THE ABCs OF MICHIGAN EVs

A POLICY GUIDE TO ELECTRIFY MICHIGAN

The Citizens Utility Board (CUB) of Michigan was formed in 2018 to represent the interests of residential energy customers across the state of Michigan. CUB educates and engages Michigan consumers in support of cost-effective investment in energy efficiency and renewable energy and against unfair rate increase requests.

CUB gives a voice to Michigan utility customers and helps to ensure that citizens of the state pay the lowest reasonable rate for utility services and also benefit from the environmental implications of investment in clean energy. CUB of MI is a nonpartisan, nonprofit organization whose members are individual residential customers of Michigan's energy utilities. For more information visit www.cubofmichigan.org.

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Electrification Is in Motion

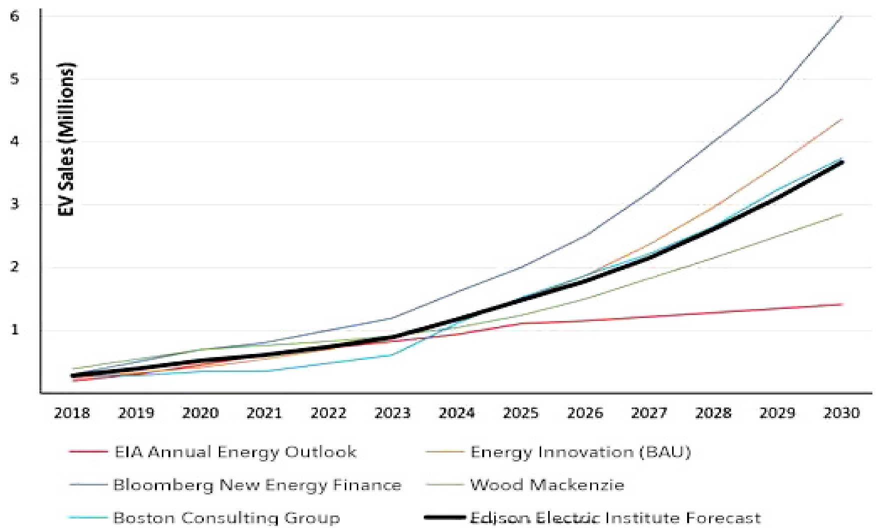
Driven by market dynamics, consumer preferences, advances in technology and public policy, electrification of the global vehicle fleet is underway. With the transportation sector as today's largest source of the carbon dioxide emissions causing climate change,[1] achieving the national objective of reducing carbon emissions to 50% of 2005 levels by 2030 will require a transition from fossil-fueled cars and trucks to Electric Vehicles (EVs).[2]

In 2020 EVs comprised 2.4% of the 15 million light vehicles sold annually in the US, but that market share is expected to mushroom in coming years, reaching 3.5% in 2021, more than 10% by 2025, and a projected 67% by 2040.[3] Many other countries are further down the EV path, with market penetration already hitting 15% in Europe and China.[4] EV sales in the US vary dramatically by region, with the EV share of the West Coast car market at 10%, while the Midwest lags with EV sales of less than 2%.[5] For EVs to reach President Biden's goal of half the auto market by 2030, national sales must grow by 35% each year for a decade.[6]

Although global automobile sales fell 16% overall in 2020 due to the COVID-19 pandemic, EV sales rose 41% for the year and more than doubled in the first half of 2021.[7] But EVs have barely scratched the surface of the Michigan auto market. As of June 2021, Michigan ranked 21st among all states, with 10,620 registered EVs—just one out of every 750 cars on our roads.[8] That may change as auto plants in Michigan

1 https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions; 29% of US carbon dioxide emissions are from transportation, 25% electricity generation, 23% industrial, 13% commercial and residential, and 10% agriculture.
2 As used herein, EV refers to a car or light truck that plugs in and can drive on electricity only, including Battery Electric Vehicles (BEV) and Plug-in Hybrid Vehicles (PHEV).
3 See https://www.bloomberg.com/news/articles/2021-08-09/at-least-two-thirds-of-global-car-sales-will-be-electric-by-2040, https://insideevs.com/news/489525/us-electric-car-market-share-record-2020/ and https://www.businesswire.com/news/home/20210208005423/en/Canalys-Global-Electric-Vehicle-Sales-up-39-in-2020-as-Overall-Car-Market-Collapses
4 https://www.acea.auto/fuel-pc/fuel-types-of-new-cars-battery-electric-7-5-hybrid-19-3-petrol-41-8-market-share-in-q2-2021/, https://www.greencarcongress.com/2020/09/20200904-acea.html, https://insideevs.com/news/522274/china-plugin-car-sales-june2021/ and https://cleantechnica.com/2021/04/23/11-plugin-vehicle-share-in-china/
5 https://insideevs.com/news/506502/california-plugin-car-sales-2021q1/
6 https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-bidenannounces-steps-to-drive-american-leadership-forward-on-clean-cars-and-trucks/
7 See https://www.iea.org/reports/global-ev-outlook-2021 and https://www.marketwatch.com/story/ev-sales-continue-to-gain-ground-11627581876
8 See national data at https://afdc.energy.gov/data/

Figure A: Annual Electric Vehicle Sales Forecast, U.S.[1,2,3,4,5,6]



Credit: DriveOhio/HNTB Electric Vehicle Charging Study, June 2020

1. U.S. Energy Information Administration (EIA) — Annual Energy Outlook 2018 Reference Case (February 2018): https://www.eia.gov/outlooks/aeo/
2. Bloomberg New Energy Finance (BNEF) — Electric Vehicle Outlook 2018 (May 2018): https://about.bnef.com/electric-vehicle-outlook/#toc-download
3. Boston Consulting Group (BCG) — The Electric Car Tipping Point (November 2017): https://www.bcg.com/en-us/publications/2018/electric-car-tipping-point.aspx
4. Energy Innovation — Energy Policy Simulator 1.4.1: https://us.energypolicy.solutions/scenarios/home
5. Wood Mackenzie — The Electric Vehicle Outlook Data (August 2018): https://www.woodmac.com/nslp/electric-vehicles-guide/
6. Edison Electric Institute and Institute for Electric Innovation. Plug-in Electric Vehicles Sales Forecast Through 2030 and the Charging Infrastructure Required. November 2018. http://www.ehcar.net/library/rapport/rapport233.pdf

begin to roll out EVs. The first ones will be GMC Hummer pickup trucks manufactured at the Detroit-Hamtramck Assembly Center, one of five GM plants that will soon be building EVs.

GM plans to produce 30 new electric models by 2025 and vows that its light duty vehicles will be 100% electric by 2035.[9] Stellantis (formerly Fiat-Chrysler) is introducing 10 new EVs in 2021, and Ford has announced it will invest $29 billion in EV development over the next five years.[10] Meanwhile, EV industry leader Tesla targets annual sales growth of 50%.[11] With the impending introduction of a new generation of EVs with higher range and lower costs, a tipping point toward mass market adoption appears to be on the horizon. At the same time, however, two-thirds of American consumers have never been inside an EV and nearly one-third say they never plan to buy one.[12]

Transportation Electrification (TE) can be a driver of cleaner air, reduced carbon emissions, lower transportation costs, enhanced grid reliability and a more efficient electricity system. But for EVs to evolve from a niche market to mass adoption in a way that captures these benefits requires supportive and effective public policy at the federal, state and local levels.

Much of the jurisdiction over the electricity industry lies with our state legislature and utility regulators. Both the Michigan Legislature and Public Service Commission (MPSC) face critical questions surrounding TE planning, infrastructure, rules, rate design, and equity. The right TE policies and programs — reflecting Michigan's market structure, supply mix, load dynamics, and social goals — can ensure that everybody from Marquette to Monroe will benefit from EVs, whether or not they drive one. But poorly designed or nonexistent policies will lead to higher costs and lower benefits, hampering the electrification trend and exacerbating economic and social divisions.

> The right TE policies and programs .. can ensure that everybody from Marquette to Monroe will benefit from EVs, whether or not they drive one.

In this report, the Citizens Utility Board of Michigan examines key issues facing our state. We propose guidelines for policy development and specific measures to help propel this emerging market transformation and ensure its benefits reach all Michiganders.

9 https://www.nbcnews.com/business/autos/gm-go-all-electric-2035-phase-out-gas-diesel-engines-n1256055
10 https://media.ford.com/content/dam/fordmedia/North%20America/US/2021/02/03/fin-4q20-ford.pdf
11 https://insideevs.com/news/482501/tesla-q4-2020-deliveries-2021-target/
12 See JD Power survey results: https://www.tdworld.com/distributed-energy-resources/article/21146109/survey-highlights-absence-of-consumer-interest-in-bevs-selfdriving-technologies

SUMMARY: THE TASK AHEAD

Why should Michigan policymakers and advocates concern themselves with EVs? After all, regulators don't typically focus on end-use electricity—there aren't proceedings about refrigerators or coffee-makers. EVs need special attention because they are different from other appliances in ways that have profound implications for the electricity system.

An EV in the garage could increase the electricity consumption of a typical household by 40%—and millions of them plugged in could require costly expansion of electricity delivery and generation capacity. But if EVs are managed as distributed energy resources, the rise of transportation electrification can lead to lower—not higher—electric rates for all consumers.

This CUB of Michigan report is intended to help our state develop a strategy to capture the potential of explosive EV growth and use it to optimize our state's electric system. We identify factors affecting EV market growth, assess its ramifications for the electric grid and for consumers, advance principles to protect the interests of electricity customers, and recommend responsive state actions.

The decisions Michigan makes must be in sync with our state's social goals, geography, energy market structure, supply technologies, load dynamics, and economic forces. Policymakers will need to consider threshold questions about the applicability of state regulatory authority to issues beyond the scope of traditional utility regulation. The lengthy list of topics for examination include:

- Equity and inclusion to bring EV benefits to all.
- Consumer protection, education and information.
- Implications of EV growth for load shapes, electric rates and rate designs.
- Options for assuring adequate charging infrastructure.
- Addressing geographic and demographic disparities in EV adoption.
- Fair allocation and recovery of EV-related costs and investments.
- Advanced metering, charging, and load-management strategies to optimize system efficiency.
- Value, scale, design and funding of pilot programs.
- Opportunities for regional cooperation.
- Roles of public utilities, private vendors, local government, EV owners, and other stakeholders.

Consumer value, system optimization, equity and fairness should be the priorities shaping EV policy. This guide provides an overview of the nascent electrification of Michigan transportation and suggests a path toward achieving these goals.

Part 1: It's Not Your Father's Automobile

Because anybody can bring home an EV and plug it in, an electric car may appear to be just like any other big electrical appliance. But EVs are different from rolling refrigerators because they store electricity and have controllable demand. With large intermittent loads and manageable charging schedules, EVs are an entirely new form of electrical device, with unprecedented potential for consumer and system benefits.

The physics of electricity—the need to keep supply and demand perfectly balanced at every moment for the power grid to function—and the limits of 20th century technology resulted in deployment of an inefficient electricity system. Generation, transmission and distribution had to be sized to serve uncontrolled peak electricity demands, leaving tremendous excess capacity most of the time. In recent decades the focus of attention turned to making the grid more efficient, through energy efficiency, demand management, and energy storage. Now the urgency of the global climate crisis has added reduced emissions to the list of objectives. The scale and flexibility of EV charging loads makes them key resources to help advance the goals of optimizing grid utilization and cost-effectiveness, while minimizing the environmental impact of transportation.

TE WILL SAVE EVERYBODY MONEY— IF WE DO IT RIGHT

Instead of higher costs for generation and delivery capacity that would otherwise be required to serve burgeoning EV demand, consumers would see lower electricity bills if surplus capacity were the primary resource for EV charging. Analyses by the Rocky Mountain Institute show that if the entire US fleet of cars and light trucks were converted to electricity, overall power consumption would go up by about 25%, but could be largely accommodated without additional power plants or grid expansion if EVs were charged at optimal times.[13] Using EVs as grid-supportive demand response resources would further fill gaps in system load shape and support grid operation, reducing the cost per unit of energy delivered. As the amount of solar and wind power grows, syncing EV charging with renewables' variable output would add another level of system optimization. No other electricity loads have this much potential value.

Consumers would see lower electricity bills if surplus capacity were the primary resource for EV charging.

Yet high EV charging demand would pose significant challenges to an ill-prepared system. When 20% of the 8 million cars in Michigan are electric—which may happen within a decade—we could see a 10% increase in overall electricity consumption. The biggest challenge will be not just cleanly producing the additional energy, but in managing when and where EV charging occurs so that all electricity users benefit. Michigan must start now to prepare for that future.

EV VS. ICE—IT'S NO CONTEST

Jump-started by Tesla more than a decade ago, EV adoption has mushroomed in part due to supportive public policy but mostly as a market phenomenon. EVs are popular with some drivers because they are healthier for the environment and cheaper to operate, but others are attracted by their performance characteristics, which are superior to comparable internal combustion engine (ICE) vehicles. An EV's immediate torque, quick acceleration, low maintenance, smoother ride and lower noise levels (not to mention lack of exhaust fumes) have moved 96% of EV owners to say they would buy one again for their next car.[14]

Charging at home instead of filling up at a gas station has proven to be a welcome consumer convenience—soon to be made even easier with the option of plug-free wireless charging[15]—and you fuel up without having to touch pump handles or be exposed to potential health risks.[16]

EVs cost far less to operate than ICE vehicles, a comparative advantage that will grow as battery and

13 https://rmi.org/insight/electric-vehicles-distributed-energy-resources/
14 https://pluginamerica.org/wp-content/uploads/2021/02/2021-PIA-Survey-Report.pdf
15 Norway, where 10% of all cars on the road and 75% of new cars sold are electric, is testing wireless charging infrastructure for taxis while they wait for passengers: https://www.fortum.com/media/2019/03/fortum-and-city-oslo-are-working-worlds-first-wireless-fast-charging-infrastructure-taxis
16 see: https://www.reuters.com/article/us-usa-health-filth/gas-pump-handles-top-study-of-filthy-surfaces-idUSTRE79O0G820111025

BETTER BATTERIES WILL BE A BIG BOOST

Today's EVs are powered by lithium-ion batteries—much like a cellphone or laptop but strung together by the thousands in large battery packs. LI batteries use a liquid electrolyte that makes them heavy, susceptible to deterioration over time, and unstable under very high temperatures. Solid state EV batteries are being developed by several manufacturers. They can hold twice the energy, weigh half as much, last twice as long, and can be charged more quickly. And in addition to being inherently safer than lithium-ion batteries, solid state batteries are expected to be cheaper to manufacture. That would be a "game changer" for EVs and sounds too good to be true—but small-scale solid-state batteries are already used for applications such as heart pacemakers. Billions of dollars are going into R&D, and solid-state EV batteries are anticipated to be commercialized later this decade.[1]

1 https://www.autoweek.com/news/technology/a36189339/solid-state-batteries/

motor technology continues to improve, and EV charging is optimized to reduce electricity costs. For example, the 2021 Chevy Bolt has a 66 kilowatt-hour (kWh) battery with an Environmental Protection Agency (EPA)-estimated range of 259 miles, so it travels 3.92 miles per kWh.[17] At the average Michigan residential rate of 17.69 cents per kWh, it would cost $11.68 to "fill the tank" with electricity, compared to $25.90 for gasoline to drive a 30 miles per gallon (mpg) ICE car the same distance (at $3.00 per gallon).[18] That's a fuel savings of 55%, even though Michigan has the highest electric rates in the Midwest.[19] But the actual cost of electricity to charge an EV at home is even less because the published average cost per kWh includes fixed monthly fees for electric service. The incremental cost to power an EV in Michigan averages about 14 cents per kWh— equivalent to paying about $1 per gallon of gas[20]—and the cost of fueling an EV can be cut further by electricity rates that provide a discount at off-peak times.[21]

For a typical car driven 12,000 miles per year, annual fuel costs would be $1,200 for the ICE car and $428 for the Bolt—a difference of $772. That's enough to finance about $5,000 of the additional cost to purchase the Bolt, which at $36,000 (and no longer eligible for a federal tax credit) remains a relatively expensive car for its size.

Figure B: Annual Fuel Costs to Power an EV vs. 30 MPG ICEV at Varying Gasoline Prices (assume 12,000 miles/year)[22]

According to a study by the National Renewable Energy Laboratory, driving an EV can save the typical US driver $14,500 in fuel costs over 15 years.[23] For many drivers, EVs are already an economical choice.

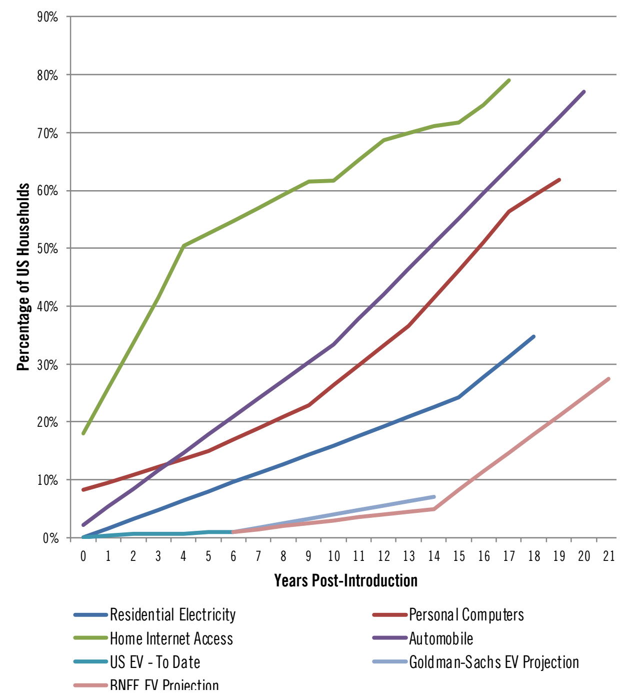
EVs also have non-fuel cost advantages over conventional cars. Electric motors can be expected to last

17 https://www.chevrolet.com/electric/bolt-ev
18 At incremental rate of 14 cents/kWh, the cost to drive a typical EV traveling 3.57 miles per kWh comes to under 4 cents per mile. An ICE vehicle getting 30 MPG and paying $3 per gallon of gas costs 10 cents per mile.
19 Average Michigan residential rates are 28% above the national average. See national rate comparison at https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a
20 https://www.eia.gov/state/rankings/?sid=MI#series/31
21 For example, see DTE off-peak rate of 11.4 cents/kWh at https://newlook.dteenergy.com/wps/wcm/connect/dte-web/home/service-request/residential/pricing/residential-pricing-options and Consumers Energy off-peak rates of 10 cents/kWh or less at https://www.consumersenergy.com/residential/rates/electric-rates-and-programs/rate-plan-options/smart-hours
22 Chart data assumes 1000 miles/month for typical light-duty passenger vehicle travel and 3.6 miles per KWh, the average efficiency of today's EVs. For list of all EVs' fuel consumption see: https://ecocostsavings.com/electric-car-kwh-per-mile-list/
23 https://www.nrel.gov/news/press/2020/research-determines-financial-benefit-from-driving-electric-vehicles.html

much longer than combustion engines. And with few moving parts in the motor, simple transmissions, no belts, hoses, muffler, spark plugs or catalytic converter, and no oil changes or engine tune-ups, EV maintenance costs have been 40% lower than ICE vehicles.[24] For example, Chevy's recommended maintenance schedule for the Bolt EV includes only tire rotation and new brake fluid every five years. One effect of low maintenance is that car dealers have been reluctant to push EV sales because servicing vehicles is a core part of their business model. That may change as EV models proliferate and competition grows.

While expensive to replace, EV batteries are required by law to be warrantied for at least 100,000 miles and may have acceptable output far beyond that.[25] The batteries also have "second life" value for potential home use and grid support when no longer retaining enough capacity for powering a vehicle. The new Bipartisan Infrastructure and Jobs Act allocates $3 billion toward expansion of facilities to recycle battery materials and another $3 billion to advance battery materials processing technology.

Figure C: Market Penetration of Major Technologies over Time



BARRIERS TO ELECTRIFICATION

Will EVs see explosive growth similar to personal computers beginning in 1984, the Internet in 1995, cellphones in 2000 or HDTV in 2005? All of these quickly became ubiquitous, supplanting earlier technologies seemingly overnight.

The car market will take longer to electrify, even as national policy begins to mandate decarbonization and support EV growth, because the average car lasts for 12 years—and 25% of cars stay on the road for more than 16 years.

One obstacle to mass adoption of EVs is uncertainty about gasoline prices, which means people can't forecast exactly how much they will save in operating costs by buying an EV. For some drivers the key barrier to going all-electric is "range anxiety." That's the concern that an EV might run out of juice and strand the driver somewhere they can't plug in or leave them waiting for hours while the battery charges. With the average car in Michigan driven less than 40 miles a day and the typical all-battery EV (BEV) having a range of 250 miles (and growing), this concern is largely unfounded for local driving. However, the occasional long-distance highway trip makes it loom large in the minds of car buyers. They want bigger batteries but that means higher prices.

Range anxiety is fully eliminated by plug-in hybrid vehicles (PHEV), which operate on electricity for 20 to 50 miles, depending on battery capacity, before switching automatically to an auxiliary gas engine for longer trips. PHEVs are not zero-emission vehicles (ZEV) because they emit pollutants when operating on the gas engine, but they are important transitional vehicles on the road to a carbon-free future. As we will discuss further, convenient and fast charging opportunities are essential to mass adoption of battery-only EVs (BEV), but public support will be needed for sufficient charge station deployment.

SHRINKING EV STICKER SHOCK

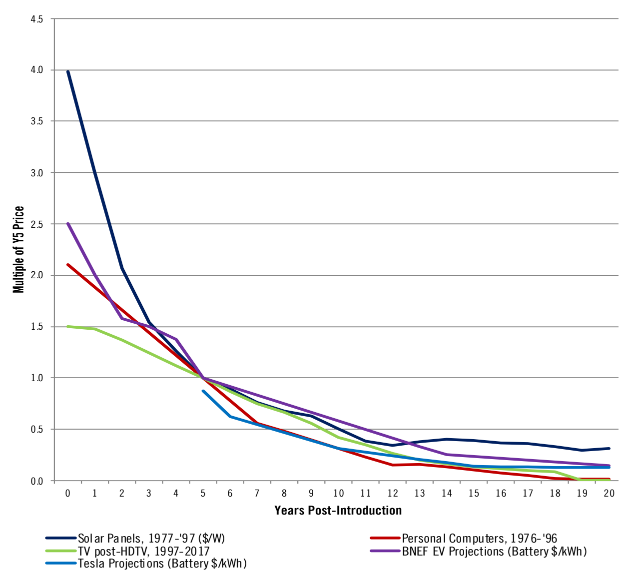
While the total life-cycle outlays to own and operate an EV have already dropped close to the average for similar ICE vehicles, EVs must have lower purchase

24 https://www.osti.gov/biblio/1780970
25 https://www.marketwatch.com/story/how-long-will-my-ev-battery-last-heres-what-to-know-11625774475#:~:text=For%20now%2C%20conservative%20estimates%20for,miles%20using%20the%20original%20battery.

prices for them to dominate the car market.[26] Federal tax credits of up to $7,500 for the purchase of a new EV have been crucial in getting the EV market off the ground, but they are phased out for each car manufacturer as their EV sales pass 200,000 units.[27] And most of the rebates have gone to high-income households that can afford to buy an EV and have sufficient income to use the tax credit. Income-qualified EV incentives applicable to both new and used EV purchases would focus public subsidies where they are needed most.

Battery costs—which can make up one-third the total cost of an EV—have fallen 90% in a decade, to an estimated average of $137 per kWh of storage capacity, and they continue to drop by about 15% each year.[28] EVs will achieve price parity with ICE vehicles when battery costs fall to about $100 per kWh, which may happen in the next couple of years.

Figure D: Unit Price Reductions after Major Product Introduction (Indexed to Year 5)



When they are price-competitive with conventional vehicles, EVs will be the preferred option for many car buyers, but another barrier to EV adoption will loom large: About one-third of homeowners and two-thirds of renters do not have a convenient place at home to plug in a car.[29] Many of these households are in multi-unit buildings in urban areas. A further challenge is that some homes don't have sufficient electric panel capacity to support high charging loads at the same time as other household usage.[30] These facts raise a range of emerging issues of EV equity that must be addressed by policymakers.

COMING SOON: AUTONOMOUS VEHICLES (AVs)

"Self-driving cars" are not quite here yet, but remaining technological obstacles may soon be overcome, as a raft of leading tech companies are racing to solve them, including Apple, Intel, Tesla, Google, as well as various startups and many legacy car manufacturers. The social and political barriers to AVs are another matter, and it will take time before people are comfortable with the idea of driverless cars on the road. The business model is uncertain, but if AVs arrive, the 100-year-old paradigm of car ownership may be upended, because when the car doesn't need a driver, many drivers will no longer need to own a car. Such a social shift seems far-fetched in a culture steeped in car ownership. However, "Mobility as a Service" may come to dominate urban transportation markets—and because of EV cost advantages, AVs will be electric. Michigan companies are in the forefront of AV development and the state is among the first to pass measures to allow the technology to be tested on public roads.

26 https://publications.anl.gov/anlpubs/2021/05/167399.pdf
27 Tesla and GM cars are no longer eligible under current law. Nissan may reach the threshold in early 2022 and Ford and Toyota not far behind. See https://www.edmunds.com/fuel-economy/the-ins-and-outs-of-electric-vehicle-tax-credits.html
28 See Bloomberg New Energy Finance survey https://www.bloomberg.com/news/articles/2020-12-16/electric-cars-are-about-to-be-as-cheap-as-gas-powered-models
29 See https://www.census.gov/newsroom/press-releases/2020/2019-american-housing-survey.html and as reported in a survey by the National Renewable Energy Laboratory: http://www.afdc.energy.gov/uploads/publication/consumer_views_pev_benchmark.pdf https://www.pecanstreet.org/2021/08/panel-size/
30 See https://www.pecanstreet.org/2021/08/panel-size/

Part 2: Propelling the Policy Process

EV policies concern many stakeholders operating beyond the usual scope of state regulation. Important players on the EV field include not just utilities, consumer advocates, and regulatory commissions, but charge station providers, carmakers and dealers, transportation service companies, electricity generators, regional grid operators, charger technology companies, commercial property and charge site owners, community and civic groups, municipal governments, labor unions, and hardware, software and energy services providers. All of these stakeholders have something important to add to EV policy considerations. EV regulatory proceedings would benefit from a process to engage interested stakeholders at the outset — not in an adversarial docket but in a collaborative effort that develops a shared base of information and allows a free exchange of ideas and views. In turn, the regulatory outcome would benefit from commonly understood policy priorities for EV integration, shared criteria for evaluating outcomes, and ultimately, a clearly stated set of goals for Michigan.

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FIRST FACE THE FUNDAMENTALS

EV policy consideration by public utility regulators raises threshold questions about regulatory scope, legal authority and policy framework including:

- **What is the statutory role of the MPSC in addressing transportation electrification?** *Improving reliability, affordability and quality of service is at the core of state regulatory responsibility. To what extent does EV policy fall under the commission's general public interest mandate? What, if any, legislative changes may be appropriate?*

- **Does the commission have authority to account for externalities such as the environmental effects of energy usage in setting regulatory policy?**
  MPSC is not tasked with environmental regulation, though its oversight of utilities has significant environmental impact and sustainable energy has become a regulatory goal, reflected in Michigan's renewable portfolio and energy efficiency standards, integrated resource planning, and now in initial EV support initiatives.

- **Does the commission have authority to target regulatory policy at a particular electricity end use such as EVs? Is it the job of regulators to promote EV expansion? Should they tackle chicken/egg issues?**
  "Build it and they will come" is not a traditional basis for regulatory policy, but utilities have always used growth projections for system planning. How should uncertain EV growth be projected in long-term utility planning?

- **What is the right decisional framework for determining scope and scale of EV-supportive programs? What factors should be included in cost-benefit projections for infrastructure investment and new programs?**
  The amount of spending and how it is recovered hinge on both the electric system effects and other key factors—such as whether to include social and environmental benefits beyond the traditional scope of commission concern, how to quantify them, and appropriate time horizons.

- **How should program or investment costs be allocated among customers and classes? Should existing costs be reallocated to support EV growth?**
  Cost allocation is a zero-sum game in the short term, and cross subsidies are generally avoided. What approaches might be justified by the social benefits of TE?

- **Does the commission have authority (and would it be advisable) to put EVs on separate rates or demand response programs?**
  Customer choice is generally preferable to regulatory mandates, but could incentives for participation by EV owners in programs to achieve regulatory goals include both "carrots and sticks"?

- **To what extent are owner/operators of EV charge stations subject to regulation? Does the commission have authority to create and enforce standards and consumer protections?**
  Can funding or other public support be contingent on compliance with rules and codes of conduct?

  The growing EV charge industry asserts that EV charge stations are like cellphone chargers and are not a regulated provision of electricity. But state regulatory laws were not written with the system impact of EV charging in mind.

- **Is the public charge market fully competitive or does it have elements of monopoly that might call for oversight and accountability?**
  Competition among EV charge providers may not be sufficient to induce open access and interoperability, or to protect consumers from price predation when they need a charge and have no other place to get it.

- **What type of evidence is needed for regulators to make electrification policy decisions?**
  At this early stage, EV policy is speculative but we need not wait for foreseeable problems to arise before addressing them. How can initiatives be "future-proofed" to avoid stranded costs?

- **How might proposed policies and programs be tested through scalable pilot programs?**
  Given the uncertainties about EV market evolution, demand for services and utilization of infrastructure, pilots are needed to gauge the efficacy of different approaches.

- **Are Michigan utilities different from one another in ways that might affect EV policies?**
  Do different geo-demographic, EV adoption rate, and other service territory characteristics have policy implications? What metering technology is in place and planned? Would existing utility systems (software, billing, and hardware) need modification to accommodate preferred EV solutions, and at what costs and benefits to whom?

Part 3: Electrification Must Leave Nobody Out

EVs are almost non-existent in low-income neighborhoods. Many households cannot afford any kind of car, or residents prefer to walk, bike or take public transportation. Those who own a car often lack a place where they can park and plug it in. And although over time the operating savings can make the cost of an EV lower than a traditional car, the initial outlay for a new EV remains beyond the reach of consumers with limited incomes. Low-income buyers also face obstacles to financing, and vital EV information can be difficult to find for those whose native language is not English.

CONFRONTING OBSTACLES TO EV OWNERSHIP

Combined with consumer education, innovative programs like the following would bring personal EVs to under-resourced communities:

- Income-based rebates for used EVs and home chargers. (Some pre-owned EVs are available at lower prices than similar ICE vehicles, and their low operating costs make them a clean energy bargain — provided that convenient charging opportunities are available.)
- Income-based swap programs to facilitate trading-in ICE vehicles for EVs or other clean energy mobility solutions.
- Geo-targeted public charge station development (perhaps with income-based discounts or local vouchers).
- EV-sharing programs in lower- and moderate-income neighborhoods. (Several cities have been experimenting with discounted EV-sharing for low-income residents. 31 Other clean and low-cost last-mile transportation initiatives, such as e-scooters and e-bicycles could be made available for sharing in environmental justice communities.)[31]
- Support for EVs used by drivers for Transportation Network Companies like Uber and Lyft, which have become major mobility providers in low-income neighborhoods.

A MICHIGAN EV ROADBLOCK

Michigan is one of the 20 states to impose special costs on EVs intended to replace gasoline taxes that pay for road maintenance. That $100 annual EV surcharge helps the road fund but it has no relationship to how many miles an EV travels on Michigan roads — and it deters EV sales at a time when we should be encouraging them.

Higher efficiency vehicles—whether ICE or EV—will soon make gas taxes an outdated and shrinking revenue stream, which could be replaced by taxes based on vehicle miles traveled (VMT), a more fair and reliable funding source. Several states, including Oregon and Utah are already testing VMT taxes, and a voluntary national pilot of the concept is included in the new Bipartisan Infrastructure and Jobs Act. Michigan should join other states in seeking better ways to make up for shrinking gas tax revenue.

- On-street charger options, perhaps using existing grid-connected infrastructure such as streetlights.[32]

Bringing TE to all communities is a key component of sound policy, and a variety of such efforts are worthy of exploration. The central goal must be to make sure everybody benefits from electrification, whether or not they ever have their own EV.

DIRTY AIR IS A SILENT KILLER

The mortal threat of the COVID-19 pandemic may be receding but there is no vaccine to stop air pollution and unchecked climate change. Overburdened and underserved urban communities are disproportionately vulnerable to these threats, just as they have been to the pandemic, making environmental justice an urgent concern for the post-pandemic world.

One hazard common in many lower-income neighborhoods is chronic exposure to dangerous levels of

31 See https://www.nytimes.com/2021/03/02/travel/ebikes-bike-sharing-us.html and https://www.bikeshare.com/
32 Kansas City has initiated a pilot program to install EV chargers on streetlight poles; see: https://metroenergy.org/programs/current-projects/streetlight-ev-charging/#readmore

toxic air. As coal plants have begun to close and electricity production has gradually become cleaner, the largest US source of pollution and carbon emissions is now the transportation sector. Petroleum fueled cars and trucks emit a noxious stew of chemicals and particulate matter.

Even before the COVID pandemic, respiratory disease was Michigan's third leading cause of death (after cancer and heart disease, both of which are also exacerbated by air pollution).[33] Michigan's average pollution level ranks 22nd among states, according to the Air Quality Index maintained by the Environmental Protection Agency (EPA).[34] Low-income neighborhoods are disproportionately harmed by dirty air because they are often located near multiple sources, including industrial facilities, oil refineries, incinerators, highways, bus depots and truck corridors.

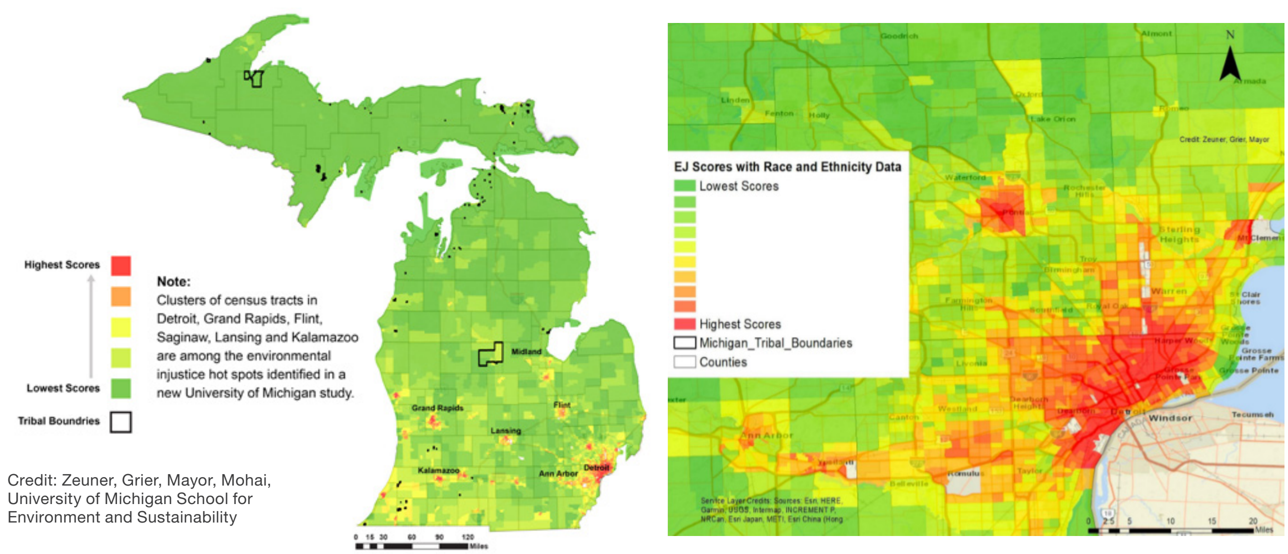
Diesel fueled buses and trucks are among the worst urban air polluters, producing 40 hazardous chemicals including hydrocarbons, smog-forming nitrogen-oxide (NOx), carbon monoxide, benzene and volatile organic compounds. Diesel fuels also produce high levels of small particulate matter (PM 2.5), a prime contributor to asthma and lung disease, which are prevalent in low-income urban communities.[35] Excessive exposure to PM 2.5 is also correlated with sub-optimal cognitive performance and learning disabilities.[36]

The Detroit/Warren area ranks 12th worst among all US cities for particulate pollution.[37] Intermodal freight terminals that produce high levels of these pollutants are often heavily concentrated in low-income Black and Latinx neighborhoods. According to the American Lung Association, 981,706 people in Michigan are exposed to excessive levels of particle pollution, putting their health at risk.[38] The state could avoid $1.66 billion in health costs during the year 2050, have 145 fewer deaths, 1,837 fewer asthma attacks and avoid 8,253 lost workdays—just by electrifying transportation.[39]

A University of Michigan student team used environmental and social factors to map the "hot spots" of environmental injustice in lower Michigan, which includes parts of Detroit, Flint, Grand Rapids, Lansing and Kalamazoo.

Electrified transportation can be an important part of remediating environmental injustice.

Figure E: Heat Map of Michigan Census Tracts Ranked by Environmental Justice Scores



33 https://www.cdc.gov/nchs/pressroom/states/michigan/michigan.htm
34 https://worldpopulationreview.com/state-rankings/air-quality-by-state
35 See EPA https://www.epa.gov/pm-pollution/particulate-matter-pm-basics
36 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5499513/
37 https://www.lung.org/research/sota/key-findings/year-round-particle-pollution
38 https://www.lung.org/media/press-releases/mi-sota-2021
39 State data at: https://www.lung.org/getmedia/99cc945c-47f2-4ba9-ba59-14c311ca332a/electric-vehicle-report.pdf

LIFE-CYCLE CARBON FOOTPRINTS: ICE VS EV

The environmental impact of a vehicle includes the emissions produced by mining and manufacturing all its components plus its operation for the 15-year period that an average car is on the road. While EVs themselves emit no pollutants or carbon dioxide, the emissions of an EV are determined by the source of its electricity, which varies from region to region and time to time. Even where coal remains the primary fuel for electricity generation, power to run EVs is generated more cleanly than by gasoline. This has been demonstrated in many studies, most recently by the International Council on Clean Transportation, which found that life-cycle EV emissions are 60-68% less than gas vehicles in the US, an advantage that is quickly growing as the electricity mix moves toward cleaner fuels. Michigan's electricity is largely provided through the Midcontinent Independent System Operator, a power pool covering all or part of 15 states (except for a portion of southwest Michigan, which is part of the PJM Interconnection). The amount of coal in the regional energy supply mix dropped from 39% to 34% in just one year and is expected to fall by more than half by 2030 as coal plants are retired.[1]

1 https://www.potomaceconomics.com/wp-content/uploads/2021/05/2020-MISO-SOM_Report_Body_Compiled_Final_rev-6-1-21.pdf

TE MEANS CLEANER AIR AND LOWER CARBON EMISSIONS

Silver linings were difficult to find in the pandemic cloud, but throughout the country, smog lifted a bit and skies cleared—temporarily. In the spring of 2020 emissions of pollutants in New York were less than half the typical amount, and in Southern California levels of particulate matter fell by 40% in April 2020.[40] Demand for gasoline and jet fuel plummeted, and the stay-at-home regimen provided a glimpse of how air quality would improve if millions of gasoline cars were replaced with pollution-free EVs.[41] NASA scientists found that levels of nitrogen dioxide, a very harmful pollutant associated with respiratory illnesses, had dropped substantially in the 15 largest metro areas, including Detroit.[42] Unfortunately, as the economy opened up, pollution levels rose.[43]

A comprehensive analysis of the effects in Michigan of different EV penetration scenarios was conducted by MJ Bradley & Associates, an energy consulting firm.[44] It showed that in a high-penetration scenario, with almost 1 million EVs in Michigan by 2030, annual oil consumption would fall by 5.8 million barrels and net vehicle emissions would fall by more than 25% by 2030—including the emissions from regional power plants used to generate the electricity for EV charging. The fuel mix is getting cleaner every year as coal plants close and more energy comes from wind and solar power.

IT'S NOT ALL ABOUT CARS

Personal vehicles are only one piece of transportation electrification. Low-income communities will benefit from electrification of a range of transportation and mobility modes, including:

- **E-transit buses**—The pandemic highlighted the need for electrification of the nation's 80,000 intra-city public buses, but today less than 2% of the US fleet are zero-emission, including battery electric and hydrogen fuel cell.

  While many office workers may be able to work from home, most lower-income people have on-site jobs in service, industrial, and retail sectors. Public transportation, especially via bus, is the only way

40 See https://www.washingtonpost.com/weather/2020/04/09/air-quality-improving-coronavirus/ and https://www-wsj-com.cdn.ampproject.org/v/s/www.wsj.com/amp/articles/coronavirus-got-rid-of-smog-can-electric-cars-do-so-permanently-11586532988?usqp=mq331AQFKAGwASA%3D&amp_js_v=0.1#ampshare=https%3A%2F%2Fwww.wsj.com%2Farticles%2Fcoronavirus-got-rid-of-smog-can-electric-cars-do-so-permanently-11586532988
41 See: https://www.nasa.gov/feature/goddard/2020/nasa-model-reveals-how-much-covid-related-pollution-levels-deviated-from-the-norm
42 https://www.nasa.gov/feature/esnt/2021/qa-scientists-analyze-how-the-pandemic-affected-air-quality
43 See: https://www.iqair.com/world-air-quality-report
44 https://mjbradley.com/sites/default/files/MI_PEV_CB_Analysis_FINAL_03aug17.pdf

THE VALUE OF ELECTRIFICATION ISN'T FLEETING

Big private vehicle fleets are going electric. Amazon has ordered 100,000 electric delivery trucks, which not only is good for the brand but will save the company lots of money in the long run. That's because central fleet housing and smart charging will mean very low operating costs, and high utilization will allow quick recovery of the extra capital outlay. These economies apply to all fleets, the biggest of which are operated by governmental units. The State of Michigan operates fleets totaling 13,500 vehicles, many of which are ripe for electrification. Initially, EVs could replace government vehicles with the highest daily usage, as they would provide the greatest fuel cost savings and emissions reduction.

The US government owns 650,000 gas-powered vehicles, which President Biden has vowed to replace with EVs.[1] That appears to be a good long-term deal for taxpayers as well as the environment. A study found that 97% of the non-postal federal fleet vehicles could be replaced with EVs by 2030 at a net savings to the government.[2]

The 192,000 light duty vehicles of the Postal Service are especially suitable for electrification because they have predictable travel, are housed centrally and their charging can be fully managed. Unfortunately, the USPS presently intends to replace its fleet in coming years, but with 90% ICE vehicles, a decision that may take an act of Congress to change.[3]

1 https://www.reuters.com/article/us-usa-biden-autos/biden-vows-to-replace-u-s-government-fleet-with-electric-vehicles-idUSKBN29U2LW
2 https://www.government-fleet.com/10149562/report-97-of-federal-fleet-buses-light-duty-vehicles-could-be-replaced-by-evs-by
3 https://chargedevs.com/newswire/us-house-advances-measure-to-provide-8-billion-funding-to-replace-usps-trucks-with-evs/

for many people to access jobs that have been shown to be as essential to the economy as they are to individual livelihoods.

Electric transit buses require higher capital outlays and installation of charging infrastructure but have many advantages over pollution-spewing diesel models.[45] In addition to being quieter, smoother and exhaust-free, e-buses provide:

- Estimated savings of $458,000 per bus in fuel and maintenance costs over their lifetime.[46] These 40% savings could be monetized through financing mechanisms to defray today's higher upfront costs.
- $150,000 per bus in reduced annual healthcare costs due to avoided pollution, according to an analysis by Columbia University.[47]
- Zero tail-pipe emissions instead of the average of 117 metric tonnes of carbon dioxide for one year's operation of a typical diesel bus.

Blue Water Area Transit in Port Huron has become the first system in Michigan to put e-buses on the street. With the help of grants from federal and state transportation agencies and electric utility DTE Energy, they have acquired an on-route charge station as well as two 40-foot e-buses. Ohio Sen. Sherrod Brown has proposed a plan to make the entire US bus fleet zero-emission by 2035.[48]

The initial rollout of e-buses should be targeted to environmental justice communities that are most in need of cleaner air. They can be configured to meet the new safety needs of passengers—for example, to have fresh rather than recirculated air flowing through the cabin.

- **Electric school buses**—America's biggest transit system is its 485,000 school buses. Only a few hundred of them run on electricity, but the new federal infrastructure legislation allocates $2.5 billion toward electrification of 20% of the US school bus fleet.[49] This is an urgent task, as new

45 For comprehensive overview of health benefits of transportation electrification see https://www.lung.org/getmedia/99cc945c-47f2-4ba9-ba59-14c311ca332a/electric-vehicle-report.pdf
46 https://www.apta.com/wp-content/uploads/Public_Transit_Leading_In_Transition_To_Clean_Technology.pdf
47 http://www.columbia.edu/~ja3041/Electric%20Bus%20Analysis%20for%20NYC%20Transit%20by%20J%20Aber%20Columbia%20University%20-%20May%202016.pdf
48 https://cte.tv/transition-us-fleet-report/
49 https://www.vox.com/future-perfect/2021/4/6/22364385/one-small-idea-in-bidens-infrastructure-plan-with-big-benefits-electric-school-buses

research shows that students who breathe diesel bus fumes on the way to and from school have lower scores on standardized academic tests.[50] Seven Michigan school districts are testing 17 e-buses partially paid for with grants from the Volkswagen diesel cheating settlement, and charge stations supported by funds from DTE. The first of these buses are on the road in Ann Arbor and Roseville.[51]

The high initial costs of an e-bus — twice as much as an equivalent diesel bus (although that's anticipated to come down with higher manufacturing volumes) — are offset over time by fuel cost savings, particularly if charged at low overnight rates.

Because school buses are often idle during the summer months of high air-conditioning demand, e-bus batteries could potentially provide grid support during peak periods.[52] The ability to have electricity flow both into and out of plugged-in vehicles — known as "V2G" (Vehicle-to-Grid) — turns school buses into potential sources of electricity when they are not on the road. DTE is studying this option and Dominion Energy in Virginia has announced plans to put 1,000 V2G-capable e-school buses in service by 2025.[53] And the nation's first V2G-capable school bus has been delivered in Illinois.[54]

- **E-trucks** — Truck exhaust causes enormous health problems, particularly in communities close to highways and truck depots, which are often predominantly lower-income areas.[55] The U.S. has 9.3 million registered commercial trucks, including 2.9 million tractor-trailers (aka semi-trucks or 18-wheelers), which produce 8% of the nation's total carbon emissions. With their enormous energy consumption and miles driven, trucks provide a huge opportunity for fuel cost savings. Like other fleet applications, they can benefit from economies of scale through central charging depots and can be smart-charged to further minimize costs.

  Giant trucks need giant batteries and a network of fast charge stations on interstate highways, but truck manufacturers including Mack, Daimler, Chinese company BYD and several new entrants are investing in electric truck development and preparing to put the first models into service. With half the fuel and maintenance costs of diesel trucks, Tesla claims that it s upcoming e-truck could pay for its extra initial cost in two years.[56]

  While access to adequate charging infrastructure on the road is a big challenge, many trucks are local day carriers that can be centrally charged using low-cost overnight power. A new freight industry study found that more than 5 million medium- and heavy-duty trucks are suitable for electrification.[57] E-truck and commercial fleet charging depots could be located where the existing grid has sufficient capacity for their high loads, so investment in new distribution infrastructure can be minimized. These locations are often in areas where deindustrialization has occurred — exactly the places that need both non-polluting vehicles and new jobs.

GETTING FROM HERE TO THERE

A strategic plan at the outset is needed to bring transportation electrification to low-income communities. Planners should examine projected benefits, costs, and risks of options — mapped to those who will pay for it, and those who will derive value. Spreading the costs over the timeframes of their projected public benefits would be fair to utility customers and/or taxpayers, who would be supporting new programs.

Crafting a TE plan requires input and participation from stakeholders representing all perspectives, including low-income advocates, consumer, business, environmental, and community groups, utilities, and government agencies.

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50 https://nationswell.com/diesel-school-bus-retrofits-improve-test-scores/
51 https://ngtnews.com/dte-energy-rolls-out-electric-buses-for-ann-arbor-roseville-schools
52 See https://electrek.co/2019/08/23/electric-v2g-school-bus-pilots-grow/
53 https://www.dominionenergy.com/our-stories/electric-school-buses; also see https://stnonline.com/partner-updates/a-guide-to-locating-funding-for-electric-school-bus-purchases/
54 https://insideevs.com/news/497272/blue-bird-first-v2g-school-bus/
55 https://www.eia.gov/dnav/pet/pet_cons_821usea_dcu_nus_a.htm
56 https://www.tesla.com/semi
57 https://www.canarymedia.com/articles/electric-vehicles/electric-trucks-could-handle-millions-of-short-haul-routes-across-north-america

environmental, and community groups, utilities, and government agencies. Such an effort entails collaboration between groups that may have little experience working with each other, as well as internal communication and coordination within public and private institutions. The “silos” within large organizations often hinder effective action and must be bridged by leadership to create common purpose.

Input from low-income communities is indispensable. Communications planning starts with hearing from affected communities about policies that would address their needs and concerns. Plans should be regularly evaluated and updated as conditions and public needs evolve.

Utility-implemented programs can be judged by their performance, including how well they achieve public goals. Metrics can be designed to measure progress in:

- Increasing availability and usage of electrified transportation in low-income areas.
- Improving efficient utilization of the electric grid.
- Lowering peak demand, improving load shapes.
- Improving affordability of electric service.
- Using EVs to integrate renewable and clean energy resources.
- Creating jobs in targeted areas.
- Cleaning air in high-pollution neighborhoods.
- Reducing carbon emissions.
- Putting downward pressure on electricity rates.

Progress and outcomes should be publicly and regularly reported. Plans should be evaluated and updated as conditions and public needs evolve. Any Electric Vehicle Service Providers (EVSP) receiving public or utility funding as part of a TE plan should be subject to reasonable standards and consumer protections.

Part 4: Charging Ahead

The environmental benefits of electrification are clear, and those who suffer the most from pollution have the most to gain. What is less widely understood is that transportation electrification can also keep down the cost of electricity for all customers—even for those who don't own an EV.

A 20% penetration of the car market—50 million EVs on American roads—could mean new complications and costs for system operation. If the delivery grid were to need added capacity to handle EV charging, all those additional wires, poles, transformers and equipment could lead to rate hikes for all electricity customers. And higher peak demand would raise market energy prices. On the other hand, if EV charging could be accomplished without significantly expanding electric system capacity, there would be downward pressure on electricity rates because the costs of the system would be spread over more kilowatt-hours (kWh) of energy sales. As we will detail, this positive outcome is achievable through regulatory policies that optimize EV charging patterns.

The MJ Bradley analysis (referenced earlier) projects the amounts by which EV charging revenue in Michigan might exceed new utility costs under different scenarios. It found that when EVs reach 40% of cars and pickup trucks—more than 3 million EVs in Michigan, which could happen before 2040—utility revenues could increase by $1.3 billion. If charging were managed to minimize the need for expanded capacity, Bradley projects the annual net present value to utility customers would amount to $100 million under this high-penetration scenario. Each EV purchased in 2030 would increase utility net revenue by about $700 over 10 years, most of which would flow to utility customers through the regulatory process.

The stakes are enormous for Michigan's electricity consumers. A typical BEV would consume about 4,000 kilowatt-hours (kWh) each year, adding 50% percent to the 8,000 kWh of annual electricity consumption of an average Michigan household (assuming 90% of charging is done at home). [58]

DIFFERENT WAYS TO FILL 'ER UP

A typical EV uses about 30 kWh to travel 100 miles. To get that amount of electricity out of a 110-120 volt regular house wall socket (a Level 1 charge) takes 15 to 25 hours. Quicker home charges require installation of "Electric Vehicle Supply Equipment" (EVSE). Level 2 EVSE uses a 208-240 volt circuit (like an electric oven or clothes drier) and cuts charging time by 70-90%, depending on the capacity of the circuit and charger. To charge up a fully depleted battery with a 250-mile range takes 8 to 12 hours on a typical Level 2 charge and more than 50 hours using a standard home wall socket.[59] Of course, an EV battery would rarely be fully depleted so actual charge sessions would take less time. Because longer distance local driving days are rare, most drivers don't need a level 2 charge every day and many don't need to charge more than once a week.

WORKPLACE SLOW CHARGE: FAST ENOUGH?

80% of EV charging occurs at home but 15% is at work and that percentage may grow as more states, cities and employers decide to support workplace charging. According to the Department of Energy, an employee with access to charging at work is six times more likely to buy an EV.[1]

The average daily round-trip commute of 30 miles could be fueled by plugging into a standard 110-volt wall socket during the workday. Unless employees move their cars around to share limited numbers of level 2 chargers, it makes sense to accommodate large numbers of EVs cost-effectively by just installing standard electric sockets in parking spaces. Daytime workplace charging could be paired with solar panels and/or energy storage to avoid grid congestion.

1 https://www.energy.gov/sites/prod/files/2017/01/f34/WPCC_2016%20Annual%20Progress%20Report.pdf

58 Energy Information Administration data at https://www.eia.gov/electricity/state/Michigan/ ; see data table 8

59 Note: The charger itself is actually in the car, not on the wall. The EVSE just delivers electricity to the charger, which converts AC to DC and sends current to the battery. Charging slows down when the battery gets to 80% capacity, to protect it from overheating.

Level 2 chargers are appearing at parking garages, retail stores, motels, shopping malls and other public locations. These chargers aren't fast enough to be most drivers' only energy source. But they are a convenient way to "top-off" the battery while parked.

For long highway trips and for those without a place to plug in at home, the next step up in charging speed is the DC Fast Charger (DCFC), also known as Level 3. Converting alternating current into direct current at 440-480 volts or above, the DCFC bypasses the onboard charger in the vehicle and feeds current directly into the battery through a separate connector (which often does not come as standard equipment).

Many fast chargers today operate at 50 kilowatts (kW), which adds 100 miles of range in about 30 minutes. Increasing the power to 150kW can provide 100 miles in 10 minutes, and a 350kW charger could provide 300 miles of range in as little as 15 minutes. However, existing stations are not yet capable of the highest charging speeds and few EVs today can accept them. Tesla has its own proprietary fast-charge network and says it will eventually be able to deliver a full charge in five to ten minutes (though its current vehicles could not accommodate this). Other car manufacturers are also building fast charging networks or partnering with third-party charge station developers. Volkswagen's "Electrify America" stations—being deployed as partial penance for the company's diesel cheating scandal—is open to all makes, and in Europe several car manufacturers jointly own "Ionity," a fast-charging network.[60]

SHOULD EV ACQUISITION BE SUBSIDIZED?

Many states provide incentives to support EV acquisition and several provide purchase rebates in addition to the federal tax credit.[1] Market data suggest that each $1,000 of state incentives corresponds to a 2.6% increase in EV sales. The most effective way to boost EV sales at the dealership may be through instant incentives. Instead of a rebate provided many months later through a tax rebate (which some customers can't even use because their tax bill isn't high enough), an immediate point-of-sale discount reduces the initial purchase price and therefore means lower monthly financing charges, a key measure of vehicle affordability. But are car purchase subsidies the best use of limited public funding to support EV growth? Should recipients be income qualified? Should such subsidies only apply to lower priced EVs? Should they be allowed for a household with multiple vehicles? What about used EVs, which are what most people can afford? Purchase incentives raise a raft of thorny issues of efficacy and equity.

1 https://www.ncsl.org/research/energy/state-electric-vehicle-incentives-state-chart.aspx

MICHIGAN BEGINS EV CHARGING SUPPORT

Across the country, the chicken/egg problem of chargers and EVs is being tackled in different ways. Approximately 45,000 public charge stations have been installed in the US, although only 5,000 locations have DCFC and half of those only charge Teslas.[61] At last count Michigan had 739 public charge stations with 1,227 Level 2 and 387 Level 3 ports, putting the state in the lower rankings of chargers per capita.[62]

The Michigan Department of Environment, Great Lakes, and Energy (EGLE) provides grants for EV charging infrastructure under its "Charge Up Michigan" program, funded by $9.7 million the state receives from settlement of the VW diesel cheating scandal. Under the program, costs of direct current fast chargers at chosen high-traveled routes are split between the site owner, the utility and EGLE.[63]

The new Bipartisan Infrastructure and Jobs Act puts $7.7 billion into expansion of the public charge network toward the 500,000 ports that are projected to be needed to achieve electrification of half of new cars by 2030.[64] Charge station development will be supported through grant and incentive programs for state and local governments to leverage private investment.[65] About $110 million will be allocated toward EV charging infrastructure in Michigan.

60 https://ionity.eu/
61 https://afdc.energy.gov/stations#/analyze?country=US&fuel=ELEC&ev_levels=dc_fast and fhwa.dot.gov/environment/alternative_fuel_corridors/resources/ev_funding_report_2021.pdf
62 https://afdc.energy.gov/stations/states
63 https://www.michigan.gov/whitmer/0,9309,7-387-90499_90640-558822--,00.html
64 See https://atlaspolicy.com/rand/u-s-passenger-vehicle-electrification-infrastructure-assessment/
65 https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/resources/ev_funding_report_2021.pdf

SUPERFAST CHARGING WON'T BE CHEAP

The technology to fill a battery with electricity almost as quickly as a gas pump can fill the tank is feasible, especially when next-generation solid-state batteries arrive. But extra-high voltage/high amperage DCFC will be expensive to install, operate, and maintain, as it requires heavy-duty power infrastructure, high power delivery capacity and special cooling of delivery cables. If these costs were reflected in the charging fees paid by drivers, public fast charging would be an expensive alternative to charging at home, and few people would want to use it as their primary source of EV power. The "gas station" model is unlikely to become the primary mode for EV charging, not only due to its high costs but because system efficiency requires that most charging occur at off-peak times, such as overnight, but EVs on the road will charge during peak driving periods. Providing accessible and affordable public fast-charging for those who cannot plug in at home is a daunting challenge. One idea is to have "swappable" batteries, so a depleted one could be quickly replaced by a full one, much like a propane tank for a barbecue grill. Many companies are working on the technology and logistics, which may be particularly suited to fleet applications.

Highway fast charge stations will need to accommodate periodic high demand, such as during a holiday weekend, and as EVs proliferate, the need for numerous charge ports at such locations will grow. Imagine a fast-charge station with 20 cars plugged in simultaneously. The combined load could be 3,000 kW (3 MW), or enough juice to supply the average demand of 1,500 homes. Put several of those at an interchange and it's the equivalent of adding the peak load of a sizeable industrial facility.

To serve passenger vehicle needs, highway charging stations would need far more capacity than would be used on an average day in order to serve peak periods, such as holiday weekends. The charging demands of big e-trucks would be even larger. But the fact that truck and car demand would peak at different times suggests that the charging needs of trucks and cars might be complementary. Adding electricity storage capacity at charge stations would be a way to moderate peak demand.

NEW RATE STRUCTURES SHOULD BE ON THE TABLE

The high draw of DCFC chargers affects how much the operators pay the local utility to deliver electricity to vehicles. Unlike residential rates, commercial electricity rates generally include a large fee based on the maximum amount of energy used at any moment during a month. If a fast charge station receives utility service under such a demand-based rate, its intermittent use can mean very high average costs per unit of energy provided. Michigan's policymakers need to consider whether a special set of utility tariffs is appropriate for charging stations. Demand charges could be reduced, perhaps temporarily, in order to encourage charge station development and reduce prices paid by drivers. At the same time, policies should encourage effective charge management to reduce costs and manage stress to the grid. Advantageous rates could be contingent on the charge provider accepting rules designed to promote system efficiencies (such as incorporating energy storage) and to protect consumers.

For now, drivers who can't plug in at home will find charging an EV to take far longer than filling up at a gas station, and the higher price of energy from a public charger may reduce or eliminate the fuel cost savings. That's why innovative approaches should be tested, such as curb-side chargers and other approaches that would enable EVs to fit into different housing settings and driving patterns.[66]

WHO SHOULD FUND, OWN AND OPERATE PUBLIC CHARGE STATIONS?

Many states are grappling with the question of what is the optimal role for utility companies in building out or supporting public EV charge stations. As owners and operators of the grid, there is no doubt that utilities have key functions. Policymakers must consider whether the advantages of having utilities build out public charging infrastructure outweigh concerns that utility-owned charging facilities would shut out competitors and stifle innovation.

66 An MIT study revealed how different combinations of charging availability and supplemental vehicles enables EV proliferation; see: https://www.nature.com/articles/s41560-020-00752-y.epdf?sharing_token=TtF-ibYnOHEfp0dI1HVp_9RgN0jAjWel9jnR3ZoTv0MuAf-m1jxfRYH9GRjVOtnA474s_uDkVM11ihzXypPm2zu1J78RncNkTadFYduTPUSF844q-KjQ_PFSJbqbu6-IhqHmJZlUMXNbkoHFtHDzbtUcx7q7juHlGZW_xWXpMUo%3D

In addition to being service and price-regulated and accountable to regulators, utilities generally have access to low-cost capital, ability to integrate EVs as distributed energy resources (DER), call center capability, established customer relationships, and other incumbent and legacy advantages. However, construction and operation of EV facilities may not be within the core competency of utilities and they may lack the incentives and entrepreneurial culture of unregulated firms. Costs and risks of utility investment are borne by ratepayers, who are at risk of absorbing stranded costs in the event of underperforming or obsolete facilities. Fundamental questions arise: Do public charging networks — particularly DCFC — have "natural monopoly" characteristics? Is there a need for charge station accountability through the regulatory process?

Most states are concluding that utilities should provide only the electricity infrastructure for public charge stations, and independent businesses should be the owners and operators. Whoever owns and operates charge stations, public (or utility) investment in them is premised on a set of implicit conditions:

- Without public funding not enough charge stations will be built — or at least not soon enough and not in optimal locations.
- Utilization of charge stations will be sufficient to justify their deployment.
- Any net ratepayer or taxpayer costs will be exceeded by system and social benefits.

Because of widely differing circumstances and conditions, regulators across the country are coming to different conclusions about these assertions and what they mean for regulatory policy.

INFRASTRUCTURE INVESTMENT INTRODUCES IMPORTANT ISSUES

Involvement of public utilities in charge station development raises issues beyond competitive market effects, including risk and cost-sharing between site owners and utility customers, criteria for siting decisions and how they are made, what (if any) technology requirements are specified, physical and cybersecurity, amounts and uses of subsidies, as well as terms, conditions and operating rules (and how to enforce them).

Utility-owned charge stations would be under the purview of state regulators, which can approve tariffs and enforce consumer protection rules. However, independent third parties may be subject to far less, if any, regulatory jurisdiction. This raises issues of service quality and consumer protection. In an effectively competitive public charging market, competition would constrain prices and protect consumers, but the very fact that subsidies would be needed shows that a robust market does not exist. When shopping for gasoline, there are usually multiple choices of where to fill up, but when drivers with a low battery pull up to a remote public charge station, they may be facing a situational monopoly, with no choice but to pay whatever it costs — or worse yet, to be unable to charge because the station is available only to certain vehicles or charge network members.

If utility funding or construction of charging infrastructure is found appropriate, adding the costs to ratebase would be one option to pay for it. Treating these investments as capital expenditures much like wires, poles, and other equipment allows longer term amortization, and a return on investment provides incentive for the utility. Alternatively, utility spending on charging infrastructure or other support could be recovered as operating expenses, or a combination of methods could be used for different types of utility funding and support.

In the initial stage of the industry, charge providers have introduced a number of business models, including closed networks and monthly fee requirements, which may not be appropriate for publicly subsidized facilities. Regulators should consider whether any subsidies be contingent on interoperability, model rate structures and constraints on terms and conditions. If Electric Vehicle Service Providers (EVSP) receive public or utility funding or other support, they should be subject to reasonable standards, reporting requirements and consumer protections.

INTEROPERABILITY IS ESSENTIAL

Level 2 charge connectors are generally standardized, but for Level 3 fast charging, competing EV manufacturers utilize three different DCFC connectors.[67] Each claims to have technological and consumer advantages over the others, but what's essential for consumers is to be able to get a fast charge when and where they need it. Eventually, one standard may come to dominate the market, as we've seen with other new technologies such as video cassettes more than 30 years ago. However, such a sorting out process could take many years, posing an obstacle to EV growth if not addressed through collaboration between Tesla and other vehicle manufacturers. The new federal infrastructure law requires development of standards for charging interoperability and allows federal funds to be used only for "non-proprietary charging connectors."

Another barrier lies in the multiple networks for customer charging transactions. The pricing methods and costs of charging differ widely, not just due to electricity price variations and rate structures, but because some states prohibit volumetric rates for non-utility charge providers and allow fees to be assessed only by length of charging session. In Michigan, public charging fees are usually per-minute or per-kWh. Some chargers require paid membership in a network and may charge extra fees to non-members. It's a buyer-beware public charging market, with consumer fees varying from less than 10 cents per kWh (or even free for some level 2 chargers at retail store parking lots) to more than $1 per kWh.

Making it easy for a driver to charge at any station anywhere in the country and to understand what it will cost are challenges to the EV charging industry. Public policy should support interoperability — where a driver can easily plug into any charger and get service from any provider, much like they can use their cellphone on any network. The new federal infrastructure law allows federal funding only for chargers with "open access payment methods that are available to all members of the public." The MPSC as well as universal regulatory and advocacy organizations, such as the National Association of Regulatory Utility Commissioners (NARUC) and the National Association of State Consumer Advocates (NASUCA), can play roles in pushing the industry toward interoperability and full pricing disclosure.

REGIONAL AND NATIONAL APPROACHES MAKE SENSE

Complicating the issues surrounding subsidies by utility customers of investment in charge stations is the fact that highway fast chargers would serve many non-local travelers who are just passing through a service territory. A multi-state approach may be an effective way to share the costs and benefits of highway fast charge infrastructure, coordinate charger locations, and provide a seamless network and uniform customer experience. Michigan has joined Indiana, Illinois, Wisconsin and Minnesota to initiate the Regional Electric Vehicle Midwest Coalition, with a stated purpose to create "a regional framework to accelerate vehicle electrification in the Midwest. REV Midwest provides the foundation for cooperation on fleet electrification along key commercial corridors to safeguard economic security, reduce harmful emissions, improve public health, and advance innovation."[68]

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67 CHAdeMO connector (an odd abbreviation for "CHArge de Move") is used by most Japanese manufacturers, though it is expected to be phased out in coming years. CCS (Combined Connector Standard) is used by most American and European companies, and Type 2 is used by Tesla (note: Teslas can be adapted to use non-Tesla stations, but other makes cannot presently connect to Tesla superchargers)

68 https://www.michigan.gov/documents/leo/REV_Midwest_MOU_master_737026_7.pdf

Part 5: System Benefits Require Smarts

While EVs pose no immediate threat to reliability— most Level 1 home chargers draw less current than a hair dryer, or about 12 amps—high EV penetrations could pose problems if many drivers charge simultaneously, especially at high Level 2 current flows, which can reach 60 amps or more. Imagine a hot day in a neighborhood full of EVs, where many drivers arrive home from work to plug in at the same time and they also turn up their air conditioners. It's a typical scenario that could overload the distribution circuit, and perhaps the local substation. Meanwhile, at off-peak times and during periods of high local solar and/or wind generation output, the electric system often has extensive underutilized capacity that could be used to charge EVs at little incremental cost. Smart rate design and smart charging are key to avoiding the potential problems posed by big EV loads and instead use them for system benefit.

> Smart rate design and smart charging are key to avoiding the potential problems posed by big EV loads and maximizing their system benefit.

REWORKED RATE DESIGNS ARE REQUIRED

Electric rate structure has a substantial impact on how much power is consumed and when that consumption occurs. Raising the cost of a kWh will cause people to use less of it. Raising prices at certain times and lowering them at other times will move some usage from the higher-priced to the lower-priced periods. A change in consumption when the price fluctuates—the elasticity of demand—is relatively low for an essential commodity like electricity, which has some usage that can't be controlled. We don't turn the refrigerator off, no matter the price. But some of us would do the laundry on nights or weekends if the price were discounted, and would turn up the temperature on our AC units during high-priced periods, especially if it were done automatically. If the overnight electricity price were cheap enough, we might even take advantage of thermal storage technology such as an air-conditioning unit that makes ice at night to store cold for use during the day or electric radiators that store heat energy. And we would certainly want to charge an EV when electricity rates were lowest, as long as the car is ready to go when we are.

The true costs of providing electricity vary substantially over the course of each day, but standard utility flat rates do not provide incentives to use more electricity when it is cheaper to produce and less when it is expensive. Because they store electricity for future use and the typical car is parked and potentially plugged in most of the time, EVs have flexibility to take advantage of rates that encourage charging at the best times for the grid.

RATE INNOVATIONS ADVANCE REGULATORY GOALS WHILE RECOVERING COSTS

Ratemaking has always been subject to an array of social goals, including economic development, universal service, support for specific energy sources, load building, load shedding, and load shaping. Rates send signals that influence the behavior of all actors in the chain of supply and demand—consumers, producers, retailers, and utilities.

A good EV rate design is a winner on many levels: producing lower charging costs, making the electric system more efficient, improving reliability, curtailing emissions and reducing average unit costs of electricity—while better aligning the interests of the utility and its customers. But the right rate design options are not the same everywhere because they must take into account a long list of factors including market structure, load characteristics, meter technology, generation mix, economic drivers, distributed resources, climate variables and social goals. For example, a largely rural winter-peaking state like Maine, with relatively high industrial load and electricity sourced primarily from hydropower, natural gas and wind, may design rates quite differently from a state like Arizona, with a small industrial sector, high air-conditioning use, heated swimming pools and substantial solar energy development.

CONSUMERS NEED TO UNDERSTAND UTILITY BILLS

Electricity costs flow from two large buckets—one for the generation of electricity by power plants and the other for its transmission and distribution. Both these functions used to be solely in the hands of Michigan utility companies. Beginning in 1998, the state “restructured” the electricity market and began to allow some large customers to buy power from non-utility sources.

Michigan became one of two states with partially deregulated retail energy markets (the other is California). In fourteen other states, all consumers can choose an unregulated supplier—an option which has had decidedly mixed results for residential customers. In Michigan, non-utility suppliers are limited to no more than 10% of a utility’s sales, meaning that only a limited number of large commercial and industrial customers buy energy from retail marketers.[69] Most residential customers get their electricity supply from their regulated public utility. The state’s two biggest utilities are DTE Energy (formerly Detroit Edison) and Consumers Energy, which together serve 82% of Michigan residents. The remainder are served by 6 smaller utility companies, 40 municipal utilities and 8 electric cooperatives.

Electricity bills are complicated. In addition to taxes and various mandated fees and surcharges, regulated utility rates for residential customers in Michigan generally have three basic components:

- **Monthly Service Charge**: A flat monthly fee recovers some costs that do not vary with usage, such as the service connection, meter, billing and other customer-based costs. These costs don’t change if there is an EV in the garage.
- **Volumetric Power Supply Charge**: This pays for the costs of owning, operating and fueling the mix of power plants that supply energy.
- **Volumetric Delivery Charge**: Although the costs of wires, poles, transformers and other equipment don’t vary with usage, these costs are largely collected based on how much energy is used in a month.

Time-variant rate plans save customers money if they move electricity usage to less costly times for the electricity system.[70] These rate designs include:

- **Time of Use (TOU) rates**: Higher prices in peak periods and lower off-peak prices are more reflective of actual energy costs. A successful TOU rate structure must have price variance large enough to incent drivers to charge their EV during the low-price periods and to avoid charging during high-price periods. A typical TOU rate design has two or three pricing periods, such as on-peak during daytime

69 https://www.michigan.gov/mpsc/0,9535,7-395-93308_93325_93423_93501_93509---,00.html
70 See https://cobbemc.com/sites/cobbemc/files/Current%20Site%20PDFs/White%20Papers/Residential_Electric_Vehicle_Rates_That_Work_Attributes_That_Increase_Enrollment_pdf.pdf for deeper discussion of EV rates

hours, off-peak for overnight hours and weekends, and shoulder-peak hours in early morning and late evening. These periods could be modified between summer and non-summer to reflect seasonal changes in load patterns. A "critical peak" rate could be added for periods of extraordinarily high demand that threaten service reliability.

To make TOU rates easy for consumers to understand, simple price ratios such as 1-2-3-4 could be used for the different periods (giving EV drivers incentive to program their EV to charge during the "1" period). The point of TOU rates is to move as much load as possible to the least costly times for the grid, and to share the savings between participating customers and all other customers.

- **Renewable Output/Carbon Emissions Rates**: The variable output of renewable generation can have a significant effect on the resource mix at any time, and price signals or managed charging could optimize use of this zero-incremental cost energy. For example, electric rates for participating customers could be reduced during peak periods of wind or solar output, or tied to the carbon intensity of the power mix. EV charging could be modulated to respond to these signals.
- **EV-Only Rates**: In conventional rate design, one set of rates is applied to all usage on a customer's meter. However, distinct rates could be applied to EV charging without need for a separate meter or submeter. Telematics can provide charging data from the EV or EVSE. Or with a single smart meter, the utility could use disaggregation software to divide a household's overall electricity usage into its end use components, allowing the volume and timing of vehicle charging costs to be estimated at sufficient accuracy for billing purposes.

The MPSC has approved a variety of TOU rate designs for Michigan utilities. AEP subsidiary Indiana Michigan Power has offered a simple two-part, whole-home TOU rate for decades. Now it also offers the option of a TOU rate applied only to vehicle charging.[71] However, the EV-only rate requires installation of a home submeter, adding unnecessary cost. DTE offers a $500 rebate for a home level 2 charger, provided that the customer is enrolled in one of their three TOU rate options.[72] Like AEP, This DTE EV-only rate also requires a submeter. Consumers Energy offers any EV owner a $500 charger rebate. If the customer already has a charger, both Consumers Energy and DTE offer "Bring Your Own Charger" programs. These programs give the customer a monthly credit of $10 (Consumers Energy) or $8 (DTE) if they use their own Level 2 charger overnight on weekdays between 11 p.m. and 6 a.m. (Consumers Energy) or 11 p.m. and 9 a.m. (DTE).[73] To encourage off-peak charging, both utilities also offer rate plans that include lower overnight rates.

Consumers Energy has become one of the few utilities in the country to make a TOU plan its default residential rate.[74] Unless you choose a different plan, all household usage during the summer period of June through September is charged at a 50% higher rate during the peak weekday hours of 2 p.m. to 7 p.m. DTE's optional whole-home TOU rate has greater variance, with summer off-peak prices about half of on-peak.

Michigan's new rate programs are on the right track but they must be examined closely and modified as needed. To get more customers enrolled and to maximize their effect on charging patterns, time-variant rates must be easy to understand and cost-free to participants. Customer education and information is key, and default whole-home TOU rates must be examined for their effect on vulnerable customers. Utilities should provide "shadow billing" that would show what a customer's actual usage would cost under different rate plans.

There is no downside to enrolling EV owners automatically in EV-only TOU rates that provide a discount for overnight charging without entailing additional costs to the driver. But to fully capture the local system benefits of EV load flexibility, an additional technology will be needed: smart charging.

There is no downside to enrolling EV owners automatically in EV-only TOU rates that provide a discount for overnight charging.

71 https://www.indianamichiganpower.com/clean-energy/electric-cars/charge-at-home-michigan
72 https://www.newlook.dteenergy.com/wps/wcm/connect/828b33a7-6ab8-48fa-9cf1-75abd9112dfd/ResidentialChargingForwardTerms.pdf?MOD=AJPERES
73 https://www.bringyourowncharger.com/consumersenergy and https://www.bringyourowncharger.com/dte
74 Rate Book at https://www.michigan.gov/documents/mpsc/Consumers_14_current_675992_7.pdf

POWERFUL PROSUMER POTENTIAL

The rise of electrified transportation coincides with the emergence of distributed energy resources (DER) as key elements of tomorrow's energy mix. Wind and solar are becoming leading supply technologies while demand response and energy storage are beginning to help balance loads and improve efficiency. Smart grid deployment is creating a more resilient and decentralized electricity system, allowing a growing number of electricity customers of all sizes to become "prosumers"—not just consumers of electricity but compensated participants in DER markets. Fundamental changes to the utility concept itself are on the table, including moving from the traditional hub-and-spoke model with the utility at the center—acquiring, selling, and distributing power and energy to its customers—to a network platform over which the utility's job is to provide reliable service and to facilitate energy resource transactions. EVs could become pivotal DER, using smart charging to optimize system load shape and discharging stored energy back to the grid in times of peak demand. Your car could even be a source of power for your home when the power goes out. Integrating all these innovations and trends to maximize system efficiency and reliability will be a key mission of the utility of the future.

SMART CHARGING TURNS EVS INTO DISTRIBUTED ENERGY RESOURCES

Unmanaged charging whenever the owner plugs in the vehicle could be called "dumb charging." But at relatively low concentrations of EVs plugged into standard 120V wall sockets (Level 1 charging), it poses no challenge to the electric grid. However, high neighborhood concentrations of Level 2 chargers could change system dynamics enough to necessitate costly upgrades. For example, earlier we described a scenario where commuters arriving home at 6 p.m. could set off a powerful neighborhood peak if they all plug-in, turn on the lights, crank up the A/C, and cook dinner in their electric ovens. An actively managed charging program would stagger the charging overnight and all the EVs could be fully charged by morning.

A smart charger communicates with the utility or central controller and adjusts charging levels based on real-time variables, creating a flexible distributed resource. Controlling variables could include overall electricity demand, local grid conditions, real-time output of renewable generation, marginal plant carbon emissions, and/or variable electricity prices under the customer's rate plan. This information is known to utilities or available from MISO or PJM, the regional grid operators. However, no applications are yet available that facilitate EV charging according to these variables. An applet to adjust charging in response to price signals and other customer settings is essential to taking advantage of flexible EV charging. It could be developed or acquired by utilities.

LARGE LOOMING LOADS DEMAND A RESPONSE

By filling in the valleys of system load shape, smart charging would allow EV penetration to grow quickly with minimal need for expanded generation or distribution capacity. Smart charging also would:

- Allow aggregated EV loads to be used as regulation service to address momentary fluctuations in voltage and power flows, turning chargers into grid-support resources for system operators.
- Facilitate charging curtailment during critical peak periods to protect reliable service.
- Avoid the need for additional power plants and hold down market energy prices.

As in other Direct Load Control (DLC) programs, the value of smart charging can be monetized as a demand response resource. Because the typical EV only needs to be charged during a few of the 22 hours a day that it is usually parked and plugged in, smart charge management wouldn't pose any problems for drivers.

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Smart charging aggregation programs are beginning to be designed and piloted, though not yet in Michigan. As distribution system operators responsible for maintaining reliable service at least cost, utility companies should test smart charging tools and invite EV owners to participate. Smart charging aggregations could also be organized by other entities with established customer relationships, including retail energy marketers, charge station companies, EVSE sellers, curtailment service providers, and vehicle manufacturers.

In northern California, BMW conducted a pilot to maximize use of solar energy and enhance grid stability. They found that by shifting load to optimal times, smart charging could increase an EV's zero-carbon travel by as much as 5,000 miles per year and save the grid $325 in annual costs.[75]

PRIORITIES FOR SMART EV POLICY

The imminent impact on the electric grid of rapidly growing EV loads shows the urgency of developing and testing charge-management strategies designed to:

- Maximize the efficient use of utility assets for EV charging loads.
- Reduce peak electricity market prices.
- Put downward pressure on electricity rates.
- Minimize charging costs to EV drivers.
- Support EV adoption and market expansion.
- Improve air quality and decarbonize transportation.
- Advance equity and fairness to all communities.

Evolution of the generation mix is changing the relationship between supply and demand. For example, southern California's millions of solar photovoltaic panels producing energy during the sunniest times of day make daytime workplace EV charging a good strategy for efficient use of the grid and renewable energy. Solar energy at large workplaces in Michigan could support daytime charging, while overnight charging would utilize our growing wind energy resources.

75 See https://bmwmovement.org/bmw-releases-chargeforward-report/

Part 6: Policies to Electrify Michigan

Michigan is on the verge of an EV boom. As the nascent EV market develops, policymakers should focus on the goals of stimulating EV market growth and bringing the benefits of transportation electrification to all neighborhoods—with special attention to households that are unlikely to acquire an EV. CUB of Michigan proposes these initial steps:

CONDUCT A STATEWIDE OPEN PROCESS

- Utilize existing stakeholder engagement efforts like the Governor's "Council on Future Mobility and Electrification" to explore emerging TE issues and how they affect regulatory policy.
- Build from recommendations submitted by stakeholders to the Michigan Public Service Commission's New Technologies and Business Models workgroup, which is specifically aimed at updating regulations to accommodate new technologies like EVs.[76]
- Solicit the input of all interested stakeholder groups.
- Investigate state legal requirements, public utility commission authority.
- Develop a shared knowledge base and articulate a common vision for Michigan.
- Convert existing utility pilot projects such as Consumers Energy's PowerMIDrive and PowerMIFleet programs and DTE's Charging Forward and Charging Forward eFleets programs to ongoing utility programs.

DEVELOP MANAGED-CHARGING PILOTS

- Identify optimal circuits based on loads, EV clusters, charging behaviors.
- Design DLC programs that:
  - respond to local system conditions.
  - manage critical peak periods.
  - aggregate EV load as a Demand Response resource.
  - maximize renewable energy utilization.
- Test participation rewards and performance-based incentives.

PROVIDE TARGETED INCENTIVES

- Focus financial support on the most cost-effective and equitable programs to promote EV acquisition.
- Reduce acquisition costs where needed to make EVs more affordable to most car-buyers. Supplemental state purchase incentives should:
  - only apply to vehicles priced below a reasonable threshold.
  - be applied at point of sale.
  - include used as well as new EVs.

IDENTIFY BARRIERS TO PUBLIC CHARGING

- Continue to consider alternative rate designs to encourage development of public charge stations.
- Continue to test ways to manage charge behaviors, encourage charge station deployment and customer-friendly operation.
- Determine additional charging sites that will build upon the network planned by Gov. Whitmer with the recently announced Lake Michigan EV Circuit.[77]
- Consider benefits, costs, and ramifications of different ways to involve utilities in developing public-charging infrastructure.
- Participate in regional efforts to expand public-charging opportunities at optimal locations.
- Use the Optimized EV Charger Placement Plan developed by the Michigan Department of Environment, Great Lakes and Energy's Office of Climate and Energy to direct where new charging infrastructure is built.[78]

ESTABLISH TIME-BASED RATES FOR EV HOME CHARGING

- Automatically enroll all EVs in EV-only time-of-use (TOU) rates, with these features:[79]
  - No separate meter required.
  - No extra monthly fees beyond the cost of service.
  - EV usage/charges listed separately on a single household bill.
  - Price differentials that offer meaningful savings between periods.

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76 https://www.michigan.gov/mpsc/0,9535,7-395-93307_93312_93593_95590_95595_95689-508669--,00.html
77 https://www.michigan.gov/whitmer/0,9309,7-387-90499_90640-568781--,00.html
78 https://www.michigan.gov/climateandenergy/0,4580,7-364-85453_85455-487840--,00.html
79 Enrollment assumes the utility is informed when a customer registers an EV acquisition. Other household usage would remain under its existing rate plan. Customers would retain the option to choose service under any applicable utility tariff. EV owners would save money by charging in off-peak periods, and other customers would benefit from a more efficient electricity system.

DESIGN INNOVATIVE PROGRAMS TO ENSURE ALL CUSTOMER SEGMENTS BENEFIT

- Identify areas in particular need of electrification benefits, such as environmental justice and lower-income communities.
- Where personal EVs are unlikely to proliferate, deploy e-buses and other initiatives, such as low-cost EV car-sharing where residents have low or moderate incomes.
- Make EV charging available at multi-unit buildings and for drivers without access to a garage or permanent parking space.

DEVELOP ONLINE TOOLS AND APPS

- Automate charging response to price and other signals such as carbon emissions and real-time renewable generation output.
- Offer shadow billing to allow customers to compare current and historical monthly utility bills under different rate plans.
- Provide cost calculators to compare EV with ICE vehicle costs, given inputs such as miles driven, purchase price, financing, gasoline cost, electricity rate plans, and other variables.

MAINTAINING MICHIGAN AS A MOBILITY MAINSTAY

Michigan is where car building started 125 years ago in Henry Ford's garage and Michigan remains the heart of the auto industry. But global competition is only growing and transportation electrification means big changes. The "Michigan Council on Future Mobility and Electrification" was established in 2020 by Governor Whitmer to assess the economic opportunities and challenges and come up with a 21st century strategy.[1] The Council's 2021 report has many recommendations to prepare Michigan's economy for the transition to electric mobility.

1 https://www.michiganbusiness.org/492f6d/globalassets/documents/mobility/cfme-report-final.pdf

INTENSIFY OUTREACH AND EDUCATION

- Use utility communications for proactive customer engagement about EVs.
- Develop and distribute electricity rate and cost information materials for car dealers and their customers.
- Employ trusted independent third parties for targeted consumer outreach tailored to diverse communities.

Conclusion: It's High Time for Michigan to Seize the EV Opportunity

Transportation Electrification presents a unique opportunity for Michigan and it should become an immediate focus of public policy. The right set of policies can support the traditional regulatory goals of safe, reliable and affordable service, while advancing new goals of sustainability, decarbonization, efficiency and customer choice.

This paper has laid out a set of public interest goals for Michigan, including:

- Support cost-effective and fair programs to encourage public and private transportation electrification.
- Protect Michigan consumers.
- Optimize system load shape through smart-charging strategies.
- Aggregate EV loads as distributed energy resources (DER).
- Design and implement advanced electricity rate plans.
- Promote interoperability, customer choice, and seamless charging networks.
- Benefit lower-income and underserved communities.
- Encourage investment, innovation, and market development.
- Integrate EV loads efficiently to reduce average per-unit energy cost.
- Work with other states on regional solutions.

Consumer protections for Michiganders must be at the heart all the public-interest goals stated above. The state must develop a plan based on our own laws, electric system characteristics, technology, market structure, regulatory framework and social/environmental objectives. While we may differ from other states in policy approach, we share the universal goals of growing and managing EV demand to create a more efficient, reliable and less costly electric system. It's a big job and Michigan needs to start now.

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