EV-101

An Introduction to
ELECTRIFICATION
– Vehicles, Charging, Power Generation

By Tom Adamich

EV Awareness Coordinator,
Monroe County Community College
(Monroe, Michigan)

MONROE COUNTY COMMUNITY COLLEGE

The Michigan Office of Future Mobility & Electrification and the Southeast Michigan Council of Governments (SEMCOG) are partners with Monroe County's government agencies, economic development organizations, and educational institutions – including Monroe County Community College (MCCC) -- to promote awareness of electrification in our area and throughout Michigan.

Photo shows the inaugural MCCC EV Show, held on the college's campus on S. Raisinville Road in 2021. (Courtesy Blake Bacho – Monroe News)

On the Cover:

Nissan was one of the first vehicle companies to sell EVs in the U.S. Its Leaf was the first fully-electric model sold beginning in December, 2010. [Photo Credits: Wikimedia Commons]

The EV Jobs Academy will produce EV job opportunities in Michigan. Monroe County Community College (MCCC) and the City of Luna Pier are EV Jobs Academy members and partners in promoting EV awareness to:

- Build local/state charging infrastructure
- Promote EV-related business/job growth
- Encourage environmental education
- Identify long-term clean fuel sources and opportunities
- Understand role of electric utilities as EV fuel and development partners

Monroe County/Michigan EV Resources and Links:

https://www.monroenews.com/story/opinion/columns/2023/03/30/tom-adamich-e-bikes-electric-vehicle-development/70059980007/

https://www.monroenews.com/story/opinion/columns/2023/03/30/tom-adamich-e-bikes-electric-vehicle-development/70059980007/

https://www.monroenews.com/story/opinion/columns/2023/04/20/tom-adamich-michigan-energy-future-bright/70130573007/

https://www.monroenews.com/story/opinion/columns/2023/06/04/tom-adamich-charging-consideration-buying-ev-e-bike/70273208007/

MONROE
COUNTY

Michigan's Cornerstone.

Monroe County, set in the bottom right corner of Michigan. But we are anything but an afterthought. We are a cornerstone: the basis and foundation of the Michigan spirit.

Set on the majesty of a Great Lake. Setting for conflicts that defined independence. Birthplace to world-changing, innovative ideas. Home to humble towns, quiet roads, and simple moments. Natural beauty, openness, kindness.

We're a gateway to Michigan, but more than that, we are symbolic of the best of what Michigan has to offer. Water Work ethic Kindness. And a mindset that's ready to change the world.

Welcome to Monroe County - Michigan's Cornerstone.

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Cover and Interior design by Bloom's Printing & Design, Dennison, Ohio

Publisher's Cataloging-in-Publication Data

Adamich, Tom. **EV-101: An Introduction to Electrification – Vehicles, Charging, Power Generation / by Tom Adamich**.

[28] pages : photographs ; 28 cm Summary: EVs and their derivatives are becoming popular clean energy choices for consumers. This volume profiles basic key elements of what has been termed *electrification* – including information on vehicle types, charging, and power generation.

[1. – Electric Vehicles – United States. 2. Monroe County (Mich.)

1. Title 2023 629.2293 – dc23]

Acknowledgements

First, thank you to Parmeshwar (Peter) Coomar – Dean of the ASET Division at Monroe County Community College (MCCC) for recognizing the value the college plays in leading EV-related education and awareness efforts. His leadership has wrought great benefits to the applied science and engineering technology-based curriculum he manages, and his diligence has brought millions of dollars to these programs since he joined MCCC in the early 2000s. Also, thanks to Dr. Kojo Quartey, current MCCC President, for championing initiatives like the EV Jobs Academy (the statewide project to bring EV training and jobs to Michigan) and for sponsoring the related SEMCOG EV Planning & Awareness Grant that is providing additional underwriting funding for this book and EV-related programming. Quartey has been a strong champion of Monroe County economic and cultural development and the positive influences such activities have on its communities.

Also, many thanks to Penny Dorcey, Assistant to the President and MCCC Board of Trustees Secretary for handling many of the administrative duties associated with the college's participation in the EV Jobs Academy and this portion of it. Helping her with logistics related to these activities is Cajetan D'Cunha, MCCC Grants Coordinator, whose grant-related efforts and content perspectives have been most welcomed.

Furthermore, thank you to MCCC Director of Marketing & Communications Joe Verkennes for his efforts to provide content and editorial support for this book. He has also been responsible for MCCC's EV marketing and awareness campaigns -- created and launched by him and his team -- which have educated and provided benefit to those seeking important EV-related information.

Additionally, many thanks to our community partners – Mayor Jim Gardner of the City of Luna Pier; Mayor Robert Clark of the City of Monroe; Matthew Vanisacker, Deputy Director of Economic & Community Development and Neighborhood Services Coordinator – City of Monroe; Jeff McBee, Director – Monroe County Community Planning & Engagement Department; Nancy Bellaire, Director – Monroe County Library System; and Dan Rock, Director – Recycling and Green Community Program, Monroe County Health Department. It is a privilege to work together to help educate and promote EV awareness (in the context of clean, sustainable energy options and environmental responsibility) for the benefit of current and future generations living, visiting, and working in our area.

Finally, thank you to the citizens of Monroe County, Michigan who continue to support their community college and value its educational and cultural contributions – both locally and also beyond the county's borders. Good people always work to build and maintain strong institutions in their neighborhoods, towns, and cities. MCCC is one of those institutions in Monroe County, and its citizens will continue to be the most important partners in maintaining the strength of the college moving forward and the key individuals/families for which its current and future staff, faculty, and administrative members/board of directors will work diligently to serve every day.

Introduction

Hello, and welcome to MCCC EV-101 – a helpful introduction to electric and micromobility vehicles brought to you by Monroe County Community College, the City of Monroe, Michigan, the City of Luna Pier, Michigan as part of a Southeast Michigan Council of Governments (SEMCOG) EV Planning & Awareness Grant.

First, let's talk about Electric Vehicles, or EVs.

This is an EV-101 overview of what electric vehicles are, some advantages behind owning and using electric vehicles, and some EV charging information.

MCCC has been a pioneer in EV utilization and awareness, beginning in 2014. It hosted the first annual EV Show in 2021 – the brainchild of MCCC ASET Division Dean Parmeshwar (Peter) Coomar who organized the inaugural event and subsequent, related programs.

What is an EV?

EVs are not a new concept; this is a photo of the Edison Electric, circa 1913.

An electric vehicle is any vehicle that can drive on electricity derived from a power plug. An all-electric vehicle (sometimes called a battery electric vehicle or BEV) drives solely on power from the plug.

A plug-in hybrid electric vehicle (PHEV) is a car that can take both electricity (from plugging in) and gasoline. Usually, they run on electricity first and then draw on gasoline later.

Why should you consider owning and driving an EV?

There are many benefits.

EVs provide instant torque allowing you to quickly accelerate and merge onto highways.

Fuel costs for EVs are approximately $1.24 per eGallon, the U.S. average.

EVs feature the latest driver-assist technology, including lane tracking, emergency braking, etc.

EVs require less overall maintenance.

EVs are ten times less likely to catch fire than conventional gas-powered vehicles.

EVs are cleaner for the environment, even when factoring in manufactured carbon emissions in producing electricity from traditional energy sources, including coal and natural gas.

Charging an EV normally takes place overnight in a garage, carport, driveway, parking space, and/or workplace-publically-accessible charger.

Charging Facts and Options

Public chargers and pay-to-charge stations are increasing in numbers daily.

Computer and smartphone applications like PlugShare can help you locate EV charges and details about them.

There are 3 types of EV charging currently available today.

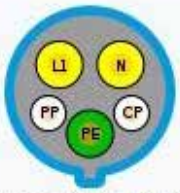
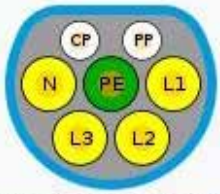
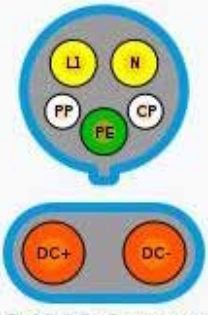
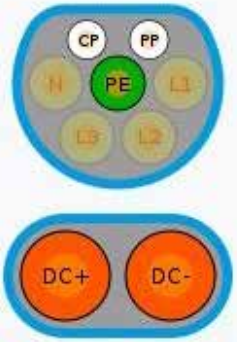
Level 1 charging uses a standard 120 volt wall outlet.

A Level 1 connector is provided with every EV.

Level 1 charging generates 4 miles per one hour of charging time.

Level 1 charging is great for overnight or workplace charging (when available at your work location).

Level 1 charging is ideal for roundtrip commutes under 40 miles (under average conditions).

Power supply	United States	European Union
1-phase AC (62196.2)	 Type 1 (SAE J1772)	 Type 2[a][b] (DE, UK)
3-phase AC (62196.2)	 Type 2 (SAE J3068)	 Type 3 (IT, FR; now deprecated)
DC (62196.3)	 EE (CCS Combo 1)	 FF (CCS Combo 2)[b]

Level 2 charging uses a 240-volt outlet.

Most electric dryers operate using the same type of outlet as a comparison.

Level 2 charging reduces the time needed to charge an EV significantly.

Pure electric vehicles can be charged in 4-8 hours.

Plug-in hybrid vehicles can be charged in 2 hours or less.

Level 2 charging generates 25 miles per one hour of charging time.

Some modifications and additional equipment are needed to charge EVs at home with Level 2 charging.

An experienced electrician can install a 240-volt outlet.

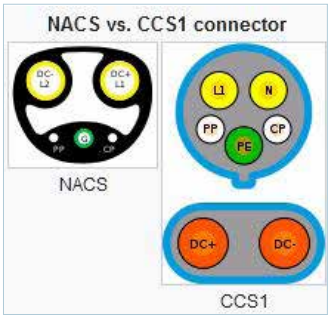
You would also need to purchase a Level 2 charging station that is either hard-wired to your home or portable.

Many electric utilities offer rebates and incentives to encourage residential Level 2 charging.

Average one-time costs for residential Level 2 charging are between $850 and $2,200 with most customers paying on average $1,200, according to published reports from several consumer information resources.

Many public EV charging stations are Level 2 stations – particularly at workplaces, hotels, restaurants, etc. where individuals may spend time working, enjoying a meal, etc.

DC fast charge, also known as DCFC, is a commercial, pay-to-charge solution that offers more miles per charge in less time.



The North American Charging Standard (NACS) was formerly known as the Tesla connector. As of 2023, it is now being widely adopted universally by automakers.

A CCS Combo charger connector (also known as the SAE Combo Combined Charging System) offers 160 miles of charge in 20 minutes.

Most EVs use the CCS Combo charging system for DC fast charging.

However, please check with your current or desired EV manufacturer for specific details.

A CHAdeMO charger connector offers 67 miles of charge in 30 minutes.

Nissan is the only vehicle manufacturer to use the CHAdeMO charging system.

As of 2022, CHAdeMO remains popular in Japan, but is being equipped on very few new cars sold in North America or Europe.

A Tesla Supercharger offers up to 200 miles of charge in 20 minutes.

Tesla Superchargers, originally, could only be used with Tesla vehicles; however, Tesla is now entering into use agreements with other EV manufacturers and may become the DCFC of choice.

Both the U.S. Department of Energy's Alternative Fuels Data Center [https://afdc.energy.gov/] and ChargeHub.com have great resources to explain EV charging and provide additional EV-related information.

e-Micromobility Vehicles Overview

Source: Tdorante-Wikimedia Commons

Now, let's take a look at e-Micromobility vehicles.

According to Wikipedia, Micromobility in general refers to a range of small, lightweight vehicles operating at speeds typically below 25 km/h (15 mph) and driven by users personally.

e-Micromobility devices include the electric versions of bicycles, scooters, skateboards, shared bicycle fleets, and electric pedal assisted (pedelec) bicycles.

Also included are electric versions of golf carts, kick scooters, onewheel, personal transporters, roller skates, segways, unicycles, tricycles, handcycles, mobility scooter, quadracycles, and wheelchairs.

Source: Ronengrinberg-Wikimedia Commons

What are e-Recreational Vehicles?

A derivative of both EVs and Micromobility vehicles describes e-Recreational vehicles.

E-Recreational vehicles are the electric versions of popular recreational vehicles, such as snowmobiles, off-highway motorcycles (dirt bikes), and all-terrain vehicles (ATVs).

Utility Task Vehicles or UTVs are similar to ATVs but are slightly larger, and the seating arrangement is different. They are used in agricultural and service environments.

Sandrails are normally custom-built recreational off-road vehicles for sandy conditions. These vehicles are not street legal and are strictly for off-road use.

Similarly, dune buggies can be driven on sand but are often street legal if properly equipped.

Enduro motorcycles are off-road bikes developed specifically for participating in long-distance off-road rallies or enduro races.

Motocross bikes are designed for a specific off-road racing and recreational riding style. Motocross racing is typically conducted on off-road tracks specifically designed for the race.

Trail bikes are the technical trail riding bikes for off-road cross-country trails rather than the high pace of a short, fast motocross race on a track.

A vehicle that may also fall in both the e-Recreational and micromobility categories is the mountain bike or MTB. They are built specifically to handle rough terrain and hilly, trail-based locations.

Jeeps, 4x4 trucks and Landrovers also cross categories – considered both e-Recreational and EV when in normal use.

Source: Jeep Canada

EV-101 Articles

On the following pages are reprints of EV-themed articles published recently in the *Monroe News* and online in both the newspaper and partner media outlets.

They offer an overview of a variety of EV-related concepts including charging infrastructure, role of electric utilities, EV job opportunities, and EV laws regulations, among others.

EV Jobs Academy

As we move forward in the age of electrification and the use of alternative fuels (and related technologies), the EV Jobs Academy will continue to place Michigan at the forefront of investment in next-generation vehicles. I've had the privilege of working on behalf of Monroe County Community College (MCCC) with partners in the EV Jobs Academy initiative.

According to the EV Jobs Academy information website, The EV Jobs Academy is an employer-led collaborative comprised of over 100 stakeholder partners to identify the electrified vehicle and mobility-related occupational skill needs while developing and scaling postsecondary credentialing programs utilizing a turn-key online shared learning platform for the Michigan Occupational Deans Administrative Council (MODAC) 32-member colleges and universities located throughout Michigan.

The Workforce Intelligence Network (WIN) and its Southeast Michigan Community Alliance (SEMCA) were awarded a $5 million grant from the Michigan Department of Labor and Economic Opportunity's Office of Employment & Training and the Michigan Economic Development Corporation (MEDC) to carry out this work over a five-year timeframe.

The EV Jobs Academy's goal is rapid and accelerated training and re-training for emerging technologies in connected, autonomous, lightweight, hybrid, electric, alternative fuel, and other advanced vehicle technologies. Following the launch of EV Jobs Academy's first phase, it is anticipated the numbers of trained and retrained individuals will continue to grow significantly.

MCCC has been talking about EVs and their role in future mobility since the mid-2010s when it was part of the 2014 Center for Advanced Automotive Technology (CAAT) grant awarded by the National Science Foundation (NSF). At that time, MCCC, as a member of the Southeastern Michigan Community College Consortium, helped establish the CAAT, currently headquartered at Macomb Community College. One of the goals of the 2014 CAAT grant was to create what was identified as the first public EV charging station installation in Monroe County. Its purpose was to educate students in renewable energies, smart grid integration, and installation and maintenance of Electric Vehicle Charging Stations.

Today, MCCC, as part of the EV Jobs Academy, has worked to identify and engage partners at the municipal government and economic development levels. As a result, Monroe County communities like Luna Pier (with Mayor Jim Garner – a former Ford engineer – as a key Monroe County EV advocate) as well as the Monroe County Economic Development Corporation (Monroe County EDC – with Matt Vanisacker who formerly served as Vice-President of Business Development and now serves as Deputy Director of Economic & Community Development and Neighborhood Services Coordinator for the City of Monroe) leading conversations about building strong EV charging infrastructure and connecting Monroe County residents and visitors with future EV/alternative fuel jobs, recreational opportunities, and other benefits.

During my time in this role, I have had the opportunity to learn more about the EV/alternative fuel landscape in Michigan and nationally. I've also reviewed and analyzed many parts of the developing electric vehicle industry (including job creation/retention, EV charging infrastructure development, etc.). Here are some of my takeaways from that work:

- **EV is part of an alternative fuels ecosystem** – It joins compressed natural gas (CNG), propane, biofuel (ethanol derived from corn is an example), and hydrogen as the major alternative fuel sources in the U.S. Each fuel type has advantages and disadvantages for personal, commercial, and public use. These pros and cons should be part of any plans to adopt an alternative fuel for long-term use.
- **Public utilities are key EV partners** – Successful EV adoption relies on public utilities to supply power and support charging infrastructure investment. For profit utilities in our area (DTE and Consumer's) join public power providers like the City of Holland to help negotiate for set utility rates with Michigan state utility regulators, develop/implement plans to upgrade and maintain power grids, and seek the most efficient fuel sources for power generation (which may include a combination of nuclear, wind, solar, natural gas, coal, and hydroelectric power generation). Productive relationships with our utilities in SE Michigan makes sense now and in the future.
- **EV jobs are growing** – While both the EV Jobs Academy and EV/alternative fuel jobs are still in their infancy, there is great potential for Monroe County and surrounding areas to benefit from the EV Technician and EV engineering jobs (and related education and training) that will become part of a total mobility network. Michigan still received three times the U.S. investment in these new technologies over its nearest state competitor (Ohio) according to recent figures. This bodes well for Michigan's growing "mobility" industry and Monroe County/Southeast Michigan's role in it.

Time of Use (TOU) Rate Details

Residential Smart Hours Rate (RSH-1040)

Thank you for participating in the PowerMIDrive Program! As part of participating in the program, you've agreed to enroll in one of Consumers Energy's TOU electric rates at home.

You are currently enrolled in the Residential Smart Hours Rate (RSH-1040).

Here's what you need to know about your time of use electric rate to make the most of your reduced electricity costs:

How it works:
The price you pay per kWh changes based on the time of day, the day of the week, and the season:

Off-Peak (lowest price) – *this is the best time to charge your EV and use energy-intensive appliances to reduce electric costs at home*

- Off-peak pricing occurs between 7 p.m. and 2 p.m. Monday – Friday.
- All weekends and holidays are considered off-peak pricing for the entire day.

On-Peak (highest price)

- Your electric rate is highest between 2 p.m. and 7 p.m. during summer months.
- Simple adjustments during this time can lower your electricity bill. Raise the set point on your thermostat and delay the use of electric-intensive appliances such as clothes washing and drying, running the dishwasher, window air conditioners and dehumidifiers.

WINTER MONTHS
October 1st - May 31st

Time of Day		Residential Smart Hours RSH1040
12	AM	9.8
1	AM	9.8
2	AM	9.8
3	AM	9.8
4	AM	9.8
5	AM	9.8
6	AM	9.8
7	AM	9.8
8	AM	9.8
9	AM	9.8
10	AM	9.8
11	AM	9.8
12	PM	9.8
1	PM	9.8
2	PM	10.8
3	PM	10.8
4	PM	10.8
5	PM	10.8
6	PM	10.8
7	PM	9.8
8	PM	9.8
9	PM	9.8
10	PM	9.8
11	PM	9.8
$ Cents per kWh		

SUMMER MONTHS
June 1st - September 30th

Time of Day		Residential Smart Hours RSH1040
12	AM	10.0
1	AM	10.0
2	AM	10.0
3	AM	10.0
4	AM	10.0
5	AM	10.0
6	AM	10.0
7	AM	10.0
8	AM	10.0
9	AM	10.0
10	AM	10.0
11	AM	10.0
12	PM	10.0
1	PM	10.0
2	PM	14.9
3	PM	14.9
4	PM	14.9
5	PM	14.9
6	PM	14.9
7	PM	10.0
8	PM	10.0
9	PM	10.0
10	PM	10.0
11	PM	10.0
$ Cents per kWh		

Sponsored by Consumers Energy, PowerMI Drive is a multi-year program to make it easier for owners of electric vehicles to charge their vehicles and to ensure the electric grid is prepared to capture the benefits for Consumers customers from the growing electric vehicle market.

Finally, another bright spot for the EV Jobs Academy and Monroe County Community College is the future growth of the E-recreational vehicles industry in Michigan and related outdoor opportunities which use E-recreational vehicles. Brad Garmon, the MEDC's Michigan Outdoor Recreation Industry Office Senior Strategic Advisor & Executive Director, shared that plans are in the works to develop an E-bike 101 presentation, share information on E-recreational vehicles and their use in Michigan (including E-snowmobiles) and help to bring together entrepreneurs and others interested in promoting E-recreational vehicle innovation and use throughout Michigan. That way, everyone has the opportunity to enjoy accessible and affordable E-vehicles as they explore the natural beauty and environmental assets Michigan offers everyone every day.

e-Bikes in Michigan

Recently, I wrote about E-mobility -- the age of vehicle electrification and the use of alternative fuels (and related technologies). I also wrote about Monroe County Community College's participation in the EV Jobs Academy. I mentioned a bright spot for E-mobility and MCCC is the future growth of the E-recreational vehicles industry in Michigan and related outdoor opportunities which use E-recreational vehicles.

One of the most accessible E-recreational vehicles to the broadest population is the E-bike. I recently spoke with Matt Penniman, who is Communications Director for the League of Michigan Bicyclists (LMB), established in 1981 and based in Lansing. Penniman shared a number of valuable LMB and State of Michigan E-bike-related resources and provided an update on efforts by the State of Michigan to sponsor and enact an E-bike rebate program to promote affordable E-bike purchasing and target potential low-income customers who can't afford an EV but can afford an E-bike.

e-Bike 101 in Michigan

Back in On October 29, 2017, Michigan's 48th Governor, Rick Snyder, signed the LMB's e-bike legislation into law. This legislation, HB 4781, 4782, and 4783, amends the Michigan Vehicle Code (MVC) to clarify the definition of e-bikes and outlines where e-bikes can be ridden legally on Michigan roadways and trails.

One of the best resources Penniman profiled to explain this legislation and E-bike basics is the Michigan Department of Natural Resources' "E-Bikes in Michigan" webpage. The following is their definition of an E-bike:

"An electric bicycle (or E-bike) is a bicycle that has a small rechargeable electric motor that can give a boost to the pedaling rider or can take over pedaling completely. To qualify as an E- bike in Michigan, the bike must meet the following requirements:

- It must have a seat or saddle for the rider to sit.
- There must be fully operational pedals.
- It must have an electric motor of no more than 750 watts (or 1 horsepower)".

Another important E-bike fact is that there are 3 classes of E-bikes. Each class type has specific technical and use requirements that one needs to know when buying and riding an E-bike on Michigan streets, trails, etc.

As defined by the Michigan DNR, a **Class 1 E-Bike** is one that is equipped with an electric motor that **provides assistance only when the rider is pedaling** and disengages or **ceases to function when the bike reaches a speed of 20 miles per hour**. Currently, there is no age restriction to ride one, and a helmet is not required but highly recommended.

A **Class 2 E-Bike** is one that is equipped with a motor that propels the bike, **whether the rider is pedaling or not,** to a speed of no more than 20 miles per hour, and disengages or **ceases to function when the brakes are applied or throttle is released**. Again, there are currently no age or helmet restrictions at the Michigan state level.

A **Class 3 E-Bike** is one that is equipped with a motor that **provides assistance only when the rider is pedaling** and disengages or **ceases to function when the bike reaches a speed of 28 miles per hour**. Riders of Class 3 E-bikes in Michigan currently must be age 14 or older and required to wear a helmet if she or he is between the ages of 14 and 18.

Where Can e-Bikes be Operated in Michigan?

All three classes of E-bikes can currently be operated anywhere a traditional non-motorized bike can be operated in Michigan. These include bike lanes or designated road shoulders.

When it comes to various types of trails, there are currently some restrictions of E-bike use in Michigan. Class 1 E-bikes are allowed on linear paved bike trails, but local regulations may apply that would restrict use. Class 2 and Class 3 E-bikes are not allowed on linear paved bike trails unless locally authorized.

When it comes to non-motorized natural surface trails (such as mountain bike trails), E-bikes of all classes are not permitted unless locally authorized. These may include trails found at city, county and/or state parks.

On the other hand, E-bikes are allowed on motorized natural surface trails (such as those used by off-road vehicles – ORVs) that may be found at some of the same public park areas mentioned earlier. With respect to use of E-bikes on private lands, there are currently no defined recommendations, but local and county officials in your area can provide specific guidance throughout Michigan in this regard.

Need for e-Bike Maintenance and Repair Technicians

Penniman also mentioned that the need for E-bike Maintenance and Repair Technicians will grow significantly in the future – especially if E-bikes become viable daily transportation options in densely-populated and/or highly inaccessible locations throughout Michigan. Most non-motorized bike repair shops still only work on traditional bikes.

Thus, the need for E-bike-related technical skills (electric motor fundamentals, electrical systems knowledge, etc.) will grow in Michigan in the near future to address these needs and provide entrepreneurial opportunities in this area as well – setting up repair networks, providing E-bike manufacturers' support, etc.

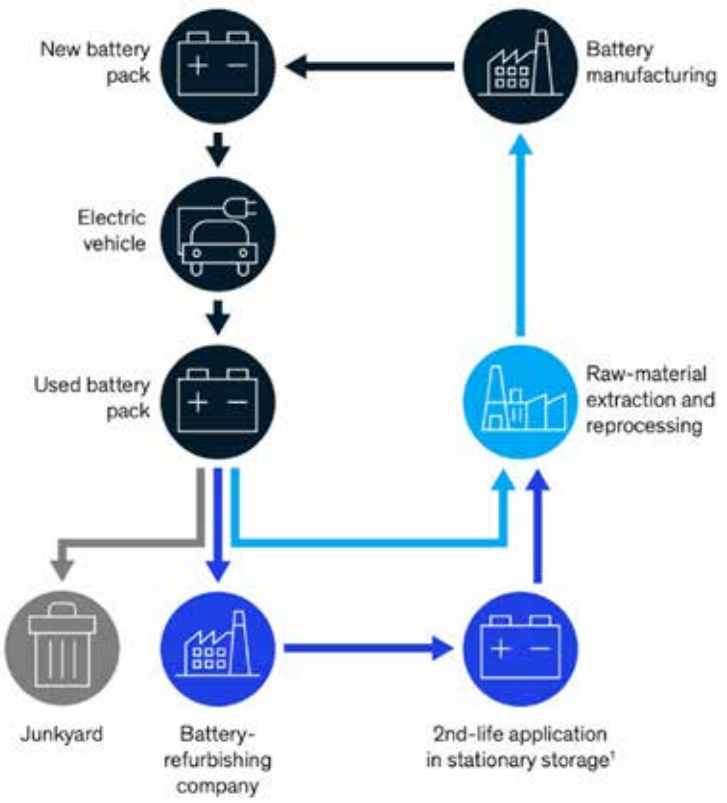
...Still the Need for e-Charging Infrastructure Development and Community-based Efforts

While the idea of the E-bike as viable transportation and recreation option for Michigan residents and visitors is a good one, there is still the need to develop E-charging infrastructure (residential, public, commercial). Again, decision makers at the business and government levels partnering with electric utilities and charging/vehicle manufacturers to provide accessible, free-or- affordable, sustainable, and realistic charging options are key to future E-bike/E-vehicle adoption, success, and opportunity.

Batteries

Batteries – in particular, lithium-ion (or li-ion batteries) -- are the fuel for EVs of all types. In our recent discussions regarding EV use – including charging and electricity generation – several big questions have come to light about batteries, including:

1. What is the composition of a li-ion battery, and how do they interact in the battery?



This flowchart of the EV battery lifecycle shows use, storage, and recycling stages. It was developed by the McKinsey Company, a Chicago-based corporate consultant company founded in 1926.

2. What are the current recommendations for disposing li-ion batteries once they have reached the end of their lives?
3. How can li-ion battery life be improved?
4. Are cleaner, safer li-ion and alternative batteries being designed?

According to the U.S. Environmental Protection Agency's *Frequent Questions on Lithium-Ion Batteries* and *How Lithium-Ion Batteries Work*, li-ion batteries contain a number of rare-earth elements, including lithium, cobalt, nickel, manganese, and titanium, as well as graphite and a form of flammable electrolyte. The lithium electrolyte in the battery interacts with the battery's anode (positive charge) and exits via the cathode (negative charge) via a separator. The cathode-enabled charge then enters the device (in this case, the electric motor(s) that power the EV) which moves the vehicle forward. Conversely, when the battery is being charged, lithium ions are released by the cathode and received by the anode, ready for use.

Over time, li-ion battery use, along with environmental conditions, will cause degradation and eventual battery failure. Also, extreme heat and cold can significantly reduce battery life and cause damage. While most of the current li-ion battery disposal recommendations apply to smaller versions -- like those used in power tools, laptop computers, and cell phones -- the same principles and best practices will certainly apply in most cases to EV li-ion batteries.

In this photo, the battery of the BYD e5 model is visible. BYD is a UK-based maker of EVs and a high-speed rail, electronics, and renewable energy producer.

This is a photo of the Nissan Leaf's li-ion battery pack. The Leaf was introduced in 2011 as the first mass-produced EV sold in the U.S. In 2026, Nissan will begin building two new EV models at its plant in Canton, Mississippi.

This is a photo of a crated Chevy Bolt HV battery pack at Allen Chevrolet in Monroe. It's being sent back to GM for recycling.

First, Li-ion batteries should not be disposed in current municipal/household recycling bins. These bins are designed to accept designated household paper, plastic, metal and glass. Li-ion batteries of all types should be taken to separate recycling facilities for batteries or designated hazardous waste collection points in your community. An authorized EV dealer or service provider will certainly comply with these rules to meet local safety regulations, maintain business licensures, and avoid criminal prosecution for violations.

Should you be handling an EV li-ion battery yourself, it is recommended that you place either electrical tape or other non-conductive tape over the battery terminals to isolate the terminals and avoid any catalyst that may cause the li-ion battery to discharge or explode. Similarly, if you are in possession of a "swelled" battery that has been compromised in some way, isolate it from flammable materials, prepare the terminals as described earlier, and store it in available fire-suppressant material (sand and/or kitty litter are examples) for transport to an authorized battery disposal site.

Most battery disposal agencies work closely with Li-ion battery recyclers to neutralize the battery and prepare it for recycling. Today, cobalt, manganese and nickel are the primary elements recovered. In some cases, lithium is also recovered, but it often must be processed further to be reused. Any reuse will reduce the need to mine these elements again, conserve energy, and protect local air/water resources.

While li-ion battery technology has advanced significantly in recent years, experts cite the need to design safer, cleaner li-ion batteries and further analyze battery management, disposal, and recycling processes. In 2023, the U.S. Department of Energy's (USDOE) Advanced Materials and Manufacturing Technologies Office (AMMTO) announced allocating $2 million for the rejuvenation, recycling, and reuse of Lithium-ion battery programs, administered through the ReCell Center located at the Argonne National Laboratory (ANL).

The ReCell Center is a national collaboration of industry, academia and U.S-based laboratories working to advance recycling technologies, current/future battery designs, and battery life cycle chemistries.

EV/e-Bike Charging

When thinking about adding an EV and/or an E-bike to your transportation inventory, charging should be one of the most important considerations in your decision. Making sure that your home, workplace, and travel destinations have adequate, working charging locations/equipment is vital to successful E-vehicle adoption. Michigan-based companies and local governments are working hard to make sure that happens.

EV and e-Bike Charging 101

Charging for both EVs and E-bikes requires some understanding as to the different levels available and the equipment needed to accomplish the task. We'll start with looking at EVs, and to

help us Jackson, Michigan-based Consumers Energy provides a great overview of EV charging levels on its corporate website.

According to Consumers, A **Level 1 charger** uses 120 volts of power and is the slowest way to charge. It comes with most EVs for free as a basic charger for standard 110-volt AC outlets. Depending on the EV, it can take more than 24 hours to reach full charge from empty.

Consumers lists a **Level 2 charger** as using 240 volts of power and charging an EV from empty to full in around 8 hours. For comparison, your home's electric dryer runs on 240-volt power. Level 2 chargers are available for private home charging and are also found as public charging stations.

A **DC Fast (DCFC) charger** is described by Consumers as using between 200 and 600 volts of power and is the fastest way to charge an EV. This charger is only available public charging (usually for a price or as part of an EV manufacturer's service plan) — not for the home. DC Fast Chargers can typically charge a car from 20% to 80% in around 20-40 minutes.

For E-bikes, according to the Battle Born Batteries website, an e-bike lithium-ion battery will require 500-800 watt-hours for a full charge, since it is smaller and requires less power. Charging from a regular 110-volt source normally takes 3.5-6 hours to reach full charge (significantly less for lower percentages).

If you use your E-bike while camping and would need to connect your charger to an available charging source, like a regular 12-volt DC car/truck battery, an **inverter** is recommended to safely charge and reduce the possibility of fire or explosion. You can also use your vehicle's charging ports (often used to power smartphones and other devices) with the proper adapters and following vehicle instructions for use.

Still, e-bike charging using vehicle battery/charging drains those resources. Hopefully, your campsite or E-bike destination would be equipped with regular 110-volt electrical outlets and/or solar-powered electric hookups to use to enable the charging over that multi-hour period.

It is important to note that many experts recommend not charging either EV or E-bike batteries to 100% in order to optimize battery life.

Once you understand the basics of how your EV and/or E-bike gets its "electrical fuel" to operate, you can then determine the status of your own "charging setup" and the availability of charging along any routes you may be traveling.

Residential/Personal Charging

As I mentioned earlier, charging for both EVs and E-bikes at the most basic level is Level 1 charging – plugging your authorized charging cord into a standard 110-volt AC outlet. This will enable charging of 30-50 mile range overnight (3-5 miles/hour).

For EV charging, Level 2 charging equipment will decrease the time to charge to the 30-50 mile range (depending on environmental conditions) to 2-3 hours. Of course, charging to 80% or 90% charge will reduce any times accordingly.

Installing a Level 2 charger at home requires purchasing an approved Level 2 charger and paying electrical installation costs (the 220-volt access discussed earlier). Mobile Level 2 charging apparatus are also available to be plugged into authorized connections at workplaces, etc. They are still relatively rare and not widely used yet.

Public Charging

Efforts are being made to connect EV and E-bike owners with public charging locations. Both PlugShare is a popular charging app, and EV charging networks like ChargePoint and EVgo also have locator tools for use.

Additionally, Michigan utilities like DTE and Consumers have locator apps on their websites. Furthermore, major automakers like Ford and Tesla include charging locator information as part of their service plans.

As more areas throughout Michigan add public charging, locations within city and county areas will continue to be identified by government agencies and the businesses that operate/maintain the charging equipment – with the goal of building a functional and robust network of charging for use.

Electrification Jobs

Michigan continues to lead EV industry development in the U.S., creating and sustaining EV-related jobs and training that are critical to serving consumers and businesses – both in Michigan and nationwide. As I shared with you earlier on these pages, Michigan's EV Jobs Academy is at the forefront of these efforts and Monroe County Community College and its partners are working hard to build from scratch the tools and networks to teach, train, and maintain Michigan's developing EV infrastructures.

Reports continue to show that EV vehicle design/development, battery production, and charging planning/maintenance (for both EVs and E-recreational/commercial vehicles) will be growth industries throughout the 2020s and into future decades. They will join other clean fuel efforts in hydrogen, compressed natural gas (CNG) and biofuels – as well as efforts to optimize efficiencies in current fossil fuel use and distribution (gas/diesel use for passenger commercial vehicles and reliable, efficient electricity generation – essential for any future EV industry success).

In a just-released report from the U.S. Bureau of Labor Statistics (a unit of the U.S. Department of Labor), authors Javier Colato and Lindsey Ice show double-digit percentage growth in software

development (to optimize EV performance with real-time vehicle software updates) and chemical engineering (for battery design/production). Smaller, yet noteworthy, gains are projected to be achieved in training electricians (to install/maintain EV charging infrastructures and be liaisons for utility companies) construction workers (to support new construction and modifications to fueling locations receiving EV charging), electrical line workers (to upgrade/maintain existing electrical power grids/equipment) and community/urban planners (to support the need to, according to the report, map out where to place public charging to support the projections that one public charger is needed for every 10 to 15 EVs, even with drivers charging at home).

Not mentioned in the Colato/Ice Report but worth noting is the role of U.S. mining companies and the national/international mining industry to source and supply copper, lithium, and other precious metals needed in battery production. The report also doesn't discuss in detail maintaining EV motors and related components, although it does reference a decline in traditional internal combustion engine (ICE) maintenance (saving $8,000-$12,000 over the vehicle's lifetime – excluding tire and brake maintenance which would not change significantly from current maintenance/cost levels).

Michigan's EV-related course curriculum will be managed via the Michigan Workforce Training & Education Collaborative (MWTEC). According to Dennis Bona, MWTEC's Director Of Manufacturing and Mobility Programs and Amy Lee, the Michigan Community College Association (MCCA) Executive Dean of Collaborative Programs, MWTEC will build upon successful efforts started in 2010 when 5 Michigan community colleges got together to teach x-ray and MRI courses in a program named the Michigan Radiologic and Imaging Sciences Consortium (MIRIS). The program was an instant success. In its very first year, MIRIS graduated and placed 100% of the student cohort and collected more revenue than expense for the operation of the program.

MIRIS later became Michigan College Online in 2015 and was operated by MCCA. Nursing was added along with 8 other health education programs, and the number of schools expanded to 16 when the program was renamed Michigan Consortium for Educational *Programs* in Collaboration (EPiC). In 2022, because the EPiC model was so successful, especially with smaller, expensive curriculum/instruction programs that often employ emerging technology and/or new occupations, it was decided that EPiC needed to grow beyond health care programs.

EPiCs EV curriculum will allow Michigan's small community colleges like MCCC to add EPiC-delivered courses and develop/share new courses in partnership with other Michigan community colleges that are EPiC members. Courses like the new Battery Technician course might not be possible without MWTEC's infrastructure and support.

EV and Michigan Utilities

In my past discussions about EV growth and adoption in Michigan, I emphasized the need to understand how Michigan's electric utilities and public power providers contribute to electrification and their **essential** roles to enable and deliver the "fuel" that is electricity needed to power EVs of all types. Throughout the state, Michigan's electric utilities and public power providers are working hard to help consumers connect to resources and have access to important information needed to successfully access EV charging and use it on a daily basis.

One key role of Michigan's electric utilities and public power providers is to provide a strong and reliable electrical power grid able to handle the rising demands of EV use as it continues to grow in Michigan. Another key role is to help electricity consumers and the communities in which they live by working with their customers and local community leaders/coalitions to help develop charging infrastructure – residential, commercial and public.

Consumers Energy – which serves 6.8 million of Michigan's 10 million residents in all 68 lower- peninsula counties -- has been a proactive Michigan utility in both its electrical power grid strategic planning and ability to provide access to EV charging infrastructure development-based resources and information. According to Brian Wheeler, Consumers' Media Relations Manager, the utility is well on its way in developing a strong, stable electrical power grid for the next 20 years.

By 2040, the company will reach goals for grid modernization and large-scale electricity storage via battery technology. At the same time, Consumers plans to make significant clean energy gains – using wind, solar, hydroelectric and pumped storage (turbine regeneration) -- while retaining access to baseline power plants (nuclear and natural gas-powered) to provide uninterrupted 24/7 electricity access.

Consumers upgraded nearly 100 substations, trimmed nearly 7,100 miles of trees/forest area, and added 32 Automatic Transfer Reclosures (a high-tech circuit breaker which reduces electricity and loss when outages develop) to its electrical grid network. Consumers is also testing conversion of power lines to underground to help generate greater efficiency in key areas.

Similarly, DTE has been proactive in an aggressive tree-trimming campaign and updating existing power grid infrastructure, according to DTE spokesperson Angela Meriedeth. DTE is also rebuilding from the ground up major portions of the power grid and transitioning to smart grid technology that, like Consumers,

provides uninterrupted 24/7 electricity access even when an outage does take place.

Nearly one third of DTE's energy mix comes carbon-free renewables, nuclear, and energy storage, with the balance of its generation mix coming from natural gas (19%) and coal (45%). DTE submitted its CleanVision Integrated Resource Plan (IRP), a 20-year proposal that achieves 85% CO_2 emission reductions in 2035, to the Michigan Public Utilities Commission for approval in 2022. It plans to accelerate coal plant retirements and develop enough Michigan-made wind and solar energy to power approximately four million homes.

In the public power arena, the City of Holland, Michigan – home to the Harbor Lighthouse and Lake Macatawa – has been the gold standard for EV support and charging infrastructure at the municipal level. Barry Rutherford, who has served as Energy Efficiencies Engineer for the Holland Board of Public Works, began sharing with me information of their proactive approach to developing charging infrastructure for residents, businesses, and visitors several years ago. The Holland Board encourages private EV charging companies to work with them to set up and run EV charging stations – establishing a free market-based partnership to provide public EV charging throughout Holland.

Again, Michigan's utilities are working hard to promote transportation electrification for all. They are involved with the National Electric Highway Coalition, a group of U.S utilities working with businesses and communities to minimize range anxiety and promote long-range EV travel.

EV Costs Comparisons to ICE Vehicles

On these pages, I have written about various aspects of EV operation, including charging logistics and related details. However, I'm sure that readers are curious to know how today's EV compares to a traditional internal-combustion engine (ICE) vehicle when it comes to purchase, insurance, fuel/charging, maintenance, and replacement costs (the latter, for example, when referring to replacing an EV battery pack versus an ICE engine replacement).

Let's take a look with the caveat that all of this information is based on today's dollar values and current technology (particularly relative to the EV, whose technology may be evolving more rapidly in most cases than ICE technology – except in the case of hybrid ICE/EV models).

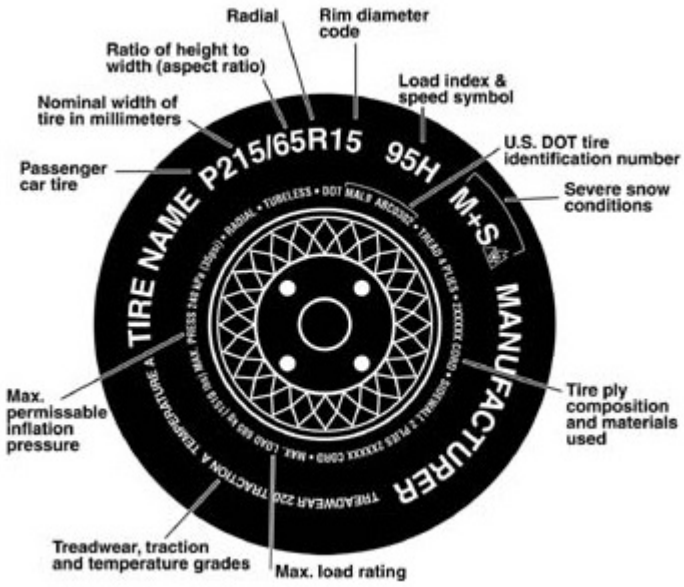
EV vs. ICE Purchase Price and Financing

According to May, 2023 data provided by Cox Automotive, the average purchase price of an EV in the United States was $55,488 compared to $48,528 for the purchase price of an ICE vehicle. This does not factor in any U.S. government credits (up to $7,500 for qualifying vehicles meeting the requirements for manufacturing source, etc.). There are also differences in the premium some manufacturers place on the EV version of a model based on its ICE equivalent. For example, some Hyundai models have a nearly $11,500 price differential while other manufacturers either have lesser differences or don't offer the model in both versions.

Additionally, EVs add an average of $1,200 to new vehicle financing charges, according to NADA.

Insurance

Like financing, buying an EV typically adds an average of $1,200 to the annual insurance bill. NADA estimates that, over a 5-year period, it cost $6,824 to insure the average EV in comparison to the average ICE vehicle insurance costing $5,707 over the same period. Also, insurance adjusters will add a higher percentage for EV replacement parts – particularly those related to replacing the battery pack, motors, and other EV-related components that may be not as readily available currently or more costly to manufacturer.



This is the anatomy of coding on a typical tire. EV tires include special sound absorption and tread wearing capabilities (to handle the additional weight of EVs). They cost more than the average tire.

Maintenance

Speaking of EV battery packs, the average battery, using today's data, is estimated to last around 10 years – based on use, care, and conditions. If the vehicle is maintained and driven properly, some estimates project battery packs will last 20 years. However, not enough data is yet available to show the actual impact of EV battery decline over time and the amount of maintenance needed before a pack needs replacement. Should a battery need replacement, it currently costs from $5,000 to $15,000, according to Edmunds.com. By

comparison, an ICE replacement costs, on average, $3,000 to $6,000, according to Jerry Insurance.

One factor to consider with respect to ICE vehicles is the maintenance of fuel systems, radiators, and oil changes -- all of which add an average of $2,000 to the overall life cost of an ICE vehicle. While EVs eliminate the need to maintain these systems, both vehicle types still share the need to maintain tires and brakes .

When it comes to tires and brakes, the EV adds costs over time to both – due to the added weight of the vehicle (averaging 1,000 pounds) and the recommendation to purchase special EV tires designed to address the added weight and road noise issues.

Charging vs Fuel Costs

As has been mentioned in previous articles, home charging at Level 2 requires 240 volt power (also used in clothes dryers) and an estimated $2,000 cost for charging equipment and installation. Charging will add from $50 to $100 per month to the average electric bill. By comparison, it costs $1,875 to operate an ICE vehicle with a 20 MPG average for 10,000 miles if fuel costs $3.75/gallon, according to *DollarTimes*.

Additional Sources

Minimizing Electric Vehicles' Impact on the Grid

Careful planning of charging station placement could lessen or eliminate the need for new power plants, a new study shows.

Source: https://news.mit.edu/2023/minimizing-electric-vehicles-impact-grid-0315

David L. Chandler | MIT News Office
Publication Date: March 15, 2023

National and global plans to combat climate change include increasing the electrification of vehicles and the percentage of electricity generated from renewable sources. But some projections show that these trends might require costly new power plants to meet peak loads in the evening when cars are plugged in after the workday. What's more, overproduction of power from solar farms during the daytime can waste valuable electricity-generation capacity.

In a new study, MIT researchers have found that it's possible to mitigate or eliminate both these problems without the need for advanced technological systems of connected devices and

real-time communications, which could add to costs and energy consumption. Instead, encouraging the placing of charging stations for electric vehicles (EVs) in strategic ways, rather than letting them spring up anywhere, and setting up systems to initiate car charging at delayed times could potentially make all the difference.

The study, published today in the journal *Cell Reports Physical Science*, is by Zachary Needell PhD '22, postdoc Wei Wei, and Professor Jessika Trancik of MIT's Institute for Data, Systems, and Society.

In their analysis, the researchers used data collected in two sample cities: New York and Dallas. The data were gathered from, among other sources, anonymized records collected via onboard devices in vehicles, and surveys that carefully sampled populations to cover variable travel behaviors. They showed the times of day cars are used and for how long, and how much time the vehicles spend at different kinds of locations — residential, workplace, shopping, entertainment, and so on.

The findings, Trancik says, "round out the picture on the question of where to strategically locate chargers to support EV adoption and also support the power grid."

Better availability of charging stations at workplaces, for example, could help to soak up peak power being produced at midday from solar power installations, which might otherwise go to waste because it is not economical to build enough battery or other storage capacity to save all of it for later in the day. Thus, workplace chargers can provide a double benefit, helping to reduce the evening peak load from EV charging and also making use of the solar electricity output.

These effects on the electric power system are considerable, especially if the system must meet charging demands for a fully electrified personal vehicle fleet alongside the peaks in other

demand for electricity, for example on the hottest days of the year. If unmitigated, the evening peaks in EV charging demand could require installing upwards of 20 percent more power-generation capacity, the researchers say.

"Slow workplace charging can be more preferable than faster charging technologies for enabling a higher utilization of midday solar resources," Wei says.

Meanwhile, with delayed home charging, each EV charger could be accompanied by a simple app to estimate the time to begin its charging cycle so that it charges just before it is needed the next day. Unlike other proposals that require a centralized control of the charging cycle, such a system needs no interdevice communication of information and can be preprogrammed — and can accomplish a major shift in the demand on the grid caused by increasing EV penetration. The reason it works so well, Trancik says, is because of the natural variability in driving behaviors across individuals in a population.

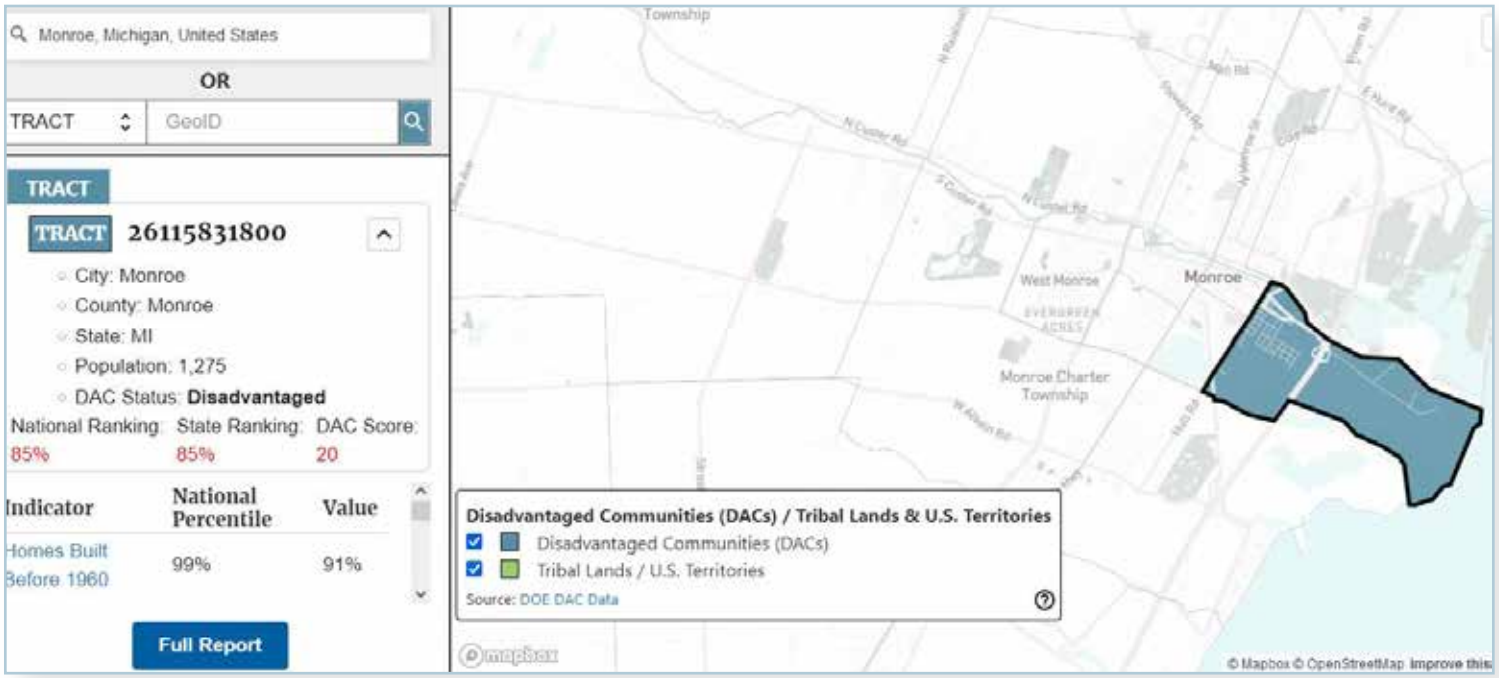
By "home charging," the researchers aren't only referring to charging equipment in individual garages or parking areas. They say it's essential to make charging stations available in on-street parking locations and in apartment building parking areas as well.

Trancik says the findings highlight the value of combining the two measures — workplace charging and delayed home charging — to reduce peak electricity demand, store solar energy, and conveniently meet drivers' charging needs on all days. As the team showed in earlier research, home charging can be a particularly effective component of a strategic package of charging locations; workplace charging, they have found, is not a good substitute for home charging for meeting drivers' needs on all days.

"Given that there's a lot of public money going into expanding charging infrastructure," Trancik says, "how do you incentivize the location such that this is going to be efficiently and effectively integrated into the power grid without requiring a lot of additional capacity expansion?" This research offers some guidance to policymakers on where to focus rules and incentives.

"I think one of the fascinating things about these findings is that by being strategic you can avoid a lot of physical infrastructure that you would otherwise need," she adds. "Your electric vehicles can displace some of the need for stationary energy storage, and you can also avoid the need to expand the capacity of power plants, by thinking about the location of chargers as a tool for managing demands — where they occur and when they occur."

Delayed home charging could make a surprising amount of difference, the team found. "It's basically incentivizing people to begin charging later. This can be something that is



These maps show areas of Monroe County designated as Justice 40 locations by several U.S. government agencies. Justice 40 is an initiative launched by President Joe Biden shortly after taking office in 2021 to ensure that 40 percent of the overall benefits of certain Federal investments flow to disadvantaged communities that are marginalized, underserved, and overburdened by pollution.

preprogrammed into your chargers. You incentivize people to delay the onset of charging by a bit, so that not everyone is charging at the same time, and that smooths out the peak."

Such a program would require some advance commitment on the part of participants. "You would need to have enough people committing to this program in advance to avoid the investment in physical infrastructure," Trancik says. "So, if you have enough people signing up, then you essentially don't have to build those extra power plants."

It's not a given that all of this would line up just right, and putting in place the right mix of incentives would be crucial. "If you want electric vehicles to act as an effective storage technology for solar energy, then the [EV] market needs to grow fast enough in order to be able to do that," Trancik says.

To best use public funds to help make that happen, she says, "you can incentivize charging installations, which would go through ideally a competitive process — in the private sector, you would have companies bidding for different projects, but you can incentivize installing charging at workplaces, for example, to tap into both of these benefits." Chargers people can access when they are parked near their residences are also important, Trancik adds, but for other reasons. Home charging is one of the ways to meet charging needs while avoiding inconvenient disruptions to people's travel activities.

The study was supported by the European Regional Development Fund Operational Program for Competitiveness and Internationalization, the Lisbon Portugal Regional Operation Program, and the Portuguese Foundation for Science and Technology.MIT researchers have found that placing EV charging stations in strategic locations and setting up charging systems to initiate charging at delayed times could help reduce the impact of EVs on the electrical grid, reports Michael Schoeck for *PV Magazine*.

MIT researchers have found that by "encouraging strategic EV charging placement, rather than allowing EV chargers to be situated merely due to charging company convenience or preferences" it may be possible to "mitigate or eliminate EV charging problems without the need for advanced technological systems of connected devices and real-time communications, which could add to costs and energy consumption," reports Carolyn Fortuna for *CleanTechnica*.

MIT scientists have found that delayed charging and strategic placement of EV charging stations could help reduce additional energy demands caused by more widespread EV adoption, reports Grace Carroll for *Fast Company*. "Leveraging these two strategies together significantly eliminates any additional energy demands," writes Carroll, "and can be tailored to specific local conditions to help cities meet their decarbonization goals."

A new study by MIT researchers finds that strategic placement of EV charging stations and creating systems to help stagger charging times could help reduce or eliminate the need for new power plants to handle the impact of EV charging on the grid, reports Sharon Udasin and Saul Elbein for *The Hill*. The researchers found that "better availability of charging stations at workplaces could help take advantage of peak power being produced midday by solar energy facilities."

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Micromobility [Fact sheet]

On pages 21-23

Source: United States. Department of Transportation. Federal Highway Administration. https://www.fhwa.dot.gov/livability/fact_sheets/mm_fact_sheet.pdf . Reprinted with permission.

I AM MCCC

EV Charging Infrastructure Development in Monroe County, Michigan

Tom Adamich - Professor,
Reference/Technical Services Librarian –
Monroe County Community College -
MCCC

MCCC has been developing EV-related awareness and educational opportunities since 2014. This presentation (available upon request) outlines some of the progress made on EV infrastructure development as well as information on key individuals/ organizations participating in these efforts.

Micromobility

Emergence of New Transportation Modes

The Federal Highway Administration (FHWA) is advancing research on the rapidly evolving field of micromobility. FHWA defines micromobility as:

> *Any small, low-speed, human or electric-powered transportation device, including bicycles, scooters, electric-assist bicycles (e-bikes), electric scooters (e-scooters), and other small, lightweight, wheeled conveyances.*

The Society of Automotive Engineers classifies powered micromobility vehicles as those with a top speed of less than 30 mph and a curb weight of less than 500 pounds.

Evolution of shared micromobility devices. (Images sourced from www.123rf.com and www.unsplash.com)

Micromobility has rapidly proliferated in cities nationwide, proving to be a popular transportation option for many users. Micromobility devices may be individually owned; however, the recent surge of devices in cities is due primarily to the deployment of shared fleets by private companies. Shared micromobility systems are deployed in targeted service areas with the usage intended for short trips such as “first- and last-mile” connections to complete trips made via other modes including transit. Shared fleets provide users with on-demand access to devices. These fleets are most commonly parked in the public right-of-way, either grouped at a dock or as “dockless” devices. Users typically unlock the devices using a smartphone application.

The Bureau of Transportation Statistics maintains an interactive map showing the extent of the deployment of bike share and e-scooter systems across the country. The resource highlights docked bike share systems, which were the first shared micromobility systems to appear in the United States, along with the more recent systems of shared e-scooters and e-bikes that have emerged.

Micromobility Topic Areas

- **Safety and Infrastructure** – Because they lack the protection of an enclosed vehicle, micromobility users are considered "vulnerable road users," similar to pedestrians. Unprotected or discontinuous bicycle and pedestrian infrastructure can lead to conflicts with other road users, increasing the risk of injury. Micromobility users rely on safe and connected bicycle and pedestrian facilities for travel. Many cities and agencies have expanded bicycle and pedestrian programs to consider and account for the needs of micromobility users, while others have prohibited e-scooter use on sidewalks and other facilities fearing modal conflicts with pedestrians. FHWA, State and local jurisdictions, and private operators engage in efforts to educate the public on safe travel behaviors and to support the expansion of robust, continuous bicycle and pedestrian infrastructure. Policymakers have also enacted strategies such as geofencing and device parking corrals, which regulate the use and parking of devices to promote safety.

- **Access and Mobility** – Micromobility devices help to close the first- and last-mile gaps to transit and can offer individuals greater access to jobs, health care, and other services. Powered and adaptive micromobility devices may also increase mobility for older adults or individuals with disabilities, as they are less strenuous to operate than traditional bicycles or scooters. Despite these benefits, shared micromobility devices have presented challenges to cities as individuals operate and park them in the public right-of-way, sometimes blocking sidewalks. To combat this, cities employ strategies to maintain compliance with the Americans with Disabilities Act by removing parked or abandoned devices that block sidewalks and multi-use paths.

- **Equity** – Micromobility can help to expand access and mobility options to underserved communities. Cities and operators have enacted strategies to ensure equitable access for shared fleets including requiring a certain number of micromobility devices to be available in underserved communities, creating discounted fare structures, and providing credit-free access.

- **Data** – Local jurisdictions and private companies collect device and travel behavior data from shared micromobility devices. In many cities, operators provide real-time information on the number, location, and condition of devices. They may also provide the origin, destination, and routing of trips. These data inform policy decisions and enable cities to better manage shared micromobility. Emerging standards for data collection can improve the availability and utility of such data, as well as establish protocols for anonymizing data to protect individual privacy.

- **Regulation** – A growing number of cities permit private companies to operate shared micromobility fleets. Permits allow cities to enforce regulations at the local level, including vehicle caps, operating speed limits, data sharing requirements, and conditions to encourage equitable device access. The National Association of City Transportation Officials (NACTO) and People for Bikes both provide resources about micromobility regulations, including examples of regulations.

- **Funding** – Shared micromobility fleets are typically funded through private investment and sponsorships. The infrastructure that these devices use for travel and parking is typically public. Existing Federal transportation legislation includes funding for Federal-aid projects such as sidewalks and on-street bike lanes, which may be used by micromobility users, pending local regulations.

Success Stories

Improving Access and Safety for Shared Micromobility Users in Santa Monica, CA

Santa Monica, California, began a Shared Mobility Services Pilot in 2018 allowing four private companies to provide shared mobility services, including e-scooters and e-bicycles, to the community. The city carefully crafted the program to enable flexibility and collaboration with the participating companies in order to encourage data sharing, equity, and accessibility within the system. A report on Santa Monica's pilot found that 49 percent of shared mobility trips replaced trips that otherwise would have been driving or ride-hailing, showing the program's success in reducing congestion and emissions.

E-scooters parked in a designated drop zone. (Courtesy of the City of Santa Monica)

Chicago Advances Micromobility Efforts through an E-Scooter Pilot and Bikeshare Expansion

The Chicago Department of Transportation (CDOT) committed to expanding its shared micromobility program in 2019. CDOT launched an e-scooter pilot and expanded the city's Divvy docked bikeshare program, adding 10,500 new electric-assist bikes and 175 new stations. CDOT coordinated extensively with community partners during this expansion to provide traditionally underserved communities with improved access to shared micromobility devices. A report on Chicago's e-scooter pilot found they fill a mobility gap for lower-income residents and help shift travel from cars to active transportation.

Los Angeles DOT Develops Data Platform to Manage Mobility Providers

The Los Angeles Department of Transportation developed the Mobility Data Specification (MDS) in 2018 to provide a standard for two-way data exchange between mobility operators and cities. MDS is an open-source tool providing a shared data vocabulary and allowing cities to communicate to and manage operators. MDS has been adopted by cities, agencies, and mobility providers nationwide.

Coordination Efforts

The United States Department of Transportation (U.S. DOT) coordinates with internal and external stakeholders to advance the state of the practice related to micromobility. Please see the following resources for a summary of micromobility activities led by FHWA and by partners across U.S. DOT.

Resources

Pedestrian and Bicycle Information Center

- The Basics of Micromobility and Related Motorized Devices for Personal Transport
- E-Scooter Management in Midsized Cities in the United States

Centers for Disease Control

- Dockless Electric Scooter-Related Injuries Study

NACTO

- Shared Micromobility in the U.S.
- Guidelines for Regulating Shared Micromobility

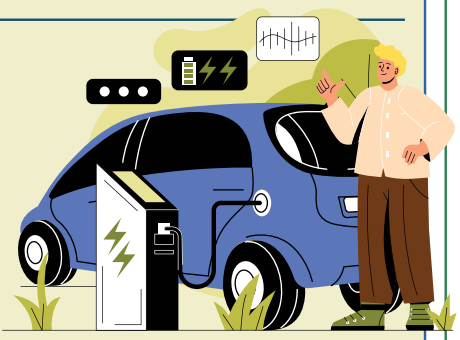
FHWA Micromobility Point of Contact – Danielle Blackshear, Danielle.Blackshear@dot.gov

ELECTRIC VEHICLE SHOW

Please bring your Electric Vehicle for display and demo

October 15, 2022
9 a.m. to 12 p.m.

(Set up is at 8 a.m.)



Monroe County Community College
Parking Lot #2, Directly in front of the Career Technology Center
1555. S. Raisinville Road • Monroe, MI 48162

MONROE COUNTY COMMUNITY COLLEGE
enriching lives

This event is free and open to the public.

For more information, contact Parmeshwar (Peter) Coomar, at pcoomar@monroeccc.edu or 734.384.4209.
You can also contact the Applied Sciences and Engineering Technology Division office at 734.384.4112.

MCCC continues to host and expand its EV Show –
an opportunity to examine EVs and learn more about EV topics and related products.

Congratulations on the purchase or lease of your Electric Vehicle!

Did you know DTE has rebates and resources that can help? As an EV owner you could...

$500 ...qualify for a $500 Level 2 charger rebate!

To qualify:

- Install a qualified Level 2 charger listed on **www.dteenergy.com/chargingforward**
- Enroll in a year-round time-of-use (TOU) electric rate

...view charger installation pricing from electricians in your area.

...find an electric pricing option that works best for your EV charging needs.

For all this and more, visit **www.dteenergy.com/ev**

190617-04/xx/xx/08-19

DTE is one of Michigan's electric utilities offering EV charging rebates and assistance to DTE customers.

This photo shows the Ford F-150 Lightning Pickup on display under a good EV charging display at the SEMCOG Community EV Event held in Canton, MI in August, 2023. (Eric Seals/Detroit Free Press)

The EV Jobs Academy is sponsored by the Michigan Department of the Environment, Great Lakes, and Energy (EGLE) in cooperation with the Michigan Department of Labor and Economic Opportunity (LEO). Its goal is to support EV job talent development. EV-related employers work with Michigan educational institutions and others to establish, develop, and distribute EV training, internship, and educational opportunities. More information is available at: https://www.michigan.gov/leo/bureaus-agencies/wd/industry-business/mobility/electric-vehicle-jobs-academy .

This is a photo from the SEMCOG Community - Electric Vehicle (EV) Expo held in Canton, MI in August, 2023. MCCC served on the planning committee and worked with the City of Luna Pier to share information at the event. (Eric Seals/Detroit Free Press)

SEMCOG | SOUTHEAST MICHIGAN COUNCIL OF GOVERNMENTS

SC2FC Smart Cities and Community Fleet Collaborative

Community Electric Vehicle (EV) Fleet Expo

As part of the Smart Cities and Community Fleet Collaborative (SC2FC) efforts, SEMCOG is in the process of planning a **Community EV Fleet Expo** in Summer/Fall of 2023.
The goal of this Expo is to showcase a range of Electric Vehicles available for Community Fleets (including parking enforcement, code enforcement, inspection, and shared fleet vehicles, as well as police cruisers, school buses, and refuse haulers), and provide an opportunity for local governments and educational institutions to:

- **see, feel, and interact with community EV fleet vehicles and charging infrastructure,**
- **hear case studies from early adopters**,
- **connect with resources and organizations** across the EV space that can help make acquiring and maintaining vehicles and charging infrastructure a feasible and cost-effective prospect.

Who is the Audience?

SC2FC aims for this event to be a hands-on experience for e-curious **representatives from local and county governments, school districts, and community colleges**, in Southeast Michigan region, particularly those that are interested in EV fleet procurement or adopting policies that involve bringing low- or zero-emission vehicles into their community garages and onto their community's fleets.

What are the Expectations of the Event?

EVs are still a relatively recent concept in the automotive sphere, and many people associate EVs with luxury roadsters. However, by showcasing diverse and cost-effective offerings in a physical setting, it can help make those who are either undecided or unsure about making the purchase more aware of the broad range of models and use cases for low- and zero-emission vehicles.

It is important to note that this Expo is **not a test drive event**, out of respect for providing organizations who may not feel comfortable with nonaffiliated people driving their vehicles. However, we expect that attendees will have the opportunity to sit in and otherwise examine the vehicles to get a feel for their scale, features, and differences from their current community fleet vehicles.

The Expo Committee

To gain a better understanding of what is involved in putting together an EV Fleet Expo, SEMCOG is convening a small committee made up of SC2FC EV partners (local governments, ISDs and community colleges, nonprofit organizations, utility providers, and OEMs). Expo committee members will help determine the material and logistical requirements for the Expo, as well as potential partners and other key stakeholders. We thank you for considering participation in the committee. By contributing your expertise, your organization can help SEMCOG identify all required considerations to make this upcoming Community EV Fleet Expo a success.

The SEMCOG EV Expo is another event to provide education and information to Michigan cities and counties exploring electrification for a portion of their fleets and for other community-based opportunities.

The Jeep Wrangler was part of an electric vehicle show held at Monroe County Community College in 2021. (Courtesy Blake Bacho/*Monroe News*)

EV Curriculum at MCCC

The following are courses under consideration to be part of the MCCC EV Curriculum at the time of the writing of this book. They are in draft form and moving through the approval process. Also included are a listing of prerequisites to be taken to become eligible to take the EV courses:

Courses

Introduction to EV Safety/Range/Consumer Education

EV Power Systems, Battery Design and Testing

EV and Hybrid Propulsion Systems Diagnosis and Repair

Prerequisites

Introduction to Automotive

Electrical 1

Engine Performance 1

Successful completion of these courses would make students eligible in the future to obtain ASE L3 Light Duty Hybrid/Electric Vehicle Specialist certification when it becomes available.

Katie Maller, Business Development Associate and Marketing Coordinator for EVUnited uses an app on her phoe to connect her Tesla EV to the new EV charging station at Monroe County Community College in front of the La-Z-Boy Center/Meyer Theater. Electrical employees Troy Cox and Trevor VanHuysse, who set up the new EV charging station, cap the old charging stations installed back in 2017.

New EV charging stations are located at the east end of the Riverfront Parking Lot in Monroe nearest South Monroe Street and are accessible via the West Front Street entrances.
(Both photos courtesy Tom Hawley/*Monroe News*)