NET ZERO F.A.S.T.

RECOMMENDATIONS FOR MICHIGAN MUNICIPALITIES TO ACHIEVE NET ZERO

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EXECUTIVE SUMMARY

EcoWorks' vision for achieving net zero carbon emissions by 2050 in Michigan is centered around uniting and empowering stakeholders of the region while keeping equity and social justice front and center. To achieve these ends, EcoWorks created the Net Zero F.A.S.T. program to work with communities and businesses to drive down emissions while prioritizing environmental justice. The program offers organizations the tools--initiatives, policies, practices, and support--they need in order to meet the global goal of net carbon neutrality. In an effort to add more tools to their toolbox, our team collaborated with EcoWorks to identify actionable policies and best practices that support the mission of the F.A.S.T. program. This broad scope was narrowed to focus on recommendations for municipal governments (i.e., cities, townships, villages, and counties).

We started by examining Project Drawdown's policy manual. Project Drawdown is a non-profit organization whose mission it is to stop global warming by bringing communities together in the struggle to lower, or draw down, our use of carbon in all sectors of life.[1] After reading through the Project Drawdown's recommendations, we identified five primary domains of local action: energy efficiency, building electrification, clean energy sources, energy siting and transportation. During that time, we also identified successful case studies featuring towns, cities, states, and provinces from around the world. We focused on places who have either reached or have implemented plans striving toward net carbon neutrality. With the knowledge of Project Drawdown's policies and a number of successful case studies in hand, we began to determine how the solutions we found could translate to the State of Michigan's climate and environmental regulatory schemes.

We aggregated solutions from environmental organizations, scholarly publications, and examples from communities leading the way in sustainability. With each policy and best practice we recommended, we analyzed its potential impact in a local community with a particular eye towards how the recommendation may affect marginalized populations, as well as the likelihood that equity is maintained during implementation. We also discuss the results of interviews with community leaders and advocates in the hopes of developing more community-tailored solutions for the future. The end goal of our project is to produce an action-oriented toolkit for municipalities who sign on to Net Zero F.A.S.T. that can facilitate their journey to net zero carbon emissions in the most efficient, streamlined, and equitable fashion possible.

INTRODUCTION + BACKGROUND

1. *Need for cost-effective, high-impact pathways that local governments in Michigan can take to combat climate change.*
2. *Vast pool of decentralized resources with varying applicability to Michigan.*
3. *Objective to create single, go-to document to help communities identify relevant policies and actions they can take to support climate goals, equity, and justice.*

DESCRIPTION:

EcoWorks is committed to encouraging municipal governments, non-profits, and businesses to sign on for the initiative "Net Zero for All, Starting Today" (Net Zero F.A.S.T.). Net Zero F.A.S.T. is a regional project to reduce greenhouse gas (GHG) emissions from corporate, municipal, neighborhood, and non-profit activities, while ensuring justice and equity are central to the strategies implemented. Net Zero F.A.S.T. seeks to provide a framework for these organizations to better achieve their climate and social goals in an economically feasible manner. Currently, EcoWorks is in the phase of finalizing the structure of the program, as well as encouraging organizations to sign on to the Net Zero F.A.S.T. Program. They have strong existing relationships with several municipalities, and have identified these as the top priority to align with the initiative. The client has expressed a "reach goal" of having several of these municipalities signed on to the climate commitment by the end of 2020.

This comprehensive white paper supports the Net Zero F.A.S.T. initiative through providing recommendations for municipalities in the areas of Energy Efficiency, Building Electrification, Energy Source, Energy Siting, Equitable Financing Access, and Transportation. Each area of research starts with an Equity and Justice section, followed by several policy and best practice recommendations based on case studies from other municipalities and states. A description of the policy or best practice and the problem it solves, a focused case study, and potential transfer and applicability to Michigan will be included for each recommendation. It is our hope that this collection of research and case studies will serve to assist Michigan-wide community efforts in implementing practical policies and practices for reaching carbon neutrality.

METHODS:

During our initial conversations, Dr. Allison Harris, director of research and innovation at EcoWorks, explained that our project is meant to assist public and private organizations achieve carbon neutrality by giving them concrete goals. Together, we decided to seek inspiration from Project Drawdown, a global initiative focused on providing innovative solutions to the climate crisis. After learning more about Michigan's environmental regulations, climate zones, environmental characteristics, and local governments, we narrowed in on five policy areas - Energy Efficiency, Building Electrification, Energy Sources, Energy Siting, and Public Transit. We identified best practices for each policy area and consulted Dr. Harris as to their feasibility and applicability to Michigan.

Relying on secondary research and case studies was appropriate for all of our policy areas but one: Transit. Each community has unique transit needs, which meant determining best practices for public transit required asking key players (e.g., municipal governments, public transit users, etc.) what they believed to be the best solutions for Southeast Michigan's public transit network. While individuals do interact with building electrification, energy siting, and the other policy areas, it is in a less direct way than with transportation. We decided that transportation policy research would be best conducted through a series of virtual interviews with key stakeholders. Prior to COVID-19, our team planned on meeting with energy professionals, local government officials, and residents throughout Southeast Michigan in-person to discuss policies in all project areas, but the pandemic dramatically reduced those opportunities. Thankfully, we were still able to conduct regular virtual updates and check-ins with EcoWorks and continue to progress towards our goal.

ENERGY EFFICIENCY

Energy efficient buildings are designed or renovated to vastly reduce the building's energy demand needs when compared to common code buildings of similar types and scale.[2] As energy efficiency measures drive energy demand downward, savings shoot up. The benefits of energy efficient design and construction are significant: these types of buildings not only consume significantly less energy than comparable code buildings, but provide optimum occupant comfort levels, pristine indoor air quality, reduce operating costs and systems size, and minimize carbon dioxide emissions.[3]

As EcoWorks' Net Zero F.A.S.T. initiative strives to unite Michigan communities from the neighborhood to municipal scale to make a net zero emissions commitment, addressing energy efficiency will be critical in achieving this goal. The building industry is the largest manufacturing activity in the United States. U.S. Buildings consume over 30 percent of America's energy, 67 percent of all electricity, and produce over 35 percent of the nation's carbon dioxide emissions.[4]The vast majority of this energy mix is coming from nonrenewable, greenhouse gas emitting resources.[5] New energy efficient buildings can achieve close to zero energy demand, and sustainably retrofitted buildings can reduce heating and cooling energy requirements by 50-90 percent.[6] If communities in Michigan join and work together to eliminate the high level of energy consumption through energy efficient and cost-effective retrofitting and new builds, the state's emissions will be significantly reduced as a whole.

Building codes, while getting more stringent as they are updated every few years, set only minimum energy efficiency standards. This is not enough to reduce the overall impact and carbon dioxide emissions of the built environment at the necessary pace to meet carbon reduction goals for the sector. Communities must take it within their own hands to maximize energy efficiency in buildings through tried-and-true best practices in sustainable design, either from the first design phase of a new build or through an innovative retrofit approach. Priorities lie in following a holistic, integrative design approach, investing in energy efficiency early where possible, and using existing sustainable building standards and certification programs as guidelines.[7]

New construction offers the best opportunity to incorporate sustainable and equitable practices from the start, as it is most cost-effective to design with energy efficiency in mind from the beginning. However, it is equally important to establish aggressive retrofit targets for existing buildings, especially those which still have a long building life-cycle to make the energy retrofits worthwhile. Energy efficient renovation and retrofit activity remains a niche market due to insufficient funding, demand, incentives, and interest. The included policies and best practices suggest ways to incorporate the major renovation work that will be essential to bringing the state of Michigan closer to net zero energy emissions. Recommendations 1-4 are categorized under New Construction and Recommendations 5-8 are categorized under Retrofitting and Renovations.

Recommendations, as detailed in Appendix A:

1-1 Adopt **Municipal Level Green Energy Codes** to set energy efficient buildings up to become the standard, not the exception.

1-2 **Implement Smart Incentives** to increase financial feasibility for energy efficient design in new buildings.

1-3 Use best practices for **New Construction Thermal Enclosures, Passive and Active Systems** in Michigan.

1-4 **Use Green and Cool Roofs** to improve building performance and reduce urban heat island effect.

1-5 **Adopt Municipal Energy Retrofit Programs** to increase the availability and feasibility of energy efficiency improvements for existing buildings.

1-6 **Implement Regulatory Efforts** such as benchmarking, auditing, energy disclosure, and improvement programs.

1-7 Use best practices for **Retrofitting Thermal Enclosures, Passive and Active Systems** in Michigan.

1-8 Connect **COVID19 and Building Energy Performance** to address interior air quality, water quality, and overall health concerns.

BUILDING ELECTRIFICATION

After energy efficiency upgrades are made to buildings, mounting research suggests the best decarbonization strategy is electrification. Electrification is the process of transitioning all energy sources, particularly in buildings (residential, commercial, and industrial), to run on electricity. While in theory renewable gases exist, electrification is the fastest, most cost effective method to transition off of fossil fuels in our houses and buildings. Full decarbonization can be readily achieved by powering electric appliances with clean energy from carbon free electricity.

Electrification offers direct and indirect advantages for local communities and households. Perhaps most importantly, reducing the use of onsite fossil fuels decreases the emission of local pollutants such as PM10 or PM2.5 and heavy metals, notably mercury and lead.[8, 9] Studies continue to identify the detrimental health effects of indoor pollution levels. Indirectly, when paired with clean electricity generation, electrification can completely eliminate carbon emissions from the energy usage of buildings. Commercial and residential buildings (excluding electricity usage) contribute 12% of all GHG emissions in the U.S. Electrification combined with clean energy offers a path to fully decarbonize the sector.[10] Finally, electrification has the potential to support the electricity grid, providing enhanced flexibility (e.g., water heaters can pre-heat water to shift electricity to peak solar production times).

Buildings, including residential households, apartment complexes, and commercial buildings, directly consume fossil fuels for various tasks including primarily space heating and water heating. In the U.S., the vast majority of residential households use natural gas to power space heaters and water heaters. A small portion of natural gas is also used for stovetops (note: air conditioning, refrigerators, and other household appliances typically run on electricity). Similarly, commercial buildings typically use natural gas for space and water heating, with an additional larger portion being used for cooking in commercial-scale kitchens. Other commercial building energy usages such as ventilation, lighting, cooling, and computing are all run with electricity.

Considering the key fossil fuel energy uses in buildings, electrification policies should be focused on accelerating the deployment of key electric appliances - electric water heaters, electric space heaters, electric stove tops, etc. Electrification can and needs to be accelerated with policy and best practices implemented at the federal, state, and local level. Particularly true at the local community-level, policies must center equity in electrification to ensure policy support and benefits are equitably and fairly distributed to all community members. Local municipalities have immense opportunity to adopt and support targeted policies and proper guardrails to support local residents. Even in the state of Michigan where building codes, the most straightforward tool to advance electrification, are under state authority, there are numerous direct policies local governments can adopt and best practices they can implement.

Recommendations, as detailed in Appendix B:

2-1 Ensure full compliance with state building and construction codes through enhanced **Building Code Enforcement.**

2-2 Reform current processes and implement **Fair and Reasonable Building Permit Process** to ensure permits for electrification are simplified and accessible to all.

2-3 **Adopt Electrification Readiness** ordinances to ensure all new and renovated buildings can easily transition in the future.

2-4 **Create an Electrification Resource Center** to promote the local workforce and serve as a one-stop shop for electrification.

2-5 Build a local, diverse workforce by **Developing Training Programs** focused on sustainability-related careers and electrification.

2-6 Host **Workshops and Showcases** to promote the environmental, economic, and health benefits of electrification.

2-7 Commit to **Municipal Action through Demonstration Projects** to show the potential of electrification and support local businesses.

2-8 **Collaborate with Utility Companies and Technology Vendors** to implement financial incentives and programs that encourage the transition to electric appliances.

ENERGY SOURCING

Michigan's energy mix has a higher average carbon dioxide rate than the national average, with over 60% of the state's energy generated by coal and natural gas.[11] In order to meet the goals of the EcoWorks Net Zero F.A.S.T. initiative, in addition to energy efficiency upgrades and electrification it is imperative that Michigan municipalities take whatever steps they can to clean their energy mix. Moving away from fossil fuels and toward clean sources of energy generation is one of the most direct and impactful ways to reduce carbon emissions, but it is also one of the most complex and politically fraught.

The progress that municipalities are able to make regarding their clean energy future is largely dependent upon their relationship with their electric utility company. There are three primary types of energy utility companies: investor-owned utilities (IOUs), municipal utilities, and cooperatives. As of 2017, Michigan had 8 IOUS, 40 municipal utilities, and 9 cooperatives.[12, 13]

A municipal utility is publicly owned and controlled by the local municipality that it serves, and is not regulated by the Michigan Public Service Commission (MPSC). Communities with municipal utilities have greater control over their energy choices because of the closer relationship between local government and energy provider. Due to this greater control, municipal utilities often have more progressive renewable energy goals and distributed generation capabilities. Two examples of Michigan municipal utilities are the Lansing Board of Water and Light in Lansing, Michigan, and Traverse City Light and Power in Traverse City, Michigan. It is no coincidence that Lansing and Traverse City are two of the most energy-progressive cities in the state. While municipal utilities allow for greater local control over energy choices, they serve far fewer people than IOUs. Only roughly 300,000 MI electric customers are served by a municipal utility, as they are typically located in smaller cities.[14]

Unlike municipal utilities, IOUs and cooperatives are both regulated by the MPSC. Cooperative utilities are more common in Michigan's rural counties, and nine co-ops service just 320,000 Michigan electric customers.[15] IOUs, on the other hand, are the predominant energy provider in the state, serving roughly 90% of Michiganders with electricity.[16] Of the 8 IOUs in Michigan, the two largest are DTE Energy and Consumers Energy. DTE serves 2.2 million electrical customers, and Consumers serves 1.8 million in 62 counties.[17, 18]

Due to the fact that communities have different relationships with their energy providers, the path to clean energy varies wildly depending on where in Michigan you are located. Municipalities that are served by cooperative or municipal utilities tend to have much more autonomy and control over their energy choices than those in IOU-controlled areas of the state. As a result, it is much easier and more common for municipal utilities to make more progressive commitments to renewable and clean energy goals.

The vast majority of Michigan municipalities receive their energy from IOUs, and IOUs are particularly restrictive, leaving far less control to their customers. For this reason, the presented policy recommendations are intended to provide opportunities for municipalities in IOU-controlled territories to advance renewable energy goals.

Recommendations, as detailed in Appendix C:

- 3-1 Incorporate **Sustainability Sister Cities as part of Existing Peer-to-Peer Learning Models.**
- 3-2 Create a **City-County Task Force on Equity**.
- 3-3 Make solar PV rooftop installations less costly through **Solar PV + Storage.**
- 3-4 Expand **Community Solar for Low- and Middle-income Michiganders** and make opt-out.
- 3-5 Partner with Investor Owned Utilities to **Expand and Pilot Community Solar Initiatives** as alternative to CCA or Municipalization.
- 3-6 Circumvent lack of state **Support for Community Solar through Creative Solutions.**
- 3-7 Develop an **Anchor-Tenant Sourcing Program.**
- 3-8 Allow **Community Choice Aggregation.**
- 3-9 Enable **Community Solar Programs in Michigan at the State Level.**

ENERGY SITING

In addition to generalized clean energy sourcing recommendations and collaborating with investor-owned utilities to reduce the carbon burden of energy generation, there is a tremendous opportunity for Michigan municipalities to foster an environment to promote siting for renewable energy development.

The current status quo is that renewable energy makes up only 17% of electricity generation in the U.S., compared to 26.2% of electricity generation globally, and Michigan is well behind both of these at only 8% renewable energy.[19, 20, 21] There are several cities in the U.S. who have managed to achieve 100% of electricity generation from renewable sources, so there is a precedent to show that this is achievable.[22]

Which sources of renewable energy and the siting for the generation of these sources is critical in furthering development in Michigan. As Michigan municipalities have complete autonomy to regulate the zoning of renewable energy, municipalities can become leaders in this area to promote the most appropriate energy sources in the most effective way possible.[23]

Based on the report by the Vermont Energy Investment Corporation, commissioned by the Michigan Public Service Commission, as well as a review of which cities have been able to achieve 100% renewable energy in the U.S., the sources that should be focused on in Michigan are solar photovoltaic (at both the consumer and utility scale), central station biomass power and utility scale onshore wind.[24]

With sufficient development, either solar or wind energy independently would provide sufficient electricity to meet the entire state's needs. Both of these types of electricity generation are carbon neutral when put in place and have a small carbon footprint related to their manufacture, making them excellent options for the goal of net zero carbon emissions. However, the issue with either is their lack of reliability in terms of natural fluctuations in both sunlight and wind, respectively, as well as the time to develop a sufficient infrastructure. That is where biomass comes in, as a method for providing dispatchable, on-demand energy without the consumption of fossil fuels, and to function as a bridge solution to having 100% of electricity generation be from carbon neutral sources.

Additionally, there is an opportunity to integrate a new technology for municipalities to integrate hydroelectric power autonomously. Due to negative ecological impact, as well as the massive investment of carbon-intensive concrete required, new traditional large-scale hydroelectric power plant development is not recommended. However, there are technologies that can be put in place to take advantage of latent energy that is currently going to waste in city drinking and wastewater systems that would also be reliably and consistently available.

With these recommendations put into practice, in tandem with the improvements in energy efficiency that other sections of this report offer, significant strides will be made toward complete independence from fossil fuels for energy.

Recommendations, as detailed in Appendix D:

- **4-1** Preferentially site all renewable energy development **on brownfields**.
- **4-2** Provide **solar** energy zoning ordinances that reduce barriers, facilitate access, and encourage development.
- **4-3** Pursue **closed landfills** as a recommended site for new construction of photovoltaic arrays.
- **4-4** Utilize **conduit hydropower** to take advantage of wasted energy of municipal water systems.
- **4-5** Cultivate a supportive environment for **onshore wind** turbine development.
- **4-6** Create **biomass power plant** specific recommendations that encourage development and maximize efficiency.
- **4-7** Capture **methane emissions from landfills** to prevent direct emissions and utilize for electricity generation.
- **4-8** Employ **wastewater treatment plant digester methane** for electricity generation.

RETHINKING TRANSIT

Nearly all Michiganders agree that the state's public transportation network needs an update, and that is especially true in Southeast Michigan. While many solutions exist to remedy the various issues identified in Southeast Michigan's transit network, transit is something that requires public buy-in, which means planning a massive update requires massive public participation. To that end, our team suggests that EcoWorks's next step should be to organize and conduct, along with your partners in the transportation policy space, a survey of transit users to get their opinion. Given COVID-related restrictions, our team was unable to do this; however, we were able to get the opinions of some of most important players in Southeast Michigan's transit community.

As was previously mentioned, interviews were the primary method through which we gathered information regarding transit in Michigan. We asked the same set of questions to people who represent different constituencies that are directly involved with Southeast Michigan's transportation system. We found that many of them believe there are infrastructural issues within Southeast Michigan's transportation network which need to be addressed--some arguing that they need to be addressed in order to allow other substantive improvements. There were differences attributed to the current state of the transportation network, however, some believe that things are not as grim as they may appear.

Recommendations, as detailed in Appendix E:

5-1 **All transit leaders** (hired, elected, and appointed) **need to have professional experience in the transit sector and/or personal experience with transit**.

5-2 **Inform the public** about the various transit options that exist in their area and de-emphasize car culture.

5-3 **Invest more thought, money, and other resources** into the transit system and transportation infrastructure.

FINANCING SOLUTIONS

Ensuring a fast-paced, equitable energy transition that reduces climate change, improves the livelihoods of local community members, and drives economic progress for all, requires solutions that are accessible at scale. A key piece for unlocking such a future is developing and promoting tools that increase access to capital by residents and businesses. Most importantly, local municipalities have an important role in promoting and establishing programs, policies, and best practices that expand access to financing to all residents, including low-income households.

There are many creative and emerging policies that local municipalities can support and establish to increase access to financing beyond simple incentives and rebates. Across the financing solutions recommended in this section, inclusive financing practices should be incorporated at every stage and for every product. Inclusive financing removes barriers to financing based on credit score, upfront costs, rental/ownership state, and language needs. All Michiganders should have equal access to financing to support clean energy and sustainability initiatives, allowing them to participate in the transition and realize the economic and health benefits.

Recommendations, as detailed in Appendix F:

6-1 Adopt **PACE Financing** and work with Lean & Green Michigan to implement the alternative financing solution.

6-2 Collaborate with the local utility to promote **On-bill Financing** to simplify and streamline the loan repayment process.

6-3 Aggregate demand to support a **Bulk Buy Program** helping expand access to more residents, ease the purchasing process, and lower costs for all.

6-4 Utilize **Power Purchase Agreements (PPAs)** in order to invest in renewable energy solutions without the need for high upfront costs or maintenance.

PROJECT IMPACT

- *Reduced Carbon Emissions*
- *Reduced Materials Consumption*
- *Waste Diverted or Avoided*
- *Cost Savings*
- *Health Benefits*
- *Social Justice Implications*

DESCRIPTION:
The impact of this project centers primarily around the impact of reduced carbon emissions and the social justice implications of the policies implemented. From power plants alone, the state of Michigan emits approximately 61 million tons of carbon dioxide per year.[25] While this report does not claim to be an all-encompassing guide to reducing this number to zero, the strategies enclosed will assist municipalities in reaching their own carbon neutral goals and working toward Governor Whitmer's executive order to reach carbon neutrality by the year 2050.

This achievement will result in benefits such as reduced fossil fuel consumption, but will also help to preserve the health of communities. Heat-related illness is the number one cause of weather-related deaths in the United States, more than any other natural disaster.[26] Additionally, minority communities, such as those that were historically redlined, bear a disproportionate burden of this suffering.[27] Based on predictive models of increasing heat with climate change, the amount of deaths due to heat-related illness is only expected to grow, so by curbing this effect through carbon neutrality, thousands of lives can be saved. Additionally, particulate matter from fossil fuel power plants results in respiratory and cardiovascular disease that is also disproportionately affecting minority and low socioeconomic status communities,, and by reducing the dependency on such power plants, the burden of these illnesses can be reduced.[28, 29]

These are examples of the impacts of this project on a broad scale. Within each of the individual sections of recommendations, there are innumerable benefits that can be reaped, including improving job growth, community empowerment, and city accessibility to name a few. When implemented, this project will make Michigan a more sustainable, healthier, and more equitable place for all.

APPENDIX A:
ENERGY EFFICIENCY

EQUITY + JUSTICE

Energy efficiency is a critical equity issue, as households around and below the federal poverty level spend a large percentage of their annual income on electricity - four times the average percentage spent compared to electric-heating households at all income levels. Not only does supply and demand of unsustainable energy affect resident energy bills, but also municipal economics and broader national and international relations.[30] A new study of Low-Income Energy Efficiency Opportunities shows that increased investments in comprehensive energy efficiency services for low-income families results in large-scale benefits, increased community resiliency, energy savings, and lowered bills.[31] Michigan communities must implement energy efficiency policies that will help all residents, and tailoring such programs to the needs of low-income community members will ensure equity across varying demographics.

As energy efficient improvements are made and associated bills are reduced, another environmental justice benefit emerges: healthier, more resilient communities. Energy efficiency and health outcomes are not independent of one another. Studies show that families with higher energy burdens have a greater risk of developing respiratory diseases, having increased stress, and facing economic hardship.[32] Incorporating energy efficiency programs that account for public health and safety issues can provide energy savings and improve the health of Michigan's most vulnerable and underserved populations.

NEW CONSTRUCTION

New construction offers the best opportunity to incorporate sustainable and equitable practices from the start, as it is most cost-effective to design with energy efficiency in mind from the beginning. New construction priorities lie in following a holistic, integrative design approach and in using existing sustainable building standards and certification programs as guidelines.

The following recommendations are categorized under New Construction: 1-1 Municipal Level Green Energy Code Adoption, 1-2 Implement Smart Incentives, 1-3 Thermal Enclosures, Passive + Active Systems, and 1-4 Implement Green and Cool Roofs.

1-1 MUNICIPAL LEVEL GREEN ENERGY CODE ADOPTION

Municipalities can set new building energy standards and codes that would allow for energy efficient structures to become the standard, not the exception, in Michigan. This will impact occupant health and lessen energy expenses for community members in an equitable way.

DESCRIPTION:
As buildings consume a large portion of Michigan's energy, an important step towards transitioning to a broader Net Zero Emissions strategy is to minimize building energy demand.[33] Municipal Level Green Energy Code Adoption sets standards for new buildings to meet energy efficiency targets to achieve citywide reduction of energy use and GHG emissions. Increased support for adopting green certification programs and "zero codes" at municipal levels is growing across North America.

Notable green certification programs include Leadership in Energy and Environmental Design (LEED), Passive House Institute U.S. (PHIUS), Living Building Challenge (LBC), and Green Globes. Where certification programs are often voluntary, zero codes can be incorporated into municipal requirements and have a greater influence on new building energy efficiency. Zero codes incorporate either Net Zero Energy or Net Zero Carbon Dioxide Emission targets. Where Net Zero Energy buildings may still rely on an energy mix that generates GHG emissions through offsetting with on-site renewables, Net Zero Emissions buildings account for embodied carbon metrics and carbon-free renewable energy sources.

While both types of zero codes are better than existing standards, Net Zero Emissions buildings minimize CO2 through both energy efficient building design (high performance building envelopes and systems) and a move to only carbon-free renewable energy sources.

CASE STUDY:
Philadelphia updated its energy code requirements through jumping ahead of state requirements and adopting the 2018 International Energy Conservation Code (IECC) (as well as ASHRAE 90.1-2016). The IECC is an energy code that outlines performance-based requirements for energy-efficient building envelope design and energy efficient mechanical, lighting and building systems.[34] This code takes a holistic approach through looking at cost savings, reduced energy usage, natural resource conservation, and overall environmental impact of energy usage. According to a Pennsylvania Department of Environmental Protection (PA DEP) analysis, adoption of modern building codes "provides the single most cost-effective and expeditious means of achieving reductions in energy-related GHG emissions in the building sector."[35] With updated energy code adoption, PA DEP estimates savings of 32.2 million metric CO2 tons over a 15-year period for the commonwealth and a positive net cost of $304 million by 2030 for the commercial sector. Philadelphia's commitment to adopting advanced codes at the municipal level generates whole building energy savings and ensures that buildings meet the highest standards of safety and quality.

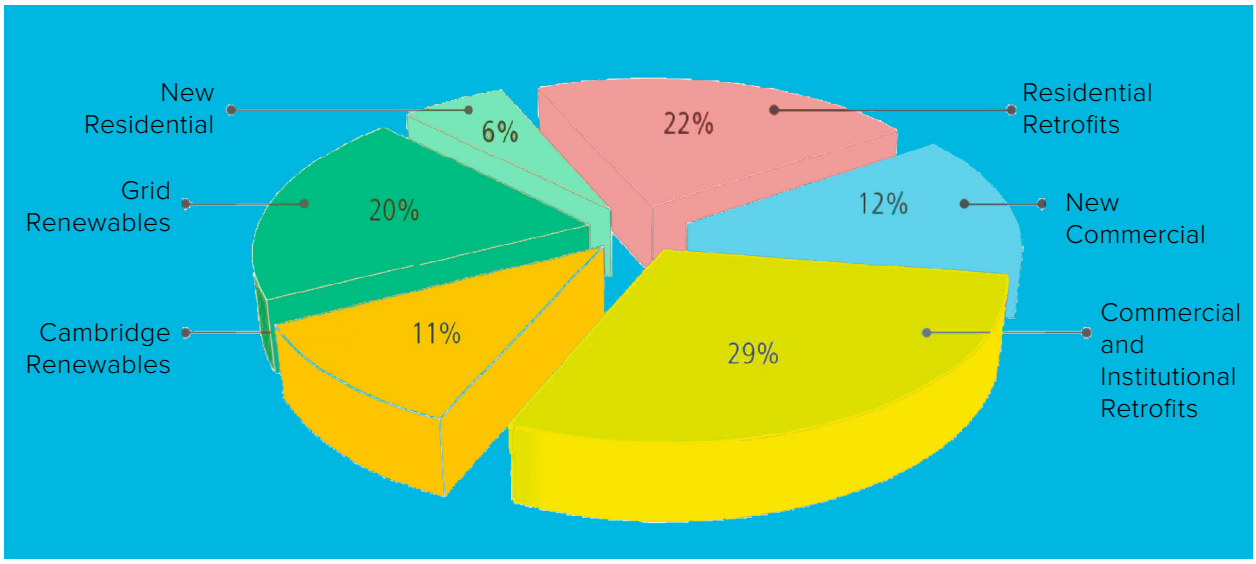
The AIA 2030 Zero Code is an appendix to the 2021 IECC that sets requirements for renewable energy sources, on-site where possible with off-site renewables also allowed. The code targets annual net zero carbon building performance using Energy Use Intensity (EUI) metrics. A prescriptive path is used to guarantee minimum

building envelope, HVAC, lighting, and equipment requirements are met as outlined in ASHRAE Standard 90.1-2016; a performance-based path is used to model energy efficiency and determine if requirements are met.[36]

The last case study turns to the Cambridge, Massachusetts 2015 Net Zero Cambridge plan.[37] As 80 percent of the city's GHG emissions result from building operations, the plan sets GHG emissions reduction targets around building operations and focuses on carbon-free energy production. Five actionable targets are outlined: energy efficiency in existing buildings, net zero new construction, renewable energy supply, local carbon fund, and engagement and capacity building. They project 70 percent overall emissions reductions by 2040 through addressing the building sector GHG emissions alone, working towards the goal of 80 percent community GHG emissions reduction by 2050.

Additional Zero Codes: Clean Energy DC 2018, The Minnesota Sustainable Building Guidelines, The Zero Carbon Building Standard (Canadian Green Building Council), City of Toronto Zero Emissions Buildings Framework

Additional U.S. Cities that have implemented municipal green building guidelines: Austin, TX; Portland, OR; New York City, NY; Seattle, WA; Fairfax County, VI; Boulder, CO; Chicago, IL; San Francisco, CA; San Jose, CA; Santa Monica, CA; San Mateo County, CA; and Los Angeles, CA.



KEY ACTIONS:

1. Retrofits to Existing Buildings
2. Net Zero New Construction
3. Energy Supply
4. Local Carbon Fund
5. Engagement and Capacity Building

FIGURE 1.1:
Cambridge Emissions Reduction Model

Base Image Source: IECC

1-2 IMPLEMENT SMART INCENTIVES

Local incentives can provide affordable energy efficient housing for residents, and make it feasible for initial investment by home builders and developers.

DESCRIPTION:
Local government green building incentives are one of the most effective strategies to encourage builders and developers to make initial energy efficiency investments. Through rewarding developers for incorporating green building techniques, increased attention is brought to innovation in the green building industry and how building residents and occupants benefit from healthier interior environments and lower energy bills long-term.

Such smart incentives fall into three categories: structural, financial, and other.[38] Structural incentives provide developers with rewards that are low cost to the municipality, including density bonuses and priority in building permit processing and plan review. Financial incentives range from offering tax credits, waiving municipal permitting fees, providing grant opportunities, to creating revolving loan funds for developments that achieve certain green building goals. While financial incentives may involve more upfront investment from the municipality than structural incentives, many of these programs often increase the city's assessed property value which makes the incentives possible without reduced revenues. Other incentives could be technical assistance, like training in green building certification or energy analysis programs, and marketing assistance, such as promoting websites, increasing signage, and offering awards. The incorporation of smart green building incentives provides one solution to the lack of proper financial support in incorporating energy efficient selections early on in the design process.

CASE STUDY:
Priority Green Expedited (Seattle, Washington, updated 2020)

The Seattle Department of Construction & Inspections developed the Priority Green Expedited program to reward green building efforts with an expedited new construction permit process.[39] To be eligible for the program, developers must build according to one of the following green building standards: Built Green 4-Star, 5-Star, or Emerald Star; LEED gold or platinum; Living Building Challenge, Petal, or Net Zero Energy; or Passive House (PHIUS). All of these standards set improved energy efficiency standards, with focus on water conservation, waste reduction, and interior air quality. According to J. Harris, green building program manager, 14% of the 781 submitted permits in 2019 went through the Priority Green Expedited program and saved applicants approximately three to four months in scheduling appointments, review of plans, and permit processing.[40]

1-3 THERMAL ENCLOSURES, PASSIVE AND ACTIVE SYSTEMS

Energy efficient building design that follows passive and active system best practices helps with creating healthier interiors and reducing resident energy bills for those who need it the most.

DESCRIPTION:
This recommendation sets forth general guidelines when approaching thermal enclosures, passive design, and active systems in new buildings. Incorporating energy efficiency considerations early into the design process allows for the effective use of energy simulation tools to analyze and prioritize opportunities. It is important to understand climate-specific design constraints in order to inform variables such as vapor control layers and targeted thermal resistance values. Climate-specific design optimizes on passive design measures and then turns to highly efficient active systems. There are three climate zones to design for across Michigan: Zone 5 in South Michigan, Zone 6 in Central Michigan, and Zone 7 in Michigan's Upper Peninsula.

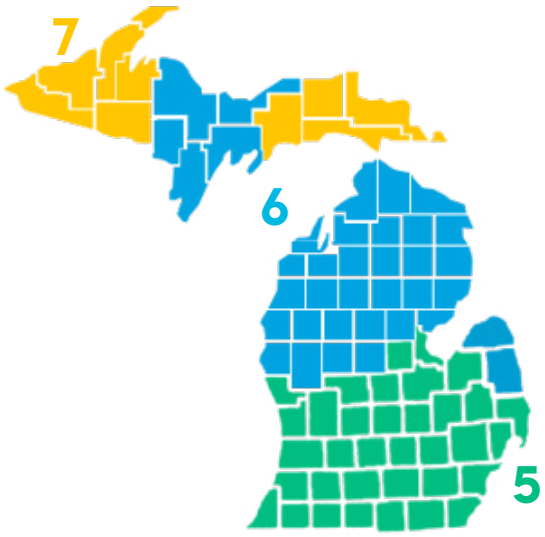


FIGURE 1.2:
Michigan Climate Zones

Base Image Source: IECC

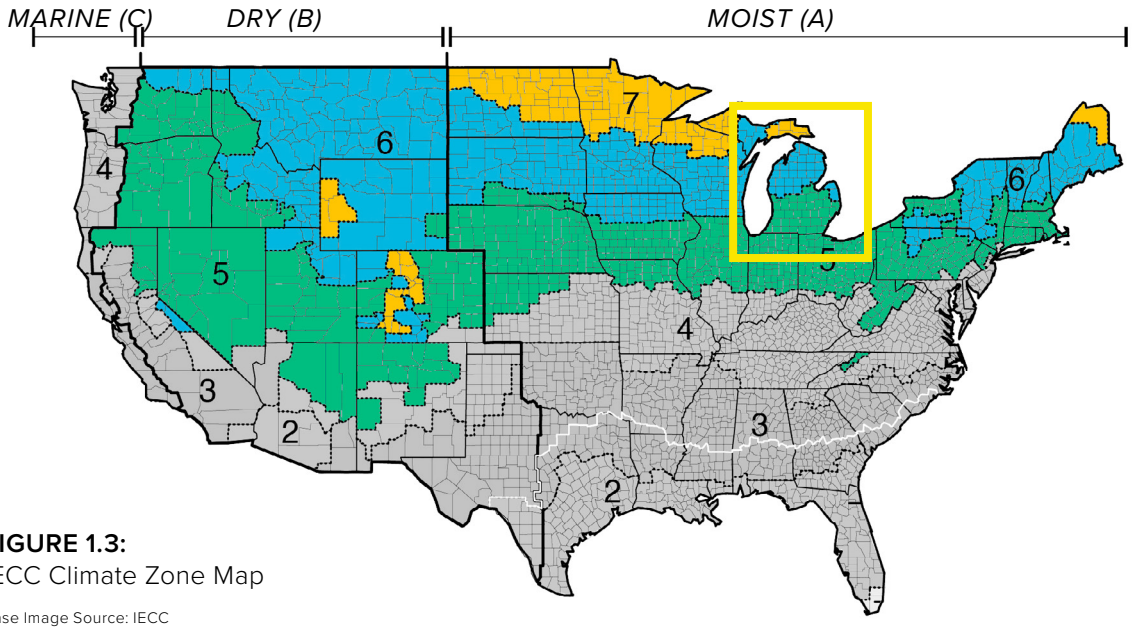


FIGURE 1.3:
IECC Climate Zone Map

Base Image Source: IECC

	Michigan Building Code	Low Energy Building (40 % below code)	Passive House Standard	Unit (IP)	Unit (SI)
Roof	R 38 (U-value 0.15)	R 50 (U-value 0.12)	R 60 (U-value 0.1)	(ft2*F)/BTU/h	W/m2/K
Wall	R 20 (U-value 0.28)	R 38 (U-value 0.15)	R 55 (U-value 0.12)	(ft2*F)/BTU/h	W/m2/K
Floor	R 30 (U-value 0.18)	R 30 (U-value 0.18)	R 55 (U-value 0.12)	(ft2*F)/BTU/h	W/m2/K
Fenestration	0.32 (2.8)	0.14 (1.1)	0.1 (0.7)	BTU/h/ft2/F	W/m2/K
Air Tightness	0,5	0,25	0.1*	1/h	1/h
Energy Goal	not given	40-60% below code	15 kWh/m2year	kBTU/ft2 year	kWh/m2year
Wall thickness					
Roof	11 inch (28 cm)	15 inch (35 cm)	20 inch (45 cm)	inch	cm
Wall	6 inch (18 cm)	11 inch (28 cm)	18 inch (42 cm)	inch	cm
Floor	8.5 inch (22 cm)	8.5 inch (22 cm)	18 inch (42 cm)	inch	cm
Fenestration	Double glazing	Double glazing (coating)	Triple glazing (coating)		

* Mechanical Ventilation with heat recovery needed

FIGURE 1.4:
Code Comparison

Base Image Source: Lars Junghans

BEST PRACTICES:

Optimize on Passive Design through the Building Envelope:

- Opaque building envelope: It is important to design the building envelope based on climate zone, which varies from Zone 5-7 in Michigan. Set R-value targets for thermal flow resistance of opaque building envelope. For Michigan's climate zones, one might expect R-30-55 walls and R60-90 roofs. (Reference R-value tips graphic)
- Improved insulation: select sustainable options with high R-value per inch, such as cellulose
- High performance glazing: Triple glazing (R-3 to R-6) to reduce heat transmission loss. Triple glazing has low-e coatings on at least two layers and a significantly greater performance value than double glazing.[41]
- Increased thermal mass: Internal thermal mass in the form of brick, concrete, or heavy timber construction can reduce heating and cooling energy demand up to 30% by passively retaining heat.
- Continuous air and vapor barriers: High airtightness created by a continuous air barrier reduces heat loss and unwanted infiltration. A continuous vapor barrier, properly located, ensures good vapor diffusion through the wall assembly to protect from mold and mildew.
- Sustainable building materials: Select materials that have low embodied CO2 for construction and transportation, and source materials locally whenever possible.

Select High-Performing Active Systems:

- High performance mechanical systems and appliances: Evaluate initial investments through Life Cycle Analysis approach.[42]
- Energy recovery ventilators (ERVs): These systems optimize on heat and humidity recovery where mechanical ventilation is required. Continuous mechanical ventilation of fresh filtered air is necessary for high interior air quality.
  - Exhaust can be connected from the kitchen stovetop to the heat recovery; however a special scrubbing filter is needed so that the duct system will not suffer
- Building automation systems (BAS): BAS can help a building to reach its best possible performance through the use of sensors, smart monitoring of energy use, and suggestions to increase efficiency. BAS can achieve 20 percent more efficient heating and cooling and 8 percent more efficient energy use for lighting and appliances.[43]
- Post-occupancy commissioning: This process evaluates if the building is performing up to expected standards through monitoring and verifying building data.

1-4 IMPLEMENT GREEN AND COOL ROOFS

While cool (white) roofs are often very affordable, green roofs pose an equity issue in terms of cost, as the new intensive technologies can be quite expensive. However, the green roof industry is improving technologies to the point where costs are starting to come down. In the big picture, it is less about who owns the green roof in an urban area and more about those in the surrounding community who benefit.[44] Commercial green roofs in low-income communities can benefit the public through improving the air quality and mitigating the urban heat island effect. Cool roofs decrease heating and cooling energy demand along with associated financial costs.

DESCRIPTION:
As a building's rooftop endures the elements and often absorbs high temperatures, the roof choice on a building can have quite the impact on building energy performance and on the broader urban network in which the building sits. Best practices include implementing green or cool roofs for new building designs. Green roofs use soil and vegetation to create living insulation, enhance urban area biodiversity, reduce building's heating and cooling demands, purify air and water runoff, reduce stormwater discharge, add to aesthetic appeal, and show a visual commitment to sustainability efforts.[45] Cool roofs, often white or a lighter color, reflect up to 80% of solar energy rather than absorbing it as a traditional dark roof would.[46] Because of their reflectivity, cool roofs reduce unwanted heat flux and decrease the heating and cooling energy demand. Both roof types mitigate the urban heat island effect that is often the result of excessive built and paved area in cities.

The 2019 Green Roof and Wall Policy in North America report contains regulations, incentives, best practices, and case studies related to green and cool roofs.[47]

CASE STUDY:
The first case study is a roof cladding material policy implemented in Saint Laurent, Quebec, Canada in 2016. The policy requires both new and existing flat and low-pitched roofs to be covered in vegetation or solar reflective materials, such as a light roof covered with white gravel or a light roof covered with a high solar reflecting material.[48] This policy was implemented in an effort to mitigate the urban heat island effect in Quebec.

Another example of improved roof policy is the 2017 Better Roofs Ordinance in San Francisco, California, which requires new buildings to have at least 15% of the roof space as solar panels or 30% of the roof space as a green roof.[49] The ordinance applies to non-residential buildings with a minimum gross floor area of 2000 square feet or residential buildings of any size with 10 or fewer occupied floors. The technical vegetation requirements include at least 4 inches of growing media and high species diversity with native plants. Low water use and low maintenance plants are desired.

The 2019 Green Infrastructure Partnership in Milwaukee, Wisconsin offers incentive funding per gallon of water runoff captured and cleaned as a strategy to encourage green infrastructure designs.[50] One of the primary eligible strategies for rainwater capture and filtration is implementation of a green roof.

RETROFITTING + RENOVATIONS

Retrofitting and renovations play a significant role in improving the existing building stock's energy efficiency. It is important to establish efficiency-focused retrofit targets for existing buildings, especially those with "good bones" which still have a long building life-cycle remaining to make the energy retrofits worthwhile. With improved funding, smart incentives, and community investment, retrofits can make cost-effective energy practices more accessible to all across Michigan.

The included policies and best practices suggest ways to incorporate the major renovation work that will be essential to bringing the state of Michigan closer to net zero energy emissions. The following recommendations are categorized under Retrofitting and Renovations: 1-5 Municipal Adoption of Energy Retrofit Programs, 1-6 Implement Regulatory Efforts, 1-7 Retrofitting Thermal Enclosures, Passive + Active Systems, and 1-8 COVID19 and Building Energy Performance.

1-5

MUNICIPAL ADOPTION OF ENERGY RETROFIT PROGRAMS

Through increasing energy efficiency improvements and availability for all, resident energy bills are reduced and occupant health is improved. This is just one aspect in working towards equitable solutions at a much broader scale.

DESCRIPTION:

Shifting focus from energy efficiency in new builds to improvements that can be made in the existing built environment, the municipal adoption of energy retrofit programs is incredibly valuable. Up to 80 percent of the energy consumed by existing buildings is wasted, either due to occupant error like leaving lights or electronics on when not using, or as a result of poor building envelope and systems.[51] There is a need for local governments to mandate the modification of existing inefficient buildings through energy retrofits and retrocommissioning in order to increase energy efficiency and meet the climate crisis.

Retrofitting typically involves making upgrades to the building envelope and equipment, and retrocommissioning provides a process for improving building equipment operations and maintenance.[52] Good building performance data makes it possible and effective to identify the necessary improvements tailored to an individual building's problem areas, with average retrocommissioning payback periods of only 8-9 months and energy savings of 15% for commercial buildings according to the EPA.[53] Programs and policies for retrofits can improve community self-reliance, save money, catalyze local economic investment, and reduce GHG emissions.

CASE STUDY:

Up to 65% of low-income, high-energy-use Philadelphia, Pennsylvania households have significant deterioration. The EnergyFIT Philly program leverages municipal and state funding to provide for energy efficient retrofits in affordable housing units with high physical deterioration.[54] EnergyFIT Philly serves the dual purpose of making energy efficient improvements (air sealing, insulation, mechanical system replacement, etc.) and providing necessary structural repairs (new roofs, plumbing, carpentry, etc.). This program provides an equitable approach for energy efficient retrofits in low-income communities that improve occupant health and energy outcomes.

In Orlando, Florida (population size: 282,000), the city has adopted a program that promotes energy efficiency in existing residential buildings.[55] The Energy Delivered program offers free energy audits for homes and $2000 for improvements repaid through the utility bill (zero-interest, on-bill financing - reference financing section). Households under $40,000 per year are subsidized 85%, and those under $60,000 per year are subsidized 50%.

Toledo, Ohio (population size: 280,000) created the BetterBuildings program to offer financing solutions for energy efficient retrofits to existing buildings that both conserve energy and generate savings. Improvements that are eligible for upgrades include the building envelope, insulation, mechanical equipment, lighting, refrigeration, and more.[56] BetterBuildings provides a path for owners of any building type to access low-cost financing to make necessary building improvements.

1-6

IMPLEMENT REGULATORY EFFORTS (BENCHMARKING, ENERGY AUDITS, DISCLOSURE)

Existing neighborhoods could benefit from one or all of potential regulatory efforts, including energy audits, energy disclosure, and benchmarking, which would directly affect houses needing affordable energy retrofits the most.

DESCRIPTION:

Standardized processes of measuring building energy efficiency and disclosing the results lead to market-based competition that drives energy efficiency investments.[57] Initial benchmarking of existing buildings provides a low-cost approach to identifying buildings that would be good candidates for energy audits. Energy audits comprehensively assess a building's energy consumption and evaluate specific improvements and measures that could be taken to increase energy efficiency. They empower a home or building owner with information and a pathway for acting on recommended retrofits. Energy disclosure requires home/building sellers to make their energy bills public available to potential buyers, which increases market awareness of energy efficiency and promotes the message that a building's energy use is an important factor that should be part of a purchasing decision. Local governments can promote free or discounted energy benchmarking and/or audits in their communities, and can require energy performance disclosure. Lastly, improvement programs should be considered that combine the efforts described above into a mandatory system with associated structural and financial incentives (reference financing section).

CASE STUDY:

The Existing Buildings Energy and Water Efficiency Program (2016) in Los Angeles, California mandates energy auditing and retrofit requirements for privately owned, large commercial and multifamily buildings of 20,000 square feet or more and city-owned buildings of 15,000 square feet or more. An energy audit report is required initially, and then every five-year period after.[58] This program requires the building owner to register, pay registration fees, and benchmark their building every year according to the ordinance schedule. Resources are available to assist with benchmarking, including the LA Better Buildings Challenge group which provides free assistance and a list of companies that can carry out the necessary benchmarking.

Portland, Oregon implemented a policy requiring all for-sale homes to have a Home Energy Score, a 1-10 rating system developed by the Department of Energy that evaluates energy use, associated costs, and potential energy solutions that would best improve the home's efficiency.[59] Potential buyers can factor energy efficiency measures into their home choice, and they also have motivation and information to take advantage of rebates and/or tax incentives to make suggested improvements.

The city of Berkeley, California's Residential Energy Conservation Ordinance (RECO) requires that all residences up for sale and valued over $50,000 comply with energy and water efficiency requirements as outlined in California's Title 24 Energy Codes.[60] Energy audits are required before or at the time of sale; any energy efficiency updates that are needed to meet the mandate's standards must be brought to compliance within a year at the homeowner's expense. Some costs may be offset through city incentives and rebates. Another Berkeley mandate, the Building Energy Saving Ordinance, also includes high-efficiency building exemptions and temporary "hardship deferrals" for low-income households.[61] The RECO document outlines that a similar prescriptive-approach program could be adopted in other cities, with special care taken to tailor energy measures to the city's climate zone according to heating and cooling degree days.

1-7

RETROFITTING THERMAL ENCLOSURES, PASSIVE + ACTIVE SYSTEMS

Energy efficient improvements that follow thermal enclosure and passive and active system best practices help with creating healthier interiors and reducing resident energy bills for those who need it the most.

DESCRIPTION:

As with Energy Efficiency Recommendation 1-3, this recommendation sets forth general guidelines when approaching building thermal enclosures, passive design, and active systems. It is important to note that there is no one-size-fits-all approach to retrofitting and renovations. A few general recommendations may be made, but energy audits and energy modeling are necessary to determine the most economically and ecologically feasible investments on a case by case basis. Evaluating an existing building with a quick energy modeling software like CasaSol can show which building improvements would create the best cost-effort balance, including both financial and carbon emissions costs. Renovation investments should focus on building envelope and systems improvements to significantly reduce CO2 emissions.

BEST PRACTICES:

Retrofit the Building Envelope...

The building envelope consists of all the building components that separate interior conditioned space from the exterior environment. This includes the foundation, wall assembly, roof, glazing, doors, and any other penetrations.[62] For an energy efficient building retrofit, the first step should be to make passive design building envelope improvements. This most often involves adding insulation, replacing inefficient glazing, and airtightening the envelope. Benefits of air tightening the building envelope include reduction or avoidance of undesirable allergens, dust, stale air leakage, drafts, water leaks, condensation, mold, exterior noise and odor penetration. A building enclosure consultant can perform initial analysis testing, model energy consumption, estimate savings and retrofit costs, and identify the most financially-feasible upgrades. Typically, an energy retrofit would target around 50% energy consumption reduction.[63]

Replace Inefficient Active Systems with Energy Efficient, Electricity-Based Active Systems...

After the building envelope has been addressed, the second step is to replace inefficient HVAC systems with energy efficient, electricity-based systems. Replacing HVAC systems will be financially-feasible and valuable to the overall performance of the building only if the building envelope is already airtight and has the appropriate thermal resistance for the climate zone. Facility managers and independent engineers can provide information on the HVAC systems within an existing building and anticipated upgrade costs, as well as payback periods.

1-8

COVID19 AND BUILDING ENERGY PERFORMANCE

Low-income communities often live and work in older buildings with poor interior air quality and disproportionately increased risk of COVID-19 transmission. Because of their lack of efficiency, many of these existing residences and commercial structures have higher energy bills. Through government-subsidized ventilation system improvement programs, community members can have a healthier interior environment and lower energy bills during a financially difficult time.[64]

DESCRIPTION:

In light of the COVID-19 pandemic, industry experts are reevaluating the current state of building interiors to develop new ventilation and filtration strategies. As most commercial buildings recirculate up to 90% of indoor air, contaminants persist within enclosed space.[65] Poorly ventilated rooms result in increased airborne transmission of disease particles. Buildings need a high interior air quality (IAQ) and improved ventilation to minimize disease transmission. IAQ is very important for all energy efficient buildings. As building owners look to upgrade operational and mechanical systems to protect against the spread of COVID-19, balance must be found between meeting immediate needs and funding long-term strategies for sustainable energy use.[66] While overbuilding a system is often not as efficient as supplementing an existing one, advanced air filtration systems and upgrades are growing in popularity as a response to COVID-19 concerns.

One efficient system example is demand-controlled ventilation. Demand-controlled ventilation incorporates carbon dioxide or other sensors into existing heating, ventilation and air-conditioning (HVAC) systems to allow for fluctuations in exterior air intake that correspond to building occupancy. As density increases, the intake of fresh outdoor air automatically increases and dilutes any airborne contaminants. As density decreases, the energy intensive process of bringing in outdoor air slows. Improvements to heating, ventilation and air-conditioning HVAC systems can provide a healthy interior environment and save energy long-term. Through addressing both energy efficiency and occupant health with such improvements in existing building stock, Michigan municipalities can lessen greenhouse gas emissions and slow the spread of COVID-19.

BEST PRACTICES:

Leadership in Energy and Environmental Design (LEED) is one of the most widely used green building rating systems. Recent LEED COVID credits have been launched in 2020, as well as the Arc Re-entry set of resources that helps with assessing and communicating recovery efforts.[67]

The LEED COVID points are as follows:

- Safety First: Cleaning and Disinfecting Your Space. This credit requires making a plan to implement green cleaning best practices for building occupant and worker safety.
- Safety First: Re-Enter Your Workspace. This tool helps facilities to make a plan for re-entry and measure progress post-occupancy. It notes building operations sustainability requirements that help slow the spread of COVID-19.
- Safety First: Building Water System Recommissioning. With buildings that have been left unoccupied for weeks or months, degraded water quality is a common and dangerous issue. This credit requires buildings to develop a water management plan and coordinate with local public health authorities to test water quality. Testing the

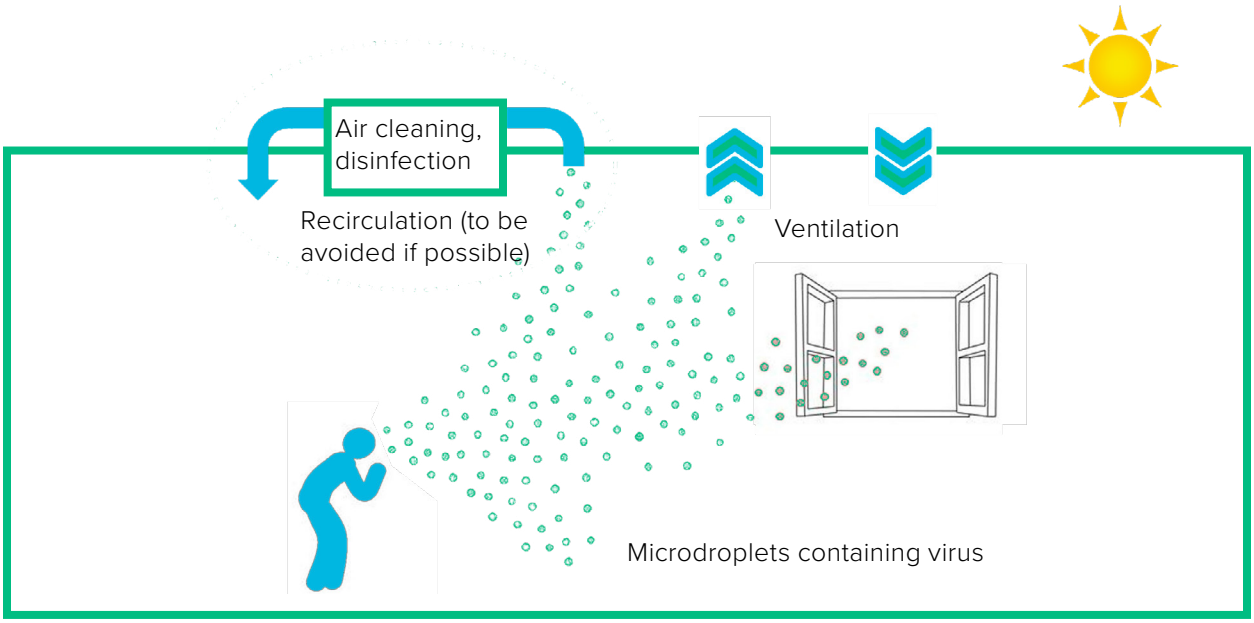


FIGURE 1.5:
COVID and IAQ

Base Image Source: health.ri.gov

water supply for the bacteria that causes Legionnaires' disease (a very serious respiratory infection) is critical in buildings that have not maintained their water systems since COVID-19 closures.[68]

- Safety First: Managing Indoor Air Quality During COVID-19. While LEED already outlines high IAQ requirements, this credit adds updated requirements that help minimize the spread of COVID-19.

The Arc Re-Entry pilot credit focuses on reducing infection risk through measuring and analyzing IAQ. The measurements are used to evaluate if there is adequate ventilation being provided in a space. Some key areas highlighted by Arc are: relative humidity between approximately 40% and 60% correlated with reduced disease transmission; high CO2 concentration levels correlated with inadequate ventilation, crowding, and reduced cognitive performance; presence of high particulate matter concentration may indicate inadequate ventilation or filtration.[69]

Additionally, a fall 2020 study indicates that increasing outdoor fresh air over indoor air relative to the recirculated component can significantly diminish coronavirus transmission.[70] The study suggests that increasing the fresh air component of interior air mixture to just 16% (with three air changes per hour) would mitigate COVID-19 outbreaks as effectively as vaccinating about half of the building's occupants. Although increasing fresh air intake corresponds to a decrease in coronavirus transmission, the associated energy costs are higher than traditional ventilation practices. Performing air-tightening retrofits puts a stop to unwanted air leakage and infiltration, making the fresh air ventilation energy cost acceptable and improving upon the building's energy efficiency.

APPENDIX B:
BUILDING ELECTRIFICATION

B

EQUITY + JUSTICE

There are numerous benefits of electrification, from increased workforce opportunities to a pathway to carbon- and pollution-free household energy usage to economic savings. Any community-level policy efforts to expand electrification must be intentional and conscious of the impact such policies may have on low-income communities with a history of experiencing environmental injustices. Without ensuring policy support is directed to these communities and households, efforts to expand electrification will naturally tend toward wealthier communities with the economic and political capital to integrate new technologies and solutions.

Low-income households, which spend a higher portion of their income on home energy and typically experience higher levels of in-home pollution due to less efficient and modern appliances, stand the most to gain from electrification - lowered household pollution levels, less contribution to climate change, and increased job opportunities.[71] *However, low-income households are also the most likely to be left behind in the transition to clean energy, lacking access to the capital needed to purchase clean energy sources and electric appliances. Additionally, low-income households skew towards renters rather than homeowners, and landlords lack the incentives to upgrade apartments, as they do not recoup their investment through the renter's energy bills, health, and comfort benefits. This is known as the "split incentive" challenge and overwhelmingly impacts low-income renters.*[72] *Policies must center these households to ensure they are able to realize the benefits of electrification.*

BUILDING CODE SUPPORT

Buildings codes are one of the most effective methods to support and accelerate the transition to clean, carbon free buildings. Building codes can be used to require effective energy efficiency standards, promote electrification, and ensure equitable access. Unfortunately, in the state of Michigan, building codes and construction codes are established under a single code determined at the state level. The Stille-Derossett-Hale Single State Construction Code Act establishes the State Construction Board as the regulatory body in charge of adopting codes related to building design and construction.[73] While Michigan communities are home rule municipalities, meaning they have legal authority to pass and adopt laws and ordinances governing their jurisdiction, such actions can be preempted by explicit state law. This is the case with regard to the adoption of construction and building codes.

While it is highly recommended that local communities engage with the state legislature and government to push reform, there is little direct action that local governments can take leveraging building codes. There is still opportunity for local governments to influence change through building code enforcement. The same law, the Stille-Derossett-Hale Single State Construction Code Act, authorizes the delegation of enforcement of these codes to municipalities and counties. If a local government is responsible for enforcing building codes, it can help push new developments and retrofits towards electrification.

2-1 BUILDING CODE ENFORCEMENT

Enforcement must be designed to ensure audits and compliance checks are not biased toward any group based on race, gender, social and economic situation, or other status, condition, or identity. Increasing compliance enforcement must also be guaranteed to not harm renters, by limiting the authority of landlords to raise rental prices or remove tenants due to code compliance.

DESCRIPTION:

Despite not having control over the actual codes adopted in the state of Michigan, many communities in the state have authority over the enforcement of building and construction codes. Though the regulations may not require carbon free buildings or electrification, adequately enforcing building codes can have a major impact on pollution and carbon emissions. Local governments can ensure compliance by funding and supporting improvements in the local enforcement of the state-level building and construction codes and by identifying common non-compliance issues and working with local developers, owners, and residents. Simply moving current construction in line with existing regulations often significantly improves outcomes by promoting more efficiency and improving the economics of electric appliances.

Local officials should engage their building department to enhance training and staffing, while additional third party auditors should be hired to perform energy code compliance inspections. Together all stakeholders should convene together to identify cost effective methods to improve compliance and encourage efficiency and electrification. Based on past case studies, each dollar invested in code compliance and enforcement yields on average $6 of energy savings, putting money directly in the pockets of residents and business owners.[74]

CASE STUDY:

The city of Austin, Texas, though able to adopt its own building codes, has also demonstrated the power of code compliance enforcement. Centered around a program of third party auditors, the city was able to dramatically increase energy efficiency in the community simply by enforcing the codes it had adopted.[75] The program in Austin was successful because of its focus on stakeholder inclusion to build support for the use of third-party enforcement. The broad support, combined with long-term financial planning, ensured the program was effective. For the city of approximately 800,000 residents, the operating budget of the enforcement administrators was $131,200. This was spread across 1,909 audits and compliance checks in 2010. The third-party based structure successfully increased compliance and kept administrative costs under control. Programs should be designed to build support from community stakeholders, while ensuring independent verification of compliance. Whether third-party auditors are used as in Austin, or city employees are hired directly, compliance is a high value opportunity to accelerate decarbonization in buildings.

2-2 FAIR AND REASONABLE BUILDING PERMIT PROCESS

Complex building permit processes are likely to disproportionately harm low income residents who may not have the time or capital to navigate the process. Removing barriers to permitting can ensure equal access to electrification opportunities without unequal barriers and unnecessary impediments.

DESCRIPTION:
Overly complex permitting processes can be excessively costly and challenging to navigate, forcing some to avoid the process altogether. Such an additional financial, time, or complexity barrier can slow the pace of electrification or deter households from transitioning all together. Improving the process, increasing education programs, and lowering the overall cost, particularly in low-income neighborhoods, can offset these challenges, helping to speed up the process.

When a household or building makes the decision to transition toward net zero carbon emissions and electrification, building permits should not be a barrier. Obtaining building permits should not cause delay or add excessive costs to electrification projects. Local governments in the state of Michigan typically have authority to set the standard for obtaining permits and designing the process.

CASE STUDY:
When creating a fair and reasonable building permitting process, municipalities should focus on three key aspects:

1. Simplifying the process to make it as clear and accessible as possible. Community members should not need to pay additional contractor fees simply to obtain permits. Additionally, the process should be made more efficient by rolling multiple permits together into a single application that can be reapplied to new permits. Thus, residents and businesses should not need to apply for separate permits for energy efficiency, electrification, and clean energy installation permits.

2. The permitting process should be low-cost, ensuring equitable access to the first step in adoption of electric appliances. In the state of Michigan, many communities assess a permitting fee on solar panels of $50 or more, which is unnecessary and can be a barrier to adoption. It is essential to ensure such costs related to all electrification appliances are removed or reduced.

3. Education and grant programs to cover the cost of permitting should be explored to support low-income communities during the transition for permitting fees that are deemed necessary and useful.

2-3 ELECTRIFICATION READINESS

Ensuring all apartments, households, and buildings are capable of transitioning to electric appliances lowers the barrier to adoption, encouraging residents of all backgrounds to make the transition. It is essential to ensure compliance with such a standard does not result in rent hikes and evictions by landlords looking to capitalize on improved energy efficiency capabilities.

DESCRIPTION:
Though local governments do not have the authority to pass building codes, local municipalities may have legal authority to enforce electric readiness policies. Additional legal consultations should be pursued to ensure such laws comply with state and local legal requirements.

The best time to convert a household or building to a net zero, electrified building is during initial construction or major renovations. A key reason is that electric appliances require additional electrical wiring and panel capacity. These are most efficiently upgraded and installed during construction and renovation. As municipalities cannot require building electrification through the construction code, a next best policy action would be to require buildings be "electrific ready." Electric ready policies require buildings (when constructed or undergoing major renovations) to ensure that all proper wiring, panel capacity, electrical requirements are installed and in place should the building owner make the decision to go electric. Electrification readiness requirements ensure building's have the capacity and capability to integrate electric appliances when old appliances need to be replaced.

Such a policy is highly cost effective as it reduces the cost of installing and assessing the need for the electrical requirements for electrification. This breaks down a major barrier to the adoption of electric appliances along with electric vehicles which have similar requirements for installing electric vehicle charging equipment. The knowledge that a building can quickly, cost-effectively, and without major intrusion, switch to electric appliances is a powerful incentive for making the transition.

CASE STUDY:
Electrification readiness policies are growing rapidly in popularity in communities taking direct action on climate change. For example, San Anselmo in Northern California requires all "mixed-fuel" households (meaning a household with a gas and electric connection) to include the pre-wiring for an all electric appliance kitchen, including an electric induction stove.[76] Such a requirement serves two purposes in the community: (1) it ensures all households are immediately ready and capable of transitioning to an all-electric kitchen; and (2) it incentivizes developers and homeowners to build a single fuel (electric only) household as they must already make the upfront wiring and panel capacity investments.

ASSET AVAILABILITY + EDUCATION

In many locations and communities, electrifying buildings and residences requires the creation and expansion of a new industry with new technologies, products, services, and skill sets. From the supply side, this includes the expansion of the workforce with the right experience and expertise and local business with the right offerings. Well placed government action at the local level can support small businesses, the local workforce, and the elimination of pollution and carbon emissions.

On the demand side, residents need more opportunities to learn about the opportunities and options available for electrification. Many developers, homeowners, and property managers have been replacing and installing conventional appliances for decades and may not be exposed to the latest technologies and solutions. Increasing awareness and education on the demand side and availability and access on the supply side will drive up demand and accelerate the speed of adoption in local communities.

2-4 CREATE ELECTRIFICATION RESOURCE CENTER

The Resource Center should be open to the public and accessible to all residents whether they are capable of engaging online, in-person or over the phone. Such a resource center can help all local residents and businesses navigate the complex process of transitioning to electric appliances leveraging existing funding, expanding code compliance, and accelerating the pace of adoption.

DESCRIPTION:

Electrification for commercial and residential residents can be a daunting task; many have been replacing equipment such as furnaces and space heaters in the same manner their entire life and are familiar with the process, or have never replaced an appliance and lack knowledge of the options. Making the transition to electric appliances can require electrical upgrades, new contractors, new permits, and more. Additionally, federal, state, and local policies and incentives (including those described in this report) can be complicated to track and apply to. Creating a one-stop resource center with all available information to ease the transition from information on incentives to a directory of professionals to materials about the appliances will support the transition and adoption of electric appliances. Local governments should work to establish a digital, one-stop shop Electrification Research Center to support local residents and businesses in the transition to electric appliances along with a staff of experts available to provide guidance and assistance. Such a center should focus on electrification along with other decarbonization initiatives such as energy efficiency, renewable energy (rooftop solar), and more.

The Resource center should include:

1. A database of federal, state, and local incentives for electrification along with information on how to apply and take advantage of the rebates. Such incentives often appear to be a black hole with complex qualification requirements, information in dispersant locations, and no central authority. Ensuring low-income households are matched with available incentives can make existing policies far more efficient and targeted to households that need them most.
2. A local directory of accredited and prequalified professionals capable of providing electrification services including contractors and vendors. The directory should focus on including a diverse workforce of local contractors and professionals.
3. Materials on the permitting process, installation process, and economic valuation of the products. Governments should work with contractors and local community colleges to estimate costs in the specific locality based on electricity prices, average weather, and gas prices to allow for comparison over gas and electric appliances. In combination with education efforts, the Electrification Resource Center should include detailed information on what steps a household should take to make the transition that highlights the benefits of electric appliances over traditional sources including estimates of the economic opportunity.

CASE STUDY:

In Chicago, an Energy Resource Center has been established by a non-profit organization, Elevate Energy. The center focuses on multifamily buildings, but serves as a model for similar efforts nation-wide. The center helps building owners, homeowners, and renters improve energy transition efforts by connecting them with a free utility-funded audit and information on available funding opportunities. Communities can follow the Chicago model and leverage local non-profit organizations to operate the Resource Center, or build it directly within the local government.

2-5 DEVELOP TRAINING PROGRAMS

Training programs should reflect the needs of the local community, ensuring that diversity and equity are centered in the program when considering access and recruitment. It is important to keep the barrier to entry - application requirements and cost - limited to ensure all community members are eligible for the program. Additionally, recruitment efforts should focus on reaching a wide and diverse population, particularly among the unemployed and underemployed. The green economy offers an opportunity to match the people that need work the most with the work the most needs to be done.

DESCRIPTION:

Electrifying commercial and residential appliances requires boots on the ground to conduct energy audits, to install equipment, to conduct sales activities, to provide maintenance and more. Given the lack of familiarity with these products in the conventional industry, few have experience with these activities as they relate to electric appliances. Creating workforce development opportunities has a two-fold impact. First, it increases the availability of electric appliances and the workforce needed to install programs. Working in parallel with other recommended efforts (cite specific policy numbers), a growing workforce helps spread education and opportunity for communities to transition. Second, it creates new jobs and modernizes existing jobs, increasing the local workforce's resilience. Transitioning every household, business, office building and other commercial building will require a large-scale, labor-intensive effort that must be done building by building. This has the potential to create significant economic opportunity in communities across the state.

One of the most effective local policies can be to establish a low to no cost local workforce development program to train professionals in electrification related services - construction, electricians, plumbers, etc. Specifically, training programs should be tailored to focus on the sale, installation, and maintenance of electric appliances for residential and commercial buildings.

In collaboration with local community colleges, vendors, and nonprofits, local governments can develop educational courses and apprenticeship programs. The training program should not be limited to appliance electrification and should work in tandem with efforts to expand the local workforce related to energy efficiency upgrades, solar installations, and more.

CASE STUDY:

The Workforce Development program within the Green Door Initiative (GDI) in Detroit is an excellent model for a jobs training program focused on putting local residents to work fighting climate change.[77] GDI is a non-profit organization that educates and engages Detroit residents on the topic of environmental impacts and climate change, including a Workforce Development program that trains participants in sustainability jobs. The program provides opportunities for underemployed and unemployed individuals, opening opportunities in new careers, while expanding the labor pool for local businesses to draw from.

The development program structure contains a number of different trainings based on federal and state-level certifications ranging from 4-16 weeks across topics from energy audits and retrofitting to green landscaping and more. A particular focus on building electrification can prepare Michigan to lead the nation in the transition to cleaner air, cleaner communities, and cleaner homes, by helping its residents find careers in sustainability.

2-6 WORKSHOPS AND SHOWCASES

Public workshops and showcases offer an opportunity for community members to come together, share their experiences and challenges, and to learn about the potential benefits of electrification appliances and solutions. Such showcases should focus not only on the technology and process for implementation, but also on incentive and financing programs available to local residents and businesses.

DESCRIPTION:

Electric appliances for space heating and hot water are often not even considered when appliances are being replaced. Many building managers and homeowners are simply not aware of the option. Additionally, those that are aware of these options, may not have information on the latest on the rapidly improving and evolving technology. Creating workshops and showcases to distribute educational materials, encourage commitments to electrification, and connect residents with contractors can break down knowledge barriers and spread proper information. These workshops, showcases, and outreach programs should work in conjunction with the Electrification Resource Center to provide in-depth information.

Local governments can support or directly conduct showcases and workshops, including the development of educational materials for community residents regarding the benefits of building electrification and the process for adoption. Governments and nonprofit organizations can work to build local interest and understanding and promote federal and state incentive programs through such programs. These workshops should encompass all stakeholders in the building development, ownership, and usage lifecycle.

Beyond simply providing educational materials, these programs are an opportunity to demonstrate electric appliances in person and to engage directly with residents. They can serve as the perfect platform for promoting pledges to switch to electric appliances when gas-powered appliances need replacement. Collected signatures and contact information can be used to follow up with individuals and maintain momentum. Additionally individuals can be matched with an “Ambassador” who has been through the process previously and can provide advice. Ambassadors would be everyday citizens eager to support their neighbors in the journey for clean energy and pollution free households. Showcases and workshops are highly effective given the personal and direct interactive nature of them.

CASE STUDY:

The city of San Jose held a workshop and showcase focused specifically on promoting information on heat pump water heaters. The City collaborated with two local non-profit organizations - Passive House California and Silicon Valley Energy Watch - to put on a workshop for architects, designers, developers, contractors, engineers, and homeowners.[78] The workshop was a cornerstone initiative within a broader effort to develop resources and information showcasing the potential for electric appliances.

2-7 MUNICIPAL ACTION (DEMONSTRATION PROJECTS)

Direct action by the municipal government is an opportunity to put the local workforce to work upgrading and retrofitting buildings. A diverse and inclusive workforce should be at the center of the municipality's efforts.

DESCRIPTION:
Local municipalities can rapidly accelerate electrification in their community by taking direct action first. Municipalities should adopt and integrate electric appliances across all municipally-owned buildings. The local government should begin by setting a target goal related to all-electric public buildings, potentially as a concrete component of broader climate targets. Additionally, the government should pass a local ordinance mandating the electrification of all municipal buildings, using their efforts to highlight the potential benefits of electrified buildings. Municipal facilities should be assessed to identify buildings already in need of appliance retrofits to help mitigate upfront costs, and accelerate implementation. It is important for municipal action to build workforce capabilities related to installing and maintaining new electric appliances by supporting local small businesses.

Taking direct municipal action is most important to serve as a demonstration project, highlighting the capability of these new technologies and the economic viability of them. These installations should be advertised locally to highlight the actions of the city, and demonstrate the potential of electric appliances including space heaters, water heaters, cook stoves and dryers.

CASE STUDY:
Among the wave of cities committing to carbon free or fully-electric municipal buildings is the City of Pittsburgh. In late 2019, the mayor signed into law an ordinance mandating net-zero carbon emissions government buildings. Under the ordinance, all new buildings and major renovations will be highly efficient and electrified.[79] Eighty percent of carbon emissions in the city are produced by buildings. Success decarbonizing municipal buildings will have a direct impact decreasing carbon emissions, while demonstrating the pollution reduction potential of electrification.

The effort is seen by the city as an opportunity to promote and show support for sustainable development in service of its broader city-wide climate goals (50% carbon emissions reduction by 2030). Importantly the transition is expected to be economically efficient, lower energy costs for the government and savings tax payer money. The economic benefits of the retrofits will further demonstrate the monetary benefits in addition to the environmental gains.

2-8

COLLABORATE WITH UTILITY COMPANIES + TECHNOLOGY VENDORS

Equity concerns exist for any potential incentive or rebate program. Guardrails should be included in any such programs to ensure a fair and equitable share of the program's support goes to low income communities and environmental justice communities. This must be of particular focus when collaborating with external parties, as local governments may not have direct control over the program. Additionally, the application and qualification process for all incentives and rebates should operate under an opt-out model in which all eligible residents are automatically enrolled or enrolled through a single application.

DESCRIPTION:

Electric utilities, electric appliance vendors, and municipalities have a shared interest in the promotion and adoption of electric appliances. Whether motivated by economic profit or action on climate change, collaboration with electric utilities and technology vendors presents a unique opportunity for local governments to support the implementation of financial incentives for electrification. Municipalities should engage and work with these parties to identify common goals and objectives by encouraging these businesses to implement rebates, incentives, and special promotions and programs tailored to heat pumps, electric water heaters, electric dryers, and other appliances. Additionally, electric utilities, whether municipally-owned, cooperatives, or investor owned, are uniquely positioned to offer incentives through electricity rates for electrification. For example, time of use rates, which incentivize customers to use electricity at specific times of the day for lower rates, and incentives to reduce demand charges for commercial customers can promote the switch to electric appliances.[80]

Unilateral action to promote electrification by local governments can be financially and operationally challenging. Collaborating with industries that stand to profit from increased electricity usage and appliance adoption can expand financial support for residents and businesses through incentives and promotions without spending taxpayer money.

CASE STUDY:

Holland Board of Public Works (BPW), the municipal electric utility in Holland, Michigan has been a key partner for the local community in promoting sustainability and reducing carbon emissions. The Energy Smart Program is a rebate program designed to encourage the adoption of more efficient, electric appliances in residential and commercial buildings within the utilities service territory. Rebates are available for appliances ranging from heat pumps to electric water heaters to electric clothes dryers.

Similar programs can be implemented in communities with municipally-owner or cooperative electric utilities. Local governments are likely to have less influence over Consumers Energy or DTE Energy; however, collaboration and engagement can still help instigate rebate and incentive programs. Again, any such rebate or incentive programs should include provisions to ensure funding reaches environmental justice and low-income communities and that residents are auto-enrolled in the program or eligible through a single, streamlined application process for all available rebates/incentives.

APPENDIX C:
ENERGY SOURCING

C

EQUITY + JUSTICE

In the state of Michigan, the pursuit of renewable energy generation by different cities and municipalities is not equal. While some more progressive cities, such as Traverse City, Lansing, Ann Arbor, and Northport, have made commitments to reach 100% clean energy, many other municipalities are not as far along in their clean energy journey. This is due to a number of different factors, including greater affluence and political clout as well as a greater likelihood that municipalities who can make these commitments have some control of their utility. A push for energy democratization, or allowing cities to make their own choices about where their energy is sourced from, would help to even the playing field.

Not only do different cities have wildly varying resources and control available over their own energy sources, but pursuing local renewable generation can be out of reach for large swaths of the population. Distributed generation assets, such as rooftop solar, often have very high upfront costs. This prevents low- and middle-income populations from being able to take advantage of long-term cost savings. It is imperative to introduce other mechanisms, such as solar+storage and community solar, to help enable more equitable access to distributed generation.

EDUCATION + LEARNING

One of the greatest barriers to clean energy sourcing at the municipal level is a lack of awareness about what options are available. While some Michigan cities are very advanced in their journey towards sustainability, others are not as developed. For this reason, utilizing models to help foster learning between municipalities in the state can prove to be a very effective tool. Additionally, encouraging the creation of a city-county task force based on models from other municipalities in the Midwest will help to ensure that equity considerations are included in the overall calculus.

3-1 INCORPORATION OF "SUSTAINABILITY SISTER CITIES" AS PART OF EXISTING PEER-TO-PEER LEARNING MODELS

A Michigan Sustainability Sister Initiative will ensure that municipalities with a greater number of resources and sustainability infrastructure already in place share and exchange those resources and expertise with those in environmental justice areas. This will result in powerful synergies for both communities.

DESCRIPTION:

There are two prominent shared learning models in the Michigan sustainability space. The first, Michigan Green Communities (MGC), was established in 2009 by the Michigan Municipal League Foundation (MMLF), and is a network of state and local government officials aiming to develop innovative solutions to sustainability challenges.[81] Even more recently, as part of her 2020 Executive Order committing the state of Michigan to carbon neutrality by 2050, Governor Whitmer established "Catalyst Communities."[82] Similar to MGC, the Catalyst Communities initiative is designed to drive resource-sharing across Michigan municipalities, and will include informational webinars and additional programming after January 2021.[83] Catalyst Communities is also a part of the MMLF, and is open to any interested municipalities.

MGC has been a powerful vehicle for sharing best practices across cities, but progress has been extremely variable from one city to the next. For example, while Ann Arbor, Grand Rapids, and Traverse City are often lauded for their sustainability efforts, other less affluent cities lag behind.[84] Pairing Michigan municipalities together by implementing a voluntary "Sustainability Sister Cities" initiative would have numerous benefits including: (1) Added accountability for both cities, (2) The ability to observe and impact how policies and programs play out in different areas of the state and with disparate populations and demographics, (3) Allowing local officials to connect and learn from each other, and (4) Aiding both cities in reaching mutual sustainability goals through pooled resources. In order to make this program successful, additional state subsidies should be sourced for local governments, predicated on program participation.

CASE STUDY:

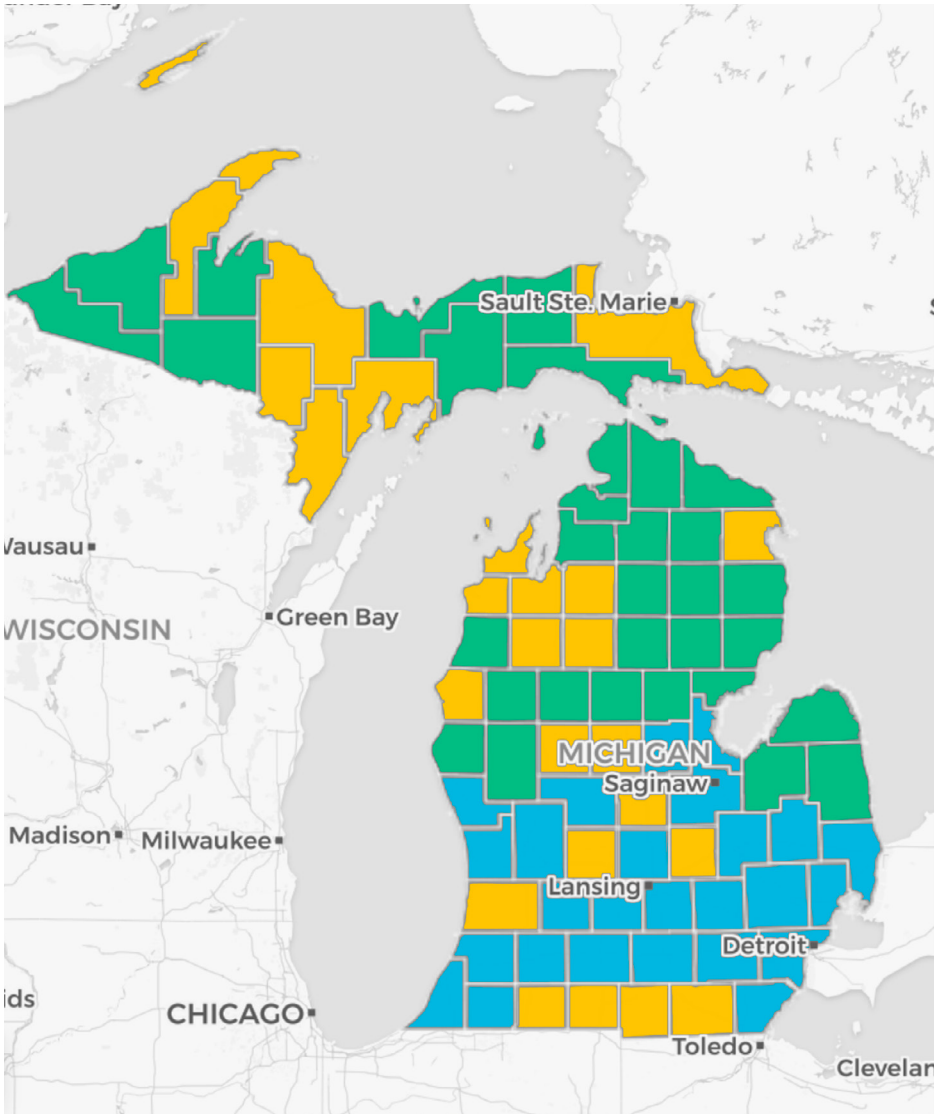
Application of PAIRS Model to Archetypal Cities in Southern California: A model developed in 2014 by researchers at the University of California Irvine known as the Partnership Assessment for Intra-Regional Sustainability or "PAIRS," provides some valuable insights and best practices for establishing sister cities with the specific goal of improved sustainability.[85] PAIRS is designed to accomplish two goals: (1) Identify sustainability strengths and potential for improvement within different municipalities and (2) Determine local receptiveness. A qualitative and quantitative approach is used to accomplish this. First, cities are ranked on a scale of 1 to 3 across five different "sectors of sustainability," encompassing water management, energy systems, food and agriculture, waste, and demographics. Then, based on survey responses, a score is granted to each city that reflects public approval or "general amicability" of both officials and the general public. Finally, these scores are added together, and a pairwise analysis is conducted to measure compatibility. The model was tested on ten archetypal cities in Southern California, and resulted in some extremely telling findings.

Historically, municipal sustainability strategies have paired like cities together, under the assumption that they would both benefit from similar resources and learnings. In direct contrast to this historic practice, however, this study found that pairings that matched two cities with a significant difference in population, growth, size, and existing level of sustainability showed the most substantial improvements. The greatest mutual benefit occurred when urban and rural cities were paired together, largely through the use of each other's waste streams. In essence, "it is the differences between neighboring cities

which make for the greatest partnerships."[86]

The PAIRS model is a powerful tool, but it does have its drawbacks. It is a data-driven model, and cannot be conducted without mass amounts of data collection and surveying. Although applying the model to Michigan municipalities would render informative results, simply incorporating the above takeaways when designing a Sustainability Sister Cities Program is likely to produce vast improvements.

Michigan has 25 counties considered urban/suburban, 26 counties with ties to smaller, "micropolitan" areas, and 32 rural counties (See Figure 3.1, below). The results of the University of California at Irvine study suggest that cities in the mostly rural and "micropolitan" Northern half of the state should be paired with the more urban counties in Southern Michigan for a Sister Cities initiative.



DESIGNATION:
- Metropolitan Area
- Micropolitan Area
- Rural County

FIGURE 3.1:
County categorization

Source: mlive.com

3-2 CREATION OF A CITY-COUNTY TASK FORCE ON EQUITY

Although there has been an increased focus on and awareness of environmental justice in recent years, it is now more necessary than ever to have specific municipal-level initiatives to ensure that equity is included in every local sustainability-related decision. Reaching carbon neutrality is important, but doing it in a way that is not inclusive and that unfairly burdens certain demographics is unacceptable. What inclusivity and equity looks like will vary by community, so it is necessary to have a designated task force focused on this and the needs of each specific municipality. Tailoring these initiatives to each specific community can be accomplished through local surveying and by conducting inclusive town hall meetings. There has also been substantial research focused on how to make this process more equitable and effective, and learnings can be taken from successful existing municipal initiatives.

DESCRIPTION:

Many sustainability plans in the past, but also still today, have not prioritized equity when making action items and policy suggestions that will impact diverse populations. As a part of aligning with the FAST framework, municipal governments should be encouraged to create city-county task forces focused on equity. These task forces should be included from the beginning of any sustainability benchmarking, and should be consulted prior to initiating any sustainability changes or finalizing new goals. This will ensure that any changes enacted are inclusive and that equity is positioned front and center within municipal sustainability plans across Michigan.

CASE STUDY:

There are many examples of municipalities who have launched task forces and initiatives focused on promoting both economic and environmental sustainability. The equity initiatives of these cities can serve as a framework for Michigan municipalities interested in joining EcoWorks FAST. For example, in July of 2019, Milwaukee launched a joint task force on climate and economic activity.[87] This task force was based on the "Just Energy Policies and Practices Action Toolkit," developed by the NAACP.[88] This toolkit includes eight individual modules focused on how to divest from fossil fuels and promote renewable energy deployment. The modules include a focus on engaging with various stakeholders such as policymakers, utility companies, and regulatory bodies, and also outlines how to start an energy cooperative and improve energy efficiency and weatherization efforts, all through the lens of energy justice. This is a recommended framework that should be considered and tailored to fit an individual community's unique needs.

Another example of a Midwestern city that has successfully incorporated equity into its sustainability plan is the city of Cleveland, Ohio. Cleveland has developed a Racial Equity Tool that provides guidance in two main areas: First, by analyzing climate action objectives and second by directly aiding in their implementation. The toolkit accomplishes this through five main question areas: (1) Language, (2) Accountability and Data, (3) Disproportionate Impacts, (4) Economic Opportunities, and (5) Neighborhood Engagement.[89]

By using the tools, best practices, case studies, and frameworks described above, Michigan municipalities will have clear guidance towards the implementation of a Municipal Taskforce on Equity while still maintaining the ability to tailor to their unique communities.

LOCAL LEVEL: SOLAR

Michigan is ranked eighth in the country for technical potential for rooftop solar, but its weak net metering laws and prohibitive community solar regulations have prevented it from advancing its solar potential as quickly as it is capable of.[90] *Additionally, despite the fact that solar generation is typically easier to site and more versatile than wind in urban areas, roughly 50% of U.S. homes cannot install rooftop solar either due to technical reasons, financial hurdles, or lack of sun exposure.*[91] *For this reason, community solar has a large role to play in Michigan's adoption of more solar assets. Currently the legality of community solar in Michigan remains challenging, but it is important to start laying the groundwork for community solar projects now in anticipation of policy changes in the future, as these projects can take years to develop. While the most impactful change would be the passage of a statewide community solar program, until then there are actions that municipalities can take in order to increase solar deployment across the state of Michigan.*

3-3

MAKE SOLAR PV ROOFTOP INSTALLATIONS LESS COSTLY THROUGH SOLAR + STORAGE

The incorporation of solar PV + storage is seen as a huge opportunity to both lower electricity costs and to make the grid more resilient for low-income communities. By taking advantage of the cost savings associated with solar+storage, Michigan municipalities can achieve greater grid resiliency for vulnerable populations while simultaneously providing savings on their monthly utility bills. The addition of storage makes the grid more reliable by providing demand peak reduction as well as backup generation in case of severe weather. This reduces the risk that people in low-income housing areas and the elderly will be stranded without power for days.[92]

DESCRIPTION:

Rooftop solar arrays are seen as a way to lower monthly electricity bills while reducing emissions, but the upfront cost of equipment and long payback period has remained a challenging barrier to construction and implementation. One way to shorten the payback period and make solar PV more affordable is through the addition of battery storage, known colloquially as "Solar+." In order to achieve net neutrality goals, Michigan municipalities should incorporate battery storage as part of all new solar array installations on public and affordable housing facilities. There are a number factors making solar plus storage an economically viable option, including the continuing decrease in the cost of battery storage due to advances in battery technology, advances in grid monitoring and load management technologies, and lowered incentives to sell back to the grid, which is incentivizing self-use.[93]

Battery costs have dropped tremendously over the past decade, and are now less than 20 percent what they were in 2010.[94] As a result, solar plus storage is now seen as a way to provide resilient power to vulnerable populations as well as essential services.[95] Solar+ can be particularly profitable for larger households as well as commercial and industrial buildings that have either Time of Use charges or high demand charges.[96, 97] This is especially true if batteries can be remote-controlled to adapt to usage needs.[98] Battery storage can also provide cost-savings for households because the storage capability allows individuals to use the excess energy generated by their solar panels instead of selling that power back to the grid. In many states, including Michigan, the remuneration price paid for excess electricity generated by solar PV is below the end-consumer price.[99, 100] Solar plus storage arrays allow individual customers to achieve partial grid defection and circumvent restrictive net metering policies by using the power generated on-site instead of selling it back to the grid at a price often below market value.[101]

CASE STUDY:

Solar+storage arrays have been steadily increasing in popularity in the past few years. In California, for example, the ISO interconnection queue had only 5,965 MW of solar+storage projects under consideration in 2018, but as of September 2019 they showed 23,377 MW solar+storage projects under review.[102] At the end of 2019, there were roughly 40 such systems in use across the U.S., primarily in California, Hawaii, Florida, and the Northeast.[103] Additionally, just last year the L.A. Department of Water and Power approved a Power Purchase Agreement for "the largest solar and battery energy storage system in the United States" and in June of 2020 Berskhire Hathaway announced that it will add 590 MW of battery storage paired with 1,190 MW of solar capacity in Nevada.[104]

Solar+storage is being seen as an increasingly viable option in other large metropolitan centers as well. Just last year in New York, solar developers OYA Solar and Crauderueff & Associates formed a joint venture to install solar+storage on 2,500

low-income and affordable housing units across the city.[105] The project is projected to save subscribers up to 10% on their utility costs, and is attractive due to the fact that two-thirds of New York City rooftops have been deemed suitable for solar installation.[106] Solar+storage will help maximize New York City's solar potential, while reducing the cost of electricity for low- and middle-income residents.

The popularity of Solar+Storage in recent years is because it has emerged as a more economically attractive option than solar PV without storage. A 2020 study published by the Rocky Mountain Institute compared the simple payback periods of solar PV on its own to the simple payback period for solar PV + storage projects. The study found that, across diverse U.S. locations including the Carolinas, Ohio, and Arizona, the expected simple payback period of the solar+storage arrays is less than eight years and was shorter than solar PV without storage at every location included in the study.[107] See Figure 3.2 for a visual representation of these findings.

Michigan has a weak net metering policy.[108] The incorporation of solar+storage would allow Michiganders to use all of the energy generated by their panels rather than sell them back to the grid at a below-market rate and navigate a complex and restrictive net metering landscape. Additionally, the percentage of household income paid towards utilities and rent is correlated to poverty; essentially, the less you make the greater the percentage you pay towards housing costs. In Michigan, of those considered "extremely low-income," 69% are considered "cost burdened," meaning that they pay more than 30% of their income on housing costs, and 85% are considered "severely cost burdened," meaning that they spend over 50% of their income on housing costs. A comparison of housing cost burden by income group in Michigan can be seen in Figure 3.3. Solar+storage is one way to help tackle this disparity for low income Michiganders by lowering monthly utility bills.

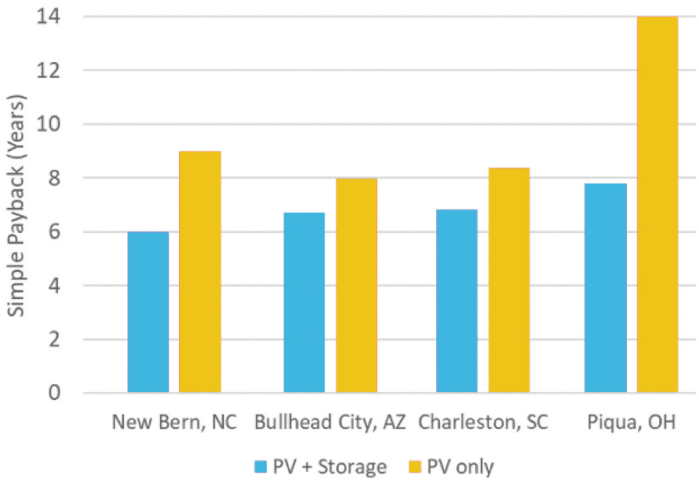


FIGURE 3.2:
Solar-plus-storage systems can be more cost-effective than standalone solar PV systems

Source: RMI.org

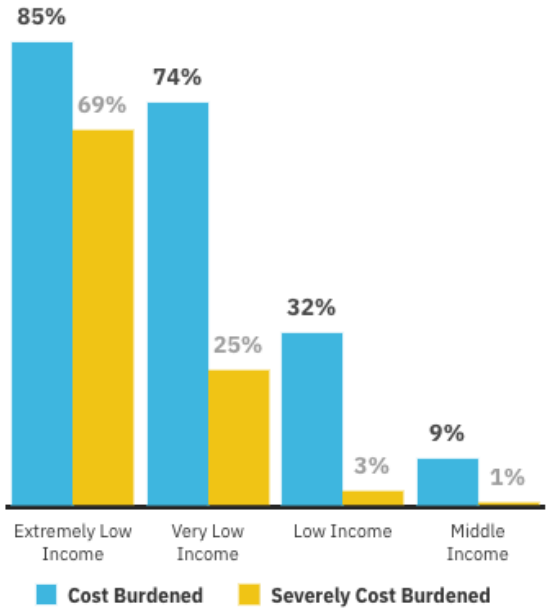


FIGURE 3.3:
Housing Cost Burden by Income Group

Source: nlihc.org

3-4

EXPAND COMMUNITY SOLAR FOR LOW- AND MIDDLE-INCOME MICHIGANDERS AND MAKE OPT-OUT

As of 2019, low-income households made up less than half of existing community solar projects in the U.S.[109] This is due to a lack of community awareness, concerns from solar developers about the acquisition of additional risk, and a dearth of policies supportive of community solar much less the inclusion of low- and middle-income (LMI) residents. Happily, however, an increasing number of states, including Colorado, Illinois, New York, DC, and others are beginning to include an LMI component as part of their community solar plans.[110] The advantages from an equity standpoint are clear: Community solar provides a way to reach customers who may not have the ability to make the substantial up-front investment in solar PV equipment, or may lack the rooftop space to begin with, such as those in multi-family residences. It is imperative to incorporate LMI customers into community solar, as this provides a way to offer meaningful savings on monthly energy bills for communities who are often left out of the conversation surrounding renewables. In order to ensure that this demographic is included, these programs should be made opt-out instead of opt-in. Not only does adding an opt-out element ensure greater adoption and cost savings for consumers, but making the projects opt-out also makes them more attractive for developers: they have more customer certainty, and don't have to worry about enrollment.[111]

DESCRIPTION:

Although community solar is still facing numerous legal hurdles in the State of Michigan, it is important to start planning now for what a model of equitable community solar could look like across the state. Once community solar becomes fully legal it is imperative to have a plan in place so that municipalities can begin implementation immediately. To that end, Michigan has a unique opportunity to incorporate strategies seen in other communities across the country to ensure that community solar is deployed in an equitable manner.

Existing low-income community solar initiatives should be expanded in Michigan. In order to do so, municipalities should work directly with the department of Health and Human Services (HHS), a method currently being utilized by the Michigan Department of Environment, Great Lakes, and Energy (EGLE), to identify low-income households who could most greatly benefit from community solar. HHS is able to provide an accurate depiction of low-income homes, as HHS oversees a substantial number of weatherization projects, which involves the retrofitting of older homes to make them more energy efficient. This is a common practice among low-income communities, because the practice is able to significantly lower the energy bills of those whose utility bills are disproportionately high.

Community solar initiatives in Michigan municipalities should also incorporate various mechanisms that have proved to help increase adoption among LMI residents. This includes carveouts, specific LMI-focused programs, and incentives. Additionally, in order to increase adoption, LMI community solar should be made opt-out.

CASE STUDY:

EGLE is currently the leader in spearheading community solar programming focused on low- and middle-income (LMI) Michigan residents. Launched in 2018, the EGLE Low-to-Moderate Income Access Program currently works with two utilities, Cherry Land Electric Cooperative, near Traverse City, and the Village of L'Anse in the Upper Peninsula.[112] This program received partial funding through grants from EGLE's Energy Services, and works with the HHS weatherization program to identify low-income residents.

Another highly successful community solar program focused on reaching LMI residents is D.C.'s "Solar for All" initiative. The goal of the program is to serve 100,000 households by the year 2032. In Fiscal Year 2019, the program had already reached 8,600 households with affordable community solar and installed nearly 7MW of solar capability.[113] Solar for All includes community solar for single-family dwellings and multi-family dwellings. They determine who to reach with their services based on those who fall below 80% of the Area Median Income.[114] Additionally, in order to accurately assess the viability of different building structures for the implementation of community solar projects, DC developed the "Vulnerability Assessment, Resilience Audit and Solar Tool for Affordable Housing." Some key takeaways from this tool include the suggestion that there be one appointed "resilience champion" designated for each multi-family housing project and that emergency planning should involve residents.[115, 116] It is recommended that this tool be used in conjunction with the expansion of municipal low- and middle-income community solar and solar PV assessments.

Other areas of the country have also placed increasing focus on developing their community solar programs in a more equitable manner. The map in Figure 3.4 showcases states, as of 2018, who had incorporated a LMI component into their existing community solar initiatives. As can be seen, carve-outs and incentives are both popular mechanisms for encouraging inclusion, and should be considered by Michigan municipalities.

Although an increasing number of states are including an LMI component in their community solar programs, they are almost always opt-in, meaning that community solar is not the default choice for customers and they have to actively register. One novel example of opt-out community solar can be found in New York. The New York State Department of Public Service approved an opt-out community solar pilot in September 2020 in Lima and Brockport, New York.[117] The program is part of a larger community choice aggregation program, where the municipality enrolls its entire population in community solar, allowing them to secure preferable terms by leveraging their collective buying power. Residents can expect to see a 10% cost-saving from the program, but are allowed to opt-out at any time.[118] This novel New York opt-out program can provide a blueprint for Michigan's approach to its LMI community solar initiatives.

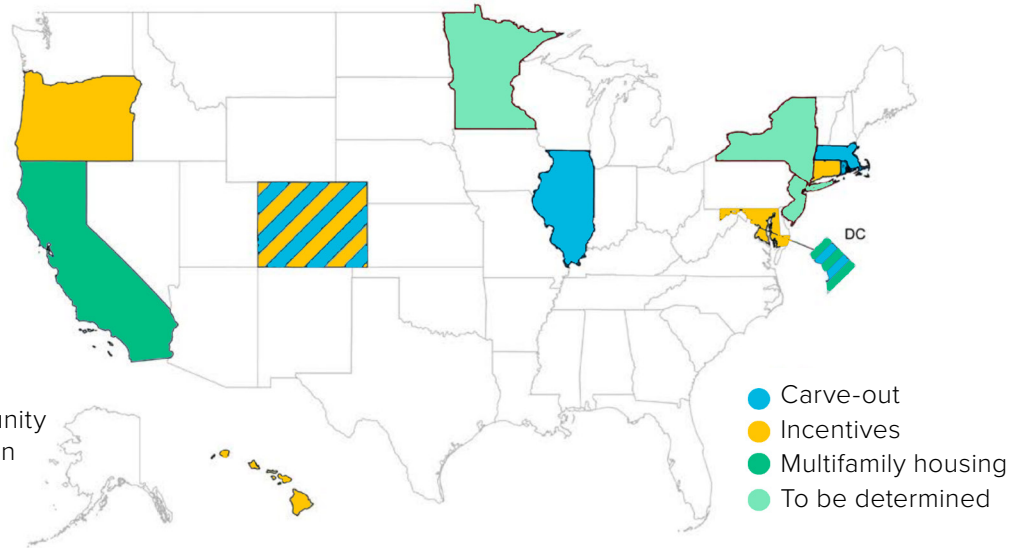


FIGURE 3.4:
States with a community solar program with an LMI component

Source: cesa.org

3-5

PARTNER WITH IOUS TO EXPAND AND PILOT COMMUNITY SOLAR INITIATIVES AS ALTERNATIVE TO CCAS OR MUNICIPALIZATION

The fastest and most efficient way to secure the benefits of community solar for low- and middle-income households is by partnering directly with the utility in your area. For the majority of Michiganers, that is an investor-owned utility company.

DESCRIPTION:

Without the cooperation of investor-owned utilities such as DTE and Consumers Energy, it will be next to impossible for municipalities in IOU territories to implement any type of comprehensive or effective community solar program. As it currently stands, community solar is effectively illegal in Michigan because utilities are using regulatory hurdles and rules surrounding property lines to prevent shared solar.[119]

This is why the majority of community solar projects, such as those in Traverse City and Lansing, are in areas under the control of municipal utilities. While threatening municipalization and effectively divesting from the utility is one way to subvert this, municipalization is not a realistic option for most municipalities as it is extremely expensive to purchase the wires from the utility.[120] Instead, municipalities interested in pursuing community solar should approach their utility and discuss the possibility of piloting a community solar project with them directly. To further justify such a pilot, municipalities can even position this as a collaborative alternative to a CCA or municipalization. Municipalities can also point to recently introduced legislation, such as Michigan House Bills 5861and 4995 introduced in 2018 and 2019 respectively, that would allow Michiganders to buy shares in solar arrays, as indicative of the direction that Michigan will likely be headed in the coming years.[121]

Approaching a utility with the option of piloting a community solar project is a productive strategy for numerous reasons. First, if the utility is willing to implement the pilot, this is by far the fastest path to implementation. The IOU has the infrastructure, siting capabilities, and developer connections to expedite these projects. Additionally, piloting a project with the utility promotes goodwill and collaboration while also applying pressure to not only allow a pilot project in one municipality, but to move forward with other pilot projects in other communities across the state.

CASE STUDY:

There are already several examples in Michigan of IOUs being receptive to the implementation of community solar projects. Consumers Energy has shown particular willingness, and currently has community solar garden projects at two universities - Western Michigan University and Grand Valley State University.[122] While DTE has not been as welcoming to the idea of community solar, in response to Ann Arbor's climate plan the utility has indicated that they are open to considering such agreements, saying that they would be willing to look into community renewables such as wind and solar in order to avoid Community Choice Aggregation.[123] EGLE has also indicated that it is developing a new community solar project with an investor-owned utility. Partnering with an IOU is listed as part of a third phase of community solar implementation after Phase One - Cooperative Utility and Phase Two - Municipal Utility. The EGLE community solar webpage states that an investor-owned utility project is "coming soon!"[124] The project was originally slated to launch in the summer of 2020, but due to the COVID-19 pandemic was delayed.[125]

3-6

CIRCUMVENTING LACK OF STATE SUPPORT FOR COMMUNITY SOLAR THROUGH CREATIVE SOLUTIONS

Determining viable workarounds to develop community solar could offer a way to make community solar more accessible for large sectors of the population. Working directly with grocery stores and houses of worship also provides a way to reach a larger swath of the community, and a way to advertise the programs directly to potential customers.

DESCRIPTION:

Currently, the state of Michigan is not supportive of community solar at the state level, and it is very challenging to implement without the support of the local utility company. While approaching the utility to pilot a new community solar project should be the first step in attempting community solar implementation, in the event that laws toward renewable solar in Michigan remain unfavorable, municipalities should be encouraged to seek innovative solutions.

CASE STUDY:

Grocery Stores: The Great Lakes Renewable Energy Association (GLREA) has been leading the charge in looking for workarounds to existing community solar laws that do not allow shared solar across property lines. Recently, GLREA has approached large stores with a lot of open roof area, such as Meijer, Lowes, Best Buy, and others, to build solar arrays on the rooftops of their stores. Customers of these stores would then be given the option to purchase into the rooftop solar array to have the power generated count towards their own energy use as part of a "solar club." In order In order to circumvent restrictions stipulating that solar power cannot cross property boundaries, instead of receiving credits on their utility bills, members of such a program would receive store credit or discounts instead. In this way, all transactions would be kept on the store's property, and the energy technically would not leave the premises.[126] GLREA has not been able to secure adoption of such a program yet, but they are approaching other grocery stores and retailers with similar proposals.

Houses of Worship: The non-profit Michigan Interfaith Power and Light (MIPL) is a group of houses of worship across the state of Michigan who are dedicated to expanding renewable energy and energy efficiency projects. MIPL has orchestrated nearly 30 rooftop solar projects, but only three of those are community solar projects.[127] All three of those solar projects are in Lansing and East Lansing, and are hosted by municipal utility The Lansing Board of Water and Light (LBWL). While so far this model has only been implemented in areas of Michigan with a municipal utility, the model of inviting parishioners to invest but keeping the energy on-site is one that could potentially be replicated in areas with an IOU.

Non-Utility Sponsored Community Solar: In Michigan, there are currently no community solar projects that are not sponsored by a utility, but some other states have found success in this model.[128] One model of community solar that is not sponsored by the utility is known as the "Special Purpose Entity." In this model, a community solar project is structured as a business and must raise the capital to fund the project. Some successful examples of this include University Park Community Solar, LLC in Maryland who installed a 22 KW solar array on the roof of a church in 2010, and Clean Energy LLC in Colorado.[129] Another type of community solar that is not sponsored by the utility is the non-profit model. This model is not a classic community solar set-up, however, as donors do not directly receive benefit from solar generation, although thanks to advancements in virtual net metering and group billing laws there may be more opportunities to benefit donors. In this model, supporters of a particular non-profit make tax-deductible donations to help establish a solar project, and the non-profit may be able to get additional funding through grants. Some examples of this type of model include the California Multifamily Affordable Housing Program and Solar for Sakai in Washington State.[130]

3-7 DEVELOPMENT OF AN ANCHOR TENANT-SOURCING PROGRAM

Community solar projects, especially those focused on including low- and middle-income participants, can be unattractive to developers due to perceived increased risk. Depending on the size of the project, there may be dozens of participants, any of whom could default on their payments. Securing an anchor tenant prior to development makes the project more feasible and attractive for both developers and potential hosts, and thus increases the likelihood that LMI participants will be able to participate and reap the cost savings and resiliency benefits. Serving as an anchor tenant provides an opportunity to invest in the local economy and contribute to community redevelopment.

DESCRIPTION:

Anchor institutions are defined as "large, place-based entities like hospitals, universities, cultural attractions, public housing, and other major public institutions."[131] Essentially, they are large businesses or institutions that are more likely to use a higher amount of energy than many other surrounding businesses and households. As a result, they are perfect candidates to serve as "anchor tenants," or participants in a community solar project who commit to purchasing a large percentage of the total energy generated by the project. Anchor institutions are important not only because of their large energy usage, but also because of their fixture in the community and the political power that they wield. Municipalities should create an anchor tenant program, where potential anchor tenants are identified and approached as part of the development process.

CASE STUDY:

Although community solar has yet to be legalized at the state level, there have been several bills introduced in the State house that provide some indication of what legalized community solar at the state level would look like. Michigan House Bills 5861 and 4995, introduced in 2018 and 2019 respectively, include language stating that a system with ten or more subscribers is considered a community system, and that "no subscriber holds more than 40% proportional interest in the output of the system."[132] This language directly refers to anchor tenants, specifying that an anchor tenant must not purchase more than 40% of the power of the system. When approaching potential anchor tenants, developers should keep this percentage in mind.

This 40% rule is used in other states as well that focus on garnering anchor tenants for their community solar arrays in an attempt to mitigate risk for developers. In New York, for example, similar to proposed community solar legislation in Michigan, a community solar array must have at least 10 users, and no single subscriber can utilize more than 40% of the overall load. The NYC Solar Partnership has been in talks with large private corporations who are interested in improving their image surrounding environmental stewardship and sustainability. Not only does the opportunity provide monthly energy cost savings, but companies see the opportunity to serve as an anchor tenant as a way to improve their public image. Ron Reisman, NYC Solar Partnership Program Manager, cited advertising community solar opportunities to developers and anchor tenants as one of the most challenging aspects of their program. Having a dedicated program focused on sourcing these risk-mitigating entities would be pivotal to seeing success in Michigan.

Michigan companies, factories, and universities should be approached and encouraged to serve as anchor tenants to reap cost savings and invest in their local communities. Even entire cities can serve as anchor tenants. For example, the City of Ann Arbor is purchasing the power for a new landfill solar project, and in this way is effectively serving as an anchor tenant for that project.[133]

STATE LEVEL

While there are many actions that municipalities can take in order to move towards carbon neutrality, ultimately regulations at the state level play a substantial role in the policies and programs that individual municipalities are able to implement, especially those that have IOUs. Historically, Michigan has not been the most progressive state when it comes to legislation surrounding clean and renewable energy, and restrictive energy policies have stymied progress. Governor Whitmer's Executive Order in September 2020 calling for carbon neutrality by 2050 and a 28% decrease in emissions from 1990 levels, however, shows that Michigan is serious about tackling climate change and prioritizing divestment from fossil fuels.[134] *There is now real momentum and added incentive towards the acceptance of state policies that would remove some of the roadblocks that have been slowing progress at the local level. In addition to implementing the aforementioned local policies to move towards clean and renewable energy, it is also imperative that municipalities lobby for the passage of two high-priority pieces of legislation at the state level: (1) allowing community choice aggregation and (2) enabling community solar state-wide.*

3-8 COMMUNITY CHOICE AGGREGATION (CCA)

Allowing CCAs empowers individual communities to make energy choices that are beneficial for their unique needs.

DESCRIPTION:

According to the Environmental Protection Agency, community choice aggregations are "programs that allow local governments to procure power on behalf of their residents, businesses, and municipal accounts from an alternative supplier while still receiving transmission and distribution service from their existing utility provider."[135] Essentially, CCAs allow municipalities to have greater control over their energy source, to procure it at a lower rate, and to prioritize renewables and clean energy sources. Michigan should pass legislation allowing CCAs, but mandate a focus on integrated resource planning. This was one of the changes that occurred in the last energy re-write in 2016, and requires that Investor-Owned Utilities use Integrated Resource Plans, or "IRPs," to determine how they are going to generate their power for the next fifteen years. This allows the PUC to make well-informed choices about which power plants to retire and which to build.[136] Allowing CCAs would aid in the timely implementation of community solar and other distributed generation.

CASE STUDY:

Ann Arbor's Net Zero Sustainability Plan assumes that CCAs will be passed at the state level for a number of its recommendations. Many of the plan's recommendations are dependent on the passage of CCAs at the state level, showcasing that Ann Arbor, one of the most progressive, affluent, and influential municipalities in an IOU territory, has identified CCAs as vital to the success of their sustainability strategy.[137] Currently, CCAs are established in just six states: California, Illinois, Massachusetts, New Jersey, Ohio and Rhode Island.[138] In order to apply pressure to the state legislature to allow CCAs, Missy Stults, Ann Arbor's sustainability manager, has indicated that Ann Arbor will be working closely with other Michigan municipalities to introduce the legislation, in order to display a united front.[139]

Although Michigan does not currently allow CCAs, Michigan is one of sixteen deregulated states (see Figure 3.5, below), meaning that its path to CCA is less complex than if it were a regulated state.[140] The six states that do allow CCA also all have deregulated energy markets.

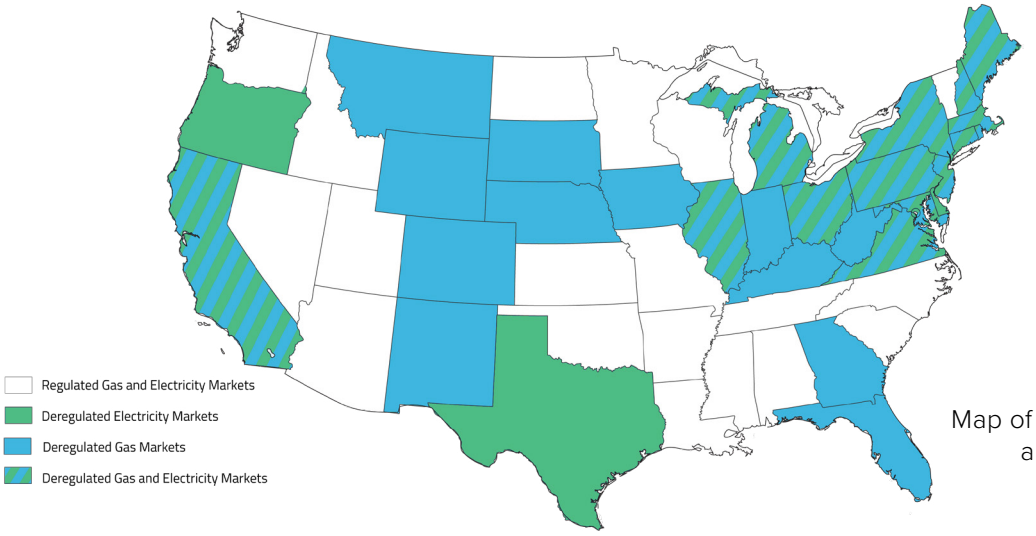


FIGURE 3.5: Map of Deregulated Gas and Utility Markets

Source: electricchoice.com

3-9

ENABLE COMMUNITY SOLAR PROGRAMS IN MICHIGAN AT THE STATE LEVEL

Legislation allowing community solar in Michigan would advance equity in the state by allowing more middle- and low-income residents to access the cost savings and resiliency benefits associated with community solar.

DESCRIPTION:
As has been referenced previously, there have been several bills introduced at the state level in recent years to allow community solar in the state of Michigan. Two of the most recent are Michigan House Bills 5861 and 4995, introduced in 2018 and 2019 respectively. The bills remained largely consistent in both years, although in 2018 the bill described shared community renewable generation as "community renewable energy gardens," whereas in 2019 that language changed to "community renewable energy programs."[141] Both bills also include language to incorporate financing options for low- and middle-income communities, and to ensure that these projects are sited there. While the policies themselves are promising, they have yet to be signed into law.

CASE STUDY:
According to David Konkle of GLREA, both Colorado and Minnesota had very similar struggles with allowing community solar in their states, but they were both able to pass legislation that was very successful at enabling community solar by passing laws stipulating that utilities had to support it.[142] See Figure 3.6 below, which showcases the success of Minnesota's program since its launch in December 2014. It is important that Michigan municipalities continue lobbying for the passage of legislation enabling community solar, and making it clear that such legislation is high-priority.

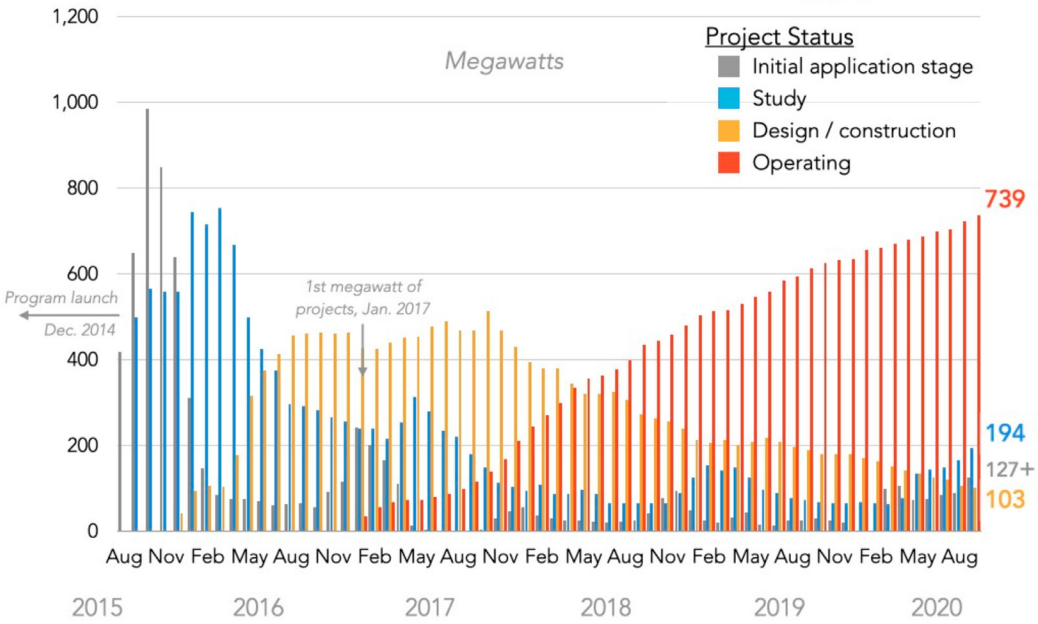


FIGURE 3.6:
Progress of Minnesota's Community Solar Program Since its inception in 2014

Source: ilsr.org

APPENDIX D:
ENERGY SITING

EQUITY + JUSTICE

The siting and development of renewable energy will result in less dependence on fossil fuels that cause a disproportionately high burden of pollution exposure for racial minorities and communities of lower socioeconomic status.[143] *This will alleviate the adverse health consequences that result from such exposure, such as respiratory and cardiovascular diseases.*

A specific way to reduce exposure to contaminated sites is also illustrated in brownfield development. By redeveloping contaminated land into a renewable energy source, this effectively eliminates two sources of pollution (the brownfield and the fossil fuel plant that can be replaced), further reducing inequitable exposure.

By making zoning ordinances as transparent and low-barrier as possible for site development, this improves access and reduces bias in the approval process. This is particularly relevant to a consumer-facing industry, like rooftop solar.

As an overarching theme that will recur in specific recommendations, there should always be a lens of looking for a way to foster equity during any development. Examples of these include ensuring local labor is used for new construction and using devices that can both monitor infrastructure status as well as provide power.

4-1 PREFERENTIALLY SITE RENEWABLE ENERGY DEVELOPMENT, OF ALL SPECIFIC ENERGY SOURCES, ON BROWNFIELDS

Communities of color and lower income individuals have been found to live closer to areas of hazardous waste, putting their health at risk.[144] Redeveloping this land would help to alleviate this disparity.

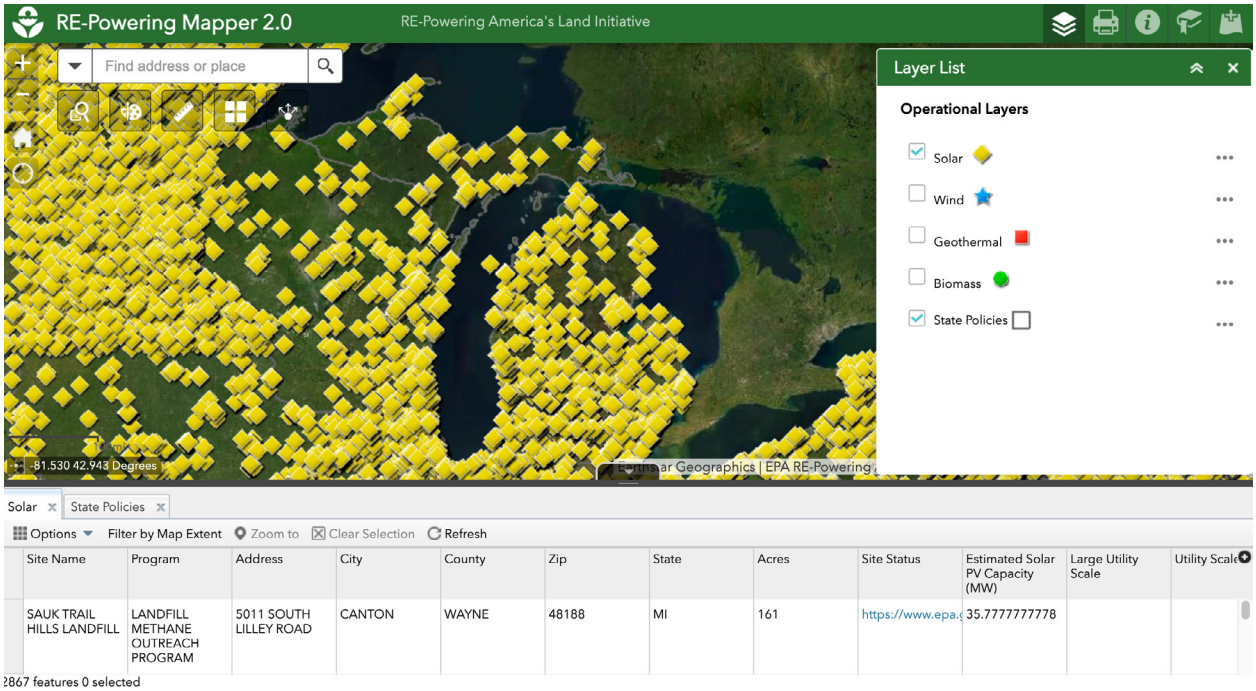
DESCRIPTION:

An overarching theme that applies to all of the sources of energy expanded upon below is to emphasize the development on brownfields. These are areas that have been previously developed and environmental contamination (either in presence or perception) can hamper redevelopment or reuse. However, developing these areas protects the environment, reuses existing infrastructure, minimizes urban sprawl and creates economic opportunities. A list of brownfields that have been screened for development of renewable energies is available via the EPA's RE-Powering Mapper 2.0 tool (Figure 4.1), there are a total of over 2800 sites in Michigan that have been screened. Additionally, the Michigan Remediation and Redevelopment Division is available to provide financial and technical assistance as well as free site assessments to facilitate the redevelopment of brownfields.[145]

CASE STUDY:

Please see specific case studies within the Solar and Biomass sections for examples on where brownfield development has been successful.

BROWNFIELDS SCREENED FOR RENEWABLE ENERGY DEVELOPMENT



How to use:

1. Access the app: https://geopub.epa.gov/repoweringApp/

2. To filter the map to display which sites have been screened for different types of energy, select different icons on the Layer List window on the right (note that some sites have been screened for multiple types of energy sources). Following this, a new tab titled with the layer of your choice will be selectable in the bottom pane.

3. To find specific areas that have been screened in your area:

   - Towards the bottom left of the overall screen (top left of the bottom panel), select Options -> Filter

   - Click Add a Filter Expression

   - Determine what you would like to filter by (state, city, zip code, etc.) and select that option in the first drop down menu, then input the appropriate value in the text box on the right side of the menu, then hit OK in the bottom right of the window

   - The results of your search will then be displayed in the bottom panel, to export the results of this search, select Options -> Export All to CSV (which is a file type openable by Excel)

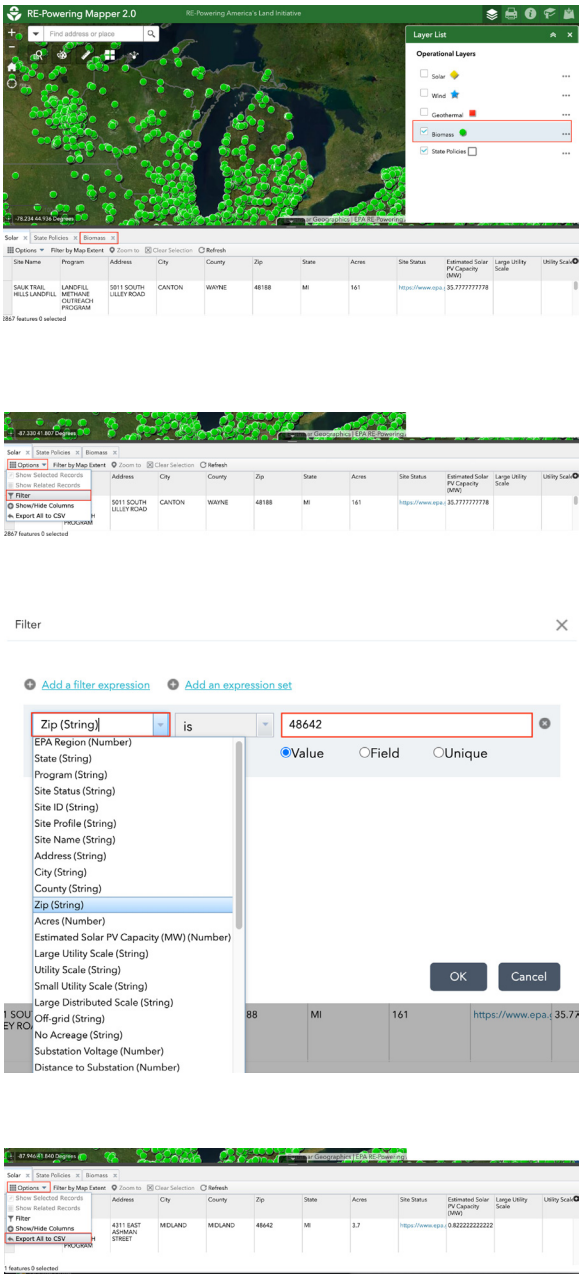


FIGURE 4.1:
Brownfield Siting Tool Walkthrough

Source: EPA.gov

SOLAR

Despite perceptions of relative lack of sunlight, solar energy should be an integral part of Michigan's journey to net carbon neutrality. If just 2.4% of the state's land area was used for solar photovoltaic (PV) systems, this would generate enough energy to fulfill the entire state's energy requirements. This level of potential impact is reflected in solar farms and rooftop solar being listed at #8 and #10, respectively, in Project Drawdown's recommendations on potential impact. To facilitate achieving growth in solar power, municipalities have a large opportunity. With autonomy over energy zoning ordinances and a lack of established ordinances throughout much of the state (Figure 4.2), improving accessibility to solar power can make an impact in moving toward this goal. Additionally, there is a specific type of brownfield, closed landfills, that make excellent candidates for solar development and can make use of land that cannot be utilized for much else and is frequently municipally owned.

4-2 PROVIDE SOLAR ENERGY ZONING ORDINANCES THAT REDUCE BARRIERS, FACILITATE ACCESS AND ENCOURAGE DEVELOPMENT

Minimizing barriers to accessing solar panels and maximizing transparency in the permitting and inspection process leads to increased availability for all communities and prevents potential biases in denying applications.

DESCRIPTION:

Accessibility to solar development can be maximized through removing restrictions inherent in the ordinances developed, improving accessibility to requirements and permit documents, enhancing transparency of the permitting process, and by setting an example in municipal buildings. The following are specifics on how to implement these practices:[146,147,148,149,150]

1. Engage stakeholders iteratively, ensuring no demographic is left out of the discussion, and create a plan with policies explicitly acknowledging the community's solar resources as a valuable asset
2. Broadly define solar energy systems as including both passive and active systems, as well as associated storage
3. Create a permitting and inspection process that is transparent and easily accessible (with online availability) to remove barriers and biases, in line with recommendations from the Electrification section of this document
4. Explicitly allow rooftop and small-scale ground PV projects as use-by-right, streamlining the process for residents and lowering administrative costs
5. Allow development in a wide range of districts, including utility scale in such districts as business, commercial, industrial and agricultural
6. Remove restrictions on visibility and provide exemptions for maximum height, as this may exclude areas from the opportunity to develop
7. Establish protections for solar access to avoid new developments from hindering their potential by causing new shading
8. Require groundcover of rural solar farms to be of pollinator-friendly native vegetation
9. Invest in solar resources from the public sector to demonstrate feasibility and commitment, as well as reduce future costs for the community

Additionally, SolSmart (a partnership between the Solar Foundation and ICMA, funded by the US Department of Energy) offers free consultation services for improving efficiency, technical assistance, and achieving recognition.

CASE STUDY:

San Diego, CA,: Spearheaded by a clear Solar Implementation Plan followed by the development of the majority of the applicable above best practices, San Diego enjoys the highest per-capita solar electricity generation in the mainland U.S.[151,152] Notably, they also employ a Solar Map function that has helped to increase engagement in the community.

Ypsilanti, MI: Success can also be demonstrated in Michigan, with Ypsilanti achieving SolSmart Gold status.[153] In addition to the majority of the above best practices, Ypsilanti has excelled in community engagement through SolarYpsi and has a PACE financing system (a principle described in Appendix E), expanding access to development. Additionally, there have been PV installations at city hall, in a low-income housing development, and at their fire station, through which the city expects to save more than $6000 annually with a payback period of just 5 years.

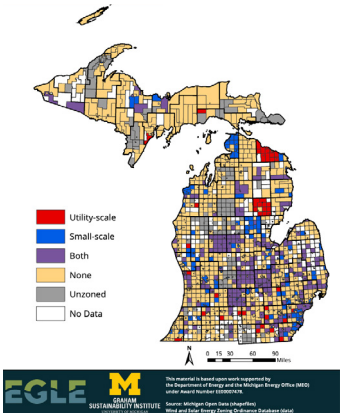


FIGURE 4.2: Solar Ordinance Map - Michigan (2019)

Source: Michigan.gov

4-3 PURSUE CLOSED LANDFILLS AS A RECOMMENDED SITE FOR NEW CONSTRUCTION OF SOLAR PHOTOVOLTAIC ARRAYS

Partnering with an investor-owned utility for development of such a site can result in an influx of quality jobs to the area for work. This can help to economically boost individuals, combined with the long-term electricity cost savings that can be passed on.

DESCRIPTION:

This recommendation highlights the overall recommendation of siting on brownfields, but landfills are particularly suited to solar development. This is due to their lack of potential for other significant development on the area that will result in return on investment, as the only other options for development in such areas are things like parks and wildlife preserves. While these certainly benefit communities and are obviously not recommended against, they do not provide energy to replace fossil fuels and do not provide as significant of a return on investment, if any. Additionally, closed landfills are unique relative to other brownfields due to their large, open space that makes them well-suited for solar development, and there is a synergistic effect in terms of infrastructure development required with landfill methane (reference the Biomass section), which is why special mention of this type of brownfield development is made. There is an online tool through the Michigan Department of Environmental Quality that can be used to identify closed landfills in the state (instructions on the following page).

FIGURE 4.3:
Scituate Solar Landfill

Source: EPA.gov

CASE STUDY:

Scituate, MA: When the city of Scituate was deciding on what to do with their landfill, they decided on a solar PV installation in order to turn what was costing the city money into being a source of revenue.[154] This was achieved through a PPA agreement with a solar developer and engagement with the investor-owned utility servicing the region. Coordination with the state Department of Environmental Protection and the IOU were key in resolving hurdles to the project, and effective communication between all entities was critical to the project's success. The labor for the project was 100% local, providing new jobs for the area. This has resulted in an estimated $200,000 in annual savings for the town in addition to 3.825 million kilowatt-hours per year of electricity for the town. Additionally, residents have stated that one of the largest benefits has been the positive perspective from the community that the city was doing the right thing for the environment.

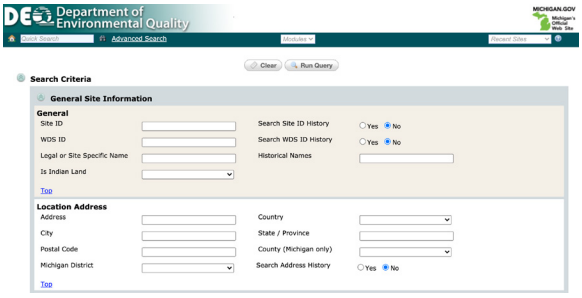
Additionally, this concept has been successfully employed in Michigan. Coming online in December of 2018, a 1000 solar panel array installed on a capped landfill in East Lansing.[155] This was achieved through partnerships with Michigan Energy Options, Pivot Energy, the city and the municipal utility. The project allows utility consumers to opt-in to the program by paying a fee, and they receive on-bill savings in return, with an expected 60% return on investment. In addition, the project was the Michigan Energy Innovators 2019 Project of the year.[156]

MICHIGAN DEPT. OF ENVIRONMENTAL QUALITY SOLID WASTE DISPOSAL FACILITY SEARCH TOOL

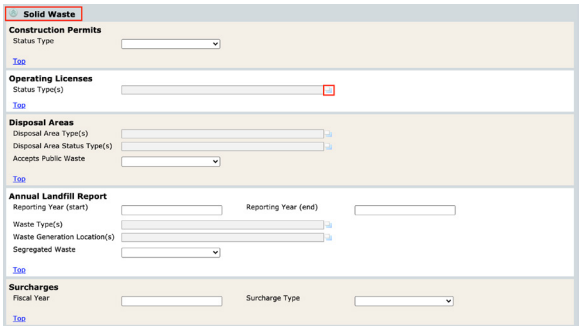
How to use:

1. Access the website's Advanced Search function: https://www.deq.state.mi.us/wdspi/AdvancedSearch.aspx

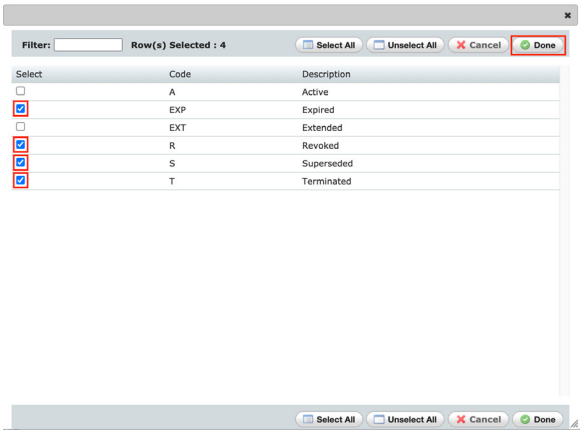
2. Enter "MI" under State / Province in the General Site Information dropdown area to display all in Michigan, or enter a specific address, city, postal code, or other information as desired.



3. Navigate to the Solid Waste dropdown area and click the button that appears as a white square above a blue square to the right of the bar in the Operating Licenses Status Type field.



4. In the window that pops up, select any of Expired, Revoked, Superseded, or Terminated as appropriate. When the selections are done as desired, select Done in the top right corner of this window.



5. Adjust any other search criteria as desired, and select Run Query at the top of the page to display search results.

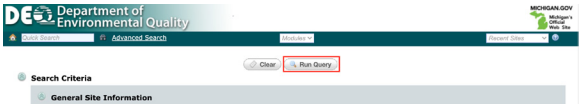


FIGURE 4.4:
Landfill Search Tool

Source: DEQ.state.mi.us

HYDROELECTRIC

While the typical depiction of hydroelectric power is large-scale concrete-based dams, this model is not recommended for new development. This is due to large ecological impact including killing of wildlife, creating harmful algal blooms, and displacing of habitats and agriculture from flooding. In addition, life-cycle inventories of these traditional hydroelectric plants have shown greenhouse gas emissions as only marginally better than natural gas usage. However, an opportunity exists for municipalities to take advantage of novel technologies to capture the wasted energy that exists in their drinking water and wastewater systems, creating cost and energy savings in municipal services that require large amounts of both of these resources.

4-4

UTILIZE CONDUIT HYDROPOWER TO TAKE ADVANTAGE OF WASTED ENERGY OF MUNICIPAL WATER SYSTEMS

Waste and drinking water utilize a significant fraction of a municipality's energy supply, which also results in wasted energy as heat. Capturing this waste to reduce the energy consumption can help to alleviate the tax burden of the area and reduce reliance on health-harming fossil fuels. Additionally, many systems offer monitoring to help maintain these systems to prevent losses and unexpected breakdown that would disrupt critical access to water and reduce maintenance costs.

DESCRIPTION:

Drinking water, along with wastewater plants, often account for 30-40% of a municipality's energy consumption, and result in 45 million tons of greenhouse gases annually in the United States.[157] However, there is an opportunity to generate electricity from water pipelines with turbines. This is a component of the #48 recommendation in Drawdown.[158]

This recommendation centers around the latent energy that exists in these systems that is simply being wasted. In drinking and wastewater transport systems, as the water travels to a location further downhill, there is a buildup of pressure. As this water is excessively pressurized to be useful or safe, pressure release valves (PRVs) are employed to reduce it to a useful level, with the excess energy being lost as heat.

If, instead, a turbine is employed rather than the PRV, or if a micro-hydro turbine was installed in the water main itself upstream of the PRV, then electricity could be generated rather than this heat waste. This is what is known as conduit hydropower, as it uses pre-existing water conduits not constructed for the primary purpose of producing power. Additionally, many of these devices require no new building construction, minimizing their associated environmental impact.

There are a number of companies that provide such a service, to varying scopes of size. For example, Rentricity offers customized Flow-to-Wire systems with complementary assessments, as well as smaller scale plug-and-play Sustainable Energy and Monitoring Systems.[159] Canyon Hydro and its division of SOAR Hydropower provide customized turbines dedicated to the specific needs and specifications of the site.[160] [161] InPipe Energy offers an In-PRV system that serves the function of a PRV while offering monitoring data within a standardized, turnkey product.[162] Leviathan Energy offers a Benkatina in-pipe turbine, which has an easily installed system that can work within smaller scale pipes and can additionally be used as an off-grid source of power for remote needs.[163]

Most of these systems offer monitoring devices and systems, which are recommended due to their ability to assess the status of the infrastructure and prevent water losses. This will protect a vital resource, especially for those that do not have the means to easily procure privately sourced water and rely on municipal tap water the most.

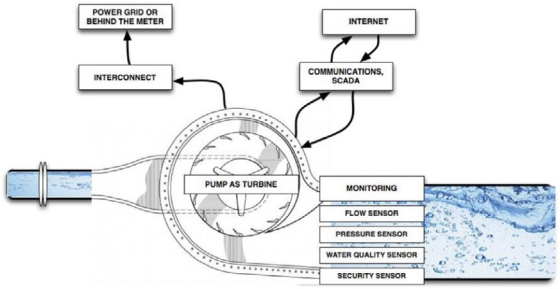


FIGURE 4.5:
Hydroelectric Pressure Release Valve

Source: rentricity.com

CASE STUDY:
Oneida Valley, PA: Demonstrating that systems can be utilized at wastewater treatment plants to reduce the high energy burden of these facilities, this plant that included a gravity fed system with an associated PRV that had a Rentricity system installed.[164]

It generates 131.4 MWh annually and predictably. This results in a reduction of 90.6 tons of greenhouse gas emissions per year. Additionally, it has a predicted 40-year lifespan, offering long-term, reliable energy generation, carbon emission reduction, and revenue. This was partially funded by a $180,000 grant from the Pennsylvania Energy Development Authority, so there is precedent for projects like this receiving government grants to assist in development.

FIGURE 4.6:
InPipe PRV

Source: Hydroreview.com

WIND

Wind is a vital component of Michigan's journey to net zero carbon emissions.[165] It has been estimated that if 7.8 percent of the state's land area is developed for wind energy generation, it could support a capacity of 59 GW, and this potential impact is reflected by onshore wind being the #2 recommendation in Project Drawdown.[166] Wind currently makes up the largest share of Michigan's renewable energy supply.[167] This demonstrates that wind is a relatively mature industry in Michigan, which is also shown by comparing the zoning map for wind (Figure 4.7) compared to solar (Figure 4.2). As a reflection of this industry's maturity in the state, there have been many recommendations for onshore wind siting in Michigan. Therefore, developing de novo recommendations within this report was deemed less marginally productive than showcasing these established recommendations. Therefore, for municipalities who require development or refining of their ordinances, this report will refer to these documents. The first two recommendations are compiled best practices. The final two recommendations are the ordinances for the two counties that generate the most electricity from wind power in Michigan, Huron and Gratiot counties.

4-5 WIND: CULTIVATE A SUPPORTIVE ENVIRONMENT FOR ONSHORE WIND TURBINE DEVELOPMENT

Wind is a critical energy source for eliminating dependence on fossil fuels and the harms they result in from local and global emissions. Wind should be developed equitably, however, without kowtowing to "not in my back yard" influence.

RESOURCE	SOURCE	DESCRIPTION
1 / On-Shore Wind Zoning Guidelines	State of Michigan	Compilation of resources for on-shore wind development
2 / Michigan Land Use Guidelines for Siting Wind Energy Systems	Michael Klepinger, Extension Specialist, Michigan State University	Catalog of considerations and recommendations for aspects of wind siting with examples from Michigan cities
3 / Huron County Wind Energy Conversion Facility Overlay Zoning Ordinance	Huron County	Zoning ordinance from Huron County, the county in Michigan with the top wind capacity at 872.2 MW
4 / Gratiot County Adopted Wind Ordinance	Gratiot County	Zoning ordinance from Gratiot County, the county in Michigan with the second highest wind capacity at 823.2 MW

Access Links:

https://www.michigan.gov/documents/mdcd/On-Shore_Wind_9-28-11_365181_7.pdf

https://www.canr.msu.edu/uploads/resources/pdfs/michigan_land_use_guidelines_for_siting_wind_energy_systems.pdf

https://www.dropbox.com/s/37850k50b328cct/Wind%20Energy%20Facility%20Overlay%20Zoning%20Revised%20Ordiance.pdf?dl=0

https://www.michigan.gov/documents/dleg/Adopted_Gratiot_County_-windordinance_350514_7.pdf

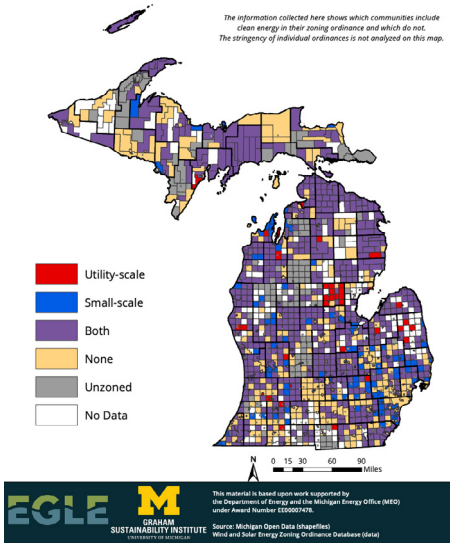


FIGURE 4.7:
Wind Ordinance Map - Michigan (2019)

Source: Michigan.gov

BIOMASS

Biomass has an integral role to play in the transition between the status quo and a net zero carbon emission future. There are many advantages to biomass utilization: fossil fuel plants can often be retrofitted with minimal required adjustments, waste materials can be utilized for biomass fuel and biomass provides dispatchable electricity ready at any time, unlike the intermittent nature of wind and solar power.[168] *However, this all has to be considered in the context that emissions do occur when combusting biomass. The carbon from this will eventually be taken back out of the atmosphere by new plant growth, and the time for this to occur is the carbon debt. The recommendations in this section therefore emphasize utilizing biomass to eliminate fossil fuel use as quickly as possible while fostering best practices to minimize this carbon debt.*

4-6

CREATE BIOMASS POWER PLANT SPECIFIC RECOMMENDATIONS THAT ENCOURAGE DEVELOPMENT WHILE MAXIMIZING EFFICIENCY

The utilization of waste from biomass harvesting industries can provide a source of income to small businesses and a boon for local economies. Utilization of local biomass sources would result in potentially less traffic related pollution and noise than fossil fuels, especially coal, that need to be transported from further away. Combined heat and power generation can result in significant cost savings and energy reliability for essential buildings, like schools and multi-family housing.

DESCRIPTION:

Biomass as a fuel for power plants is a tremendous opportunity to reduce reliance on fossil fuels for similar energy generation. This is reflected by its mention as one of the three primary sources in the VEIC study as well as being the #34 recommendation in Drawdown. The following is a list of best practices to emphasize rapid transition from fossil fuel use, maximize the efficiency of the plants and minimize carbon debt.

1. Conversion of existing fossil fuel plants should be encouraged, as much of the infrastructure can be retained, apart from the boiler.[169] This applies especially to coal-fired plants, which have a higher impact on carbon emissions than natural gas.[170] While not under the municipality's direct control, partnerships with investor-owned utilities and/or developing ordinances can be employed to encourage this conversion.

2. Sourcing of fuel should be primarily from waste material, and siting ordinances should be employed to reflect this. In terms of wood waste, this can come from forest management, residue from timber and scrap from sawmills and paper mills. In terms of agricultural waste, this can be from discarded stalks, husks, leaves and cobs. It is important to note that dedicated harvest of trees or annual grain crops cannot be a meaningful solution to contributing to carbon neutrality.

3. Combined heat and power (CHP) is a way to significantly improve the efficiency of biomass-fired plants. This broadly means using a single system to generate both electricity and heat. CHP is the #50 recommendation in Drawdown, and it works synergistically with biomass electric power by making productive use of the byproduct heat. Ordinances should be implemented to facilitate the use of CHP to heat the facility itself, especially due to high heating requirements in Michigan.

- Note that this can be achieved in individual buildings, not just power plants, and there are systems that can be employed in buildings that have steady thermal and electrical needs. This includes large municipal-owned buildings, such as schools, prisons and wastewater treatment facilities, or as an option for large multi-family housing units.[171] It is recommended to use feasibility analysis studies available through the EPA to investigate for savings that can be achieved through these systems.

- Also note that a larger scale version of this can be seen in district heating. If the infrastructure exists in a municipality to utilize biomass to fuel a district heating system, this can be used as an efficient way to heat the area. However, as the ultimate goal is to transition to a non-combustion-based system that district heating is incompatible with, there is not a recommendation to invest in new district heating infrastructure.

CASE STUDY:
Northern European Retrofitted Coal Plant: This plant encompasses all of the above recommendations, as a coal-fired plant that was retrofitted to be fueled by biomass by replacing the boiler with little other refurbishment required.[172] The heat aspect of the CHP is fed into district heating, providing efficient heating to the surrounding area, and the sourcing is primarily wood residue. In the life cycle analysis, with the model of the sources of the biomass being 100km from the plant, it was found that the carbon debt payback period was within 1 year. Note that the plant was anonymized as part of this life cycle analysis.

Genesee Power Station: This plant in Flint, MI has a 40 MW capacity, enough to power approximately 40,000 homes.[173] It is fueled primarily by locally-sourced wood waste, including urban waste, and employs approximately 100 people between the plant itself and the transport and handling of the wood waste.[174] The output is sold pursuant to a long-term PPA with Consumers Energy.

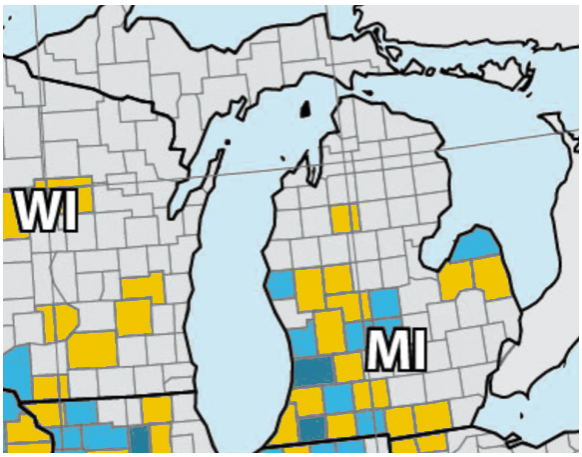


FIGURE 4.10:
Methane Generation Potential from Animal Manure (2007)

Source: NREL.gov

TONS/YR
> 5000
2500 to 5000
1000 to 2500
500 to 1000
< 500

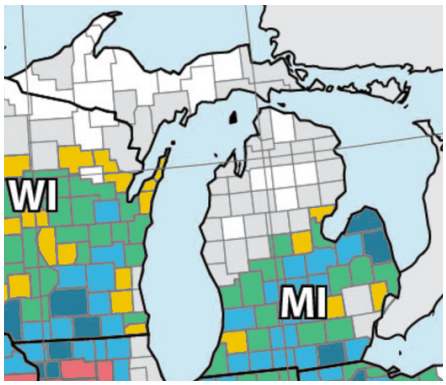


FIGURE 4.8:
Crop Residues (Average from 2003-2007)

Source: NREL.gov

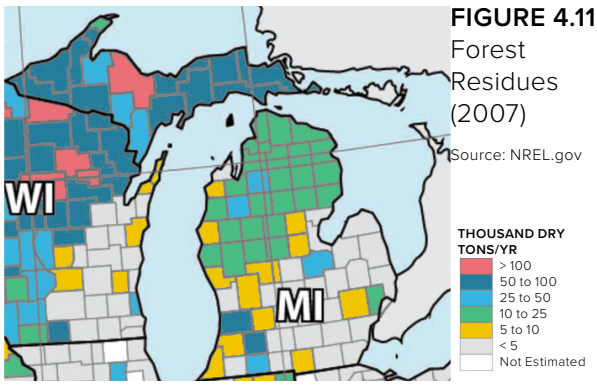


FIGURE 4.11:
Forest Residues (2007)

Source: NREL.gov

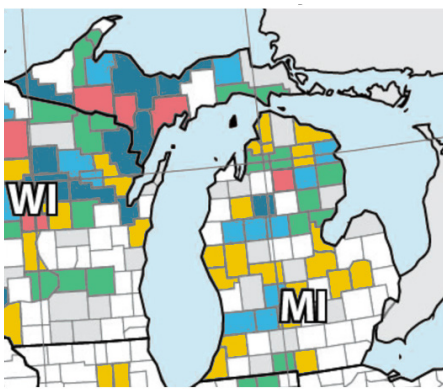


FIGURE 4.9:
Primary Mill Residues (2007)

Source: NREL.gov

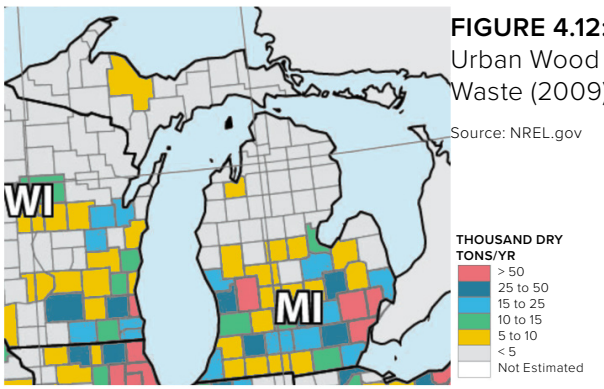


FIGURE 4.12:
Urban Wood Waste (2009)

Source: NREL.gov

4-7

CAPTURE METHANE EMISSIONS FROM LANDFILLS TO PREVENT DIRECT EMISSIONS AND UTILIZE FOR ELECTRICITY GENERATION

In addition to reduction in a potent greenhouse gas and the health effects associated with that effect, the construction of the capturing system can lead to local economic growth.

DESCRIPTION:

Methane is 72 times more potent in terms of warming than carbon dioxide over a 20 year period. As another specific example of brownfield site development as listed in the first recommendation of this appendix, landfills are the third largest source of anthropogenic methane in the US, and landfills are frequently owned by municipal governments, providing an opportunity for municipalities to take ownership of emissions reduction.[175] By capturing this methane, the warming is prevented, and it can additionally be used as a fuel source. While this will result in some emissions relative to capture and storage, it still is superior to releasing the methane directly to the atmosphere and saves from the need from fossil fuel use. Note that this does not have the carbon debt associated with biomass combustion as above. Additionally, the infrastructure required for landfill methane use has a significant amount of overlap with what is required for solar siting on landfills.

CASE STUDY:

South Kent Generating Station: The South Kent Landfill in Byron Center, MI was developed in partnership with developer Granger Energy, who had arranged a PPA with Consumers Energy.[176] Uniquely, Kent County invested in the project and split ownership with Granger Energy, and the county's strong desire to serve the community led to their recognition as the EPA's Landfill Methane Outreach Program's 2009 Community Partner of the Year. The station was completed in 11 months and has a rated capacity of 3.2 MW in a 7.85 million tons waste-in-place sized landfill.

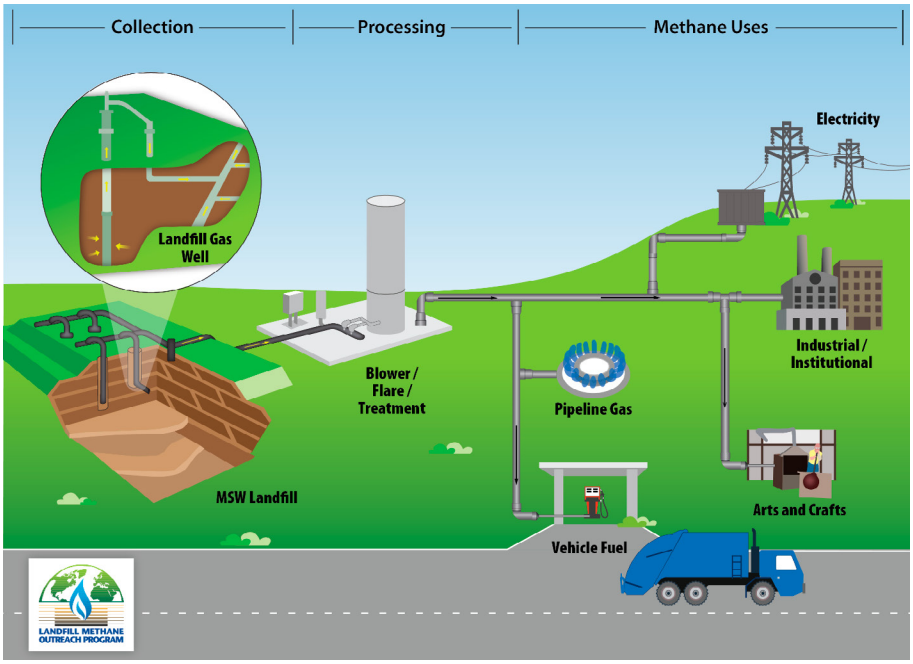


FIGURE 4.13:
EPA Landfill Methane

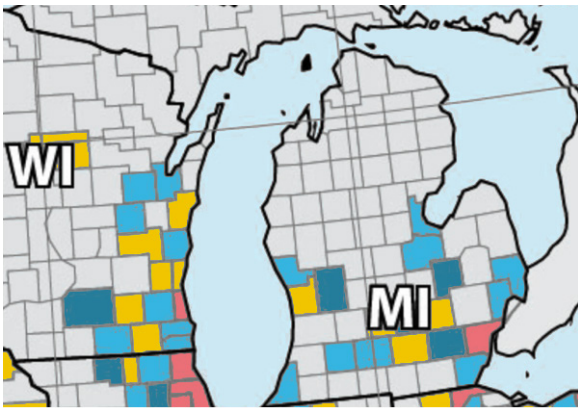
Source: epa.gov

4-8 EMPLOY WASTEWATER TREATMENT PLANT DIGESTER METHANE FOR ELECTRICITY GENERATION TO OFFSET OPERATING ENERGY

By reducing a large portion of the municipality's energy consumption, the tax burden on its constituents can be reduced to alleviate economic hardship.

DESCRIPTION:

The wastewater treatment industry uses the equivalent of 56 billion kWh of electricity per year, 3% of the total electricity usage in the U.S. It is also responsible for the emission of 26.7 million million metric tons of CO2 equivalents of methane per year. Most large facilities already use anaerobic digestion as a step in their cleaning process, but simply flare the gas instead of capturing it for energy use, only approximately 10% of current facilities with anaerobic digestion utilize the biogas for heat or electricity generation.[177] To maximize efficiency of the project, combined heat and power (CHP) should be utilized to both heat and power the facility. Many plants have been able to totally offset capital costs through savings and revenue from generating this heat and electricity. It is possible to produce electricity for as little as $0.038 per kWh through this system with a 20-year capital repayment horizon assumption. As wastewater treatment plants are frequently municipally owned and operated, this is another opportunity for municipalities to take ownership of carbon emission reduction, while in the process making major buildings in the municipality less energy intensive.



The areas of Michigan that have been deemed by the NREL's resource data demonstrates that many counties in the southern half of the Lower Peninsula have an opportunity to reap benefits from this type of system (see Figure 4.14).[178] For those facilities that already have a digester, it is strongly recommended to construct the infrastructure required to capture and use that methane, as the digester is the most expensive aspect of the construction. For those that do not have a digester, it is recommended that they undergo feasibility analysis to determine the benefits and costs of adding one, including the potential of municipal bonds as a funding source for upfront costs.

CASE STUDY:

Point Loma Wastewater Treatment Plant: This plant in San Diego, CA captures methane to run two continuously running generators capable of producing 4.47 MW of power.[179] This has allowed the plant to become energy self-sufficient and provide excess power into the energy grid to receive credits on other Public Utilities facility energy bills. They additionally produce thermal energy used to heat the plant's digesters in a CHP fashion, maximizing efficiency.

FIGURE 4.14:
Methane Generation Potential from Wastewater Treatment (2008)

Source: NREL.gov

TONS/YR

- > 5000
- 2500 to 5000
- 1000 to 2500
- 500 to 1000
- < 500

APPENDIX E:
RETHINKING TRANSIT

EQUITY + JUSTICE

Historical inequities have caused Michigan's transit network to be quite spaced out, but transforming a system with access and equity at the forefront of the conversation can make a network that works for everyone. It is always important to consider how a policy may affect the most vulnerable members of our society. The pandemic has highlighted this need and shown us just how important it is to push for initiatives that assist the most marginalized among us. The desire to suggest equitable initiatives and next steps in transportation that put residents of Southeast Michigan first is why we decided to conduct interviews as our form of research. Transportation, as a number of the interviewees said, is often at the forefront of social movements and could serve as the solution to tackling various inequities. The following remarks were written with these truths in mind.

BACKGROUND + OVERVIEW

Similar to the research methods utilized in the other research areas, we began our research by drawing ideas and inspiration from Project Drawdown. From there, we researched transportation policies that help reduce carbon emissions; however, it became quite apparent that there are no "best practices" with regards to transportation policies in the same way that they exist in our other policy areas. Because each geographic area has different climate and communal needs, the solutions need to be tailored to the geographic area. When we brought this realization to EcoWorks's attention, they told us that they were unsure of what the Southeast Michigan community wants because EcoWorks rarely engages in transportation policy advocacy. To that end, we decided the best approach to finding the transportation solutions that work best for Southeast Michigan is to ask the people of Southeast Michigan - specifically those planning, administering, maintaining, operating, and using the various public transit use.

METHODS

We define Southeast Michigan as including Livingston, Macomb, Oakland, Washtenaw, and Wayne counties, though most attention was given to the City of Detroit, located in Wayne county. There are numerous busing systems, bike trials, ride hailing services (e.g., Lyft, Uber, etc.), vehicle sharing services (e.g., Zipcar, etc.), bike sharing services (e.g., Mogo), electric scooter sharing services (e.g., Bird, Lime, etc.), and train services (i.e., Amtrak).

The Pandemic altered how and who we interviewed. We met all 7 interviewees via Google Meets or Zoom. Though we were unable to speak with a large number of people or travel around using the public transit systems within the area, we were able to ask important questions to very knowledgeable and influential people in the area's transit network. The interview questions fit within four subject areas. The subject areas and questions were as follows:

Structural Evaluation

- What are 3 things you love, 3 things you want to change about the current system?
- Could you briefly please tell me why transportation is the way it is in Southeast Michigan?

Policy Priorities

- What transportation policy priorities do you have?
- What is the best way to address SE MI's transportation system for more equitable access?

Models to Emulate

- What are examples of good, low carbon, equitable transportation initiatives around the world?
- What specific improvements to Southeast Michigan's transportation network most need to occur to effectively combat climate change?
- Are there existing transportation models you think will work well in Southeast Michigan?
- Are there creative financial models that you are aware of or ones you are trying to bring to Southeast Michigan?

Role for Non-Profits

- What role would you like nonprofits to play in SE Michigan transportation solution?

INTERVIEWS

STRUCTURAL EVALUATION:

All participants in the survey expressed positives and negatives about the current slate of transit systems in Southeast Michigan. Commonly mentioned positives included the number of available options in the current setup and the amount of interaction between the various systems. In many Southeast Michigan towns and cities today, there exists a plethora of public transportation options. Buses are the first thing most people think about when "public transportation" is the topic of conversation. However, other options like motorized scooters, bikes to rent by the hour, and cars to rent by the hour also fall under that umbrella. Some of the interviewees pointed out the symbiotic relationship that exists between the different modes of transportation. Someone can walk a short distance to their bus stop, bus across town, hop on a scooter for a brief period of time, and arrive at their destination. There are a number of barriers to non-bus transportation, namely, financial and physical barriers; but, for those whom those concerns are not a factor, they are indeed great options.

Other positive points mentioned by only one or two of the participants were centrality of transit options, reach of main routes, and interest in bettering transit. However, some people found those positives to be a friendly spin on the negatives within the transit systems. Multiple participants mentioned the low reliability of buses, low investment in transit, and underuse of transit as the largest negatives.

Reliability in busing is a function of coverage across the area and the frequency with which buses come to each bus stop. Anecdotal accounts of the buses being late and real time data corroborate this complaint. According to our interviewees, relying on buses as a means for transportation often means relying on long distance walking as well. This is because the laws that created transportation systems in Southeast Michigan allowed communities to "opt out" of regional plans.[180] One of the interviewees framed this issue as a consequence of the massive amounts of white flight from Detroit to the suburbs that occurred in the early 1960s in response to school desegregation.[181] Regardless, this means for the Detroit residents who work outside the city, which is thought to be more than 60 percent of Detroiters, public transportation may not be a real option.[182]

Investment in transit systems and transportation infrastructure in general are also an issue. Michigan is the car state, but it is also notoriously bad roadways that are known to take out a tire and ruin a morning commute.[183] As the old adage goes "You get what you pay for" and many, including most of the interviewees, point to Michigan's road infrastructure funding as the culprit.[184,185] Another issue is less about the physical than it is about the ethereal system. It is no secret that Michigan loves cars. All interviewees pointed to the strong car culture in Michigan as an issue for furthering transit goals.

POLICY PRIORITIES:
The number one policy priority that came out of our interviews was the need to make public transportation easier, safer, and more affordable for all people. That may sound broad, aspirational, or vague, but it is important to remember that, for many in Michigan, transportation is a business where the ultimate goal is to make money, not serve the people. From that, the transit recommendations were formed.

CONCLUDING THOUGHTS

ROLE FOR NON-PROFITS:
When asked what role organizations like EcoWorks have in creating a better, more accessible public transportation network that also addresses climate change, interviewees expressed a need for community engagement and thought leadership. More specifically, interviewees said:

- Listening to community members to identify their wants and needs is necessary, and educating communities on how they can use transit.
  - People often rely on outdated information with regards to bus routes and schedules. Informing communities as to how they can best utilize transit may help alleviate the public's frustration with public transportation and get more people to use it.
  - Inform people on the importance of public transit and the need for it to be properly funded.
- Advocating for policy that will provide better funding and cleaner forms of energy.
- Organizing alongside other organizations already working in the transportation space.
- Supporting existing methods of public transportation (e.g., busing) as opposed to advocating for new transit methods (e.g., high speed rail).
- Working with government leaders to get the changes the community identifies. formed.

The information gathered from the 7 interviews we were able to conduct is useful and should help to inform further research into what Southeast Michigan residents want out of their public transportation network. Of course, the pandemic limited the number of people we were able to interview and which people we could interview. Future surveys should reach many more people and the bulk of those people should be transit users--those who regularly ride buses, checkout shared bikes, and otherwise engage with aspects of Southeast Michigan's transit systems.

5-1

ALL TRANSIT LEADERS (HIRED, ELECTED, AND APPOINTED) NEED TO HAVE PROFESSIONAL EXPERIENCE IN THE TRANSIT SECTOR AND/OR PERSONAL EXPERIENCE WITH TRANSIT

DESCRIPTION:
Multiple interviewees expressed the need for those in charge of transit to have experience with transit. If the leaders are unaware of the importance of transit and how it works, they cannot begin to understand how it may be improved. Elected, appointed, and otherwise hired leaders should have experience in the transit sector before becoming a leader and/or should regularly consult with operators, customers/consumers, and planners.

5-2

INFORM THE PUBLIC ABOUT THE VARIOUS TRANSIT OPTIONS THAT EXIST IN THEIR AREA AND DE-EMPHASIZE CAR CULTURE

DESCRIPTION:
- Higher transit usage is one of the best ways to reduce carbon emissions with the tools that are currently available.
- The availability of multiple transit options--motorized scooters, buses, bikes, etc.--are great! This creates multiple entry points to the transit network.
- Advertise accurate and updated information about the public transportation network.
- Reduce the number of individual car use perks (e.g., reducing or eliminating free parking days).
- With regards to bussing reliability, get rid of the "opt out" provisions in state law.

5-3

INVEST MORE THOUGHT, MONEY, + OTHER RESOURCES INTO THE TRANSIT SYSTEM AND TRANSPORTATION INFRASTRUCTURE

DESCRIPTION:
- Electric vehicle infrastructure needs to be built out in preparation for future EV buses and personal vehicles.
- Infrastructure development needs to incorporate an inclusive design with factors like dedicated bus lanes.
- Electrification needs to be fueled by clean energy. Burning coal to generate electricity will not do as much.
- Transit systems work better in denser areas where people live near their workplaces, grocery stores, and recreational areas and facilities. City planning should take sprawl's effect on public transportation into consideration.

When considering models to emulate, multiple interviewees made it a point to mention that a true copy-and-paste is impractical because transit networks vary depending on geographic features and the needs of the population. However, places with well working transit networks may help spur ideas. To that end, interviewees mentioned the Los Angeles-metro area in California and the Seattle-metro area in Washington as places with strong transit networks.[186,187] Additionally, many said areas that are similar to Southeast Michigan, like the Indianapolis-metro area in Indiana, should also be examined.[188]

APPENDIX F:
FINANCING SOLUTIONS

EQUITY + JUSTICE

Equitable access to the benefits of a sustainable access hinges on access to financing and credit to support the investment in upgrades and solutions. Without access to direct subsidies, households need access to financing structures that support sustainability and are readily available to all residents. These funds are essential to cover the often large upfront costs related to energy efficiency upgrades, distributed clean energy resources, and electric appliances. Localized health benefits, economic appliances, and climate action must be made available to all residents and businesses. Financial solutions are a key component of achieving equitable and just access.

F

6-1 ON BILL FINANCING

DESCRIPTION:
On-bill financing is an innovative loan program operated and managed by a local electric utility company. A highly simplified loan repayment process, on-bill financing payments are made monthly as part of the property electric bill. No additional payments, accounts, or regulatory hurdles are required.

Holland Board of Public Works and the City of Holland have implemented the only on-bill financing program in the state of Michigan thus far.[189] Under the Holland plan, a non-profit partner, Michigan Saves, conducts an energy audit to identify home energy improvements. To finance the identified improvements, property owners than apply for the loan; however, under inclusive financing principles, no credit score or debt-to-equity checks are required. Qualification only hinges on (1) being a property owner in Holland; (2) having 12-months of payment history with Holland Board of Public Works; and (3) have no delinquent taxes, unsatisfied money judgments, and no bankruptcies within the past three years.

After qualifying for the loan and the installation of the equipment, the property owner pays the loan back over time on their traditional electric bill. Like PACE financing, the loan is associated with the property and can transfer to the new owner in the event of a sale. Holland's program and other on-bill financing structures across the country simplify the process of financing energy improvements. Inclusive financing principles further increase the accessibility of the loans in low-income communities. Such financing structures should be implemented to expand access to clean energy and energy efficiency. In communities with municipal utilities or cooperatives, the local government should push the utility to adopt programs mirroring Holland's effort. For communities in DTE's and Consumer Energy's territories, it is important to engage the utilities and promote on-bill financing as a productive solution.

6-2 PACE FINANCING

DESCRIPTION:
PACE financing (property assessed clean energy financing) is a financing program designed to support sustainability related investments, including energy efficiency and renewable energy. Under PACE financing, commercial property owners are eligible to enter into 25 year, non-recourse loan agreements with payback tied to the property. This has a number of key advantages, particularly for low-income communities.

PACE financing allows a project's entire cost to be covered, ensuring there are no upfront costs and that costs are spread over a long time horizon. Additionally, as the financing is tied to the property, when property owners move, the new occupant simply continues to pay the PACE repayments. Local governments are essential to the PACE structure, providing security to the lender and coordination and administration roles. To establish PACE financing in Michigan, local governments pass a resolution. It is highly recommended to work directly with Lean & Green Michigan, the program's third-party administrator when considering becoming a PACE community.[190] Lean & Green Michigan provides support for communities to ensure no additional staff is needed and program expertise is brought to all communities.

6-3 POWER PURCHASE AGREEMENTS

DESCRIPTION:
Power purchase agreements (PPA) work through coordinating with a developer that specializes in renewable energy who owns, operates and maintains the power system, from which the user of the power purchases the power generated at a fixed or escalating rates.[192,193] In this scenario, the developer is the one who monetizes associated tax credits to make the project more profitable, typically leading to a rate (in either the fixed or escalating scenarios) that is lower than the local utility's rate. The length of the contract is typically 10 to 25 years, at the end of which a variety of options are open to the purchaser, including renewing the contract, having the developer remove the system, or buying the system from the developer.

The advantages of this system for the purchaser includes little or no upfront costs, thereby eliminating the need for a large funding source and offering the opportunity to save money as soon as the system is operational. The fixed rate also offers an advantage for the purchaser in terms of financial planning. As the developer is responsible for system performance and maintenance, there is limited risk for the purchaser in this realm. As developers are experienced in these systems, they are also usually able to better leverage tax credits and incentives, leading to maximizing the financial viability of the project.

The disadvantages to be aware of includes the "locked in" nature of the PPA, such that if electricity rates from conventional utilities decrease (or remain stable under the PPA escalator model), the savings of the PPA would be eroded. However, energy prices have historically increased (by about 6% per year from 2008-2018) and have also increased slightly in all sectors from 2019-2020. The other primary disadvantage is a potential lack of in-house skill to properly negotiate a PPA, for which advisers and consultants can be employed to negotiate.

A case study of a successful PPA is the city of Pendleton, Oregon's agreement with Honeywell Building Solutions and Advanced Energy Systems to install a 100 kWh solar PV system on the roof of its water treatment plant.[194] This involved no upfront costs for the city and the per kWh cost for the generated power at time of installation was lower than the cost from the local utility, with an escalator model of increasing 3% per year. The options for the city at the end of the 20-year contract are to buy the system or opt out and have it removed from the plant's roof.

6-4 BULK BUY PROGRAMS

DESCRIPTION:
Bulk buy programs work by aggregating demand across a community and leveraging that purchasing power to negotiate lower prices, getting a discount for all involved parties. Such programs are often operated by local non-profits, but municipalities themselves should explore the possibility. Bulk buy programs work by bringing together multiple purchasers of the same product (e.g., solar panels, hot water heaters and more) to achieve economies of scale. They support lower costs by increasing purchaser negotiating power and lowering the "soft costs" for solar installers by aggregating orders into a single order. Such programs can conduct community outreach to sign-up purchases, lowering the barrier to adoption, while decreasing the overall cost of the systems.

The Midwest Renewable Energy Association has been operating bulk buy programs to help residents across the region purchase solar panels at a lower overall cost.[191] They conduct a Request for Proposal process to select a single solar installer for the program. They then host community education sessions used to educate the public and sign up participants. The result is a collective action by community members to purchase solar energy for their homes, while saving money and supporting local installations. This program can serve as a model for communities, non-profits, and local governments across Michigan.

APPENDIX G: **TEAM BIOS**

JONATHAN NEWMAN is a dual-degree student in the Erb Institute (MBA/MS) focused on the intersection of technology and business in the renewable energy industry. Prior to graduate school, Jonathan worked in management consulting focused on supply chain and corporate sustainability. He earned his BS in Materials Science and Engineering from Cornell University. He is now building on his technical and business background to help accelerate the transition to clean, reliable energy.

CASEY PATNODE is a dual degree Doctorate of Medicine and Master of Public Health in Environmental Health Sciences at U of M's School of Medicine and School of Public Health, respectively. He is passionate about climate change as a public health crisis that disproportionately affects the most vulnerable and marginalized communities who have contributed to it the least. His goal is to become an Emergency Medicine physician and public health advocate for policies and practices that mitigate climate change and its effects on health.

NICOLE RUSK is a Master of Architecture candidate at U of M's Taubman College. She is a Certified Passive House Consultant who believes in bringing a higher level of consciousness to what architecture can become in service to the community and the environment through sustainable building principles. Nicole's goal is to become a licensed architect, with the intention of creating equitable, socially responsible designs that address our collective and individual spatial experiences.

LANE WOLLERTON is pursuing a dual-degree Master of Science in the Environment and Sustainability with a focus on Environmental Policy and Master of Business Administration from the Ross School of Business. She has experience working in cause marketing and non-profit management, and is hoping to transition to social impact consulting after graduating. Lane is passionate about finding market-driven solutions to social and environmental problems.

SOLOMON FURIOUS WORLDS is a Juris Doctor candidate in his final year at the University of Michigan Law School who focuses on civil rights, government, and First Amendment jurisprudence. He has experience working criminal legal system reform, disability justice, and local government. He also has experience developing scholarship as the Executive Notes Editor of the Michigan Journal of Race and Law and co-authoring a soon-to-be-published piece on the intersection of race and First Amendment jurisprudence. Solomon intends to use his legal skills for the betterment of marginalized communities.

APPENDIX H: **ENDNOTES**

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ACKNOWLEDGEMENTS

ECOWORKS / **DR. ALLISON HARRIS & TEAM**
U-M PROJECT CONSULTANT / **MIKE MAZOR**
U-M ADVISOR / **ODAY SALIM**
DOW ADVISORS / **ELIZABETH LAPORTE + MARGARET WOOLDRIDGE**

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