused price volatility have not changed. The economic slump has caused energy consumption to decrease in the United States. In Michigan, the recession could also decrease demand for labor and engineering services. Labor and engineering firms which were adversely affected during the 2000-01 recession became cautious about adding new staff to meet increased demand for their services. This prudence is likely to continue once the U.S. recovers from the current recession, leading to escalation in labor rates that are much greater than the rate of inflation.

The analyses used to construct the 21st Century Electric Energy Plan assumed a limited range of construction costs for a new coal plant. The plan estimated that a pulverized plant would run between $1,478 per kW (sub-critical pulverized coal) to $1,675 per kW (ultra supercritical pulverized coal).[60] As can be seen in Table A.2, below, such construction costs are significantly lower than the recently estimated costs of other coal-fired power plants that are being planned for the 2012-2014 time frame.

Table A.2: Recent Coal-Fired Power Plant Cost Estimates (2006 year dollars, no financing costs)

Plant	Type of Coal Plant	Owner	Date of Estimate	Cost/ kW (2006$)
21st Century Energy Plan	SubCritical PC		January-07	1,478
21st Century Energy Plan	SCPC		January-07	1,551
21st Century Energy Plan	Ultra SCPC		January-07	1,675
21st Century Energy Plan	CFB PC		January-07	1,628
Turk	SCPC	SWEPCO	Spring 2008	2,200
Karn-Weadock	SCPC	Consumers Energy	September-07	2,400
Meigs County	SCPC	AMP-Ohio	October-08	2,956
Nelson Dewey 3	CFB PC	Wisconsin Power & Light	September-08	3,400
Columbia 3	SubCritical PC	Wisconsin Power & Light	September-08	3,400
Marshalltown	SCPC	Interstate Power & Light	September-08	3,100

SCPC = supercritical pulverized coal plant
CFB PC = circulating fluid bed pulverized coal plant
Ultra SCPC = Ultra supercritical pulverized coal plant
Sub Critical PC = subcritical pulverized coal plant

As can be seen from the figures in the last column of Table A.2, recent (i.e., since September 2007) coal plant cost estimates are 40 percent to 120 percent higher than the coal plant construction costs assumed in the modeling used to develop the 21st Century

60 *21st Century Electric Energy Plan*, Appendix Volume II, Chapter 1, at page 15.

Electric Energy Plan.[61] Reliance on unrealistically low coal plant construction costs biases the results of the analysis in favor of building new coal plants and against competitive alternatives.
Even though there is now a worldwide economic slowdown, there still is great demand for power plant design and construction resources, equipment and commodities in nations like China and India. At the same time, a number of countries, most particularly the United States and China, have stated their intention to undertake very significant stimulus spending packages on infrastructure repairs and improvements. Such stimulus spending will increase the demand for the same resources and commodities that are used to build new coal-fired power plants. Indeed, there is no reason to expect that the worldwide competition for resources or the existing supply constraints and bottlenecks affecting coal-fired plant construction costs will clear anytime in the foreseeable future.

Assumption of No Federal Greenhouse Gas Regulations

Coal is the most carbon intensive fuel. As noted above, eight new coal-fired power plants were proposed in response to the 21st Century Energy Plan, eight new coal-fired plants have been proposed in Michigan. Two of these proposals have been cancelled. The remaining six plants would include 2,680 MW of new coal capacity. Coal plants have historically had an extremely long lifespan. While not all of these plants would be built, if they operate at an average annual 85 percent capacity factor, they will emit an estimated 19 million tons of CO_2 each year for the next 60 years of operations. These 19 million new tons of annual CO_2 emissions are in addition to the nearly 75 million tons of CO_2 which are currently emitted by coal-fired plants in Michigan.

It is estimated that legislation to curb global climate change will impose a price on CO_2 and other greenhouse gas (GHG) emissions. Whether this is accomplished through a CO_2 trading schema (commonly referred to as “Cap and Trade”) or a tax on carbon emissions is less important than what a CO_2 price would mean for the operators, or more precisely, the ratepayers, of a coal-driven utility. Costs for carbon are typically considered at a price per (short) ton of CO_2; the exact price required to curb carbon emissions is based on a wide range of factors and is as yet unknown. Models, research and past precedent suggest a range of prices, explored further below.

Most of the scenarios and sensitivities modeled during the development of the 21st Century Electric Energy Plan assumed that there would be *no federal regulation of greenhouse gas emissions*. In other words, the costs of mitigating greenhouse gas emissions or purchasing emissions allowances were ignored. This assumption heavily biased the results of these modeling scenarios and sensitivities in favor of coal, the most carbon intensive fuel. Subsequently, alternative energy sources, such as renewable energy and energy efficiency, are under valued in the Plan.

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61 A review of estimated coal power plant construction costs from 2006 and early 2007 shows that the construction costs assumed in the modeling for the 21st Century Electric Plan were unreasonably low even at that time.

CO_2 Price Forecasts

Synapse has developed a set of CO_2 price forecasts that we believe should be used in resource planning and to evaluate proposed projects. These forecasts are presented in Figure A.5, and characterize a high, mid, and low forecast set of prices in 2007 dollars per ton of CO_2 equivalent.

Figure A.5: Synapse 2008 CO_2 Price Forecasts (in 2007 dollars)

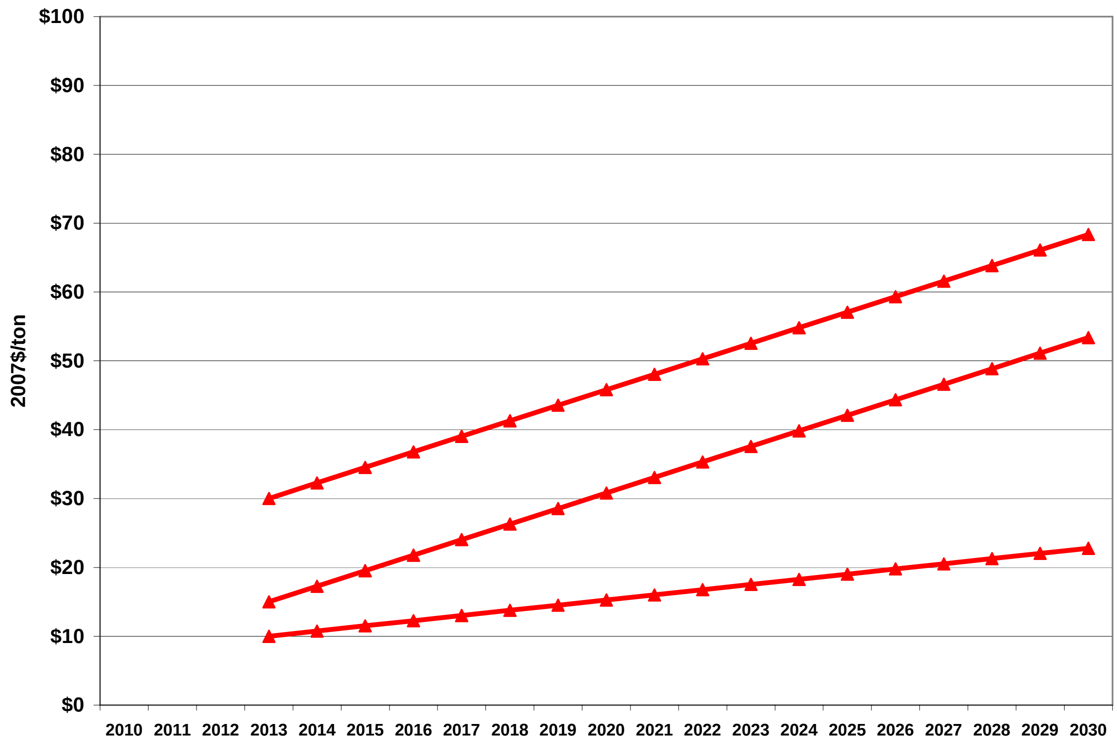


Table A.3: Synapse 2008 CO_2 Price Forecasts, $/ton CO_2Eq (2007$)

	Cost in 2013	Cost in 2030	Levelized Cost (2013-2030)
High estimate	$30	$68	$45
Mid	$15	$53	$30
Low	$10	$23	$15

In 2008, Synapse updated an earlier series of price forecasts to reflect an appropriate level of financial risk associated with greenhouse gas emissions.[62] Amongst the

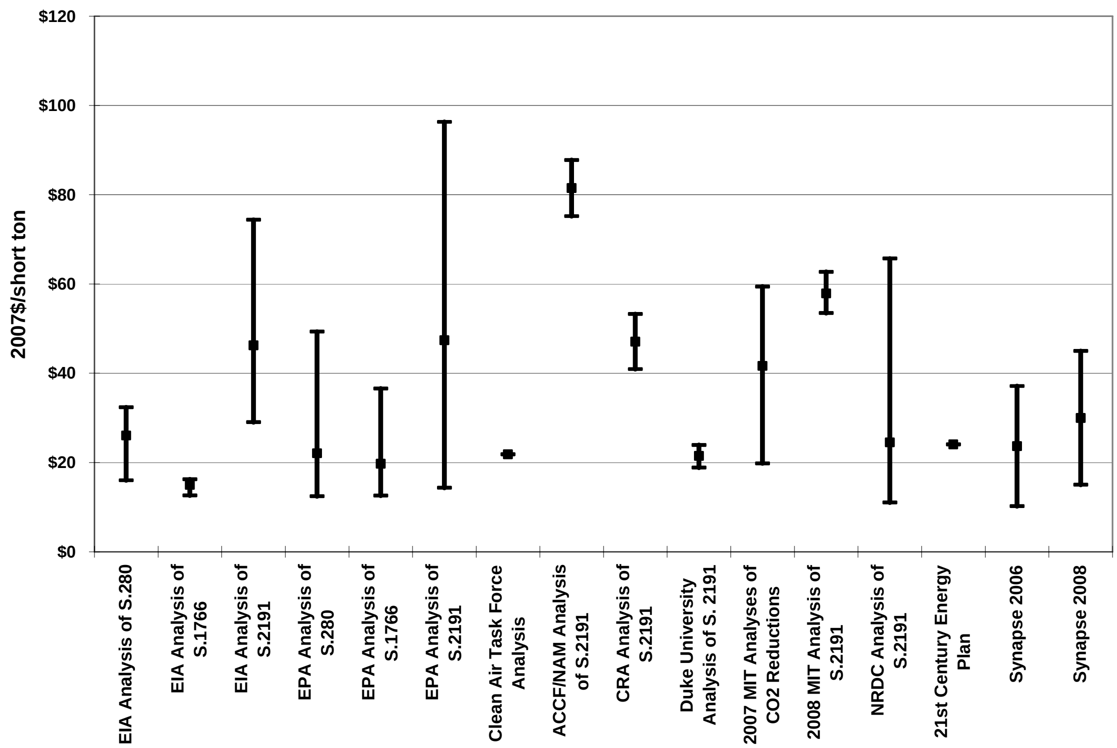
[62] See the July 2008 report *Synapse 2008 CO2 Price Forecasts* available at http://www.synapse-energy.com/Downloads/SynapsePaper.2008-07.0.2008-Carbon-Paper.A0020.pdf

dynamically changing system, one of the most important factors is the rapidly solidifying political support for serious climate change legislation or regulation. Support for legislative efforts have expanded significantly in Federal and State governments and within the public at large as the scientific evidence of climate change has become more certain. Greenhouse-gas-regulation bills proposed in the 110th U.S. Congress contained emissions reductions significantly more stringent than would have been required by proposals introduced in earlier years. An increasing number of states have adopted policies, either individually and/or as members of regional coalitions, to reduce greenhouse gas emissions. In addition, additional information has been developed regarding technology innovations in the areas of renewables, energy efficiency, and carbon capture and sequestration, leading to greater clarity about the cost of emissions mitigation. Taken together these developments lead to higher financial risks associated with future greenhouse gas emissions and justify the use of higher projected CO_2 emissions allowance prices in electricity resource planning and selection for the period 2013 to 2030.

In the 21st Century Energy Plan, only one scenario with several sensitivities used prices for CO_2 emissions. In this scenario, the cost of CO_2 emissions was assumed to be $10 per ton in 2010, rising to $30 per ton in 2018, a trajectory roughly similar to the Synapse low mid forecast. In the Plan, it is unclear whether it was assumed that CO_2 emissions allowance prices would remain at $30 per ton after 2018 or if higher prices were used in subsequent years.

Figure A.6 below compares the range of CO_2 prices that Synapse now recommends be used for resource planning with the CO_2 price scenario used in the development of the 21st Century Electric Energy Plan and the results of analyses of the CO_2 prices that would be required to achieve the emissions reductions that would be mandated by the legislation proposed in the current 210th U.S. Congress:

Figure 1.6: CO_2 Prices Recommended by Synapse vs. Results of Modeling Analyses of Major Bills in Current U.S. Congress–Levelized CO_2 Prices (2013-2030, in 2007 dollars)[63]



As can be seen in Figure A.5 the CO_2 prices used in the single scenario carbon examined in the 21st Century Electric Energy Plan are low compared to the ranges of CO_2 prices that could result from adoption of the major greenhouse gas regulatory legislation that has been introduced in the current U.S. Congress. In fact, there are a significant number of possible scenarios where CO_2 emissions allowance prices could be substantially higher than the CO_2 prices used in the development of the 21st Century Electric Energy Plan. Consequently, a much broader, and higher, range of CO2 emissions prices should have been used.

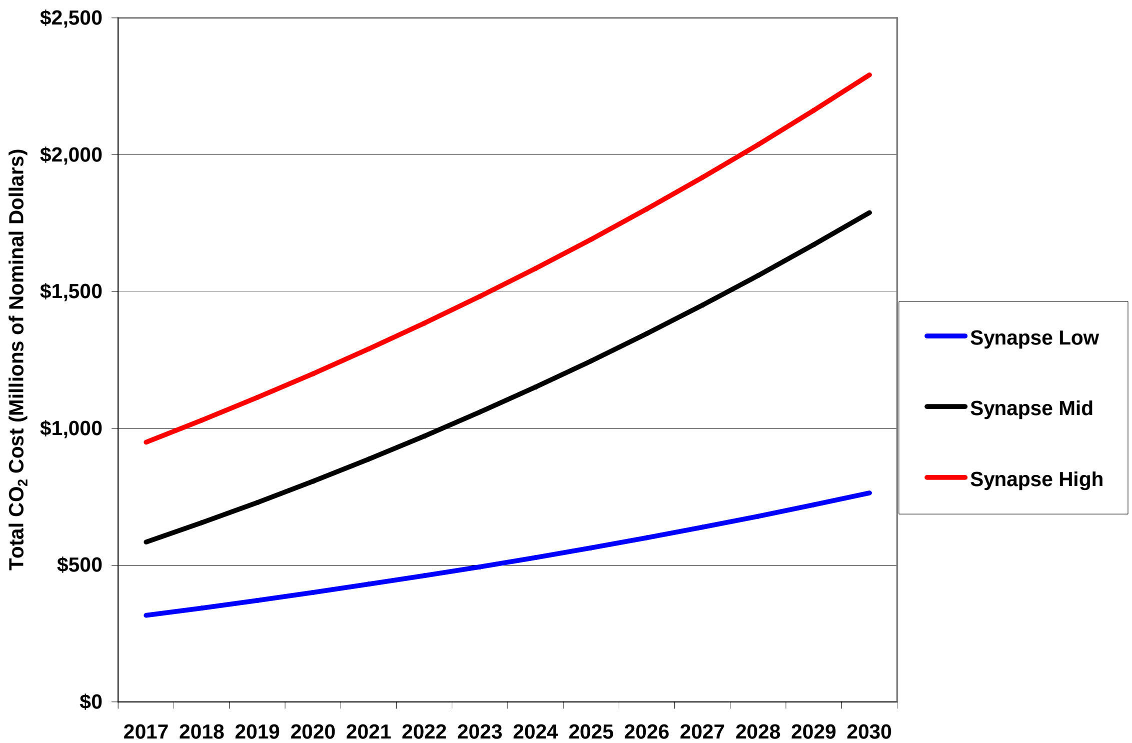
Cost Impact of CO_2 Emissions

As noted above, the 2,683 MW of new coal capacity proposed for the State of Michigan can be expected to emit approximately 19 million tons of CO_2 each year. It is unlikely that all of these plants will be constructed, given current economic conditions and decreased electricity demand. Consumers Energy has recently announced that it will revise its forecast for example. But, construction of even one coal plant will have a significant impact on Michigan's greenhouse gas emissions and the costs necessary for compliance. The current legislative proposal includes provisions to ease the transition to a carbon constrained future for customers; however, a new coal central generating station

63 The Congressional proposals included in Figure 5 are Senate Bill S. 280, sponsored by Senators Lieberman and McCain; Senate Bill S. 1766 sponsored by Senators Bingaman and Specter; and Senate Bill S. 2191, sponsored by Senators Lieberman and Warner.

locks a company, and its customers, into about 50 years of high costly carbon emissions. Figure A.7 below shows how much it would cost to purchase the emissions allowances that would be needed for one coal plant, the Consumers Energy plant, under each of the Synapse Low, Mid, and High emissions allowance price forecasts.

Figure A.7: Proposed Coal Plant Annual CO_2 Costs –Operating at an Average 85 Percent Capacity Factor–Millions of Nominal Dollars



Since, once a plant is built, it is highly inefficient to retire it unless compliance costs are truly astronomical, it is likely that the ratepayers of Michigan will be paying for the excessive emissions from these eight coal plants. If the number of coal plants anticipated by the 21st Century Electric Energy Plan were built, ratepayers could be paying between $260–$800 million annually in early years, and between $760 million to $2.3 billion annually in later years simply to purchase emissions allowances for these new plants. The purpose of any climate legislation will be, by definition, to reduce carbon emissions. Since the largest source of carbon emissions in the U.S. are from coal-fired generators, it stands to reason that these generators will face the highest costs to mitigate climate change. It is reasonable to expect that ratepayers would have to continue paying such costs throughout the entire operating life of each of the proposed new coal facilities. While the above analysis assumes that the proposed coal plants would have to pay a per-ton rate for their CO_2 emissions, it is important to remember that the Clean Air Act requires those plants to install Best Available Control Technology ("BACT") for limiting such emissions (for more detail, please see Appendix H).[64] The cost of capturing and sequestering CO_2 from pulverized coal plants is expected to be very significant.

[64] U.S. EPA *In Re Deseret Power Electric Cooperative*. PSD Appeal No. 07-03. Order Denying Review in Part and Remanding in Part. Nov. 13, 2008.

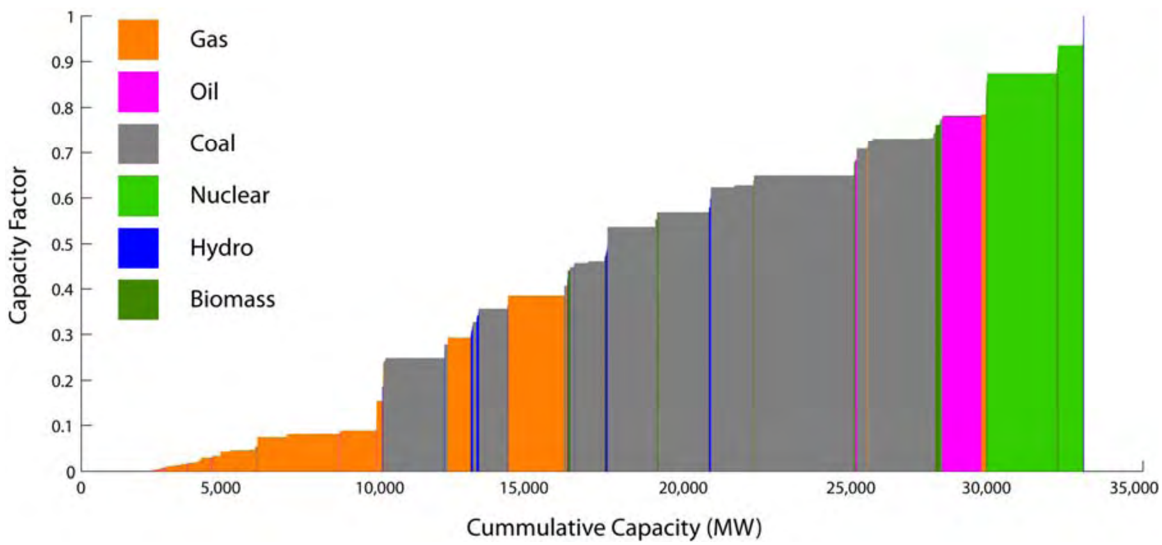
Estimates by a range of sources such as Duke Energy, the Edison Electric Institute, the DOE's National Energy Technology Laboratory and the Massachusetts Institute of Technology have estimated that just adding carbon capture capability would increase the cost of producing power at a new pulverized coal facility by 60 percent to 80 percent.

Appendix B. Michigan's Existing Generation

Michigan's existing generating capacity totals 30,189 MW (2006 summer peak). Generating output for August 2008 was 10.256 million MWh. Of this quantity, 60% was from coal and about 25% was from nuclear generators.[65] Michigan imports 100% of the coal used in its generating plants.

Michigan's largest generating units have operated at low to medium capacity factors over the last several years. In 2006, which experienced the highest peak electricity demand, nuclear units, colored light green, operated nearly continuously, with occasional outages for maintenance and refueling. Coal baseload plants should be able to operate at a capacity factor of around 85%, with regular scheduled outages for maintenance, while gas units tend to operate as intermediate or peaking units. In Michigan, coal plants averaged a capacity factor of 63.5% (weighted by generation), indicating that there is significant headroom available for existing generators to run more frequently. See Figure B.1.

Figure B.1: Capacity Factors at the Fifty Largest Facilities. Note the headroom available.



In 2005, the coal plant with the largest rated capacity, Detroit Edison's 3,279-MW Monroe station, had a capacity factor of only 65%, well below optimal. The next-largest facility, the 547-MW St. Clair coal station, ran with a capacity factor of less than 55%. Large facilities might operate at less than their optimal capacities for any of the following reasons:

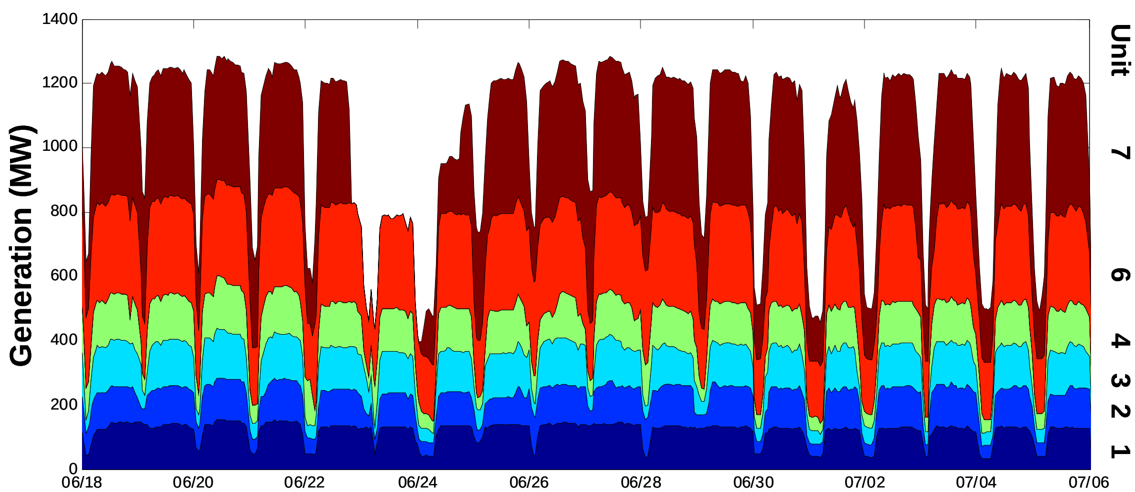
65 Energy Information Administration, State Energy Profile for Michigan, November 27, 2008. Accessed via http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=MI

- Michigan's generating fleet is one of the oldest in the United States.[66] Older facilities can require more maintenance, meaning longer outage times;

- Higher natural gas prices may have caused Michigan's units to be dispatched infrequently, due to economic dispatch rules, which cause the least-expensive units to be dispatched first. This factor would explain the high capacity factors for nuclear units. However, large coal plants, like the Monroe and St. Clair stations, should also have much higher capacity factors and operate as baseload. Coal fuel costs in 2006 should have favored these plants running more frequently.

An analysis of the generation pattern of the coal-fired St. Clair generation station suggests a third reason. The low capacity factor of this unit is due to a high degree of ramping every day.[67] See Figure B.2, below. Coal units operate most efficiently at high capacity factors and take several hours to ramp from high generation down to a minimum. This behavior, replicated across Michigan's coal plants, strongly suggests that Michigan does not require additional baseload generation, and indeed would be much better served by retiring inefficiently operating coal plants and replacing them with a mixed portfolio able to handle intermediate and baseload requirements.

Figure B.2: Generation Pattern of St. Clair Coal Facility in Mid-Summer, 2007



66 Michigan Climate Change Action Plan, Energy Supply Policy Option Document, version November 20, 2008, ES-11. "Power Plant Replacement, EE and Repowering" Accessed via http://www.miclimatechange.us/ewebeditpro/items/O46F20550.pdf

67 Data from the EPA Clean Air Markets Division dataset, 2007.

Appendix C. Demand Response Resources Taxonomy

There are many types of demand response resources (collectively “DR” or “DDR”). They vary by a variety of parameters. The two most significant are the the degree of responsiveness to system requirements and the type of mechanisms employed to acquire them. The U.S. DOE in its 2006 report to Congress defined demand resources in terms of mechanisms, as shown below.

Price Based Programs

- Time-of-Use (TOU): a rate with different unit prices for usage during different blocks of time, usually defined for a 24 hour day. TOU rates reflect the average cost of generating and delivering power during those time periods.

- Real-time Pricing (RTP): a rate in which the price for electricity typically fluctuates hourly reflecting changes in the wholesale price of electricity. Customers are typically notified of RTP prices on a day-ahead or hour-ahead basis.

- Critical Peak Pricing (CPP): CPP rates are a hybrid of the TOU and RTP design. The basic rate structure is TOU. However, provision is made for replacing the normal peak price with a much higher CPP event price under specified trigger conditions (e.g., when system reliability is compromised or supply prices are very high).

Incentive-Based Programs

- Direct load control (DLC): a program by which the program operator remotely shuts down or cycles a customer’s electrical equipment (e.g. air conditioner, water heater) on short notice. Direct load control programs are primarily offered to residential or small commercial customers.

- Interruptible/curtailable (I/C) service: curtailment options integrated into retail tariffs that provide a rate discount or bill credit for agreeing to reduce load during system contingencies. Penalties maybe assessed for failure to curtail. Interruptible programs have traditionally been offered only to the largest industrial (or commercial) customers.

- Demand Bidding/Buyback Programs (DB/B): customers offer bids to curtail based on wholesale electricity market prices or an equivalent. Mainly offered to large customers (e.g., one megawatt [MW] and over).

- Emergency Demand Response Programs: programs that provide incentive payments to customers for load reductions during periods when reserve shortfalls arise.

- Capacity Market Programs: customers offer load curtailments as system capacity to replace conventional generation or delivery resources. Customers typically receive day-of notice of events. Incentives usually consist of up-front reservation payments, and face penalties for failure to curtail when called upon to do so.

- Ancillary Services Market Programs: customers bid load curtailments in ISO/RTO markets as operating reserves. If their bids are accepted, they are paid the market price for committing to be on standby. If their load curtailments are needed, they are called by the ISO/RTO, and may be paid the spot market energy price.

Responsiveness is a combination of two qualities, the amount of time required to acquire the resources, and the certainty that they will be acquired. Direct load control programs are equivalent to spinning reserves. Throwing a switch can put them on line immediately. Price base programs, on the other hand, inherently have comparatively high degree of uncertainty both as to the quantity of load shed and the time. Other program approaches fall between these two extremes.

Appendix D. Designing Energy-Efficiency Programs

The estimate of energy efficiency potential for Michigan was built from the bottom-up.[68] 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. Measures are organized into programs by sectors and markets. The programs comprise the *demand-side-management* portfolio. Sector definitions vary across jurisdictions but generally reflect significant differences in energy use and customer decision factors. Common sector definitions include residential, industrial, and commercial-and-institutional, though these are not absolute definitions.

At the program level, sectors are disaggregated into markets. A market may be broadly defined, for example as non-residential existing buildings, or more finely partitioned into several markets, e.g. municipal buildings, schools, retail buildings, office building, & warehouses. At the most basic level, markets are often described as either retrofit/early retirement ("retrofit") or lost opportunity. The primary difference between the two lies in the discretionary nature of the decision. Retrofit decisions involve replacing or adding to existing equipment that is still functioning. These decisions offer more flexibility as to timing of the investment. Lost opportunity decisions involved installation of new equipment, as in new construction, or replacement of equipment at the end of its life, or replacement on burnout. In these cases, decisions are schedule driven.

Administratively, programs address barriers and opportunities that are common to a distinct set of customers or market actors. Even a program where the needs and resources of each customer are analyzed on a case-by-case basis can use a common set of protocols for analysis (e.g. "analyze all energy flows in the facility, regardless of fuel") and interaction (e.g. "build a long term trusting relationship with the customer based on technical expertise, not incentives"). As matter of administrative efficiency, a proliferation of programs targeted at very small markets is generally not desirable.

Another consideration for portfolio design is the balance between resource acquisition and market transformation. The former refers to acquiring measurable energy or demand savings from the installation of specific equipment. The latter, according to the Consortium for Energy Efficiency (CEE), "is a strategy that promotes the manufacture and purchase of energy-efficient products and services. The goal of this strategy is to induce lasting structural and behavioral changes in the marketplace, resulting in increased adoption of energy-efficient technologies."[69] *Resource-acquisition* strategies are comparatively easy to justify, design, implement, and evaluate. It can be a simple as paying dollars to acquire kilowatt-hours of savings. *Market-transformation* strategies can

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68 For a complete description of potential study methodology, see the National Action Plan for Energy Efficiency (NAPEE) "Guide to Conducting Energy Efficiency Potential Studies"

69 *http://www.cee1.org/cee/mt-primer.php3*, accessed 12/2/08

be generally more challenging, but may have a greater impact over time. The key point for the purposes of this discussion is that *the best portfolio is a mix of both.*

Just as market-transformation investments can be prudent and productive, efficiency portfolios often devote resources to codes and standards support. These regulatory tools define, in effect, the worst product that the law will allow on the market place. Efficiency programs can participate in the development of more rigorous regulation, in compliance measurement and encouragement, and in educational and training activities to help close the gap between what the regulations requires and what the market delivers.

Finally, energy-efficiency portfolios generally include programs for hard-to-reach or special-circumstances customers. Small C&I customers are one example of hard-to-reach customers. The business owner is often the facilities manager, operations manager, and bookkeeper, and pulls a few shifts as line staff as well. They may want to invest in efficiency and have the authority to make that decision, but not the time to even consider it. Programs targeted to low-income customers are another example of special circumstances. These customers typically do not have the resources to invest in saving energy, but have the greatest need for saving money. Programs that serve these customers save energy as well as improving the quality of life for participants. They meet several societal objectives with one intervention.

This cursory coverage of energy efficiency portfolio components is intended to provide a base for the description of programs that follows. The EPA guide, *Advancing State Clean Energy Funds: Options for Administration and Funding* contains a more detailed, yet still brief, description of program design concepts in Chapter Six of that document for those seeking more information.[70]

DR Benefits and Cost

Several studies are available that evaluate the benefits and costs of DR. A 2006 study of demand response for PacifiCorp found expert consensus on at least three broad categories of benefits: economic, system reliability, and environmental.[71] Economic benefits included the avoided capacity, energy, and transmission-and-distribution costs. Reliability benefits included the increase in overall system reliability and the value of insurance against low-probability–high-consequence events. Environmental benefits included avoided carbon and other emissions. The value of benefits ranged between $60/kW-year and $108/kW-year. Similarly, the Bonneville Power Authority set avoided costs at $77.62/kW-year for a study of the potential on Oregon's southern coast.[72]

The costs of demand-response resources range widely by type. In general, firm resources, such as direct load control, have a greater cost than non-firm. The PacifiCorp study found

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70 *http://www.epa.gov/cleanenergy/documents/clean_energy_fund_manual.pdf*, accessed 12/2/08

71 Haeri, Hossein, Miller, Lauren, Perussi, Matie. Demand Response Proxy Supply Curves. Portland, OR. PacifiCorp, 2006. p7

72 Assessment of Energy Efficiency, Demand Response and Distributed Generation Potential in the Southern Oregon Coast Area, page 5-9

costs ranging from $14/kW-year to $118/kW-year, depending on technology and market. In a 2008 filing Seattle City Light found that the national average demand-response cost was between $84–$100/kW-year for commercial and industrial customers and between $36-$69/kW-year for residential direct load control technologies.[73]

New England's independent system operator has evaluated its demand-response programs for several years. It recently found a benefit-cost ratio of 1.80 to 1 for these programs.[74] Southern Maryland Electric Company developed a benefit ratio of 2.13 to 1 in March of this 2008.[75] These studies take a conservative approach and only count the benefits that accrue within the electric system.

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73 Seattle City Light staff. Seattle City Light 2008 Integrated Resource Plan—Appendix E. Seattle City Light. 18 September 2008 *http://www.seattle.gov/light/news/issues/irp/docs/2008IRPfinal.pdf*

74 An Evaluation of the Performance of the Demand Response Programs Implemented by ISO-NE in 2005

75 Southern Maryland Electric Cooperative. SMECo Demand Response Filing. March 18, 2008. 21 October 2008.

Appendix E. Details of Combined Heat and Power and Energy Efficiency Programs

Residential Sector Programs

Residential New Construction (RNC)

Program Description

The ENERGY STAR Homes program will serve as the base for Michigan's RNC effort. It is a mature program, supported nationally and implemented in many jurisdictions. In Michigan, the effort will offer incentives to builders and/or homeowners for achieving higher than code tiers of building performance and provide support for training and certification of builders and home energy raters. Michigan will need to develop a Home Energy Rating System (HERS) or comparable infrastructure to certify energy rating professionals.

Market Barriers

Additional market barriers include:

- Limited technical skills on the part of builders and their subcontractors to address key elements of efficiency

This program employs several key strategies to overcome barriers:

- Direct incentives to builders for homes that meet program standards
- Marketing and outreach efforts designed to drive homebuyer demand for ENERGY STAR Homes and make trade allies (e.g. lenders, real estate agents, town officials) aware of the benefits of ENERGY STAR Homes
- Technical assistance to builders and their subcontractors on energy efficient construction and installation practices
- Verification (inspections and testing) and program certification of qualified homes

Target Market and Marketing Approach

The target market includes all new single-family attached and detached homes of three stories or less. Builders, developers, architects, contractors, code officials and home buyers will all be targeted in order to convey 1) the benefits of constructing an energy efficient building, and 2) how the program can help. The key marketing messages will be the ENERGY STAR Homes label, an emphasis on higher energy efficiency tiers above this level, and the benefits of building efficiency and performance into a home from the start.

Target End Uses, Recommended Technologies, and Financial Incentives

This program will emphasize a whole-house performance approach to qualifying for the EPA ENERGY STAR Homes label and higher tiers. In an attempt to maximize kWh savings, the program will work with energy raters and electrical contractors to directly-install screw-based CFLs in lighting sockets in participating homes. The program will offer ENERGY STAR Homes and three tiers of efficiency above this level, with each level set at approximately 10-15% less energy than the prior level. Each tier is comprised of a HERS energy rating score and a kWh savings target. Incentives will be offered to the builder or developer to encourage building to higher tiers. The energy raters are paid by the builder for the bulk of their services, and by the program to ensure accurate and timely data reporting.

Efficient Products Program

Program Description

The Efficient Products Program will support the stocking, promotion and sale of efficient lighting, appliances and other consumer products that are primarily sold at retail. The program will work closely with both retailers and manufacturers to jointly promote these products. For most products efficiency levels will be set at or above ENERGY STAR specifications.

Market Barriers

Additional market barriers are:

- Limited availability of a full line of certain products, (e.g., CFLs) and absence from key retail channels (e.g., drug and grocery)
- Perceptions of inferior quality and performance based on past experience
- Inability or reluctance of retailer sales staff to “upsell” to efficient products

This program employs several key strategies to overcome barriers:

- Direct incentives to customers, retailers, and manufacturers to lower the initial cost for efficient products and to encourage the stocking, promotion and purchase of these products
- Marketing and outreach to consumers to convey the energy, cost and environmental benefits of the program

- Training to retailer sales staff to provide them with the information and skills necessary to upsell customers to efficient products

Target Market and Marketing Approach

The program will target residential and small commercial customers. Marketing approaches will include: bill inserts; co-op advertising with retailers and manufacturers; point of purchase materials; website, including an "opt-in" consumer newsletter; quarterly retailer newsletter; mass media outreach, including direct mail and newspaper inserts; in store demonstrations and promotions; and in-house corporate events. The program will leverage and coordinate with federal promotions such as ENERGY STAR whenever feasible.

Target End Uses, Recommended Technologies, and Financial Incentives

The targeted end uses of the Efficient Products Program will be lighting, appliances, pool pumps, and consumer electronics, including solid state lighting fixtures and other developing technologies as they achieve ENERGY STAR or comparable qualifications. Incentives amounts will vary depending on the total and incremental cost of the measure and product availability. Rebate levels will be informed by the efforts and successes of similar on-going programs in the region/nation. Initially, rebates will be directed to the consumer. Over time, efforts will be made to move incentives upstream to retailers and manufacturers to better leverage ratepayer funding and trade ally interest. Lighting will be the initial focus of such upstream efforts, followed by appliances and possibly consumer electronics.

Heating Ventilation & Air Conditioning and Domestic Hot Water (HVAC & DHW) Program

Program Description

This program will support the quality installation of efficient cooling, heating, ventilation and domestic hot water systems through incentives and contractor training. Measures will include duct sealing, instrumented tune-ups, and installation of efficient air handler (furnace) fans, both as retrofit and new measures. It will work closely with manufacturers, distributors, and retailers to bring these products and techniques to wider market acceptance.

Market Barriers

Additional market barriers include:

- For many HVAC measures, the benefits to homeowners–lower operating costs—do not fully reflect the much larger benefits to the electric distribution system due to the value of avoided capacity; i.e., peak load reduction

- Poor contractor installation practices, including lack of duct sealing.

- Absence of quality installation verification (QIV).

This program employs several key strategies to overcome these barriers:

- Direct incentives to customers, contractors, distributors and manufacturers
- Marketing assistance to contractors, distributors and manufacturers
- Direct marketing/outreach to drive customer demand for program services
- Technical and sales assistance and training of contractors on energy efficient HVAC specification and installation practices
- Contractor incentives for the purchase of diagnostic equipment such as Duct Blasters
- Verification (inspections and testing) of Program installations

Target Market and Marketing Approach

Residential customers are the target audience. The program will consider a variety of marketing approaches including: bill inserts; co-op advertising; website; mass media; contractor and distributor breakfast/meal meetings; and presence at design professional and contractor trade shows.

Target End Uses, Recommended Technologies, and Financial Incentives

Considering the high saturation of central air conditioning (CAC) in Michigan, the program will primarily focus on cooling. More specifically, the following products and services will be promoted and rebated and phased in over time.

- ENERGY STAR CAC and air source heat pump (HP) equipment, including a requirement that such equipment be properly sized (as per Michigan State Building code when adopted and the requirements and Manual J) and properly installed (correct refrigerant charge and airflow). Ductless mini-splits will be eligible for program incentives.
- Quality installation of new CAC and HP systems that do not meet Program requirements for efficient equipment incentives
- Efficient fans as part of a new oil or gas furnace
- Instrumented tune-ups of existing central cooling systems
- Duct sealing of new and existing HVAC distribution systems. This effort will be closely coordinated with the Existing Homes Program.

- Furnace fan retrofits
- Heat pump water heaters, subject to product availability

Given the recent dramatic changes in the cost of fossil fuels, the program will also investigate and consider the promotion of geothermal heat pump systems if found to be cost-effective.

Incentive amounts will vary depending on the total and incremental cost of the measure, and the availability of the equipment or service. Rebate levels will be informed by the efforts and successes of similar on-going programs.

Existing Homes Program

Program Description

The program will achieve comprehensive energy savings for existing non-low-income residential customers through direct installation of measures, energy audits, arranging supplemental services, and providing financing options. The program will work to develop market-based home performance contracting while focusing on immediate resource acquisition. The program will also provide or support the highest quality installation and diagnostic testing through its participation requirements with the objective of developing market-based diagnostic and verification services to assure that customers receive the benefits they are expecting.

Market Barriers

Additional market barriers include:

- Lack of reliable and credible information sources on costs and benefits
- Absences of trained contractors, and diagnostic equipment

Successful programs directly address each of these barriers through a combination of strategies designed to build consumer confidence in both the measure selection and installer selection process and to minimize participation costs. These activities may include:

- Direct installation of measures–duct sealing and air sealing–that are typically overlooked by most existing home contractors. These measures, plus CFL DI, would be done at no cost for electric heat, central cooling, and other high use customers.
- Contractor referral services to instill confidence
- Marketing and outreach to drive customer demand

- Technical assistance and training for contractors
- Verification of program installations.

Target Market and Marketing Approach

The program will be open to all residential customers but will focus on those with electric space heat, central air conditioning, or otherwise high usage. It will be marketed through direct consumer outreach from bill analysis and select mass media.

Target End Uses, Recommended Technologies, and Financial Incentives

For the Direct Installation component, targeted end-uses include:

- Incandescent lighting: Direct installation of CFLs for all participants for all sockets fitted with incandescent lamps except those in very low-use locations
- Electric water heater: DHW measures when electric hot water is present
- Space conditioning: Air sealing for sites that are electrically heated or have central air conditioning
- Space conditioning: Duct sealing for sites that have central air conditioning with ducts located in the attic
- Home Assessment: Identification of remaining efficiency opportunities to be obtained through program follow-on services. Analysis of customer savings and costs, including all available program rebates.

For the Follow-on Services component (Contractor Arranging), services/measures include:

- Space conditioning: Insulation for sites that are electrically heated or have central air conditioning and with attic insulation levels averaging less than R-27
- Space conditioning: High SEER/EER CAC installations (including early retirement) with quality installation verification (QIV)
- Space conditioning: Instrumented tune-ups of existing central cooling equipment
- Appliances: Early retirement and replacement of inefficient appliances

The program will also provide energy education and assistance with bill arrearages.

The technologies used to ensure the deepest possible savings will include:

- High-quality ENERGY STAR CFLs
- Low-flow hot-water devices (e.g., shower-heads, faucet aerators) and tank and pipe insulation as applicable
- Blower door directed air sealing
- Pressure-differential diagnostic techniques and approved air and duct sealing materials
- Approved insulation materials and installation techniques
- Equipment efficiencies higher than 2009 ENERGY STAR (14.5 SEER/12.0 EER) levels

The DI component will be offered at no cost to electric heat and central air conditioning customers. Alternatively, a small ($50-$100) co-pay could be required that would be reimbursed once an equal value of follow-on measures are installed. For other customers, a slightly larger co-pay will be required.

Low Income Program

Program Description

This program will coordinate with the Michigan Weatherization Assistance Program (WAP) to achieve comprehensive energy efficiency savings for low-income residents. Where appropriate, the electric efficiency program will coordinate with the gas utility program serving the customer's residence. The program resource will be used to increase the depth of savings that can be achieved for each individual customer and increase the number of customers reached on an annual basis.

Market Barriers

Low income customers face the barriers of money, knowledge, and split-incentives. The program will overcome these barriers through:

- Direct installation of all eligible measures at no cost to participant
- Technical assistance and training of contractors
- Verification
- Energy efficiency education

- Encouraging a streamlined and simplified application process, and, if necessary, advocating for customers in the administrative process

- If practicable, expanding the eligibility pool beyond the WAP guidelines by exclusive use of program funds to assist the marginal income customers

Target Market and Marketing Approach

The program will target all income-eligible (or expanded eligibility) customers with a focus on customers with electric space heat or central air conditioning. Program marketing will supplement existing WAP marketing and include outreach through community action agencies and bill inserts.

Target End Uses, Recommended Technologies, and Financial Incentives

The service will mirror those provided by the Existing Homes Program above without cost to the participant.

Commercial Sector Programs

Commercial Direct Install Program

Program Description

This resource acquisition program will rapidly acquire durable savings in energy and peak demand usage among small and medium C&I customers that are traditionally hard to reach. The program will focus on overcoming the numerous barriers existing among this customer group to target cost-effective retrofit (early retirement) efficiency opportunities.

Market Barriers

Numerous market barriers exist that inhibit the selection and purchase of energy efficiency technologies by small and medium C&I customers, and some are unique to this smaller class of customers. These barriers include:

- High information or search costs: Small customers are especially prone to this barrier. They have little time and work with smaller contractors who themselves face barriers in gathering information. Many customers do not hire someone to address energy issues for their facility. This poses significant challenges for distinguishing energy-efficient products or services from those that are not.

- Hassle or transaction costs: Small businesses do not want to invest the time required to research and evaluate multiple options. Because their focus is on running their own business, many simply ignore efficiency opportunities and only address electrical and mechanical systems when equipment failures occur. At that point, they generally simply rely on contractors to provide the most expedient and lowest cost solution to repair or replace equipment.

- Performance Uncertainties/Perceived Risk/Hidden Costs: C&I customers have high implicit discount rates when introducing new technologies in production facilities, as "down time" has significant impacts on profitability and performance. Additionally, design professionals and contractors may be unwilling to change standard practice due to concerns about supporting new equipment after installation.

- Split Incentives: For those small C&I customers where landlords pay for equipment, but tenants pay the bills, there is little incentive for either landlords or customers to invest in improvements.

- Access to capital: Concerns about debt burdens push businesses to focus on first costs, rather than life-cycle costs, as do the practices of lending institutions that fail to account for the unique features of energy-saving products. Smaller customers often have difficulty obtaining credit in general.

- Lack of availability: Energy-efficient equipment may not be stocked by distributors or vendors, and longer lead times might prevent companies from selecting this equipment to minimize downtime. This barrier is particularly acute in this market, where most investments are made on an emergency basis or with little planning time.

- Organization Practices or Customs: Businesses may establish procurement policies requiring purchase of least-first-cost equipment, rather than lowest life-cycle cost.

- Competition for resources: Businesses are inundated with salespeople offering equipment and services. Energy efficiency must compete in this environment.

This program employs several key strategies to overcome these barriers:

- Turnkey service combines project analysis, financial incentives, and installation into a unified package to reduce the time and effort required on the part of the customer. This service is designed to make efficiency adoption as simple as signing a commitment letter, removing many of the transaction costs these customers face.

- Identification of opportunities and selection of efficiency measures accomplished by a trained, experienced contractor.

- Installed measures will be mature, well-tested technologies from reliable vendors

- Participation should only require two site visits, one to identify opportunities and one to install selected measures.

- Incentive payments to reduce first cost barrier and financing arrangements to provide access to capital

- Information and education to inform businesses of the economic benefits of efficiency investments.

Target Market and Marketing Approach

The Small-Medium C&I Direct Install program will target C&I customers with annual usage of less than 600,000 kWh. This is roughly equal to customers with peak demand of less than 200 kW. Such customers typically make up a significant majority of the C&I customer base.

The initiative will require marketing through a combination of telemarketing, direct mail, and neighborhood outreach (door-to-door) to market the program. Other Program Administrators have marketed Direct Install programs in targeted areas to "blitz" a particular town or commercial district. This can generate substantial press coverage and result in higher acceptance rates when customers see that their neighboring businesses are participating.

Target End Uses, Recommended Technologies, and Financial Incentives

As with virtually all existing small C&I direct install programs, the majority of program savings are expected to come from interior lighting improvements. However, Michigan can address all cost-effective efficiency opportunities in a comprehensive manner. In addition to an array of lighting measures, other measures will include:

- a package of refrigeration system improvements for convenience stores, restaurants and other customers with small to medium-sized refrigeration systems

- a standard HVAC tune-up service which will inform the customer of units that could be cost-effectively replaced immediately or in the near term due to age or irreparable performance degradation.

- additional standard measures will be offered where applicable, such as water heater tank wraps and pipe insulation

- identification of cost-effective custom measures, which based on experience from other programs are likely to include new controls or control strategies, compressed air efficiency measures, variable frequency drives, and selected insulation measures

Financial services include a combination of cash rebates and financing. The initial customer incentive will be set at 80% of the total installed cost. Financing will be available to customers to finance the 20% customer co-pay if desired.

Simple, easy-to-use financing will be provided for the remainder of measure installation costs, structured to provide an immediate positive cash flow for customers while allowing them to receive a minimum of 20% of the estimated bill savings during the loan repayment period.

This financing component will not require administratively burdensome reviews of customers financial and credit records. While payments will not be on the electric bill at least initially, the program will investigate the possibility of providing on-the-bill financing in the future. Experience shows that well designed, positive cash flow, on-the-bill financing can be used to dramatically reduce incentive levels while maintaining high participation rates.

Commercial Existing Buildings

Program Description

This program will target all existing C&I customers with retrofit and lost opportunity services. It will be particularly targeted to large C&I customers, as these represent a small number of customers but a majority of the total C&I energy use. These customers differ from small/medium size customers in their management structures, building operation expertise, and the capacity to undertake capital projects. Small/medium customers will be eligible to participate in this program, in particular for lost opportunity (e.g., planned equipment replacement) opportunities.

The program will include aggressive outreach (both to customers and other market actors), provision of technical analysis and services, financial services, and general project assistance to minimize transaction costs. The primary outreach and delivery mechanism will be through enhanced account management in a "Solution Provider" (SP) framework. Solution Providers will establish direct relationships with all large customers to maximize the capture of both retrofit and lost opportunity projects. The goal is to develop long-term relationships with key customer staff to ensure that Solution Providers are viewed as integral to capital planning activities at as many Large C&I customers as possible. The SP will bring value beyond electricity savings to the table, such as resources to assist with power factor correction, demand management, capital needs, long term infrastructure planning, and other energy and non-energy issues. Since this level of service requires significant personal contact, it will focus initially on the largest customers. For smaller customers, the program will provide prescriptive incentives and a streamlined custom incentive track.

Market Barriers

The program's long-term goal is transforming markets such that most consumers and contractors take advantage of currently deployable high efficiency equipment and design.

The program would seek to overcome additional market barriers to achieve this goal including:

- limited technical skills to address key elements of efficiency;
- perception that efficiency technologies may not perform as expected;
- focus on first costs rather than long term operating costs.

The program would employ a number of important strategies to address these barriers:

- Financial incentives to offset the higher first costs of efficient equipment and practices.
- Marketing and outreach to design professionals, vendors, contractors, ESCOs, and consumers to engage with relevant market allies throughout the specification, design and installation process. These allies then serve as a resource for customers, reducing the need to gather information on efficiency opportunities on their own.
- Technical assistance to design professionals, vendors, contractors, ESCOs, and consumers to assist in analyzing efficiency opportunities and educating decision makers about the technical and financial aspects of efficiency

Target Market and Marketing Approach

Bill analysis will allow solution providers to target customer with the highest usage. Outreach to other market actors in equipments, system and efficiency markets will be through media, direct mail, training and conferences. Prescriptive and custom incentive tracks will be marketed to all C&I customers, regardless of size, through bill inserts, direct mail, mass media, and trade ally conduits.

Target End Uses, Recommended Technologies, and Financial Incentives

The Program will target all cost-effective electric efficiency opportunities. Targeted end-uses include, but are not limited to:

- Interior and Exterior Lighting–higher efficiency technologies (e.g., CFLs, Super T8 and T5 fluorescent lamps and pulse-start metal halides) and fixtures; improved lighting design; controls (e.g., occupancy sensors, daylight dimming)
- HVAC–higher efficiency unitary AC, heat pump, and chillers; control systems; operational improvements (e.g., tune-ups, duct sealing); economizers; VFDs; premium efficiency motors
- Refrigeration–(e.g., Vending Misers, high-efficiency packaged refrigeration equipment)

- Other–(e.g., high efficiency kitchen equipment; water heating measures; retro-commissioning; high-efficiency customer-sited transformers)

It will offer both prescriptive (standardized) incentives and custom incentives. Prescriptive incentives will be available for those technologies that are typically cost-effective in most applications, and have been shown to be effectively promoted through prescriptive approaches. They will include incentives for lighting, motors, and HVAC equipment at a minimum. Consideration of additional prescriptive measures such as compressed air, refrigeration, plug load equipment, VFDs and others will be considered over time. Prescriptive incentive levels will be based on lost opportunity (planning investments) markets, and will be set to defray, on average, 75% of the incremental cost from standard practice efficiency to high efficiency. Minimum efficiency criteria will be set to ensure maximum savings and minimization of free riders, while balancing the need to ensure that numerous products are available and stocked to meet the criteria. Where appropriate, prescriptive minimum efficiency criteria will align with other standards or targets to leverage regional or national efforts (e.g., CEE Tier II levels, EPA Energy Star, etc.)

Custom incentives will be available for all cost-effective measures not offered prescriptively, including all retrofit measures. Custom financial incentives will be a function of whether individual projects are retrofit or lost opportunity.

- For discretionary retrofit measures, the incentives will start at, on average, 50 percent of retrofit project cost, where the project cost includes the full labor and equipment installation costs for retrofit measures plus the incremental labor and equipment costs associated with replacement.

- For lost opportunity measures, the incentives will start at, on average, 75 percent of the full incremental cost of high-efficiency building and equipment choices, consistent with the New Construction program.

- For large customers addressed through the Solution Provider approach, incentive offers will be presented in the form of a cash flow analysis that compares the project against financial criteria defined by the customer (e.g., internal rate of return, return on investment). The program goal is to set the incentives at the minimum level that still meets the customer's criteria.

The above targets are estimated average incentive levels, however, we expect to capture many at lower costs, while being prepared to cover up to the full cost if necessary to ensure adoption.

Non-financial services will include provision of technical assistance studies to customers, possibly with a customer/utility cost share. Initially, the program will provide these services at no cost, but will investigate co-pay options if appropriate.

While customers eligible for the Small/Medium C&I Direct install will also be eligible for this program, it will be primarily targeted to larger customers and to trade allies and other upstream market actors in efforts to transform various equipment replacement markets.

Commercial New Construction

Program Description

The C&I New Construction Program will promote the construction of high performance business facilities by targeting all new buildings and significant building expansions. Major renovations (defined as complete replacement of at least one major building system) are also included; smaller renovation or remodeling opportunities will be covered under the C&I Existing Buildings Program. It will offer comprehensive services including: financial incentives (covering measure, and incremental design and analysis costs); technical and design assistance; and coordination services to assist consumers, design professionals, vendors and contractors to overcome various transaction barriers. The long-term objective is to transform the new construction market such that most new buildings take advantage of appropriate high efficiency equipment and design. The Solution Provider approach will be used for large projects/customers while small projects will receive incentives through a prescriptive path that requires performance beyond code requirements.

Market Barriers

Additional barriers in this market include:

- institutional barriers related to government and other entities that create disincentives to adopt efficiency
- perception of risk that efficiency technologies may not perform as expected
- an inordinate focus on first costs rather than long term operating costs
- tight schedules that often make consideration of efficiency opportunities undesirable because of perception they will delay design or construction
- budgeting and contracting mechanisms between consumers and design professionals that create barriers to investigation and analysis of efficiency opportunities because they increase costs of designers that they will not get compensated for
- inability of consumers, tenants, lenders, appraisers and realtors to differentiate between efficient and standard new buildings.

The program would employ a number of important strategies to address these barriers including:

- Marketing and outreach to design professionals, vendors, contractors, developers, builders, lenders, and building occupants to identify new construction opportunities prior to the start of the design phase and build interest in relevant market allies throughout the design and construction process

- Technical and design assistance and training to design professionals, vendors, contractors, developers, builders, and building occupants

- Financial incentives to design professionals to cover incremental design and analysis costs, developers, builders, and ultimately occupants to construct high performance buildings.

The New Construction program is distinguished from the Existing Buildings program by it's use of specific strategies designed to overcome the barriers found in the new construction market, particularly those related to aggressive outreach and training to design professionals and contractors, and the need to engage at the very beginning of the design process and be part of the design team to effectively capture comprehensive opportunities.

Target Market and Marketing Approach

The target market is all C&I new construction and major renovation projects, with an emphasis on those implemented by larger customers, as well as relevant actors involved in the planning, purchase, design, specification, and construction of new C&I buildings. Marketing efforts will be coordinated with those of the C&I Existing Buildings Program and extended to trade allies who work primarily in new construction and major renovation markets, such as architects and large general contracting firms.

Target End Uses, Recommended Technologies, and Financial Incentives

The program will focus comprehensively on total building energy use. It will seek to capture all cost-effective opportunities through a comprehensive approach that will address interactions between systems and take advantage of synergies and cost savings from efficiency (e.g., ability to reduce capital costs of mechanical systems by reducing heat gains from lighting and building shell measures). All electric energy usage will be addressed through all aspects of design, including siting, building envelope, lighting, and HVAC system selection and sizing, and process or other systems in the facility.

For large buildings (approximately 75,000 sq. ft. or larger) the focus will be on comprehensive analysis of the total building and systems. For medium sized buildings (10,000–75,000 sq. ft.) the program will align with the New Building Institutes Core Performance program, which uses a standardized approach to ensure an average savings of at least 30% improvement over current building codes through a menu of commonly applicable measures. This approach will leverage existing program development and materials. Custom incentives would still be available for these medium sized customers, but with somewhat lower investments in detailed engineering analysis. For the smallest new construction projects, we anticipate most efficiency improvements would focus on specific equipment and systems improvements that are widely cost-effective, many of them through the prescriptive offerings of the C&I Existing Buildings Program.

- All customers can use the prescriptive offerings from the C&I Existing Program, on average covering 75 percent of incremental project costs. However, for larger projects we anticipate more customized, comprehensive projects with negotiated incentives for the overall package of measures.

- The Core Performance menu of measures and incentives will also be designed to cover, on average, 75% of incremental costs.

- Design and analysis incentives will cover the incremental cost of architect and engineering services, energy modeling, and commissioning services above and beyond those typically incurred by a baseline project.

Technical assistance will be provided at no cost to customers and design teams through program staff or contractors.

Appendix F. Estimating CHP Potential in Michigan

State-estimated CHP Potential

Opportunities for CHP exist wherever there is use for both thermal and electric energy. The energy output can be used by one customer or shared among many. Our analysis estimates the potential in three separate sectors, commercial/institutional, industrial, and residential.

In January of 2006, the Capacity Needs Forum of the MPSC estimated that companies currently equipped with large boilers (100,000+ lbs steam / hr) would be best equipped convert to CHP capacity (i.e. from heat generation only to heat and power generation). Combined, 1,404 MW of CHP potential could be tapped in facilities across the state, 77% of which are in large industrial manufacturing and processing facilities.[76] The breakdown of the CHP potential from large institutions is shown in Table F.1.

Table F.1: Estimated CHP Potential in Michigan

CHP Sector	Percent of Total	Potential MW
Automotive / Transportation	43%	466
Mining / Metal Forming	18%	193
Pulp / Paper	15%	159
Chemical / Pharmaceutical	10%	108
Food Processing	9%	99
Other	5%	59
Total	**100%**	**1,084**

Source: Michigan Public Service Commission, Capacity Needs Forum

The MSPC further estimated that since much of the CHP potential is captured in the declining automotive industry, the total penetration should be revised downwards. In a modeling exercise, the MPSC report assumed a 50% market penetration of CHP from large boiler facilities, or 547 MW total. Therefore, the MPSC has assumed an industrial CHP technical potential Michigan of 1,404 MW.

We consider the MSPC estimate a lower bound on total CHP potential: it does not include commercial or institutional potential from facilities such as malls, hotels, and entertainment venue, or CHP at large residential facilities, all of which can have favorable economics relative to central generating stations.

Independent Estimate of Industrial Potential

A second study performed for the U.S. DOE Energy Information Administration (EIA) estimated the market potential for CHP in the industrial sector. [77]The study determined

76 Michigan Public Service Commission. 2006. Public Needs Forum: Final Report. http://www.dleg.state.mi.us/mpsc/electric/capacity/cnf/cnf_reportvol2_1-3-06.pdf

77 The Market and Technical Potential of CHP in the Industrial Sector. Onsite for EIA, January 2000.

that a nation-wide potential of over 88,000 megawatts existed in 2000.[78] Scaling to only Michigan and ramping to 2006, a process described at the end of this Appendix, we estimate that at the upper end, Michigan has approximately 2,724 MW of industrial CHP technical potential.

Independent Estimate of Commercial and Institutional Potentials

Commercial and institutional facilities may be able to benefit from on-site or district CHP at larger scales. In other states, large hotels, entertainment venues, shopping plazas, and commercial buildings are self-powered with CHP ranging from microturbines to large gas-fired generators. CHP at these facilities is economic if the costs of installing, maintaining, and fueling a turbine is lower than the costs of procuring electricity and/or heat from other sources.

The EIA estimated that Michigan had an available potential of 2,560 MW for CHP in 2000, or over 8% of peak load.[79] The breakdown of this potential is shown in Table F.2.

Table F.2: EIA-based CHP Estimate for Michigan (1995)

Facility Type	**MW Potential**	**Facility Type**	**MW Potential**
Hotel / Motel	126.6	Nursing Homes	297.9
Hospitals	330.7	Schools	459.2
Colleges and Universities	131.0	Commercial Laundries	16.7
Car Washes	8.4	Health Clubs / Spas	116.0
Golf Clubs	51.4	Museums	16.0
Correctional Facilities	96.8	Water Treatment / Sanitary	21.6
Extended Service Restaurants	163.9	Supermarkets	46.8
Refrigerated Warehouses	23.4	Office Buildings	654.0
Total (2000)	**2560**		

For the current study, we scaled the 2000 EIA estimate by changes in the commercial sector in Michigan between 1995 and the most recent report for the year 2003. This estimate is based on data from the EIA's 2004 Commercial Building Energy Consumption Survey (CBECS) published in 2004. Scaling is proportional to the change in square feet of building usage by facility type between the 1995 and 2003. The scaled potential is valid for 2004, and has not been updated to reflect 2009 conditions. Nonetheless, we believe it is a reasonable approximation of the maximum potential in these sectors.

78 Ibid, Table 3.1, Total CHP Potential, Existing CHP, and Remaining Potential by 2-Digit SIC, pg 37.

79 The Market and Technical Potential of CHP in the Commercial/Institutional Sector. Onsite for EIA, January 2000. Table B-1, page 57

Table F.3: Scaled EIA-based CHP Potential in Michigan (2004)

Facility Type	MW Potential	Facility Type	MW Potential
Hotel / Motel	111.7	Nursing Homes	331.0
Hospitals	367.4	Schools	678.8
Colleges and Universities	193.7	Commercial Laundries	7.1
Car Washes	3.6	Health Clubs / Spas	61.7
Golf Clubs	27.3	Museums	8.5
Correctional Facilities	96.8	Water Treatment / Sanitary	21.6
Extended Service Restaurants	150.0	Supermarkets	46.8
Refrigerated Warehouses	19.0	Office Buildings	749.0
Total (2000)	**2,874.2**		

Our independent estimate of CHP for the Michigan commercial sector is 2,874 MW.

Residential Sector

The potential for CHP in the residential sector is harder to determine than for the non-residential sector. The technology faces significant barriers to adoption in this sector and, with the exception of larger multifamily buildings or complexes, has generally not been explored. There is a significant installed base of CHP or distributed generation on educational and healthcare campuses and in larger residential units where the economies of scale have made them economically beneficial for decades.

A recent state-wide Massachusetts study provided constrained estimates the potential for distributed generation in the residential sector. This study considered the potential for CHP systems in apartment buildings and condominiums with 100 or more units. The study determined that the technical potential for CHP in this residential sub-sector was 66MW at 438 sites.[80] Even though Michigan has almost twice the total number of housing units that Massachusetts has in buildings twenty or more units in size they are roughly comparable for the purposes of a lower bound.[81]

One of the changing factors in the CHP landscape is the consideration of retrofit district energy systems. Technological advances, constraints on generation, transmission and distribution, increasing fuel costs, and concern over total emissions are encouraging communities to evaluate the benefit of adding district energy systems to their infrastructure base. This is far more complicated and expensive than installation in a single building, but still proving to have significant potential. A study of residential district heating was completed in 2008 for a rural community in northern New Hampshire.[82] It determined that the community would see an economic benefit from district energy, even without subsidies. The study indicated the economic feasibility of installing a district energy system in a small town in a rural setting in a northern climate

80 Mattison, pg 44

81 Michigan had 259,083 units in buildings with 20 or more units while Massachusetts had 260,265 according to the U.S. Census American Community Survey 2006.

82 *Preliminary Feasibility Analysis for Distributed Energy and District Heating in the Village of Groveton, New Hampshire*. The North Country Resource Conservation and Development Area, Inc, 2008

zone with aging housing stock and infrastructure. This description would fit many of Michigan's towns and villages.

Small CHP units, such as micro-turbines and reciprocating engines, are increasingly available and cost effective. Installations in smaller residential buildings are approaching the level of cost effectiveness even without subsidies. With over 566,000 housing units (12.5% of the total) in buildings with 5 or more units, this market represents a tremendous opportunity for CHP. Under a set of conservative assumptions, Michigan's technical potential for CHP in this market sub-sector is on the order of 900 MW.

Total CHP Potential in Michigan

The levelized cost of electric energy produced from CHP was estimated at between 3.9 cents and 9.2 cents per kilowatt hour in 2002.[83] A study for the Pacific Northwest in 2004 estimated levelized (all-in) costs in the range of 4 to 12 cents /kWh for mature technologies (technologies available today).[84] Compared to the prevailing price of electricity and heat, CHP is often price effective at scale.

Combined heat and power has the potential to increase Michigan's capacity to produce the energy it needs. We estimate that Michigan residential, commercial, and industrial institutions could economically self-generate 6498 MW. A metric used in the State Capacity Needs Forum estimates that there would be only a 50% penetration of CHP into eligible and economic markets.[85] Residential and commercial institutions may require additional incentives to move from traditional heating and power sources to CHP, and therefore we estimate a lower penetration overall of only 30% of total economic potential, or 1949 MW of capacity. At a capacity factor of 80%, these generators would supply 13,243 GWh directly to load (see Table F.4).

Table F.4: Total estimated CHP technical potential and achievable potential for green alternative

Sector	Capacity (MWh)	Energy (GWh)
Industrial	2,874	20,140
Residential	2,724	19,089
Commercial	900	6,307
Total Technical Potential	**6,498**	**45,537**
Achievable Potential	**1,949**	**10,414**

Addendum: Scaling the EIA's National CHP Estimate to Michigan

A second study performed for the EIA by the same team of researchers estimated the market potential for CHP in the industrial sector. The study determined that a nation-wide potential of over 88,000 megawatts existed in 2000. The study found that Michigan's industrial sector had 41 industrial CHP installations with total capacity of 1,894 megawatts. Regrettably, the report does not disaggregate potential at the state level. The

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83 CHPFinalReport2002NYSERDA.pdf. pages 5-3, 5-4

84 Chp_Market-Assessment_In_PNW_EEA_08_2004.pdf, extracted from Tables 5-1 & 5-2.

85 Michigan Public Service Commission. 2006. Public Needs Forum: Final Report. http://www.dleg.state.mi.us/mpsc/electric/capacity/cnf/cnf_reportvol2_1-3-06.pdf

following figure shows the potential at the national level and scaled to Michigan for two time periods.

Table F.5: Industrial CHP Potential

Estimate of Industrial CHP Potential							
		National Estimate -2000			Scaled to MI	
SIC	Description	Total Potential (MW)	Existing CHP	Remaining CHP Potential	MI share 2000	MI Share 2006
20	Food&Kindred	12,680	4,594	8,086	195	136
21	Tabacco&Allied*	103	131	0	0	-1
22&23	TextileMill&ApparelManufacture	3,940	651	3,289	77	57
24	Luimber&WoodProducts	2,542	806	1,736	42	36
25	Furniture	401	68	333	19	13
26	Paper&Allied	34,751	8,553	26,198	889	571
27	Printing&Publishing	404	19	385	12	8
28	Chemicals&Allied	27,132	17,692	9,440	342	276
29	Petroleum&Coal	12,407	5,618	6,789	113	91
30	Rubber&MiscPlastics	4,413	787	3,626	238	192
31	Leather&Tanning	98	0	98	4	1
32	Stone,Clay,Glass,Concrete	2,698	774	1,924	68	57
33	Primary Metals	9,814	2,873	6,941	430	263
34	FabricatedMetals	5,726	78	5,648	330	249
35	IndustrialMachinery&Equip	6,385	149	6,236	463	307
36	Electrical&Electronics	987	180	807	19	13
37	TransportEquip	5,412	808	4,604	668	423
38	Instruments&Related	1,562	59	1,503	22	15
39	Misc	1,128	402	726	18	16
	TOTAL	**132,583**	**44,242**	**88,369**	**3,949**	**2,724**

* - Existing CHP is greater than estimated potential

Scaling National CHP Estimates to Michigan

The estimate for the industrial CHP potential for Michigan is based in the data from the EIA's national CHP potential study of January 2000 (SYCOM Energy Corporation. *The Market and Technical Potential for Combined Heat and Power in the Industrial Sector.* U.S. DOE EIA, 2000.). This study estimated the national potential for CHP by Standard Industrial Classification (SIC) code. This study used data from various sources for the years ranging between 1994 and 1999. It did not allocate the potential by state. The following steps allocated a share of the potential to Michigan in the study year and then projected forward to 2006.

Step 1–Michigan allocation 2000.

- Determine number of employees by industry nationally for 1997
- Determine number of employees by industry in Michigan for 1997
- Calculate ratio of Michigan employees/ U.S. employees by industry
- Multiply total potential by industry by ratios above to determine MI CHP potential

Steps 2–Scale 2000 national estimate to 2006

- Determine number of employees by industry nationally for 2006
- Calculate ratio of employees in 2006 to employees in 1997 by industry
- Multiply total potential by industry from 2000 study by ratio above to determine national potential in 2006

Step 3–Michigan allocation 2006

- Determine number of employees by industry in Michigan for 2006
- Calculate ratio of Michigan employees/U.S. employees by industry for 2006
- Multiply total potential by industry scaled to 2006 by ratio above to determine MI CHP potential for 2006

Notes and Rationale:

1) *Scaling by number of employees*–This data was the mostly consistently available across the years of the analysis. It is a reasonable proxy for the number of establishments in operation.

2) *Data Years 1997 & 2006*–The base data for the 2000 was collected in 1997. There is reliable census data for this year. The most recent year with a complete and comparable data set is 2006.

3) *SIC to NAICS*–Between the 1997 and 2006 the industrial classification system changed from SIC to the North American Industrial Classification System (NAICS). Translation from SIC to NAICS is not precise. Some categories were blended, and some were disaggregated. This analysis accommodated these changes.

Appendix G. Energy Efficiency in Integrated Resource Planning: Sample Legislation

An example of state legislation to require all cost-effective energy efficiency in integrated resource planning can be found in Connecticut's Public Act 07-242, section 51, which provides:

> (a) The electric distribution companies, in consultation with the Connecticut Energy Advisory Board… shall review the state's energy and capacity resource assessment and develop a comprehensive plan for the procurement of energy resources, including, but not limited to, conventional and renewable generating facilities, energy efficiency, load management, demand response, combined heat and power facilities, distributed generation and other emerging energy technologies to meet the projected requirements of their customers in a manner that minimizes the cost of such resources to customers over time and maximizes consumer benefits consistent with the state's environmental goals and standards.
>
> (b) On or before January 1, 2008, and annually thereafter, the companies shall submit to the Connecticut Energy Advisory Board an assessment of (1) the energy and capacity requirements of customers for the next three, five and ten years, (2) the manner of how best to eliminate growth in electric demand, (3) how best to level electric demand in the state by reducing peak demand and shifting demand to off-peak periods, (4) the impact of current and projected environmental standards, including, but not limited to, those related to greenhouse gas emissions and the federal Clean Air Act goals and how different resources could help achieve those standards and goals, (5) energy security and economic risks associated with potential energy resources, and (6) the estimated lifetime cost and availability of potential energy resources.
>
> (c) Resource needs shall first be met through all available energy efficiency and demand reduction resources that are cost-effective, reliable and feasible. The projected customer cost impact of any demand-side resources considered pursuant to this subsection shall be reviewed on an equitable bases with nondemand-side resources. The procurement plan shall specify (1) the total amount of energy and capacity resources needed to meet the requirements of all customers, (2) the extent to which demand-side measures, including efficiency, conservation, demand response and load management can cost-effectively meet these needs, (3) needs for generating capacity and transmission and distribution improvements, (4) how the development of such resources will reduce and stabilize the costs of electricity to consumers, and (5) the manner in which each of the proposed resources should be procured, including the optimal contract periods for various resources.
>
> (d) The procurement plan shall consider: (1) Approaches to maximizing the impact of demand-side measures; (2) the extent to which generation needs can be met by renewable and combined heat and power facilities; (3) the optimization of the use of generation sites and generation portfolio existing within the state; (4)

fuel types, diversity, availability, firmness of supply and security and environmental impacts thereof, including impacts on meeting the state's greenhouse gas emission goals; (5) reliability, peak load and energy forecasts, system contingencies and existing resource availabilities; (6) import limitations and the appropriate reliance on such imports; and (7) the impact of the procurement plan on the costs of electric customers.

(e) The board, in consultation with the regional independent system operator, shall review and approve or review, modify and approve the proposed procurement plan as submitted not later than one hundred twenty days after receipt. For calendar years 2009 and thereafter, the board shall conduct such review not later than sixty days after receipt. For the purpose of reviewing the plan, the Commissioners of Transportation and Agriculture and the chairperson of the Public Utilities Control Authority, or their respective designees, shall not participate as members of the board. The electric distribution companies shall provide any additional information requested by the board that is relevant to the consideration of the procurement plan. In the course of conducting such review, the board shall conduct a public hearing, may retain the services of a third-party entity with experience in the area of energy procurement and may consult with the regional independent system operator. The board shall submit the reviewed procurement plan, together with a statement of any unresolved issues, to the Department of Public Utility Control. The department shall consider the procurement plan in an uncontested proceeding and shall conduct a hearing and provide an opportunity for interested parties to submit comments regarding the procurement plan. Not later than one hundred twenty days after submission of the procurement plan, the department shall approve, or modify and approve, the procurement plan. For calendar years 2009 and thereafter, the department shall approve, or modify and approve, said procurement plan not later than sixty days after submission.

(f) On or before September 30, 2009, and every two years thereafter, the Department of Public Utility Control shall report to the joint standing committees of the General Assembly having cognizance of matters relating to energy and the environment regarding goals established and progress toward implementation of the procurement plan established pursuant to this section, as well as any recommendations for the process.

(g) All electric distribution companies' costs associated with the development of the resource assessment and the development of the procurement plan shall be recoverable through the systems benefits charge."

Appendix H. New Plants Required to Demonstrate Best Available Control Technology for CO_2 Emissions

On November 13, 2008, the U.S. EPA's Environmental Appeals Board (EAB) ruled that the EPA had failed to justify its refusal to require best available control technology ("BACT") for carbon-dioxide emissions from the proposed Deseret Power Plant, located near Bonanza, Utah. Failing to justify the lack of a BACT demonstration, the EAB remanded the PSD permit to EPA Region 8 to correct this deficiency. Having rejected every assertion offered to excuse a failure to require CO_2 limits as part of a Clean Air Act permit, this decision reaffirms the need for proposed coal plants to include BACT limits for CO_2.

Most, if not all, of the proposed coal plants for Michigan will require PSD review by Michigan's Department of Environmental Quality. Given the effects of the EAB decision, failure to address BACT for CO_2 would expose the proposed plants to the same sort of legal infirmities found for the Deseret plant permit. and the permit for the now-withdrawn Northern Michigan University coal plant, which was remanded to Michigan DEQ for the same failure to justify a lack of BACT limits for CO_2. Currently, integrated gasification combined cycle (IGCC) is the technology being focused on to capture CO_2. Carbon dioxide can technically be captured from pulverized coal plants, but costs today are very expensive. Only the proposed Alma, Michigan, plant is an IGCC and the cost of an IGCC plant is even greater than that of a supercritical coal plant. Michigan's ratepayers and economy would be better served by policies seeking lower cost resources, a scenario described in Chapter 1 of the report.

Appendix I. Ramping Baseload in Michigan

The following figure (Figure I.1) shows hourly gross generation from fossil plants over 40 MW in Michigan during mid-summer of 2007. The color of the area indicates the CO_2 emissions rate of each unit in tons per MWh. Plant units coded red are coal fired, with emissions rates of 1.0 to 1.2 tons of CO_2 per MWh. The wide swing in generation from hour to hour over the course of this three day period suggests that coal plants in Michigan, built for baseload purposes, are being used to meet daily peaks.

Figure I.1: Ramping baseload generation in Michigan. Individual areas represent fossil units in Michigan; color represents the CO_2 emissions rate. Coal plants appear red.