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SB 643 Inaugural Assessment Draft Staff Report Workshop

California Energy Commission, Fuels and Transportation Division

October 16, 2023

Housekeeping

- Workshop is being recorded
- Workshop Event Webpage:

  https://www.energy.ca.gov/event/workshop/2023-10/workshop-2023-senate-bill-643-staff-report
- Written Comments to Docket # 22-HYD-02: https://efiling.energy.ca.gov/EComment/EComment.aspx?docketnumber=22-HYD-02

Deadline for Written Comments: Monday, October 30, 2023

Commitment to diversity

The CEC adopted a resolution strengthening its commitment to diversity in our funding programs. The CEC continues to encourage disadvantaged and underrepresented businesses and communities to engage in and benefit from our many programs.

To meet this comment, CEC staff conducts outreach efforts and activities to:

- Engage with disadvantaged and underrepresented groups throughout the state;
- Notify potential new applicants about the CEC's funding opportunities;
- Assist applicants in understanding how to apply for funding from the CEC's programs;
- Survey participants to measure progress in diversity outreach efforts

Diversity survey

Diversity Survey - SB 643 Staff Report Workshop

Scan the code on a phone or tablet with a QR reader to access the survey.

One Minute Survey

The information supplied will be used for public reporting purposes to display anonymous overall attendance demographics

Zoom Participants, please use the link in the chat to access the survey or scan the QR code on the left of the screen with a phone or tablet to access the survey

Survey will be closed at the end of the day

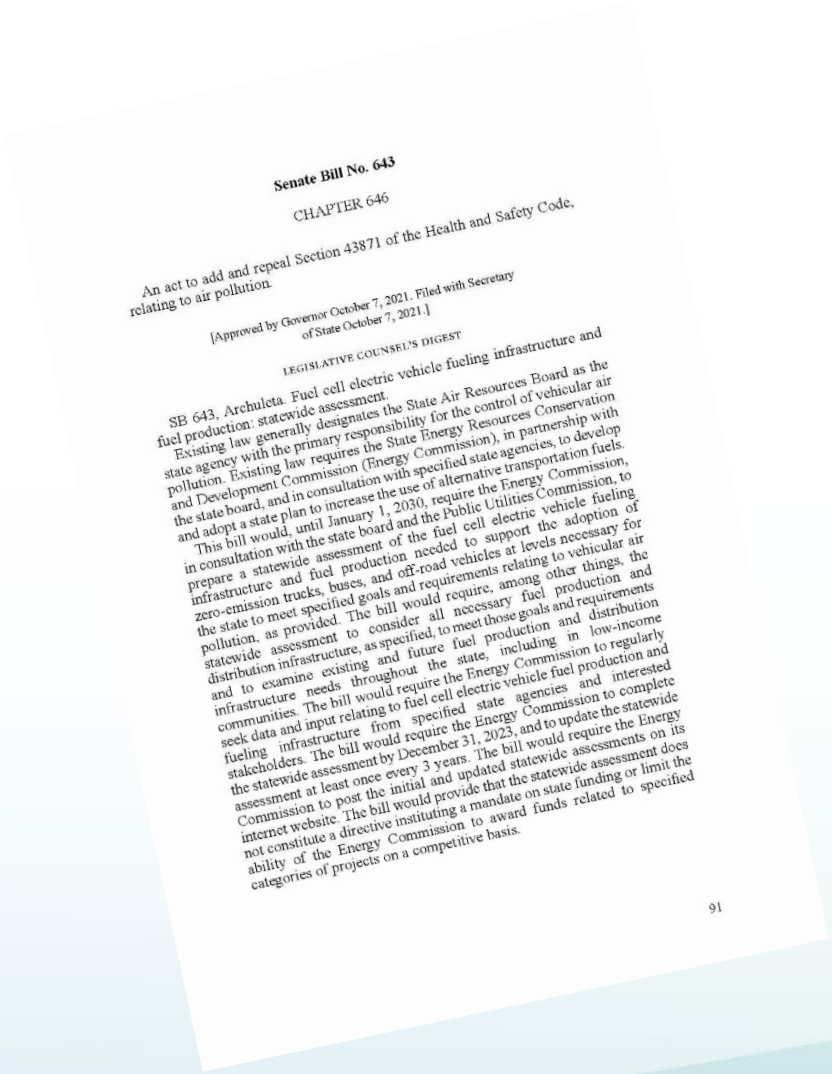
Survey Link: https://forms.office.com/Pages/ResponsePage.aspx?id=RBI6rPQT9k6NG7qicUgZTtQ-G7GrbGJFmZJPv38ckjJURTBDMURSQk81N01EOUc2MEVES01HRk4yQy4u

Workshop Agenda

1. Introduction to the inaugural SB 643 assessment
2. Scenarios of medium- and heavy-duty (MDHD) fuel cell electric vehicle (FCEV) refueling infrastructure
3. Innovative Clean Transit regulation and fuel cell electric buses
4. Clean hydrogen production
5. Off-road/non-road hydrogen applications
6. Potential for hydrogen to enable a more renewable grid
7. Discussion Items, Q&A and public comment

Introduction to the Inaugural SB 643 Assessment

SB 643 Inaugural Assessment



Senate Bill No. 643

CHAPTER 646

An act to add and repeal Section 43871 of the Health and Safety Code, relating to air pollution.

[Approved by Governor October 7, 2021. Filed with Secretary of State October 7, 2021.]

LEGISLATIVE COUNSEL'S DIGEST

SB 643, Archuleta. Fuel cell electric vehicle fueling infrastructure and fuel production: statewide assessment.

Existing law generally designates the State Air Resources Board as the state agency with the primary responsibility for the control of vehicular air pollution. Existing law requires the State Energy Resources Conservation and Development Commission (Energy Commission), in partnership with the state board, and in consultation with specified state agencies, to develop and adopt a state plan to increase the use of alternative transportation fuels.

This bill would, until January 1, 2030, require the Energy Commission, in consultation with the state board and the Public Utilities Commission, to prepare a statewide assessment of the fuel cell electric vehicle fueling infrastructure and fuel production needed to support the adoption of zero-emission trucks, buses, and off-road vehicles at levels necessary for the state to meet specified goals and requirements relating to vehicular air pollution, as provided. The bill would require, among other things, the statewide assessment to consider all necessary fuel production and distribution infrastructure, as specified, to meet those goals and requirements and to examine existing and future fuel production and distribution infrastructure needs throughout the state, including in low-income communities. The bill would require the Energy Commission to regularly seek data and input relating to fuel cell electric vehicle fuel production and fueling infrastructure from specified state agencies and interested stakeholders. The bill would require the Energy Commission to complete the statewide assessment by December 31, 2023, and to update the statewide assessment at least once every 3 years. The bill would require the Energy Commission to post the initial and updated statewide assessments on its internet website. The bill would provide that the statewide assessment does not constitute a directive instituting a mandate on state funding or limit the ability of the Energy Commission to award funds related to specified categories of projects on a competitive basis.

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- Established by Senate Bill 643 (Archuleta, 2021)
- Requires a statewide assessment of clean hydrogen production, and MDHD FCEV and off-road refueling infrastructure
- Inaugural report due December 31, 2023, every 3 years through January 1, 2030

SB 643 Inaugural Assessment

Fuel cell electric vehicle (FCEV) refueling infrastructure and clean hydrogen fuel supply needed to support medium- and heavy-duty (MDHD) FCEVs and off-road/non-road applications.

- **Executive Order N-79-20**
  - By 2035, 100 percent zero-emission vehicle (ZEV) operations for drayage trucks and off-road vehicles and equipment
  - By 2045, 100 percent ZEV operations for MDHD vehicles, where feasible

World-Leading Regulations

- Advanced Clean Trucks – Requires manufacturers to accelerate sales of new zero-emission heavy-duty vehicles from 2023-2035.
- Advanced Clean Fleets – Manufacturers are allowed to sell only zero-emission MDHD ZEVs beginning in 2036.
    - Drayage trucks, local delivery and government fleets must transition by 2035.
    - Garbage trucks must be zero-emission by 2039.
    - All other vehicles covered by the regulation must be zero-emission by 2042.

Source: Hyzon Motors

World-Leading Regulations

- In-Use Off-Road Diesel-Fueled Fleets regulation (Off-Road Regulation) requires fleets to phase out oldest, highest polluting off-road diesel vehicles and prohibits adding high-emitting vehicles to fleets.

- Innovative Clean Transit regulation (ICT) requires public transit agencies to transition gradually to a 100% ZEV fleet.

Source: Center for Transportation and the Environment

Unprecedented Federal and State Investments in Hydrogen

- Bipartisan Infrastructure Law/Infrastructure Investments & Jobs Act
  - One of the largest investments in U.S. DOE's history: $7 billion toward the establishment of Regional Clean Hydrogen Hubs
    - $1.2 billion awarded to California
  - $2.5 billion in the discretionary grant program for charging and refueling infrastructure
- Inflation Reduction Act (IRA) provides a tax credit of up to $3/kg of clean hydrogen produced.

CEC Hydrogen Investments: $376 million and growing

- $176 million for light duty (LD) FCEV refueling stations
- $56 million for MDHD FCEV refueling
- $22 million for clean hydrogen production
- $17 million in fuel standards and equipment certification, demonstrations, and regional alternative fuel readiness planning

CEC Hydrogen Investments (continued)

- $22 million for clean hydrogen production
- $40 million in hydrogen research and demonstration projects on emerging hydrogen production, storage, transmission and distribution, and end-use technologies
- $18 million for Energy Research and Development Division solicitations on innovative hydrogen refueling solutions for heavy transport, hydrogen blending and lower NOx emissions in gas-fired generation and assessing hydrogen's role in California's decarbonizing electric system.

Refueling Infrastructure Scenarios

Preliminary Results

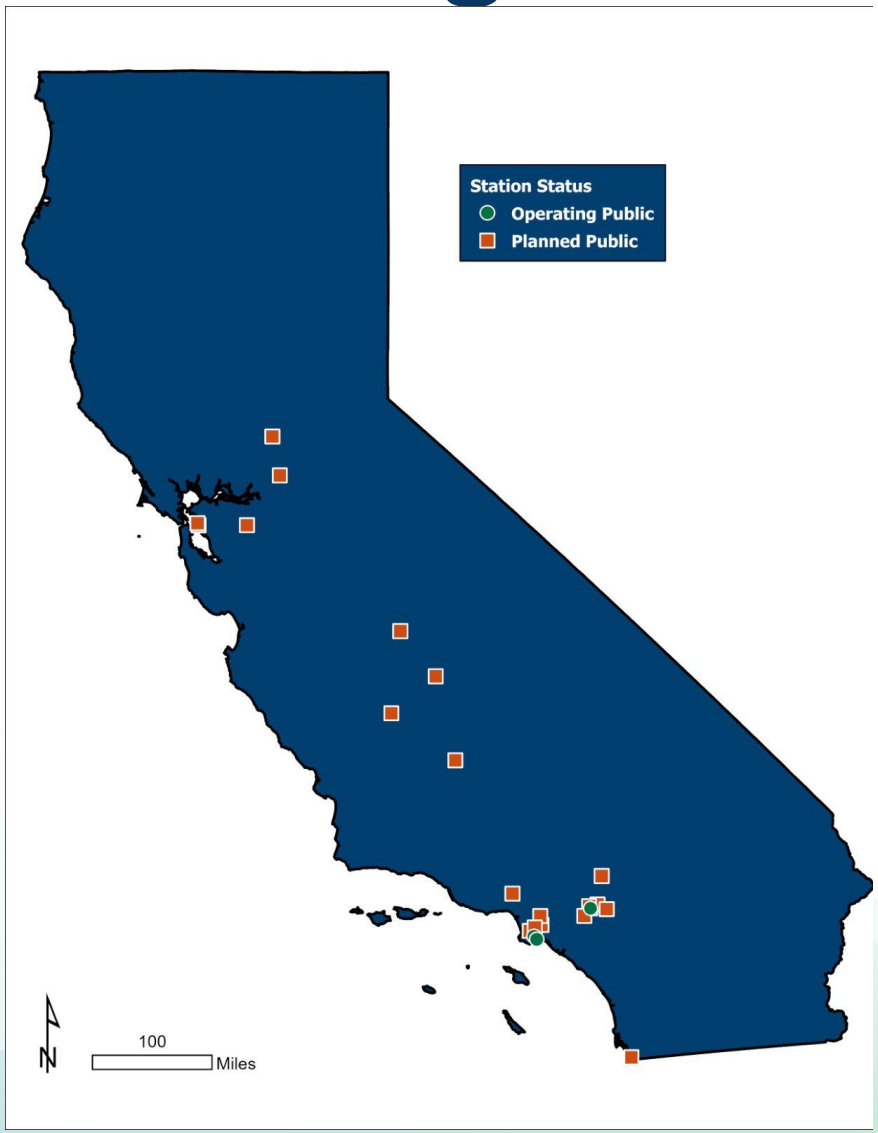
The *SB 643 Staff Report* includes four scenarios of MDHD hydrogen fuel cell electric vehicle (FCEV) refueling infrastructure produced a wide range of results:

In 2030: 1 to 602 stations

In 2035: 11 to 2,157 stations

Current and Planned Publicly Available MDHD Fueling Stations

- Three stations are operating in Southern California
- The remaining 22 stations on the map are in varying stages of development
- The CEC is developing an interagency map that will show the station location along with major corridors



GFO-23-602 CRITICAL PATHS

Activity	Action Date
Deadline to Submit Applications by 11:59 p.m.	November 17, 2023
Anticipated Notice of Proposed Awards Posting	Week of February 5, 2024

Updates to solicitation documents will be posted on the GFO Webpage: https://www.energy.ca.gov/solicitations/2023-09/gfo-23-602-charging-and-refueling-infrastructure-transport-california

Scenario 1: 2022 Scoping Plan

- In 2006, the Legislature passed AB 32, which created a multiyear program to reduce greenhouse gas emissions in California.
  - Required CARB to develop a Scoping Plan to indicate how California can reduce emissions.
  - The *2022 Scoping Plan* explores technology and fuel options to reduce dependence on fossil fuels
    - Not forecasts and contingent on key assumptions, limitations of data sets, and model capacity.

Scenario 1: 2022 Scoping Plan

Assumptions

CEC staff used MDHD FCEV stock (not buses) from *2022 Scoping Plan Appendix H*

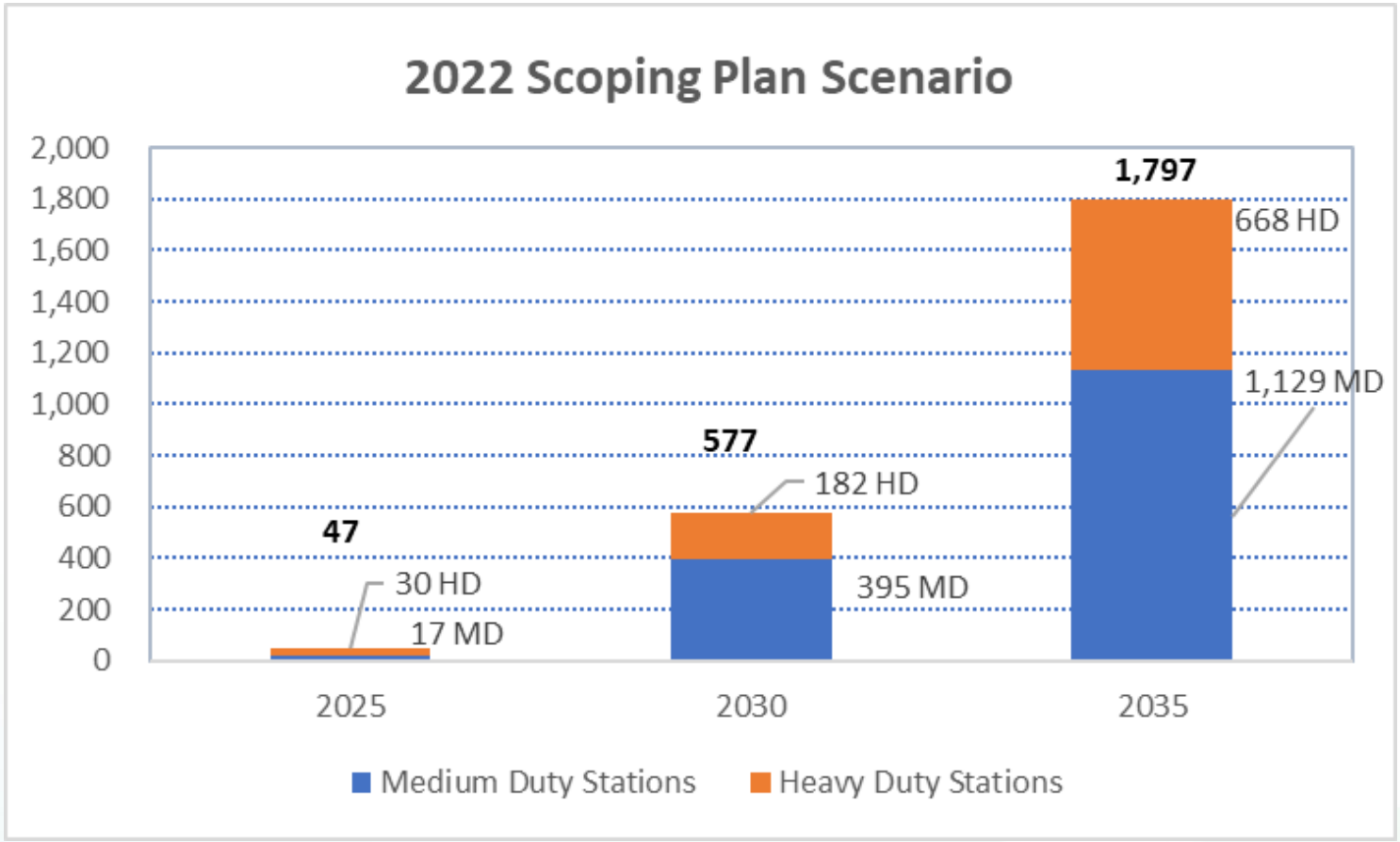
MD stations: 1,000 kg/day, 10 kg fills; HD stations 3,000 kg/day, 30 kg fills

Public/depot stations are not differentiated

Assumes MD and HD FCEVs will refuel at separate stations

395 MD & 182 HD in 2030

1,129 MD & 668 HD in 2035

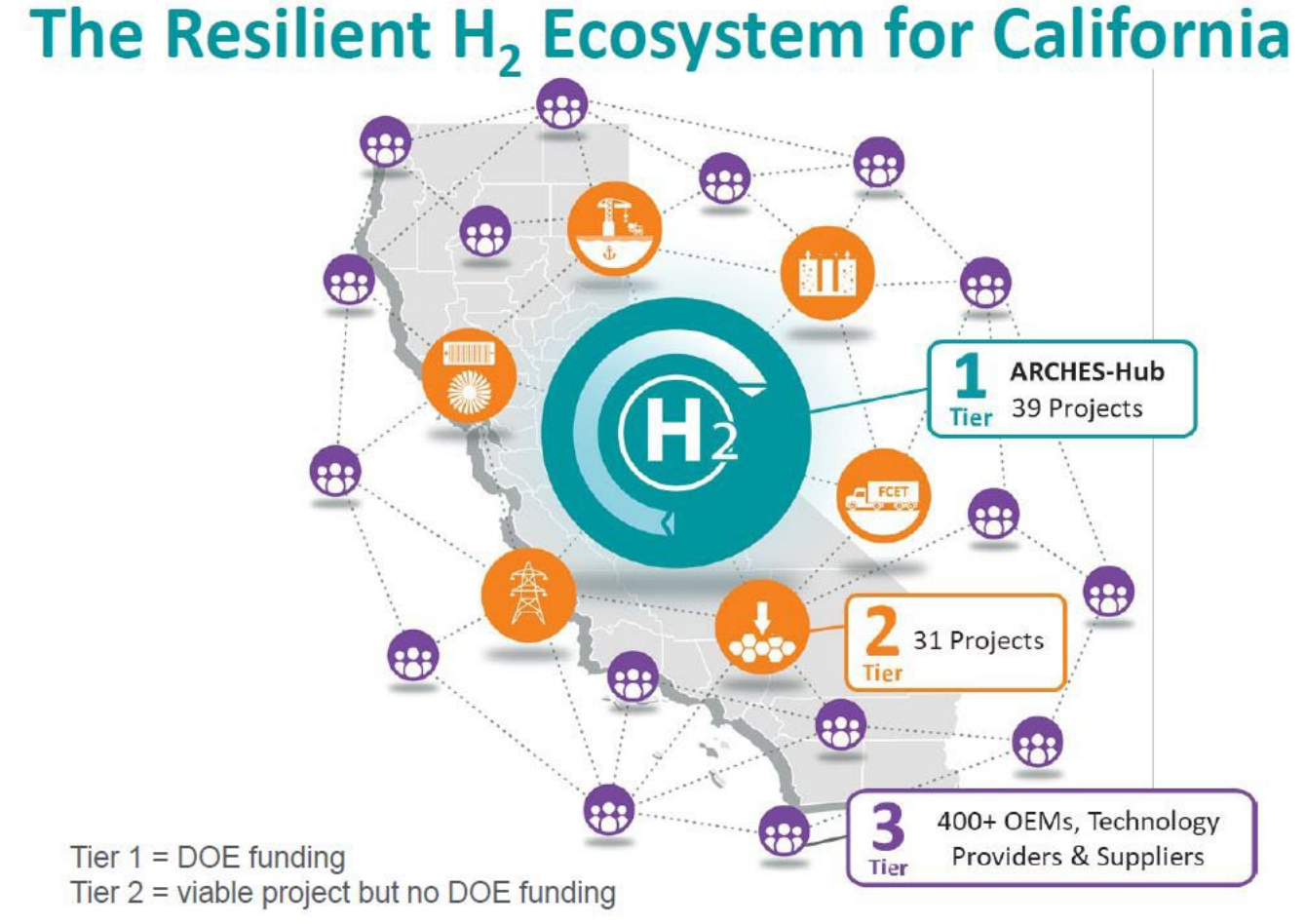


Alliance for Renewable Clean Hydrogen Energy Systems (ARCHES)

- **ARCHES** is a public-private partnership created to promote and oversee the design, development, and deployment of hydrogen infrastructure projects in California across at least three sectors, including power, heavy-duty transportation, and marine and inland ports.

- **October 13, 2023**: President Biden announced that ARCHES proposal to win one of seven hydrogen hubs was successful (***California awarded up to $1.2 billion***).

Alliance for Renewable Clean Hydrogen Energy Systems (ARCHES)



Credit: GO-Biz

Scenario 2: ARCHES

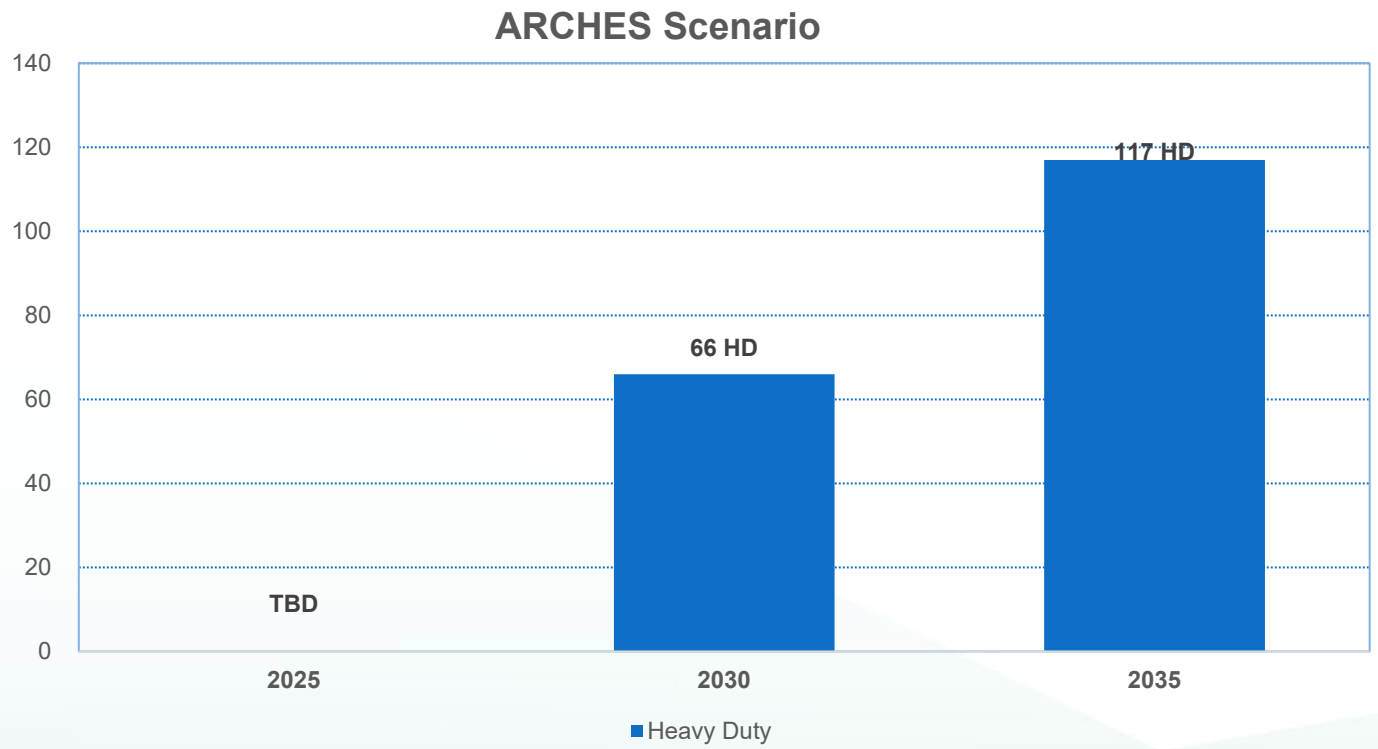
Assumptions:

MD FCEVs will mainly refuel at LD stations.

Project specific: Few details about the assumptions for this scenario, which was prepared in consultation with ARCHES but limited due to confidentiality.

66 HD stations in 2030

117 HD Stations in 2035

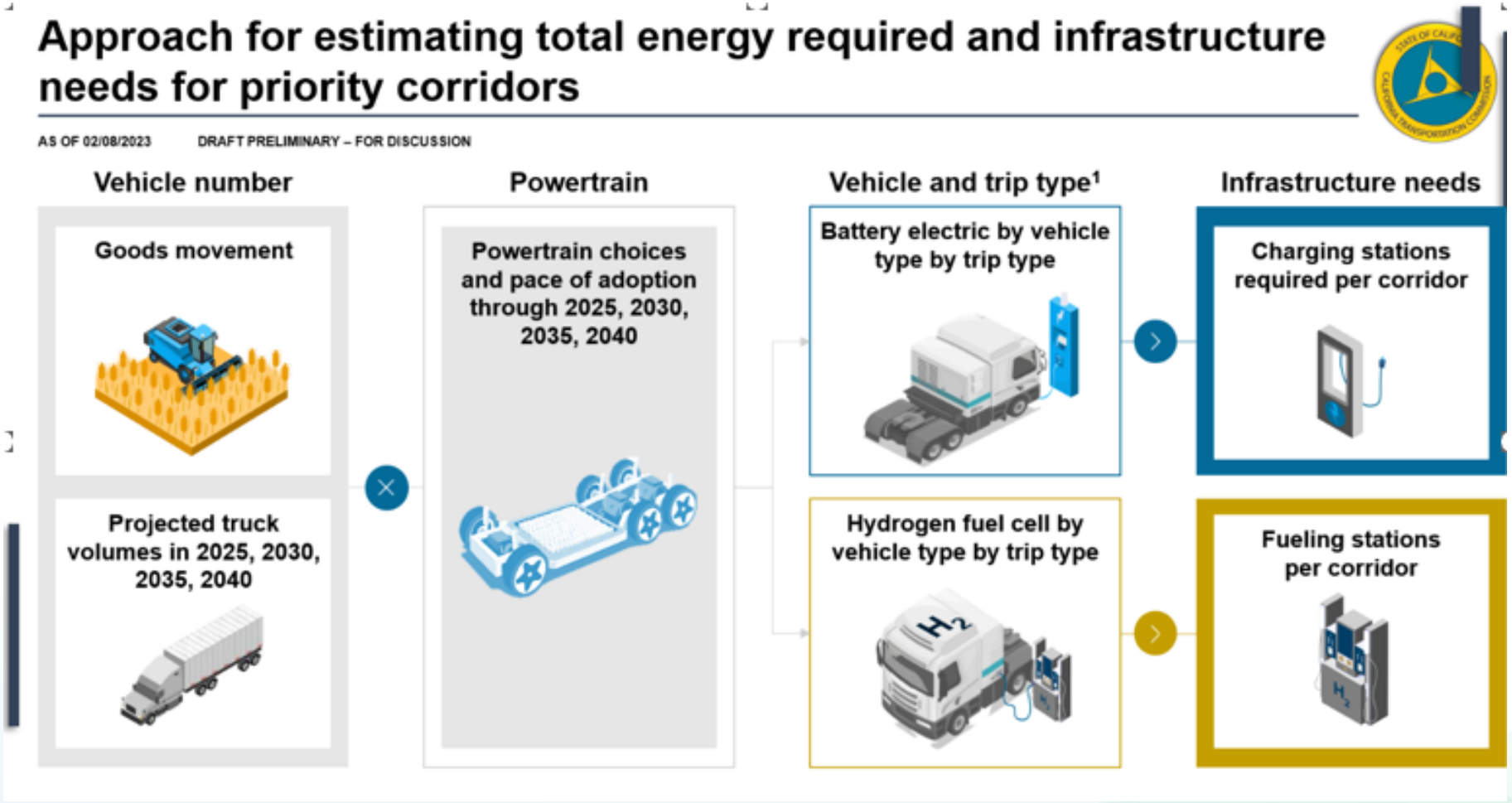


SB 671: Clean Freight Assessment

- SB 671 requires the CTC to prepare a Clean Freight Corridor Efficiency Assessment that identifies freight corridors, or segments of corridors, and the infrastructure needed to support the deployment of zero-emission MDHD vehicles.

- Estimates of zero-emission freight infrastructure needs depend on ***several variables***, and there is uncertainty when predicting what will occur over the next 20 years. Hence, three potential scenarios of infrastructure needs were prepared.
- Draft Assessment for public comment.

SB 671: Clean Freight Assessment



Credit: CTC staff

Scenario 3: SB 671 (Balanced)

Approach:

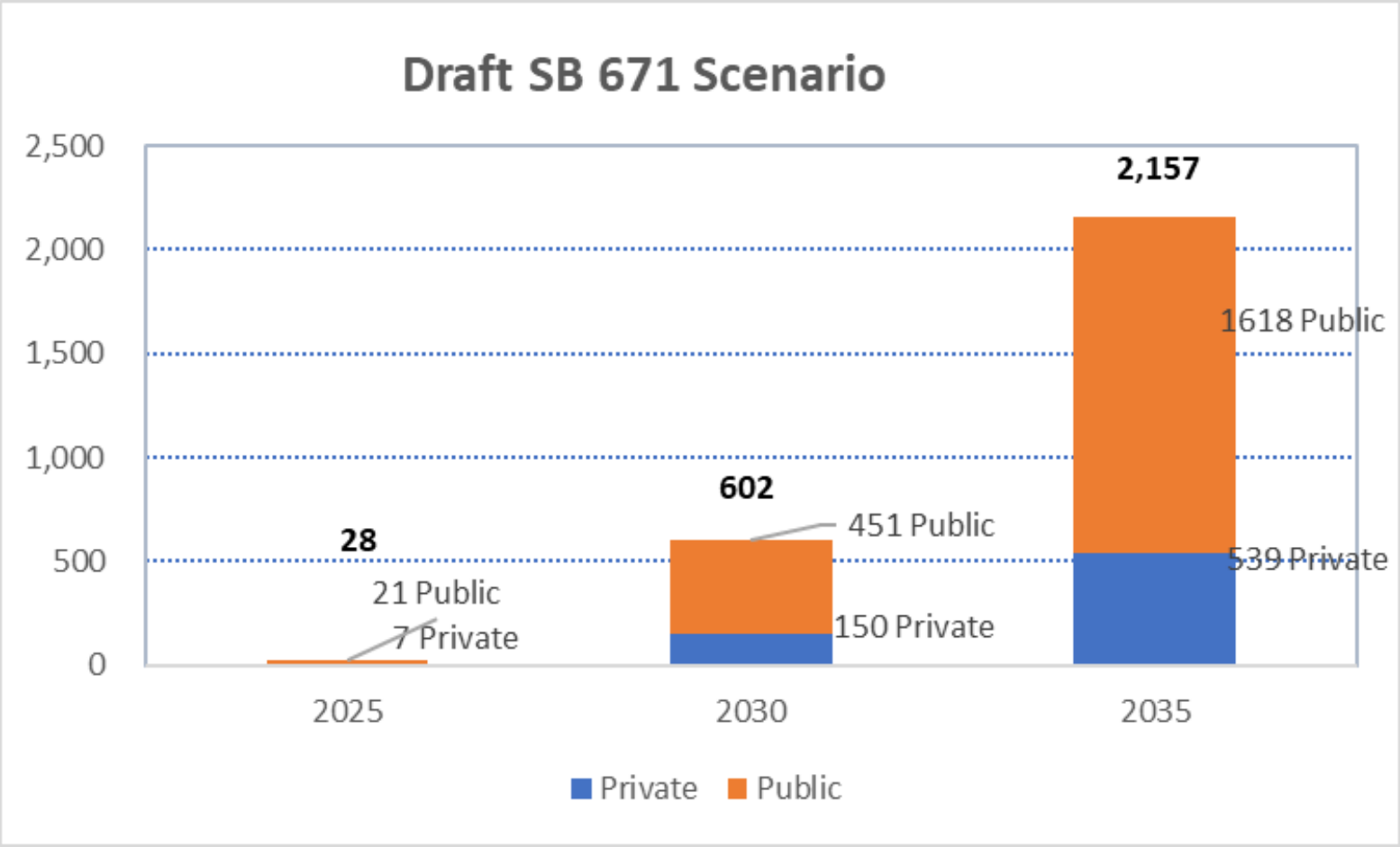
Annual average truck vehicle miles statewide

Fuel efficiency of BEVs, FCEVs

Driven by information from fleets have made in the past and trip types

602 stations in 2030

2,157 stations in 2035



Integrated Energy Policy Report (IEPR) AATE3 Scenario

- The *2022 IEPR Update* Additional Achievable Transportation Electrification (AATE3) scenario shows a low uptake in MDHD hydrogen vehicles due to a range of modeling inputs including a relatively high hydrogen fuel price.
  - Future AATE scenarios will include additional inputs and assumptions.

Scenario 4: *2022 IEPR Update* - AATE3

Assumptions:

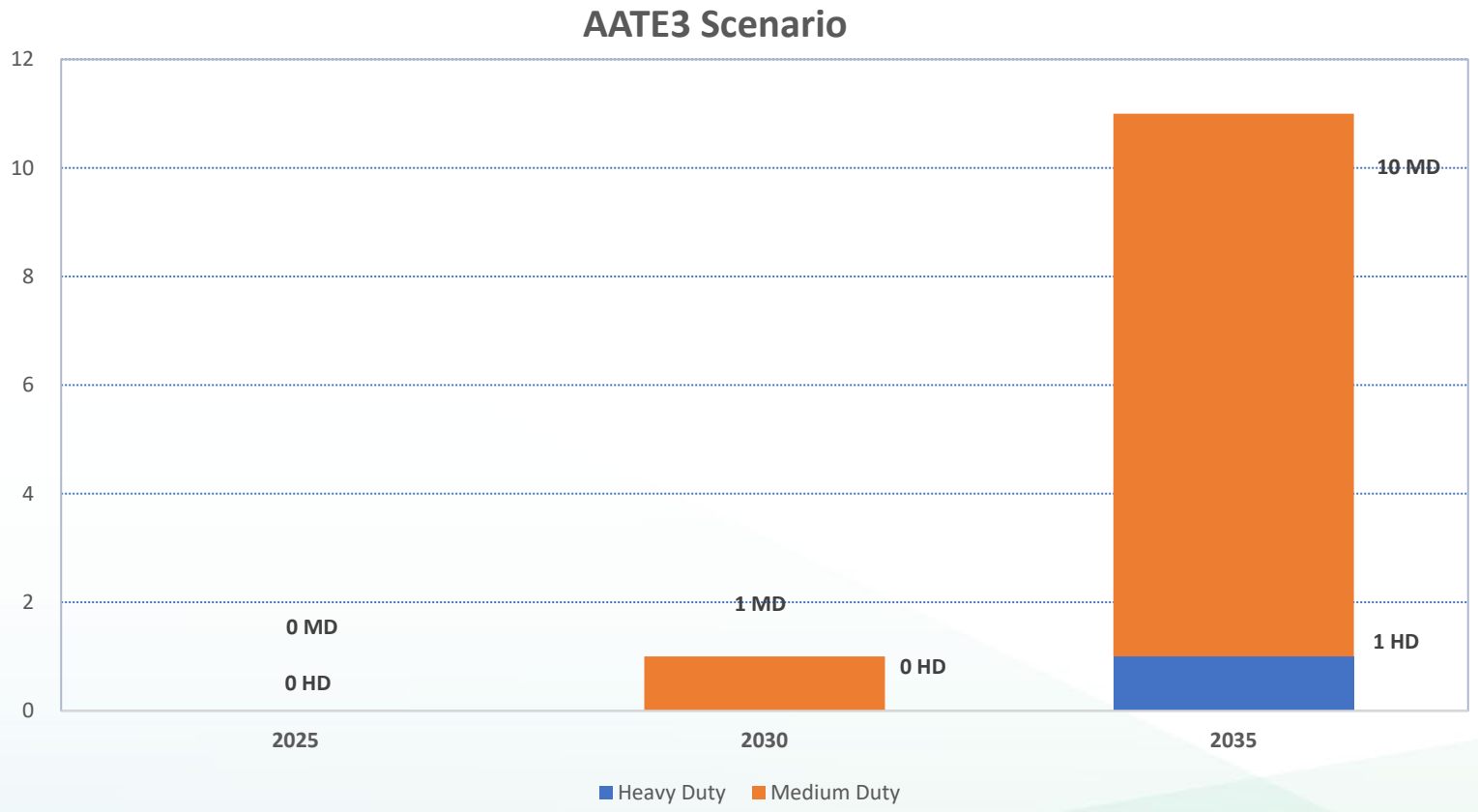
MDHD FCEV stock from AATE3

MD stations are 1,000 kg capacity/day,10 kg fills/day; HD stations are 3,000 kg capacity/day, 30 kg fills/day.

Stations Needed:

1 MD station in 2030

10 MD stations and 1 HD station in 2035



Innovative Clean Transit (ICT) Fuel Cell Electric Buses (FCEB)

CALIFORNIA
AIR RESOURCES BOARD

Innovative Clean Transit Regulation and Fuel Cell Electric Buses

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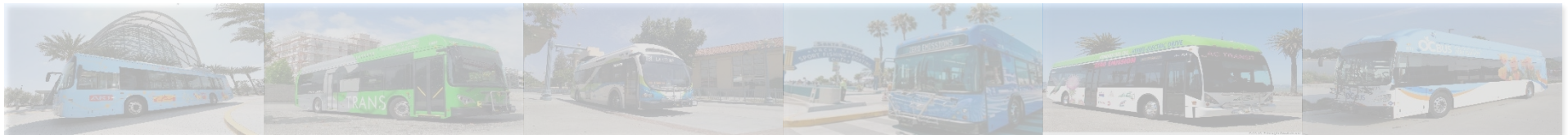
Workshop on 2023 Senate Bill 643 Staff Report

October 16, 2023

Shirin Barfjani, Air Pollution Specialist



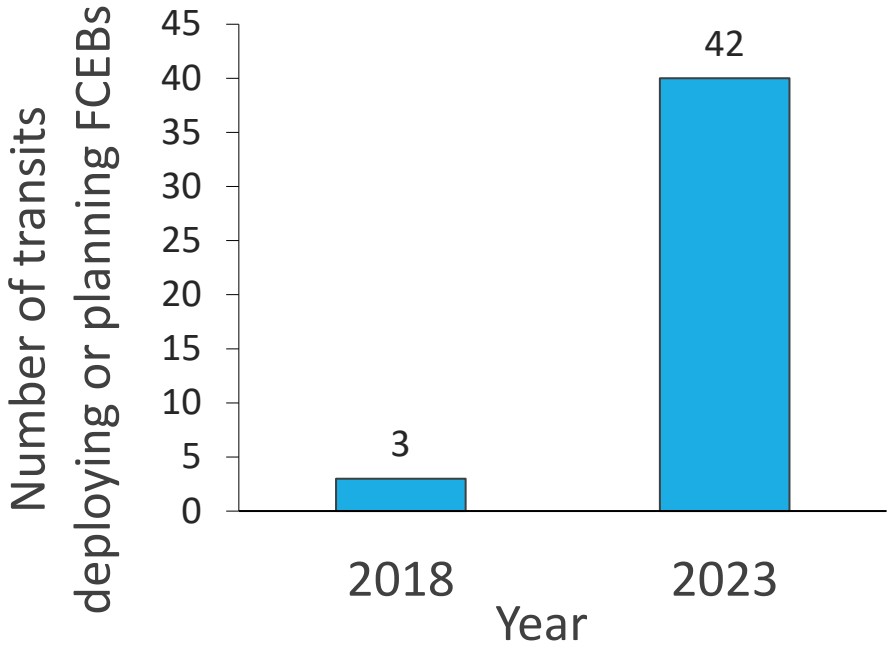
Innovative Clean Transit (ICT) Regulation

- Adopted in 2018 as the first heavy-duty zero-emission vehicle regulation in California and the U.S.
- Aims for complete tailpipe emissions reduction by 2040
- Utilizes a phased-in approach to allow pilot experience and ensure a smooth process
- ZEBs are beachhead technologies for heavy-duty vehicle applications
  - Electric drivetrain design
  - Range demand and management
  - Infrastructure and scaling up
  - Planning and cost management
  - Curriculum for workforce training

ZEB Status and Deployment of Fuel Cell Electric Bus (FCEB)

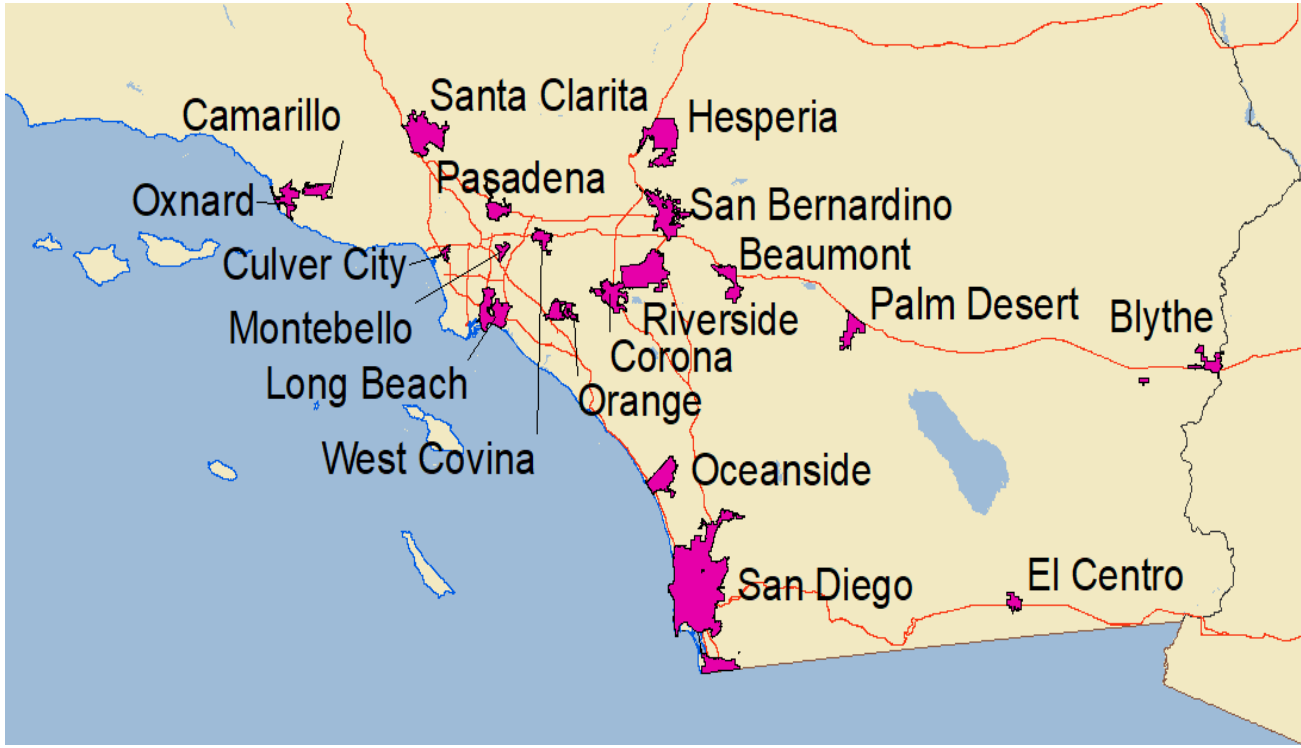
	Batter Electric Buses	Fuel Cell Electric Buses	Sum
In Service	540	96	636
On Order	405	53	458
Sum	945	149	1,094

Source: 2022 data reported in the Innovative Clean Transit Reporting Tool (ICTRT)



Sources: 2022 reported data in the ICTRT, Rollout Plans, and federal discretionary and various state incentive programs

Where to See and Ride FCEBs in California



FCEB—Advantages and Continued Progress

- Advantages
  - Long range
  - Short fueling time
- Further progress focuses
  - Provide other types of buses (i.e., cutaways, motor couches)
  - Lower hydrogen cost (e.g., ARCHES, statewide hydrogen procurement project for transit agencies)
  - Further develop workforce in various areas, e.g., fleets, OEMs, infrastructure builders, technology providers, etc.

Resources

- ICT Team ICT@arb.ca.gov
- Innovative Clean Transit website https://ww2.arb.ca.gov/our-work/programs/innovative-clean-transit
- Funding Finder Tool: https://fundingfindertool.org/

Clean Hydrogen Production

Clean Hydrogen Production

- The color-spectrum of hydrogen production: Color codes used within the energy industry to differentiate types of hydrogen.
- Standardization of California's definitions for hydrogen are under development.
    - SB 1075: Evaluation to include policy recommendations and strategies for decarbonization, and definitions for hydrogen, to be completed by June 2024.

Defining Clean Hydrogen Production

- Pending standardized definitions for California, the *SB 643 Staff Report* recognizes the definition proposed by U.S. DOE. a target of 4.0 kg of CO2 equivalent produced per kilogram of hydrogen that is directly produced: **4.0 kg CO2e/kgH2**
  - This is a proposed standard that allows different pathways of production
  - Not a regulation, but awardees of federal hydrogen hub funding are required to follow this guidance.

Clean Hydrogen Production

- Clean hydrogen production in California is nearly non-existent
- The CEC has awarded $22 million to six clean hydrogen fuel projects that will increase production by nearly 40,000 kg per day
- Four of the projects will use electrolysis, while two will produce hydrogen through gasification.
- ARCHES' goal includes ramping production to over 500 tons (454,000 kg) per day by 2030

Clean Hydrogen Production

A CEC-funded project by developer H2B2 recently began commercial production with an initial production of about 1,000 kg/day initially powered by biogas.

Source: H2B2

Off-Road/Non-Road Hydrogen Developments

Aviation, Maritime, and Rail Demonstrations

- Aviation, maritime, and rail hydrogen applications
  - Primarily limited to demonstrations

Source: All Marine

Source: Universal Hydrogen

Source: Stadler

Aviation, Maritime, Rail, and Off-Road Hydrogen Applications

- In 2023, the CEC is partnering with CARB to support Advanced Technology Demonstration and Pilot projects.
  - The CEC will provide emerging opportunities for infrastructure to support vehicle demonstrations in zero-emission aviation, locomotive and marine sectors, as well as funding for construction, agriculture, and other off-road sectors.

Aviation, Maritime, Rail, and Off-Road Hydrogen Applications

- The CEC's contract with Lawrence Berkeley National Lab was recently augmented to expand the HEVI-LOAD modeling to MDHD hydrogen fuel cell applications, including those in the off-road/non-road sectors.

Using Clean Hydrogen to Support California's Grid

Clean Hydrogen to Support the Grid

- Through utility-scale electricity generation (i.e. a power plant).
- Some utilities are upgrading gas turbines for hydrogen combustion to reduce emissions (Northern California Power Agency).
- San Diego Gas & Electric is developing a grid-connected electrolyzer to generate hydrogen, which will be stored in high pressure tanks. A fuel cell will consume the stored energy to provide grid power.

Discussion topics

- What are some assumptions the CEC could use to inform refueling stations requirements by 2030, 2035 and beyond?
  (Capacity of station, mixed-use concept, fuel delivery methods, etc).

- What are the greatest challenges faced by infrastructure developers? How could they be addressed, within the next year, 5 years, 10 years?

- Do you have suggestions on how the CEC can provide relevant information and create an ongoing platform to help inform developers and fleet owners in their decision making?

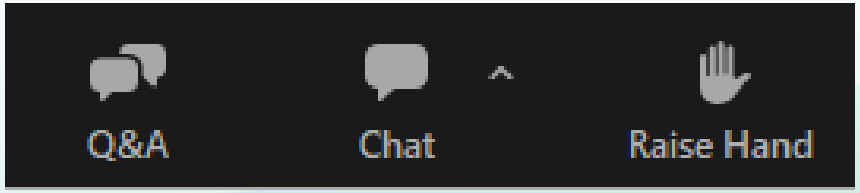
Public discussion

Zoom Participants:

- Use the "raise hand" feature to make verbal comments
- Use the Q&A feature to type in your question

Telephone Participants:

- Dial *9 to raise your hand
- Dial *6 to mute/unmute your phone line.



Q&A and Public Comment

Written comments

Electronic Commenting System

Visit the comment page for this docket at:

https://efiling.energy.ca.gov/EComment/EComment.aspx?docketnumber=22-HYD-02

Comment by E-mail

Email: docket@energy.ca.gov

Subject Line: "SB 643 Staff Report"

All comments due by Monday, October 30, 2023

Thank You!