MI POWER GRID

Making the Most of Michigan's Energy Future

New Technologies and Business Models

Stakeholder Meeting 2: Electric Vehicles

The meeting will begin promptly at 1:00 pm.

February 10, 2021

1PM – 5 PM

MPSC

Michigan Public Service Commission

MI POWER GRID
Making the Most of Michigan's Energy Future

New Technologies and Business Models: Welcome and Overview

Joy Wang
WangJ3@Michigan.gov
Smart Grid Section
Michigan Public Service Commission

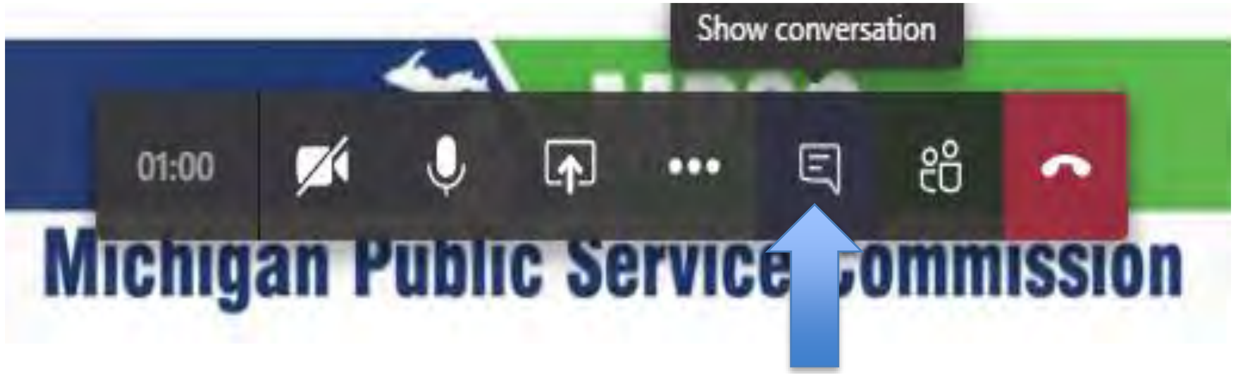
MPSC
Michigan Public Service Commission

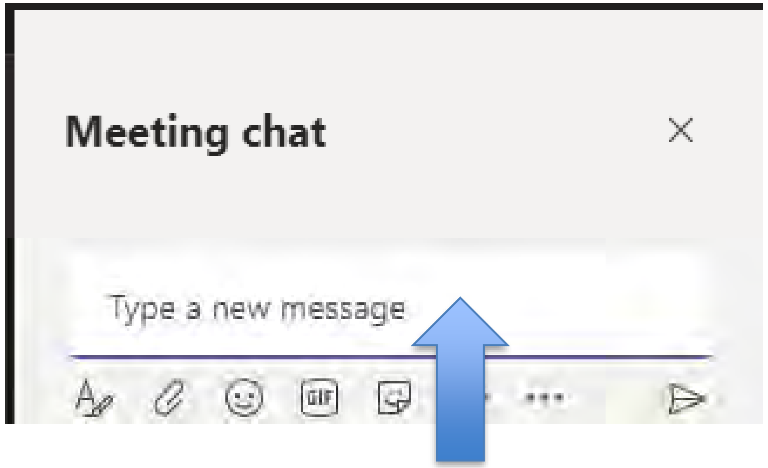
Agenda

1:00 pm	Welcome & Opening Remarks	Joy Wang, MPSC Staff, and Tremaine Phillips, Commissioner, MPSC
1:05 pm	Electric Vehicle Grid Integration: System Level Perspectives	Matteo Muratori, National Renewable Energy Laboratory
1:40 pm	Electric Vehicle Regulatory Barriers & Solutions: A National Perspective Panelists: Max Baumhefner, Natural Resources Defense Council Daniel Bowermaster, Electric Power Research Institute Andrew Dick, Electrify America Annie Gilleo, Greenlots Philip Jones, Alliance for Transportation Electrification	Moderator: Britta Gross, RMI
2:35 pm	Break	
2:45 pm	Utility EV Pilot Updates & Challenges in Michigan Panelists: Ben Burns, DTE Craig Morris, Indiana Michigan Power Co. Jeff Myrom, Consumers Energy Joseph Stephanoff, ITC	Moderator: Al Freeman, MPSC Staff
3:55 pm	Break	
4:00 pm	Transportation Electrification in Michigan & Opportunities for Vehicle-to-Grid Integration Panelists Hawk Asgeirsson, Pacific Northwest National Laboratory Jim Gawron, Ford Motor Company Jamie Hall, General Motors Tanya Krackovic, eCamion Trevor Pawl, Office of Future Mobility and Electrification	Moderator: Cory Connolly, Michigan Energy Innovation Business Council
4:55 pm	Closing Statements	Joy Wang, MPSC Staff
5:00 pm	Adjourn	

Housekeeping

- This meeting is being recorded
- Recording and slides posted on workgroup website in about a week
- All audience members will be muted
- Please type questions into the chat box
    - To access chat box:





- Staff will ask chat box questions during Q&A

Housekeeping, cont.

- During the meeting, if clarification of your question is needed, we will ask you to unmute.
  - To unmute:
    - Phone: Press *6
    - Teams: Click mic button
  - Please mute yourself again after your clarification.
- Chat box may note when audience members enter/exit.
  - These notices are automatic:

- If you are not a session speaker, please turn off your video.
- If Teams via web browser is not working, try a different web browser.
  - All work except Safari
- Please share your thoughts on the meeting with us by filling out the survey.

Making the Most of Michigan's Energy Future

New Technologies and Business Models Opening Remarks

Tremaine Phillips
Commissioner
Michigan Public Service Commission

Stakeholder Meeting 2: Electric Vehicles
February 10, 2021

Electric Vehicle Grid Integration: System Level Perspectives

Matteo Muratori

Team Lead

Integrated Transportation and Energy Systems Analysis

National Renewable Energy Laboratory

NREL
Transforming ENERGY

MI POWER GRID

Transforming ENERGY through SUSTAINABLE Mobility

Electric Vehicle Grid Integration: System Level Perspectives

Matteo Muratori, Ph.D. – Senior Engineer & Team Lead

February 10th 2021

NREL at a Glance

2,685

Employees,
postdoc researchers, interns, visiting professionals, and subcontractors

World-class
facilities, renowned technology experts

871

Partnerships
with industry, academia, and government

Campus
operates as a living laboratory

Center for Integrated Mobility Sciences
Integrated Transportation and Energy Systems Analysis

The National Renewable Energy Laboratory (NREL) **spearheads transportation research** to accelerate the widespread adoption of high-performance, low-emission, energy-efficient passenger and freight vehicles. Among other things, NREL is currently **providing technical support to national, state, and local entities** to:

- ✓ Assess **electrification opportunities** across different transportation segments, including light-duty as well as commercial medium/heavy-duty vehicles
- ✓ Evaluate policy/technology scenarios for **alternative long-term futures**
- ✓ Estimate **infrastructure requirements** to support vehicle electrification (or H_2 vehicles)
- ✓ Understand **charging/fueling costs** and optimize behind-the-meter asset design
- ✓ Explore **integration opportunities** with buildings and the electric grid and **synergies with renewables**

Agenda

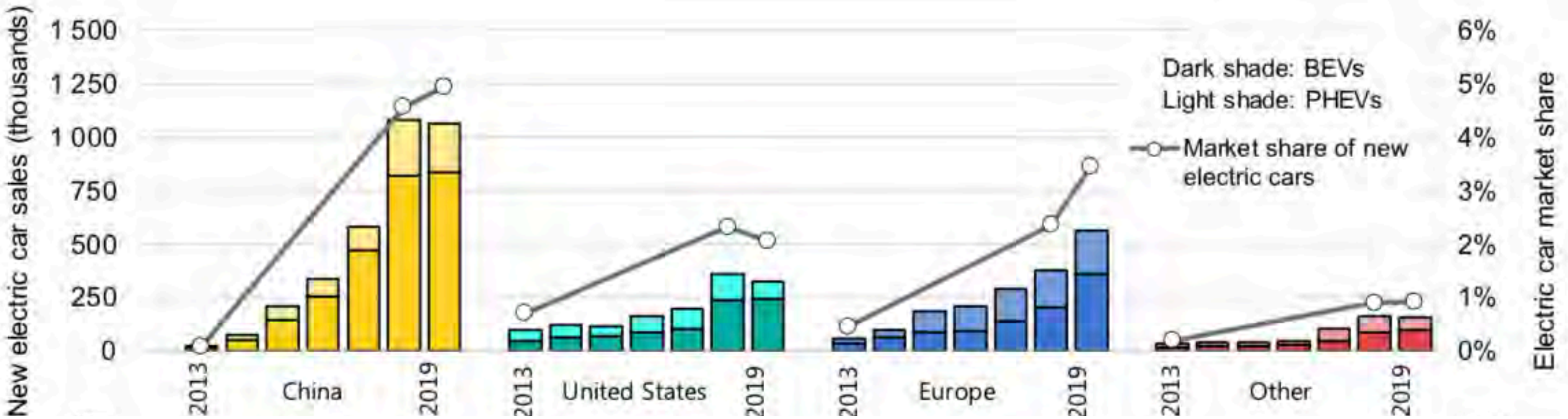
- Electric Vehicle (EV) Charging Loads
- EV-Grid Integration: Impacts
- EV Trucks and Impact on Distribution Systems
- EV-Grid Integration: Synergies and Benefits

Electric Vehicle (EV) Adoption and Charging Loads

Global LDV EV market expanding rapidly

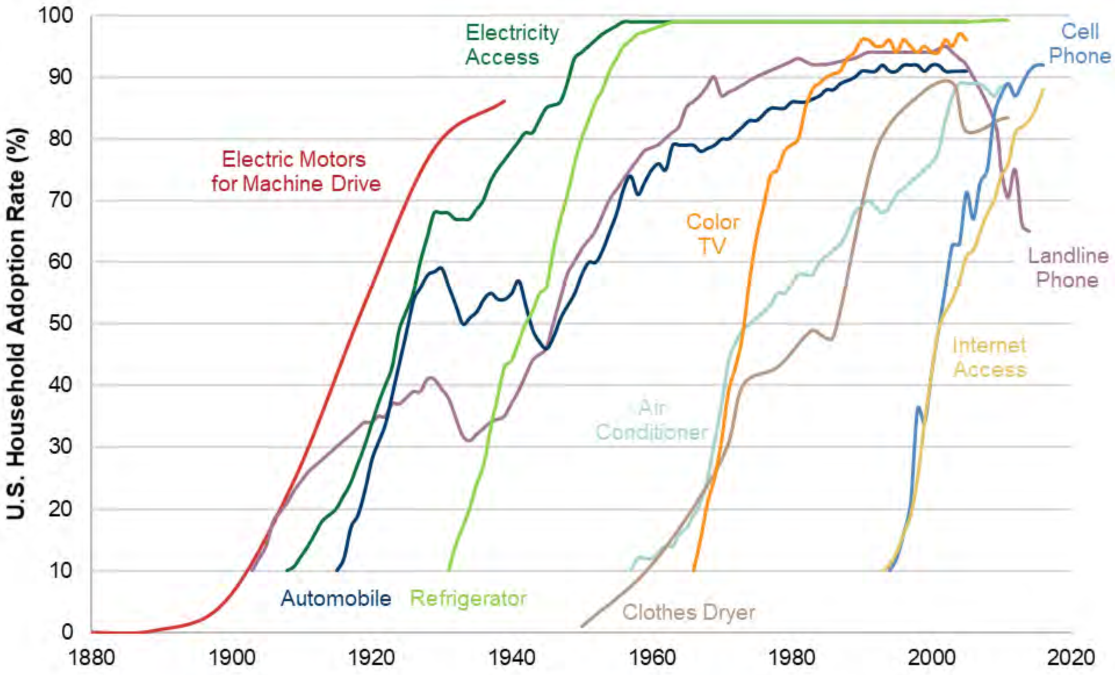
The worldwide **market share of electric cars reached a record high** of 2.6% in 2019, expanding in all major markets except Japan, Korea and United States.

Norway: 56% of 2019 sales. California: 8% of 2019 sales. Michigan: <1% of 2018 sales



Source: 2020 IEA Global EV Outlook

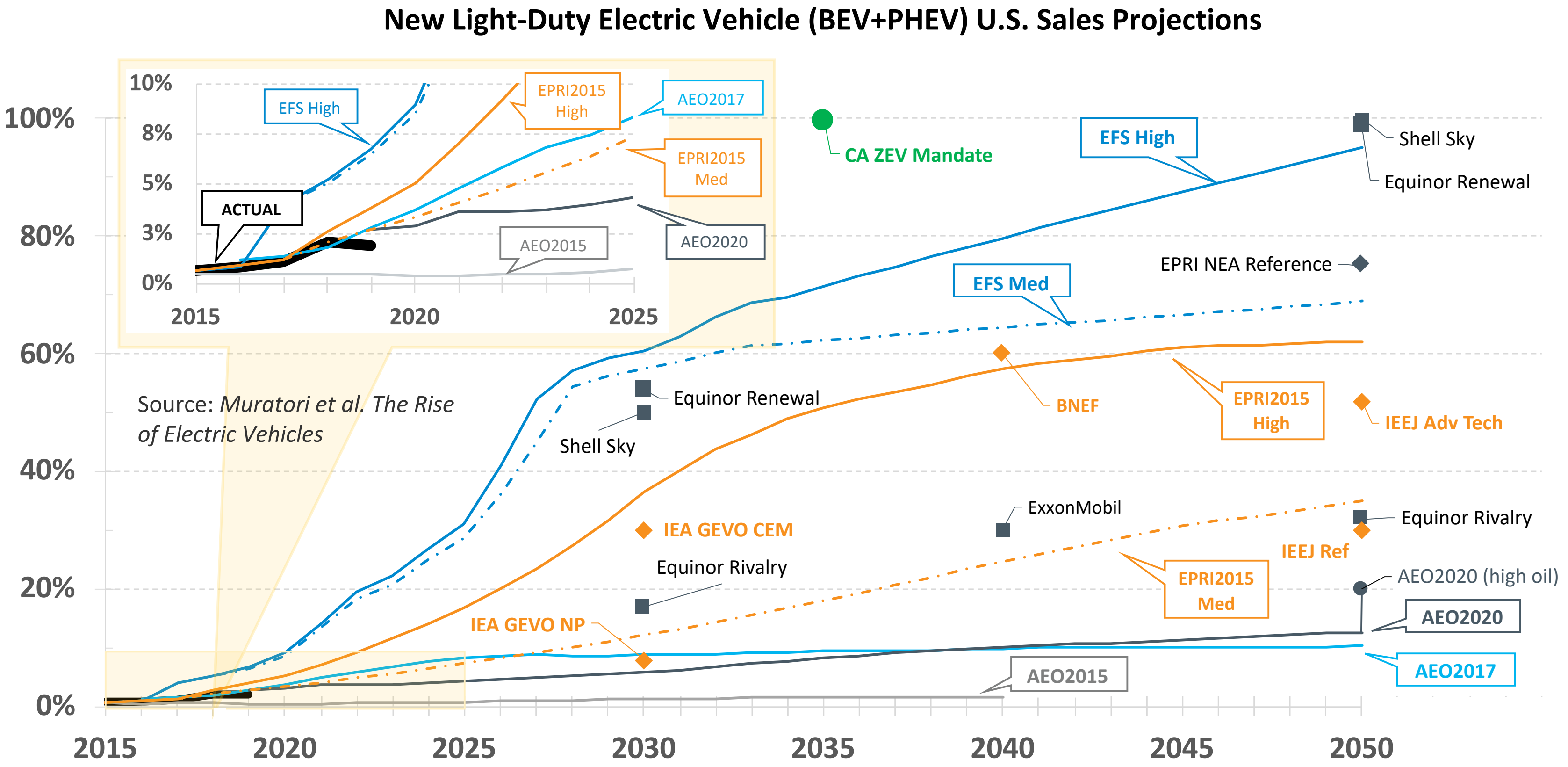
Technology adoption and energy transitions generally follow S-curve shape and are generally underestimated



invention → innovation → niche market → pervasive diffusion → saturation → senescence

Source: https://www.nrel.gov/analysis/electrification-futures.html

Future expectations: high uncertainty but consistently more optimistic



Future expectations: beyond LDV towards commercial vehicles

EVs have **zero exhaust emissions and cost less to fuel and maintain.**

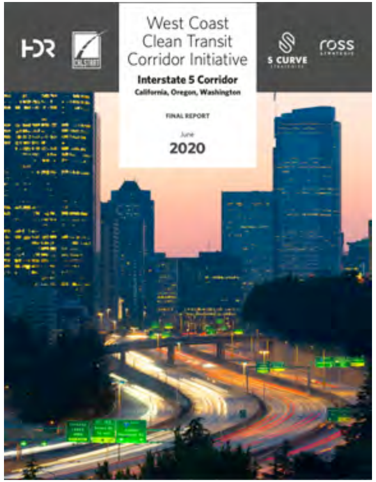
Recent policy momentum for heavy-duty truck electrification:

- In June 2020, **CARB approves M/HDV sales mandate** starting in 2024 and requiring all new sales be ZEVs by 2045[1].
- In July 2020, Governors from 15 states (+ Washington, D.C.) signed **joint MOU committing to 100% of M/HDV sales be ZEVs by 2050 with an interim target of 30% ZEV sales by 2030**[2].

CALIFORNIA
AIR RESOURCES BOARD

California takes bold step to reduce truck pollution

First-of-its-kind requirement for electric trucks will help communities hardest hit by air pollution



MONEY

Tesla stock closes at record highs on electric Semi news

Dalvin Brown USA TODAY

MARKETS

Meet Nikola, the speculative electric vehicle stock that traders believe is as valuable as Ford

TRANSPORTATION

EV Truck Company Hyliion Is Soaring — and It Isn't Even Publicly Traded Yet

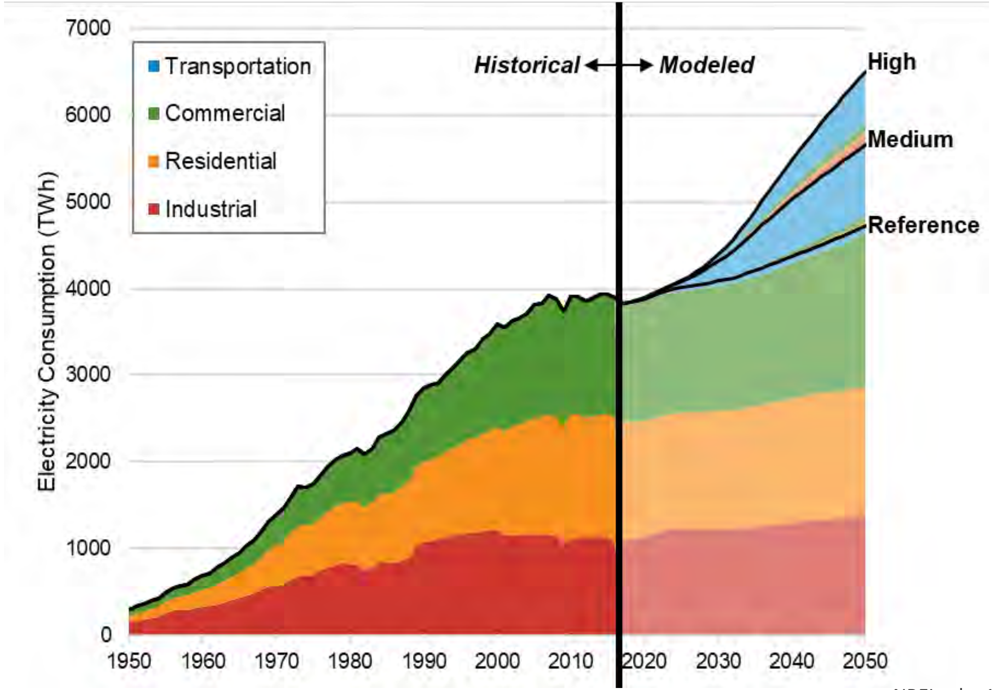
[1] California Air Resources Board – CARB, June 25, 2020, https://ww2.arb.ca.gov/news/california-takes-bold-step-reduce-truck-pollution
[2] New York State, Gov. Cuomo, July 14, 2020, https://www.governor.ny.gov/news/governor-cuomo-announces-new-york-and-14-states-and-dc-ramp-electrification-buses-and-trucks

U.S. scenarios of widespread electrification

EFS scenarios project **great degree of future electrification, especially for transportation**, in line with several energy system transformation scenarios

EFS High scenario, 2050:

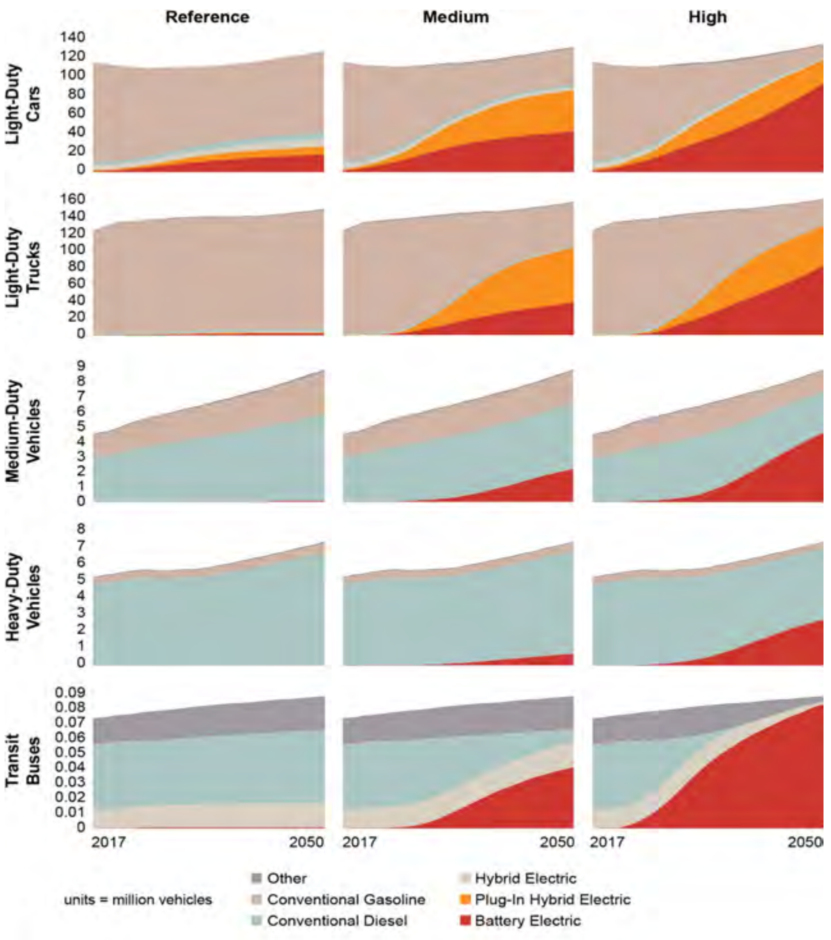
- Transportation share of electricity use increases **from 0.2% in 2018 to 23% of electricity consumption in 2050.**
- **1,424 TWh increase in transportation-related electricity consumption** relative to the 2050 Reference scenario.



Source: https://www.nrel.gov/analysis/electrification-futures.html

EFS transportation sector details

- 2050 U.S. transportation fleet (High scenario):
  - **240 million** light-duty plug-in electric vehicles
  - **7 million** medium- and heavy-duty plug-in electric trucks
  - **80 thousand** battery electric transit buses
- Together these deliver up to **76%** of miles traveled from electricity in 2050
- 138,000 DCFC stations (447,000 plugs) and 10 million non-residential L2 plugs for light-duty vehicles



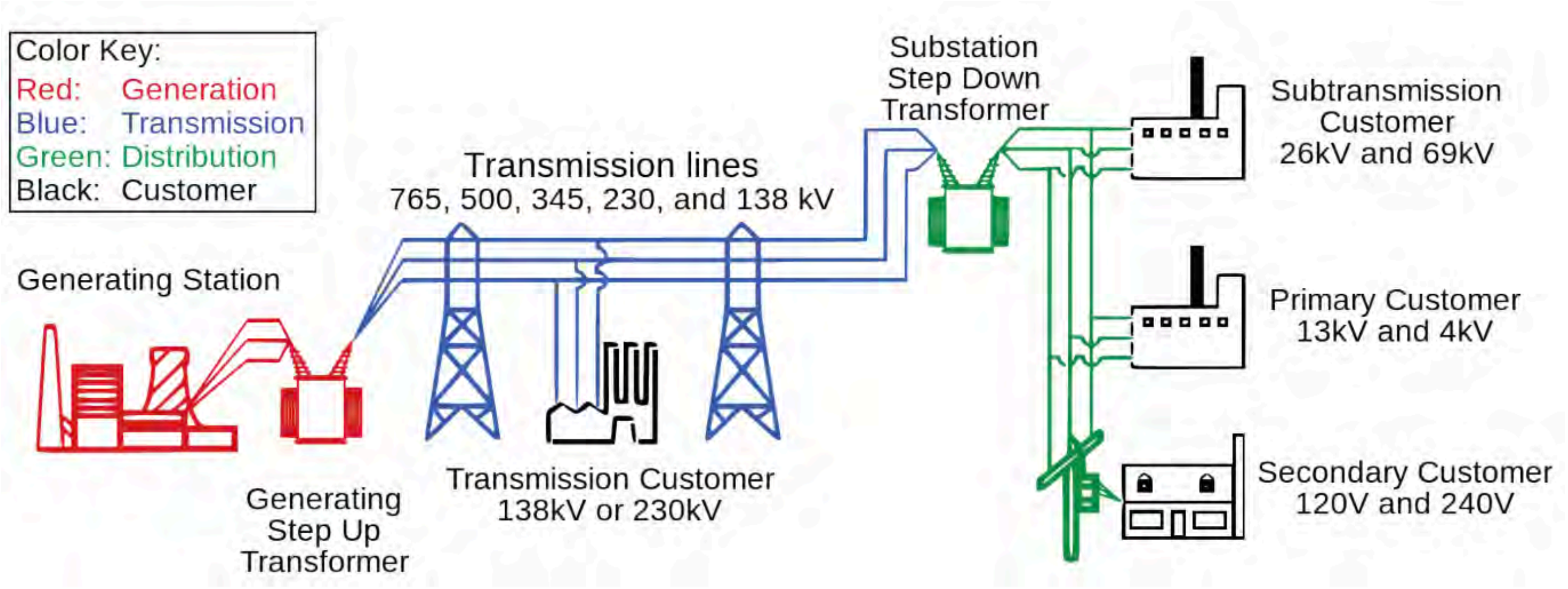
Vehicle stock

Source: https://www.nrel.gov/analysis/electrification-futures.html

EV-GRID INTEGRATION

Impacts

Traditional electricity system: large-scale generation; centralized, one-way control; and passive loads



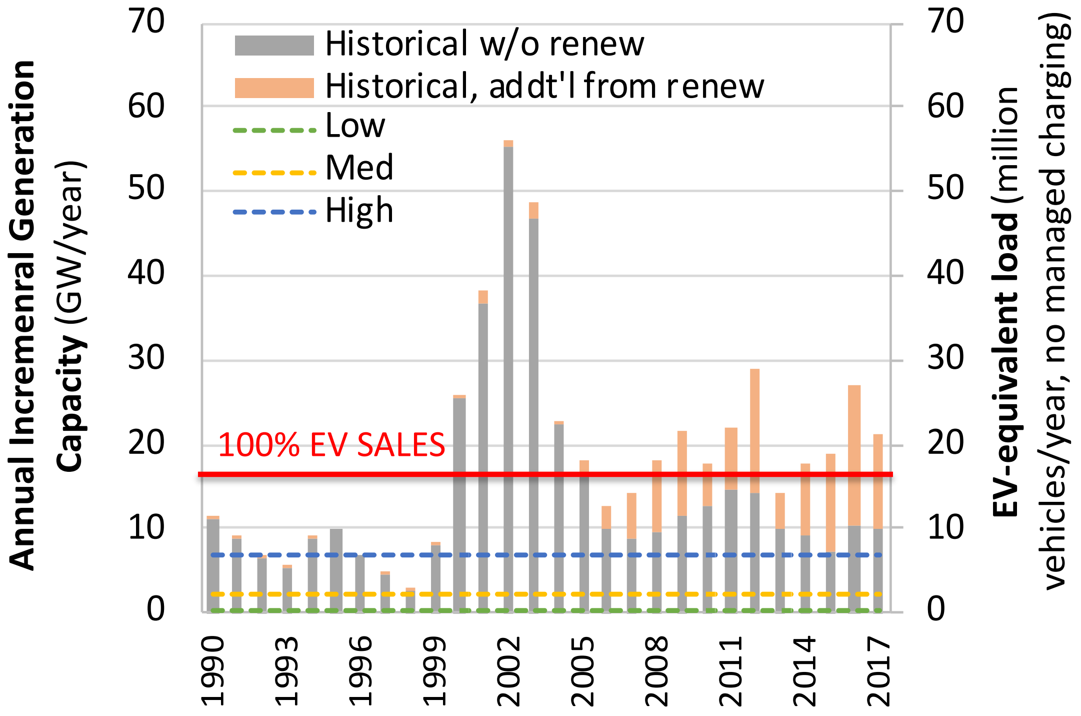
Source: DOE 2015 QTR

- Breakdown of **US average retail electricity prices** (data from EIA):

Generation: 58% Transmission: 13% Distribution: 29%

Are EVs going to “break” the grid (bulk systems)? Unlikely

- **~17M light-duty vehicles** are sold each year in the US
- The **grid has evolved** over time to accommodate greater annual load additions
- Based on historical growth rates, sufficient energy generation and generation capacity is expected to be available to **support a growing EV fleet as it evolves over time.**

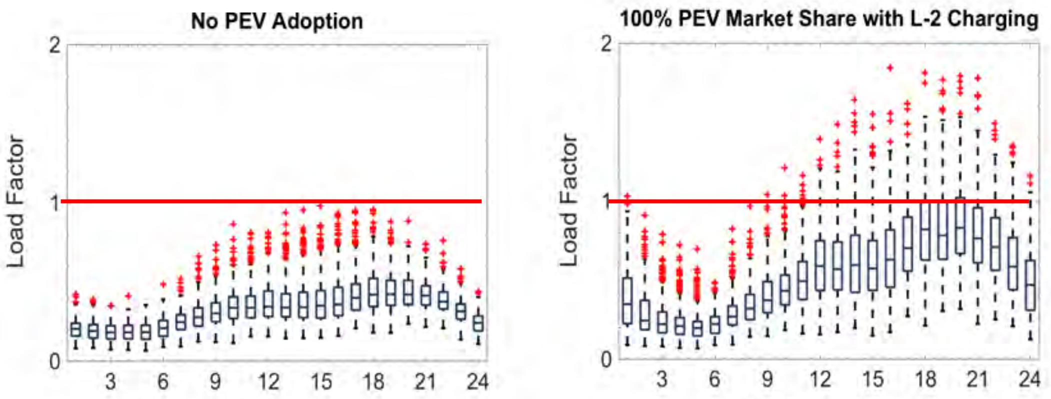


Source: US DRIVE 2019

Are EVs going to "break" the grid (local distribution systems)?

Residential EV charging represents a significant increase in household electricity consumption that can require upgrades of the household electrical system and unless properly managed it may lead to exceeding the maximum power that can be supported by distribution systems, especially for legacy infrastructure and during high demand times.

- **Clustering effects** in EV adoption and **higher power** charging exacerbates these issues
- Effective planning, smart EV charging, and distributed energy storage systems can help to cope with these potential issues.
- Key to **consider EVs in system upgrades**



Source: Muratori, M., 2018. Impact of uncoordinated plug-in electric vehicle charging on residential power demand. Nature Energy, 3(3), pp.193-201.

EV Trucks and Impact on Distribution Systems

Team:

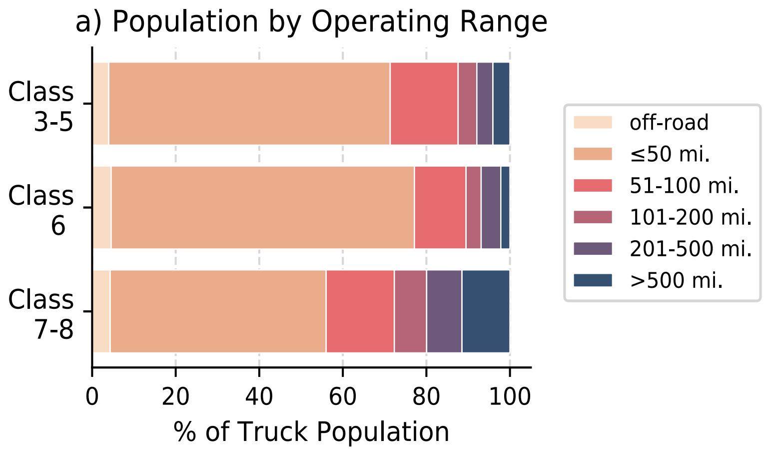
Brennan Borlaug, Matteo Muratori, Madeline Gilleran (NREL)

David Woody, William Muston (Oncor)

T. Canada, A. Ingram, H. Gresham, C. McQueen (Southern Company)

Background & Motivation

- Recent policy announcements (such as **CARB's Advanced Clean Trucks regulations**) require near-term heavy-duty truck electrification.
- There is a large segment of Class 8 trucking operations that are promising candidates for electrification today – **short-haul operations:**
  - Low daily range requirements
  - Consistent operating schedules
  - Extended off-shift dwell time at a central location (depot)

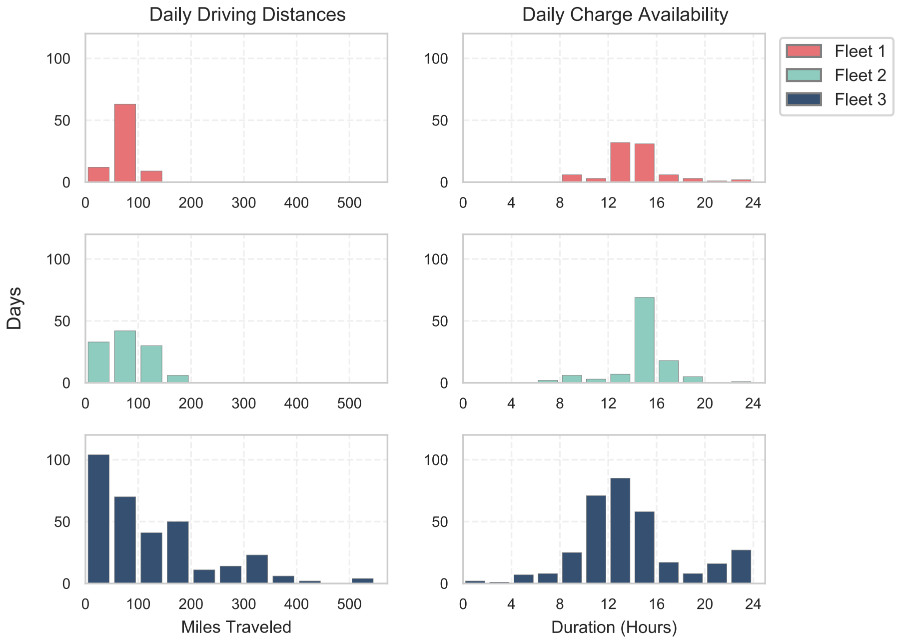


What are **the charging requirements** for short-haul electric Class 8 semi trucks charged at their depots? And the **impacts of different charging strategies on electricity distribution systems?**

Fleet Operations Data

Selected three (3) fleets from [Fleet DNA](www.nrel.gov/fleetdna) fitting the utilization profile of the **short-haul trucking segment**:

- Fleet 1 and Fleet 2 vehicles travel **20,000 – 30,000 miles per year** (extrapolated) and operate within 50 mi. of depot. Vehicles average ~**14-15 hours of downtime per day** (daily charge availability).
- Fleet 3 vehicles travel **30,000 – 40,000 miles per year** (extrapolated) and typically operate within 100 mi. of depot. Vehicles average nearly **14 hours of downtime per day** (daily charge availability).



Fleet 1 = beverage delivery
Fleet 2 = warehouse delivery
Fleet 3 = food delivery

Charging Strategies

a) **100 kW, Immediate**

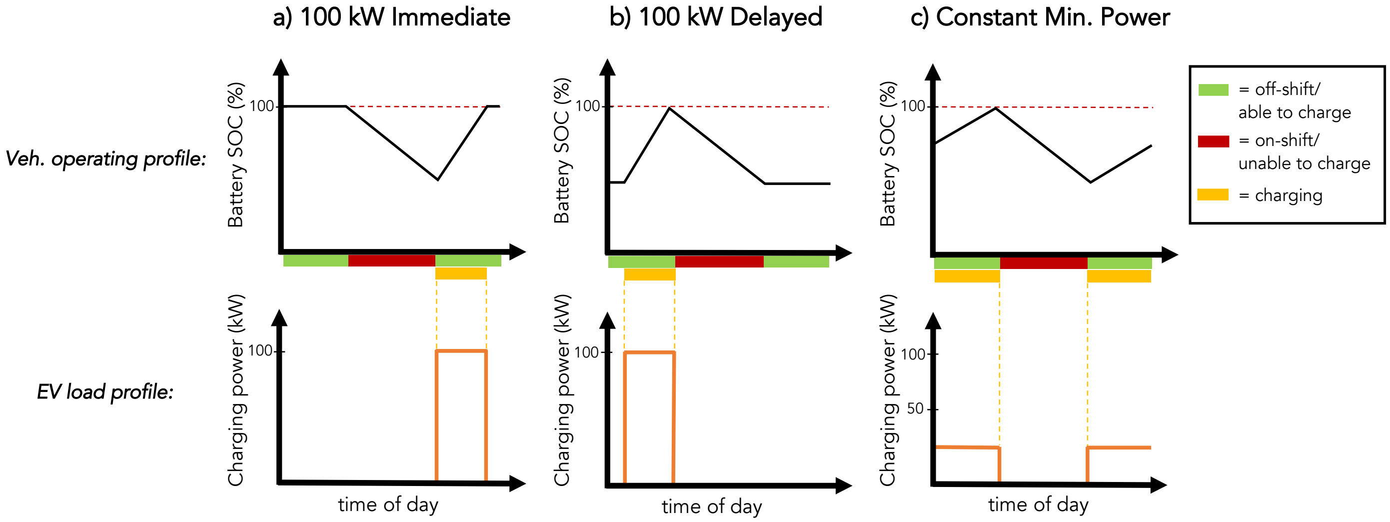
100 kW charging is performed "as soon as possible" (*i.e.*, 15 min. after designated shift period) and continues until either (1) all depleted energy is recharged; or (2) the next shift starts.

b) **100 kW, Delayed**

100 kW charging is performed "as late as possible" beginning at either (1) the latest possible time to fully recharge all depleted energy prior to the next designated shift period; or (2) immediately in the case where there is not enough time to fully recharge depleted energy prior to the next shift.

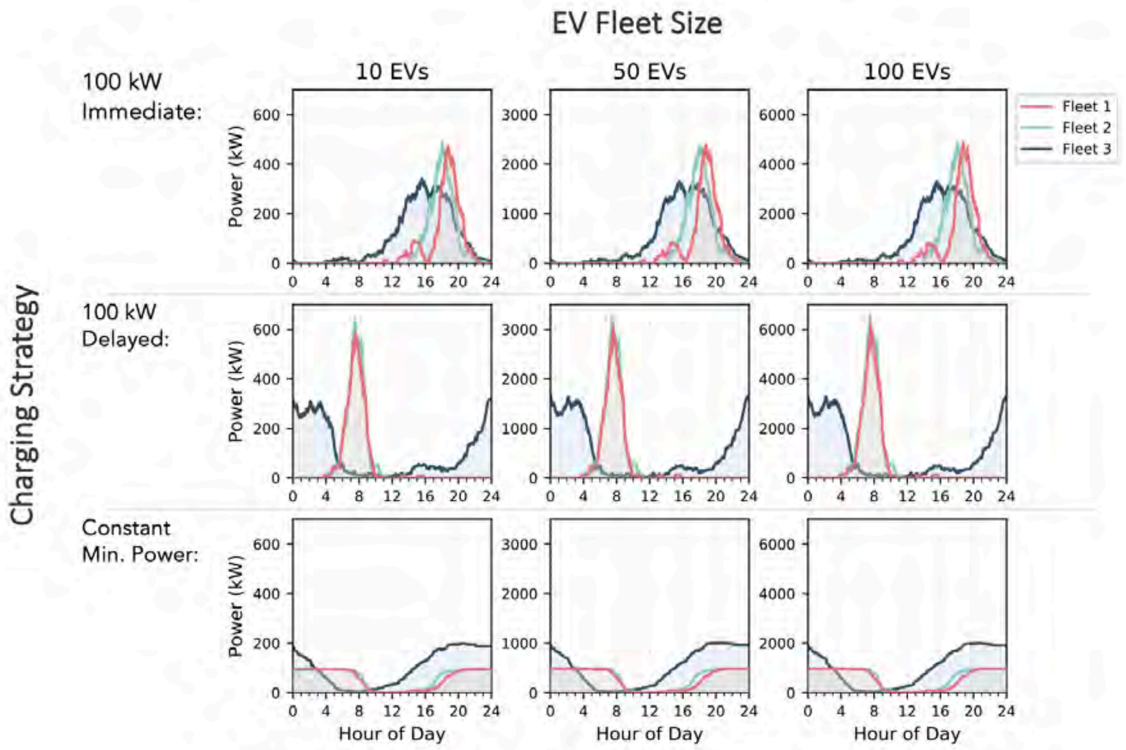
c) **Constant, Min. Power**

Charging is performed whenever a vehicle is available (to charge) at the lowest possible rate to fully recharge the day's depleted energy.



Electricity Demand Profiles for Fleet Operations

Fleet 1 – beverage delivery
Fleet 2 – warehouse delivery
Fleet 3 – food delivery

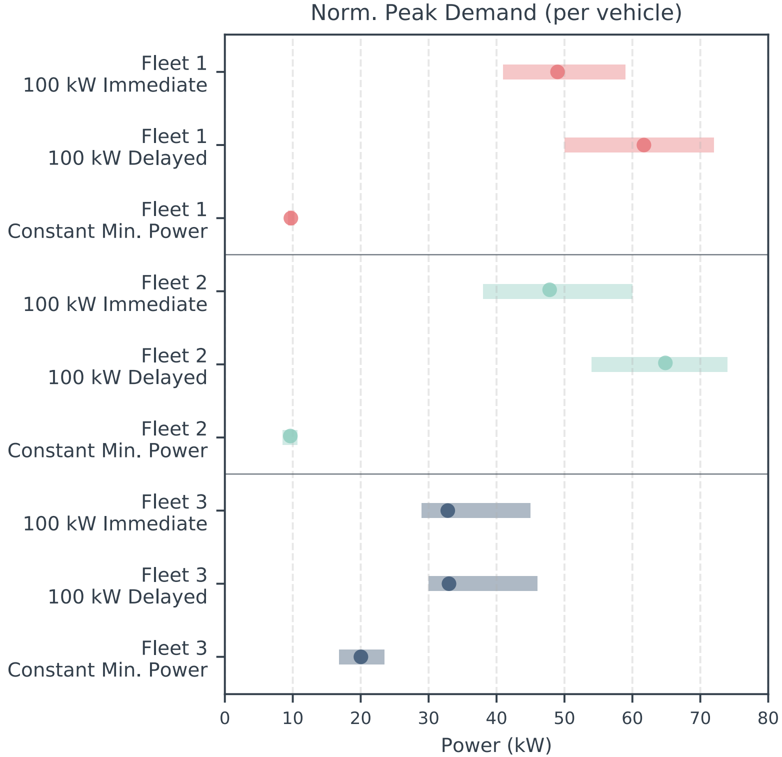


- Despite higher energy requirements for Fleet 3, fixed routes and consistent operating schedules lead to higher peak power demands for Fleet 1 and Fleet 2 if charging is not managed
- With **unmanaged charging** ("100 kW immediate"), peak demand coincides with the typical system-level peak period (5 pm – 9 pm)
- Through **scheduled charging** ("100 kW delayed"), peak demand may be shifted 8-12 hours throughout the course of the night
- By charging vehicles at **minimum necessary power levels** ("Constant min. power"), peak demand is greatly reduced

Fleet Electricity Demand – Insights

Fleet 1 – beverage delivery
Fleet 2 – warehouse delivery
Fleet 3 – food delivery

- Each fleet can be charged at modest power levels.
  - Fleet 1 – 16 kW/vehicle
  - Fleet 2 – 23 kW/vehicle
  - Fleet 3 – 103 kW/vehicle
- Charging at the lowest possible power level **reduces peak power demand by ~40-90%**
- Charging at **higher power levels (e.g., 100 kW), results in increased flexibility** to schedule charging
- Fleets with consistent operating schedules benefit more from managed charging strategies (temporal shifting, peak shaving, etc.) than fleets with staggered schedules

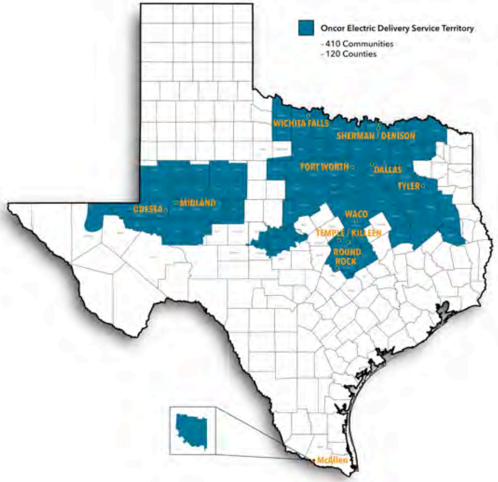


Average (**dots**) and range (**bars**) of added peak power demand (in kW/vehicle) for all fleets and charging strategies

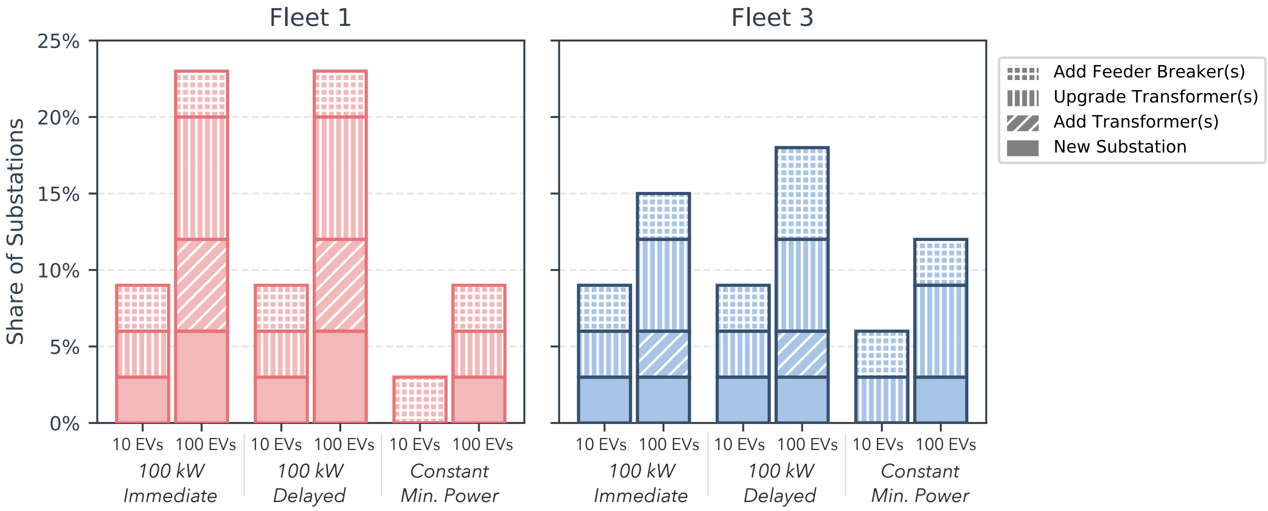
Substation Load Integration Case Study: Methods

- **36 substations** of >850 total in Oncor service territory were selected for their **proximity to existing vehicle depots and other sites where electric truck fleets are anticipated**.
- For each substation, fleet charging demand profiles were added to 2019 non-coincident peak demand profile (worst case scenario).
- Substation component-level capacity constraints were used to determine **upgrades required to accommodate added charging demand**.

ONCOR



Substation Load Integration Case Study: Results



ONCOR

- Majority of substations could supply 100 EVs charging at 100 kW without upgrades; Nearly all could supply 100 EVs charging at minimum power levels.
- The magnitude of charging loads are more indicative of the likelihood of substation upgrades than the timing
- Given locational variabilities in grid conditions and operations, though, **some substation upgrades may be unavoidable without alternative on-site solutions** (e.g., storage).

Summary of Distribution System Upgrades

To facilitate dialogue between utilities, OEMs, fleet operators, and other stakeholders

Component Category	Upgrade	What Initiates Upgrade	Typical Cost[a]	Typical Timeline[a]
Customer On-Site	50-kW DCFC EVSE	New charger	Procurement: $20,000–$36,000 per plug; Installation: $10,000–$46,000 per plug[b]	1–3 months
	150-kW DCFC EVSE		Procurement: $75,000–$100,000 per plug; Installation: $19,000–$48,000 per plug[b]	
	350-kW DCFC EVSE		Procurement: $128,000–$150,000 per plug; Installation: $26,000–$66,000 per plug[b]	
	Install separate meter	Desire to separately meter	$1,200–$5,000	
Utility On-Site	Install distribution transformer	>200 kW added	Procurement: $12,000–$175,000	3–8 months
Distribution Feeders	Extend or upgrade feeders	>5 MW added[c]	$2–$12 million[d]	3–12 months[e]
Distribution Substation	Add feeder breaker	>5 MW added[c]	~$400,000	6–12 months[f]
	Upgrade existing substation	>3–10 MW added[g]	$3–$5 million	12–18 months
	Build new substation	>3–10 MW added[g]	$4–$35 million	24–48 months[h]

* Cost and timeline ranges include procurement, engineering, design, scheduling, permitting, and construction and installation; Estimates are project-specific and can vary greatly (fleet operators should engage their local utility early when considering fleet electrification).

EV-GRID INTEGRATION

Synergies and Benefits

The grid is also transforming

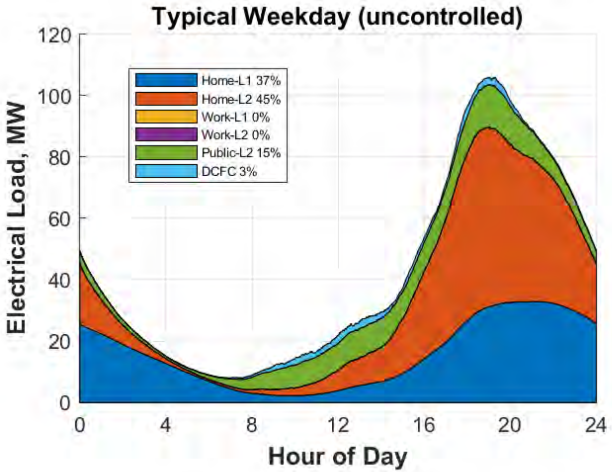
The **electric power system is undergoing profound changes**.

The traditional system based on the predicament that generation is dispatched to match demand is evolving into a more **integrated supply/demand system** in which demand-side distributed resources (generation, energy storage, and demand response) respond to supply-side requirements, mainly driven by variable renewable generation.

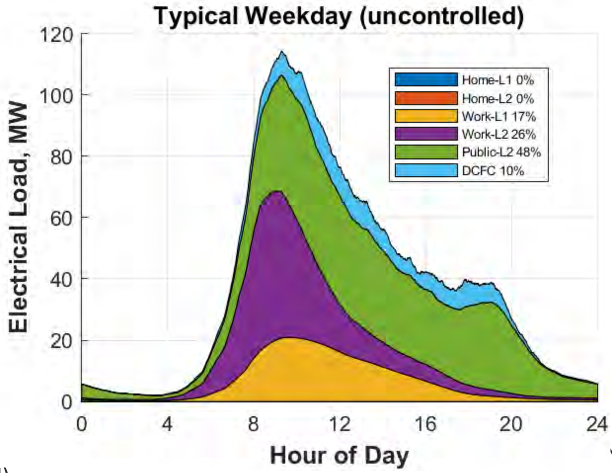
And EVs are not just a ”burden”, flexible EV charging can satisfy mobility needs while also supporting the grid

- **Vehicles are underutilized assets**: parked ~95% of the time. EV charging profiles can look significantly different if vehicles are charged at different locations or times
- **Flexibility is secondary to mobility needs and is enabled by charging infrastructure**

Home-dominant charging



No-home charging

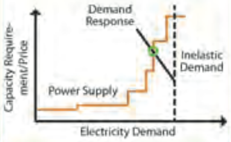


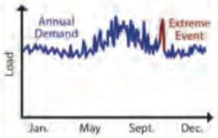
Source: NREL (EVI-Pro Model)

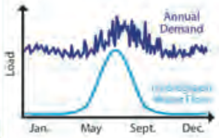
EVs can support the grid in multiple ways providing values for different stakeholders, including non-EV owners

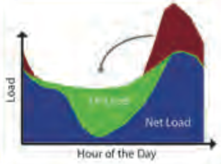
Smart electric vehicle-grid integration can provide flexibility – the ability of a power system to respond to change in demand and supply – by charging and discharging vehicle batteries to support grid planning and operations over multiple time-scales

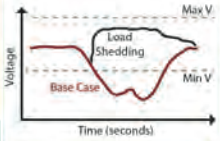
Power System Application	**Generation Capacity and Transmission/ Distribution Planning**	**Resilience To Extreme Events**	**Seasonal Planning (Hydro/Long-Term Storage Dispatch)**	**Commitment and Dispatch Decisions**	**Balancing and Power Quality**	**Support End Consumers**
Time scale	*Multi-year*	*Years (planning), hours (real-time response)*	*Months*	*Days to Hours and Sub-Hours*	*Seconds to sub-seconds*	*Years (planning), hours (real-time response)*
Vehicle-Grid Integration value	Ability to reduce peak load and capacity requirements and defer distribution systems upgrades if reliable EV charging flexibility is available	Load response to natural events (heat waves, tornados) or human-driven disasters, load postponement over days, and support microgrid management and grid restoration (V2G)	No role for EVs	Leverage EV charging flexibility to support supply dispatch and load-supply alignment (tariff management), variable renewables integration, operating reserves, energy arbitrage (V2G)	Provide voltage/frequency regulation and support distribution system operations	Tariff management (e.g., mitigate retail demand charges), complement other distributed energy resources (smart load, generation and storage), and minimize equipment aging/upgrades











Source: *Muratori et al. The Rise of Electric Vehicles*

Value of managed EV charging

Missing a holistic assessment of the value of smart charging across multiple value streams

SYSTEM-LEVEL (GRID)

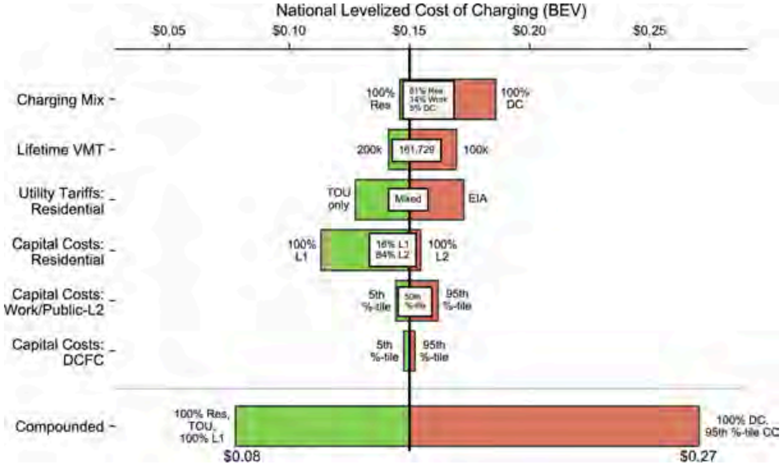
Smart charging of **3M EVs in California in 2030**:

- 3%–8% reduction in **electricity production costs** ($210–$660M)
- Reduce **peak demand** by 2.8% (avoided capacity)
- Reduce **renewable curtailment** by up to 13%
- Reduce grid **CO_2 emissions** by 3%–5%

Source: *Zhang et al. 2018*

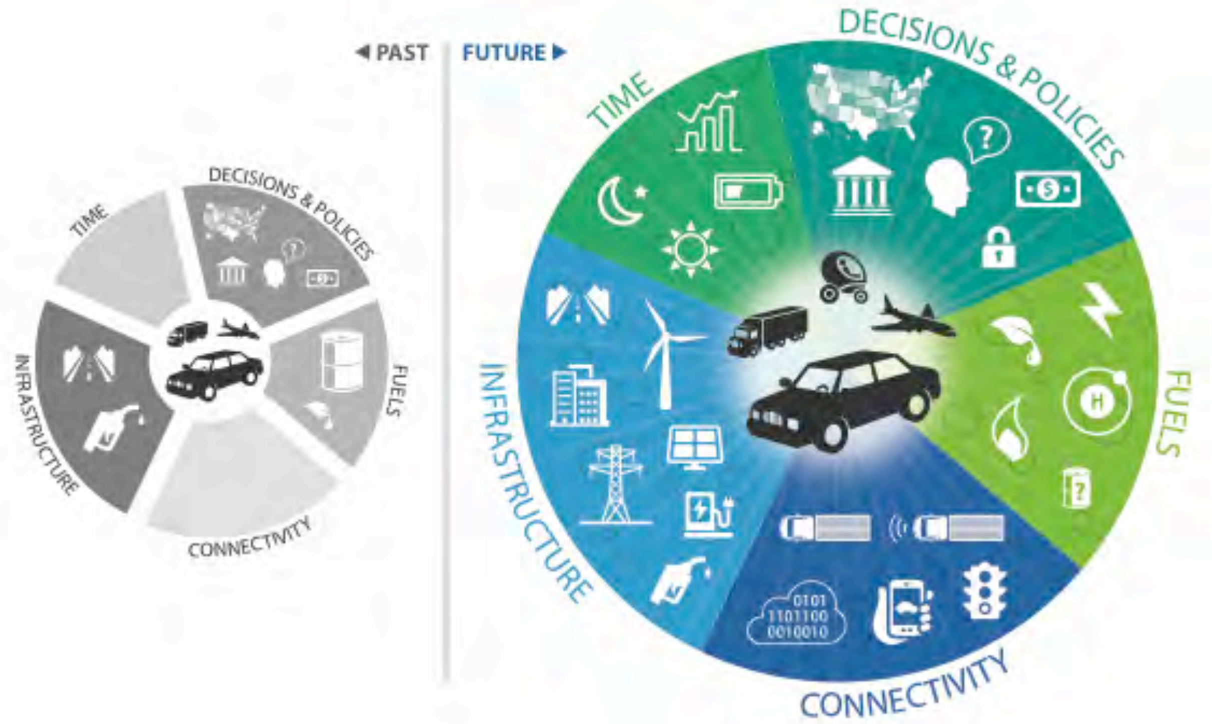
RETAIL-LEVEL (CONSUMER)

Shifting residential charging to off-peak time-of-use (TOU) periods **reduces charging costs by 26%**



Source: *Borlaug et al. 2020*

We envision a future transportation system that will be optimally **integrated** with smart buildings, the electric grid, renewables, and other infrastructure to maximize energy productivity and achieve an economically competitive, secure, and sustainable future.



Emerging topic: electric vehicles are rapidly changing the transportation demand landscape

Integration challenges/opportunities:

- **Electric vehicles provide a pathway** to decarbonize on-road transportation system, eliminate tailpipe emissions, solve petroleum dependency, and improve system efficiency
- EV success is dependent on **cheap and abundant clean electricity**, but EV flexibility enables for **synergistic improvement** of the efficiency & economics of mobility and electricity systems:
  - **Optimize the design and operation** of future integrated systems
  - **Reduce mobility and energy costs** for all consumers
  - Smart charging unlocks the synergies between EVs and VRE as both promise large-scale deployment
- **System-level integrated demand/supply thinking** is required

Two large and complex industries are on a “collision path”: how to enable effective integration?

- What are the **tradeoffs across different VGI value streams**?
- What **technologies and infrastructure** are required to enable smart charging?
- How to **engage and properly compensate EV users** for providing flexibility?

References

1. U.S. Energy Information Administration (EIA). Annual Energy Review
2. Muratori, 2020. Integrated Transportation-Energy Systems Modeling. NREL/PR-5400-76566
3. International Energy Agency (IEA), 2020. Global EV Outlook 2020. Entering the decade of electric drive?
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7. Wood et al., 2018. New EVSE Analytical Tools/Models: Electric Vehicle Infrastructure Projection Tool (EVI-Pro). NREL/PR-5400-70831
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14. Muratori, Kontou, and Eichman, 2019. Electricity rates for electric vehicle direct current fast charging in the United States. Renewable and Sustainable Energy Reviews, 113, p.109235.
15. Muratori et al., 2021. The Rise of Electric Vehicles: 2020 Status and Future Prospects. Progress in Energy

Thank you!

Matteo.Muratori@NREL.gov

www.nrel.gov

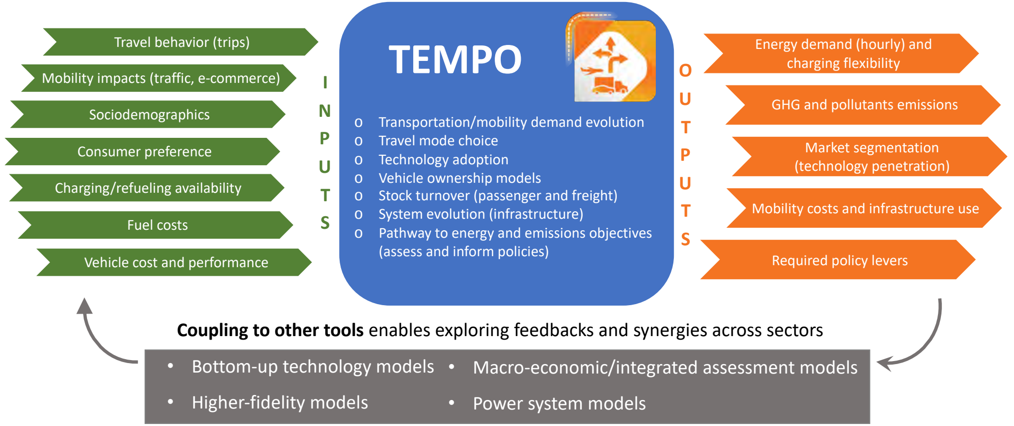
This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, under Contract No. DE-AC36-08GO28308. No funding was provided. The views expressed are those of the author alone and do not necessarily represent the views of the DOE or the U.S. Government.

Projecting disruptive pathways is complex, and requires new "thinking" (modeling)

TEMPO

TEMPO (Transportation Energy & Mobility Pathway Options) is intended to generate future **pathways to achieve system-level goals**, explore the impacts of technological breakthroughs and behavioral changes, estimate energy/emissions implications of different scenarios and decisions, affordability and infrastructure use impacts, and assess **multi-sectoral integration opportunities**.

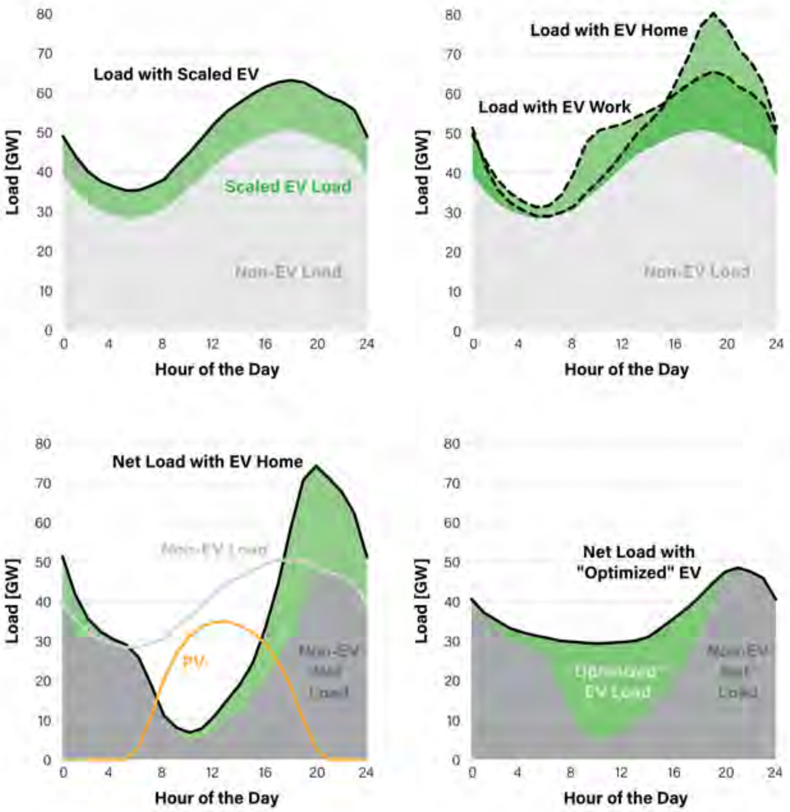
TEMPO *finds pathways* to achieve energy/emissions goals and estimates implications of different scenarios and decisions



When and *where* EV charging occurs will be as critical as *how much* electricity is needed.

a) ASSUMPTION: EV charging is often assumed to simply scale up electricity demand.

b) COMPLEXITY: Future EV charging could change the shape of demand, depending on when and where charging occurs.



c) INTEGRATION: EV charging can impact power system planning and operations, particularly with high shares of variable renewable energy.

d) FLEXIBILITY: Optimizing EV charging timing and location could add flexibility to help balance generation and demand.

Source: *Muratori and Mai, The Shape of Electrified Transportation*

More nuanced demand-side modeling needed to assess the integration opportunities of EVs on the power system.

Electric Vehicle Regulatory Barriers & Solutions: A National Perspective

Moderator

Britta Gross
Managing Director
Carbon-Free Mobility
RMI

Max Baumhefner
Senior Attorney, Climate & Clean Energy Program
Natural Resources Defense Council

Daniel Bowermaster
Senior Program Manager
Electric Transportation
Electric Power Research Institute

Andrew Dick
Manager, State Government Affairs & Public Policy
Electrify America

Annie Gilleo
Manager
Policy & Market Development
Greenlots

Philip Jones
Executive Director
Alliance for Transportation Electrification

New Technologies and Business Models

Break: 2:35 – 2:45 PM

Stakeholder Meeting 2: Electric Vehicles

February 10, 2021

Utility EV Pilot Updates & Challenges in Michigan

Moderator

Al Freeman
Assistant Division Director
Electric Resources Division
Michigan Public Service Commission

Ben Burns
Director of Electric Marketing
DTE Energy

Craig Morris
Energy Services Manager
Indiana Michigan Power

Jeff Myrom
Director of Renewable Energy &
Electric Vehicle Customer Products
Consumers Energy

Joseph Stephanoff
Finance Manager
ITC Holdings Corp.

Charging Forward Overview

MI Power Grid EV Discussion

February 10, 2021

Charging Forward was approved by the MPSC in May 2019 for $13M and has since expanded by $1M to include additional components supported by stakeholders

	Description
Customer Education & Outreach	• Increase EV awareness through customer education • Inform and recruit potential site hosts • Enable equitable access to EVs
Residential Smart Charger Support	• Provide up to 2,600 $500 residential rebates for installation of a Level 2 smart charger – Requires enrollment in a year-round time-of-use (TOU) rate
Charging Infrastructure Enablement	• Deploy up to 90 DC fast chargers (DCFCs) • Deploy up to 1,000 Level 2 charging ports • Support deployment of charging infrastructure for fleets
Additional Program Components	• Perform EV-Grid impact study • Pilot EV-Only Time-of-Use (TOU) rate without the installation of a 2nd meter • Provide EV-ready builder rebate • Execute other EV Pilots, including ChargeD and battery-powered DCFCs

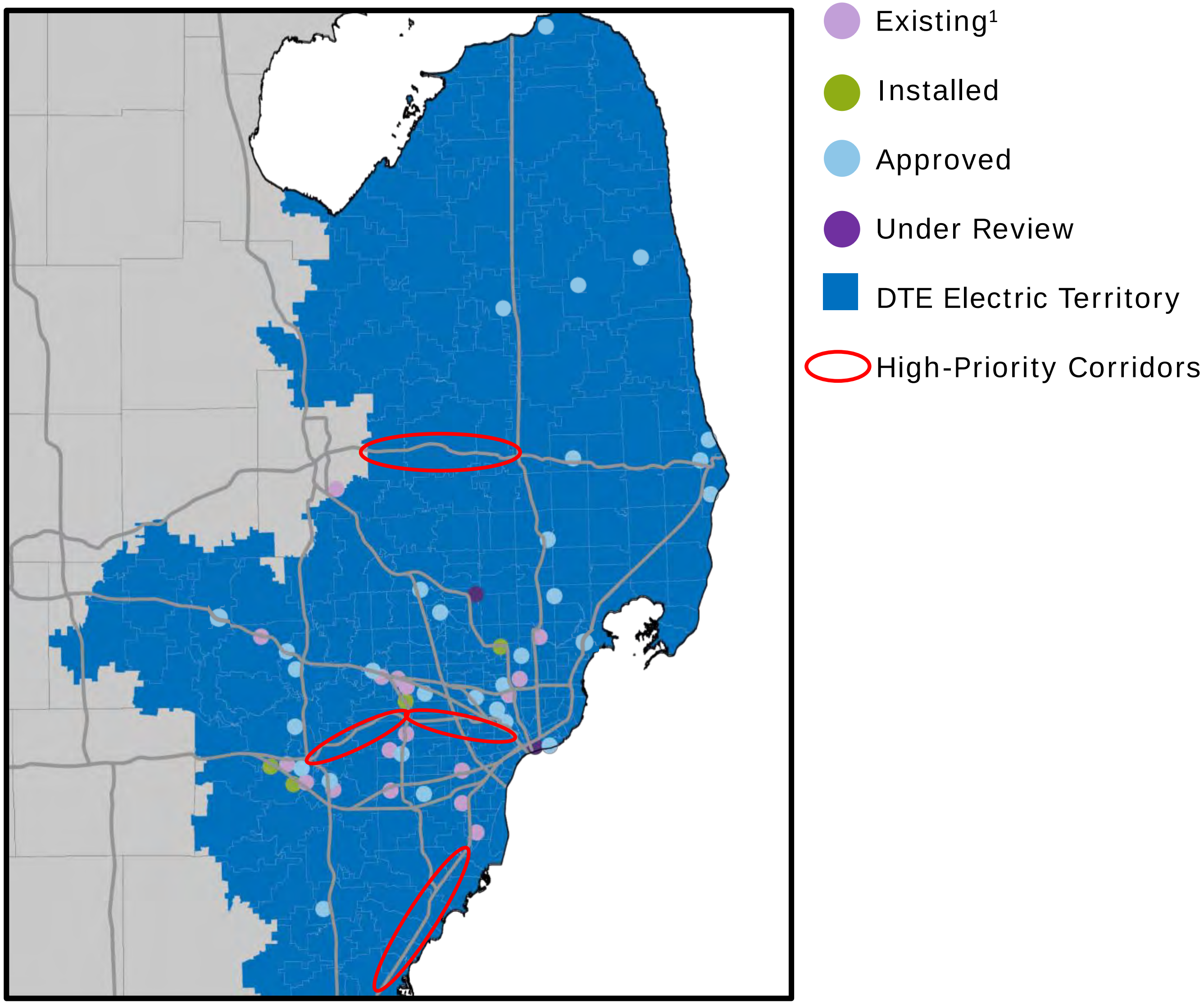
As of January 31st, Charging Forward has executed over 28M customer impressions and approved almost 900 rebates

	Approved	Installed	Under Review	On-Hold / COVID Delay	Rejected / Withdrawn
Residential	372	372	24	-	34
Make-Ready Level 2 Sites (Ports)	72 (435)	33 (145)	2 (12)	-	3 (18)
Make-Ready DCFC[1] Sites (Chargers)	38 (83)	5 (10)	2 (4)	12 (26)	13 (26)

1. Approved: all applications that have been approved by DTE (including installed); Installed: applications that have been approved, installed, and issued rebates; Under Review: applications that have been received and are under review; On-Hold: applications with medium or high distribution system costs (12 DCFCs); COVID Delay: applications that have been paused by customer due to COVID-19 (14 DCFCs); Rejected: applications that do not meet program qualifications (34 Residential, 4 DCFCs); Withdrawn: applications that have been pulled by the customer (18 Level 2s; 22 DCFCs)

DTE

We are holding our remaining DCFC rebates for four high-priority corridors to ensure coverage across SE Michigan



1. Existing infrastructure includes any public, non-Tesla DCFC installed outside of the Charging Forward program

Source: Alternative Fuels Data Center

The team continues to refine program design and adapt to the quickly evolving market based on lessons learned

Selected Lessons Learned	Program Adjustments
The EV Service Connection costs were overestimated, especially for Level 2 charging	Shift funds to support additional rebates in the high-demand Fleet and DCFC components
Time-of-use rates work - residential participants charge 90% off-peak	Introduced Bring Your Own Charger (BYOC) pilot to incentivize off-peak charging without a 2nd meter
Residential rebate component limits incentives to those who have purchased or leased EVs	Offer variety and enable equitable access to EVs by carving out funds to collaborate with EVNoire and potentially deploy ride-hailing EVs in the Detroit region
Program flexibility is critical to adapting to the rapidly-evolving EV market	Adjusted min/max ports per site, eligibility requirements, DCFC rebate amounts, etc.
Dealership training and availability of EV inventory continues to be a barrier to adoption	Add the Virtual EV Showroom to the DTE EV website
Single family home builders are interested in the EV-Ready Builder Rebate, but multi-unit dwelling developers are not	Continue to investigate charging solutions for multi-unit dwellings

DTE

INDIANA MICHIGAN POWER

An AEP Company

BOUNDLESS ENERGY

MPSC New Technology & Business Models Workshop

Electric Vehicles – 02.10.21

Presentation by I&M

INDIANA MICHIGAN POWER
An AEP Company

Our Direction

MISSION: Increase adoption of electric vehicles in our service territory and provide customer charging options that optimize the use of the grid for the benefit of all customers.

Education & Outreach
- Proactively engage customers to normalize electric vehicle ownership
- Advise customers on benefits, economics and program offerings

Lead By Example
- Procure AEP Fleet EVs
- Increase employee access to EV charging at AEP workplaces

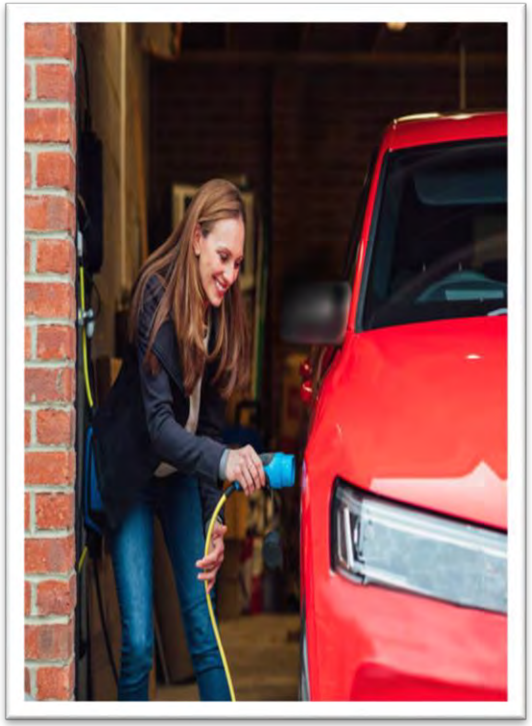
Encourage Off-Peak Charging
- Deploy residential solutions to accommodate load and move off-peak
- Design and deploy customer fleet charging solutions

Get the Rules Right
- Advocate for policies that support increased EV sales and access to charging infrastructure
- Advocate for active utility role in transportation electrification

Improve Public Infrastructure
- Design and deploy customer workplace charging solutions
- Advise and support municipalities on electric transit opportunities and vehicle corridors

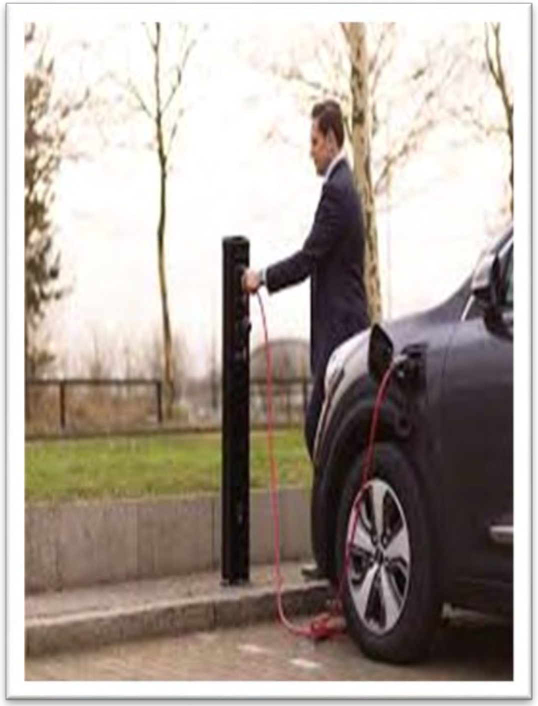
INDIANA MICHIGAN POWER
An AEP Company

IMPluggedIn Pilot Customer Segments

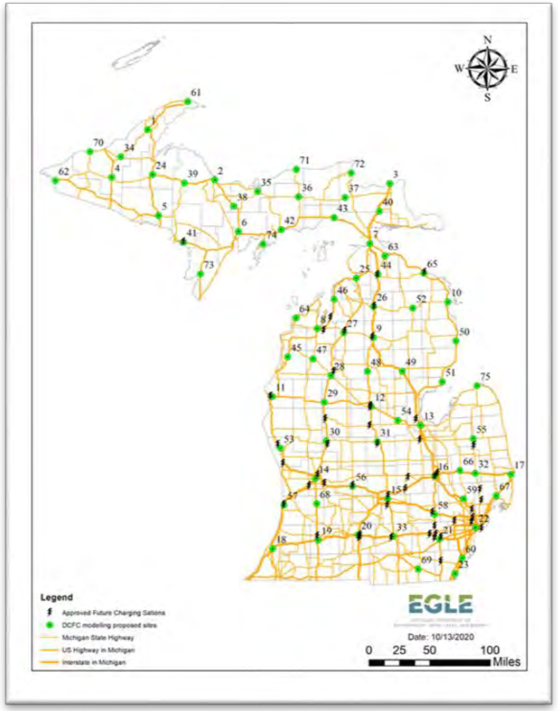


Residential

Multi-Unit Dwellings



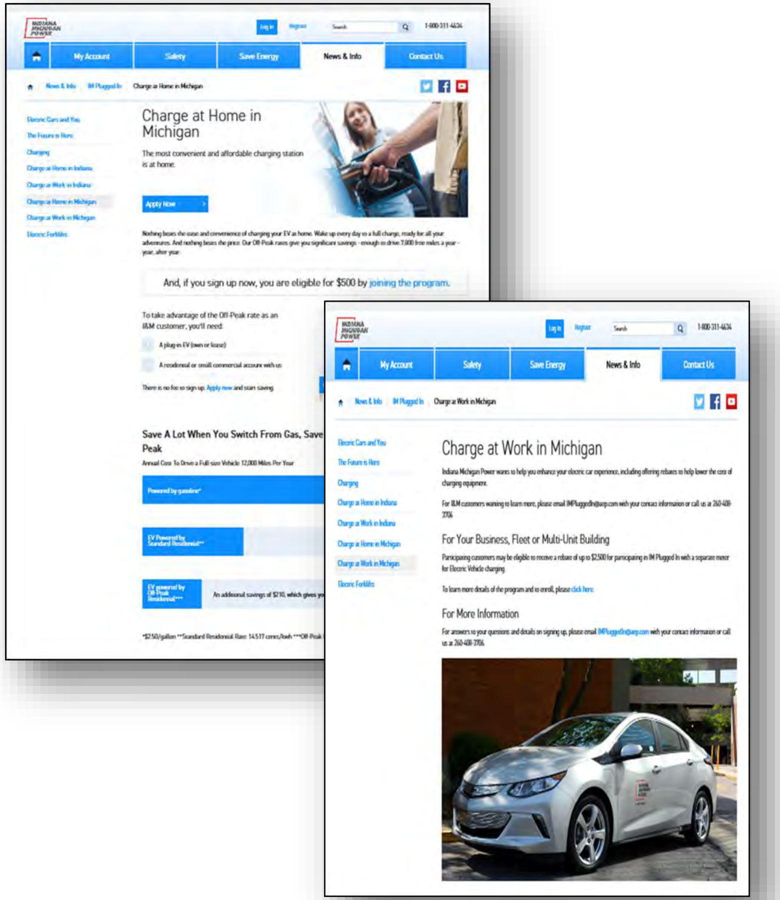
Fleet/Workplace



Corridor Fast Charge

Customer Engagement Elements

Website



IM Field Segment Collateral


MICHIGAN | Indiana Michigan Power IMPluggedIn

Electric Vehicle Charging Station Incentives

For Michigan Residential & Small Commercial Customers

Michigan Incentives are available for your Home or Small Commercial Business charger installation.

Participating customers may be eligible to receive a one-time enrollment rebate of $500 for 240 volt wiring and/or Level 2 EV chargers with proof of qualifying purchase and addition of separate AMI Meter.

To view eligibility requirements visit: IndianaMichiganPower.com/IMPluggedIn

To Participate

Step 1: Visit the website - IndianaMichiganPower.com/IMPluggedIn

Step 2: Select the "Charge At Home in Michigan" link

Step 3: Click the "Apply Here" button

Step 4: Submit your application and supporting documentation

260-408-3706 | IndianaMichiganPower.com/IMPluggedIn

Community Outreach Events

Dealership Education

Signature DEALER GROUP

TYLER AUTOMOTIVE CHRYSLER DODGE JEEP RAM

INDIANA MICHIGAN POWER
An AEP Company

Current / Future State

Current

1. *COVID impact:*
   - *Residential purchasing power challenges*
   - *Commercial business reduced operations*

2. *Dealership available inventories*

3. *Loss of in-person community outreach events i.e. Berrien Fair*

4. *Corridor Fast Charge progress*

Future State

1. *Reinforce long-term financial benefits of EV ownership thru digital and direct customer messaging*

2. *Dealership engagement:*
   - *Education campaign*
   - *Address Chicago gap (Tesla)*

3. *Commercial Workplace/Fleet Field Outreach thru IM Field team*

Thank you!

Please forward any other questions to:

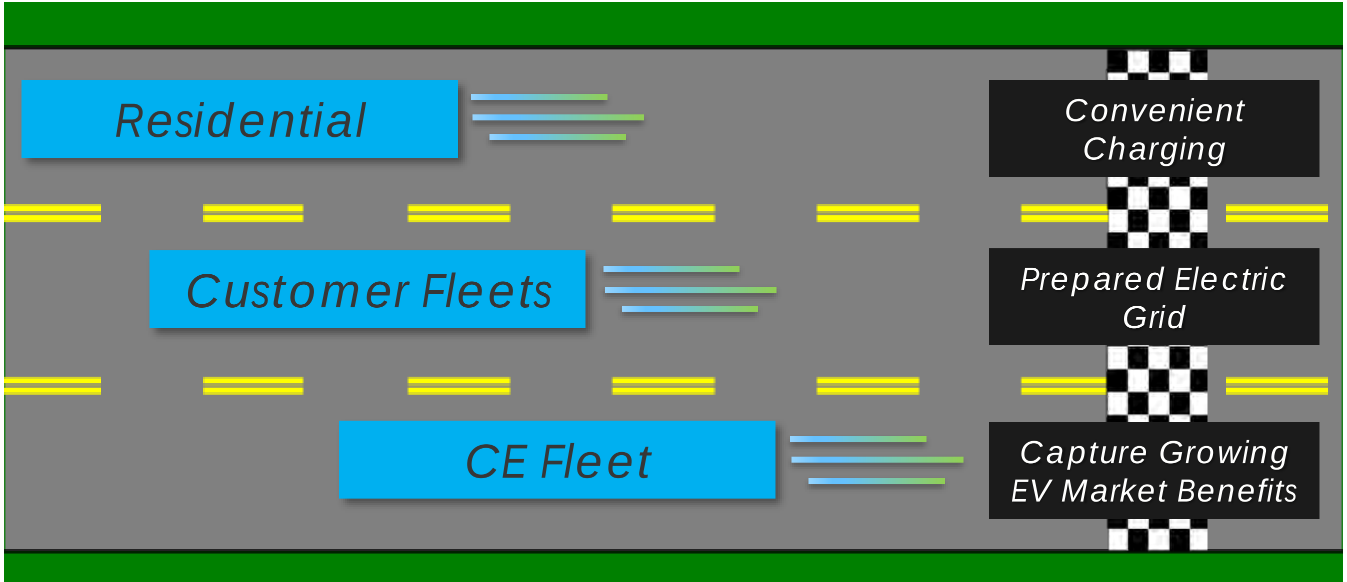
impluggedin@aep.com

CONSUMERS ENERGY

PowerMIDrive Program Update for MPSC Workgroup

Jeff Myrom
Director Renewable Energy &
Electric Vehicle Customer Products
February 2021

Three program lanes, same destination



Outcomes:

- ✓ Reducing Greenhouse Gas Emissions
- ✓ Clean Energy Plan

People
Planet

- ✓ New EV Load
- ✓ Managing Time-of-Use Charging (Grid Benefit)

Prosperity

Power MI Drive | Consumers Energy Count on Us®

3-year program until June 2022

- ✓ **Easier to charge EV's**
- ✓ Ensure grid ready to capture benefits

Includes:

- TOU Rate Options to help EV owners maximize the value of their vehicle by charging off peak and at night
- Education campaign to build awareness and understanding

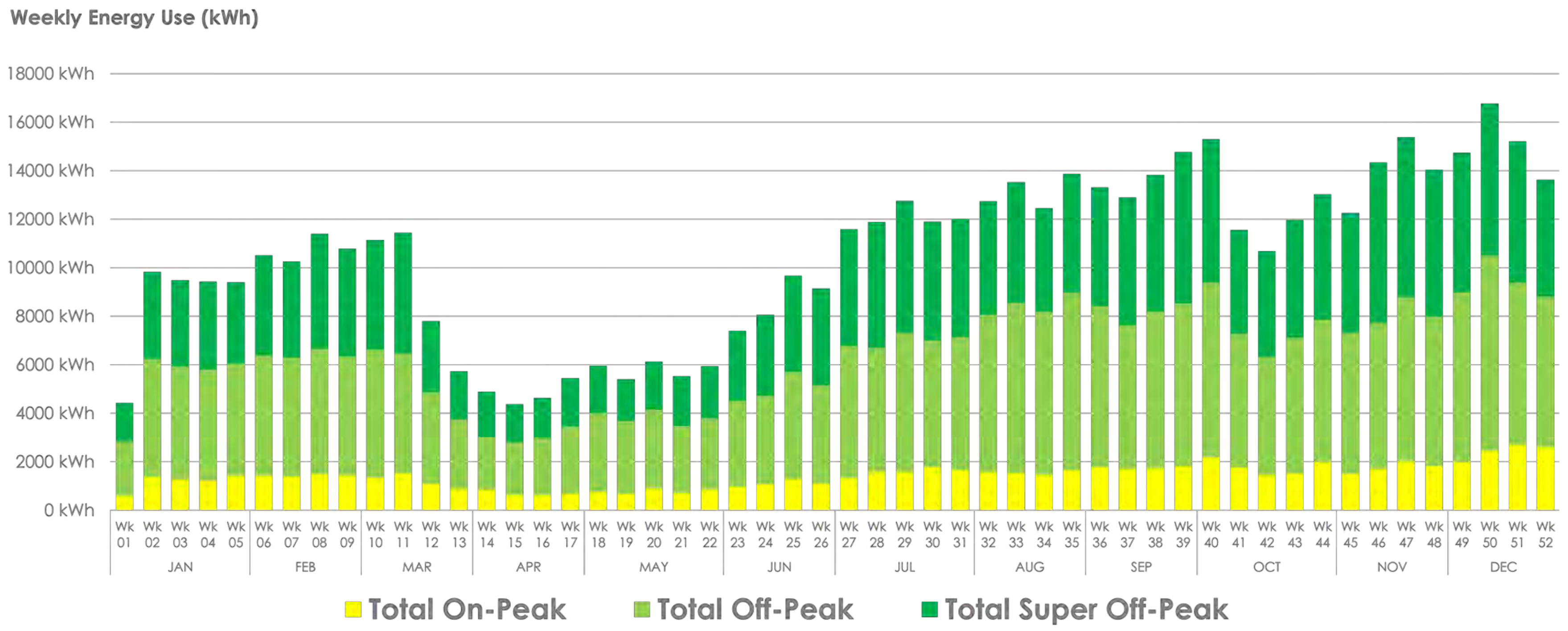
$500 for customers who install an approved Level 2 Charger at their residence, and enroll on a TOU Rate

$200 FleetCarma Incentive option available for 200 customers originally ineligible for home charger rebate

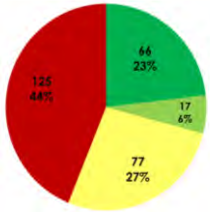
Up to $5,000 for commercial customers who install an approved Level 2 Charger in public location; 200 rebates limit

Up to $70,000 for commercial customers who install an approved DC Fast Charger in public location; 36 rebates limit

Fantastic Grid Benefit Results



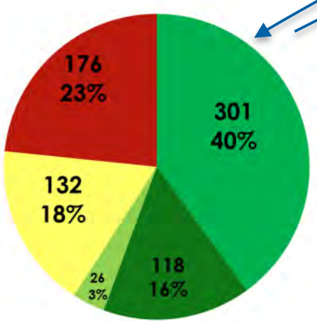
PowerMIDrive Participation Strategies



- Approved to Participate
- Eligible ESVE Owner (documentation required)
- Level One / No ESVE Owned
- Ineligible Level 2 EVSE Owned

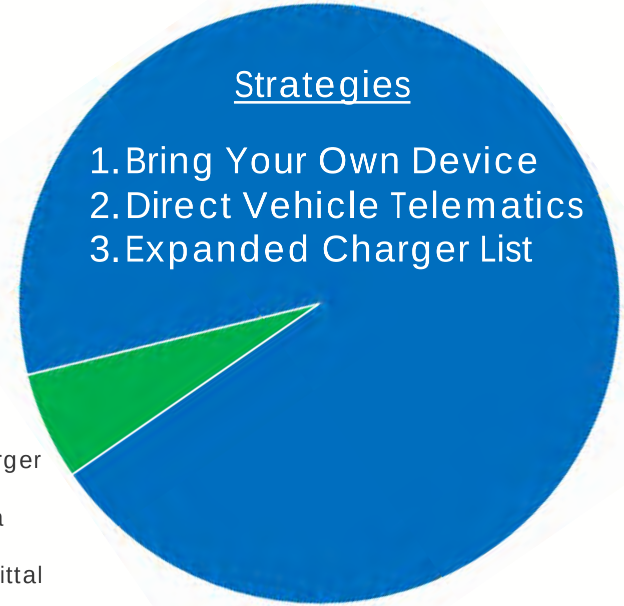
September 2019

419 Engaged



- Approved to Participate w/ Home Charger
- Approved to Participate w/ FleetCarma
- To Be Approved Upon Document Submittal
- Potential for Approval w/ New Purchase & Document Submittal
- Program Participation Unlikely

October 2020



Potential
7,000+

PowerMIFleet Approved
New program launching Q2 2021-2024+

1. Education & Outreach / Concierge Service
   - Consultants analyze
     - Identify vehicles best suited for electrification per duty cycle and use
     - Best locations for charging infrastructure
     - Cost benefit analysis of electrification
     - Public reports on findings and lessons learned
2. Rebates for fleet charging infrastructure optimizing grid lessons
   - $5,000 rebate per Level 2 (up to 500 rebates in total and 10 per site)
   - $35,000-$70,000 per DCFC ($500,000 limit, so 7-14 rebates in total)
3. Technical Development
   - Workplace demand response
   - Bi-Directional power flow demonstration - Dependent on market/customer readiness
     - Vehicle to building
     - Vehicle to grid

Jeff Myrom
Director of Renewable Energy & Electric Vehicle Customer Products

Questions Please

ITC Holdings Corp.

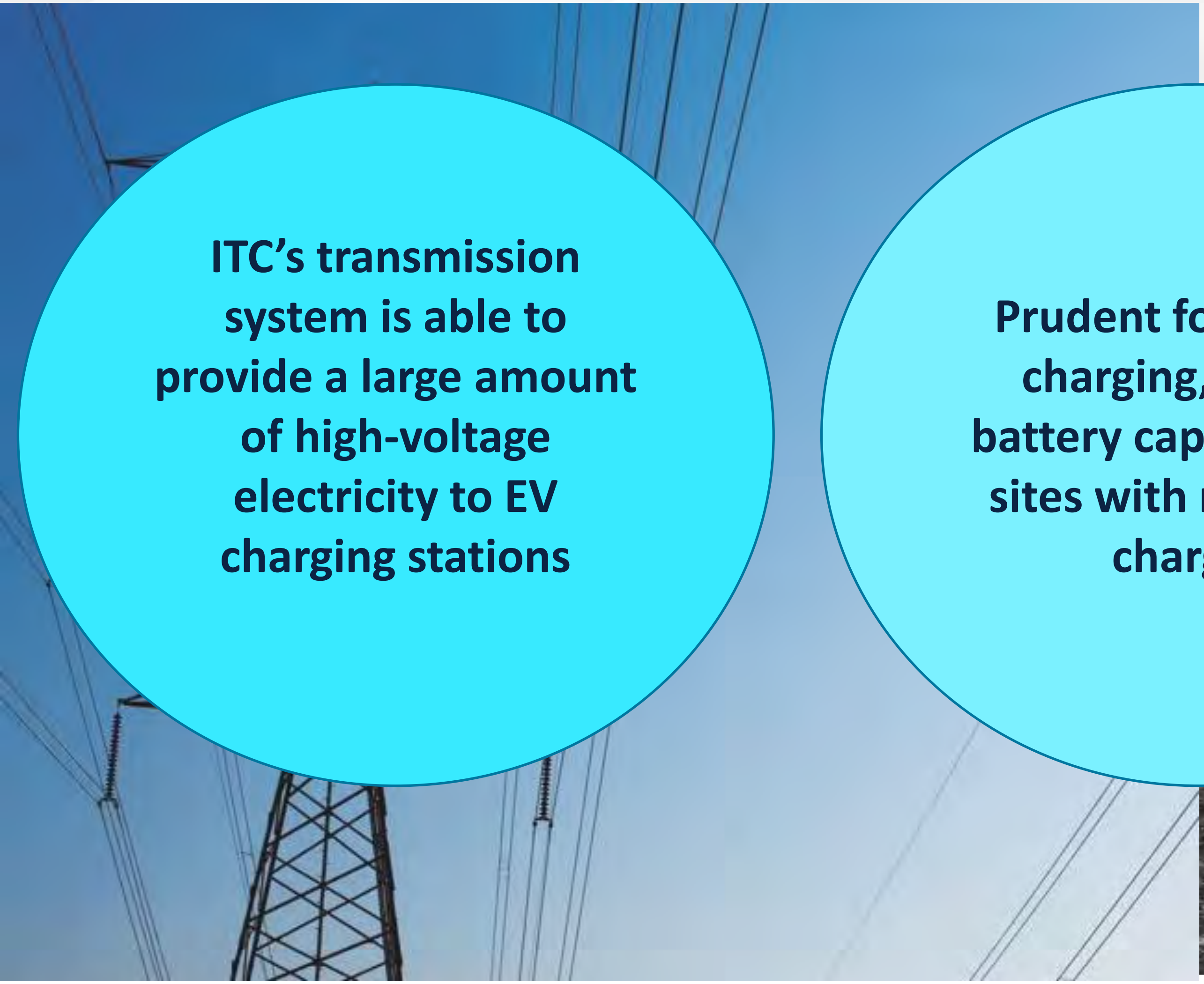
Electrification of Transportation + Mobility

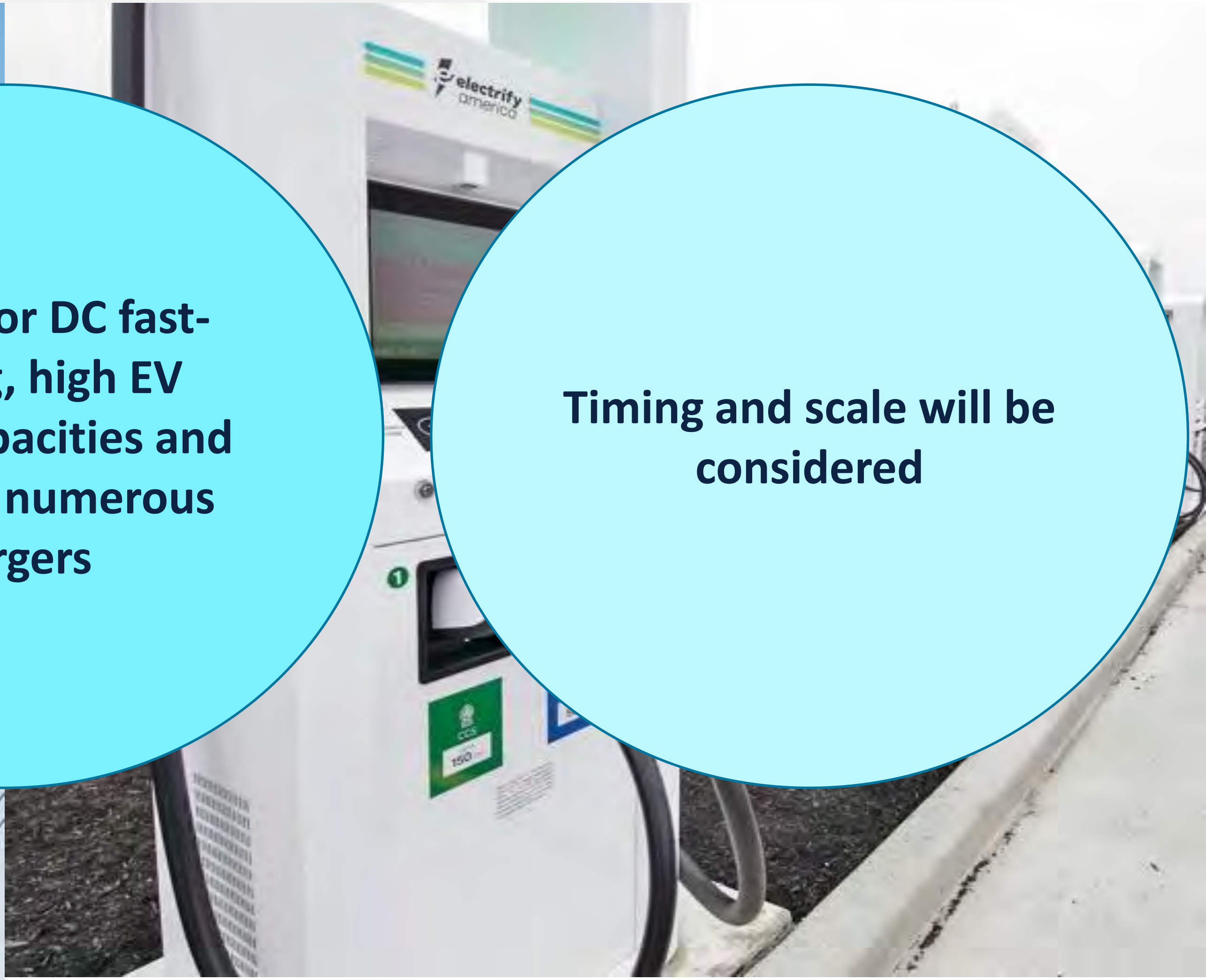
MI Power Grid: Utility EV Pilot Update

February 10, 2021

FOR THE GREATER GRID

Electricity transmission will play a role in EVs





ITC's transmission system is able to provide a large amount of high-voltage electricity to EV charging stations

Prudent for DC fast-charging, high EV battery capacities and sites with numerous chargers

Timing and scale will be considered

ITC made a regulatory filing for EV pilot approval

Make-ready infrastructure at the transmission level

Filing at Federal Energy Regulatory Commission (FERC) requesting rate recovery

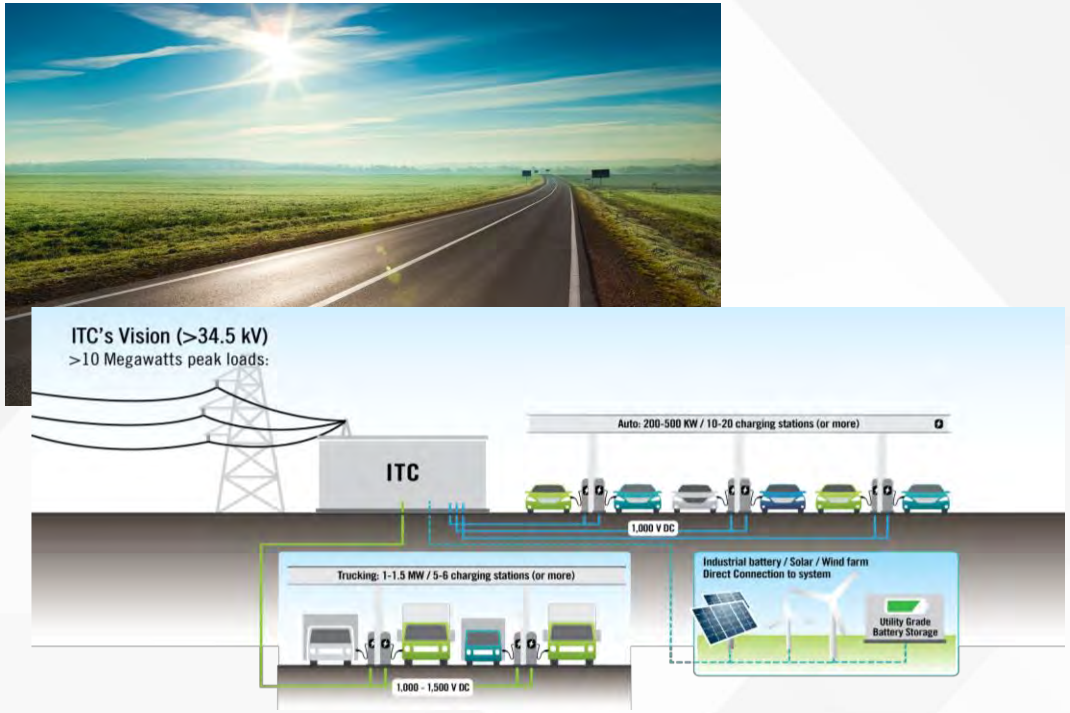
ITC is focused on forging DCFC pilot programs in Michigan

Long-distance passenger travel and fleets (medium-duty and long-haul trucks)

The intent is to set regulatory precedent, prove the concept and spur scale

ITC pilot is focused on two applications

Long-distance charging



Fleet charging

Pilot status and next steps

ITC will collaborate with other entities to establish pilot stations in Michigan

- **Decision by regulator (FERC) on pilot approval is expected in near-term**
- Promote ITC’s pilot and the value of make-ready at the electricity transmission level
- Outreach to interested parties, including other utilities, government entities and third-party businesses
- Our effort will compliment the Michigan utilities that have various EV pilot approvals

Thank **You**

ITC A FORTIS COMPANY | FOR THE GREATER GRID

MI POWER GRID

Making the Most of Michigan's Energy Future

New Technologies and Business Models

Break: 3:55 – 4:00 PM

Stakeholder Meeting 2: Electric Vehicles

February 10, 2021

Transportation Electrification in Michigan & Opportunities for Vehicle-to-Grid Integration

Moderator

Cory Connolly
Vice President of Policy
Michigan Energy Innovation Business Council

Hawk Asgeirsson
Consultant, Pacific Northwest National Laboratory

Jim Gawron
Electric Vehicle Ecosystem Manager
Ford Motor Company

Jamie Hall
Advanced Vehicle & Infrastructure Policy Manager
General Motors

Tanya Krackovic
VP Special Projects
eCamion

Trevor Pawl
Chief Mobility Officer
Office of Future Mobility & Electrification

New Technologies and Business Models
Closing Comments

Stakeholder Meeting 2: Electric Vehicles

February 10, 2021

Michigan Public Service Commission

Thank You and Please Stay Engaged!

- Thank you for your participation
  - Share your thoughts on the meeting in the survey
- Please stay engaged
  - Sign up for the listserv if you have not already
    - Go to MI Power Grid New Technologies and Business Models workgroup page
    - Scroll to bottom to add email
  - Attend future meetings
    - Next Meeting on February 24 from 1 – 5 PM
    - Topic: Space & Water Heating using Heat Pumps
  - Speak at a future meeting
    - Limited slots available for stakeholder input/experiences
    - If interested, email: Joy Wang at WangJ3@Michigan.gov.

Thank you!