COMMUNITIES LEAP
U.S. DEPARTMENT OF ENERGY

# Minneapolis American Indian Center Solar + Battery Resilience Hub

The Minneapolis American Indian Center (MAIC) is exploring opportunities to become a clean energy resilience hub to provide critical community services during power outages, including shelter and warmth or cooling. Resilience hubs that are powered by renewable energy can support the Minneapolis Climate Equity Plan by reducing carbon emissions and increasing community resilience to extreme weather conditions.

The National Renewable Energy Laboratory (NREL), through the U.S. Department of Energy's Communities LEAP (Local Energy Action Program) pilot, worked with MAIC as well as Renewable Energy Partners—a Minnesota-based, Black-owned and -operated solar developer—to quantify the costs and benefits of installing stand-alone solar photovoltaics (PV) and PV paired with battery systems to reduce energy costs, avoid emissions, and improve resilience.

> The Minneapolis American Indian Center (MAIC) is one of the country's first urban American Indian Centers. MAIC provides educational and social services to more than 10,000 members of the city's Native American community annually and aims to preserve cultural traditions through art, youth, and intergenerational programs. Learn more: https://www.maicnet.org/.

## Solar PV and Battery Analysis Approach

NREL used REopt®, a techno-economic decision support platform, to assess the economic, emissions, and resilience impacts of potential on-site solar PV and battery storage investments at MAIC. This tool identifies the optimal mix of renewable energy, energy storage, and grid electricity to meet cost savings, resilience, emissions reductions, and energy performance goals. Learn more about the REopt web tool at https://reopt.nrel.gov/tool.

## PV and PV + Battery REopt Results

The NREL team modeled different solar plus battery options using REopt for MAIC to better understand the range of possible benefits. The following results consider four investment options: (1) solar PV on MAIC's currently available roof area, with no battery, (2) pairing the rooftop solar with a battery to provide resilience for 2 days, (3) pairing the rooftop solar with a larger battery to provide additional resilience, and (4) the cost-optimal size of solar PV and battery capacity to provide resilience. The three battery system designs highlighted below can provide 2 days of resilience for MAIC, assuming 50% of typical loads must be powered during an outage. Note that the results and benefits from this analysis are preliminary and may change based on project needs, system design, and engineering analysis.

**Figure 1. Analysis of PV and PV + Battery Infrastructure Options for the Minneapolis American Indian Center**

| | | Scenarios Providing Two Days of Resilience | | |
|---|---|---|---|---|
| **Investment Strategies** | **Rooftop Solar PV**<br>268 kW PV,<br>no battery | **Rooftop Solar PV + Resilient Battery***<br>268 kW PV,<br>268-kW battery | **Rooftop Solar PV + Extra-Resilient Battery**<br>268 kW PV,<br>400-kW battery | **Expanded Solar PV** + Resilient Battery**<br>729 kW PV,<br>240-kW battery |
| **Net Present Value (NPV)** | **$193k** | **-$442k** | **-$852k** | **-$38k** |
| Solar PV Capital + Operations and Maintenance *Costs* | -$404k | -$404k | -$404k | -$1,128k |
| Battery Capital *Cost* | $0 | -$847k | -$1,265k | -$709k |
| Utility Bill *Savings* | $597k | $809k | $817k | $1,799k |
| **% of Demand Met with Renewable Energy** | 38% | 38% | 38% | 100% |
| **Avoided Carbon Dioxide Emissions***** | 768 tons | 831 tons | 837 tons | 2,448 tons |
| **Avoided Health Damage Cost****** | $285k | $280k | $280k | $763k |
| **Probability Powering Critical Loads During a 2-day Outage** | 0% | 86% | 95% | 97% |

* All modeled batteries have an 8-hour duration. Battery operation and maintenance costs are not included.

** The "Expanded PV" scenario captures the cost-optimal PV sizing, or the system size that could provide the most savings for MAIC, compared to their current energy costs, while still meeting the 2-day resilience goal.

*** Estimated avoided carbon dioxide emissions from grid-purchased electricity over 25 years in metric tons.

**** Estimated value of avoided premature deaths due to sulfur dioxide, nitrogen oxide, and particulate matter emissions from fossil fuel generation on the grid over 25 years.

Rendering of the Minneapolis American Indian Center, currently under construction. *Image courtesy of Full Circle Indigenous Planning + Design, LLC.*

## Anticipated Financial and Resilience Benefits

By investing in a 268 kW (DC) solar PV system, which maximizes current rooftop area, MAIC could experience 25-year net savings of $193k (11% savings) compared to expected energy costs without solar. Net savings are the difference between the cost of the system and the reduced utility costs over the lifetime of the system. To meet its resilience goals, MAIC would need to pair this solar PV system with an 8-hour, 268-kW battery to achieve 86% chance of surviving a 2-day outage. This solar PV + resilient battery system would come at a net financial cost of $442k before considering potential grant funding.

To provide additional resilience, MAIC could pair the 268-kW rooftop solar PV system with a larger 8-hour, 400-kW battery, which would increase the probability of surviving a 2-day outage to 95%. However, this system would almost double the net financial cost to MAIC. If MAIC were able to expand beyond the current roof area (e.g., through solar PV parking canopies), a 729- kW solar PV system paired with a smaller battery system could provide more resilience at a much lower net cost of $38k (only 2% higher than current energy costs). This system would have an expected 97% probability of surviving a 2-day outage.

## Anticipated Environmental Benefits

Investment in a solar PV or a solar PV + battery system could meet 38% to 100% of MAIC's electricity demand and reduce carbon dioxide emission from MAIC's electricity consumption by 831 to 2,448 metric tons over 25 years, based on the size of PV system installed. This is equivalent to taking 171 to 545 gas-powered cars off the road for one year. By using less electricity from the grid, a solar PV and battery system at MAIC, over 25 years, could avoid up to $763k in health damages from sulfur dioxide, nitrogen oxide, and particulate matter.

To learn more about this project, visit https://www.energy.gov/communitiesLEAP/minneapolis-minnesota.

## Key Modeling Assumptions Used in the NREL Analysis

- Results from NREL's assessment do not include costs for battery operations and maintenance, interconnection, potential grid upgrades, or additional islanding equipment. These costs can vary between projects and may be considerable based on project needs.
- This analysis assumes capital costs of $1,900/kw and O&M cost of $18/kW for solar, and capital costs of $403/kW plus $350/kWh for battery systems, as estimated by Renewable Energy Partners. Note that if solar parking canopies are pursued, capital costs are likely to be higher than those estimated in this analysis.
- The batteries are assumed to have a maximum duration of 8 hours.
- A 40% investment tax credit has been included in the capital cost for both battery and solar PV. No grant funding was considered in this analysis but is likely to be pursued.
- For all scenarios that include a battery, the system was sized such that the solar and battery could support 50% of MAIC's typical loads through a "worst-case" 48-hour power outage.
- Net savings equal the present value of total savings over a 25-year period, as compared to business-as-usual energy costs, assuming a 5% discount rate.
- The assumed net metering compensation reflects Xcel's Net Energy Metering program and the Solar Demand Credit, as available at the time of the analysis.
- Avoided climate emissions are estimated using NREL's Cambium dataset, assuming long-run hourly marginal emissions for Minnesota averaged over years 2024 to 2049.
- Avoided health-related emissions are estimated using the U.S. Environmental Protection Agency's AVERT database, and avoided health costs are estimated using the EASIUR model.



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