MPSC EV Technical Conference

January 24, 2024

MPSC
MICHIGAN PUBLIC SERVICE COMMISSION

Keynote Speakers
Deploying EVs- State and Federal Perspective

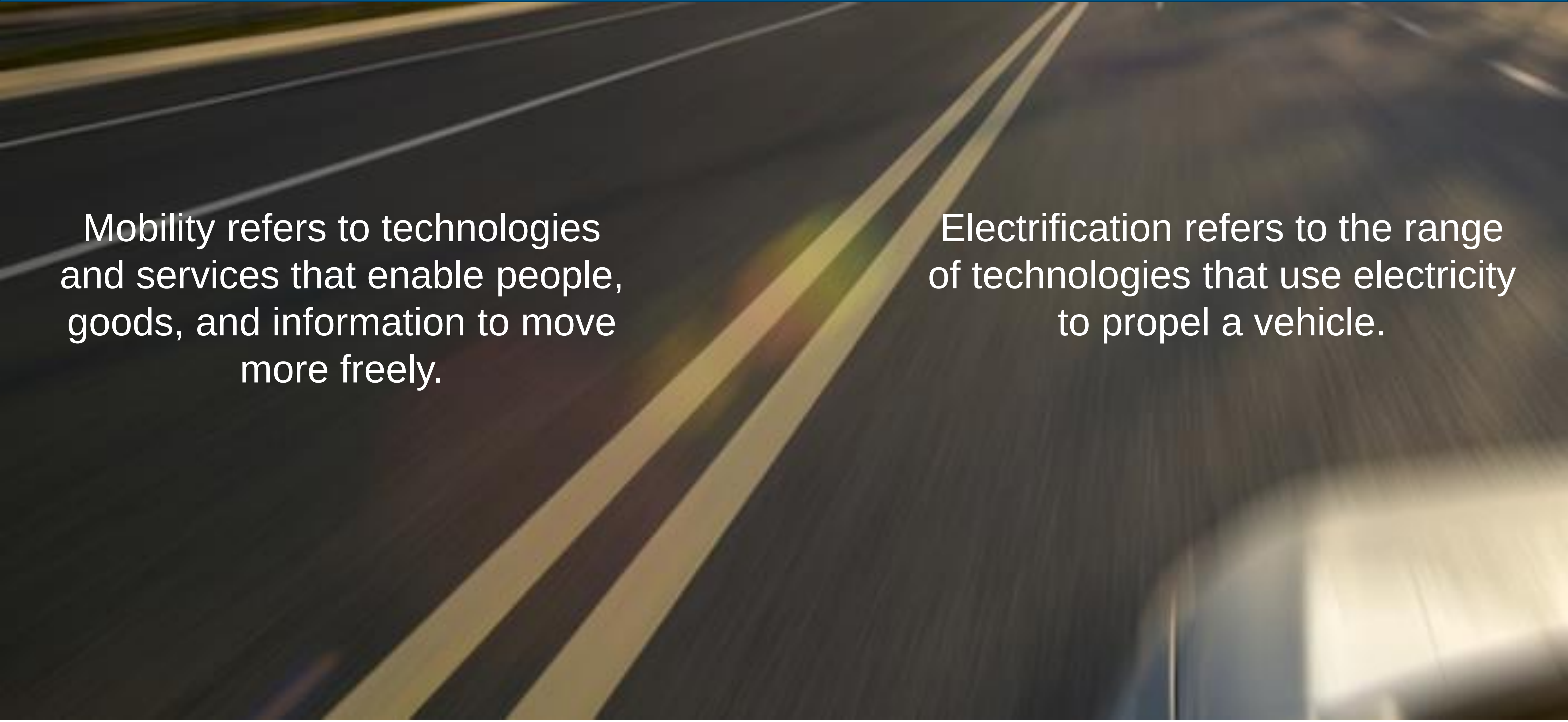
Justine Johnson, OFME

Jacob Mathews, JOET

MICHIGAN OFFICE OF
FUTURE MOBILITY & ELECTRIFICATION

Agenda

- About OFME
- About the Council for Future Mobility and Electrification
- MI Future Mobility Plan
- Programs and Initiatives
- Closing Remarks



Mobility refers to technologies and services that enable people, goods, and information to move more freely.

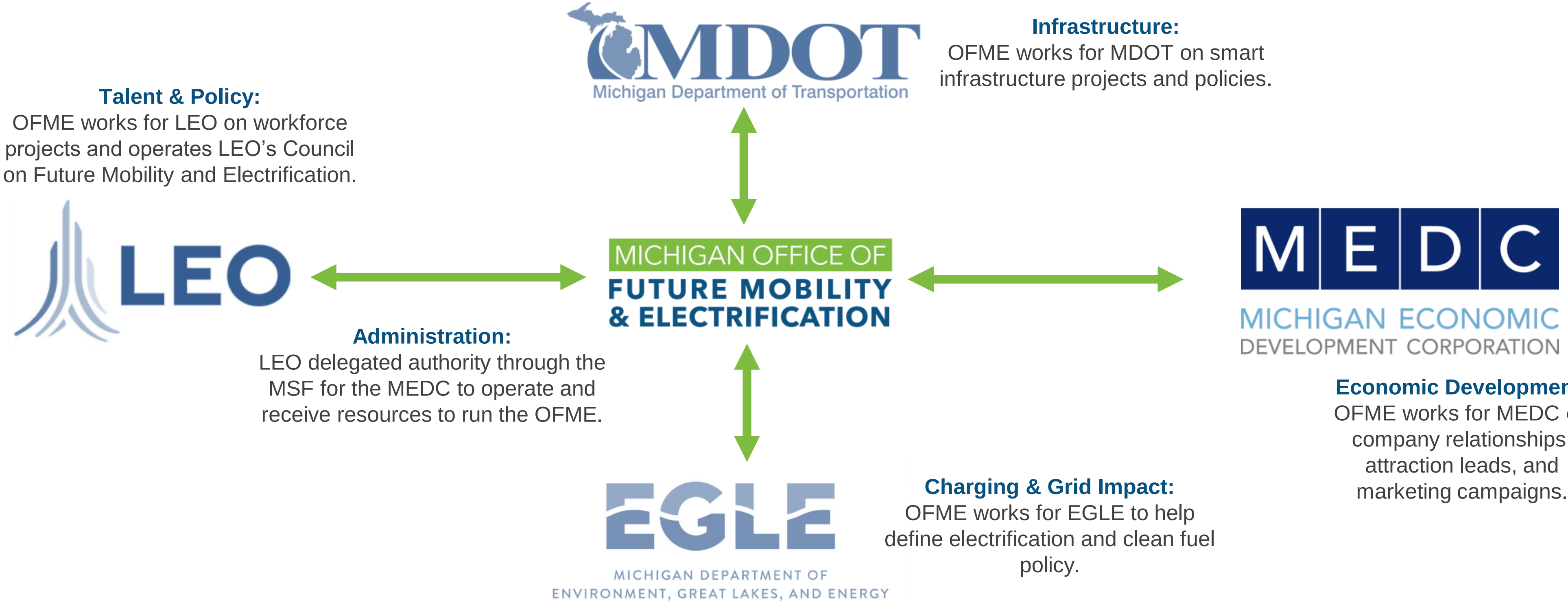
Electrification refers to the range of technologies that use electricity to propel a vehicle.

OFME Vision:

A stronger state economy through safer, equitable, and environmentally-conscious transport for all Michigan residents.

.

Executive Directive 2020-1 from the Governor Whitmer charged the OFME with coordinating a statewide approach for future mobility and electrification that bolsters Michigan's economy, workforce, environment, and infrastructure priorities. That is why OFME is nestled between the four departments responsible for these priorities, creating the "tools" and "extra hands" necessary to help these teams maintain mobility leadership.



Infrastructure:
OFME works for MDOT on smart infrastructure projects and policies.

Talent & Policy:
OFME works for LEO on workforce projects and operates LEO's Council on Future Mobility and Electrification.

Administration:
LEO delegated authority through the MSF for the MEDC to operate and receive resources to run the OFME.

Economic Development:
OFME works for MEDC on company relationships, attraction leads, and marketing campaigns.

Charging & Grid Impact:
OFME works for EGLE to help define electrification and clean fuel policy.

Council for Future Mobility and Electrification

Since 2021, the council presented a set of visionary recommendations aimed at bolstering the state's position as a hub for mobility and technological advancements.

Here are some key examples:

Based on the council's recommendation for a large site development fund to acquire and create "ready" site properties for mobility business development and attraction, the Michigan Legislature passed the bipartisan $1.5 billion Strategic Outreach Attraction Reserve (SOAR) fund in Dec. 2021 to ensure we can lead the future of mobility and electrification and bring supply chains of chips and batteries home to Michigan.

The council recommended the establishment of a high-tech talent attraction and retention fund which influenced the creation of LEO's EV Jobs Academy and MEDC's EV Scholars Program to implement nation's most extensive campaign to promote careers in the surging mobility sector, as well as MichAuto's High-Tech Talent Initiative Perception Study.

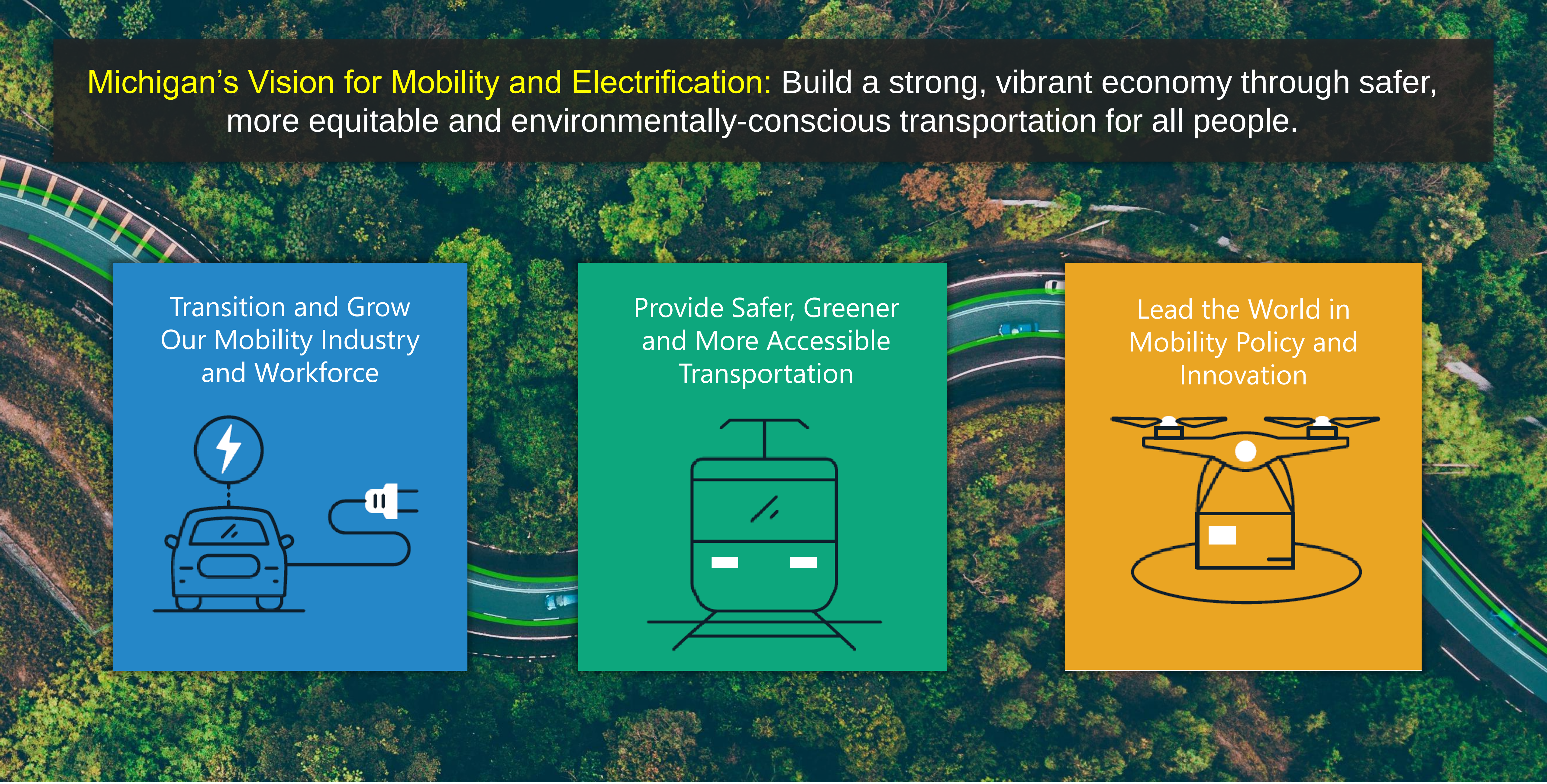
The council also recommended policies supporting the world's first deployment of a Connected and Autonomous Vehicle (CAV) corridor on Interstate 94. The project is designed to improve safety, reduce congestion, improve mobility and support advanced vehicle technology.

The council recommended and supported the allocation of $130 million in 2022 for the establishment of the Global Center of Excellence for electric vehicle teaching, training, and development center at the University of Michigan. The council also influenced the allocation of $125 million for the Clean School Bus program to help school districts across the state bring the benefits of zero-tailpipe-emissions electric school buses to their communities

Council on
Future Mobility
& Electrification

2023 REPORT

MICHIGAN OFFICE OF
FUTURE MOBILITY
& ELECTRIFICATION



Michigan's Vision for Mobility and Electrification: Build a strong, vibrant economy through safer, more equitable and environmentally-conscious transportation for all people.

Transition and Grow Our Mobility Industry and Workforce

Provide Safer, Greener and More Accessible Transportation

Lead the World in Mobility Policy and Innovation

MICHIGAN ECONOMIC DEVELOPMENT CORPORATION

MICHIGAN OFFICE OF FUTURE MOBILITY & ELECTRIFICATION

GOALS DASHBOARD

PILLAR 1: Transition and Grow Our Mobility Industry and Workforce

✓ Achieved

Create **20,000 new jobs** in mobility and automotive sector by **2026**

Add **7,000 workers** with mobility credentials by **2030**

✓ Achieved

Support at least **170,000 new manufacturing jobs** by 2030

PILLAR 2: Provide Safer, Greener and More Accessible Transportation Infrastructure

Deploy 100,000 chargers to support 2 million electric vehicles and improve access to hydrogen infrastructure

✓ Achieved

Maintain at least 80% of EV charging off-peak to minimize impacts to the grid by 2030

Reduce congestion and traffic crash rates statewide by 2026

Provide all residents with access to mobility-as-a-service operations across Michigan's 77 public transit agencies by 2026

PILLAR 3: Lead the World in Mobility and Electrification Policy and Innovation

✓ Achieved

Maintain #1 state ranking for mobility and electrification research and development spend

✓ Achieved

Become a top 10 state for growth in venture capital funding by 2026

✓ Achieved

Become a top 10 state for federal investments related to mobility and vehicle electrification

Lead the nation in electric and automated vehicle friendliness through responsive policies

- Michigan has created 20,289 mobility jobs since 2020.
- Our economy supports nearly 200,000 manufacturing jobs
- Support grid resiliency by maintaining nearly 90% of EV charging during off peak hours.
- Maintain our mobility and electrification R&D leadership position
- Securing more VC funding than 45 other states
- Ranking #4 for federal investments in mobility and vehicle electrification

About MMFP

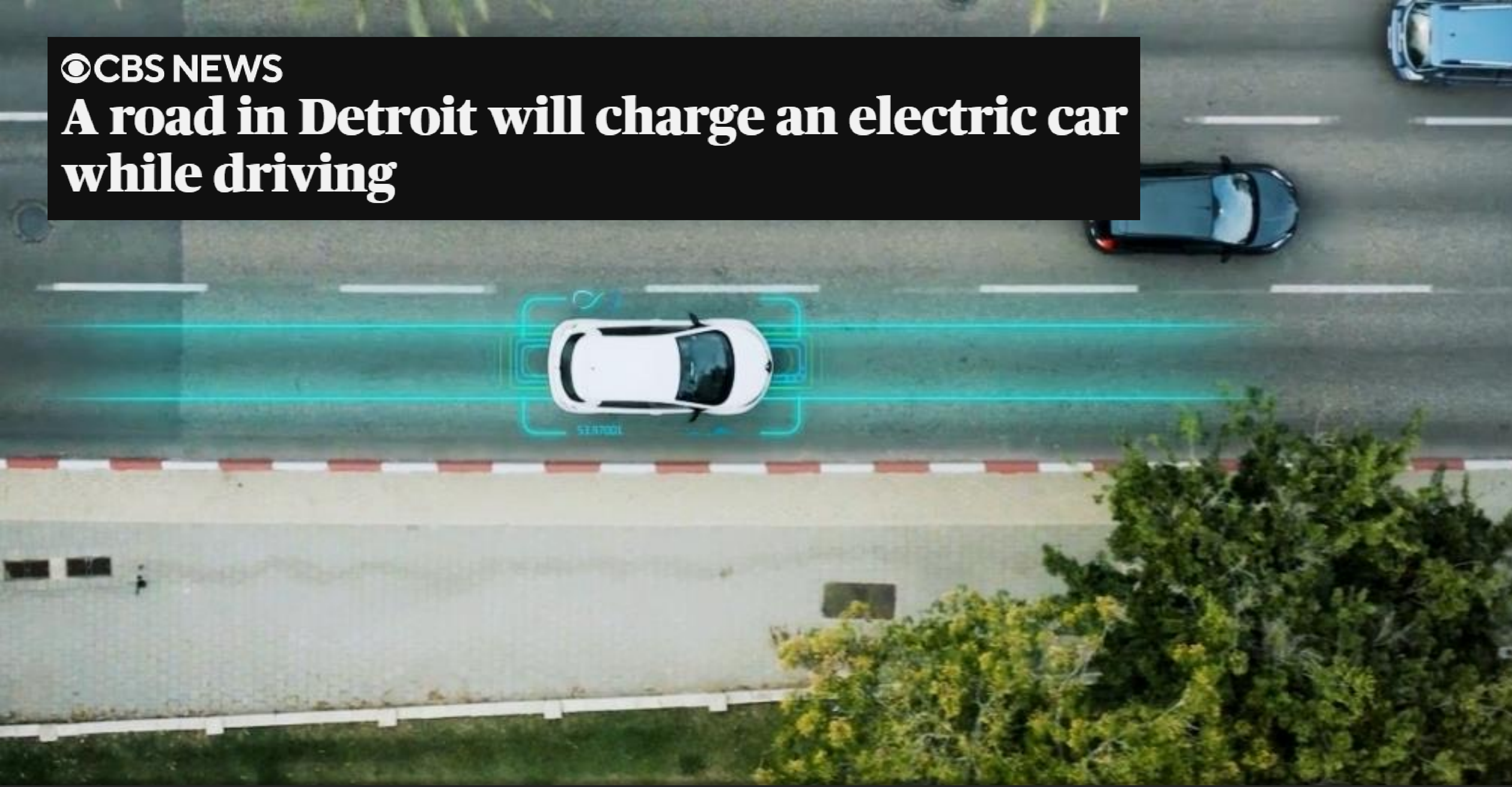
Since 2021, the Michigan Mobility Funding Platform (MMFP) has awarded **over $9M in state grants** to mobility and electrification companies looking to deploy their technology solutions in the state of Michigan – this accounts for **over 125+ individual grants**.

Key details:

MMFP grants are comprised of three unique pillars: Test Site Grants (typically ranging from $10,000 - $100,000), Real World Deployment Grants (typically ranging from $50,000 - $200,000), and Challenges (ranging from $50,000 - $700,000 per grant depending on funding source).

MMFP grant-funded projects span across the industry and represent a long list of focus areas including autonomous vehicle technology, unique charging strategies and use cases (wireless, automated, etc.), academic research, outdoor recreation innovation, roadway safety, infrastructure, and more.

The MMFP program leverages several funding sources to secure the longevity of the platform as well as increase the impact in the state. Over the last several years the program has expanded to leverage funds from MEDC, LEO, and MDOT as well as federal grant dollars.



CBS NEWS

A road in Detroit will charge an electric car while driving

CAR AND DRIVER

Michigan Will Build Out EV Charging Stations for Lake Michigan Road Trips

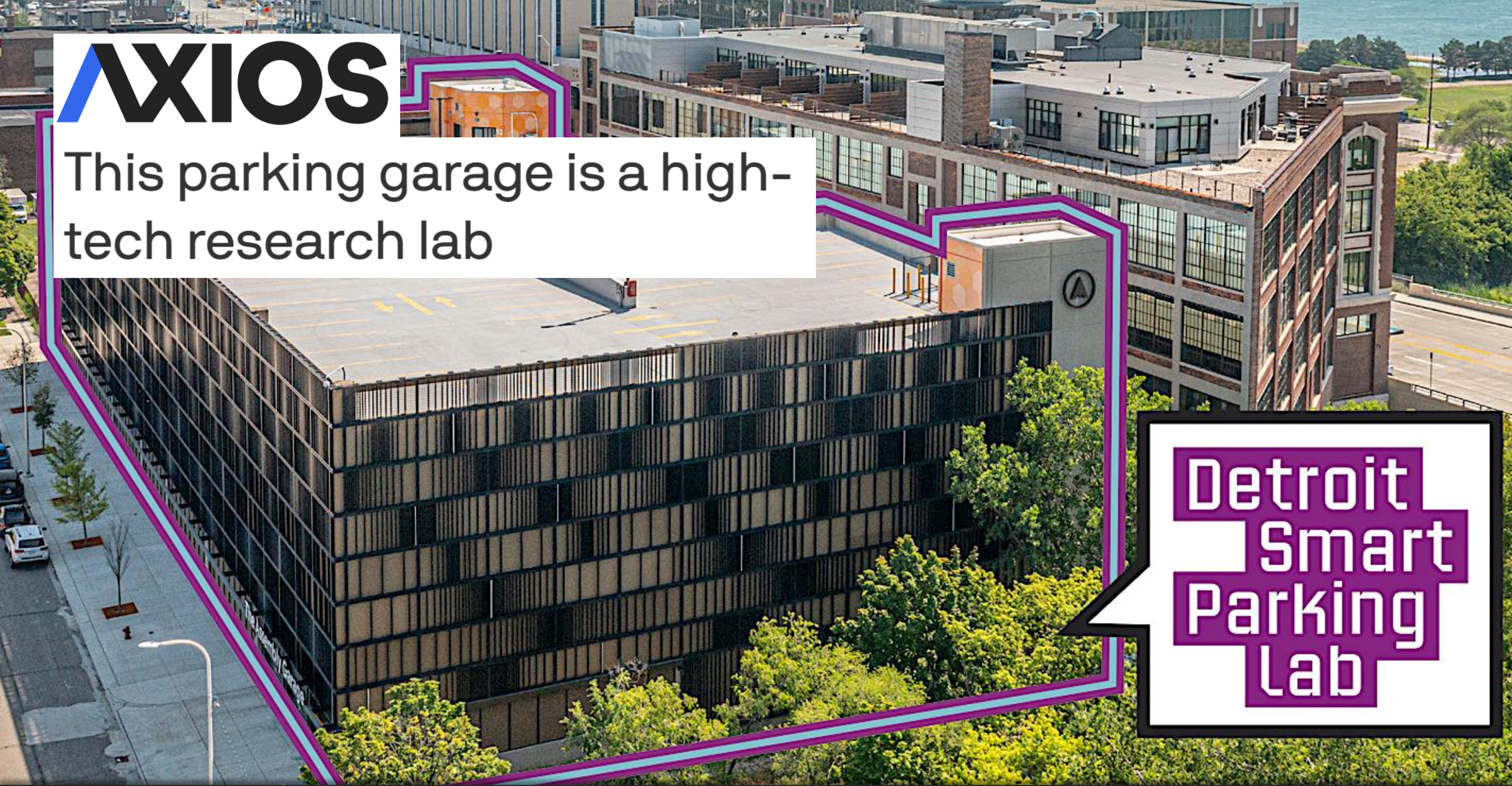
NATIONAL PARK SERVICE

Michigan, NPS to Partner on Transportation Innovation Projects

Michigan Airport to Experiment With More Autonomous Tech

AXIOS

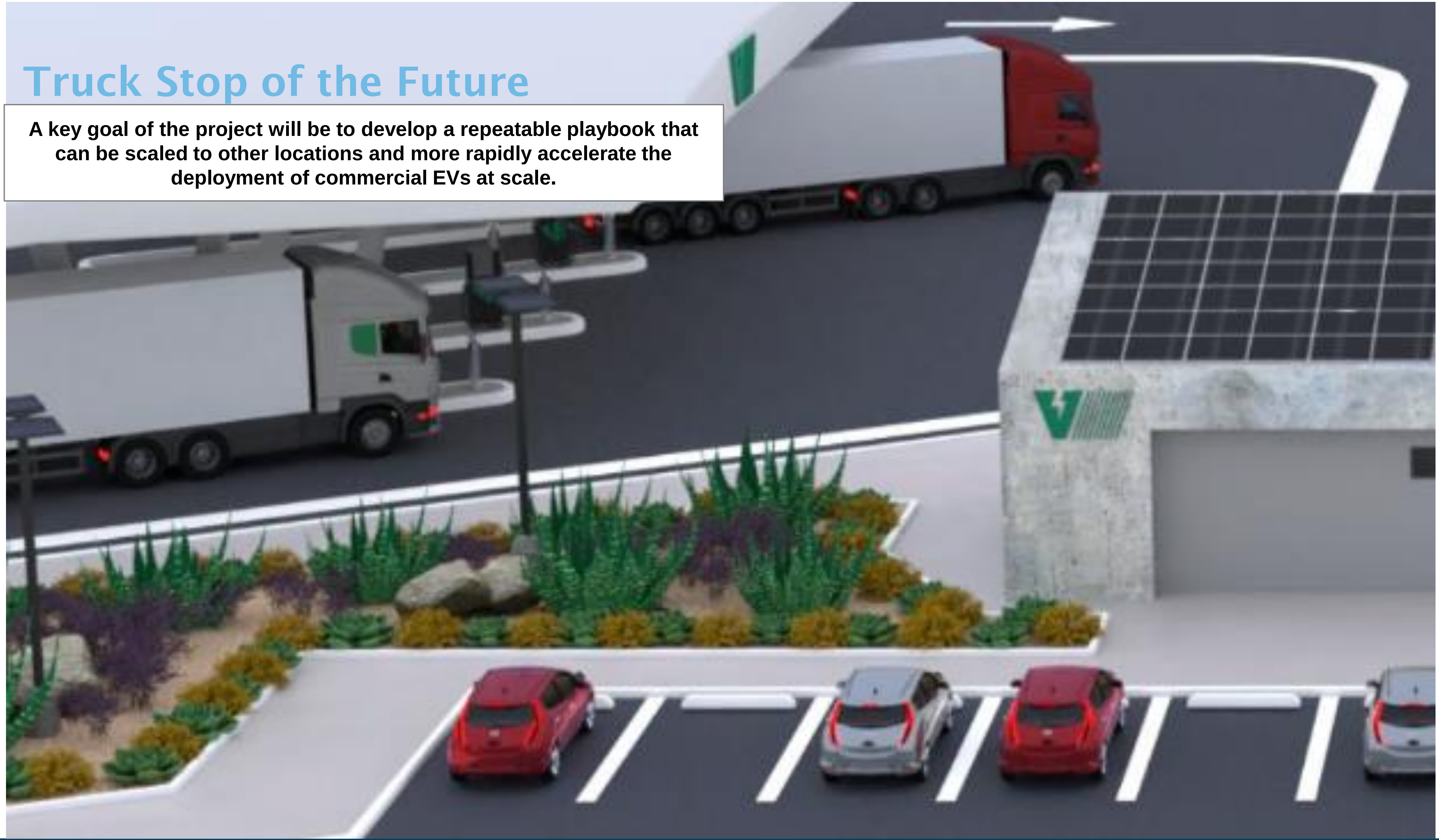
This parking garage is a high-tech research lab



Detroit Smart Parking Lab

Truck Stop of the Future

A key goal of the project will be to develop a repeatable playbook that can be scaled to other locations and more rapidly accelerate the deployment of commercial EVs at scale.



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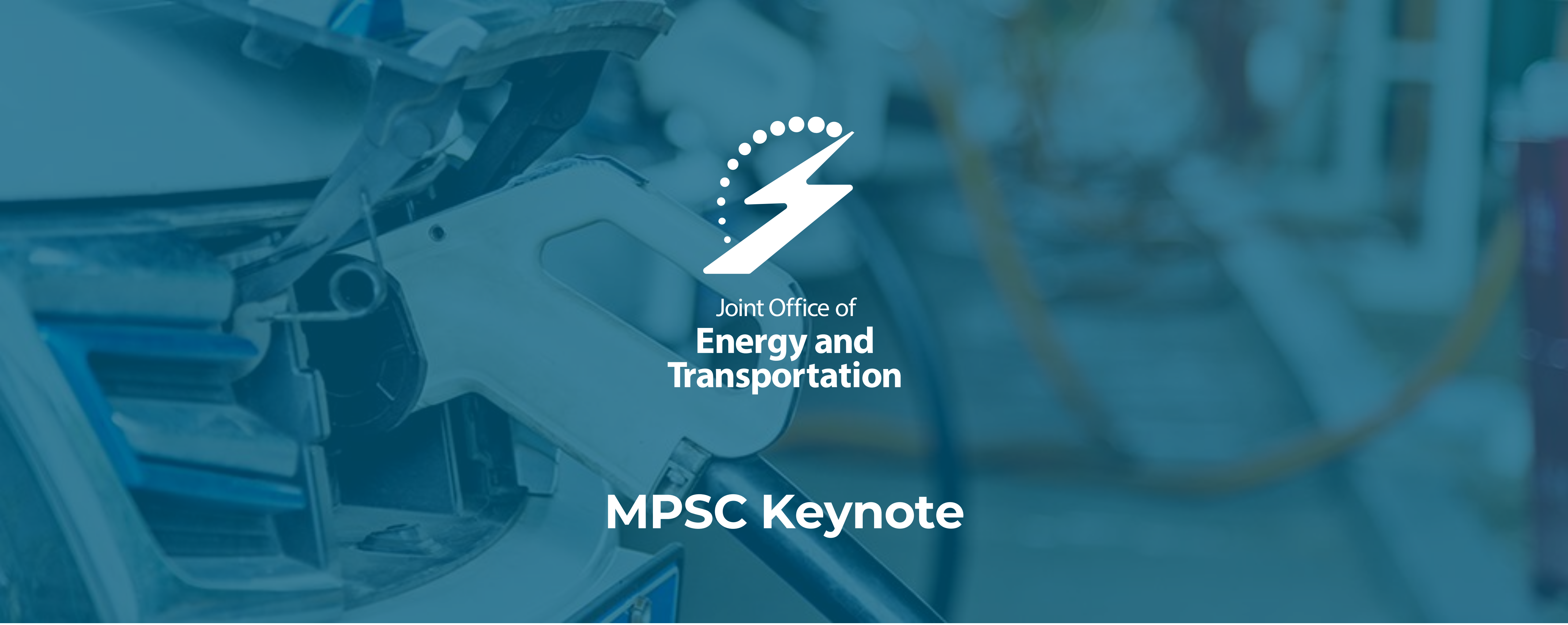
Thank you!



Joint Office of
Energy and Transportation

MPSC Keynote

Standards, Reliability, & Cyber Security

Jacob Mathews

January 2024

driveelectric.gov

Joint Office Overview and Priorities

Joint Office of Energy and Transportation

Established in the Bipartisan Infrastructure Law to address areas of joint interest to the Departments of Energy and Transportation

$300M

in FY22 funds to DOT
with transfer authority to DOE

9

major areas of emphasis

Mission and Vision

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

DEPARTMENT OF TRANSPORTATION · UNITED STATES OF AMERICA

JOINT OFFICE OF
Energy and
Transportation

Mission

To accelerate an electrified transportation system that is affordable, convenient, equitable, reliable, and safe.

Vision

A future where everyone can ride and drive electric.

Vision for the Joint Office of Energy and Transportation

1. Support **deployment of zero-emission, convenient, accessible, equitable transportation infrastructure**—coordinating and leveraging activities between the U.S. Department of Energy and the U.S. Department of Transportation.

2. Serve as the **front door to the Federal Government for expertise and technical assistance**.

3. Serve as a **convenor of federal agencies, private sector companies, NGO and academia** to bring an all of government and stimulate an all of society approach to zero emissions transportation and mobility services.

4. Focus on **social return on investment and providing pilot funding to test outcomes** vs. simply hardware.

Infrastructure Investment & Jobs Act (IIJA) Programs Supported by the Joint Office

The Joint Office provides unifying **guidance**, **technical assistance**, and **analysis** to support the following programs:

National Electric Vehicle Infrastructure (NEVI) Formula Program (U.S. DOT)
$5 billion for states to build a national electric vehicle (EV) charging network along corridors, including a **$100 million** funding opportunity to repair and replace chargers

Charging & Fueling Infrastructure Discretionary Grant Program (U.S. DOT)
$2.5 billion in community and corridor grants for EV charging, as well as hydrogen, natural gas, and propane fueling infrastructure

Low-No Emissions Grants Program for Transit (U.S. DOT)
$5.6 billion in support of low- and no-emission transit bus deployments

Clean School Bus Program (U.S. EPA)
$5 billion in support of electric school bus deployments

Approach to Improve EV Charging Interoperability & Reliability

We are tackling the overarching challenges to build a reliable, convenient national charging network

- Reliability
- Cybersecurity
- Interoperability
- Data Sharing
- Equity
- Utility Coordination

Standards & Reliability Program Activities

Simplify

FHWA & JO

Min Standards & Requirements

Reliability Metrics & Standards

Require

Solutions and Shortcuts

National Laboratories & Industry Partners

Open-source Deployments

CHARGEX consortium

Support

Data and Certification

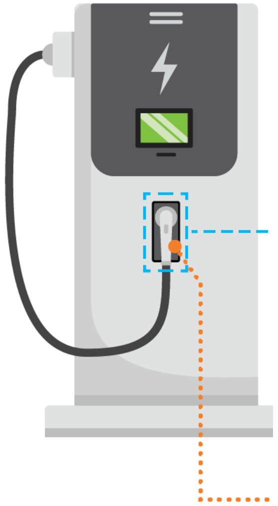
Industry Partners

Commercial Lab Capacity Building

Data Collection and Sharing

Verify

EV Charging Minimum Standards



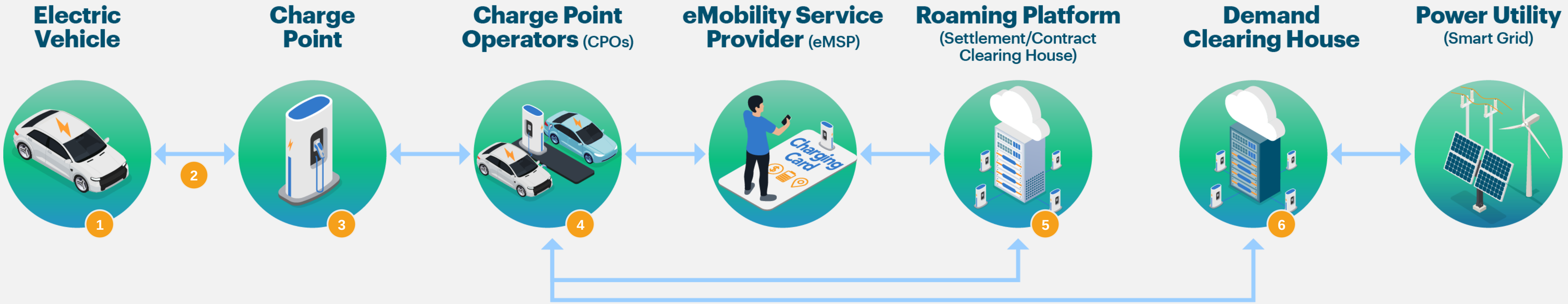
- ***Charging is a predictable and reliable experience***, by ensuring that there are consistent plug types (at least 4 CCS), power levels, and a minimum number of chargers capable of supporting drivers' fast charging needs;
- ***Chargers are working when drivers need them to***, by requiring a 97 percent uptime reliability requirement;
- ***Drivers can easily find a charger when they need to***, by providing publicly accessible data on locations, price, availability, and accessibility through mapping applications;
- ***Drivers do not have to use multiple apps and accounts to charge***, by facilitating several payment types
- ***Chargers will support drivers' needs well into the future***, by focusing on interoperability and ensuring that chargers and vehicles work seamlessly, similarly, and together

Linux Foundation Energy (LF Energy)

Joint Office Applied Interoperability Initiative

Create a point of industry focus through enhancement and development of a common and unique open-source reference architecture and implementation to galvanize adoption and integration of EV charging standards, communications, and processes and ultimately accelerate the EV transition.

Our Charging Ecosystem



Electric Vehicle

Charge Point

Charge Point Operators (CPOs)

eMobility Service Provider (eMSP)

Roaming Platform (Settlement/Contract Clearing House)

Demand Clearing House

Power Utility (Smart Grid)

① **Electric Vehicle OEM**
- Vendor lock in
- Tier 1 suppliers control code stack in EVCC
- Fragmented implementations 15118-2
- Hardware cable lengths affecting communication (SLAC)
- Testing capabilities: black box source code

② **EV to Charge Point**
- Inconsistent reinitialization behavior i.e. re-authentication after session failure is not part of the standard
- Non-happy path testing capabilities
- Non-deterministic testing makes it difficult to debug errors

Opportunities
- Authorization/payment: contract communication

③ **Charge Point**
- Multiple operating systems
- Inconsistent reinitialization behavior i.e. re-authentication after session failure is not part of the standard
- Hardware cable lengths and noise affecting communication
- Fragmented implementation of 15118-2
- Testing capabilities: black box source code

Opportunities
- Authorization/payment: contract communication

④ **Charge Point Operators**
- Non-happy path testing capabilities
- OCA OCPP testing is happy path only
- Poor diagnostics capabilities
- Different CSMS/OCPP implementations

Opportunities
- Authorization/payment
  - Remote starts
  - Credit card handling
  - Plug & Charge support

⑤ **Roaming**
- Lack of choice between roaming

Opportunities
- PKI providers
- Roaming platform providers
- Smart/Multi-Party Contracts

⑥ **Smart Charging**

Opportunities
- Smart charging profile generation
- Utility protocol translation
- Vehicle-Grid Integration at scale and pace to buy time for distribution upgrades.

Priorities We Heard From Industry

01

Fully Tested ISO 15118-2 SECC Reference Implementation

02

Fully Tested OCPP 2.0.1 Reference Implementation

03

CSMS Integration

04

Dynamic Price Signals & Power Limits

Fully Tested ISO 15118-20 SECC Reference Implementation

Plug and Charge Authentication Testing in an end-to-end PKI Environment

SECC Simulator

Improved EVCC Simulation for testing SECC Stacks

Improved Developer Quality-of-Life with Implementation Guides

Virtual Test Harness for HIL Simulation

Charging Experience Consortium (ChargeX)

Vision

Any driver of any EV can charge on any charger the first time, every time

Mission

Bring together EV charging industry members, national laboratories, consumer advocates, and other stakeholders to measure and significantly improve public charging reliability and usability in North America **within 24 months**

Scope

Focus on complex issues that require multi-stakeholder collaboration and national lab support to solve and simplify

Scope of Work

Working Group 1

Defining the Charging Experience

- Define KPIs
- Set and validate targets
- Track industry performance

Working Group 2

Reliability / Usability Triage

Create fixes for:

- Payment and user interface
- Communication
- Hardware

Working Group 3

Solutions for Scaling Reliability

Improve:

- Diagnostics
- Interoperability testing methods

Outcomes

- Labs produce recommended practices, prototype tools, voluntary recognition program design
- Industry adopts practices and tools, improves standards

Participants

Charger Manufacturers and Suppliers

Customer-Facing Charging Station Operators

Charging Network and Software Providers

Auto Manufacturers

3rd-Party Roaming Hubs and eMSPs

Field Services and Analytics Firms

Consumer Advocates

Fleets

Payment Industry Stakeholders

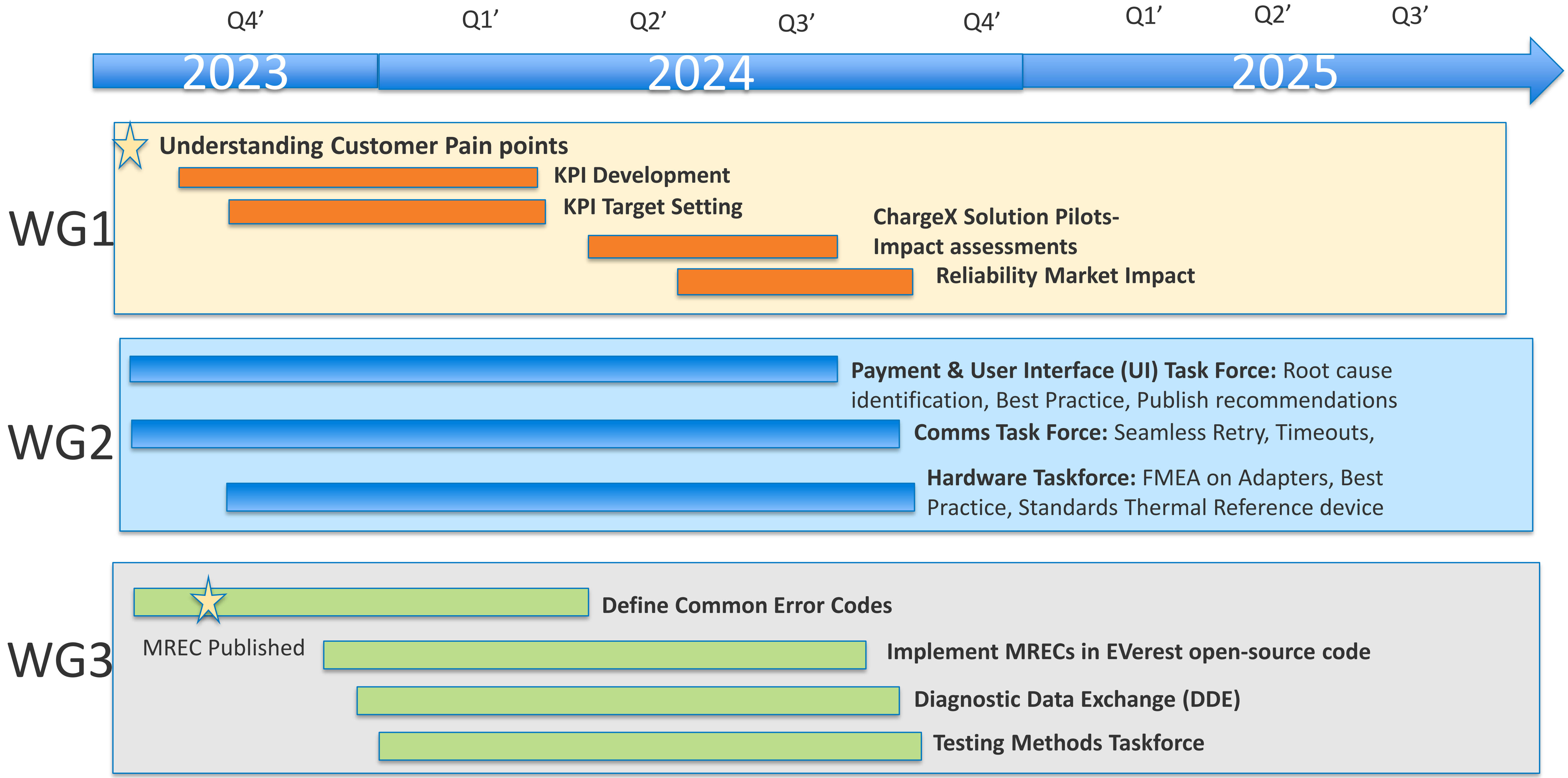
Standards and Testing Organizations

Electric Utility Representative

Universities

State Agencies and Policy Firms

ChargeX Roadmap



Q4’ Q1’ Q2’ Q3’ Q4’ Q1’ Q2’ Q3’

2023 2024 2025

WG1

Understanding Customer Pain points

KPI Development

KPI Target Setting

ChargeX Solution Pilots- Impact assessments

Reliability Market Impact

WG2

Payment & User Interface (UI) Task Force: Root cause identification, Best Practice, Publish recommendations

Comms Task Force: Seamless Retry, Timeouts,

Hardware Taskforce: FMEA on Adapters, Best Practice, Standards Thermal Reference device

WG3

Define Common Error Codes

MREC Published

Implement MRECs in EVerest open-source code

Diagnostic Data Exchange (DDE)

Testing Methods Taskforce

Cyber Security

Mission and Vision

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

DEPARTMENT OF TRANSPORTATION · UNITED STATES OF AMERICA

JOINT OFFICE OF
Energy and
Transportation

Mission

To accelerate an electrified transportation system that is affordable, convenient, equitable, reliable, and safe.

Vision

A future where everyone can ~~ride and drive~~ electric.

Hack?

Guiding Principles for our Cyber Activities

- **Guide** grant recipients via cybersecurity resources relevant to our grant programs
    - Sample procurement language
    - EVSE incident reporting framework
- **Analyze** complex multi-stakeholder barriers to aid industry decision-making
    - Theory and practice of the Plug-and-Charge Public Key Infrastructure
    - Field Testing informed best practices
- **Coordinate** product security experts from all parts of the EV charging community
    - Charging Ecosystem Security Working Group

What makes us different?

Our activities are focused on TRL 7+

- Strategy: Waterfall
- Timeline: Years
- Success: Incremental
- Failure: Normal

- Strategy: Agile
- Timeline: Months
- Success: Transformative
- Failure: Unacceptable

Department of Energy · United States of America

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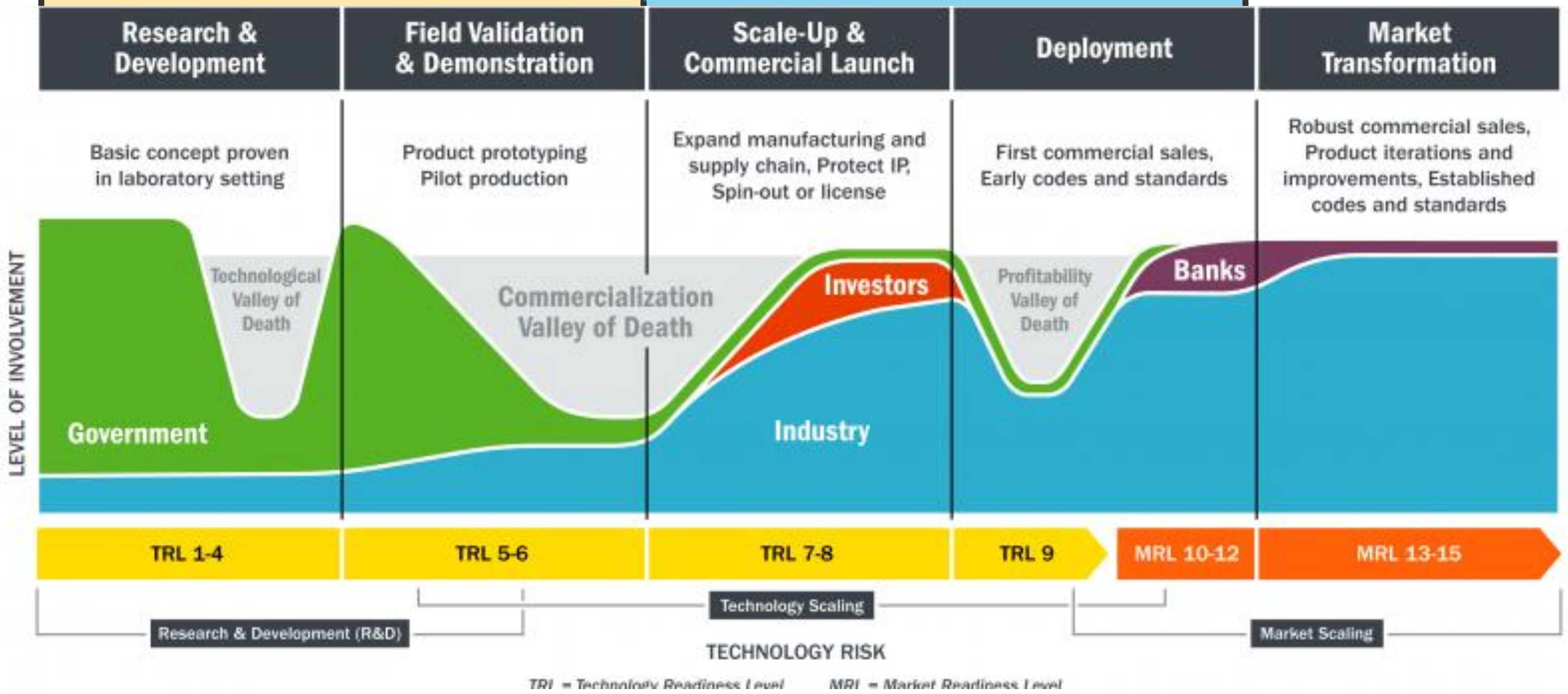
Joint Office of
Energy and Transportation

Most Federal R&D

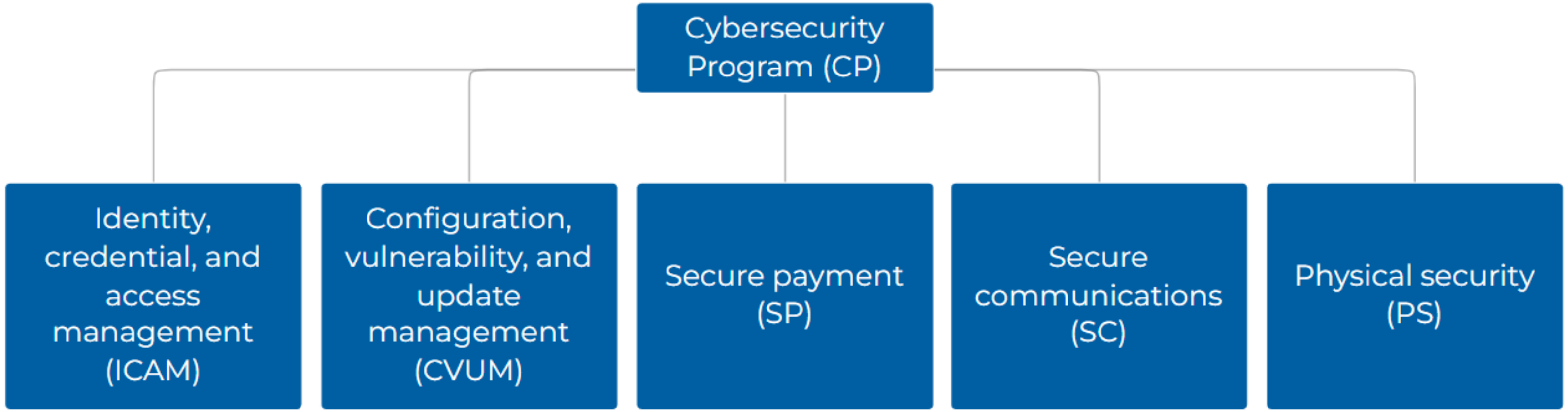
Our R&D



Guide: Sample Procurement Language for NEVI Grants

Performer: PNNL

- States are the early implementers of federal EV charging investments
- Equip states with unified set of sample language to meet the NEVI minimum standards
- driveelectric.gov/cybersecurity-clauses

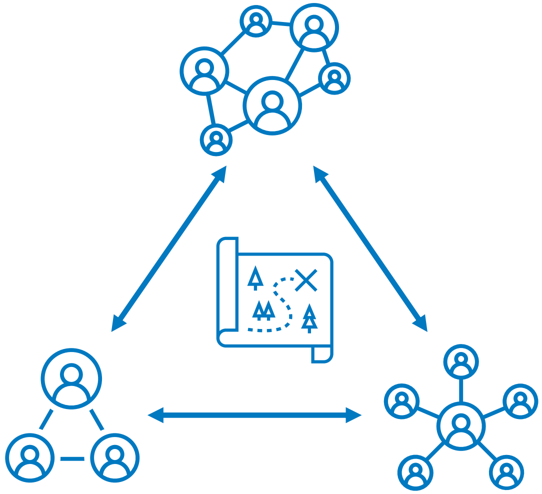


Visual representation of the cybersecurity procurement language

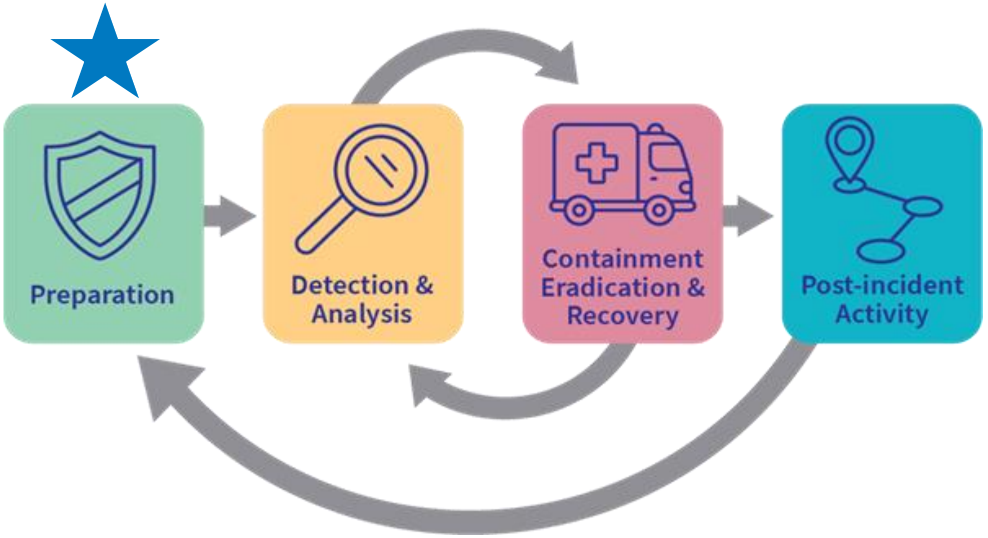
Guide: EVSE Incident Reporting Framework

Performer: PNNL

- Ensure EVSE stakeholders are prepared to respond to potential cyber incidents
  - What are existing incident reporting processes?
  - What does NEVI require?
  - How can EVSE incident reporting integrate with existing IR processes?
- Develop & validate approach with stakeholders and incident response professionals



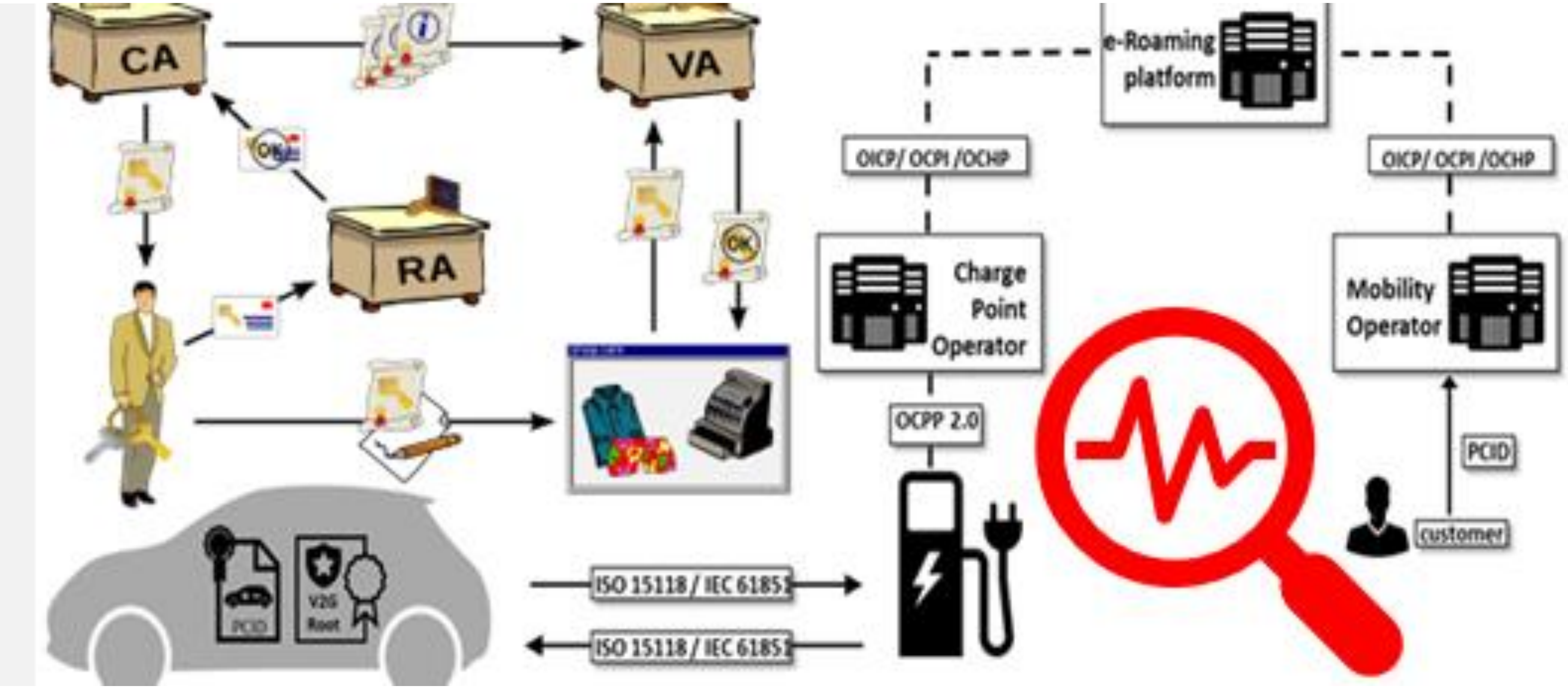
Cyber Incident Response Cycle



Analyze:
NEVI Standards
PKI Analysis

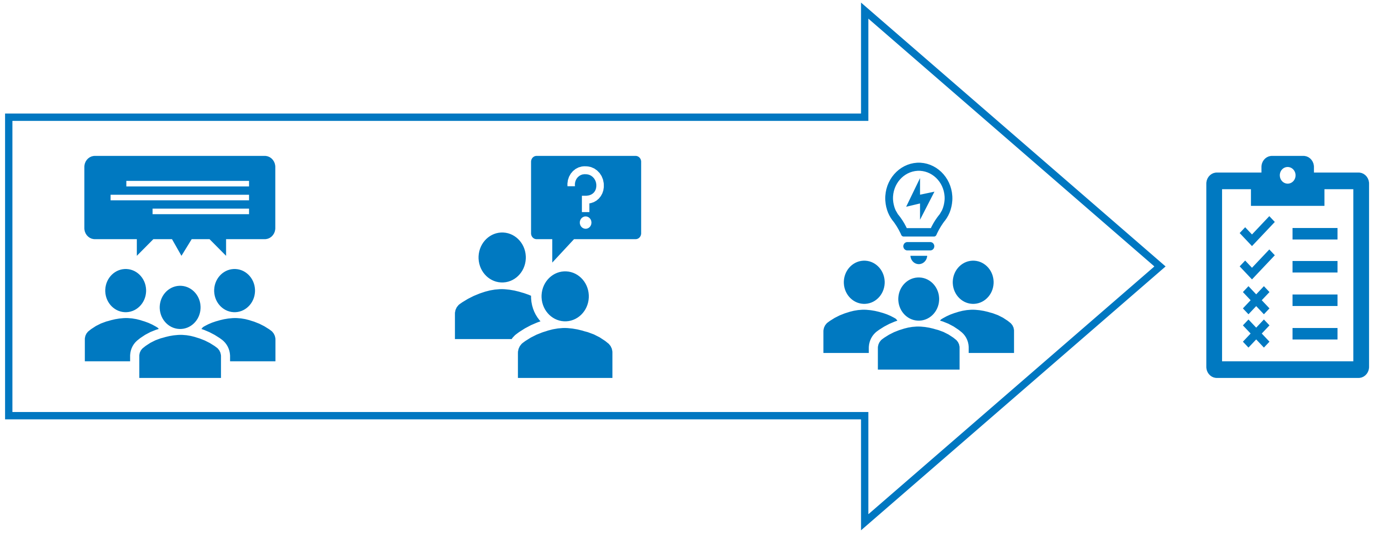
Performer: SNL

- Get our Theory right
- Ensure PKI does not introduce new "future legacy" cyber issues
- Technical analysis to standards groups by end of the year



Coordinate: Charging Ecosystem Security Working Group

- Membership- product security engineers
- Identify, prioritize, and assign short term, high impact actions that require a united approach
  - Consensus based
  - Interdisciplinary
- CIPAC, not FACA
  - Open (only) to Sector Coordinating Council member organizations and invited SMEs



Cybersecurity:

Bottom Line: Bring friends to achieve impactful results with aggressive timelines

Task	Timeline	Description
EV Charging Security Working Group	Q3 2023 & ongoing	Convene broad stakeholder community to achieve consensus-based definition of “secure charging ecosystem” and how to get there
Cyber analysis of PKI in NEVI minimum standards	Q4 2023 & ongoing	Due-diligence to reduce risk of introducing new systemic legacy vulnerabilities in NEVI
PKI Adversarial Testing events	Q4 2023 and Q2 2024	Partner with industry to stress test their preferred implementation
Field-testing informed best practices	Q1 2024	Help new deployers by examining the state of practice in existing infrastructure
EVSE Cyber Incident Response Playbook	Q3 2024	Establish critical information sharing links between state, federal, and private sector entities

Joint Office of
Energy and Transportation

Thank You

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Energy and Transportation

Back-up

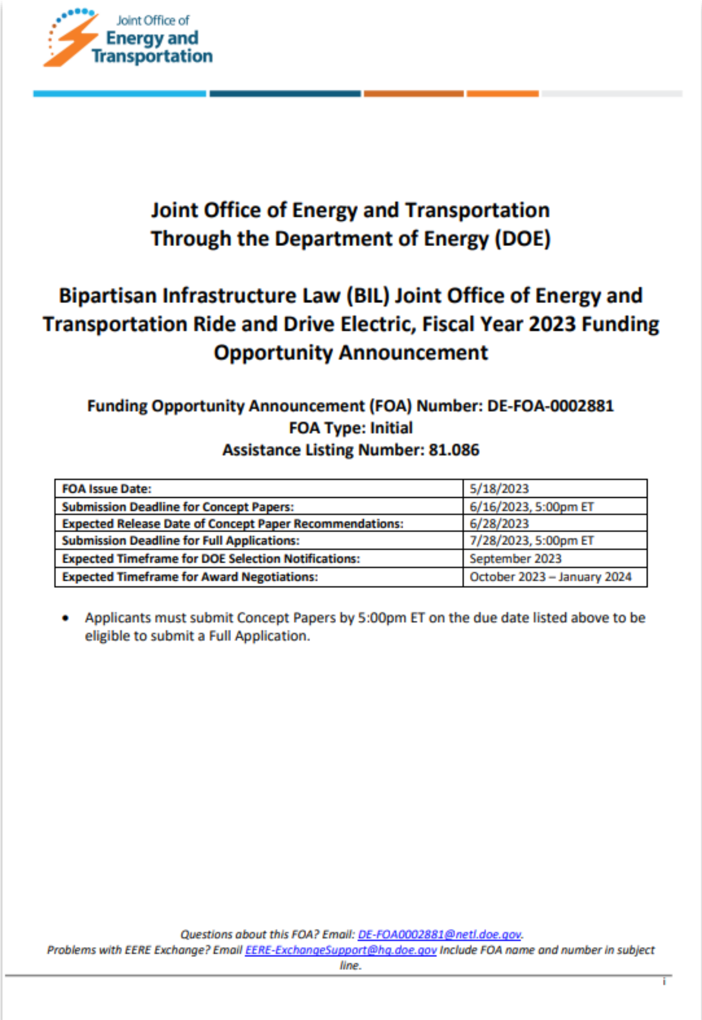
Funding Opportunity Announcements (FOA)

Joint Office Selection Announcement Soon!

Topics:

3a – Increasing Commercial Capacity for Testing and Certification of High-Power EV Chargers

3b – Validating High-Power EV Charger Real-World Performance and Reliability



Joint Office of
Energy and
Transportation

Joint Office of Energy and Transportation
Through the Department of Energy (DOE)

Bipartisan Infrastructure Law (BIL) Joint Office of Energy and Transportation Ride and Drive Electric, Fiscal Year 2023 Funding Opportunity Announcement

Funding Opportunity Announcement (FOA) Number: DE-FOA-0002881
FOA Type: Initial
Assistance Listing Number: 81.086

FOA Issue Date:	5/18/2023
Submission Deadline for Concept Papers:	6/16/2023, 5:00pm ET
Expected Release Date of Concept Paper Recommendations:	6/28/2023
Submission Deadline for Full Applications:	7/28/2023, 5:00pm ET
Expected Timeframe for DOE Selection Notifications:	September 2023
Expected Timeframe for Award Negotiations:	October 2023 – January 2024

- Applicants must submit Concept Papers by 5:00pm ET on the due date listed above to be eligible to submit a Full Application.

Questions about this FOA? Email: DE-FOA0002881@netl.doe.gov.
Problems with EERE Exchange? Email EERE-ExchangeSupport@hq.doe.gov Include FOA name and number in subject line.

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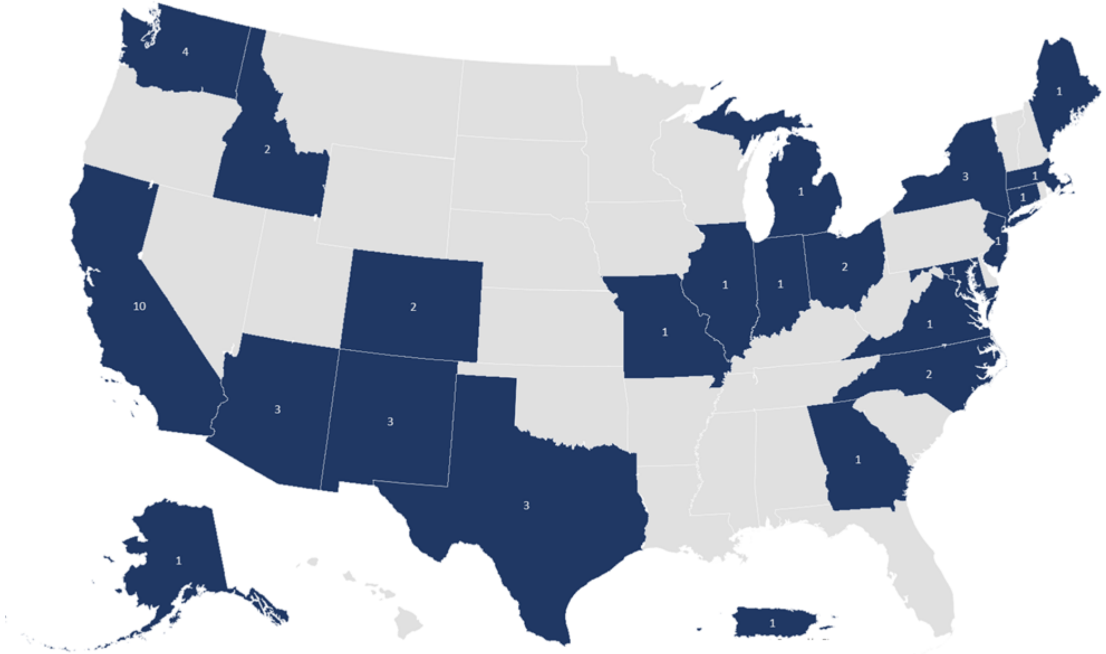
CFI Funding

Discretionary Grant Program for **Charging and Fueling Infrastructure (CFI)**

- **$623 million** awarded January 2024
- **47** EV charging and alternative-fueling infrastructure projects
- **22 states** and Puerto Rico, 2 tribes
- Building about **7,500 EV charging ports**



Corridor Projects

focus on:

long-distance travel and

connecting major areas

Example Projects

$70 million to the North Central Texas Council of Governments

- **What:** Five hydrogen fueling stations for medium- and heavy-duty freight trucks
- **Where:** Dallas-Fort Worth, Houston, Austin, and San Antonio.
- **Goal:** create a hydrogen corridor from southern California to Texas.

$15 million to Energy Northwest

- **What:** A joint operating agency in Washington State to install 40 fast chargers and 12 Level 2 chargers
- **Where:** Western Washington State and northern Oregon.
- **Goal:** provide EV access to largely rural and disadvantaged communities, including on Indigenous Tribal lands.

Community Projects

focus on:

underserved communities,

multifamily housing

multimodal transportation

and workforce development

Example Projects

$10 million to the New Jersey Department of Environmental Protection

- Build EV charging stations for residents in multi-family housing in disadvantaged communities and rural areas near transit stations
- Encourage the use of shared transportation services

$15 million to the Maryland Clean Energy Center

- Build **58** EV charging stations in urban, suburban and low- and moderate-income communities and **34** disadvantaged communities with multi-family housing
- Include workforce development programs.

$15 million to the County of Contra Costa in California

- Build a total of **52** fast chargers and **60** Level 2 chargers at **15** branch locations of the county’s library system.

Tons of excitement and momentum for CFI

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Biden administration

White House unveils $623m in funding to boost electric vehicle charging points

Funding comes amid concerns t transportation isn't keeping pa

Oliver Milman

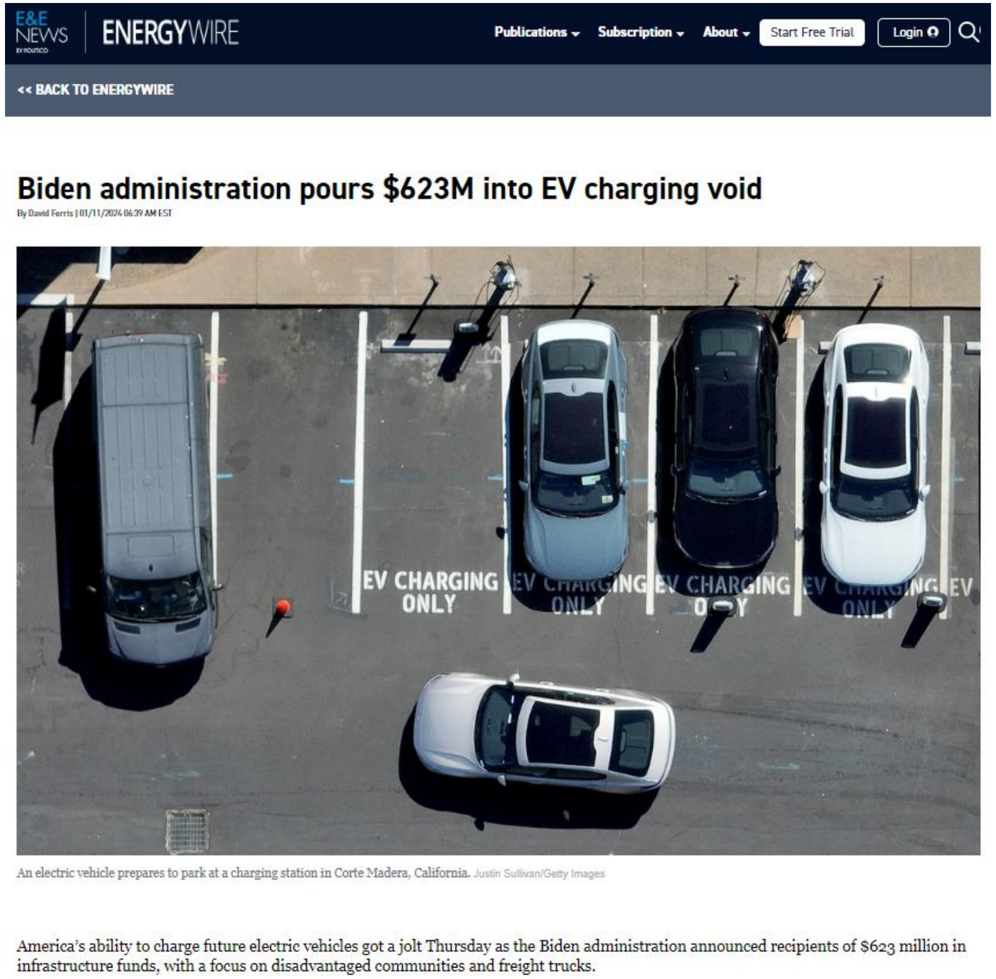
@olliemilman
Thu 11 Jan 2024 05.00 EST

ARIZONA NEWS

Nearly $12M going to Mesa for installation of dozens of electric vehicle charging ports

Jan 9, 2024, 9:06 AM

Mesa is getting a federal grant of nearly $12 million to support the expansion of its electric vehicle charging network, U.S. Rep. Greg Stanton announced Monday, Jan. 9, 2023. (AP Photo/Paul Sancya)



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Biden administration pours $623M into EV charging void

By David Ferris | 01/11/2024 06:39 AM EST

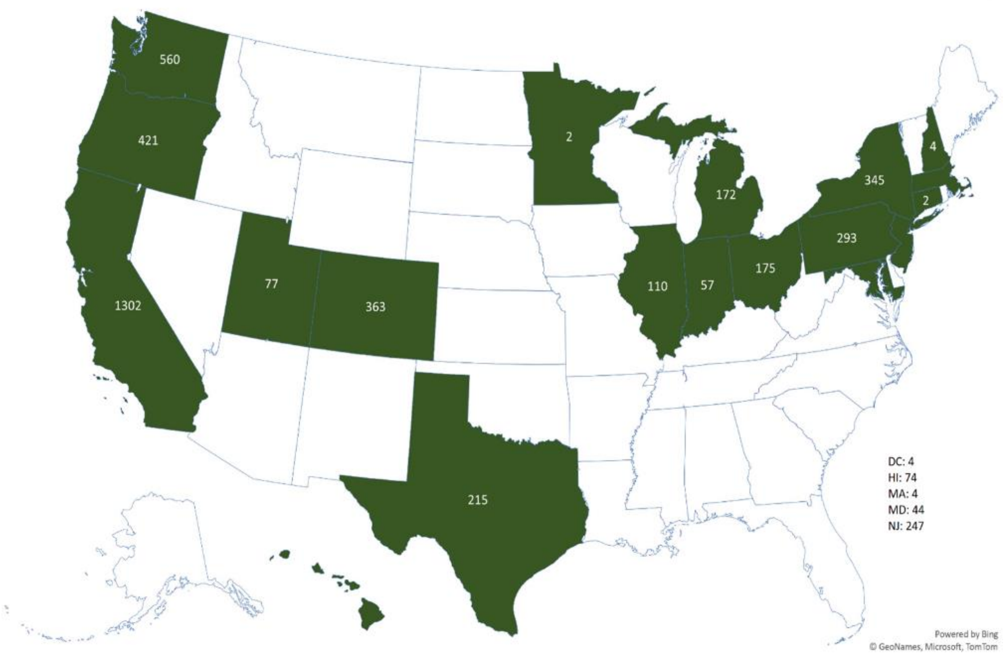
An electric vehicle prepares to park at a charging station in Corte Madera, California. Justin Sullivan/Getty Images

America's ability to charge future electric vehicles got a jolt Thursday as the Biden administration announced recipients of $623 million in infrastructure funds, with a focus on disadvantaged communities and freight trucks.

RAA Program

Reliability and Accessibility Accelerator (RAA)

- **$150 million**
- **24 grant recipients**
- **20 states**
- Repair or replace nearly **4,500** existing EV charging ports



Estimated Number of Ports

Powered by Bing
© GeoNames, Microsoft, TomTom

California Department of Transportation	CA	1302	$63,702,988.00
Colorado Department of Transportation	CO	363	$8,340,820.48
Capitol Region Council of Governments	CT	2	$684,800.00
District of Columbia Department of Energy	DC	4	$588,200.00
Hawaii Department of Transportation	HI	74	$6,918,400.00
Illinois Department of Transportation	IL	110	$7,074,498.00
Indiana Municipal Power Agency	IN	2	$71,400.00
Indiana Department of Transportation	IN	55	$778,600.00
Town of Norwood, MA	MA	4	$240,000.00
Maryland Department of Transportation	MD	44	$4,360,175.68
City of Imlay, MI	MI	2	$13,157.25
Michigan Department of Transportation	MI	170	$1,836,042.75

City of Blue Earth, MN	MN	2	$48,533.00
New Hampshire Department of Transportation	NH	4	$683,408.00
New Jersey Department of Transportation	NJ	247	$5,973,066.88
City of Glenn Falls, NY	NY	10	$20,000.00
New York Department of Transportation	NY	335	$13,032,670.75
Mid-Ohio Regional Planning Commission	OH	175	$2,000,000.00
Oregon Department of Transportation	OR	421	$10,000,000.00
Pennsylvania Department of Transportation	PA	293	$5,000,000.00
North Central Texas Council of Governments	TX	197	$3,660,000.00
City of Austin, TX	TX	18	$270,000.00
Utah Department of Transportation	UT	77	$3,384,149.00
Washington Department of Transportation	WA	560	$10,112,000.00

Joint Office FOA

$46.5 Million in Funding to Ride and Drive Electric

Topic areas focus on:

EV charging resiliency

Reliability

Equity

Workforce Development

30 projects across 16 states to:

- address barriers to charging in multifamily housing facilities,
- explore new approaches to curbside charging in urban areas
- promote seamless connections across modes through e-mobility hubs, and
- test new incentive structures to provide affordable public charging access

Transition Between Pilot to Permanent Program

Al Freeman
Assistant to Division Director
Energy Resources Division
Michigan Public Service
Commission

Kellee Christensen, P. E. Director
Strategic Planning &
Development, Lansing Board of
Water and Light

Bethany Tabor,
Manager of Commercial Electric
Transportation Programs
Consumers Energy

Milena Marku
Manager of Customer Marketing
DTE Energy

Laura Sherman, PhD
President of Michigan Energy
Innovation Business Council

Managed Charging for a Sustainable EV Future

Julie Baldwin, Director
Energy Operations Division
Michigan Public Service Commission

Ben Shapiro, Manager
Carbon Free Transportation

Pina Bennett, Director
DTE Electric Marketing

Cora Walter, Project Manager
Con Edison

Mathias Bell, Sr. Director
WeaveGrid

Timing is Everything

Managing EV Load to Reduce System Costs & Emissions

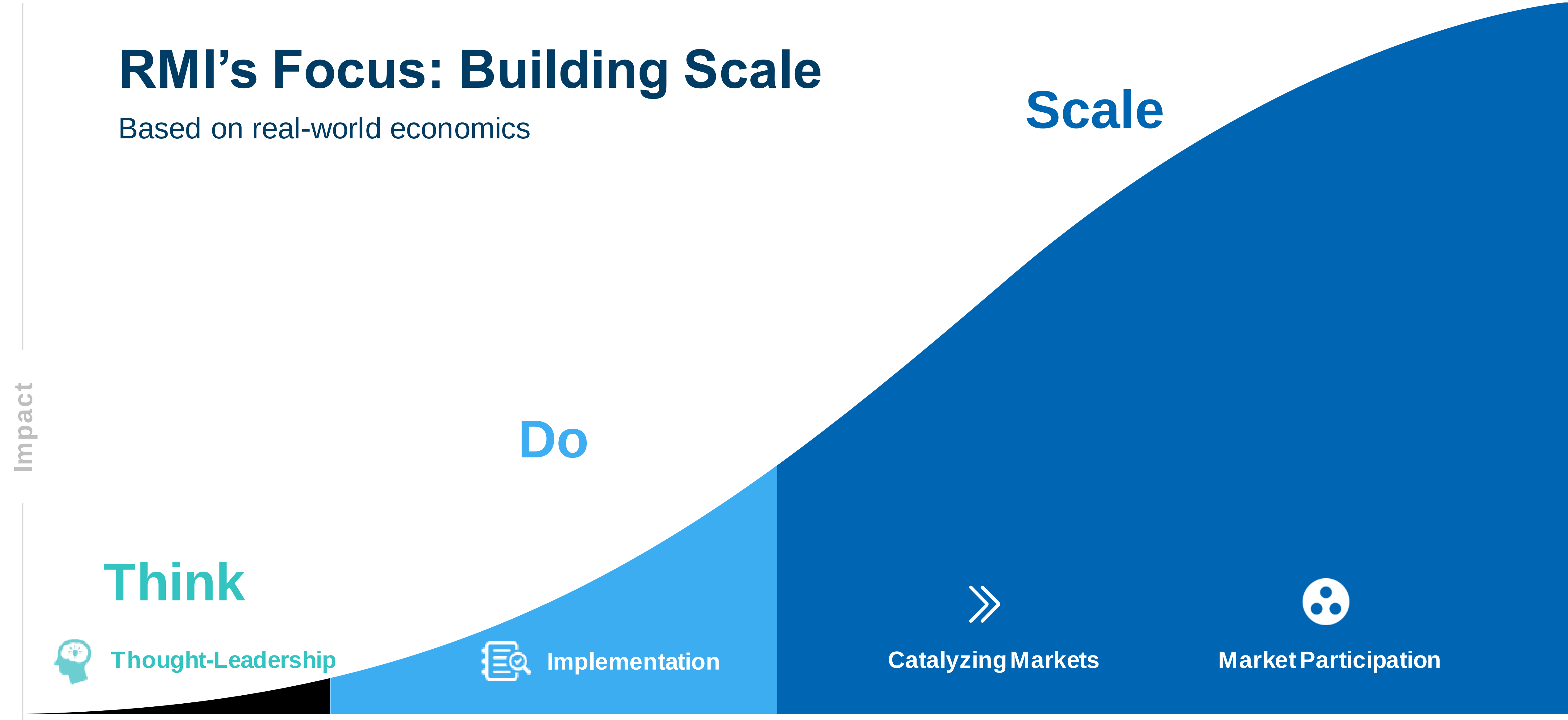
Ben Shapiro | RMI

EV Technical Conference | Michigan Public Service Commission

January 24, 2024

RMI’s Focus: Building Scale

Based on real-world economics



Impact

Scale

Do

Think

Thought-Leadership

Implementation

Catalyzing Markets

Market Participation

Establish an alternative vision for the energy future

Validate critical proof-points for the clean energy transition

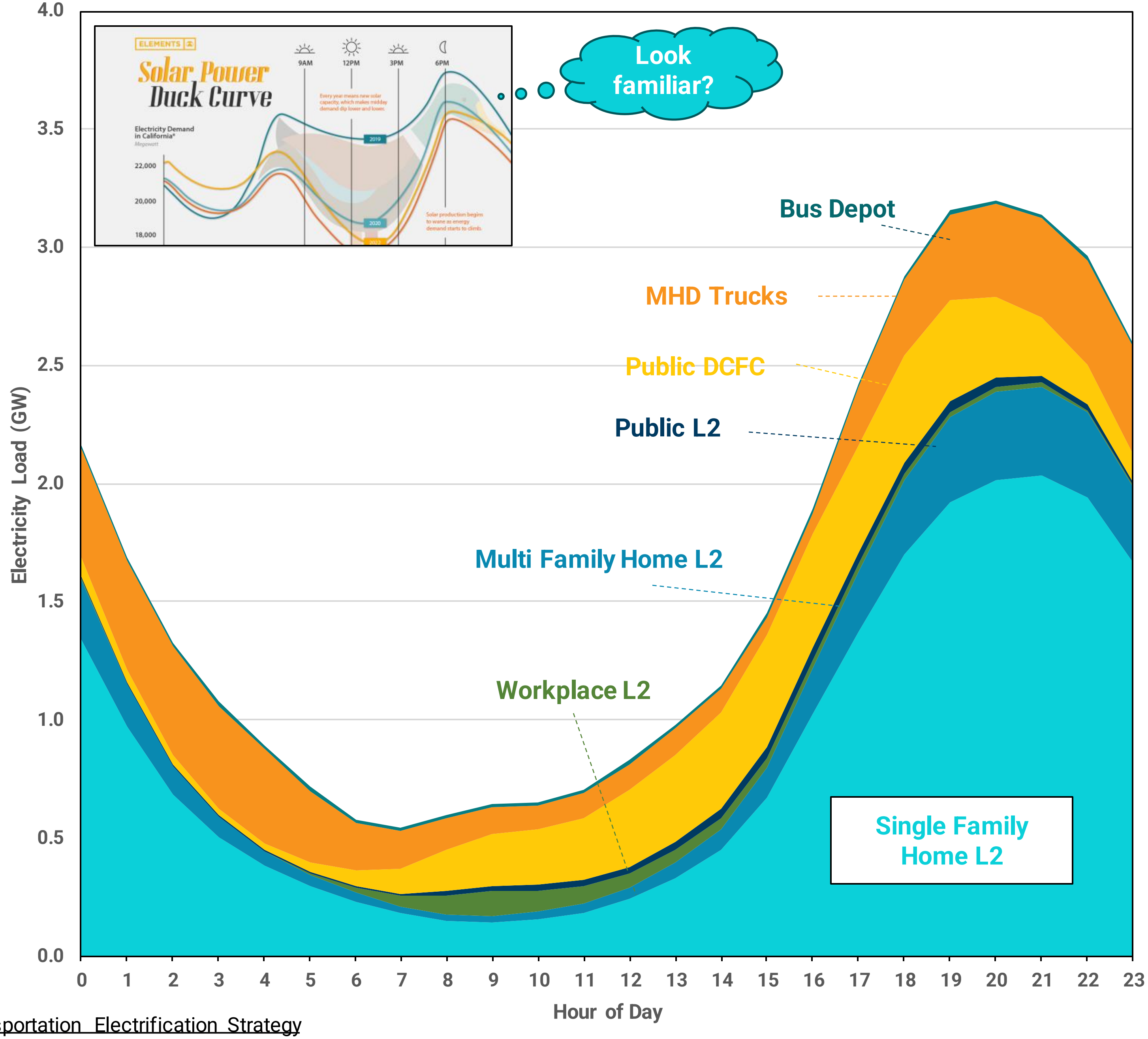
Remove existing market barriers, spur competitive innovation and accelerate adoption through market affiliates.

What’s the scale of the challenge (opportunity)?

- **By 2035, RMI estimates EVs in Washington state will require 14-15 TWh annually**

- **Critical to manage load and avoid driving up peak (3+ GW)***

Est. 2035 EV Charging Load | WA State (weekday, *unmanaged*)

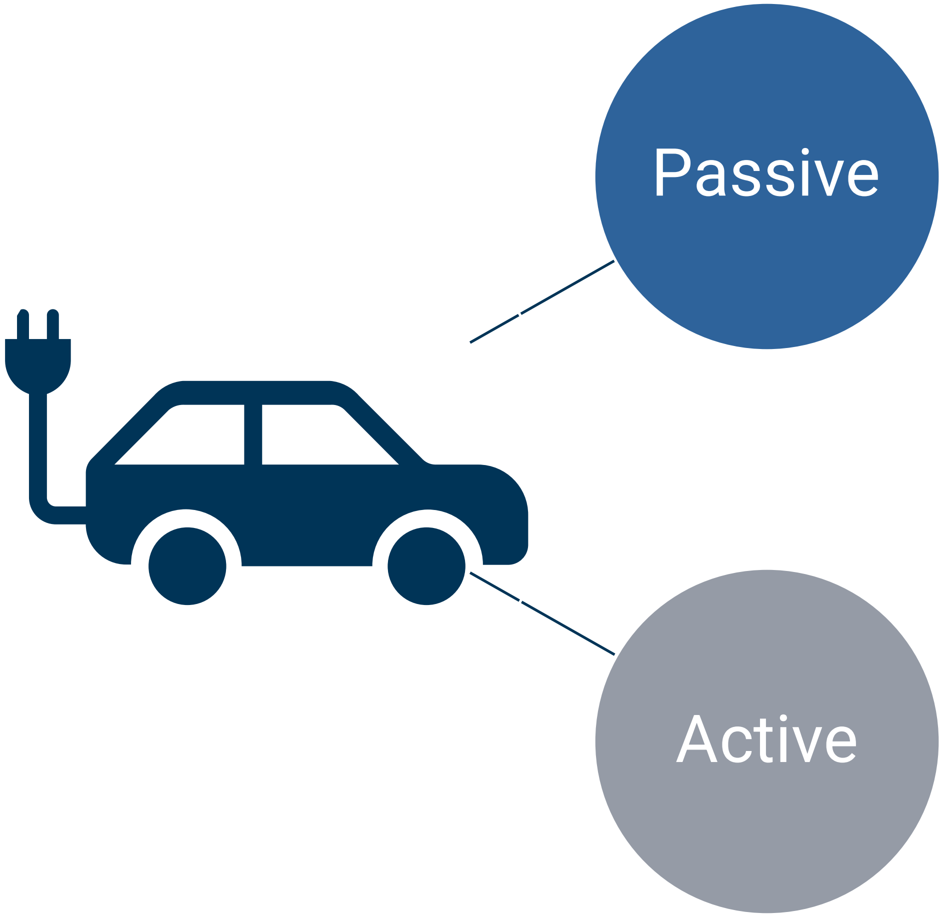


RMI – Energy. Transformed.

RMI analysis for Washington Transportation Electrification Strategy

*Northwest Power Pool (not WA state) current peak of ~55 GW (summer), 63 GW (winter), FERC Electric Power Market Assessment

Refresher: two broad flavors of managed charging



Passive

- Time-variant rates (e.g., TOU)
- Behavioral demand response

Active

- Direct load control
- Using EV, EVSE (charger), smart panel / breaker

Adapted from Smart Electric Power Alliance

Brief case studies highlight different options

- Passive (behavioral)
- 2017-present
- Telematics-based
  - ev.energy (2023)

SmartCharge NY

conEdison

- Active (DLC*)
- 2022-present
- Telematics-based
  - WeaveGrid DISCO**

EV Smart Charge

SRP

Sources: ConEd SmartCharge New York | SRP EV Smart Charge

*DLC: Direct Load Control | **DISCO: Distribution Integrated Smart Charging Orchestration

Medium-/Heavy-duty charging can also be managed

- **Depot charging easier to manage**
  - Duty cycles may allow for load shifting
  - School buses well-suited for V2G*
- **On-site storage (and generation) increases flexibility**
- **MHD-specific managed charging programs somewhat nascent**
  - Many fewer electric MHDVs than LDVs, but electric fleet rapidly expanding
- **Greatest opportunity from high-value, infrequent events (DR* and A/S*)**
  - Reduces battery wear

V2G*: Vehicle-to-Grid | **DR: Demand Response | **A/S**: Ancillary Services

Programs to date provide important lessons

No one-size-fits-all approach

Customers

- Customer ease is key
- Utilities are essential; partnerships w/ other stakeholders hold significant value
- Targeted messaging can be highly effective

Grid

- Significant potential value from load shifting (+ V2G)
- Grid value is not uniform across customers
- Secondary peaks can easily occur if not planned for

Food for Thought

- **We are creatures of habit.**
    - Establish desirable charging behavior ahead of mass market adoption
- **Opt-in vs. opt-out? (both can be effective)**
- **EVSE, telematics, both?**
- **How can we avoid a singular focus on single-family homes?**
- **How best to deploy effective MHD managed charging programs?**

Further reading, SEPA 2023: *Managed Charging Programs: Maximizing Customer Satisfaction and Grid Benefits*

RMI
ENERGY. TRANSFORMED.

Thank you!

Ben Shapiro
bshapiro@rmi.org

Appendix

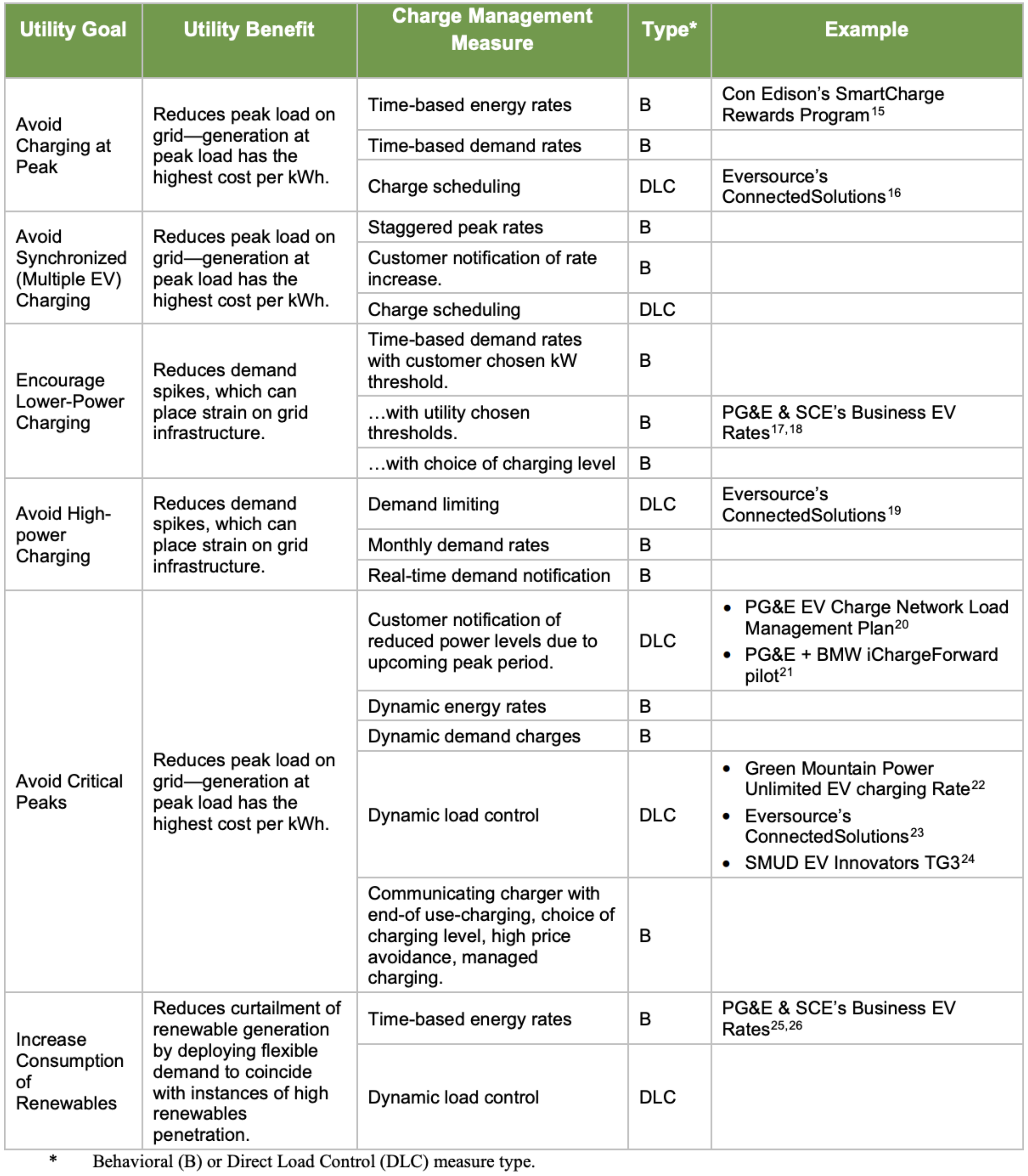
Table 2. Types of Pricing and Other Economic Incentives Discussed by Parrish et al.

Price Based Schemes	Description
sTOU (static time-of-use)	Prices vary by time of day between fixed price levels and over fixed periods. These may vary by season.
CPP (critical peak pricing)	Prices increase by a known amount during specified system operating or market conditions. This applies during a narrowly defined period and is usually applied only during a limited number of days annually.
TOU-CPP (time-of-use plus critical peak pricing)	Critical peak pricing overlaid onto time-of-use pricing. TOU-CPP therefore has two pricing components - daily time-of-use pricing, and occasional critical peak pricing applied during critical system events.
VPP (variable peak pricing)	Similar to time-of-use, but the peak period price varies daily based on system and/or market conditions rather than being fixed.
dTOU (dynamic time-of-use)	Prices vary between fixed price levels, but the timing of different prices is not fixed.
RTP (real time pricing)	Prices can differ on a daily basis and change each hour of the day (or more frequently) based on system or market conditions.
Incentive-Based Schemes	**Description**
CPR (critical peak rebate)	Similar to CPP, but customers are provided with an incentive for reducing usage during critical hours below a baseline level of consumption.
DLC (direct load control)	Customers are provided with an incentive for allowing an external party to directly change the electricity consumption of certain appliances. Customers can usually override control although they may lose some incentive. DLC may also be combined with time varying pricing.

Source: Parrish, B., Gross, R., & Heptonstall, P. (2019). *On demand: Can demand response live up to expectations in managing electricity systems?* Energy Research and Social Science, 51, 109. https://doi.org/10.1016/j.erss.2018.11.018

Source: Smart Electric Power Alliance

Behavioral and Direct Load Control Measures for Enabling and Incentivizing Responsible EV Charging



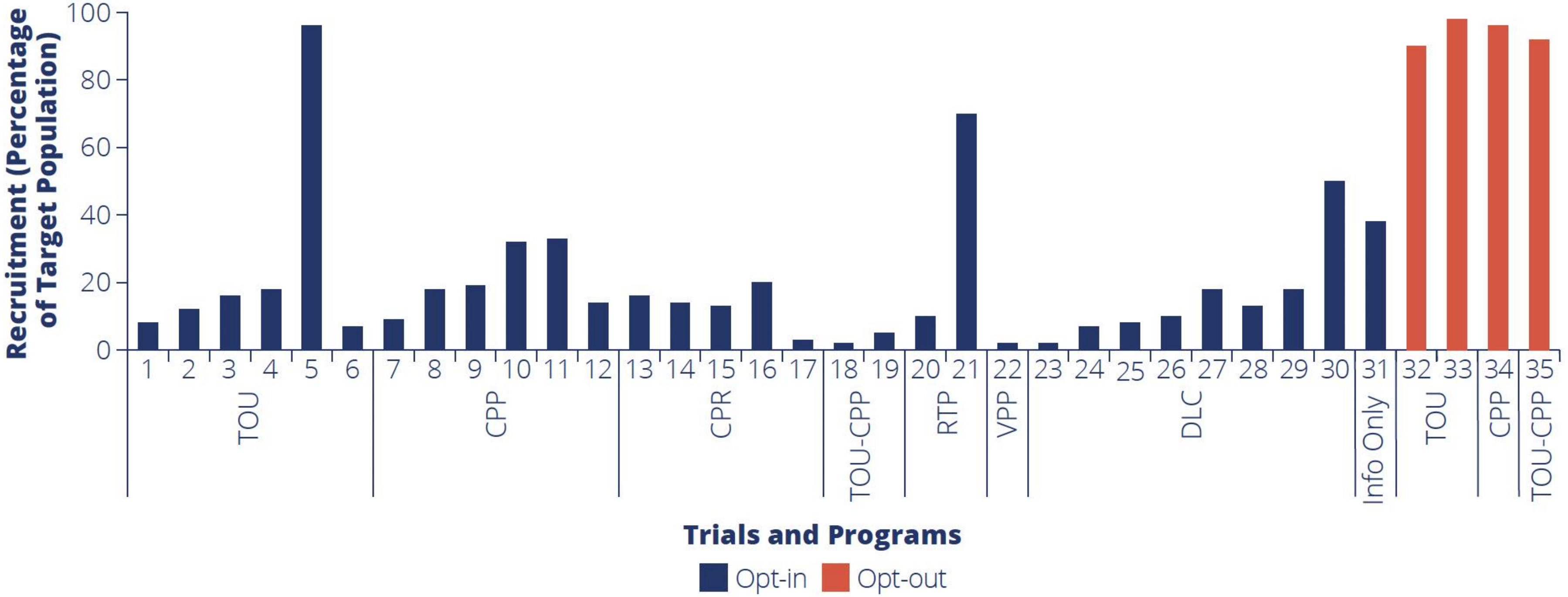
Utility Goal	Utility Benefit	Charge Management Measure	Type*	Example
Avoid Charging at Peak	Reduces peak load on grid—generation at peak load has the highest cost per kWh.	Time-based energy rates	B	Con Edison's SmartCharge Rewards Program[15]
		Time-based demand rates	B	
		Charge scheduling	DLC	Eversource's ConnectedSolutions[16]
Avoid Synchronized (Multiple EV) Charging	Reduces peak load on grid—generation at peak load has the highest cost per kWh.	Staggered peak rates	B	
		Customer notification of rate increase.	B	
		Charge scheduling	DLC	
Encourage Lower-Power Charging	Reduces demand spikes, which can place strain on grid infrastructure.	Time-based demand rates with customer chosen kW threshold.	B	
		…with utility chosen thresholds.	B	PG&E & SCE's Business EV Rates[17,18]
		…with choice of charging level	B	
Avoid High-power Charging	Reduces demand spikes, which can place strain on grid infrastructure.	Demand limiting	DLC	Eversource's ConnectedSolutions[19]
		Monthly demand rates	B	
		Real-time demand notification	B	
Avoid Critical Peaks	Reduces peak load on grid—generation at peak load has the highest cost per kWh.	Customer notification of reduced power levels due to upcoming peak period.	DLC	• PG&E EV Charge Network Load Management Plan[20] • PG&E + BMW iChargeForward pilot[21]
		Dynamic energy rates	B	
		Dynamic demand charges	B	
		Dynamic load control	DLC	• Green Mountain Power Unlimited EV charging Rate[22] • Eversource's ConnectedSolutions[23] • SMUD EV Innovators TG3[24]
		Communicating charger with end-of use-charging, choice of charging level, high price avoidance, managed charging.	B	
Increase Consumption of Renewables	Reduces curtailment of renewable generation by deploying flexible demand to coincide with instances of high renewables penetration.	Time-based energy rates	B	PG&E & SCE's Business EV Rates[25,26]
		Dynamic load control	DLC	

* Behavioral (B) or Direct Load Control (DLC) measure type.

Source: NYSERDA, Cadmus, and WRI

Reported Enrollment by Type of Demand Response

Figure 3. Reported Enrollment by Type of Demand Response



Source: Parrish, B., Gross, R., & Heptonstall, P. (2019). *On demand: Can demand response live up to expectations in managing electricity systems?* Energy Research and Social Science, 51, 108. https://doi.org/10.1016/j.erss.2018.11.018

Source: Smart Electric Power Alliance

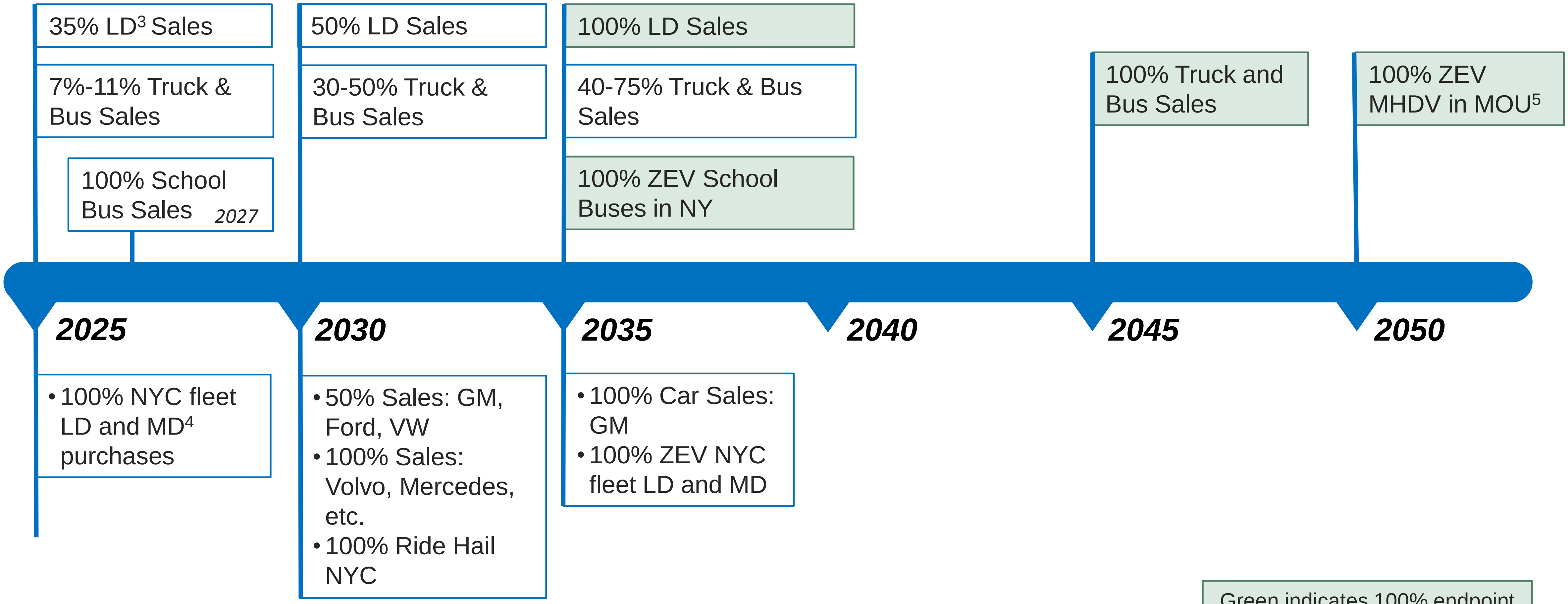
Accelerating Managed Charging Adoption in New York

EV Technical Conference | Michigan Public Service Commission

Cora Walter
Con Edison E-Mobility

Ambitious policy goals rooted in the CLCPA[1] are driving the pace of clean transportation progress in NY state

NY State Clean Transportation Policy Goals for ZEVs[2]



2025

35% LD[3] Sales

7%-11% Truck & Bus Sales

100% School Bus Sales *2027*

- 100% NYC fleet LD and MD[4] purchases

2030

50% LD Sales

30-50% Truck & Bus Sales

- 50% Sales: GM, Ford, VW
- 100% Sales: Volvo, Mercedes, etc.
- 100% Ride Hail NYC

2035

100% LD Sales

40-75% Truck & Bus Sales

100% ZEV School Buses in NY

- 100% Car Sales: GM
- 100% ZEV NYC fleet LD and MD

2040

2045

100% Truck and Bus Sales

2050

100% ZEV MHDV in MOU[5]

Green indicates 100% endpoint

---

1. Climate Leadership and Community Protection Act, passed by NY State Legislature in 2019
2. ZEVs = zero-emission vehicles
3. LD = Light Duty
4. MD = Medium Duty
5. Multi-state Zero Emission Medium- and Heavy-Duty (MHDV) MOU has a 100% ZEV goal by 2050

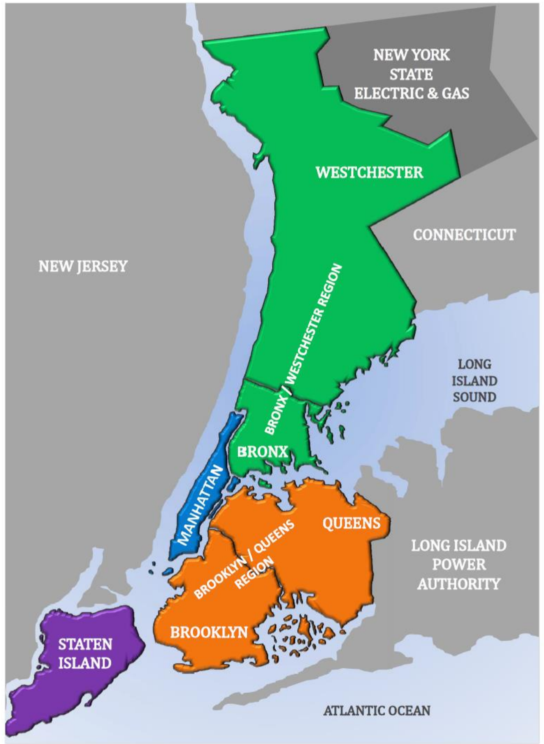
Con Edison’s managed charging programs promote EV adoption across residential & commercial sectors

FOR THE EV OWNER / EV CHARGER OWNER

- Reduce operating costs for EV and EV charger ownership when charging in grid-beneficial manner
- Optimize EV charger siting and charging schedule at stations and across fleets
- Improve attractiveness of load management and encourage DER adoption

FOR THE GRID

- Entrench grid-beneficial charging behavior among customers early on
- Paced and reliable grid infrastructure build-out to support electrification
- Develop knowledge and data to improve EV forecasts, planning, and programs



System Characteristics

- ● 600 square miles
- ● Population of 9.2 million
- ● 3.6 million of electric customers

SmartCharge NY managed charging program provides incentives to drivers

What it is:
Predictable cash **incentives** to EV drivers (includes fleets) to charge their EVs at system off-peak times to reduce stress on the electric grid

Since 2017, enrolled > 10,000 EVs across 45 different EV models.
In 2022, achieved a 24% enrollment rate of EV registrations in Con Edison service territory!

Summer Peak Avoidance Incentive

- **$35 per month Avoided Summer Peak Incentive:**
- Earned per vehicle or charging station for avoiding charging weekdays 2 – 6 PM (June – September)

Off-Peak Charging incentive

- **$0.10 per kWh** for off-peak charging, all days, year-round, between 12 – 8 AM

User-Friendly Process

- **Vehicle** telematics and connected chargers
- Quick application process
- Personalized dashboard
- **Own or lease your EV to participate**

The SmartCharge Commercial program incentivizes charging station operators

Peak Avoidance Incentive

Earn incentives during 4-hour network peak window with every kW avoided relative to nameplate capacity

- **$10** per kW avoided from June – September
- **$2** per kW avoided from October – May

What it is:

Cash incentives for charging during off-peak periods. Helps provide predictable incentives as a revenue stream to Commercial EV Charging customers while also encouraging grid-beneficial charging behavior to manage grid impacts

Off-Peak Charging incentive

- **$0.03** per kWh avoided from 12 – 8 AM, all days, year-round

Eligible commercial stations:

- Public stations
- Workplace
- Light-duty, medium-duty, heavy-duty fleets
- Multifamily housing
- Industrial locations

Enhanced Incentives

For **public DCFC/ L2 charging** and **transit** through early 2025

Coming Soon! SmartCharge Load Tech Program

EV Charger Cost Calculator estimates SmartCharge Commercial incentives and compares rates options

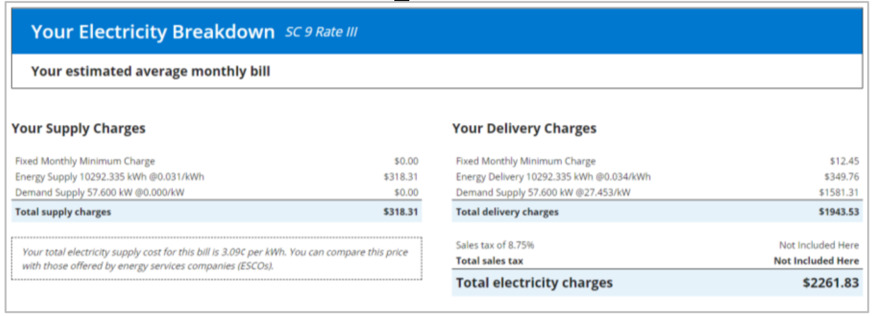
EV Charger Cost Calculator

A web tool designed to help you understand the potential electric costs associated with EV charging as well as potential SCC incentives!

Charging.coned.com

Includes directions, trainings, and one-on-one sessions to help you navigate the web tool.

How much will my electric bill be?



Your Electricity Breakdown *SC 9 Rate III*

Your estimated average monthly bill

Your Supply Charges

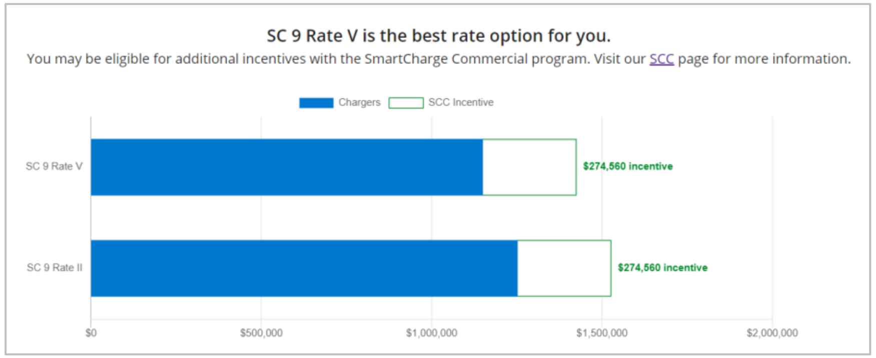
Fixed Monthly Minimum Charge	$0.00
Energy Supply 10292.335 kWh @0.031/kWh	$318.31
Demand Supply 57.600 kW @0.000/kW	$0.00
Total supply charges	**$318.31**

Your total electricity supply cost for this bill is 3.09¢ per kWh. You can compare this price with those offered by energy services companies (ESCOs).

Your Delivery Charges

Fixed Monthly Minimum Charge	$12.45
Energy Delivery 10292.335 kWh @0.034/kWh	$349.76
Demand Supply 57.600 kW @27.453/kW	$1581.31
Total delivery charges	**$1943.53**
Sales tax of 8.75%	Not Included Here
Total sales tax	**Not Included Here**
Total electricity charges	**$2261.83**

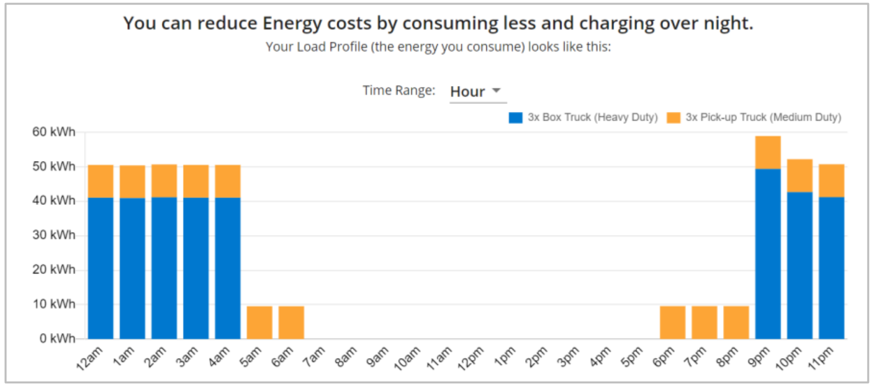
Which rates are available, how do they compare, and how much could I earn through SCC?



SC 9 Rate V is the best rate option for you.

You may be eligible for additional incentives with the SmartCharge Commercial program. Visit our SCC page for more information.

How do my charger size, charging schedule and/or utilization rate impact charging costs?



You can reduce Energy costs by consuming less and charging over night.

Your Load Profile (the energy you consume) looks like this:

Time Range: Hour

Truck Stop of the Future
Redford, MI

Truck Stop of the Future (TSOF)

As electric vehicles become ubiquitous across passenger and commercial contexts, truck stops face a fundamental challenge to their existing model. This challenge also represents a generational opportunity to unlock new revenue, create new jobs, and redesign urban, suburban, and rural spaces into sustainable community assets.

Truck Stop of the Future (TSOF) refers to the concept of a real-world prototype that would enable companies to transition their fleets to electric and futureproof their businesses by testing new technologies, digital services, and business models.

The project seeks to develop the partnerships, integrations, and business model(s) necessary for a Truck Stop of the Future playbook that can be replicated across truck stop locations nationwide and accelerate the transition to EVs at scale.

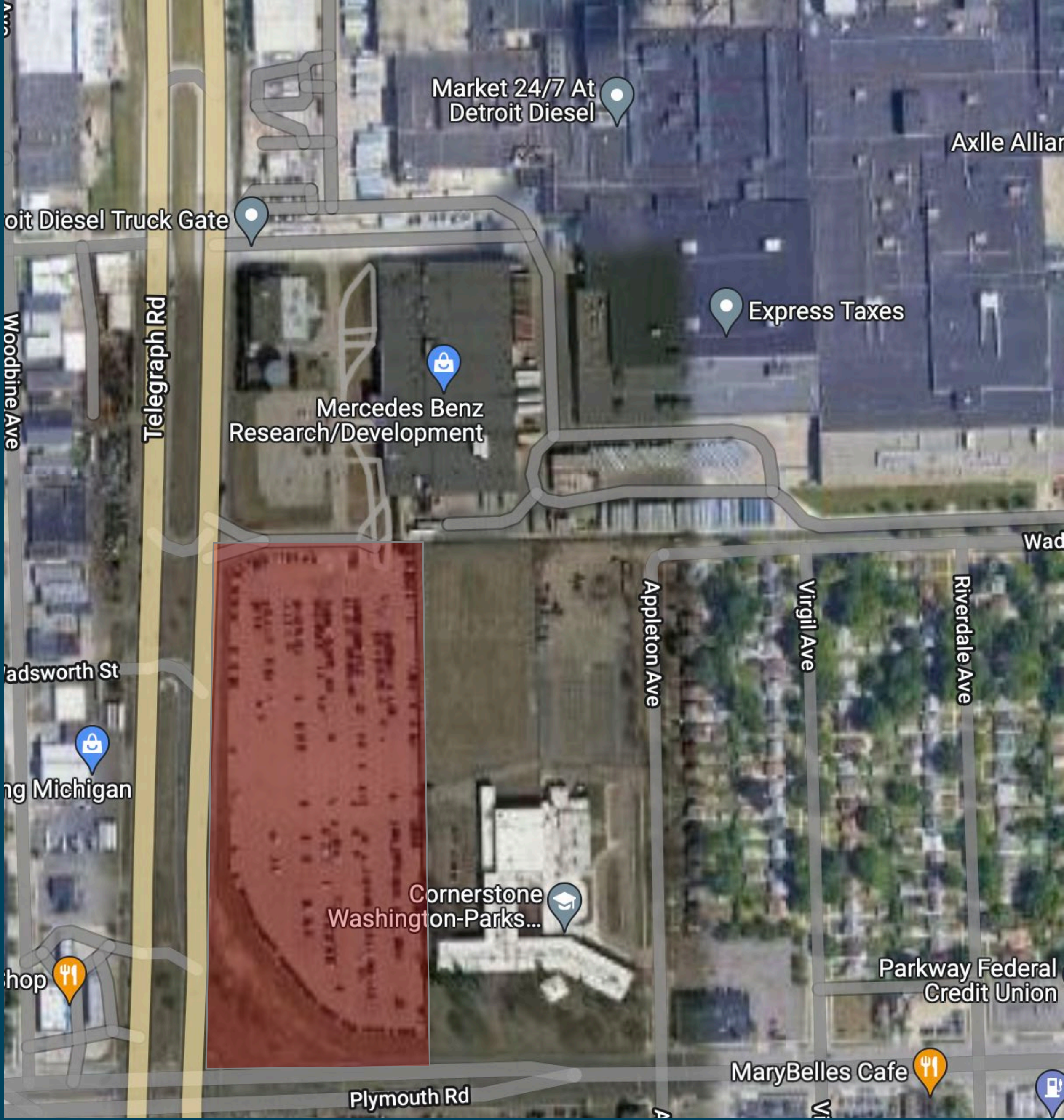
Context

Daimler Truck North America has partner with **DTE**, **the State of Michigan (OFME)**, and others to create a TSOF on approximately 2.5 acres at the Redford facility near I-96. There is an interest in creating a **multi-use asset** with infrastructure for passenger vehicles, medium/heavy duty fleets, semis, and school buses.

While a core priority for the project will be **charging infrastructure**, there is also an appetite to look at value-added services and retail models for the TSOF. This structure would also enable other partners to test, deploy, and integrate atop the asset.

Daimler's existing plans for workforce training programs could potentially be expanded with support from the State to provide agnostic EV charging infrastructure and/or AV manufacturing/maintenance training programs.

A key goal of the project will be to develop a repeatable playbook that can be scaled to other locations and more rapidly accelerate the deployment of commercial EVs at scale.



CONFIDENTIAL AND PROPRIETARY

New

$8.5M Awarded through USDOT RAISE Grant

CRAIN'S DETROIT BUSINESS

$13M 'truck stop of the future' coming to metro Detroit

DBUSINESS
DETROIT'S PREMIER BUSINESS JOURNAL

Michigan, Daimler North America, DTE Working to Build Truck Stop of Future

electrek

Michigan is building a trailblazing electric truck stop with Daimler, DTE

trucknews.com
By the editors of Today's Trucking

'Truck stop of the future' designed for EVs to be built on Daimler land in Michigan

DETROIT DTE Energy DAIMLER MICHIGAN ECONOMIC DEVELOPMENT CORPORATION

Partner Ecosystem

Founding Partners

MICHIGAN OFFICE OF
FUTURE MOBILITY
& ELECTRIFICATION

DAIMLER TRUCK
North America

DTE

Public Sector Supporting Partners

MDOT
Michigan Department of Transportation

EGLE
MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY

MEDC
MICHIGAN ECONOMIC DEVELOPMENT CORPORATION

LEO

Potential Industry Partners

Pilot FLYING J

Love's

SUNOCO

ups

bp

DHL

PENSKE

Ford

gm

BOLLINGER MOTORS

RIVIAN

hypermile

einride

WattEV

Growing Market Demand

OFME, Daimler, and DTE are securing Letters of Intent from fleet operators who would utilize this charging asset near-term for their existing or future small, medium or heavy-duty electric vehicles.

fluidtruck

meijer

SMART

SOUTH REDFORD SCHOOL DISTRICT

via

C★MAC TRANSPORTATION

GREAT LAKES GLB BEVERAGE

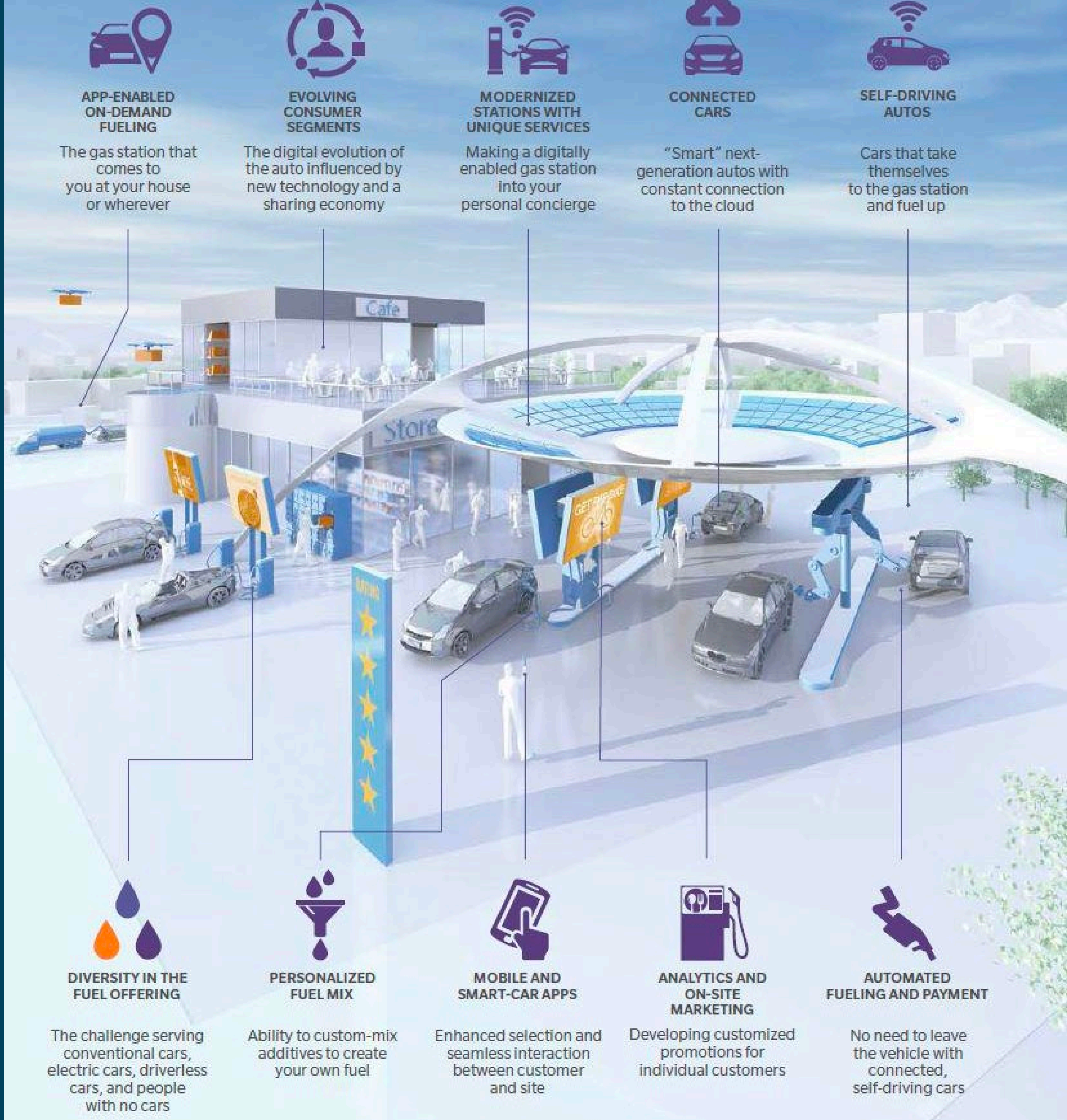
Platform for Innovation

After launching the initial phase to demonstrate usage and commercial viability, **the goal for the second phase will focus on enabling the TSOF as a platform for testing innovation** similar to other assets like the Detroit Smart Parking Lab, Michigan Central Station, and the FLITE Program at GRR International Airport.

Potential use cases and technologies might include:

Onsite Power Generation & Storage (E.g., Microgrids)
EV Charging (E.g., Battery Swapping, Fast Charging, Wireless)
Hydrogen Production & Refueling Infrastructure
Modular Nuclear Reactors
Micro-Fulfillment
Ecommerce Pre-ordering With Contactless Robot Delivery
Smart Retail (E.g., Cashierless Checkout, Smart Shelves, Dynamic Digital Screens, Real-time Analytics & Personalization, Smart Kiosks)
Test / Cloud Kitchens
On-site Vertical Farms
Immersive Entertainment
Contactless Payments Including Crypto
Location-based Social AR
Membership NFTs
Small Scale Drone Infrastructure
Restrooms / Showers With Sanitization Robots
Upskilling / Reskilling Programs With On-the-job Training and Apprenticeships to Service Onsite EV and Other Infrastructure (Location Dependent)
Telehealth / Mini Pharmacy
Mini-nap Stations With Sound-proof Individual Sleeping Pods Paid By The Hour
Landing Pad For eVTOL And Other Forms of Air-taxis
Automated Switching of Trailer Loads
Automated Safety Checking Of Vehicles (E.g., With Computer Vision)
Teleoperators Hub

*Image is for visual context and may not reflect intended use cases



APP-ENABLED ON-DEMAND FUELING
The gas station that comes to you at your house or wherever

EVOLVING CONSUMER SEGMENTS
The digital evolution of the auto influenced by new technology and a sharing economy

MODERNIZED STATIONS WITH UNIQUE SERVICES
Making a digitally enabled gas station into your personal concierge

CONNECTED CARS
"Smart" next-generation autos with constant connection to the cloud

SELF-DRIVING AUTOS
Cars that take themselves to the gas station and fuel up

DIVERSITY IN THE FUEL OFFERING
The challenge serving conventional cars, electric cars, driverless cars, and people with no cars

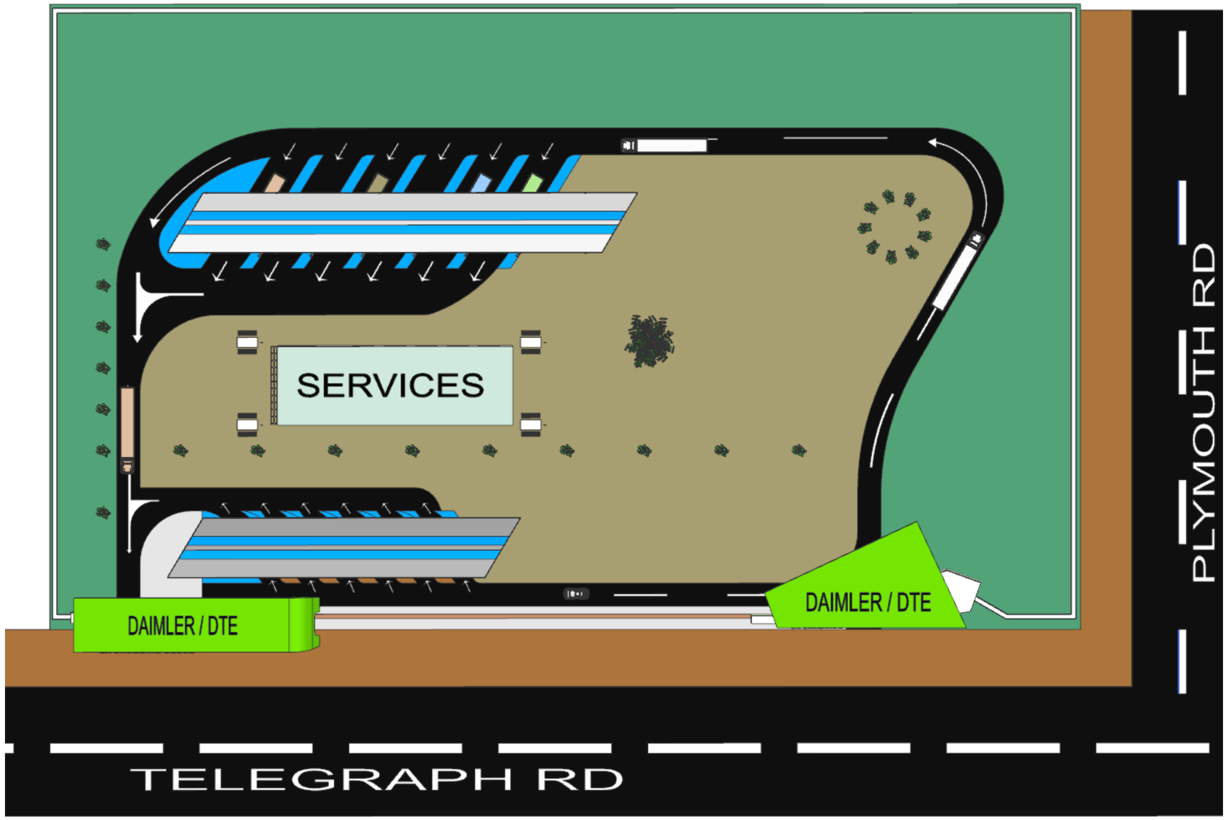
PERSONALIZED FUEL MIX
Ability to custom-mix additives to create your own fuel

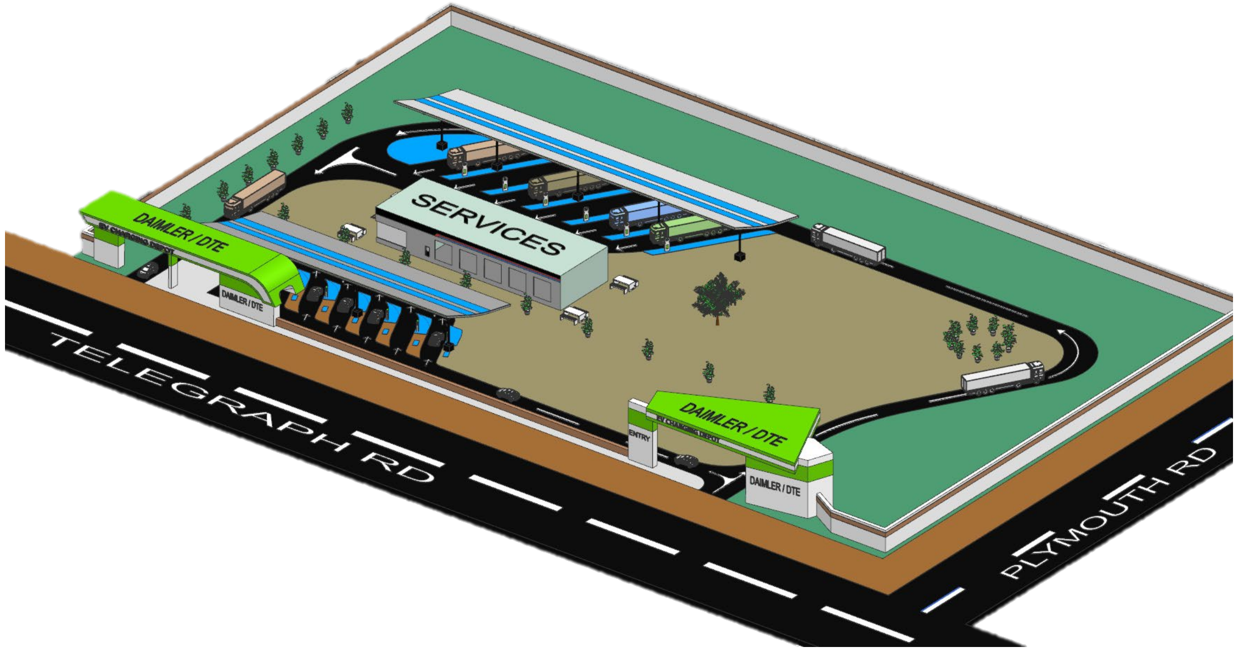
MOBILE AND SMART-CAR APPS
Enhanced selection and seamless interaction between customer and site

ANALYTICS AND ON-SITE MARKETING
Developing customized promotions for individual customers

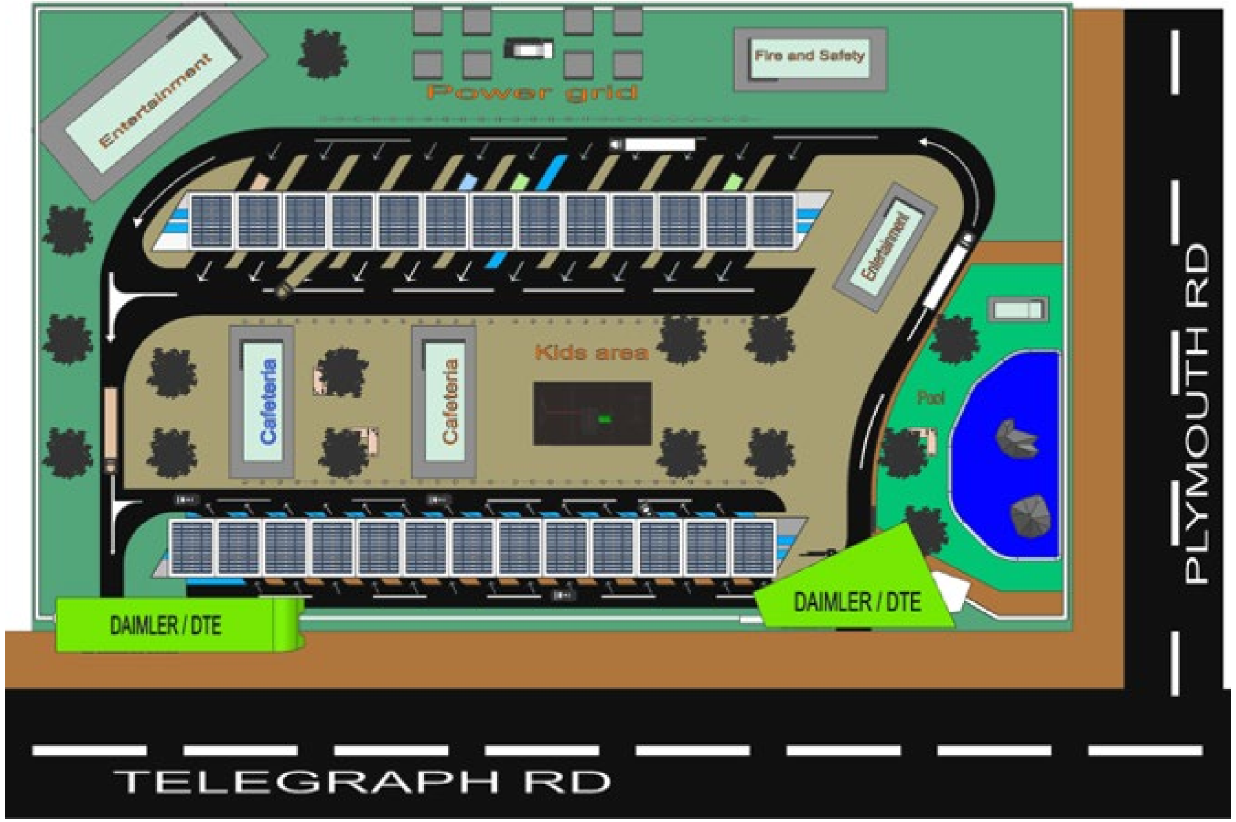
AUTOMATED FUELING AND PAYMENT
No need to leave the vehicle with connected, self-driving cars

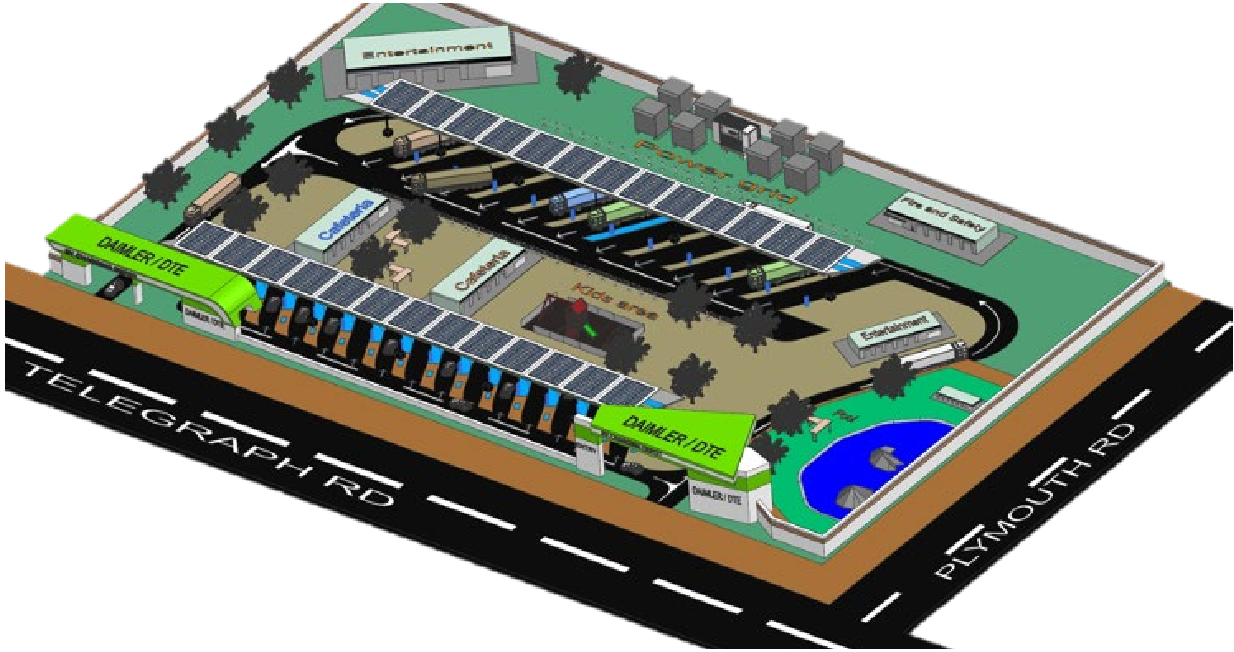
Early Phase Concept





Full Vision


Entertainment
Power grid
Fire and Safety
Entertainment
Kids area
Cafeteria
Cafeteria
Pool
DAIMLER / DTE
DAIMLER / DTE
PLYMOUTH RD
TELEGRAPH RD


Entertainment
Power grid
Fire and Safety
Cafeteria
Cafeteria
Kids area
Entertainment
Pool
DAIMLER / DTE
DAIMLER / DTE
DAIMLER / DTE
TELEGRAPH RD
PLYMOUTH RD

Thank you!

Charlie Tyson
Technology Activation Director
Michigan's Office of Future Mobility & Electrification
tysonc1@michigan.org

https://www.michiganbusiness.org/ofme/
https://www.michiganbusiness.org/mobility/

DTE Smart Charge – Overview

EV Managed Charging

1.24.2024

Smart Charge is DTE’s Managed Charging pilot that began recruitment in July 2023 and will run through December 2024

How It Works

When able, DTE Smart Charge will schedule your EV to charge during off-peak time periods, based on the electric rate you’re on throughout the duration of the program.

If you charge your EV during on-peak time periods, DTE may shift your charging to occur during off-peak times. You may be notified in advance of these shift events and can override if needed.

OEM PARTNERS

Ford, Chevrolet, BMW and Tesla (WeaveGrid)

PILOT DURATION

July 2023 – December 2024

ENROLLMENT

OVGIP: 1,000 EV cap (Ford, GM, BMW)
WeaveGrid: 1,000 EV cap (Tesla)

INCENTIVE

$50 up-front, $50 year-end

OPTIMIZATION

Managed Charging and up to 5 DR events annually, which shifts charging to off-peak

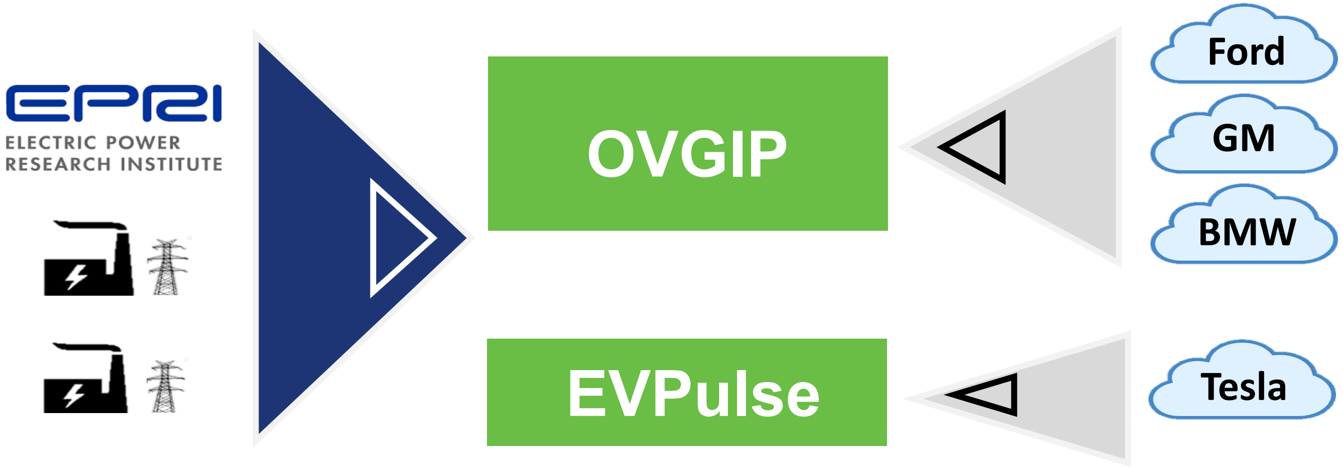
Vehicle Telemetry is used to communicate to enrolled EVs during DR events. EV data is collected from our partners for program evaluation and monitoring

EV DATA COLLECTED

Plug In Time/Plug Out Time	Charge Power [kW]	Energy Used
Schedule Charge Start Time	Charger Type	Energy Avoided
Session Start	Session Start SOC	Battery Capacity [kWh]
Customer Override Time stamp	Session End SOC	Max Charge Rate [kW]

DTE

Managed Charging schedules are based on each participants TOU rate and/or day ahead pricing signals



OEMs

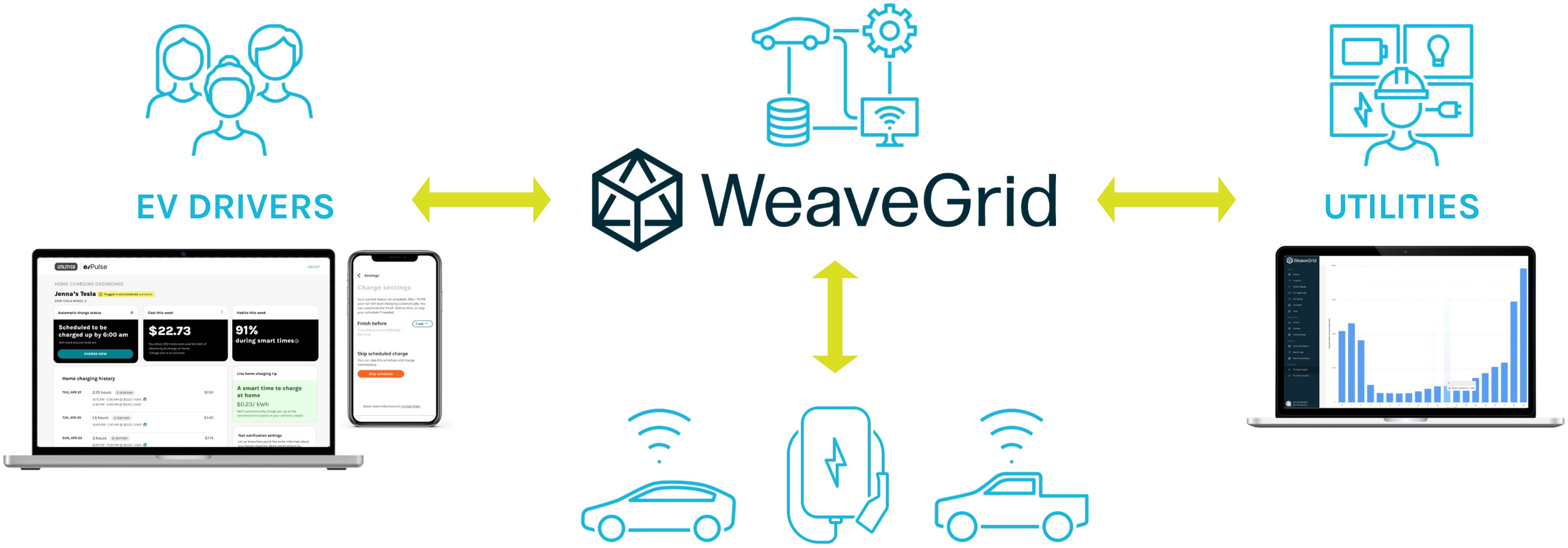
Send signals to enrolled EVs to shift or curtail charging via telematics

WeaveGrid

Michigan PSC Managed Charging for a Sustainable EV Future Panel

Jan 24, 2024

WeaveGrid builds software that helps integrate EVs and the electric grid



EV DRIVERS

WeaveGrid

UTILITIES

AUTOMAKERS &
CHARGERS

UTILITYCO | evPulse

LOG OUT

HOME-CHARGING DASHBOARD

Jenna's Tesla Plugged in and scheduled as of 6:27 am

2018 TESLA MODEL 3

Automatic charge status

Scheduled to be charged up by 6:00 am

Will start around 12:00 am

CHARGE NOW

Cost this week

$22.73

You drove 200 miles and used 93 kWh of electricity to charge at home.
*Charge cost is an estimate

Habits this week

91%
during smart times

Home charging history

THU, APR 27	2.75 hours 25.99 kWh 12:15 AM - 2:00 AM @ $0.23 / kWh 3:30 PM - 4:30 PM @ $0.43 / kWh	$7.65
TUE, APR 25	1.5 hours 15.02 kWh 12:00 AM - 1:30 AM @ $0.23 / kWh	$3.40
SUN, APR 23	3 hours 34.17 kWh 8:00 PM - 11:00 PM @ $0.23 / kWh	$7.74

Live home charging tip

A smart time to charge at home

$0.23/ kWh

We'll automatically charge you up at the smartest time based on your vehicle's needs

Text notification settings

Let us know how you'd like to be informed about your home charging. Mute notifications by

Settings

Charge settings

Your current status: on schedule. After 10 PM your car will start charging automatically. You can customize the finish before time, or skip your schedule if needed.

Finish before 7 AM

Fully charge to limit (85%) by this time.

Skip scheduled charge

You can skip this schedule and charge immediately.

Skip schedule

Need more information? Contact Kate.

WeaveGrid is currently supporting DTE on several EV initiatives

1. EV Detection

WeaveGrid leverages AMI data and EV charging data to support forecasting and program marketing

2. EV Data Sharing Program

Collected telematics data to provide insights, including load shapes and home/away charging patterns, for programs and planning

3. Smart Charge Program

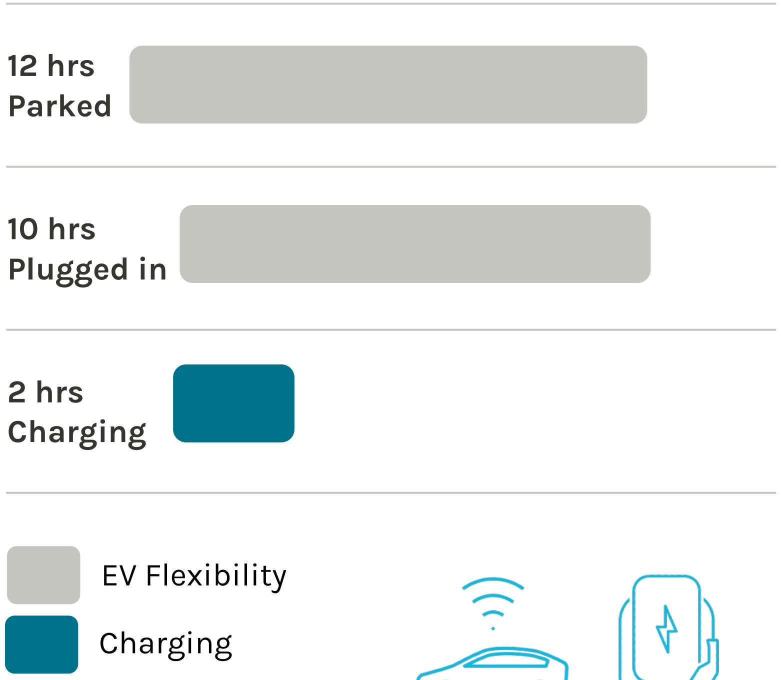
Utilizing platform that actively moves EV charging load to lower demand periods based on customer TOU rates. GM, Ford, and BMW are also supporting this program.

EVs are different from other loads utilities manage

TRADITIONAL LOADS	EV LOADS
Existing. Flat or declining	**New.** Doubling every 2-3 years
Low Powered. Home loads rarely go above 2 kW	**High Powered.** L2 chargers often >8 kW
Peak-coincident. Affects peak disproportionately	**Non-coincident peak.** Charging mostly occurs outside system peaks but taxes distribution system
Uni-directional. Electricity flows one way	**Bi-directional.** Potential to flow both ways, back to the home or the grid
Constant. Consumed consistently, with little long-duration flexibility	**Flexible.** Drivers typically charge for 2 hrs during 10 hr session
Stationary. Used at home	**Mobile.** Home charging common (~80%) and public charging impacts commercial class
Unconnected. Slowly shifting but generally needs new device for control	**Hyperconnected.** ~85+% of customers have capable vehicles or chargers

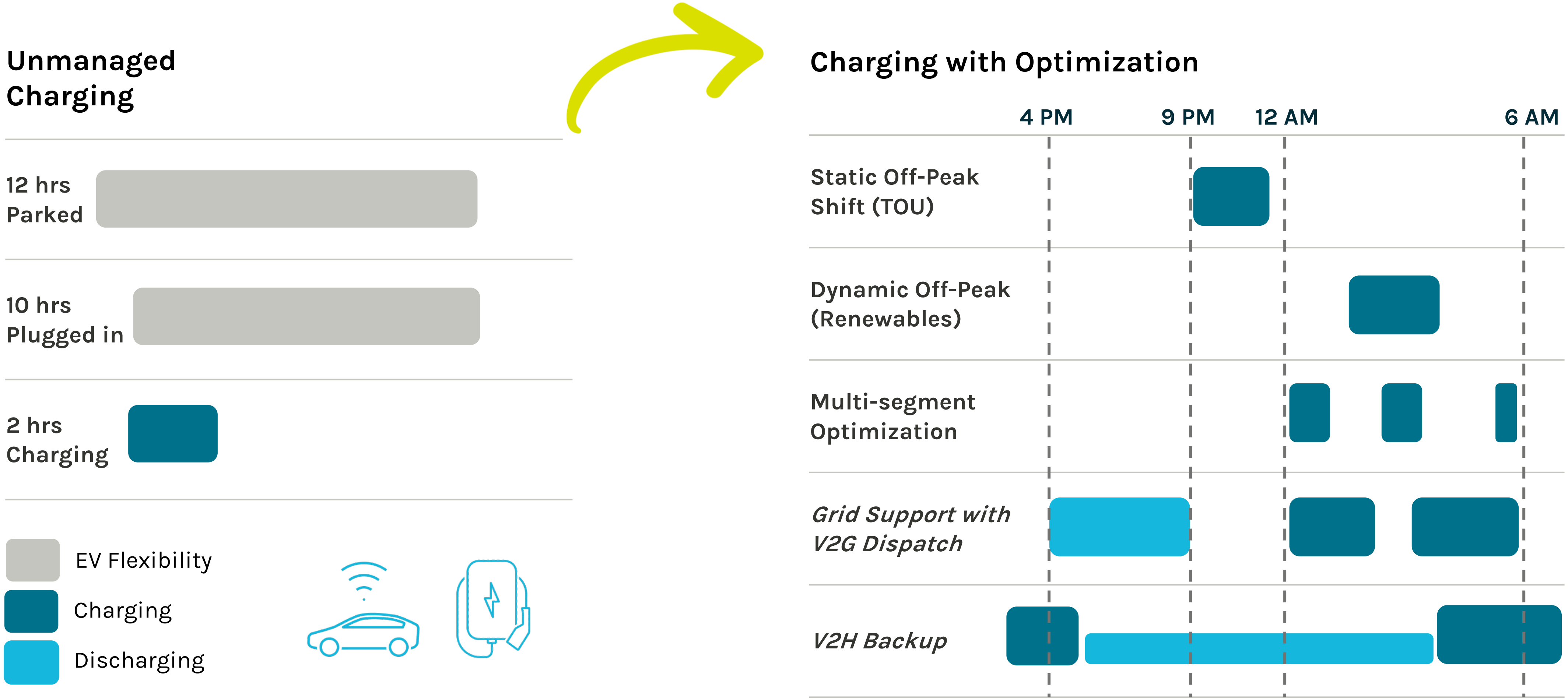
EV flexibility enables optimal response to grid conditions

Unmanaged Charging



*Residential L2 example

EV flexibility enables optimal response to grid conditions



Unmanaged Charging

12 hrs Parked

10 hrs Plugged in

2 hrs Charging

Charging with Optimization

4 PM · 9 PM · 12 AM · 6 AM

Static Off-Peak Shift (TOU)

Dynamic Off-Peak (Renewables)

Multi-segment Optimization

Grid Support with V2G Dispatch

V2H Backup

▨ EV Flexibility

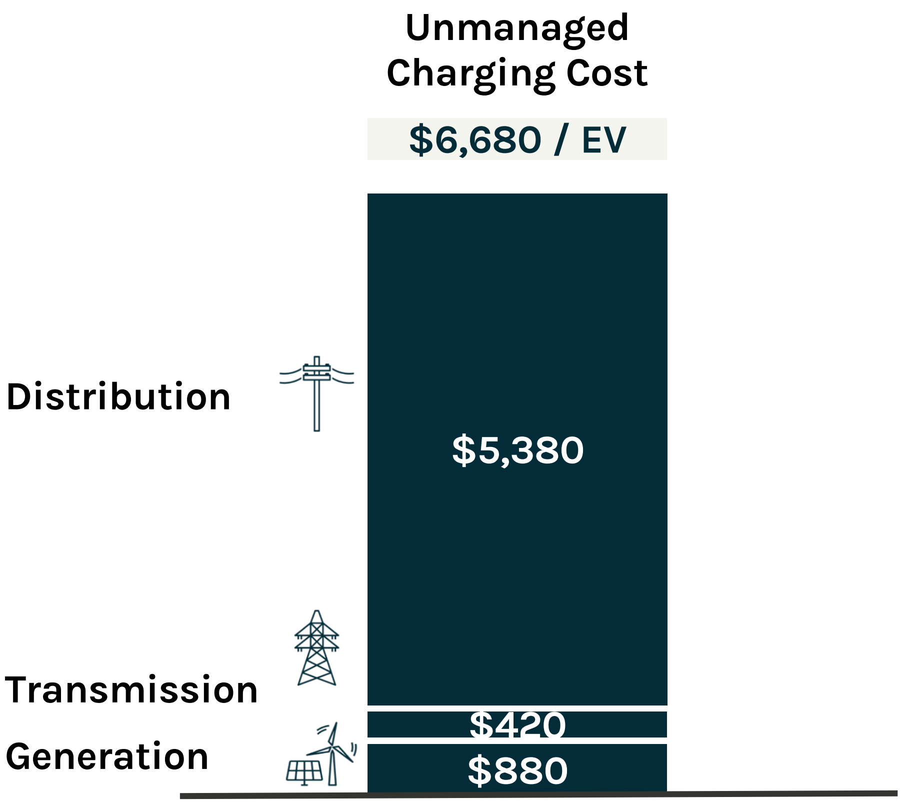
■ Charging

■ Discharging

*Residential L2 example

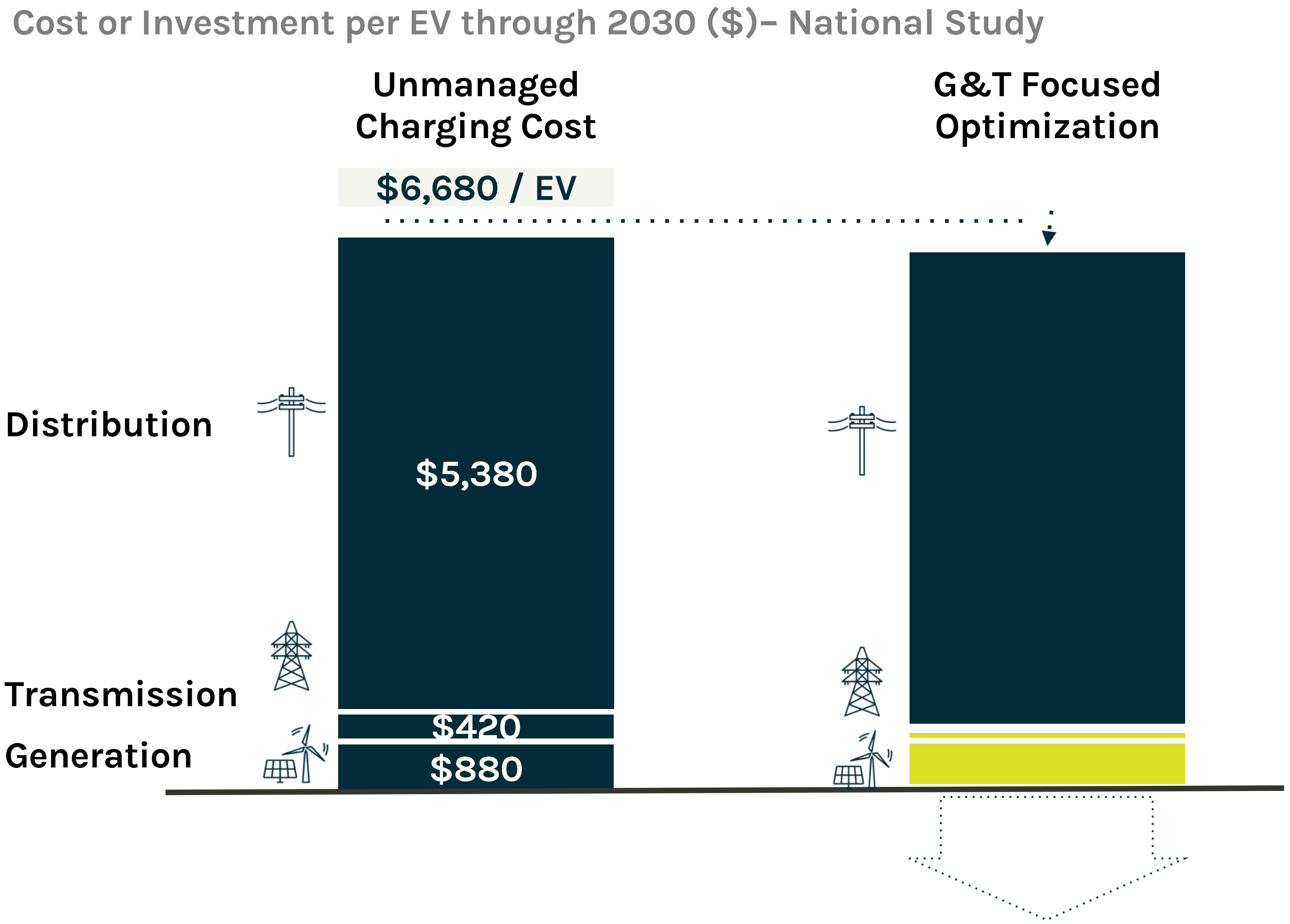
Preparing the grid for EVs will require distribution-focused optimization

Cost or Investment per EV through 2030 ($)– National Study



Sources: BCG, WG Analysis

Demand response and other forms of G&T-focused optimization can help make charging more affordable



Sources: BCG, WG Analysis

Managing to dynamic rates

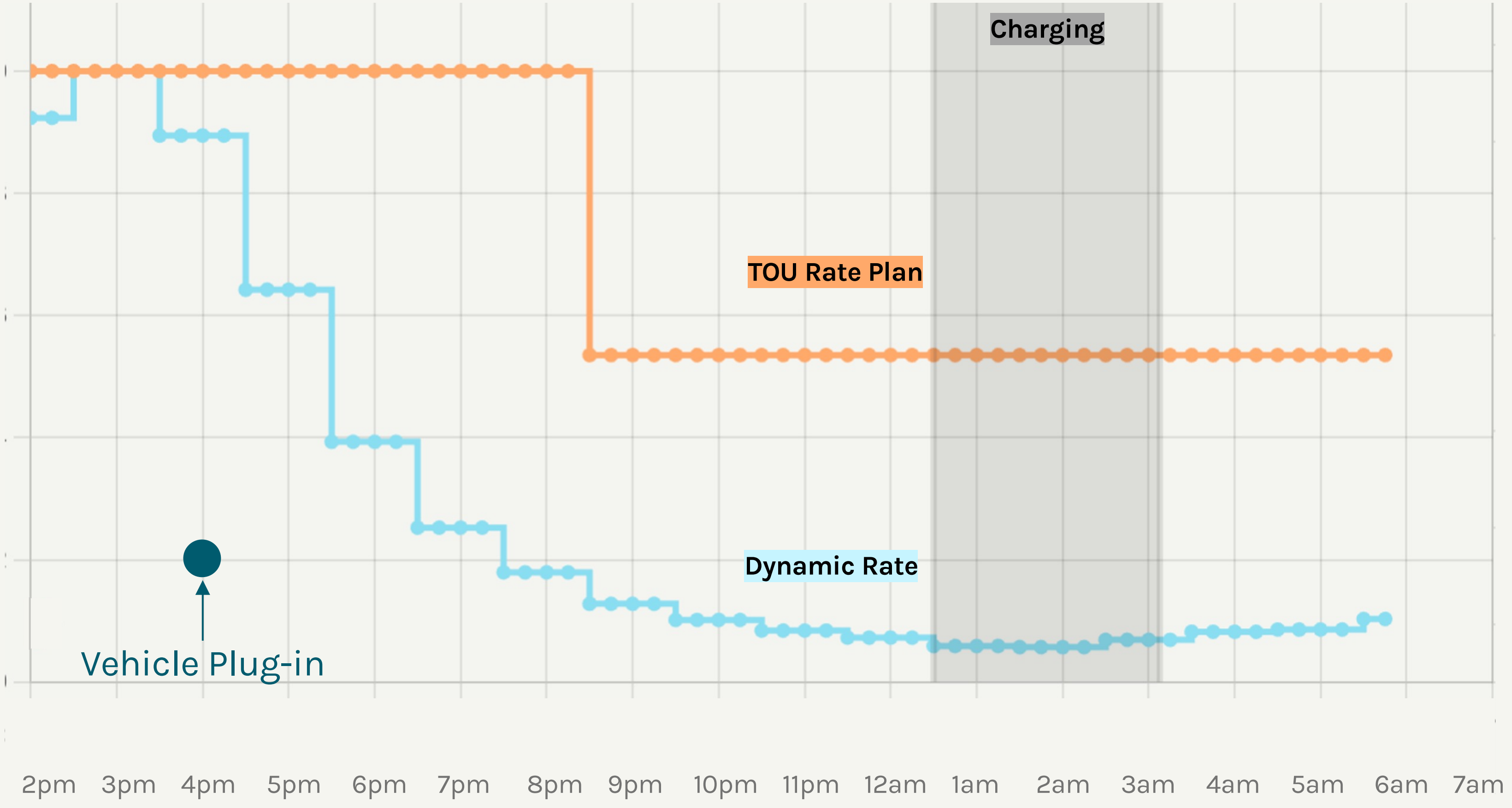
Dynamic rates give timely signals on cost to serve customers more accurately than customer rates.

WeaveGrid analyzes these and other signals together to optimize for grid constraints, financial efficiency, and carbon savings.

WeaveGrid will determine optimal periods to charge, discharge, and store energy throughout the vehicles plugged in period to account for these aggregate and dynamic signals.

Charging with TOU and Dynamic Rates

Charging occurs during low dynamic rate periods while mirroring driver expectations of TOU rates



CASE STUDY: RENEWABLES INTEGRATION

Xcel Energy aligns EV charging with expected renewables output

OPPORTUNITY

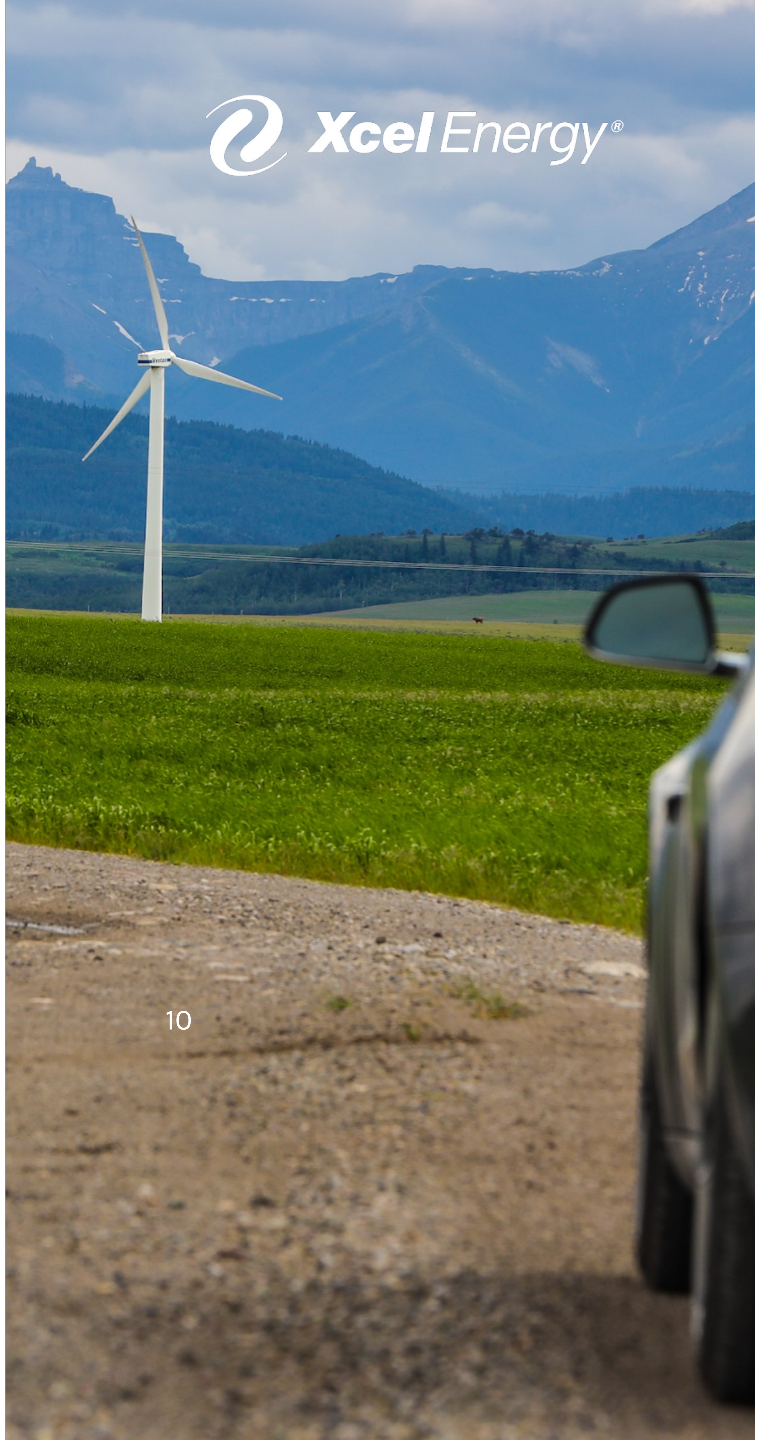
Xcel Energy wanted to improve wind and solar utilization during off-peak periods by leveraging the growing number of EVs in its service territory.

SOLUTION

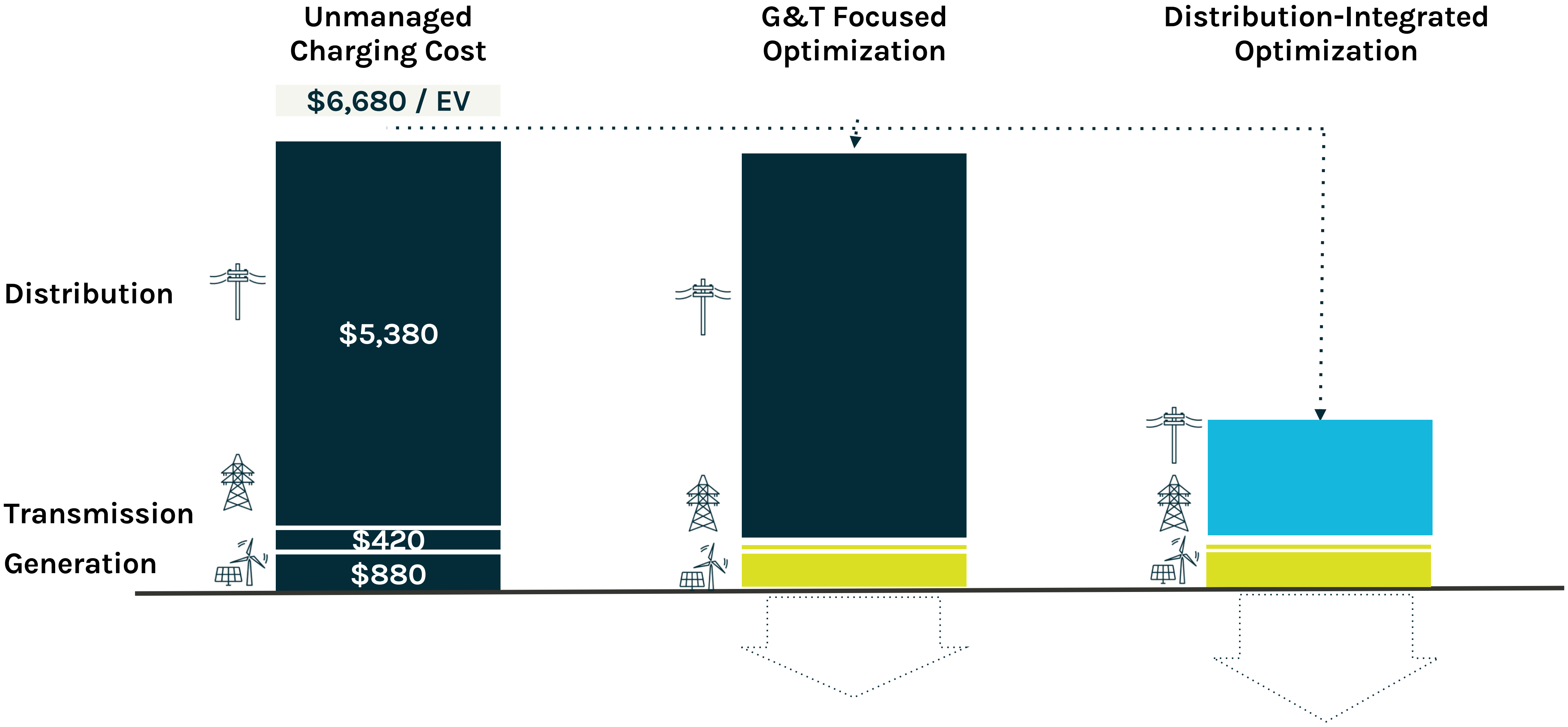
WeaveGrid manages EV charging of Xcel Energy's customers based on driver preferences, hourly cost data, and a proxy wind and solar output forecast provided by the utility.

RESULTS

- Xcel Energy has increased renewable power supply while simultaneously lowering the cost to serve its EV customers
- Participant charging ramps up in the evening, slowly peaking around 2 a.m. while ensuring all vehicles are fully charged when needed



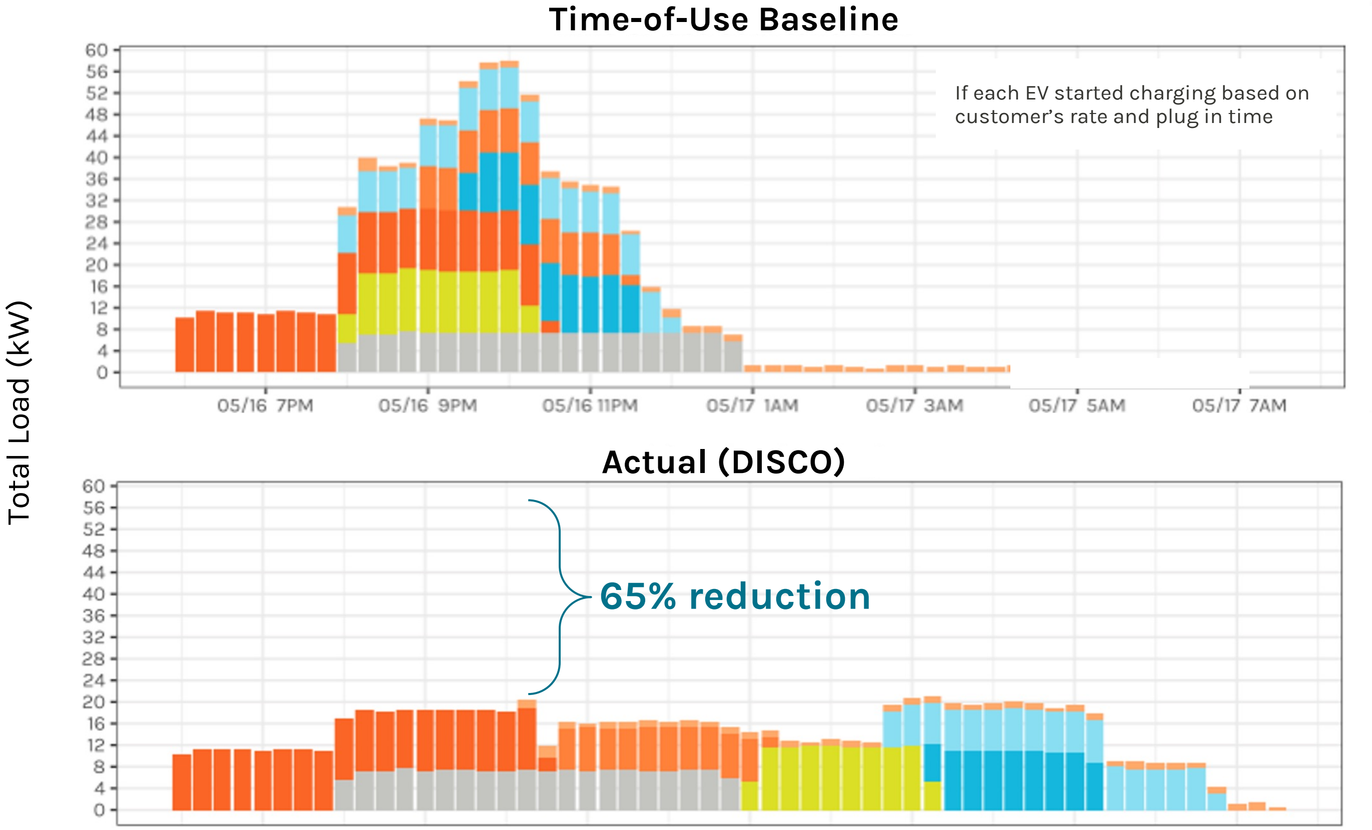
Distribution-optimization, as EVs scale, becomes increasingly important for reducing costs to serve



Sources: BCG, WG Analysis

DISTRIBUTION SAMPLE RESULTS*

Load-balancing successfully reduces non-coincident peak EV loads



Time-of-Use Baseline

If each EV started charging based on customer's rate and plug in time

Actual (DISCO)

65% reduction

*Actual program results are from a managed EV charging program with a large Southwest electric utility during a week in May

SRP cohort characteristics:

10 EVs, modeled single transformer

Majority on TOU rate

7 charged this night

6 charged via L2

🟦 This car plugged in late

DISCO Result:

65% reduction in predicted peak load at a local grid asset

WeaveGrid load balancing spread charging throughout the night for the group.

WeaveGrid

Thank you!

Mathias Bell
mathias.bell@weavegrid.com

Role of the Utility in Scaling Charging Infrastructure

Cory Bullis
Public Affairs Director
FLO EV Charging

Britta Gross
Director of Transportation
Electric Power Research Institute

Al Freeman
Assistant to Division Director
Energy Resources Division
Michigan Public Service Commission

Jeff Myrom, Director of
Electric Transportation
Customer Products
Consumers Energy

Julie Staveland
Assistant Division Director
Materials Management Division

EVs2Scale™ 2030

Michigan Public Service Commission

“Role of the Utility in Scaling Charging Infrastructure”

Britta Gross
EPRI, Director of Transportation

24 January 2024

EPRI

The Utility Challenge

- Government, Industry, and Fleets are **increasingly aligning on aggressive 2030 vehicle electrification goals**

- The **pace of needed year-over-year action and investment to prepare charging sites and the grid is not clear**

- There is a **significant timing mismatch between vehicle procurement and utility grid interconnection** that is already impacting EV deployment (particularly in the trucking sector)
  - Electric Trucks can be delivered in < 4-6 months
  - Utility grid interconnects can take 18–24 months (or much longer)

THIS TRANSITION IS UNPRECEDENTED AND COMPLEX. IT REQUIRES:

- **Extraordinary collaboration and partnering** across all the major EV stakeholder groups

- **Stakeholders must "meet in the middle" with transparent electrification plans** so early planning can occur and long-leadtime investments can be prioritized

Addressing the Barriers to Achieving EVs at Scale

A Three-Pillar Strategy to Address the Key Industry Gaps

EVs2Scale2030

1

COALITIONS & ROADMAPS

Industry Forum Convenings
- Utility-OEM Forum
- Utility-Fleet Forum

National EV Driver Research Board

50-state eRoadMAP™ to 2030
outlining EV loads, grid impacts,
leadtimes, workforce, costs

2

STRUCTURAL SYSTEM REFORMS

Charging Infrastructure

- Reliability: Benchmarking, Standards
- Charging innovation & affordability

Grid Readiness

- Streamlined Grid Interconnect
  - Expedited Interim Charging Solutions
- Managed Charging at Scale
- Interconnect Standards for V2H/V2B/V2G

3

UNIFYING TOOLS & PILOTS

- Approved Product List (APL)
- NEVI/NEHC Coordination with EEI

- GridFAST™ Online Data Exchange
- OEM/Utility V2H/V2B Pilot
- EV Resilience/Evacuation Pilot

Enabling Regulatory and Oversight Framework

Equity Blueprint & Workforce Development

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Enabling Regulatory and Oversight Framework

Equity Blueprint & Workforce Development

Collaboration + Partnerships

Ongoing Outreach

EVs2Scale2030

UTILITY INDUSTRY

EPRI

LPPC LARGE PUBLIC POWER COUNCIL

EEI

NRECA America's Electric Cooperatives

AMERICAN PUBLIC POWER ASSOCIATION

Alliance for Transportation Electrification

NASUCA NATIONAL ASSOCIATION OF STATE UTILITY CONSUMER ADVOCATES

NARUC National Association of Regulatory Utility Commissioners

AUTO & TRUCKING INDUSTRY

Ford

Audi

Tesla

BMW

Toyota

Mercedes-Benz

VOLVO

PACCAR

gm

RIVIAN

DAIMLER

HONDA

ALLIANCE FOR AUTOMOTIVE INNOVATION

VW

NACFE NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

NADA

FLEET OPERATORS

amazon

PENSKE

Enterprise Mobility™

US. FOODS

Uber

lyft

Walmart Save money. Live better.

PITT OHIO SUPPLY CHAIN • GROUND • LTL • TL

FedEx Federal Express

J.B. HUNT

element

NAFA FLEET MANAGEMENT ASSOCIATION

LeasePlan

CHARGING PROVIDERS AND FUELING RETAILERS

Circle K

electrify america

flo EV Charging

chargepoint

EVgo FAST CHARGING

bp

Shell

NGO & STANDARD-SETTING ORGANIZATIONS

NRDC

EDF ENVIRONMENTAL DEFENSE FUND

RMI

CHARIN

SAE INTERNATIONAL

ATLAS PUBLIC POLICY

Plug In America

Electric Vehicle ASSOCIATION

GOVERNMENT

- Joint Office of Energy & Transportation (JOET)
- US DOE
- US DOT
- National Labs
- FERC/NERC
- State DOEs, DOTs, DEQs
- State PUCs
- League of Cities
- Climate Mayors

EVs2Scale2030 Advisory Board

Chair: **PG&E,** Patti Poppe

AAI, John Bozzella

Amazon, Sujit Mandal

Ameren, Mark Fronmuller

APPA, Paul Zummo

ATE, Phil Jones

ComEd, Gil Quiniones

Daimler Truck, Diego Quevedo

EEI, Kellen Schefter

GRE, Jeff Haase

JOET, Rachael Nealer

LCRA, Khalil Shalabi

NARUC, Katherine Peretick (Michigan PSC)

National Grid, Rudy Wynter

NRECA, Angela Strickland

NYPA, Fabio Mantovani

Southern Company, Chris Cummiskey

EVs2Scale2030™

PROJECT PARTNERS

BROAD INDUSTRY SUPPORT

amazon

Ameren

AUSTIN ENERGY®

CenterPoint® Energy

conEdison

FirstEnergy®

GREAT RIVER ENERGY®

JEA® Building Community®

nationalgrid

NewYorkPower Authority

Your Energy Partner® OPPD Omaha Public Power District

PGE

PG&E®

Seattle City Light

SOUTHERN CALIFORNIA EDISON®

Southern Company

SMUD®

SRP

Xcel Energy®

Regulatory/Board Oversight Workstream:

Why is proactive grid infrastructure build so challenging?

Utilities not confident in the timing/pace of EV adoption across their service territories (demand varies across the U.S.)

Regulators not confident in the timing/pace of EV adoption (hearing only the voice of utilities); want to avoid stranded assets. Unclear on the cost impacts to ratepayers of proactive grid infrastructure build vs. later build

Ratepayer advocates not confident in the timing/pace of EV adoption and the need for proactive grid build; concerns on the cost impacts

EVs2scale2030 data will send clear demand signals, building confidence, and enabling utilities (and regulators) to prioritize "no regret" investments.

eRoadMAP™

EVs2Scale2030

ANALYTICS

EPRI

RMI
ENERGY. TRANSFORMED.

U.S. DEPARTMENT OF ENERGY

icct
THE INTERNATIONAL COUNCIL

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

ATLAS PUBLIC POLICY

Environmental Defense Fund

BERKELEY LAB
Lawrence Berkeley National Laboratory

DATA

amazon

DAIMLER TRUCK

Enterprise Mobility™

FIRSTstudent

NADA
NATIONAL AUTOMOBILE DEALERS ASSOCIATION

PACCAR

VOLVO TRUCKS

WORLD RESOURCES INSTITUTE

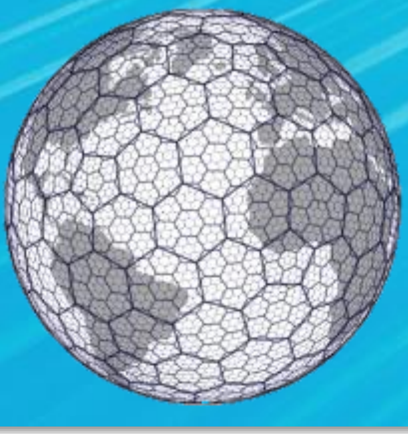
Other:

- Experian™
- GEOTAB ITS
- REPLICA
- INRIX

1 Improved Data Resolution Techniques

Res	Average Hexagon Area (km^2)	Average Hexagon Area (mi2)
0	4,357,449.42	1,682,419.93
1	609,788.44	235,440.54
2	86,801.78	33,514.34
3	12,393.43	4,785.13
4	1,770.35	683.53
5	252.90	97.65
6	36.13	13.95
7	5.16	1.99
8	**0.74**	**0.28**
9	0.11	0.04
10	0.0150	0.0058
11	0.0021	0.0008
12	0.0003	0.0001

Where Hex8 ~ 1 or 2 feeders



2 LAYERED DATA APPROACH

LD Vehicles

- Registrations
- Travel Models

MDHD Vehicles

- OEM data
- Fleet data
- Travel Data

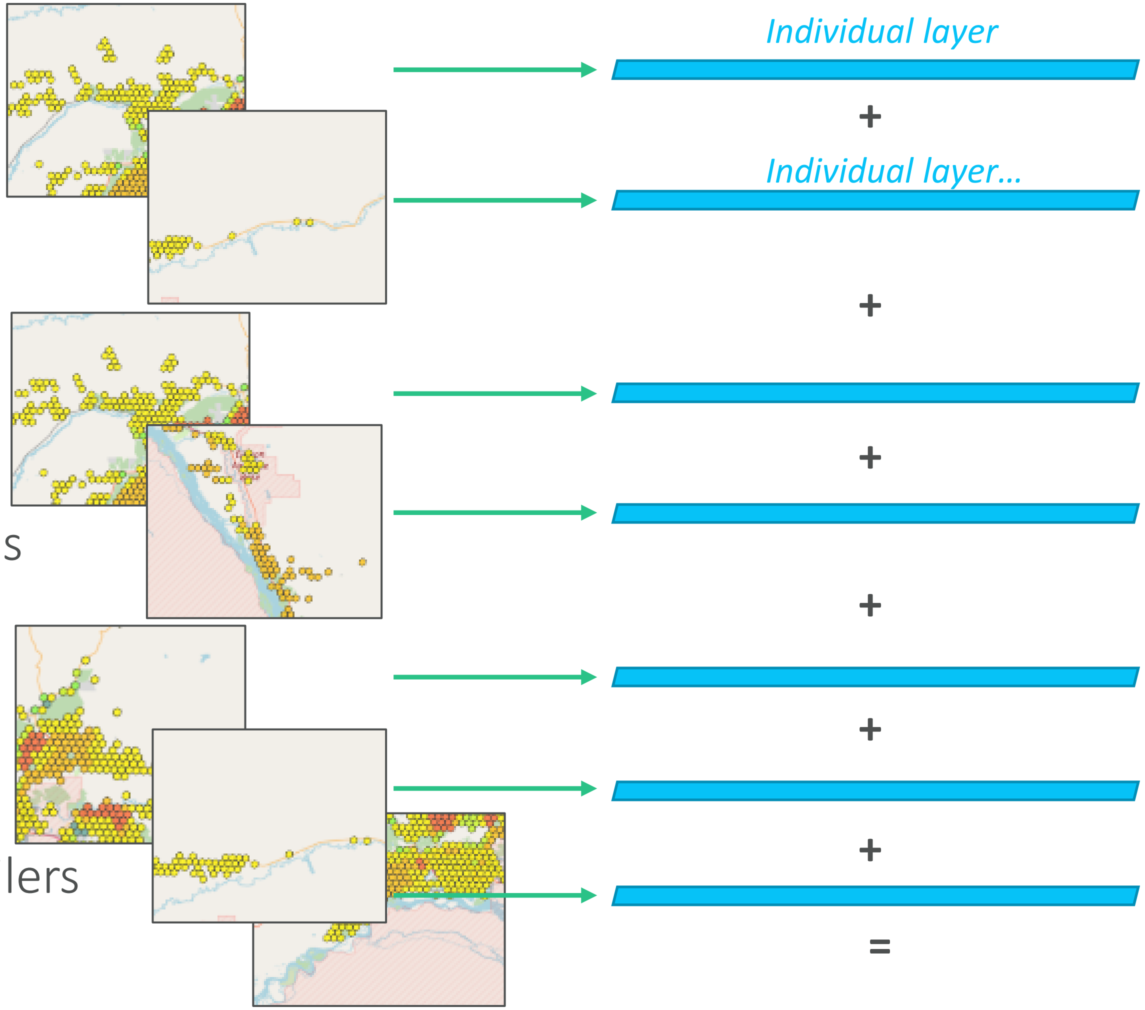
Other Vehicle Sectors

- Transit/School Buses
- **Government Fleets**
- Ports/Airports
- Vocational Fleets

Other Load Data

- EVSPs/Fueling Retailers

H3 – Level 8 Maps

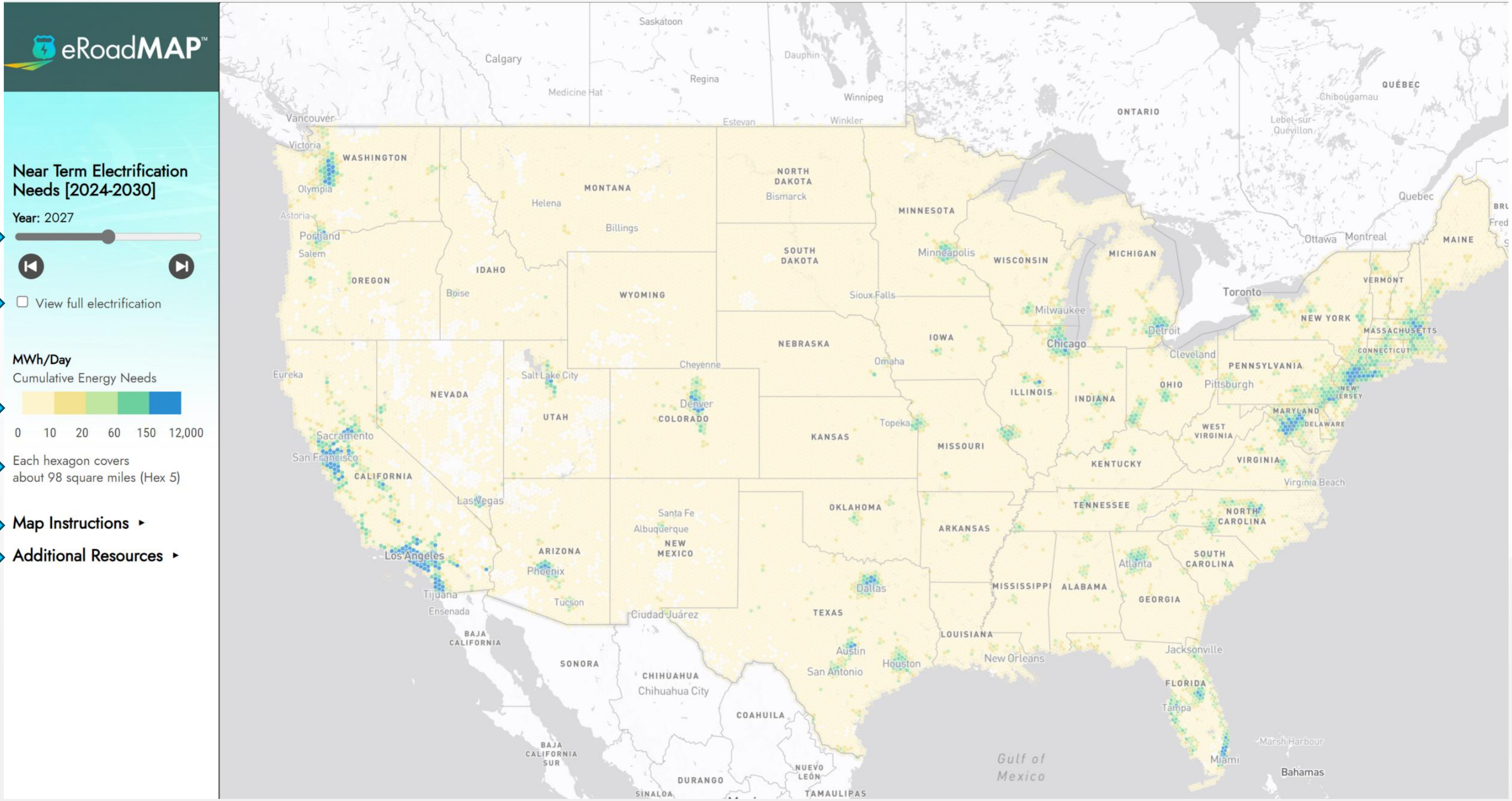


One map with energy + power needs

**EV Service Providers*

Interactive Energy Map: *Hex 5 Resolution* eroadmap.epri.com

EVs2Scale2030



eRoadMAP™

Near Term Electrification Needs [2024-2030]

Year: 2027

☐ View full electrification

MWh/Day

Cumulative Energy Needs

0	10	20	60	150	12,000

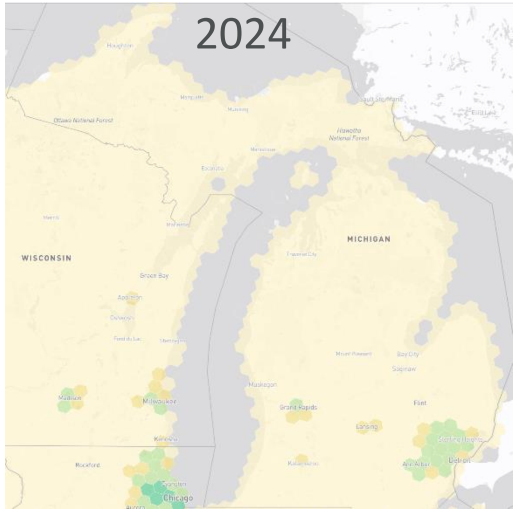
Each hexagon covers about 98 square miles (Hex 5)

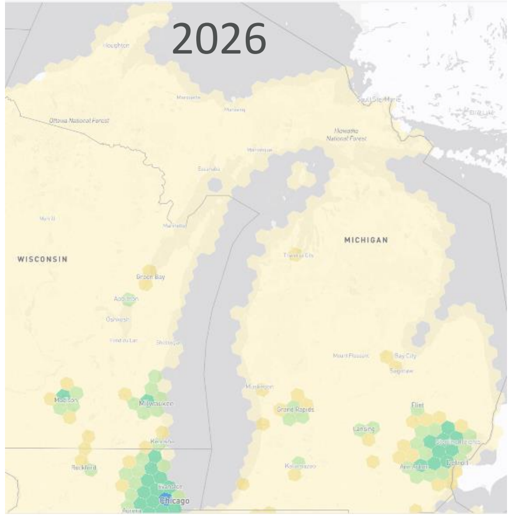
Map Instructions ▸

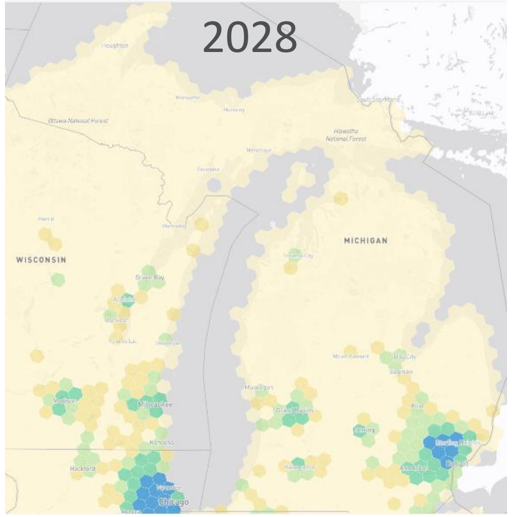
Additional Resources ▸

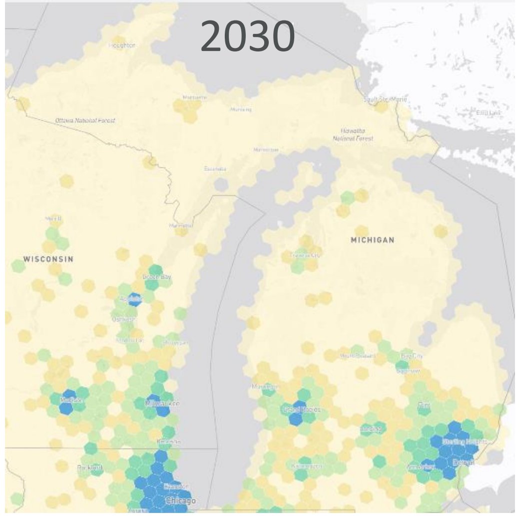
Interactive Energy Map: 2024 to Full Electrification (Hex 5)

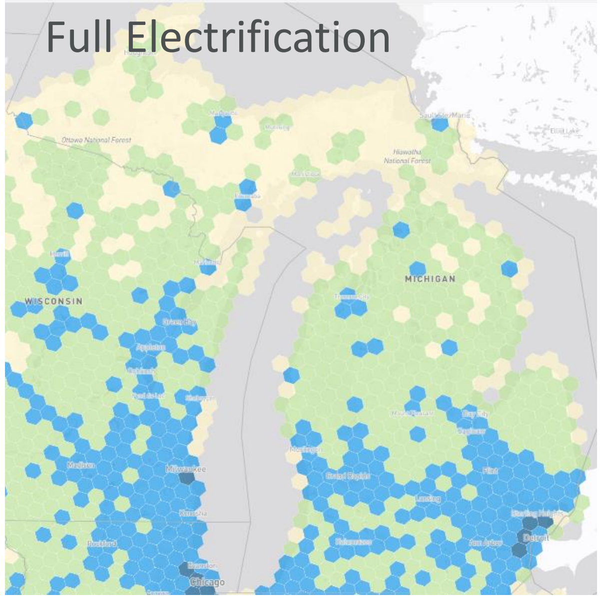
EVs2Scale2030


2024


2026

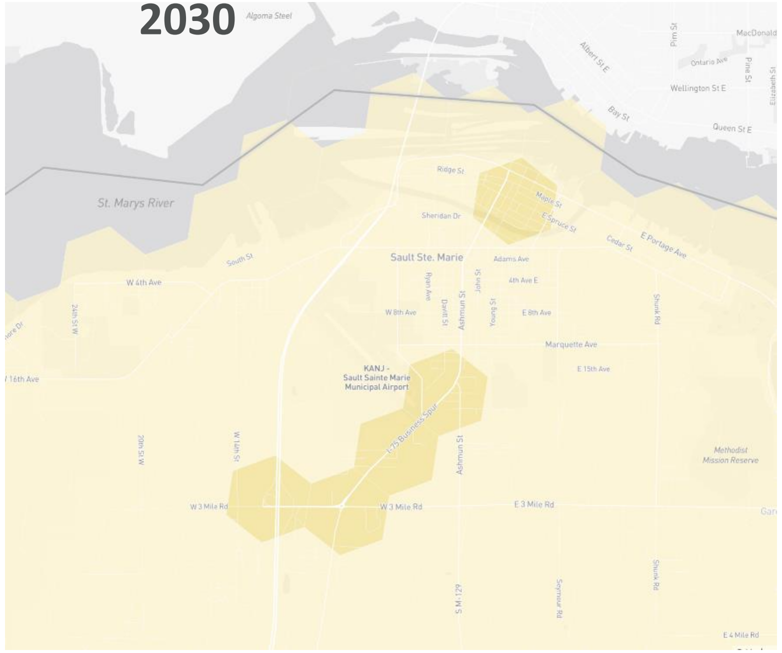

2028

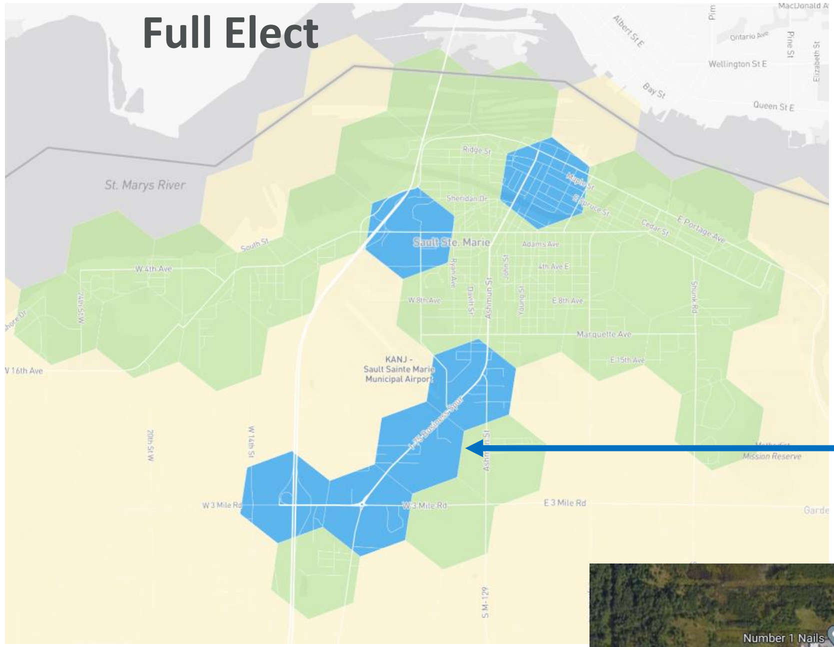

2030

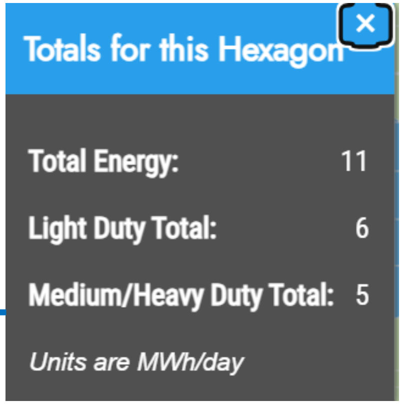

Full Electrification

Hex 5 (98 mi^2)

Interactive Energy Map: Sault Ste Marie, MI

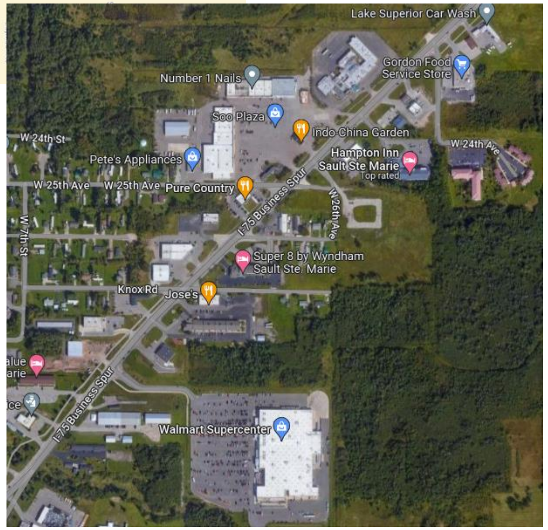

2030


Full Elect


Totals for this Hexagon

Total Energy:	11
Light Duty Total:	6
Medium/Heavy Duty Total:	5

Units are MWh/day



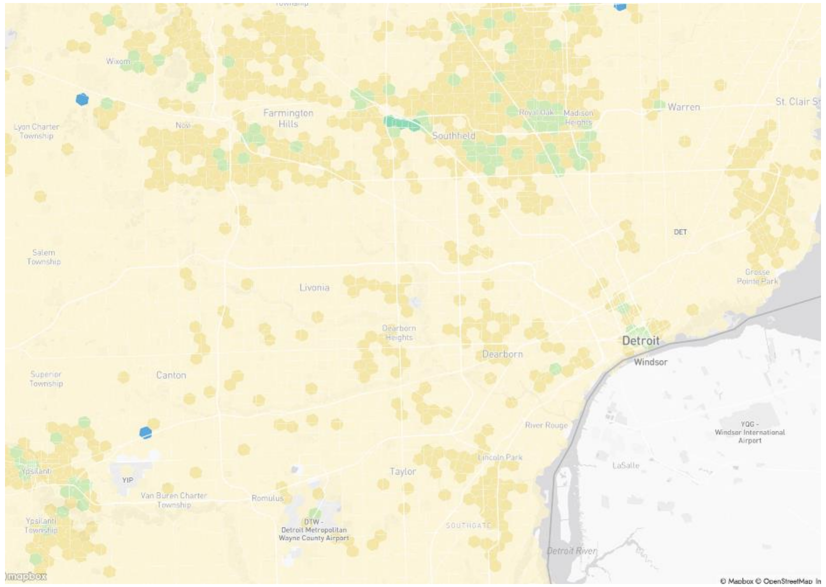
- Walmart Supercenter
- 2 Hotels
- 2 Restaurants
- Nail Salon

Hex 8 (0.28 mi^2)

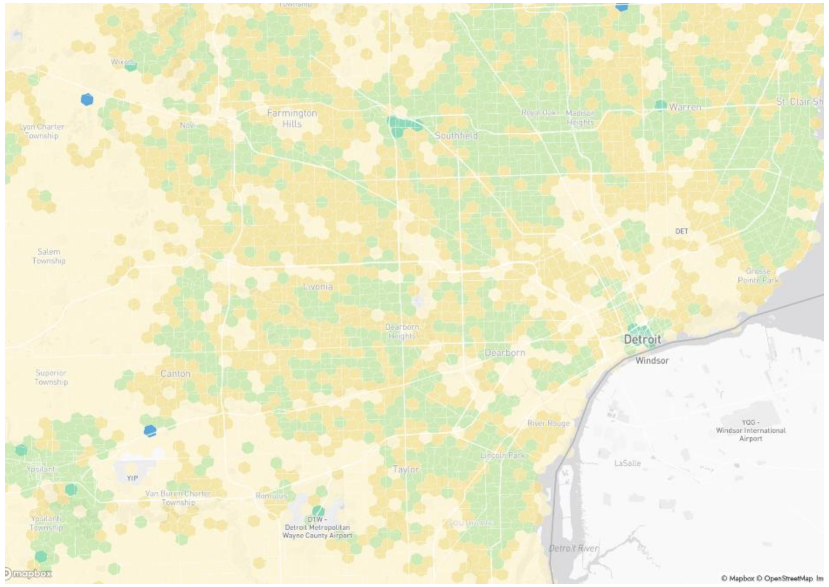
Interactive Energy Map: Detroit Metropolitan Area

2027 to 2030 to Full Electrification Comparison

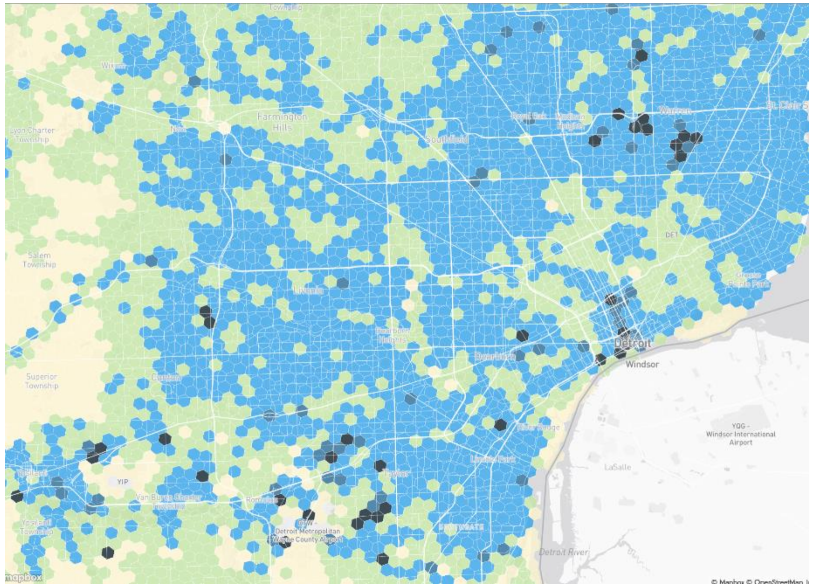
2027



2030



Full Elect



Hex 8 (0.28 mi^2)

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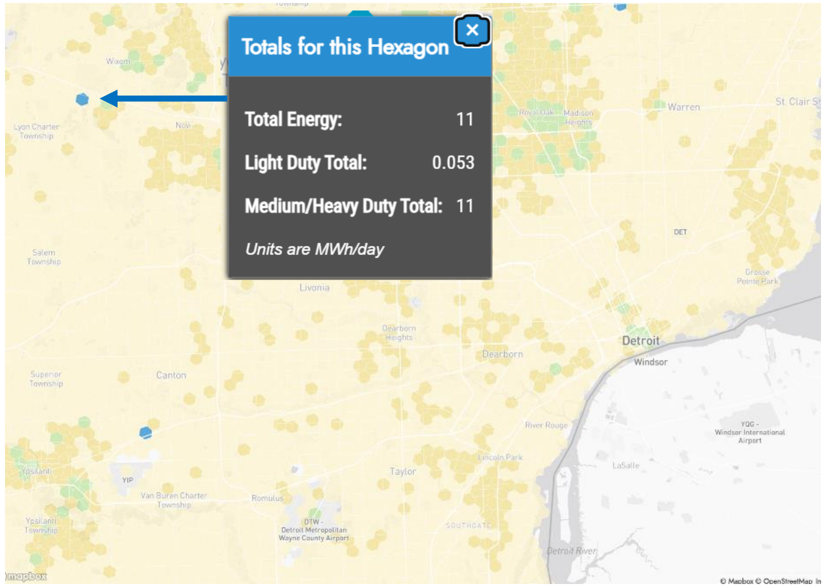


Totals for this Hexagon

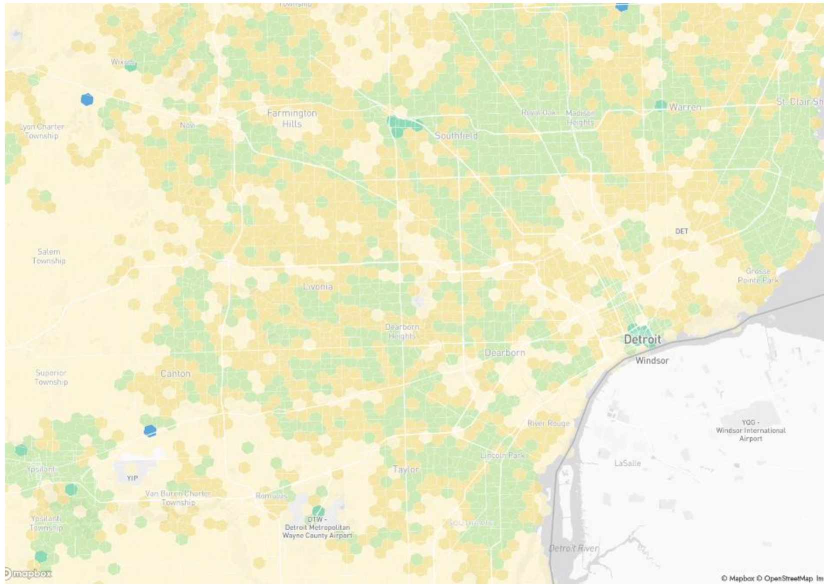
Total Energy: 11

Light Duty Total: 0.053

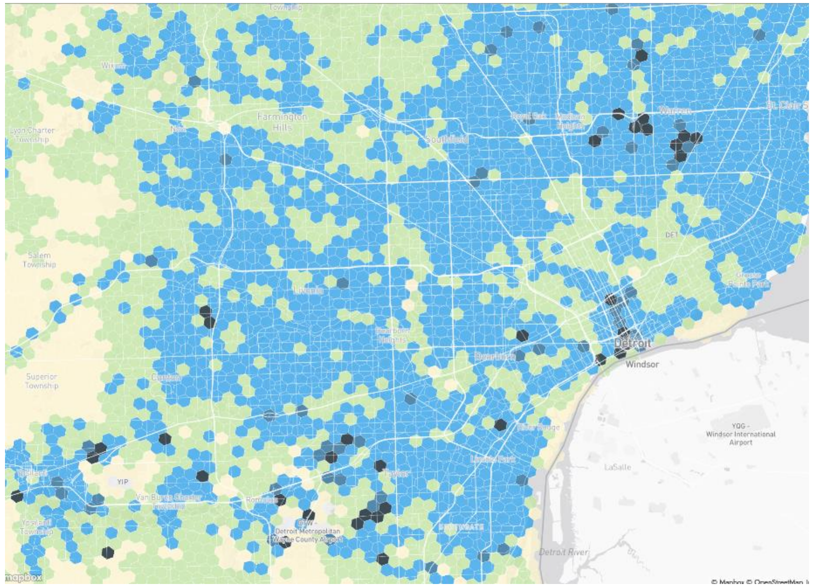
Medium/Heavy Duty Total: 11

Units are MWh/day

2030



Full Elect



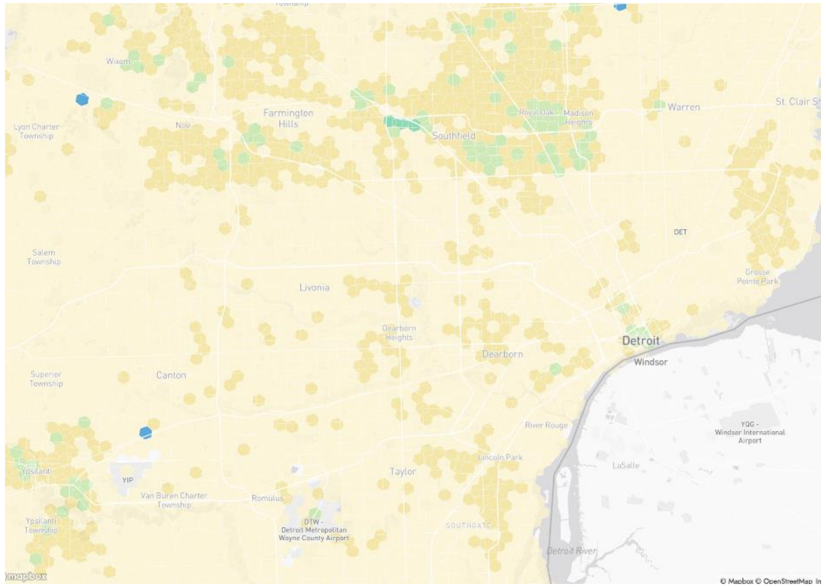
- US Foods
- Kawasaki Robotics
- Testek Solutions
- NLB Corp
- ZEISS Industrial

Hex 8 (0.28 mi^2)

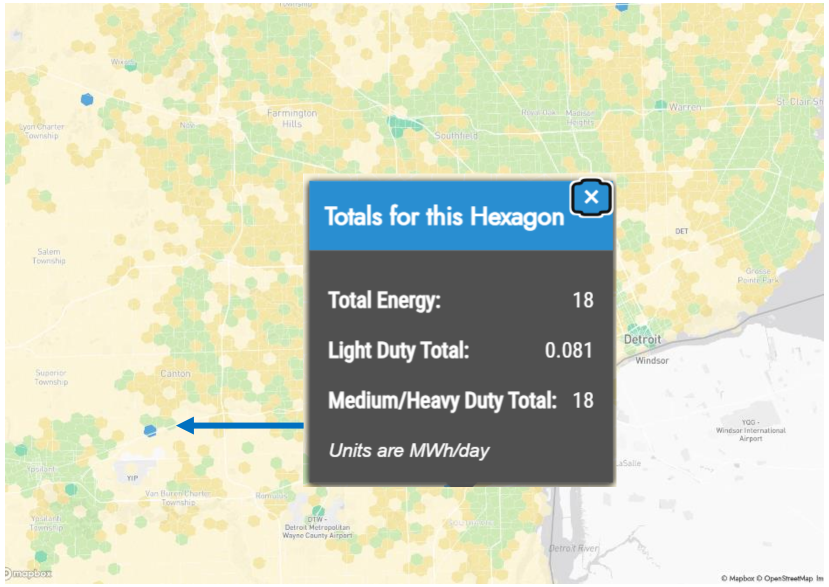
Interactive Energy Map: Detroit Metropolitan Area

2027 to 2030 to Full Electrification Comparison

2027



2030



Totals for this Hexagon

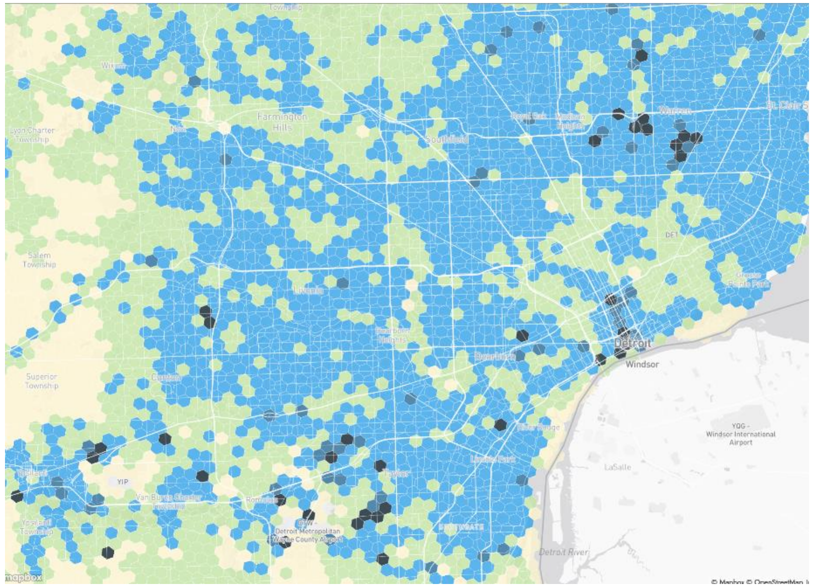
Total Energy: 18

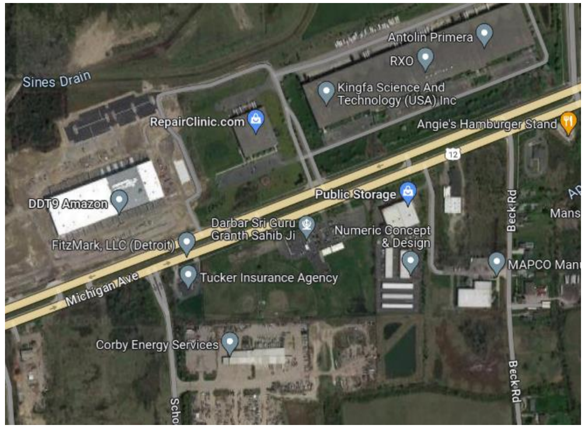
Light Duty Total: 0.081

Medium/Heavy Duty Total: 18

Units are MWh/day

Full Elect





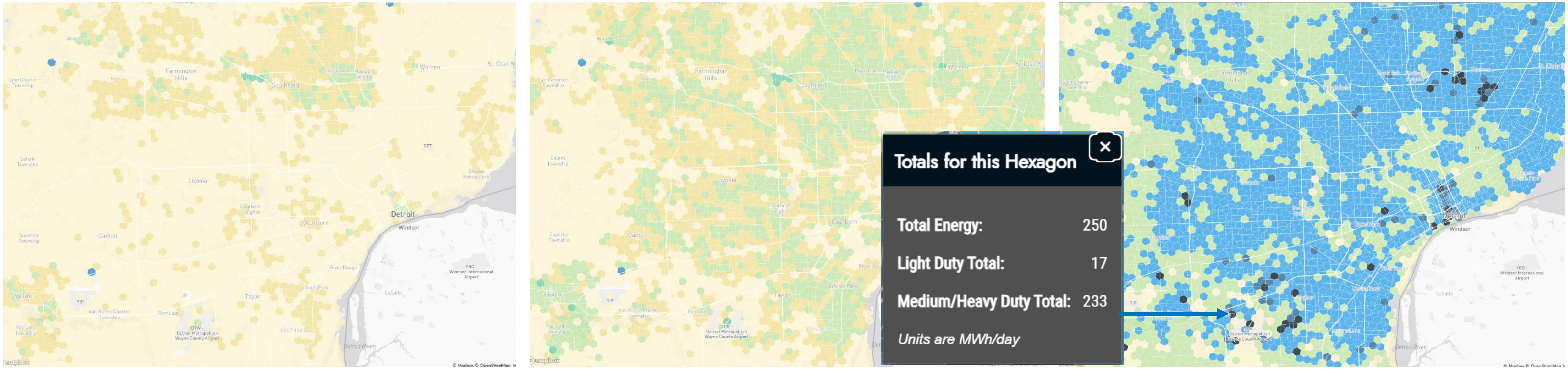
- Amazon
- Kingfa Science and Technology
- RXO
- Antolin Primera
- MAPCO Mftg
- FitzMark

Hex 8 (0.28 mi^2)

Interactive Energy Map: Detroit Metropolitan Area

2027 to 2030 to Full Electrification Comparison

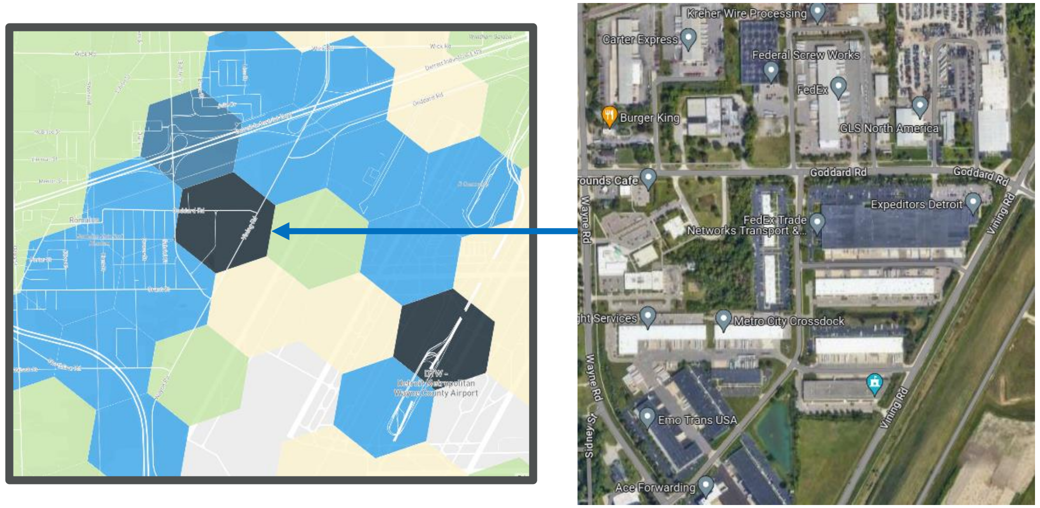
2027 **2030** **Full Elect**



Totals for this Hexagon

Total Energy:	250
Light Duty Total:	17
Medium/Heavy Duty Total:	233

Units are MWh/day



- FedEx
- FedEx Transport
- GLS N.A.
- Carter Express
- Kreher Wire Processing
- Federal Screw Works
- Expeditors Detroit
- Metro City Crossdock
- Pilot Freight Services
- Emo Trans

Hex 8 (0.28 mi^2)

2024 Plan

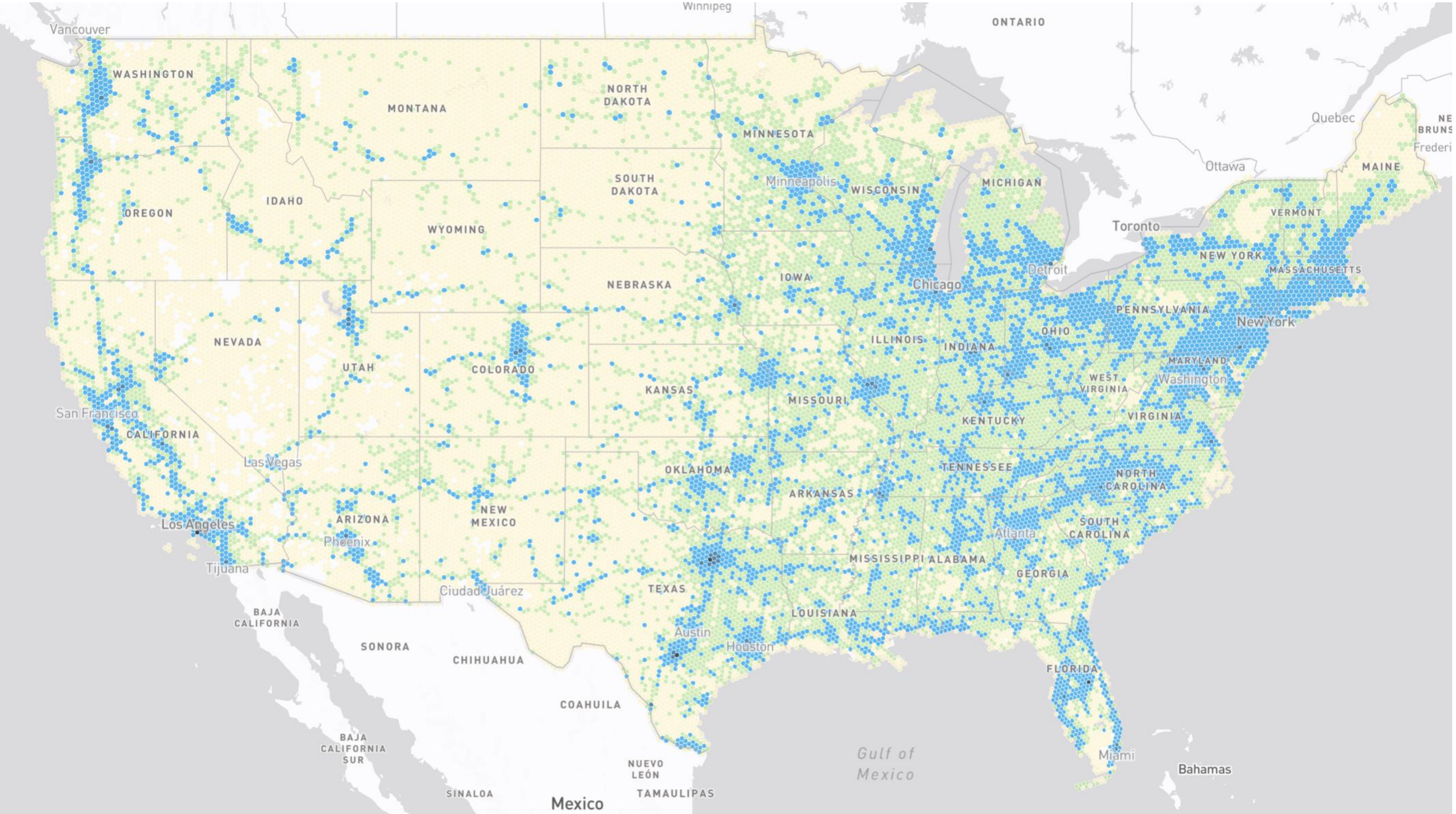
Features:

- Power
- Grid Capacity
  - Hosting capacity maps
  - Substation capacity analysis
- Demographic layers
  - Justice 40, HH income, MDU %
- Fueling stations (EV and gasoline)
- Separation of long-haul trucks and other refined segmentation

Data:

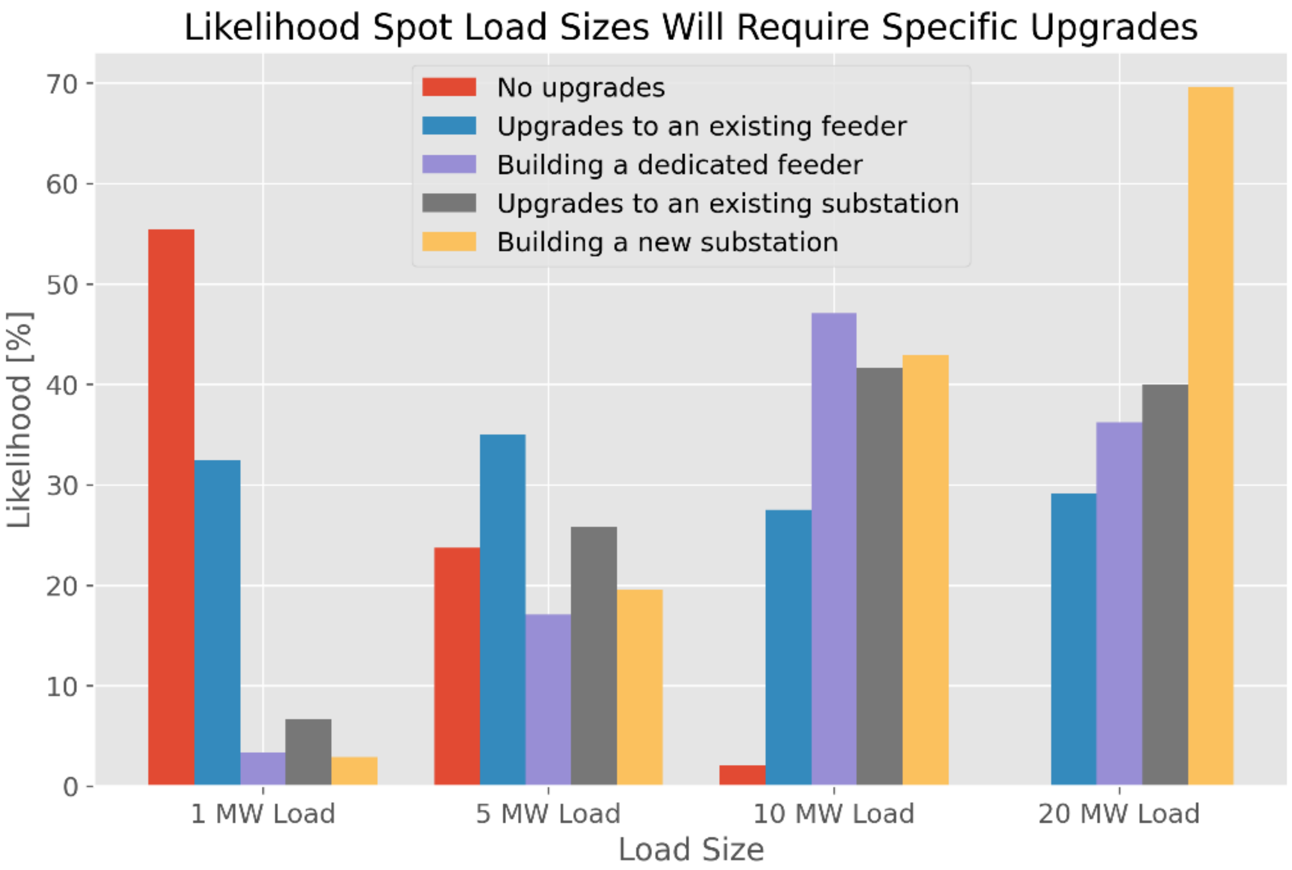
- Fleet Data (ongoing)
- School Buses
- Transit Buses, Airports, Ports, Vocational
- Charging Provider Plans

Load … but what about Capacity?



Utility Grid Survey
Preliminary Responses

➡The utility grid, as a system, is relatively well positioned to serve EV charging – however challenges exist in some locations

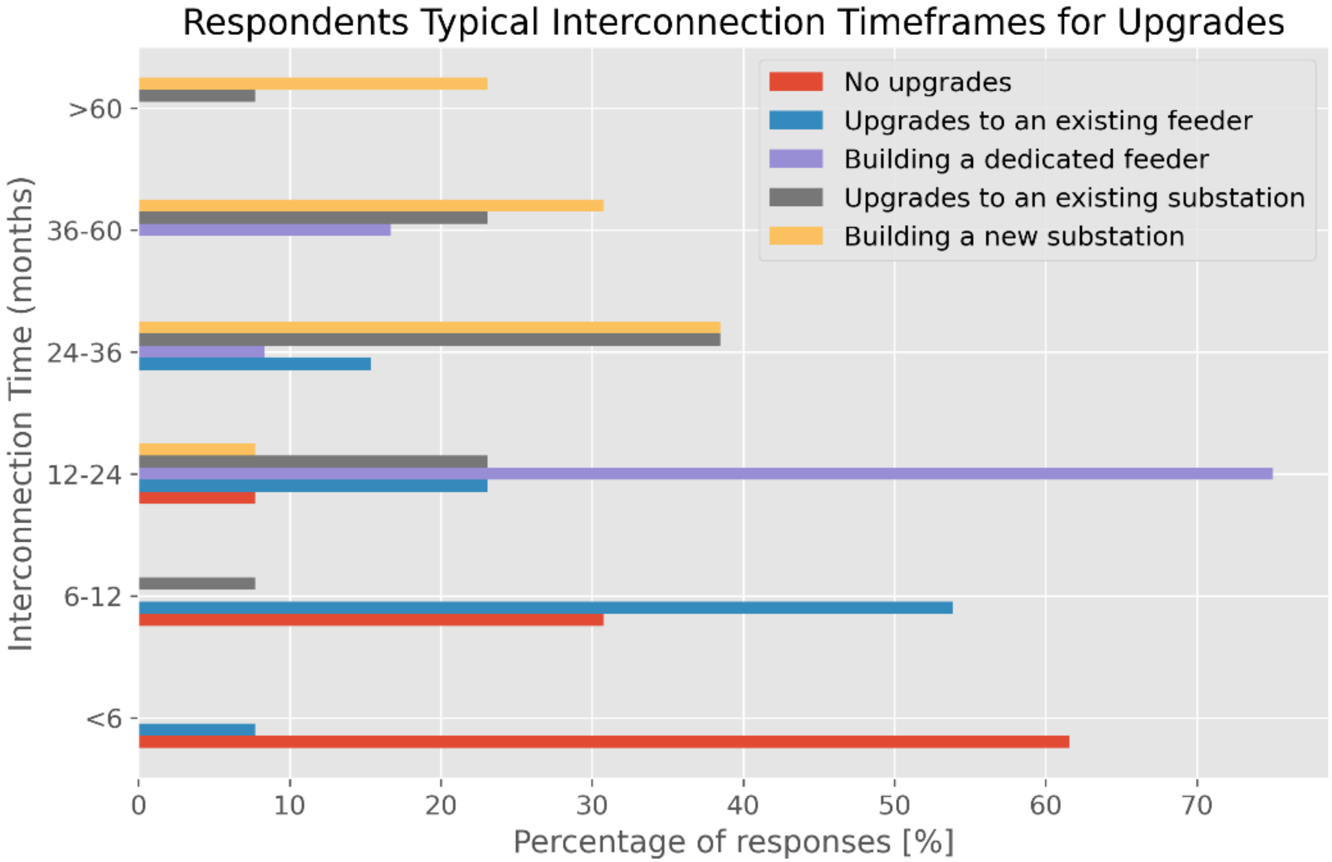


Preliminary Findings:

- ***5MW load*** – 30% likely to need a feeder upgrade
- ***10MW load*** – 48% likely to need a dedicated feeder, 42% likely to need substation
- ***20MW load*** – 70% likely to need a new substation

Utility Grid Survey

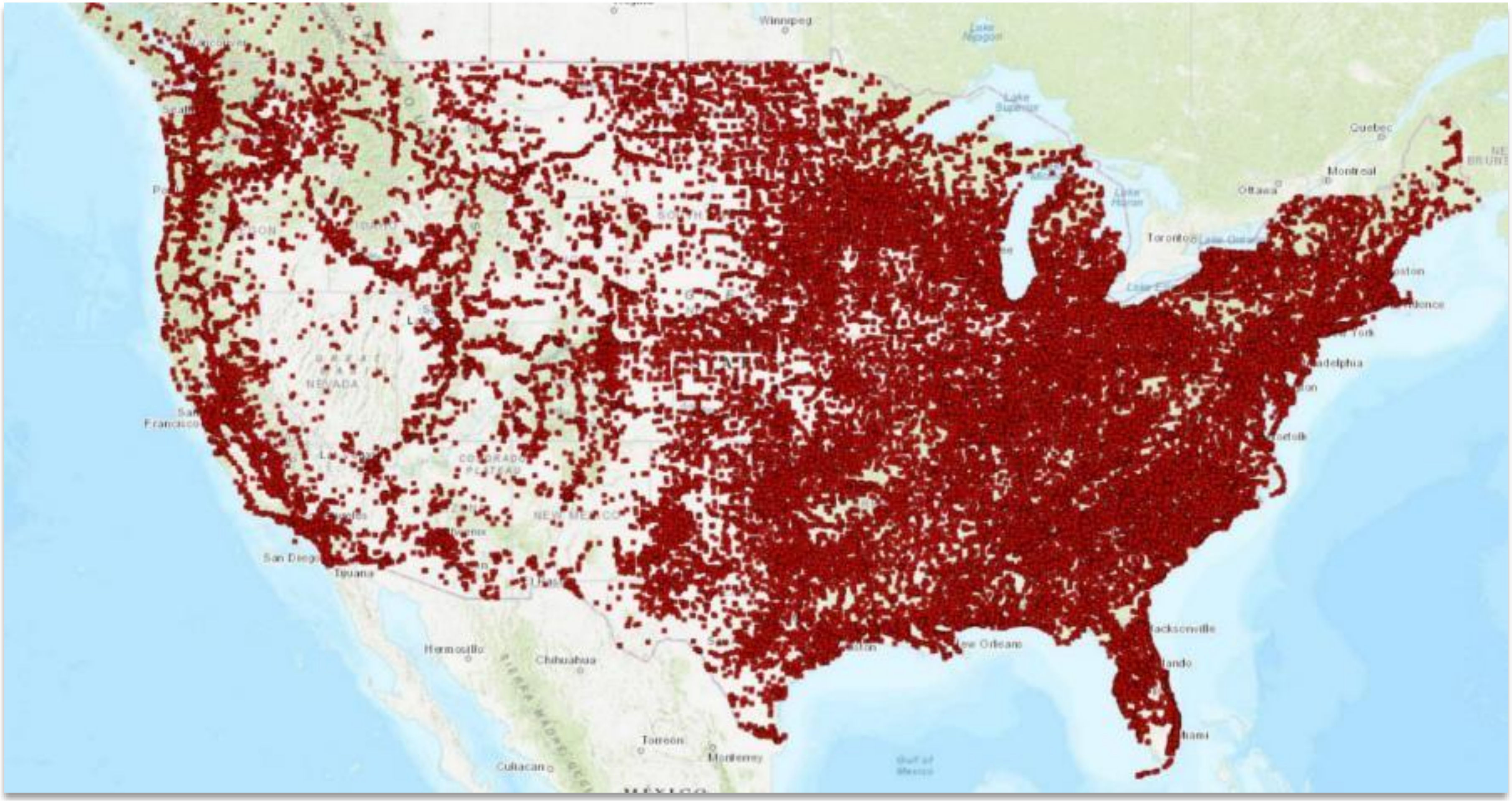
Preliminary Responses



Preliminary Findings:

- ***Upgrades to an Existing Feeder:*** 6-12 months
- ***Dedicated Feeder Lead Time:*** 12-24 months
- ***Build a new Substation:*** 24-36 months

Database of Substations Already Exists



Geospatial Energy Mapper (GEM), Argonne National Laboratory, https://gem.anl.gov/

Includes

- Substation name
- Lat/Long coordinates
- Max/Min voltage

Estimating Local Capacity?

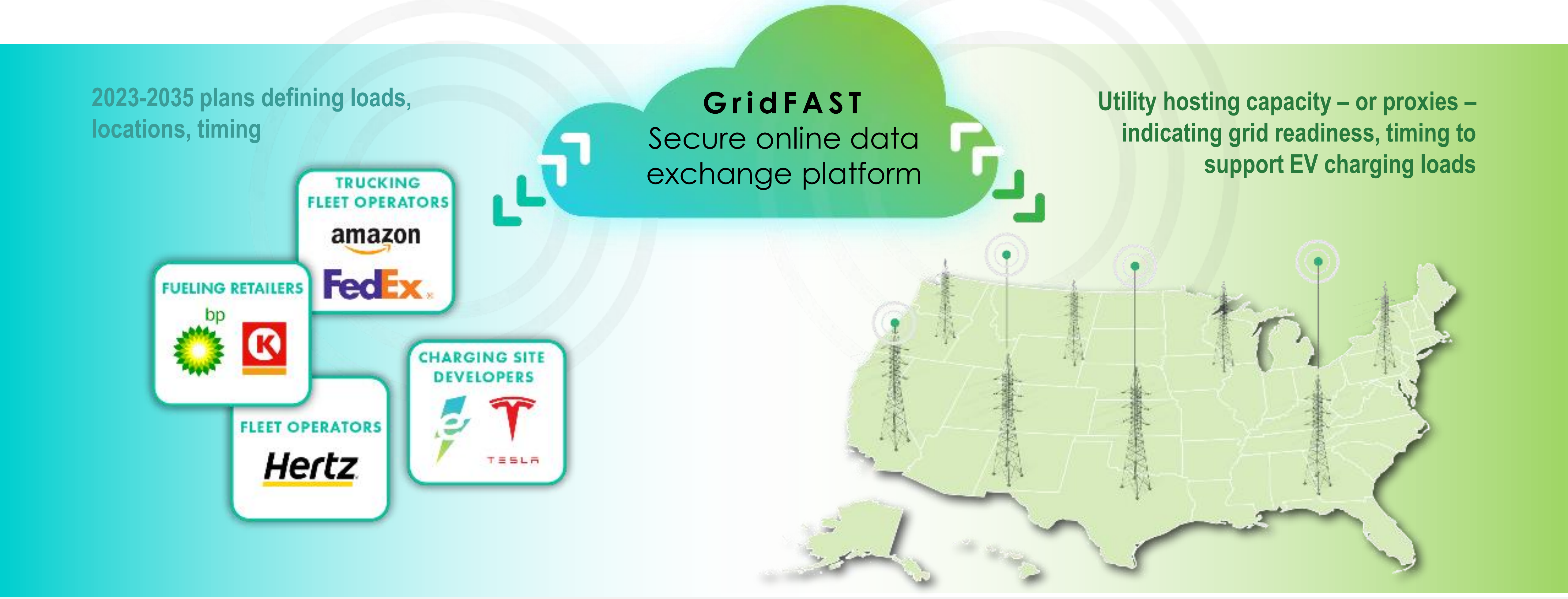
For each substation:

- Location (lat/long)
- Rated capacity (incl. planning limits)
- Voltage class
- Historical peak load

GridFAST vision

EVs2Scale2030

Improve transparency in EV charging planning to inform grid investments and accelerate grid interconnects



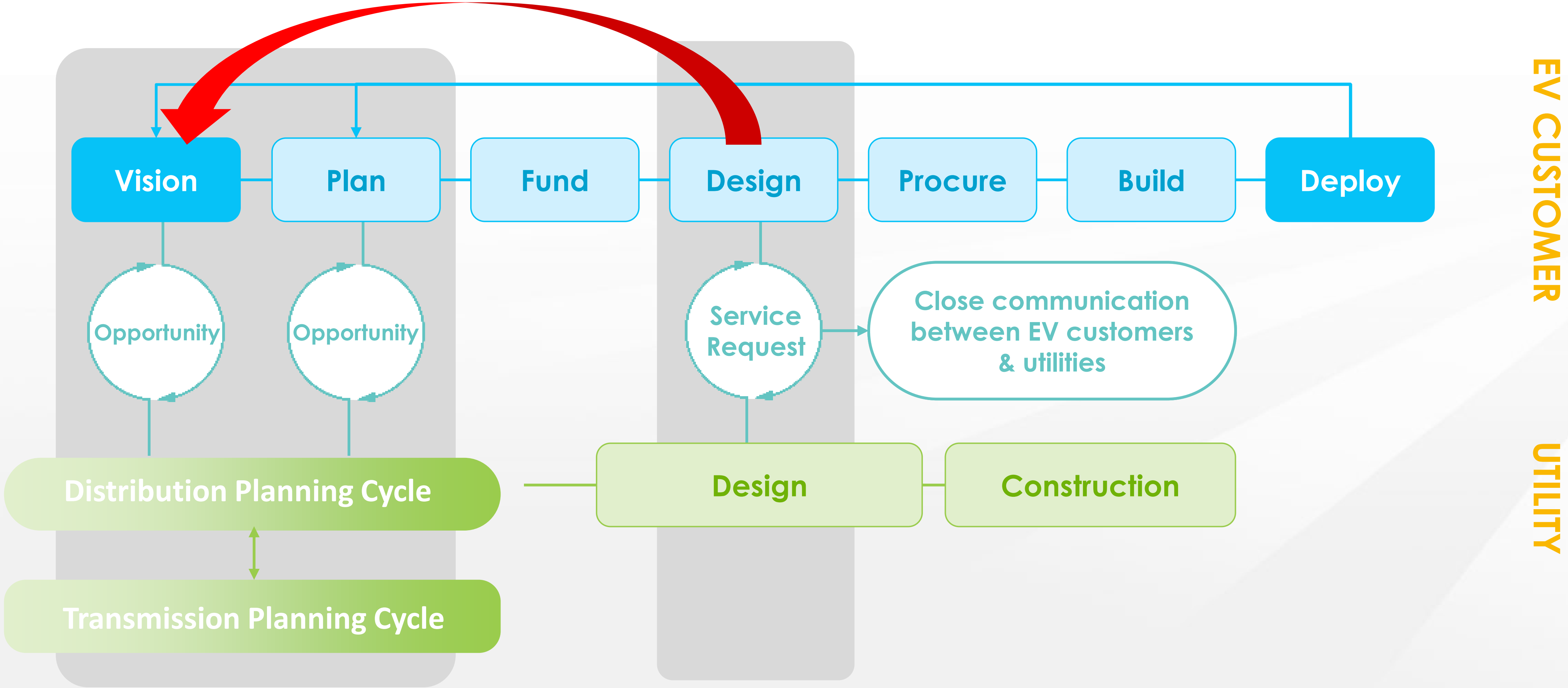
2023-2035 plans defining loads, locations, timing

GridFAST
Secure online data exchange platform

Utility hosting capacity – or proxies – indicating grid readiness, timing to support EV charging loads

Role of GridFAST

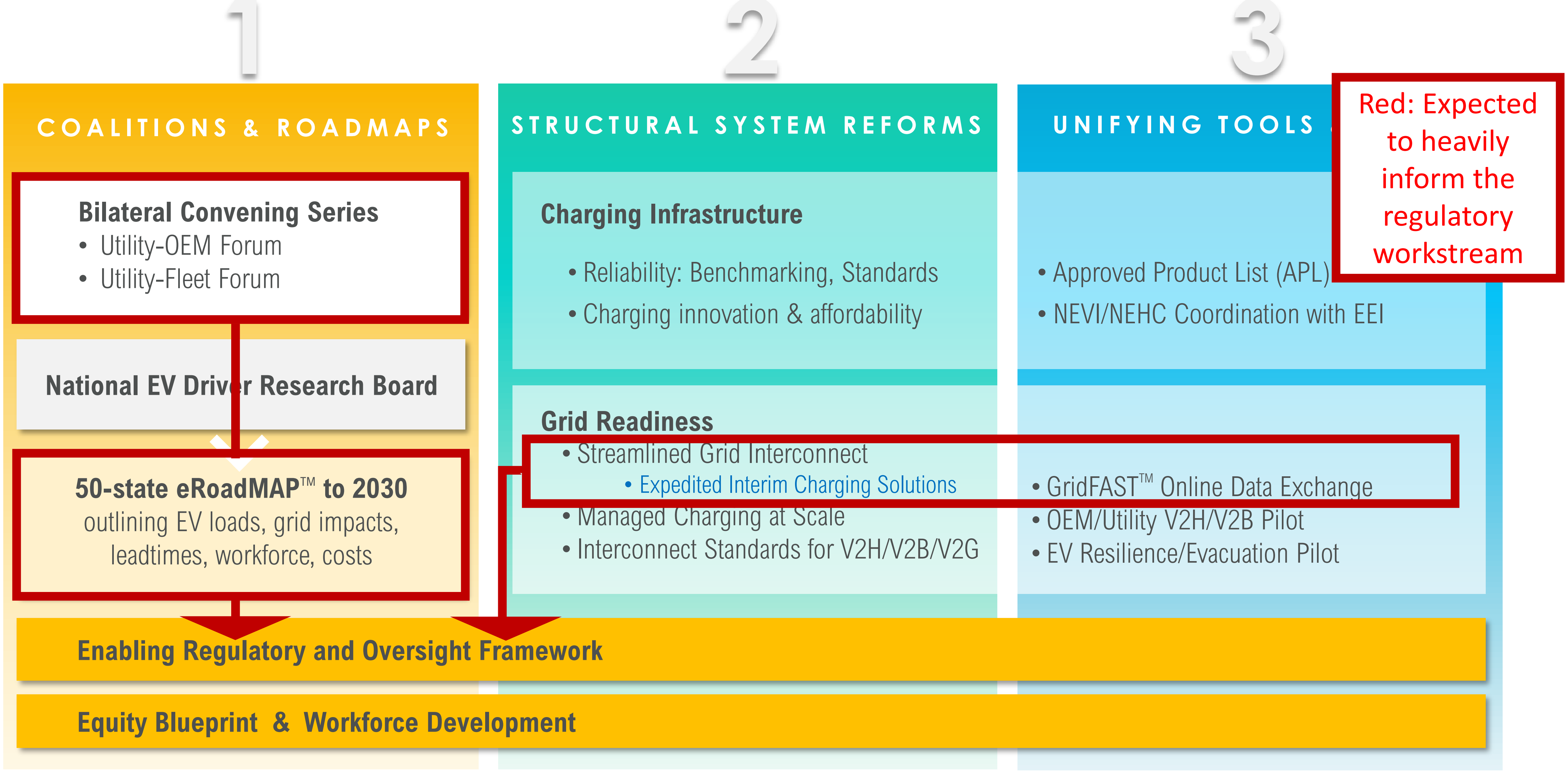
How might we help EV customers and utilities get *actionable* transportation load information, *earlier* into the utility planning process?



Addressing the Barriers to Achieving EVs at Scale

A Three-Pillar Strategy

EVs2Scale2030



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COALITIONS & ROADMAPS

Bilateral Convening Series
- Utility-OEM Forum
- Utility-Fleet Forum

National EV Driver Research Board

50-state eRoadMAP™ to 2030
outlining EV loads, grid impacts, leadtimes, workforce, costs

2

STRUCTURAL SYSTEM REFORMS

Charging Infrastructure
- Reliability: Benchmarking, Standards
- Charging innovation & affordability

Grid Readiness
- Streamlined Grid Interconnect
  - Expedited Interim Charging Solutions
- Managed Charging at Scale
- Interconnect Standards for V2H/V2B/V2G

3

UNIFYING TOOLS

- Approved Product List (APL)
- NEVI/NEHC Coordination with EEI

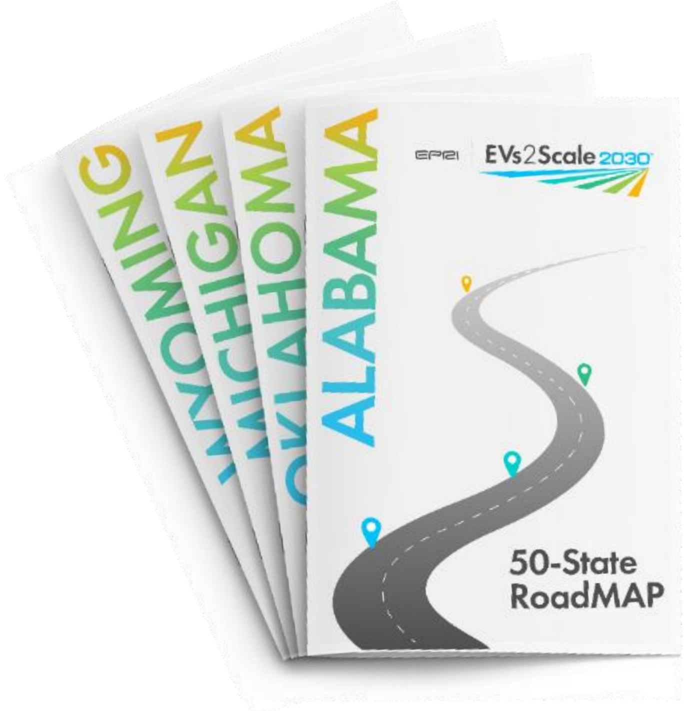
- GridFAST™ Online Data Exchange
- OEM/Utility V2H/V2B Pilot
- EV Resilience/Evacuation Pilot

Red: Expected to heavily inform the regulatory workstream

Enabling Regulatory and Oversight Framework

Equity Blueprint & Workforce Development

Regulatory/Policy Outreach



PROPOSED DELIVERABLE:

A **50-State/National Outreach Package** for regulators, legislators, consumer advocates, and federal agencies that leverages eRoadMAP™ and GridFAST™ to build a case for proactive grid investment that enables timely scale

BY STATE:

- **Economic Opportunities** *(battery plants, assembly plants, EVSE,…)*
- **In-State Revenue Opportunities** *(electricity sales/taxes, downward pressure on rates)*
- **Industry Support** *(letters of support, PUC hearings,…)*
- **Load Forecasting Data Analysis** *(near-term priorities)* ***eRoadMAP™***
- **Grid Impact Analysis** *(substation and feeder level priorities)* ***eRoadMAP™***
- **Leadtime Impacts**
  - Costs (potential solutions and approaches to who pays)

NATIONALLY:

- **Supply Chain Impacts** (transformers, switch gear,…)
- **Grid-Side Costs** (potential solutions and approaches to who pays)
- **IOU vs. Public Power vs. Rural Coop**

Released Reports + Tools

1

EVs2Scale Website

EPRI's EVs2Scale2030™ initiative is a three-year commitment focused on leveraging industry scale to galvanize not only the utility industry, but to align all critical market stakeholders as electric vehicle goals increasingly target 50 percent new vehicle sales by 2030. EPRI will leverage its industry partnerships to mobilize utilities, fleet operators, the automotive industry, and charging providers, and coordinate with federal agencies and labs, to support the rapid deployment of millions of electric vehicles – while minimizing grid impacts and enabling critical benefits to the nation's grid.

EPRI's eRoadMAP™ estimates energy and power needs from transportation electrification at the distribution feeder level. This effort visualizes the unprecedented 2030 electrification challenge in a 50-state roadmap that outlines the

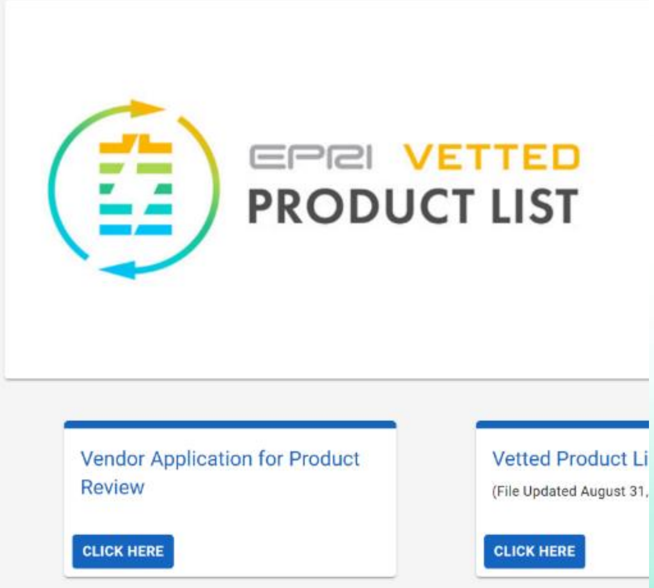
EPRI's GridFAST™ improves transparency in EV charging planning to better inform grid investments and accelerate grid interconnects. This secure online platform is designed to facilitate early conversations and information sharing to

EPRI's Vetted Product List is the nation's most transparent and comprehensive resource for industry stakeholders that evaluates electric vehicle supply equipment against consensed industry criteria and the National EV Instructure

EVs2Scale2030 | EPRI --
https://msites.epri.com/evs2scale2030

2

VPL (Vetted Product List)



Vendor Application for Product Review

CLICK HERE

Vetted Product Li

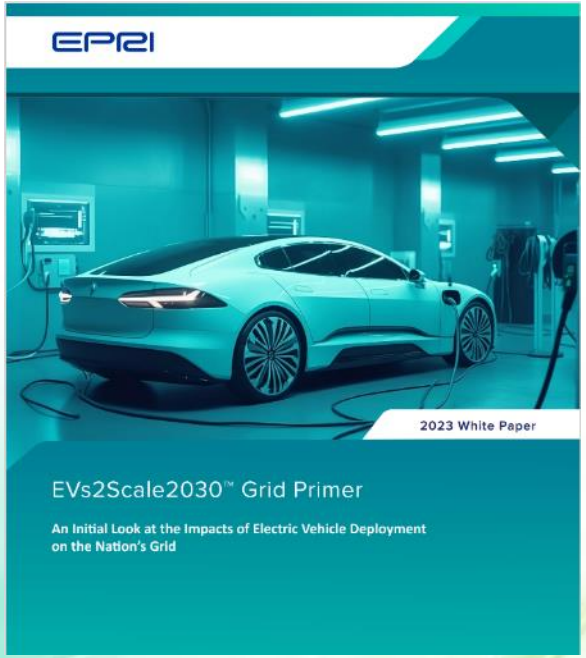
(File Updated August 31,

CLICK HERE

https://www.epri.com/vpl

3

Grid Primer

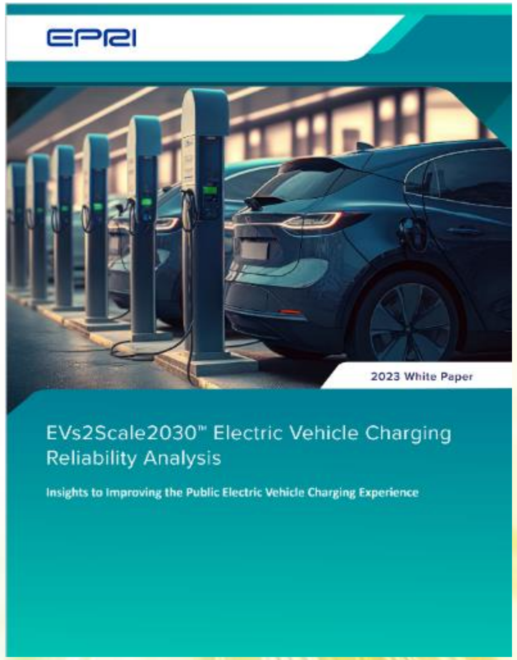


EVs2Scale2030™ Grid Primer

An Initial Look at the Impacts of Electric Vehicle Deployment on the Nation's Grid

4

EV Charging Reliability Analysis



EVs2Scale2030™ Electric Vehicle Charging Reliability Analysis

Insights to Improving the Public Electric Vehicle Charging Experience

5

eRoadMAP™

Mark your calendars:

EPRI's "Electrification 2024" Conference in Savannah, GA 12-14 March, 2024

Thank You

www.epri.com

Thank You for Joining!

MPSC
MICHIGAN PUBLIC SERVICE COMMISSION