



CALIFORNIA HYDROGEN
BUSINESS COUNCIL

California Hydrogen Business Council

Hydrogen and Fuel Cells in the Ports - A CHBC Webinar -

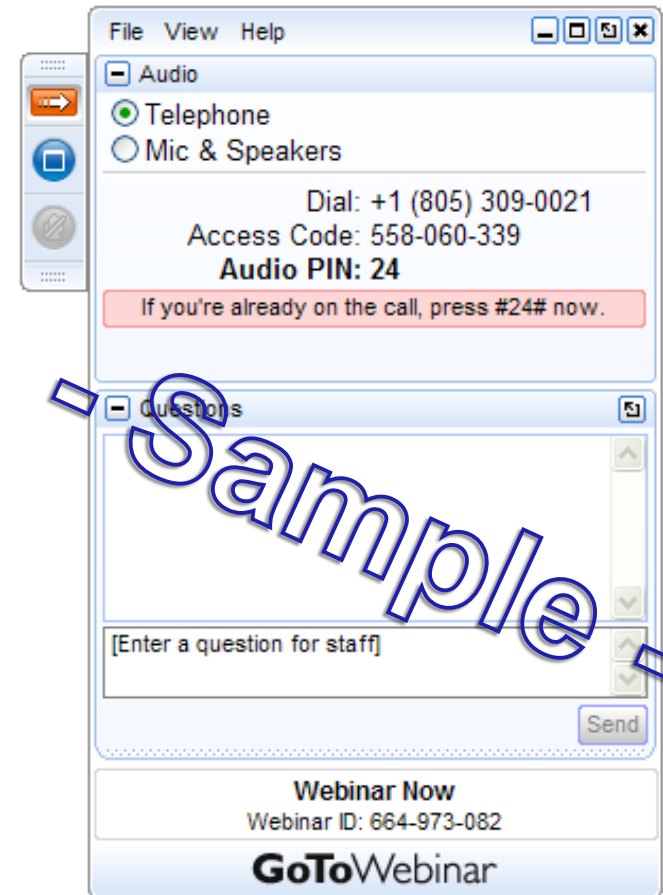
February 20, 2018

www.CaliforniaHydrogen.org



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
- Overview of Workshop and Report Highlights – Cory Shumaker
- Role of Hydrogen in the Ports – Renee Moilanen
- Funding Opportunities – Chris Jenks
- Funding Opportunities – Leslie Goodbody
- Discussion/Q&A



Welcome and Overview



Emanuel Wagner

Assistant Director

California Hydrogen Business Council



CALIFORNIA HYDROGEN BUSINESS COUNCIL

MEMBER ORGANIZATIONS

Platinum



Gold



Silver



Innovators



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 Advocacy

- Overall goal is inclusion of Hydrogen and Fuel Cells in transportation, energy and clean air decisions made in California.

CHBC Committees and Market Sector Action Groups (SAGs):

- Hydrogen Energy Storage and Renewable Hydrogen
- Heavy Duty Transportation, Goods Movement, and Clean Ports
- Public Transportation
- Communications and Business Expansion
- Infrastructure and Vehicle Deployment (under consideration)

Scheduled 2018 CHBC Events

- Hydrogen and Fuel Cell Policy Summit (April)
- Freight Workshop at ACT Expo (April 30)
- Public Transportation Briefing at APTA (May)
- Hydrogen + Fuel Cells NORTH AMERICA in partnership with CHBC and CaFCP at SPI (September)

Overview of Workshop and Report Highlights



Cory Shumaker
Development Specialist
California Hydrogen Business Council



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HYDROGEN & FUEL CELLS in the PORTS WORKSHOP

October 3, 2017 | CalMaritime Academy | Vallejo, CA

HYDROGEN AND FUEL CELLS IN THE PORTS BRIEFING

DEC. 6, 2017 • BANNING'S LANDING COMMUNITY CENTER • PORT OF LA



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Hydrogen Means Business in California!



- Two workshops, both well attended filling the venues
- Purpose:
 - Bring together key stakeholders in the ports industry, hydrogen and fuel cell industry, and State government agencies
 - Continue the conversation around accelerating the use of hydrogen and fuel cells in ports
 - Project updates
 - Technology updates
 - Funding updates
 - Show & Tell

Ports Workshop

Discussion Topics

- Addressing the Shift of Energy in the Maritime Sector
 - Thomas Cropper, President, CSUMA
 - “The ocean is the driver of the world; 90% of trade moves across the oceans. Each week, \$10 billion of goods moves through west coast ports”
- Current Hydrogen and Fuel Cell Activities in Ports and Maritime
 - Viking Cruise Lines announced it is developing a 20,000 kg/day hydrogen powered cruise ship.
 - A liquid hydrogen tanker is able to transport 175,000 kg of H₂.
 - Many ports are looking at LNG; can be seen as a stepping stone towards cleaner technologies.
 - Norway mandated all ferries must be zero emission by 2030.



Ports Workshop

Discussion Topics

- Current Hydrogen and Fuel Cell Activities in Ports and Maritime (Con't)
 - European fuel cell maritime projects are increasing; FCH JU recently put out a call for two fuel cell passenger vessels.
 - European ports such as Hamburg, Rotterdam, Amsterdam, Antwerp, Gothenburg are all looking to reduce emissions and are anticipating more stringent standards in the future.
 - Many are interested in Hydrogen
 - Hydrogen projects are continuing in the California Ports
 - Recently announced tri-generation hydrogen production plant to go into Port of Long Beach to supply hydrogen for Toyota hydrogen truck and cars.
 - DOE ZECTII is ongoing with fuel cell Class 8 trucks in demonstration.
 - Pressure is mounting to go zero emission terminal operations by 2030.



Ports Workshop Discussion Topics

- Voice of the Customer: Opportunities and Constraints for Hydrogen and Fuel Cells in Ports and Maritime Applications
 - Ports are a captive fleet
 - Hydrogen can be same work process as diesel
 - Port of Oakland is involved in a number of efforts to increase air quality by reducing diesel particulate matter.
 - Adopted Air Quality Improvement Plan in March 2008 to reduce cancer causing agents by 85% of 2005 levels by 2020.
 - Fuel cells on ships for cold ironing (shore-to-ship) needs to be considered
 - Port of West Sacramento is looking to use electric and zero emission vehicles and equipment wherever possible.



Ports Workshop Discussion Topics

- Hydrogen and Fuel Cell Solutions for Ports and Maritime
 - Tri-generation systems and electrolyzers are good options for hydrogen production in ports.
 - Rail needs to be looked at more closely.
 - Hyster-Yale produces 25,000 electric vehicles a year and developed a 52 ton fuel cell electric hybrid top loader.
 - US Hybrid will be producing 12,000 fuel cell engines for China.
 - Fuel cells enable fast refueling and 24/7 operation, as well as more efficient and zero emission compared to CNG.
 - PowerCell has developed a 40 foot container housing 3MW of fuel cell power. Also has a fuel cell Class 8 truck and large forklift project which are ongoing.



Ports Workshop Discussion Topics

- Keynote – Safety Regulations, Codes and Standards for Hydrogen in the Ports and Maritime Environment
 - Building a hydrogen station to NFPA standards is less risky than a conventional gas system.
- Keynote – Opportunities and Barriers to Hydrogen Infrastructure in Ports
 - As part of ZECT II, Air Products will be refueling six drayage trucks at the Port of Long Beach; 240 kg/day by trucking multiple gas trailers filled with gaseous hydrogen.
 - With a wide variety of fuel cell applications available, the ports offer multiple customers for fueling stations.



Ports Workshop Discussion Topics

- Government Programs and Funding Opportunities for Hydrogen Projects in Ports and Maritime
 - Large source of emissions are from ocean going vessels.
 - ARB is developing regulations to treat each vessel with same requirements.
 - CARB last year put out an Off-Road Advanced Technology Demonstration Project solicitation
 - Large amount of funds will be available in the 2017-2018 CARB Funding Plan for clean transportation incentives.
 - California Sustainable Freight Action plan was created to address numerous issues with emissions and freight efficiency throughout the State of California.
 - California passed SB1 into law on April 28, allocating \$3 billion to improve trade corridors over the next decade.



Ports Workshop Discussion Topics

- Audience Discussion Points

- Stakeholders need to continue outreach and education efforts, encourage collaboration between policymakers and industry.
- The industry needs to take advantage of funding opportunities, especially from the VW settlement.
- The Bureau of Shipping has focused on LNG; other partners have been looking to hydrogen and fuel cells.
- There is an opportunity with building ships or vehicles with electric drives that have a Genset or other generator, which fuel cells could eventually replace.
- BMW is seeking a truck supplier as a platform to test fuel cells.
- The business case for hydrogen production in the ports needs to be developed that addresses the permitting situation, as well as concerns from the Coast Guard.

Ports Briefing Show & Tell





Next Steps/ Activities

- Workshop Report – Completed; Available online
- Summary of Workshop Report Webinar
- Freight Workshop – Scheduled for April 30th, 2018 at the ACT Expo
- Distribution Center Workshop – Scheduled for May 3rd at the ACT Expo
- Subsequent follow-up ports workshop – Fall 2018



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Role of Hydrogen in the Ports



Renee Moilanen

**Manager, Air Quality Practices
Port of Long Beach**



Port of Long Beach

Advancing Zero Emissions



Port of
LONG BEACH
The Green Port

Renee Moilanen
Manager, Air Quality Practices

February 20, 2018



2017 Update **Clean Air Action Plan**

Zero Emissions Goal

Terminal Equipment by 2030, Trucks by 2035



Achieving this goal

Technology and Funding

Unprecedented Amount of Money in 2018

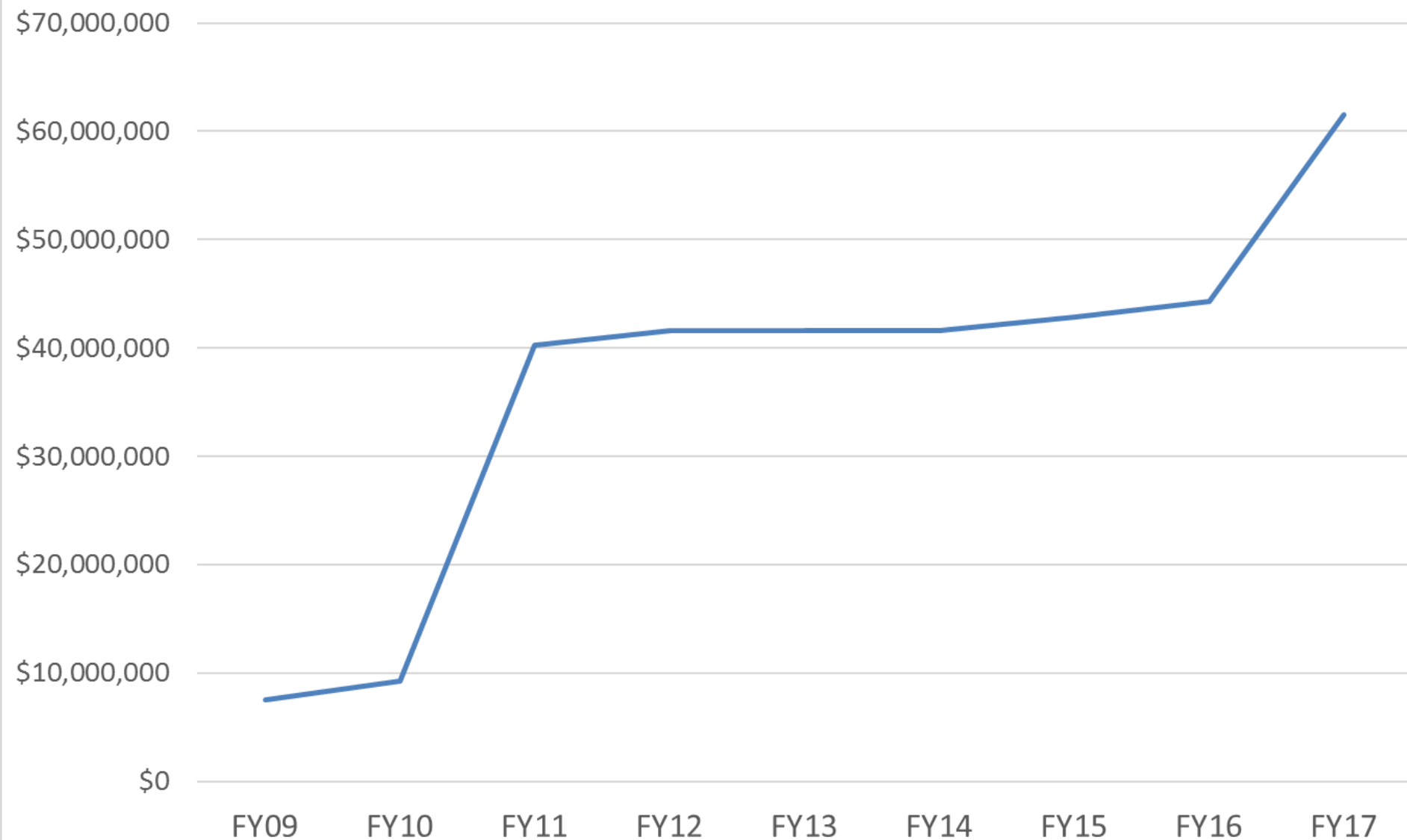
Our Team

- Environmental Planning
- Tenant Services and Operations
- Government Affairs
- Professional Grant Writers

What We Do

- Advocate for Funding
- Shape Funding Programs
- Build Competitive Projects
- Develop Partnerships
- Write Proposals
- Manage Grants

Cumulative Funding Secured, 2009-2017



Funding Opportunities

- Demonstration of Advanced Technologies
- Deployment
- Infrastructure
- Energy
- System Efficiencies



Programs

The background of the slide is a photograph of a large port, likely Los Angeles or Long Beach, viewed from an elevated perspective. The water is a deep blue, and the sky is a lighter blue. In the foreground and middle ground, there are numerous container ships docked at piers, with their colorful cargo containers (red, blue, yellow) visible. Large white gantry cranes are positioned along the piers, some with their booms extended over the ships. The city skyline is visible in the distance, with various buildings and structures. The overall scene is a busy maritime hub.

South Coast AQMD Air Pollution Control Projects

ARB Near-Zero/Zero-Emissions Freight Facility

California Energy Commission AFRVTP

Off-Road Vouchers (ARB)

VW Settlement (ARB)

Proposition 1B (AQMD)

Carl Moyer

Diesel Emissions Reduction Act (EPA)

Targeted Air Shed Funding (EPA)

Ports Technology Advancement Program

SB 350 Transportation Electrification

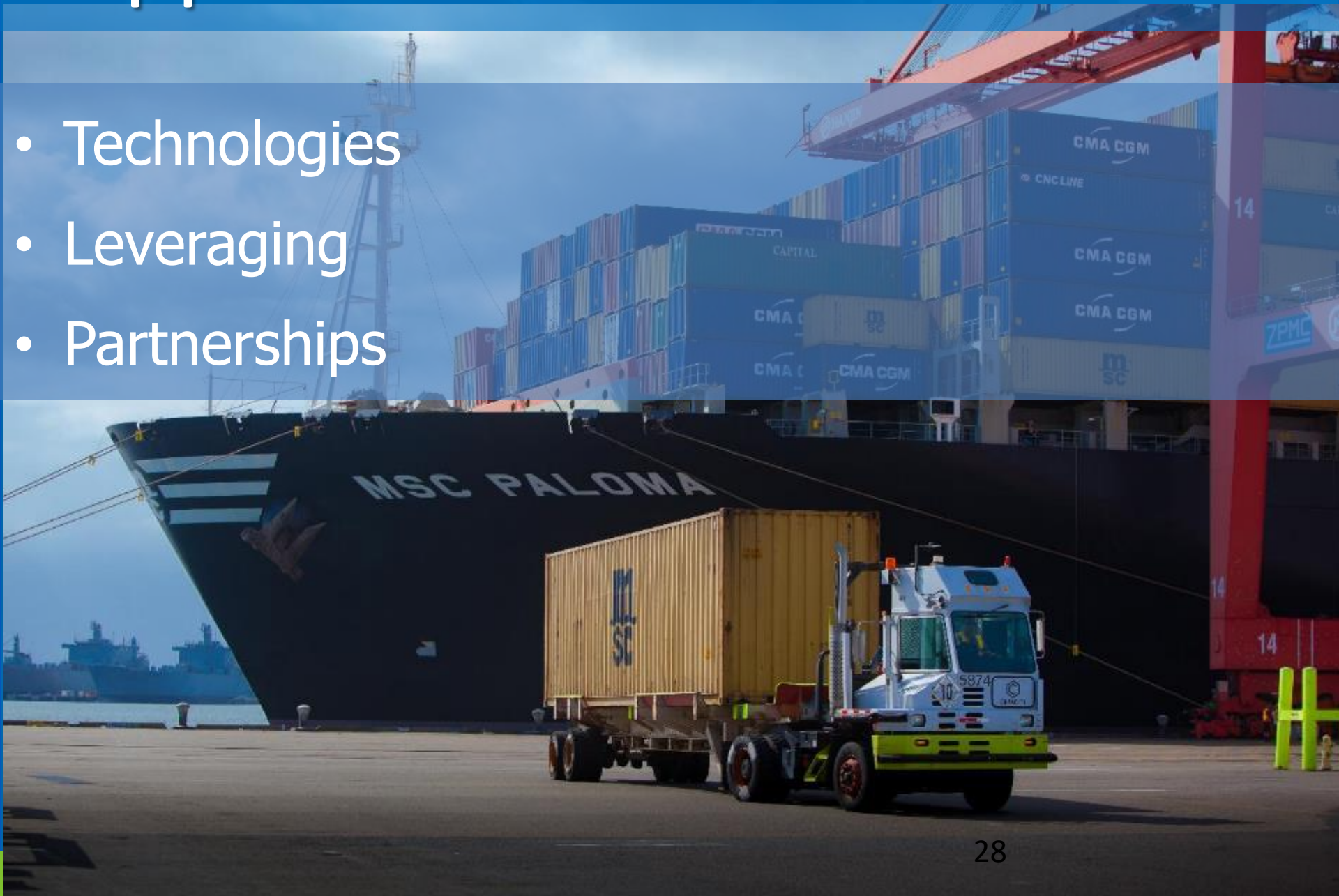
Challenges

- Infrastructure
- Match funding
- Timing



Opportunities


- Technologies
- Leveraging
- Partnerships



What We're Looking For

- “Wish Lists”
- Think Creatively
- Demonstration Partnerships
- Support Letters and Advocacy
- Education

Case Study: eRTGs



$\$8.8 \text{ million} - \$3.4 \text{ million} =$
 $\$5.4 \text{ million} - \$4.86 \text{ million} =$
 $\$540,000 - \$470,000 =$
\$70,660

www.polb.com

www.cleanairactionplan.org





Chris Jenks

**Advanced Freight Technologies and Planning Unit
Fuels and Transportation Division
California Energy Commission**



Advanced Freight and Fleet Technologies

Chris Jenks

Advanced Freight Technologies and
Planning Unit
Fuels and Transportation Division
California Energy Commission

February 20, 2018

Summary of MD-HD Vehicle Demonstrations

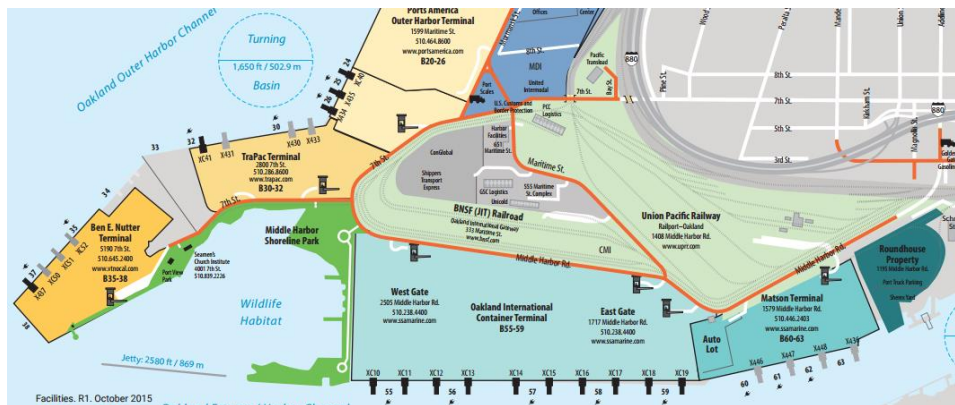
Vehicle/Technology Type	# of Vehicles	ARFVTP Funding (in Millions)
Medium-Duty Hybrids, PHEVs and BEVs	166	\$16.4
Heavy-Duty Hybrids, PHEVs and BEVs	78	\$48.6
Electric Buses	35	\$14.6
Natural Gas Trucks	51	\$19.1
Fuel Cell Trucks and Buses	13	\$14.5
Vehicle-to-Grid	6	\$7.7
Off-Road Hybrids	2	\$4.5
E85 Hybrids	1	\$2.7
Intelligent Transportation Systems	110	\$2.0
Total	462	\$130.1



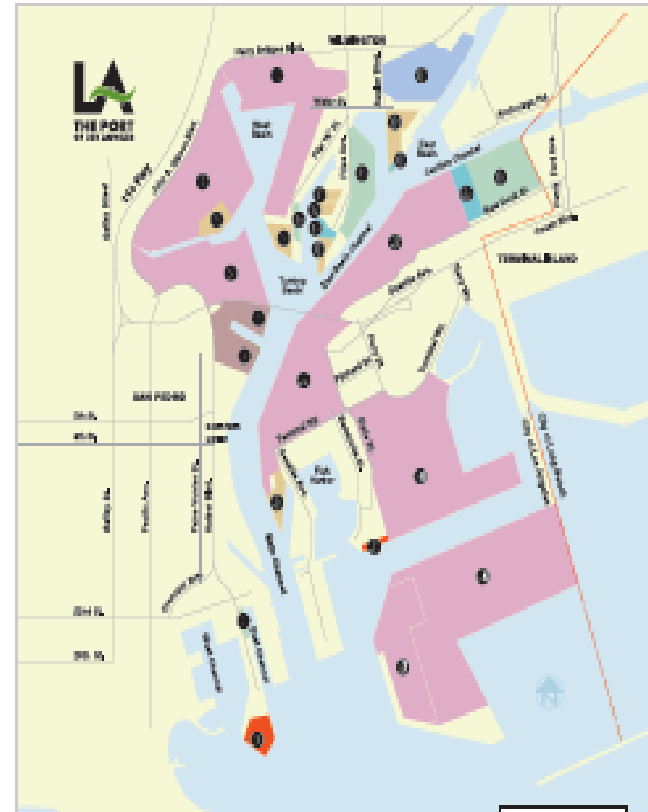
Port Energy Collaborative

Focus Areas

- MD-HD Vehicle Demonstrations
- Electric Truck Charging Standardization
- Grid Resiliency
- Clean Energy and Efficiency Measures
- Lighting Enhancements



Container Terminal at Port of
Oakland

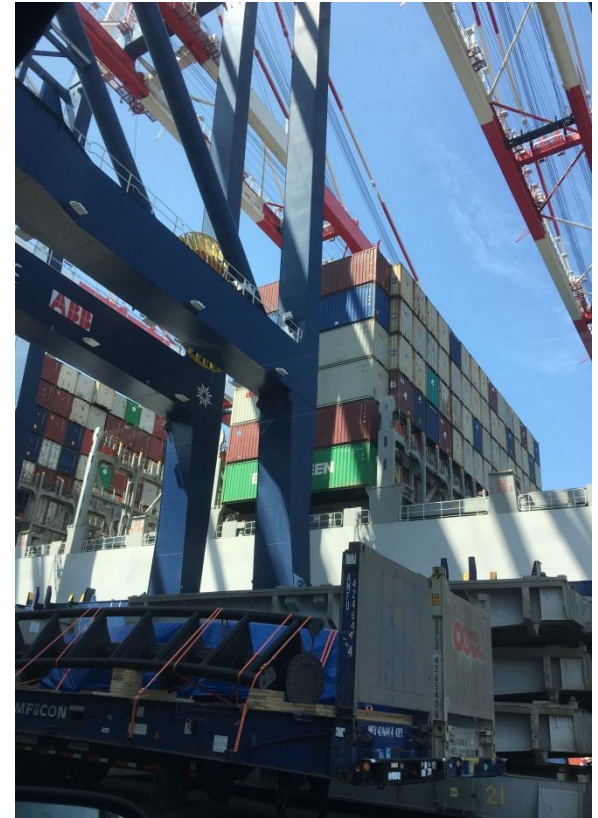


Port of Los Angeles



Advanced Freight and Fleet Projects 2016-2018

- GFO-16-604 released November 2016
- Awarded \$24.3 million for 3 projects
- Focused on demonstrating technologies at California Seaports
- 28 drayage trucks (20 Low NO_x, 7 PHEV, 1 BEV), 15 BEV yard trucks, 3 BEV top handlers, and 9 electric RTGs
- Direct reduction of 3,900 MT CO₂e, 22 tons NO_x, 0.4 tons PM₁₀ over term of projects.
- Released GFO-17-603 in December 2017
- \$22 million with focus on zero-emission freight infrastructure



(Port of Long Beach)



GFO-16-604 Project Summaries

Recipient	Advanced Vehicles	Technology Vendors	Fleet Demonstrators
Port of Los Angeles	5 BEV (2 Top Handlers, 3 Yard Tractors)	<ul style="list-style-type: none"> Taylor Machine Works, BYD 	<ul style="list-style-type: none"> Everport Terminal
Port of Long Beach	<ul style="list-style-type: none"> 9 electric RTGs 12 BEV Yard Trucks 4 PHEV-LNG Drayage Trucks 	<ul style="list-style-type: none"> BYD Cavotec US Hybrid 	<ul style="list-style-type: none"> SSA Marine Long Beach Container Terminal Total Transportation Services
SCAQMD	<ul style="list-style-type: none"> 20 Low NOx Drayage Trucks 3 PHEV-CNG Drayage Trucks 1 BEV Drayage Truck 1 BEV Top Handler 	<ul style="list-style-type: none"> Cummins Westport Efficient Drivetrains Hyster-Yale Wave 	<ul style="list-style-type: none"> APM Terminals Total Transportation Services Mayor Logistics Southern Counties Express Heavy Load Transfer Three Rivers Trucking



Hydrogenics FCEV Drayage Truck

Award: \$2.7M; Match: \$1.5M; Total: \$4.2M

Description: Demonstrate Class 8 Fuel Cell drayage truck for 12 months at POLA/LB and along Alameda Corridor

Purpose: Collect performance data, validate the technical and market viability of the technology

Partners: Siemens Industry Inc. (hybrid drive technology); Actia Corporation (energy storage); Freightliner Trucks (technical assistance)

Status: Secured facility; design completed; acquired glider



Fuel Cell support cradle assembly with thermal management system and test rig in front of DTNA glider chassis.



Questions

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Air Pollution Specialist
California Energy Commission
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Leslie Goodbody

**Engineer, Innovative Heavy Duty Strategies
Mobile Source Control Division
California Air Resources Board**



Funding Opportunities for Hydrogen and Fuel Cells in the Ports

Leslie Goodbody, Air Resources Engineer
February 20, 2018

CARB Heavy-Duty Funding Portfolio

Today...

- ▶ Low Carbon Transportation
- ▶ Zero-Emission Warehouse Program
- ▶ Carl Moyer
- ▶ AB 617
- ▶ VW Mitigation Trust



Ongoing and Completed Projects in Ports

Green Omni Terminal - Port of Los Angeles (complete in 2020)

- ▶ \$14.5 million award to the Los Angeles Harbor Dept.
- ▶ Demonstrate multiple battery electric technologies with supporting charging infrastructure
 - ▶ 4 Yard trucks
 - ▶ 2 Drayage trucks
 - ▶ 2 21-ton forklifts
 - ▶ Top handler
- ▶ At-berth vessel emission control system for CO₂, NO_x, PM
- ▶ Rooftop solar to supplement power usage

For reports on completed port-related demonstration projects

- ▶ <https://www.arb.ca.gov/msprog/aqip/demo.htm>



Recent CARB funding for heavy-duty fuel cell technology



Executed grant agreements:

- ▶ Zero-Emission Bus Pilot Commercial Deployment Projects (\$84M)
 - ▶ \$35 million: 25 fuel cell transit buses, 2 new hydrogen stations and one upgrade
 - ▶ Demonstrate economies-of-scale cost reductions + higher throughput hydrogen refueling

Solicitations closed with grant agreements pending

- ▶ On-Road Advanced Technology Demonstration Projects (\$17 M)
- ▶ Off-Road Advanced Technology Demonstration Projects (\$17 M)

View Solicitations and lists of applicants

- ▶ <https://www.arb.ca.gov/msprog/aqip/solicitations.htm>

FY 2017-18 Funding Plan for Clean Transportation Incentives



- ▶ \$338M from Low Carbon Transportation and Air Quality Improvement Program
 - ▶ \$188M Clean truck and bus vouchers (HVIP) (pg. I-77)
 - ▶ \$40M Zero-Emission Off-Road Freight Voucher Project (pg. I-72)
 - ▶ \$150M Zero- and Near Zero-Emission Freight Facilities Project (pg. I-67)

www.arb.ca.gov/msprog/aqip/fundplan/fundplan.htm

- ▶ FY 2018-19 Funding Plan - first workshop March 15

Clean Truck and Bus Vouchers (HVIP)

HVIP and Low NOx Engine Incentives

- ▶ FY 2017-18: \$180M LCT funds for Clean Truck and Bus Vouchers (HVIP) plus \$8M from AQIP exclusively for 12 liter low-NOx engines
 - ▶ Funds available on first-come, first-served basis with \$35M reserved specifically for zero emission buses
 - ▶ \$300,000 voucher for 40' FCEB, with \$100,000 enhancement for hydrogen infrastructure with 5 or more buses
 - ▶ \$300,000 voucher for fuel cell electric trucks with similar infrastructure enhancement once they enter the market

HVIP to-date

- ▶ Over 3,100 vouchers issued for \$89 million
- ▶ Eligible vehicles and current data available at CaliforniaHVIP.org

Next workgroup focusing on the charging and hydrogen fueling infrastructure enhancement, Feb. 27, arb.ca.gov/aqip



Zero-Emission Off-Road Freight Voucher Incentive Project

- ▶ \$40 million from Low Carbon Transportation for zero-emission technologies
- ▶ Potential eligible equipment
 - ▶ Off-road terminal tractors
 - ▶ Large forklifts
 - ▶ TRUs, ground support equipment, and RTG cranes
- ▶ Voucher amounts off-set portion of incremental costs
- ▶ Will include enhancements for technology support costs such as infrastructure
- ▶ Next workgroup meeting/teleconference: February 21, 2018 in El Monte
www.arb.ca.gov/aqip
- ▶ Solicitation for statewide project administrator: Spring 2018
- ▶ Contact: David Eiges, david.eiges@arb.ca.gov, 626-575-6602

Zero- and Near Zero-Emission Freight Facilities Project (FY 2017-18)

- ▶ \$150 million to demonstrate and deploy advanced technology, vehicles, equipment and system efficiencies at freight facilities
 - ▶ \$100M from Low Carbon Transportation (AB 134) plus \$50M from the Transportation Corridor Enhancement Account (SB 132)
- ▶ Supports warehouses, distribution centers, ports, freight airports and railyards
- ▶ Includes battery electric, fuel cell electric, and hybrid technologies (vehicles, equipment and infrastructure)
- ▶ Anticipated solicitation release in Spring 2018 following March workgroup
- ▶ Contact: Earl Landberg, Earl.Landberg@arb.ca.gov

Carl Moyer Funding for Hydrogen Infrastructure, Vehicles, and Equipment

- ▶ Carl Moyer program receives \$69M annually to fund mobile sources and infrastructure
- ▶ Air districts determine project priority and select projects
 - ▶ On-road fuel cell vehicles
 - ▶ Off-road fuel cell equipment
 - ▶ Fueling infrastructure
- Additional Incentives Information:



South Coast AQMD
Mei Wang Mwang@aqmd.gov
909-396-3257



Bay Area AQMD
Anthony Fournier
Afournier@baaqmd.gov
415-7494961

Community Air Protection Program (Assembly Bill 617)

- ▶ Community-focused framework to reduce exposure in communities most impacted by air pollution
- ▶ Aligns with and builds on existing CARB programs
 - ▶ Community emissions reduction programs
 - ▶ Community-level air monitoring and enhanced reporting
 - ▶ Accelerate reductions at industrial facilities, including ports

For Concept Paper and Draft Process and Criteria for 2018 Community Selections, go to: ww2.arb.ca.gov/our-work/programs/community-air-protection-program-ab617

FY 2017-18 Funding: \$250 million in clean technology incentives to support community focused immediate reductions





Future Funding - VW Environmental Mitigation Trust

\$423 million for NOx mitigation (Consent Decree Appendix D)

- ▶ Discussion Document recommends a suite of measures for the Beneficiary Mitigation Plan to fully mitigate excess NOx emissions and fund zero-emission transformation in the heavy-duty sector
 - ▶ \$130M for zero-emission transit, shuttle and school buses
 - ▶ \$90M for zero-emission Class 8 freight and port drayage trucks
 - ▶ \$70M for zero-emission freight and marine equipment
 - ▶ \$60M for combustion-based freight and marine equipment when zero-emission is unavailable
 - ▶ \$10M for charging/fueling infrastructure for light-duty zero-emission vehicles
 - ▶ \$63M reserve for administrative costs
- ▶ Six workshops statewide in late February/early March to share Discussion Document and get stakeholder input
- ▶ Present proposed Beneficiary Mitigation Plan to CARB Board late spring 2018

Get involved...

Zero- and Near Zero-Emission Freight Facilities Project:

Earl.Landberg@arb.ca.gov, 916-323-1384

- ▶ Join the workgroup email list - Third workgroup teleconference in March 2018
- ▶ Join the Team Building List - email company info and description of products/services
- ▶ Solicitation release early Spring 2018, www.arb.ca.gov/aqip

Off-Road Freight Vouchers: David Eiges, david.eiges@arb.ca.gov, 626-575-6602

- ▶ Next workgroup meeting, tomorrow, February 21, 2018, www.arb.ca.gov/aqip

AB 617 - contact: Melissa.Niederreiter@arb.ca.gov, 916-323-6576

- ▶ Participate in February 2018 public workshop
- ▶ <https://www.arb.ca.gov/msprog/cap/capmtgs.htm>

VW Mitigation Trust: Lisa.Williams@arb.ca.gov, 916-324-7582

- ▶ Comment on Draft Discussion Document - via docket or mititrust@arb.ca.gov
- ▶ Participate at a public workshop: Feb. 26 & 28, March 1, 5, 7 & 8
- ▶ www.arb.ca.gov/msprog/vw_info/vsi/vw-mititrust/vw-mititrust.htm



CALIFORNIA
AIR RESOURCES BOARD

Leslie Goodbody

Air Resources Engineer

Innovative Heavy Duty Strategies Section

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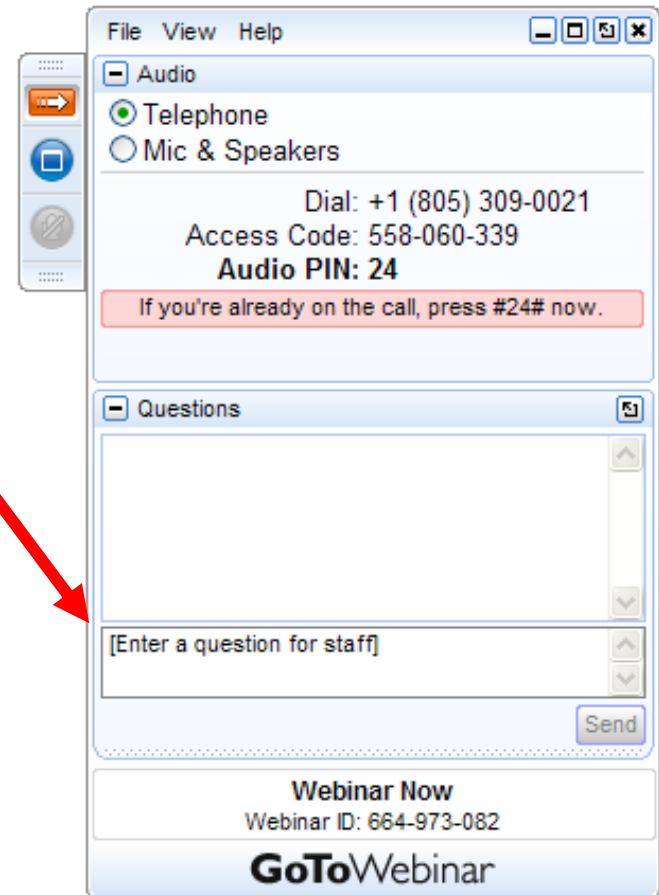
Leslie.Goodbody@arb.ca.gov



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.





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.

For more information, contact:

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