CITIZENS RESEARCH COUNCIL OF MICHIGAN

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

February 22, 2023

The National Electric Vehicle Infrastructure Program Gets Rolling

In a Nutshell

- Michigan is set to receive $110 million in federal funding from the National Electric Vehicle Infrastructure (NEVI) program. This program will fund the installation of public electric vehicle charging stations across the state.
- NEVI is designed to demystify electric vehicle charging while expanding availability. Charging stations will be standardized so that users know what to expect. The objective is to make the public charging experience similar to fueling-up at a gas station.
- The State of Michigan and several electric utility providers currently subsidize charging stations through existing programs. These programs should be considered for revision to best support the goals of the federal NEVI program.

The federal 2021 Bipartisan Infrastructure Law established the National Electric Vehicle Infrastructure (NEVI) program and dedicated $5 billion to build a nationwide network of public electric vehicle (EV) charging stations. Michigan is set to receive $110 million in NEVI funding, which will cover up to 80 percent of acquisition and operating costs.

The Federal Highway Administration (FHWA) published the NEVI final rules on February 15, 2023, establishing minimum standards for EV charging stations that are supported with federal funds. The intent of the NEVI Program is not only to increase the number of public EV charging stations across the country, but to demystify the experience of owning and operating an EV. Michigan should embrace the objectives of the NEVI program and adapt state policy to compliment the new federal guidance.

Electric Vehicle Charger Terminology

Electricity Basic Terms

Voltage (V) is the potential difference between two electric charges. Higher voltages imply greater potential for energy storage and transfer.

Amps (A) is a measure of electric current, or charge transferred over time. 1A is defined as 6.28×10^{18} electrons per second.

Watts (W) are units of power, calculated by multiplying voltage by amperage (1W=1V×1A). For EVs, power is usually expressed in terms of kilowatts (kW), which is equivalent to 1,000W or 1.34 horsepower.

Kilowatt-hours (kWh) are units of energy; simply 1kW delivered for 1 hour. Energy is equivalent to the capacity to do work. An EV battery that discharges 1kWh has converted its stored energy into work, equivalent to 1.34 hp for 1 hour.

Alternating current (AC) & direct current (DC) are two types of electric power delivery systems. Alternating current literally alternates the direction of current flow, back and forth. The North American power grid alternates directions at 60Hz, or 60 times each second. Batteries must be charged with DC power; this is accomplished with a device called a rectifier. All EVs have a rectifier on-board and so can be charged with AC current.

Key EV Charger Terms

Charger Output Voltage impacts the potential power delivery from the charger. EV batteries are typically in the range of 400-800 operating volts. EVs can use lower voltage chargers because an on-board transformer converts the power supply to a lower-amp, higher-voltage current. However, faster more efficient charging is enabled when the charger output voltage matches the battery voltage.

Charger Continuous Power Delivery Rating is the maximum power that is available from a charger port, measured in kW. This rating applies to the entire range of output voltages, allowing efficient charging across many EV models.

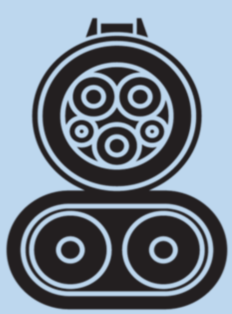
Level 1/2/3 Chargers distinguish the output voltage and power delivery range of different classes of chargers. **Level 1** chargers use 120V household AC current. **Level 2** chargers use 2-phase 240V AC current, which is the same as used for larger electrical appliances like clothes dryers and central air conditioners. **Level 3** chargers, also called direct current fast chargers (DCFC), deliver high-voltage direct current to the vehicle without the need for rectification and transformation. This drastically reduces the time required to recharge an EV's battery.

Previous to NEVI, there were no national standards for EV charging stations. This has resulted in a confusing amalgam of charging infrastructure. There are differences in charging speed and power, payment methods, pricing, hours of operation, and so on. Charging stations in the U.S. are also notoriously unreliable. This has contributed to EV "range anxiety." EV drivers are often hesitant to take long trips because public charging stations are intermittent and often inoperable.

EV Charger Plugs used in the U.S.

J1772 (Levels 1 & 2)
The J1772 connector has become the standard for Level 1 and 2 AC charging in the US. This standard will be required for Level 2 chargers receiving NEVI funds. NEVI will not fund Level 1 chargers.

CCS Type 1 (Level 3)
Combined charging system (CCS) Type 1 extends the J1772 configuration with two additional contacts for a high-voltage DC connection. This standard will be required for Level 3 chargers receiving NEVI funds.



CHAdeMO (Level 3)
CHAdeMO was an early DC fast-charge standard. The Nissan Leaf is the most notable model to use CHAdeMO, but Nissan is now transitioning to CCS1 for US models. NEVI will fund CHAdeMO chargers, but chargers must also have a CCS1 option.

Tesla (Level 1/2/3)
Tesla uses a proprietary charger configuration in its North American market. NEVI will fund chargers offering Tesla's proprietary system so long as they also offer CCS-1. Adapters are available to allow Tesla vehicles to use CCS-1 chargers.

All NEVI chargers will have J1772 (Level 2) or CCS-1 (Level 3) configurations and minimum performance requirements.

Some NEVI chargers may have CHAdeMO or Tesla connections but *must also* offer CCS-1.

All NEVI chargers will have J1772 (Level 2) or CCS Type 1 (Level 3) ports meeting new standard performance requirements. Some NEVI chargers may also include CHAdeMO or Tesla ports, but must also include CCS Type 1.

Through NEVI, FHWA is coordinating an effort that will make charging an EV more like fueling-up at a gas station. For example:

- Every charging station will accept credit card payments without requiring a membership with the service provider.
- Every charging station will display charging costs in kilowatt-hours (kWh) and any additional fees before the transaction is initiated.
- Charging stations along major highways (designated "Alternative Fuel Corridors" [AFCs]) will be located every 50 miles or less, and available all day, every day.
- Charging stations along AFC highways will have at least four Level 3 CCS Type 1 ports. Each port will have a continuous power delivery rating of at least 150 kW and support a range of 250-920 output voltages.
- Charging stations away from AFC highways will have at least four Level 2 ports, or a combination of Level 2 and Level 3 ports. Each Level 2 port will have a type J1772 connector with a continuous power delivery rating of at least 6 kW.
- Detailed info on all NEVI stations will be publicly available and easily accessible.

T**his common J1772/CCS-1 combination vehicle charger port inlet will be supported by all new federally funded charging stations.**

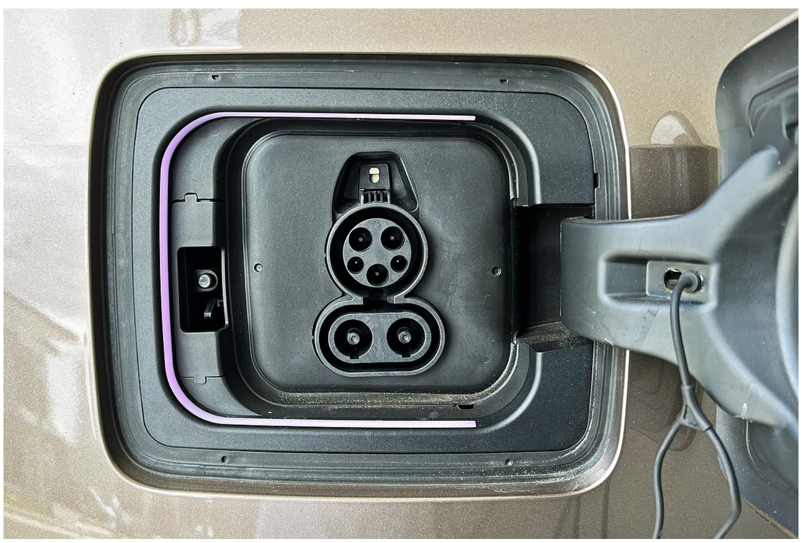


Image Source: Wikimedia commons

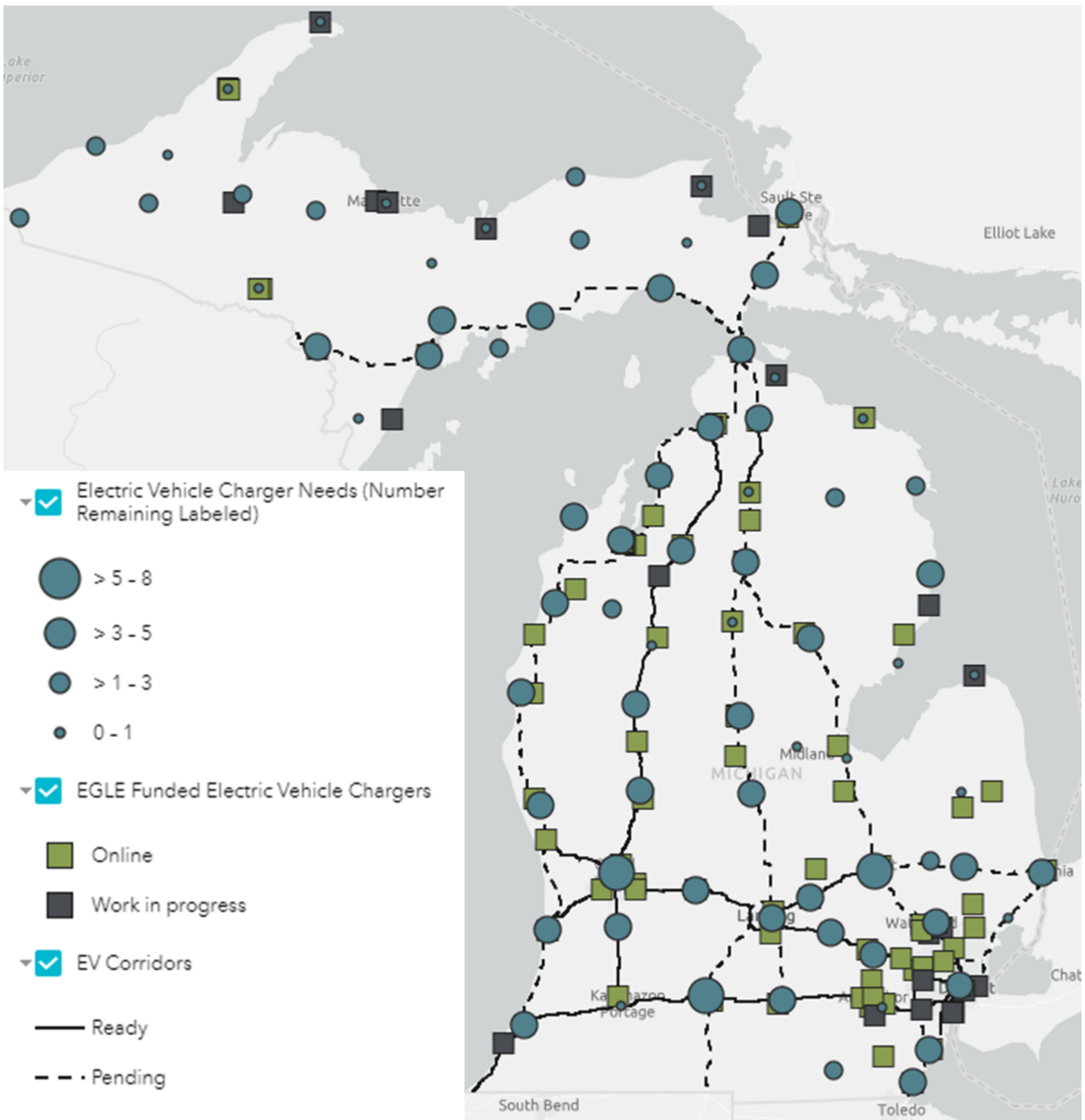
As a result of the NEVI program standardization, any EV driver will be able to pull into a charging station on the new federal network and anticipate a predictable, reliable experience. They will know if their vehicle is compatible (most are). Drivers will be able to pay with a credit card or mobile payment app without needing to establish any kind of membership with the charging service provider. Drivers will know how much charging will cost, and about how long it will take. This is a paradigm shift in the customer experience of EV ownership.

Michigan has been getting ready to hit the ground rolling on the NEVI program. Now that FHWA has finalized the program requirements, project planning and contracting can proceed in earnest.

NEVI prioritizes major highways (designated Alternative Fuel Corridors [AFCs]). Once the minimal requirements for AFC network coverage is met, states have broad leeway to distribute the rest of the funding. Michigan's EV charging infrastructure deployment strategy is led by the Department of Environment Great Lakes and Energy (EGLE) in partnership with other stakeholders and state agencies.

In the map below, the blue circles represent pending NEVI deployment sites. The squares represent sites that have been funded or agreed to be funded by EGLE under the preexisting Charge Up Michigan Program.

EGLE maintains a live map of EV charger deployment projects.



Source: EGLE Charge Up Michigan: Electric Vehicle Charging Infrastructure Network Web Map

Michigan Policy Implications

This pending influx of NEVI funding, along with new federal standards, should prompt a review of EV charging infrastructure policy in Michigan. Several Michigan utilities already have programs to accelerate charging infrastructure build-out within their service region. For example: Consumers Energy PowerMiDrive, DTE Charging Forward, Indiana Michigan Power Plugged In, Alpena Power Company EV Charging Pilot, and the Upper Peninsula Power Company EV Charging Pilot. Eligibility and project requirements often vary between these programs.

The most notable effort is EGLE's Charge Up Michigan program, which has already subsidized the installation of dozens of chargers across the state.

These programs were designed before FHWA disseminated standards and expectations for charging stations. These programs have a broad range of requirements for charger power, user interfaces, and other features. Most of the requirements are less stringent than the new federal standards.

EGLE and other program providers should revisit the conditions of existing subsidy programs and seek to support and complement the goals of NEVI.

This does not necessarily imply that all charger installations should duplicate NEVI standards. There may be cases where variation allows more efficient use of funds and wider coverage. But any use of public funding for EV chargers should reflect the overall goals of the NEVI program in providing consistent, reliable, charging infrastructure in all areas of the country.

An important feature of NEVI is that funding can be applied to operating and maintaining the new chargers for up to five years. EV charging provision is a relatively new business model and costs can vary widely, making it difficult to achieve a return on capital investments. This has contributed to the problems of chargers falling into disrepair as service providers deprioritized operational and maintenance support. Michigan should explore policy options to verify and support sufficient performance of public charging stations across the state, particularly in locations with low utilization rates where the economics of EV charging are difficult.

Take-home Message

The NEVI Program is set to supercharge the adoption and use of electric vehicles by setting expectations for standard, reliable public charging availability. There are likely to be lessons learned along the way, but real progress should be evident within just a few years.

Michigan policymakers can leverage the new federal standards and guidance provided by NEVI to develop reliable user-friendly EV charging infrastructure across the state. Embracing and building-on this approach will further Michigan's goals in EV adoption and establish Michigan as a leader in low-carbon transportation. This is a huge step away from fossil fuels and towards an electrified future of mobility.

ABOUT THE AUTHOR

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Eric joined the Citizens Research Council in 2022 as an expert in civil infrastructure policy. Previous to his position with the Research Council, Eric spent nearly ten years as a transportation systems analyst, focusing on the policy implications of emerging technologies such as autonomous vehicles, connected vehicles, and intelligent transportation systems. Eric has been a Michigan-licensed professional engineer (PE) since 2012. As a practicing engineer, Eric has design and project experience across multiple domains, including highways, airfields, telecommunications, and watershed management. Eric received his Bachelor's degree in civil engineering from Michigan State University in 2006. Eric also holds Masters degrees in environmental engineering and urban/regional planning, both from the University of Michigan.

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