Zero-Emission Vehicle Workshop Agenda

Date: April 25, 2022
Time: 8:30 am-3:00 pm
ZEV Display and Ride and Drives: 3:00 pm-5:00pm
Location: Ruthe Jackson Center

Time	Session Overview	Panelists
8:30- 9:00 am	**Registration and Networking**	
	Setting the Stage	
9:00-9:10 am	**Welcome and Introductions**	Lori Clark, North Central Texas Council of Governments (NCTCOG)/ Dallas-Fort Worth Clean Cities Phillip Martin, Environmental Defense Fund (EDF) Andrew DeCandis, Houston-Galveston Area Council (H-GAC)
9:10- 9:40 am	**Why Electrify in Texas:** *Discuss why fleets should electrify in Texas, including the diverse fuel sources, lower cost of doing business, large workforce, the current state of air quality in Texas and how zero-emission vehicles (ZEV) can benefit the environment and minority communities.*	Ann Xu, ElectroTempo Rob Orr, Texas 2036 Doug Lewin, Stoic Energy - *moderator*
9:40- 10:10 am	**Interstate Highway-45 (IH-45) Project Overview** *Introduce IH-45 Project background, scope, and goals.*	Lori Clark and Soria Adibi, NCTCOG Ann Xu, ElectroTempo
10:10- 10:20 am	***Networking Break***	
	Zero-Emission Infrastructure	
10:20- 11:00 am	**Hydrogen Infrastructure 101** *High level overview of available hydrogen infrastructure and how it differs from electric infrastructure.*	Brian Weeks, GTI Ed Young, Toyota Jeff Harrington, Air Liquide Robert Meaney, Kaizen Mike Lewis, UT Austin

Source: NCTCOG

11:00-11:30 am	**Electric Infrastructure 101** *Discuss available charging infrastructure for medium- and heavy-duty ZEV, installation process, utility demand, managing charging, and panel of electric utilities and infrastructure providers.*	Randy Boys, Oncor Cary Gniffke, Holt Truck/Nikola Will Adams, Charge Point
11:30 am - 12:30 pm	***Lunch and ZEV Display***	
Path to Zero-Emission Vehicles (ZEV)		
12:30-1:30 pm	**The State of ZEV Technology Panel** *Discuss current and future ZEVs.*	Rick Mihelic, NACFE Bobby Cherian, Hyliion Don Hall, MHC Mike Moynahan, HEB Blake Yazel, Lonestar SV
1:30 - 1:50pm	**Resources to Assist in Identifying Appropriate Use of ZEVs** *Discuss the different resources available to assist in acquiring the right type of ZEV for your fleet.*	Cliff Gladstein, GNA- Grant Assistance Amy Hodges/Andrew DeCandis, NCTCOG/H-GAC Phillip Martin, EDF
1:50-2:00 pm	***Networking Break***	
Funding		
2:00-3:00 pm	**Funding Options and Opportunities** *Discuss the different funding opportunities for public and private entities.*	Amy Hodges, NCTCOG Andrew DeCandis, H-GAC Kirk Fauver, FHWA Texas Division Salim Youssefzadeh, Watt EV Esteban Santos Lopez, Hunt Energy Solutions Omar Gonzalez, Nikola
Closing Remarks: EDF		
ZEV Vehicle Display and Ride and Drives		
3:00-5:00 pm	**ZEV Display and Ride and Drives** *Hands-on demonstration of ZEVs and ride drives for attendees*	• Hyliion Hypertruck ERX • Lonestar Specialty Vehicle All-Electric Terminal Tractor • Nikola TRE: Battery-Electric Daycab Semi-Truck and Mobil Charging Trailer (MCT) • Toyota Mirai and bZ4X • XOS Electric Step Van

Source: NCTCOG

Workshop Evaluation Form: **Please scan the QR code below to complete the short workshop evaluation form:**

Source: NCTCOG

Panelist Information			
Name	**Title**	**Organization**	**Email**
Lori Clark	Program Manager	NCTCOG/DFWCC	lclark@nctcog.org
Soria Adibi	Sr. Transportation Planner	NCTCOG/DFWCC	sadibi@nctcog.org
Amy Hodges	Principal Air Quality Planner	NCTCOG/DFWCC	ahodges@nctcog.org
Phillip Martin	Manager, Zero-Emission Truck Initiative in Texas	Environmental Defense Fund (EDF)	pmartin@edf.org
Andrew DeCandis	Principal Air Quality Planner	H-GAC	Andrew.DeCandis@h-gac.com
Ann Xu	CEO	ElectroTempo	ann.xu@electrotempo.com
Rob Orr	Senior Policy Advisor	Texas 2036	rob.orr@texas2036.org
Doug Lewin	President and Founder	Stoic Energy	doug@stoicenergyconsulting.com
Brian Weeks	Sr. Director, Research Operations	GTI	bweeks@gti.energy
Mike Lewis	Sr Engineering Scientist- Center for Electromechanics	University of Texas, Austin	mclewis@cem.utexas.edu
Jeff Harrington	Director; Systems at Air Liquide Global Markets and Technologies	Air Liquide	jeff.harrington@airliquide.com
Robert Meaney	Co-Founder	Kaizen	robert.meaney@kaizencleanenergy.com
Ed Young	Toyota Infrastructure Development	Toyota	edmond.young@toyota.com
Randy Boys	Strategy & Technology Manager	Oncor	randy.boys@oncor.com
Cary Gniffke	Business Development Manager	Holt Trucking/Nikola	cary.gniffke@holtcat.com

Source: NCTCOG

Will Adams	Director, Fleets Sale	ChargePoint	will.adams@chargepoint.com
Rick Mihelic	Director Emerging Technologies	NACFE	rick.mihelic@nacfe.org
Bobby Cherian	Senior VP, Sales & Supply Chain	Hyliion	bobby.cherian@hyliion.com
Don Hall	Lease Account Manager	MHC Truck Leasing	don.hall@mhc.com
Mike Moynahan	Assets Design & Procurement	HEB	moynahan.mike@heb.com
Blake Yazel	General Manager	Lonestar Specialty Vehicles	blake.yazel@lonestarsv.com
Cliff Gladstein	Founding President	GNA- Grant Assistance	cliff@gladstein.org
Kirk Fauver	Planning & Research Engineer	FHWA Texas Division	kirk.fauver@dot.gov
Salim Youssefzadeh	CEO	Watt EV	syoussefzadeh@wattev.com
Esteban Santos Lopez	Business Development Director	Hunt Energy Solutions	esantos@huntenergy.com
Omar Gonzales	Manager, State & Local Government Affairs, US West	Nikola	omar.gonzales@nikolamotor.com

Source: NCTCOG

EDF ENVIRONMENTAL DEFENSE FUND®
Finding the ways that work

Dallas-Fort Worth CLEAN CITIES

North Central Texas Council of Governments

Zero-Emission Vehicle Workshop

April 25, 2022

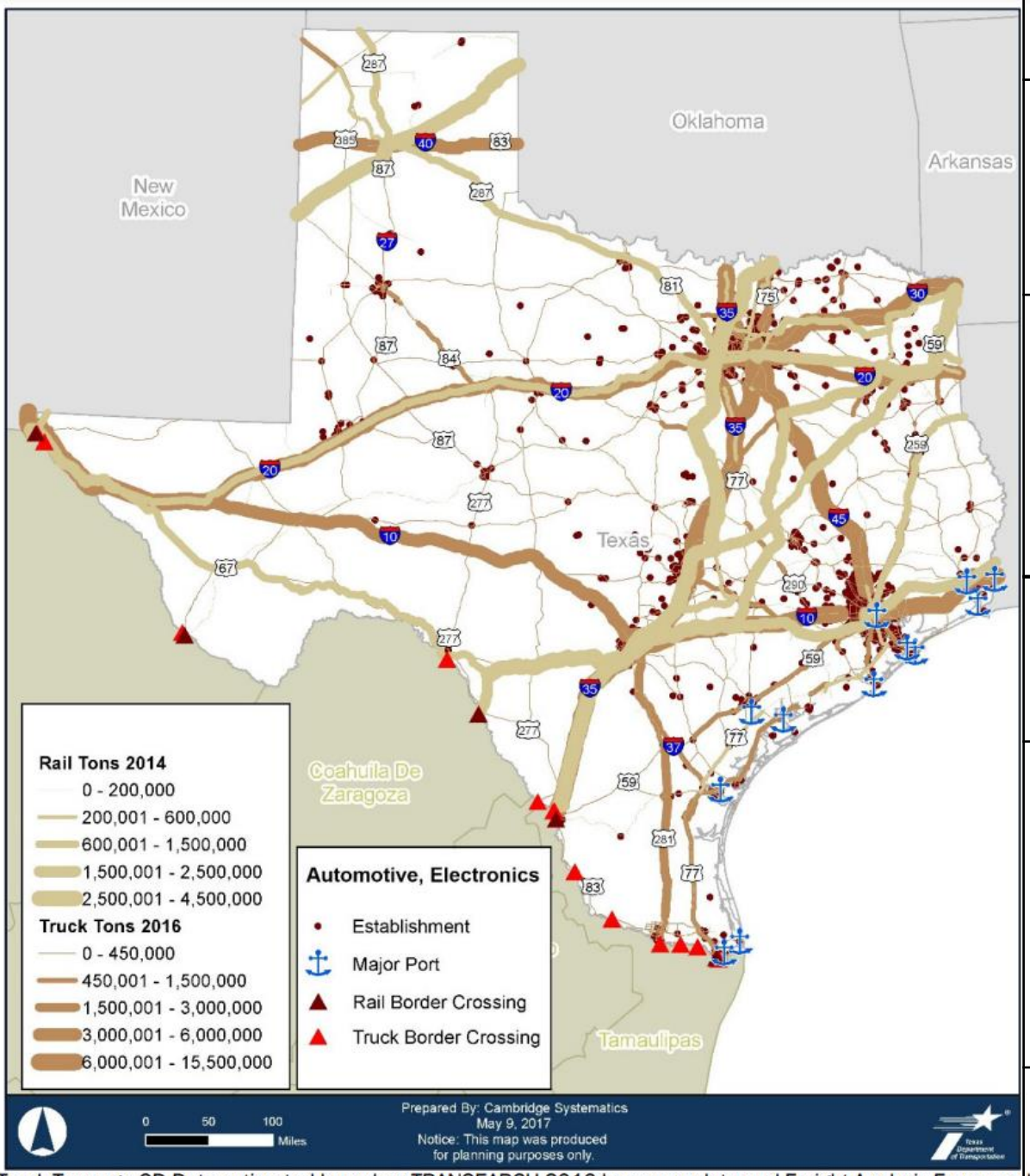
Question and Answer

We will be using Online Questions throughout the presentation. Event number is: **4252022**

- Visit **OnlineQuestions.org**
  OR
- Scan the QR Code to join

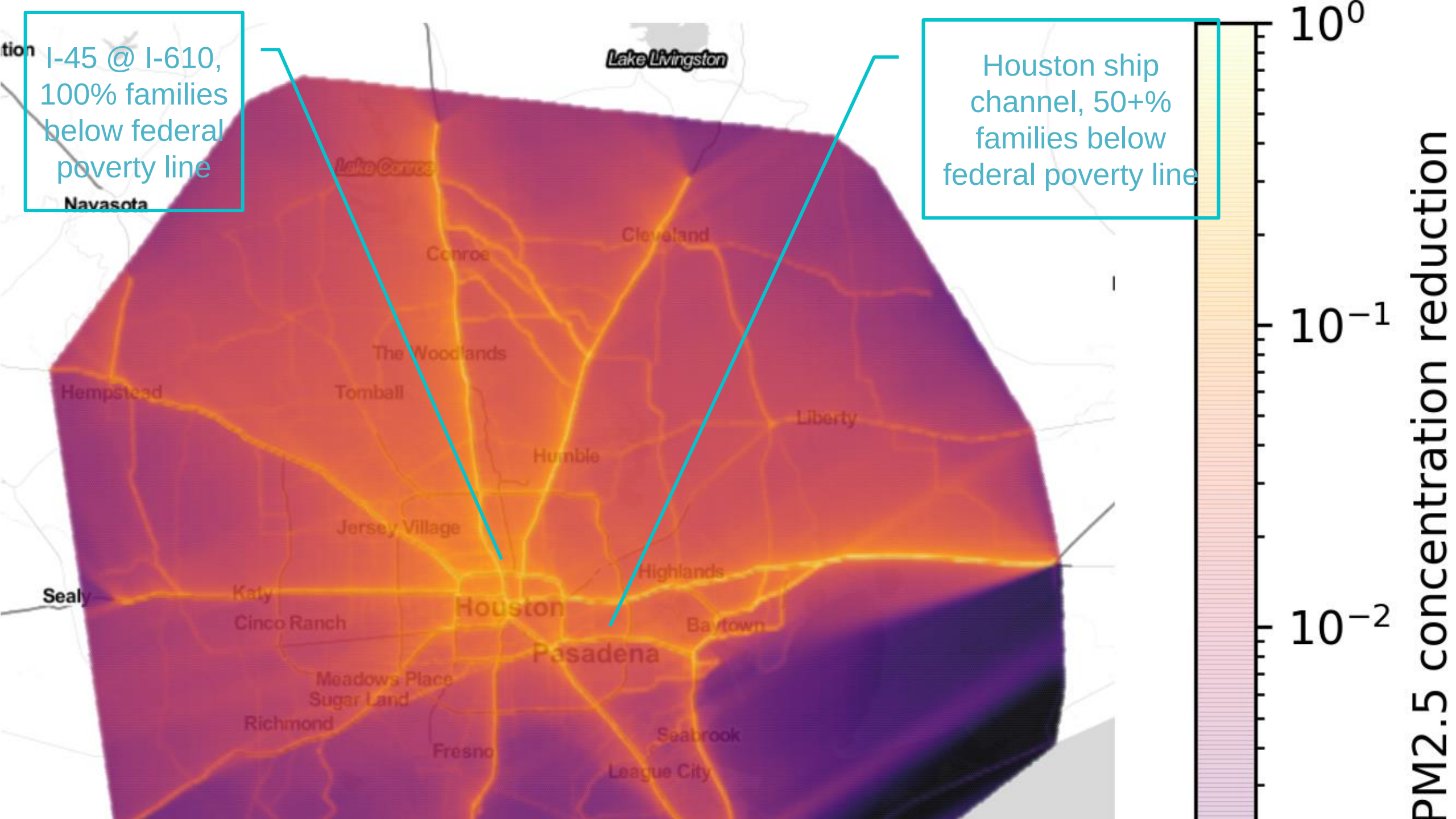
electrotempo

Charging Network Planning and Intelligence Software



Trucks play a semi-sized role in Texas		
Total shipments	% intrastate shipments	Truck % for intrastate shipments
$2.6 trillion # 1 in the US; # 2 CA has $2.2 trillion	71%	80
Truck electrification has a semi-sized emissions benefit		
NOx reduction if 100% electric	% total onroad mobile NOx emissions	% of total vehicle population
52 tons/day	65%	3%

Sources: 2016 Truck Tonnage OD Data estimated based on TRANSEARCH 2010 base year data and Freight Analysis Framework version 4 (FAF4) Database and assigned to the highway network using Texas Statewide Analysis Model version 3 (SAM-V3); 2014 Rail Tonnage


I-45 @ I-610, 100% families below federal poverty line
Houston ship channel, 50+% families below federal poverty line
Lake Livingston
Navasota
Conroe
Cleveland
The Woodlands
Hempstead
Tomball
Liberty
Humble
Jersey Village
Highlands
Sealy
Katy
Houston
Cinco Ranch
Baytown
Pasadena
Meadows Place
Sugar Land
Richmond
Seabrook
Fresno
League City
10^{0}
10^{-1}
10^{-2}
PM2.5 concentration reduction

TEXAS VOTER POLL

Energy and Electric Vehicle Data Points

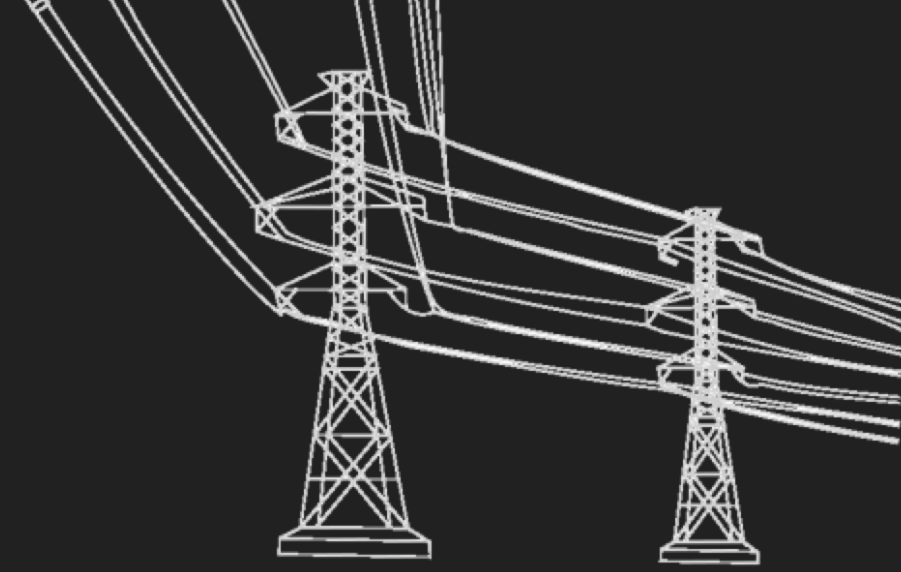
72% of voters want Texas to **remain an energy leader**, especially when it comes to pursuing new energy technologies.

74% of voters are concerned the state **won't apply for infrastructure funds** for energy technologies.

53% of **18-to-34-year-olds** have purchased or considered purchasing an **electric vehicle.**

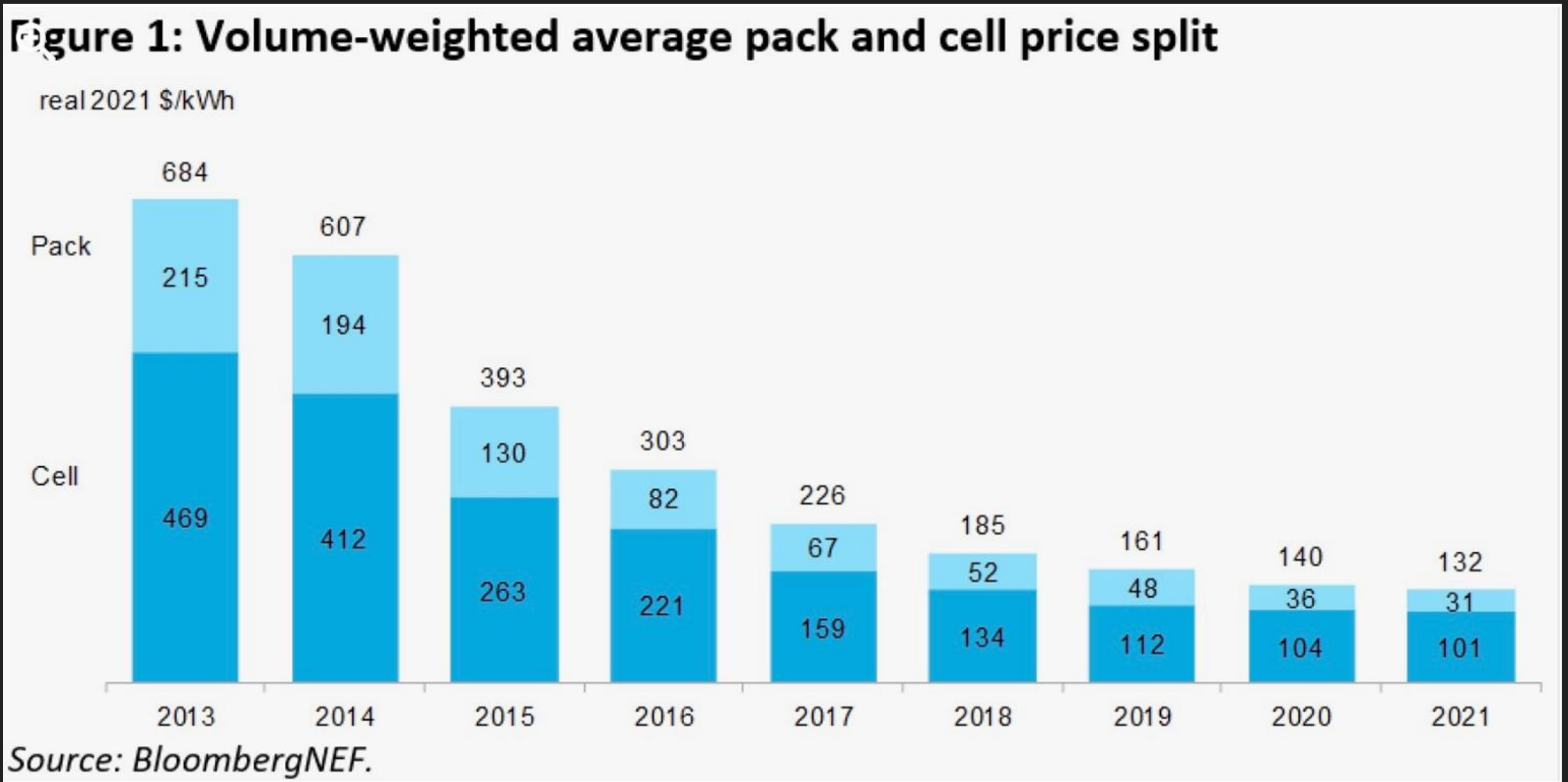
56% of **35-to-44-year-olds** have purchased or considered purchasing an **electric vehicle.**

Source: Texas Voter Poll, April 2022. Available at www.texas2036.org/poll

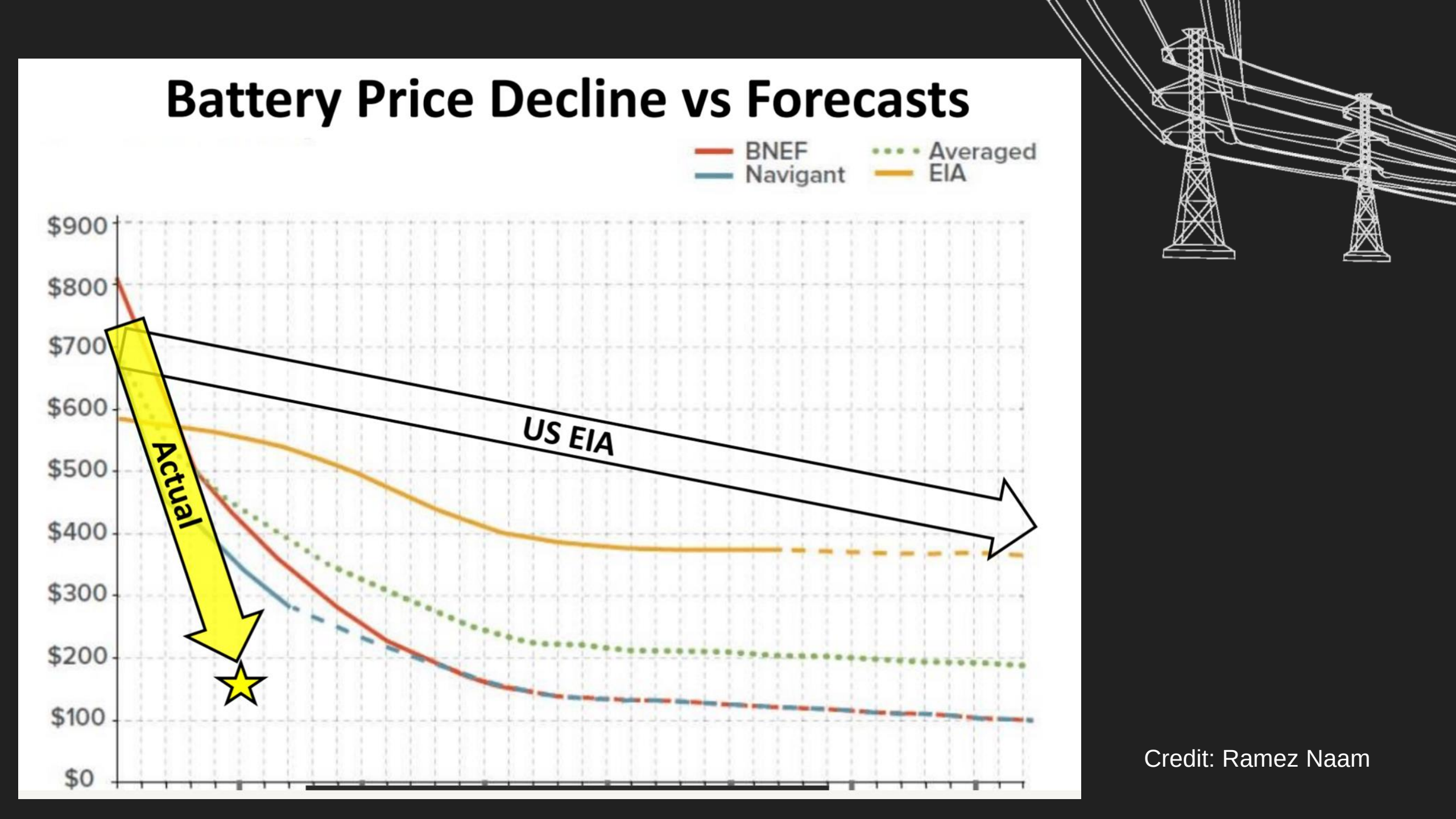


EVs and the Grid

Doug Lewin | Stoic Energy



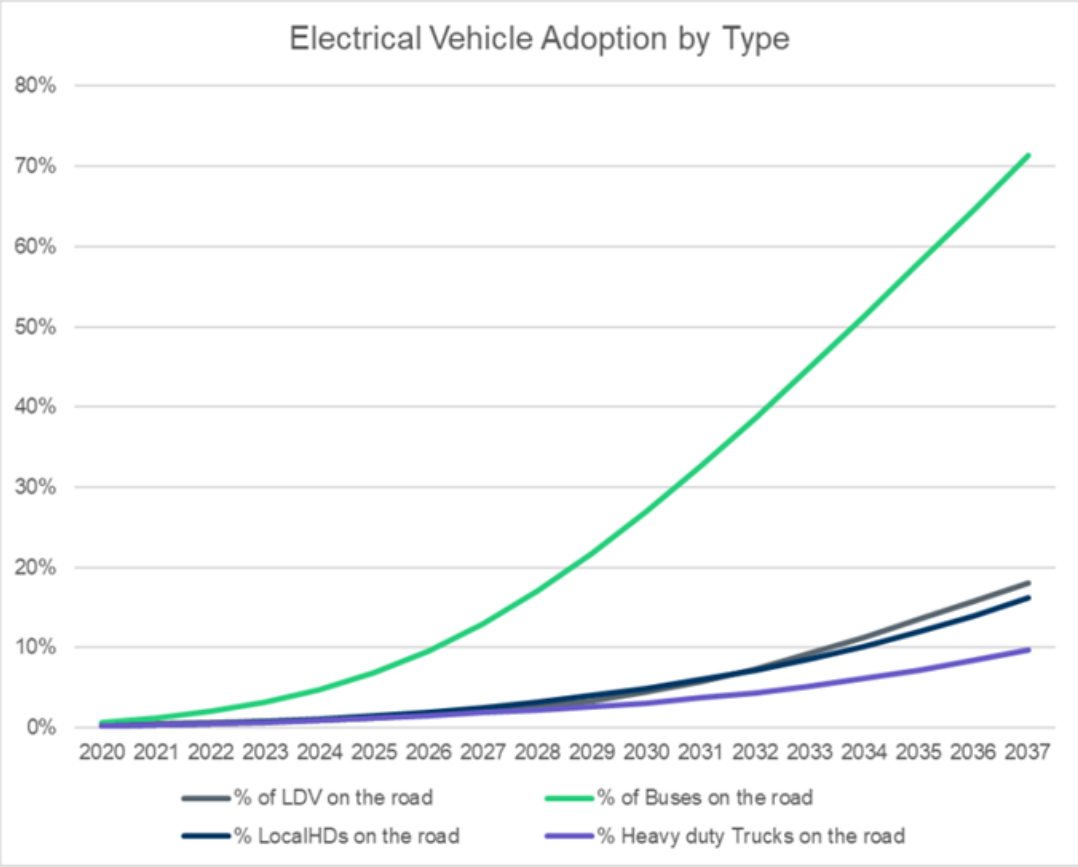
Volume-weight average battery pack and cell prices 2013-2021 (from BNEF report)

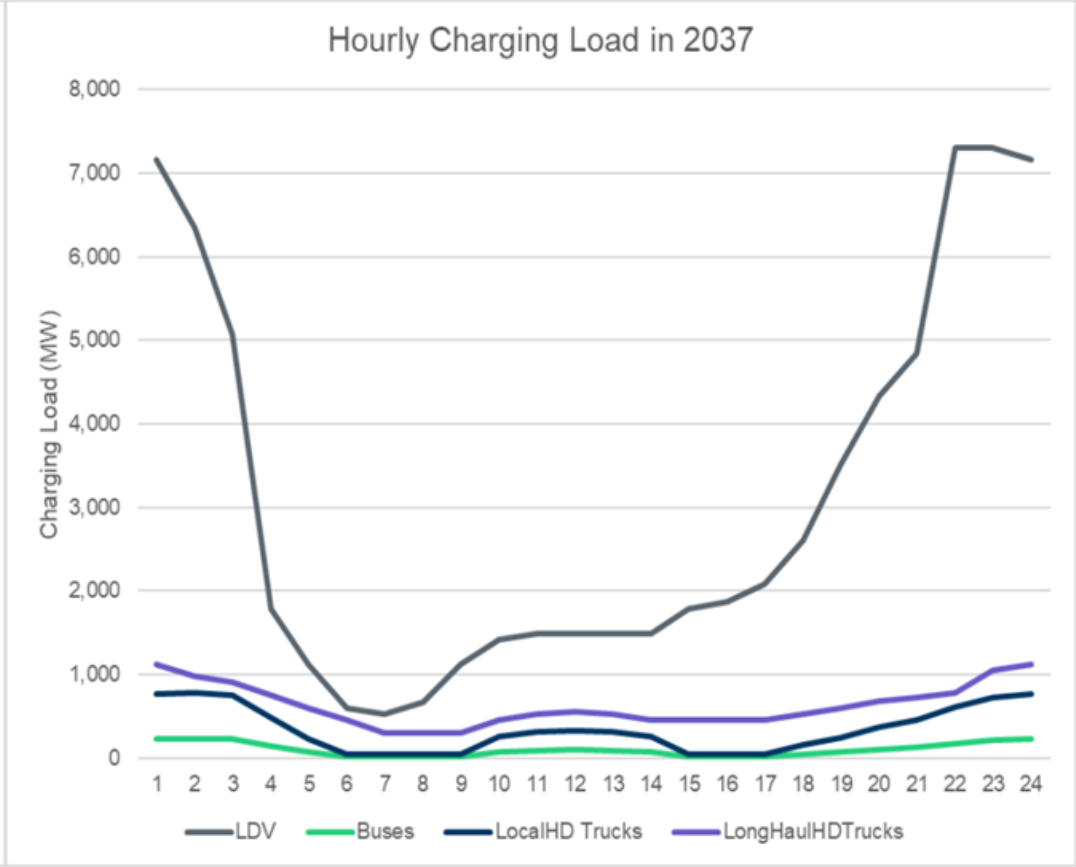


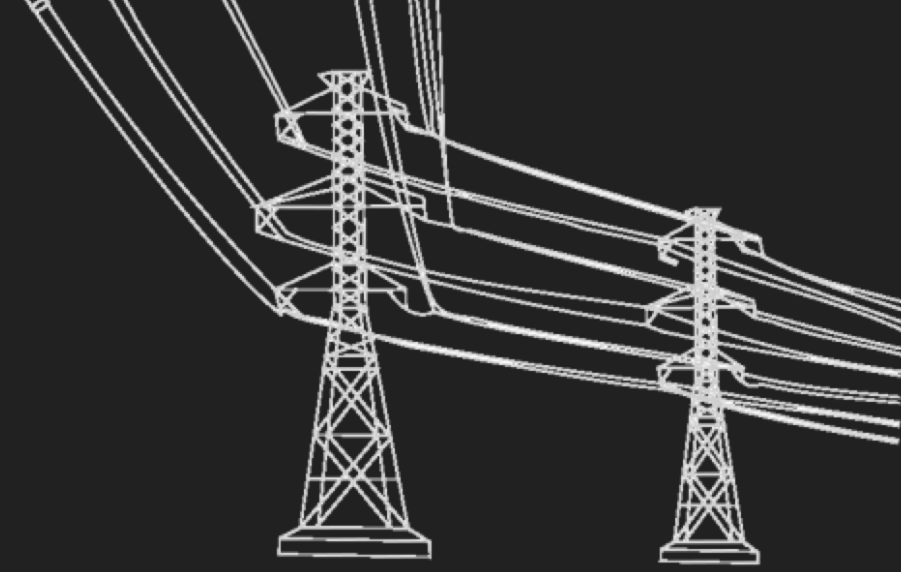
Credit: Ramez Naam

Electric Vehicle Adoption

- Electric vehicle adoption by type based on adjusted Bloomberg New Energy Finance (BNEF) 2020 projection and hourly charging load in 2037

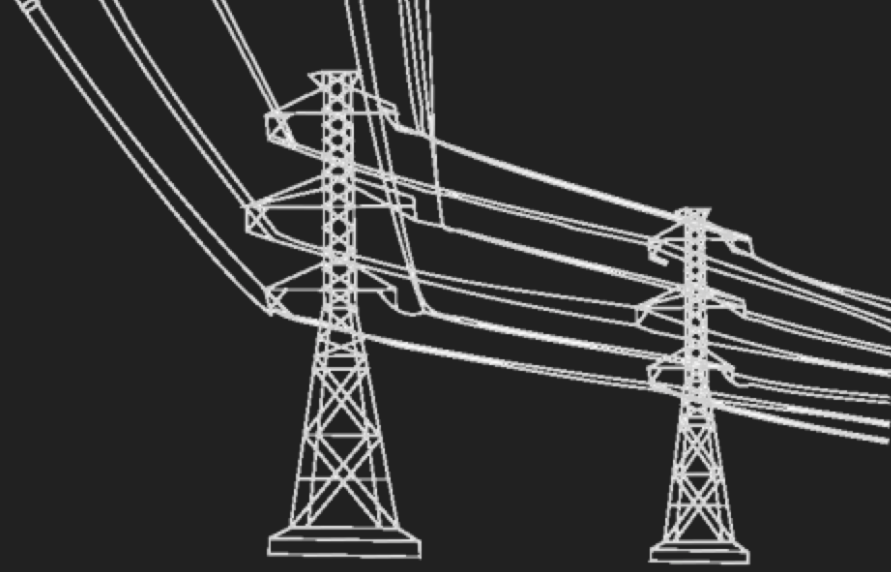




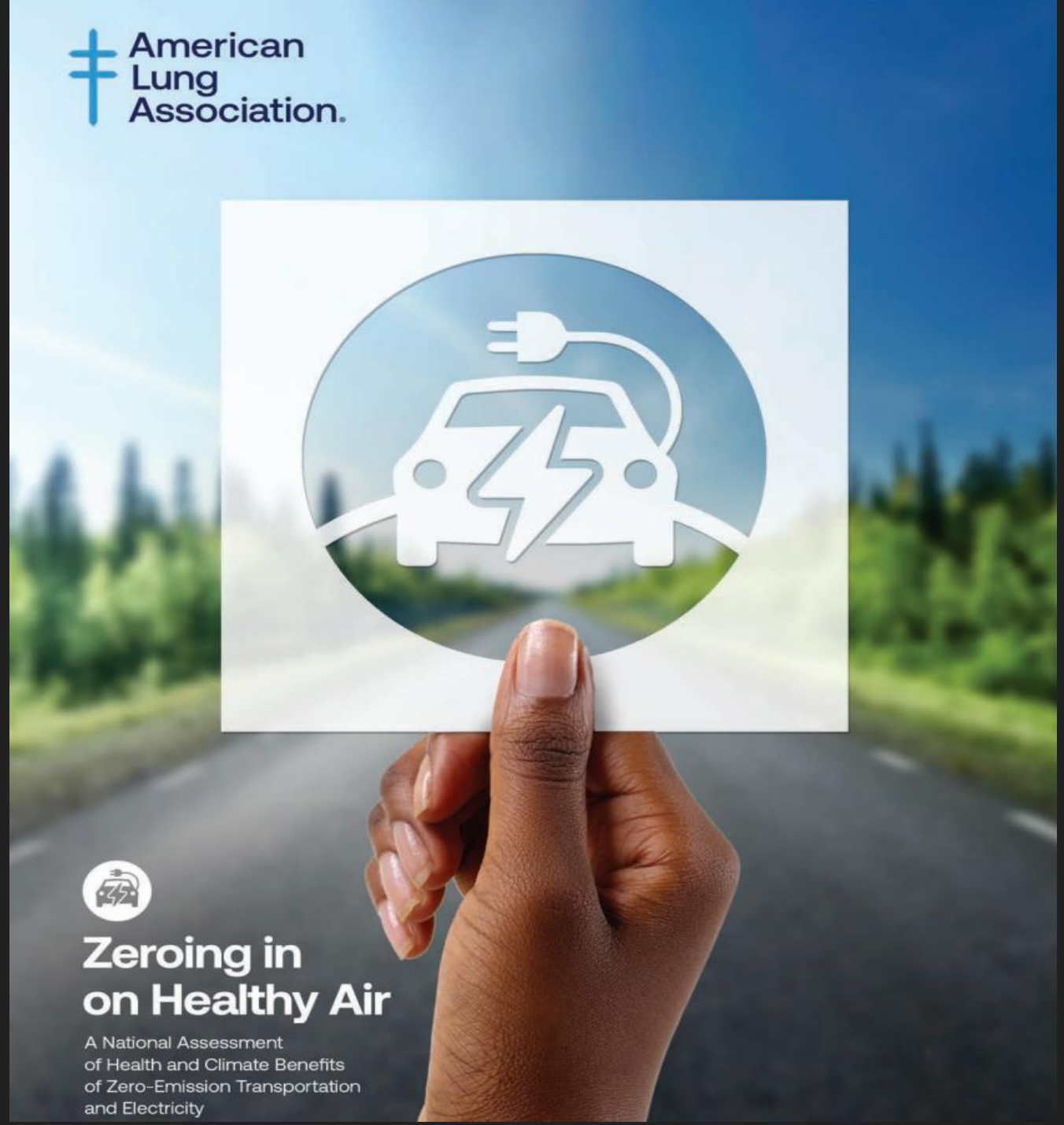


Contact info

Twitter: *@douglewinenergy*
Email: *doug@stoicenergyconsulting.com*



Appendices



The widespread, rapid shift to zero-emission transportation and electricity generation is critical to healthy air, and can yield more than $1.2 trillion in health benefits and 110,000 pollution-related deaths avoided over the coming decades along with over $1.7 trillion in global climate benefits.

END ENERGY POVERTY/

Field Note

Frozen Out in Texas: Blackouts and Inequity

JP Carvallo — Principal Scientific Engineering Associate at Lawrence Berkeley National Laboratory, **Feng Chi Hsu** — Researcher, Colorado School of Mines, **Zeal Shah** — UMass Amherst, **Jay Taneja** — UMass Amherst

13 MIN READTIME / 04.14.21

Huge equity implications to outages in Feb.

4x time of outages for poorest compared to wealthiest.

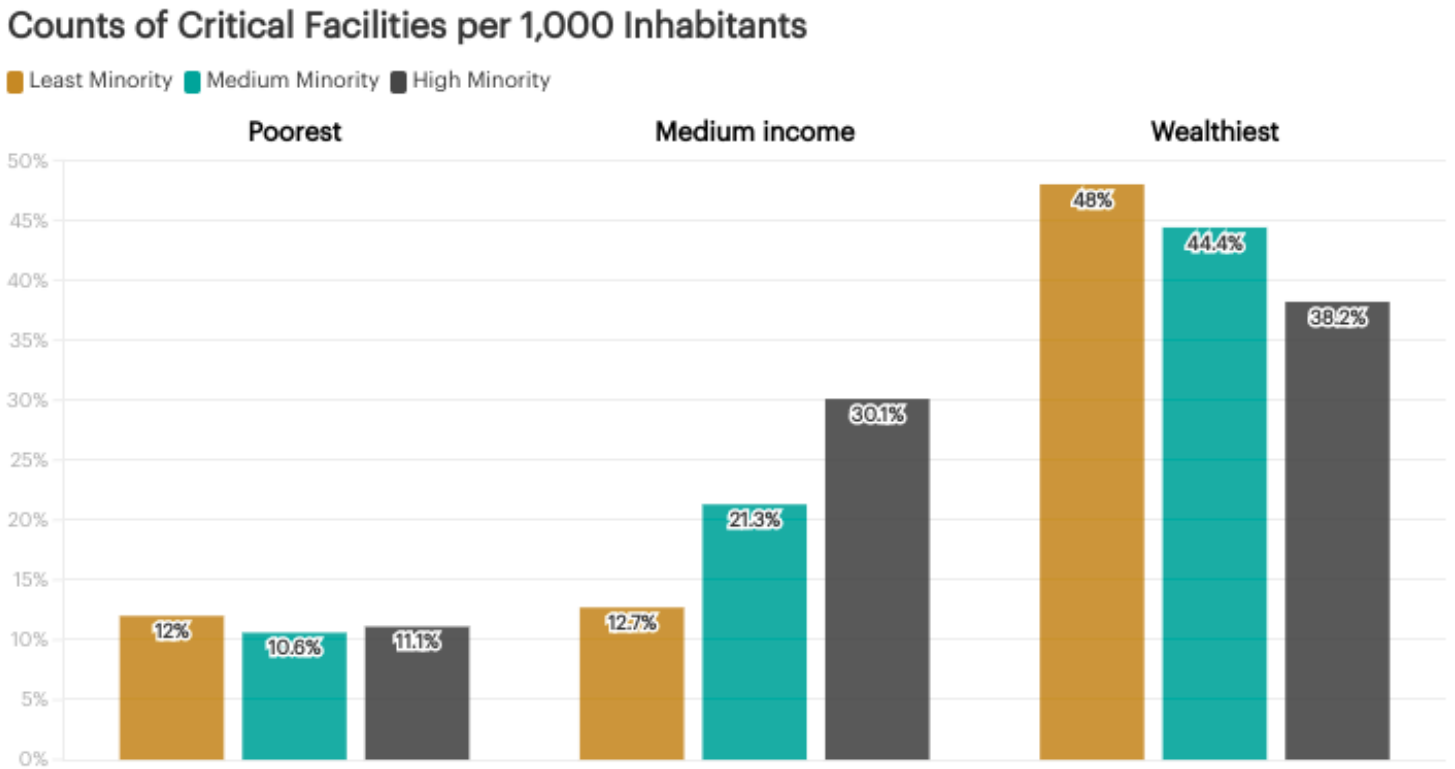
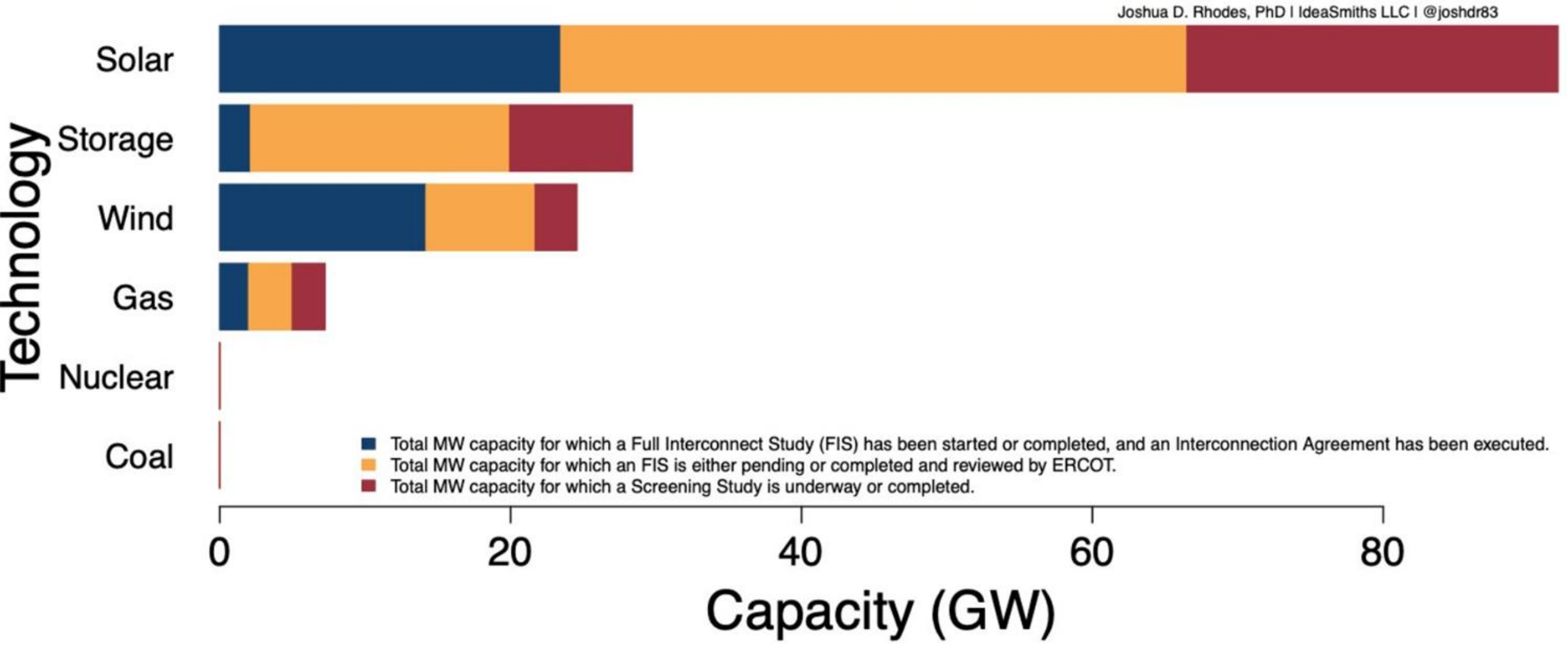


Figure 3. Distribution of critical facilities - hospitals, fire and police stations, and water and wastewater treatment plants - among the least minority, medium-minority, and highest-minority quintiles in the poorest, medium-income, and wealthiest quintiles of CBGs across Texas.

The ROCKEFELLER FOUNDATION

ERCOT Interconnection Queue (February 2021)



Dallas-Fort Worth
CLEAN CITIES

Interstate 45 Zero-Emission Corridor Infrastructure Deployment Plan

Lori Clark and Soria Adibi

NCTCOG/DFW Clean Cities

Zero Emission Vehicle Workshop

4.25.2022

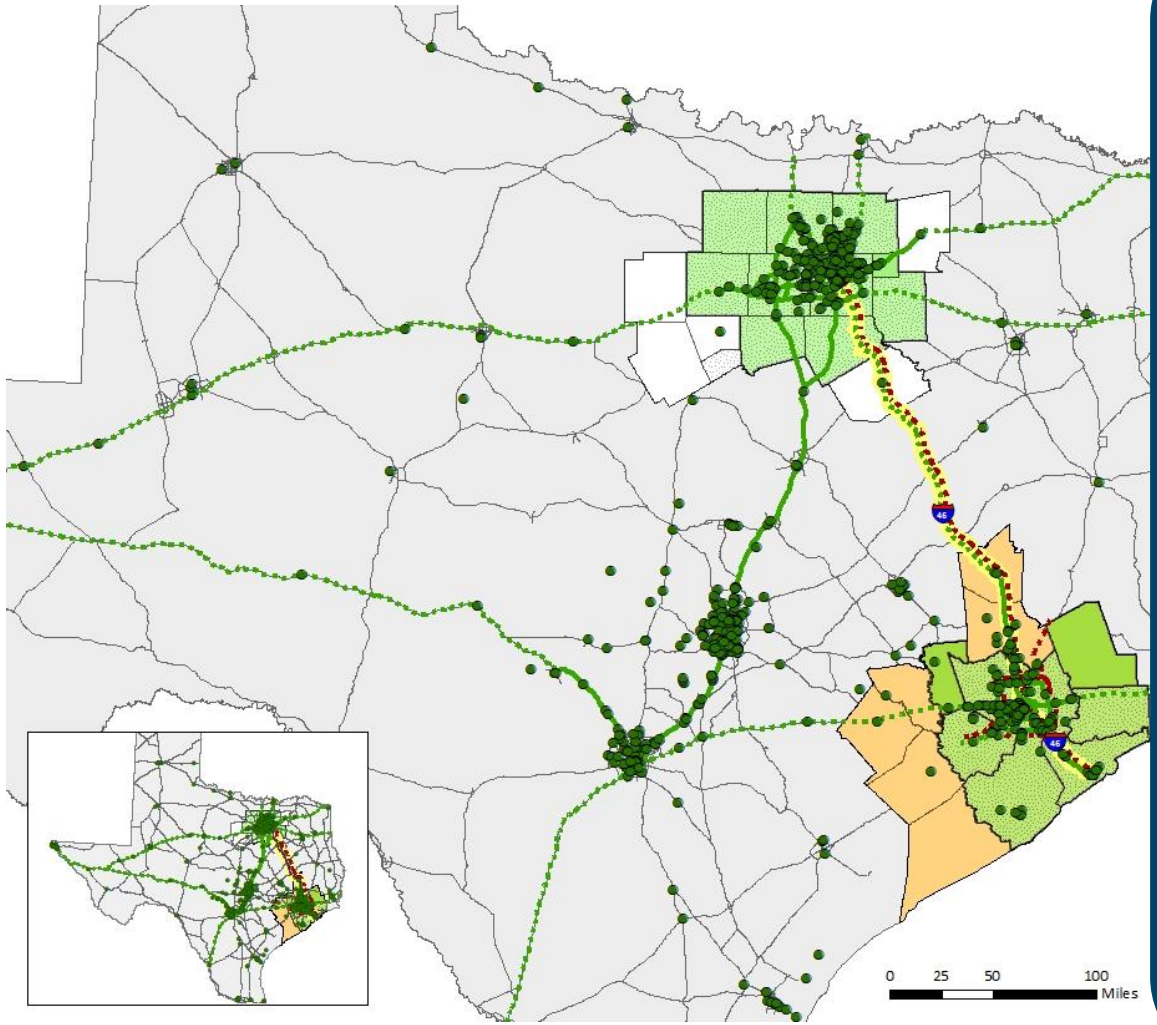
Plan Goals

Provide Actionable Recommendations to Facilitate Battery Electric and Hydrogen Fuel Cell Electric Deployments

Support Future Strategic Initiatives (e.g. Autonomous Vehicles)

Engage Wide Range of Stakeholders

Acknowledge Need to Revisit in 3-5 Years



I-45 Corridor Profile:

290 Miles

10 Counties

(5 Designated Nonattainment for Ozone)

Carries Nearly Half of Texas' Truck Freight

2017 Cargo Totaled Over 62.6 Billion, Over 10,000 Ton-Miles

Plan Deliverables

- Stakeholder Lists
- Corridor Workshop
- Infrastructure Deployment Plan
- Stakeholder Meetings
- ZEV Ride and Drives & Display
- Stakeholder Letters of Support

Light-Duty Battery EV Charging

Current Status

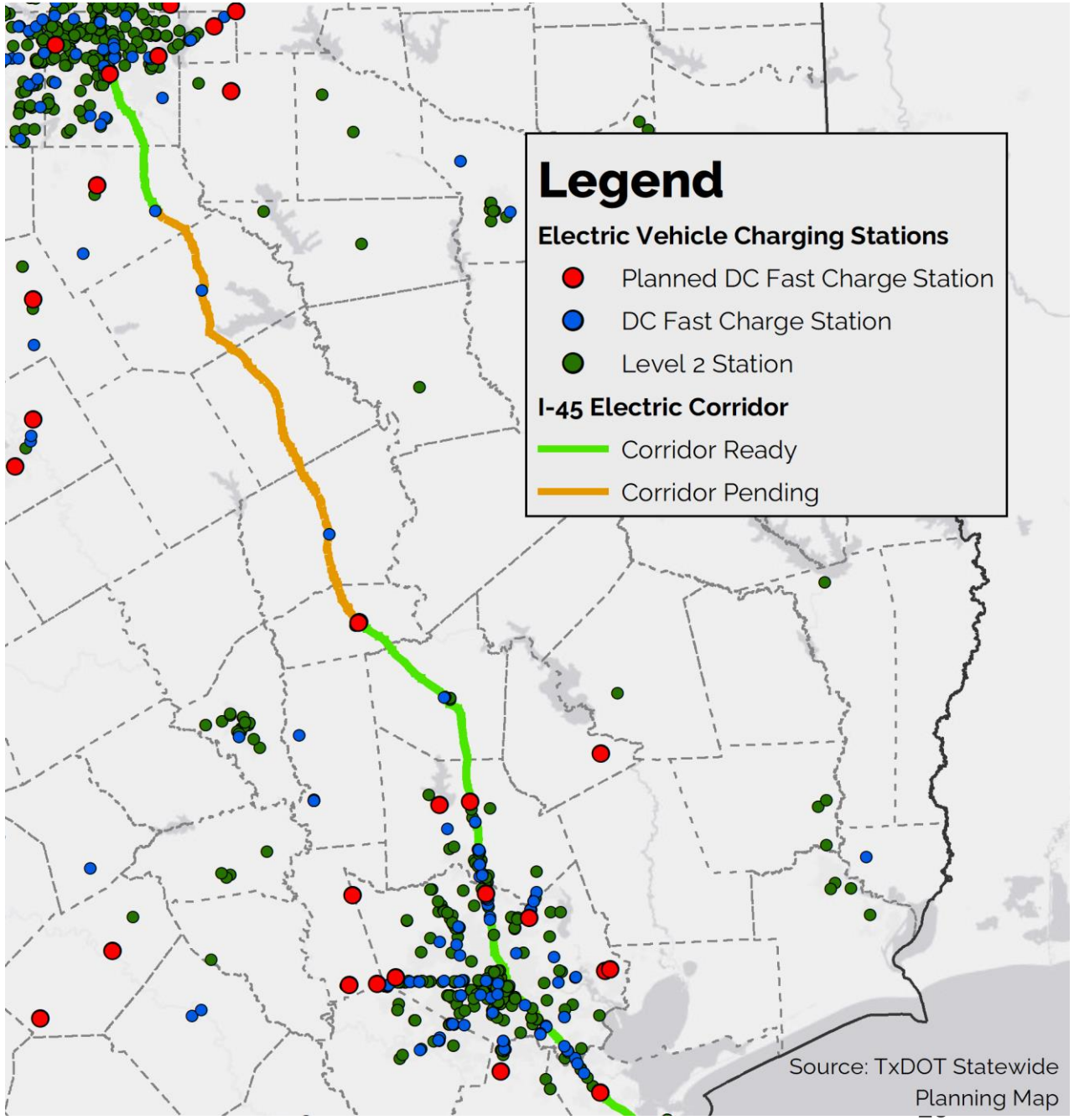
111 Mile Gap From Ennis to Madisonville

Goal to Meet FHWA Criteria

1 Qualifying DC Fast Charge Station Every 50 Miles

As of February 2022, Qualifying Stations Must:

- Be Within 1 Mile of the Corridor
- Provide at Least 4 CCS Connectors Capable of Providing at Least 150 kW Charging Simultaneously



Light-Duty Battery EV Charging

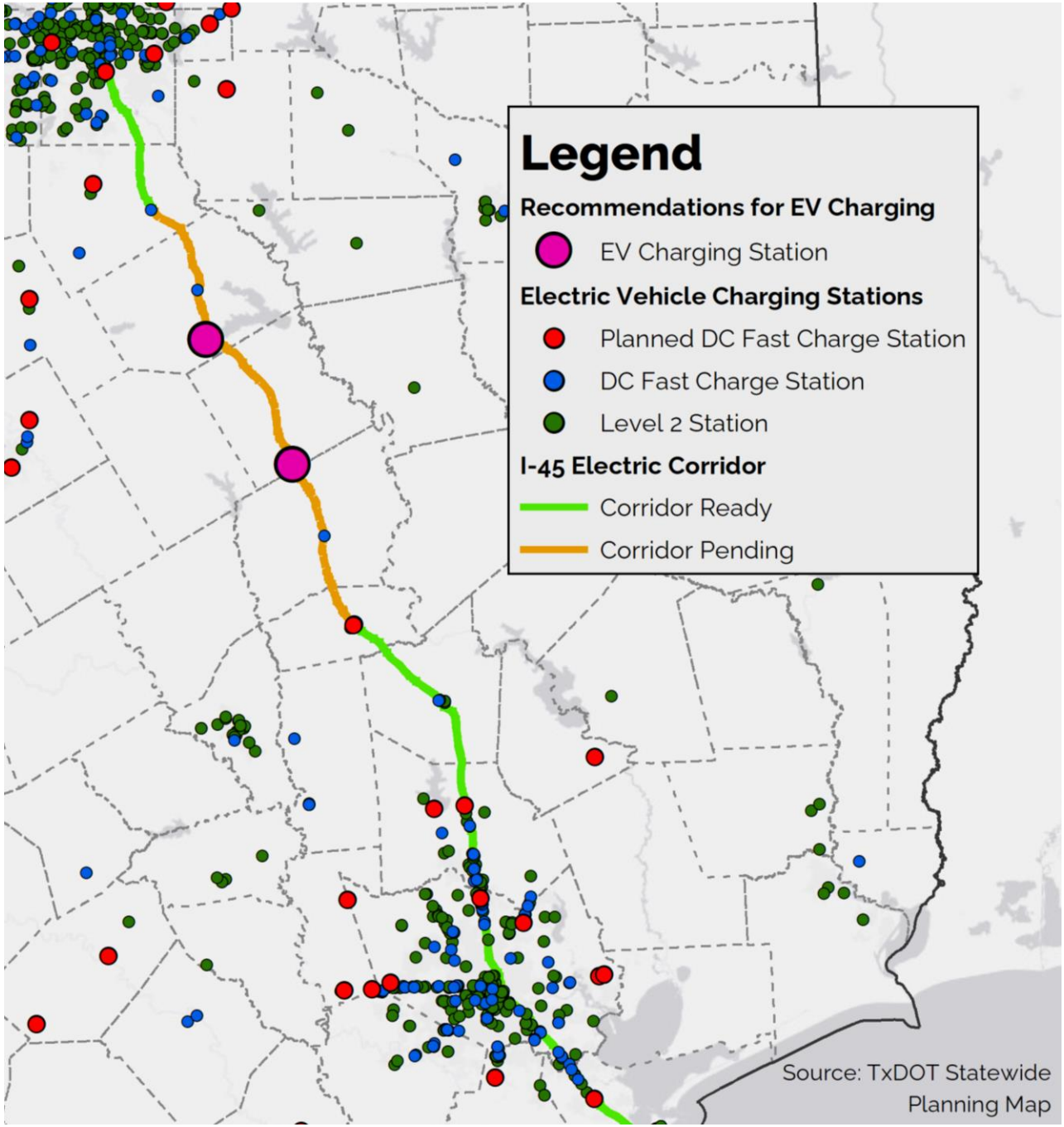
Approach to Recommendations

1. Located in the "Pending" Gap
2. Intersects Another National Highway System Corridor
3. Number of Amenity Types (e.g. food, shopping, etc.)
4. No Direct-Connect Ramps

Recommendations

Add Charging Stations At/Near:

1. Exit 178: US 79 in Buffalo
2. Exit 229 (US 287) or Exit 231 (TX-31) in Corsicana



Infrastructure for Heavy-Duty Vehicles

Current Status	Goal to Meet FHWA Criteria
No EV Charging Designed for Heavy-Duty Vehicles	1 Qualifying DC Fast Charge Station Every 50 Miles
No Hydrogen Fueling	1 Hydrogen Fueling Station Every 150 Miles

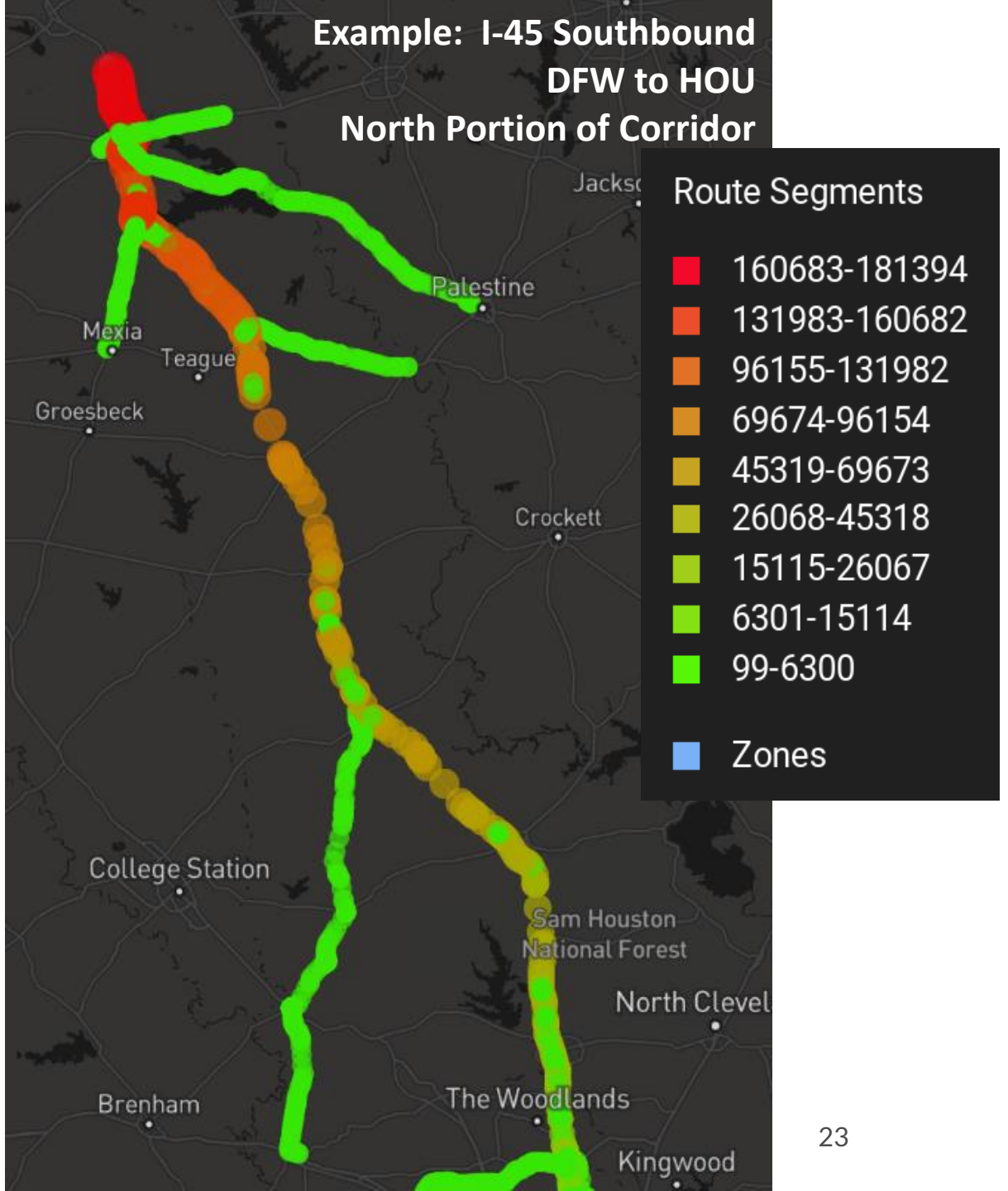
StreetLight Analysis

Approximately 40 Billion Data Points Each Month From Smart Phone and Navigation Systems

Validated Against Sensors and Traffic Counters

Isolated Commercial Truck Traffic

Used "Top Routes" Analysis to Visualize Truck Routes Traveled After Passing Through a Zone Placed on IH-45 or at a Freight-Oriented Development

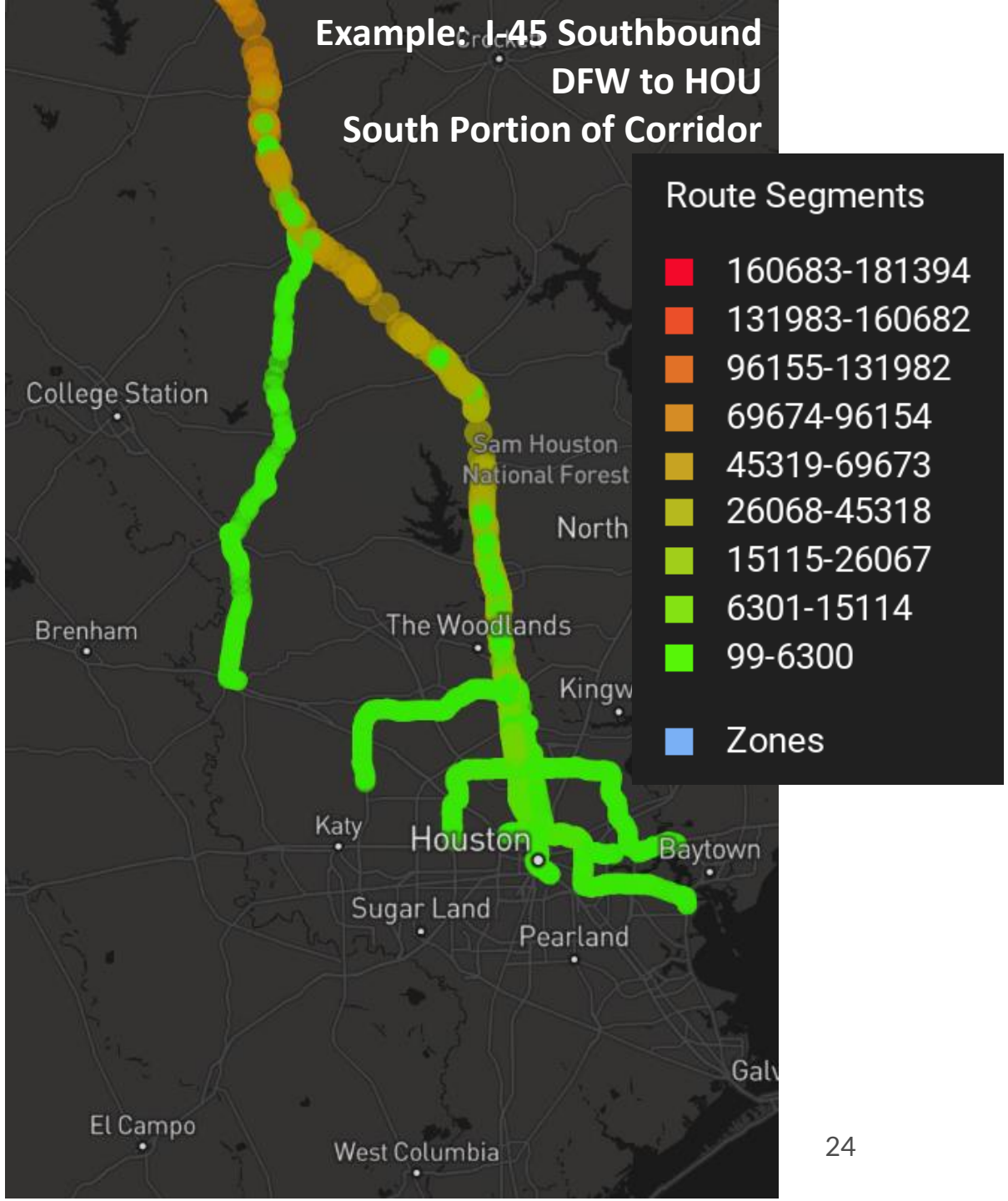


How Streetlight Is Being Applied

Confirms the Nature of Traffic Leaving Houston is Largely Destined for DFW, and Vice-Versa

Indicates Where Corridor "End Points" May be Set to Capture Freight Trips

Few Turnoff Points Between Metros

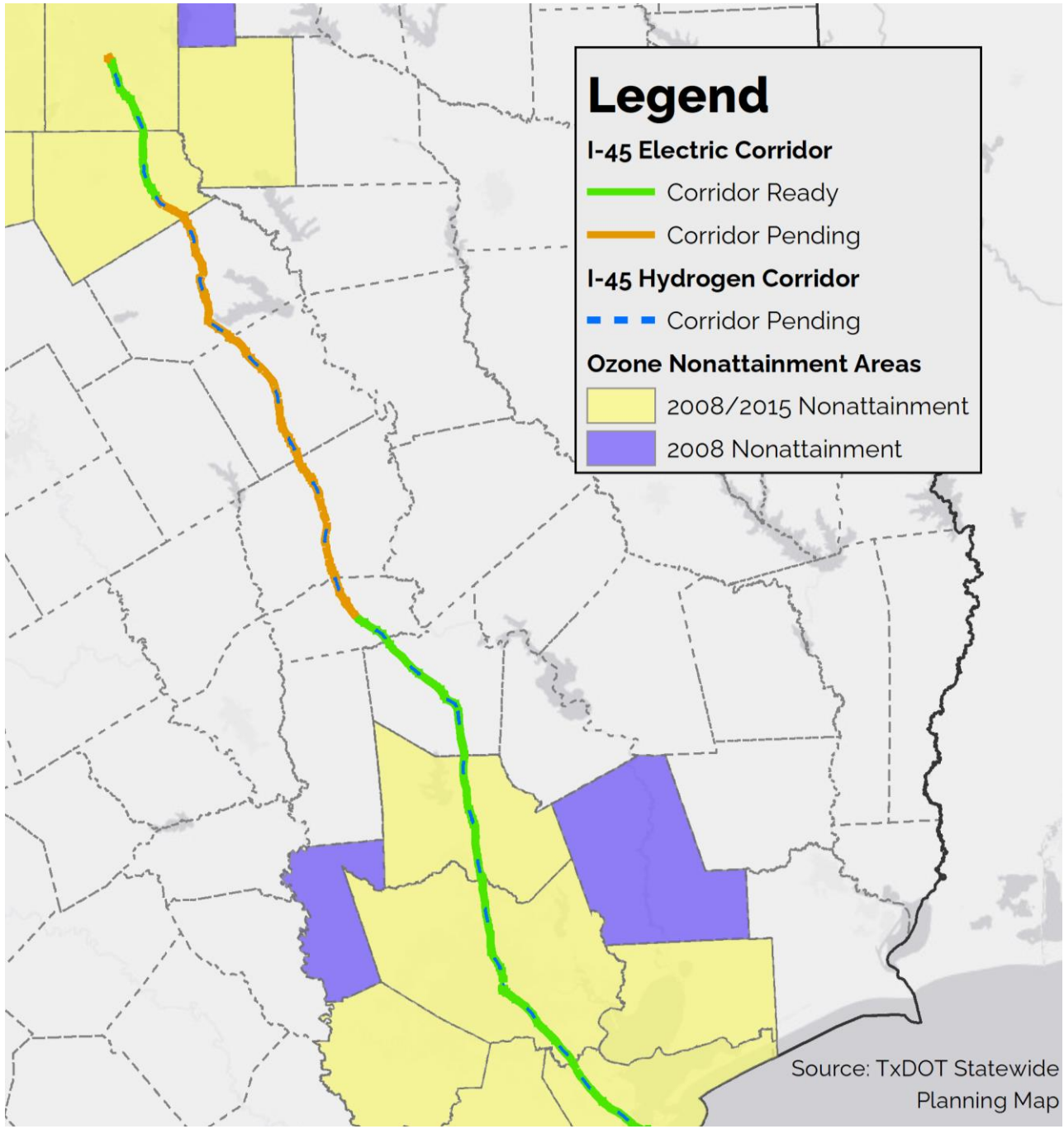


Infrastructure for Heavy-Duty Vehicles

Approach to Recommendations

1. Intersects a Freight System Corridor
2. No Direct-Connect Ramps
3. Cross-Street Accessible from Both NB and SB Directions of Travel
4. Turning Point Indicated by Streetlight Data
5. Access to at Least 2 Types of Amenities
   - Truck Stops Key

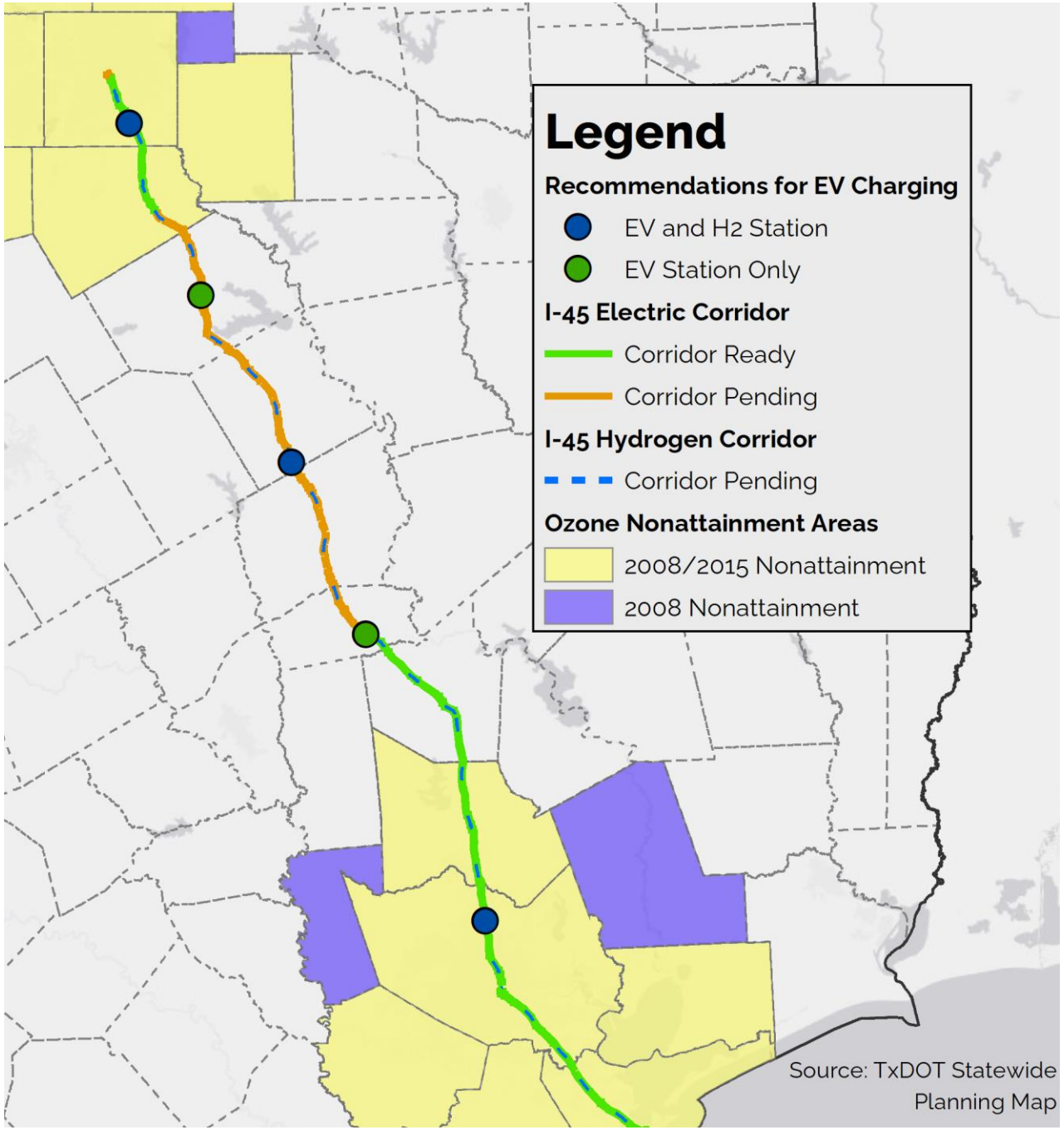
Identify End-Points, Then Fill to Meet Required Distance Intervals



Infrastructure for Heavy-Duty Vehicles

Recommendations:

- EV and H2: Exit 60B (Beltway 8 South), Houston
- EV Only: Exit 118 (TX 75/FM 1791), Huntsville
- EV and H2: Exit 178 (US 79), Buffalo
- EV Only: Exit 229 (US 287), Corsicana
- EV and H2: Exit 273 (Wintergreen Road, at Union Pacific Intermodal Facility)



Additional Plan Content

Market Outlook

Potential Emissions and Economic Benefits

Autonomous Truck Considerations

Inventory of Incentives, with Key Barriers & Recommendations

Policy and Regulatory Environment – Benefits and Barriers

Accomplishments and Next Steps

For More Information

Lori Clark

Program Manager & DFW Clean Cities Coordinator

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Soria Adibi

Senior Air Quality Planner

sadibi@nctcog.org | 817-704-5667

www.nctcog.org/IH45-ZEV

Scalable Truck Charging Demand Simulation for Cost-Optimized Infrastructure Planning

A Houston-Dallas Case Study

Ann Xu, Ph.D.
CEO, ElectroTempo, Inc.
ann.xu@electrotempo.com
www.electrotempo.com

electrotempo

Project Overview

Objectives

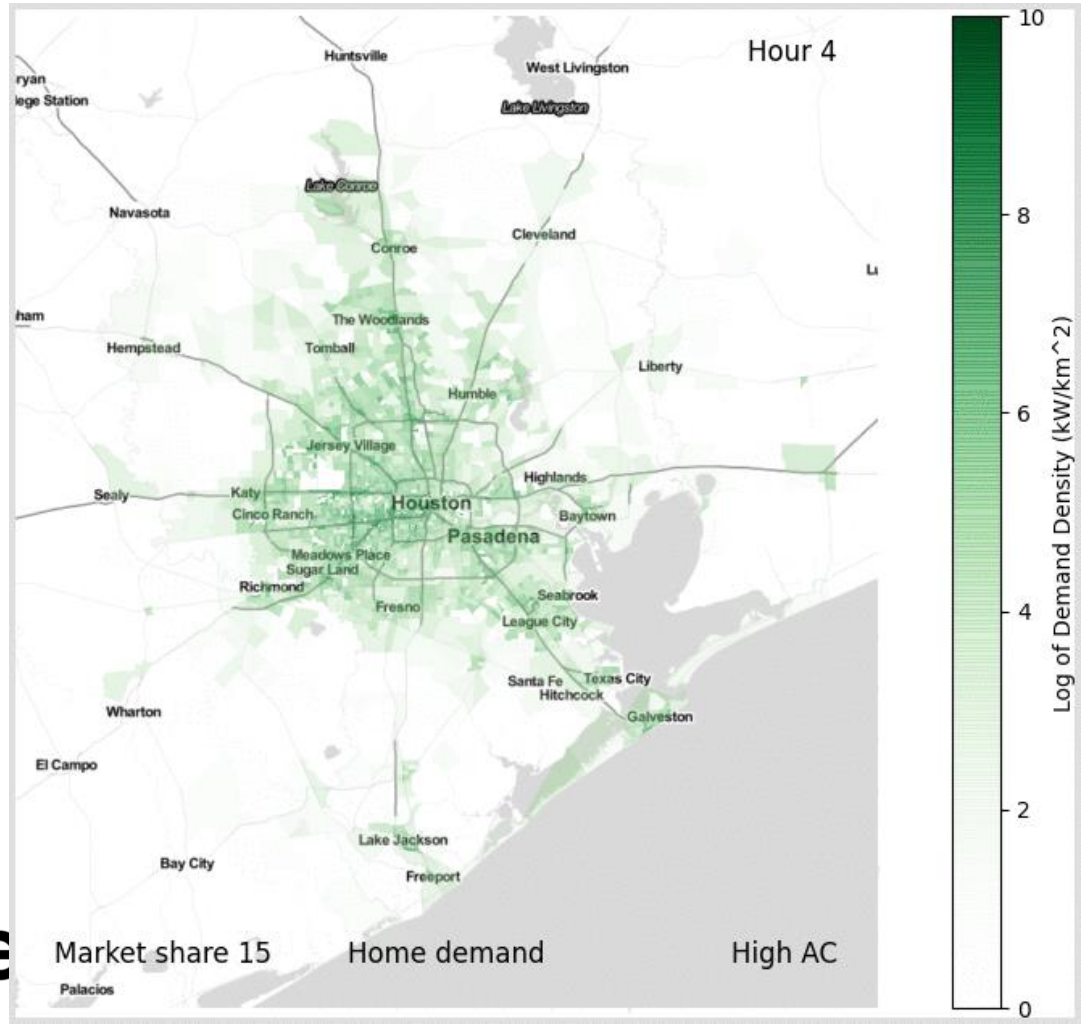
- Develop a truck charging demand model for large urban areas and along highway corridors
- Establish cost-optimization strategies for placing and sizing charging infrastructure

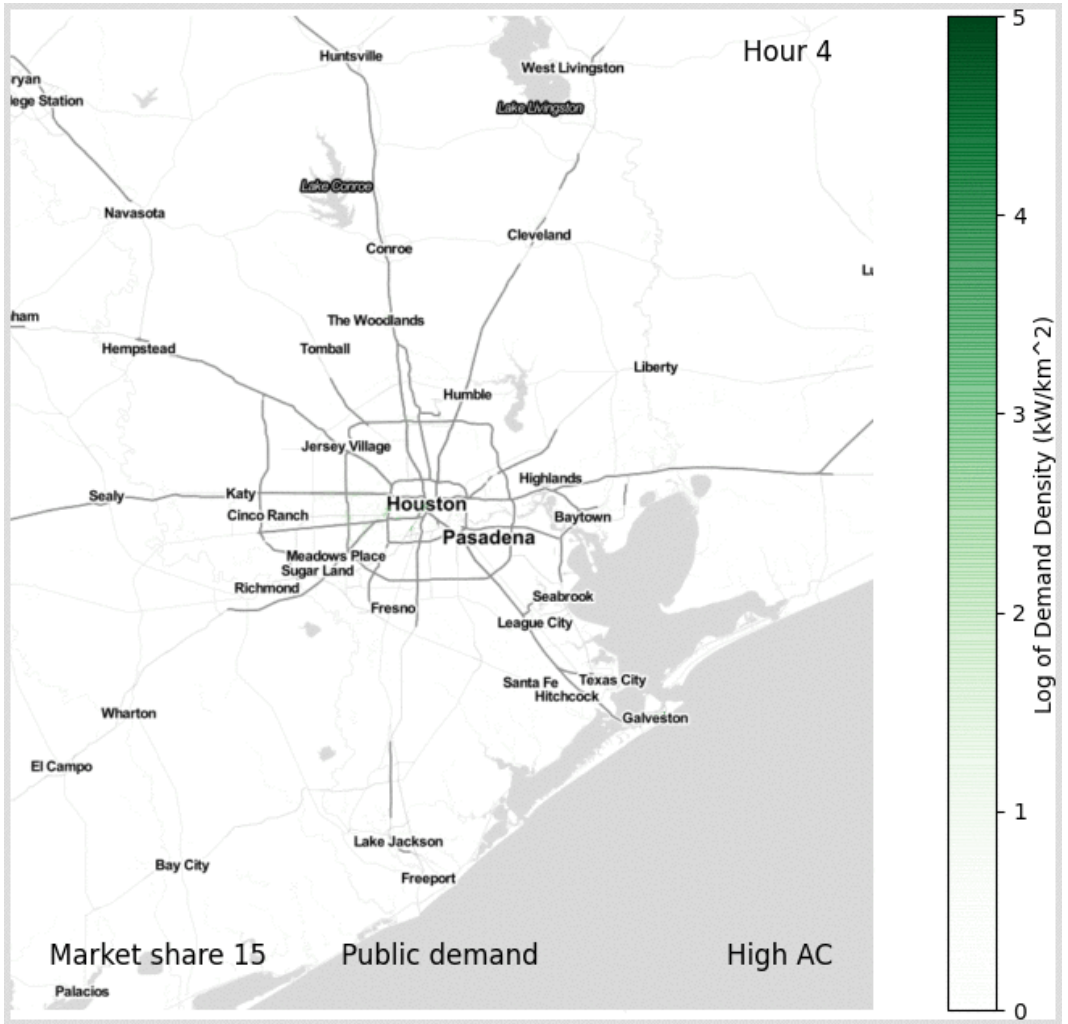
Scope of Work

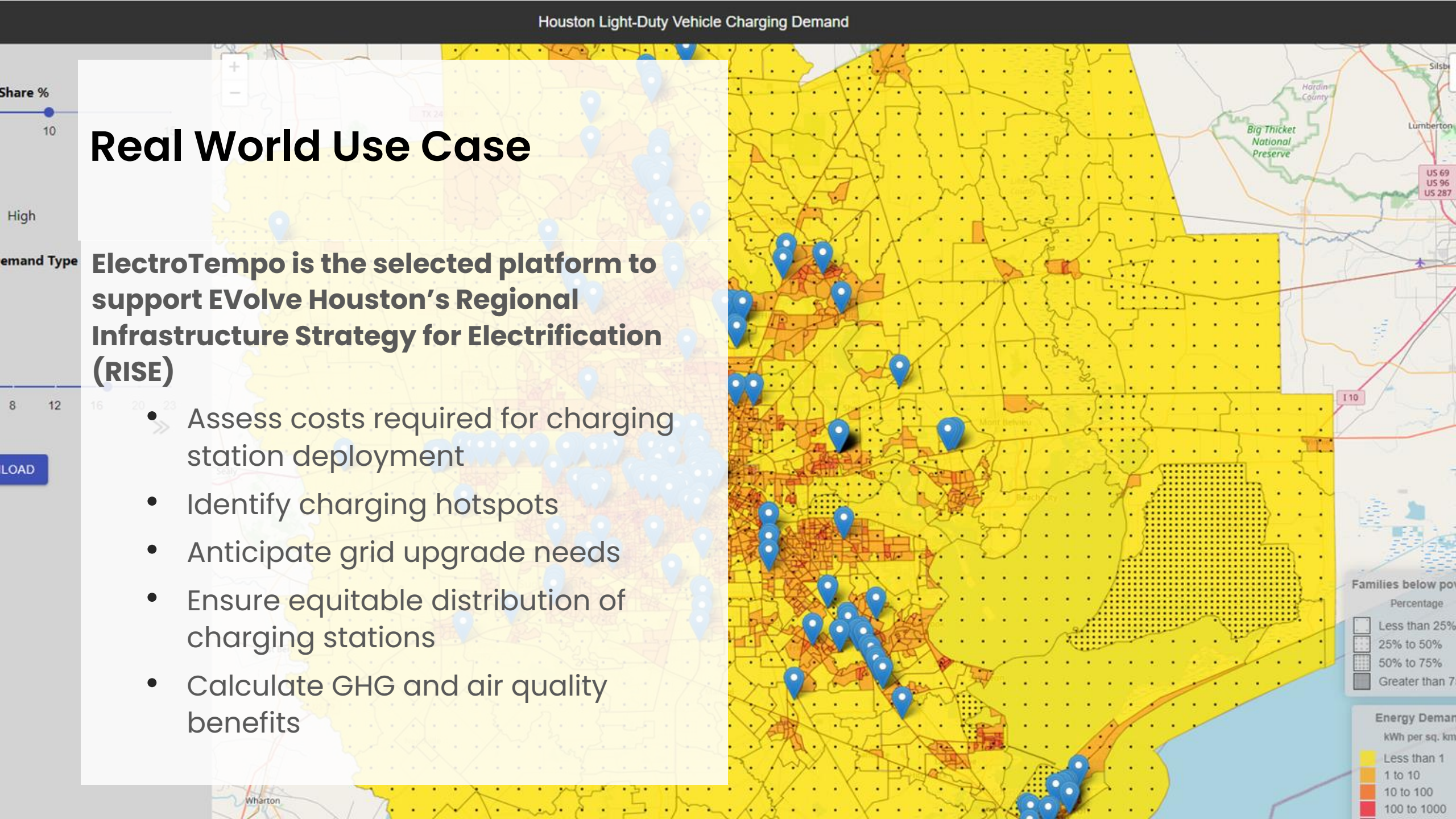
- 2021Q4 - 2022: Truck Charging Demand Simulation and Validation
- 2023: Cost Optimization
- 2024: Stakeholder Engagement

Foundational Work

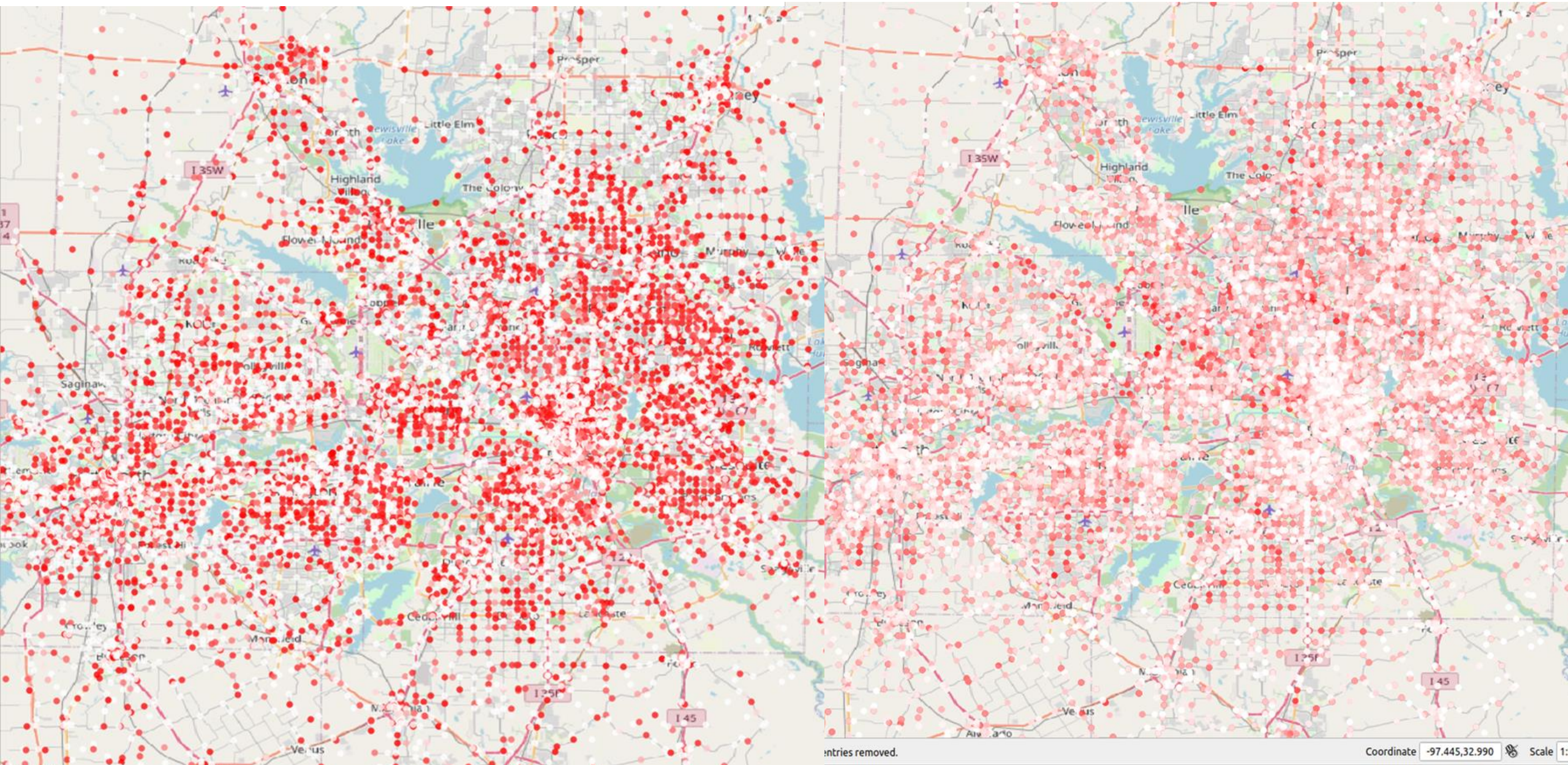
Light-Duty Charging Demand Simulation





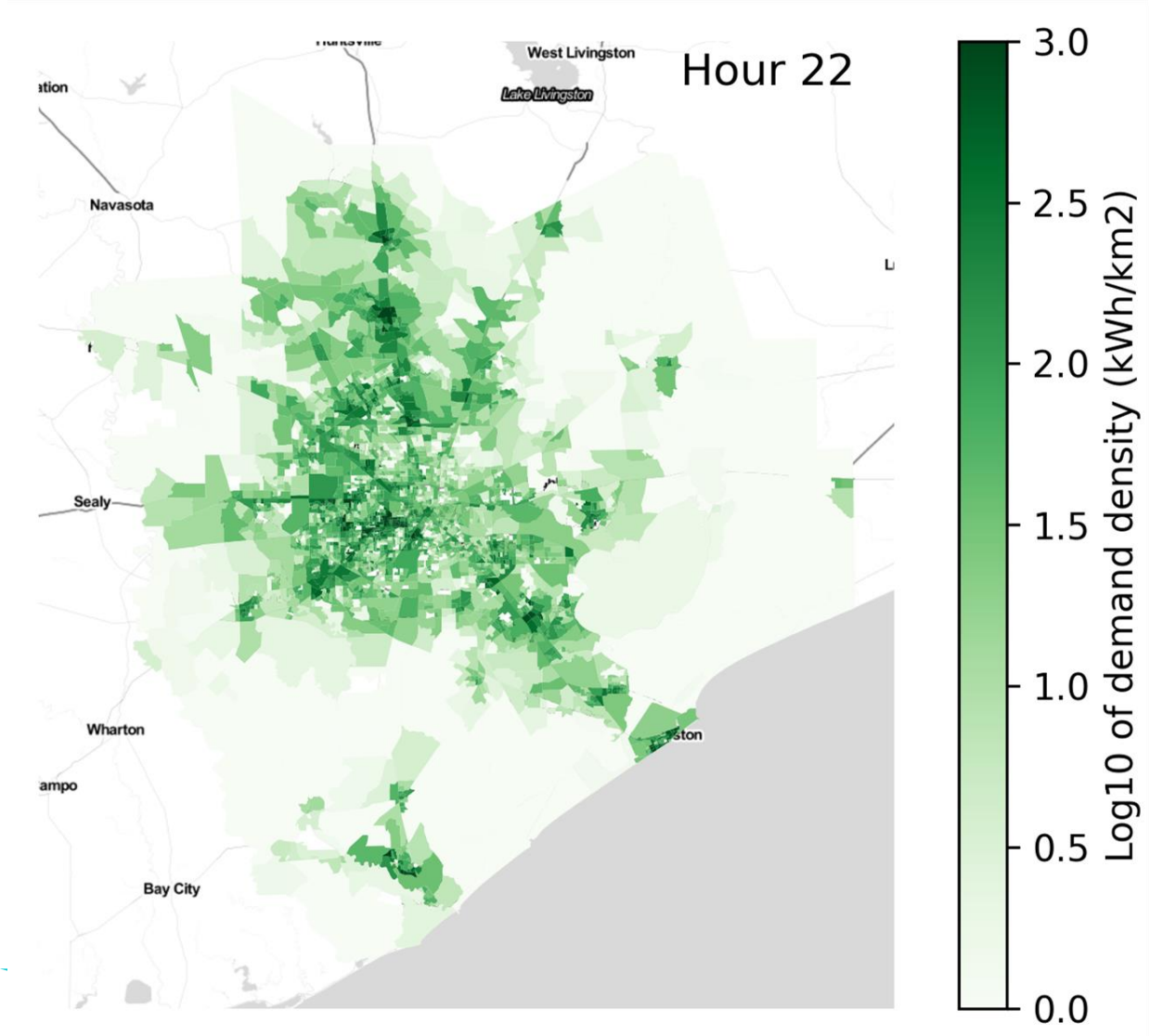

Houston Light-Duty Vehicle Charging Demand
Share %
10
High
emand Type
8
12
LOAD
Real World Use Case
ElectroTempo is the selected platform to support EVolve Houston's Regional Infrastructure Strategy for Electrification (RISE)
Assess costs required for charging station deployment
Identify charging hotspots
Anticipate grid upgrade needs
Ensure equitable distribution of charging stations
Calculate GHG and air quality benefits
Big Thicket National Preserve
Lumberton
US 69
US 96
US 287
I 10
Families below po
Percentage
Less than 25%
25% to 50%
50% to 75%
Greater than 7
Energy Deman
kWh per sq. km
Less than 1
1 to 10
10 to 100
100 to 1000
Wharton

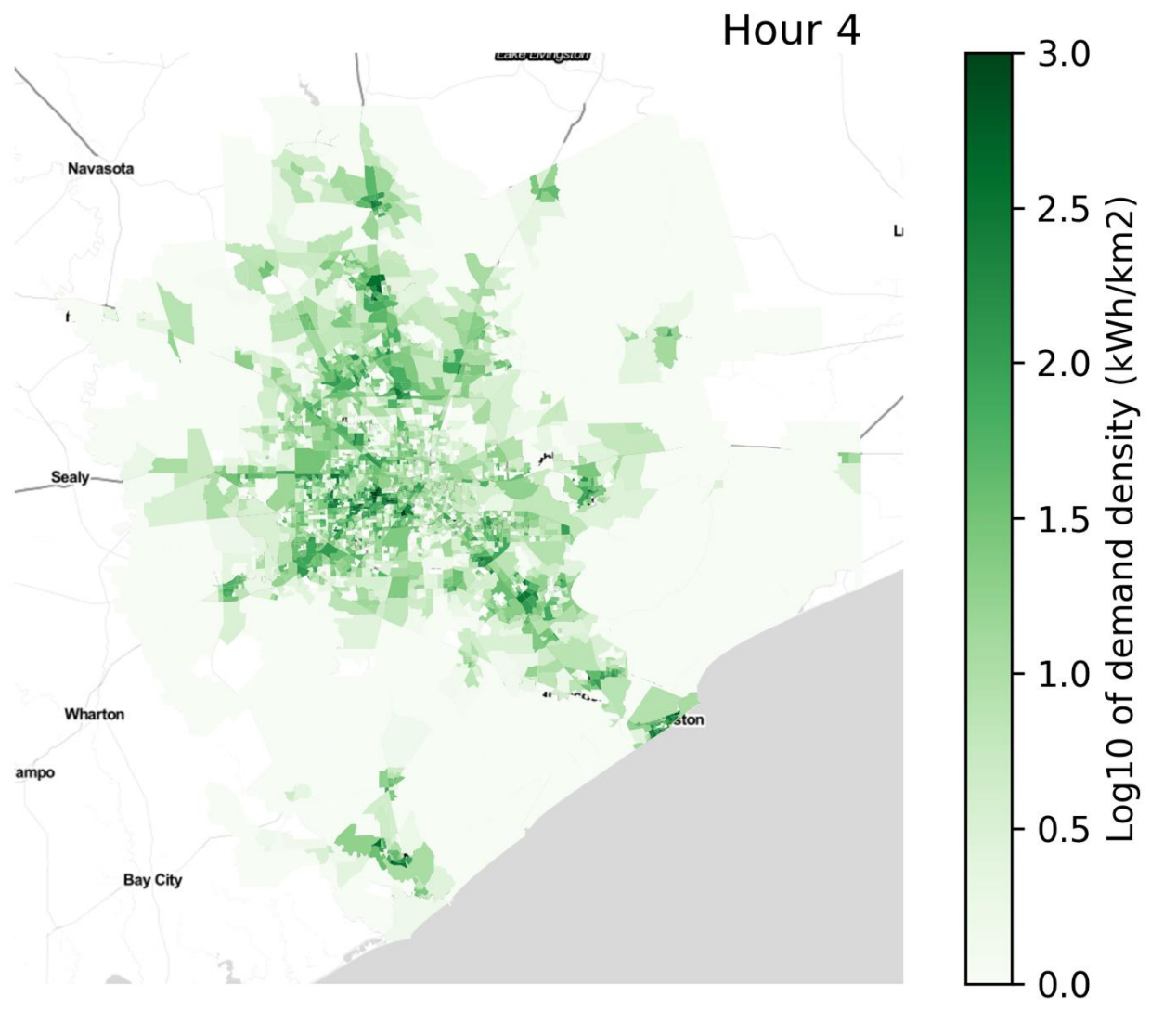
DFW Home and Public Charging Demand

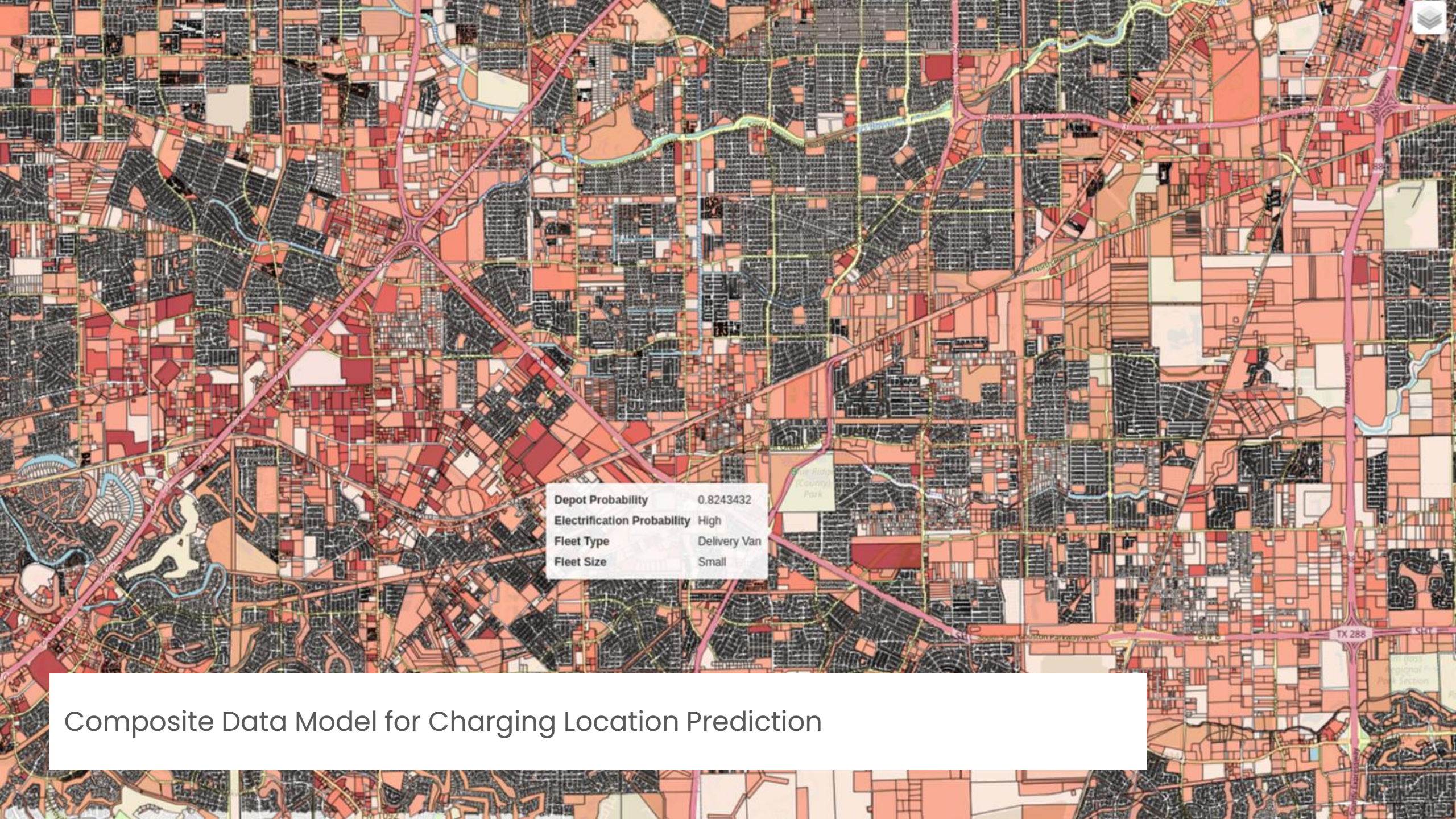


Current Status

Prototype Charging Demand Simulation







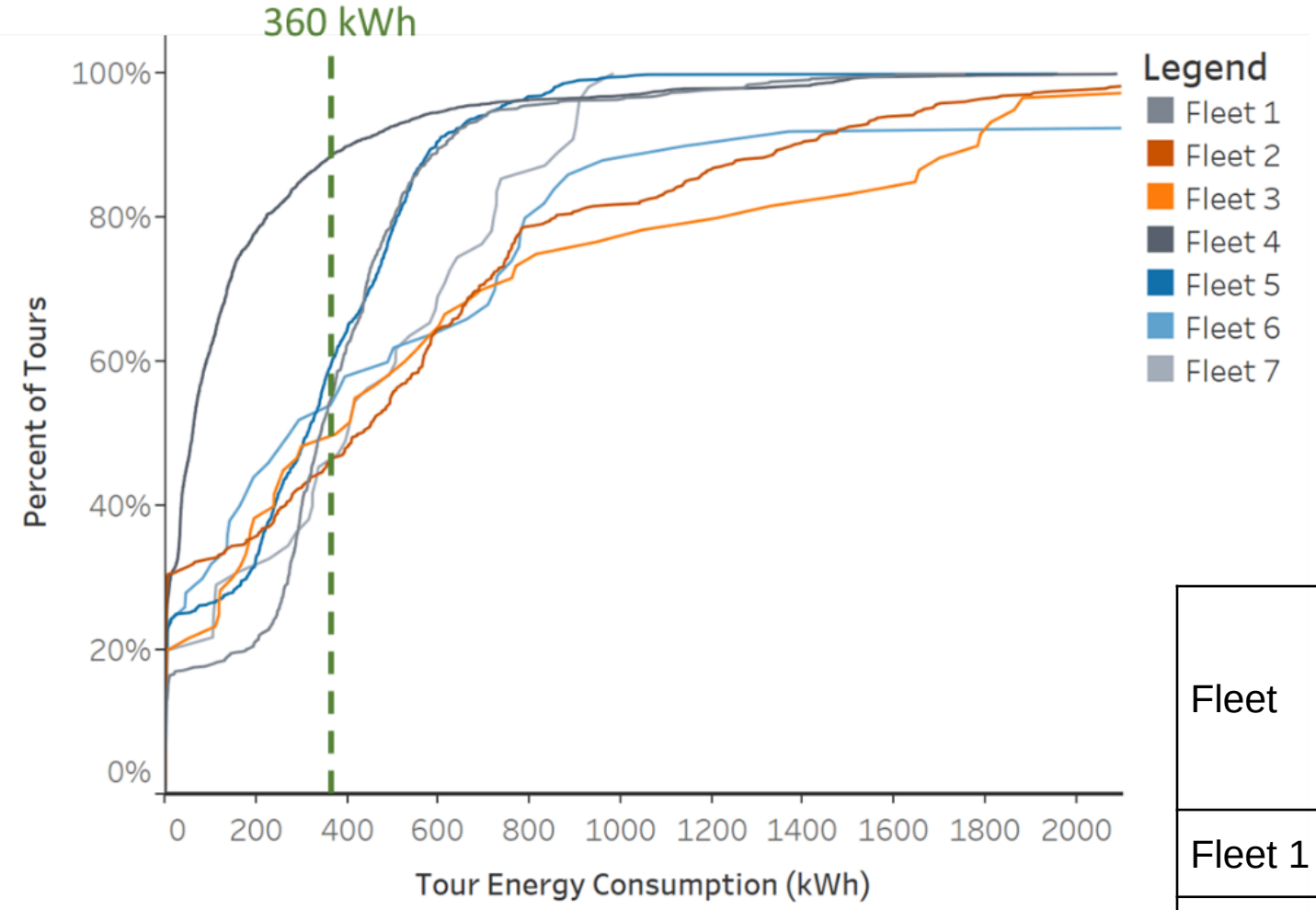
Composite Data Model for Charging Location Prediction

Next Steps

What to Expect This Year

Milestone	Description	Quarter
Base Urban Truck Charging Demand Simulator Implemented	The base urban truck charging demand simulator is developed for subsequent refinement	1
Urban Truck Traffic Simulation Validated	The urban truck traffic module is refined by land use and vocational characteristics; The resulting truck traffic simulation is validated	2
Truck Energy Consumption Estimates Validated	Truck energy consumption is estimated by vocation and validated against a DOE-recognized source	3
Long-haul Truck Traffic Simulation Validated (Because depot charging is not enough)	The long-haul truck traffic module is refined by cargo and destination; The resulting truck traffic simulation is validated against real-world data or a credible simulation model	4

Drayage Truck Electrification Study



Need tools to

- Identify range limitations specific to load, grade, and weather
- Identify suitable vehicle models
- Optimally assign trips to maximize electric truck utilization while balancing operational and lifetime considerations

Fleet	Current number of diesel trucks	Minimum required number of diesel trucks for long-haul operation	Annual mileage for one electric truck
Fleet 1	15	8	36,436
Fleet 2	8	7	19,997

Get Involved

Become an Industry Advisor

Simply send an email indicating your interest to info@electrotempo.com. Space on the board is limited, so priority will be given to the first applicants across each industry category. We will be in touch with you shortly to discuss participation.

What is the commitment?	What are the benefits to me?
• There is no cost associated with joining the ElectroTempo Industry Advisory Board • Beta test new products being developed by ElectroTempo and provide feedback • Participate in quarterly board meetings to provide feedback on ElectroTempo's latest tools and provide guidance towards future product development activities • Provide operational data if you wish to obtain targeted analytics for your organization	• Access customized electrification reports for your organization • Obtain potential revenue and projections for different scenarios to help determine where the primary costs and benefits of electrification may lie for your organization • Gain the ability to help shape the future of vehicle electrification planning and operational tools to ensure they fit your organization's needs • Network and collaborate with other electrification stakeholders

electrotempo

About ElectroTempo

Spun out of Texas A&M Transportation Institute (TTI) and founded in 2020, **ElectroTempo** is a **Software-as-a-Service** company providing data insights in transportation electrification. We help utilities meet the needs of next-generation fleets with optimally planned charging networks.

Our Mission is to create the e-mobility ecosystem to accelerate EV deployment

Our Vision is to be the analytic backbone of strategic planning and impact accounting systems for EV investment

electrotempo

About the Project

Team: ElectroTempo, Inc. and Texas A&M University

Funding Agency: U.S. Department of Energy Vehicle Technologies Office

Coverage: Dallas, Houston, and the 250-mile I-45 corridor in between, covering more than 13 million residents and rural and economically disadvantaged areas

Partners:

CenterPoint Energy

Houston and Dallas Clean Cities

Texas Electric Transportation Resources Alliance (TxETRA)

Find out how to get involved!

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The Problem

Long time to deploy EVs

- Diverse stakeholders
- Siloed information
- Split incentives

To deploy a diesel truck involves fleet managers & truck dealers

Order — 12 weeks — Receive

To deploy an electric truck involves fleet managers, truck dealers, charging providers & electric utilities

Plan — Coordinate with utilities — Build infrastructure — 18 months

To deploy electric cars and trucks in a region involves fleet managers, dealers, charging providers, electric utilities, property owners, & the government

Identify charging needs & opportunities — Seek government grants and approvals — Build infrastructure — ?? years

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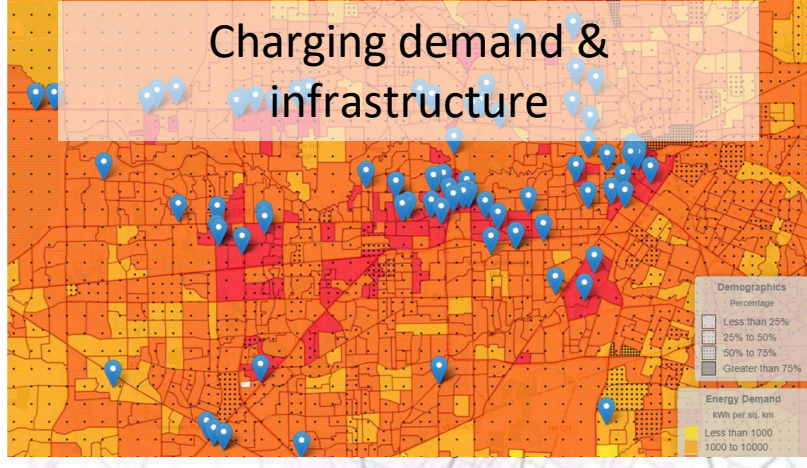
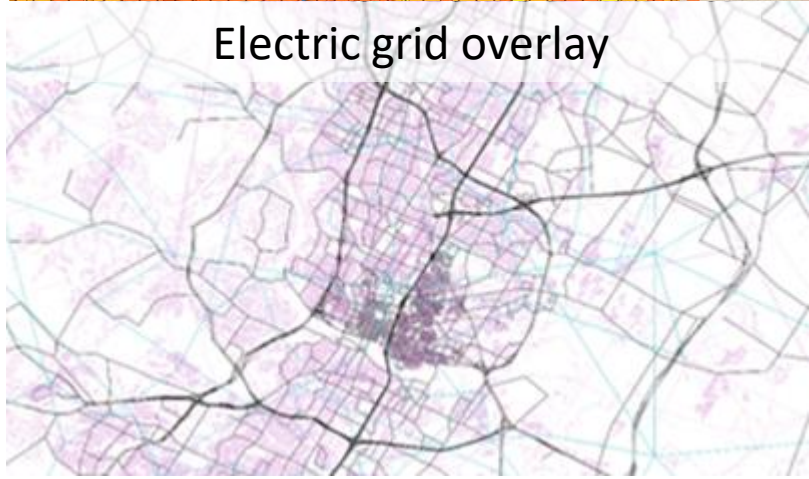
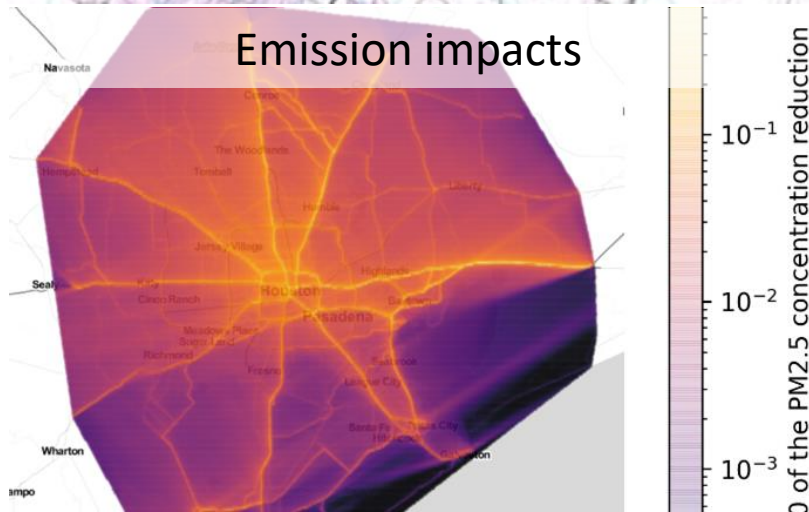
The Solution

A unifying data and simulation infrastructure integrating transportation demand, grid assets, land use, demographics, and emissions to optimally:

Accelerate EV deployment	Maximize return	Measure impacts
Through a shared view	For each stakeholder	On climate & equity







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Value to Utilities

Identify potential charging hotspots

Assess costs associated with EV charging infrastructure

Prioritize grid infrastructure upgrades

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Value to Fleets

Help electric utilities anticipate truck charging demand and thus prepare the electric grid to support charging

Estimate the type and size of chargers needed to support operations

Identify charging strategies to save up to $10k per year per truck in electricity cost

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Question and Answer

We will be using Online Questions throughout the presentation. Event number is: **4252022**

- Visit **OnlineQuestions.org**
  OR
- Scan the QR Code to join

80-year History of Turning Raw Technology into Practical Energy Solutions

FOR A BETTER ECONOMY AND A BETTER ENVIRONMENT

SUPPLY ▶ CONVERSION ▶ DELIVERY ▶ UTILIZATION

RESEARCH & DEVELOPMENT

PROGRAM MANAGEMENT

TECHNICAL/ ANALYTICAL

CONSULTING

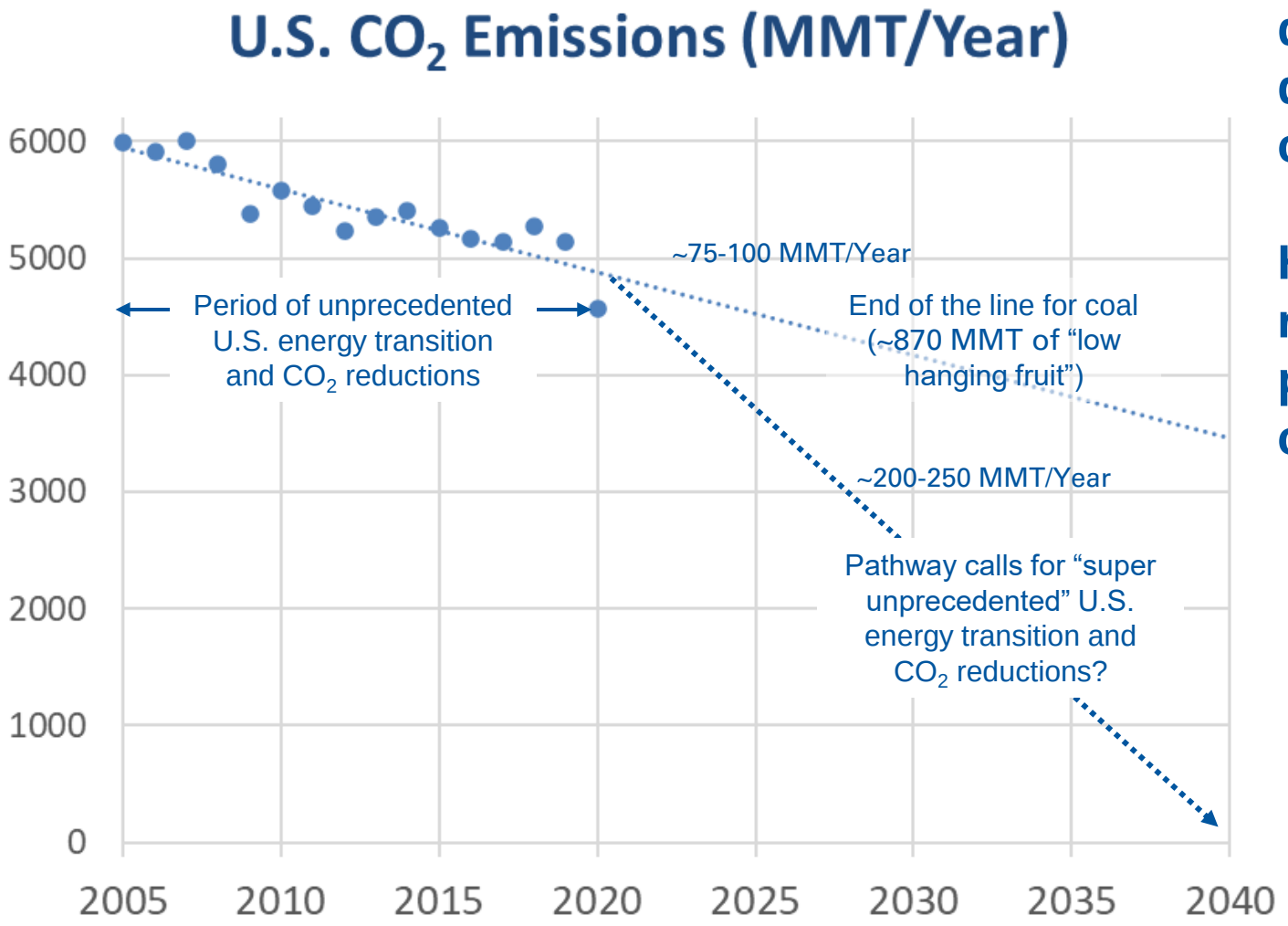
TRAINING

COMMERCIALIZATION

400+ EMPLOYEES

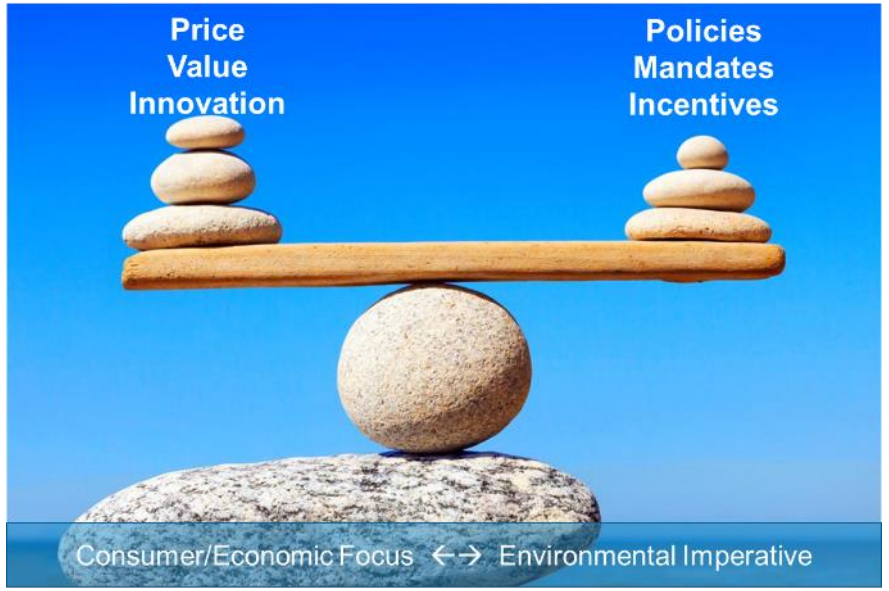
World-class piloting facilities headquartered in Chicago area

www.gti.energy

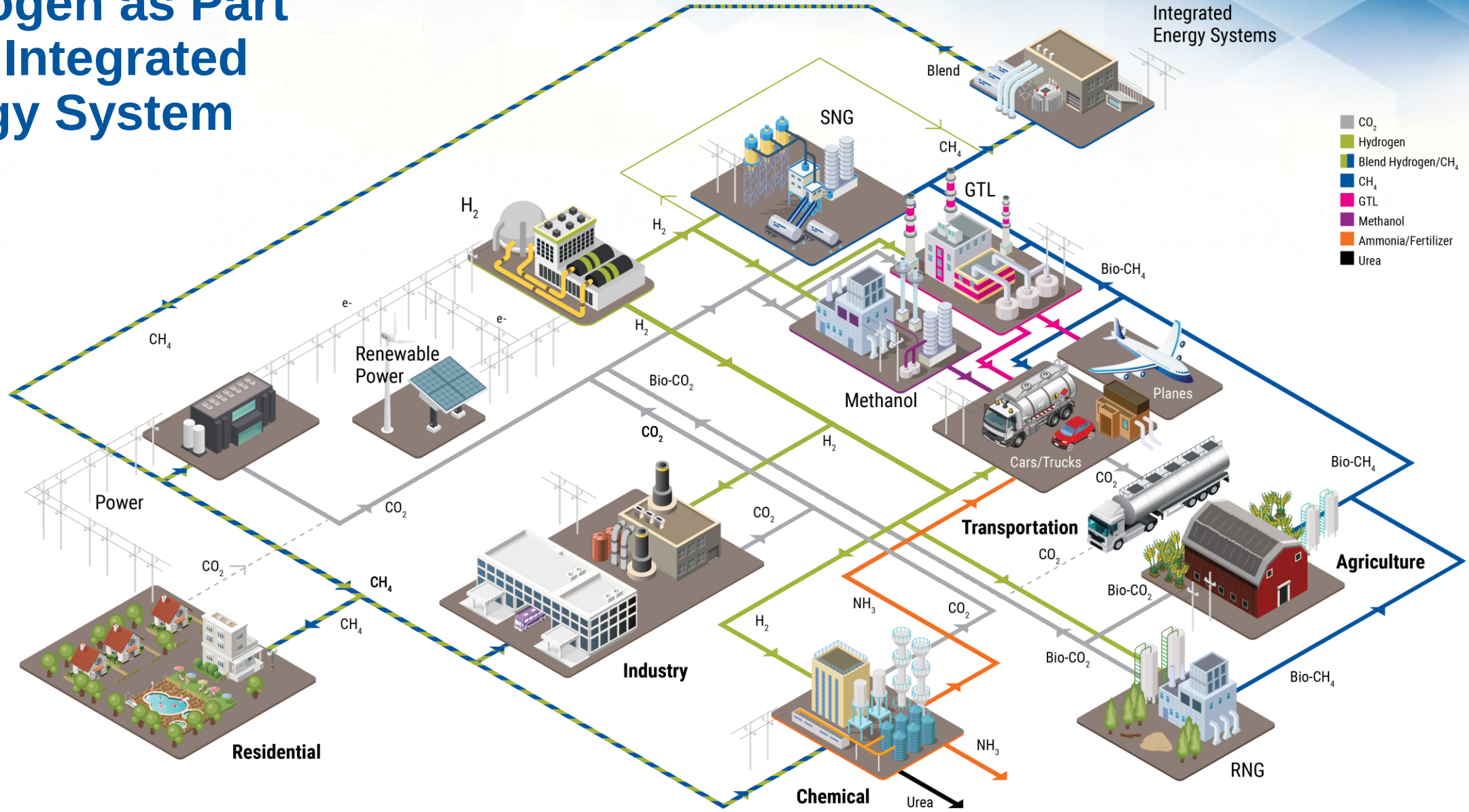


Most CO_2 emission reductions since 2005 due to shale gas cost-effectively displacing coal (and with minimal consumer energy cost impacts).

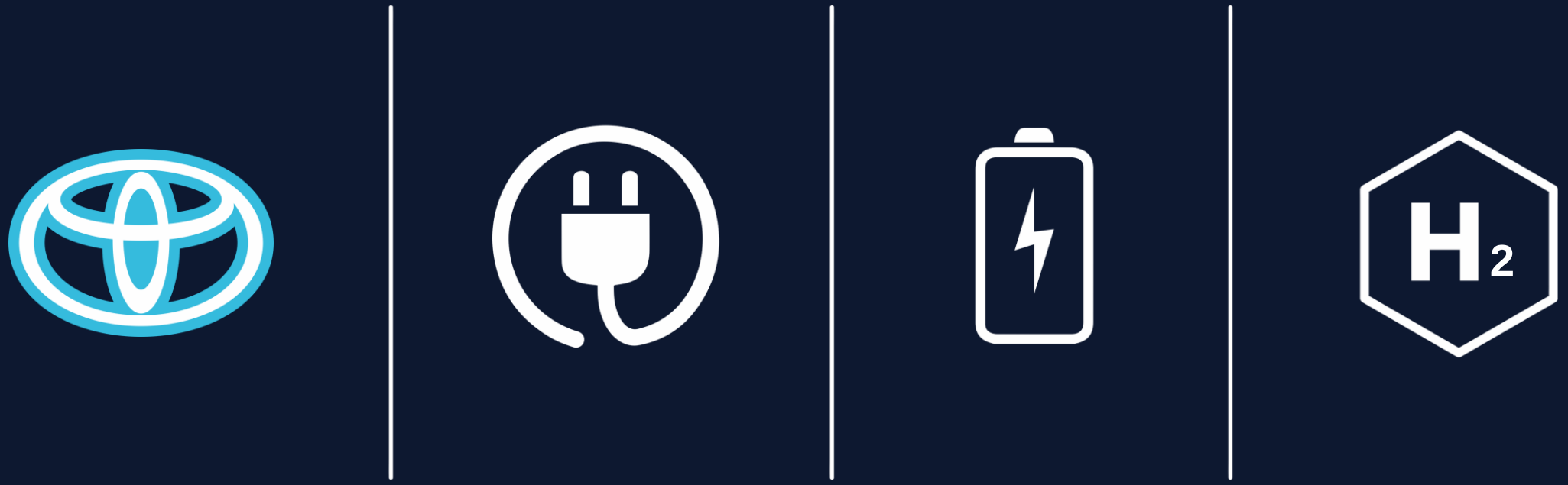
How do we achieve even greater rates of reduction after "low hanging fruit" is picked? What are the consumer energy cost and energy system implications?



Hydrogen as Part of an Integrated Energy System



Expand, Modify, Repurpose, Leverage Existing Infrastructure



NCTCOG
APRIL 25, 2022

Annual Production Volume

3,000/yr

Gen 1

30,000/yr

Gen 2

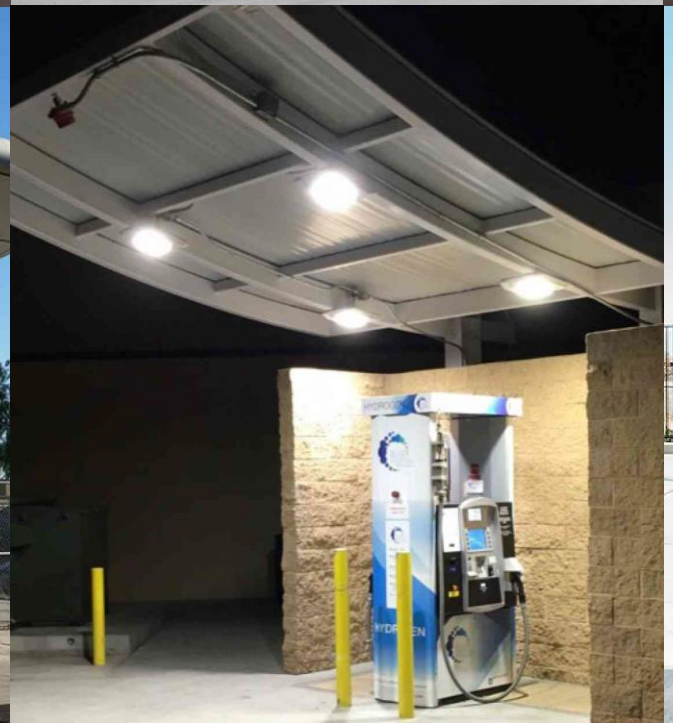
Future Scale Up


H2
H2


Hydrogen
Hydrogen


Iwatani
Hydrogen
Station
Iwatani


Hydrogen




ITM POWER
Energy Storage | Clean Fuel
HYDROGEN PRODUCED
ON-SITE
ITM POWER
Energy Storage | Clean Fuel

Initial Prototypes

10 Truck Pilot

Production Intent

2

INITIAL HEAVY-DUTY STATIONS

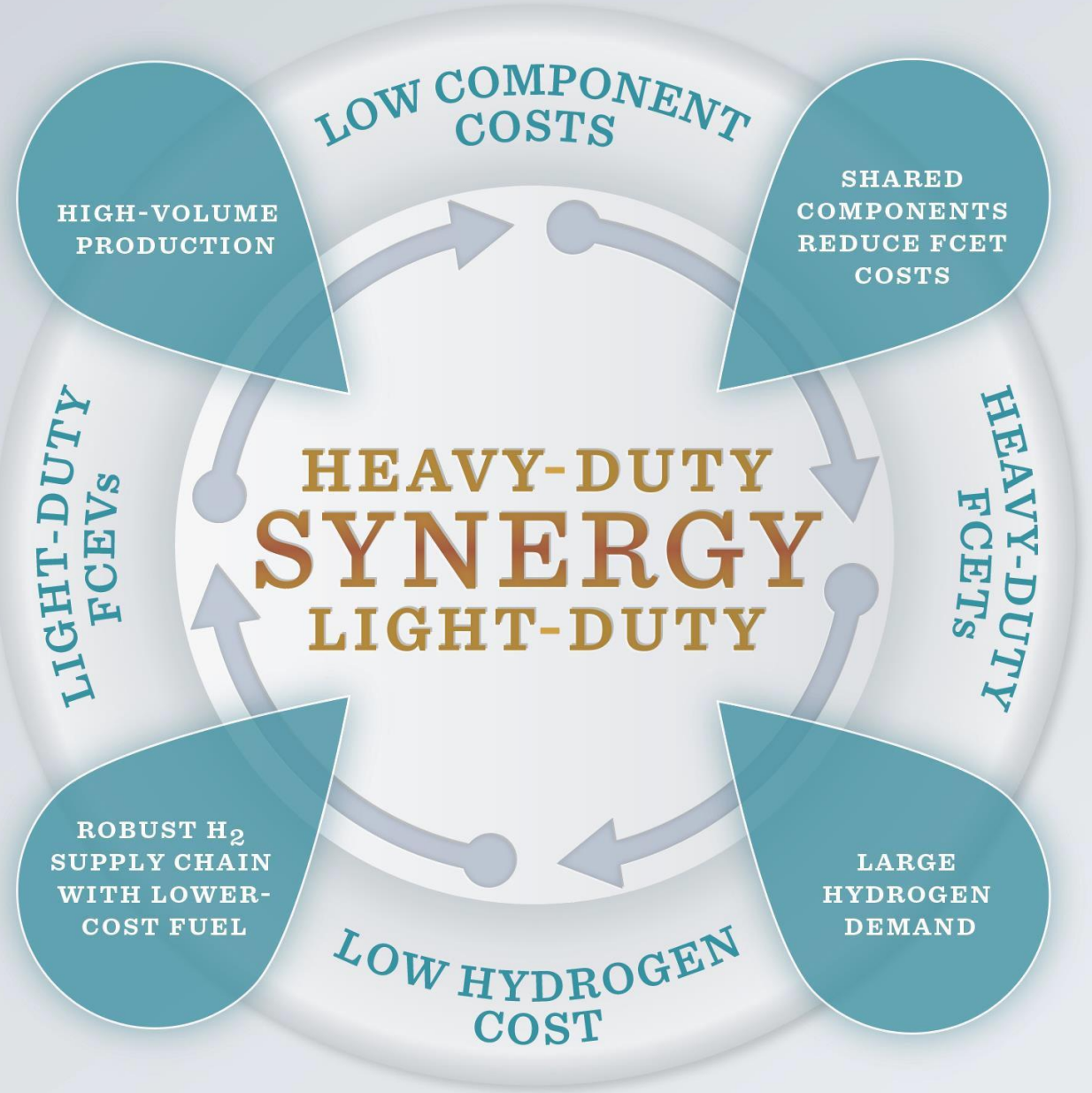
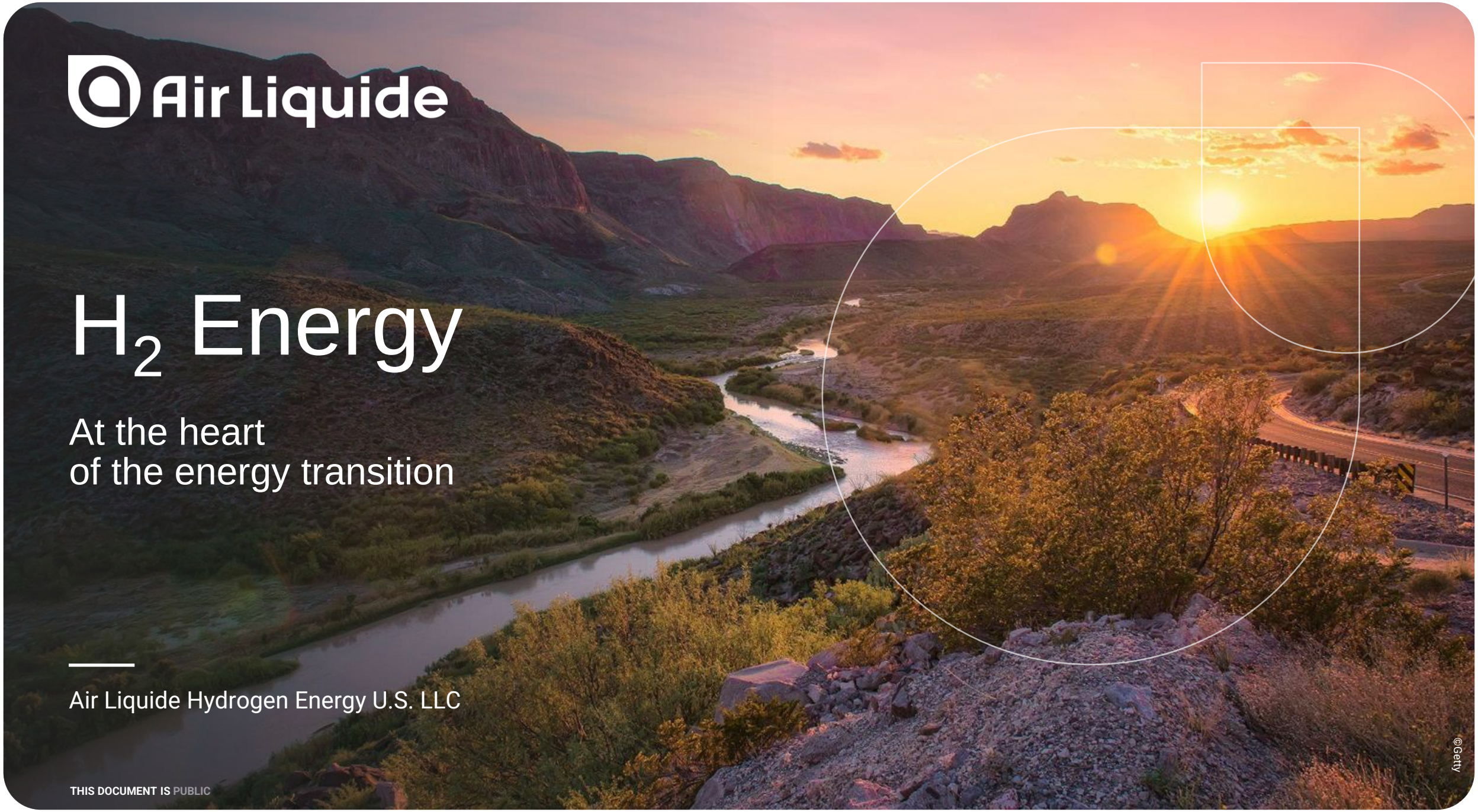


FIGURE 9 | *Economies of scale reduce cost*

Thank You!


Air Liquide
H_2 Energy
At the heart
of the energy transition
Air Liquide Hydrogen Energy U.S. LLC
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Hydrogen Supply Chain

Gaseous Hydrogen vs Liquid Hydrogen

Won't discuss onsite generation today

- All hydrogen is *produced* as gaseous hydrogen
  - Compressed and transported as high pressure gaseous hydrogen (GH2)
  - Liquified and transported as liquid hydrogen (LH2)
- Raw gaseous hydrogen - cheap to produce
  - *Won't get into colors or NG-derived vs electrolysis today*
- H2 *fuel* cost - compression/liquefaction and distribution
- No "best" option - depends on number of factors
- GH2:
  - Can use any H2 source (of any size)
  - Requires compression for transport
  - Significantly more expensive to transport ($/mile)
  - Best for: relatively low usage rates and when close to source
- LH2:
  - More expensive to produce - production costs minimized at scale
    - 15-30 tpd
  - Cheaper to transport - 4-10x cheaper than GH2 transport
  - Best for: relatively high usage rates or longer distances from source

Hydrogen Dispensing

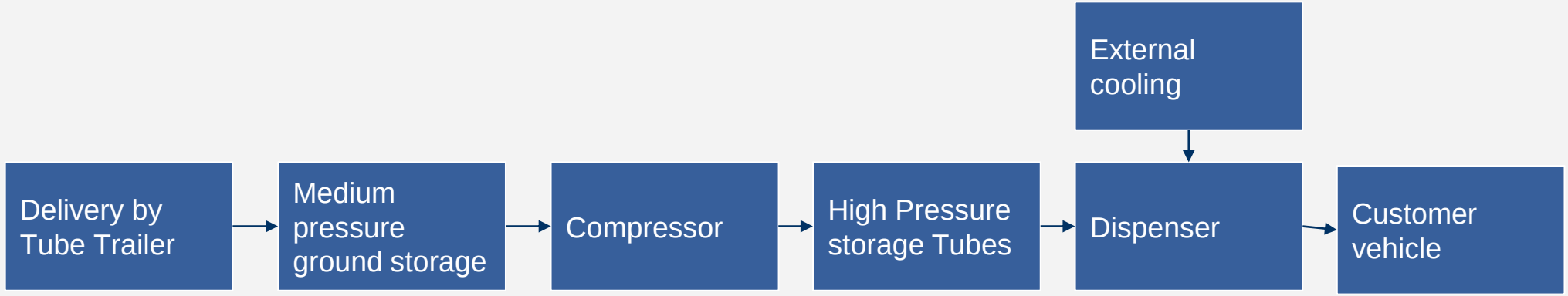
Gaseous Hydrogen vs Liquid Hydrogen

- All hydrogen is currently *dispensed* as GH2
- Hydrogen heats up during dispensing
  - Therefore, cooling is generally needed to ensure temperature does not exceed fuel tank limits
- 2 different primary protocols today
  - 350 bar - buses
  - 700 bar - automobiles
  - HD Trucks?
    - No standard - could go either way….
    - Fueling protocols under development
    - Require higher flowrates than buses or cars
    - *Future may be LH2 stored on board*

Hydrogen Dispensing - GH2

Gaseous Hydrogen

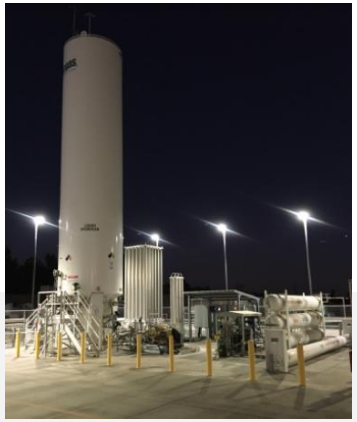
- Easily containerized
- Requires compression at the point of use
- Requires external cooling at the point of use
- Lower CAPEX
- Higher OPEX
- Requires more frequent refills
- Relatively large footprint for given capacity

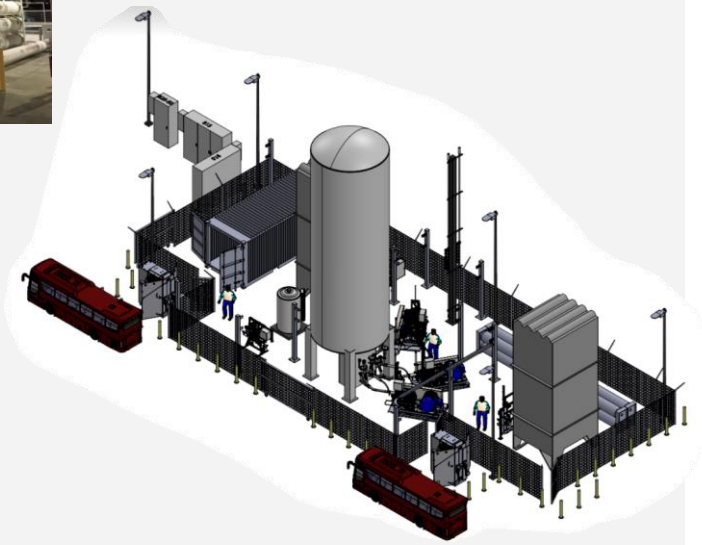


**Can be left on site in lieu of MP storage*

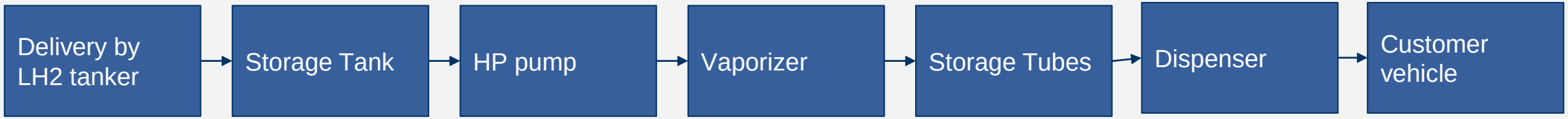
Hydrogen Dispensing - LH2

Liquid Hydrogen





- Normally uses LH2 for cooling - no external cooling required
- Higher CAPEX
- Lower OPEX - pumps more efficient than compressors
- Potentially higher losses from boiloff and leakage
  - *If turnover is low*
- More storage on site - Less frequent refills
- Smaller footprint for a given capacity
- Better for higher demand applications
- More flexible if demand increases



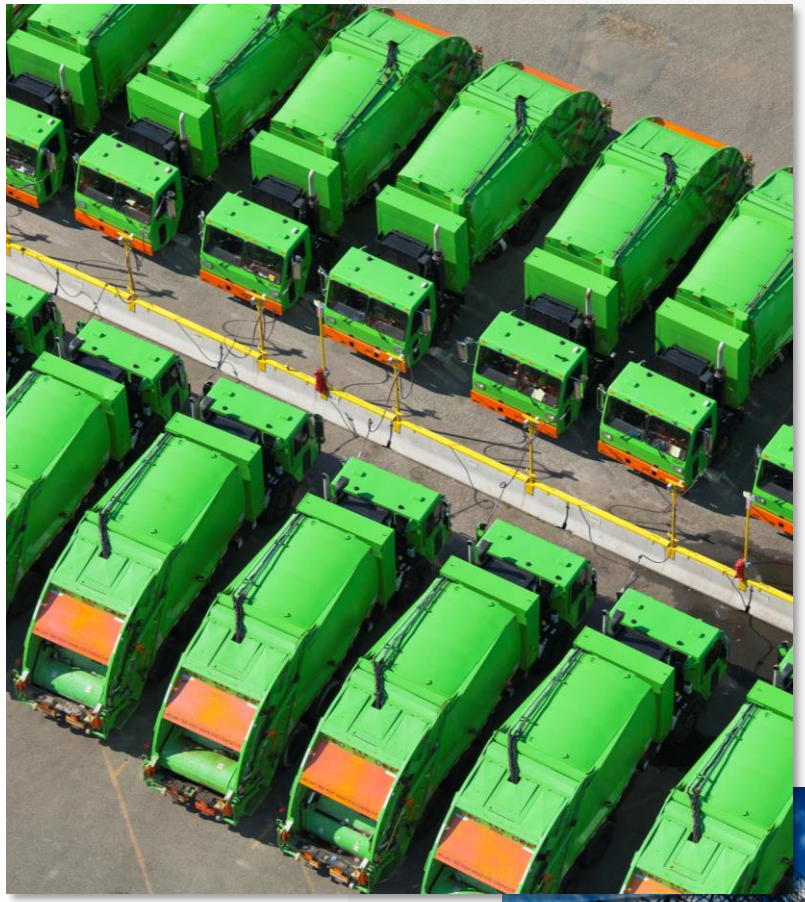
KAIZEN Clean Energy

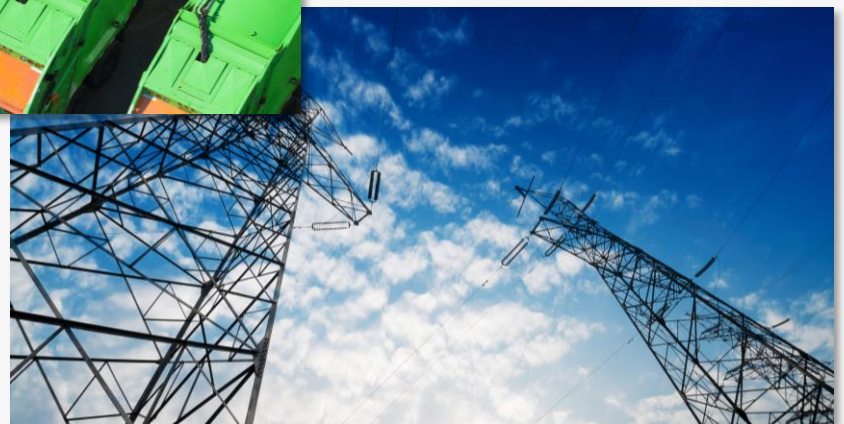
Kaizen Clean Energy

Hydrogen For FCEV & EV Charging

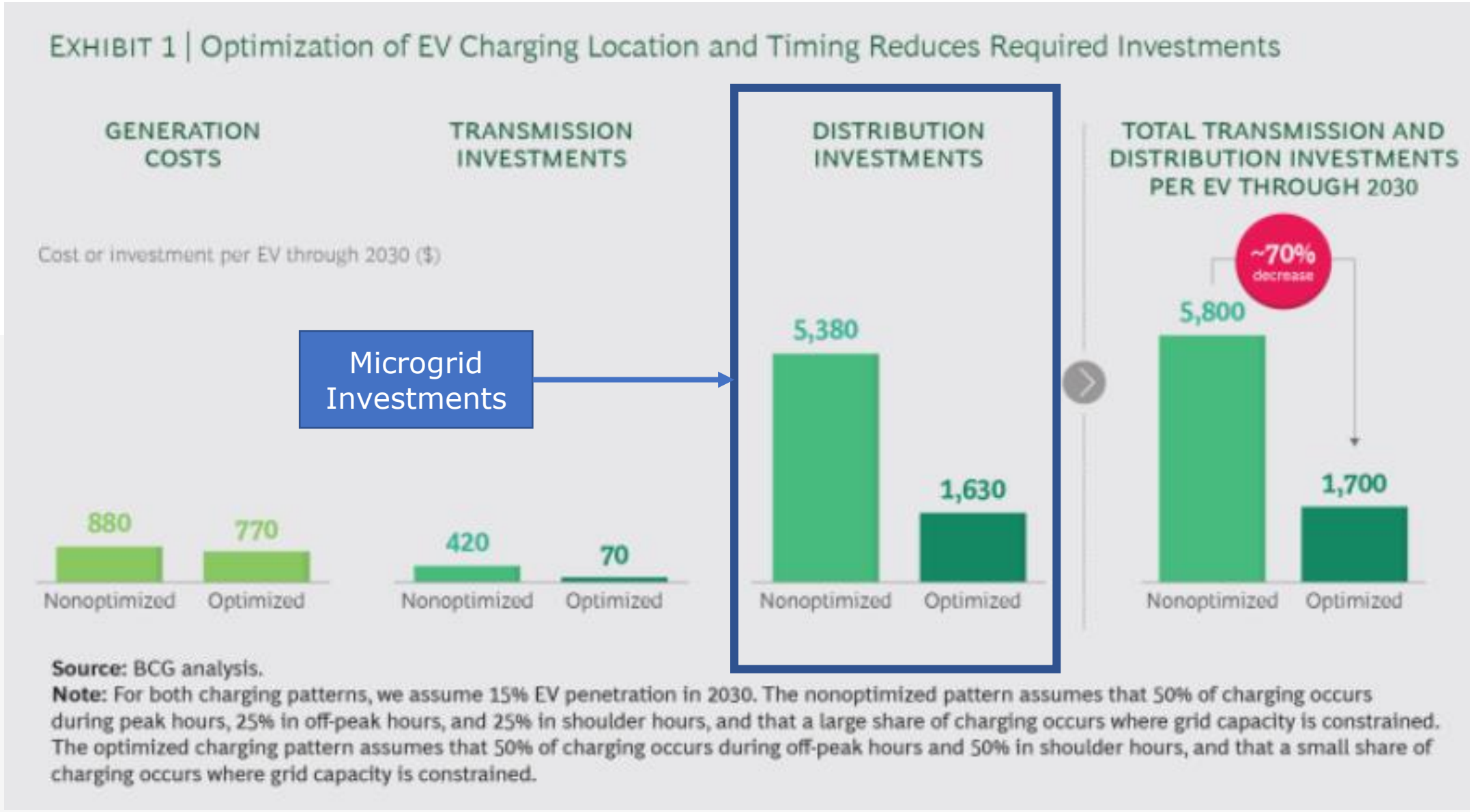
Overview Presentation

April 2022



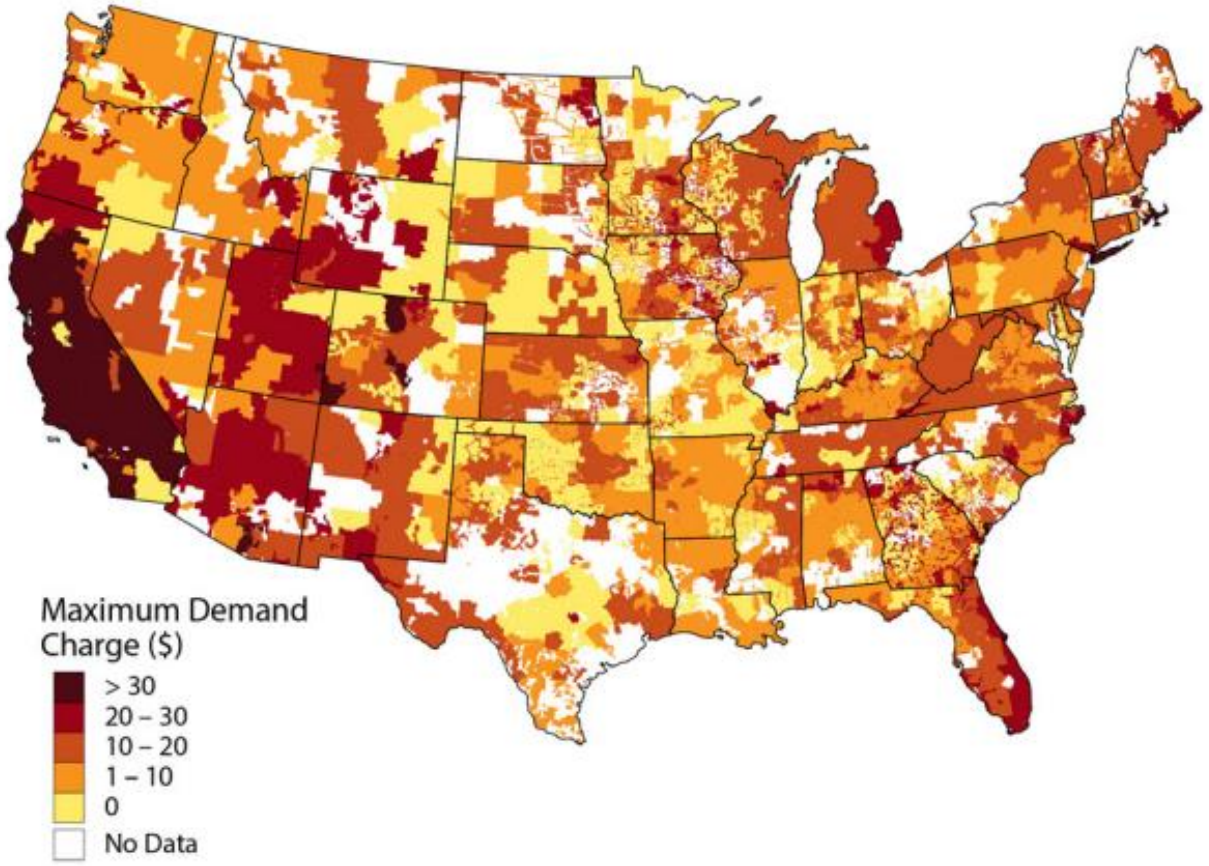


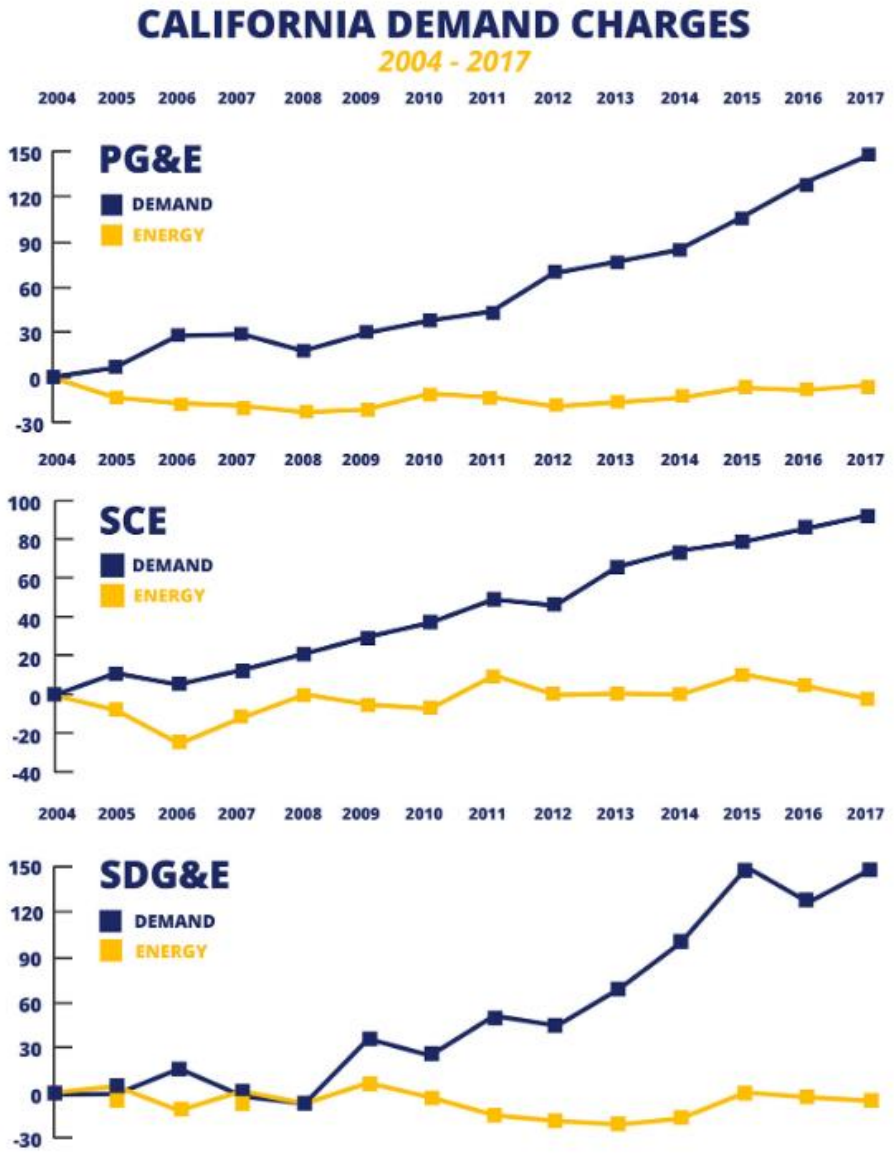
Investment Needed At Microgrid Level



US Map Of Demand Charges

Demand Charges Increase With EV Adoption





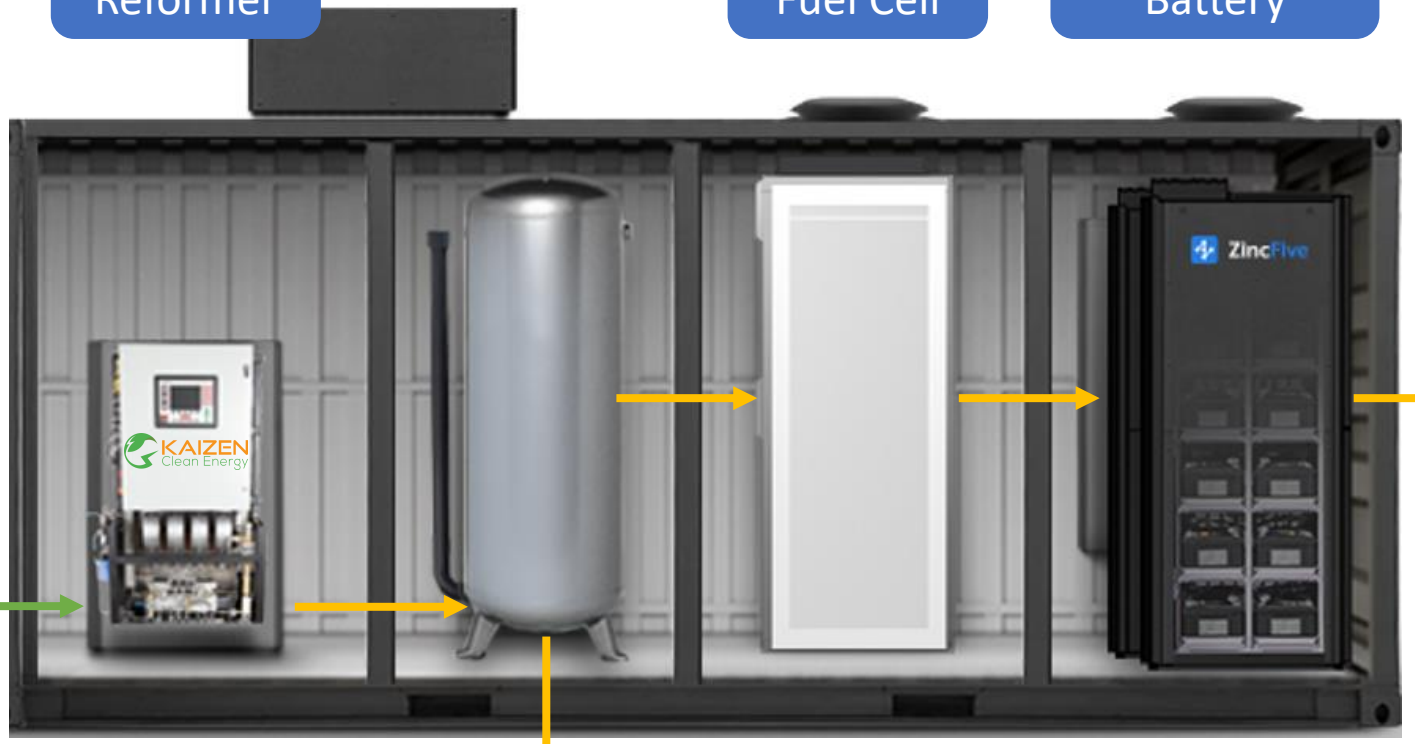
1) NREL Demand Charge Map
2) California Demand Charge Rate Increase – Ecom-Energy

KAIZEN Clean Energy

KCE Integrated Design

Supporting EV Or H2 (Or Both)

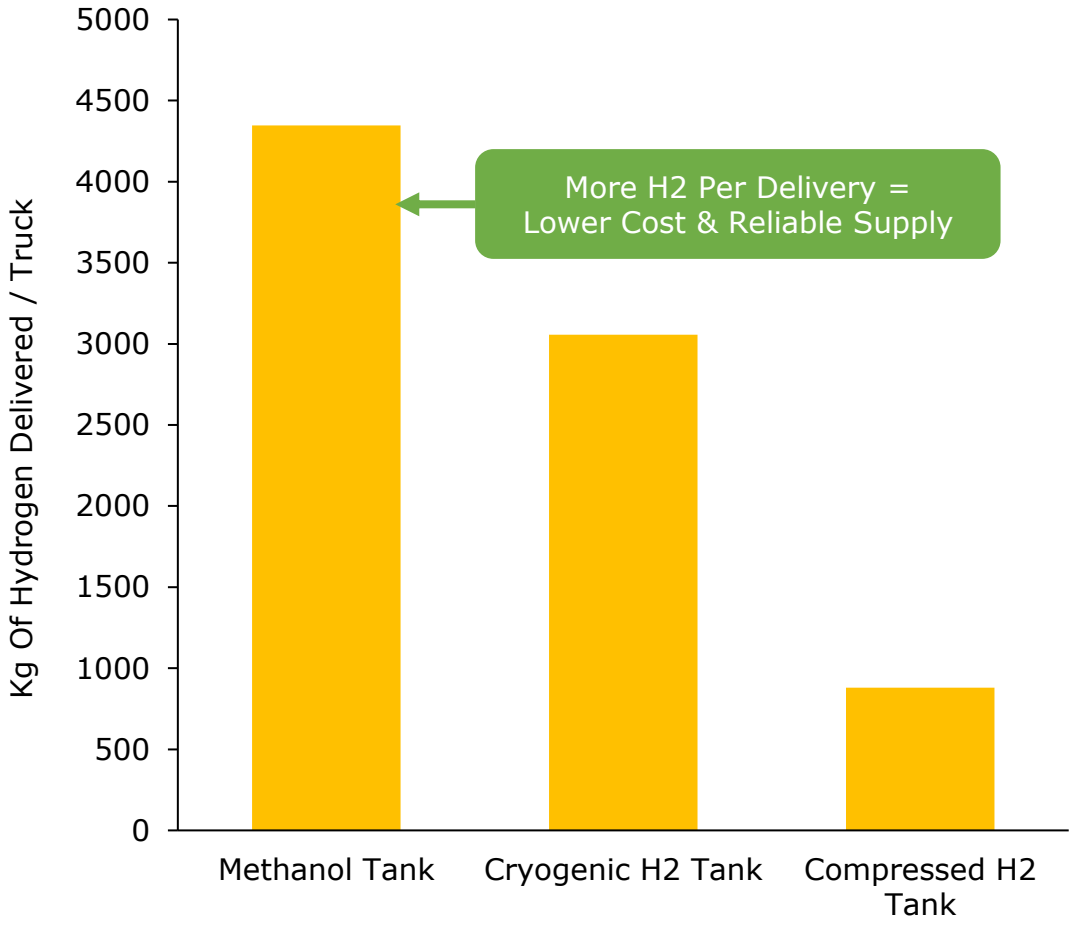
Methanol:
A Stable Liquid and
Low-Cost H2 Carrier



Economic & Logistic Benefits

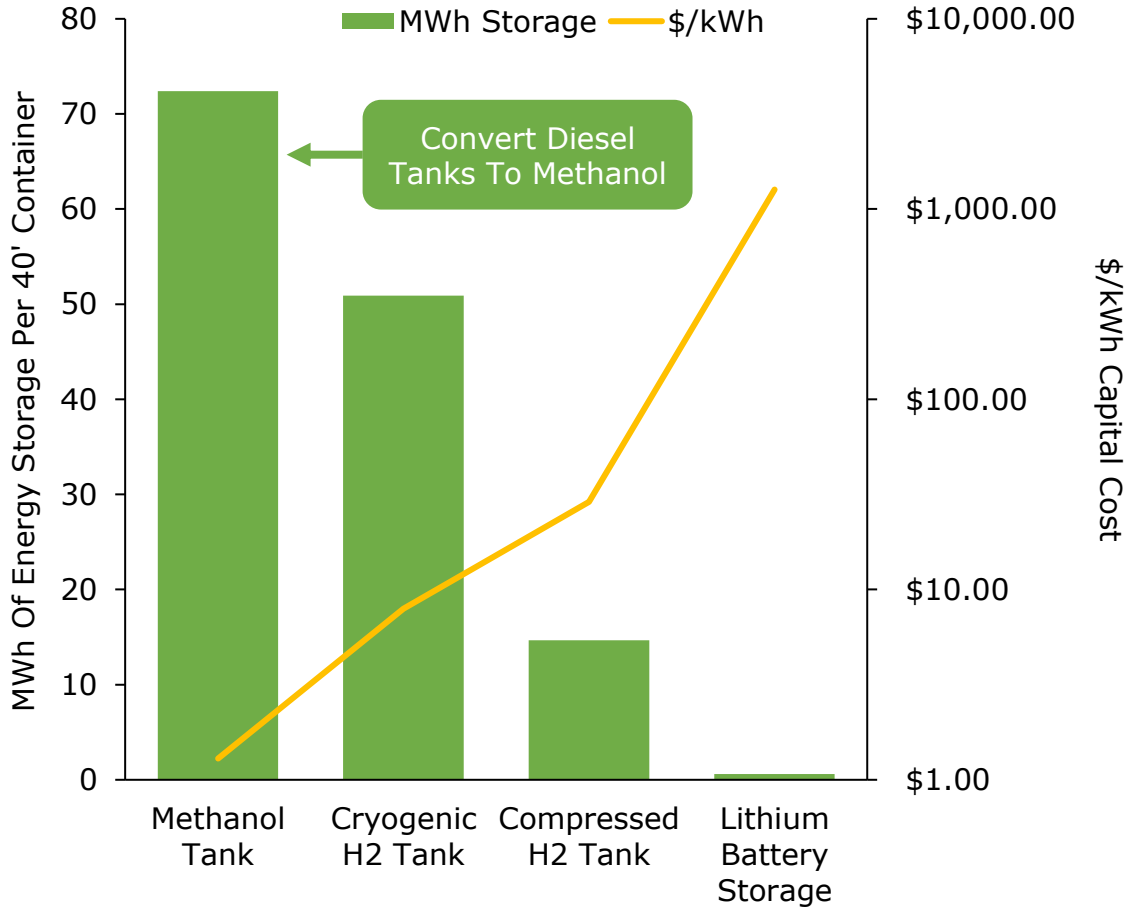
Hydrogen Storage & Distribution

Dense Hydrogen Carrier



Supporting Fleet EV Adoption

Low-Cost Energy Storage



CONTACT US

Where to Find Us

Let’s Cut The Cost of Your ZEV Transition With a Mobile Container.

CALL US NOW

Contact Kaizen Clean Energy

Phone & Email

+1 (346) 337-7788

Info@kaizencleanenergy.com

The University of Texas at Austin
Center for Electromechanics
Cockrell School of Engineering

HYDROGEN TECHNOLOGIES RESEARCH, DEVELOPMENT, AND DEMONSTRATION

Michael Lewis
Sr. Engineering Scientist
(512) 232-5715
mclewis@cem.utexas.edu

CEM Hydrogen Vehicles Research Program

Advance state-of-art and aid commercialization and adoption of new low carbon energy technologies

- Research and Development
  - Prototype builds and demonstrations
  - Testing of advanced technology and integrated systems
- Education
  - Evaluation of zero emissions vehicles for fleet operators
  - Students involvement on projects
- Technology Transfer
  - Projects with industry partners
  - Working with small business to evaluate technologies

ESPN Longhorn Network filming at CEM for Game Changers show on electric vehicles

Hydrogen Vehicle Research

UT-CEM / GTI Hydrogen Fueling Station – first in Texas

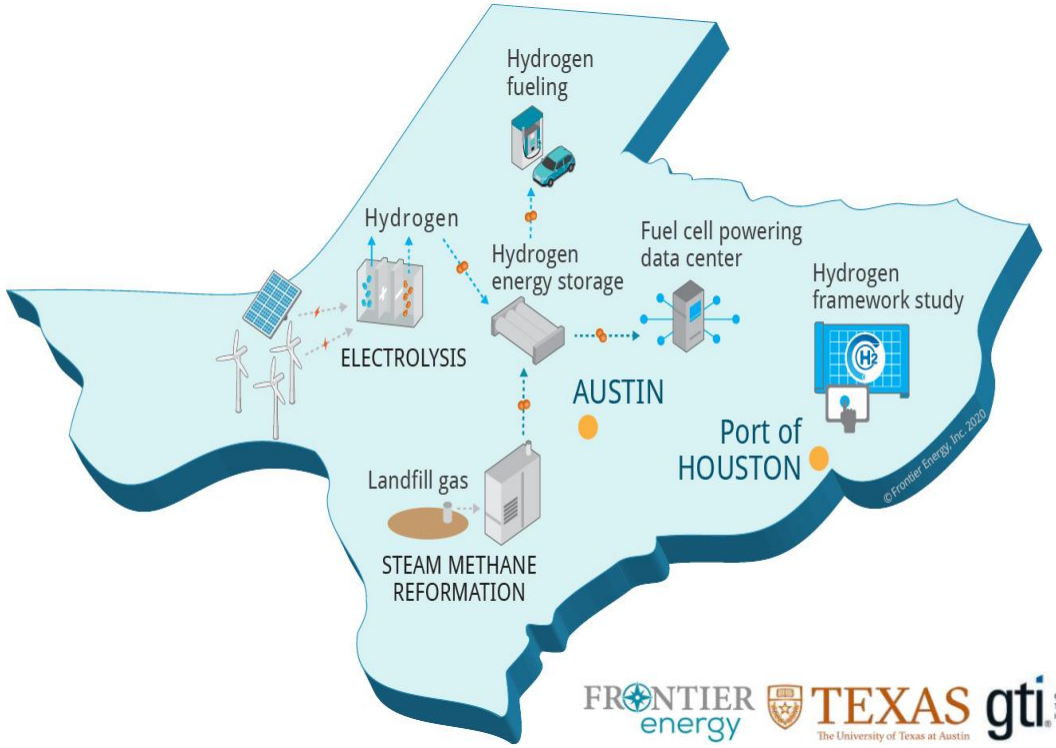
First Commercial Fuel Cell Vehicle in Texas

Fuel Cell Parcel Delivery Van

National Fuel Cell Bus Program Demonstration

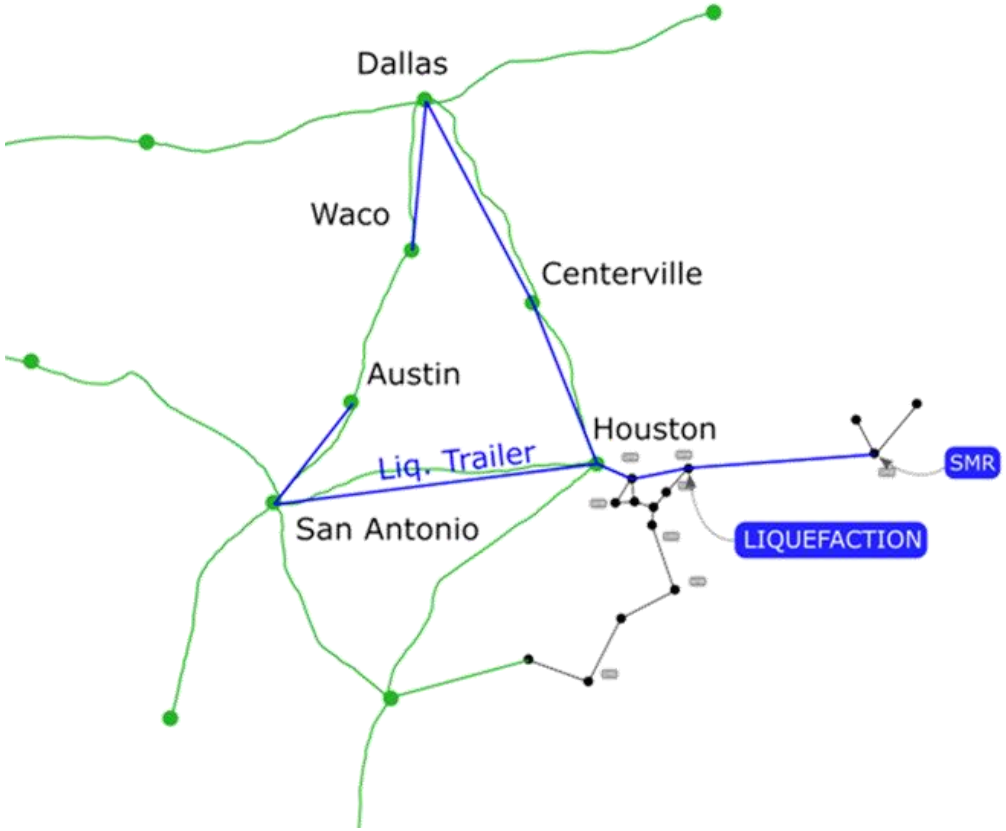
Hydrogen Utility Vehicle

H2@Scale Demonstration Project



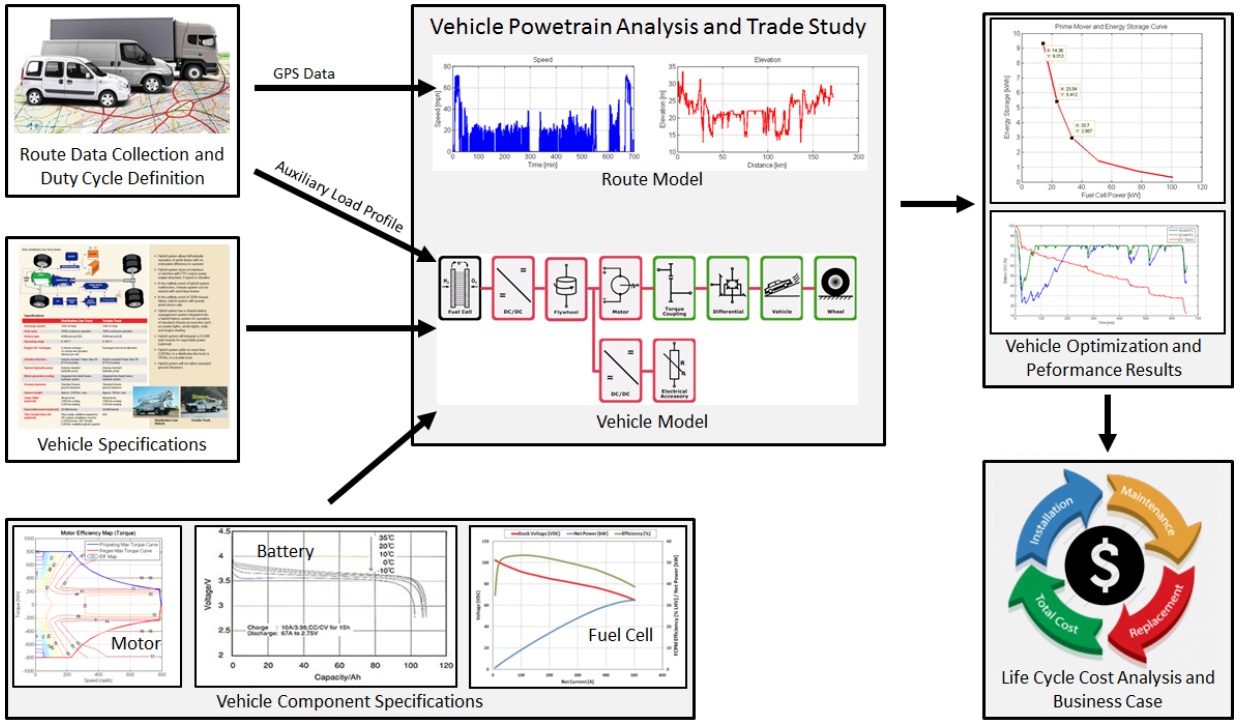
Sponsored by the Department of Energy – EERE with cost share from project partners

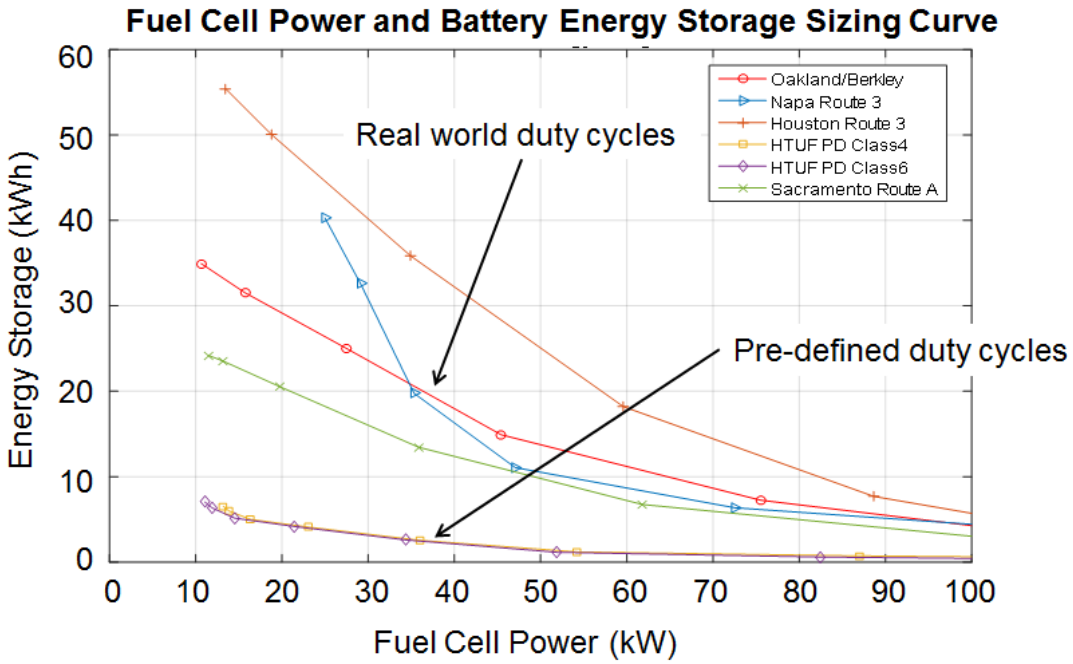
Part of the project is modeling the deployment of hydrogen fueling infrastructure and vehicles in Texas



Not all Fleets are the Same

- Vehicle size, duty-cycle, range, fueling logistics all can impact the type of hydrogen your vehicle uses and the infrastructure requirements





http://ieeexplore.ieee.org/document/7993321/

Question and Answer

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  OR
- Scan the QR Code to join

EVSE Siting & Infrastructure

ZEV Corridors Workshop

April 25, 2022 Randy.Boys@Oncor.com

BLUF (Bottom Line Up Front)

An EVSE (or island/site of multiple EVSEs) can be placed anywhere if:

- You have property rights, or they have been conveyed to you by the owner
- You meet any usage/zoning constraints (note: NOT as a fueling station)
- What's NOT on this list? The electrical service.
  - The applicable Utility* can install anything, anywhere, if given (a) time and (b) site commitments. In some cases, the owner/operator may have to contribute to the Utility cost of installation.
  - Behind the meter (BTM), the installation is between the owner/operator and their electrician, not the Utility; EVSE installation may not even involve the Utility

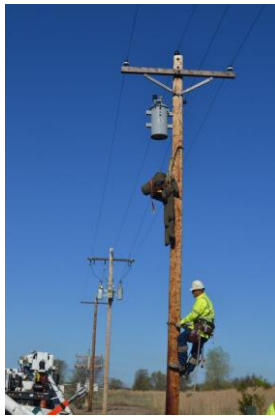
This provision of electrical service applies to new service requests, and MAY need to be revisited for service changes

The Utility ... And forward-thinking owner/operator ... Would prefer that 'make ready' for expected expansion be included where practical

* As determined by PUC-regulated 'Certifications'. These are NOT determinate for all locations.

Working with the Utility

Does a single Utility exist?



- Many areas, including alone undeveloped highways, are “Dually” or “Multipally” Certificated, and you can work with any party (noting that this results in modification of not only the site, but possibly area, Certification status
- This has to do with brining the electrical infrastructure to that site

In the 90% of load serviced in Texas under ERCOT authority, there are 3 Utility types: CoOp, Municipal, and TDE (Transmission/Delivery Utility, just ‘wires’), all regulated by the PUC-T.

- Each has different operating constraints; Services provided by TDUs must be available to all comers

In most single premise cases, the ‘Line Extension Policy’ (also PUC regulated) would determine that initial installation fees are paid by the Utility, becoming Utility assets. In some cases, clients can *opt* to pay fees, including certain design options (e.g., dual feed resilience)

‘Routine’ service occurs when there is a proximal Distribution line with sufficient capacity; NLT 90 days after the formal request is typical

- This is where the ‘time’ issue comes in. If new Distribution, or (more rarely) Transmission redesign or new installation is required, it can literally take years (new substations, Transmission right of way, etc.).

The Utility ... And the forward-thinking owner/operator ... Would prefer that ‘make ready’ for expansion be included where practical

And, the site may be more complicated than just a single metered EVSE or set of EVSEs

What Differentiates EVSE Sites? (...with regard to power/energy)

Overall ‘peak’ load

- Part of an existing site? (and Utility ‘PCC’ metered service) ... Which will determine energy costs, and possible non-EVSE energy management)
- AC vs. DC charging ... An indicator of peak load, but only by association
  - DC as three phase electrical service, usually as higher kW levels

Electrical service provider(s); REPs (retailers) that will serve that area

- Proximity to available electrical infrastructure (power, vs. energy)
- Possible costs > Utility service extension policies (e.g., reliability extensions, moved service, remote service, timeline)

Site Energy Management (yes/no and with what other energy resources)

- As related to {other?} manageable loads, or as self-generation (cost and resilience risk management, or as part of energy policy/goals

Access management, and Types/#s of charging ports (EVSE cost issues, not a power/energy issue)

EVSE power management and energy management PLANNING

- Power management [as peak]: ‘Capacity’, and associated Demand Charges) ... Can be managed during sessions and as expansion over years (also as enabled be EVSE hardware and software solutions)
- Energy management [as consumption]: Must be addressed at > ‘session’ opportunities
- Planning as mechanisms to control these costs, generally independently


NIKOLA®


DRIVING
CHANGE

Cary Gniffke

EV Development Manager

The Electric Revolution Is Here.

Our obsession? Making it easy.

chargepoint

Company Overview

- ***7x charging stations relative to next largest provider in NA, rapidly growing in EU***
- Publicly listed on NYSE (ticker: CHPT)
- Founded 2007, HQ in Silicon Valley, 100% focused on EV charging
- Operates in North American and European markets
- 130,000 charging spots in NA
- Provides access to 85% AC and 65% DC charging stations in NA
- Full integration with WEX and Voyage fuel cards
- Drivers plug into a ChargePoint station every 2 seconds
- 1400+ employees
  - 300+ Engineering & Software (largest for a charging company)
  - 100+ Customer Support staff
  - 200+ (25%+) headcount growth over next 12 months

● ChargePoint corporate facilities

Comprehensive Portfolio to Fit Every Need

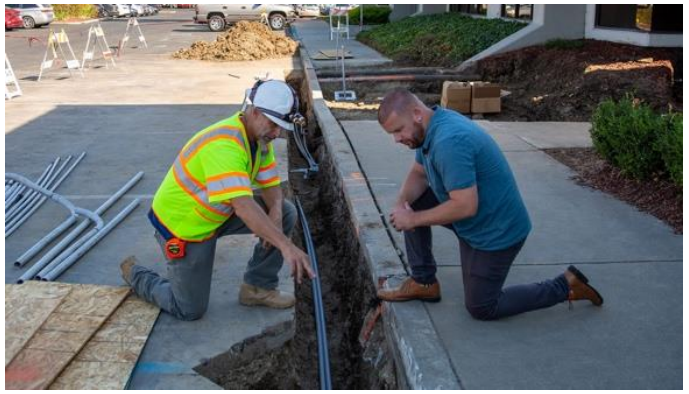
Software +

- Access control: Who can use the stations and when
- Pricing: Site host can choose to set fees
- Waitlist: Drivers can get in line when all ports are occupied
- Scheduled charging
- Power sharing to maximize ports while avoiding costly upgrades
- Proactive and remote diagnosis
- Power management to avoid demand charges

Hardware +

- Solutions for every use case, all vehicle types and brands
- High efficiency in power and footprint
- Modular, scalable, secure architecture designed for serviceability
- Unparalleled quality: advanced testing (vehicle, functional, climate, environment) for long-term reliability
- Options for site hosts to use custom branding

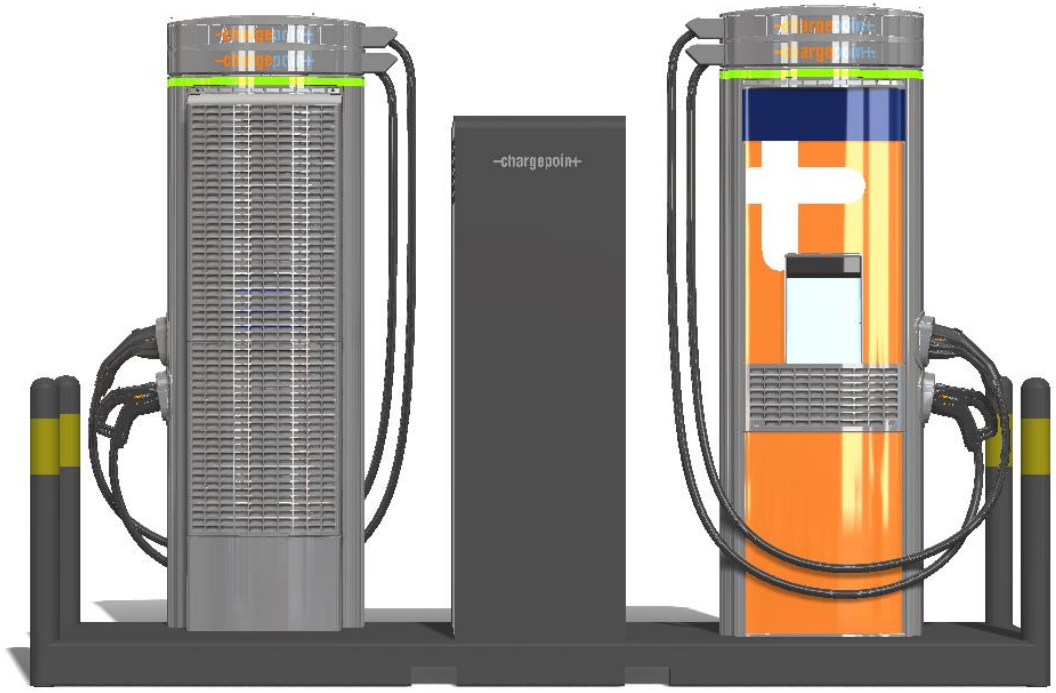
Services



- Accurate site qualification, quality site preparation and professional installation
- Nationwide network of O&M partners
- Initial activation and configuration services
- Standard warranty coverage for one year
- ChargePoint Assure maintenance and management program
- Station owner phone support during business hours
- 24/7 driver support in multiple languages
- GSRP CPaaS

CPE250 Paired-Skid Solutions

- Great for Pilot locations
- Great for locations where the lease may be coming up for renewal
- Open to Delivering/Test 6 months at a location around the country.
- Built-in electrical distribution panel with quick attach facilities
- Built on a skid for easy transport after job site completed



Thank You

For further information,
please contact Will Adams:

will.adams@chargepoint.com

972-955-8393

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Path to Zero Emission Vehicles (ZEV)

NCTCOG/EDF Zero-Emission Vehicle Workshop

Rick Mihelic

April 25, 2022

Today's Panel

Rick Mihelic
Director
EmergingTechnologies
NACFE

Bobby Cherian
Senior Vice President
Sales & Supply Chain
Hyliion

Don Hall
Lease Account Manager
Medium Duty Sales
MHC Kenworth

Mike Moynahan
Assets Manager
HEB

Blake Yazel
General Manager
Lonestar SV

North American Council for Freight Efficiency

- Unbiased, non-profit
- Mission to double freight efficiency
  - Scale available technologies
  - Guide future change
  - Demonstrate efficiency potential
- Include all stakeholders
- Primary focus: HD Tractor-trailers
- Secondary focus: Class 2b-6
- Founded in 2010

www.NACFE.org

Trends

NA Trucks in Commercial Use

- 2.8M Tractors
- 8.8M Single Unit Trucks

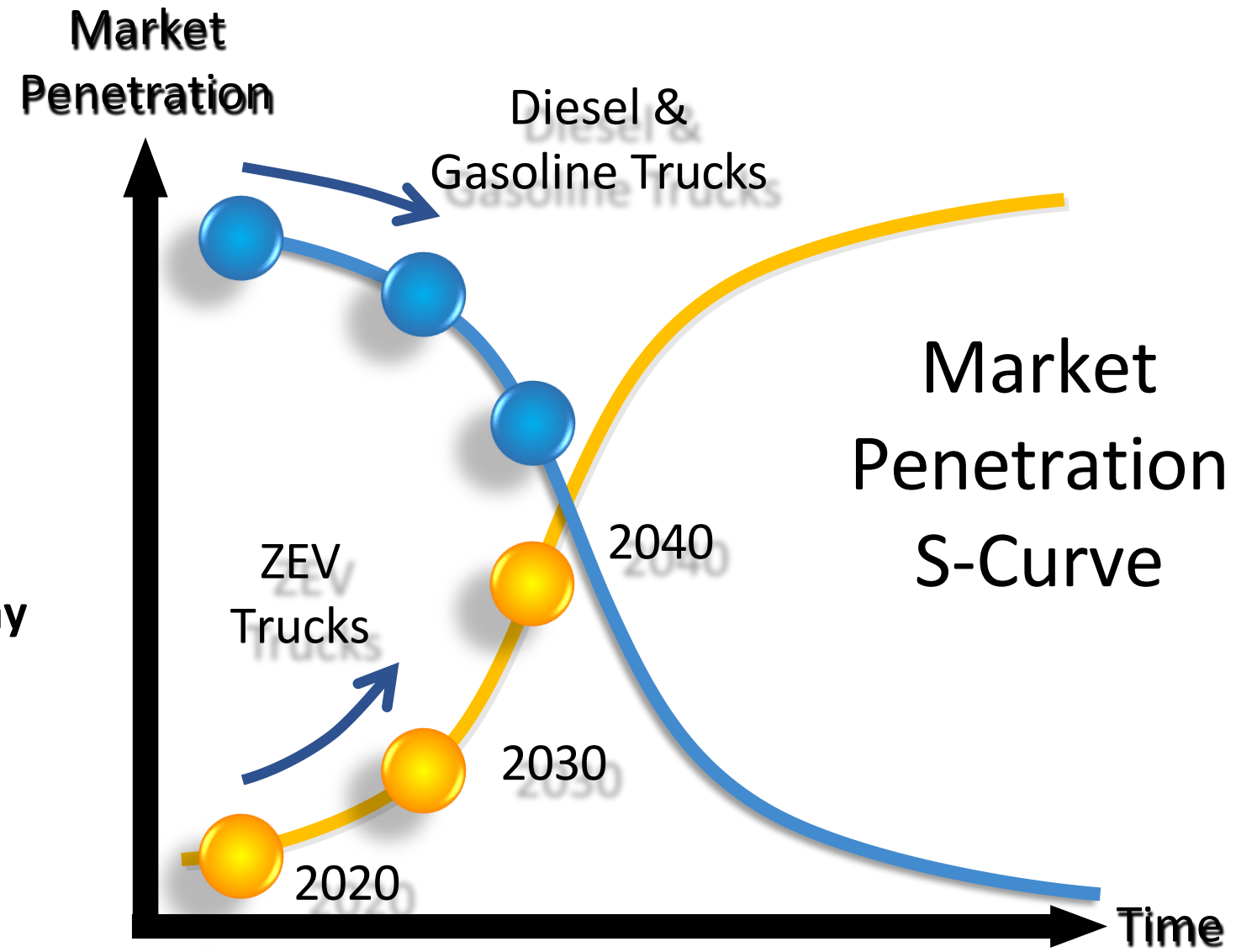
NA Annual Production Capacity

- ~320k HD Truck/Tractors
- ~350k MD Trucks

NA Production EV/FCEV Trucks Today

- < 100 HD
- < 500 Terminal Tractors
- < 1,000 MD

NA = North America



NACFE NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

EDF ENVIRONMENTAL DEFENSE FUND

North Central Texas Council of Governments

Many Bridges to the Future

PRESENT

Technology immature

Many unknowns & challenges

"MESSY MIDDLE"

Many optimized solutions

Growing infrastructure

Multi fuel choices

Innovation & maturation

Facts replace estimates

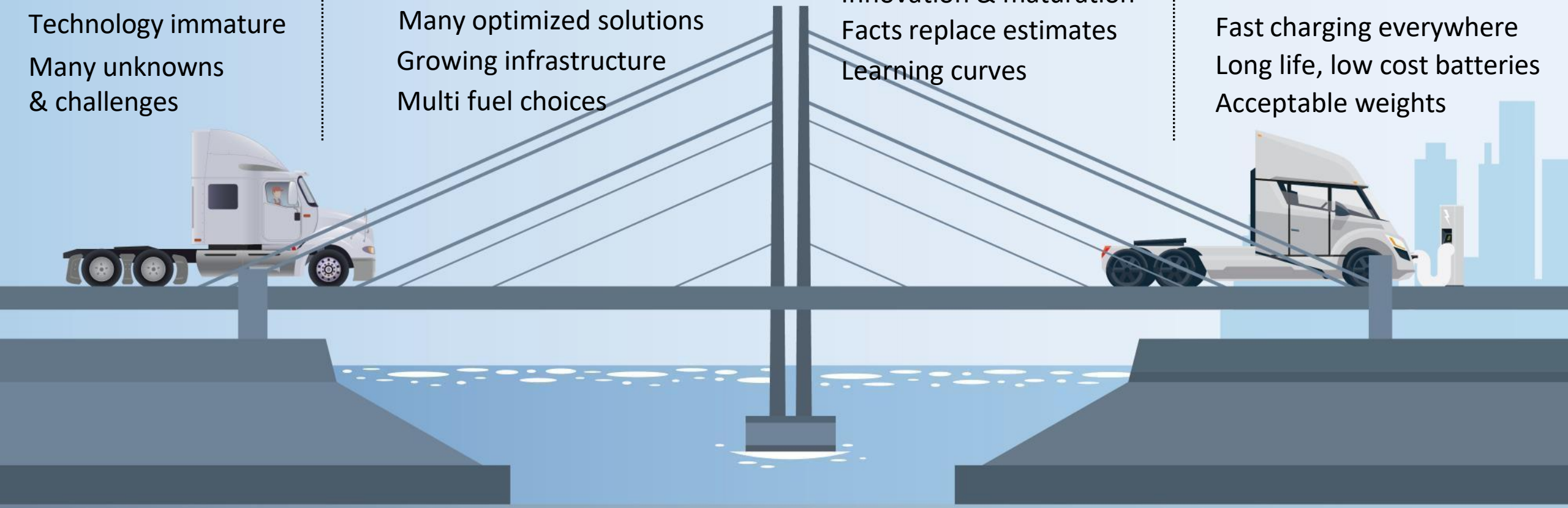
Learning curves

FUTURE 2050

Fast charging everywhere

Long life, low cost batteries

Acceptable weights



Legacy Diesels
Natural Gas

Diesel Advancements
Natural Gas
Hybrids

Battery Electric
Hydrogen Fuel Cells
Renewable Natural Gas & Diesel

CBEV & HFCEV from Clean Energy

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

Why Zero Emission Trucks Now?

- Efficiency
- Sustainability
- Regulation

Sustainability

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

EDF
ENVIRONMENTAL DEFENSE FUND

North Central Texas Council of Governments

What is an “electric truck”?

Zero Emission
&
Near Zero Emission

- Electric motors power the wheels

Powertrain Choices:

- Battery Electric Vehicle BEV
- Catenary Electric Vehicle CEV
- Hybrid Electric Vehicle HEV
  - Fuel Cell Electric Vehicle FCEV
  - Diesel Hybrid Electric Vehicle
  - CNG Hybrid Electric Vehicle
  - Other Hybrid Electric Vehicle

These also could be called range extended BEVs

Electric Trucks Are Here (Nearly)

April 2022

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

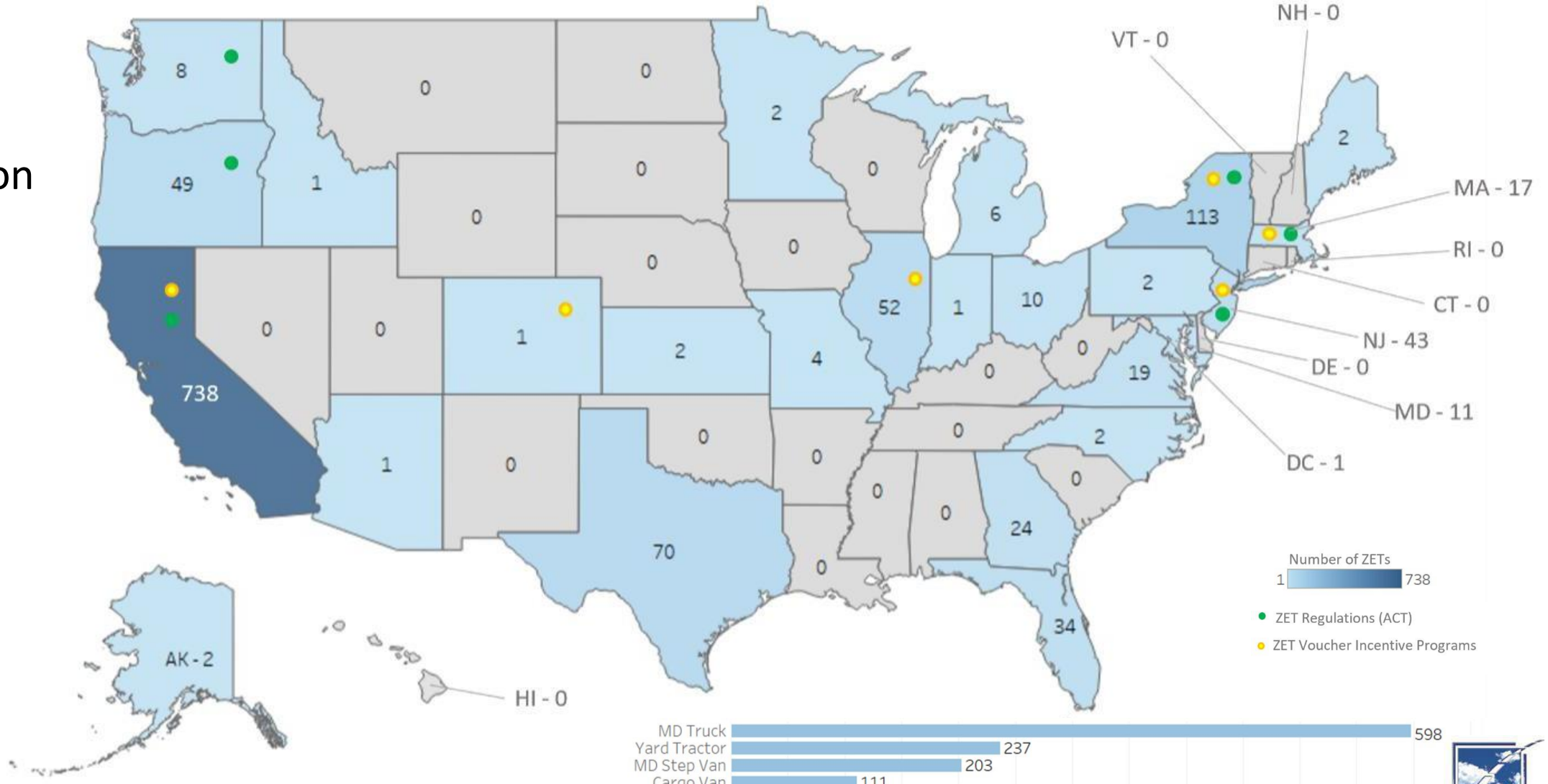
EDF ENVIRONMENTAL DEFENSE FUND

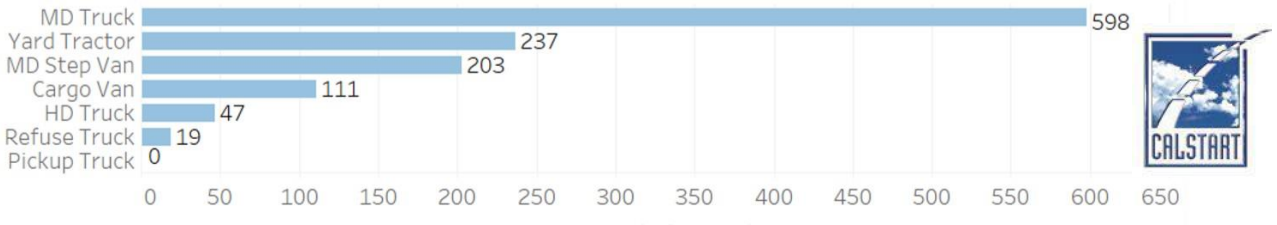
North Central Texas Council of Governments

Where are Electric Trucks today?

1,215
Zero Emission
Trucks
Deployed
2b-8

140,000
on order
145 models



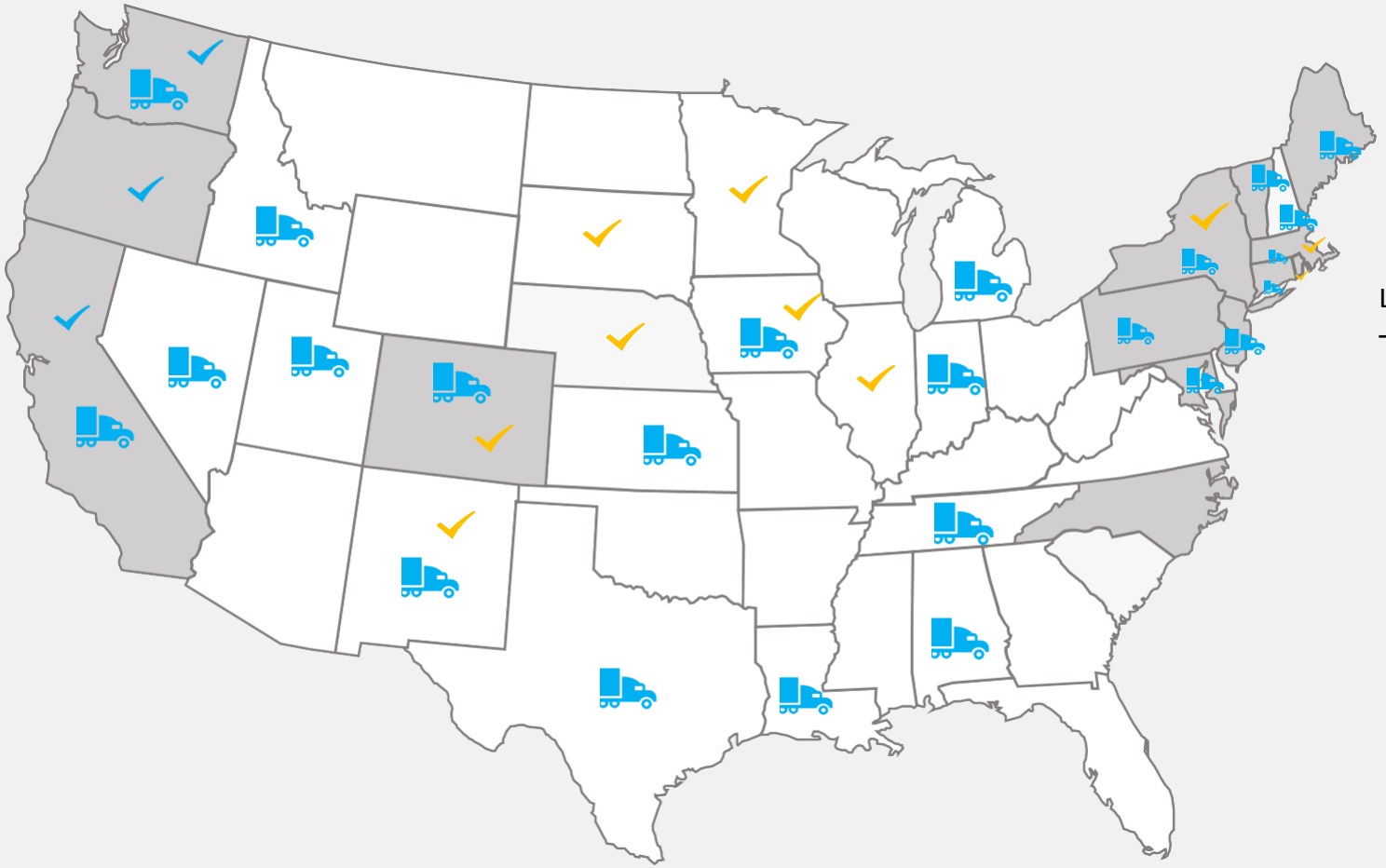


April 2022

As of 12/2021
https://calstart.org/zeroing-in-on-zero-emission-trucks/

State & Local Influences

STATE GOVERNMENT POLICIES AND INCENTIVES



LEGEND

- ZEV MHD MOU Signatories and Advanced Clean Truck Rule - Current /Considering
- LCFS Credit Program –Active
- LCFS - Considering
- Vehicle Incentives

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NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

Texas and Heavy Duty ZEV Trucks

Texas

Light-Duty AFV Rebates: The Light-Duty Motor Vehicle Purchase or Lease Incentive Program provides rebates up to $5,000 for leasing or purchasing a new EV. Vehicles purchased after Sept. 1, 2019 are eligible.

Texas Emissions Reduction Plan (TERP): The TERP program offers incentives for projects that reduce emissions, including clean transportation projects. Find information about current funding opportunities.

Heavy-Duty Vehicle Repower and Replacement: The state used its portion of the Volkswagen Environmental Mitigation Trust funds to support clean transportation projects focused on replacing or repowering heavy-duty vehicles. Access information about current funding opportunities.

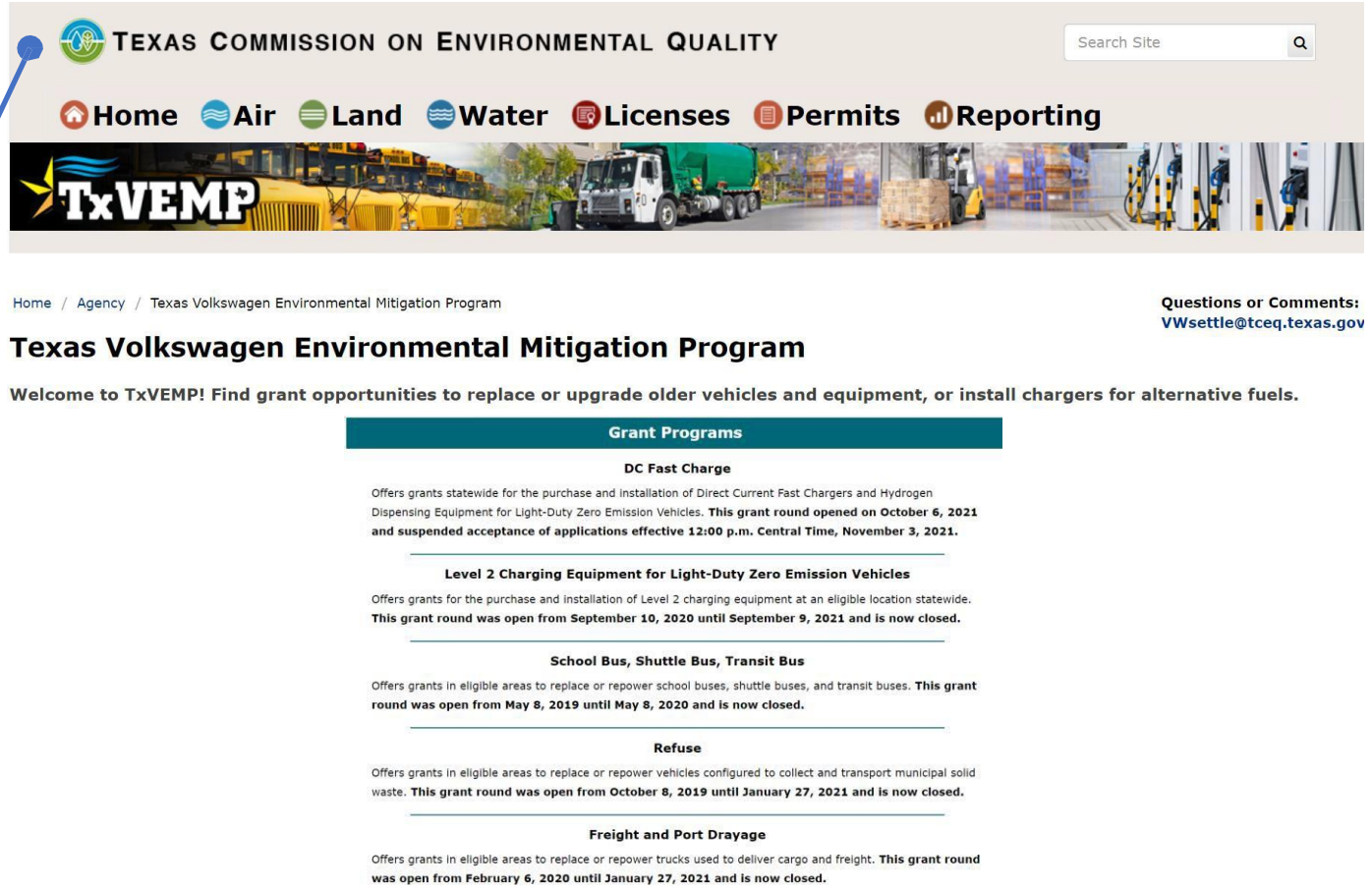
EVSE Rebate: United Cooperative Services (UCS) offers residential customers a rebate of up to $500 to install Level 2 chargers.

EVSE Rebate: Southwestern Electric Power Company offers residential customers a $250 rebate to install ENERGY STAR certified Level 2 chargers. Rebates are available on a first-come, first-served basis.

EVSE Incentive: Entergy customers are eligible to receive a $250 incentive for purchasing a Level 2 charger.

EVSE Incentive: Austin Energy customers are eligible for a rebate covering 50% of the cost to purchase and install a qualified Level 2 charger, up to $1,200. The utility also offers a rebate for installing Level 1, Level 2, and DC fast-charging stations at the workplace and multiunit housing locations.

EV Charging Rate Program: CPS Energy offers a rate option for qualified customers for charging EVs. The flat rate option is $60 annually for each EV.



- https://www.ncsl.org/research/energy/state-electric-vehicle-incentives-state-chart.aspxS
- https://www.tceq.texas.gov/agency/trust

Other Resources for Heavy Duty Trucks

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Alternative Fuels Data Center

FUELS & VEHICLES | CONSERVE FUEL | LOCATE STATIONS | LAWS & INCENTIVES | Maps & Data | Case Studies

EERE » AFDC » Fuels & Vehicles » Electricity

- Electricity Basics
- Benefits & Considerations
- Stations
- Vehicles
- Laws & Incentives

Electricity Laws and Incentives in Texas

The list below contains summaries of all Texas laws and incentives related to electricity.

Laws and Regulations

Alternative Fuel Use and Vehicle Acquisition Requirements
State agency fleets with more than 15 vehicles, excluding emergency and law enforcement vehicles, may not purchase or lease a motor vehicle unless the vehicle uses natural gas, propane, ethanol or fuel blends of at least 85% ethanol (E85), methanol or fuel blends of at least 85% methanol (M85), biodiesel or fuel blends of at least 20% biodiesel (B20), or

Alternative Fuel Vehicle (AFV) Registration Tracking Program
The Texas Department of Motor Vehicles (Department) collects data on the number of AFVs registered in the state. The Department must submit an annual report to the Texas Legislature detailing the results of each data collection year. For the purpose of this program, AFVs include plug-in electric vehicles, hybrid electric vehicles, and natural gas vehicles. (Reference Texas Statutes, Transportation Code, 502.001 and 502.004)

Authorization of Governmental Alternative Fuel Fleet Grant Program
The Texas Commission on Environmental Quality (TCEQ) must administer a grant program for governmental alternative fuel fleets to provide grants for the purchase or lease of a new vehicle and the purchase, lease, or installation of alternative fueling equipment. Eligible alternative fuels include natural gas, propane, hydrogen, and electricity. State agencies and political subdivisions are eligible to apply for a grant under the program if the entity operates a fleet of more than 15 vehicles. Mass transit and school transportation providers will also be eligible for grants.

TCEQ must establish standardized vehicle grant amounts based on the incremental costs associated with the purchase or lease of different categories of motor vehicle, including the fuel type, vehicle class, and other categories TCEQ considers appropriate. TCEQ will also establish standardized fueling equipment grant amounts.

State Incentives

Clean Fleet Grants
The Texas Commission on Environmental Quality (TCEQ) administers the Texas Clean Fleet Program (TCFP) as part of the Texas Emissions Reduction Plan (TERP). The TCFP provides grants to fleets to replace existing fleet vehicles with alternative fuel vehicles (AFVs) or hybrid electric vehicles (HEVs). An entity that operates a fleet of at least 75 vehicles and commits to placing 20 or more qualifying vehicles in service for use in the Clean Transportation Zone may be eligible. Qualifying AFV or HEV replacements must reduce emissions of nitrogen oxides or other pollutants by at least 25% as compared to baseline levels and must replace vehicles that meet operational and fuel usage requirements. Neighborhood electric vehicles do not qualify. For more information, including current application periods, see the TCEQ TERP website. (Reference Texas Statutes, Health and Safety Code 386 and 392, and Texas Administrative Code 114.650-114.658)

Clean School Bus Grants
Any public school district or charter school may receive a grant through the Texas Commission on Environmental Quality (TCEQ) to pay for the incremental costs to replace school buses or install diesel oxidation catalysts, diesel particulate filters, emission-reducing add-on equipment, and other emissions reduction technologies in qualified school buses. For more information, see the TCEQ Texas Emissions Reduction Plan website. (Reference Texas Statutes, Health and Safety Code 390, and Texas Administrative Code 114.640-114.648)

Clean Vehicle and Infrastructure Grants
The Texas Commission on Environmental Quality (TCEQ) administers the Emissions Reduction Incentive Grants (ERIG) Program and Rebate Grants Program as part of the Texas Emissions Reduction Plan (TERP). The ERIG Program provides grants for various types of clean air projects to improve air quality in the state's nonattainment areas and other affected counties. Eligible projects include those that involve replacement, retrofit, repower, or lease or purchase of new heavy-duty vehicles; alternative fuel dispensing infrastructure; idle reduction and electrification infrastruc
provides grants to upgrade
Qualifying projects must re
25% as compared to baseli
For more information, inclu
website. (Reference Texas
Code 114.620-114.629)

Utility/Private Incentives

Commercial Electric Vehicle Supply Equipment (EVSE) Rebate - Austin Energy
Austin Energy offers commercial customers a rebate for 50% of the cost to install qualified EVSE at workplaces and multi-unit dwellings (MUD). Applicants that install Level 1 and Level 2 EVSE may receive up to $4,000, and applicants that install direct current fast (DC Fast) EVSE may receive up to $10,000. EVSE installed in MUDs must be accessible to all residents. For more information, see the Austin Energy Workplace Charging and Multifamily Charging websites.

Electric Equipment and Electric Vehicle Supply Equipment (EVSE) Incentive - Entergy
Qualified Entergy customers are eligible to receive incentives in varying amounts for the purchase of select on- and off-road electric vehicles and Level 2 EVSE. For more information, including eligible technologies, see the Entergy eTech website.

Electric Vehicle Supply Equipment (EVSE) Incentive - Austin Energy
Austin Energy offers residential customers who own an electric vehicle a rebate of 50% of the cost to purchase and install a qualified Level 2 EVSE, up to $1,200. For more information, see the Austin Energy Home Charging website.

Electric Vehicle Supply Equipment (EVSE) Rate Incentives - CPS Energy
CPS Energy offers a $250 bill credit to residential customers who own a Level 2 EVSE and allow CPS Energy to make remote adjustments to their EVSE when electricity demand is high. CPS Energy also offers residential customers a $125 bill credit if they agree to charge during off-peak hours. Customers may earn an additional $10 bill credit per month if they limit charging during peak hours to twice a month. For more information, visit the CPS FlexEV Rewards website.

Electric Vehicle Supply Equipment (EVSE) Rebate – Southwestern Electric Power Company (SWEPCO)
SWEPCO offers residential customers a $250 rebate for the installation of an ENERGY STAR certified Level 2 EVSE. Rebates are available on a first-come, first-served basis. Additional terms and conditions apply. For more information, including how to apply, see the SWEPCO Level 2 Home EV Charging Station Rebate Program website.

Electric Vehicle Supply Equipment (EVSE) Rebate – United Cooperative Services (UCS)
UCS offers residential customers a rebate of 50% of the cost to install a Level 2 EVSE, up to $500. For more information, including eligibility and how to apply, see the UCS Energy Rebate Programs website.

Plug-In Electric Vehicle (PEV) Charging Rate Pilot Program - CPS Energy
CPS offers residential customers that own a PEV a flat electricity rate of $96 annually per PEV. For more information, see the CPS Energy Electric Vehicles website.

Plug-In Electric Vehicle (PEV) Infrastructure Support
Texas utilities joined the National Electric Highway Coalition (NEHC), committing to create a network of direct current fast (DC Fast) charging stations connecting major highway systems from the Atlantic Coast to the Pacific of the United States. NEHC utility members agree to ensure efficient and effective fast charging deployment plans that enable long distance EV travel, avoiding duplication among coalition utilities, and complement existing corridor DC fast charging sites. For more information, including a list of participating utilities and states, see the NEHC website.

Plug-In Electric Vehicle (PEV) Rebate – Denton Municipal Electric (DME)
DME offers residential customers a $300 rebate for the purchase of a PEV. Eligible customers must agree to charge PEVs during off-peak hours. For more information, see the DME Residential Customers website.

Governmental Fleet Grants
The Texas Commission on Environmental Quality (TCEQ) administers the Governmental Alternative Fuel Fleet Grant Program (GAFF) as part of the Texas Emissions Reduction Plan (TERP) for the purchase or lease of new vehicles powered by natural gas, propane, hydrogen, or electricity. Grants are available in the following amounts:

Vehicle Class	Grant Amount
Class 1	$15,000
Class 2-3	$20,000
Class 4-6	$35,000
Class 7-8	$70,000

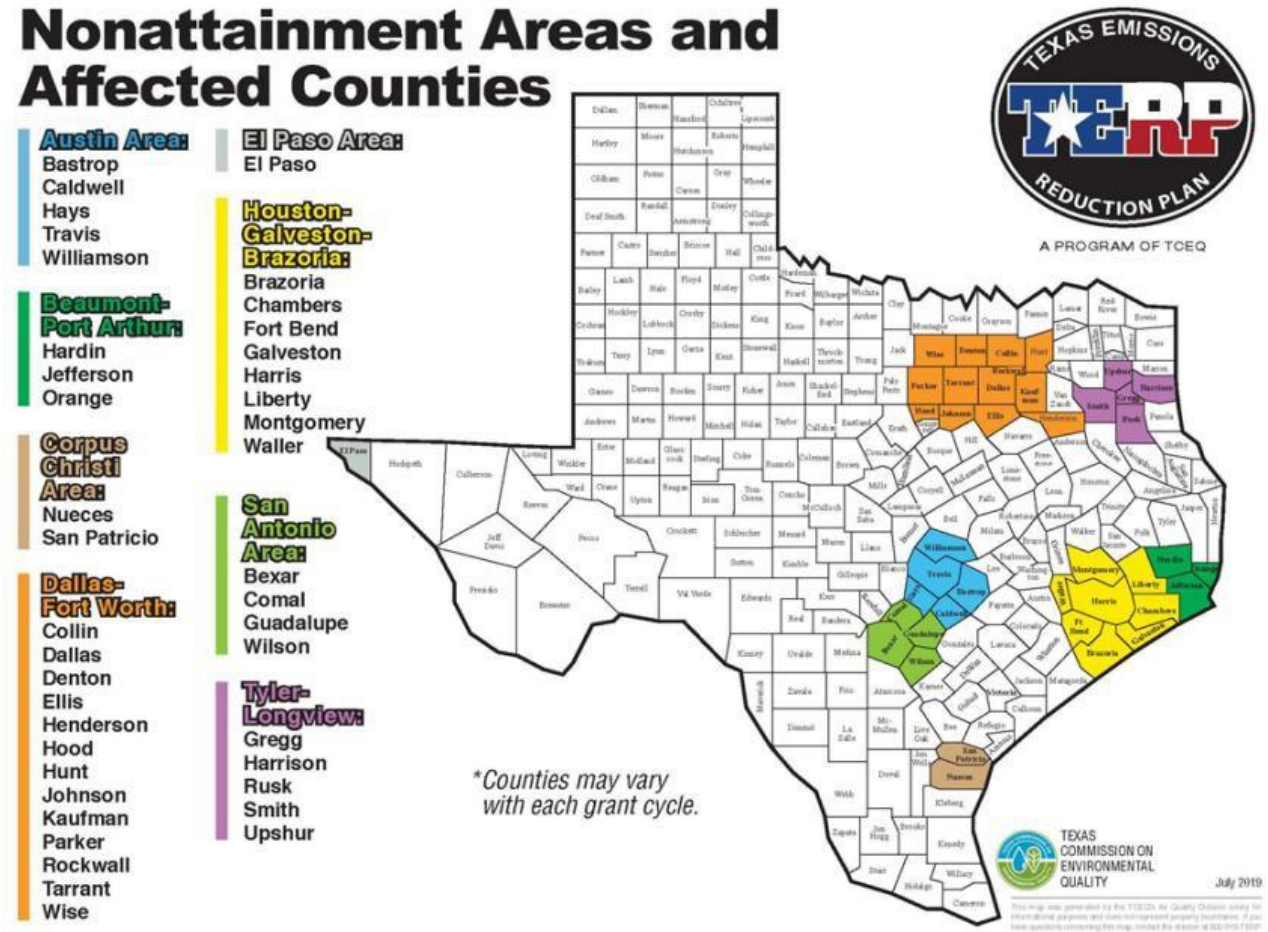
Up to 10% of awarded funds may be granted for the purchase, lease, or installation of refueling infrastructure or equipment, or refueling services in conjunction with an eligible vehicle purchase or lease. Special districts and government entities that operate a fleet greater than 15 vehicles are eligible. For more information, see the TCEQ GAFF website. (Reference Texas Statutes, Water Code 5.124 and 5.229, and Texas Statutes 386.153)

Heavy-Duty Vehicle and Equipment Grants
The Texas Commission on Environmental Quality (TCEQ) administers the Rebate Grants Program (Program) as part of the Texas Emissions Reduction Plan (TERP). The Program provides grants to eligible entities to replace or repower existing heavy-duty ,diesel-powered vehicles. Replacement vehicles and engines may not be more than three years older than the calendar year purchased and must reduce nitrogen oxide emissions by at least 25% compared to the vehicle or engine being replaced. Eligible replacement on- and off-road vehicles must be powered by diesel, natural gas, propane, or electricity. For more information, see the TCEQ Texas Emissions Reduction Plan TERP website. (Reference Texas Statutes, Health and Safety Code 386.104)

Seaport and Rail Yard Emissions Reduction Grants
The Texas Commission on Environmental Quality (TCEQ) administers the Seaport and Rail Yard Areas Emissions Reduction Program (Program) as part of the Texas Emissions Reduction Plan (TERP). The Program provides grants to eligible entities to replace, repower, or purchase drayage and cargo handling equipment. Eligible projects include heavy-duty on-road vehicles with a gross vehicle weight rating over 26,000 pounds, off-road yard trucks, and other cargo handling equipment. Eligible engines or motors must be powered by electricity or meet federal emissions standards and reduce nitrogen oxide emissions by at least 25% compared to the engine being replaced. For more information, including current application periods, see the TCEQ TERP website. (Reference Texas Statutes, Health and Safety Code 386 Subchapter D-1)

https://afdc.energy.gov/fuels/laws/ELEC?state=tx

Priority Areas for Air Quality Investment



- https://www.tceq.texas.gov/assets/public/implementation/air/terp/GAFF/FY21-GAFF-Workshop-Final.pdf
- https://www.tceq.texas.gov/airquality/terp/gaff

EV Market Opportunities

Terminal Tractors

Box Trucks

Vans and Step Vans

Short and Medium Regional Haul

- Return to Base Operations
- Lower Daily Mileage Routes
- Stop/Go Driving

- Overnight & En Route Charging
- Low Operating & Maintenance Cost
- Available Incentives/Grants/etc.

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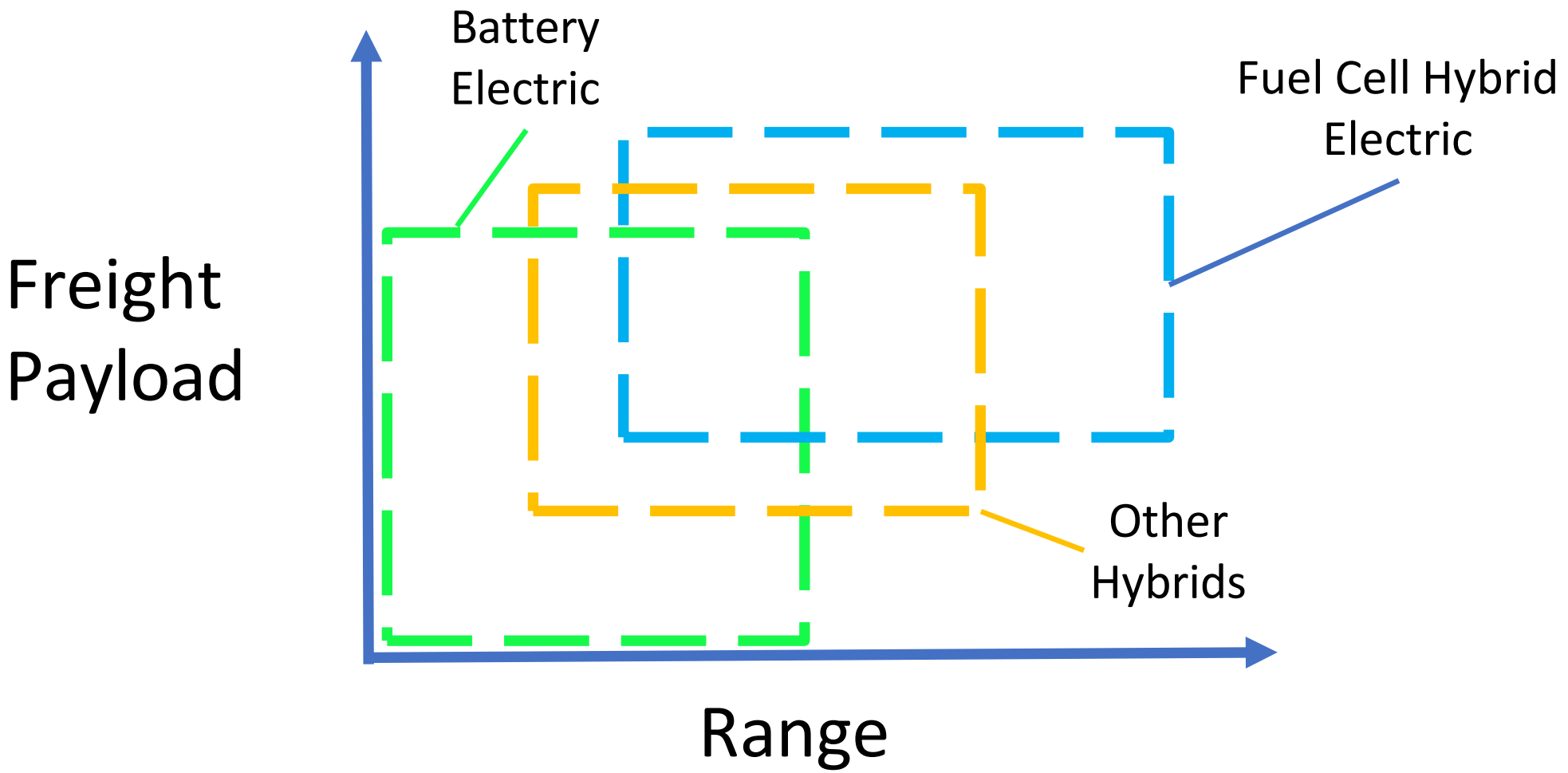
Duty Cycle Sweet Spot



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EDF ENVIRONMENTAL DEFENSE FUND

North Central Texas Council of Governments

ZEV Truck Resources

Run On Less: Presented by NACFE and RMI

Electric Trucks - North American Council for Freight Efficiency (nacfe.org)

Dashboard for Rapid Vehicle Electrification: DRVE Tool - Electrification Coalition

BEAN - Vehicle & Mobility Systems Group - Argonne National Laboratory (anl.gov)

Energy Consumption and Cost Reduction of Future Light-Duty Vehicles through Advanced Vehicle Technologies: A Modeling Simulation Study Through 2050 (Technical Report) | OSTI.GOV

Argonne GREET Model (anl.gov)

Operating Cost Calculator | Peterbilt

Total Cost of Ownership Calculator (dana.com)

Episode #27: 'Fleet Electrification is Bigger in Texas' with David Treichler of Oncor Electric Delivery - [an Energy Central Power Perspectives™ Podcast] | Energy Central

COMMERCIAL (oncor.com)

AVs are Also Emerging

tu simple

TORC ROBOTICS

EMBARK

LOCOMATION

Outrider

nuro

GAUSSIN
Be Faster... Safer & Cleaner

plus.ai

Aurora

WAYMO

einride

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Contact Information

Rick Mihelic
Director Emerging Technologies
North American Council for Freight Efficiency
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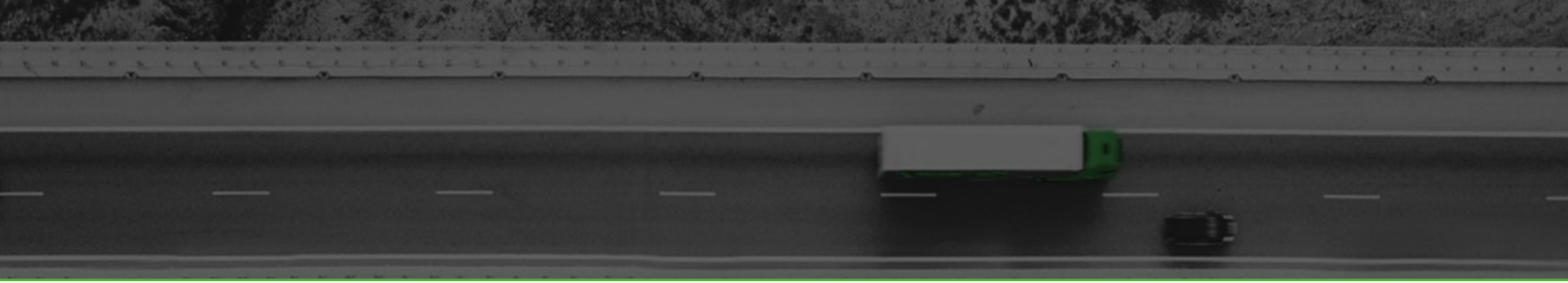
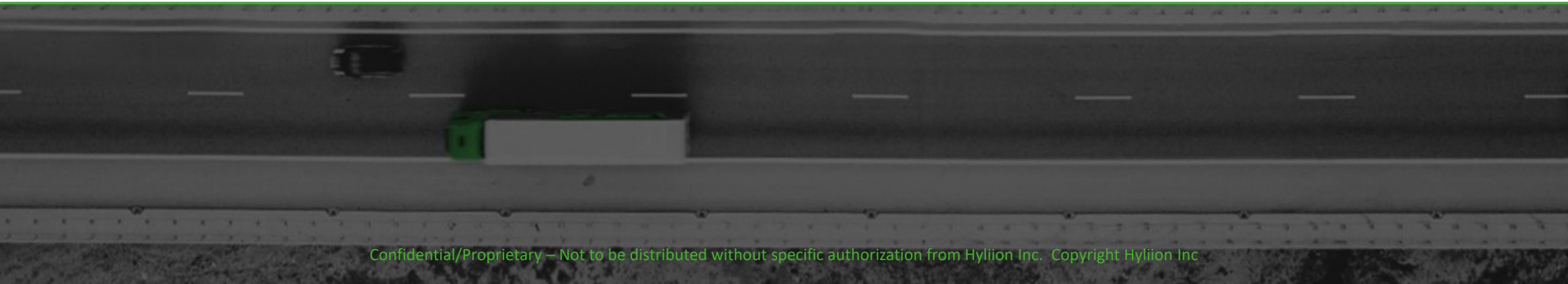
rick.mihelic@nacfe.org



HYLIION



COMPANY

- Publicly traded (NYSE:HYLN)
- Fully-funded - $700M+ raised
- 200+ employees

CURRENT PRODUCT LINES

HYBRID EX

- Commercialized **Hybrid EX** – deployed across US / CA
- Over 3 million miles on customer vehicles, and counting

HYPERTRUCK ERX

- Commercialization of **Hypertruck ERX** in-progress
- Focusing on development for the long-haul application

HEADQUARTERS

- 120,000 sq. ft. facility located in Austin, TX
- Complete design, engineering, testing and install facilities

TECHNOLOGY

Focus on advanced CV powertrains, software, batteries and data analytics

HYPERTRUCK ERX OVERVIEW

OPERATING COST [2]
Offers a reduced cost of ownership vs. diesel

ERX < DIESEL

RANGE [1]
Long-haul and BEV capable

1,000+ Hybrid miles

up to 75 All electric miles

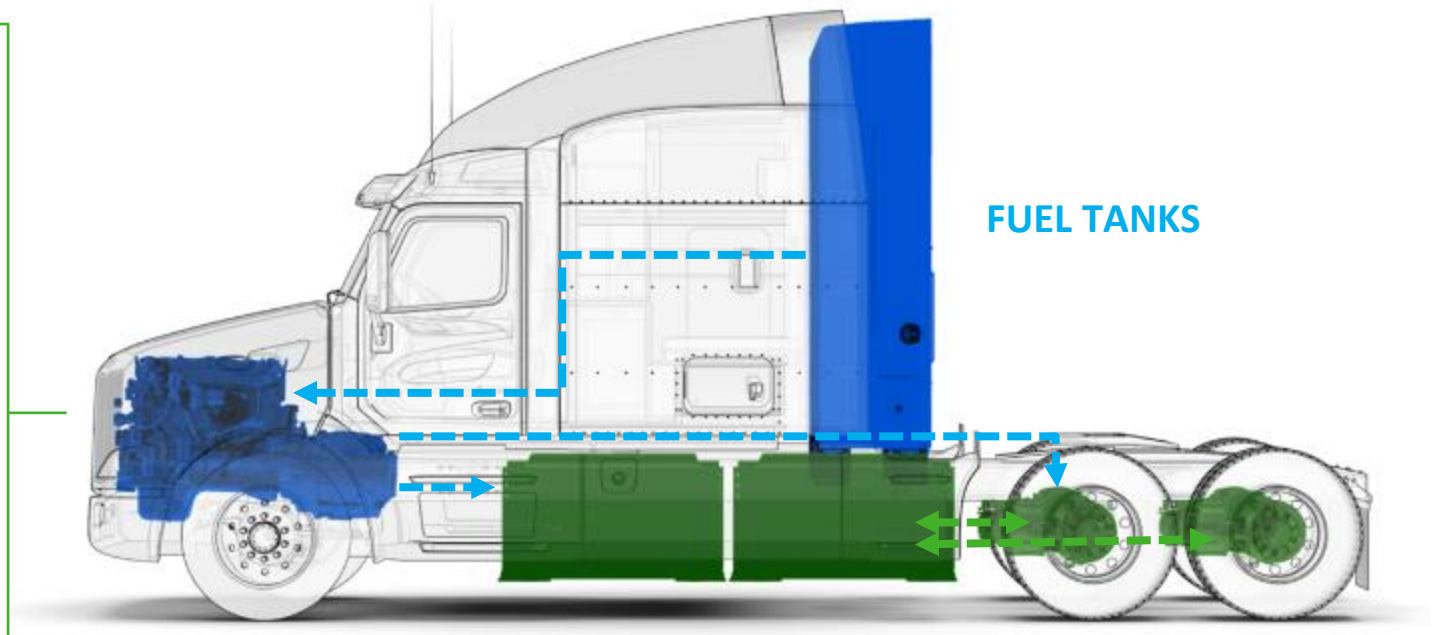
PAYLOAD [4]
Fleets can haul more freight, not battery weight

DRIVER EXPERIENCE
Improved driving experience and operational performance

670 Peak HP

INFRASTRUCTURE [3]
Non stop performance that leverages existing nationwide RNG network

700+ Existing heavy-duty natural gas stations



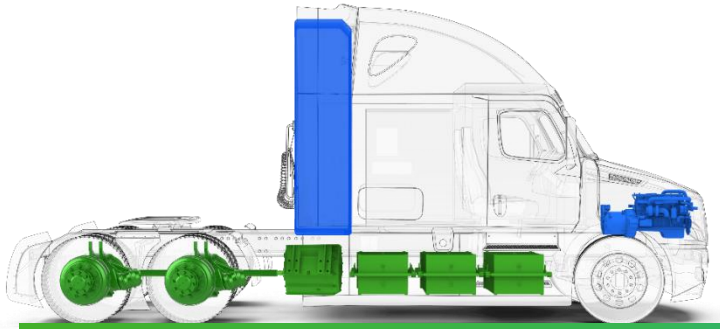
ZERO-EMISSION EV DRIVE

The Hypertruck ERX powertrain provides pure electric vehicle (EV) drive capability, with zero tailpipe emissions. This feature allows fleets to make deliveries within city limits or at ports and terminals without producing any emissions and eliminating the need to swap trucks. Power for this feature can come from DC fast-charging or the onboard generator.

HYLIION

1. Based on vehicle configuration and real-world conditions - results may vary depending on a number of factors, including but not limited to, exact route, road conditions, driver, load and fuel pricing 3. US & Canada https://afdc.energy.gov/fuels/natural_gas_locations.html#/analyze?fuel=CNG&cng_vehicle_class=HD&cng_fill_type=Q&cng_psis=3600 4. Assumes maximum hauling capacity of 80,000lbs, 500+ mile range BEV, Hypertruck ERX vehicle weight based on Company estimates, BEV vehicle weight based on published report from the Department of Mechanical Engineering at Carnegie Mellon University

HYPERTRUCK POWERTRAIN EVOLUTION

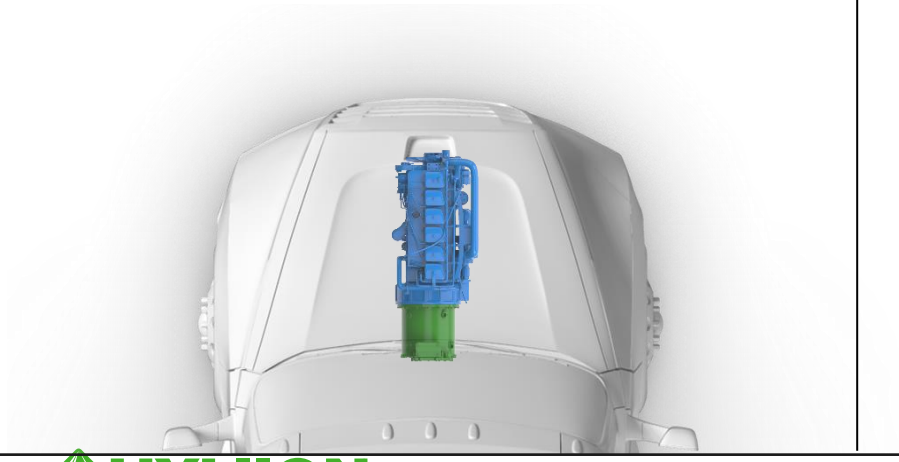


RENEWABLE NATURAL GAS

HYDROGEN FUEL CELL

HYPERTRUCK™ ERX → HYPERTRUCK™ FUEL AGNOSTIC → HYPERTRUCK™ FUEL CELL

CNG/RNG GENERATOR



FUEL-AGNOSTIC

HYDROGEN FUEL CELL

HYLIION

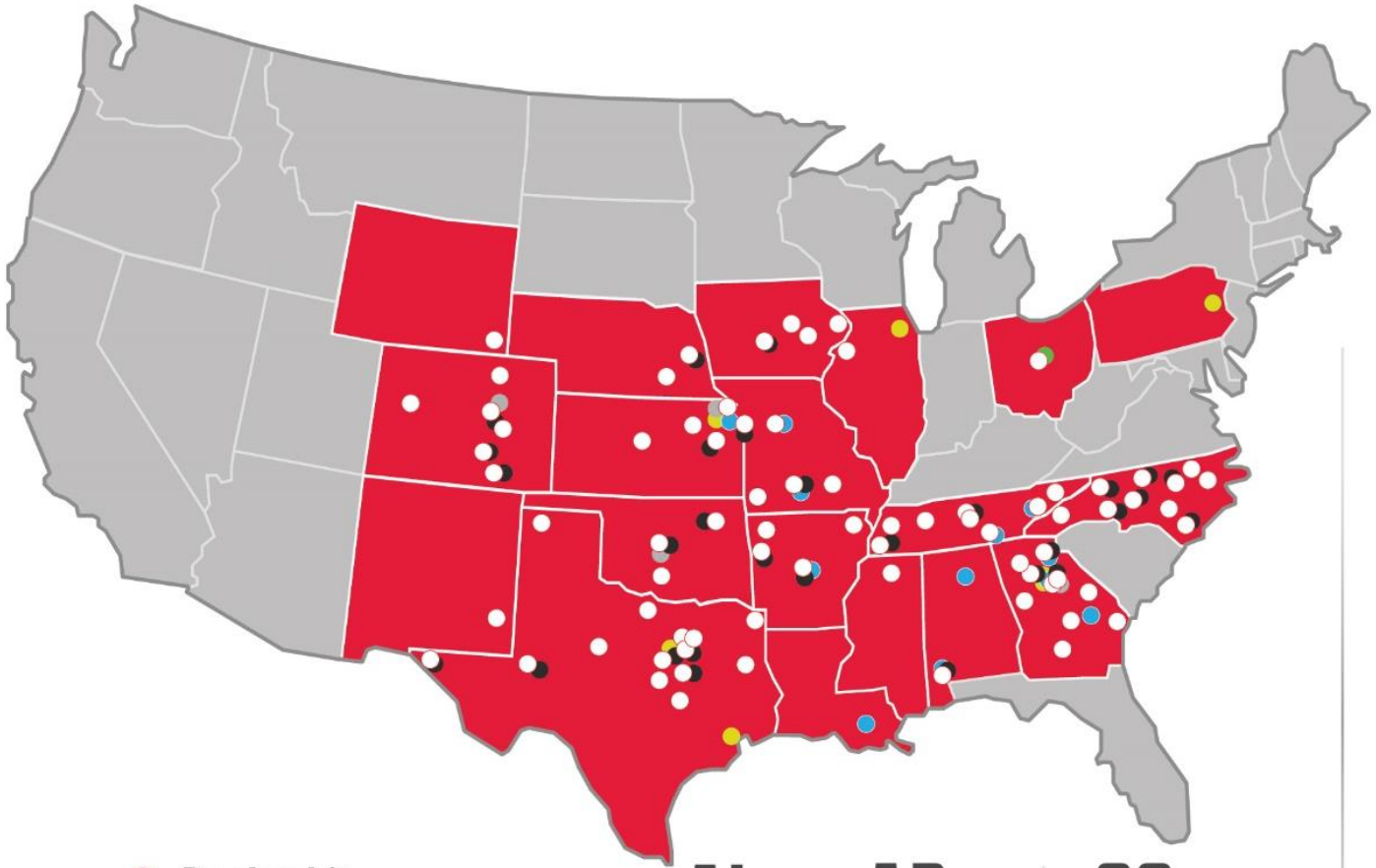
THANK YOU

HYLIION

MHC®

SALES I PARTS I SERVICE I FINANCE

- All makes/models service in major markets provided 7 days a week, 24 hours a day
- Warranty-certified technicians
- Over $125 million in parts inventory
- All makes parts with consistent pricing
- Emergency 7/24 breakdown service
- Flexible information system capabilities
- Local support for truck sales, service or parts
- New/Used Truck Sales; Full Service Leasing and Rental



- Dealership
- Leasing
- Carrier
- Truck Source
- Road Ready
- TRP

AL
BIRMINGHAM
MOBILE

AR
FORT SMITH
JONESBORO
LITTLE ROCK
SPRINGDALE
VAN BUREN

CO
COLORADO SPRINGS
DENVER
SOUTH DENVER
GRAND JUNCTION
GREELEY
PUEBLO

GA
ATLANTA
EAST ATLANTA
SOUTH ATLANTA
ADAIRSVILLE
AUGUSTA
BAXLEY
GAINESVILLE
MACON
NORCROSS
SAVANNAH
STATESBORO

IA
CEDAR RAPIDS
DES MOINES
DUBUQUE
WATERLOO

IL
QUAD CITIES
CHICAGO

KS
KANSAS CITY
OLATHE
SALINA
TOPEKA

LA
BATON ROUGE
NEW ORLEANS

MS
TUPELO

MO
CABOOL
COLUMBIA
JOPLIN
KANSAS CITY
SPRINGFIELD
ST. JOSEPH

NE
LINCOLN
OMAHA

NM
HOBBS

NC
ASHEVILLE
CHARLOTTE
CLINTON
CONCORD
DURHAM
GREENSBORO
HICKORY
RALEIGH
ROCKY MOUNT
WILMINGTON

OH
CHILLICOTHE

OK
ARDMORE
OKLAHOMA CITY
TULSA

PA
W. ALLENTOWN

TN
CHATTANOOGA
JACKSON
KINGSPORT
KNOXVILLE
MEMPHIS (KW)
MEMPHIS (FORD)
MURFREESBORO
NASHVILLE

TX
ABILENE
CACTUS
DALLAS
SOUTH DALLAS
DENTON
EL PASO
FORT WORTH
SOUTH FORT WORTH
HOUSTON
MCKINNEY
LONGVIEW
ODESSA
TEXARKANA
WACO
WICHITA FALLS

WY
CHEYENNE

21 LOCATIONS:

Abilene
Cactus
Dallas
South Dallas
Denton
El Paso
Ft. Worth
S. Ft. Worth
Houston
Longview
McKinney
Odessa
Texarkana
Waco

- XoS – *Now* class 5/6 stepvan; 2023 Cab/Chassis; Tractor
- Kenworth – *Now* class 6/7 cab/chassis, T680e tractor
- Hino – launch late ’23 class 5/6; ‘24 eAxle; Fuel Cell Electric Truck (prototype CA ports)
- Isuzu – launch Q2 ’24 - electric N Series (14.5 – 19.5K gvw);
- Ford – *Now* Transit

- Available NOW
- Class 5/6 – 23K GVW, 10K payload
- 110 – 130 mile range
- Morgan/Olsen step van

- Available Q2 ‘23
- Cab/Chassis – Class 6/7
- Multiple body options

- Available Q3 ‘23
- Single and Tandem Axle

HEB Fleet Maintenance

Mike Moynahan - HEB Asset, Design and Procurement Manager

Porne Cavan – Operations Leader

Dennis Allen – Operations Leader

HEB – Electrical Continuous Improvement Initiatives

- **HEB continuously pursues excellence and we do not accept the status quo. Some examples of these efforts over the years as it pertains to electrification are:**
  - Solar panels and use of that electrical energy in our overall store consumption
  - Fuel cell operated forklifts in our warehouse
  - Plug in electric stand by refrigeration units on our trailers
  - Wind generators
  - Partnered and Tested Hyliion E-Axle
  - Testing several OEM’s electric powered yard mules
  - Volvo/DOE tractor electrification project

PRIORITY 1 - YARD MULE ELECTRIFICATION FOR HEB

- **Diesel Yard Mule Challenges**
  - New emissions regulated diesel powered engine no longer viable product for HEB applications
  - Yard mules don't run 'hot' enough for passive regeneration opportunities which requires more active or 'forced regens'
  - Emission related issues causing more costs and downtime
  - Excessive downtime requires more yard mules than necessary to run operation

- **Why Electrify HEB's Yard Mule Fleet Now?**
  - Electrification technology has 'matured' enough to become a viable option – financially and dependability
  - HEB expected normal life cycle of electric yard mule is 7 years (35,000 hours) vs 5 years (25,000 hours) for diesel
    - Refurb with new batteries and minor repairs for 7 more years – effective life cycle of 14 years vs 10 years for diesel
  - Secondary life of batteries – storage capacity for solar panels at new Super Regional Distribution Center (estimated 3.5 megawatts)

HEB ELECTRIC MULE EXPERIENCE

Tested 2010 - Capacity PHETT (Pluggable Hybrid Electrical Terminal Tractor)

Tested 2013 - TransPower Electric Yard Mule

Tested 2019 – Single Axle Kalmar Electric T2 Mule

2021 – Purchased 2 Single Axle Orange EV Yard Mule (Partnered in DERA project with AACOG)

Currently Testing 2 Different Electric Mules – Orange EV and Lone Star EV

Orange EV Charging Station

Orange EV Mule

LSEV Charging Station

Lone Star EV Mule

HEB ELECTRIC YARD MULE CHARGING SOLUTION

PROTERRA 1.5 MEGAWATT CHARGER
– Allow up to 20 yard mules to charge at the same time

PROTERRA CHARGING DISPENSER

PRIORITY 2 – EXPLORE ZERO EMISSION TRACTOR OPTIONS

VOLVO – DEPARTMENT OF ENERGY PROJECT

- Partnering with Volvo and DOE to test the durability, efficiency and viability of a full electric Volvo VNR tractor (565kW battery pack with expected range of 250 miles)

Still exploring options on BEV, Fuel Cells and Renewable Natural Gas engines


LONESTAR SV
DANA
DRIVELINE FORENSICS
Vehicles In Service
21,927
XOS
XOS

LONESTAR SV INTRODUCTION

OVERVIEW

Founded in 2014

Headquartered in Texarkana, Texas

75 employees

11-acre campus

30,000 sq ft production floor

20,000 sq ft battery manufacturing facility

ACCOMPLISHMENTS

Over 4,000 Class 8 glider kits assembled and deployed

Remanufactured 300 terminal tractors

Support over 350 individual customers

Delivered multiple fleet orders of 100 units or more

Established a 24/7 customer support center

Developed and deployed the first tandem axle electric terminal tractor

CAPABILITIES

Contract Manufacturing

Commercial vehicle assembly

Heavy equipment remanufacturing

Graphic design

Vinyl fabrication and installation

Fleet management

Electrification consultation

PARTNERS

DANA — Drivetrain and e-Propulsion Systems

Bendix — Commercial Vehicle Systems

HYLIION — Electric Powertrain Solutions

DUKE ENERGY — Infrastructure Solutions

LONESTAR TRUCK GROUP — DTNA Dealership Group

LINK MFG. — Heavy Duty Suspensions

In-Charge — Scalable Energy Solutions

TAG TRUCK CENTER — DTNA Dealership Group

tm4 — e-Propulsion Systems

MAJOR COMPONENTS

SUMO MD

DANA TM4

Proven permanent magnet technology for optimal efficiency

Outer rotor topology for maximum torque density

1,275 ft lbs. more torque than a Cummins 6.7L

PEC (POWER ELECTRONICS CRADEL)

DANA

Contains most of the system's power electronics

Uses HVIL connections

IP67 rated junction box

Max charge rate of up to 163 kW

POWER STEERING

DANA

Dana LV motor and pump assembly

Allows for improved turning and reduced operator fatigue

Almost silent operation

S190 SERIES DRIVE AXLE

250,000-mile initial lube drain with approved lubricants for reduced maintenance

Gearing with extra-wide face width and larger wheel differential gearing for maximum strength

E-SERIES STEER AXLE

Forged knuckle reliability for turn angles up to 55°

Greater durability and reduced maintenance

Enhanced maneuverability

LONESTAR SV

ADVANTAGES

RANGE

Two different pack configurations, sized to meet the demand of any application

In-cab remaining range estimate allows the operator peace of mind

Up to 22 hours of continuous operation

CHARGING

All units come standard with fast charge capabilities

J1772 / CCS1 protocol compatible, allowing for reduced infrastructure complexity

Charge to 90% in less than 2 hours

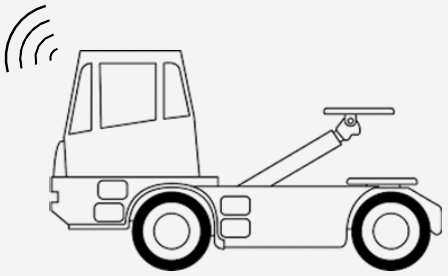
BATTERY

Internally heated modules for cold weather operation

Forced air cooled for heat dissipation

Exceptional energy density

Packs designed by Dana



TELEMATICS

Robust telematics suite allows fleets to monitor and manage their terminal tractor fleet with detailed data.

Allows for the monitoring of energy consumption, GPS location, and remote diagnostics

SAFETY

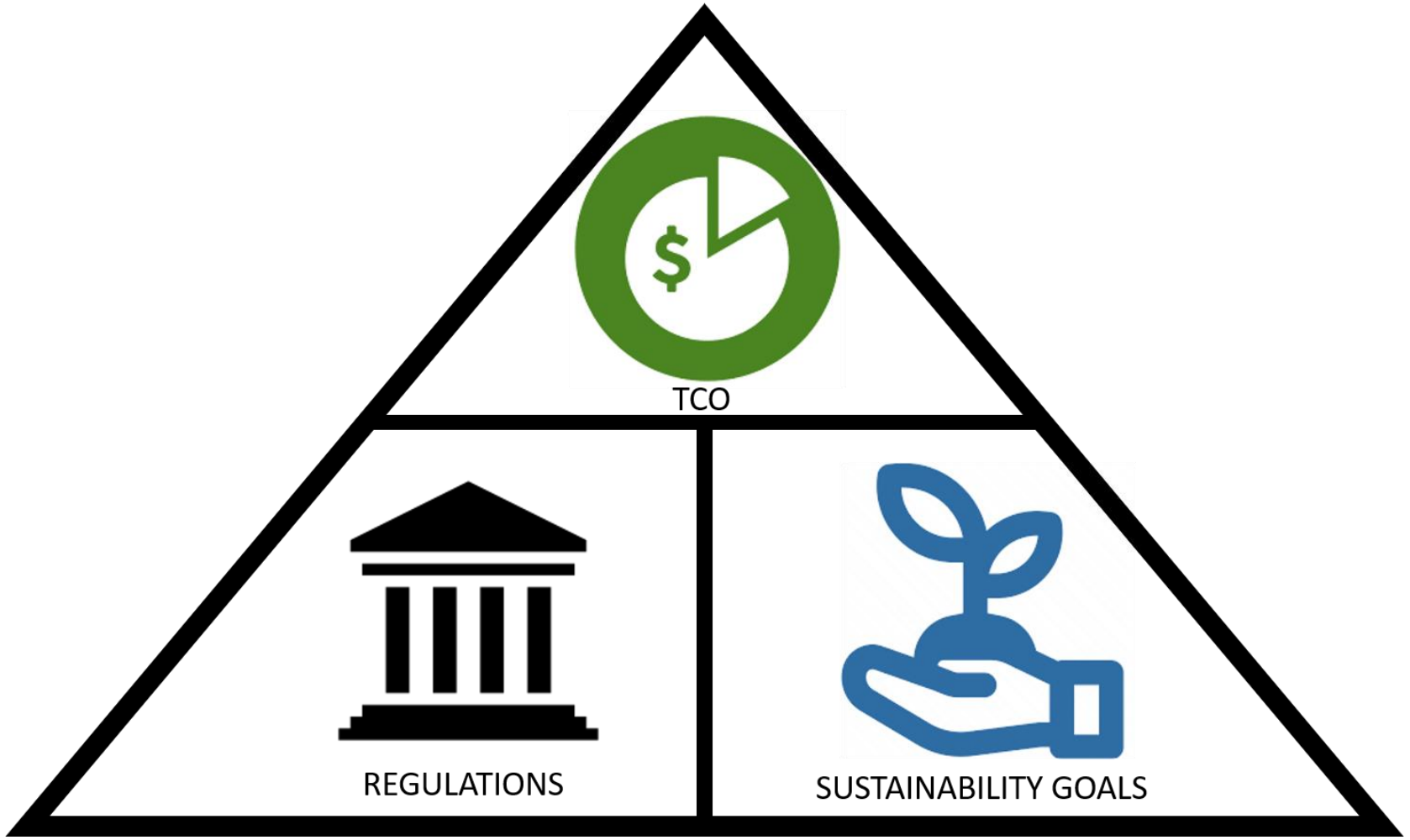
Bendix ABS/ATC meeting FMVSS 121 certification

Extensive battery safety testing certifications

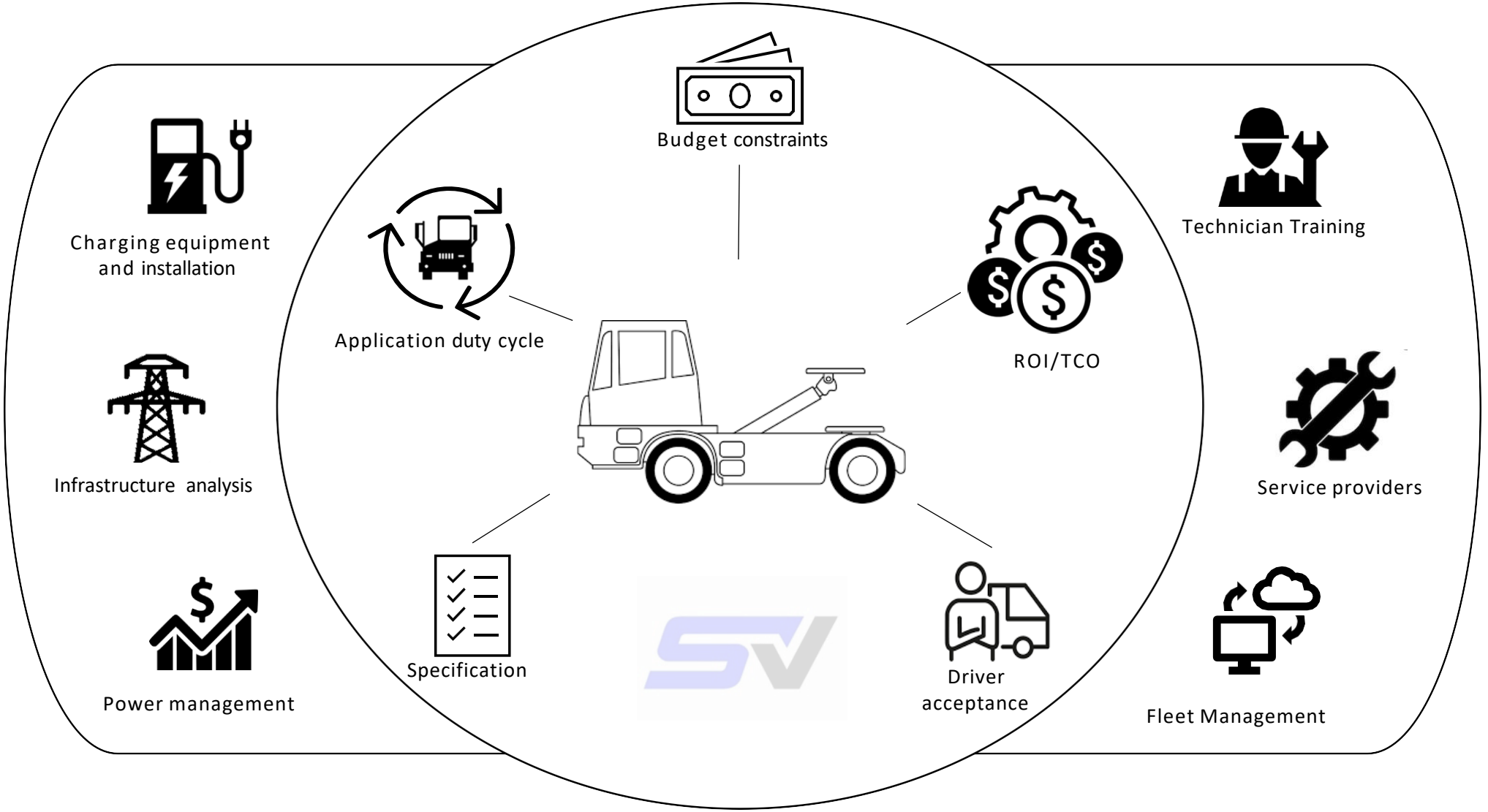
Full view camera system for optimal operator visibility

LONESTAR SV

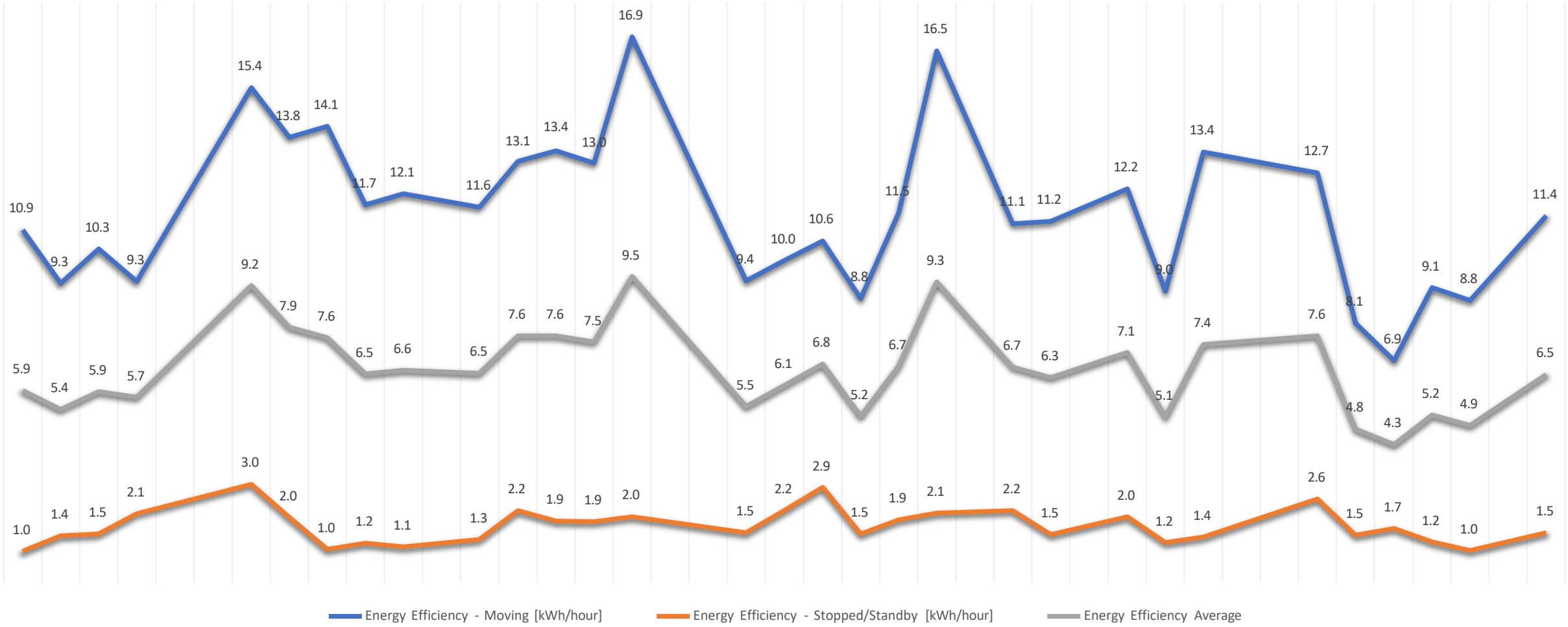
ELECTRIFICATION MOTIVATORS



ELECTRIFICATION COMPLEXITY



KWH EFFICIENCY ROL



OPERATION COST

VARIABLES

Daily Operating Hours	16
Annual Operating Days	350
Annual Operating Hours	5,600
Maintenance Cost p/hour	$3.50
Diesel Fuel Price	$3.29
Electricity Cost p/kWh Nat. AVG.	$.11

PERFORMANCE AVERAGE

KWH PER HOUR	6.61
KWH REGEN PER SHIFT	5.21
AVERAGE SPEED	8.8
UPTIME	>98%
HOURS IN TRANSIT PER DAY	9.9
CHARGE HOURS PER DAY	1.87

COST	DIESEL	ELECTRIC
Daily Energy Consumption	26.56 Gal.	128 kWh
Daily Energy Cost	$87.38	$14.08
Annual Maintenance Cost	$19,600	$5,880
Annual Energy Cost	$30,583.84	$4,928
Total Costs	$50,183.84	$10,808

ANNUAL ELECTRIC VEHICLE SAVINGS	$39,375.87
PAYBACK WITHOUT INCENTIVES	~3 YEARS

70%

reduction in maintenance cost

90%

more energy efficient that diesel

LONESTAR SV

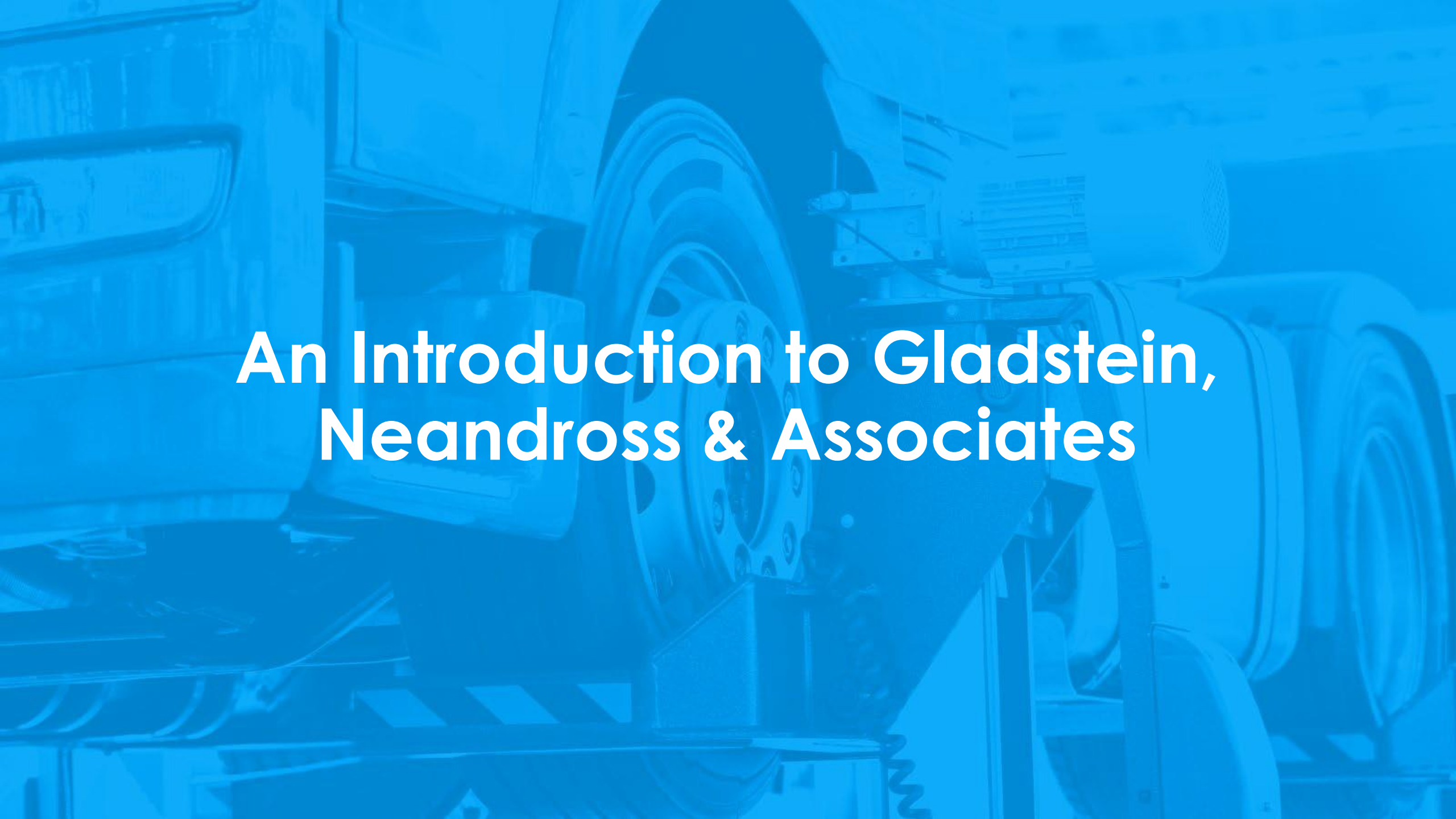
Question and Answer

We will be using Online Questions throughout the presentation. Event number is: **4252022**

- Visit **OnlineQuestions.org**
  OR
- Scan the QR Code to join

gna CLEAN TRANSPORTATION & ENERGY CONSULTANTS

Let's work together to drive a more sustainable future.



An Introduction to Gladstein, Neandross & Associates

gna CLEAN TRANSPORTATION & ENERGY CONSULTANTS

- **North America's Leading Clean Transportation Consulting Firm**
- **Established in 1993**
- **HQ in Santa Monica, CA**
  - AZ, LA, NC, NY, OR, and TX
- **Diverse Staff of 75+**
  - Financial Incentives
  - Market Analysis & Strategy
  - Technical Services
  - Regulatory Compliance
  - Public Affairs & Government Relations
  - Creative Services: Marketing, Communications & Experiential

What We Do

GNA works with clients to build the market for advanced transportation technologies and clean fuels.

Here's a snapshot of our consulting services:

Market Analysis & Development

Assess the market landscape for clean transportation and energy products and services.

Clean Fleet Strategy & Execution

Achieve economic and environmental sustainability goals for public and private fleets.

Sustainability Planning & Programs

Establish a comprehensive sustainability strategy to future-proof your operations.

Funding & Incentives

Maximize the financial benefits of advanced vehicles and clean fuels.

Policy & Regulatory Support

Navigate regulatory and legislative initiatives that impact the commercial transportation sector.

Creative & Events

Build brand awareness, influence key decisionmakers, and increase your market share.

What We Do: Funding & Incentives

Gladstein, Neandross & Associates (GNA) Grant Funding Statistics		
Amount Applied		594
Amount Awarded		535
Success Rate (%)		90.07%
Grant Amount Awarded ($)	$	927,293,146
ERC Value	$	33,428,000
LCFS Value	$	50,896,520
Total Funding (Grant, LCFS and ERCs)	$	1,011,617,666
Amount Pending ($)	$	27,004,265
Total Vehicles and Equipment Funded		8,720
Awarded No. ZEV's		841
Awarded $ZEVs	$	214,015,607
Awarded No. EV Stations		224
Awarded $ EV Stations	$	93,678,465
Total Natural Gas Trucks Funded		5,809
Total Dollars Awarded for Natural Gas Trucks	$	255,582,156
Total Natural Gas Stations Funded	$	173
Total Dollars Awarded for Natural Gas Stations	$	81,399,138
Total Economic Activity - $ Spent on GNA Projects	$	2,400,450,597
Total Annual NOx Reductions (tons)		7,239
Total Annual PM Reductions (tons)		204
Total Annual GHG Reductions (tonnes)		1,389,104
Total Annual Diesel Displaced (gallons)		174,343,130

Support for EDF's Texas Medium & Heavy Duty Zero Emission Truck Collaborative

- Fleet operator engagement and education
- Technology evaluation
- Assessment of Total Cost of Ownership
- Policy analysis & TERP reform (more favorable to ZEVs)
- Incentive identification
- Grant writing

ACT EXPO

Advanced Clean Transportation Expo:

GNA produces the largest advanced transportation and clean fleet event, hosted at the Long Beach Convention Center:

- **5,000+** registered attendees
- **1000+** commercial fleet operators
- **250+** sponsors & exhibitors
- **10+** co-located events

ACT NEWS

Advanced Clean Transportation News:

GNA publishes a digital media publication that covers the trends and technologies driving the future of the transportation sector:

- **35,000+** subscribers
- **60%** public and private fleet operators
- **20+** content partners
- **1st** clean tech industry buyers' guide

gna CLEAN TRANSPORTATION & ENERGY CONSULTANTS

Let's work together to drive a more sustainable future.

Cliff Gladstein, Founding President

cliff@gladstein.org

(310) 573-8547

www.Gladstein.org www.ACTExpo.com

Resources to Assist in Transitioning to Zero-Emission Vehicle

Dallas-Fort Worth CLEAN CITIES

North Central Texas Council of Governments

April 25, 2022

National Network of Clean Cities Coalitions

Nearly 100 Clean Cities coalitions with thousands of stakeholders, representing ~80% of U.S. population

cleancities.energy.gov

Clean Cities Coalition Network

Building partnerships to advance affordable, domestic transportation fuels and technologies

cleancities.energy.gov

Clean Cities Coalitions:

- Serve as forums for local stakeholders to connect and collaborate on saving energy and using affordable alternative fuels
- Provide grassroots support and resources on new transportation technologies and infrastructure development
- Support networks to help their stakeholders identify cost-effective solutions that work locally

DOE Technology Integration Program

Provide objective/unbiased data and real-world lessons learned that inform future research needs and support local decision-making

Your Texas Regional Resources

Austin Area

Andrew Hoekzema
Director of Regional Planning and Services
ahoekzema@capcog.org
512-916-6043

Christiane Alepuz
Regional Planning and Services Program Coordinator
calepuz@capcog.org
512-916-6005

Elizabeth Munger
Lone Star Clean Fuels Alliance
elizabeth@lonestarcfa.org

Dallas-Fort Worth Area

Lori Clark
Program Manager & DFW Clean Cities Coordinator
lclark@nctcog.org
817-695-9232

Amy Hodges
Principal Air Quality Planner
ahodges@nctcog.org
817-704-2508

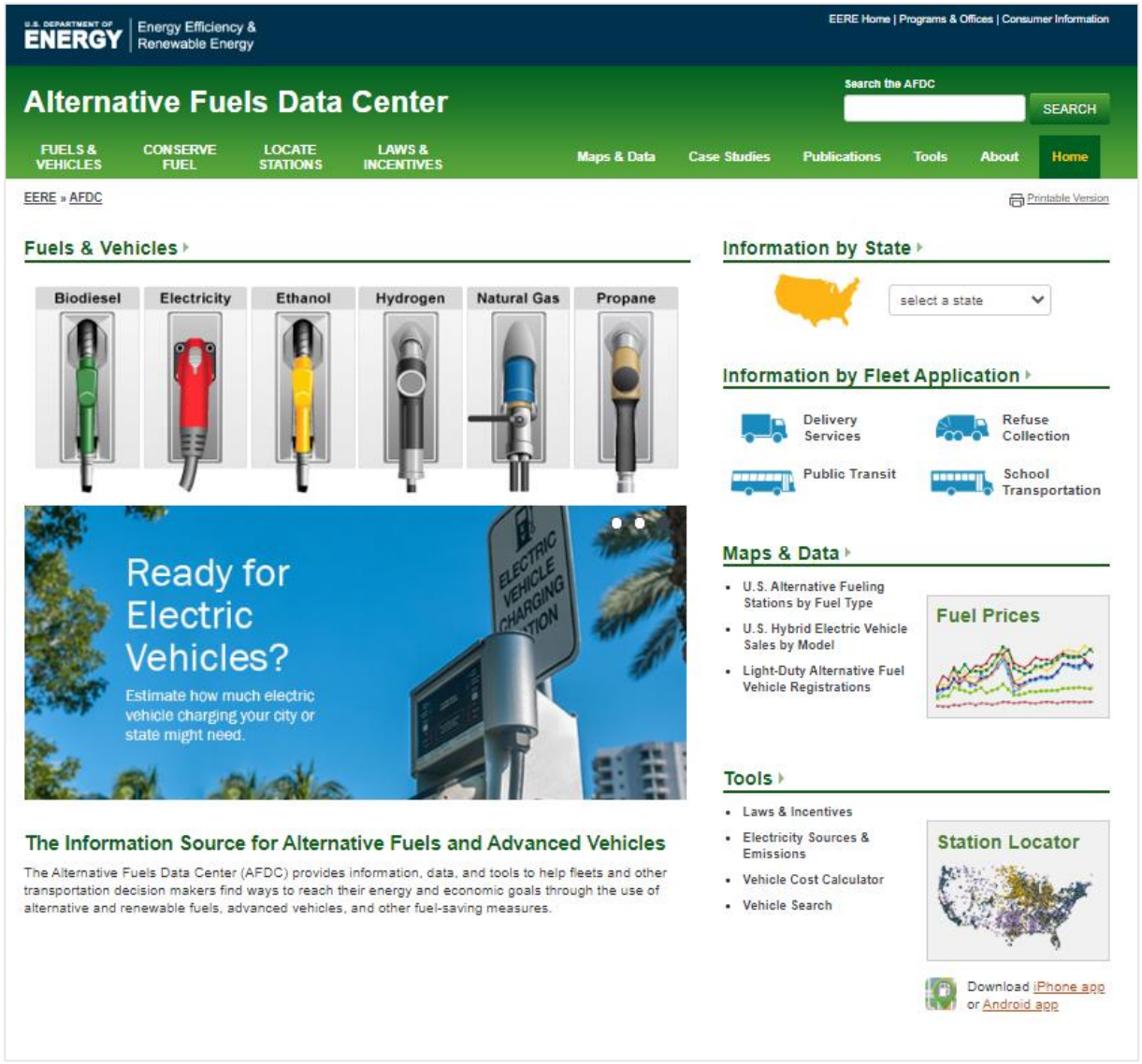
Houston Area

Andrew DeCandis
Principal Planner and Clean Cities Co-coordinator
Andrew.DeCandis@h-gac.com
832-681-2589

San Antonio Area

Lyle Hufstetler
Natural Resources Project Coordinator
lhufstetler@aacog.com
210-376-9901

Alternative Fuel Data Center



Resources Include:

- Currently Available Alternative Fuel Vehicles
- Information on Alternative Fuel Vehicles
- Alternative Fuel Station Locator
- Map-a-Route Tool
- Grants, Laws, and Incentives
- And More!

Global Commercial Vehicle Drive to Zero

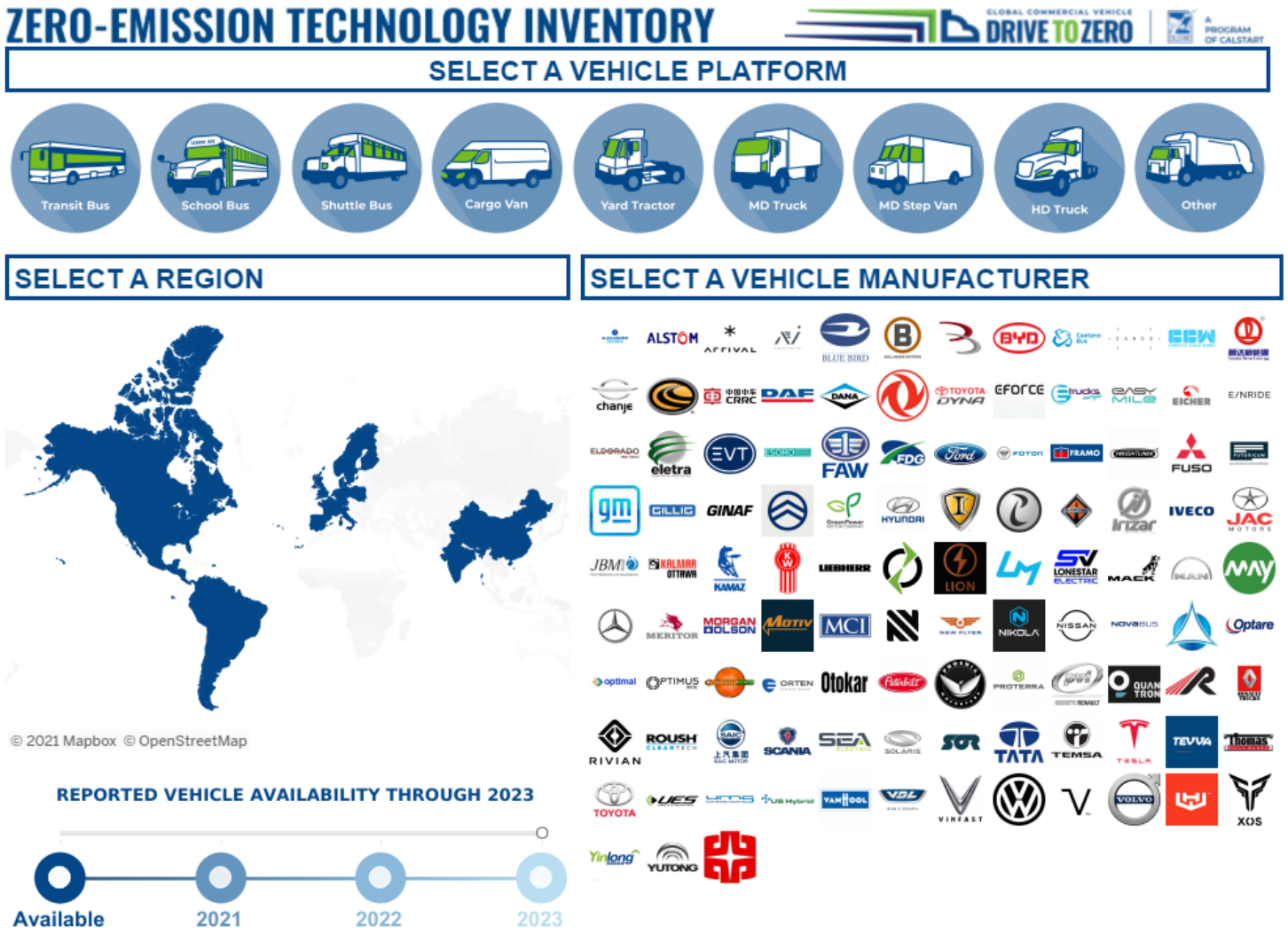
[Global Commercial Drive To Zero Program — Zero-Emission Technology Inventory]

Drive to Zero – program of CALSTART

Search by

- Vehicle Platform
- Region
- Vehicle Manufacturer

Displays Vehicle Model Availability



Calculate Benefits Using AFLEET Tool

Alternative **F**uel **L**ife-Cycle **E**nvironmental and **E**conomic **T**ransportation Tool

- Compares alternative fuels to diesel

AFLEET Online

- Simple Payback- Easy Online Tool!

AFLEET Tool (.xlsx)

- Simple Payback, Total Cost of Ownership, Fleet Footprint and More!

https://afleet-web.es.anl.gov/home/

AFLEET has Inputs for:

- State, County Where Vehicle Operates
- Vehicle Type and Vehicle Fuel, Fuel Economy, Vehicle Cost
- Maintenance and Repair Cost ($/mi), Fuel Price, Annual Mileage, Years of Ownership

Resources

AFDC Alternative Fueling Station Locator

AFDC Electric Vehicle Charger Selection Guide (PDF)

AFDC Vehicle Search

AFLEET Tool

DFWCC Try and Drive Alternative

DFWCC Success Stories

Drive to Zero - Zero-Emission Technology Inventory

Electric Vehicles North Texas EV Registration Tool

NCTCOG AQ Funding

Contacts

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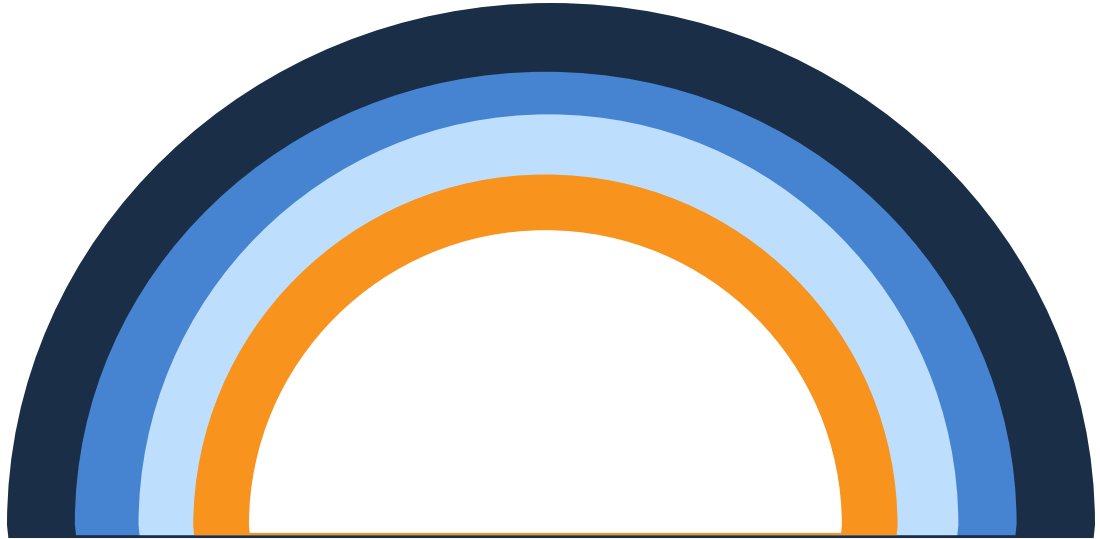
Lori Clark
Clean Cities Coordinator
lclark@nctcog.org

Savana Nance
Air Quality Planner II
snance@nctcog.org

www.dfwcleancities.org

Dallas-Fort Worth
CLEAN CITIES



North Central Texas
Council of Governments

EDF
ENVIRONMENTAL DEFENSE FUND

Sign Up Log In

Fleet Electrification

Solution Center

Everything you need to know about transitioning your Class 3-8 vehicles. Electrifying your fleet is a long-term strategy for your company. The journey is worth it — but until now, there hasn't been a comprehensive map to guide your team through the process.

www.electricfleet.org

Home | My Account | Resource Library | Download the Journey

Phase 1

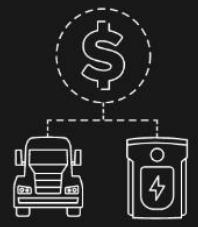
Review the landscape and gather the team

Get started by learning from other companies' efforts and tapping an internal project management team.

Phase 2

Identify what is possible now

You're ready to analyze how available technologies fit your business needs, budgets and timelines.



Phase 3

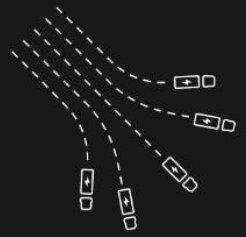
Create a plan for near-term deployment

It's time to earn senior leadership's approval, then apply for grant funding and procure the equipment.

Phase 4

Deploy

The phase you've been waiting for: your pilot program is in the field. The results will guide your next steps.



Phase 5

Expand adoption

The journey isn't over. You can apply your experience to a new feasibility analysis and plan for expansion.

Electric Vehicles on the Road

www.electricfleet.org

EDF ENVIRONMENTAL DEFENSE FUND

Sign Up Log In

The Journey

Step 1

Learn from existing electrification road maps, industry publications and successful case studies

Things To Do | Things To Consider | Resources

- ◯ Gather general information and deepen your understanding of the steps involved in fleet electrification.
- ◯ Read the articles, papers and one-pagers in our resource directory to learn from industry experts (like NACFE and RMI, which developed the Run On Less-Electric

www.electricfleet.org

Things To Do | Things To Consider | **Resources**

- A corporate accounting and reporting standard — Visit
- Chicago Commercial Electric Vehicle Readiness Guidelines — Download
- Alternative Fuels Data Center laws and incentives — Visit
- Clean Transit Innovation Network — Visit
- Electric Vehicles 101: A guide to electric vehicle types — Visit
- Power your drive for fleets — Visit

Sign Up Log In

Create your account

Electrifying your fleet is a multi-phase process. Help your team take the right steps in the right order by creating an account — you can check off each task as you complete it and monitor your progress.

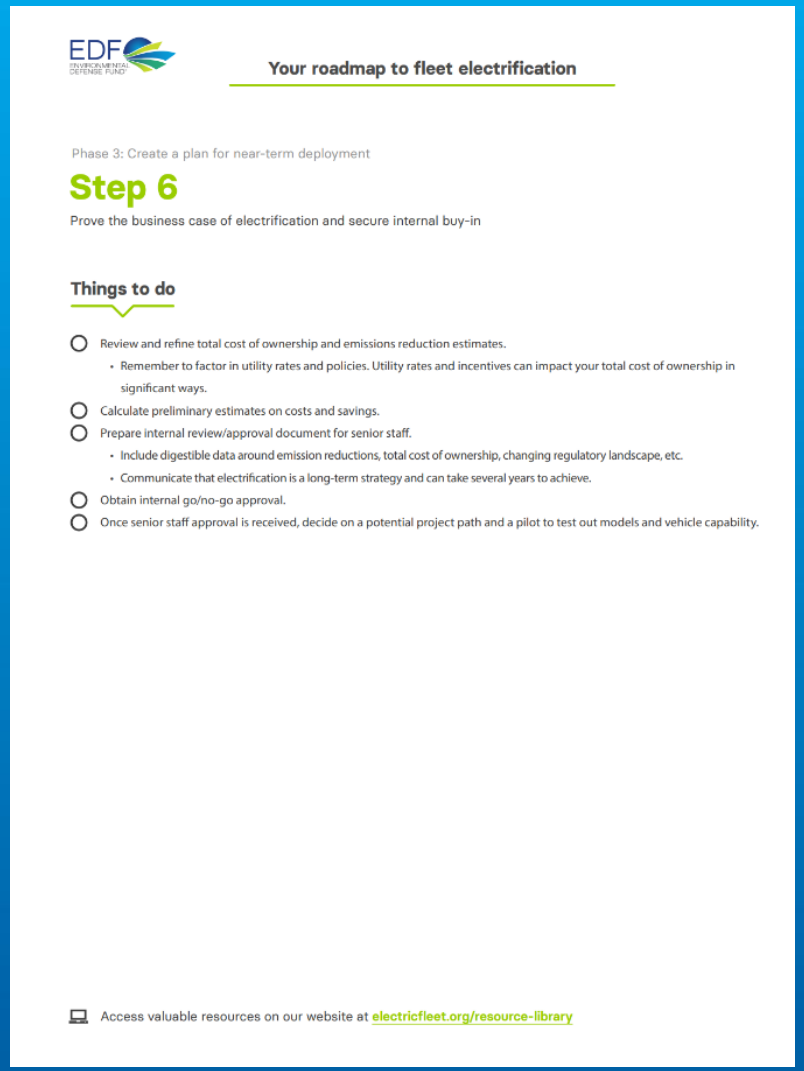
Username | Password

Full Name | Business Email Address

Title | Company

Industry Sector | Zip

Submit →



EDF

Your roadmap to fleet electrification

Phase 3: Create a plan for near-term deployment

Step 6

Prove the business case of electrification and secure internal buy-in

Things to do

- ○ Review and refine total cost of ownership and emissions reduction estimates.
  - Remember to factor in utility rates and policies. Utility rates and incentives can impact your total cost of ownership in significant ways.
- ○ Calculate preliminary estimates on costs and savings.
- ○ Prepare internal review/approval document for senior staff.
  - Include digestible data around emission reductions, total cost of ownership, changing regulatory landscape, etc.
  - Communicate that electrification is a long-term strategy and can take several years to achieve.
- ○ Obtain internal go/no-go approval.
- ○ Once senior staff approval is received, decide on a potential project path and a pilot to test out models and vehicle capability.

Access valuable resources on our website at electricfleet.org/resource-library

www.electricfleet.org

Ellen Bell

Senior Manager,
Zero Emission Vehicle Initiative
Environmental Defense Fund

ebell@edf.org
312-208-6747

EDF
ENVIRONMENTAL DEFENSE FUND
Finding the ways that work

Funding for Zero-Emission Vehicle Projects

Dallas-Fort Worth CLEAN CITIES

North Central Texas Council of Governments

April 25, 2022

Environmental Protection Agency Funding

Diesel Emissions Reduction Act (DERA) Funding

- Grants and Rebates To Replace and Retrofit Diesel Engines
- Eligible Entities: Public Agencies
  - Private sector can engage through public-private partnerships
- Eligible Diesel Vehicles, Engines and Equipment Include:
  - School Buses, Class 5 – Class 8 Heavy-Duty Highway Vehicles, Locomotive, Marine and Non-road Engines
- Funding Level: 45% for Electric; 35% for California Air Resource Board Low-NO_X Certified, 25% for All Others

https://www.epa.gov/dera/national

Texas Commission on Environmental Quality Funding

Seaport and Rail Yard Areas Emissions Reduction Program – Open Now!
Funds: Replace or repower drayage trucks and cargo handling equipment

Texas Clean Fleet Program - Expected to Open Spring 2022
Funds: Up-to 80% of cost to replace diesel vehicles with alternative fuel and hybrid vehicles

Rebate Grants Program – Expected to Open Summer 2022
Funds: Up-to 80% of cost to Replace or repower heavy-duty vehicles or equipment

Emissions Reduction Incentive Grants – Expected to Open Fall 2022
Funds: Up-to 80% of cost to replace or retrofit diesel vehicles

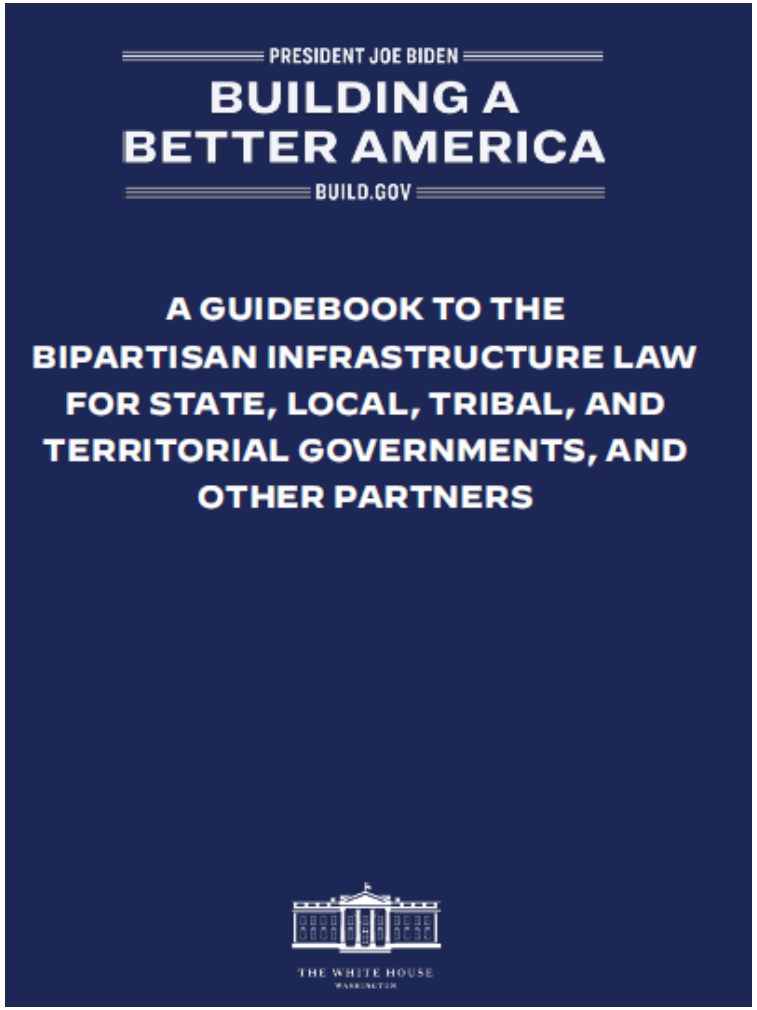
Alternative Fueling Facilities Program – Expected Summer 2022
Funds: 50% of the total eligible costs with a maximum grant amount of $600,000 for construction or expansion of alternative fueling infrastructure, with funding for projects open to the public being prioritized

Website: www.terpgrants.org
E-mail: terp@tceq.texas.gov
Toll Free: 800-919-TERP(8377)

Bipartisan Infrastructure Law Competitive Infrastructure Grants

The Bipartisan Infrastructure Law established various programs funding infrastructure for local governments. Private sector can engage through public-private partnerships.

To read about various programs go to https://www.whitehouse.gov/build



Next Steps

1. **Connect with your local Clean Cities Coalition, Council of Governments (COG), or Metropolitan Planning Organization (MPO)**

   Clean Cities - https://cleancities.energy.gov/coalitions/

   COG - https://txregionalcouncil.org/regional-councils/

   MPO - https://www.texasmpos.org/texas-mpos/

   To connect with the North Central Texas Council of Governments/Dallas-Fort Worth Clean Cities, sign-up for our email updates at **https://www.nctcog.org/stay-informed.**

2. **Research Funding Opportunities**

   https://www.nctcog.org/trans/quality/air/funding-and-resources

3. **Identify Potential Candidates for Transitioning to Alternative Fuel Vehicles**

   Create a Fleet Inventory List! Include vehicle year, engine model year, mileage, fuel type, Gross Vehicle Weight Rating (GVWR) and VIN for each vehicle in your fleet.

   Understand Your Fleet's Duty Cycle: Net miles traveled daily, where the fleet parks, and how long are they parked. To identify fueling stations near you- **https://afdc.energy.gov/stations**

Contacts

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Clean Cities Coordinator
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Savana Nance
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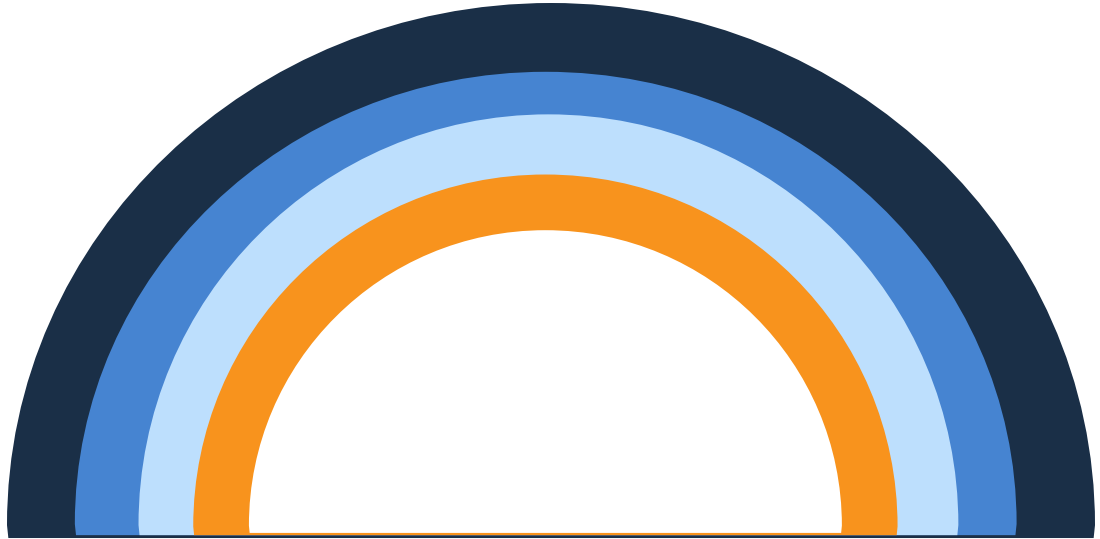
Dallas-Fort Worth
CLEAN CITIES



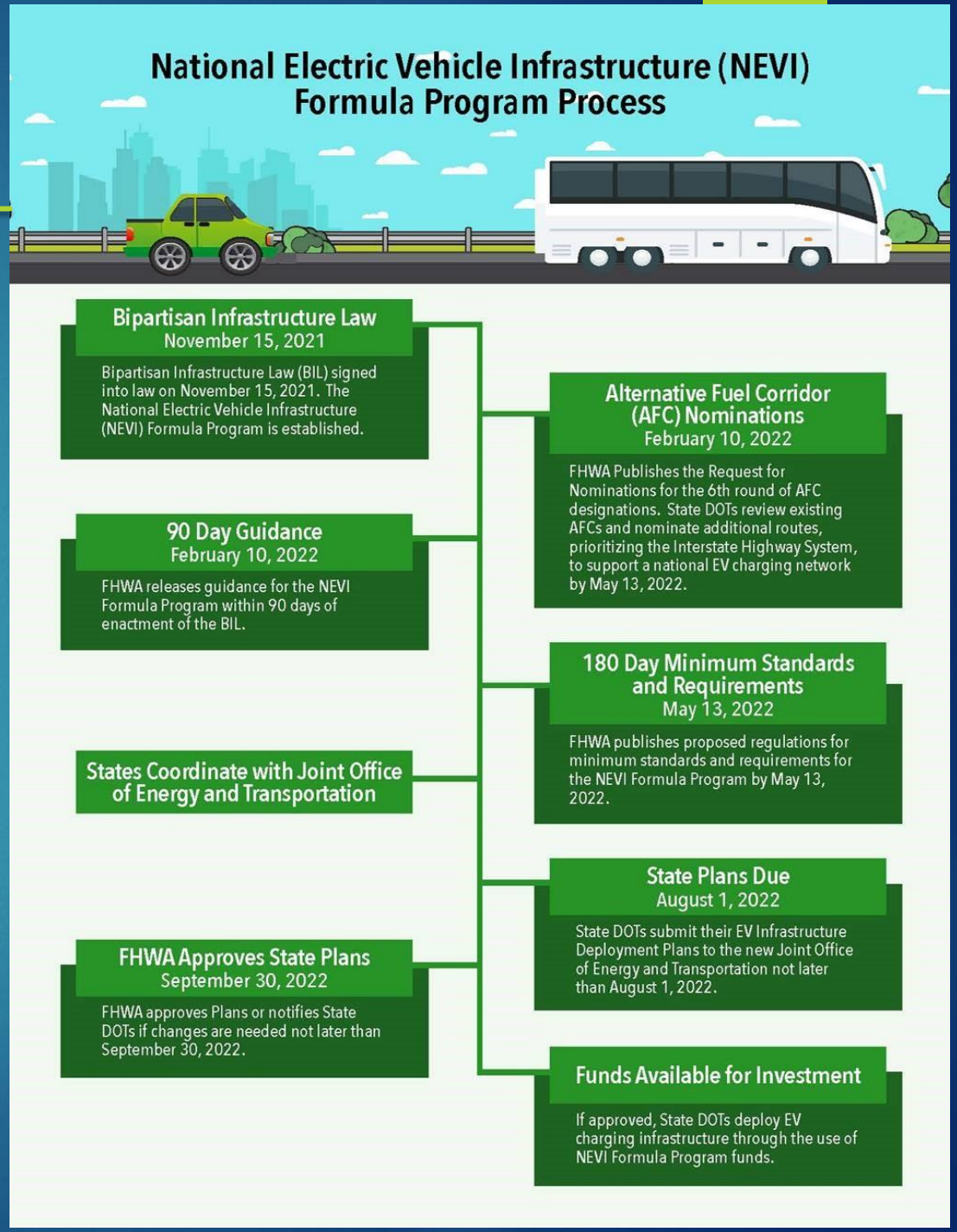
North Central Texas
Council of Governments

Bipartisan Infrastructure Law
Electric Vehicle Provisions

U.S. Department of Transportation
Federal Highway Administration

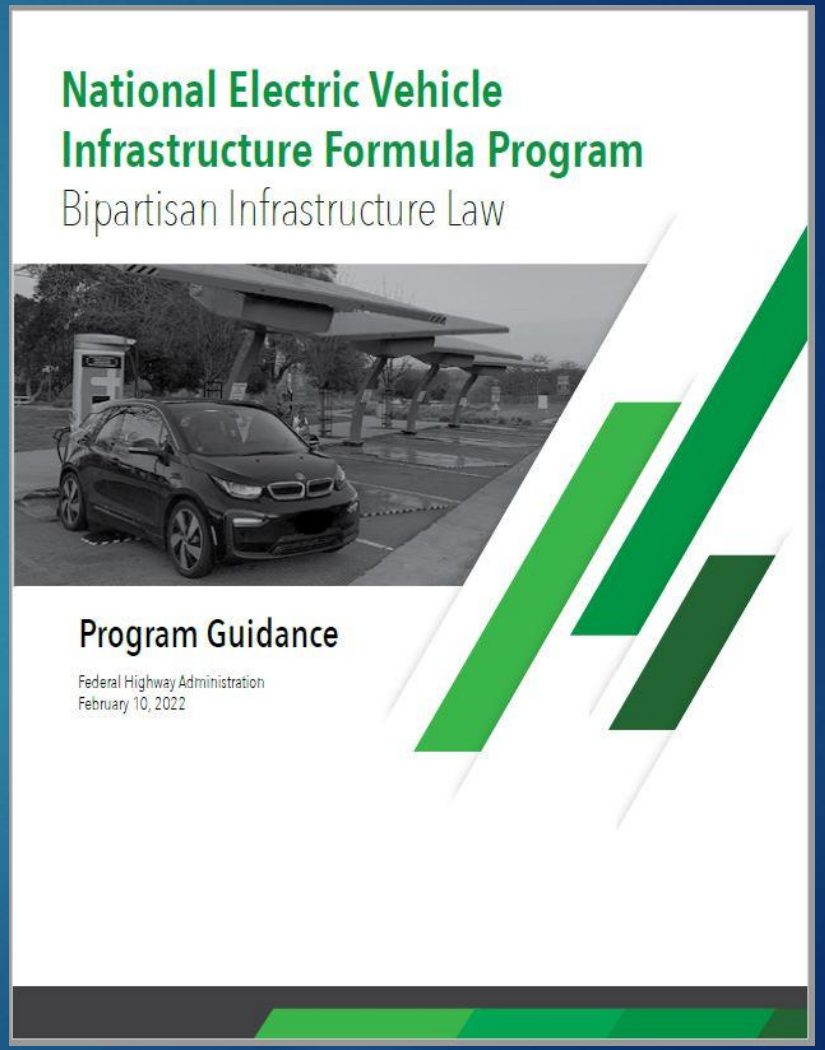
NEVI Formula Program- Important 2022 Dates

- **Feb 10**:
  - ❑ NEVI Program Guidance
  - ❑ AFC Round 6 RFN
- **May 13**:
  - ❑ 180 Day Minimum Standards and Requirements proposed regulation published
  - ❑ Round 6 Nominations Due
- **Aug. 1**: State Plans Due
- **Sept 30**: FHWA approves State Plans



National Electric Vehicle Infrastructure (NEVI) Formula Program*

- $5.0B for **EV Corridors**
  - $1.0B/year for FY2022-2026
- Any EV charging infrastructure acquired or installed shall be located along a designated alternative fuel corridor
- States required to develop an EV Infrastructure Deployment Plan
- FY22-26 BIL sets aside 10 percent of EV Formula funding for grants to States and local governments that require additional assistance to strategically deploy EV charging infrastructure, as determined by the Secretary of Transportation



*Paragraph (2) under the Highway Infrastructure Program heading in title VIII of division J of the BIL

State EV Deployment Plans

- Pages 14-17 of NEVI Formula Program Guidance
  - Coordination/stakeholder input
  - Vision and goals
  - Contracting
  - Existing and future conditions/infrastructure deployment
  - Implementation
  - Civil rights/equity
  - Labor and workforce considerations
  - Cybersecurity
  - Program evaluation
  - Discretionary exceptions
- Template posted on JPO website

Discretionary Grant Program for Charging and Fueling Infrastructure

- For EV charging, hydrogen, propane, and natural gas fueling infrastructure
- Divided into two distinct $1.25 billion grant programs to support EV charger deployment

  - **Corridor Charging Grant Program.** This program will strategically deploy publicly accessible EV charging infrastructure and hydrogen, propane, and natural gas fueling infrastructure along designated **Alternative Fuel Corridors**
  - **Community Charging Grant Program.** This program will strategically deploy publicly accessible EV charging infrastructure and hydrogen, propane, and natural gas fueling infrastructure in **communities**

2022/Round 6 Request for Nominations

- Nominations for **EV** "ready corridors" must meet requirements outlined in the National Electric Vehicle Infrastructure (NEVI) Program Guidance
- Focus of nominations is on Interstates, but does not preclude other state highways/US roads on the NHS through "exception" process
- Request for Nominations will be released through the Division Offices on **Feb. 10, 2022**
- Nominations are due to FHWA on **May 13, 2022**

Joint Office of Energy and Transportation

- Will play a key role in the implementation of charging infrastructure
- Technical assistance will aim to first leverage existing tools, datasets, best practices, and programs built by partners, DOE, DOT, and national laboratories
- Will work in concert with FHWA Division Offices to support the State in developing EV Infrastructure Deployment Plan.
- Plan will be submitted to the Joint Office and FHWA approves the Plan

Home Page · Joint Office of Energy and Transportation (driveelectric.gov)

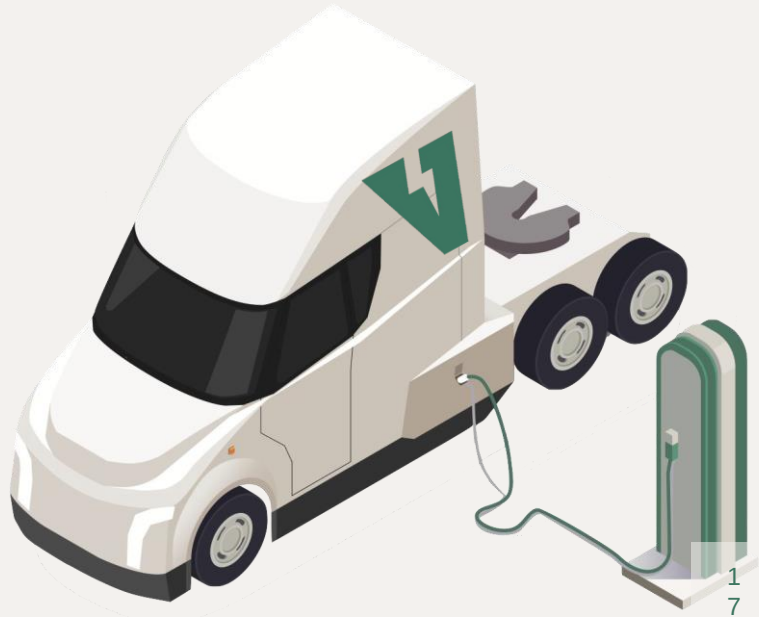
Joint Office of Energy and Transportation

WattEV

Accelerating the Transition to Electric Heavy Duty Trucking

VISION

WattEV accelerates the inevitable transition to HD ZE transport in the US with its complete solution



AN ALL-INCLUSIVE SOLUTION

Charging infrastructure

- starting with strategic sites in California
- CCS/MCS charging stations (30-min charge)
- growing to 1GW of capacity by 2030

EV fleet (TaaS)

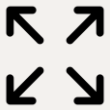
- 50 trucks in 2022 >> 12000 trucks in ten years
- TaaS solution for scale and affordability
- all inclusive of maintenance and insurance

Proprietary Software

- Route optimization and charge management
- Freight brokerage on defined routes
- Data collection and monitoring for routes, vehicle, infrastructure, and performance

Maximizing efficiency, energy supply, and consumption by

Utilizing solar energy



Increase asset utilization by maximizing miles driven

Minimizing downtime for charging

Peak shaving during grid charging

Increasing utilization

Using tech & telematics

OUR SITES

Legend:

Solar Power △

Grid ○

Locations Under construction 2022 Opening:

- Port of LA-HWY 110
- Bakersfield- HWY 99
- San Bernardino-HWY 215

Future Locations Under Study 2023 Opening:

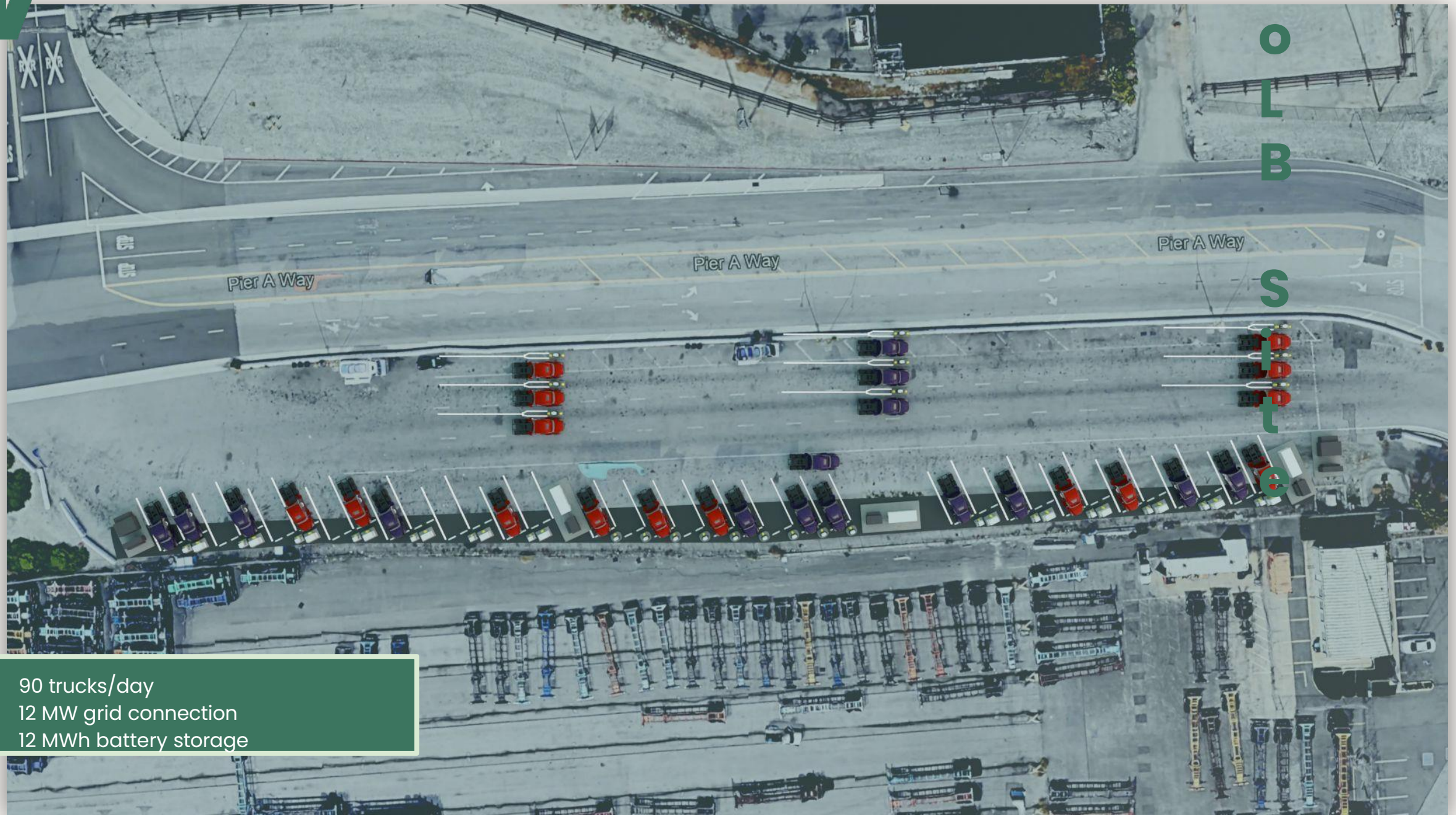
- Port of Long Beach-HWY 710
- Vernon-HWY 5
- Buttonwillow – HWY-5
- Indio- HWY-10
- Wheeler Ridge-HWY-5

Bakersfield

- 200 trucks / day
- 40 MW solar
- 40 MWh battery storage
- close to Amazon, Target, Walmart, FedEx, Ross distribution centers

- 60 trucks/day
- 8 MW grid connection
- 8 MWh battery storage
- close to Inland Empire warehouses

POLB Site



- 90 trucks/day
- 12 MW grid connection
- 12 MWh battery storage

Truck as a Service “TaaS”

An all-inclusive model operated on a software platform based on usage

Charging Infrastructure + EV Truck on defined routes + Maintenance & Insurance = Reliable WattEV Solution

01

Eliminates uncertainty of downtime from maintenance, availability of charging, and cost of charging

02

Providing transporters the best model based on routes and average daily range

03

Guaranteed availability of charged trucks, to swap, at WattEV depots

EXPANSION PLAN

Legend:

Solar Power

Grid

Volvo

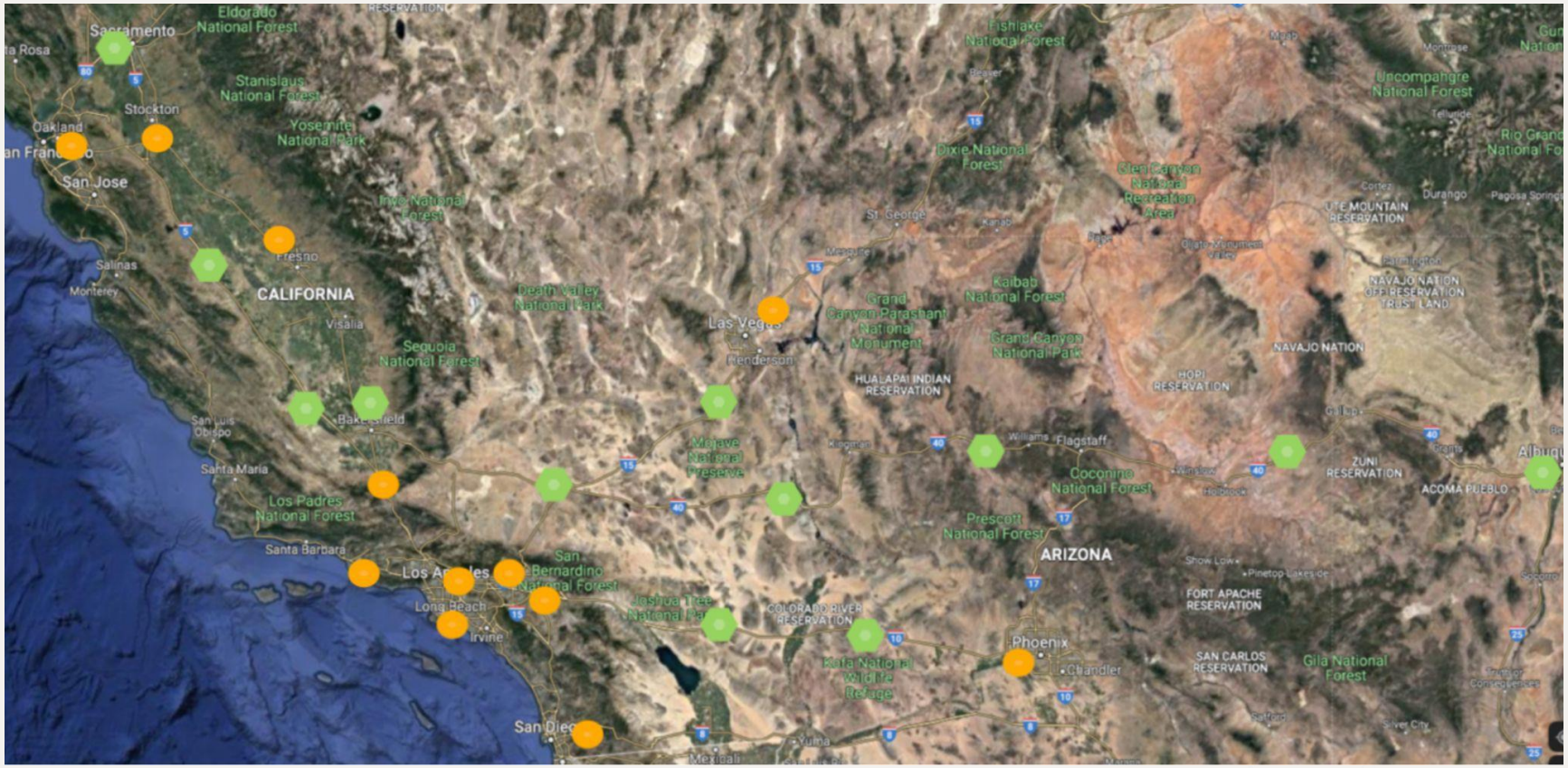
Quantity: **50+**
Delivery: Dec 2022
Charging:
CCS-250KW
Charge Time: 1.8hr

Tesla

Quantity: **50**
Delivery: 2024
Charging:
MCS-1,000KW
Charge Time: 28m

Future

Quantity: **1,000+**
Delivery: 2025
Charging:
MCS-1,250KW
Charge Time: 20m



Summary

WattEV is committed to making EV transport affordable, accessible, and reliable to shippers and carriers

01
Robust network of public charging stations utilizing utility and DER

02
Offer Trucks-as-a-Service (TaaS) to make the trucks more accessible to fleets of all sizes

1GW of capacity and 12,000 trucks on the road in California by 2030

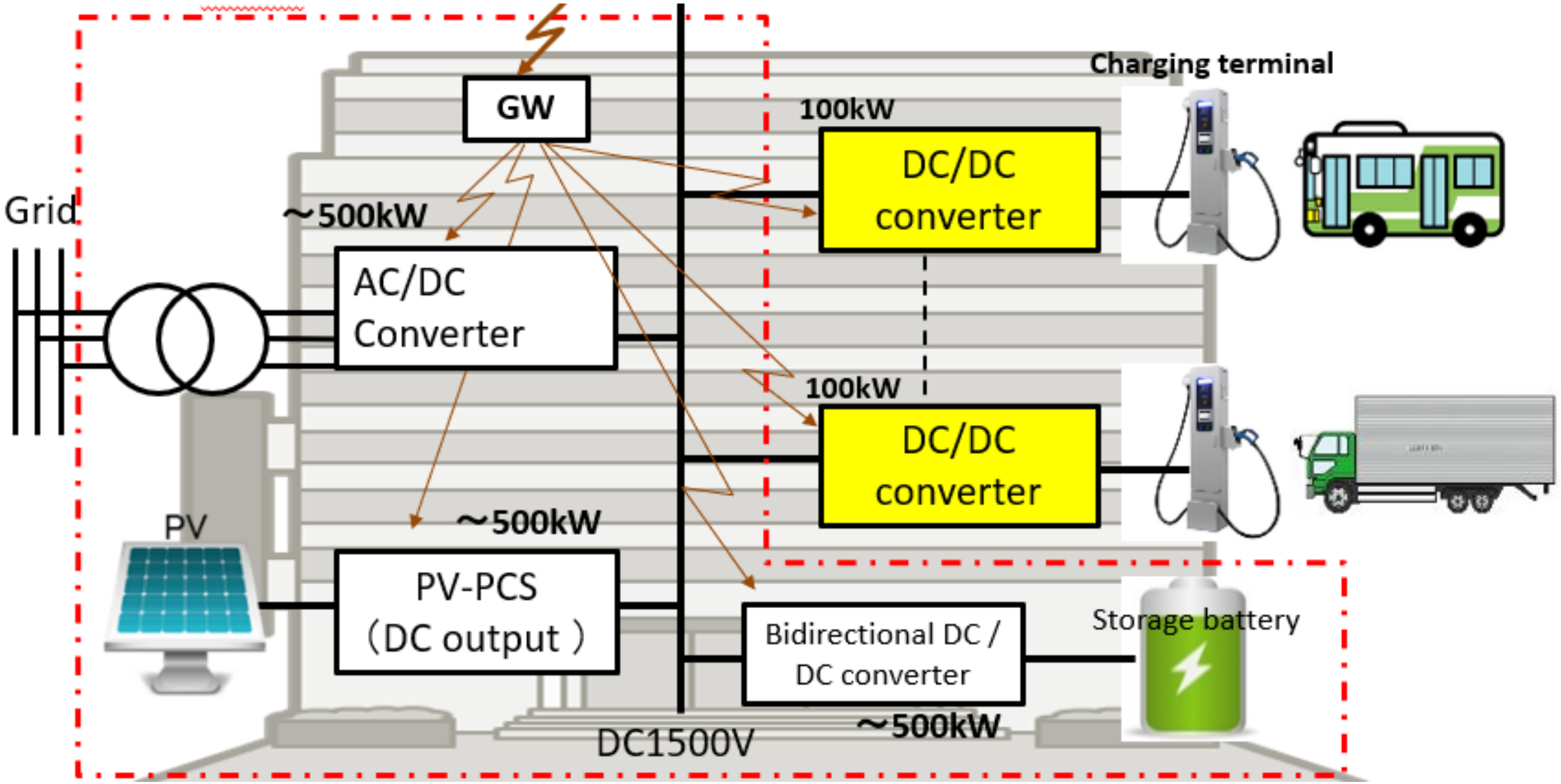
Battery Electric Vehicle Fleet Infrastructure Funding

Hunt ENERGY SOLUTIONS

Hunt Energy Solutions Background

- Hunt Energy Solutions has integrated of over 4,000 MW of renewable resources in Texas,
- HES is supporting the siting of 500 MW of Battery Energy Storage Solutions (BESS) across Texas for our affiliate Hunt Energy Network,
- HES is interested in investing in BEV charging infrastructure,
- BEV fleets, along with a Smart System, can help both accelerate EV purchases and help our Texan grid reliability

Combining Renewables and Batteries into BEV Fleets



Hunt BEV Fleet Program Alternatives

Options	Minimum Partnership	BEV and BESS	Fleet-as-a-Service
Hunt provides charging infrastructure and electric service	✓ Customer Owns the BEV	✓	✓
Hunt adds a HEN Battery (customer provides land)		✓	✓
Hunt owns BEV fleet and maintains it			✓

QUESTIONS?

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NIKOLA

APRIL 25, 2022

ZERO-EMISSION WORKSHOP

FUNDING OPTIONS AND OPPORTUNITIES

PRESENTED BY:
OMAR GONZALES
MANAGER OF STATE
AND LOCAL RELATIONS

INTRODUCTION: WE ARE NIKOLA

NIKOLA'S VISION: Be the leader in zero-emission commercial transportation, by building and managing the next generation truck and fueling ecosystem

COMPANY OVERVIEW

- Founded in 2015
- Headquartered in Phoenix, AZ
- As of March 2022, **~1,012 employees**
- **+$1.8B** of capital raised to-date[1]
- Business combination completed with VectoIQ and listed on NASDAQ in June 2020

STRATEGIC PARTNERS

OPAL FUELS · aps · TA · OGE · RIG360 SERVICE NETWORK · CNH INDUSTRIAL / IVECO · Hanwha · BOSCH · TC Energy · QUINN CAT · ABInBev · ALTA EQUIPMENT COMPANY

CLASS 8 TRUCKS

TRE BEV

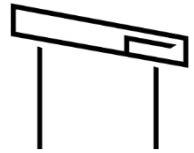
TRE FCEV

NEXT GEN

H_2 FUELING ECOSYSTEM

PRODUCTION

Nikola Energy Supply & Trading (ES&T)
"Supply Co."



DISPENSING

1) *Does not include undrawn value of equity line of credits (ELOCs) with Tumim Stone Capital LLC. As of Feb 2022 $409M remains undrawn on ELOCs*

STATE INCENTIVES

VEHICLE VOUCHER/REBATE/REPLACEMENT PROGRAMS ("CASH OFF THE HOOD")

- CA HVIP
- NY TVIP*
- NYC Clean Trucks* (Vehicles domiciled or operating in NYC Industrial Business Zones)
- NJZIP (In process of being expanded to include Class 8 Vehicles)
- MA MOR-EV

GRANTS/EMISSIONS REDUCTION PROGRAMS (VEHICLES AND INFRASTRUCTURE)

- MD CFIP
- Diesel Emissions Reduction Act (DERA)*
- VW Settlement Funding*
- ENERGIIZE (CALSTART)
- TERP Grant Programs

TAX CREDITS/EXEMPTIONS (VEHICLES AND INFRASTRUCTURE)

- Sales/Use/Fuel

REGULATORY AND UTILITY INCENTIVES

- Advanced Clean Truck (ACT) Rule
- Low Carbon Fuel Standard/Clean Fuel Standard
- State Weight Exemption
- BEV MHD Fleet Rates

Incentive programs can take several forms—tax credits, sales tax waivers, low-interest loans, rebates, or point-of-sale voucher programs. The most effective incentive programs are point-of sale programs that provide "cash-on-the-hood" at the time of purchase.

* Scrappage Program

FUNDING, POLICY, AND PARTNERSHIPS

KEY OPPORTUNITIES AND ACTIVITIES

VEHICLES: DEMOS AND PILOTS

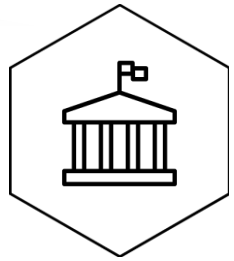
- ✔ Support technology advancement at the demonstration, pilot, and commercial deployment stages
- ✔ Make financing tools and nonfinancial support tools available to the operators of heavy-duty vehicle fleets, to enable those operators to transition their fleets to zero-emission vehicles

INFRASTRUCTURE: FUNDING AND SITING SUPPORT

- ✔ Provide equitable funding for both charging and H2 fueling infrastructure
- ✔ Support onsite fueling needs at ports, intermodal facilities, railyards
- ✔ Streamline permitting and inspection protocols for facility construction and operation
- ✔ Identify land for project opportunities

GRANTS AND INCENTIVES

- ✔ Incentive opportunities can shift to programs focused on legacy fleet turnover
- ✔ As sales grow and economies of scale are achieved, incentive funding levels and vehicle eligibility requirements can be adjusted.
- ✔ Programs should focus on value for their dollar both in terms of faster adoption and long-term momentum



POLICY SIGNALS

- ✔ Advanced Clean Trucks
- ✔ Advanced Clean Fleets
- ✔ Clean Fuels Standard
- ✔ Clean Air Action Plan (i.e. Texas Emissions Reduction Plan)

TAKEAWAY

ZEV deployment will be bolstered by strategic partnerships, effective policy, and multiple funding mechanisms. Local, regional, state, and federal programs must address the total cost of ownership.

THANK YOU

NIKOLA

Question and Answer

We will be using Online Questions throughout the presentation. Event number is: **4252022**

- Visit **OnlineQuestions.org**
  OR
- Scan the QR Code to join

EDF ENVIRONMENTAL DEFENSE FUND®

Finding the ways that work

Closing Remarks

TOYOTA

Mirai and bZ4X

LONESTAR ELECTRIC

All-Electric Terminal Tractor

MHC®

XOS Electric Step Van

NIKOLA

TRE: Battery-Electric Daycab Semi-Truck and Mobil Charging Trailer (MCT)

HYLIION

Hypertruck ERX

Ride and Drive