CITIZENS RESEARCH COUNCIL OF MICHIGAN

"The right to criticize government is also an obligation to know what you're talking about."
Lent Upson,
First Director of the Citizens Research Council

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Meeting Michigan's Renewable Energy Goals will Require Substantial Investment and Sustained Effort

In a Nutshell

- The MI Healthy Climate Plan sets a goal for 60 percent of Michigan's electricity to be generated from renewable resources by 2030.
- Michigan has ample resource and land availability to reach this goal and there are feasible solutions to addressing the intermittency and public resistance challenges, all while keeping the lights on for Michigan residents and businesses.
- Potential difficulties in achieving this goal include the lack of adequate transmission infrastructure and regional coordination.

In 2021, Michigan residents and businesses consumed 115.5TWh of electricity. That's enough to power 220 million 60W incandescent light bulbs for an entire year! With the increasing electrification of vehicles, home heating, and other appliances, consumption is estimated to grow nearly forty percent to over 160TWh by 2030.

In 2021, under 10 percent of Michigan's electricity was generated from renewable sources such as solar, wind, and hydro. Another 30 percent was generated from nuclear power, a carbon free but nonrenewable energy source. Further, 32 percent was generated from coal and 27 percent from natural gas, two fossil fuels that emit greenhouse gasses (GHGs) such as carbon dioxide (CO2) and methane (CH4).

Many industries, such as the transportation sector, are relying on electrification to reduce GHG emissions and mitigate climate change. The full benefits of this transition, however, cannot be realized until the electrical grid itself is decarbonized.

In 2020, Michigan Governor Gretchen Whitmer took action to move towards a renewable energy future. The Council on Climate Solutions was developed within the Department of Environment, Great Lakes, and Energy (EGLE) and tasked with preparing a plan for Michigan to reduce GHG emissions. In April of 2022, EGLE released the MI Healthy Climate Plan.

The MI Healthy Climate Plan sets forth a goal to "generate 60 percent of the state's electricity from renewable resources…by 2030." Michiganders may wonder if the state has enough sunshine and wind to achieve this ambitious target. Further concerns draw into question what happens when the sun sets or demand spikes, where renewable power facilities would be sited, and how to overcome local skepticism. An often overlooked challenge to meeting this target is the requirement for new transmission lines to carry power from generation sites in rural areas to end users in urban areas.

Technical Potential: Sufficient sun and wind

In 2012, the National Renewable Energy Laboratory (NREL) released a report analyzing Michigan's technical potential for renewable electricity generation. Technical potential is an estimate based on physical constraints (i.e. how much sunshine there is), system constraints (i.e. the efficiency of existing technology), and some land-use constraints (i.e. topography).

NREL found that there is enough sunshine in Michigan in a year to generate 50.8TWh of electricity in urban centers and 5,215.6TWh in rural areas. NREL's research further found a potential to generate 143.9TWh of electricity via onshore wind. These estimates do not include distributed generation (DG) – citizen owned and sited electricity generation – for which NREL estimated an additional potential of 23.5TWh.

NREL's research shows that Michigan has enough technical potential to far exceed the 2030 consumption estimate of 160TWh per year. However, it will be a challenge for policymakers and power utilities to pursue this goal while considering the economic, social, and policy constraints of renewable energy development.

Intermittency: Available power during low generation periods

NREL's estimates are based on yearly totals, but cloud cover and wind speed vary day by day. Even when Michigan has enough renewable generation capacity to consistently meet regular demand, there will be times when solar panels and wind turbines are unable to produce power. When renewable resources are unavailable, traditional energy sources will have to temporarily fill the void.

Currently, over half of Michigan's electricity production comes from coal and nuclear plants. These types of plants, however, take a long time to ramp up electricity production and are therefore ill-suited for backup power, which may be needed at a moment's notice. Michigan will instead have to rely on natural gas plants, which can be ramped up quickly. Considering this, the Plan's goal assumes up to 40 percent of annual electricity will be generated from traditional fuel sources through 2030.

Michigan also can utilize energy storage to help mitigate the intermittency of renewable energy. The MI Healthy Climate Plans calls for 2,500MW of storage capacity by 2030. Storage would act similarly to a backup gas plant, contributing electricity to the grid only when renewable resources decrease or demand rises. Michigan already has about 1,875MW of grid-scale storage capacity at the Ludington Pumped Storage Plant. This plant takes advantage of low electricity demand to pump water from Lake Michigan uphill where it is stored in a reservoir. When extra electricity is needed in the grid, the water is allowed to flow back downhill into the lake, passing through a series of turbines that generate electricity.

The Ludington Pumped Storage Plant can produce about 1,875 MW of generation capacity during peak periods. (Image via POWER Magazine)

Peak Events: Addressing demand spikes

Even with just 10 percent of electricity being generated from renewable sources, Michigan is already among the top five states with the most power outages in the last 20 years. These outages are largely caused by stress on the grid that is exacerbated by extreme weather events and high demand, two things that are expected to increase in the coming years. In the summer of 2022, when air conditioners were cranked up to beat the heat, Michigan electricity demand peaked at 17,711MW. While it's not necessary to be able to produce this amount of electricity at all times, Michigan should assure that transitioning to a renewable grid is done without compromising reliability.

Similar to other intermittency concerns, this can be best addressed by backup natural gas plants and electricity storage devices. In 2021, Michigan had about 12,000MW of natural gas and 1,875MW of storage capacity. Utilities are continuing to add storage and natural gas capacity that will allow them to keep the lights on, even during these high demand events.

In addition to relying on backup power, however, demand response programs and technologies can help reduce peak demand. Demand response refers to a consumer's ability to adjust their energy usage in real time based on costs, which are higher during times of high demand. Both of Michigan's major utilities, Consumers Energy and DTE, have already set seasonal "peak hours" during which prices are higher. This encourages consumers to shift their electricity use to "off peak hours," saving them money and reducing the risk of peak demand events.

Location: Siting renewable energy facilities

Not every square mile in Michigan is desirable or available for renewable energy development. There are many opportunities to establish renewable energy in the state without taking land away from other uses. For example, approximately 10 million acres are used for agriculture and 80 percent of that is in the southern Lower Peninsula, where much of Michigan's renewable resource potential is. Wind turbines can be erected on agricultural land with minimal disturbance to agricultural activities. This is also often viewed as a favorable deal for farmers who receive income from leasing their land to developers.

Agrivoltiac farms can combine grazing animals with renewable generation facilities, increasing production value of the land. (Image via NewScientist)

Other examples of low impact land that could be utilized for renewable energy development include highway medians or atop existing roofs. Another possibility is brownfields, former industrial sites or landfills that are so polluted they are unsuitable for habitation without costly remediation. Despite the environmental degradation, these sites may still be suitable for solar panels or wind turbines.

NIMBYism: Overcoming local skepticisim

Finding suitable land is only the first step in deciding where to build renewable energy facilities. Perceived drawbacks from the development of renewable energy often culminate in a phenomenon called NIMBYism – "not in my backyard." Local opposition can stop development in its tracks.

The Michigan Zoning Enabling Act of 2006 granted zoning and permitting authority to local governments. This gives local communities a lot of power to prevent renewable energy development in their area, resulting in the widespread differences in renewable energy adoption across the state. Some communities, such as Grand Rapids and Ann Arbor, have their own renewable energy goals. Others are not only opposing renewable energy development, but ousting elected officials that support it.

The MI Healthy Climate Plan does not call for the removal of zoning authority from local governments, but instead recommends assistance to "communities in adopting best practices for siting renewable energy." However, it's unclear whether Michigan will be able to reach its renewable energy development goals while maintaining local autonomy over renewable energy zoning laws.

Transmission: An overlooked challenge

Michigan has the technical potential and land availability to meet its MI Healthy Climate Plan goals. There are viable solutions to the intermittency problems and NIMBYism threats. But perhaps the biggest challenge to Michigan achieving 60 percent renewable energy generation by 2030 is the lack of necessary transmission infrastructure.

Historically, power plants have been concentrated near the ppulation centers that consume the power. Fuel, such as coal, is mined and transported to the plants. Once generated, electricity passes through a network of substations, transformers, and power lines to reach end users. Renewable resources, however, cannot be mined like traditional fuels. Thus, all new transmission infrastructure will be needed wherever the renewable resources are available.

In addition, traditional power plants are energy dense – a lot of homes can be powered by one facility because more fuel can always be transported in. Renewable energy facilities are significantly less energy dense. They are spread across more land and new resources cannot be procured. There's also a lot of potential for clean energy away from population centers. This means not only will Michigan need to relocate much of its existing electrical grid, but it will need to expand the grid overall.

There is another solution, however, to all of the challenges Michigan will face reaching its MI Healthy Climate Plan goal: imported power. Developing renewable energy facilities in other states may be more efficient and face less local opposition. Sharing renewable electricity across state lines is a very promising solution to a global climate crisis. To leverage such an approach, Michigan will have to engage in and embrace regional and national energy planning. Although beyond the scope of this article, the Citizens Research Council is starting to investigate Michigan's role in establishing a national electricity grid.

Conclusion

The MI Healthy Climate Plan is a critical step towards reducing dependency on fossil fuels and helping to mitigate global climate change. However, implementation will require consideration of complex trade-offs, strategic long-term planning, and regional coordination. Meaningful

development of renewable generation must be increased quickly and significantly for Michigan to meet its 2030 renewables target.

Michigan's power utilities are in the process of retiring coal power plants, and the MI Healthy Climate Plan calls for all coal generation facilities to be shuttered by 2030. Traditionally, coal generation has been replaced with natural gas. While an improvement over coal, natural gas generation still produces climate-impacting GHGs. Meeting renewable goals will require that future coal be replaced by renewable generation.

To get a sense of the scale of investment and effort that will be required, we can assume a scenario whereby Michigan power utilities will meet future generation capacity demand with 50 percent wind and 50 percent solar. Assuming an average capacity of 3MW per wind turbine, Michigan will need to add about 213 new turbines each year from 2023 to 2030. Solar module capacity spans a much larger range than wind turbines. DTE's largest solar farm in Lapeer (featured in banner image), for example, has 45MW of capacity on 250 acres. Opened in 2017, this averages 0.18MW per acre. Consumers Energy has 4.5MW of capacity on 28.27 acres at its three Solar Garden sites. The last of these sites came online in 2021, averaging 0.16MW per acre. Using such figures as a baseline, Michigan will need to establish around 3,750 acres of solar each year between now and 2030.

In addition to these new renewable energy facilities, Michigan utilities will need to continue to expand storage capacity and, counterintuitively, natural gas capacity. These two technologies will be necessary to combat the intermittent availability of renewable resources as well as to secure ample backup power should peak demand continue to rise. Michigan will need to take advantage of idle lands and partner with local farmers to find sites for these new facilities. Developers and policymakers must also address local resistance. Perhaps most importantly, though, Michigan must invest in the rebuilding and expansion of its electrical grid such that power generated at new renewable sites in rural areas can be efficiently and reliably transferred to urban areas where it is most needed.

The challenge of successfully meeting these policy goals should not be overlooked, but the importance of pursuing them cannot be overstated.

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