NARUC
National Association of Regulatory Utility Commissioners

How Can the Grid Meet Medium-Heavy Duty Vehicle Charging Needs in 2024 and in 2030s?

Commission Staff Only Workshop

Tuesday, February 27, 2024

Part 1: 11:15am - 12:15pm

break for lunch (on your own)

Part 2: 1:45pm - 2:45pm

www.naruc.org/cpi/cpi-home

NARUC would like to thank the U.S. Department of Energy (DOE) for their support.

WELCOME & INTRODUCTIONS

DANIELLE SASS BYRNETT

ROBERT BENNETT

NARUC CENTER FOR PARTNERSHIPS & INNOVATION (CPI)

Overview of the Day

Workshop Objectives:

- Explore near-term challenges & promising approaches to medium and heavy-duty charging infrastructure planning.
- Discuss strategies to energize charging infrastructure quickly.
- Identify longer-term capacity needs, data, & planning with tools such as EPRI's eRoadMAP™

Agenda Review

NARUC Medium-Heavy Duty Vehicle Charging Needs in 2024 and in 2030s Workshop

Tuesday, February 27, 2024 | 11:15 am – 12:15 pm and 1:45 pm – 2:45 pm
NARUC Winter Policy Summit | Westin Hotel - Meeting Room 5 | Washington D.C.

Description:
The NARUC Center for Partnerships & Innovation will host a two-part workshop during the NARUC Winter Policy Summit on "How Can the Grid Meet Medium-Heavy Duty Vehicle Charging Needs in 2024 and in the 2030s." Part 1 will focus on Near-Term Challenges & Promising Approaches. Part 2 will discuss Longer Term Capacity Needs, Data, & Planning. The workshop will feature moderated speaker presentations on recent medium-heavy duty fleet experiences and the new EPRI eRoadMAP™ for understanding where, when, and how much EV charging load could reasonably materialize on the U.S. electric grid. Attendees will be led through an interactive demonstration of eRoadMAP and collaborate with experts and each other to discuss options for connecting large-capacity vehicle chargers.

Workshop Agenda

Part 1: Near-Term Challenges & Promising Approaches (11:15 am – 12:15 pm)

- **11:15 – 11:20am: Workshop Overview**
  - Danielle Sass Byrnett & Robert Bennett, NARUC Center for Partnerships & Innovation
- **11:20 – 12:00pm: Medium-Heavy Duty Fleet Electrification Experiences** (*moderated presentation & questions*)
  - Moderator: Steve Olea, Arizona Corporation Commission
  - Featured Speaker: Mike Roeth, North American Council for Freight Efficiency: Run on Less Campaign
  - Q & A: All attendees
- **12:00 – 12:15pm: Options for Energizing Large Capacity Chargers (***facilitated attendee roundtable***)**
  - Lead Facilitator: Sejal Shah, Joint Office of Energy and Transportation
  - Roundtable: All attendees

Part 2: Longer-Term Capacity Needs, Data, & Planning (1:45 pm – 2:45 pm).

- **1:45 – 2:20pm: Overview of EPRI EVs2Scale2030 and eRoadMAP™** (*moderated presentation & questions*)
  - Moderator: Sarah Mullkoff, Michigan Public Service Commission
  - Featured Speaker: Katherine Stainken, EPRI
  - Q & A: All attendees
- **2:20 – 2:40pm: Predicting Charging Needs: Engagement with the eRoadMAP™ Tool** (*interactive exercise*)
  - Facilitator: EPRI & NARUC
  - Interactive Exercise: All attendees (bring a laptop or use a NARUC laptop)
- **2:40- 2:45pm: Closing and Next Steps**
  - Danielle Sass Byrnett, NARUC Center for Partnerships & Innovation

KEY FACTS FOR MHD CHARGING

ROBERT BENNETT

NARUC CENTER FOR PARTNERSHIPS & INNOVATION (CPI)

FROM 2024 ATLAS PUBLIC POLICY ANALYSIS

Key Fact 1: MHD Charging is here to stay, and will continue to grow

Schneider National, Inc. | El Monte, CA | Operational

- There are currently 16 chargers, each capable of charging two trucks at 350 kW simultaneously, with plans to electrify all 92 heavy-duty tractors on site.

Daimler Trucks North America and Portland General Electric "Electric Island" | Portland, OR | Operational

- The public "Electric Island" opened in April of 2022. The site has eight 350 kW chargers designed to support heavy-duty truck charging. The site is less than one mile from I-5.

One Energy's 30 megawatt (MW) Charging Hub | Findlay, OH | In Construction (energized)

- Once complete, the site will host 90 300 kW chargers, capable of being used by 90 semi-trucks simultaneously. The site is expandable to 150 MW.

Axis Electrified Truck Charging Site | Newark, NJ | Planned (end of 2024)

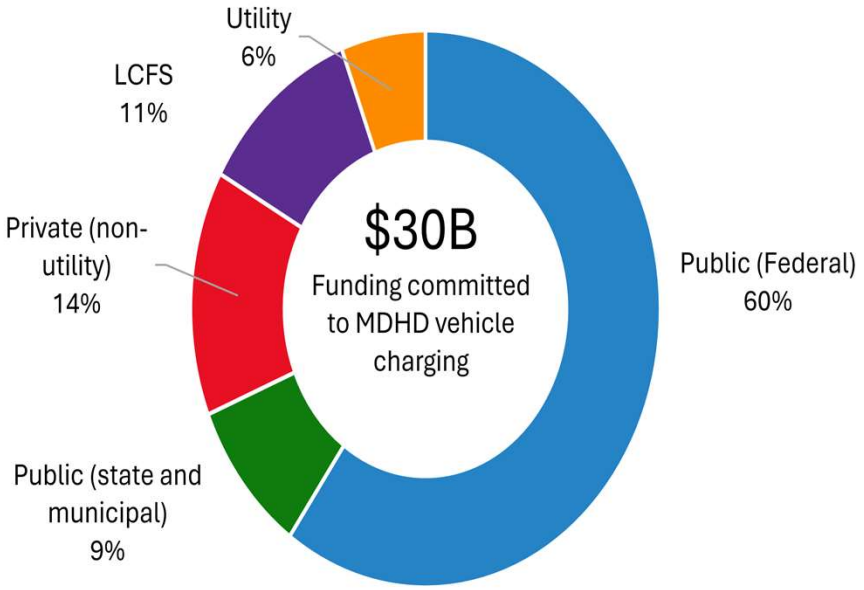
- Axis Electrified is developing an electric truck charging site with eight 120 kW chargers. The site will also include 60 Level 2 chargers to support MDHD vehicles as well as other vehicle types. The site is near Route 21, Route 9, and the New Jersey Turnpike.

Key Fact 2: MHD Charging Infrastructure Investments reached $30 Billion through 2023

Utility investment for MHD reached over $6 Billion in 2023

- There are now active and planned utility programs, credits, rebates, etc., for MHD charging:
  - Duke Energy (Florida, North Carolina, Indiana)
  - Xcel Energy (Minnesota, Colorado)
  - DTE Energy (Michigan)
  - Ameren (Illinois)
  - Eversource (Massachusetts)

Estimated U.S. MHD Charging investments available through November 2023



Key Fact 3: Over $300 Billion in federal funding opportunities eligible for MHD charging investments

Federal Funding Opportunities where MHD is eligible	Investment (billions)
National Highway Performance Program	$148.0
Surface Transportation Block Grant Program	$72.0
Congestion Mitigation and Air Quality Improvement program	$13.2
Infrastructure for Rebuilding America Grant Program	$8.0
Rebuilding American Infrastructure with Sustainability and Equity	$7.5
National Highway Freight Program	$7.2
Carbon Reduction Program	$6.4
Low or No Emission Vehicle Program	$5.6
Federal Lands and Tribal Transportation Program	$5.2
Bus and Bus Facilities Grant Program	$5.1
National Electric Vehicle Infrastructure Formula Program	$5.0
Clean School Bus Program	$5.0
Climate Pollution Reduction Grants	$5.0
Clean Ports Program	$3.0
Grants for Charging and Fueling Infrastructure	$2.5
Port Infrastructure Development Program	$2.3
Rural Surface Transportation Grant Program	$2.0
Clean Heavy Duty Vehicle Program	$1.0

Agenda

Medium-Heavy Duty Fleet Electrification Experiences

Moderator:

- Steve Olea, Arizona Corporation Commission

Speaker:

- Mike Roeth, North American Council for Freight Efficiency: Run on Less Campaign

EV Workshop: How Can the Grid Meet Medium-Heavy Duty Vehicle Charging Needs in 2024 and in 2030s

NARUC, February 27, 2024

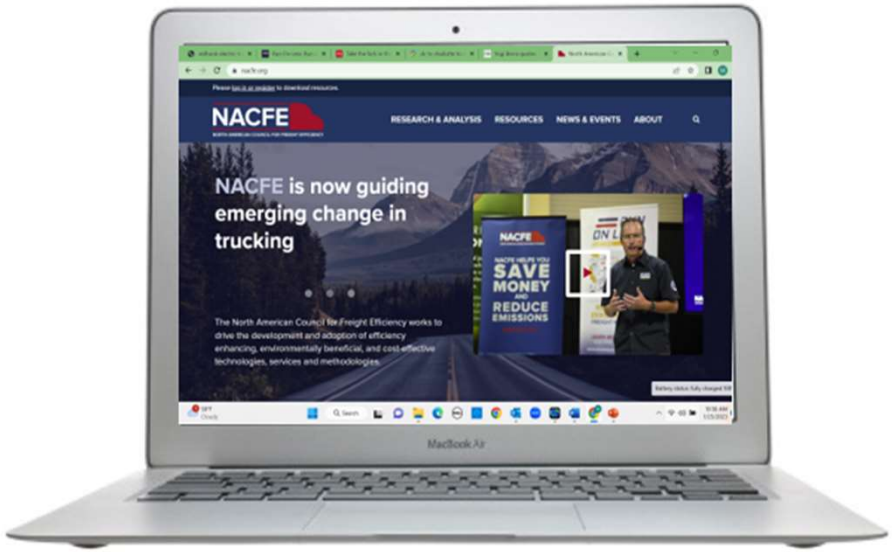
Run on Less – Electric DEPOT

Mike Roeth, Executive Director

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

RMI
ENERGY. TRANSFORMED.

North American Council for Freight Efficiency



- Unbiased, fuel agnostic, non-profit
- Mission to double freight efficiency
- All stakeholders
- Scale available technologies, guide emerging change and Run on Less demonstrations.

www.NACFE.org

www.RunonLess.com

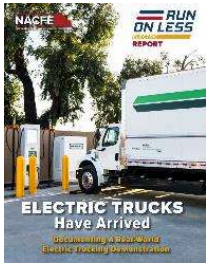
NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

IN PARTNERSHIP WITH

RMI
ENERGY. TRANSFORMED.

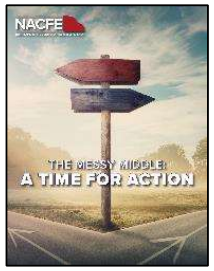
February 18, 2024

Key NACFE Reports on ZEV Trucks



Jan 2022
Review Of Demonstration:
Electric Trucks Have Arrived

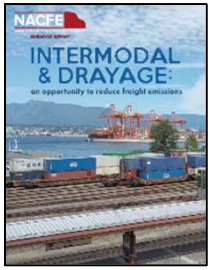
4 Market Segment Fact Sheets



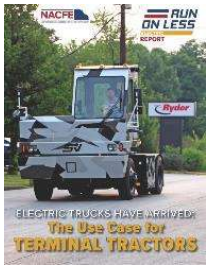
Feb 2023
The Messy Middle:
A Time For Action

Dec 2020
Making Sense of Heavy Duty
Hydrogen Fuel Cell Tractors

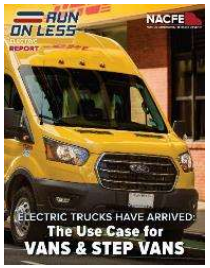
Apr 2023
Hydrogen Trucks:
Long-Hauls Future?



Dec 2023
Intermodal &
Drayage

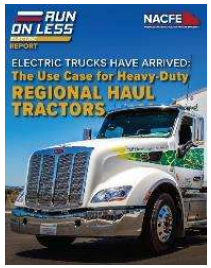


Mar 2022
The Use Case For
Terminal Tractors

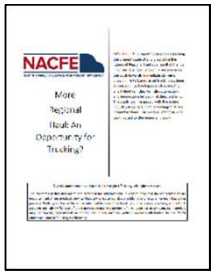


Apr 2022
The Use Case For
Vans & Step Vans

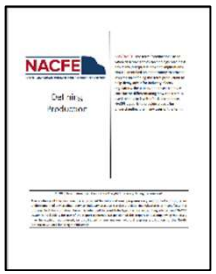
Jun 2022
The Use Case For
Medium Duty
Box Trucks



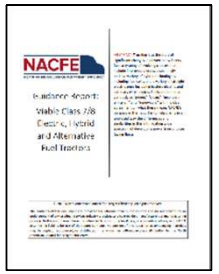
May 2022
The Use Case For
Regional Haul
Tractors



Apr 2019
More Regional Haul:
An Opportunity for
Trucking?

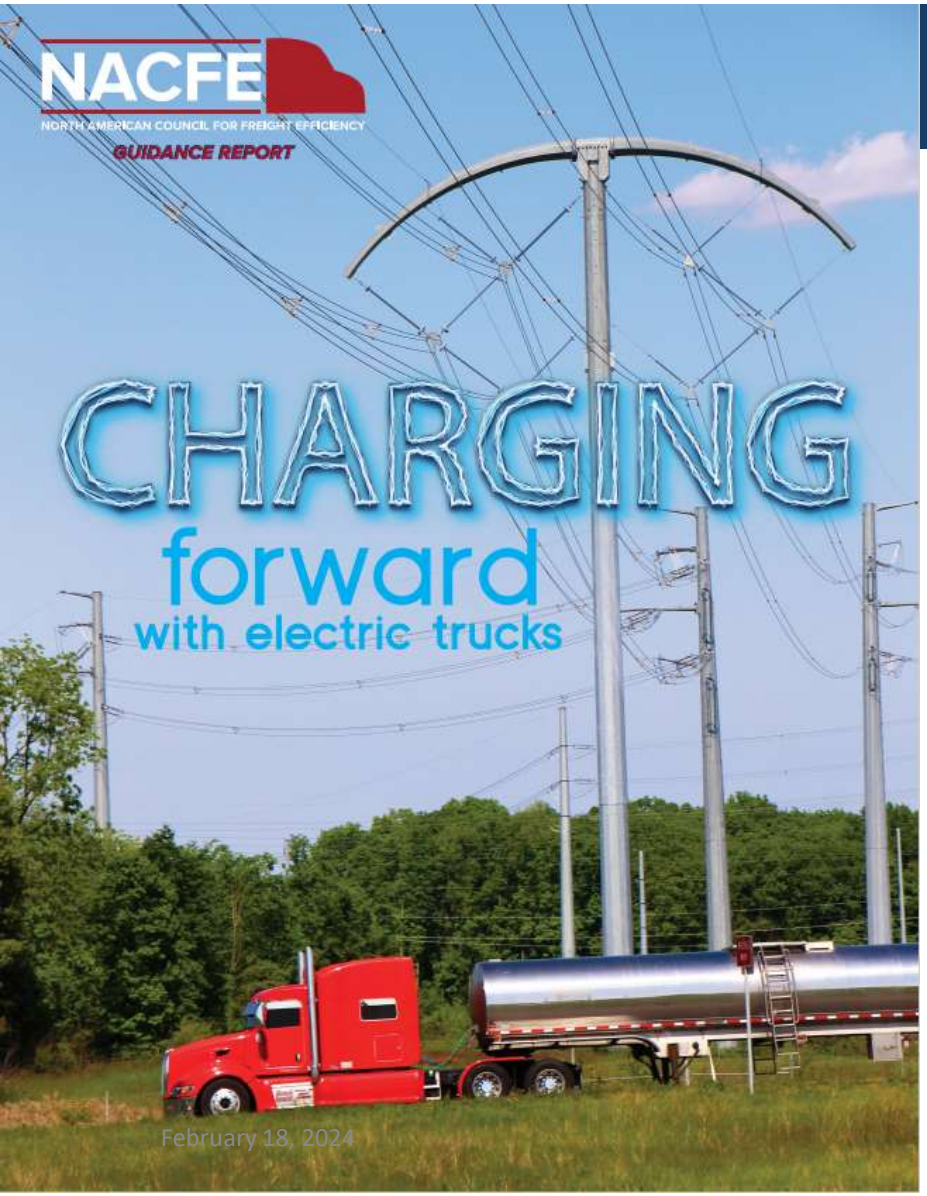


Jan 2020
Defining
Production



Dec 2019
Viable Class 7/8
Electric, Hybrid and
Alternative Fuel
Tractors

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY



Charging Forward GR

Conclusions:

- Electric trucks and chargers must work together
- Your utility is a key partner
- Use and design greatly affect charging cost
- The transition requires staff and attention
- Consider other charging business models
- Other key considerations
  - Grants & incentives
  - Microgrids
  - Landlords
  - Reliability and interoperability of chargers
  - And more…

https://nacfe.org/research/electric-trucks/#charging-infrastructure

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

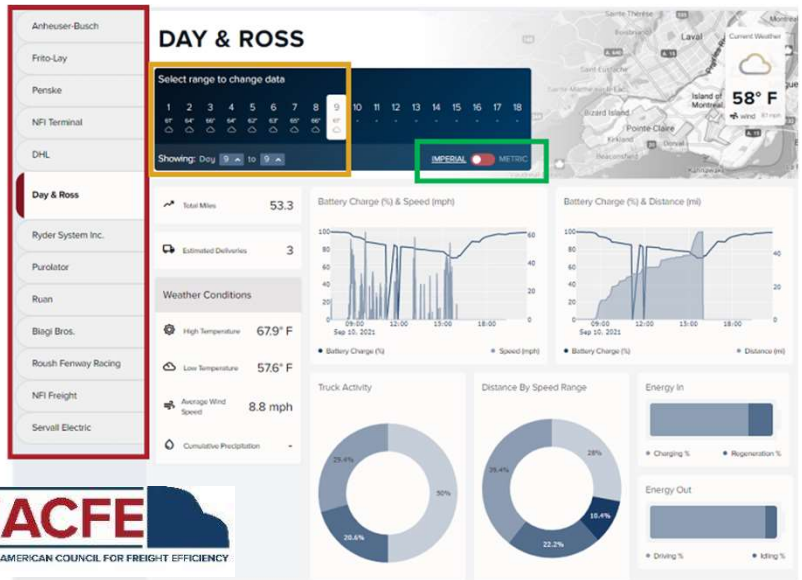
Run on Less - “Best of the Best”

2017	2019	2021	2023
RUN ON LESS BY NACFE	RUN ON LESS REGIONAL	RUN ON LESS ELECTRIC	RUN ON LESS ELECTRIC DEPOT
			
Long Haul 7 Fleets 10.1 MPG	**Regional Haul** 10 Fleets 8.3 MPG	**All BEVs** 13 Fleets New metrics!	**BEV Depots** 10 Depots Infrastructure

Real-World, Real-Time Case Studies

- For each fleet & OEM
- Fleet Interviews: Drivers & Leaders
- OEM Interviews & more

1. Select any of the 13 fleets
2. Select a day or range of days
3. Select Units of Measure
4. Use the data!



NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

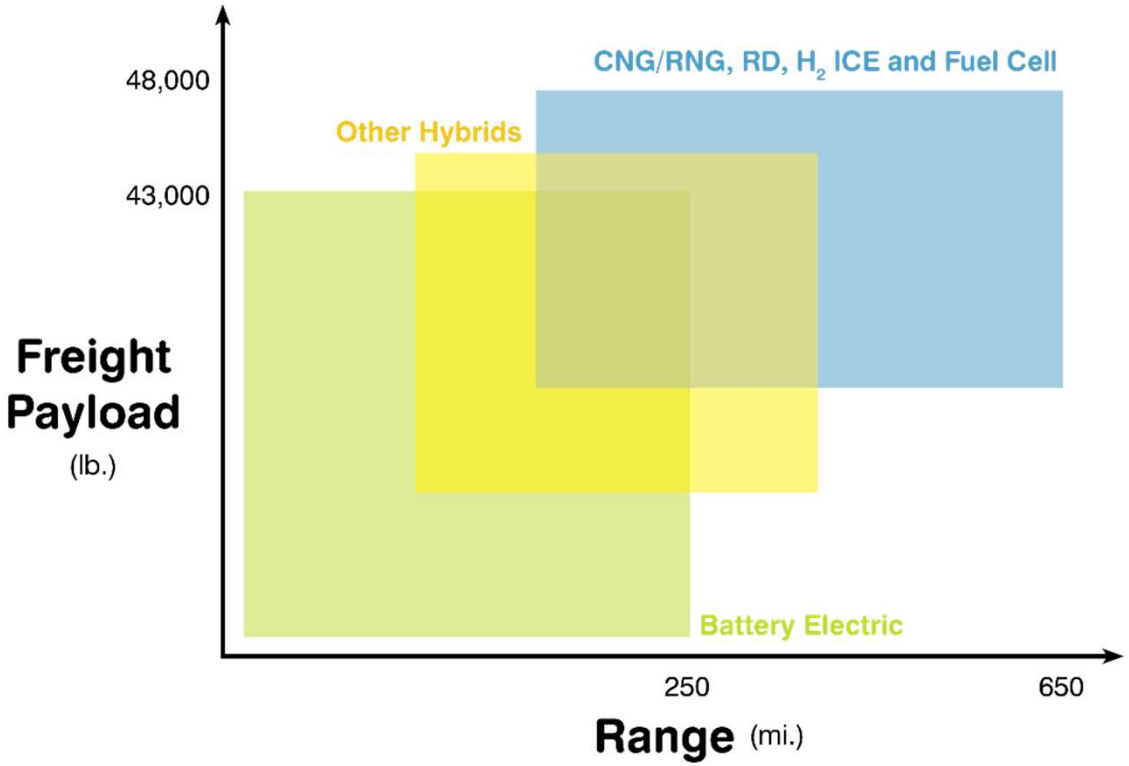
Market Segmentation & ZEV Reports

Class 3-6	Vans & Step Vans		RoL-E Vans & Step Vans EV Use Case – Apr ‘22
Class 6	MD Box Trucks		MD Electric Trucks TCO – Oct ’18 RoL-E MD Box Trucks EV Use Case – Jun ‘22
Class 7&8	Reg Haul - Return to Base	Short	ZEV for Drayage Report – Coming Jan ’24 More Reg Haul – An Opportunity – Apr ’19 Viable Class 7/8 Electric Trucks – Dec ‘19 RoL-E Report EVs Have Arrived – Jan ‘22 RoL-E Terminal Tractors Use Case – Mar ’22 RoL-E HD Tractors Use Case – May ’22 Charging Forward (Infrastructure) – Jun ‘23
		Medium	
		Long	
	Long Haul - Disparate Routes		Elec Trucks Where They Make Sense – May ’18 Hydrogen Trucks LH’s Future – Apr ‘23

Run on Less – Electric DEPOT

BEV AND HFCEV - Weight and Range

Optimum Duty Cycle Sweet Spot



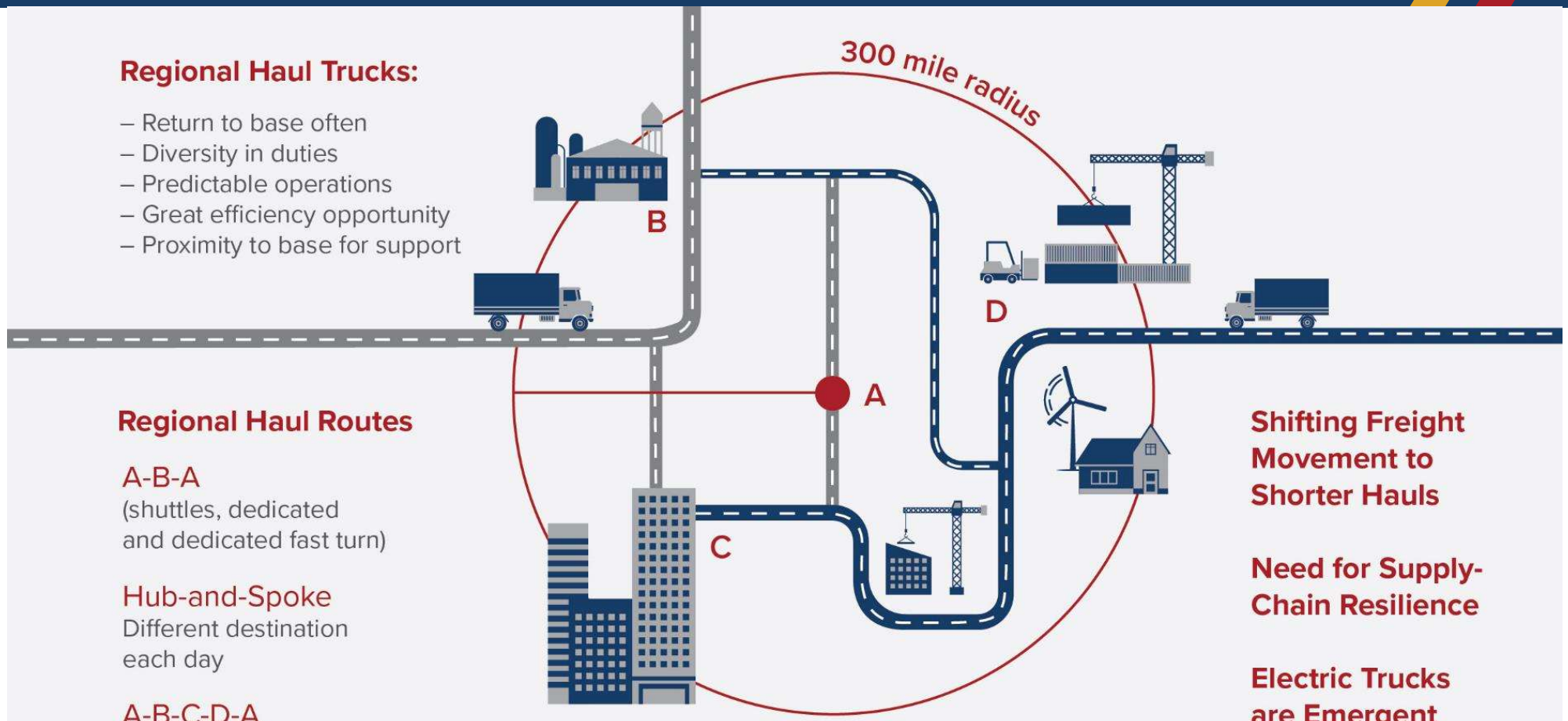
Different Solutions Perform Differently

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

More Regional Haul: Good for Trucking

Regional Haul Trucks:

– Return to base often
– Diversity in duties
– Predictable operations
– Great efficiency opportunity
– Proximity to base for support



Regional Haul Routes

A-B-A
(shuttles, dedicated and dedicated fast turn)

Hub-and-Spoke
Different destination each day

A-B-C-D-A
(city, diminishing load, and milk runs)

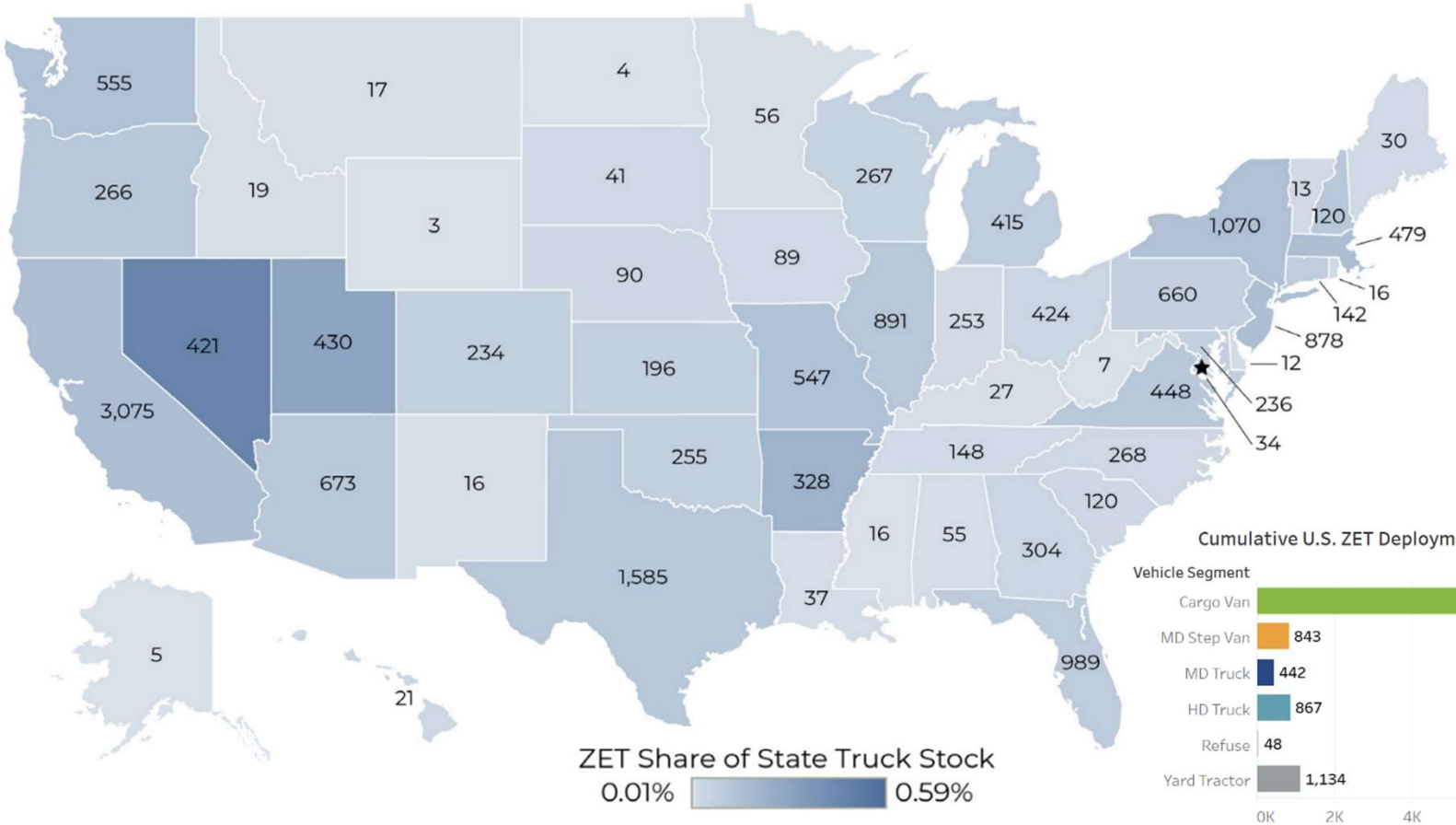
Shifting Freight Movement to Shorter Hauls

Need for Supply-Chain Resilience

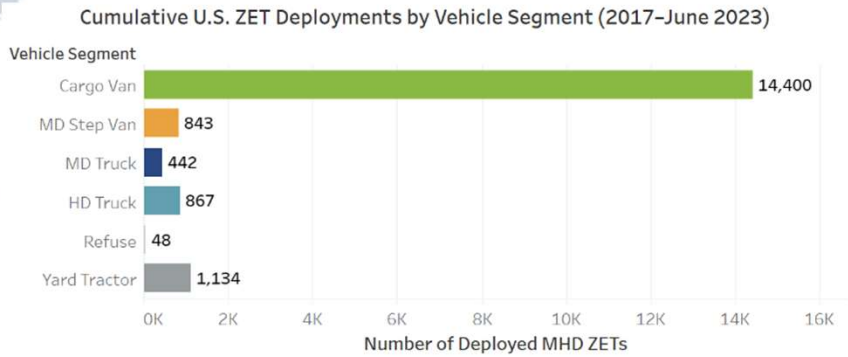
Electric Trucks are Emergent

Source: https://nacfe.org/research/thought-leadership/#more-regional-haul

EV Truck Deployments (Jan '24)



- Deployed as of June 2023
- 17,734 Zero Emission Trucks Deployed 2b-8
- 13% are in California (2022 = 46% and 2021=60%)



Source: Calstart January 2024

[Zeroing in on Zero-Emission Trucks: The State of the U.S. Market (calstart.org)]

HD Truck Charging

1) Fleet Depot Based

2) Opportunity Charging

3) Shared Locations

4) Charging Hubs

5) Truck Stops

6) Other Areas?

7) Mobile Roadside Charging (emergencies & service calls)

8) In Motion Charging

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

DEPOT Learning

122 Interviews!!

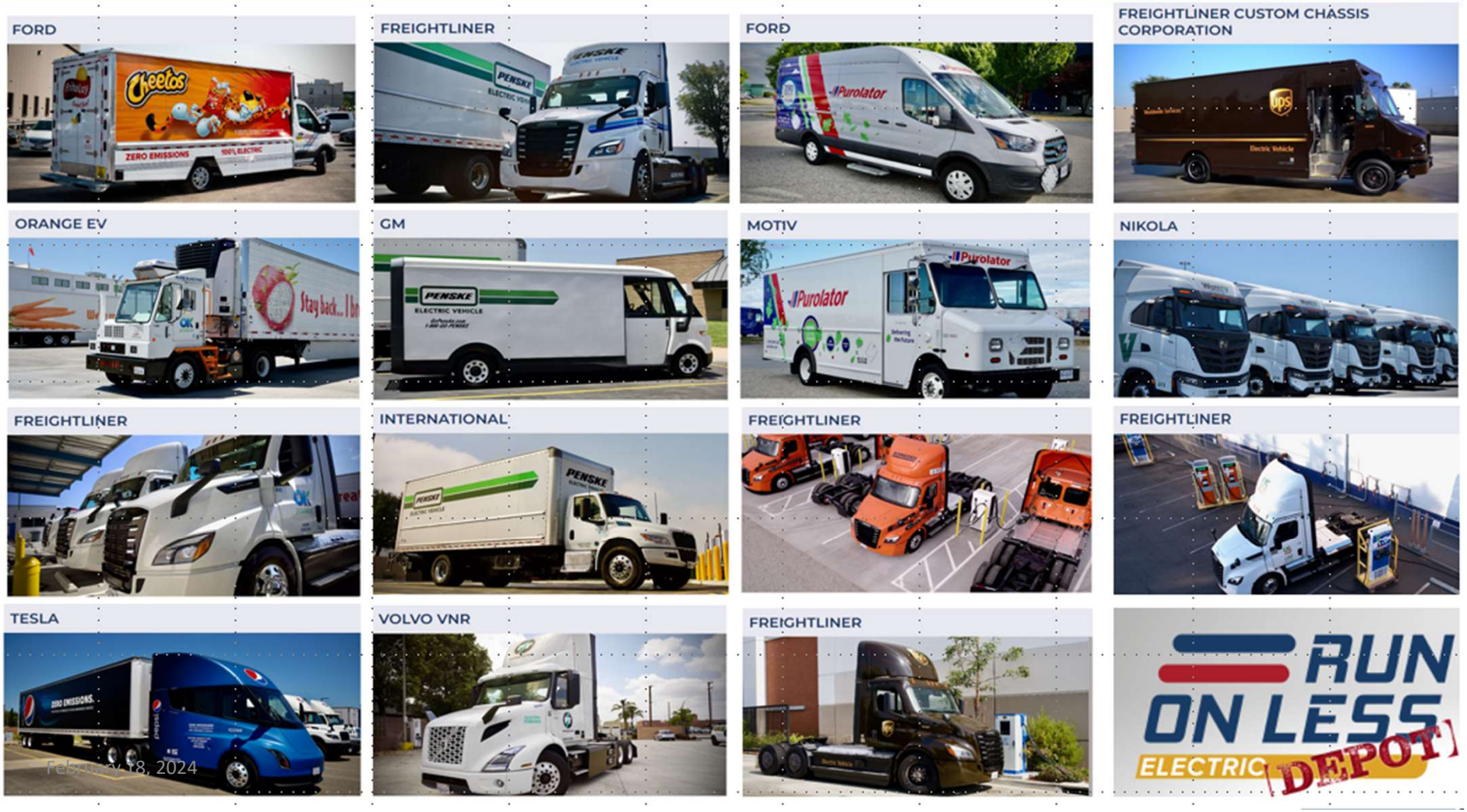
10 Fleet Profile Videos

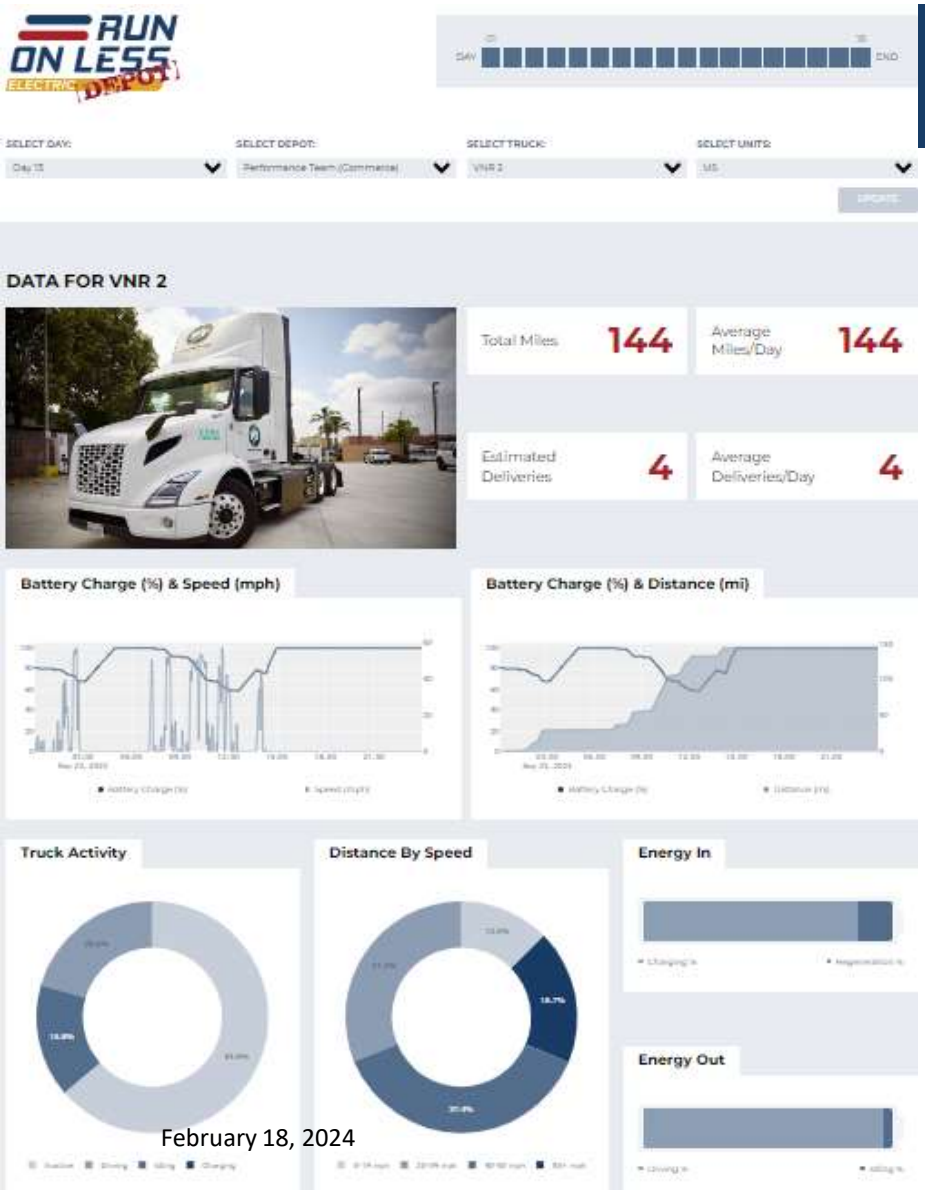
10 Stories from the Run Videos

Video - https://vimeo.com/875689229


Purolator
Richmond, BC
pepsi
Sacramento, CA
US. FOODS
La Mirada, CA
Frito Lay
Good fun!
Queens, NY
ok produce
Fresno, CA
PENSKE
Ontario, CA
SCALING
REAL-WORLD, ZERO-EMISSION
FREIGHT MOVEMENT
SCHNEIDER
South El Monte, CA
PERFORMANCE TEAM
Commerce, CA
ups
Compton, CA
WattEV
Long Beach, CA
RUN ON LESS
ELECTRIC
DEPOT

Run on Less Electric DEPOT BEVs





Metrics

DATA at RunOnLess.com!

Select:

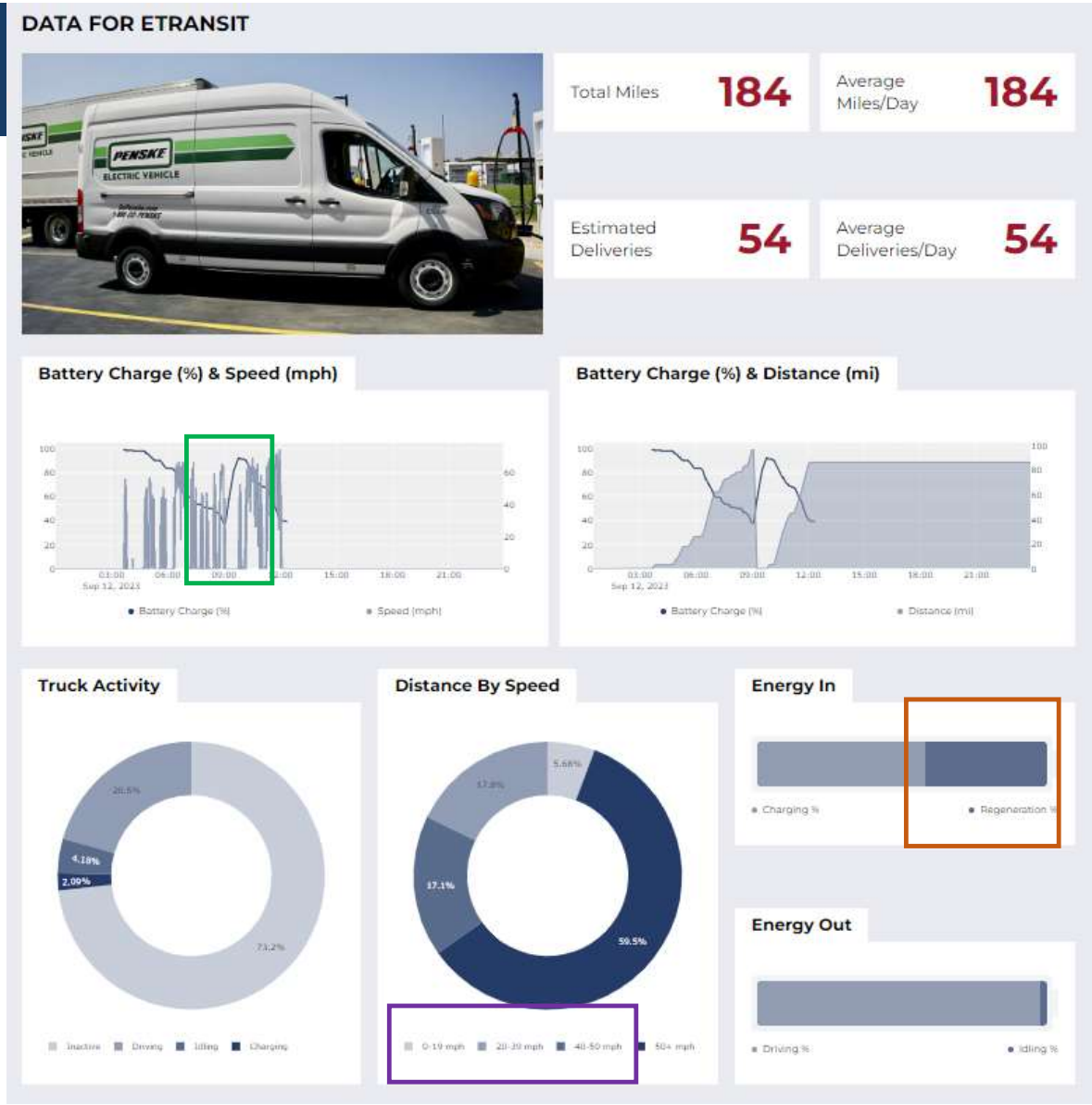
1) Fleet
2) Truck
3) Day
4) Units of Measure

https://results-2023.runonless.com/

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

RoL-E DEPOT

- Penske Day 2 eTransit
- 184 miles in a single shift
- 54 deliveries
- Fully charged with another charge middle of the day
- A lot of regenerative braking
- 41% of miles under 50 MPH



https://results-2023.runonless.com/

February 18, 2024

Art of Probable

- Tesla Semi 3 Day 17 at Pepsi
- Sacramento CA depot
- 410 miles on a single charge 1076 miles in 24 hours
- 5 deliveries
- Three charging sessions
- Some regenerative braking
- Most of the day above 50 MPH

https://results-2023.runonless.com/

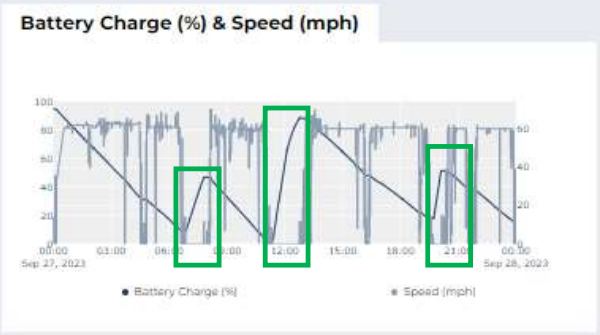
February 18, 2024

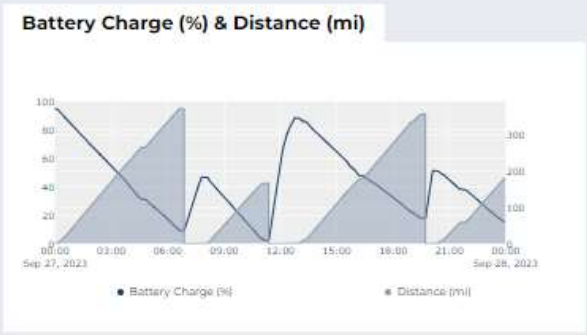
Total Miles 1076

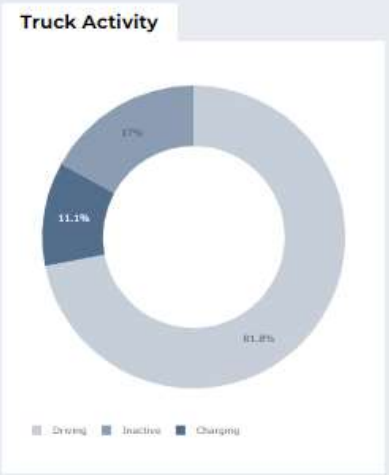
Average Miles/Day 1076

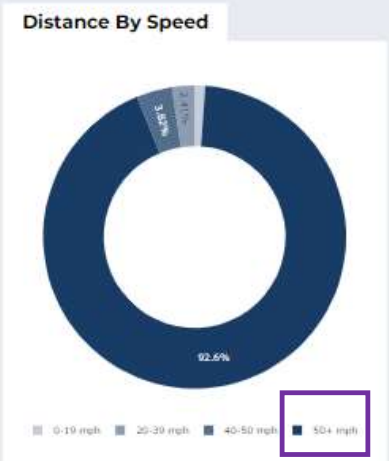
Estimated Deliveries 1

Average Deliveries/Day 1









Depot Energy for 100% EVs

- Small Energy Depots = <10 MWh/day
- Medium Energy Depots = 10 – 35 MWh/day
- Large Energy Depots > 35 MWh/day

- Frito-Lay Queens = 0.9 MWh/day
- Schneider El Monte = 52 MWh/day

Given NACFE modeling of current electric trucks and known duty cycles for all trucks at each site.

February 18, 2024 https://runonless.com/run-on-less-electric-depot-reports/

Complexity In Both Industries

Truck Fleets

Trucks
Tractors
Trailers

Drivers:
Company
Independent Contractors
Owner-Operators

Vehicles:
Owned
Leased

Facilities:
Owned
Leased

Dozens of different applications

Fuels: diesel, biodiesel, CNG, LNG, LP, DME, electric, hydrogen, renewable diesel, RNG, RLP, hybrids & more

Utilities

Services:
Generation
Transmission
Distribution

Ownership:
Independent
Municipal
Cooperatives

Rate Structures:
Time Of Use
Demand Charges

Regulated
& Unregulated

Fuels: NG, coal, hydroelectric, solar, wind, nuclear, and more

"If you've seen one ___, you have only seen one."

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

NACFE

NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

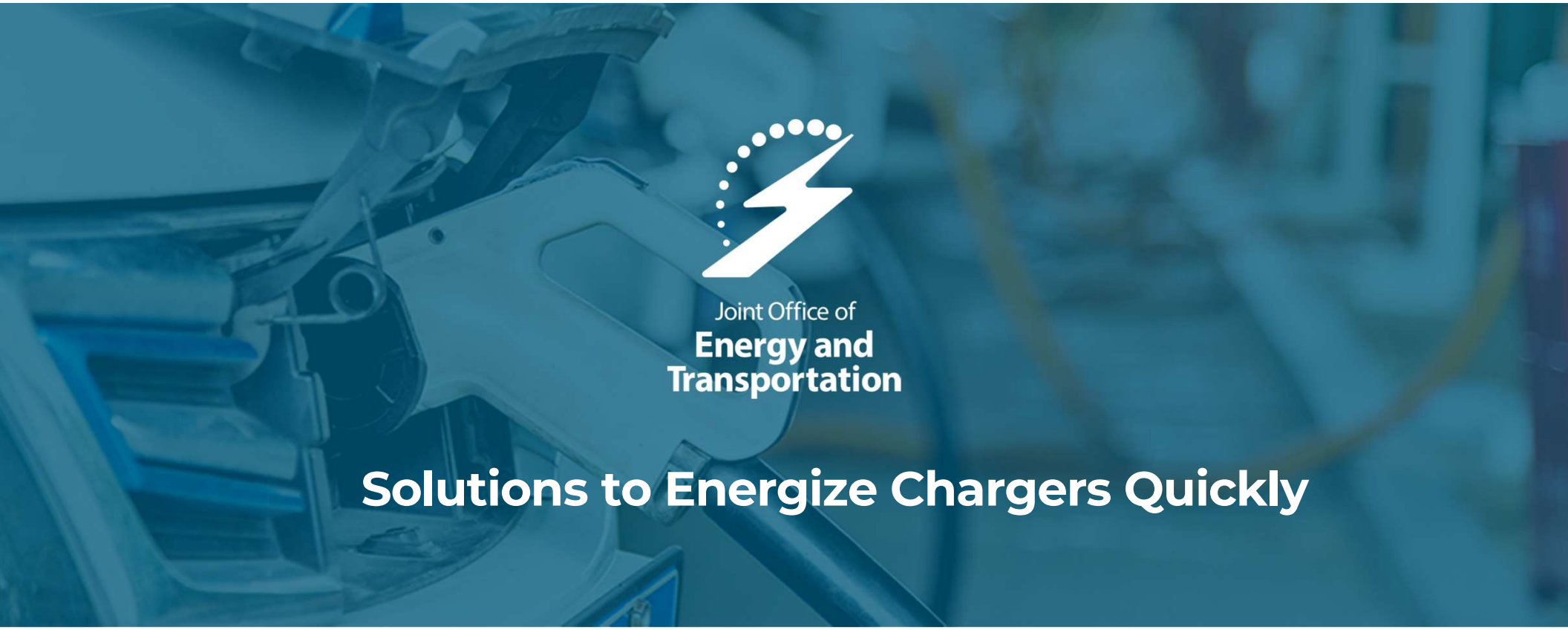
THANK YOU

February 18, 2024

Options for Energizing Large Capacity Chargers

Lead Facilitator:

- Sejal Shah, Joint Office of Energy and Transportation



Solutions to Energize Chargers Quickly

February 27, 2024

Sejal Shah, Senior Advisor for Utility Programs and Policies

driveelectric.gov

The Issue of EV Charger Energizing Timelines

- EV charger installations have relatively short lead times
- Given available funding (federal/state/utility), large number of service load/interconnection request applications may be submitted at a given time
- Electric utility tools/techniques/processes are NOT setup to handle this increased number of applications

EV Charger Energization Timelines

- Level 2 and DC Fast charger timelines

- From The Interstate Renewable Energy Council (IREC) 2022 paper
- Survey results from 6 EV charging station developers that work across multiple states
- Timelines are longer if utility side upgrades are not planned or further delays due to supply chain issues

Paving the Way: Emerging Best Practices for Electric Vehicle Charger Interconnection. IREC June 2022

Terminology

- Interconnection is often used interchangeably to describe EV charging service requests
  - However, generation interconnection queue (to transmission) is different and separate
  - Using load/new service request terminology can provide clarity

Load/New Service Requests

EV Charging, building

Interconnection Requests

Generation or bi-directional or EV charger with storage
EV charger project above specific kW

Some ideas for utilities to speed charger energization

Data Access and Transparency	Improve Process and Timing	Promote Economic Efficiency
• Communicate early / often re: ICN studies & modeling assumptions • Share distribution & ICN data w/customers • Use modern utility-facing tools to manage, analyze, visualize HCA	• Allow flexible ICN & service requests until upgrades complete • Balance effectiveness, equity, and open access thru commercial readiness req'ts • Automate ICN process steps • Upskill utility workforce, e.g., training on IEEE 1547-2018	• Group studies & group cost allocation • Pursue strategic proactive distribution investments • Improve coordination & data exchange b/t ICN and distribution planning processes • Collaborate w/ customers to reduce peak load impacts

What can you add? Fill out an index card and raise your hand to share.

Break for lunch!

Please return at 1:45 pm – 2:45 pm with your laptop for:

Part 2: Longer-Term Capacity Needs, Data, & Planning

Agenda

Overview of EPRI EVs2Scale2030 and eRoadMAP™

Moderator:

- Sarah Mullkoff, Michigan Public Service Commission

Speakers:

- Katherine Stainken, EPRI
- Mike Rowand, EPRI

EVs2Scale 2030™

Presentation for NARUC: Longer-term capacity needs, data, and planning

Katherine Stainken

Mike Rowand

February 27th, 2024

About EPRI

- EPRI is a 501c3 non-profit that does research on issues related to electric utilities for the public good.
- Founded in 1972.
- EPRI represents about 90% of the electricity in the U.S.
- Mission is:
  - Advancing safe, reliable, affordable and clean energy for society through global collaboration, science and technology innovation, and applied research.
- EPRI does research in ~30 countries.

Agenda

- Part 1: Near-term challenges and promising approaches (11:15am – 12:15pm).
- Part 2: Longer-term capacity needs, data, and planning (1:45pm – 2:45pm).
    1. Level set and brief background on EVs2Scale 2030 Initiative
    2. eRoadMAP
        - Interactive! Get your computers ready!
        - Approach, data.
        - Future plans.
    3. Proactive planning: three starting points.

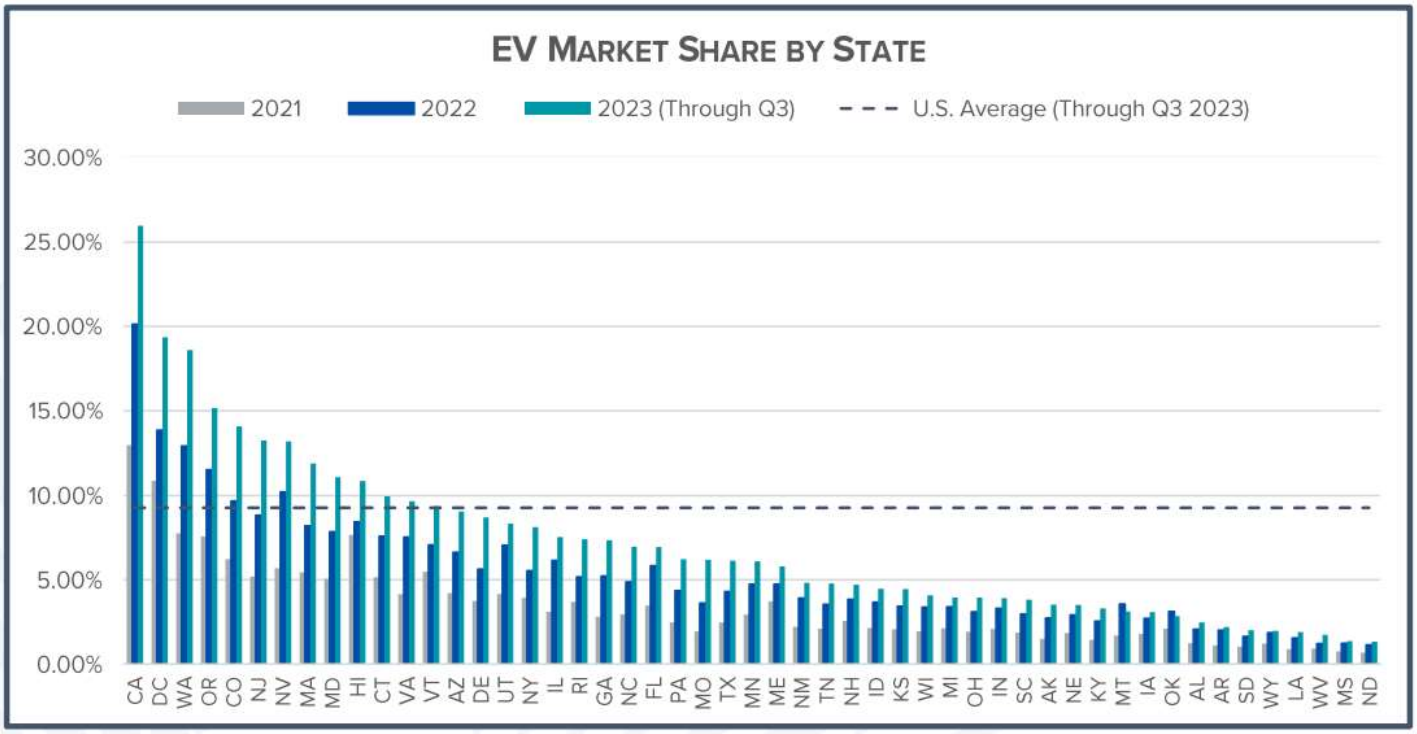
EV load is different than normal building load.

- Timing mismatch: Fleets can receive vehicles in a much shorter timeframe than electric service upgrades can be completed. This is impacting EV adoption today.
  - Electric Trucks can be delivered in < 4-6 months
  - Utility grid interconnects can take 18–24 months (or much longer)
- "Energy density" increasing: Load increases at fleet depots of 10x or more will be common, frequently exceeding distribution infrastructure capacity – no comparable precedent.
- Increasing role of public policy: Many states have decarbonization goals, EV mandates that are accelerating adoption rates.
- Being proactive is needed to ensure: 1) affordability for all customers, 2) public policy objectives met, and 3) utilities can serve the EV loads in a timely manner and meet obligation.

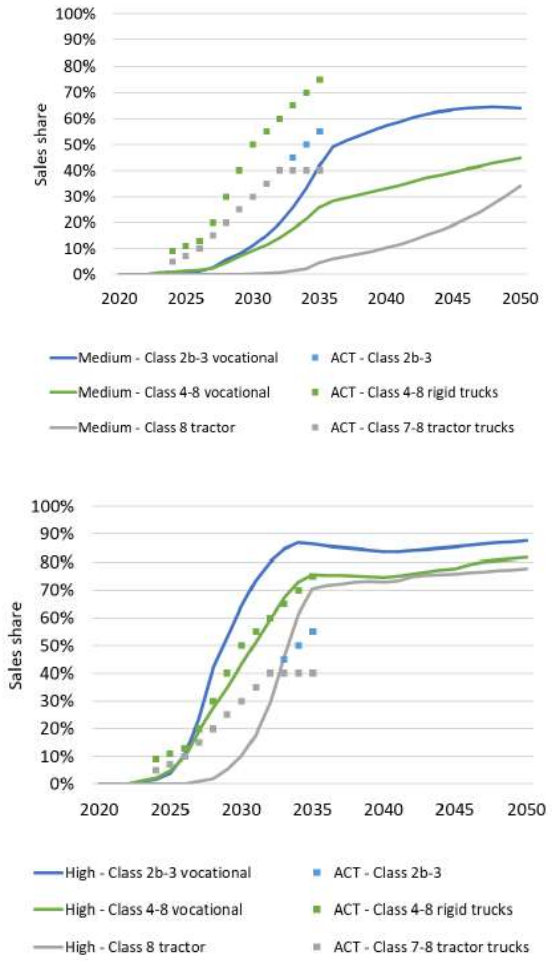
BAU is not an option. Utilities should not be impeding early adoption – or any adoption – of EVs.

EVs2Scale 2030

Light-Duty



MHD



1) *Source: Alliance for Automotive Innovation, "Get Connected EV Quarterly Report", Third Quarter 2023. https://www.autosinnovate.org/posts/papers-reports/Get%20Connected%20EV%20Quarterly%20Report%202023%20Q3.pdf*

EPRI

The Utility Challenge – Why EVs2Scale 2030

- 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**
- Consumers and fleets operators are **increasingly looking to the utility industry to scale up efforts** to support charging solutions, ensure the grid is capable of meeting vehicle loads

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

EVs2Scale 2030

1 2 3

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

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

UNIFYING TOOLS & PILOTS

- Vetted Product List (VPL)
- 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

Addressing the Barriers to Achieving EVs at Scale

A Three-Pillar Strategy to Address the Key Industry Gaps

EVs2Scale 2030™

1 2 3

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

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

UNIFYING TOOLS & PILOTS

- Vetted Product List (VPL); 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

Collaboration + Partnerships

Ongoing Outreach

EVs2Scale 2030

UTILITY INDUSTRY	AUTO & TRUCKING INDUSTRY	FLEET OPERATORS	CHARGING PROVIDERS AND FUELING RETAILERS	NGO & STANDARD-SETTING ORGANIZATIONS
EPRI	Ford	amazon	Kroger	NRDC
LPPC	Tesla	PENSKE	electrify america	EDF
EEI	BMW	Enterprise Mobility	US FOODS	RMI
NRECA	Audi	Uber	flo EV Charging	CHARIN
American Public Power Association	Toyota	lyft	chargepoint	SAE International
Alliance for Transportation Electrification	Mercedes-Benz	Walmart	EVgo FAST CHARGING	ATLAS PUBLIC POLICY
NASUCA	Volvo	PITT OHIO	bp	Plug In America
NARUC	PACCAR	FedEx	Shell	Electric Vehicle Association
	GM	J.B. HUNT		
	Rivian	element		
	Daimler	NAFA		
	Honda	LeasePlan		
	Alliance for Automotive Innovation			
	Volkswagen			
	NACFE			
	NADA			

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
LPPC, Rachel Huang
NARUC, Katherine Peretick (Michigan PSC)
National Grid, Rudy Wynter
NRECA, Angela Strickland
NYPA, Fabio Mantovani
Southern Company, Chris Cummiskey

EVs2Scale 2030™

PROJECT PARTNERS

BROAD INDUSTRY SUPPORT

amazon

Ameren

AUSTIN ENERGY®

CenterPoint® Energy

conEdison

FirstEnergy®

GREAT RIVER ENERGY.

JEA® Building Community®

nationalgrid

New York Power Authority

Your Energy Partner® OPPD Omaha Public Power District

PGE

PG&E®

Seattle City Light

SOUTHERN CALIFORNIA EDISON®

Southern Company

SMUD®

SRP

Xcel Energy®

eRoadMAP™

EV load is coming – but where and when exactly?

- We need granular level data from the fleets themselves.
  - DMV data doesn't always work.
  - Buying data sets aren't always complete.
  - County level, census tract level data isn't granular enough.

- **The eRoadMAP data builds confidence** and **shows clear signals** for where and when EV load is coming.

eRoadMAP

ANALYTICS

EPRI

U.S. DEPARTMENT OF ENERGY

ATLAS PUBLIC POLICY

BERKELEY LAB
Lawrence Berkeley National Laboratory

icct
THE INTERNATIONAL COUNCIL

Environmental Defense Fund

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

RMI
ENERGY. TRANSFORMED.

DATA

amazon

DAIMLER TRUCK

Enterprise Mobility™

FIRSTstudent

NADA NATIONAL AUTOMOBILE DEALERS ASSOCIATION

PACCAR

VOLVO TRUCKS

WORLD RESOURCES INSTITUTE

Other:

Experian

GEOTAB ITS

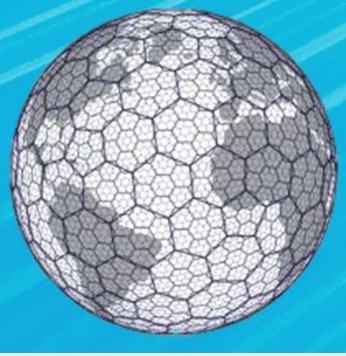
INRIX

REPLICA

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



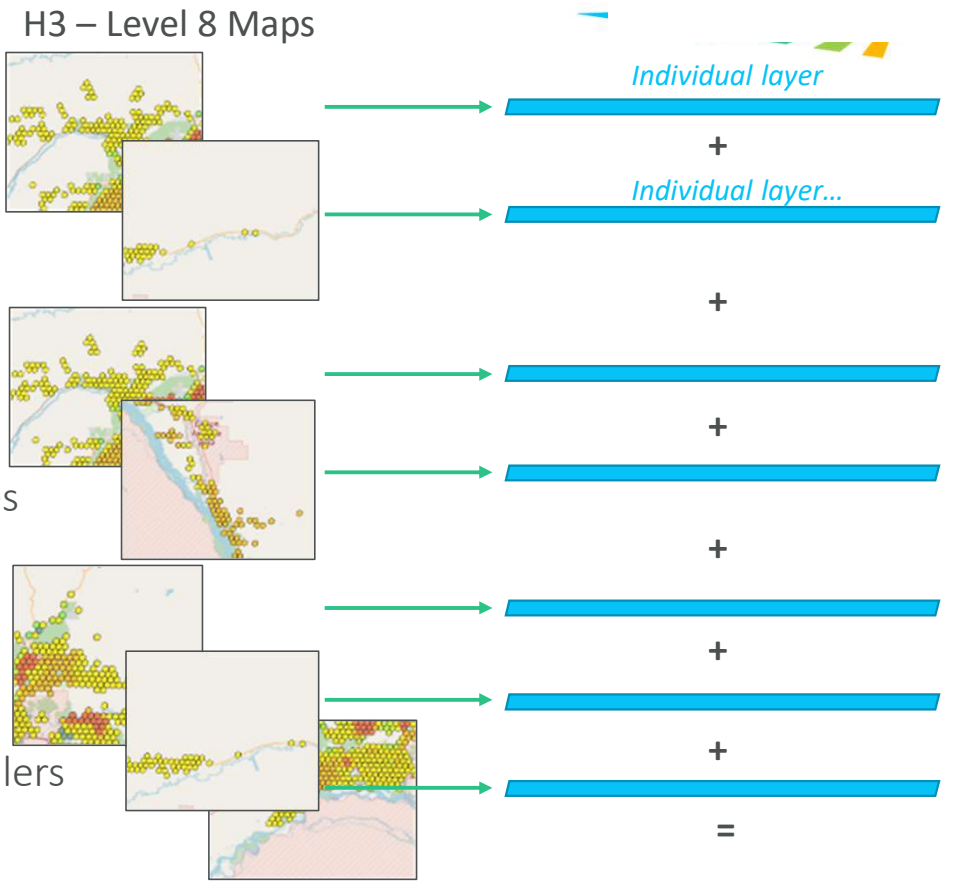
2 LAYERED DATA APPROACH

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



One map with energy + power needs

**EV Service Providers*

Interactive eRoadMAP Session

eroadmap.epri.com

- Find your state.
- Pick a city.
- Zoom in.
- Questions:

1. How does the load change over time?
2. How does the hex color change?
3. What is the split between LD and MHD?

Interactive eRoadMAP Session

EVs2Scale 2030

eroadmap.epri.com

- Find your state.
- Pick a city.
- Zoom in.
- Questions:

1. How does the load change over time?
2. How does the hex color change?
3. What is the split between LD and MHD?

- Click on full electrification scenario.
- Zoom in and out.

- Questions:

1. Are trends appearing for rural vs. urban loads?
2. Breakdown of hotspot areas in IOU vs. muni vs. coop service territories?
3. What do you see appearing along corridors?
4. How many hexes are greater than 32 MWh?

Going deeper - Where can I find more on the methology and approach?

U.S. = Hex 5 (98 mi^2)

eRoadMAP Overview | Data Sources and Methodology

EVs2Scale 2030

Document Conventional Vehicle Behavior

REGISTRATIONS	TRAVEL AND DWELL BEHAVIOR
Experian	REPLICA, DAIMLER TRUCK, VOLVO TRUCKS, INRIX, GEOTAB ITS, PACCAR

+ Weighting as needed to supplement and represent the behavior of the full LDV-MDV-HDV U.S. vehicle fleet

Convert to EV Energy Needs to Meet 2030 State and Federal Policy Mandates/Goals

FEDERAL GOAL	STATE MANDATES		
50% LDV sales electric in 2030	**ACT by 2030 (CA + 7 States):** Class 2b-3 = 30% of sales Class 7-8 tractors = 30% of sales Class 4-8 = 50% of sales	**ACF by 2030 (CA):** Class 2b-3= ~47% Class 7-8 tractors = 100% Class 4-8= ~79%	**Rest of U.S.:** No policy assumed; some spillover effects from tech advances

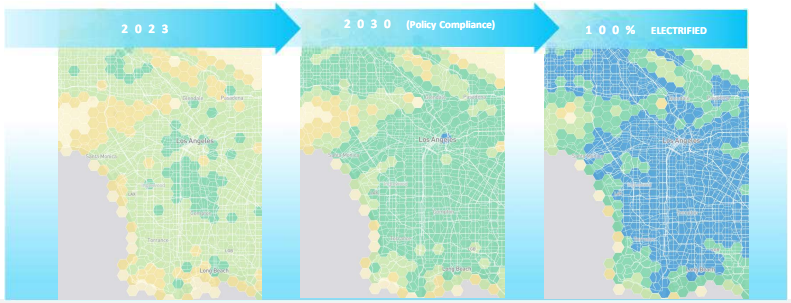
+ Adoption Trajectories which align with the state and federal goals and mandates

Add Fleet Electrification + Charging Plans

ELECTRIFICATION PLANS (ongoing)

amazon, Enterprise Mobility™, WORLD RESOURCES INSTITUTE, FIRSTstudent, NADA NATIONAL AUTOMOBILE DEALERS ASSOCIATION

- Overlapping Fleet Data above to ensure no double-counting of load data

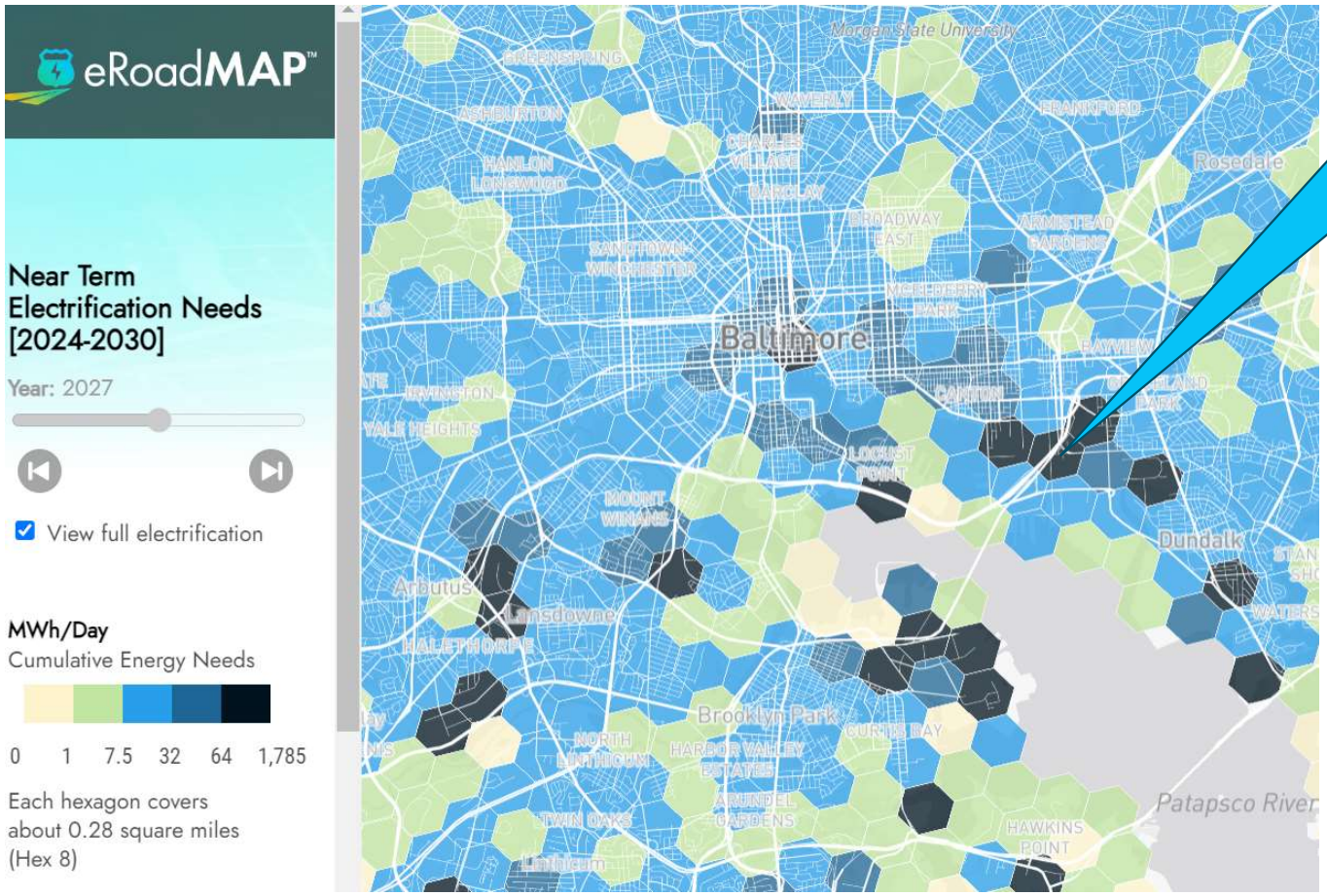


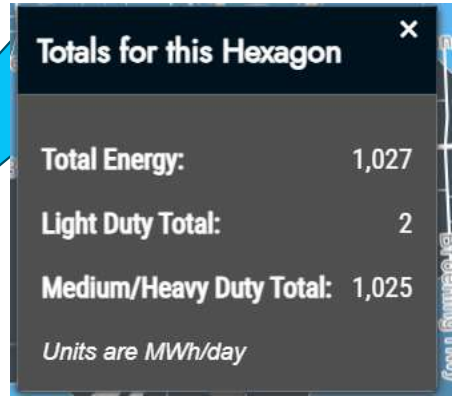
eRoadMAP.epri.com

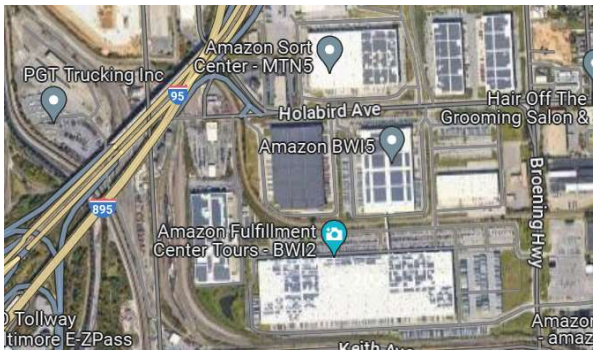
EPRI

Google Satellite

U.S. = Hex 8 (0.28 mi^2)







(Shows: Amazon fulfillment center, PGT Trucking, ACE Warehouse, Blueprint Robotics, etc.)

Future Plans

Near Term – E2024 - March

- Satellite layer
- Ability to filter by MWh/day
- Public Hosting Capacity Maps (sample)
- Justice 40 layer
- Household income layer
- Multi Family Dwelling layer
- Flood Plain layer
- Truck Stops layer
- Current Charging Stations
- API – to have access to up to date data

Mid-Term - Sept

- Power
- Managed charging scenarios
- Segmenting vehicles by VMT
- Local temperature/terrain effects on efficiency
- Grid Capacity

Data Layers in the works - Ongoing

- GeoTab
- Navistar
- Add'l Class 8 provider
- Enterprise – airports
- School buses – multiple sources
- Additional supplemental Layers

Power

- What managed charging scenarios should be assumed?

1. Plug in when the vehicle gets to its destination. (5pm)
2. Managed charging so the vehicle is ready. (7am)
3. Perfectly managed charging- minimized power over maximum time. This scenario also represents potentially multiple TOU scenarios together.

Capacity

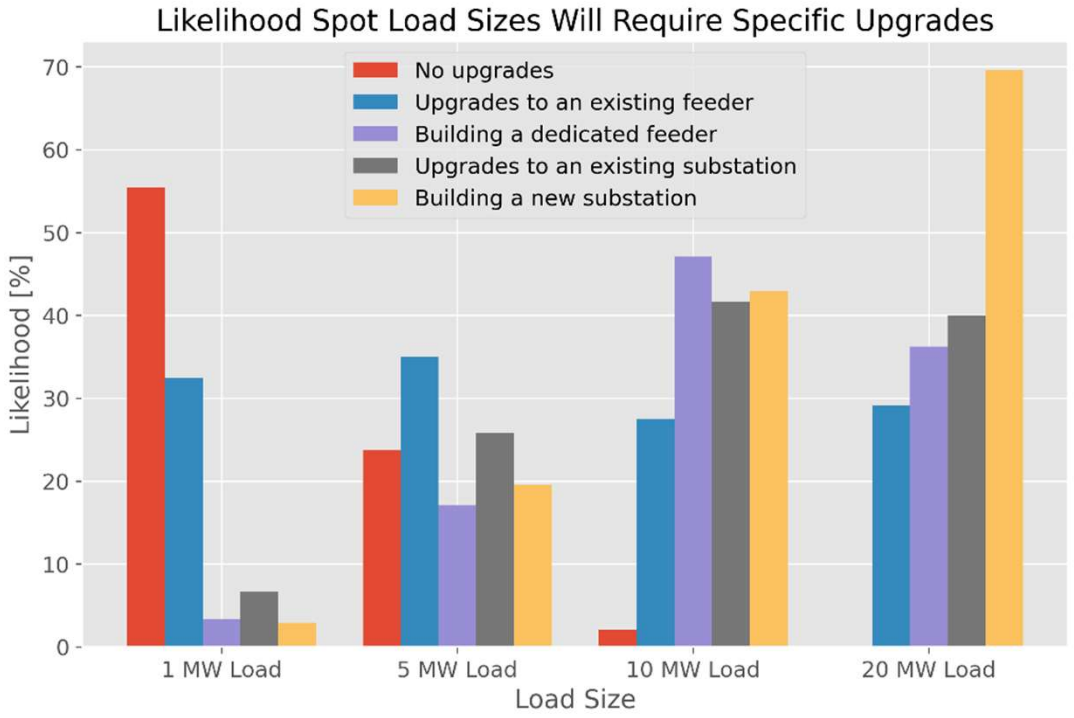
- First step: EPRI's EVs2Scale 2030 Grid Primer report:
  - Provides an initial look at how various levels of load at the distribution feeder level drives distribution system upgrades, lead-times, and more.
  - Represents the first step to better understanding how we might estimate on a national level the utility costs and efforts required to support transportation loads.

Grid Primer

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

Preliminary Findings:

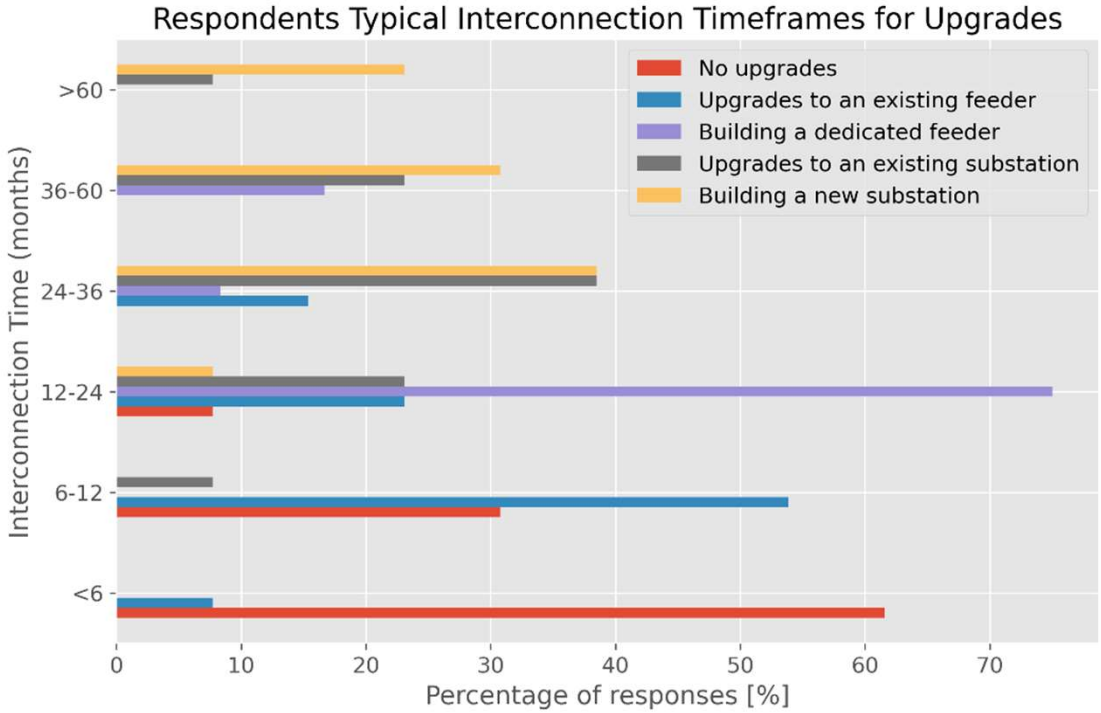
- *5MW load* – 30% likely to need a feeder upgrade
- *10MW load* – 48% likely to need a dedicated feeder, 42% likely to need substation
- *20MW load* – 70% likely to need a new substation



Grid Primer

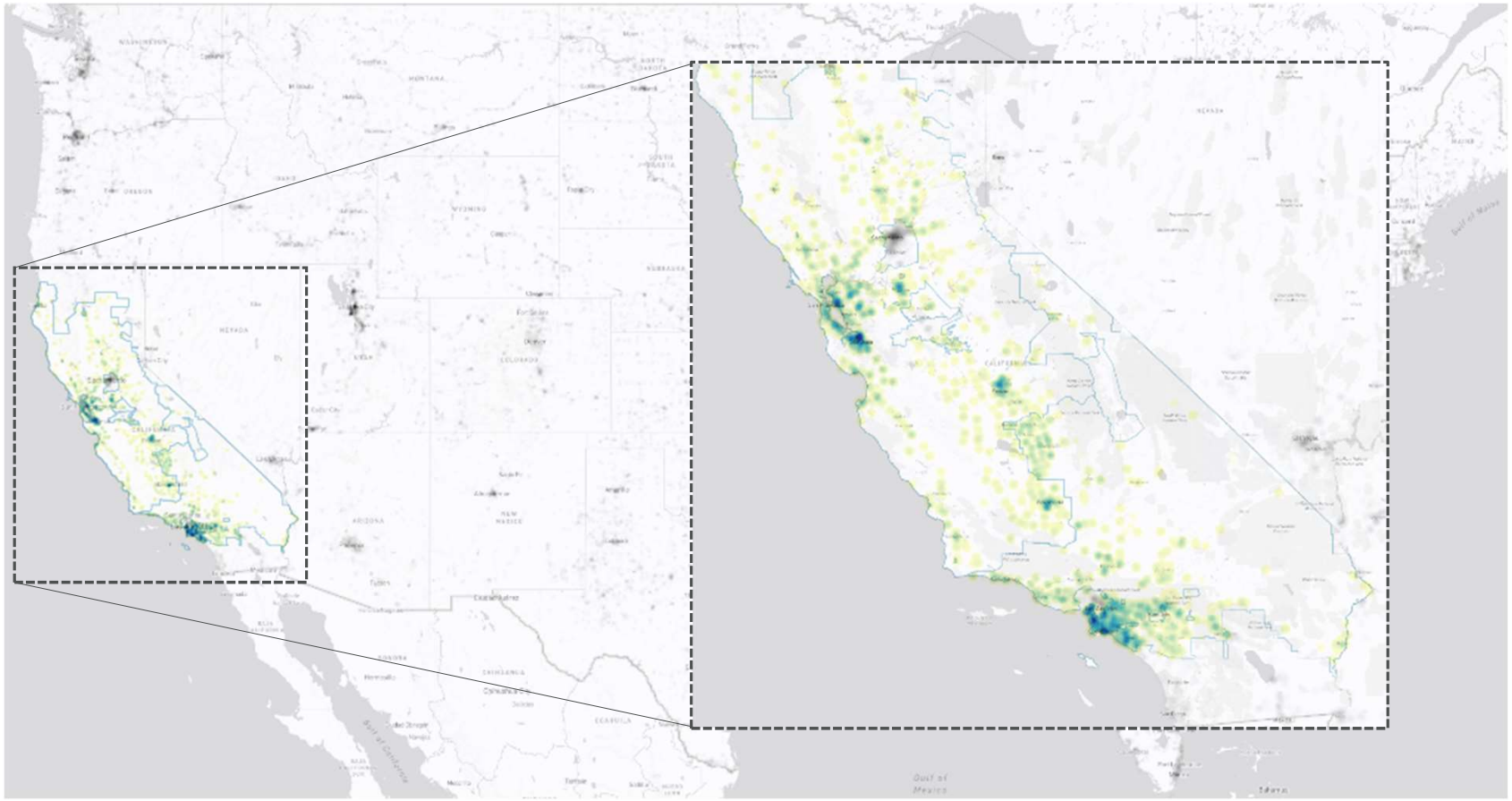
Preliminary Findings:

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

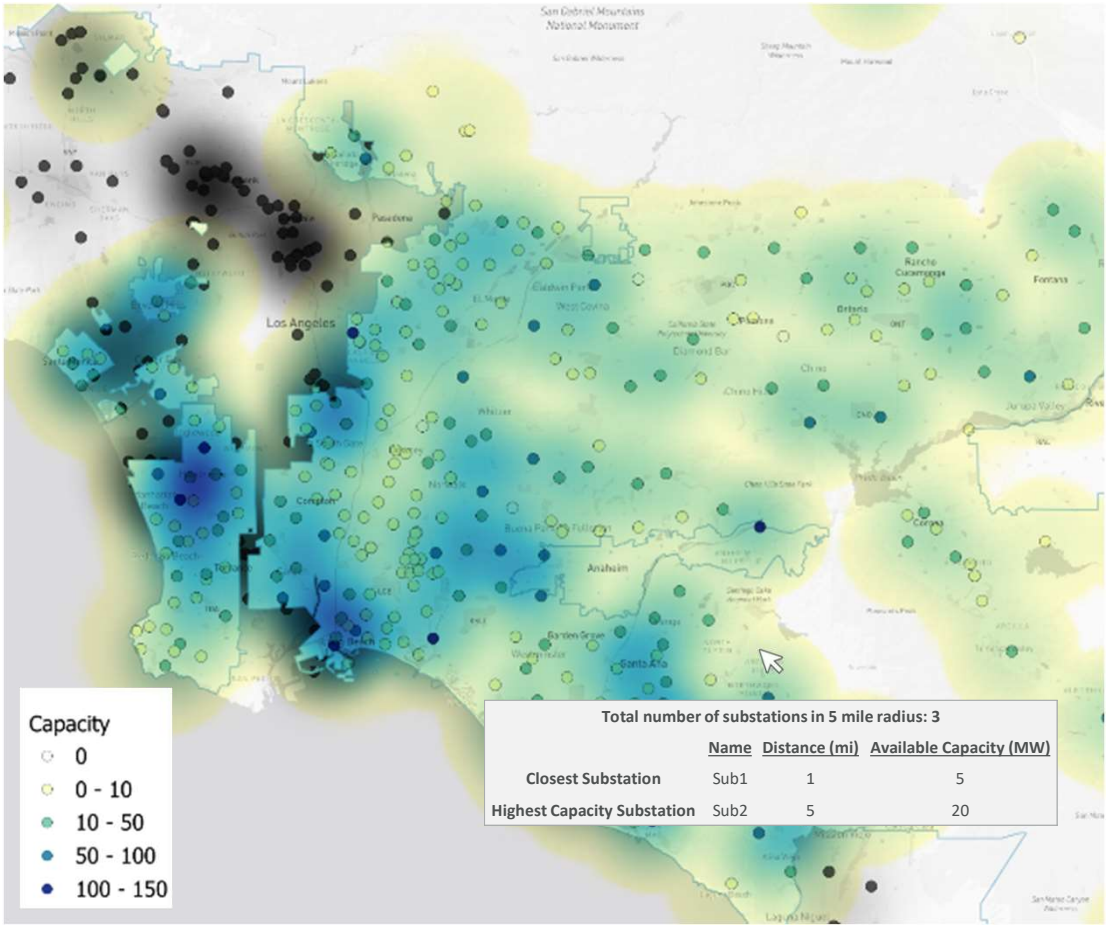


Next step: adding published hosting capacity data

Substation Capacity Heatmap



Substation Capacity Heatmap – SCE

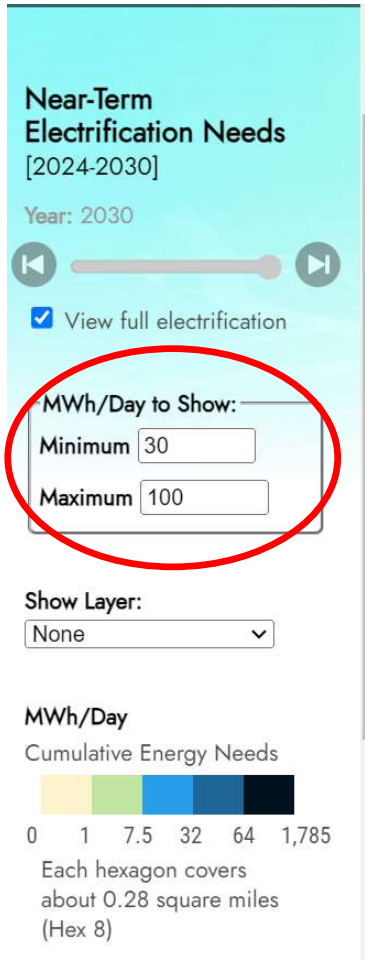


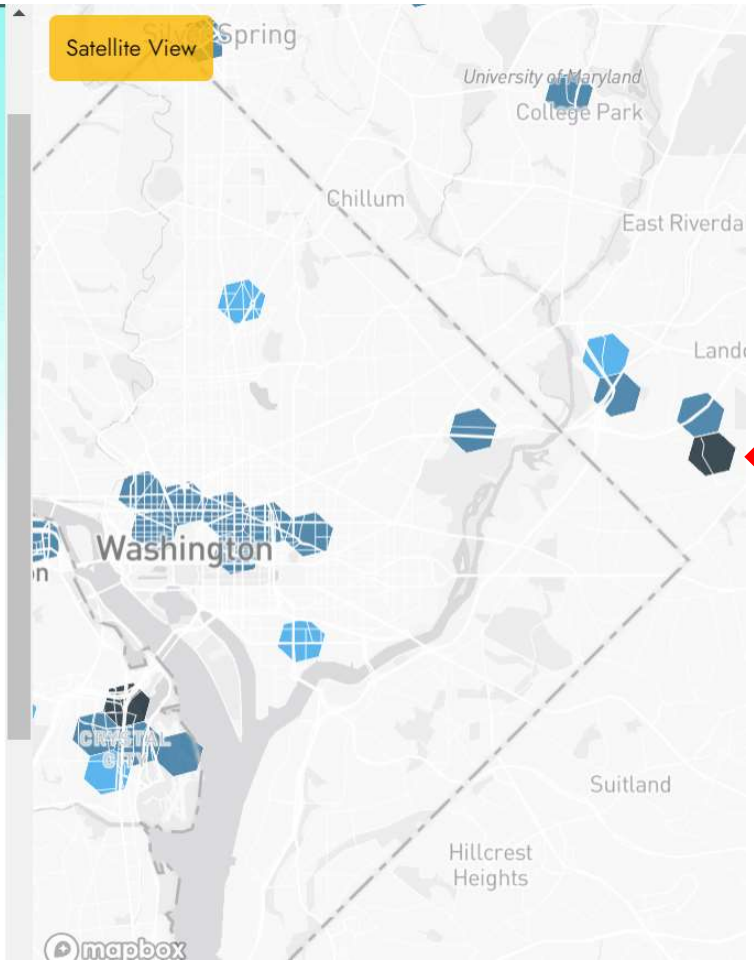
Proactive planning: Three starting points.

Proactive planning: Three starting points

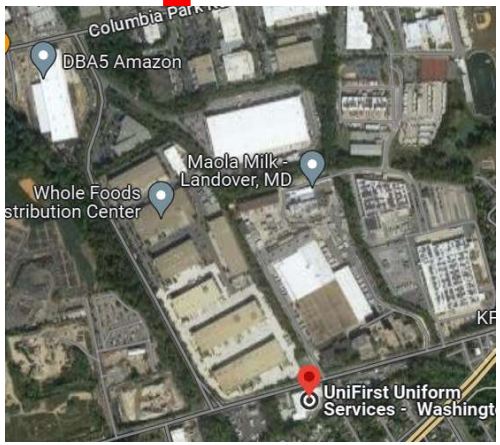
1. Get fleet electrification plans from small through large customers.
   - Acknowledge the challenges with this.
   - Multiple ways to approach.
   - Get these plans…yesterday.

Utilize eRoadMAP to identify hotspots





- Coming features allow for min and max settings
- Perform outreach to the fleets in this hexagon for more detailed fleet electrification plans.



- **Amazon**
- **Whole Foods Distribution Center**
- **Maola Milk Dairy Supplier**
- **ABC Supply Co.**
- **General Machine Shop, Inc.**

GridFAST

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

- Complementary to eRoadMAP™ ; continues the communication across all parties.
- Complementary to fleet advisory services.

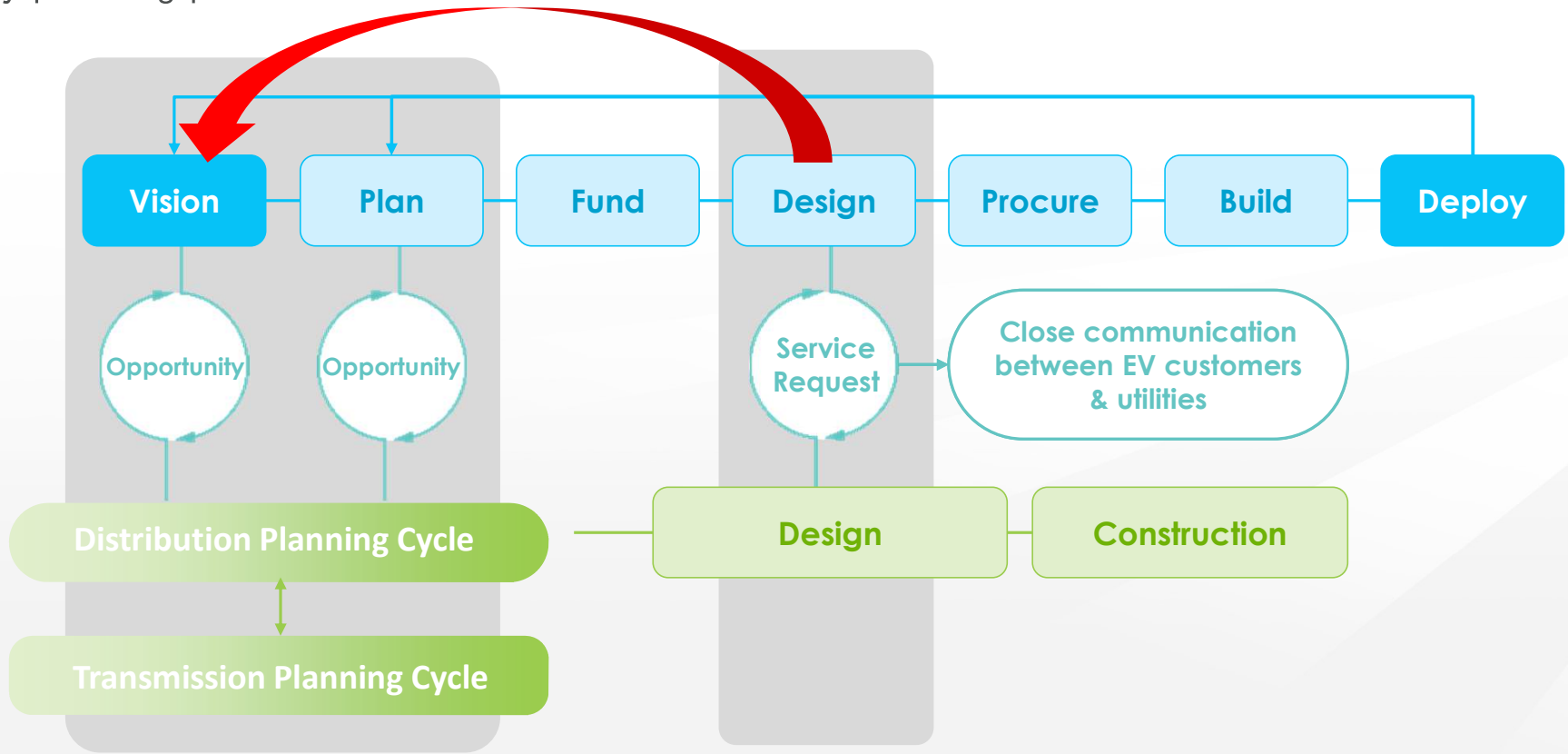
2023-2035 plans defining loads, locations, timing

GridFAST
Secure online data exchange platform

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

GridFAST

Enable EV customers and utilities to have *actionable* transportation load information *earlier* in the utility planning process.



Proactive planning: Three starting points

1. Get fleet electrification plans from small through large customers.
2. Build for the coming EV load.
   - Prioritize the “no regrets” grid investment spots.
     - By vehicle class or end use
     - By policy drivers
     - By charging location
     - By size of the EV load above a certain threshold.
     - By performing a risk analysis on distribution infrastructure.

Proactive planning: Three starting points

1. Get fleet electrification plans from small through large customers.
2. Build for the coming EV load.
3. Evaluate current utility policies and processes that may need to be adjusted or modified for EVs.

EVs2Scale 2030™

Thank You

Mike Rowand
Mike.Rowand@outlook.com

Katherine Stainken:
kstainken@epri.com

Predicting Charging Needs: Engagement with the eRoadMAP™ Tool

Facilitator: EPRI & NARUC

- Interactive Exercise: All attendees (please pull out a laptop!)
- Please use the EPRI **eRoadMAP™ Tool to answer the following questions:**
  - How many dark blue hexes do you see in your state in 2027? 2030?
  - What does this show you for rural vs urban?
  - What does this show you for IOU vs. coop vs. muni?
  - What does this show you for your state's MHD vs. LD loads?
  - Are loads appearing along the corridors where you'd expect?

eRoadMAP™ QR Code

RB0

Closing and Next Steps

- NARUC will share PPT slides & notes.
- All Commissioners and Commission staff are invited to join NARUC's EV State Working Group
  - Monthly webinars + peer exchange discussions
  - Highlights of EV-related news & NARUC events

www.naruc.org/core-sectors/energy-resources-and-the-environment/energy-customers/electric-vehicles/

Thank you for attending!

NARUC NEVI Formula Program Brief for PUCs

Slide 77

RB0 I will replace with NEVI once it is published.
Robert Bennett, 2024-02-22T15:06:40.842

APPENDIX

What are the solutions for utilities to energize chargers quickly?

Data Access and Transparency

Improve Process and Timing

Promote Economic Efficiency

Maintain a Reliable Grid Considerations

Data Access and Transparency

Solution 1.1: Enhance **communication** with interconnection customers related to technical requirements of interconnection study models and modeling assumptions that are utilized by utilities.

Solution 1.2: Develop both **public-facing and utility-facing tools** to manage, analyze, and visualize the distribution and interconnection data. Tools should indicate available capacity at differing locations along a circuit, with Hosting Capacity Analysis tools for generators and energy storage aligned with load capacity tools for EV charging infrastructure.

U.S. Atlas of Electric Distribution System Hosting Capacity Maps | Department of Energy

Improve Process and Timing
Solution 2.1: **Enable flexible interconnection & service requests** to allow projects to continue to move through the queue despite upgrade needs by agreeing to utilize energy/load management technology until upgrades are implemented.
Solution 2.2: Implement appropriate **commercial readiness requirements**, financial commitments, withdrawal penalties, and time limits that balance effectiveness, equity, and open access principles
Solution 2.3: Continue to **automate the interconnection process**, such as data input and validation, identification of projects for fast-track processing, customer communications, and data sharing across processes and models
Solution 2.4: **Upskill the existing workforce** through continuing education programs, such as training for application of standard IEEE 1547-2018

Promote Economic Efficiency
Solution 3.1: **Explore group study cost allocation options**, where upgrade costs are spread amongst a group of load request applicants within a cohort. Costs are recovered proportionally to each project's relative need for the upgrade, reducing the upgrade costs per-project.
Solution 3.2: **Implement strategic proactive distribution investments** that anticipate growing DER and EV growth and recover prorated costs from future DER and EVSE deployments.
Solution 3.3: **Improve coordination and data exchange** between interconnection process and distribution planning process.
Solution 3.4: **Work with customers** on approaches to reduce their impact on peak load. Will need to validate load management software and may need incentives to reward behavior.

Maintain a Reliable Grid Considerations
Consideration 1: Adopt and implement a harmonized and comprehensive set of generation interconnection requirements consistent with IEEE Standard 1547-2018.
Consideration 2: Align understanding and communication of the impacts of inadvertent export and standardize export control equipment response time requirements.
Consideration 3: Assess need for new interconnection requirements/standards to cover expected performance from emerging technologies such as grid-forming inverters and Vehicle-to-Grid (V2G) systems.
Consideration 4: Investigate the relationship between the interconnection process and system reliability issues.

Resources

Alternative Fuels Data Center – Station Locator

Interconnection Innovation e-Xchange (i2X)

U.S. Atlas of Electric Distribution System Hosting Capacity Maps | Department of Energy

IREC Model Interconnection Procedures 2023 - Interstate Renewable Energy Council (IREC) (irecusa.org)

Improving State Interconnection Policies: New Model Rules to Accelerate DER Adoption Webinar, 9/7/2023 - Interstate Renewable Energy Council (IREC) (irecusa.org)

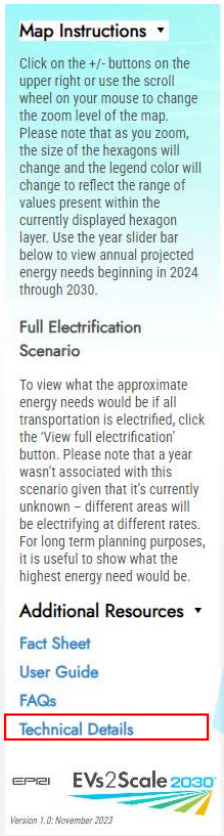
Extra Slides

eRoadMAP™ FOR UTILITY STRATEGY + EARLY T&D PLANNING ENABLES LOCAL PLANNING PROCESSES

ELECTRIC UTILITY PLANNING STAGES

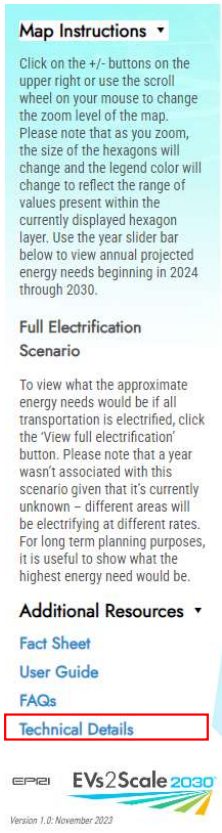
Light-duty and MHD Methodology and Granularity

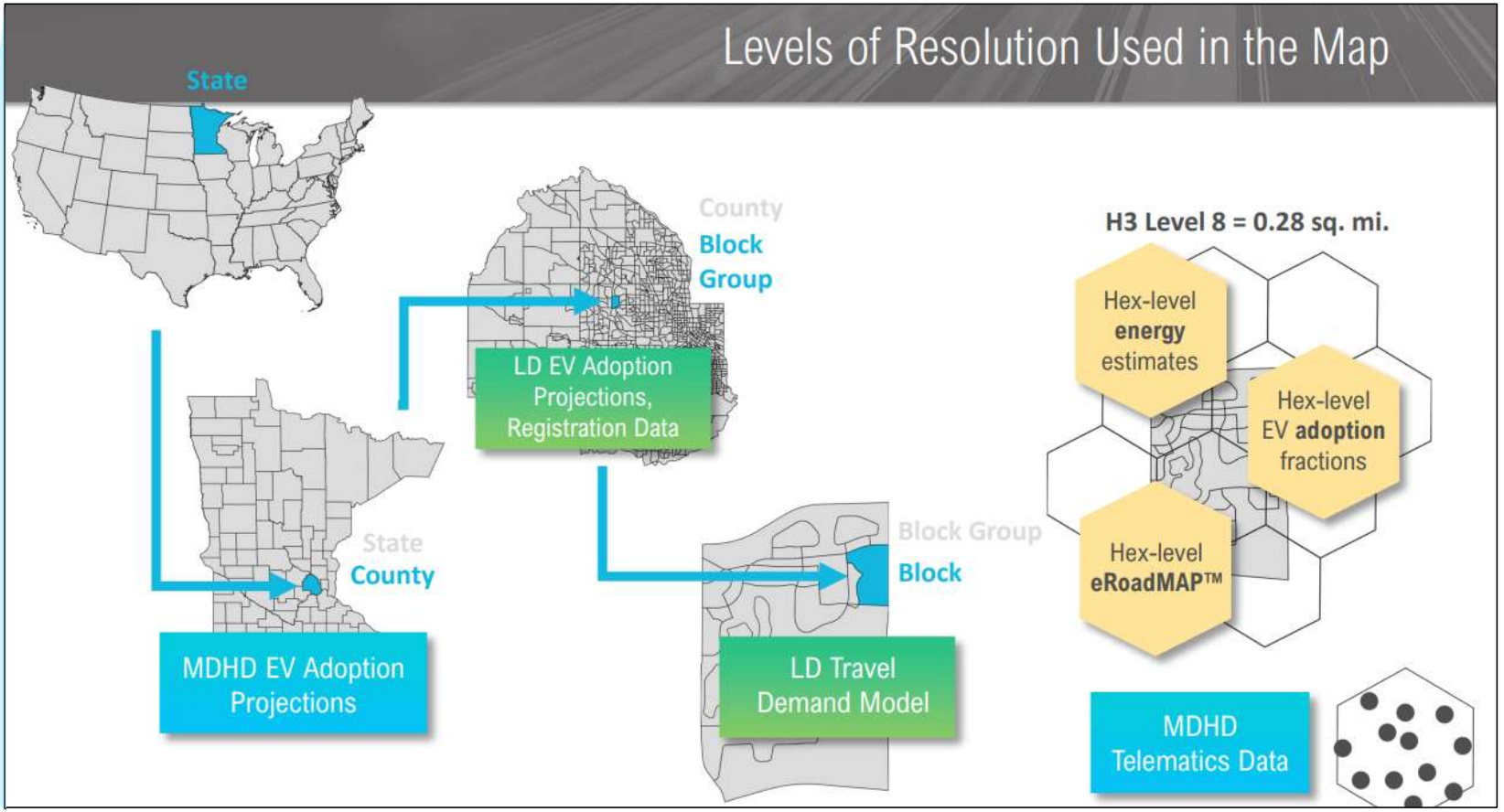
- *Found in the Technical Details*



Data Granularity

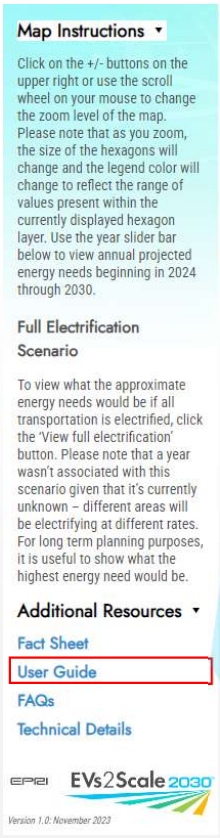
- *Found in the Technical Details*

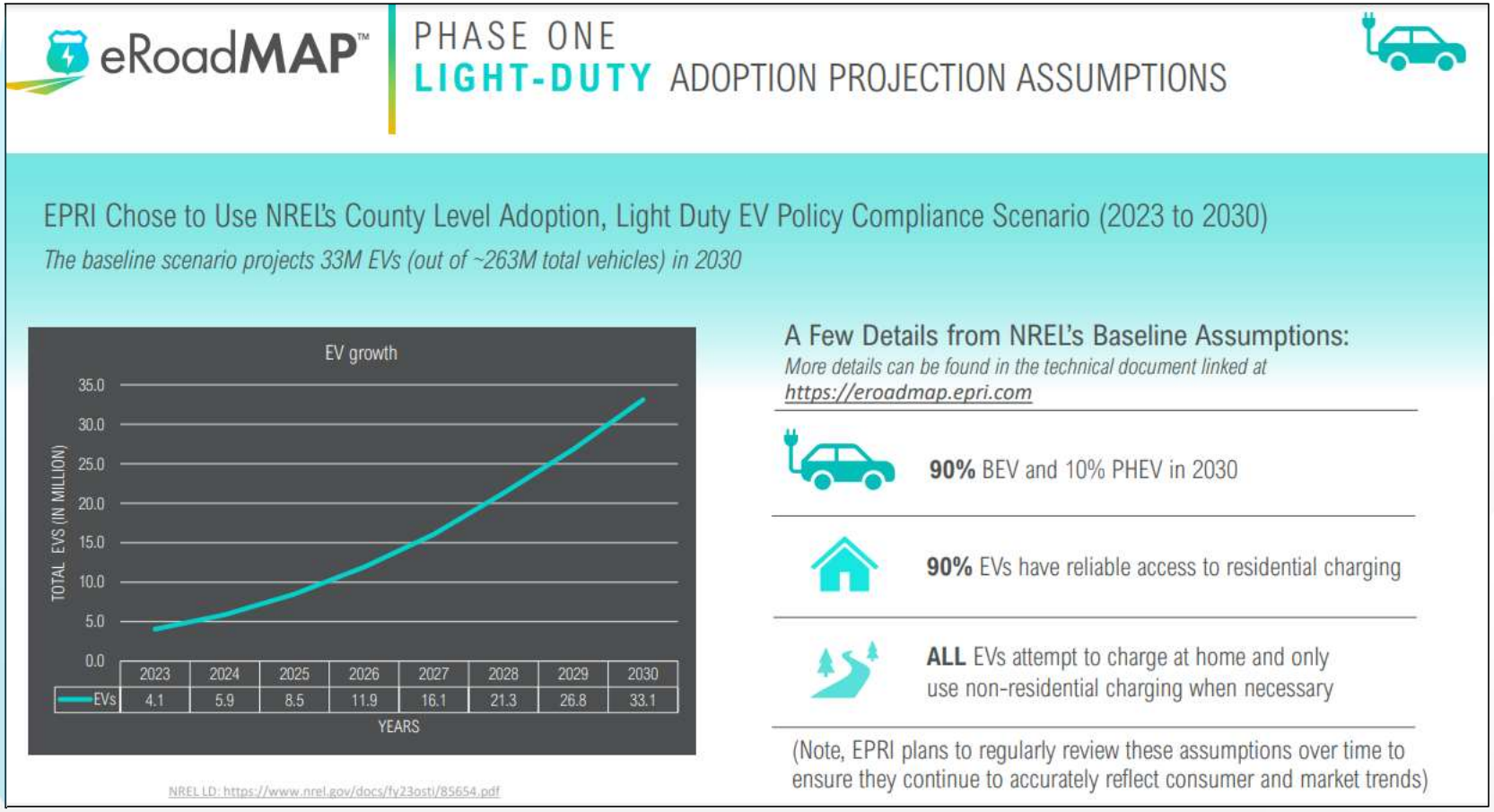




Light-duty Assumptions

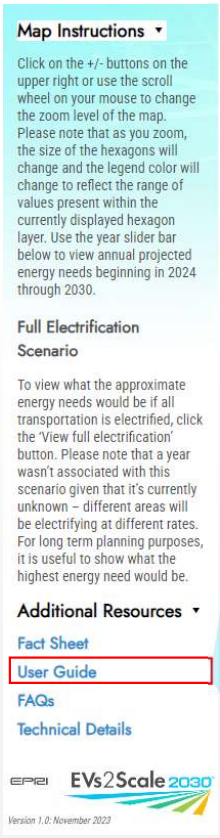
- *Found in the User Guide*

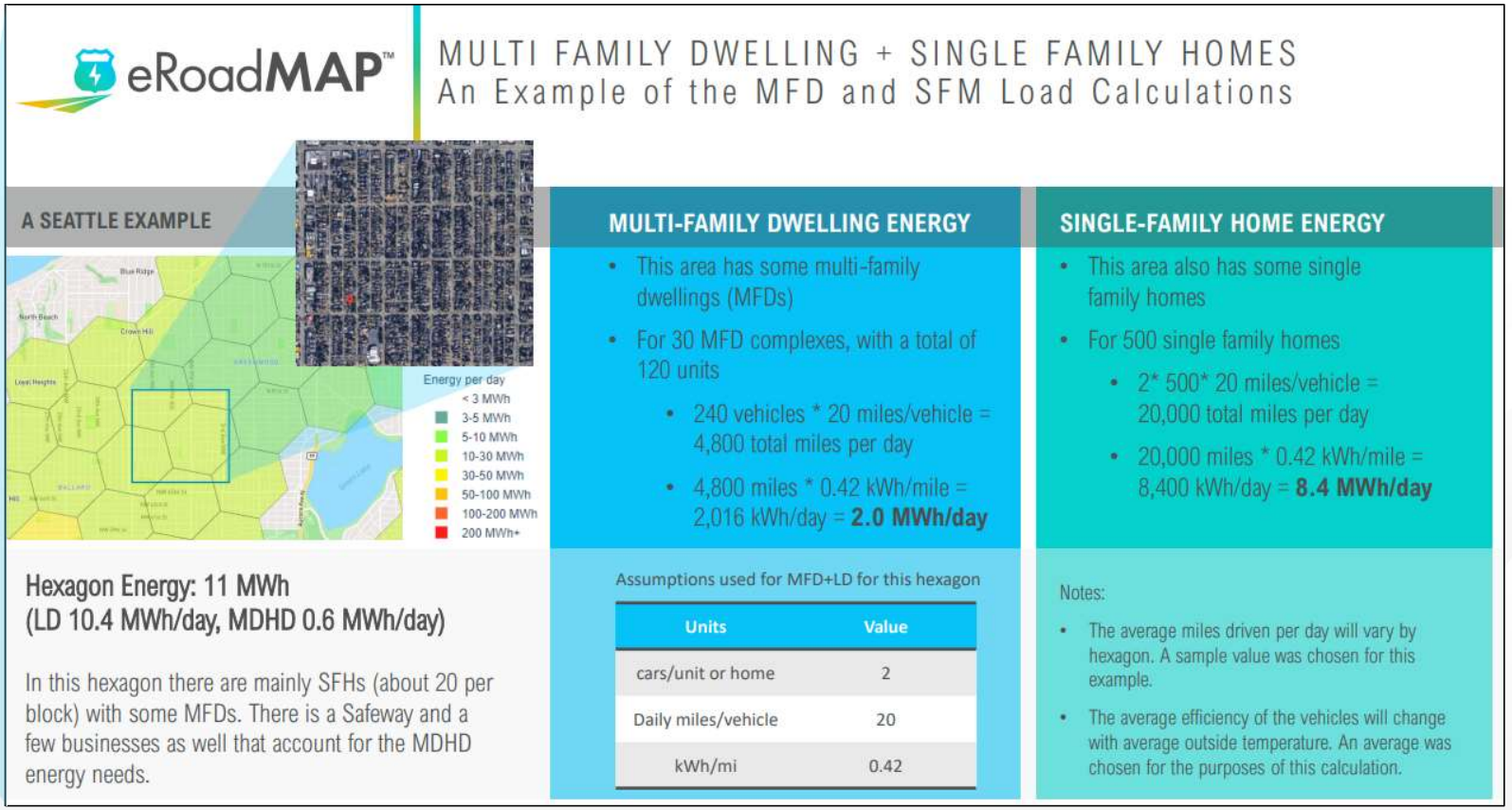




Light-duty Assumptions

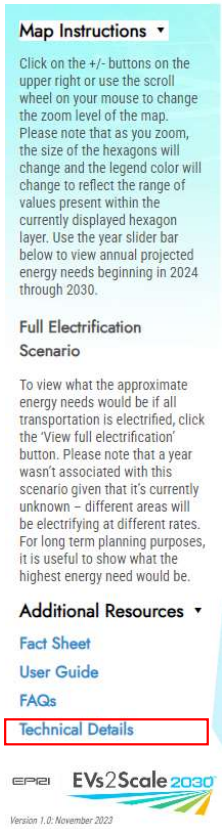
- *Found in the User Guide*





Light-duty Assumptions

- *Found in the Technical Details*



Residential vs Non-Residential Charging:

- 85% of energy is replenished at home, 15% elsewhere [this includes workplace].
- In full electrification scenario, 75% of energy is replenished at home
- Non-home charging energy locations were assigned based on 'charging at every stop' to replenish the miles traveled in the trip before the stop.

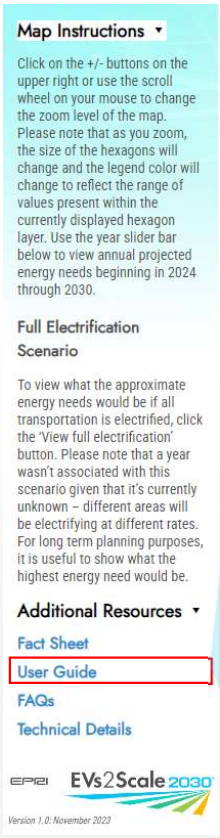
Efficiency Assumption: Passenger vehicles: **0.42 kWh/mi (= 2.38 mi/kWh)**

Local Temperature impacts will be addressed in v2.0. In v1.0, temperature effects are included via average efficiency across all vehicles, but not localized.

Local Adoption - NRELs projections only go to county level. We used conventional vehicle registration age to allocate EVs in a more granular level- ie a county with newer vehicles currently, will likely adopt new EVs earlier.

MHD Assumptions to Accompany Data

- *Found in the User Guide*



eRoadMAP™

PHASE ONE
MEDIUM + HEAVY-DUTY ADOPTION PROJECTION ASSUMPTIONS

EPRI Developed a 'Policy Compliant Scenario' that Assumes Compliance with Current Policy to Show EV Adoption Over Time. The Adoption Trajectory Supporting These Policies Was Taken From NREL Analysis.

For MDHD Adoption, States Were Divided Into Three Categories as Defined Below as Different Policies are Applicable for Each Category

California	ACT States	Rest of US
The Advanced Clean Fleet and Advanced Clean Truck Rules are met (AATE3 was used).	The Advanced Clean Truck Rule is assumed to be met.	No policy was assumed, but due to technology improvements and spillover effects some adoption occurs.

National resolution NREL scenarios were used to guide adoption levels in the three policy zones. More details about the NREL scenarios used for the three categories above can be found in the technical document (https://eroadmap.epri.com).

ACT requirement: by 2030, 30% of sales of Class 2b-3 trucks and Class 7-8 tractor trucks and 50% of sales of Class 4-8 trucks to be zero emission

ACT States: California, Oregon, Washington, Colorado, New Jersey, New York, Vermont, and Massachusetts

ACF requirement by 2030:

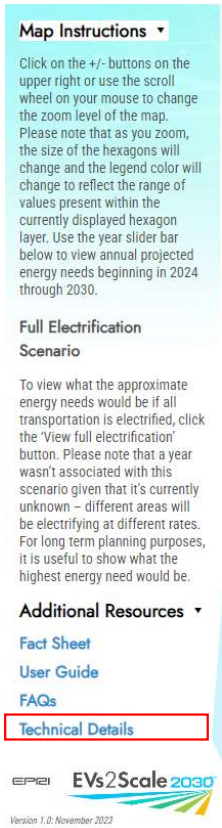
- Class 2b-3: ~13% of vehicle stock zero emission
- Class 4-8 vocational: ~42% of vehicle stock zero emission
- Class 7-8 tractor: ~25% of vehicle stock zero emission

ACF States: California

AATE3 Information: https://efiling.energy.ca.gov/GetDocument.aspx?tn=247954 [efiling.energy.ca.gov]
NREL MDHD Scenario Information: Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis (nrel.gov)

MHD Assumptions to Accompany Data

- *Found in the Technical Details*



Adoption over time is constant over a county

- *We are working to get direct fleet plans, but absent that, MDHD adoption in a county is uniform.*
- *Slide 25 - shows adoption assumptions by state (3 types- CA, ACT states, Non-ACT States)*

Efficiency Assumption (will be updated over time):

Class 3-5: **1.1 kWh/mi** | Class 6-8: **1.8 kWh/mi**

Depot vs Non-depot Charging: Constant across MDHD vehicles (to be updated in v2.0 by VMT segments)

- 85% at depot, 15% at non depot
- 85% of energy assigned to the longest dwell time in a day. 15% assigned to the rest of the stops proportional to the miles driven before each stop.
- Minimum stop length varies between 20 min and 1 hr.