Winter 2021

Detroit Solar Toolkit

Benefits of Solar

Our Team

THIS TOOLKIT IS SUPPORTED BY A TEAM LEAD BY ELEVATE ENERGY WITH PARTNERS DETROIT COLLABORATIVE DESIGN CENTER, DATA DRIVEN DETROIT, ECOWORKS, GREAT LAKES ENVIRONMENTAL LAW CENTER, MICHIGAN ENERGY OPTIONS, AND THE NATIONAL RENEWABLES ENERGY LABORATORY.

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Background

The goal of the Detroit Solar Toolkit (the toolkit) is to promote the development of privately owned local solar photovoltaic (PV) energy systems in Detroit and encourage the community to deploy projects throughout the city. To that end, this toolkit provides the following resources:

- An introduction to the benefits of solar in your community
- A description of how solar works on your home or business
- Information on the health and safety of solar systems and consumer protections
- Information on connecting with DTE electric service
- Financing options
- Education and training opportunities

Solar PV systems generate clean, cost-effective power anywhere the sun shines. A system has the basic function of converting solar energy in the form of light into electrical energy. It takes multiple panels to provide power to a typical home or office. A collection of panels in your system is called an array. Panels wired into the same inverter are known collectively as a string of panels.

According to the World Health Organization (WHO), solar panels are safe for homeowners and business occupants. However, solar PV systems do pose electrical shock and fire hazards. These hazards are generally mitigated by following building permitting requirements already in place by the State of Michigan and the City of Detroit. For example, solar shut-off systems are required to be within eye sight (five feet from electric meter) for firefighter safety purposes. When considering solar, the first step is always to complete other energy efficiency upgrades or vital repairs in a home or business prior to the solar installation. However, as with other new or emerging technologies, predatory sales practices exist within the solar industry. Assistance may be available for such upgrades, including Wayne Metro Community Action Agency, a resource for those who don't have the means to pay utility bills or afford energy efficiency upgrades or repairs. Some common yet fraudulent claims from predatory sales companies (from the Just Energy Policies & Practices Action Toolkit[1]) are as follows:

1. *"Customers should purchase systems sized to eliminate 100% of their utility bill."*
2. *"It is in the customer's best benefit to offset 100% of their expected electric use."*
3. *"Leasing a solar energy system has the same benefit as owning a solar energy system."*
4. *"All solar energy systems have the same 25-year warranty."*
5. *"If you purchase a battery storage system, you will always have electricity even if you lose power from the utility".*
6. *"You will not have any potential roof warranty issues after we install solar panels on the roof."*

Solar PV systems do not need to eliminate 100% of your utility bill. Often, smaller systems make better financial sense. Leasing agreements are an option, but to realize the full benefits of solar, owning the system often produces a better long-term payout. Warranties will vary. Small battery systems only provide backup power for limited use and for short periods of time. While the best time to install solar is when getting a new roof, or shortly after, always check with your roof warranty on the solar installation clause.

Upon making the decision to purchase and/or have a solar PV system installed, DTE requires that you submit a formal application for customer electric generation. DTE provides information on acceptable equipment and other connection-related details. Specifically, PowerClerk is the software interface to begin an interconnection agreement application. It tracks applications through the entire process for residents and commercial entities for both Category 1 and Category 2 (less than 150 KW) systems (see the section entitled Solar Permitting Process), which covers most applications of solar PV for residents and business in Detroit.

The current pricing trend of residential solar is decreasing in cost, approaching $2.00 per watt installed. Further, the cost of solar and storage behind the meter will reach an inflection point in 5 to 10 years. This reality will benefit communities that have been able to expand residential solar before this period is reached. The addition of batteries to existing systems will quickly expand, ushering in a new resiliency for grid tied behind the meter PV. Currently, the best funding options to install solar PV include leveraging the 30% federal investment tax credit and utilizing financing

1 Marcus Franklin, Katherine Taylor, Lorah Steichen, Swetha Saseedhar, Elizabeth Kennedy, NAACP Environmental and Climate Justice Program, 2017 "Just Energy Policies and Practices: Action Toolkit", available at http://www.naacp.org/climate-justice-resources/just-energy/

options including Michigan Saves and the Detroit Home Repair Loan programs or utilizing a power purchase lease agreement (PPA). Additional financing and incentive options are listed below.

Solar Investment Tax Credits (ITC): The 30% federal investment tax credit (ITC) is among the most important incentives currently available for solar PV. The ITC is a tax credit that can be claimed on federal income taxes for 30% of the cost of a solar PV system. A tax credit is a dollar-for-dollar reduction in the amount of income tax you would otherwise owe. For example, claiming a $1,000 federal tax credit reduces your federal income taxes due by $1,000. The ITC will step down to 26% in 2020, 22% in 2020, 22% in 2021, and a permanent 10% for commercial and utility construction projects started during respective years cited.

Michigan Saves Home Energy Loan Program: Michigan Saves is a nonprofit organization that operates as a "green bank" to offer financing programs that help Michigan residents take control of their energy costs through efficiency and renewable projects. Michigan Saves has a Home Energy Loan Program with available financing up to $40,000 over 12 years at standard rates as low 4.99% APR. This program is eligible for energy efficiency measures, water efficiency measures, and renewable energy systems (e.g., solar PV and battery storage).

Detroit 0% Interest Home Repair Loans: This program for Detroit homeowners offers 10-year, interest-free loans (0% APR) from $5,000 to $25,000 to invest in and repair your home including installing a new roof and solar. Program eligibility requires that safety hazards like mold/lead/asbestos be addressed first. Electrical, roofing, door, window, furnace, plumbing, energy efficiency, and foundations are all potential repair projects.

Solar Lease/Power Purchase Agreement: If utilizing a loan or direct ownership is not a viable option, third-party ownership of solar PV may be a good alternative, as it allows homeowners to avoid upfront installation costs while spreading out the payments. The two third-party ownership arrangements are a solar lease or power purchase agreement (PPA). Under a solar lease arrangement, a homeowner or business enters into a service contract to pay scheduled, pre-determined payments to a solar installation company, which installs and owns the solar system on the homeowner's property. The homeowner consumes the electricity that the leased solar system produces. If the system provides excess electricity to the grid, the owner gets credit for that generation from DTE. The homeowner or business pays the regular utility rate for any electricity consumed beyond what the solar system generates. With a solar PPA, the owner contracts with a project developer that installs, owns, and operates a solar system on the homeowner's site and agrees to provide all of the electricity produced by the system to the homeowner at a fixed per-kilowatt-hour rate, typically competitive with the owner's electric utility rate. Both products allow a homeowner or business to benefit from solar while paying no upfront costs.

Health and Environmental Benefits of Solar

Greenhouse Gas Emissions

There are clear benefits when Detroit residents take a proactive stance toward facilitating greater adoption of solar in the city. One direct and measurable impact for residents is the mitigation of greenhouse gases produced as result of coal and, albeit smaller, natural gas plant energy generation. This has an even more far-reaching impact for local residents when waste to energy or "incinerator" processes are taken into account as it relates to the benefits of municipal policy that drives more commercial and multifamily integration of solar PV. The Detroit-Warren-Ann Arbor area ranks 14th out of 187 metropolitan areas studied for the worst metropolitan area for pollution based on yearly particulate matter (PM) or particle pollution for 2017 from the American Lung Association State of the Air 2018 report.[1]

Approaching the issue from a social equity lens, there is an untapped solar potential in the LMI group: 33% of these LMI rooftops could potentially contribute 970 gigawatts to national solar PV production. The benefit here is that it presents a significant impact on coal fired power plants or waste to energy facilities for electric generation.[2] There is an overwhelming pattern in other cities, including Detroit, in which low income and minority households are disproportionately living near widely dispersed stationary or "point-source" pollution sources.

Approximately 68% of African Americans live within 30 miles of a coal-fired power plant and nearly 40% of communities of color breath polluted air. Meanwhile, environmental justice communities are disproportionately affected by public health effects of traditional generation.[3]

Asthma and Respiratory Health Impacts

Leveraging the Environmental Protection Agency's EJSCREEN: Environmental Justice Screening and Mapping Tool shows that the residents, and, more importantly, the children of Detroit are exposed to the widespread clustering of point-source air pollution based on compliance and permit data for stationary sources.

Embracing solar can reduce coal and natural gas power production reducing air pollution that causes asthma and other chronic lung diseases. Currently, rates of asthma hospitalizations in Detroit are three times higher than the state average[4] and asthma is the leading chronic cause of school absenteeism in Detroit.[5]

Water Resource Quality

Indirectly, the benefits of a reduction in central power plant energy generation through fossil fuels has a net-plus for all residents that reside in southeast Michigan. There are already positive co-benefits that can be gained with an increase in distributed generation utilizing renewable energy. While our study did not focus on this aspect, you can review of some of the near-term steps in the Economic Impact of The Detroit Climate Action Plan[6]. The strategic direction taken in these steps links energy and water together through outreach programs that target youth engagement. Some of these steps are summarized below.

- Engage with the City of Detroit Water & Sewage Department and stakeholders in the community.
- Establish training by retirees (possibly with the Retired Engineers Technical Assistance Program) for high school students to conduct energy and water audits.
- Develop strategies for storm water management such as on-site green/blue infrastructure, rain gardens, and sustainable development.

The Water Resources Assistance Program (WRAP) – Great Lakes Regional Water Authority and DWSD offer programs that directly engage audiences in the areas of energy and water, respectively, and should be considered when creating broader and larger sustainable systems for the city.

1 American Lung Association, State of the Air 2018, available at https://www.lung.org/our-initiatives/healthy-air/sota/city-rankings/msas/detroit-warren-ann-arbor-mi.html#pmann
2 NREL Webinar: "Rooftop Solar Technical Potential for Low-to-Moderate Income Households in the United States", May 1, 2018, 1:00 PM – 2:00 PM EDT.
3 GTM Research, Wood MacKenzie, July 2018, "The Vision for U.S. Community Solar: A Roadmap to 2030", prepared for Vote Solar.
4 Wasilevich, Elizabeth, et al. "Epidemiology of Asthma in Michigan Chapter 12: Detroit - The Epicenter of Asthma Burden." *Chapter 12: Detroit - The Epicenter of Asthma Burden,* Michigan Death File, MDCH, https://www.michigan.gov/documents/mdch/14_Ch12_Detroit_Epicenter_of_Asthma_276687_7.pdf Detroit.
5 Detroit Alliance for Asthma Awareness." *Detroit Alliance for Asthma Awareness | Asthma Initiative of Michigan (AIM),* https://getasthmahelp.org/detroit-alliance-for-asthma-awareness.aspx.
6 Anderson Economic Group, LLC, Jason Horwitz, July 12, 2018, "Detroit Climate Action Report", prepared for Detroiters Working for Environmental Justice, available at https://detroitenvironmentaljustice.org/wp-content/uploads/2018/07/DCAPImpact_Report_FINALv5-2.pdf

Solar 101

The Basics

Photovoltaic, or PV, has the basic function of converting solar energy in the form of light into electrical energy. A cell is the smallest unit in a PV system where 60 or 72 cells are the two quantities produced. The process requires that the solar panels or modules capture a percentage of the light that irradiates the panel. Efficiency is the percent value that is assigned to a module that reflects the highest or "best case scenario or ideal conditions" at which the module can match the manufacturing nameplate production measured in watts (W) and amps (A) of useable energy.

Under real world conditions, this number is rarely achieved based on losses along the path; systems are sized to compensate for the calculated small losses. Ultimately, the wires, connections, inverter, temperature, and conduit for wires have all contributed a small part in reducing the actual usable energy that reaches the main electrical box. A solar installation contractor designs a system that takes into account all of these factors so that the amount of modules installed meets your particular energy production needs. A battery based system sends some of the energy produced to a storage battery where energy can later be used whenever it is needed, based on how a particular PV system is wired for a period of time when electricity is not being generated or taken from the utility grid.

Safe Solar

Solar PV technology is a clean source of energy that offers the benefits of renewable energy and is accessible to a greater number of people. As a mature technology that continues to improve as costs go down, it provides numerous positive impacts for individuals and communities while eliminating the negative health impacts of burning fossil fuels like coal and gas for electricity needs.

Low-Risk Solar PV

1. **Solar PV Panels:** Research by the World Health Organization (WHO) concludes that the health risks for electric fields (between 0 to 100,000 Hz) pose no substantial risk to the public. PV panels produce a direct current (DC) that is stationary (0 Hz). An operating PV panel produces an electro-magnetic field (EMF) that has no impact on a compass needle placed directly on the surface of a panel.[14]

2. **Non-Panel System Components**

- **Racking:** Vertical and horizontal post portions of the mounting structure are composed of galvanized steel or aluminum. This includes both ground-mounted systems and rooftop systems. The racking systems are made of common building materials and would have the same environmental, health, and recycling protocols of existing building materials of similar composition.

14 NC Clean Energy Technology Center, "Health and Safety Impacts of Solar Photovoltaics, May 2017.

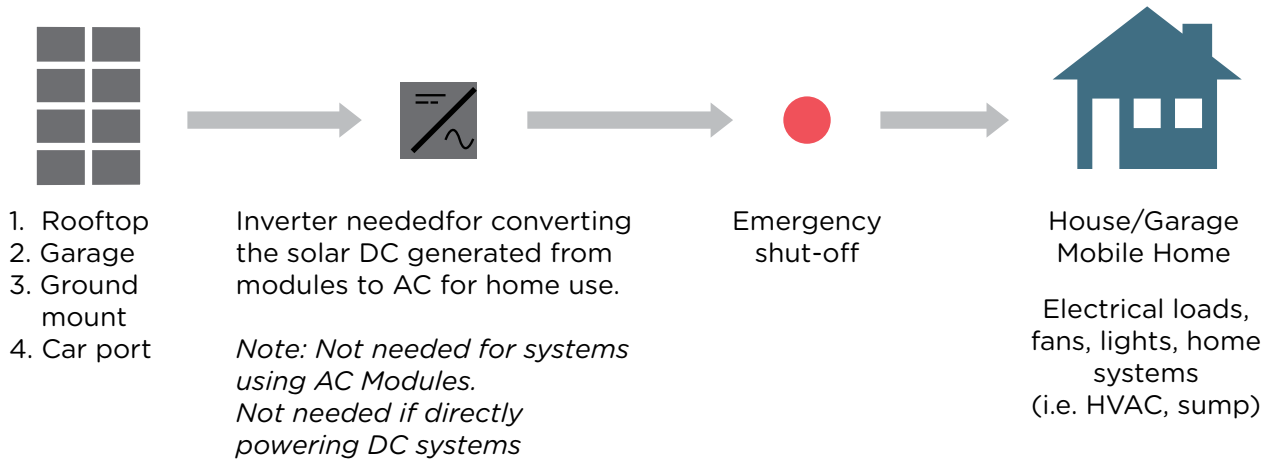


Figure 1: *Basic Solar Layout*

- **Electromagnetic Fields (EMF):** During the operation of a PV system, there is an EMF generation which may be commonly referred to as radiation. An electric field and a magnetic field are the two aspects that comprise the electromagnetic field. The radiation that is generated from large solar facilities is not significant to individuals walking outside of a perimeter of a facility. The radiation that solar facilities produce is not beyond the normal exposure observed for the daily lives of individuals.

3. **Electrical Shock:** There are multiple limited dangers within a residential, commercial, or utility PV system that can cause a dangerous electrical shock. The design and equipment installed for PV systems creates a safe system when industry standard protocols are followed.

4. **Fire Hazards:** There are a small number of components in PV systems that are flammable but the primary fire hazard is associated with the heat generated from a larger intense structural fire. Fire personnel have the greatest risk with fire hazards and only if the system is "not disconnected". There are special PV training programs to address the procedure and techniques for fire personnel to safely address a fire at a structure or site that has installed PV systems.

The safety of PV systems in the U.S. for electrical, mechanical, and fire risk is addressed in the National Electric Code (NEC), International Residential Code (IRC) coupled with the International Energy Conservation Code (IECC), and International Fire Code (IFC), respectively, with additional support in the International Solar Energy Provisions (ISEP). Local municipal codes for the City of Detroit are based on the most up to date standards and procedures that ensure the safety of residents and fire personnel.

PVC System Category Types

Category 1

- Single utility meter
- Single family, commercial
- Rooftop or ground-mounted
- Less than or equal to 20kW

Category 2

- Two utility meters (inflow and outflow)
- Multifamily, commercial, industrial
- Rooftop or ground-mounted
- 21kW up to or equal to 150kW

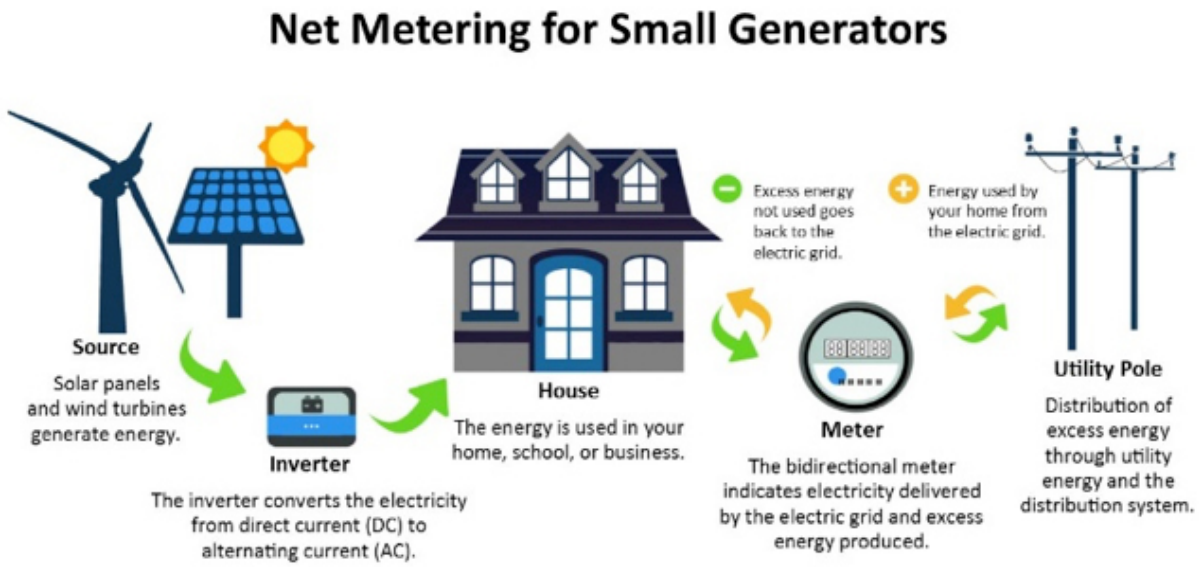


Figure 2: *Current Distributed Generation "retail credit" program in Michigan*[17]

Solar Energy Savings

Residential Solar Declining Cost

The current trend in cost for residential solar is decreasing, approaching $2.00 per watt, installed cost. Solar and storage behind the meter costs could reach an inflection point in five years. This reality will benefit communities that have been able to expand residential solar before this period is reached. The addition of batteries to existing systems will expand quickly, also ushering in a new resiliency for grid tied behind the meter PV. If the trends in Figure 6 and 7 are taken in consideration together, the overall cost for implementing solar PV and solar + storage based systems will be increasingly price positive for not only single family households but also for affordable housing development projects.

Energy efficiency can be considered a two-legged stool when the two major components that define a resident's energy cost or savings is firstly occupant behavior or "habits" and the second is house systems (i.e., furnace, refrigerator, air conditioner). But the third leg that supports integrated energy efficiency is addressing the house shell.[15] There are proven gains in energy bill reduction when a Holistic Residential Strategy is taken to address multiple priority issues and opportunities when supporting LMI households.

As Michigan's utility prices are expected to rise signficantly over the next decade, solar and storage is becoming a more viable option, too . According to the Energy Democracy Initiative, solar and storage will save citizens of Detroit on utility costs by 2022.

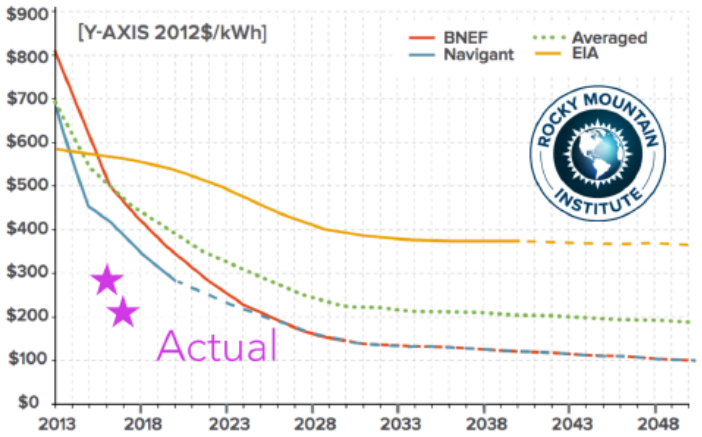


Figure 3: *Solar plus Battery Levelized Cost of Electricity vs. Utility Retail Price Projections*[16]

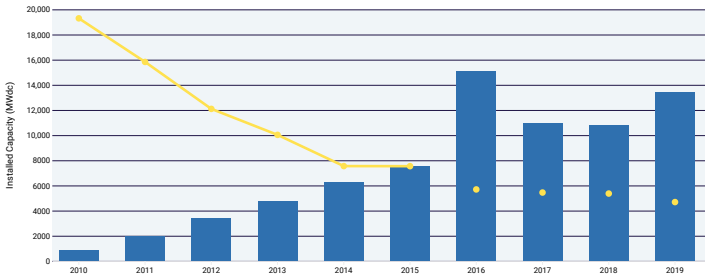


Figure 4: *U.S. Solar: Falling Cost, Rising Deployment* [17]

15 EcoWorks Energy Smart Workbook Curriculum, 2018.

16 Bronski, Peter, et al. *The Economics of Grid Defection, When and Where Distributed Solar Generation Plus Storage Competes With Traditional Utilities.* Rocky Mountain Institute, Feb. 2014, httpswww.rmi.org/wp-content/uploads/2017/04/RMIGridDefectionFull_2014-05-1-1.pdf.

17 "Clean Energy for Low Income Communities Accelerator (CELICA) NEADA Annual Meeting." *Neada.org/,* Better Buildings U.S. Department of Energy, 26 June 2017, www.neada.org/wp-content/uploads/2013/05/DOE-CELICA-NEADA-slides-06-26-17.pdf.

Energy Equity

Local Impact and Energy Equity

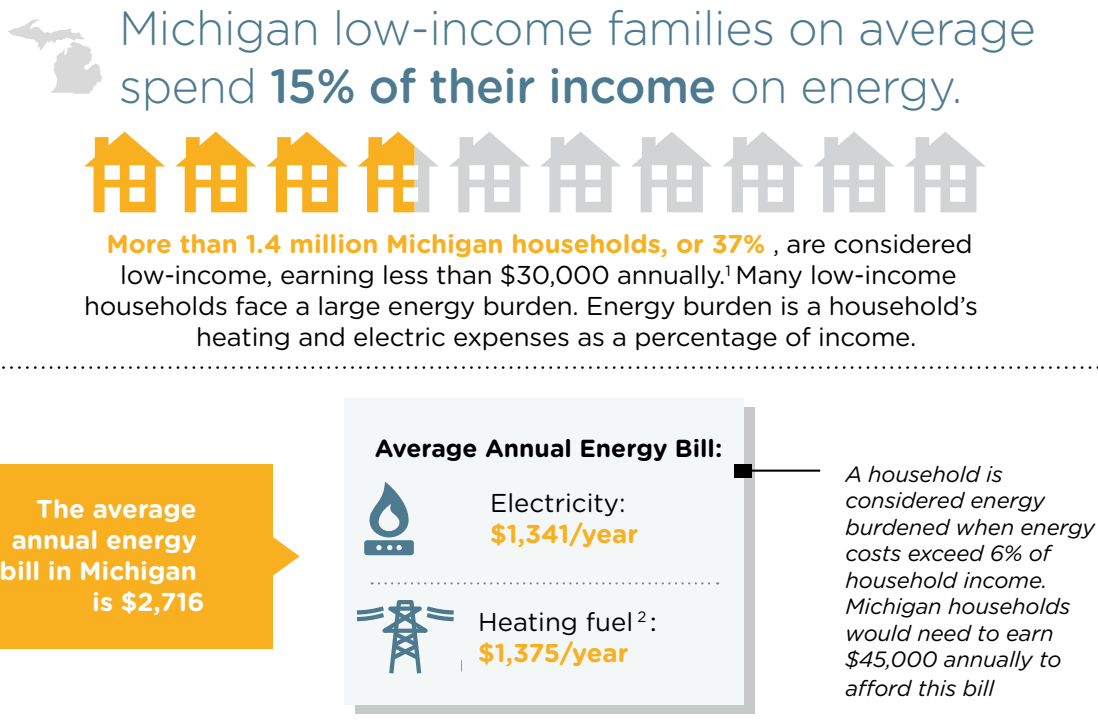
As the energy landscape enters a turning point, the lens on the strength and impact of residential energy programs bears being revisited with the growing interest and demand in solar energy options. LMI residents currently, and in the future, will bear higher energy burdens as costs rise amidst a lack of access to solar programs. Extreme climate and weather events have an even greater burden on urban communities where infrastructure coupled with older housing stock can have cumulative impact on household utility expenses.

Energy Inequality and Energy Burden

In-depth studies have undertaken the task of quantifying the current status of energy policy equity in the State of Michigan through energy efficiency programs as outlined by the Michigan Public Service Commission (MPSC) in their Energy Waste Reduction (EWR) policy.

The state spending trends in the funding for Energy Efficiency Assistance (EEA) and Weatherization Assistance Programs (WAP) have been shown to be underfunded for both the Investor Owned Utilities (IOUs) that operate in Michigan and other utility providers in the Energy Waste Reduction programs mandated by the Michigan Public Service Commission (MPSC). There is a wide variance in the MPSC-approved plans in comparison to the actual investments during the 2010 to 2016 period, having an electric deficit of $73.4 million for both utilities' low-Income programs, according to a report, Social Equity in State Energy Policy: Indicators for Michigan's Energy Efficiency Programs.[7]

When the various demographic characteristics are considered in mapping the disparities in energy



1. The definition of low-income used here is 200 percent of the Federal Poverty Level. For example, a household of two people would be included in our estimate if the income level was at or below $31,020, per the U.S. Department of Health and Human Services 2013 Poverty Guidelines.
2. Eighty percent of survey respondents reported natural gas as their heating fuel.

Figure 5: *Michigan Low-Income Family Energy Burden*[9]

7 Ben Stacey, Tony Reams, Urban Energy Justice Lab School for Environment & Sustainability University of Michigan, December 01, 2017, "Social Equity in State Energy Policy: Indicators for Michigan's Energy "Efficiency Programs"

8 *Energy Burden in Michigan.* Elevate Energy, www.elevateenergy.org/wp/wp-content/uploads/Energy-Burden-in-MI.pdf.

equality, a pattern emerges in which education and household incomes below poverty have a correlation to greater heating inefficiency for systems.[9] This explains, in part, the higher energy use intensity that may be observed for particular census blocks in Wayne County and, in particular, Detroit.

Michigan, despite state disconnection protection policies that include notice requirements, date-based protection, temperature-based protection, payment plans, medical protections, and disconnection limitations that do not include a temperature-based protection in addition to the aforementioned list above regarding utility disconnection policies.[10]

The need for uninterrupted service has been championed locally by Maureen Taylor of the Michigan Welfare Rights Organization. This can be seen on the broader spectrum as a fundamental part of an Inclusive Financing Model[11] that addresses vulnerable populations while providing the benefits of existing energy efficiency programs and DTE Energy Efficiency Assistance (EEA), coupled with direct access to renewables, through all possible mechanisms available.

There is a growing body of work from a wide spectrum of projects around the country that indicate that flat rate discounts and bill payment assistance lack the long-term benefits in dollar savings compared to those receiving LIHEAP or other utility directed programs. This would allude to the potential for LIHEAP directed funds that

incorporate some restricted utilization of funds for solar PV to reduce and provide sustained energy equity for economically vulnerable populations. Increases in fixed charges or distribution rates to recover costs from investor owned utilities transitioned from fossil fuel based generation being taken offline can be expected as the transition cost are passed through to rate payers.

Category	Description	Correlation	
		Heating Consumption	Heating Inefficiency
Economic Status	Median HH income	↑	↓
	% HHs below poverty	↓	↑
Education	% Less HS diploma	↓	↑
Race/Ethnicity	% White HHs		↓
	% African Americans HHs		↑
	% Hispanic HHs		↑
Housing Tenure	% Owner-occupied	↑	↓

Figure 6: *Economic Household Status and Heat Consumption*[12]

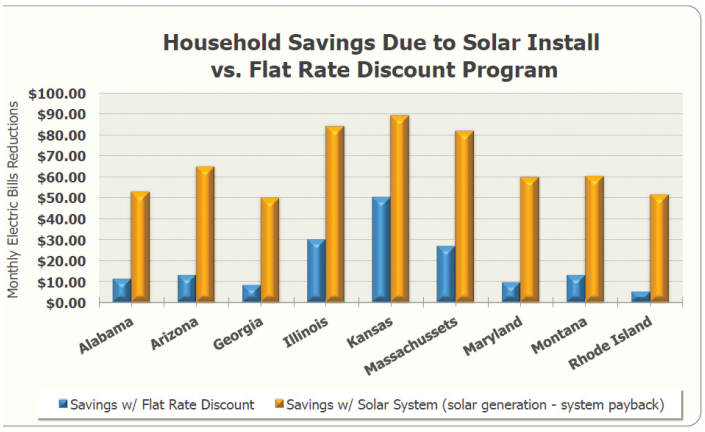


Figure 7: *Flat Rate Utility Discounts and Solar PV Lifetime Savings* [13]

9 Bednar, D.J., Reames, T.G. and Keoleian, G.A., 2017. Energy and Buildings "The intersection of energy and justice: Modeling the spatial, racial/ethnic and socioeconomic patterns of urban residential heating consumption and efficiency in Detroit, Michigan", 143, pp. 25-34.

10 Marcus Franklin, Carolina Kurtz, Mike Alksnis, Lorah Steichen, Chiquita Younger, NAACP Environmental and Climate Justice Program, March 2017 "Out In the Cold, Reforming Utility Shut-Off Policies as If Human Rights Matter".

11 Local Self-Reliance's Energy Democracy Initiative.

12 Bednar, D.J., Reames, T.G. and Keoleian, G.A., 2017. Energy and Buildings "The intersection of energy and justice: Modeling the spatial, racial/ethnic and socioeconomic patterns of urban residential heating consumption and efficiency in Detroit, Michigan", 143, pp. 25-34.

13 Amit Ronen, Dor Hirsh Bar Gai, and Lucas Crampton, GW Solar Institute, "Can Electricity Rate Subsidies Be Reallocated to Boost Low-Income Solar?", available at https://solar.gwu.edu/sites/g/files/zaxdzs2391/f/image/Reallocating%20Subsidized%20Rates%20for%20Low-Income%20Solar.pdf

Example Solar PV Systems in the Community

Solar energy is a proven technology that harnesses energy from the sun to create electricity with many different installation types existing in Detroit and similar communities in Michigan today. Figures 9 through 14 display different local installation types. These are most commonly roof- or ground-mounted, but carports and siding installation options are also available depending on the location and size of the installation.

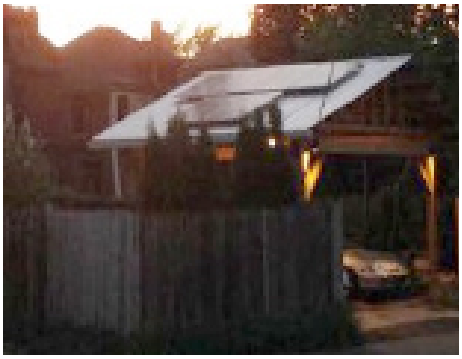


Figure 8: *Solar Carport in Detroit (East English Village Eastside)*

Figure 9: *Gesu Catholic School rooftop array in Detroit (6 Mile-Northwest)*

Figure 10: *Single family rooftop array in Detroit (Cherrylawn-Northwest)*

Figure 11: *Multifamily apartment ground mount array in Detroit (Brainard St. Apts-Midtown)*

Figure 12: *Commercial building with Building Integrated PV (BIPV) as facade - Detroit, MI (Navitas House-Downtown)*

Figure 13: *Solar parking lot bays in East Lansing MI (MSU)*

The Community Solar Landscape

Any discussion about the opportunities, challenges, and policies around community solar development in the U.S. must begin with the existing policy landscape. This was clearly recognized at the onset of this assessment and has been fully dissected with regard to the legal underpinnings of what is and what is not possible with current energy policy regulations in the State of Michigan.

At the present time, there are 11 states with policies or developments to support LMI adoption of community solar through carve-outs, incentives, policies, or a combination of carve-out and LMI incentives. A brief overview of some "flavors" of community solar programs follows.

Baltimore Gas and Electric Community Pilot Energy Program[18]

Program Highlights:

- Category Limits: Subscriber Organization minimum of 30% kWh output provided to LMI customers
- Minimum Subscription size of 2kW
- Open to nonprofits, schools, and businesses

Pilot Programs (Baltimore)

The Baltimore Gas and Electric Community Pilot Energy Program promotes greater access to solar for residents through the use of subscription and on-bill payment options. While these options are not currently available in Michigan, the Baltimore program shows how minimum requirements for LMI subscribers can be applied to help ensure equitable access to reduced energy costs by all residents. The pilot program is currently in the second of three years.

Figure 14: *Community solar "canopy" over parking lot in BGEC Community Pilot Site* [19]

Figure 15: *Nixon Farm solar garden - Power52 solar farm project, BGEC Community Pilot Site* [20]

18 "BGE Community Solar Pilot Program." *BGE Community Solar Pilot Program | Baltimore Gas and Electric Company,* Baltimore Gas and Electric Company, 2019, https://www.bge.com/SmartEnergy/InnovationTechnology/Pages/BGECommunitySolarPilotProgram.aspx.

19 Bedell, John. "Solar Panels at the Community College." *Solar Panels at the Community College,* 2 July 2017, http://www.benedante.blogspot.com/2017/07/solar-panels-at-community-college.html.

20 Peltier, Laurel. "Greenlaurel: Ray Lewis' Power52 Solar Farm Offers Training for At-Risk Job Seekers." *Baltimore Fishbowl,* 7 Nov. 2017, www.baltimorefishbowl.com/stories/greenlaurel-ray-lewis-power52-solar-farm-offers-training-for-at-risk-job-seekers/.

Co-Ops (Minnesota)

Community Energy Futures (CEF) is an energy efficiency-based, community-owned clean energy cooperative located in South Minneapolis with membership that extends throughout Minnesota. Outside of the products and services available to its members, CEF develops community solar gardens for members including renters, homeowners, businesses, and other organizations.

Energy Service Companies (Philadelphia)

An energy service company (ESCO) could be considered as a valuable partner for public buildings or infrastructure projects that may not have payback periods or minimal gains if undertaken by the city. Performance-based contracts through an ESCO could potentially increase the deployment rate for projects deemed not suitable by financial modeling.

Nonprofits (Colorado)

The State Energy Office of Colorado holds a unique and groundbreaking pathway for equitable solar deployment as the first example of LIHEAP funds utilization with 300 single family WAP and LIHEAP funded solar rooftop installations. It is of note that the Colorado Energy Office, Energy Resource Center, and Colorado Springs Utilities partnered to craft the program.

Special Purpose Entities (Massachusetts)

With a special purpose entity, the outcome is similar to community solar gardens in other states but much of the legal and business technicalities are handled by a third party, like My Generation Energy in Massachusetts. It facilitates the deployment of community solar gardens by creating an LLC that represents the community cooperative while the development and management responsibilities are handled by the special purpose entity (the LLC) to serve the members of the community cooperative corporation.

Mid-Rise Cooperative (Detroit)

The Riviera Cooperative will be a transitional affordable housing community sponsored by Nardin Park Nonprofit Housing and Community Development Corporation (NPHACDC). The cooperative concept enables the residents to own an equal share of stock in the cooperative corporation with shared expenses associated with the operation of the cooperative buildings, grounds, and mortgage expenses. A solar PV array is included in this concept. This form of ownership is also a pathway to wealth building.

Marcus Garvey Apartments Microgrid, Brooklyn, New York

Program Highlights:

Start of operations: 2017
Energy storage: 300 kW/1.2 MWh
Renewables: 400 kW solar PV
Other energy source: 400 kW fuel cell
Client benefits: Lower energy expense, resilient back-up power
Grid services: Four-hour daily load reduction, solar self-consumption, improved grid reliability

Figure 16 *Rooftop arrays of Marcus Garvey Apartments Microgrid, Brooklyn, New York* [21]

21 Froese, Michelle. "How Solar Storage Changed a New York Neighborhood." *Energy Storage Networks,* 8 Feb. 2018, https://www.energystoragenetworks.com/solarstorage-changed-new-york-neighborhood/.

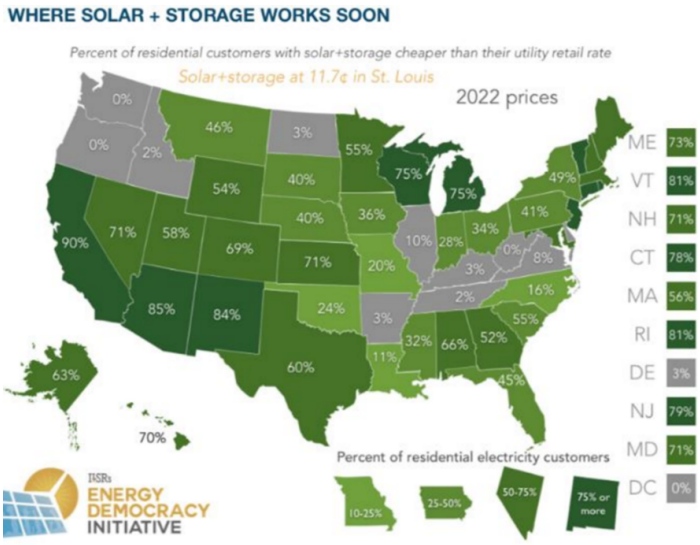


Figure 17 *Forecasted percentage of commercial customers where solar and storage will cost less than utility rates with demand charges* [22]

The map suggests that if current trends continue with increases in current utility prices through 2022, declining PV system prices per kW, and lithium solar storage batteries, there will be a favorable payback case for 75% of Michigan residents. The 75% is based on a 5 kW array and 7 kW Tesla Powerwall compared to retail rate utility prices. The Rocky Mountain Institute and Bloomberg New Energy Finance in recent reports have shown that the actual cost of battery storage has declined at a far greater rate than prior industry predictions of 3 to 4%.

22 Farrell, John. "Reverse Power Flow: How Solar Batteries Shift Electric Grid Decision Making from Utilities to Consumers." *Institute for Local Self-Reliance,* 12 Dec. 2018, www.ilsr.org/solar-plus-storage.

Solar FAQs

Q. Do we get enough sunshine in Michigan for solar to work?

A. Yes, our solar daylight hours are over four hours when averaged for the entire year.

Q. Can I still obtain a permit for solar if I have blight violations?

A. No.

Q. Can I mount solar panels on my garage?

A. Yes, that would be considered under Accessory Use Zoning.

Q. Where do you go online to submit permits for the City of Detroit?

A. ePlans is name of the online submission portal. https://detroitmi.gov/departments/buildings-safety-engineering-and-environmental-department/building-permit-information/electronic-plan-review-eplans-building-permits

Q. How should I handle a neighbors' branches growing over my yard, shading my solar panels?

A. Michigan does not recognize any common law rights to sunlight. Therefore, you have no right to solar access unless negotiated privately or by a state or local law.

Q. Do I need a mechanical permit for installing solar panels on my roof?

A. No. But an electrical permit is one of the requirements.

Q. How far from the property line do my solar panels need to be for zoning requirements?

A. There are no special requirements for solar energy systems.

Q. All of my plans have been submitted and approved by DTE, do I still need to deal with Detroit permits?

A. Yes, this is a safety and health issue for all residents so that EMS or firefighters can approach homes with awareness of electrical hazard potential.

Q. Can I submit all of my paperwork for DTE and City of Detroit online?

A. Yes.

Q. I already installed my PV array, Should I still file an interconnection with DTE and permits to the City of Detroit?

A. Yes, if you would like any net-metering credits for solar energy you are generating beyond your daily consumption. (The current net-metering option will only be available for interconnection applications filed before rate case decision sometime after April and before June 2019. If you are not connecting through the DTE smart meter, then you would not need to file with DTE. The City of Detroit could potentially cite you with a code violation.

Q. Can I legally share my electricity with my next door neighbor?

A. No. Current Michigan law will not permit you to transport over parcel boundaries to another entity.

Q. Can I install solar panels in the empty lot that I own next to me?

A. Yes, that system would be considered an accessory use for the empty lot.

Q. I'm a developer looking to install solar on some empty lots next to different homes I own in Detroit. Do I need to get permits for each system or can I just submit one package for them all together?

A. Each house is considered a separate system so they will all require individual review but you could submit all at the same time.

Q. Will my solar PV system still work if the power goes out in my area?

A. No. Solar PV systems are set up to shut down but a "hybrid inverter system" design can operate in "island mode" and allow you to be completely removed from the grid while still feeding power to your secondary/backup electrical panel.

Q. Do I still have to pay DTE even if I only use my own solar generated electricity and none of theirs?

A. After May 2019, you will be required to pay a monthly service connection fee despite not using any electricity through the DTE meter.

Solar Glossary

This is a list of some of the common terminology that is used in describing and discussing photovoltaic systems for residential or small commercial systems. A PV installation solar contractor, advocacy group, or utility company may use some or all to explain the different aspects of the PV systems and development. For additional definitions including language associated with community solar and financial models for PV systems.

Array: Any number of photovoltaic modules connected together to provide a single electrical output. Arrays are often designed to produce significant amounts of electricity.

Behind the meter: Refers to solar installed on the property of a residence or business for the customer's own use. The electricity generation from the solar array is used on-site and reduces that customer's demand on the electricity grid.

Balance of system (BOS): Represents all components and costs other than the PV modules. It includes design costs, land, site preparation, system installation, support structures, power conditioning, operation and maintenance costs, batteries, indirect storage, and related costs.

Solar battery: A device that reserves energy for later consumption that is charged by a connected solar system. The stored electricity is consumed after sundown, during energy demand peaks, or during a power outage.

Cell: The basic unit of a photovoltaic panel or battery.

Charge controller: An electronic device which regulates the voltage applied to the battery system from the PV array. It is essential for ensuring that batteries obtain maximum state of charge and longest life.

Community solar: Also known as Shared Solar or Community Shared Solar. Under a community solar model, multiple shareholders (owners) purchase one or more solar panels or kW capacity in a centralized array. These shareholders receive financial benefits (credit on their utility bills, cash payments, etc.) from the solar energy production.

Distributed systems; distributed generation (DG): Systems that are installed at or near the location where the electricity is used, as opposed to central systems that supply electricity to grids. A residential photovoltaic system is a distributed system.

Electrical grid: An integrated system of electricity distribution, usually covering a large area.

Grid-connected (PV system): A PV system in which the PV array acts like a central generating plant, supplying power to the grid.

Inverters: Devices that convert dc electricity into ac electricity (single or multiphase), either for stand-alone systems (not connected to the grid) or for utility-interactive systems.

Kilowatt (kW): 1000 watts.

Kilowatt-hour (kWh): One thousand watts acting over a period of one hour. The kWh is a unit of energy. 1 kWh=3600 kJ.

Load: Anything in an electrical circuit that, when the circuit is turned on, draws power from that circuit.

Megawatt: 1,000,000 watts.

Module: A number of PV cells connected together, sealed with an encapsulant, and having a standard size and output power; the smallest building block of the power generating part of a PV array. Also called a panel.

Peak load; peak demand: The maximum load, or usage, of electrical power occurring in a given period of time, typically one day.

Photovoltaic (PV) array: An interconnected system of PV modules that function as a single electricity-producing unit. The modules are assembled as a discrete structure, with common support or mounting. In smaller systems, an array can consist of a single module.

Photovoltaic (PV) cell: The smallest semiconductor element within a PV module to perform the immediate conversion of light into electrical energy (dc voltage and current).

Photovoltaic (PV) efficiency: The ratio of electric power produced by a cell at any instant to the power of the sunlight striking the cell. This is typically about 9% to 14% for commercially available cells.

Photovoltaic (PV) system: A complete set of components for converting sunlight into electricity by the photovoltaic process, including the array and balance of system components.

Power Purchase Agreement (PPA): A legal contract in which a developer owns and operates a solar array and customer or group of customers agree to purchase the system's electric output for a predetermined period.