City of Detroit
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TO: The Detroit City Council

FROM: David Whitaker, Director
Legislative Policy Division

DATE: April 14, 2022

RE: The Creation and Usage of Micro Grids in Detroit

The Legislative Policy Division (LPD) has been requested by Council Member Coleman A. Young, II to provide a report on the City of Detroit's plans for developing microgrids, what areas of the city are being considered, and how the federal, state, and city government can aid in these projects. Additionally, Council Member Young II would like to know what role DTE, and the Public Lighting Authority can play.

The Michigan Public Service Commission (MPSC) defines microgrids as a series of interconnected loads and distributed energy resources (DERs) within clearly defined electrical boundaries. Microgrids can act as a single controllable entity with respect to the grid and can operate in both grid-connected mode or island mode.[1] They are an important part of integrating the energy produced from renewable energy sources such as solar panels or wind turbines. Microgrids provide a distribution option for decentralized energy production and can aid in ensuring that essential systems remain operational in the case of a power outage. There are several reports that have been written about the importance of moving from centralized electrical system towards decentralized systems to provide more opportunity to incorporate renewable energy and local production of electricity.

[1] https://mi-psc.force.com/sfc/servlet.shepherd/version/download/0688y000001jEwjAAE

The flooding events of June 2021 and the failure of the electrical systems of pumping stations throughout the City of Detroit has been a cause of particular concern for the city.[2] With climate change continuing to worsen events like those of last summer will continue with more regularity. Microgrids can store large amounts of energy and divert backup power to support critical loads, particularly in emergency situations. One example of the use of microgrid projects in severe weather was when Hurricane Sandy hit new England in 2012.[3] Sandy knocked out power for millions of households and many backup generators failed at critical facilities. However, existing microgrid systems continued to function and kept hospitals, school buildings, and other critical facilities operational.

DTE and Solar Energy

DTE, the City of Detroit's energy provider, has continued to report issues with the reliability of their grid in recent years. In fact, the company's system-wide average interruption frequency index (SAIFI) and system average interruption duration index (SAIDI) showed that substations in the city were some of the worst performing in the state.[4] One of the main factors that has caused outages in Detroit is the aging electrical infrastructure that presently exists. Although this infrastructure is continuingly being replaced, it comes at a high cost and will take time to be completely overhauled. DTE has invested millions into production of electricity from renewable sources such as solar. However, much like fossil fuel, renewable energy is currently being produced in large solar parks like the Lapeer Solar Park and then distributed to the users, sometimes over long distances. This kind of centralized production and distribution causes large losses in the transfer of energy and does not have the kind of battery storage that can help local communities in the event of an outage.

DTE does support customers investing in rooftop solar systems and encourages them to sell back excess production to them. However, they do not encourage communities to invest in microgrids and battery storage. In fact, they inform their customers that the use of battery storage could disqualify eligibility for service. DTE requires customers to apply to add a battery storage system to determine eligibility.

Case Studies

Brightmoor Neighborhood (Detroit, MI)

Wayne State professor Caisheng Wang and his former student Chelsie Dundas authored a research paper titled *Urban Microgrids: A Review and Applications in Postindustrial Detroit*

[2] https://www.freep.com/story/news/local/michigan/2021/07/02/detroit-pumping-stations-had-breakdowns-during-heavy-rains/7839172002/
[3] Urban_Microgrids_A_Review_and_Applications_in_Postindustrial_Detroit_Area.pdf
[4] https://mi-psc.force.com/sfc/servlet.shepherd/version/download/0688y000002VfFsAAK

Area in 2018.[5] The report reviewed and explored the application of microgrids throughout the United States and how they could be utilized in the City of Detroit. The report stated that Detroit has many opportunities to apply urban microgrids. The city's high vacancy rates and the remaining utility infrastructure that necessitates maintenance are a burden that can be mediated by microgrids. Neighborhoods that this report highlighted as having the highest vacancy rates include Brightmoor, Condon, Chadsey, and Ravendale.

The Brightmoor Neighborhood was chosen by the researchers as a case study on how an urban microgrid could benefit the community. The current conditions of the neighborhood and its declining population were factors that contributed to the neighborhood being chosen. The National Renewable Energy Lab (NREL) estimates that to produce 1 megawatt (MW) or 30,000 kWh of solar powered electricity would require approximately 4 acres of crystalline fixed solar powers. The researchers used these estimates to develop a 6 MW solar energy system which would have the capacity to power 1,100 homes. In addition, the usage of battery storage would provide higher rates of solar energy utilization.

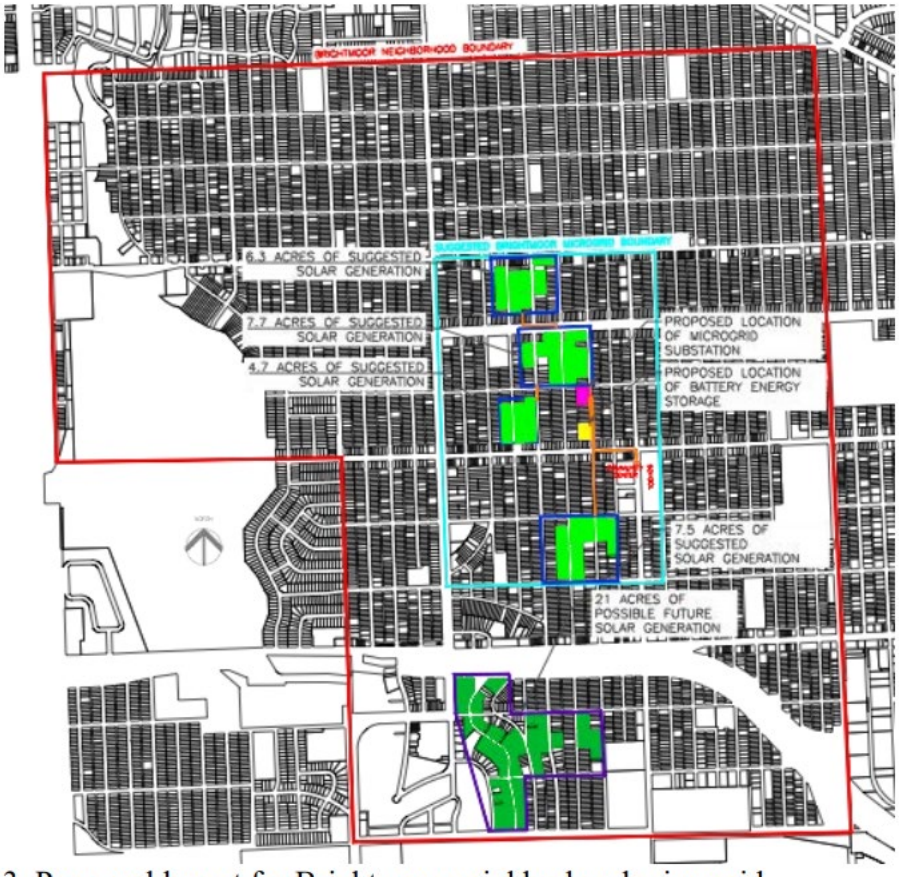


Fig. 3. Proposed layout for Brightmoor neighborhood microgrid.

Source: Urban Microgrid: A Review and Applications in Postindustrial Detroit Area

[5] Urban_Microgrids_A_Review_and_Applications_in_Postindustrial_Detroit_Area.pdf

The figure above shows the battery storage station (yellow box) centrally located and close to the sites of solar generation on vacant land. This system could provide 1 MW of backup power for the1,100 homes for one day. Although this plan has not been implemented it provides a model for a pilot project that could be done in Detroit.

Parker Village Microgrid (Highland Park, MI)

Figure 1. Parker Village Comprehensive Plan

SOURCE: Paul Bierman-Lytle, Sustainable Environment Associates Corporation (SEAS).

Parker Village, a neighborhood in Highland Park, MI, designed a plan for a solar-plus-storage microgrid.[6] In their report they mentioned that "neighborhoods microgrid can connect with one another to form a network of clean energy resources having greater resilience and flexibility and assisting communities desiring energy sovereignty and greater local control of their energy needs." The plan focused on the installation of rooftop solar within the neighborhood and the usage of a centralized battery storage system. The HOMER Grid model was used to identify how a microgrid could be incorporated into Parker village.[7] The NREL was also used to identify the electrical load profile of Parker Village. Park Village's analysis showed that the use of a grid-separated or islanded microgrid was feasible, however, it would require a large amount of solar and battery capacity. Fossil fuel backup generation would also be required to run during periods when solar and battery storage cannot completely meet power demands.

Ann Arbor Microgrid Study (Ann Arbor, MI)

[6] www.ucsusa.org/resources/let-communities-choose-clean-energy

[7] LPD notes HOMER Grid "combines engineering and economics to rapidly perfume complex calculations enabling you to compare design outcomes and consider options for minimizing project risk and reducing energy expenditures."

The City of Ann Arbor requested for the University of Michigan to conduct an assessment of possible sites for microgrids, focusing on resilience of assets and reduction of emissions. This request was made to work towards reducing the city's emissions by 90 percent of year 2000 by 2050. Ann Arbor sees the use of microgrids as a tool to increase the usage of renewable energy instead of fossil fuels. The University of Michigan *Solar Microgrid Feasibility Study for City of Ann Arbor* was completed in 2017 by students and staff from the University.[8] Initial research and discussion concluded that solar photovoltaic (PV) systems were the most easily adapted to available city sites and therefore provided the best opportunity for microgrid usage. Additionally, the use of battery storage was seen as an important factor for increasing resiliency.

A team of University of Michigan students and staff selected 60 sites from an initial listing of 212 city-owned sites. This list included fire stations, parking structures, the city landfill, and Ann Arbor Public School properties as potential sites for the creation of microgrids. To calculate annual energy-per-area solar ratios, estimates from the NREL's PBWatts calculator were used. Those ratios were then multiplied by land area footprints to create production estimates for each site.

NREL's System Advisor Model (SAM) was used to model and compare lithium-ion and lead-acid battery installations at select sites. The results of this study concluded that fire stations 2,3, and 4 would be feasible sites for solar and battery storage and would cost approximately $306,200. This installation would result in total life cycle analysis (LCA) emissions reductions of 81.4 tonnes of CO2e/year, with a combined potential generation capacity of 162.3 MWh/year. The payback period of the solar and battery storage microgrid system would be about 13 years.

Brooklyn Microgrid (Brooklyn, NY)

The Brooklyn Microgrid (BMG) focuses on a communal energy network between neighbors and businesses within the local community.[9] The BMG is an energy marketplace for locally generated solar energy. The BMG marketplace allows prosumers to sell the excess solar energy they generate to other NYC residents who prefer renewable energy.[10] Prosumers are not disconnected from the grid but are able to create energy for themselves and others in the community.

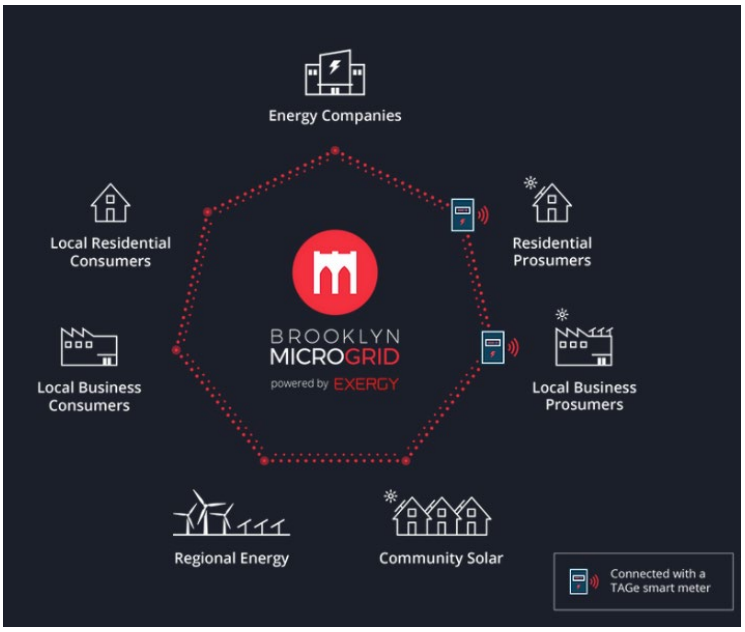
The science behind the Brooklyn Microgrid includes the utilization of blockchain technology a permissioned data platform (the Exergy platform) to create a local energy marketplace for transacting energy across existing grid infrastructure. Using the Exergy platform prosumers generating energy through their own renewable resource can transact energy autonomously in near-real time with consumers on the platform in their local marketplace. The BMG defines a microgrid as an ecosystem of connected prosumer and consumer energy assets. Energy in a

[8] 2017j-Arnuk_et_al_Microgrid_Study_Ann_Arbor.pdf

[9] The BMG can be contacted at info@brooklynmicrogrid.com and more information is available at https://www.brooklyn.energy/

[10] LPD notes "Prosumers" are residential, and commercial solar panel owners who produce the energy that can then be used and sold.

microgrid is generated, stored, and transacted locally, creating more efficient, resilient, and sustainable communities.



Source: Brooklyn Microgrid | Community Powered Energy

The benefits of the Brooklyn Microgrid are it supports the local economy through purchasing energy. Reduces the greenhouse gas emissions and air pollution from conventional fossil fuel energy production.

Funding Opportunities

FEMA Hazard Mitigation Assistance Grant Funding

The Federal Emergency Management Agency (FEMA) provides grants for microgrid projects through FEMA Hazard Mitigation Assistance programs.[11] Hazard mitigation is considered any sustainable action that reduces or eliminates long-term risk to people or property from future disasters. A microgrid used to provide backup power for pumping stations in Detroit could be considered hazard mitigation and therefore be eligible for funding from FEMA. In 2020, FEMA announced that $500 million would be distributed through the Building Resilient Infrastructure and Communities (BRIC) grant program for microgrids, energy storage, and other energy solutions that reduce disaster risk and losses.[12]

Department of Energy GMI Funding

In the past, the Department of Energy's Grid Modernization Initiative (GMI) has offered several grants that support the creation and usage of microgrids to combat the impacts of climate

[11] https://www.fema.gov/grants/mitigation
[12] https://microgridknowledge.com/fema-infrastructure-grants-microgrids/

change.[13] For example, the Resilient Electricity Delivery Infrastructure (REDI) Initiative is a past funding opportunity that was available to deploy smart grid technologies to improve climate preparedness and resiliency of the electricity delivery infrastructure.

EGLE's Office of Climate and Energy

The State of Michigan Department of Environment, Great Lakes, and Energy (EGLE) Office of Climate and Energy has several funding opportunities for solar and other renewable energy production programs. These include MI Solar Communities Program, Community Energy Management Program, and Sponsorship Program.[14]

Detroit Green Taskforce

As a part of the research for this report LPD staff spoke with and presented to the Detroit Green Taskforce's Renewable Energy Committee about microgrids and their incorporation in the city. The Green Taskforce is in support of exploring possible sites for microgrids in the city and points to the urgency of the climate crisis. They referenced the Intergovernmental Panel on Climate Change's (IPCC) report on the state of the worsening climate and the small amount of time left to reverse the warming of the planet.[15] The committee explained that the city's Public Lighting Authority status as independent of DTE's influence could be utilized to pursue microgrids and renewable energy usage.

According to the Michigan Public Service Commission (MPSC), there are state regulations that hinder the pace and adoption of microgrids and energy storage.[16] Specifically, Michigan Administrative Code Rule 411(1)(a) makes distinctions on the distinction between customers and producers of energy and restricts the transferring of utilities from one customer to another. For example, this rule would restrict a rooftop solar homeowner from transferring their excess power to others in the community, which is one of the attractive capabilities of a microgrid. However, integrating microgrids and removing regulatory barriers are a priority for the MPSC's MI Power Grid Initiative. LPD recommends that the Detroit Green Taskforce be consulted in any plans for microgrids, or other renewable energy projects initiated by the City Council. Although there are barriers to the use of microgrids in the State of Michigan, the urgency of the worsening climate crisis necessitates immediate action towards alternative sources of energy production and investment in renewable energy.

Conclusion

The City of Detroit is indeed ready for microgrids and there are enough examples of the effectiveness and feasibility of these projects across the state and country. Unfortunately, the

[13] https://www.energy.gov/gmi/gmi-funding-opportunities
[14] https://www.michigan.gov/climateandenergy/0,4580,7-364-85453_85455_85523---,00.html
[15] https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf
[16] https://mi-psc.force.com/sfc/servlet.shepherd/version/download/0688y000001jEwjAAE

flooding events of June 2021 in Detroit are a sign of things to come as climate change continues to intensify severe weather events. The use of microgrids to provide backup power for pumping stations is a realistic mitigation option that the city can help to facilitate. A feasibility study of city-owned sites like the study conducted by the City of Ann Arbor is one step the City Council could pursue.

If we can be of any further assistance, please call upon us.