



CALIFORNIA HYDROGEN
BUSINESS COUNCIL

CHBC Hydrogen and Fuel Cells On-Road Freight Webinar

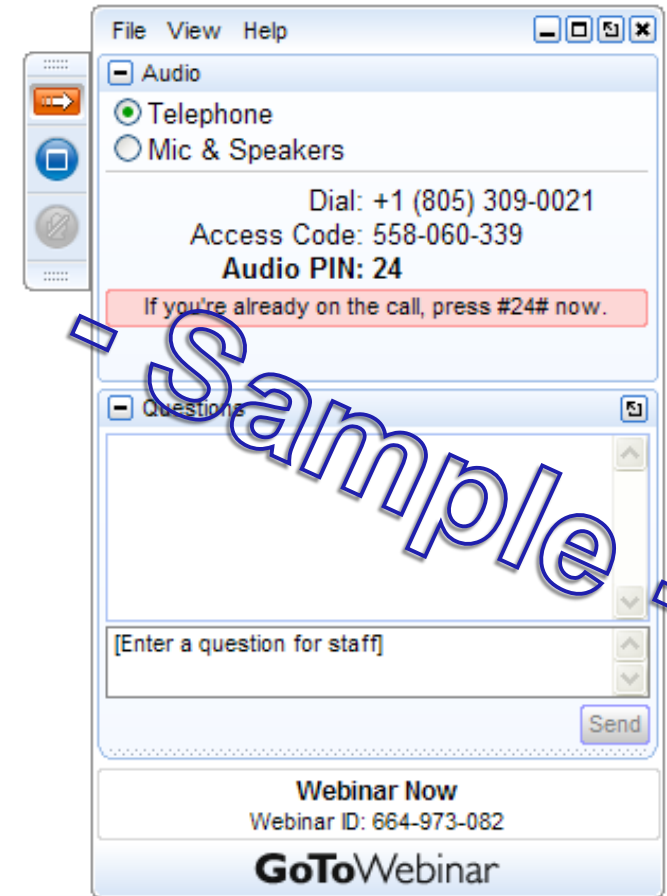
Update on the Freight Workshop Report

July 18, 2018



Quick Notes

- Two Audio Options: Streaming Audio and Dial-In.
- Streaming Audio/Computer Speakers (Default)
- Dial-In: Use the Audio Panel (right side of screen) to see dial-in instructions. Call-in separately from your telephone.
- Ask questions using the Questions Panel on the right side of your screen.
- The recording of the webinar and the slides will be available after the event. Registrants will be notified by email.





Webinar Agenda and Speakers

- Welcome – **Emanuel Wagner, CHBC**
- Overview of Workshop and Report Highlights – **Cory Shumaker, CHBC**
- Update on ZECT II FCETs in Operation – **Tony Williamson, TTSI**
- Pathway to Commercialization, Financing Hydrogen Infrastructure – **Andrew Bermingham, Hydrogen Partners, LLC**
- Discussion/Q&A



CALIFORNIA HYDROGEN
BUSINESS COUNCIL

Welcome and Overview



Emanuel Wagner

Deputy Director

California Hydrogen Business Council



Purpose and Activities

■ CHBC Overview

- The California Hydrogen Business Council (CHBC) is comprised of over 100 companies, agencies and individuals involved in the business of hydrogen. Our mission is to advance the commercialization of hydrogen in the energy sector, including transportation, goods movement, and stationary power systems to reduce emissions and dependence on oil in California.

■ CHBC Activities

- Advocacy
- Communications & Business Expansion
- Goods Movement, Heavy-Duty Transportation, and Clean Ports
- Hydrogen Energy Storage and Renewable Hydrogen
- Public Transport
- Infrastructure & Vehicle Deployment



MEMBER ORGANIZATIONS

Platinum



Gold



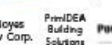
Silver



energy independence now



Innovators



Affiliates



Our Members Include:

- Hydrogen producers and distributors
- Automotive companies
- Public transit systems and suppliers
- Fuel cell, electrolyzer, compressor and storage manufacturers
- Fueling station developers
- Engineers and consultants
- Municipal, state and federal agencies
- Component suppliers



CHBC Signature Events

- Fuel Cell Electric Bus Lunch Workshop at Zero Emission Bus Conference at LA Metro, September 11, in Los Angeles, CA
- Decarbonizing Energy Sector with Hydrogen at Global Climate Action Summit, September 13, San Francisco, CA
- Hydrogen and Fuel Cells North America at Solar Power International September 24-27, Anaheim, CA
- Hydrogen and Fuel Cells in Ports & Shipping Workshop October 8-9, Los Angeles, CA
- Role of Renewable Hydrogen in Decarbonizing the Grid Workshop at Energy Storage North America, November 6, Anaheim, CA
- California Hydrogen and Fuel Cell Summit, November 14-15, Sacramento, CA

Overview of Workshop and Report Highlights



Cory Shumaker
Development Specialist
California Hydrogen Business Council



CALIFORNIA HYDROGEN BUSINESS COUNCIL

Hydrogen and Fuel Cell On-Road Freight Workshop

APRIL 30, 2018 | LONG BEACH, CA

Co-located with
Advanced Clean Transportation Expo

ACTEXPO

- Over 120 attendees
- Purpose:
 - Build awareness of hydrogen fuel cell freight
 - Hear from stakeholders on the ability of hydrogen and fuel cell technologies to meet zero emission objectives,
 - Address the technical and non-technical challenges with transitioning to hydrogen powered fleets, and
 - Understand the fundamental economic and operational benefit drivers as well as government funding programs

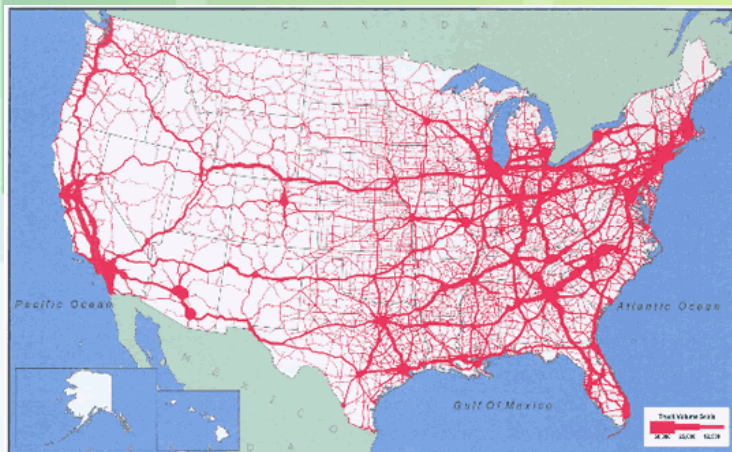




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San Pedro Bay Ports Los Angeles & Long Beach

- Account for nearly half of all goods imported into the US
- POLB: 27 terminals; POLA: 22 terminals
- Total twenty-foot container units (TEU) throughput in 2017:
 - POLB: 7,544,507
 - POLA: 9,343,192

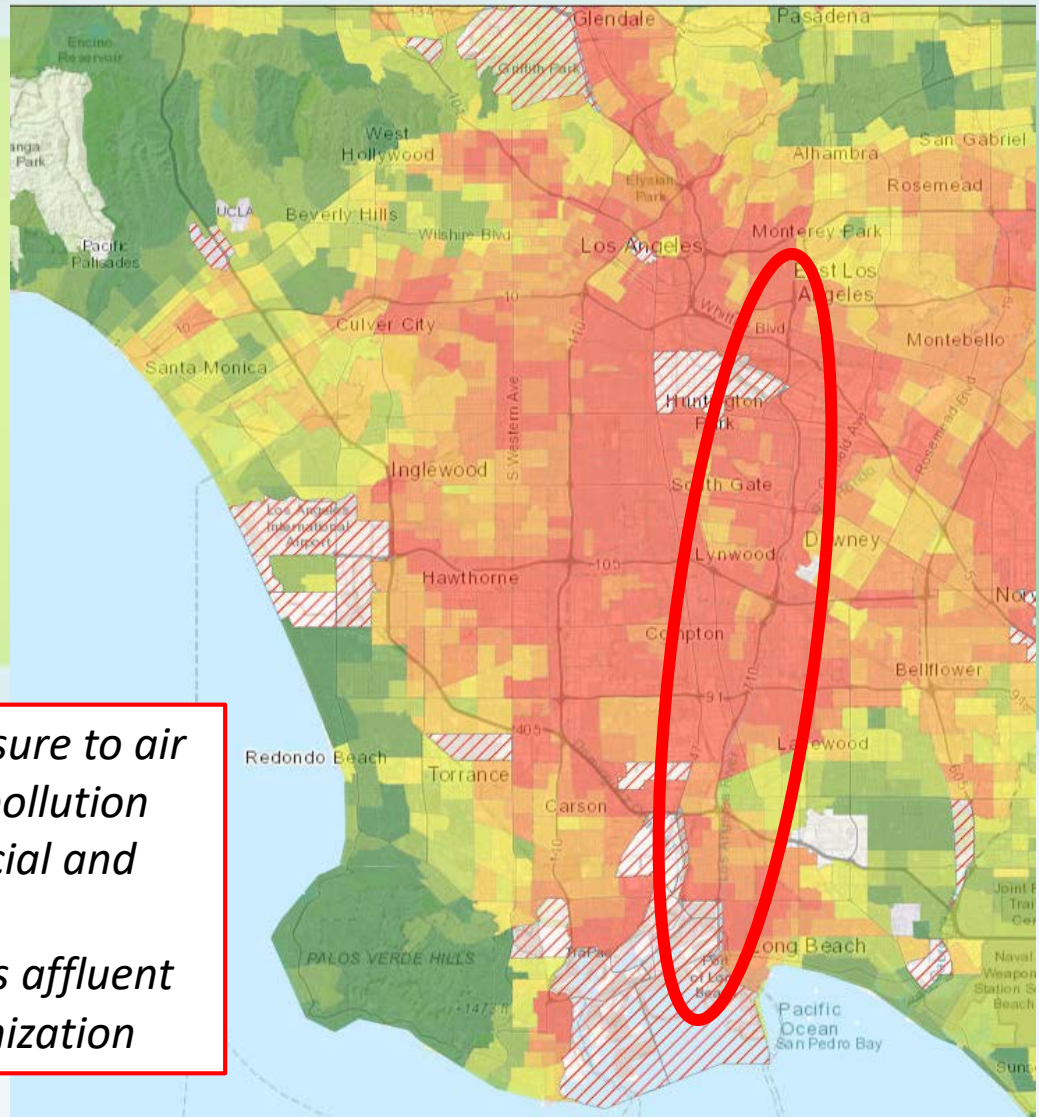




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South Coast Air Basin I-710 Corridor – A Need for Action

- Need to bring goods from port to railhead
- Dangerous PM2.5 & NOx emissions
- Disadvantaged communities disproportionately penalized for commerce
- Great opportunity for fuel cell trucks



“There is significant inequality in exposure to air pollution and related health risks: air pollution combines with other aspects of the social and physical environment to create a disproportionate disease burden in less affluent parts of society” – World Health Organization



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EPA West Coast Collaborative Public Fleet & Trucking Sector

- Public-private partnership with 1,000 partners from western region
- Objective is to create forecast of infrastructure required to meet hydrogen demand for heavy duty vehicles through industry survey
- CHBC created a working group with monthly calls
- To join the West Coast Collaborative in its efforts, interested parties can sign-up at <http://westcoastcollaborative.org> and contact Cory



WEST COAST COLLABORATIVE

A public-private partnership to reduce diesel emissions



User and Operator Perspectives

- UPS has a long history of electric and alternative fueled vehicles spending over \$750 million in development since 2009
 - UPS is looking at building hydrogen stations at their locations across the U.S.; Focused on CA at the moment with Class 6 delivery vans
- TTSI to test eight Class 8 FCETs
- The industry needs to create a long-term vision for hydrogen, across all sectors, focused on making it renewable as much as possible





Truck OEM Perspective

- OEMs need a sustainable business case to invest the amount of time and money required for commercialization of FCETs (TRL 9)
- Peterbilt is interested in hydrogen powered FCETs because of hydrogen's high energy density
 - Hydrogen is 39kWh/kg compared to .693kWh/kg for battery
- Peterbilt and TransPower collaborating on Class 8 FCET
 - 60kW Loop Energy fuel cell
- Future of fleets will be a variety of technologies
- Kenworth FCET being tested in Seattle; roadworthiness last hurdle
- Challenges for FCETs are multiple cooling loops, thick gage electrical cable, placement of components, and communication
- Toyota Project Portal completed 8,200 miles; goal is to reduce cost of hydrogen to \$0.60/mi





Technology Developer Perspectives

- Fuel cells provide constant power generation
- FCET is up to 6 tons lighter than a battery electric truck, has long-range operation, no roadside charging, fast refueling, and high asset utilization with low downtimes
- FCETs can be utilized in double and triple shifts for commercial use
- Fuel cells are a combustion-less engine with better per joule energy performance than a diesel engine
- TransPower's FCET has a total weight of 20,500lbs, performing testing in San Diego hauling raw materials to car parts facility
- Goal is to get the cost of hydrogen on parity with diesel





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Vehicles

Zero Emission Cargo Transport II



HYDROGENICS
SHIFT POWER | ENERGIZE YOUR WORLD



Heavy-Duty Hydrogen Refueling

- Challenges for heavy duty hydrogen fueling are cost, supply chain, CEQA permits, capacity limitations and fueling protocols
- Stranded renewables and utilization of power-to-gas need to be more in focus to cleanly meet future hydrogen demand
- Hydrogenics has developed a containerized solution using electrolyzers with a capacity of 1,000 kg/day. This is a project with StratosFuel using wind power in the desert of Southern California
- Electrolyzer costs are dropping rapidly and becoming competitive with SMR of natural gas on a large scale; \$6/kg hydrogen possible
- A centralized hydrogen production facility producing hydrogen in cheaper areas is a way to get hydrogen cost down from \$16/kg
- FuelCell Energy has a 1.4MW tri-generation plant going into POLB to support Toyota's Project Portal using biogas to produce 1,270kg



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California State Funding Programs

- California Air Resources Board (CARB) is creating a balanced set of investments in zero and near-zero emission solutions
- Funding programs focused on heavy duty are:
 - Low Carbon Transportation
 - Carl Moyer
 - Community Air Protection
 - First year of funding at \$250 million
 - Volkswagen Mitigation Trust
 - Hybrid & Zero Emission Truck and Bus Voucher Incentive Project (HVIP)
 - \$300,000 for fuel cell buses & trucks; \$100,000 per vehicle for infrastructure (minimum 5 vehicles per site)



CALIFORNIA
AIR RESOURCES BOARD



Conclusions

- The State of California is committed to making a concerted effort to reduce emissions and improve the air quality for all
- Fuel cells, powered by hydrogen, is emerging as one of the best possible options to replace diesel in heavy duty applications due to its longer range, quick refueling time, and ability to handle high duty demand cycles
- OEMs, industry, and government will need to continue to invest in hydrogen fuel cell technology to reach commercialization and bring down costs of components and fuel
- Takeaways for industry: be lean, creative, and hungry





Next Steps/Activities

- Workshop Report – Completed; Available online
- Summary of Workshop Report Webinar
- **Hydrogen and Fuel Cells in the Ports Workshop – October 9-10th 2018, Banning's Landing Community Center, Los Angeles, CA**



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Update on ZECT II FCETs in Operation



Tony Williamson

Director, Compliance & Sustainability

TTSI



CA Hydrogen Business Council Presentation



Hydrogen Fuel Cell Trucks in Use

150 Mile Range @ 442hp



130 Mile Range @ 560hp



200 Mile Range @ 429hp





Drive/Duty Cycle of Hydrogen Fuel Cell Electric Trucks: Drayage Application

■ Drive Cycle - How we will use the vehicles

□ Vehicle speed against time

- Operational Goal to get as many dray moves/turns in an 8 Hour Shift
- Power to move loads efficiently
 - Grade
 - Container Weight

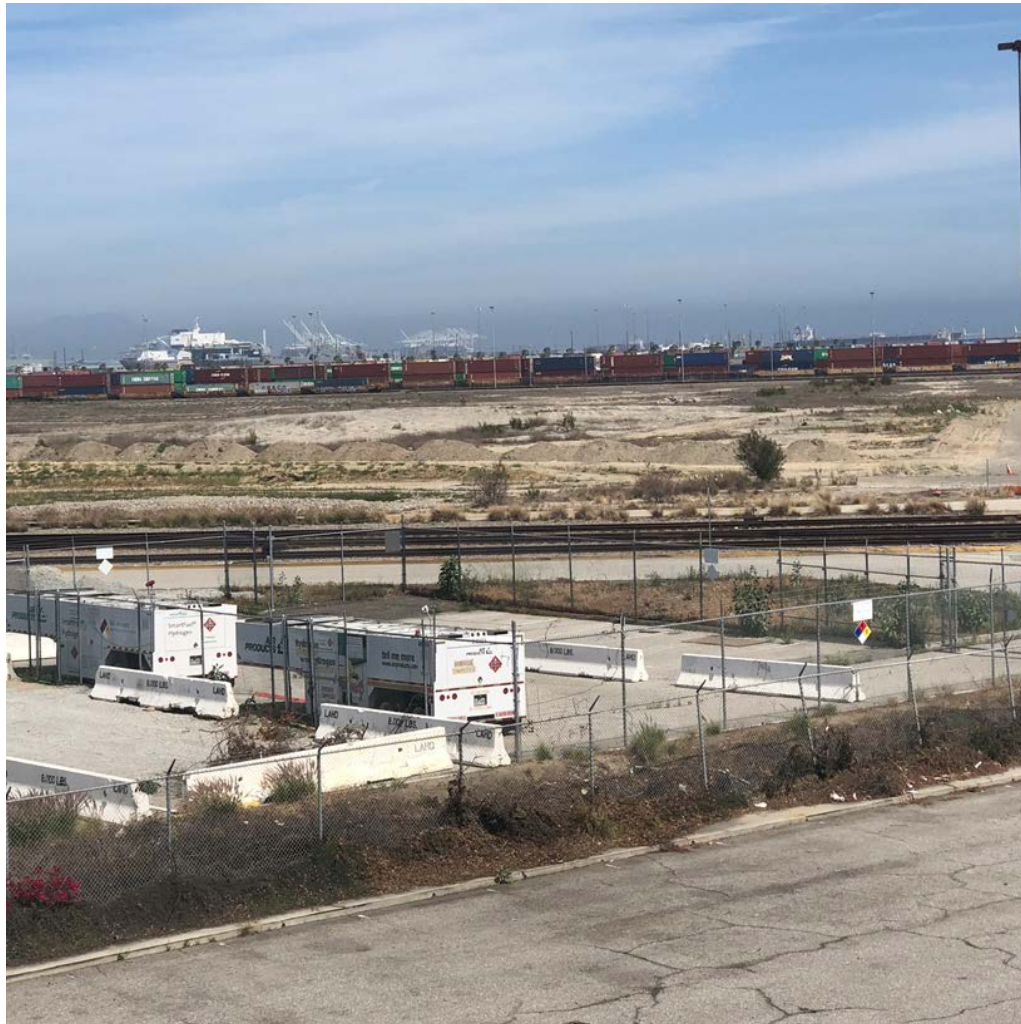
■ Duty Cycle - How much we will use the vehicles

□ Vehicle Usage

- Dependability
- Fueling infrastructure Availability
- Distance – How far can I operate from fuel source
- Number of trips performed before fueling required



Hydrogen Fueling Station



Hydrogen Fueling Equipment

The HF-150 Hydrogen Fueler is a self contained, 5,076 psig (350 bar) hydrogen fueling station that holds 150 kg (63,450 SCF) of compressed, gaseous hydrogen [not liquid, cryogenic hydrogen]. The trailer is pulled by a tractor, parked and left in a secure location until it needs to be refilled, at which point it is taken to an Air Products facility for refilling.

When the trailer is parked in position, a parking brake is applied, the landing gear is lowered, and the wheels are chocked to secure the trailer in its place. The HF-150 requires no utilities and only needs to be connected to a grounding rod at the site.



**For more information on TTSI, please
visit our website at: www.tts-i.com**

Thank You





CALIFORNIA HYDROGEN
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Pathway to Commercialization Financing Hydrogen Infrastructure



Andrew Bermingham

CEO

Hydrogen Partners, LLC



California Hydrogen Business Council

Freight Webinar - July 18, 2018

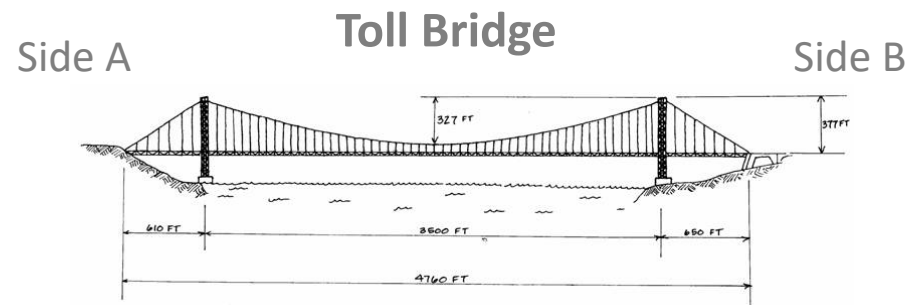
Andrew W. Bermingham

General Partner, Hydrogen Partners LLC

THREE CRITICAL INVESTMENT TOOLS FOR HYDROGEN INFRASTRUCTURE

1. **PROJECT FINANCE**: Maximize use of Debt and Equity
2. **US. FEDERAL OPPORTUNITY ZONES**: ~\$6 Trillion in unrealized U.S. capital gains now has a place to go in every state & territory
3. **U.S. LOAN GUARANTEE PROGRAMS**: Critical to lower your cost of debt, support existing or potential debtor relationships
4. **Moving forward**

1) Project Finance



SUPPLY SIDE

- Wind
- Solar
- Hydro
- Ag Waste
- Natural Gas
- Coal
- Nuclear
- Biofuels
- Municip Waste

Feedstock
Supply
Contracts

PROJECT FINANCE

\$30 Million

Debt 80%

\$24 Million

Interest Rate:
8%

Equity 20%

\$6 Million

Projected IRR:
20%

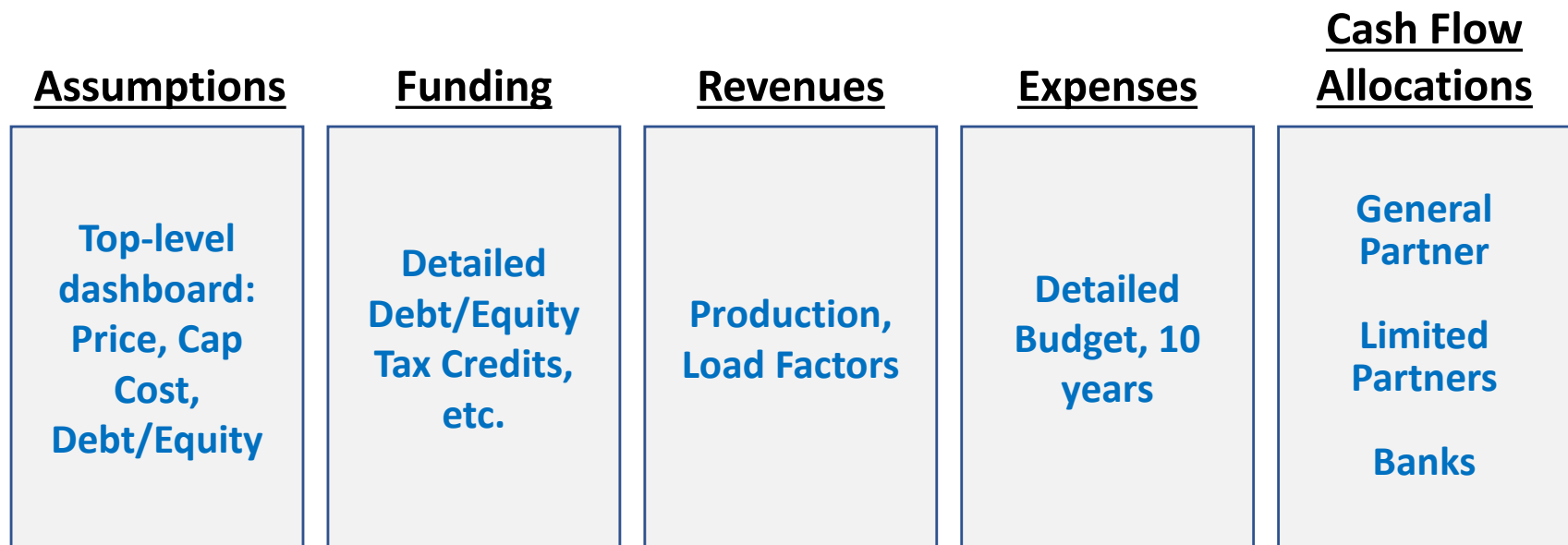
Hydrogen
Offtake
Contracts

DEMAND SIDE

- Fleets
- Materials Handling
- Fueling Stations
- Cars, SUVs, Trucks
- Class 8 Trucks
- Municipalities
- Storage
- Power to Gas
- Merchant/ Industr
- Military

1) Project Finance

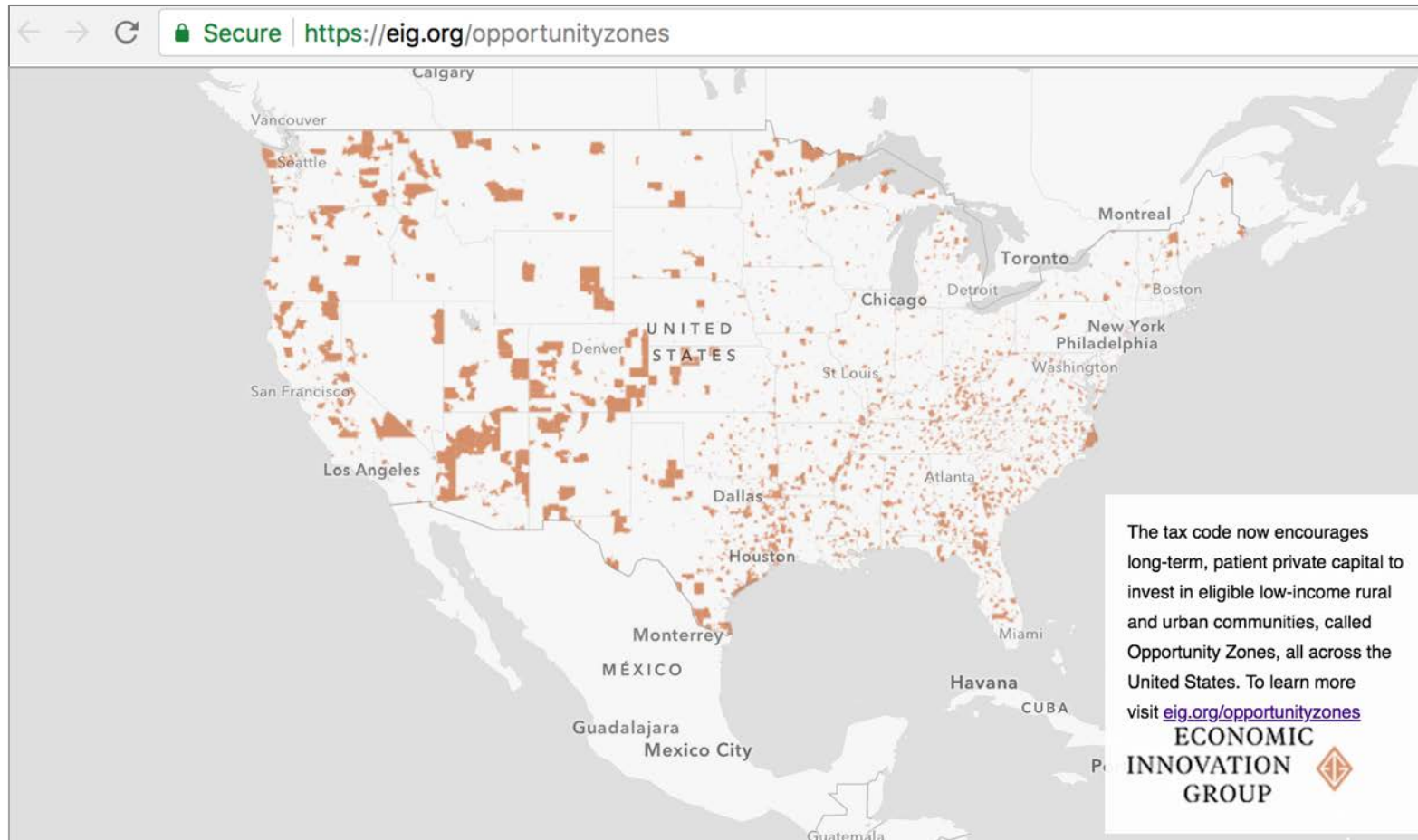
Detailed Financial Models:



2) U.S. Federal Opportunity Zones

- 1) Created in 2016 Tax Bill
- 2) Potential to unlock over \$6 Trillion in unrealized capital gains from stocks and mutual funds by reinvesting capital gains into “**Opportunity Funds**,” which then invest into low-income census tract areas called “**Opportunity Zones**.”
- 3) All 50 States, District of Columbia, and all U.S. Territories

2) U.S. Federal Opportunity Zones



Opportunity Zones 101



Beginnings

ORIGINS

Bipartisan group of legislators introduced the Investments in Opportunity Act (IIOA) in the 114th, 115th Congresses.

BECAME LAW

Provisions of IIOA were part of the tax reform legislation signed into law by President Donald Trump Dec. 22, 2017.



Definitions

OPPORTUNITY ZONES

25 percent of each state's low-income community population census tracts can be designated as qualified Opportunity Zones, which have the same definition as "low-income community" under the New Markets Tax Credit program.

OPPORTUNITY FUNDS

Funds that are invested in qualified Opportunity Zones. The Funds must be certified by the Treasury Department and invest at least 90 percent of their assets in Opportunity Zone businesses and/or property.



Benefits

BASICS

Investors can defer taxes on gains if they invest in Opportunity Funds within six months of realizing the gain.

DEFERRAL DEADLINE

Earlier of Dec. 31, 2026 or when the investment in the fund is sold or exchanged.

BONUS

Investments in Opportunity Funds for at least five years get a 10 percent increase in tax basis of original gain. Investments for at least seven years get a 15 percent increase in the tax basis of the original gain. Investments held for at least 10 years are exempt from any additional gains beyond that which was previously deferred.



Details

WHERE

Opportunity Zones will be in all U.S. states, territories and Washington, D.C.

SMALL STATES

In states with fewer than 100 Opportunity Zones exist in a state, the governor may add as many as 25.

POPULATION

About 30 million Americans, roughly 10 percent of the nation's population, live in Opportunity Zones.

UPCOMING DEADLINES

Governors must identify Opportunity Zones by March 22. Treasury Secretary has 30 days to certify them.

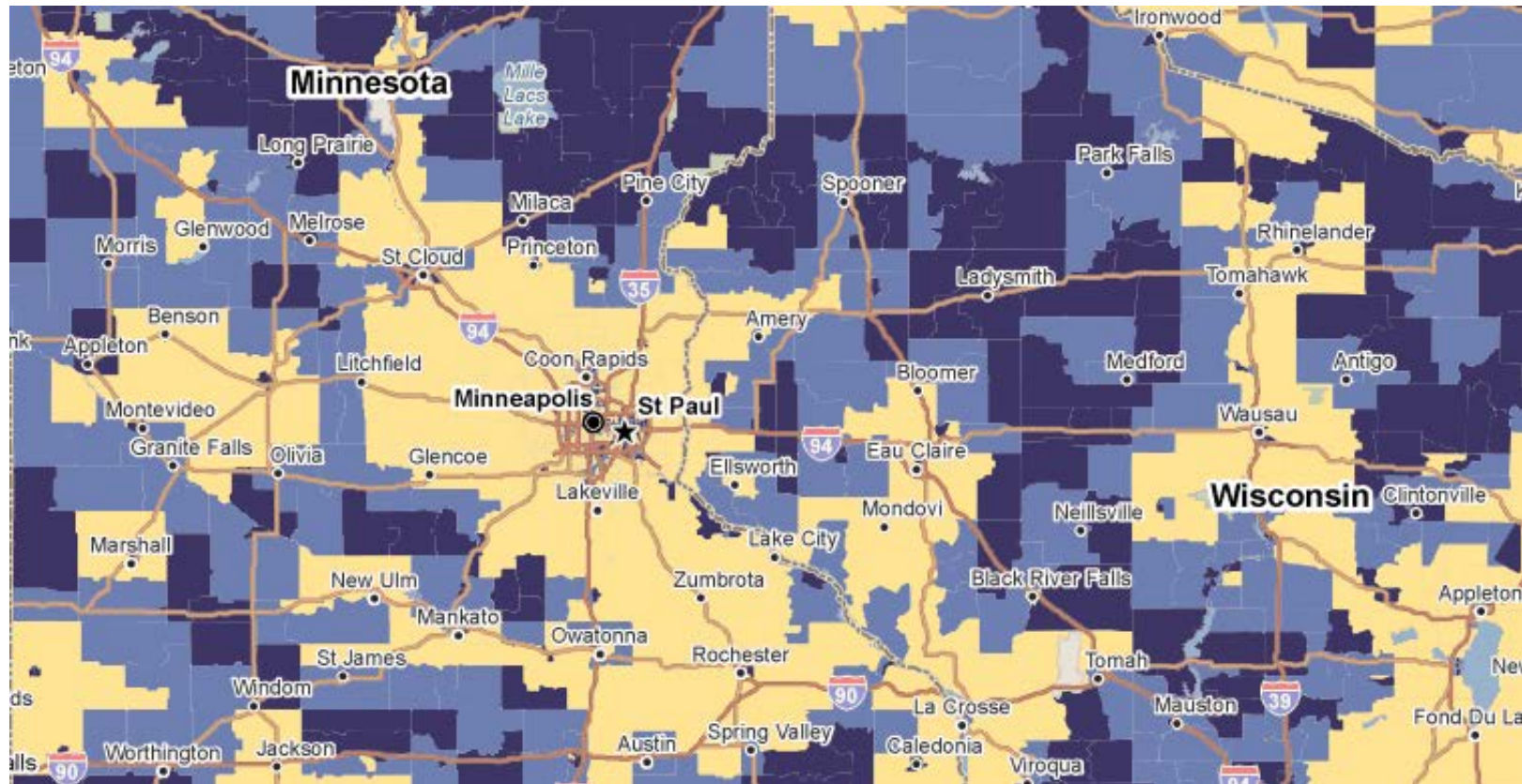


More Info

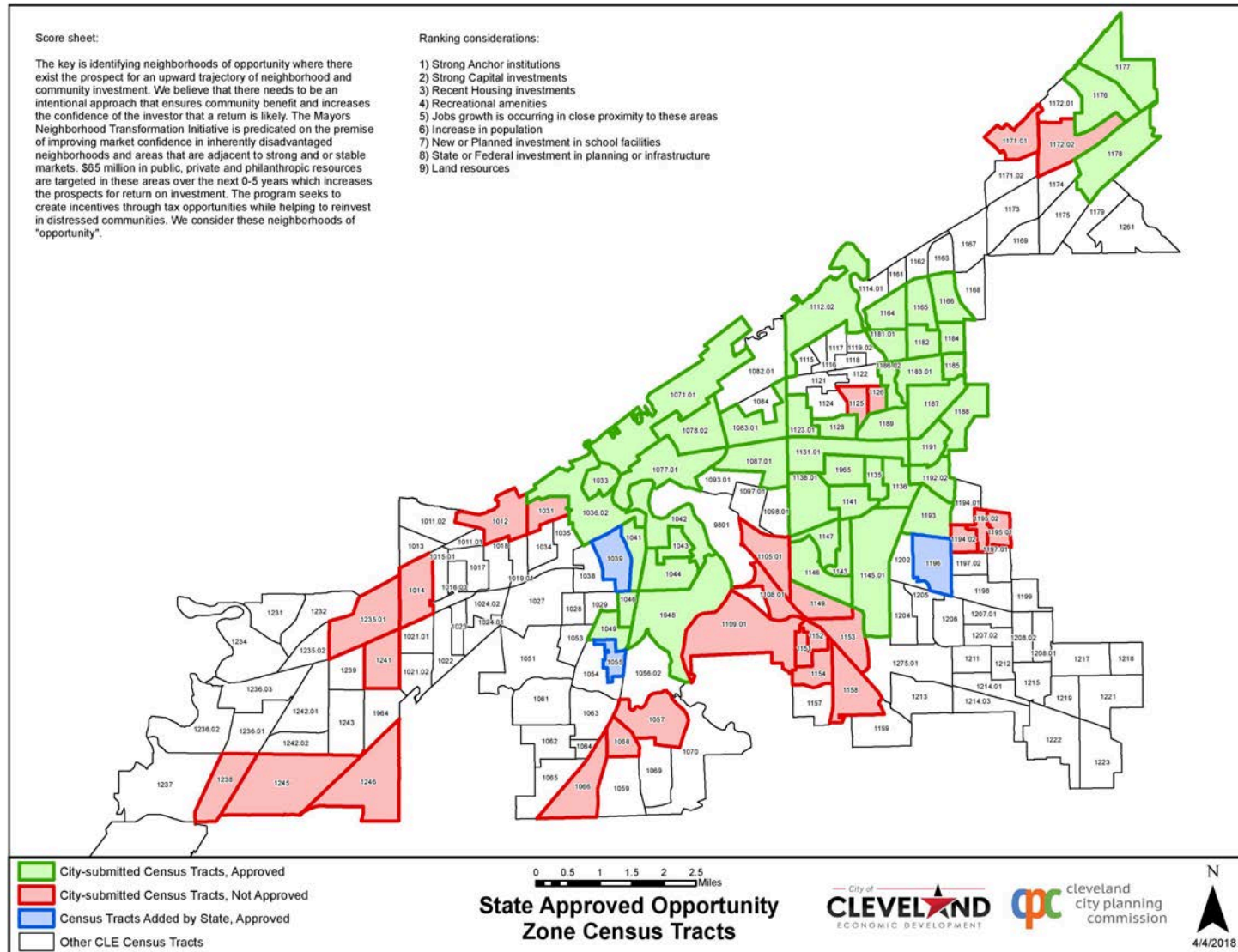
WEBSITE ADDRESS

For more information, updates, go to our Opportunity Zone Resource Center www.opportunityzoneresourcecenter.com

2) U.S. Federal Opportunity Zones




2) U.S. Federal Opportunity Zones



2) U.S. Federal Opportunity Zones

← → ↻ **Secure** <https://www.irs.gov/pub/irs-irbs/irb18-28.pdf> ☆

INTERNAL REVENUE BULLETIN



HIGHLIGHTS OF THIS ISSUE

These synopses are intended only as aids to the reader in identifying the subject matter covered. They may not be relied upon as authoritative interpretations.

ADMINISTRATIVE

Bulletin No. 2018-28 July 9, 2018

Notice 2018-28
This notice is being published in the Internal Revenue Bulletin for the week of July 9, 2018, and will be published in the Federal Register on July 16, 2018.

Notice 2018-29
This notice is being published in the Internal Revenue Bulletin for the week of July 9, 2018, and will be published in the Federal Register on July 16, 2018.

California	San Diego	06075019505	Low-Income Community	2011-2015
California	San Diego	06075020214	Low-Income Community	2011-2015
California	San Francisco	06075017902	Low-Income Community	2011-2015
California	San Francisco	06075023103	Low-Income Community	2011-2015
California	San Francisco	06075023400	Low-Income Community	2011-2015
California	San Francisco	06075026001	Low-Income Community	2011-2015
California	San Francisco	06075026004	Low-Income Community	2011-2015
California	San Francisco	06075026100	Low-Income Community	2011-2015
California	San Francisco	06075026301	Low-Income Community	2011-2015
California	San Francisco	06075026404	Low-Income Community	2011-2015
California	San Francisco	06075060502	Low-Income Community	2011-2015
California	San Francisco	06075061200	Low-Income Community	2011-2015
California	San Francisco	06075980600	Low-Income Community	2011-2015
California	San Joaquin	06077000100	Low-Income Community	2011-2015
California	San Joaquin	06077000300	Low-Income Community	2011-2015

pealed; (2) the ruling position is specifically covered by a statute, regulation, or subsequent published position; or (3) the position is not sufficiently described in the current statute and regulations. The notice also contains revenue rulings that address the application of section 3121(b)(8)(B) of the Internal Revenue Code, which provided for the treatment of contributions Act for

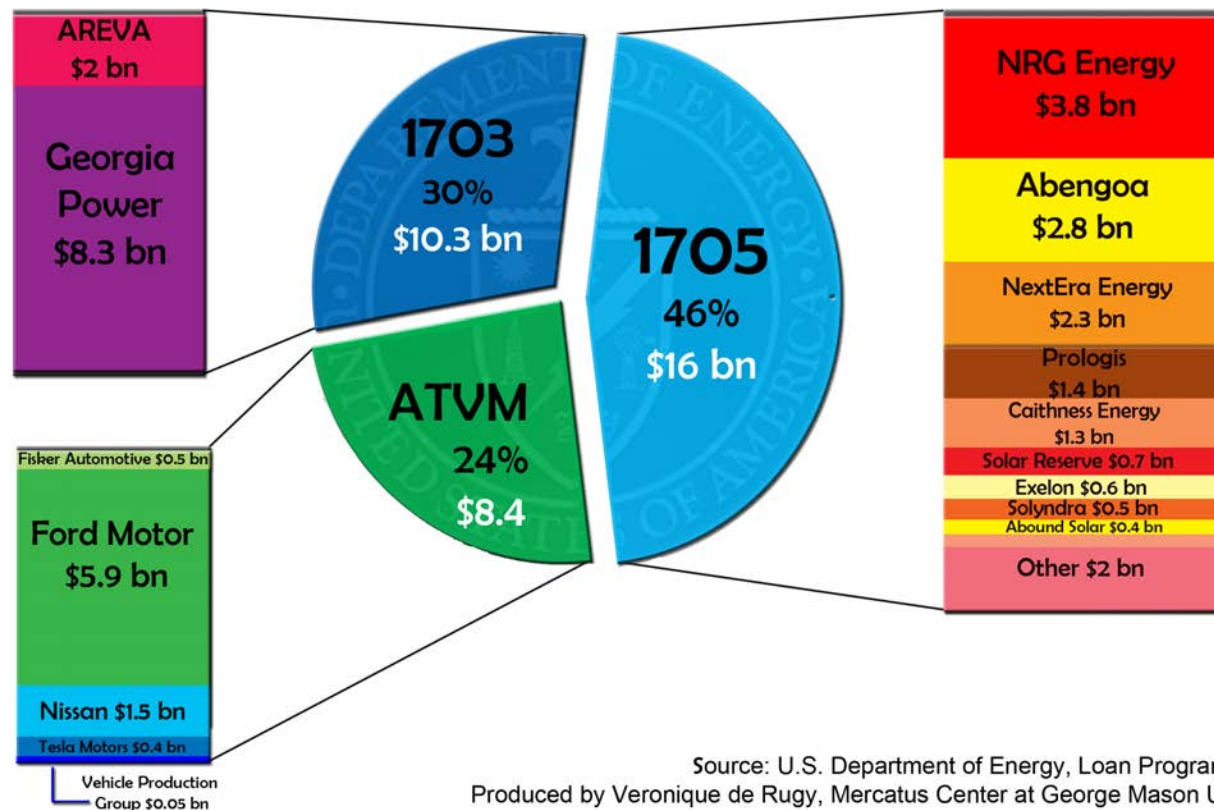
July 9, 2018
34
Bulletin No. 2018-28

3) Loan Guarantee Programs

DEPARTMENT OF ENERGY Loan Programs

Breakdown by Program and Company (in billions)

Since 2009 the DOE Has Guaranteed \$34.7 Billion in Loans



Source: U.S. Department of Energy, Loan Programs Office.
Produced by Veronique de Rugy, Mercatus Center at George Mason University.

3) Loan Guarantee Programs

FINANCING THE FUTURE



ADVANCED TECHNOLOGY VEHICLES MANUFACTURING DIRECT LOAN PROGRAM

Advanced Technology Vehicles Manufacturing (ATVM) Loan Program

The Advanced Technology Vehicles Manufacturing (ATVM) loan program provides direct loans to automotive or component manufacturers



[Learn More](#)

TITLE XVII INNOVATIVE CLEAN ENERGY PROJECTS LOAN GUARANTEE SOLICITATIONS

Advanced Fossil Energy Projects Solicitation

\$8.5 billion in loan guarantee authority for innovative advanced fossil energy projects



[Learn More](#)

Advanced Nuclear Energy Projects Solicitation

\$12.5 billion in loan guarantee authority for innovative advanced nuclear energy projects



[Learn More](#)

Renewable Energy & Efficient Energy Projects Solicitation

Up to \$4.5 billion in loan guarantee authority for innovative renewable energy & efficient energy projects

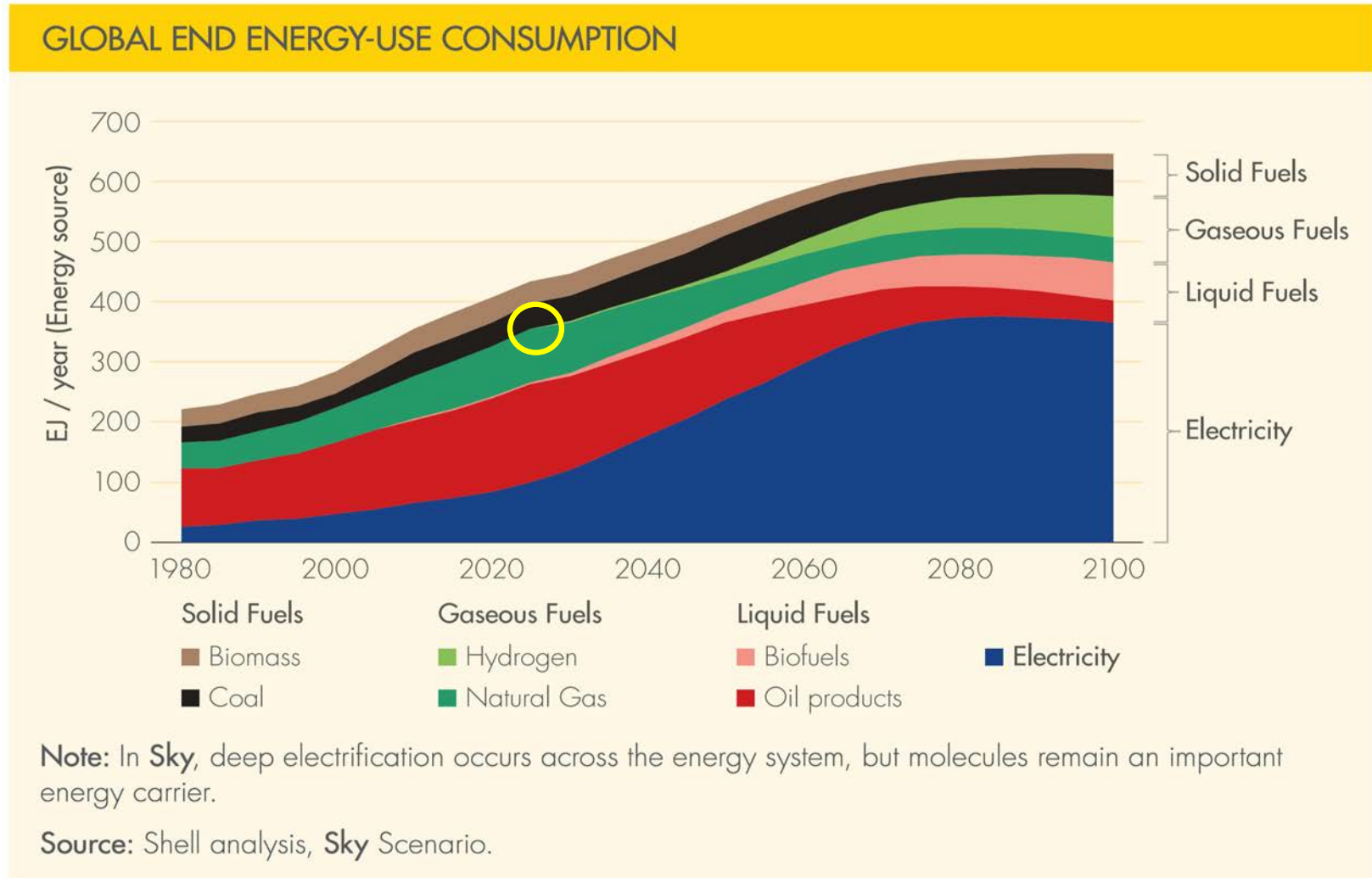


TITLE XVII PROJECT ELIGIBILITY

- Be an “Eligible Project” as defined via an open solicitation
- Employ new or significantly improved technologies as compared to commercial technologies in service in USA.
- Avoid, reduce, or sequester greenhouse gases.
- Be located in the United States (foreign ownership or sponsorship of the projects is permissible as long as the projects is located in one of the fifty states, the District of Columbia, or a U.S. territory).
- Provide a reasonable prospect of repayment.

4. OUR CHALLENGE:

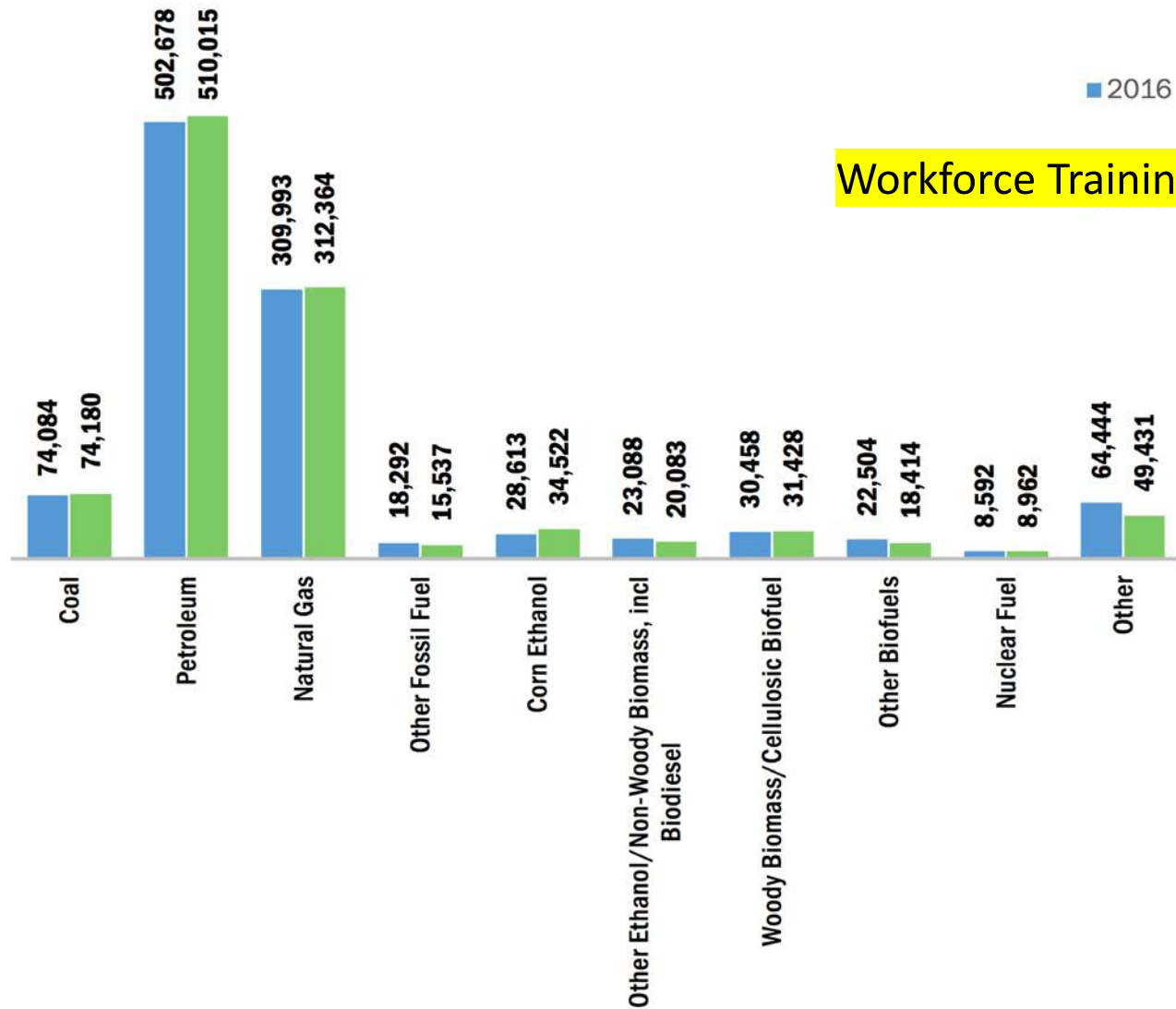
How can we scale fast now?!

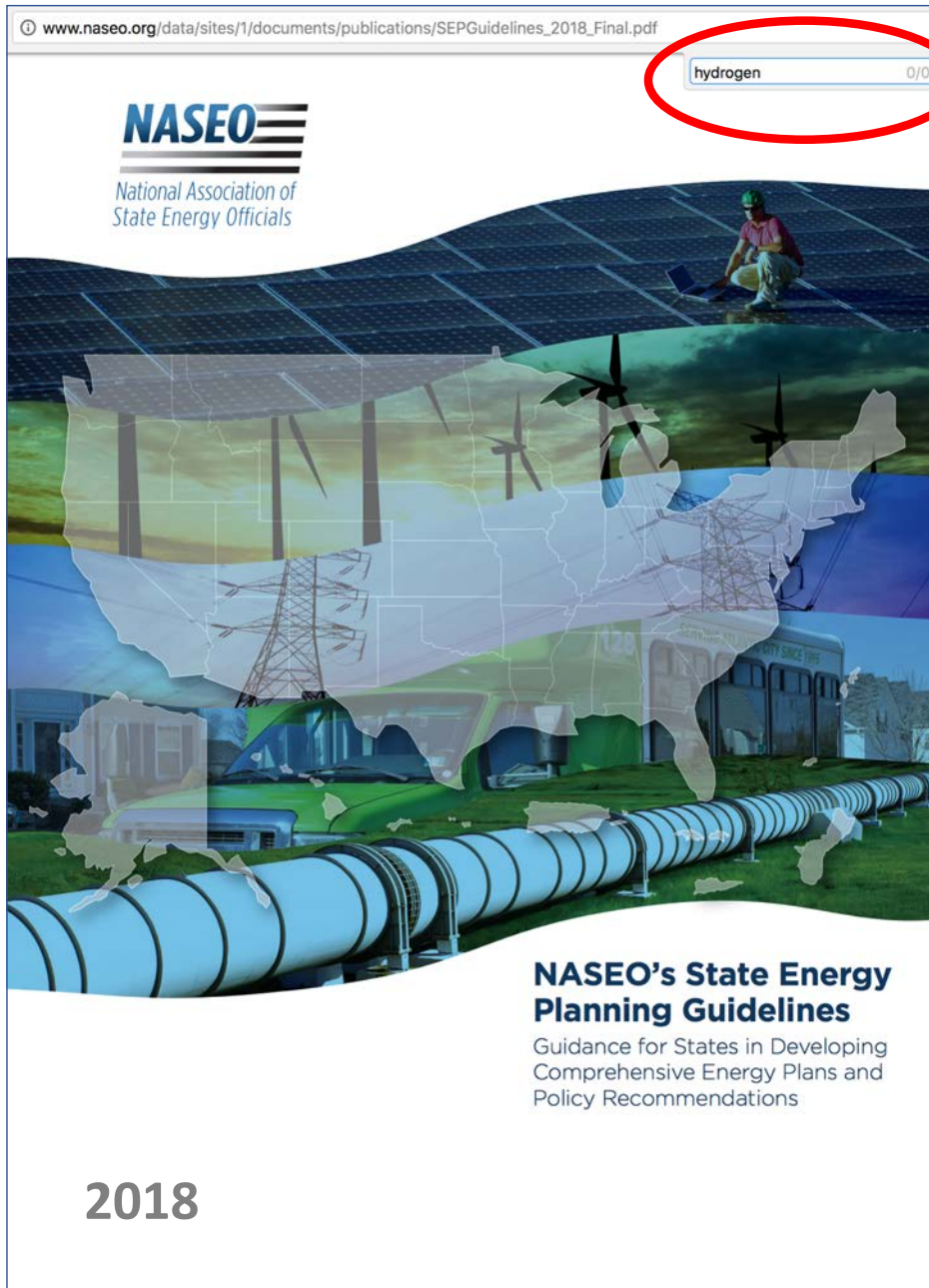


OUR CHALLENGE:

Figure 17.

Fuels Employment by Detailed Technology Application, Q2 2016 – Q2 2017 ⁴¹

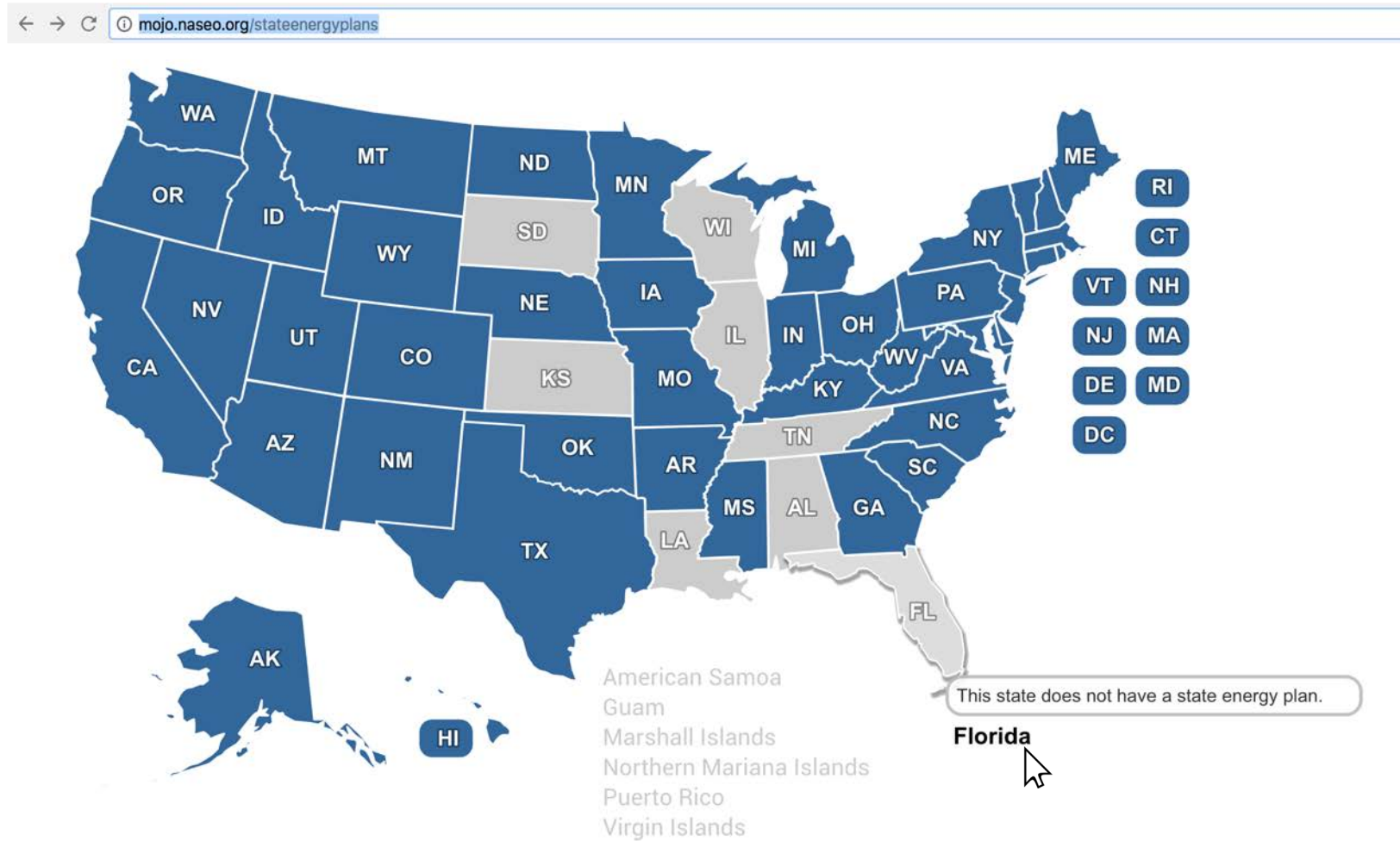




Enormous role for all State Energy Offices, particularly now with Opportunity Zones

OUR CHALLENGE:

No State left Behind!



THREE CRITICAL INVESTMENT TOOLS FOR HYDROGEN INFRASTRUCTURE

1. PROJECT FINANCE: Maximize use of Debt and Equity
2. US. FEDERAL OPPORTUNITY ZONES: ~\$6 Trillion in unrealized U.S. capital gains now has a place to go in every state & territory
3. U.S. LOAN GUARANTEE PROGRAMS: Critical to lower your cost of debt

CONCLUSION: **WE NEED TO USE ALL THREE!**



1) Project
Finance



2) Opportunity
Zones



3) Loan
Guarantee

**Hydrogen
Infrastructure
Projects**

THANK YOU



Andrew@Hydrogen.com



Question and Answer Session

Ask questions using the
Questions Panel on the
right side of your screen.

The webinar slides and
recording will be made
available after today.
Please fill out survey
upon leaving.

A screenshot of the GoToWebinar interface. On the left is a vertical sidebar with icons for chat, questions, and a survey. The main window has a menu bar (File, View, Help) and two main panels. The top panel is titled 'Audio' and contains radio buttons for 'Telephone' (selected) and 'Mic & Speakers'. Below these are the dial-in details: 'Dial: +1 (805) 309-0021', 'Access Code: 558-060-339', and 'Audio PIN: 24'. A red banner below the PIN says 'If you're already on the call, press #24# now.' The bottom panel is titled 'Questions' and features a large text input area with a placeholder '[Enter a question for staff]' and a 'Send' button. At the very bottom, a status bar displays 'Webinar Now' and 'Webinar ID: 664-973-082' above the 'GoToWebinar' logo. A red arrow points from the text 'Questions Panel' in the left-hand text block to the 'Questions' panel in the screenshot.

Thank you for attending today's webinar and remember to fill out attendee survey. Slides and Recording will be made available within a few days.

Emanuel Wagner

Deputy Director

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Join us and help shape the industry in CA!

www.californiahydrogen.org