CHBC

Hydrogen Means Business in California

Decarbonizing California with Hydrogen

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November 20, 2024

Overview

Advocacy

Goods Movement, Heavy-Duty Transport, and Clean Ports

Public Transportation

Renewable Hydrogen, Energy Storage, and Power Generation

- We are the California Hydrogen Business Council (CHBC)
- 110 members in the business of hydrogen
- Our mission is to support the commercialization of hydrogen in the energy and transportation sectors to aid California in achieving its climate, air quality, and decarbonization goals

- **Our Objectives:**
- Enhance market commercialization through effective advocacy and public sector education; the go-to resource on Hydrogen and Fuel Cell technology for policymakers and policy influencers
- Accelerate market growth via information exchange for the industry and its customers through our Sector Action Groups
- Promote the market by facilitating connections and providing ample networking opportunities for our members through our events

Our Network

- ✓ HYDROGEN PRODUCERS AND DISTRIBUTORS
- ✓ AUTOMOTIVE COMPANIES
- ✓ UTILITIES
- ✓ 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

U.S. Department of Energy Hydrogen Hubs

Alliance for Renewable Clean Hydrogen Energy Systems (ARCHES) Hub

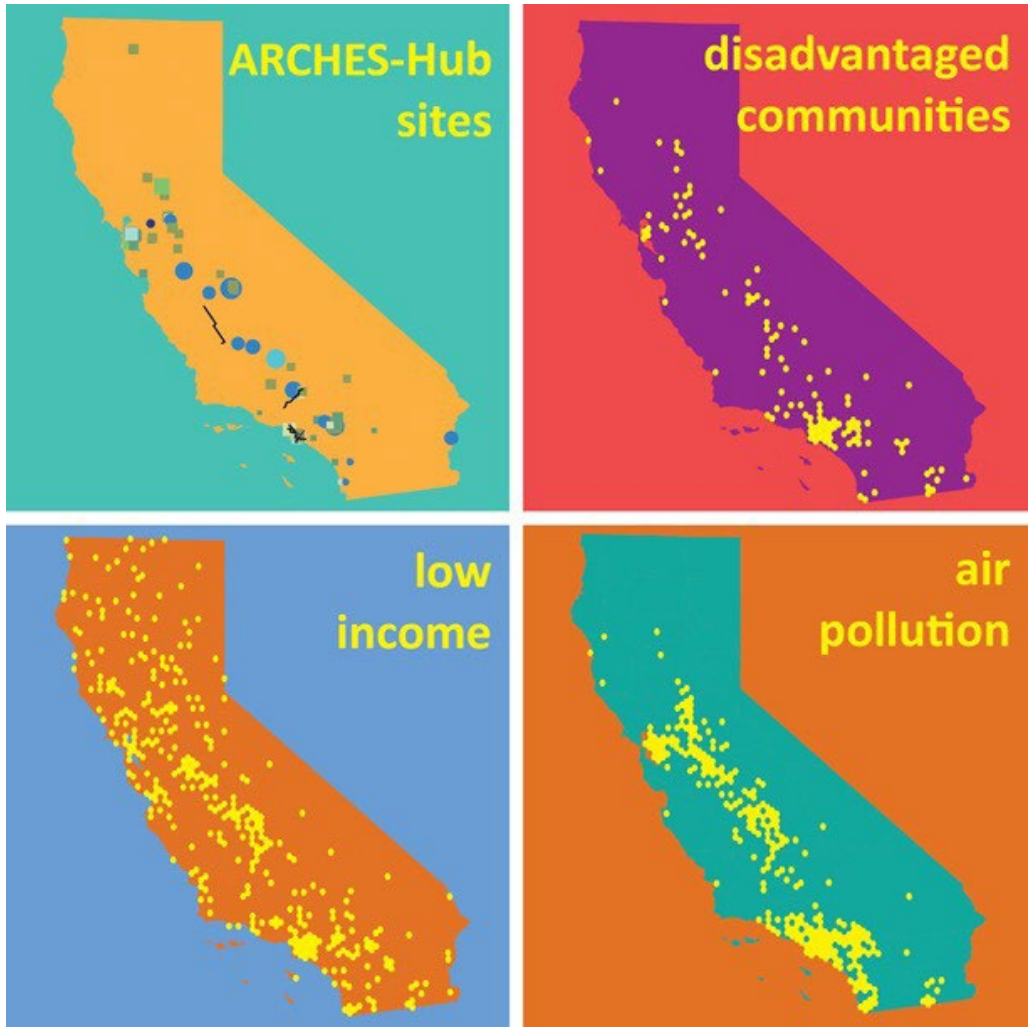
ARCHES is a **public-private partnership** to create a **sustainable renewable, clean hydrogen (H_2) market** and **ecosystem** in California and beyond by 2030

ARCHES' main goals are to:

- Kickstart the **commercial viability of H_2**
  - Focus on hard-to-decarbonize sectors: **Ports, Power, Heavy-Duty Transportation**
  - Initiate expansion to: **Heavy Industry, Aviation, Maritime, Agriculture, and others**
- Increase production/offtake of renewable, clean H_2 from **30 TPD** to **500+ TPD**
- Develop a comprehensive **H_2**regulatory framework to accelerate **H_2** deployment
- Produce **measurable benefits** for California communities, with **robust monitoring**, and **strong accountability**
- Develop a **H_2 workforce** for California, and a **H_2 workforce development model** for the nation, including a universal **H_2** certification program as well as **H_2** specific codes and standards
- **Meet CA air quality and climate goals and work regionally and nationally to build out the H_2 marketplace and ecosystem.**

Any proposed future work is subject to change based on funding levels

ARCHES Community Benefits

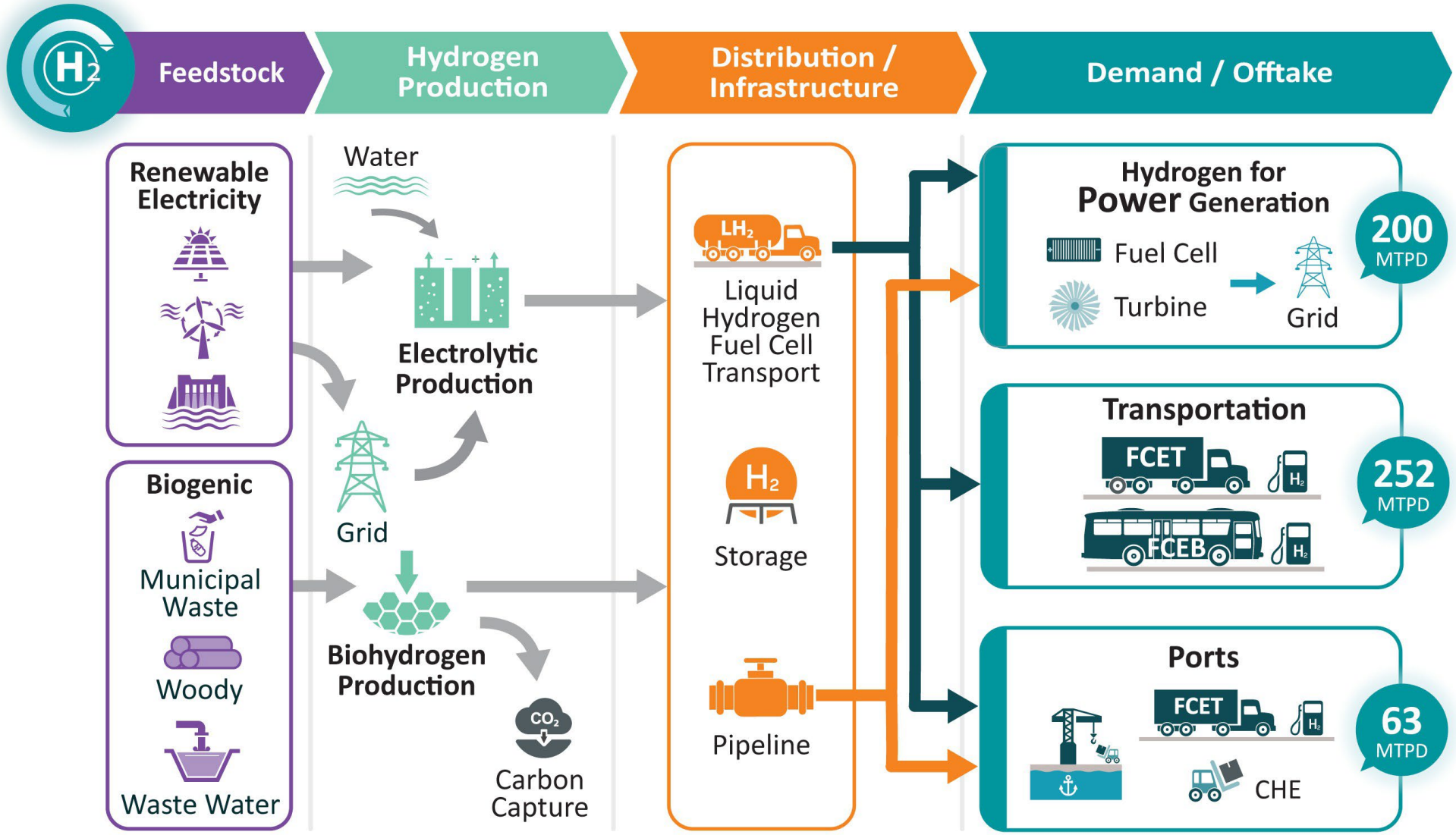


Any proposed future work is subject to change based on funding levels

▲ $2.95 billion	Economic Value of increased health and associated health costs savings per year*
▲ 222,400	Number of jobs created
▼ 2,097	Fewer hospitalizations for respiratory & cardiac illness per year
▼ 13,292	Fewer work loss days per year
▼ 6,900	Nitrogen oxide net emissions avoided (MTPY)
▼ 239	Sulfur dioxide net emissions avoided (MTPY)
▼ 326	Particulate matter net emissions avoided (MTPY)
▼ 48	Fewer premature deaths per year
▲ $380 million	Invested in community benefits & workforce development

**Reduced premature death, asthma, cancer, missed work days*

ARCHES from Feedstock to Off-take



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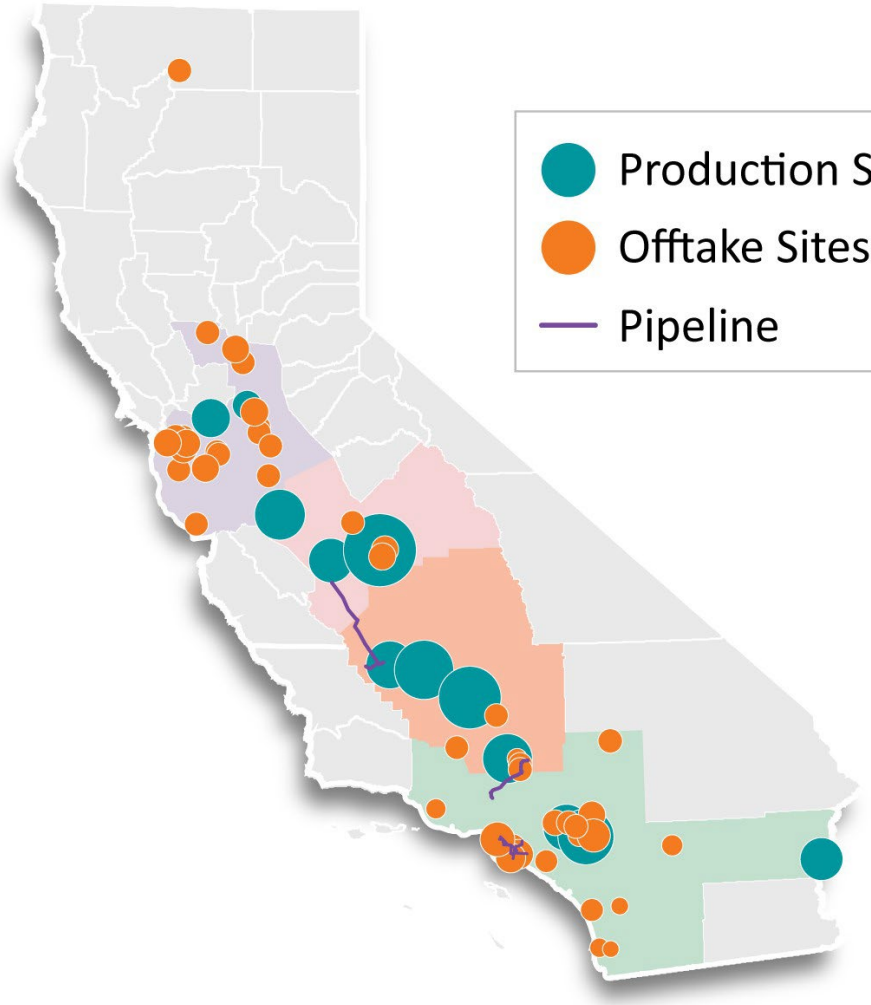
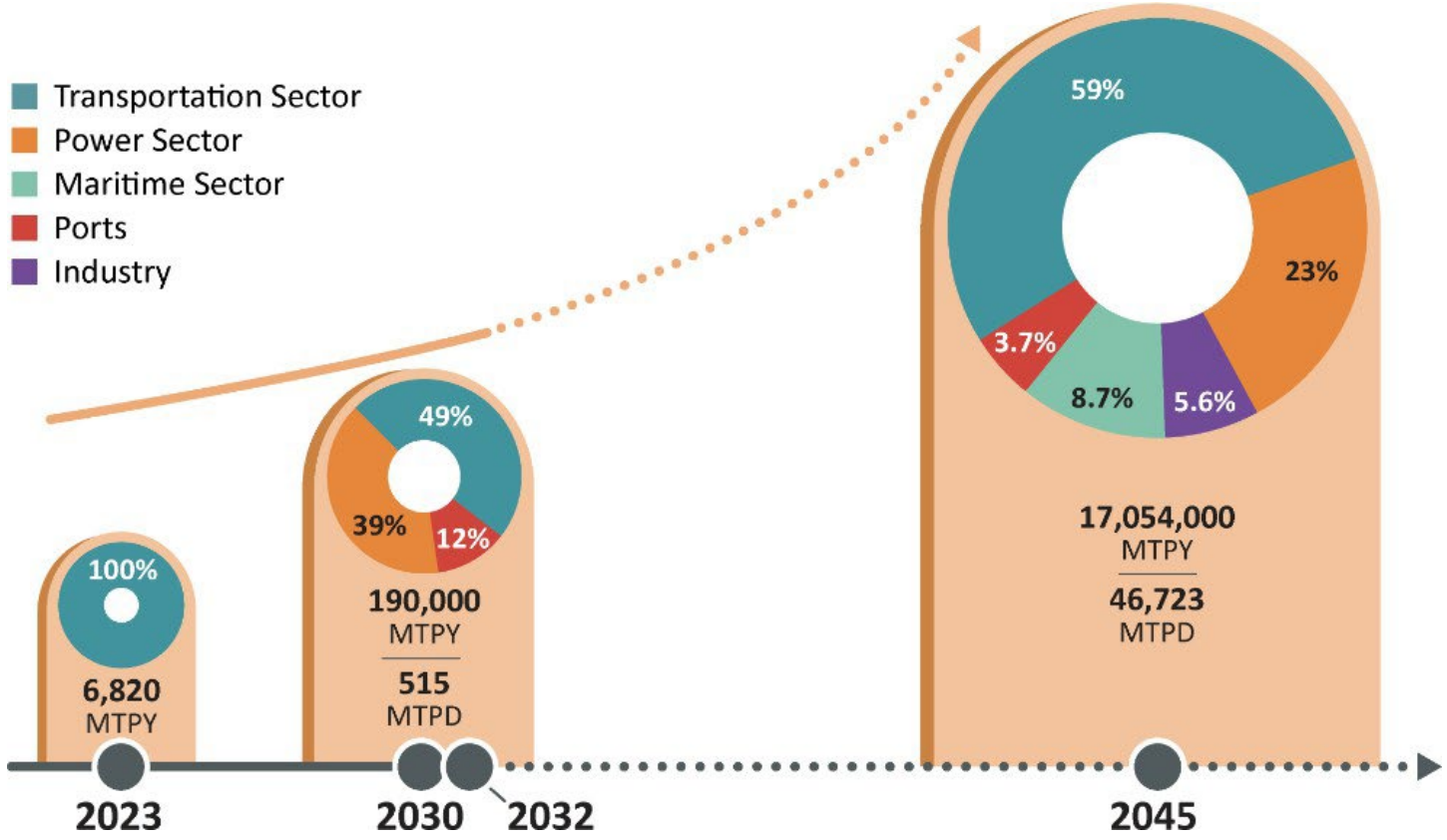
ARCHES Systems Approach Initiates Large Future Growth





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Life Cycle Assessment: Production

Carbon Intensities of Produced Hydrogen by Region

Region	Carbon Intensity	Quantity
	$kgCO_2eq/kgH_2$	MTPD
Northern CA	-1.13	41
Northern CA Valleys	2.15	185
Southern CA Valleys	-6.03	140
Southern CA	2.89	149
Weighted Average	**-0.15**	**515**

Section 45V Tax Credit for Production of Hydrogen

- Essential for the hydrogen hubs projects
- Legislation calls for up to $3/kg of technology-neutral H2 tax credit
- Provides a **ten-year incentive** for qualified clean hydrogen facilities which begin construction before January 1st, 2033
- Based on kilograms of qualified clean hydrogen produced at facility
- Value determined by the carbon intensity of the hydrogen produced
- Lifecycle greenhouse gas emissions are tracked only through the point of production (well to gate) as determined by the most recent GREET model developed by DOE or a successor model
- Potential impact of political variables and Loper Bright decision

Kg of CO_2 per kg of H_2	Credit Value ($)
4 - 2.5 kg CO_2	$0.60 / kg of H_2
2.5 - 1.5 kg CO_2	$0.75 / kg of H_2
1.5 - 0.45 kg CO_2	$1.00 / kg of H_2
0.45 - 0 kg CO_2	$3.00 / kg of H_2

Policy and Advocacy

California hydrogen support

- Driven by decarbonization and air quality objectives
- Ambitious regulation
- Initiatives to align federal and state policy to leverage federal funding
- Legislative wins include expedited permitting for federal and state funded projects

California Regulatory Market Drivers

California Air Resources Board

- Advanced Clean Cars II – phase-in of light-duty, pickup truck and SUV ZEV by 2035
- Advanced Clean Fleets – supply side phase-in adoption of ZEV and manufacture only ZEV by 2036
- Advanced Clean Trucks – phase-in of zero-emission truck fleets from 2024 to 2035
- Innovative Clean Transit – phase-in of zero-emission bus fleets by 2040
- In-Use Locomotives – phase-in adoption of zero-emission locomotives by 2047
- Zero-emission forklifts rule in consideration summer of 2024
- Low-Carbon Fuel Standard – proposed updates include potential changes to hydrogen pathways and station credits
- SB 1075 Report: Hydrogen Development, Deployment, and Use (interagency)
- Cap and Trade potential amendments

Governor's Office of Business and Economic Development (GoBiz)

- Hydrogen Market Development Strategy (interagency)
- ARCHES leadership

California Energy Commission

- Clean Transportation Program and infrastructure funding
- Renewable Portfolio Standard Guidebook
- Hydrogen production funding programs

California Public Utilities Commission – hydrogen in pipelines and infrastructure; energization of infrastructure

Hydrogen Blending Pilot Project Summary

CPUC D.22-12-057, Ordering Paragraph 11

Project Title	Live Blending Description	H2 Blends Considered	Pipeline Detail	End Use Equipment Detail	Location & Climate Detail	Project Costs
SoCalGas – UCI H2 Blending Pilot	Isolated portion of distribution system.	Up to 20% by volume	Medium Pressure Distribution Pipeline (Steel and Plastic)	Commercial and Residential	Irvine, CA; Moderate coastal conditions	$14.82 MM
SoCalGas – Open System Blending	"Open" portion of distribution system	Up to 5% by volume	TBD	Commercial and Residential	TBD	TBD
SDG&E – UCSD H2 Blending Pilot	Isolated portion of distribution system	Up to 20% by volume	Medium Pressure Distribution Pipeline (Polyethylene Pipe)	Fuel cell	La Jolla, CA; Moderate coastal conditions	$13.9 MM
Southwest Gas H2 Blending Pilot	Isolated portion of distribution system	Up to 20% by volume	Medium Pressure Distribution Pipeline (Polyethylene Pipe)	Commercial	Truckee, CA; Extremely cold weather conditions, high elevation	$10.21 MM
PG&E	Isolated, standalone, and new transmission system	Up to 30% by volume	High pressure (steel)	Power Plant and Fueling Station	City of Lodi, CA; Mediterranean climate	$90-330 M

Source: Stakeholder Workshop: Joint Utilities Hydrogen Blending and Injection Pilots for California, June 13, 2023

Angeles Link

How Does It Work?

25-35 GW
Curtailed/New/Solar/Wind
2 GW Batteries

10-20 GW
Electrolyzers

Mileage of hydrogen infrastructure is preliminary at this time and will be addressed in study.

14.3 million tons of CO_2 emissions eliminated

Start with 100% renewable electricity that is on the grid, new build, or being curtailed to provide power to the electrolyzer.

Then use it to make clean, renewable hydrogen with electrolyzers. Electrolysis splits water into hydrogen and oxygen with virtually zero greenhouse gas and criteria pollutant emissions.

SoCalGas safely delivers hydrogen from outside of the LA Basin to industries that need it most.

Use clean, renewable hydrogen to decarbonize hard-to-electrify sectors such as dispatchable electric generation, heavy-duty transportation and industrial processes while driving job creation.

Source: Angeles Link | SoCalGas

Mobility

- 18,355 fuel cell electric vehicles (cars) sold and operating in the U.S.
- 66 fuel cell electric buses operating in California (over 108 in development)
- 43 retail hydrogen refueling stations available in California and 108 in development
- 3 truck hydrogen stations operating and 9 funded in California

Source: Hydrogen Fuel Cell Partnership, September 11, 2024

Photo Courtesy of Hyzon Motors

Photo Courtesy of SunLine Transit

Photo Courtesy of Cummins

Power Generation

Photo Courtesy of Plug Power

Photo Courtesy of Bloom Energy

Over 320 MW of stationary fuel cell systems installed in California

Source: Stationary fuel cell manufacturers, August 2023

Photo Courtesy of HyAxiom, a Doosan Company

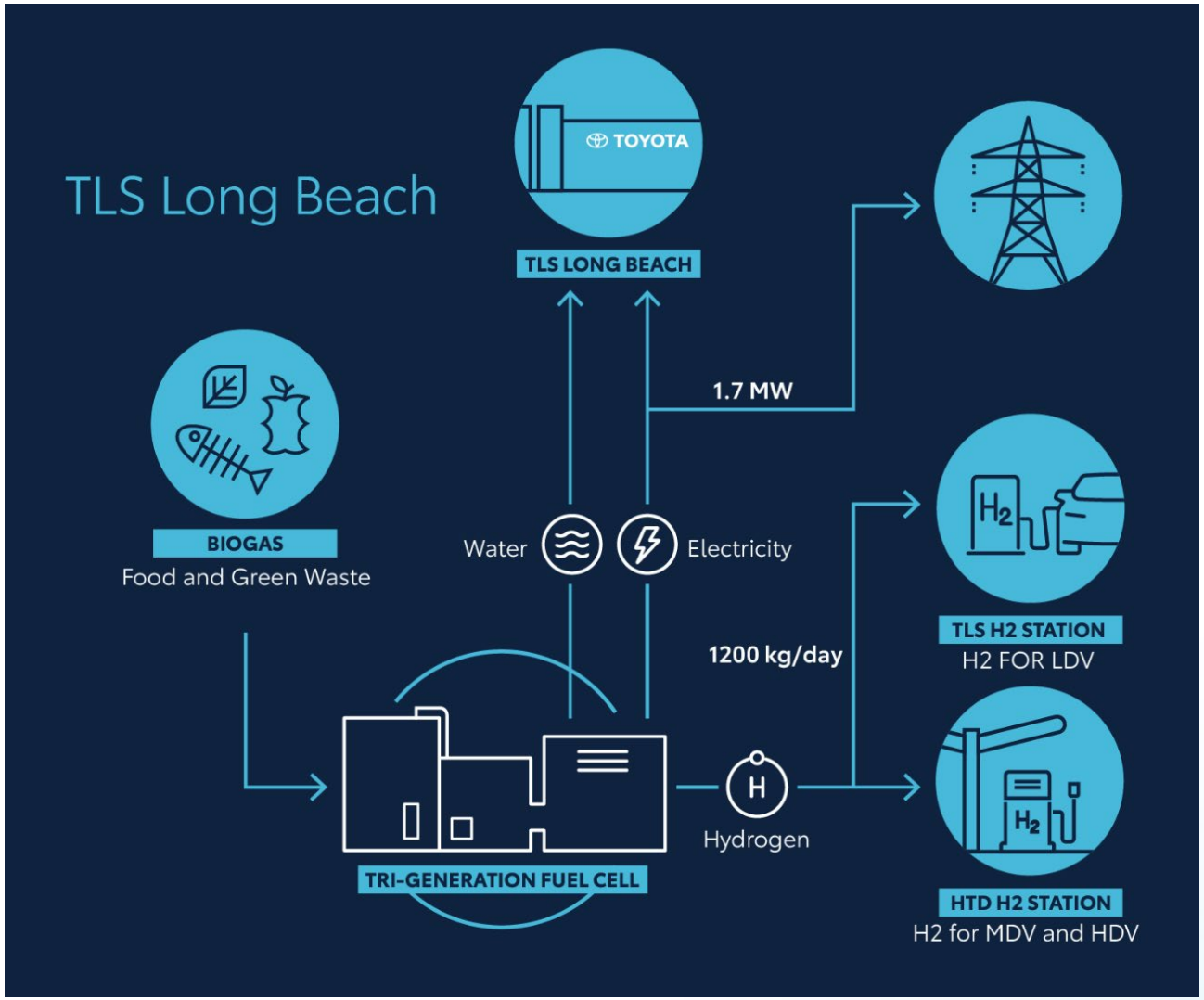
Maritime and Rail

29 Intercity Trains (10 ordered, 19 option) – San Bernadino County
CALSTA, CALTRANS, Stadler, Ballard
Photo Credit: Keith Fender, International Railway Journal

Valley Link: Tri-Valley & San Joaquin Valley Regional Rail Authority
Photo Credit: Valley Link Rail

The SEA CHANGE, San Francisco Bay
Photo by Sheila Fitzgerald via Shutterstock

Ports



Toyota Logistics Services
Port of Long Beach
FuelCell Energy
FASTECH
The Fiedler Group

Source:
https://www.toyota.com/usa/environmentalsustainability/carbon/toyota-port-facility-nears-carbon-neutrality

Republic Services West Contra Costa Landfill

Richmond, CA
Republic Services West Contra Costa Landfill
S-Series • Organic Waste-To-Hydrogen

Technology:
Steam/CO_2 Reformation, non-combustion

Expected Launch Date:
Spring/Summer 2024

CEQA Approval:
May 16, 2023

BAAQMD Expected Approval:
Fall 2023

Construction:
Fall 2023

Feedstock:
Organic waste, up to 99 wet tons per day, 34,155 MT per year (*based on 345 days of operation per year)*

Hydrogen Production:
5 tons per day/2,400 MT per year

Avoided Emissions:
7,200 MT CO_2e annually

Safety

- The CHBC actively promotes and engages in a safety culture through our strategic alliance with the Center for Hydrogen Safety
- All stakeholders benefit from our members' safety practices
- Communicating and sharing safety information and resources is critical

Affiliates

Formal affiliations established with the following

- American Biogas Council (national)
- ARCHES Hydrogen Hub
- California Hydrogen Coalition
- Canadian Hydrogen and Fuel Cell Association
- Center for Hydrogen Safety (global)
- Center for Transportation and the Environment (national)
- Coalition for Clean Air
- Compressed Gas Association (national)
- Fuel Cell and Hydrogen Energy Association (federal)
- Hispanics in Energy
- Hydrogen Fuel Cell Partnership
- Renewable Hydrogen Alliance (Pacific Northwest)
- Renewables 100 Policy Institute (global)
- University of California Irvine

Thank You

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