



WELCOME

North Central Texas Hydrogen User Forum

June 11, 2024

Forum Agenda

8:00 a.m.	Registration and Networking
9:00 a.m.	Opening Welcome
10:00 a.m.	Panel 1: Transportation - Vehicles/Refueling
11:00 a.m.	Panel 2: Transportation - End Users
12:00 p.m.	Lunch
1:00 p.m.	Panel 3: Industry Suppliers & Consumers
2:00 p.m.	Panel 4: Power & Blending
3:00 p.m.	Closing Remarks
3:30 p.m.	Networking



North Central Texas
Council of Governments



Texas
Hydrogen
Alliance



Scan QR Code or visit nctcog.publicinput.com/nthydrogen to register.

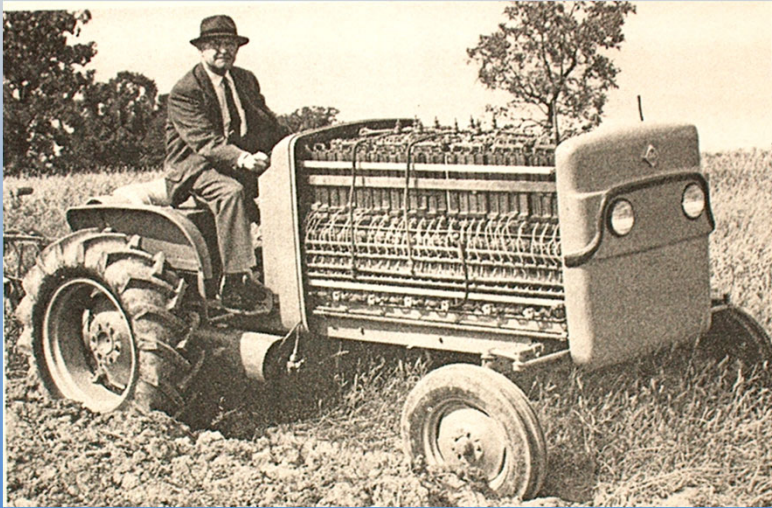
Forum will take place in the Rio Grande Ballroom, University Center
The University of Texas at Arlington, 300 W. First St., Arlington, TX.



HYDROGEN



Then
and
Now



New B.S. Major - Resource Energy Engineering (REE)



Strategic Analysis



Development



Construction



Operations



Decommissioning



Hydroelectric Power



Geothermal Power



Coal Power



Fossil Resources



Refining & Processing

Solar Power



Wind Power



Nuclear Power



Electric Transmission

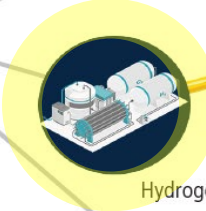


Energy Storage

Gas Power



Hydrogen Plant



Fuel Transmission



Biofuels



Fuel Storage



Residential, Commercial, Industrial and Transportation Consumers



North Central Texas
Council of Governments



Dallas-Fort Worth
CLEAN CITIES

Hydrogen in North Texas

Lori Clark, NCTCOG and Dallas-Fort Worth
Clean Cities

North Central Texas Hydrogen User Forum

Tuesday, June 11, 2024

Who We Are

Regional Planning
Agency



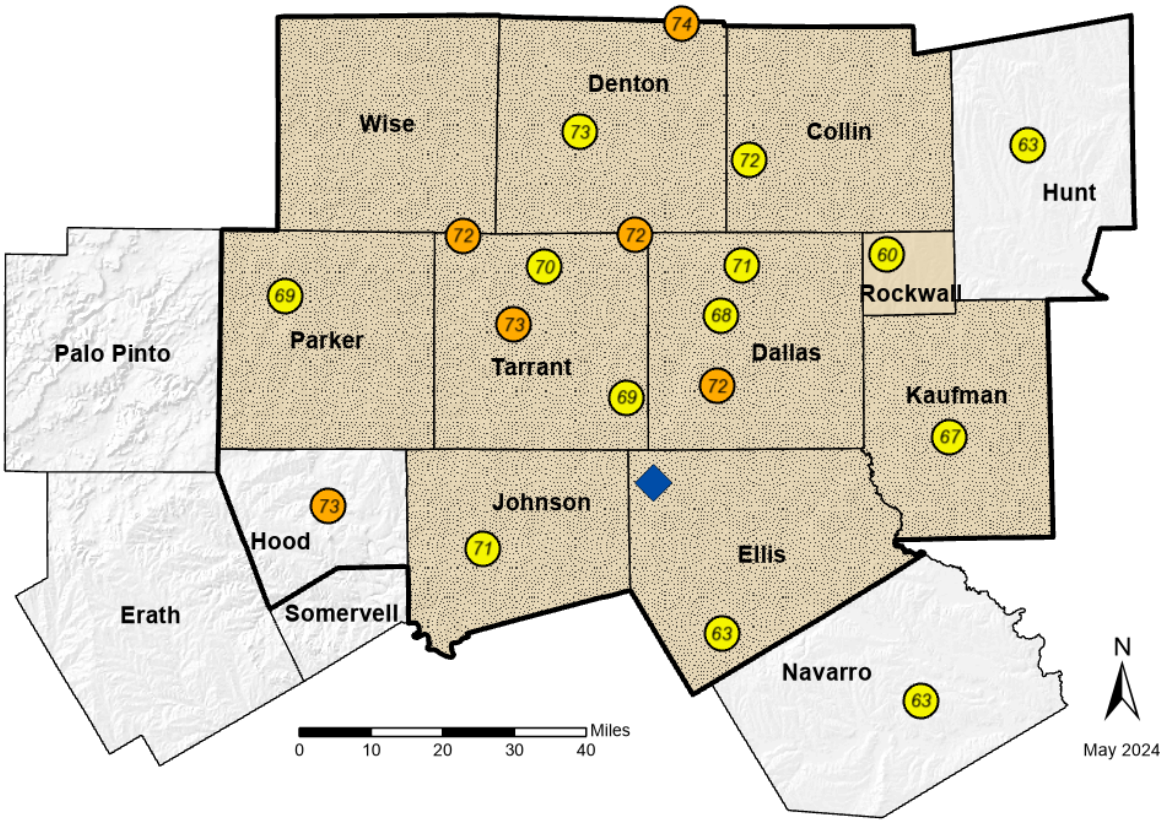
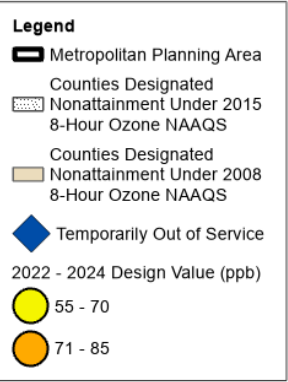
Metropolitan Planning
Organization (MPO)



Department of
Energy-Designated
Host Agency for
Local Clean Cities
and Communities
Coalition



Hydrogen in North Texas



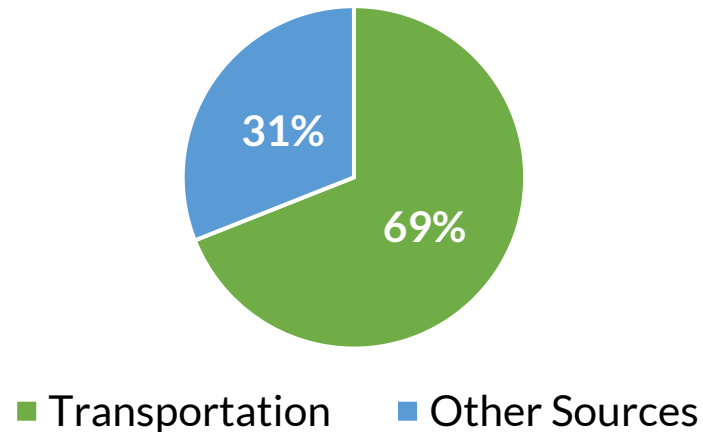
Ozone-10 counties designated by EPA as Nonattainment

Fine Particulate Matter (PM_{2.5})-Nonattainment designation likely for Dallas and Tarrant Counties

Air Quality Status in Dallas-Fort Worth

2019 Nitrogen Oxides (NO_x) Emissions Inventory 10-County DFW Ozone Nonattainment Area

Nitrogen Oxides (NO_x) = 247.02 Tons per Day

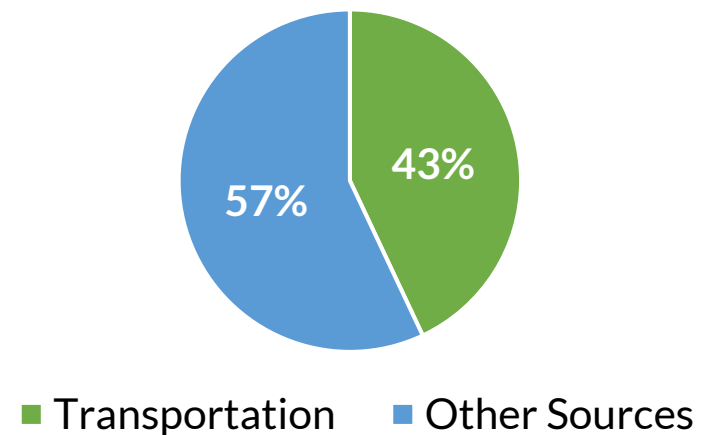


"Transportation" includes off-road, on-road, and non-road mobile
"Other Sources" includes point, area, and oil and gas production

Source: TCEQ, 2019 summer weekday anthropogenic emissions for the DFW 10 County Ozone Nonattainment Region, **Proposed DFW Moderate Attainment Demonstration State Implementation Plan Revision for the 2015 Eight-Hour Ozone NAAQS**

2019 Greenhouse Gas Emissions Inventory 12-County Metropolitan Planning Area

Carbon Dioxide Equivalent (CO₂e) = 102,856,587 Metric Tons per Year



"Transportation" includes off-road, on-road, and non-road mobile
"Other Sources" currently includes energy, water, wastewater, and solid waste; agricultural, process & fugitive emissions not included to date

Source: NCTCOG, [North Central Texas 12-County Metropolitan Planning Area 2019 Inventory of Community Greenhouse Gas Emissions](#)

Hydrogen 101

Current production pathways:

- Steam methane reformation (95%)
- Electrolysis (5%)

Hydrogen can either be delivered to an end-user or produced onsite

Most hydrogen today is produced at large plants and distributed with special hydrogen trailers

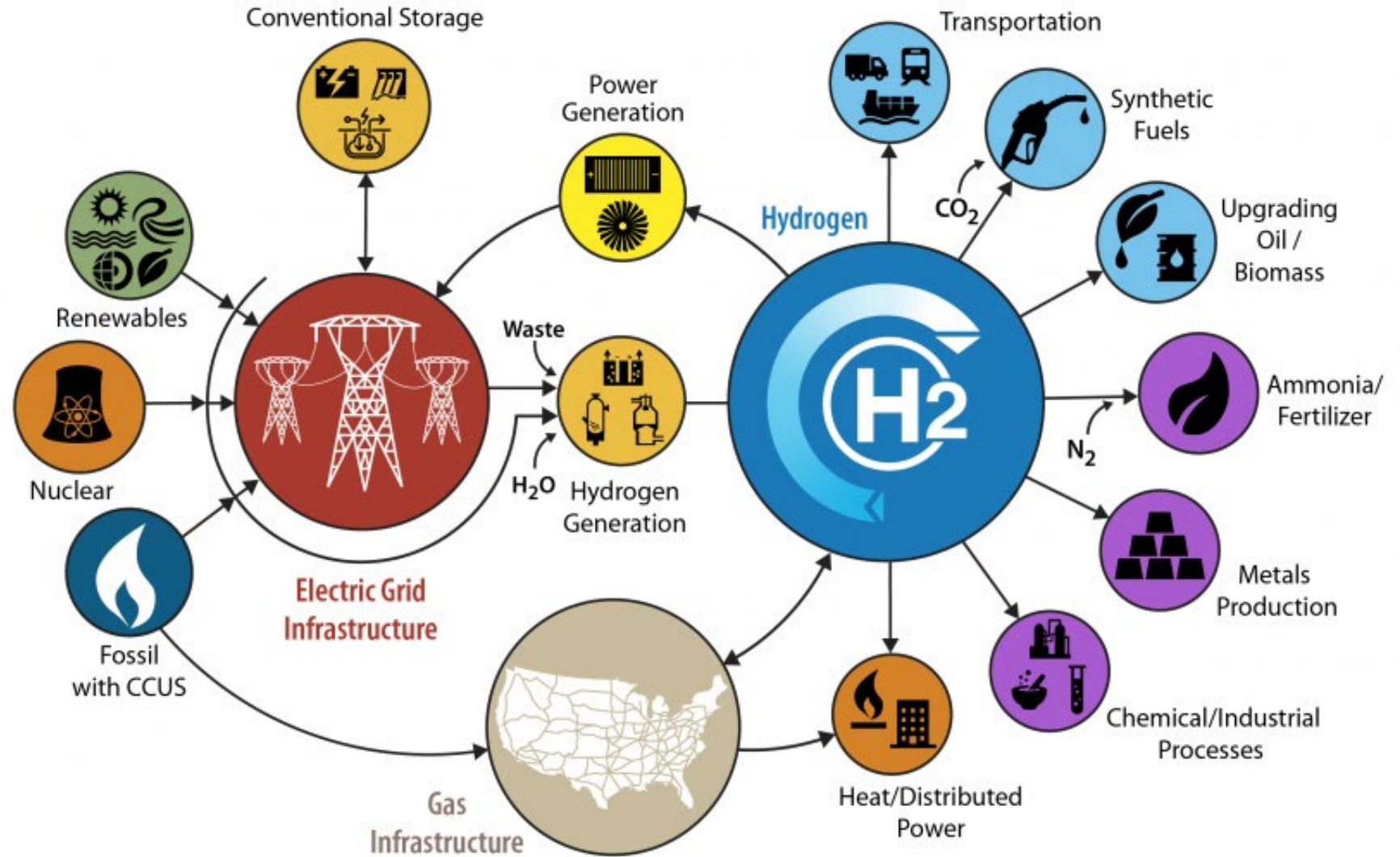


Image Source: Department of Energy

Clean Hydrogen Opportunities

\$9.5 billion from the Bipartisan Infrastructure Law

\$3/kg production tax credit from Inflation Reduction Act

Priorities from the **U.S. National Clean Hydrogen Strategy and Roadmap** for hydrogen production, transport, storage, and use:

- Focus on regional networks
- Reduce the cost of clean hydrogen
- Target high-impact end-uses
 - Industrial: Chemicals, Steelmaking, Industrial Heat
 - Transportation: Medium and heavy-duty trucks and buses, maritime, aviation, rail
 - Power Sector: Grid services, backup power, long-duration energy storage

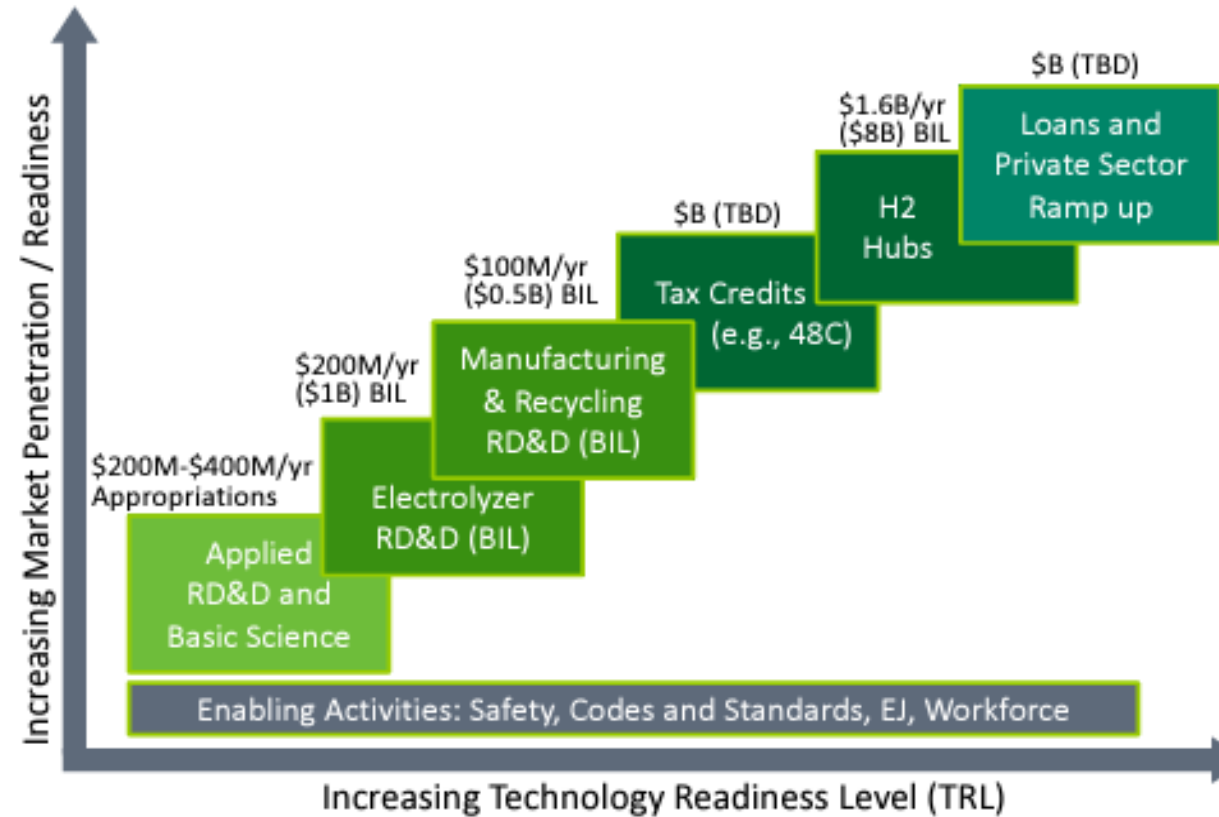
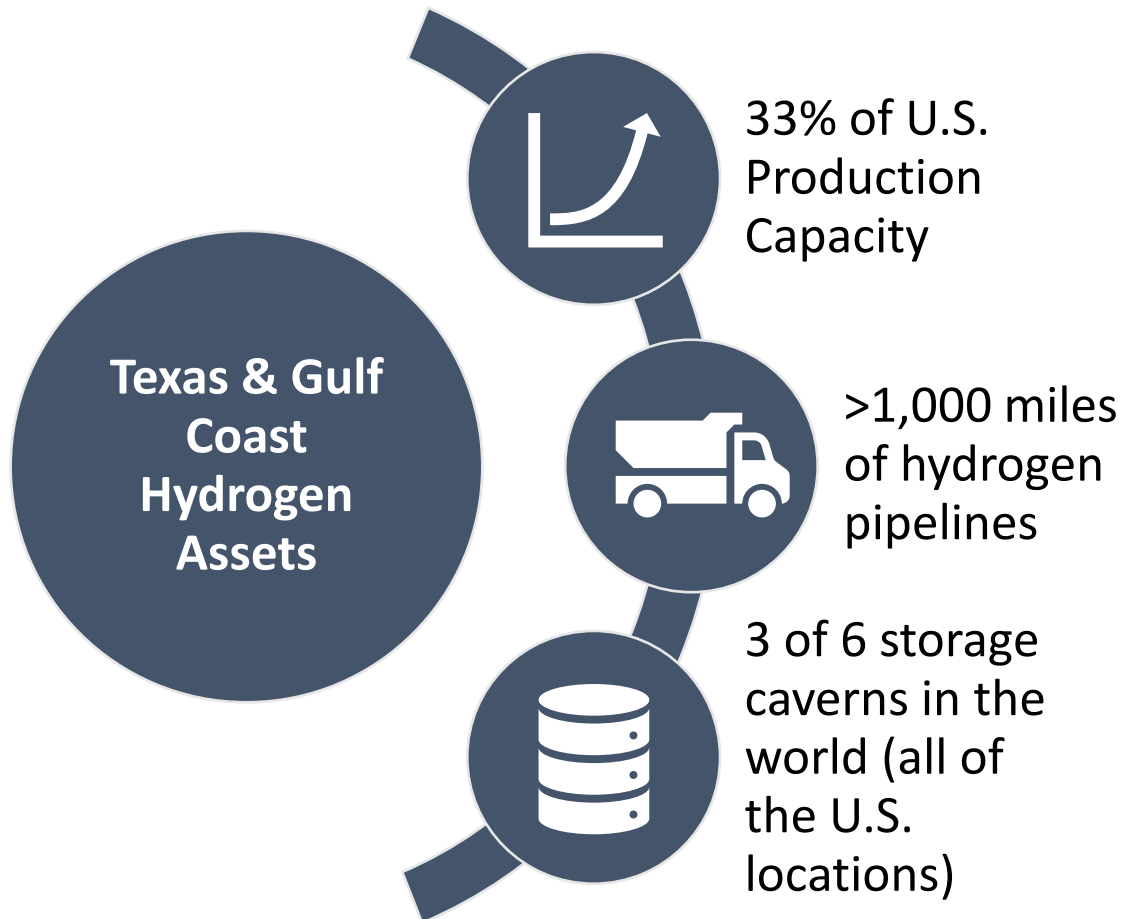


Image source: Department of Energy



Why Texas

Existing Assets



New Assets

HyVelocity Gulf Coast Hydrogen Hub

Industry-led hub administered by GTI Energy
Up to \$1.2 Billion DOE Investment
Rapidly scale clean hydrogen supply and demand
Texas Gulf Coast and Southwest Louisiana

Texas Hydrogen Alliance

Railroad Commission of Texas Hydrogen Production Policy Council

Hydrogen Planning, Deployment, and Incentive Projects in the Transportation Sector

Hydrogen for Transportation

Technology solutions for travel modes to reach a net-zero economy in 2050

	 BATTERY/ELECTRIC	 HYDROGEN	 SUSTAINABLE LIQUID FUELS
1 icon represents limited long-term opportunity  2 icons represents large long-term opportunity  3 icons represents greatest long-term opportunity 			
Light Duty Vehicles (49%)*		—	TBD
Medium, Short-Haul Heavy Trucks & Buses (~14%)			
Long-Haul Heavy Trucks (~7%)			
Off-road (10%)			
Rail (2%)			
Maritime (3%)			
Aviation (11%)			
Pipelines (4%)		TBD	TBD
Additional Opportunities	• Stationary battery use • Grid support (managed EV charging)	• Heavy industries • Grid support • Feedstock for chemicals and fuels	• Decarbonize plastics/chemicals • Bio-products
RD&D Priorities	• National battery strategy • Charging infrastructure • Grid integration • Battery recycling	• Electrolyzer costs • Fuel cell durability and cost • Clean hydrogen infrastructure	• Multiple cost-effective drop-in sustainable fuels • Reduce ethanol carbon intensity • Bioenergy scale-up

* All emissions shares are for 2019

† Includes hydrogen for ammonia and methanol

Hydrogen in North Texas

Source: [The U.S. National Blueprint for Transportation Decarbonization](#) (USDOT, USDOE, USEPA, USHUD)

Impact of Heavy-Duty Trucks on Ozone Nonattainment Issues

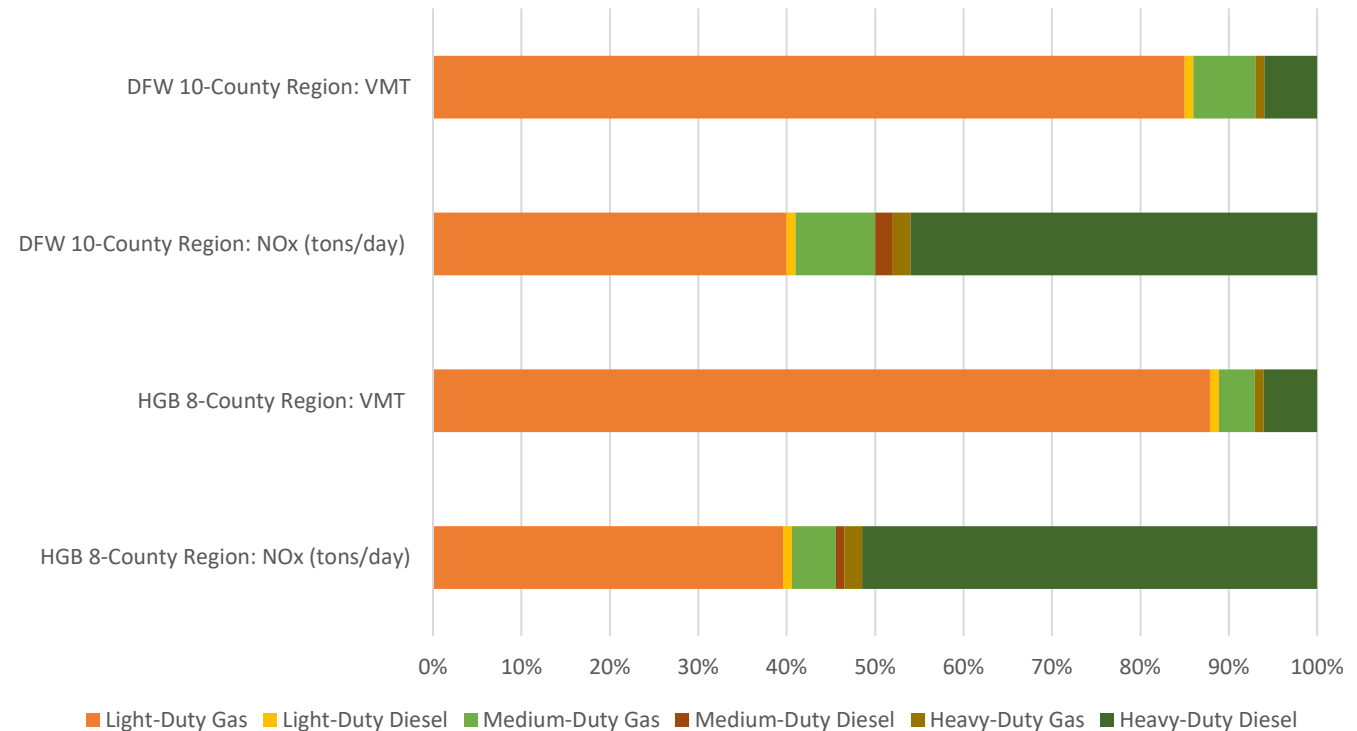
Improve Air Quality

- Ongoing ozone nonattainment issues in DFW, Houston-Galveston-Brazoria, and San Antonio Areas

Reduce Medium/Heavy Duty Vehicle Emissions

- In DFW and San Antonio, heavy-duty trucks make up 48% of all ozone-forming NOx emissions
- In Houston-Galveston-Brazoria, heavy-duty truck make up 54% of all ozone-forming NOx emissions

Vehicle Miles Traveled Versus Nitrogen Oxides Contribution by On-Road Vehicle Type in DFW and Houston-Galveston Areas



Emissions Impact of Heavy-Duty Diesel is Disproportionately High Compared to Miles Traveled

National Zero-Emission Freight Corridor Strategy

PHASE 1: ESTABLISH HUBS

**Establish
priority
hubs**
based on
freight
volumes.

2024–2027

PHASE 2: CONNECT HUBS

**Connect
hubs** along
critical
freight
corridors.

2027–2030

PHASE 3: EXPAND CORRIDORS

**Expand
corridor
connections,**
initiating
network
development.

2030–2035

PHASE 4: COMPLETE NETWORK

**Achieve
national
network** by
linking
regional
corridors for
**ubiquitous
access.**

2035–2040



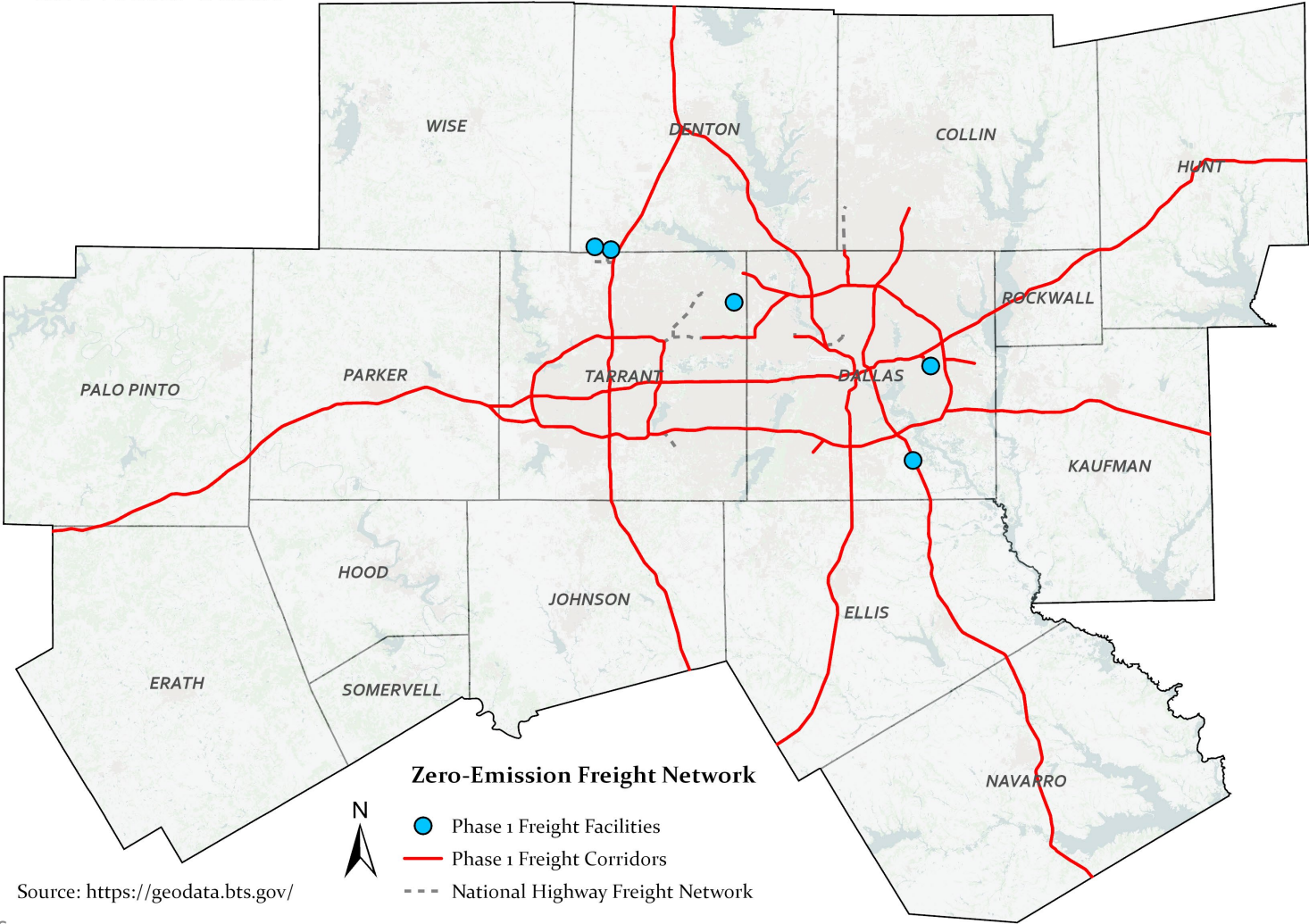
National Zero-Emission Freight Corridor Strategy in Texas

Phase 1 of the National Zero-Emission Freight Corridor Strategy in North Texas

**PHASE 1:
ESTABLISH HUBS**

Establish
priority
hubs
based on
freight
volumes.

2024–2027



Source: <https://geodata.bts.gov/>



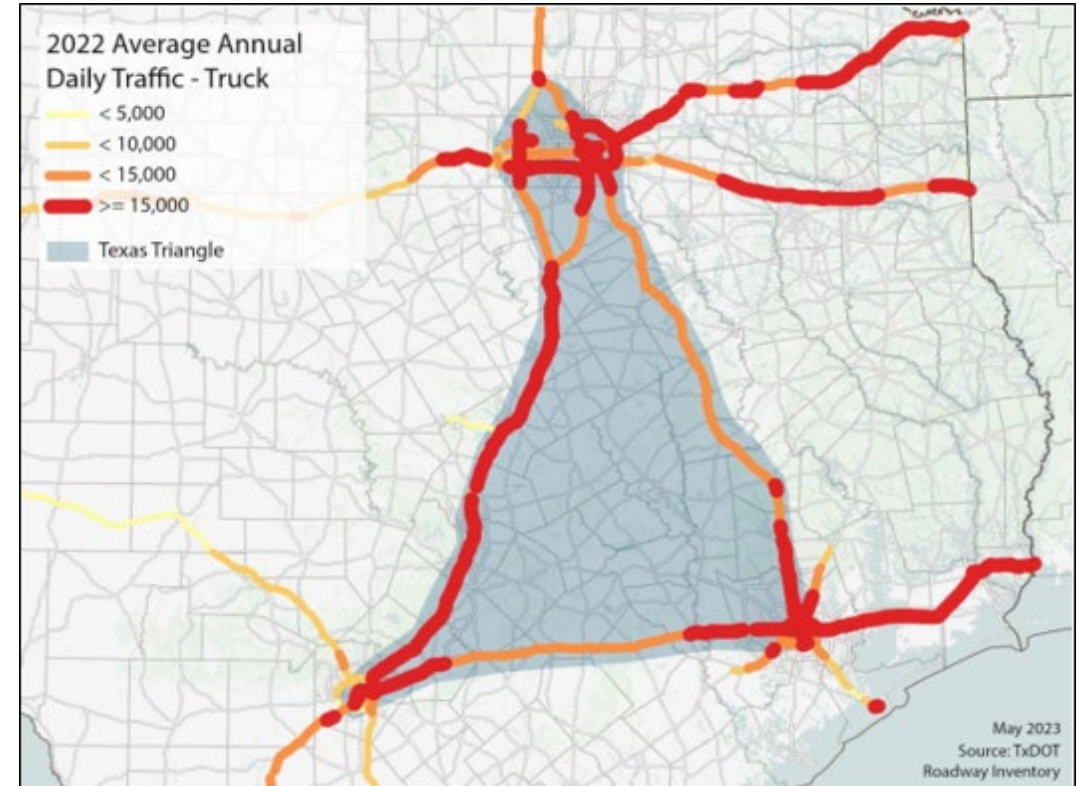
Texas Triangle Freight Traffic

Each leg of Texas Triangle has an average annual daily truck traffic over 10,000 trucks

3 of 4 Texans live within the Texas Triangle

Intrastate freight estimated to grow from 2.17B tons in 2019 to 4.46B tons in 2050

Network of alternative fuel infrastructure along entire Texas Triangle necessary to move adoption beyond pilot stages



IH 45 Zero Emission Vehicle Plan

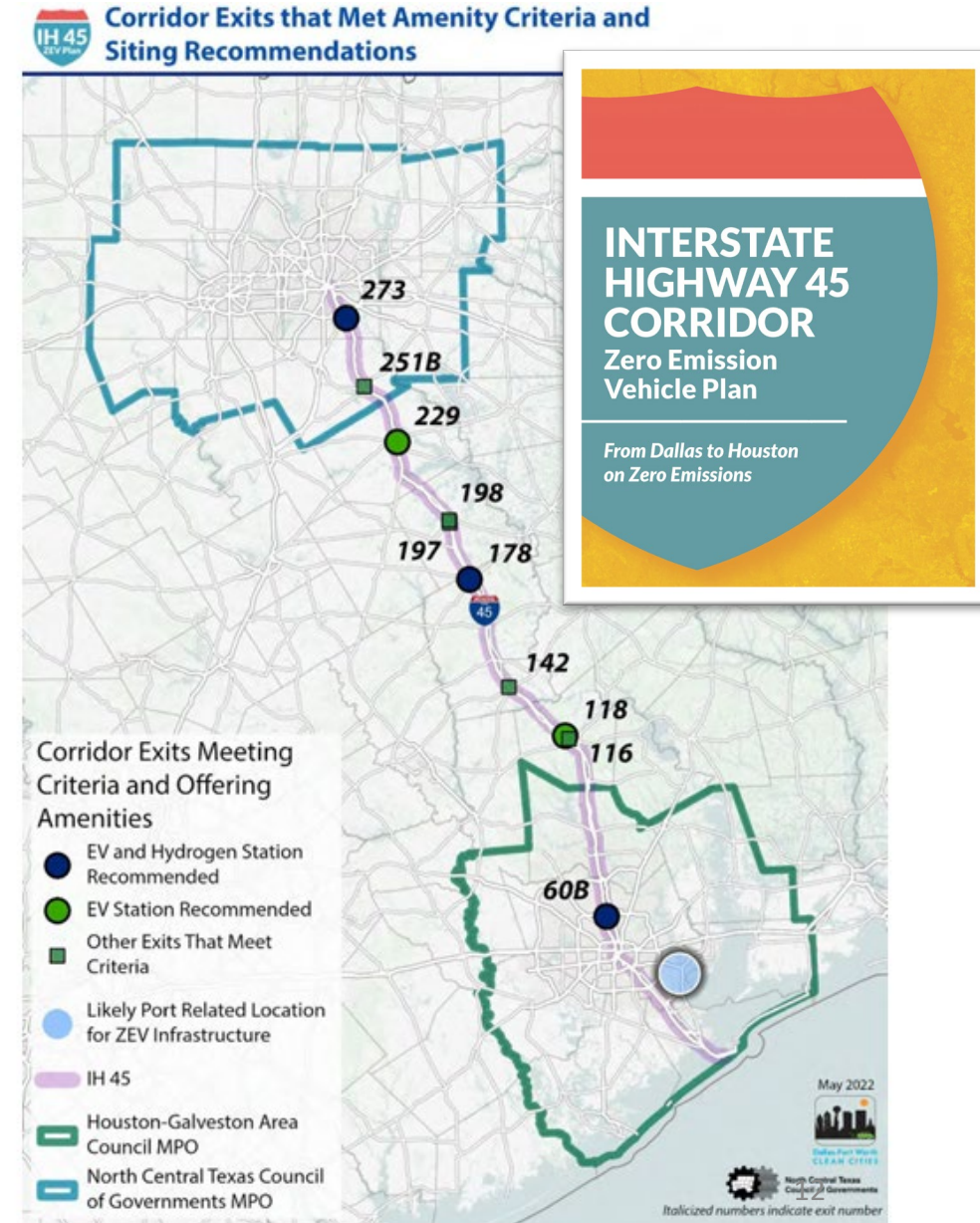
Developed recommendations for refueling/recharging stations to facilitate zero emission vehicle travel from Houston to DFW

- 5 medium-/heavy-duty EV charging sites
 - Adoption may be limited to short, regional haul routes that return to depot
- 3 medium-/heavy-duty hydrogen refueling locations (co-located with EV charging)
- Additional light-duty EV charging sites recommended

nctcog.org/IH45-ZEV



Hydrogen in North Texas



Houston to Los Angeles IH 10 Corridor Project

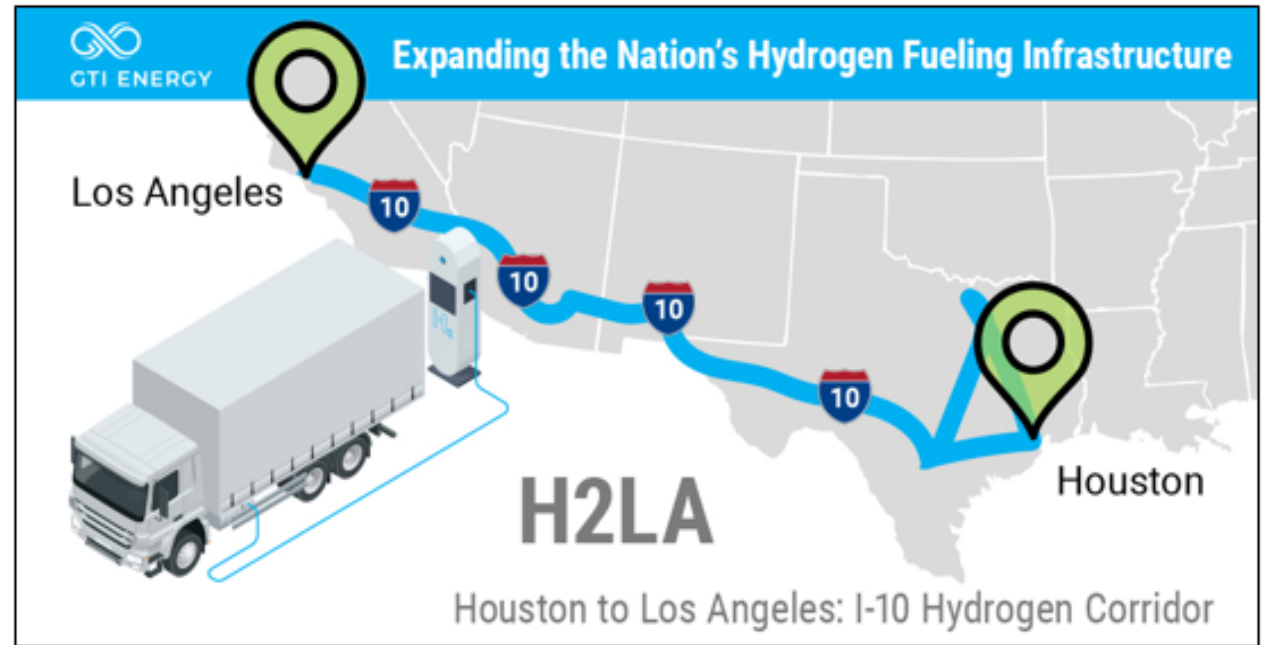
GTI Energy-led project awarded by the Department of Energy (DOE)

- Utilize computer modeling to develop a replicable blueprint for heavy-duty hydrogen refueling in the Texas Triangle and IH 10 corridor

NCTCOG Role as Project Partner

- Supply GTI Energy with travel demand and property location data
- Create a Local Project Advisory Group and share findings publicly and with identified minority serving institutions

For local governments or community members interested in joining, please email cleancities@nctcog.org

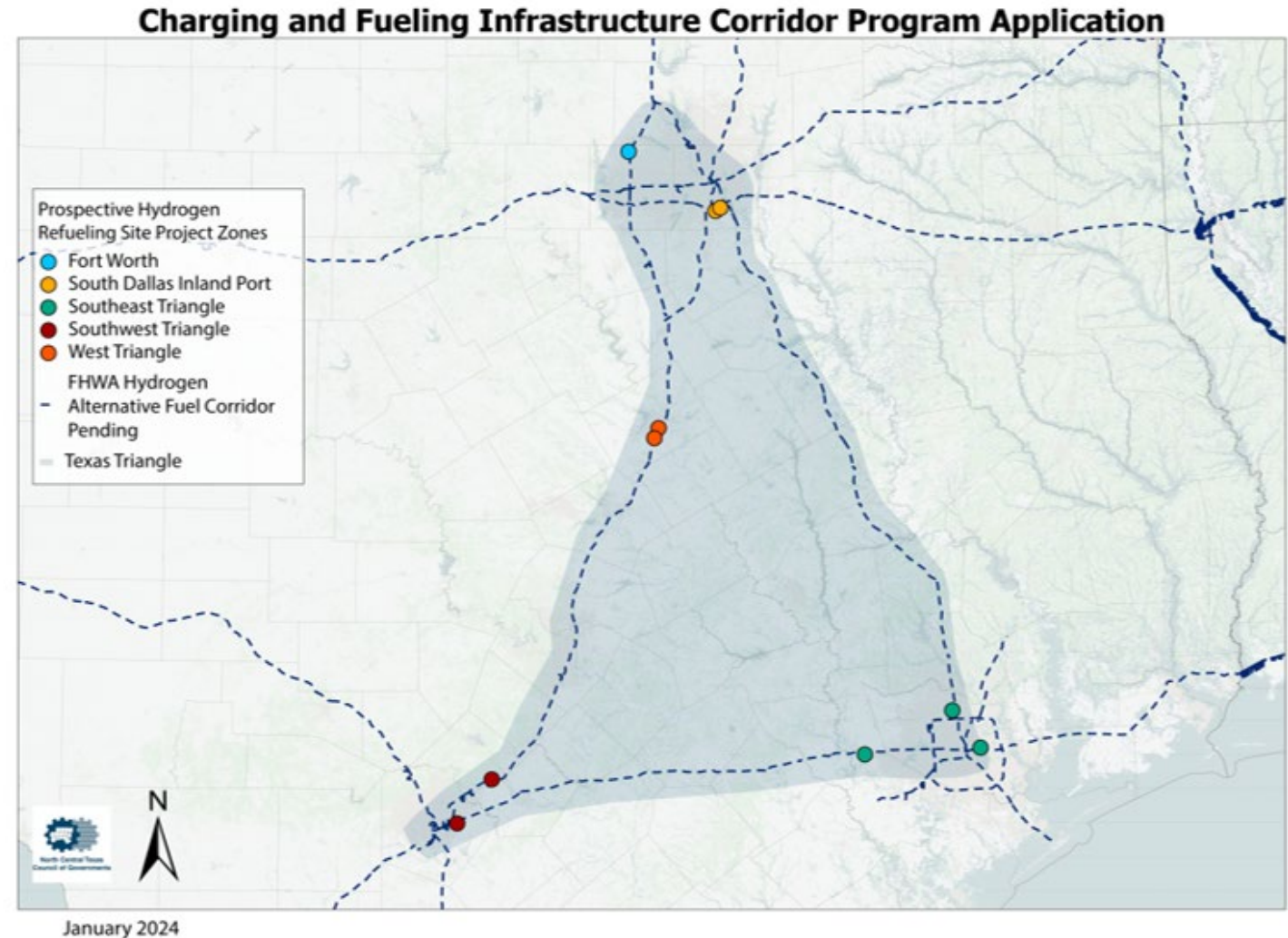


Charging and Fueling Infrastructure Corridor Program

Texas Hydrogen and Electric Freight Infrastructure Project (Tx-HEFTI)

Awarded \$70 million to construct 5 medium-/heavy-duty hydrogen refueling stations

All stations will be open to the public and co-located with truck stops



Scope of Technology and Activities



Light-,
Medium-, and
Heavy-Duty
Vehicles



Alternative and
Renewable
Fuels and
Infrastructure



Idle Reduction
Measures and
Fuel Economy
Improvements



New Mobility Choices
and Emerging
Transportation
Technologies



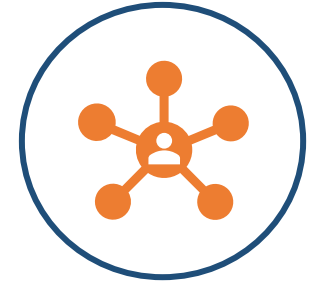
Funding Support



Technical Assistance



Planning Activities

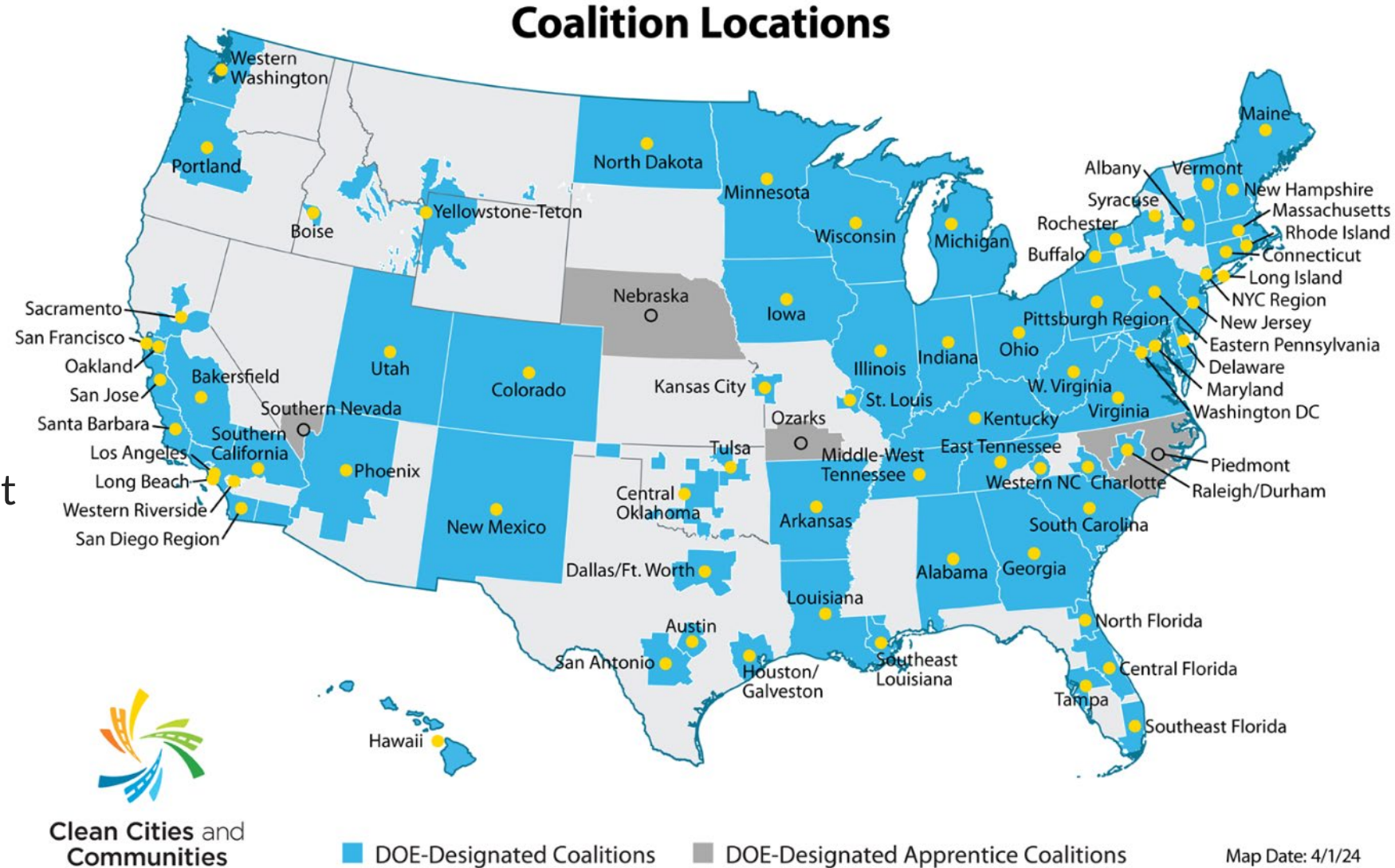


Raising Awareness

National Network of Clean Cities Coalitions

More than 75 Clean Cities coalitions with thousands of stakeholders, representing ~80% of U.S. population

Designated by the Department of Energy



Contact Us



Lori Clark
Senior Program Manager
& DFW Clean Cities Director
lclark@nctcog.org



Jared Wright
Senior Air Quality Planner
jwright@nctcog.org



Maggie Quinn
Air Quality Planner
mquinn@nctcog.org



**Dallas-Fort Worth
CLEAN CITIES**



dfwcleancities.org



cleancities@nctcog.org



Hydrogen in North Texas



Texas Hydrogen Alliance

June 11, 2024

Application:

- Power (Orange)
- Industry (Purple)
- Mobility (Blue)
- Export/Ammonia (Red)

Fuel source

Project Stage:

- Aspiration announced (Black bar)
- Feasibility being reviewed (Light blue bar)
- Operations planning reviewed (Medium blue bar)
- Operational (Dark blue bar)

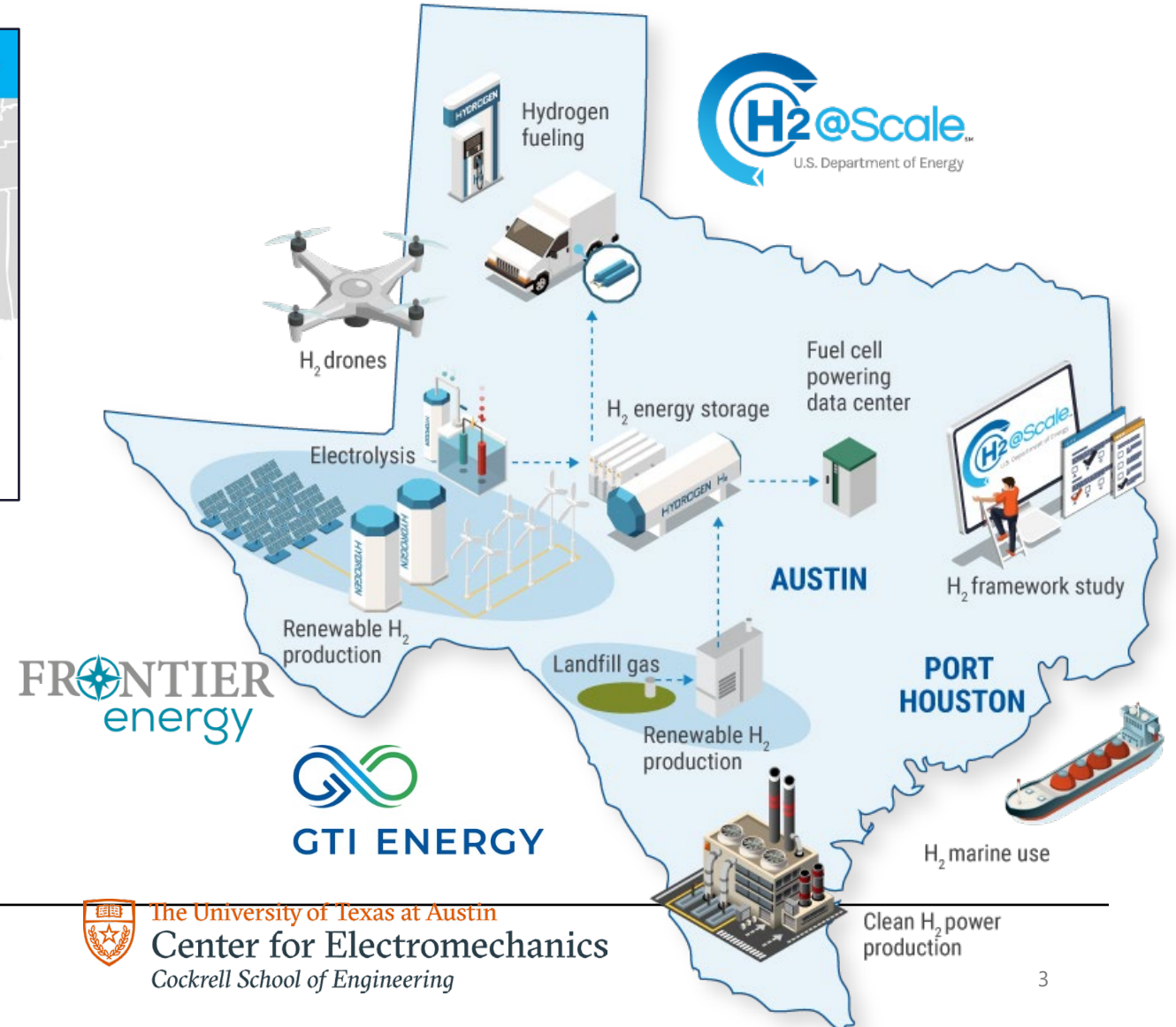
Map Details:

- Dallas:** Mega-scale green H2 production facility (AES, Air Products); NHE Biomethanol Production Plant (2023/2024) (New Hope Energy); Texas - MOU Enel Green Power, NextChem: Road Runner; Mitsubishi-Denbury Ammonia and CCS (Denbury, Mitsubishi); Ingleside Humble Blue H2 Ammonia Plant (TBA) (Humble, Enbridge); GHI and Energy Estate Hydrogen City Project (2026) (GHI Energy); Avangrid Renewables Gulf Coast Project (TBA) (Avangrid).
- Houston:** Zero Parks - NFE + PlugPower Green Hydrogen production facility (2030) (New Fortress Energy, Plug Power); Green Hydrogen partnership in St. Gabriel (2023) (Plug Power, Olin); Donaldsonville, LA - FID CF Industries, thyssenkrupp: Donaldsonville Nitrogen Complex; DG Fuels Sustainable Aviation Fuel Facility (2022); La Place, LA - Announced AmmPower: Port of South Louisiana; Blue Hydrogen Energy Complex at Ascension Parish (TBA); Donaldsonville Ammonia Pilot (2021); Gulf Coast TX - locations unspecified; DG Fuels, HydrogenPro: Gulf Coast Ammonia Plant; Chevron, Air Liquide, Lyondellbasell, Uniper: Project Jupiter; ConocoPhillips, Jera Americas, Uniper: Gulf Coast ammonia project.
- San Antonio:** Blue H2 Projects (TBA) (Siemens Energy); MMEX Green (TBA) (MMEX Resources Corporation); Texas - MOU Enel Green Power, NextChem: Road Runner; Mitsubishi-Denbury Ammonia and CCS (Denbury, Mitsubishi); Ingleside Humble Blue H2 Ammonia Plant (TBA) (Humble, Enbridge); GHI and Energy Estate Hydrogen City Project (2026) (GHI Energy); Avangrid Renewables Gulf Coast Project (TBA) (Avangrid).
- Corpus Christi:** Gulf Coast Green Methanol LOI (2025) (Orsted); Gulf Coast Ammonia (2023) (Air Products); HIF USA: Project Helix (HIF); Port of Corpus Christi 2021 & 2022 MOU (2030 / TBA) (Port of Corpus Christi); Port of Corpus Christi: Javelina Refinery (Howard Energy Partners, Port of Corpus Christi); Avangrid Renewables Gulf Coast Project (TBA) (Avangrid).
- Other:** Utility Liquefaction (TBA) (Saulsbury, Chart); NHE Biomethanol Production Plant (2023/2024) (New Hope Energy); La Porte liquefaction (Lyondellbasell); Baytown H2 Project (2030) (ExxonMobil); Lake Charles Methanol (2022) (OCI N.V., KBR, Maire Tecnimont); Gelsmar Clean Ammonia Project (TBA) (Denbury); Valero Port Arthur Refinery (Completed 2013) (TBA); Orange County Advanced Power Station (2026) (Entergy); Grön Fuels, LLC TBA; AmmPower in S. LA port (TBA) (AmmPower); Blue Hydrogen Energy Complex at Ascension Parish (TBA); Donaldsonville Ammonia Pilot (2021) (CF, thyssenkrupp).

U.S. DOE'S EXISTING HYDROGEN DEMONSTRATION INVESTMENTS IN TEXAS



- Build AGENT-based models (ORNL's proprietary model) for transport infrastructure
- Acquire relevant vehicle, fueling infrastructure, and operational data
- Establish a hydrogen fueling and heavy-duty freight truck network leveraging this fueling infrastructure in the Texas Triangle and I-10 corridor from Houston to Los Angeles



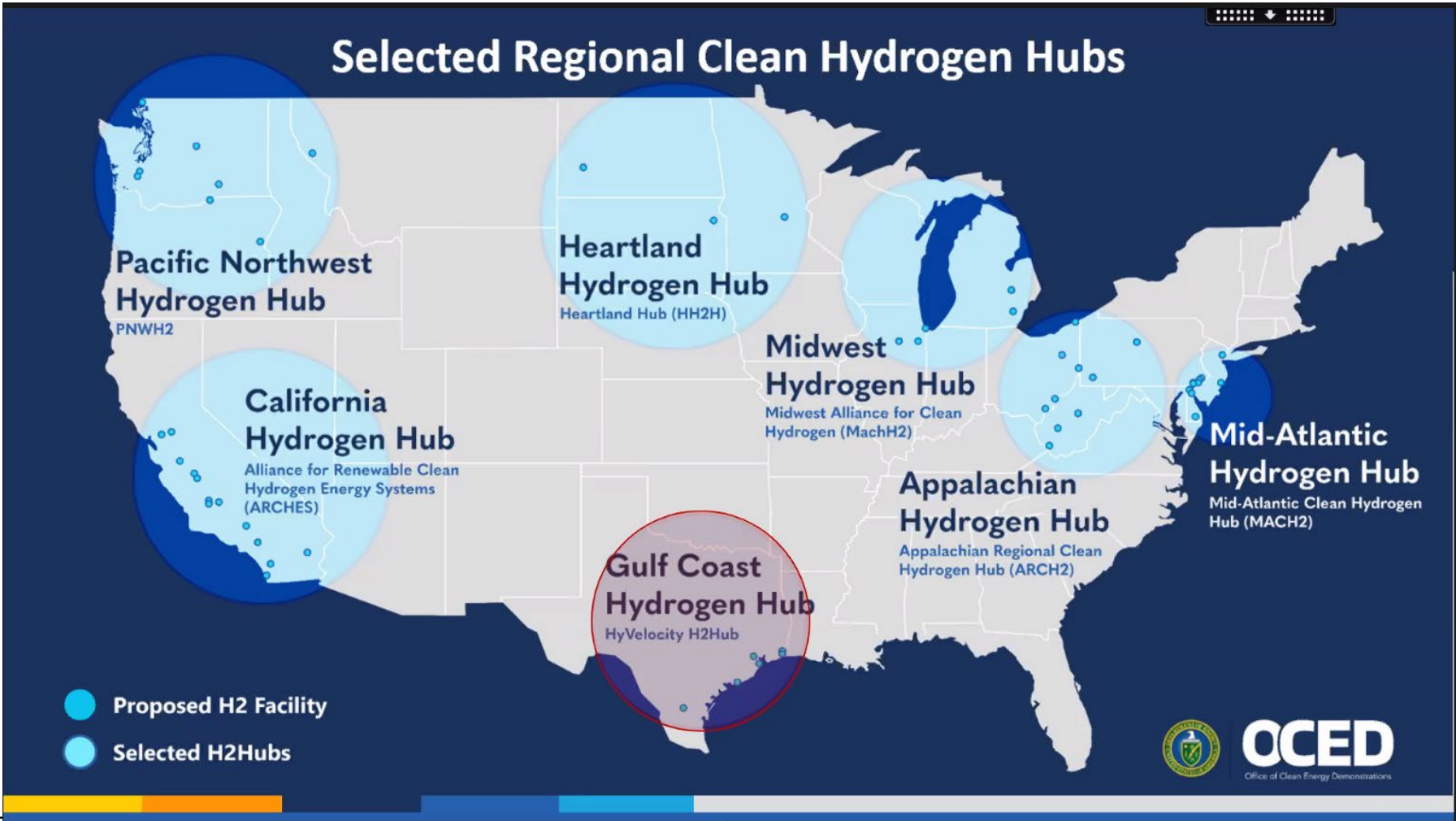
The University of Texas at Austin
Center for Electromechanics
Cockrell School of Engineering

REGIONAL CLEAN HYDROGEN HUBS SELECTED BY DOE

Bi-Partisan
Infrastructure
Bill (BIL)

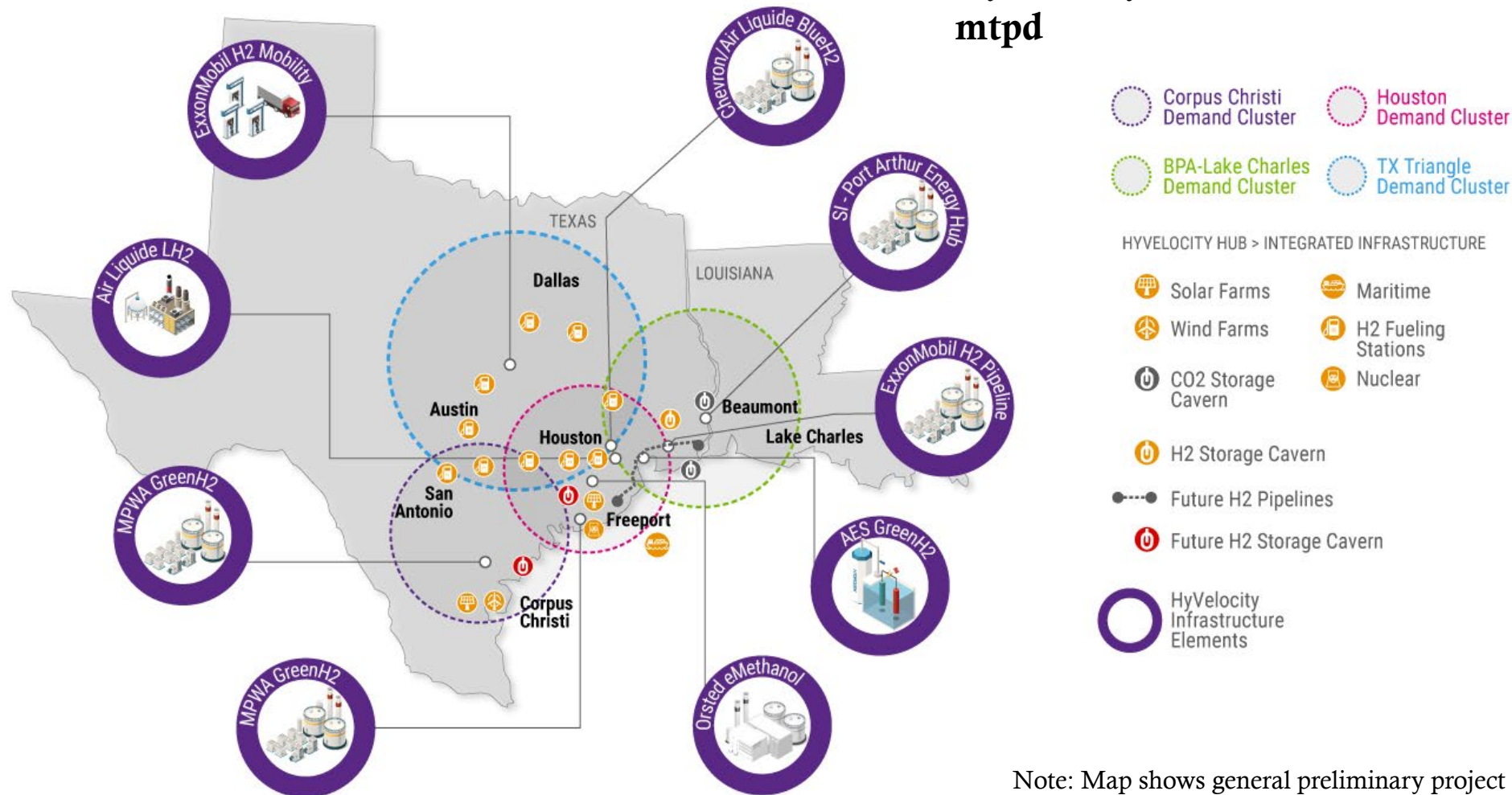
Inflation
Reduction Act
(IRA)

45Q , 45V



HYVELOCITY ENVISIONED PROJECTS

HyVelocity Clean H2 Production Capacity: >5,000 mtpd



Note: Map shows general preliminary project locations and are subject to change during future negotiations and site planning

TEXAS HYDROGEN ALLIANCE'S MISSION:

To broaden and enhance the understanding of opportunities for hydrogen in Texas and advocate for reshaping the State's policy and regulatory framework to expedite the adoption of hydrogen technology. With the overall goal to support and maintain the State's position as the energy capitol of the world, a coalition of industry leaders has assembled to pursue this task.



OUR SUCCESS IN THE 88TH LEGISLATIVE SESSION:

HB 2847 (Darby):

Relating to the jurisdiction of the Railroad Commission of Texas over and a study of production, pipeline transportation, and storage of hydrogen

- Creates the Hydrogen Production Policy Council, an 11-member board comprised of public and industry members



OUR SUCCESS IN THE 88TH LEGISLATIVE SESSION:

HB 4885 (Landgraf):

Relating to programs established and funded under the Texas Emissions Reduction Plan

- Creates the \$16m Texas Hydrogen Infrastructure, Vehicle, and Equipment (THIVE) grant program
- The Program has been over subscribed.



OUR BOARD OF DIRECTORS:

- AES
- Ambient Fuels
- Air Liquide
- CenterPoint Energy
- Chevron
- Chart Industries
- Cummins/ Accelera
- Exxon Mobil
- FCE
- H2Ranch
- Monarch Energy
- Orsted
- Pilot
- Port Houston



OUR MEMBERS:

- 174 Power Global
- AES
- Air Liquide
- Ambient Fuels
- APEX Clean Energy
- CenterPoint Energy
- Chart Industries
- Chemtec New Energies
- Chevron
- Conoco Phillips
- Cummins/Accelera
- Exxon Mobil
- FastTech US
- Fuel Cell Energy
- H2Ranch
- HIF Global
- Hydria
- HyRoad Energy
- Hyzon Motors
- Industrial Sun
- Linde
- LRQA
- Maximum Hydrogen
- MODA Midstream
- Modern Hydrogen
- Monarch Energy
- Neuventus
- NextEra Energy
- Orsted
- Pilot
- Port of Corpus Christi
- Port Houston
- Priority Power Management
- RW Energy
- Stormfisher Hydrogen
- Symbio
- Taylor Wharton
- TLM One
- WEH US



OUR FUTURE TOGETHER:

Susan M. Shifflett

Texas Hydrogen Alliance

Executive Director

979/270-2045

susan@s3-services.com

www.texashydrogenalliance.org

@TexasHydrogenAlliance (LinkedIn)



Ask
Questions
through
Slido.com.
Code:
3785389





June 11, 2024, 9:00 a.m. - 3:30 p.m.
The University of Texas at Arlington

Panel 1: Transportation- Vehicles/ Refueling



Cory Shumaker,
Hyzon Motors



Bill Kahn,
Paccar



Bill Zobel, Pilot
Travel Centers



Dmitry Serov,
HyRoad Energy



North Central Texas
Council of Governments



Texas
Hydrogen
Alliance





June 11, 2024, 9:00 a.m. - 3:30 p.m.
The University of Texas at Arlington

Panel 2: Transportation- End Users



Nick Konen,
Hillwood



Hugo Contreras,
DFW Airport



Rijin Easow,
DART



Cole Rogers,
Talke



North Central Texas
Council of Governments



Texas
Hydrogen
Alliance



UNIVERSITY OF
TEXAS
ARLINGTON



June 11, 2024, 9:00 a.m. - 3:30 p.m.
The University of Texas at Arlington

Panel 3: Industrial Suppliers and Consumers



Mothusi Pahl,
Modern Hydrogen



Gerson Duran,
RTE Pro



Darin Knicely,
RW Energy



Chris Shugart,
Ambient Fuels



North Central Texas
Council of Governments



Texas
Hydrogen
Alliance



UNIVERSITY OF
TEXAS
ARLINGTON



June 11, 2024, 9:00 a.m. - 3:30 p.m.
The University of Texas at Arlington

Panel 4: Power and Blending



Garry Waggoner,
Vistra



Peter Baldwin,
Harnyss



Kevin Boudreaux,
Monarch Energy



John Fredian,
Fuel Cell Energy



North Central Texas
Council of Governments



Texas
Hydrogen
Alliance



UNIVERSITY OF
TEXAS
ARLINGTON

Upcoming Dallas-Fort Worth Clean Cities Events

Clean Vehicle Vendor Expo

Vendors will be presenting information on products and services, displaying light, medium, and heavy-duty vehicles, and answering questions from local stakeholders

- Date: Tuesday, August 6, 2024
- Time: 10:30 a.m. - 12:30 p.m.
- Location: 616 Six Flags Dr, Arlington, TX 76011

If you are interested in participating or sponsoring lunch, please email cleancities@nctcog.org

DFW National Drive Electric Week Event

DFWCC is looking for sponsors and exhibitors to join us in a celebration to educate the public on the benefits of owning EVs through free EV displays and EV ride-and-drives, and more

- Date: Sunday, October 6, 2024
- Time: 10:00 a.m. - 2:00 p.m.
- Location: Tanger Outlets, 15853 North Fwy Fort Worth, TX 76177

Upcoming webinars and events posted regularly at dfwcleancities.org/events

Past events presentations and recordings available



North Central Texas Hydrogen User Forum

NCTCOG/Dallas-Fort Worth Clean Cities Hydrogen Infrastructure Projects

IH 45 Corridor Zero Emission Vehicle Plan

- Planning project; Complete
- Recommended fueling site placement along IH-45
- nctcog.org/IH45-ZEV

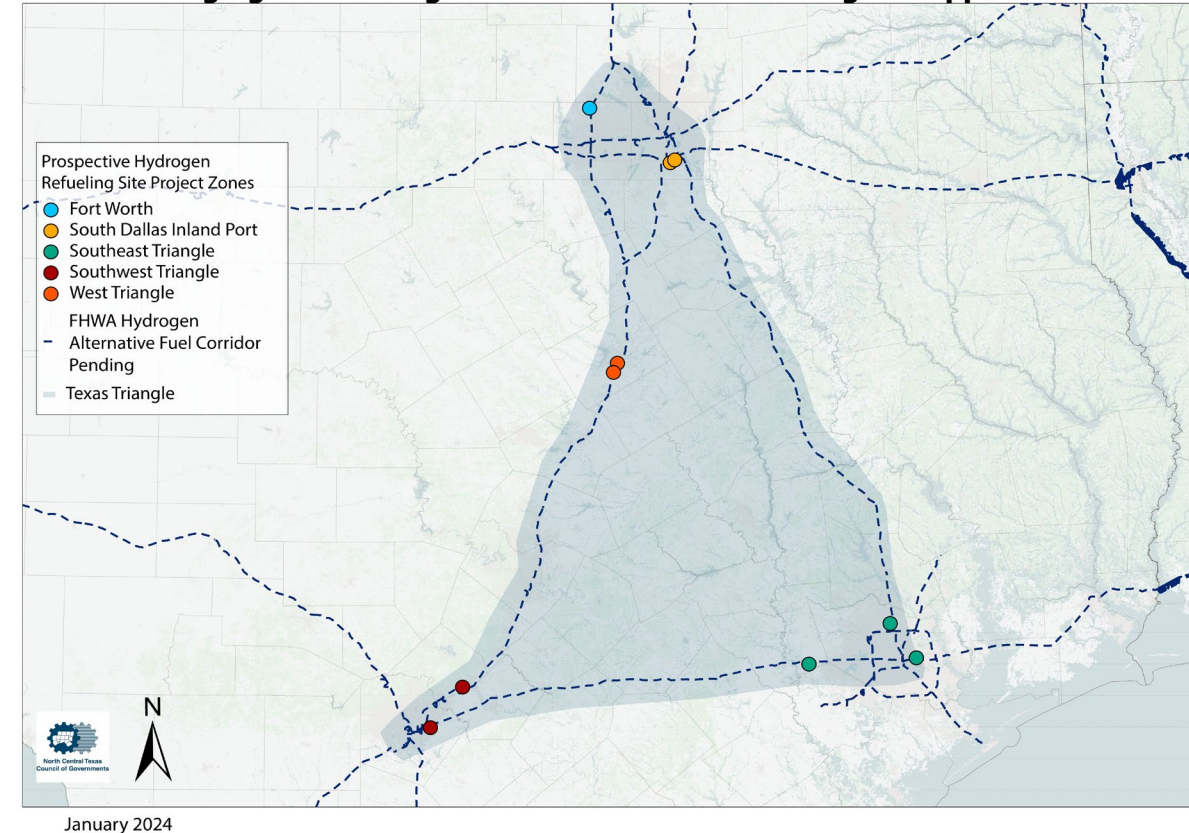
Houston to Los Angeles (H2LA) IH-10 Hydrogen Corridor Project

- Planning project; In Progress
- GTI Energy-led project awarded by the Department of Energy (DOE) to develop a replicable model for heavy-duty hydrogen refueling
- If interested in joining a local project advisory group, contact cleancities@nctcog.org

Texas Hydrogen and Electric Freight Infrastructure Project (Tx-HEFTI)

- Deployment project; Awarded
- \$70 million to construct 5 publicly accessible medium/heavy-duty hydrogen refueling stations in the Texas Triangle

Charging and Fueling Infrastructure Corridor Program Application



Key Funding Programs for Hydrogen Projects

Program/Incentive	Eligible Activities	Funding Amount	Deadline to Apply
EPA Clean Heavy-Duty Vehicles Grant Program	Replacement of non-zero-emission heavy-duty vehicles zero-emission vehicles, including hydrogen	Funds the incremental cost of replacing vehicles	July 25, 2024
TERP Rebate Grants Program	Replacements or upgrades of on-road heavy-duty diesel vehicles	Incremental cost for new purchase projects or up to \$600,000 for infrastructure projects	July 29, 2024
Charging and Fueling Infrastructure Discretionary Grant Program	Publicly accessible alternative fuel infrastructure, including hydrogen refueling	Up to 80% of project costs	August 28, 2024
TERP New Technology Implementation Grant Program	New technology-stationary sources, new technology oil and gas projects, and electricity-storage projects	Up to 50% of project costs	Closed; Expected to re-open Fall 2024
TERP Texas Clean Fleet Program	Replacement of at least 10 diesel-powered vehicles for fleets of 75 or more vehicles	Up to 80% of the incremental cost	Closed; Expected to re-open early 2025

Research more funding here: www.nctcog.org/aqfunding



Dallas-Fort Worth Clean Cities

Designated by Department of Energy, Hosted at NCTCOG

Our mission is to improve North Texas air quality through initiatives and partnerships that reduce transportation emissions, improve efficiency, and strengthen the local economy

We offer assistance on alternative fuel initiatives such as zero emission vehicles & infrastructure, energy resilience, and funding opportunities

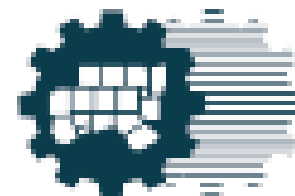
Contact us at cleancities@nctcog.org

Sign up for our weekly email list
dfwcleancities.org/getinvolved



North Central Texas Hydrogen User Forum

THANK YOU
TO OUR
SPONSORS!



North Central Texas
Council of Governments



Texas
Hydrogen
Alliance



UNIVERSITY OF
TEXAS
ARLINGTON