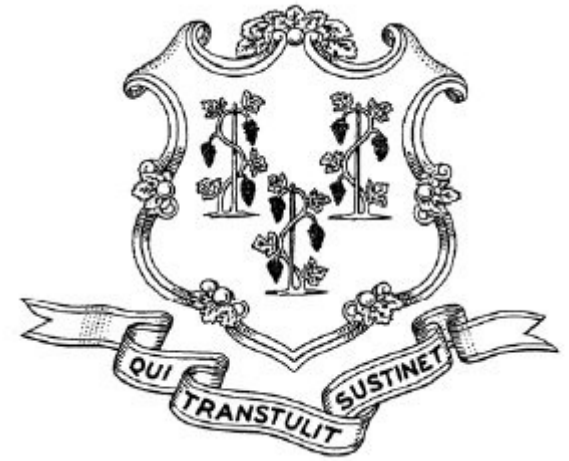




Welcome!

**Please stand by, we will begin
in a few moments.**



Special Act 22-8: Task Force to Study Hydrogen Power

Webinar & Listening Session

December 8, 2022

Online Meeting

Meeting Logistics

- **Mute Microphone** – in order to prevent background noise that disturbs the meeting, if you aren't talking, please mute your microphone or phone.
- **Chat Box** – if you aren't being heard, please use the chat box or raise your hand to ask a question. Please try to limit comments in the chat as these may not be officially captured in the record.
- **Recording Meeting** – we will record and post the meetings at www.ctgreenbank.com/hydrogentaskforce.
- **State Your Name** – for those talking, please state your name for the record.

Agenda

- **Overview of the Green Bank and Special Act 22-8** – 10 min
- **Hydrogen 101** – 10 min
- **Task Force Processes for Public Engagement and Transparency** – 5 min
- **Summary of Key Findings and Next Steps** – 20 min
- **Public Comments** – 15 min
- **Adjourn**

Overview of the Green Bank



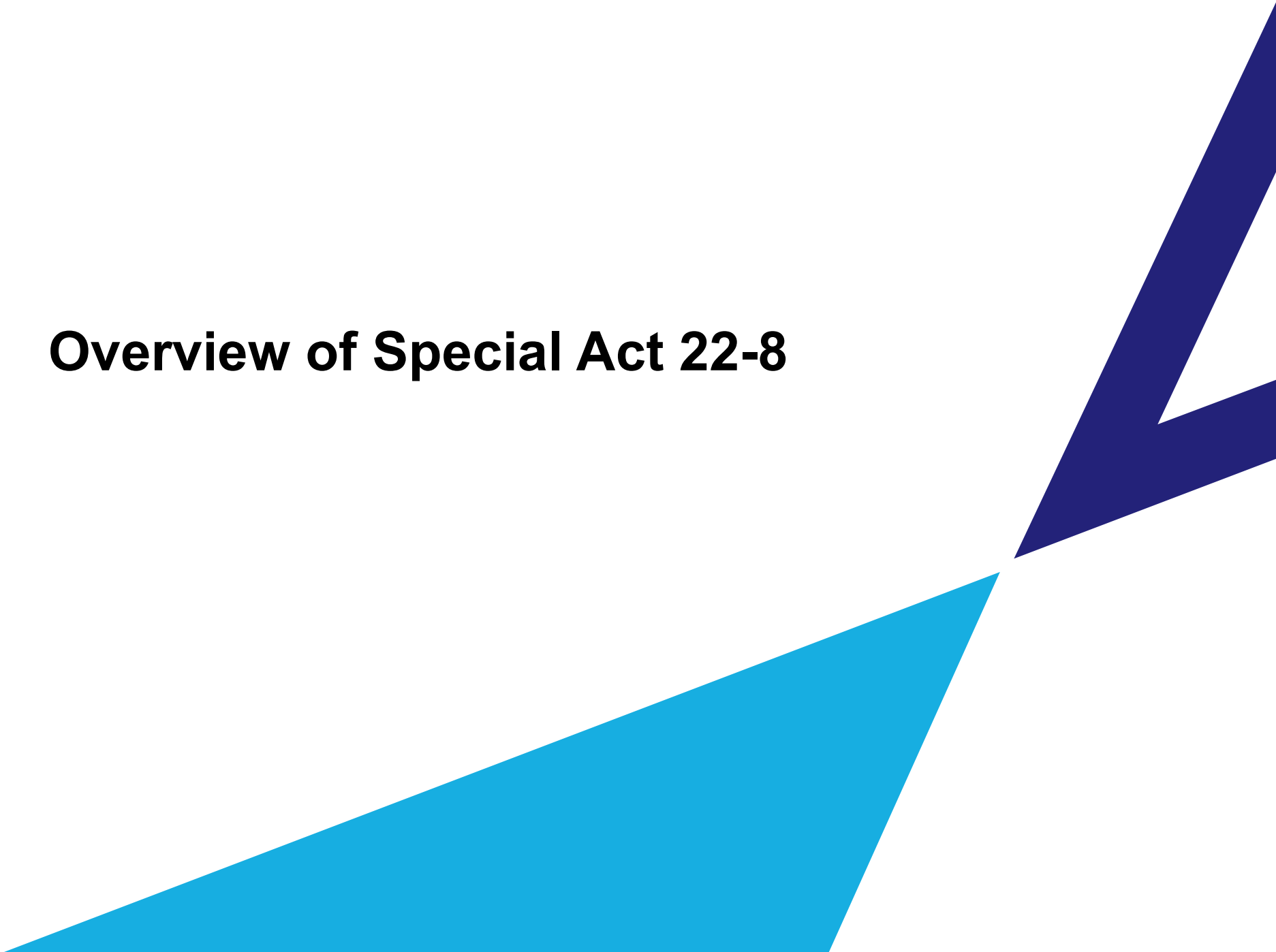


Connecticut Green Bank is the nation's first green bank. Established in 2011 as a quasi-public agency, the Green Bank uses limited public dollars to attract private capital investment and offers green solutions that help people, businesses and all of Connecticut thrive.

Our mission is to confront climate change by increasing and accelerating investment into Connecticut's green economy to create more resilient, healthier, and equitable communities

**Guiding this mission is our vision for
“...a planet protected by the love of humanity.”**

Overview of Special Act 22-8



Special Act 22-8

Background



- **Passage** – nearly unanimously bipartisan (April 20 and May 3, 2022) and signed by the Governor (May 23, 2022)
- **Overview** – establishes a task force to study hydrogen-fueled energy in the state's economy and energy infrastructure (i.e., first meeting no later than 60 days from passage)
- **Composition** – identifies ex officio and political appointed members to the task force (i.e., no later than 30 days from passage)
- **Deliverable** – not later than January 15, 2023, the task force shall submit a report on its findings and recommendations to the Energy & Technology Committee

Special Act 22-8

Areas to Address



Such study **shall** include, but **need not be limited to**:

1. A review of regulations and legislation needed to guide the development and achievement of economies of scale for the hydrogen ecosystem in the state
2. Recommendations for workforce initiatives to prepare the state's workforce for hydrogen-fueled energy-related jobs
3. An examination of how to position the state to take advantage of competitive incentives and programs created by the federal Infrastructure Investment and Jobs Act
4. Recommendations for funding and tax preferences for building hydrogen-fueled energy facilities at brownfield sites through the Targeted Brownfield Development Loan program
5. Recommendations regarding funding sources for developing hydrogen-fueled energy programs and infrastructure
6. An examination of the sources of potential clean hydrogen, including, but not limited to, wind, solar, biogas and nuclear
7. Recommendations for potential end uses of hydrogen-fueled energy

Task Force Membership



Appointer	Name and Title	Title and Organization
Ex Officio	Katie Dykes	Commissioner, DEEP
Ex Officio	Marissa Gillett	Chairwoman, PURA
Ex Officio	Ugur Pasaogullari	Professor, UCONN
Ex Officio	Joel Rinebold	Director, CCAT
Ex Officio (Chair)	Bryan Garcia	President, Connecticut Green Bank
Ex Officio (Co-Chair)	Sara Harari	Associate Director of Innovation & Advisor to the President, Connecticut Green Bank
President Pro Tempore	Enrique Bosch	Director of Innovation, Avangrid
	Sridhar Kanuri	Chief Technology Officer, HyAxiom
	Shannon Laun	Vice President & Director, Conservation Law Foundation Connecticut
Majority Leader Senate	Keith Brothers	Business Manager & Secretary Treasurer, AFL-CIO
Minority Leader Senate	Adolfo Rivera	Senior Director, Avangrid
	Frank Reynolds	President & CEO, Avangrid
Speaker of House	Digaunto Chatterjee	Vice President of System Planning, Eversource
	Katherine Ayers	Vice President of Research & Development, Nel Hydrogen
Majority Leader House	Nikki Bruno	Vice President of Clean Technologies, Eversource
	Samantha Dynowski	State Director, Sierra Club
	Anthony Leo	Vice President & CTO, Fuel Cell Energy
Minority Leader House	Jennifer Schilling	Vice President of Grid Modernization, Eversource
	Mary Nuara	State Policy Director, Dominion Energy
	William Smith	President & CEO, Infinity Fuel Cell

Task Force & Working Group

E⁴ Objectives

- **Educate** – inform Task Force, Working Groups, and Stakeholders about the science and markets for clean (green) hydrogen (i.e., from 101 through 301) nationally, regionally, and locally
- **Engage** – facilitate interaction amongst Task Force and Working Group members, including Public engagement, and tours of various facilities around the state
- **Enable** – Working Groups to make recommendations for Task Force consideration within final report to the Energy & Technology Committee
- **Environmental Justice** – Task Force and Working Groups must include voices from the EJ community to go from inform and consult to collaborate and empower.

Science and Justice: Inviting Expert Opinion



**Connecticut Roundtable
on Climate and Jobs**

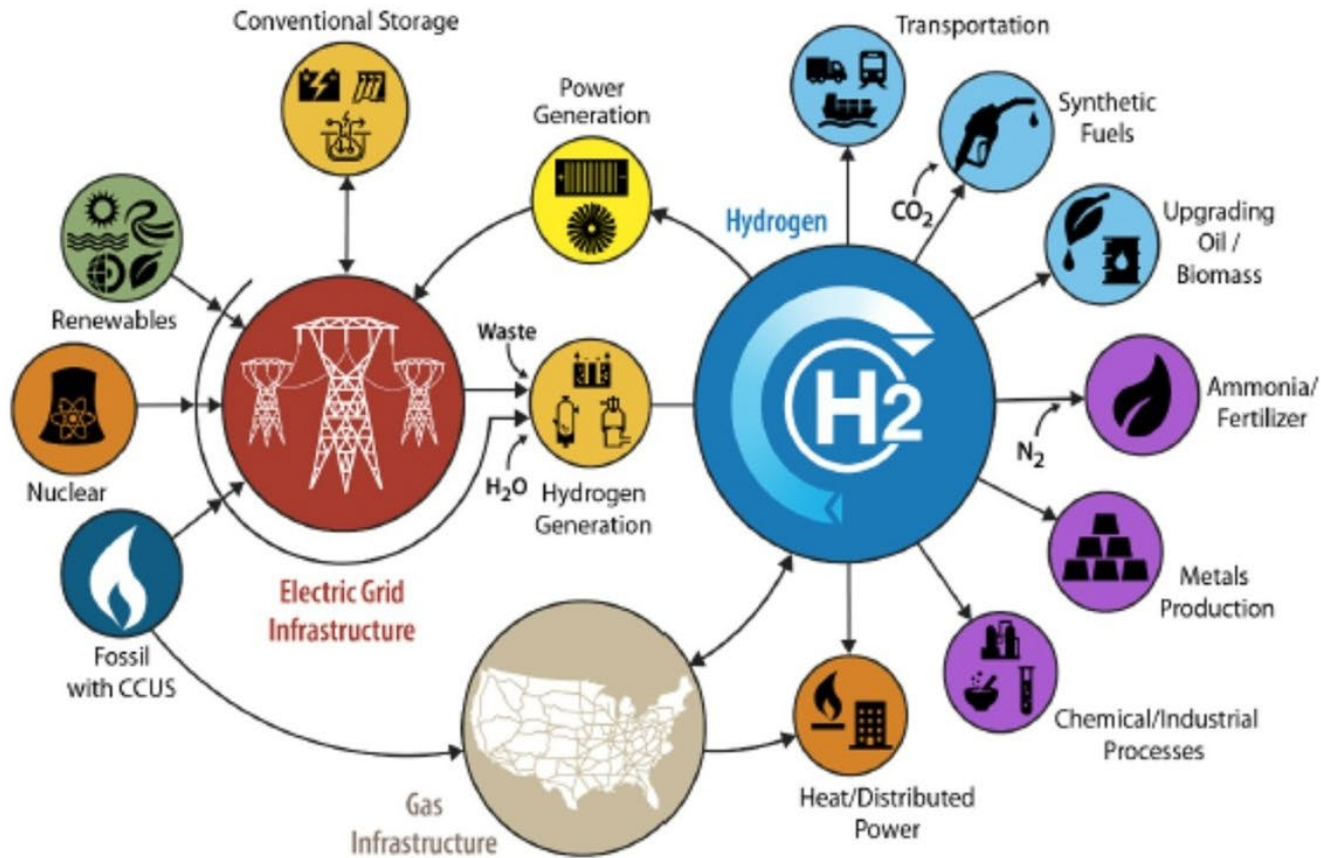
Hydrogen and Fuel Cells in Connecticut



About Hydrogen



Hydrogen has the ability to decarbonize multiple sectors



Source: U.S. DOE Hydrogen and Fuel Cell Technologies Office, <https://www.energy.gov/eere/fuelcells/h2scale>

Interest in clean hydrogen is skyrocketing



GM and Honda partner to mass produce hydrogen fuel cells in Michigan



Toyota is pushing ahead with hydrogen-powered cars
Doubling down on its bet that fuel cells will help secure Toyota's future as the industry comes under enormous pressure to slash carbon emissions



Air Products Plans \$5 Billion Green Fuel Plant in Saudi Arabia

Air Products signed an accord with Saudi-based ACWA Power International and the kingdom's planned futuristic city of Neom to develop a \$5 billion hydrogen-based ammonia plant powered by renewable energy



Coalition Aims for 25GW of Green Hydrogen by 2026
Seven firms join forces for fiftyfold scale-up of global hydrogen production capacity.



Vestas backs world's first commercial green ammonia plant

2000

2022



New hydrogen buses hit the road

Three buses powered by H₂ are to be introduced on routes in central London as part of a two-year trial



Hydrogen cars join EV models in showrooms



Fuel Cells Power Up: Three Surprising Places Where Hydrogen Energy Is Working

Hydrogen may not be fueling many cars, but it is delivering clean power for warehouses, data centers, and Telcom towers.



European nations plan to use more hydrogen for energy needs

Energy officials from 25 countries pledged Tuesday to increase research into hydrogen technology and accelerate its everyday use to power factories, drive cars and heat homes.



Initiative Seeks to Fuel Use of Green Hydrogen in West

The push to develop green hydrogen got a boost with the announcement of a new program to hasten its development for use in the Western Interconnection



Lancaster, CA Becomes the First Hydrogen City in the US



Utility of the Year

NextEra Energy is investing in green hydrogen, solar energy and grid resilience,

Hydrogen-powered flight

Is the time now ripe for planes to run on hydrogen?

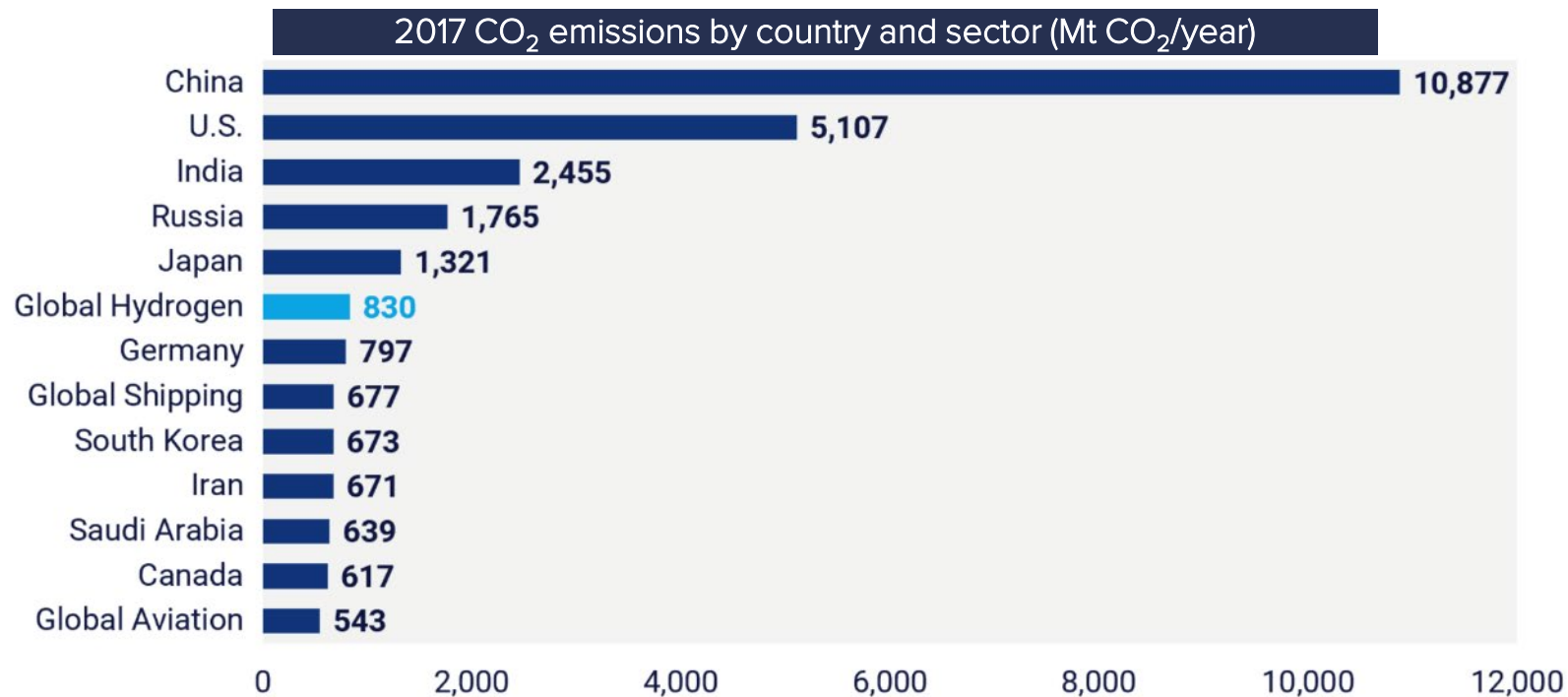
Enel teams up on US green hydrogen project



Hydrogen and fuel cells will future-proof shipping

Future Proof Shipping is taking a pioneering step by retrofitting a vessel to run on hydrogen fuel cell propulsion

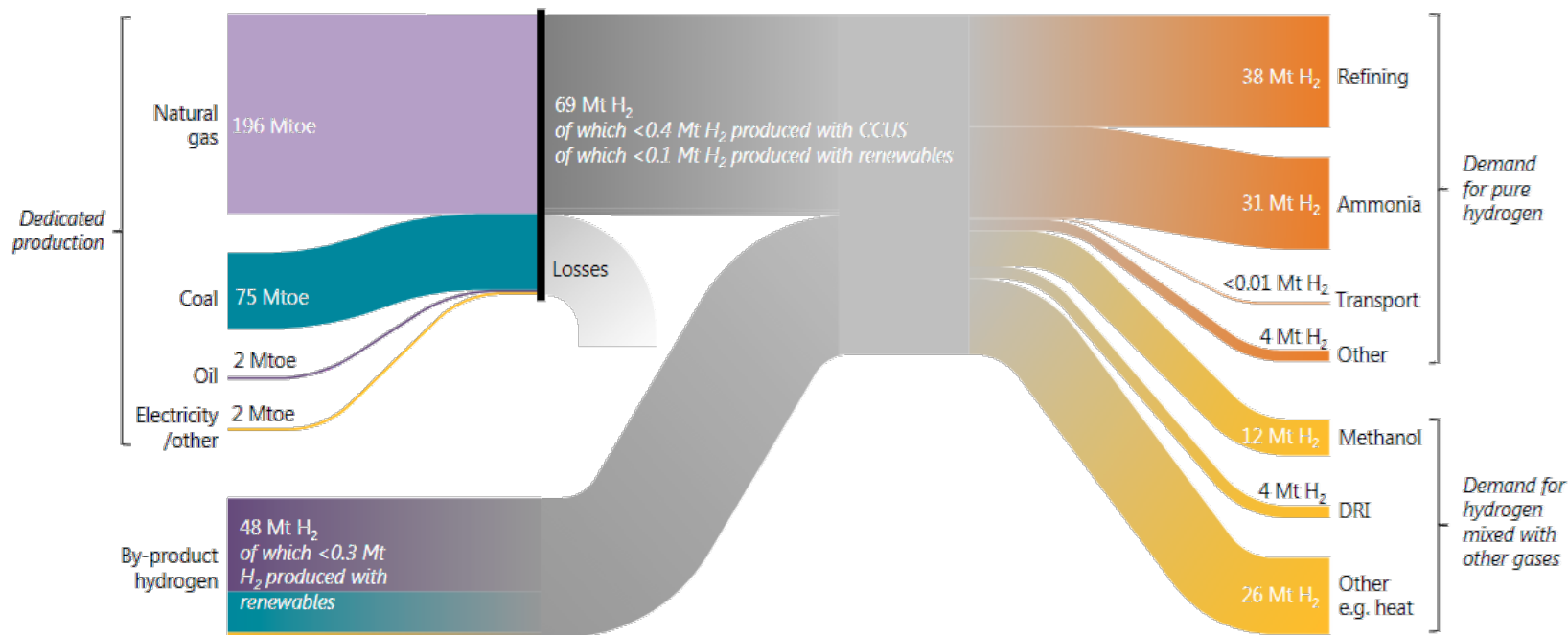
Today global (gray/brown) hydrogen production accounts for 832 Mt CO₂/year...more than the emissions of Germany



Source: Wood Mackenzie, 2019. "The Future of Green Hydrogen"

Clean or Green Hydrogen can decarbonize today's global hydrogen commodity markets

Today's Global Hydrogen Value Chains



Source: "The Future of Hydrogen: Seizing today's opportunities" report prepared by IEA for the G20, Japan.
Mtoe=million tons of oil equivalent. Mt=million tons

But today >99% of hydrogen is made from fossil fuels

The hydrogen supply chain is composed of four key elements



Production



Transportation



Storage



Offtake

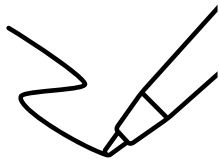
Task Force Public Engagement and Transparency



Robust stakeholder participation has helped to highlight areas of additional focus and research

Industry Participants	Environmental Participants	Labor Organizations
<ul style="list-style-type: none"> + How do proposed offtake areas align with industry activity and interest, and what can we do to support near-term hydrogen deployment opportunities? + What steps can we take to ensure an inclusive approach to supporting hydrogen industries? + How can we approach end use support and prioritization recognizing continued technology advancement and improvements? 	<ul style="list-style-type: none"> + How can we ensure that hydrogen production and usage is prioritized to address reduction of climate and local pollutants? + What steps can we take to ensure that hydrogen deployment does not unduly extend the life of fossil infrastructure? + What steps can be taken to continue to create transparency and visibility in hydrogen planning processes? 	<ul style="list-style-type: none"> + How will hydrogen market development impact the existing workforce? + What skills will workers need to contribute to the hydrogen economy? Are these transferrable from current jobs? + How can we provide support for a just transition for workers in the fossil fuel industry? What training programs may be appropriate?

There are multiple ways to get involved in the Hydrogen Task Force!



Written Comment Opportunity

The Hydrogen Task Force is offering a written comment opportunity for stakeholders to provide feedback.

Written comments are due on December 9th and can be emailed to cthydrogentaskforce@strategen.com



Upcoming Meetings

- + Task Force: Dec. 13, 10am-Noon
- + Funding WG: Dec. 15, 10:30-Noon
- + Policy & WF Dev WG: Dec. 15, Noon-1pm
- + Sources & Uses WG: Dec. 20, 1-2:30pm
- + Infrastructure WG: Dec. 19, 3-4pm



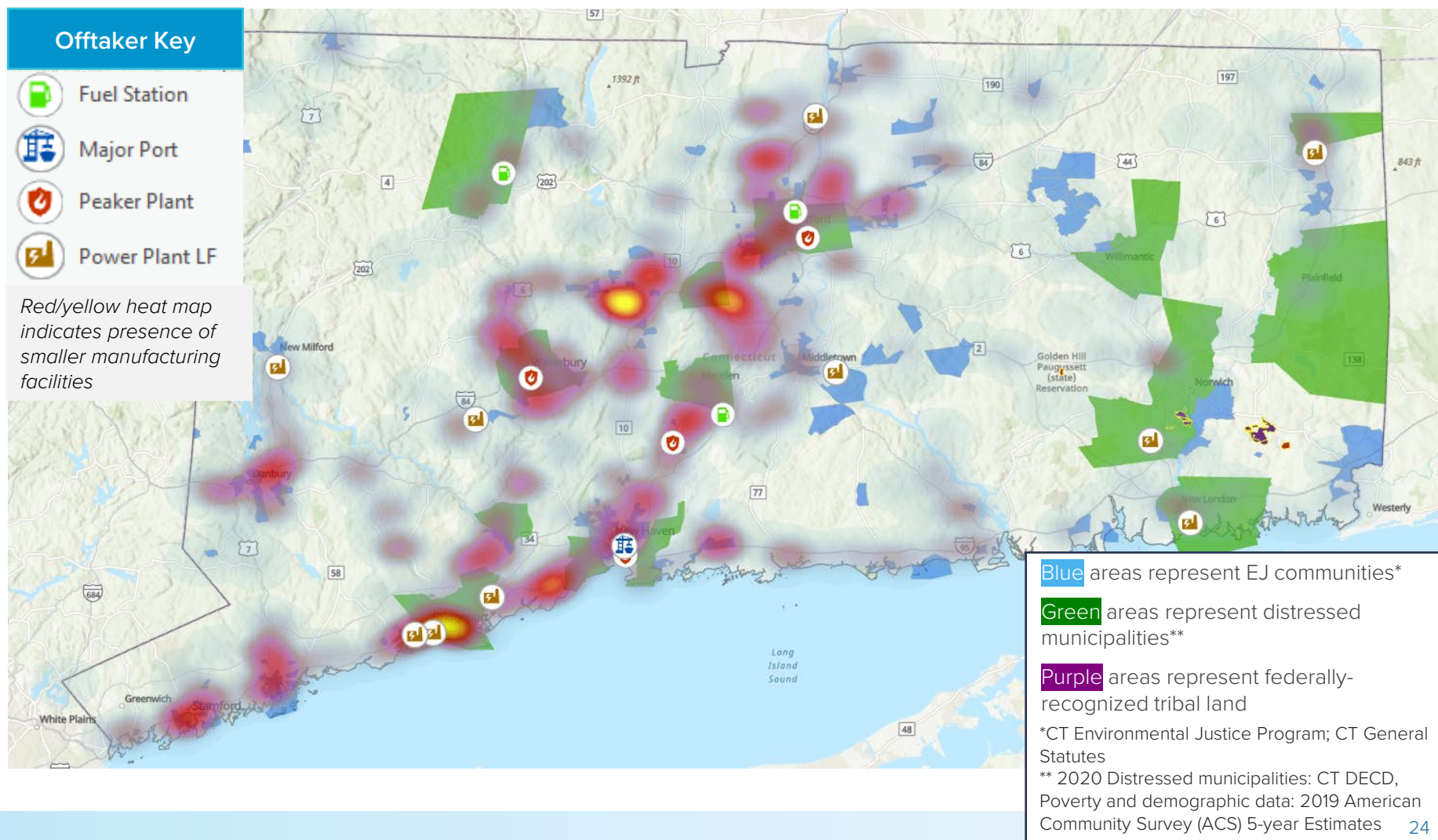
Review Materials

All Task Force and Working Group materials are publicly available on the Green Bank's Task Force [website](#). Meeting minutes are also translated into Spanish.

Summary of Key Findings and Next Steps

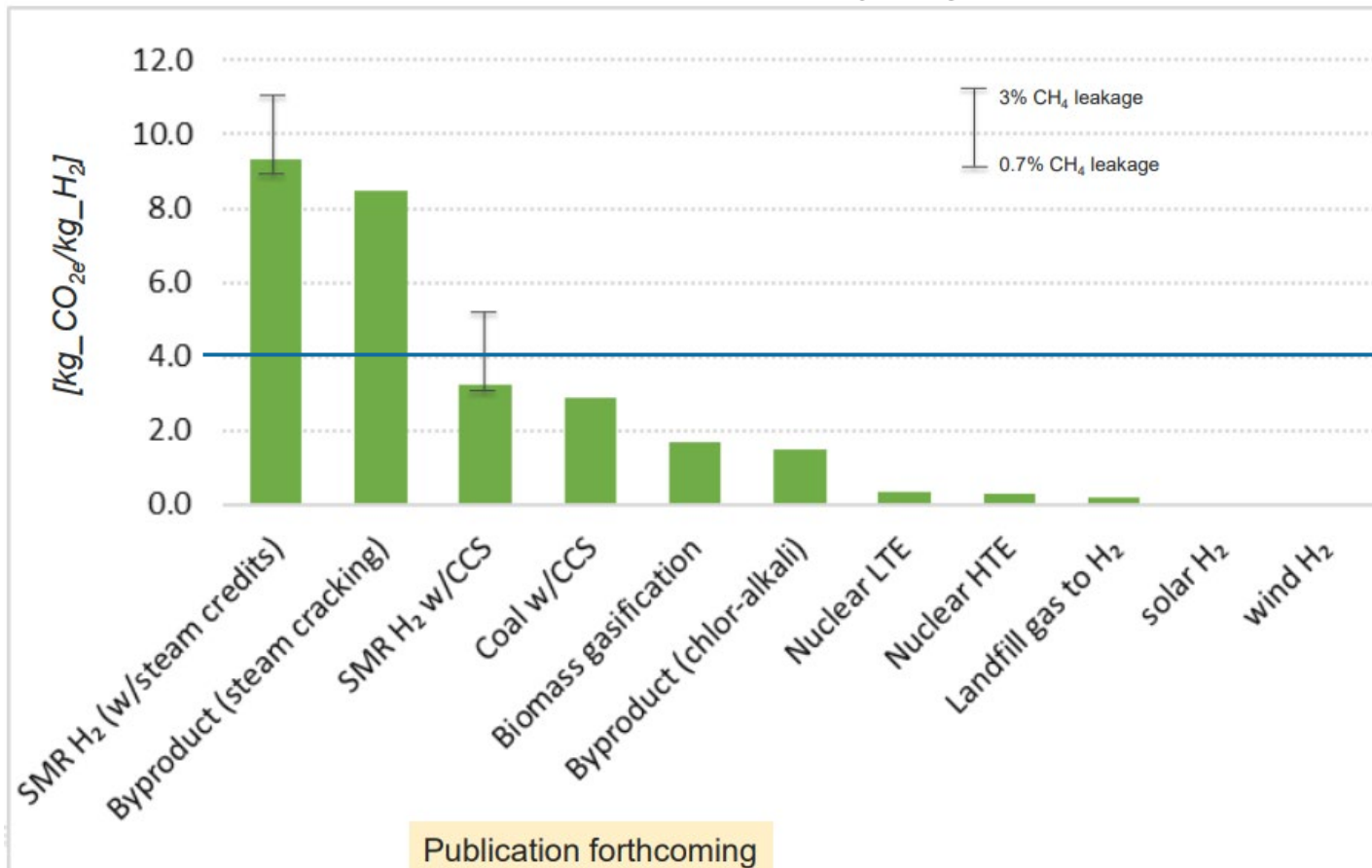


Low or zero-carbon hydrogen can provide an important tool to address economy-wide deep decarbonization and to address many issues related to energy equity, energy justice, and enabling a just and sustainable clean energy transition



Hydrogen can only achieve its promise as a decarbonization tool if the full lifecycle production of hydrogen produces de minimis GHG emissions

Well-to-Gate GHG Emissions of Hydrogen Production Pathways



Clean Hydrogen
Production
Standard limit

A high-level prioritization of opportunities will be helpful to ensure appropriate focus and attention

- + **State and regional efforts will have resource and time constraints impacting their engagement on hydrogen hub and other deployment activities**
 - + Funding, regulatory resources, convening opportunities, and stakeholder engagement support are all in high demand to facilitate regional hub activities
- + **The ability to identify areas of highest interest for near-term action will help to enable targeted engagement in priority areas**
 - + If we recommend too many actions or priorities, we may dilute meaningful action on tangible, high-value opportunities
- + **Lower prioritization should not be taken as a lack of opportunity! Hydrogen strategy and deployment will be a multi-year process, we just need to figure out where to get started today**

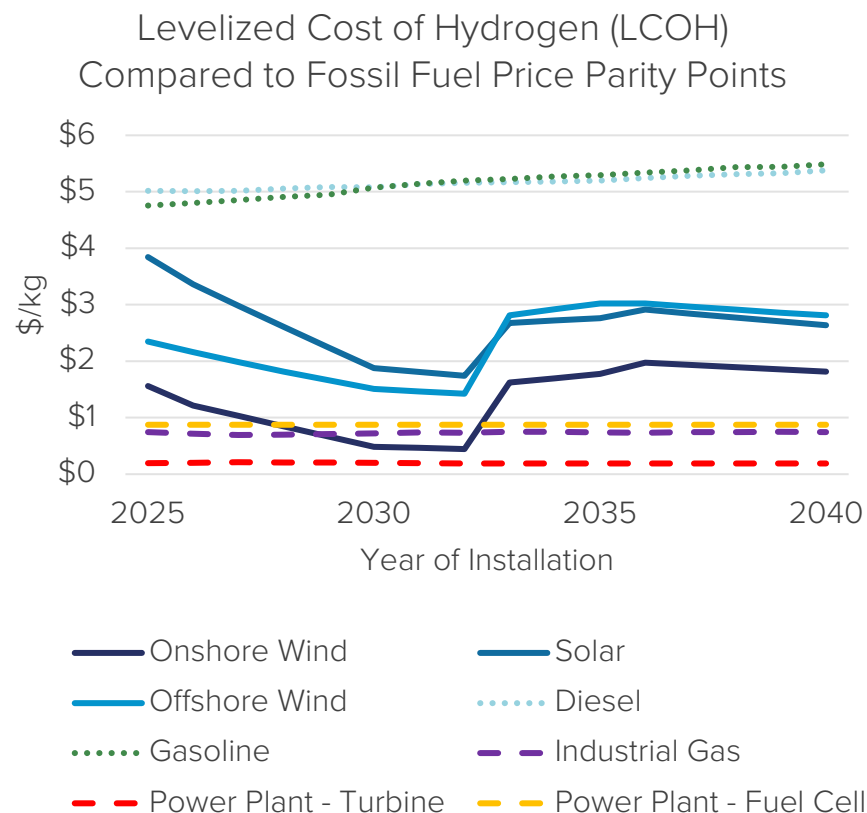
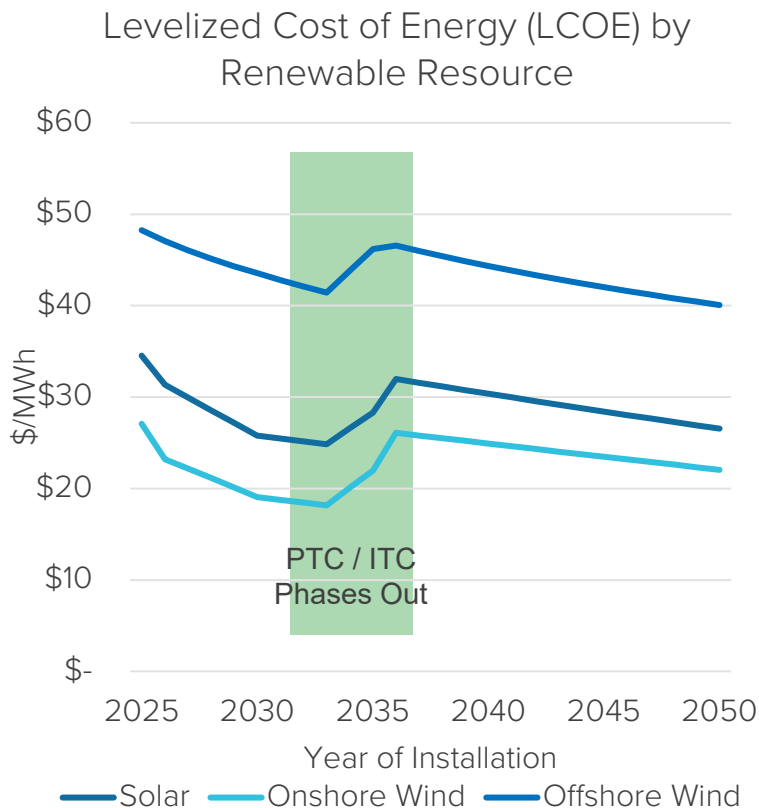
Accordingly, we are seeking to identify a set of highest priority opportunities that the funding and policy workgroups can further pursue. We are not seeking to prohibit or prevent progress on other use cases, but rather provide direction on where to prioritize effort and engagement

A large portion of the potential value from low or zero-carbon hydrogen is derived from its ability to provide a potential fuel that for many hard-to-abate end uses that have not yet decarbonized

Highest Priority for Additional Investigation	High Priority for Additional Investigation	Other Valuable Applications
<ul style="list-style-type: none"> + Focused on end uses that: <ul style="list-style-type: none"> + Are very likely to use hydrogen due to underlying economics + Create substantial societal benefits (e.g. GHG reduction, workforce development) + Proposed end uses include: <ul style="list-style-type: none"> + Critical facilities (24-hour backup need) + Aviation (long- and medium-haul) + Cargo ships + Material handling equipment with long uptimes and charging space constraints + Long-haul heavy duty trucks + Fuel cells for peak power generation + High heat industrial processes 	<ul style="list-style-type: none"> + Focused on end uses that: <ul style="list-style-type: none"> + Have a strong financial case for hydrogen use + Create societal benefit, but on a smaller scale due to size of industry + Proposed end uses include: <ul style="list-style-type: none"> + Long-distance buses + Ferries + Freight rail + Fleet vehicles with long uptimes and specific refueling locations + Heavy duty vehicles with charging constraints (e.g. drayage trucks, some commuter buses) + Hydrogen blending for non-core customer (i.e. power generation and industrial heat) 	<ul style="list-style-type: none"> + Focused on end uses that: <ul style="list-style-type: none"> + Can be kept “in view” as economics of hydrogen vs. alternatives develop + Could provide additional opportunities for market development + Proposed end uses include: <ul style="list-style-type: none"> + Hydrogen blending for core customers (e.g. commercial and residential) + Buses and other heavy-duty vehicles with shorter driving ranges and no charging constraints + Privately-owned light-duty vehicles + Low heat industrial processes + Short-haul aviation

A technical assessment considered a wide range of applications connected to the identified end uses (e.g. commuter rail, short-range harbor craft, forklifts with shorter uptimes) but research suggested that these end uses present stronger cases for electrifications due to economics and technological development.

Preliminary analysis provides insights into hydrogen's cost-competitiveness against fossil fuels



Solid lines show cost of hydrogen produced from different feedstocks for projects. Dashed lines show required H2 price to be competitive with equivalent fossil fuel by energy content. Hydrogen costs represent LCOH at point of production and excludes additional costs from transportation or delivery infrastructure.

Significant federal funding is available to support the growth of a hydrogen economy

Bipartisan Infrastructure, Investment and Jobs Act of 2021

- \$8B for regional clean H2 hubs
- \$1B for electrolysis research, dev, and demonstration
- \$0.5B for clean hydrogen technology manufacturing and recycling RD&D
- \$13.2 billion for air quality improvement
- \$5.6 billion for low or no emissions buses
- \$2.5 billion for charging and fueling infrastructure
- \$500 million to decarbonize the industrial sector
- \$250 million for low or zero emissions ferries

Inflation Reduction Act of 2022

- 10-year production tax credit based on the kilograms (kg) of qualifying hydrogen produced at a facility that begins construction prior to January 1, 2033.
 - provides up to \$3.00 per kg of H2 produced at a given facility, based on the carbon intensity of production
- Billions in additional funding for clean hydrogen applications, such as:
 - \$3bn for pollution reduction at ports
 - \$1bn for clean heavy-duty vehicles
 - \$5.8bn for industrial decarbonization tech

Connecticut is well positioned to capitalize on hydrogen-related federal funding

- + Participation in a well-coordinated and structured hub effort via the Northeast Regional Hub.
- + Presence of a robust and nation-leading fuel cell industry.
- + Demonstrated history supporting community engagement, particularly from disadvantaged communities (e.g. SB 999), which is required under the Biden Administration’s “Justice40” Initiative.
- + Location along significant transit corridors positions Connecticut to focus on decarbonization of goods and people movement along the east coast.

We will discuss recommendations based on these findings at the upcoming Task Force meeting on December 13th from 10am-Noon

Task Force meeting information:

Dial-In

(949) 346-4134

Access Code: 781 548 359#

Teams

[Click here to join the meeting](#)

Meeting ID: 276 913 467 857

Passcode: QgeLuG

For access to Task Force or Working Group materials, visit:

www.ctgreenbank.com/hydrogentaskforce

Public Comments



Green Bonds US



Thank You

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