Hydrogen Webinar Series Part 2

May 18, 2020
11:00 am – 12:30 pm

FOR AUDIO
Please use:
1-800-250-3900
Participant Pin: 442318#

Please mute your phone when you are not speaking

CLEAN CITIES COALITION NETWORK

Agenda

1. Welcome
2. Hydrogen Funding Opportunities
3. Environmental Benefits of Fuel Cell Vehicles and Hydrogen
4. Portal Project Update
5. ZANZEFF Project Update
6. I-45 Project Update
7. Closing Remarks

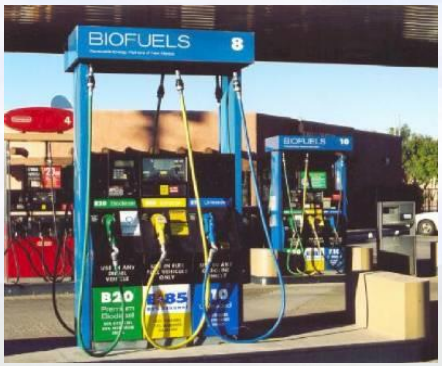
Hydrogen Funding Opportunities

Air Grants Division • May 2020

Alternative Fueling Facilities Program (AFFP)

The AFFP offers grants for the construction and expansion of alternative fueling facilities in order to:

- provide fueling facilities for alternative fuel in the Clean Transportation Zone (CTZ);
- ensure alternative fuel vehicles have access to fuel; and
- build the foundation for a self-sustaining market for alternative fuels in Texas.



AFFP Eligible Fuel Types

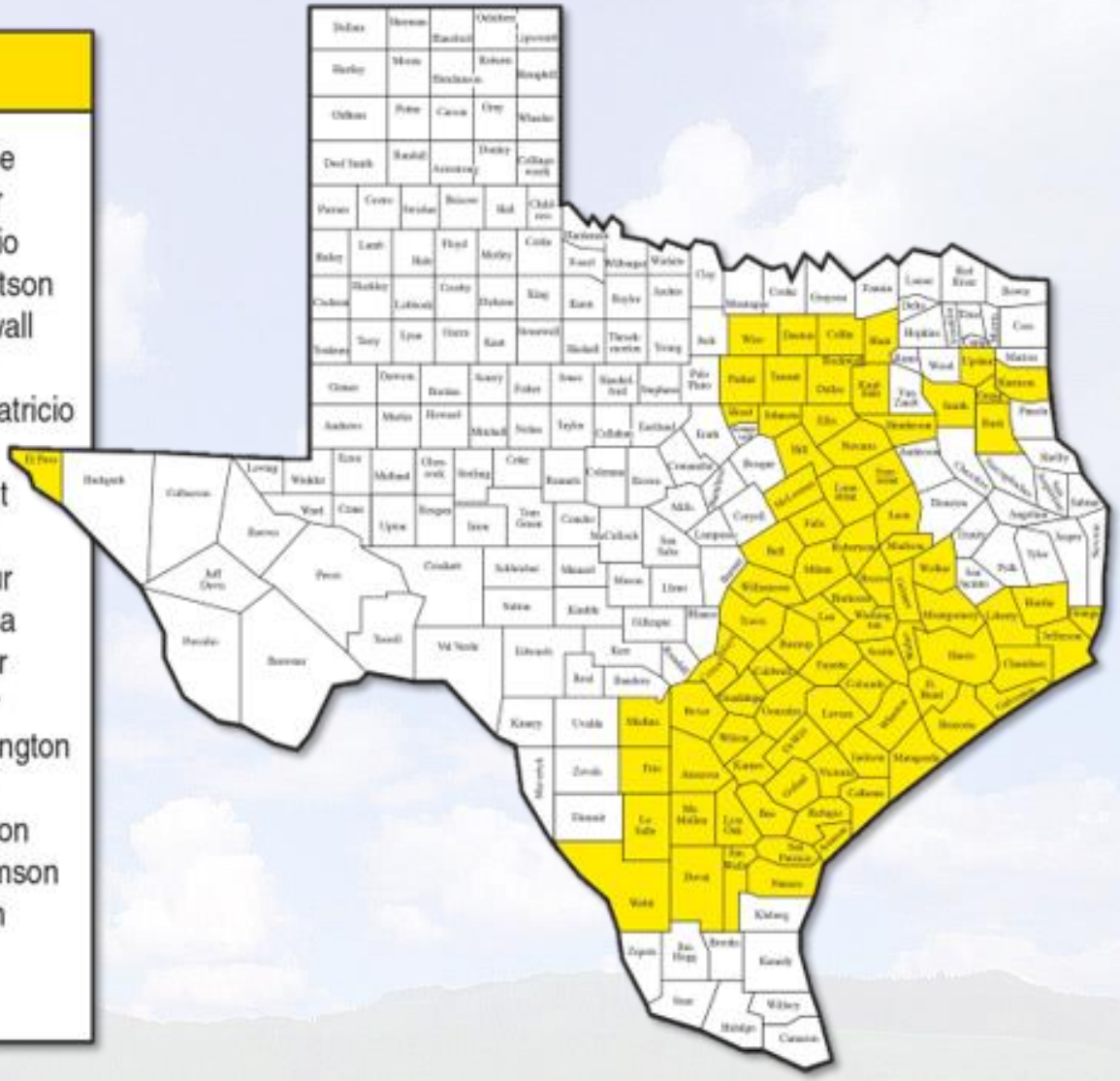
Eligible fuels include:

- compressed natural gas (CNG) and/or liquified natural gas (LNG);
- hydrogen;
- biodiesel (at least 20% by volume);
- propane;
- electricity; and
- methanol (at least 85% by volume).

AFFP Eligible Areas
Clean Transportation Zone (CTZ)

Eligible Counties

Aransas	Ellis	Jefferson	Orange
Atascosa	Falls	Jim Wells	Parker
Austin	Fayette	Johnson	Refugio
Bastrop	Fort Bend	Karnes	Robertson
Bee	Freestone	Kaufman	Rockwall
Bell	Frio	La Salle	Rusk
Bexar	Galveston	Lavaca	San Patricio
Brazoria	Goliad	Lee	Smith
Brazos	Gonzales	Leon	Tarrant
Burleson	Gregg	Liberty	Travis
Caldwell	Grimes	Limestone	Upshur
Calhoun	Guadalupe	Live Oak	Victoria
Chambers	Hardin	Madison	Walker
Collin	Harris	Matagorda	Waller
Colorado	Harrison	Medina	Washington
Comal	Hays	McLennan	Webb
Dallas	Henderson	McMullen	Wharton
Denton	Hill	Milam	Williamson
DeWitt	Hood	Montgomery	Wilson
Duval	Hunt	Navarro	Wise
El Paso	Jackson	Nueces	



AFFP Funding Available

- Eligible grant awards include:
  - 50% of the total eligible project cost up to a maximum of $600,000 for fuels other than natural gas.
- Next grant round in the FY22-23 biennium.

TERP Contact Information

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

VW Infrastructure Funding

A total of $31,397,874 in funding is available for equipment to supply light-duty ZEVs with electricity or hydrogen for hydrogen fuel cells.

Program Goals:

- Prepare for and sustain the increased use of light-duty ZEVs by providing the public with convenient access to supply equipment.
- Ease range anxiety between the population centers of Texas by providing access to supply equipment along or near interstate, US, and state highways in Texas.
- Complement other incentive funding programs (e.g. National ZEV Investment Plan and TERP Alternative Fueling Facilities Program).

VW Infrastructure Funding

- DC Fast Chargers & Hydrogen Fueling Facilities
  - $20,931,916 available
  - Competitive grant awards based on program scoring criteria.
- Applicants may be eligible for:
  - Up to 60-70% of the eligible costs associated with electrical vehicle supply equipment;
  - Up to 33% of the eligible costs associated with installation of hydrogen dispensing equipment capable of at least 250 kg/day; or
  - Up to 25% of the eligible costs associated with installation of hydrogen dispensing equipment capable of at least 100 kg/day.

TxVEMP Contact Information

- **Website:** **www.txvwfunds.org**
- **E-mail:** **vwsettle@tceq.texas.gov**
- **Toll Free:** **(833) 215-TXVW (8989)**

Environmental Benefits of Fuel Cell Vehicles and Hydrogen

FCHEA
Fuel Cell & Hydrogen Energy Association

Our Members…


3M


Air Liquide
creative oxygen


AIR PRODUCTS


altergy
Leading the
Fuel Cell Revolution


ALAKAI
TECHNOLOGIES


AngloAmerican


Audi


BayoTech
ON-SITE HYDROGEN


BLACK & VEATCH
Building a world of difference.


Bloomenergy


BMW


California
FUEL CELL
PARTNERSHIP
DRIVING FOR THE FUTURE


CSA
Group


Cummins


DOOSAN


fuelcellenergy


FUEL CELL
SEMINAR & ENERGY EXPOSITION


Fuji Electric

Garrett
ADVANCING MOTION


GORE
Creative Technologies
Worldwide


GM


HONDA
The Power of Dreams


HEXAGON


Intelligent
Energy


IONOMR
The Source for Ion-Exchange Solutions


Johnson Matthey Fuel Cells
the power within


Nebraska Public Power District
Always there when you need us


nel


NISSAN GROUP
OF NORTH AMERICA
NISSAN


NUVERA
Making hydrogen make sense.


OFCC
OHIO FUEL CELL
COALITION


pdc
MACHINES.COM
An ISO 9001:2008 certified company.
Certification No. 1112232.01
We perform
under pressure.


PLUG
POWER


POWERCELL


POWER
INNOVATIONS
Building a Safer & Greener Future


ARIS
ENERGY
SOLUTIONS
Powered by
SOLID
POWER


TOYOTA


United Hydrogen
FUELING THE FUTURE

Today's U.S. Fuel Cell Markets

Transportation

- Cars / SUVs
- Buses
- Trucks
- Material Handling

Hydrogen

- Production
- Distribution
- Hydrogen Refueling Stations

Stationary Power

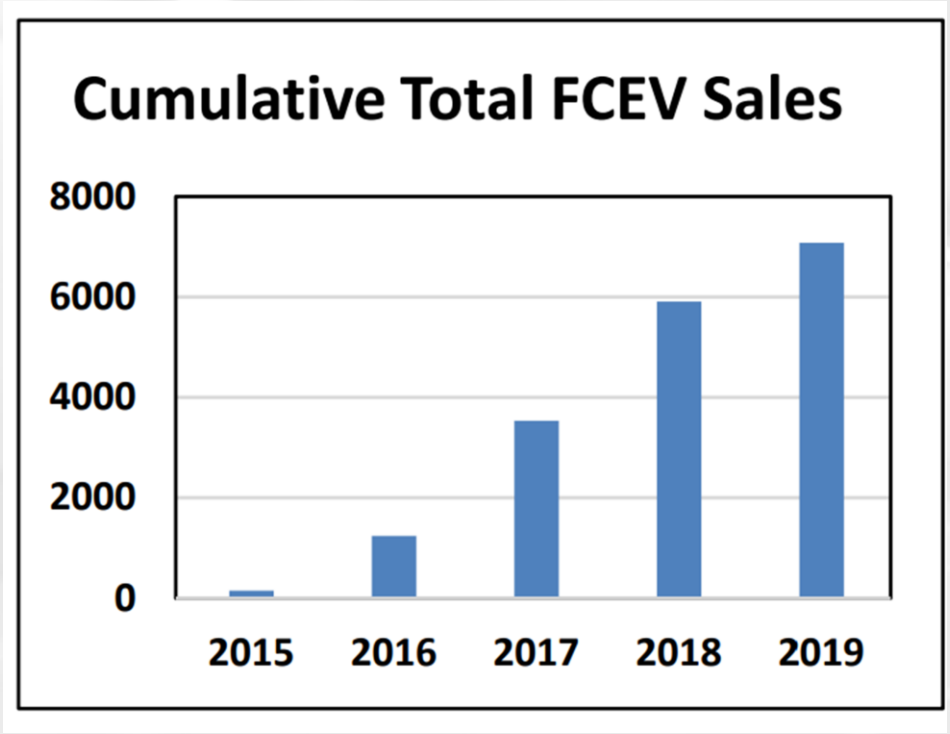
- Primary Power
- Back up power

Portable Power

- Remote/off-grid
- Military
- Unmanned aerial vehicles

The Momentum is Building

From a couple of hundred cars on the road in 2015... to over 8,000 FCVs on the roads of California today!



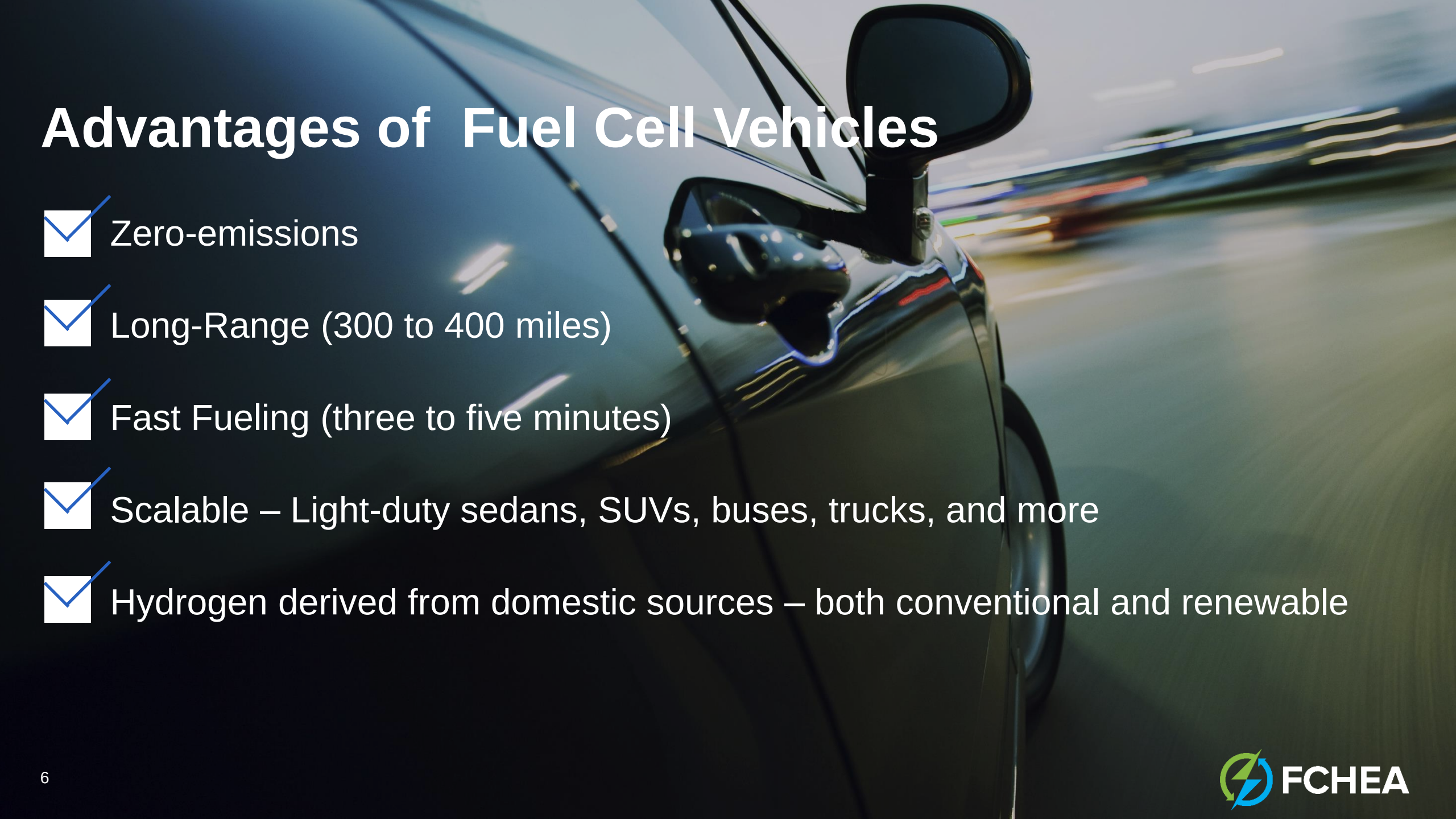
From a few demonstration fleets… to three automakers selling commercial cars to consumers!

Zero Emissions, Zero Compromise

FCVs are the only electric vehicle available now and for the near-term future that totally replicates today's drivers experience of traveling 300-400 miles on a single tank and refueling in just three to five minutes, while having zero tailpipe emissions

FCHEA

Advantages of Fuel Cell Vehicles



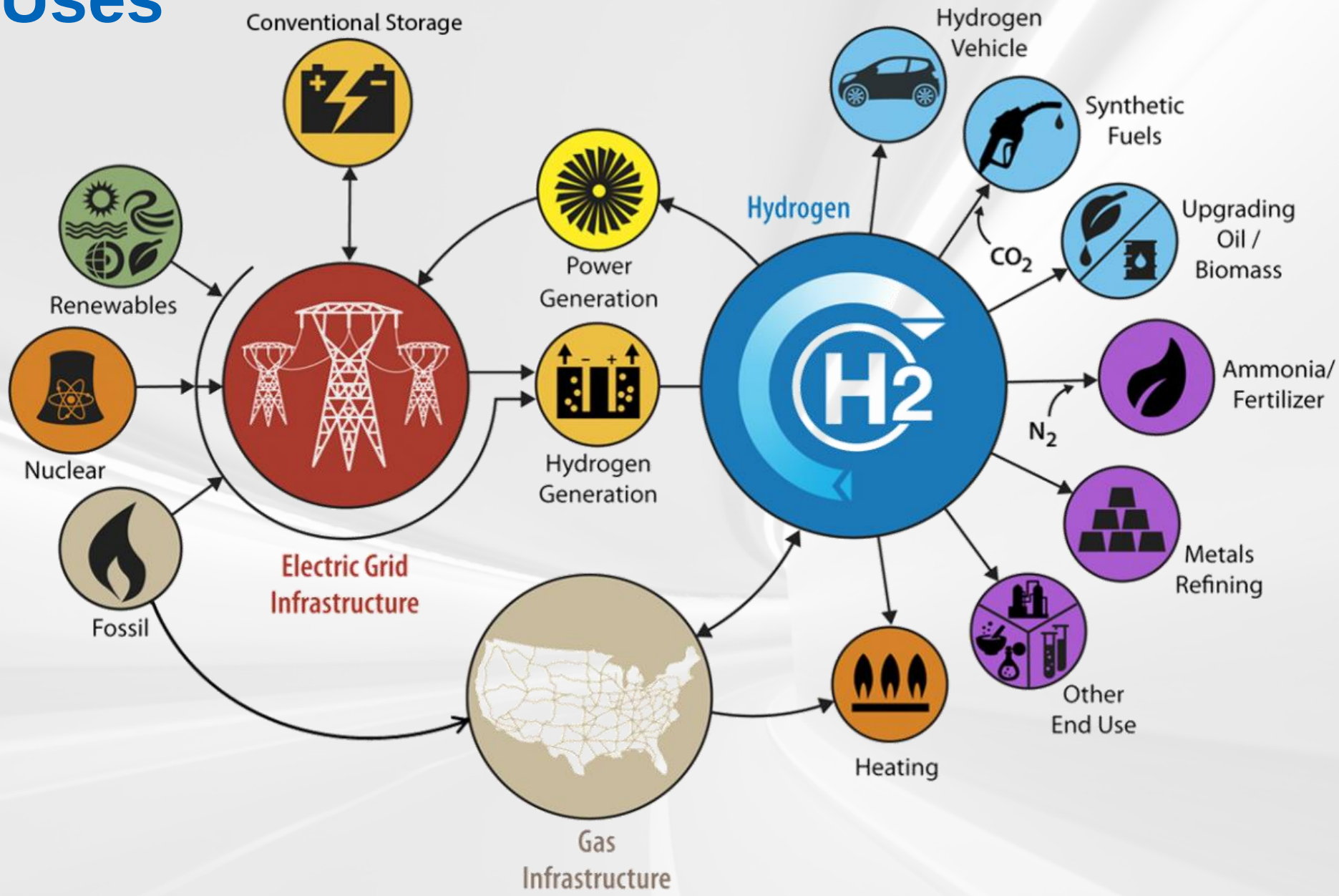
- Zero-emissions
- Long-Range (300 to 400 miles)
- Fast Fueling (three to five minutes)
- Scalable – Light-duty sedans, SUVs, buses, trucks, and more
- Hydrogen derived from domestic sources – both conventional and renewable

FCHEA

Sources and Uses of Hydrogen

There are many diverse sources of hydrogen, from renewable electrolysis to natural gas reformation

Hydrogen also has a great mix of applications, from transport, to power, heating, and more

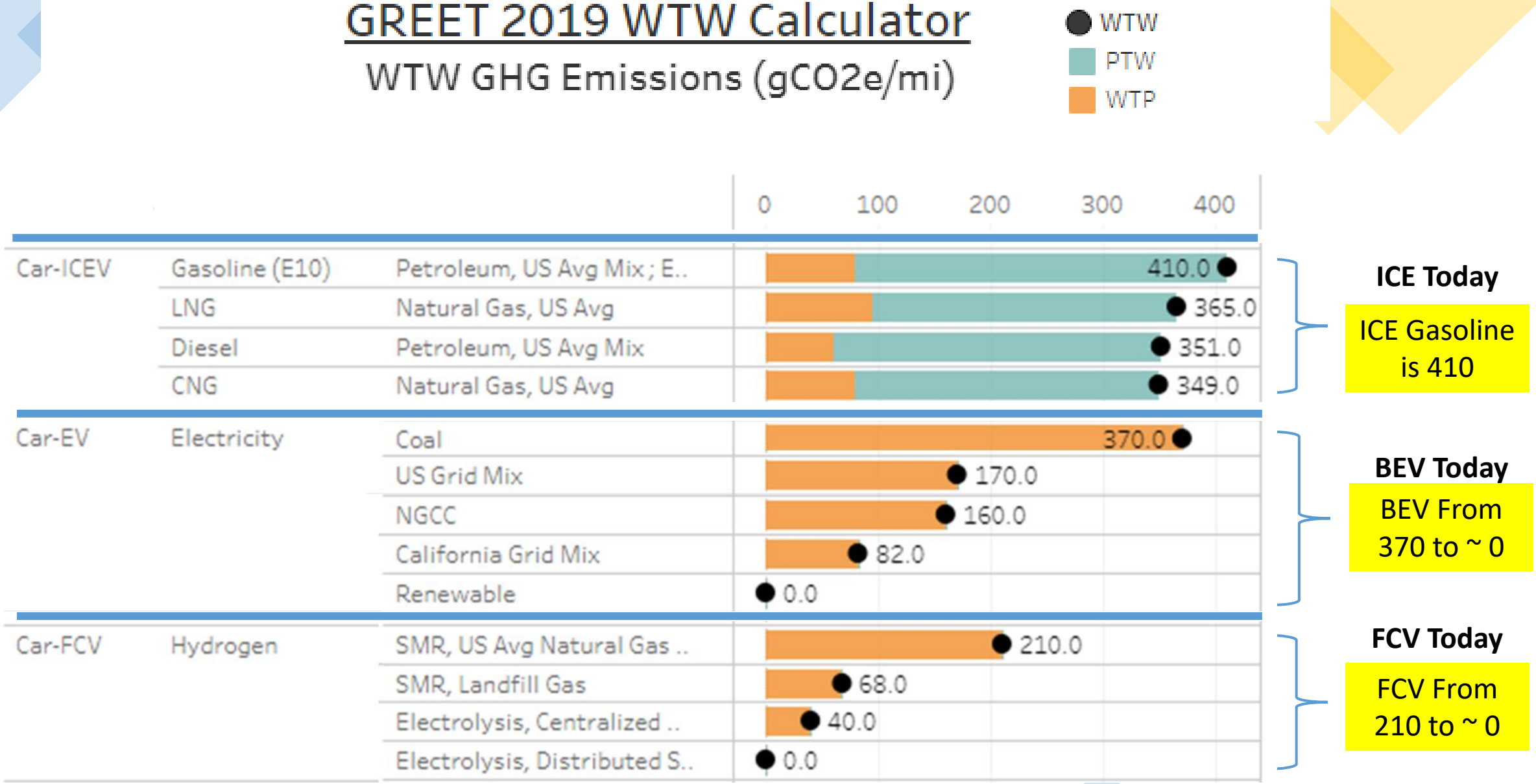


Argonne National Laboratory GREET Model

- ***The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model by Argonne National Laboratory***
- ***GREET.net provides the user with an easy to use toolbox to perform life cycle analysis simulations of alternative transportation fuels and vehicle technologies***
- ***Based on the GREET model, GREET Well to Wheel (WTW) Calculator summarizes WTW results of energy use, greenhouse gas emissions, water consumption, and air pollutants emissions for different vehicle technologies with different functional units***

GREET 2019 WTW Calculator

WTW GHG Emissions (gCO2e/mi)



ICE Today

ICE Gasoline is 410

BEV Today

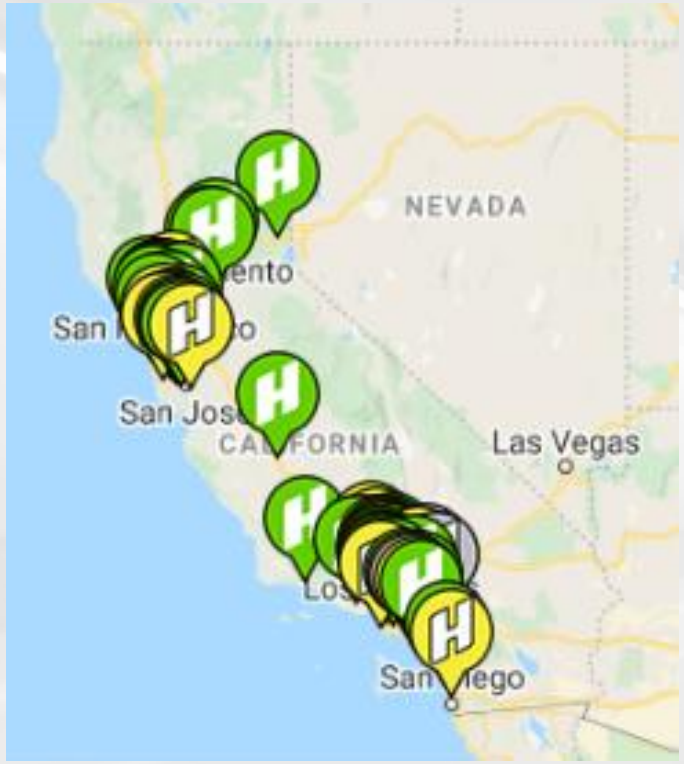
BEV From 370 to ~ 0

FCV Today

FCV From 210 to ~ 0

Pathway to Decarbonized Hydrogen

California requires at least 33% of hydrogen for transport from decarbonized sources…



…which industry is exceeding!

And industry has set an ambitious goal of 100% decarbonized hydrogen fuel by 2030!

We call on governments to build a global alliance that will help us deliver on

an ambitious goal of decarbonizing 100% of hydrogen fuel used in transport by 2030.

Transport may be our first target—but with the right level of support, we will see positive effects across many sectors.

GLOBAL CLIMATE ACTION SUMMIT

Hydrogen Council

Questions?

FCHEA

Thank you.

Fuel Cell and Hydrogen Energy Association

1211 Connecticut Avenue, Suite 650

Washington, DC 20036

www.fchea.org

FCHEA

TOYOTA ELECTRIFICATION

TOYOTA MOTOR NORTH AMERICA

Electrified Vehicle & Technologies Office
CORPORATE STRATEGY & PLANNING

ELECTRIFYING OUR FUTURE SMARTLY AND SUSTAINABLY

CREATING A CLEAN ZERO-EMISSIONS WORLD **TOGETHER**

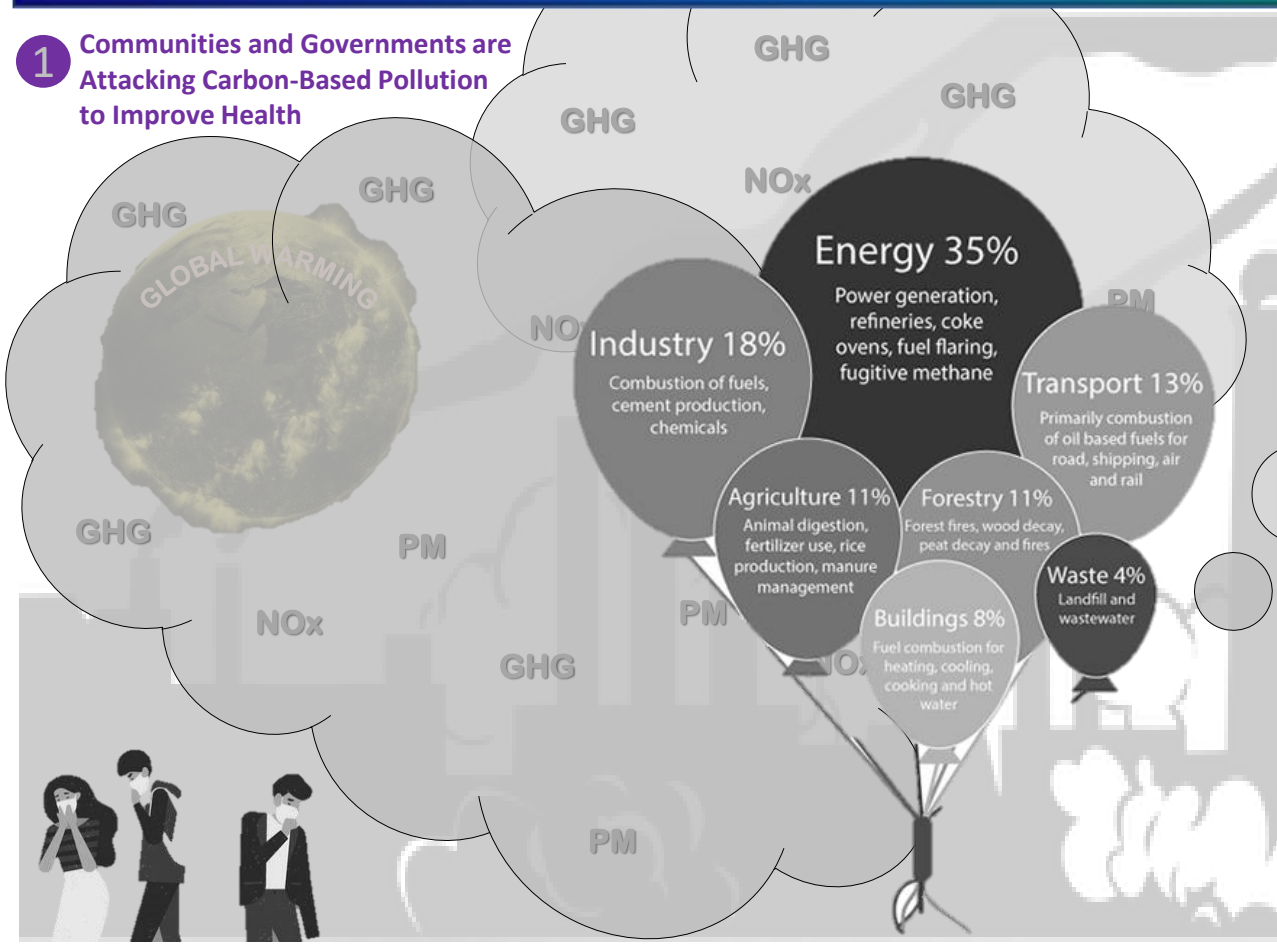
General Overview
Progressive Electrification

May, 2020

NEED FOR TRANSFORMATION

❖ Pollution/Carbon-Reduction Need is Severe, Growing, Global
❖ Solutions Must Scale Across Fleets, Facilities, Fuels, Regions

1 **Communities and Governments are Attacking Carbon-Based Pollution to Improve Health**



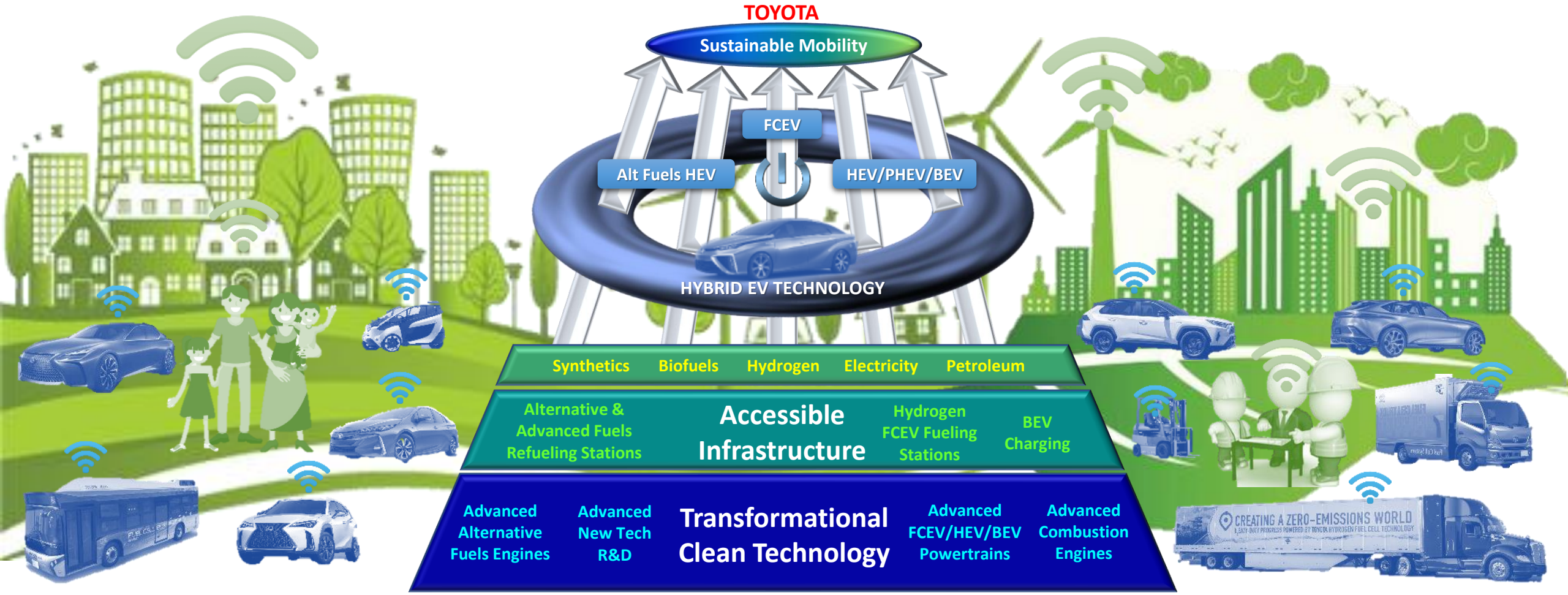
2 **Global Cities are Activating Towards Zero-Emissions:**

Paris, London, Mexico City, Hamburg, Los Angeles, Oslo, Austin, Stockholm, Vancouver, Toronto, Copenhagen, Houston San Francisco, Madrid, Cape Town, Stuttgart, Boston, Milan, Seattle, Etc.

3 **Commercial Customers are Being Driven Towards Zero-Emission Transport & Power-Generation Paths, But Lack Available, Proven, Cost-Effective, & *Scalable* Zero-Emissions Solutions for Their Vehicles, Facilities, and Operations**

TRANSFORMATIONAL TRANSPORT

- Intelligent, Electrified, Connected, & *Sustainable* Mobility
- Smart, Harmonious, Society-Benefiting Transport Solutions



TOYOTA 2050 CHALLENGE

❖ Drive To Decarbonize Toward Zero-Emissions & Net-Positive
❖ Apply Across Products, Plants, Processes, Lifecycles, Society

TOYOTA ENVIRONMENTAL CHALLENGE 2050

CHALLENGE 1
New vehicle Zero CO_2 Emissions Challenge

CHALLENGE 2
Life Cycle Zero CO_2 Emissions Challenge

CHALLENGE 3
Plant Zero CO_2 Emissions Challenge

CHALLENGE 4
Challenge of Minimizing and Optimizing Water Usage

CHALLENGE 5
Challenge of Establishing a Recycling-based Society and Symptoms

CHALLENGE 6
Challenge of Establishing a Future Society in Harmony with Nature

PROGRESSIVE ELECTRIFICATION

❖ Synergistic, Progressive Portfolio Spanning HEV→BEV→FCEV
❖ Portfolio Spread Provides Optimized Fit per Customer Need

TOYOTA GLOBAL PORTFOLIO APPROACH

- Customer-based, progressively-electrified, portfolio-approach to smart, scalable, & sustainable mobility
- Optimizes solution to customer duty cycle via complementary, modular market-offerings
- Synergistic technical progression from HEV → BEV → FCEV via shared architecture
- FCEV as most advanced, versatile, & scalable means of electrification and ZEV

VEHICLE SIZE: LARGE / MEDIUM / SMALL

BEVs

Optimized Solution for:

Shorter-Range
Fixed-Routes
Lighter-Cargo

PHEV

HEVs

Optimized Solution for:

Mid-Range
More-Varied-Routes
Mixed-Cargo

TOYOTA Mirai FCEV introduced to Japan, EU, & North America

LD FCEV

312-mile range, 67 MPGe, 5-min fill, 247-lb-ft, 113 kW

10K+ global sales (station-limited)

Gen 2 Mirai coming soon with significant level-up

FCEVs

Optimized Solution for:

Longer-Range
Higher-Variety-Routes
Heavier-Cargo

MD Truck

HD Bus

HD Truck

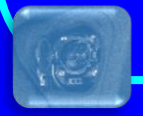
Ship

Rail

Rover

CHE

Power-Gen



PTO

Key advantages of H2 FCEV include:
Range, turns, cargo, performance across duty-cycles & conditions, TCO, PTO, infra-throughput/-scalability, E-storage, Tri-Gen regional RH2 grid-independency

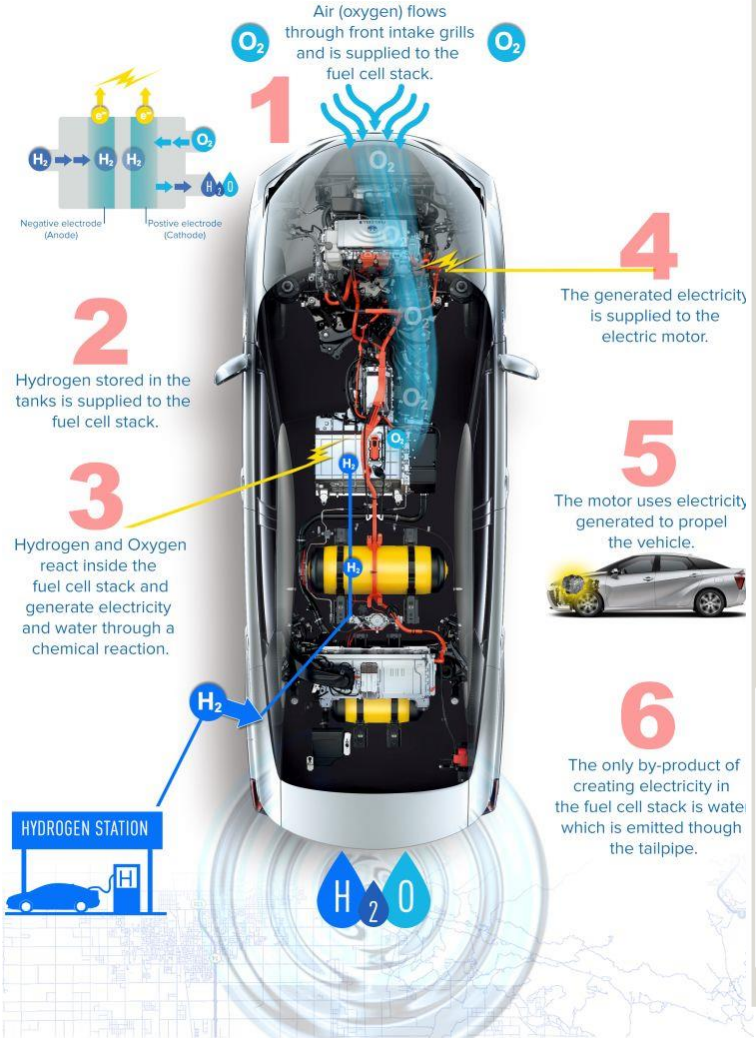
Fuel: Electricity — Oil, Bio-fuel, CNG, Synthetic fuel, etc. — Hydrogen infrastructure as key FCEV enabler

SHORT — MEDIUM — LONG
OPERATING DISTANCE

Note: HEV=Hybrid Electric Vehicle; BEV=Battery Electric Vehicle; FCEV=Fuel Cell Electric Vehicle

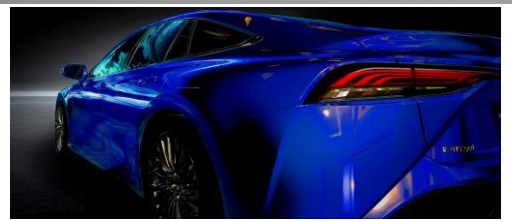
PROGRESSIVE ELECTRIFICATION—*LD ZEV EXAMPLE*

- Toyota Mirai FCEV: Zero-emissions, long-range, fast-fill, refined operation
- Vehicle Demand is Significant: Sales increasing w/ every new H2 station



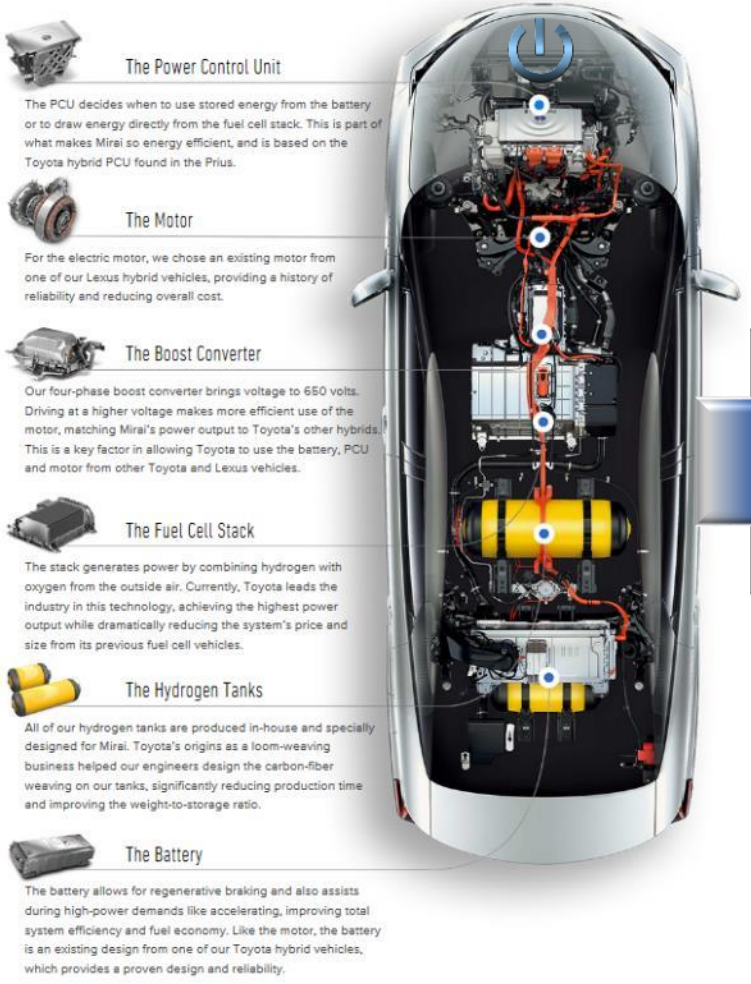
PROGRESSIVE ELECTRIFICATION—*NEXT GENERATION*

- Gen 2 Toyota Mirai Coming Soon with Major Advances
- Better Power, Performance, Efficiency (400-mi Range), Dynamics, Style



FCEV SCALABILITY

❖ Hybrid-Electric-Based Backbone Enables Proven Modularity
❖ Scale Bypasses Binding Constraints of Big Batteries/E-Grids



Performance Bandwidth

Load-Following
(Flexibility/Duty-Cycle Mapping)

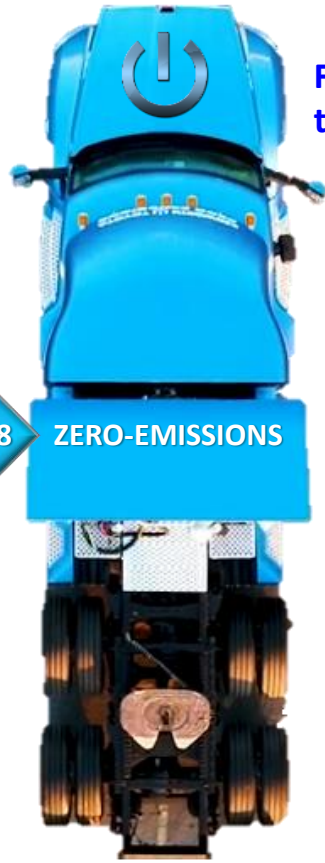
Modular FCEV Powertrain
(LD, MD, HD)

Plug & Play
(Hardware/Software Integration & Upgrade)

Generational Advancements
(Performance-Up/Cost-Down)

Passenger Vehicle

LD FC 2x → HD Class 8

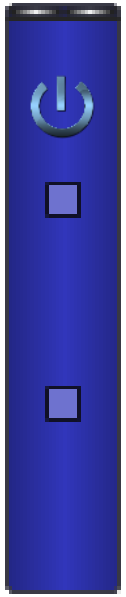


Class 8 Truck

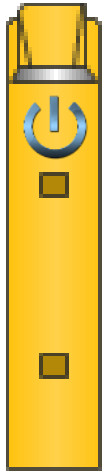
FCEV Scalability Provides Solution to Mounting Pressures for ZEV HD

Increasing market pressure/incentives toward ZEV HD

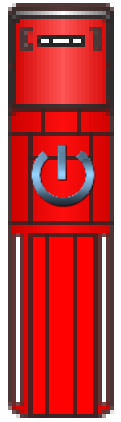
Bus, Class 4-7, other duty-cycle needs can be similarly met via FCE powertrain modularity



Transit Bus



School Bus



Emergency Vehicle

Delivery Truck

Electrification Path Advantage—FCEV Fueling Infra Also Scales Better

A single, shared, scalable, & sustainable H2 FCE fueling infrastructure like Tri-Gen (next page) can support a bigger-breadth & -depth of fleets & facilities w/o the binding constraints of BEV EVSE, grid limitations, & demand charges

INFRASTRUCTURE SCALABILITY

❖ E-Growth Must be Intelligent, Efficient, & Future-Proofed
❖ Synergistic HV→BEV→FCEV Portfolio = Scalable Solution Set

How Do I Electrify?

E-Growth Must Address E-Grid Constraints

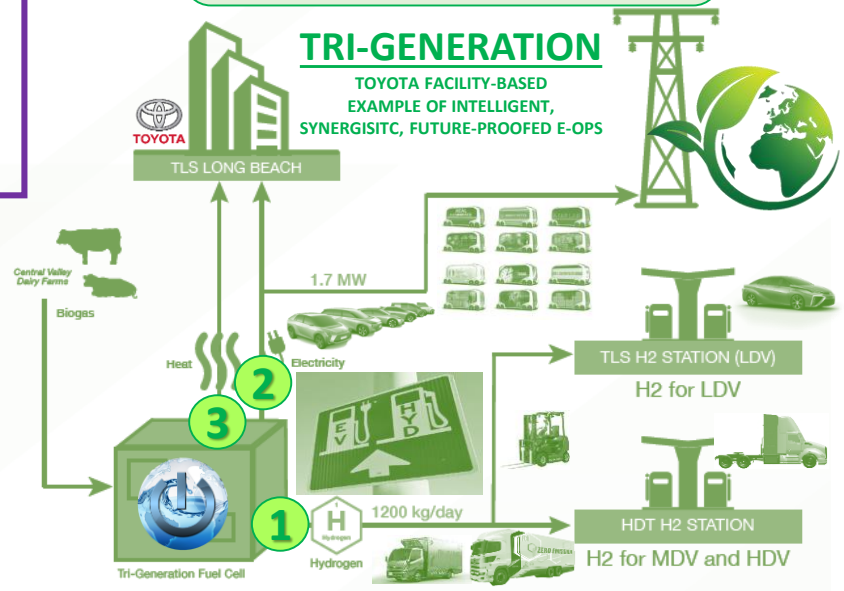
- ❖ *Electrical Needs Expanding Exponentially*
- ❖ *Current Grid Capacity & Cost Constraints*
- ❖ *Fleetwide BEV Transition Challenges*
- ✓ *H2 FCEV Augmentation Helps Solve*
- ✓ *Scales EV Load, Strengthens E-Grid*

BENEFITS OF 'ONE-STOP E-SHOPPING'

Tri-Gen E-Power an example of smart infrastructure investment: *future-proofing for electrification*

TRI-GENERATION

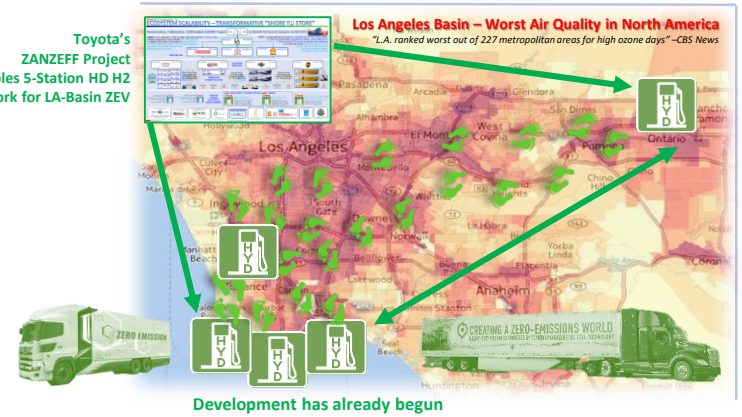
TOYOTA FACILITY-BASED EXAMPLE OF INTELLIGENT, SYNERGISITC, FUTURE-PROOFED E-OPS



E-Implementations Must Integrate Operationally

- ❖ *Meet duty-cycle, operating, fueling, servicing, & TCO needs*
- ❖ *Transition from existing assets & avoid stranded investment*
- ❖ *Ease adoption hurdles & enable path to economic viability*
- ✓ *Toyota is already progressing our own e-facilities & -fleets*
- ✓ *And helping advance synergistic regional 'greenprints'*
- ✓ *LA port/basin example could translate well nationally/globally*

Toyota's ZANZEFF Project Enables 5-Station HD H2 Network for LA-Basin ZEV



Development has already begun

TRI-BENEFIT [Supports *BEV + FCEV + FACILITY**]

1. **Renewable H2 for FCEV** *(will supply 1-Ton+ of RH2 per day)*
2. **Renewable E for BEV** *(will supply nearly 2MW of RE per day)*
3. **Renewable E & Heat for Facility** *(will be 1st renewably-powered TMNA facility)*

CREATING A ZERO-EMISSIONS WORLD

**Tri-generation is being developed as part of TLS Long Beach port facility upgrade*

ECOSYSTEM SCALABILITY

- FCEV Solutions Scale Well to Holistic Port Greenprints
- H2 Breadth Can Help Electrify Seaports, Landports, Airports

FCEV Forklift

Top Handler

Reach Stacker

Straddle Carrier

All Applications Could Leverage Shared, Standardized, & Scalable H2 Energy Infra

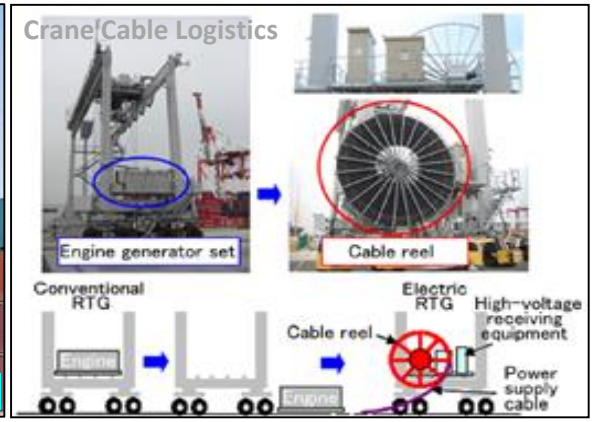
Large, Continuous, & Stable H2 Consumption Aids Energy Provider and Economies of Scale

Guided Cargo Vehicle

UTR Yard Truck

Wheel- & Rail-Mounted Cranes

Crane Cable Logistics



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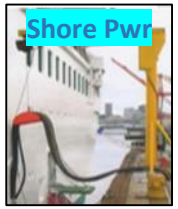


RCU Power

Note: FCE=Fuel Cell Electric; CHE=Cargo Handling Equipment

MARINE SCALABILITY

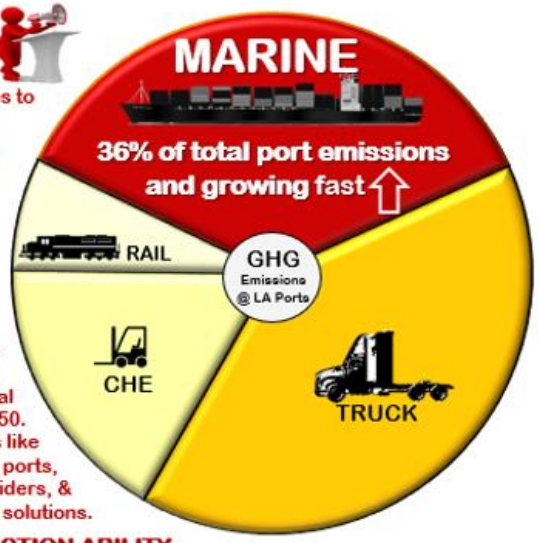
❖ Marine H2 FCE Can Have Biggest Scale/Emissions Potential
❖ CA/NE/NA/Global Need with Big Upside for Energy Majors

URGENT NEED FOR ZERO-EMISSIONS MARINE

"Commercial shipping is the fastest growing sector in terms of GHG emissions." *CARB 5/1/18 Assessment*

A. SEVERE MARKET NEED

- As the world's 50,000+ fleet of Ocean-Going-Vessels (OGVs) of 10,000 tons or more continues to grow in number & size, marine emissions are reaching record levels with 60,000+ premature deaths a year attributable to OGV particulate emissions.
- The largest container ships can each generate more SOx emissions than 10 million cars via high-polluting bunker fuel.
- ~90% of freight is transported by ship and if marine emissions remain unchecked, they could constitute nearly one-fifth of total global emissions sources by 2050.
- Worldwide marine stakeholders like IMO*, NA, China, Korea, Japan, ports, shippers, cruise lines, fuel providers, & more seek emissions-reduction solutions.



Big Shipping Industry Need

Recent Global Commitment to 50% GHG-Reduction by 2050

U.N.'s International Maritime Organization (IMO)

B. GOOD H2 FC COST REDUCTION ABILITY

- Significant scope for FC- & H2-molecule-cost-down via large marine scale to achieve supply-chain economies

ZERO-EMISSIONS FUEL-CELL-ELECTRIC SOLUTION CAN SCALE TO MASSIVE MARINE POWER OPPORTUNITY AND EXPONENTIALLY ACCELERATE H2 FCEV ECONOMIES OF SCALE

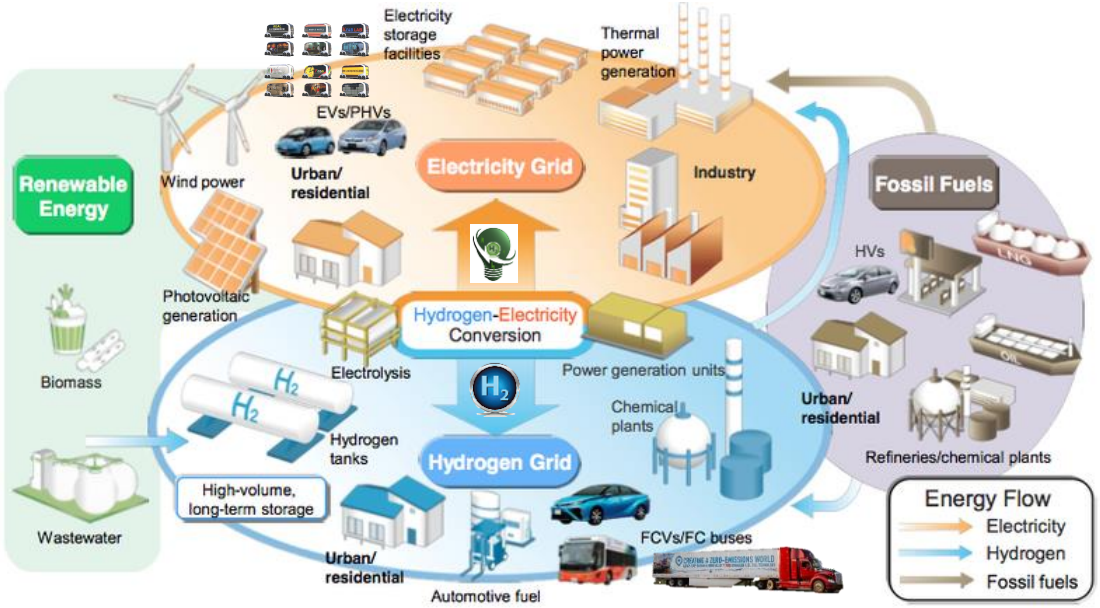
H2 FCEV Marine Activity, Trials, & Targets All Increasing

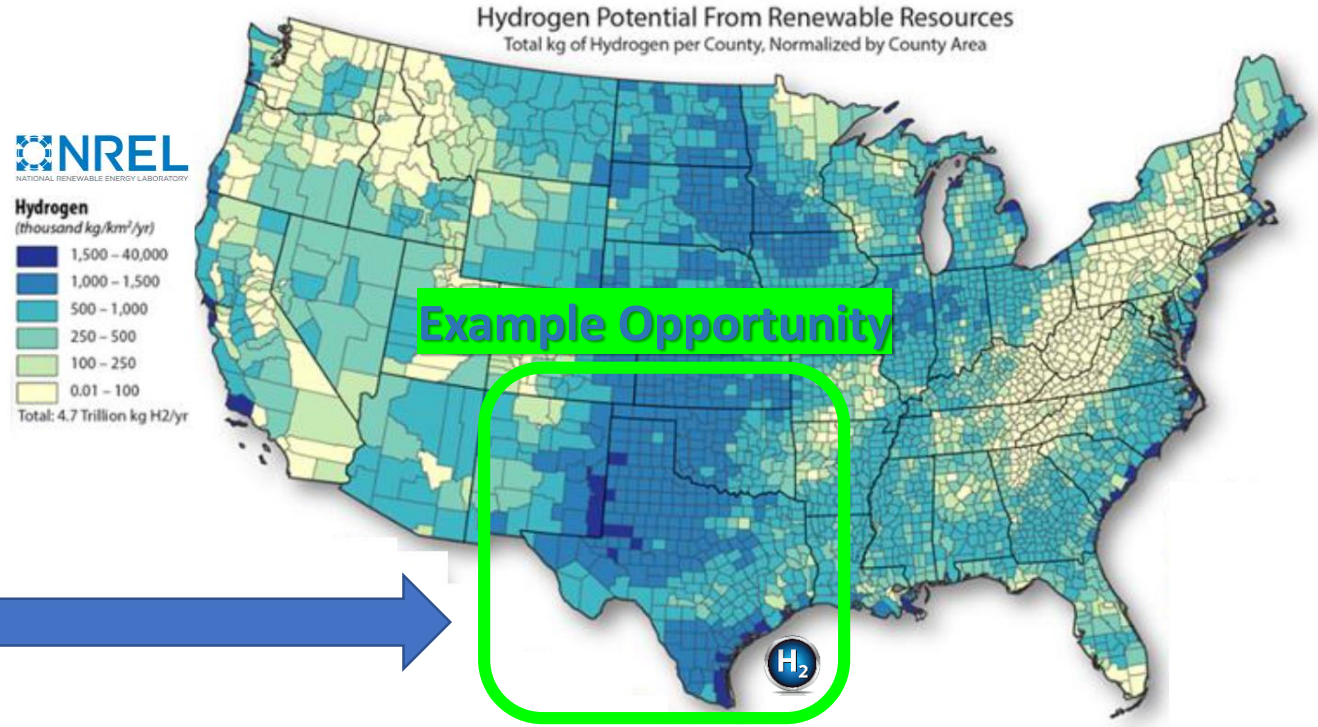
H2 Ferries, Fishing Boats, Vehicle Transporters, Ocean Going Vessels, Tanker Carriers, & Cruise Ships All Being Explored

ENERGY SCALABILITY

❖ H2 Scalability, Availability, Flexibility Augments Electrification
❖ Texas H2, NG, Wind, Port, Infra, Storage, & More = Big Opp.

H2 Integral to Intelligent Electrification





Leading Companies Already Fostering H2 Opportunity

Example H2 Council Participants (C-Suite Level Support)

THE LINDE GROUP · TOTAL · HONDA · AIR PRODUCTS · TOYOTA · DAIMLER · SINOPEC · AngloAmerican · MITSUBISHI HEAVY INDUSTRIES · HEXAGON · nel · SoCalGas · Shell · HYUNDAI · Cummins · GM · BMW GROUP · NGK NTK · PLUG POWER · Iwatani · Air Liquide · AIRBUS · 3M · ENGIE · Kawasaki · JXTG Nippon Oil & Energy · BOSCH

"Hydrogen production based on wind power can already be commercially viable today. Until now, it was generally assumed that this environmentally friendly power-to-gas technology could not be implemented profitably. Economists at the Technical University of Munich (TUM), the University of Mannheim and Stanford University have now described, based on the market situations in Germany and Texas, how flexible production facilities could make this technology a key component in the transition of the energy system."

-TUM Article

CONTEXT WITHIN H2 SOCIETY PROGRESSION

Global Momentum Increasing Toward H2 [China, Korea, Japan, NA, etc.]

Large, 'At-Scale' Countries, Regions, & Port-Based Ecosystems Starting to See Necessity of H2 to Aid Mass Electrification

HRS Materializing Toward Commercialization

Better Throughput/Scalability Bypasses Binding Constraints of E-Grids/Big Batteries/EVSE

NORTH AMERICA

CA, NE, NW NA Corridor, and Strategic Trans-US Transportation Paths

- ~50+ Retail Stations Today
- ~200+ HRS Targeted by 2025 (LD + HD)
- HD Fueling Collab.

Power Generation
Clean, Strategic Power Gen for Facility/Data Center Resiliency and Strategic H2 Distribution

LATIN AMERICA

Region is targeting 70% Renewables by 2030 (Double the EU); Assessing Potential Biofuel-/Biomass-Pathways to H2

EUROPE

Germany, France, UK, Scandinavia, etc. are Increasing their HRS Installations/Pace

- ~80+ Retail Stations Today
- ~800+ HRS Targeted by 2025 (LD + HD)

AFRICA

Roadmapping Exercises Begun with EU for Potential Regional RH2 Supply Chain Development

MIDDLE EAST

Countries like UAE are Trialing H2 and Assessing Potential Petroleum→H2 Paths

ASIA

Japan, Korea, China All Implementing H2 into Their National E-Roadmaps

- ~130+ Retail Stations Today
- ~1,300+ HRS Targeted by 2025 (LD + HD)
- China Targeting ~50K FCEV by 2025; Korea Targeting All CV to be FCEV by 2035

AUSTRALASIA

Countries like Australia are Developing Regional RH2 Supply Visions

TOYOTA

The Continued Development of a Mobility-Enabling, Society-Improving, Environmentally-Scalable, Electrification-Enhancing, & Economically-Sustainable Hydrogen Society is a Core Foundation of Toyota's Global Goals, Holistic Plans, Regional Efforts, 2050 Contributions, Commercial Expansion, Community Engagement, & Worldwide Events like the 2020 Tokyo Olympic Games

H2 Enables Scalable & Sustainable Electrification to Help Power Toyota's Transformation

Transformational Transport Towards a Pollution-Free Planet

THANK YOU

TOYOTA MOTOR NORTH AMERICA

Electrified Vehicle & Technologies Office
CORPORATE STRATEGY & PLANNING

ELECTRIFYING OUR FUTURE SMARTLY AND SUSTAINABLY

CREATING A CLEAN ZERO-EMISSIONS WORLD **TOGETHER**

ZANZEFF GRANT UPDATE

Bill Kahn

Peterbilt Senior Principal Engineer

ALTERNATIVE FUELS

Fuel	Specific Energy	Energy Density	Range
	kWh/kg	Wh/L	Miles / L
Diesel	13.3	9944	3.9
LNG	14.9	6167	2.4
DME	8.0	5361	2.1
CNG	15.4	2500	1.0
Hydrogen	39	1555	0.6

APPLICATIONS

Refuse

Base Vehicle $130K
Upfit Cost $83K
Savings $21K / Year
ROI 4 Years

Drayage

Base Vehicle $110K
Upfit Cost $72K
Savings $12.5K / Year
ROI 6 Years

Med-Duty

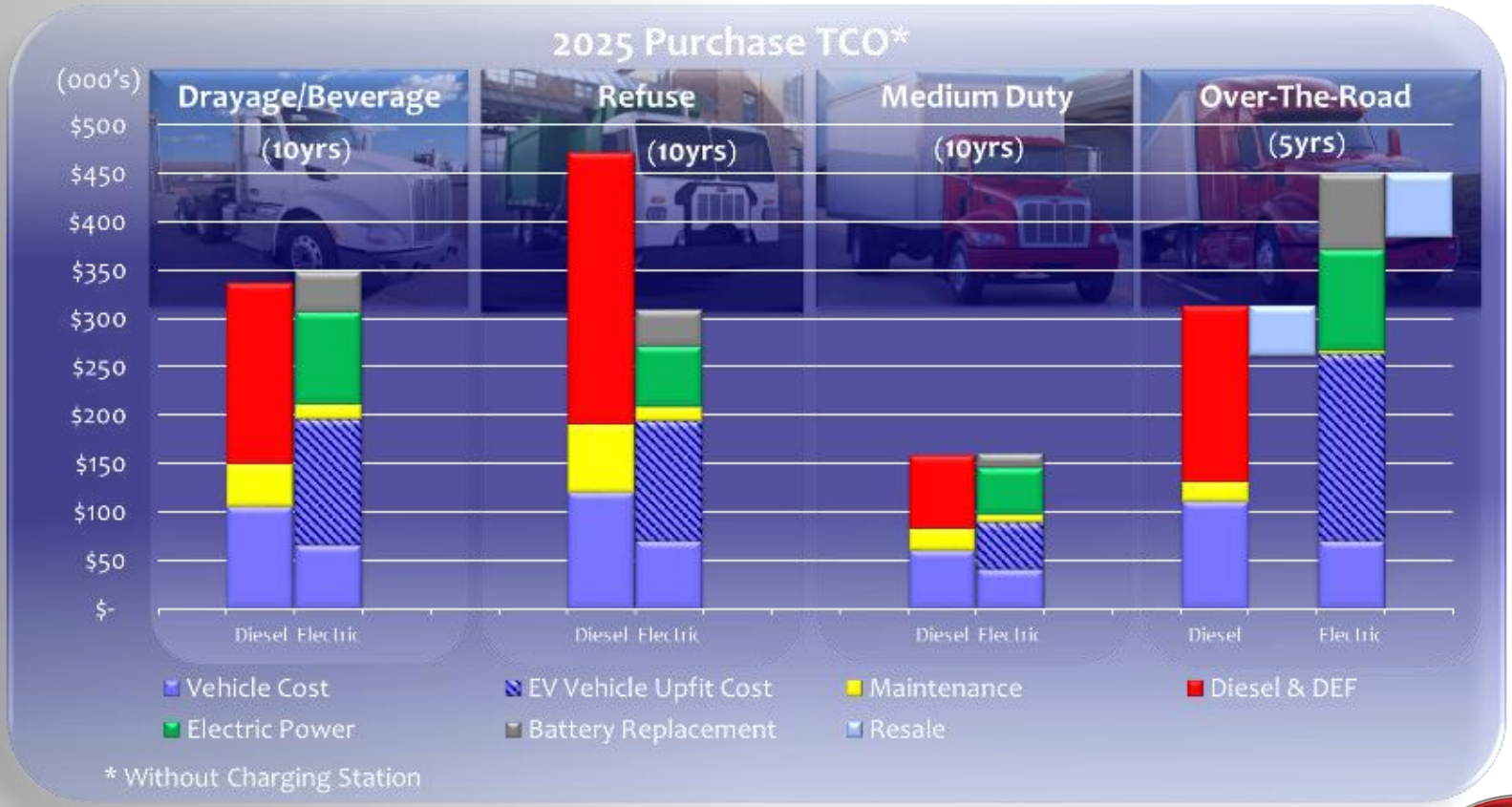
Base Vehicle $60K
Upfit Cost $44K
Savings $4.4K / Year
ROI 10 Years

OTR

Base Vehicle $120K
Upfit Cost $162K
Savings $14K / Year
ROI 11.5 Years

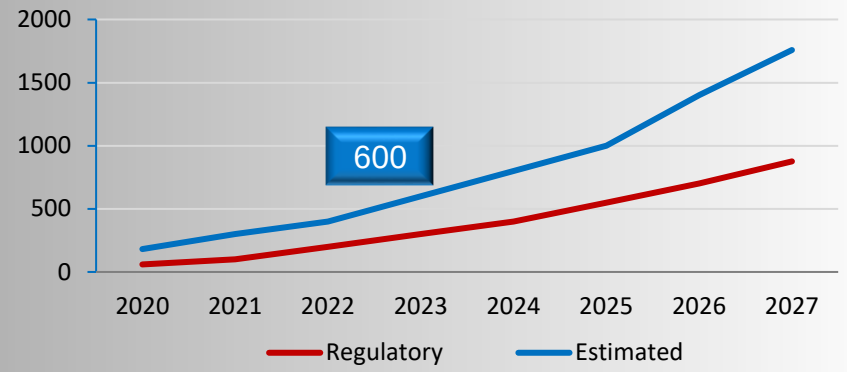
Peterbilt

TOTAL COST OF OWNERSHIP

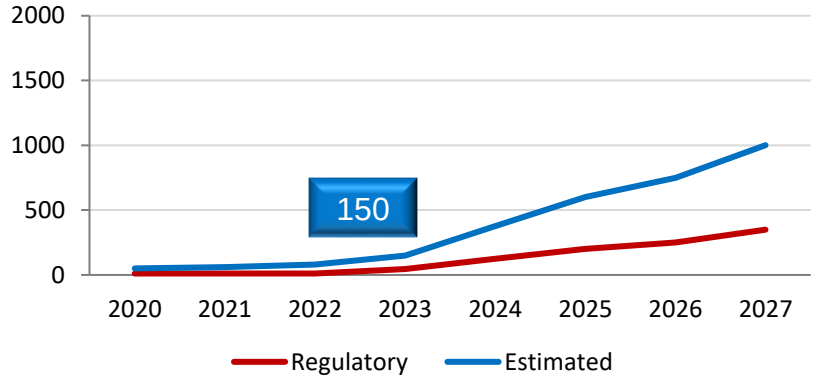


NA BEV Estimated Volumes

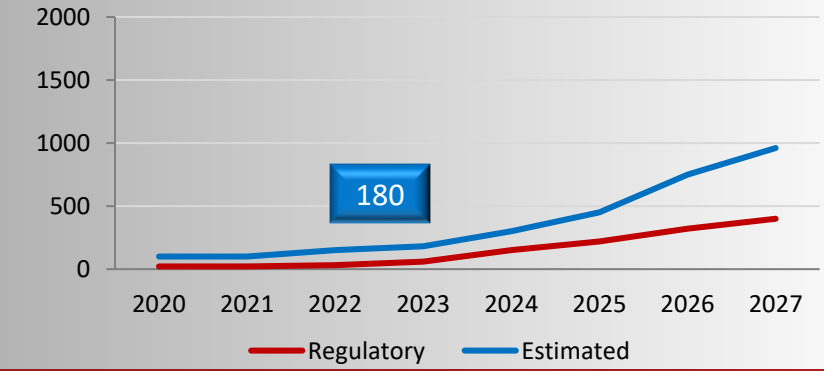
P&D / City Distribution



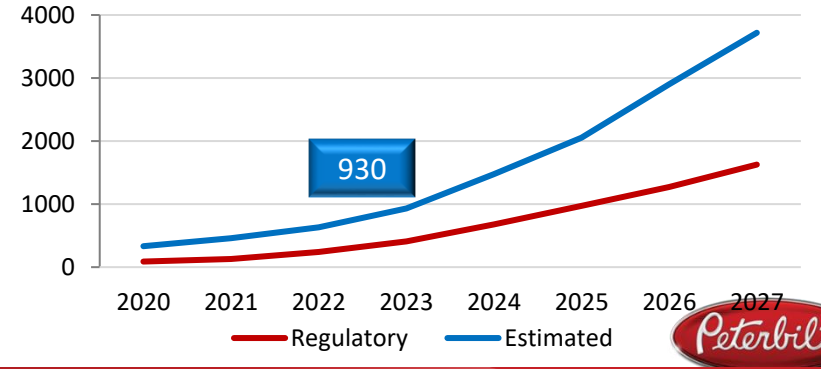
Municipality / Refuse



Drayage / Regional Haul



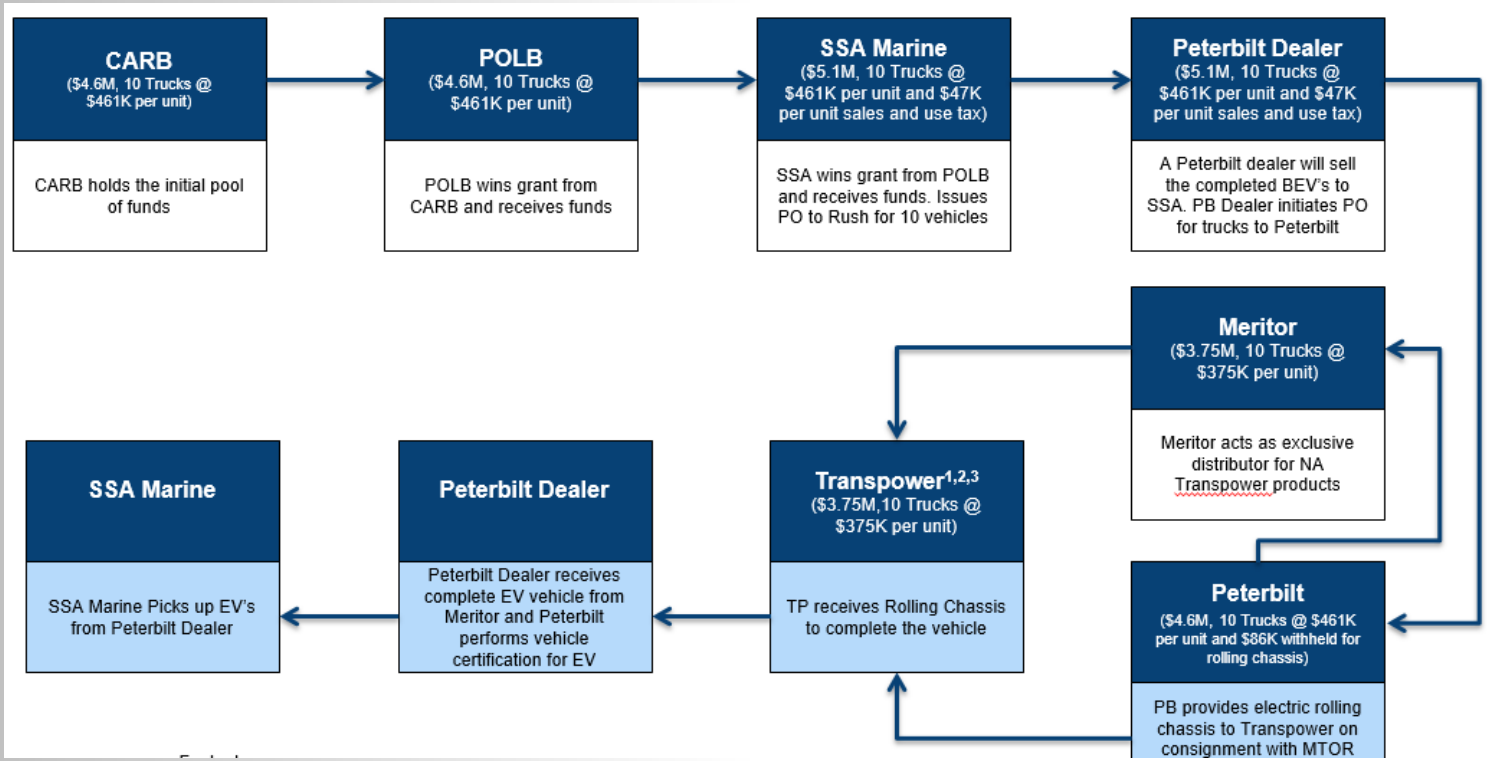
Total



ZANZEFF GRANT

- Zero and Near Zero-Emission Freight Facilities Project
- 2017-18 CARB Grant
- Awards - $205M
  - 15 Peterbilt Model 579EV – Port of Long Beach ($50M)
  - 6 Peterbilt Model 220EV – PepsiCo / Frito Lay ($15M)
  - 6 Kenworth / Toyota T680 Fuel Cell Trucks ($41M)
  - 5 Volvo VNR – City of LA ($36.7M)
  - Misc. Locomotives, Cranes, Fork Lifts, etc.

GRANT PAYMENT FLOW

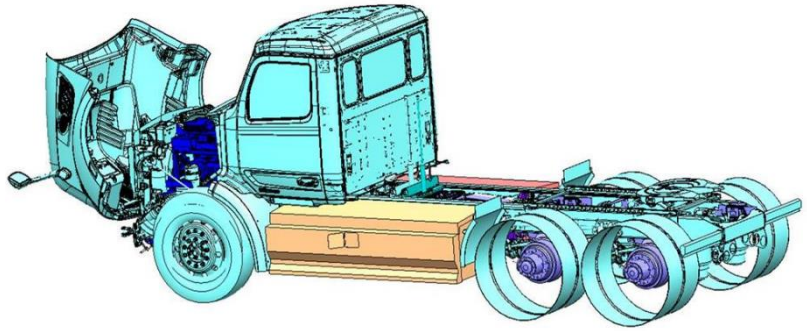


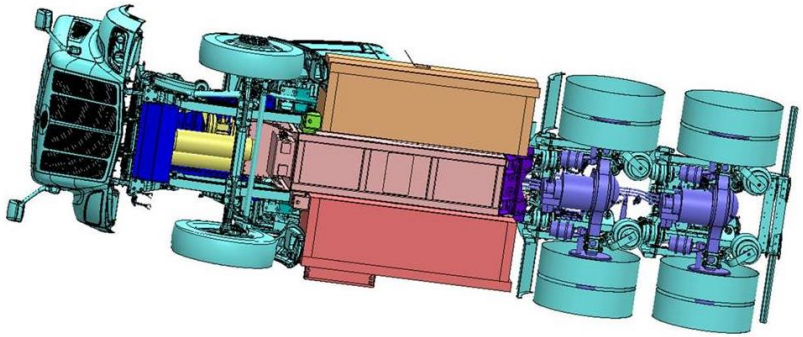
MODEL 579EV (MIDSHIP POWERTRAIN)

- 2019 - 10 Trucks
- Cloned from Previous Grant (Now 25 Total)
- 2 X 200HP Motors / AMT Transmission
- 352kW-hr of Nissan Leaf Batteries
- 140 Mile Range
- PACCAR Tech Center Tested

MODEL 579EV (E-AXLE)

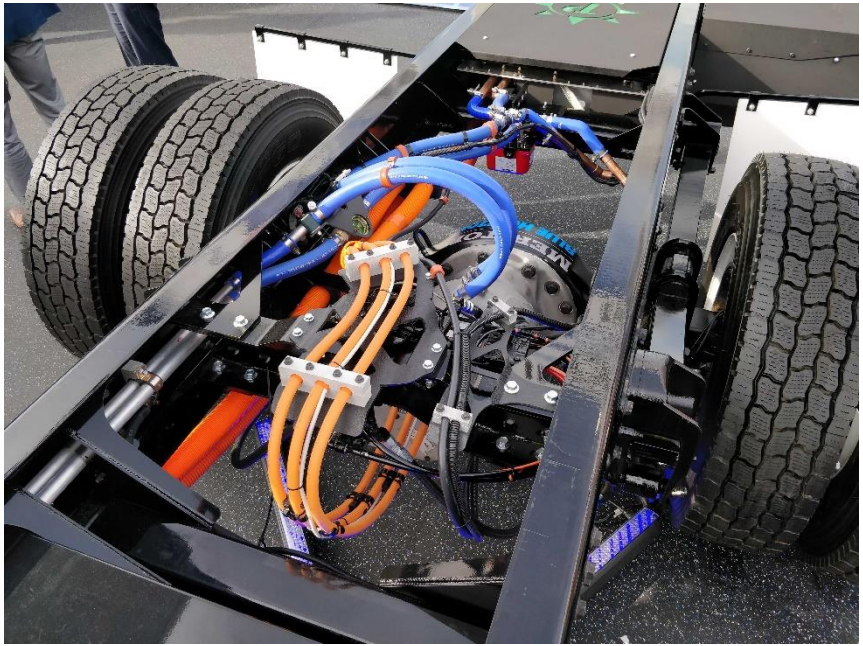
- 2020 - 5 Trucks
- Meritor Electric Axles
  - 2 X 200 HP
  - Integrated 2-Speed Transmission
- 396 kW-hr CATL Batteries
- 180 Mile Range
- Axles Installed in Factory





MODEL 220EV

- 5 Trucks for PepsiCo
- Meritor Electric Axles
  - 200 HP Peak
  - Integrated 2-Speed Transmission
- 396 kW-hr CATL Batteries
- 180 Mile Range
- Axles Installed in Factory



TRUCK BUILDING

Incomplete Trucks Delivered to Transpower

System Integration at Transpower

Truck Returns to Denton for Final Test

Trucks Delivered to CA

DFW Trucks for the DFW Environment

Thank You

Interstate Highway 45 Zero-Emission Vehicle Corridor Plan

May 18, 2020

Hydrogen Webinar Series Part Two

Bethany Hyatt

Dallas-Fort Worth CLEAN CITIES

North Central Texas Council of Governments

CLEAN CITIES COALITION NETWORK

Response To FHWA Alternative Fuel Corridors Deployment Plan Goals

FHWA Goals:

- Develop an Infrastructure Deployment Plan
- Transition the Corridors from “Pending to Ready”
- Identify Public-Private Partnerships

NCTCOG Proposal:

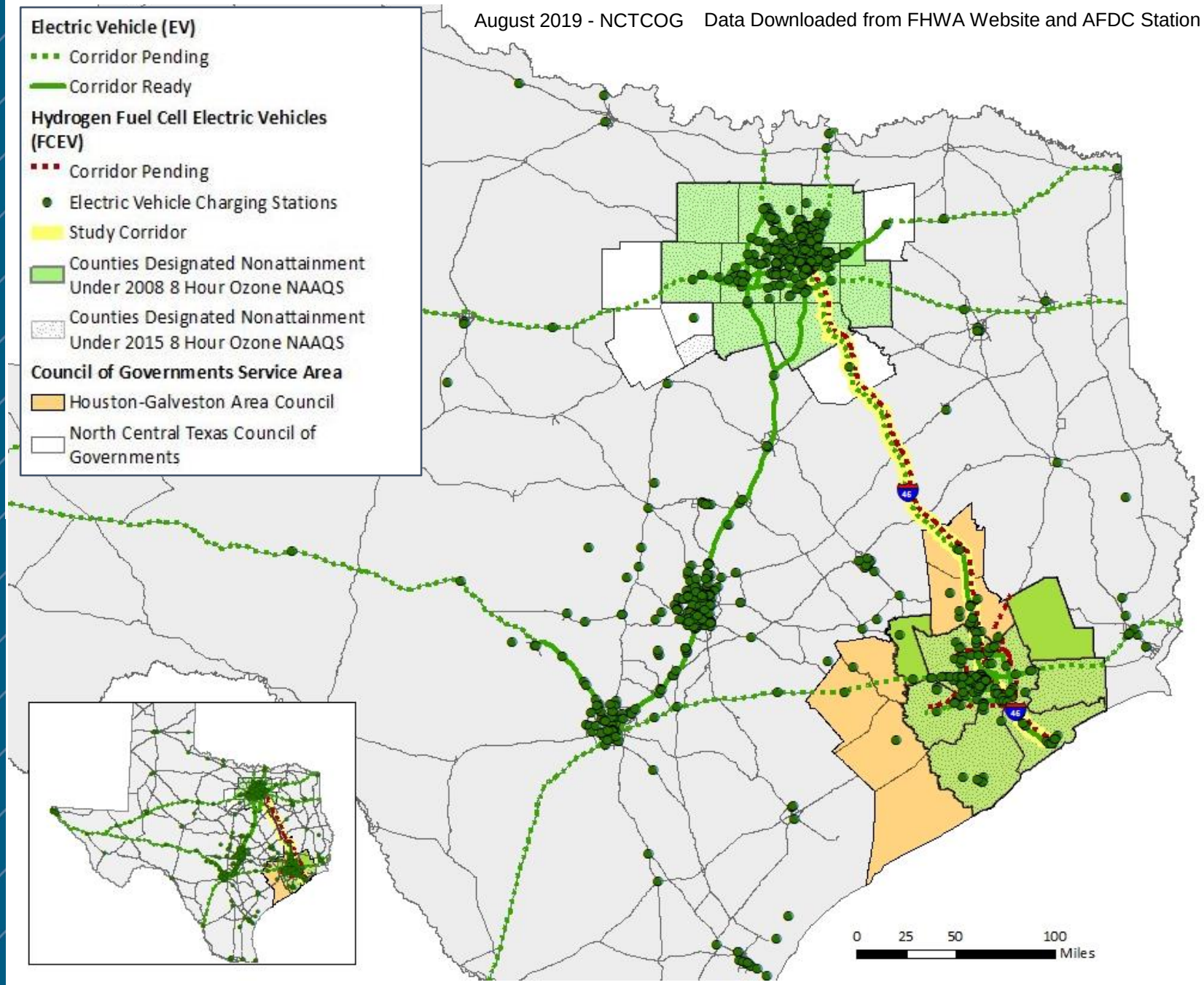
- Develop Electric and Hydrogen corridor along IH-45
- Expand Infrastructure Needs Suitable for Medium and Heavy-duty Electric Trucks and Buses
- Support Future Strategic Initiatives in the Corridor, such as AV Technology Deployment and Truck Platooning

Corridor Profile

290-Mile Corridor

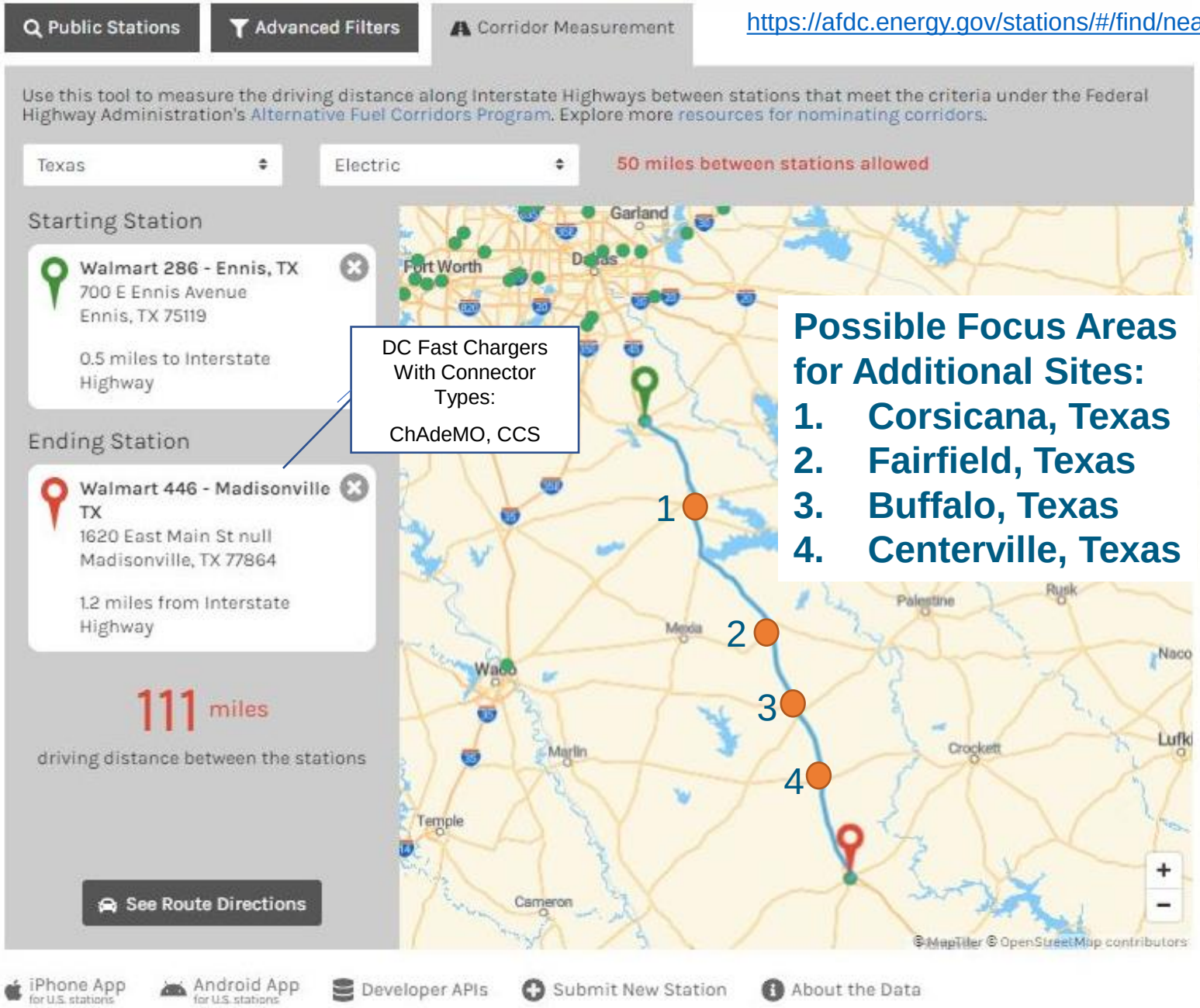
Nearly half of truck freight is in Texas is moved through this corridor.

Over 10,000 ton-miles of cargo traveled between Dallas and Houston in 2017, totally over $62.6 billion.

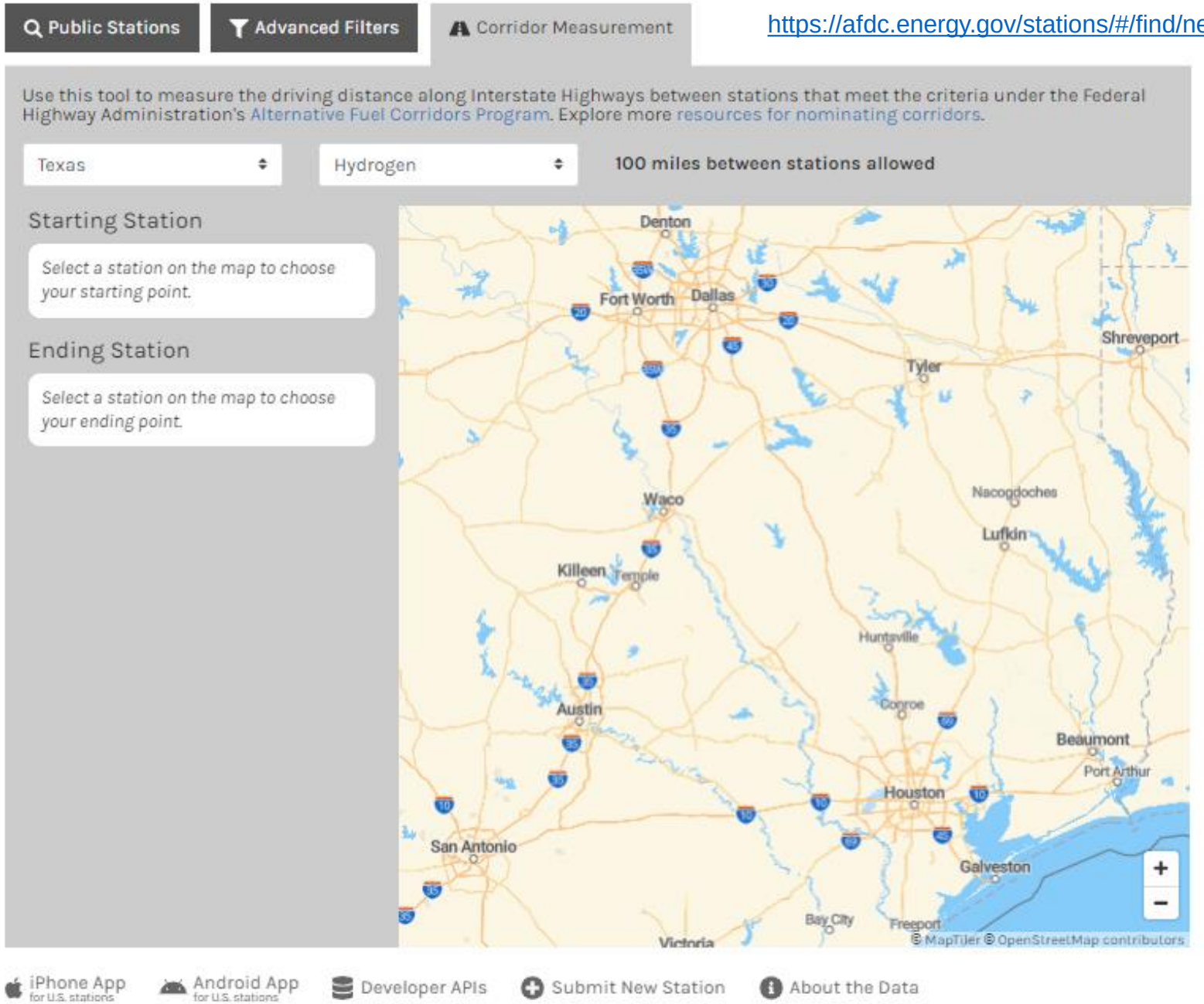


Current State of Electric Vehicle Supply Equipment (EVSE)

One Gap Remaining to Meet "Corridor-Ready" Status per FHWA Criteria: 111 Mile Gap from Ennis to Madisonville



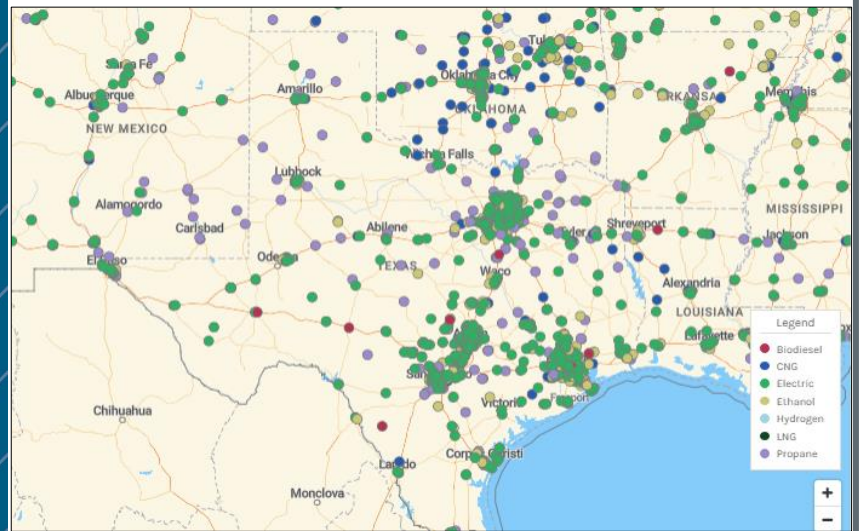
Current State of Hydrogen Fueling Stations



Data Available From NCTCOG and H-GAC

Travel Volumes/Patterns:

Station Locations:



Freight Flows:

Freight Analysis Framework (FAF) integrates data from a variety of sources to create a comprehensive picture of freight movement among states and major metropolitan areas by all modes of transportation.

https://ops.fhwa.dot.gov/freight/freight_analysis/faf/

Through the Plan, NCTCOG Will…

Identify Best Technologies suitable for vocational needs

Identify best market development opportunities

Develop and convene stakeholder groups including:

TxDOT

Utilities

Fleets

Fueling providers

Consumer interest groups

Solicit infrastructure needs from industry

Deliverables

Stakeholder Lists

Stakeholder Meetings

Corridor Workshops

Case Studies

Infrastructure Development Plan

Stakeholder's Role

- Identify Optimal sites
- Solicit Infrastructure Needs and Criteria
- Identify and Contact Property Owners

- Identify Best Technologies Suitable for Vocational Needs
- Evaluate Commercialization Status of Suitable Vehicles
- Access Timeframe for Commercial Availability

- Identify and Engage End-User Fleets
- Match User Needs to Vehicle Availability
- Assess Potential Vehicle Adoption

- Identify and Prioritize Non-Monetary Policies/Incentives
- Assess Existing and Needed Monetary Incentives
- Develop Engagement Plan

Infrastructure Development

Vehicle Availability

Customer Identification

Policy/Incentives

IH-45 ZEV Corridor Stakeholder Survey

In 2019, the Federal Highway Administration (FHWA) released a solicitation for a Alternative Fuel Corridors Deployment Plan. The North Central Texas Council of Governments submitted a proposal to develop a Zero-Emission Vehicle corrridor along Interstate Highway 45 from Dallas to Houston. This plan involves building infrastructure for both electric and hydrogen fuel cell electric vehilces with an emphasis on medium and heavy duty trucks and buses.

NCTCOG is seeking stakeholders representing fuel providers, fleets, infrastructure developers, fuel associations, government agencies, utilities, and interest groups to inform development of the infrastructure plan. Stakeholders are needed to support both plan elements - battery electric vehicle charging, and fuel cell electric vehicle fueling.

https://forms.office.com/Pages/ResponsePage.aspx?id=vH5eL7Aivk-TTKq9204psdQleriIutVJstC1lh81MHtUM1BZQUdSTzRINVZWTERSVDNZTkNMUjdMUCQlQCN0PWcu

For More Information:

Bethany Hyatt
Air Quality Planner
(817) 704 5663
Bhyatt@nctcog.org

Lori Clark
Program Manager and
DFW Clean Cities Coordinator
(817) 695-9232
Lclark@nctcog.org

Dallas-Fort Worth
CLEAN CITIES

www.dfwcleancities.org

cleancities@nctcog.org

North Central Texas
Council of Governments