



SDG&E and SoCalGas Hydrogen Activity Overview

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Presented by:

- Melanie Davidson, H2 Commercial Dev Manager
(mdavids1@sdge.com)
- Pooyan Kabir, Senior H2 Engineer
(pkabir@sdge.com)



AGENDA



- Introduction to California Hydrogen Policy Landscape
- Select Hydrogen Project Initiatives of SoCalGas and SDG&E
 - Angeles Link
 - H2 Innovation Experience
 - H2 Blending Application
 - Borrego Springs Microgrid, Palomar Energy Center
- Discussion and Q&A

California Leads in Climate & Clean Energy Policy

Governing Law – SB100

By 2045, obtain

100%

of electricity from
renewable sources

Governing Law – SB1383

By 2030, reduce
methane emissions

40%

below 2013 levels

Executive Order B-55-18

By 2045,
economy-wide,
become

Carbon Neutral

Governing Law – SB 1075

State agencies
must consider

Green H2

in decarbonization
strategies

As of 2020, 59% of California's delivered electricity was clean/non fossil.

California Leads in Climate & Clean Energy Policy

California Air Resources Board 2022 Scoping Plan Actions Call out Hydrogen in Various Sectors:

Transportation:

- Aviation
- Ocean Going Vessels
- Rail
- Low Carbon Fuels

Industry:

- Chemicals and Allied Products, Pulp and Paper: H₂ for 25% of process heat by 2035 and 100% by 2045

Buildings:

- Renewable hydrogen blended in fossil gas pipeline at 7% energy (~20% by volume), ramping up between 2030 and 2040
- In 2030s, dedicated hydrogen pipelines constructed to serve certain industrial clusters

California Hydrogen Themes



- Overall interest and support of hydrogen from Governor and other key state agencies
- Stakeholder engagement and education is very important
- Significant concerns about “greenwashing”
- Hydrogen is controversial in terms of what its role should be for supporting decarbonization
- Hydrogen policy is still under development and can take years before we know where the state will go



PROJECT INITIATIVES – SoCalGas

Angeles Link

H2 Innovation Experience

Situation City





Shaping the Future

[2022]

SHAPING THE FUTURE: Executive Summary



The Challenge

California's ambitious climate and clean air-quality goals will not be achievable unless hard-to-electrify sectors of the economy are fully decarbonized, and we're running out of time.

The Solution

This project has the potential to replace natural gas-fired electric generation facilities with clean-burning hydrogen, service hard-to electrify industrial sectors, provide the fuel needed to convert the heavy-duty trucking industry from diesel to fuel cells, and can assist in facilitating permanent retirement of Aliso Canyon.

Project Benefits

Produced entirely from renewable electricity – expands our renewable energy storage capabilities, allows us to utilize more renewable electricity and avoid curtailment, reduces emissions in hard-to-electrify sectors, protects stakeholders and communities of concerns, and creates and maintains thousands of union jobs in the process.

Why SoCalGas?

With **22 million customers**, the benefits of a regulated utility framework, decades-long relationship with the region's largest industrial end-users, more than 100,000 miles of transmission and distribution pipelines already in place, local expertise, and an established track record of project development at scale, we are uniquely positioned to move this transformative project forward.

Angeles Link Overview

Potential Project Benefits



Haynes



Scattergood



Harbor



Valley

Could provide **zero-carbon green hydrogen** to assist LADWP's conversion of its natural gas electric generation facilities



Displace **3 million gallons of diesel per day** reducing NO_x (**24,721 tons per year**), PM_{2.5} and other hazardous air pollutants associated with diesel emissions

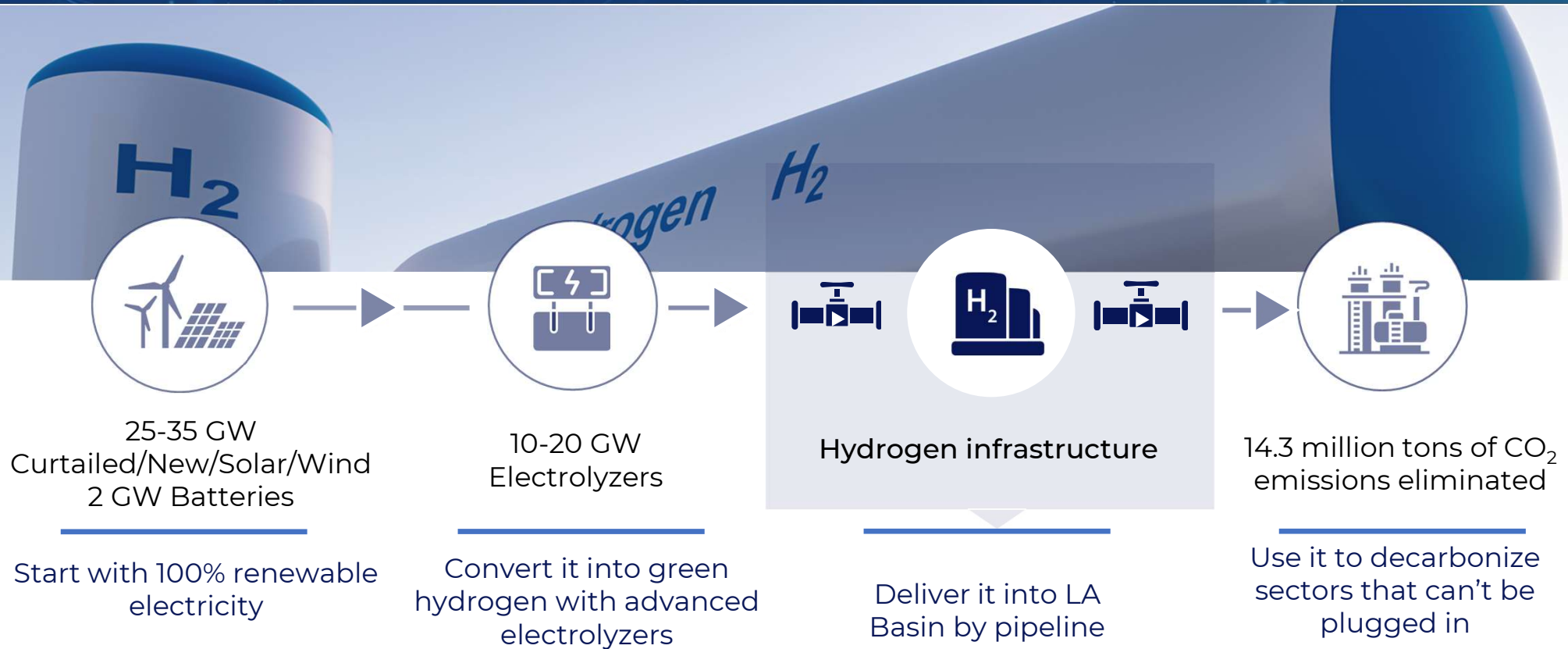


Could significantly reduce regional natural gas demand to potentially remove **14.3 million metric tons of CO₂**

Equivalent to eliminating **57%** of LA County's large stationary source CO₂ emissions

Angeles Link Overview

How Could It Work?



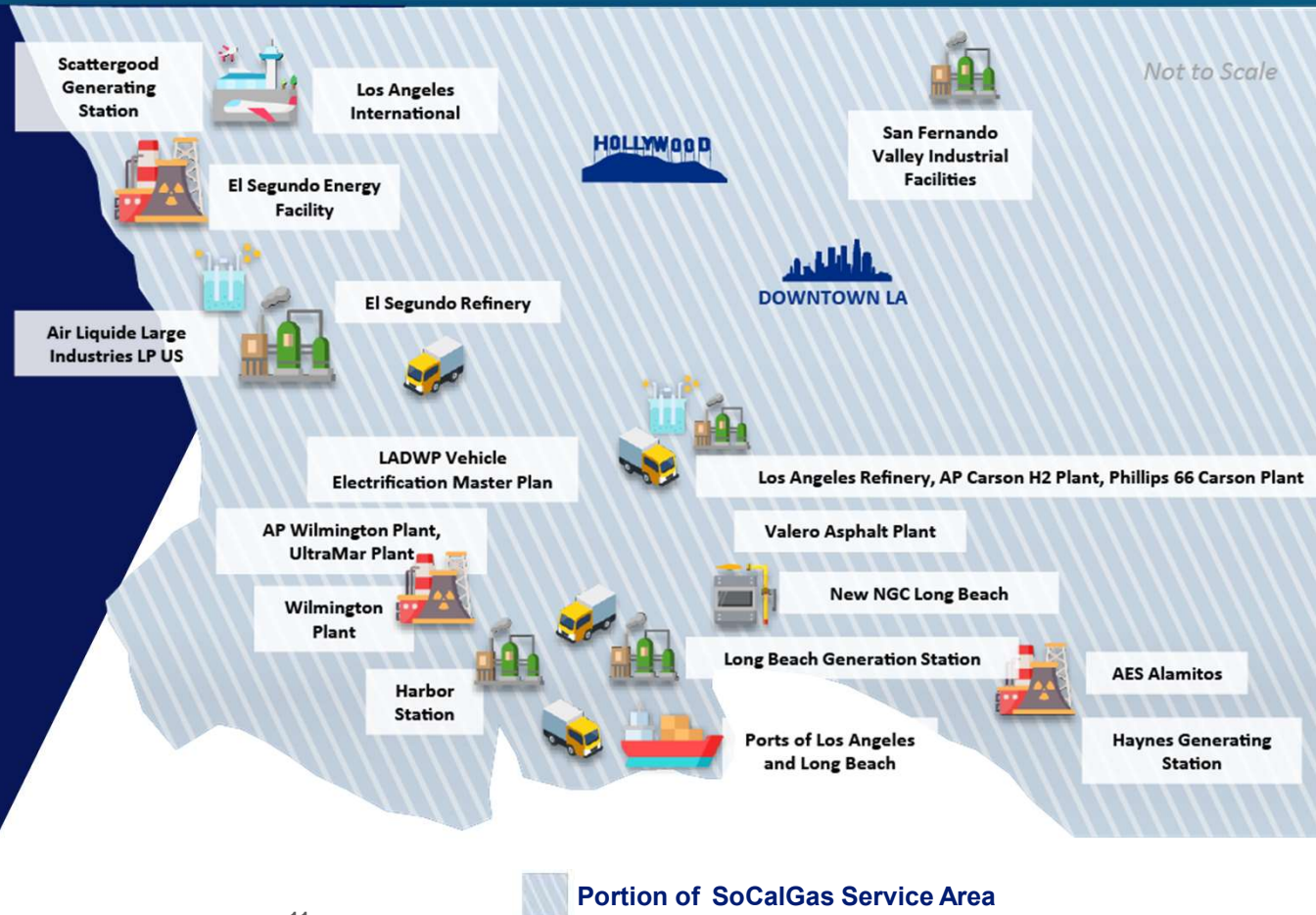
SHAPING THE FUTURE: How Could It Work?



Green Hydrogen Could Anchor Industrial & Hydrogen Hub in the L.A. Basin

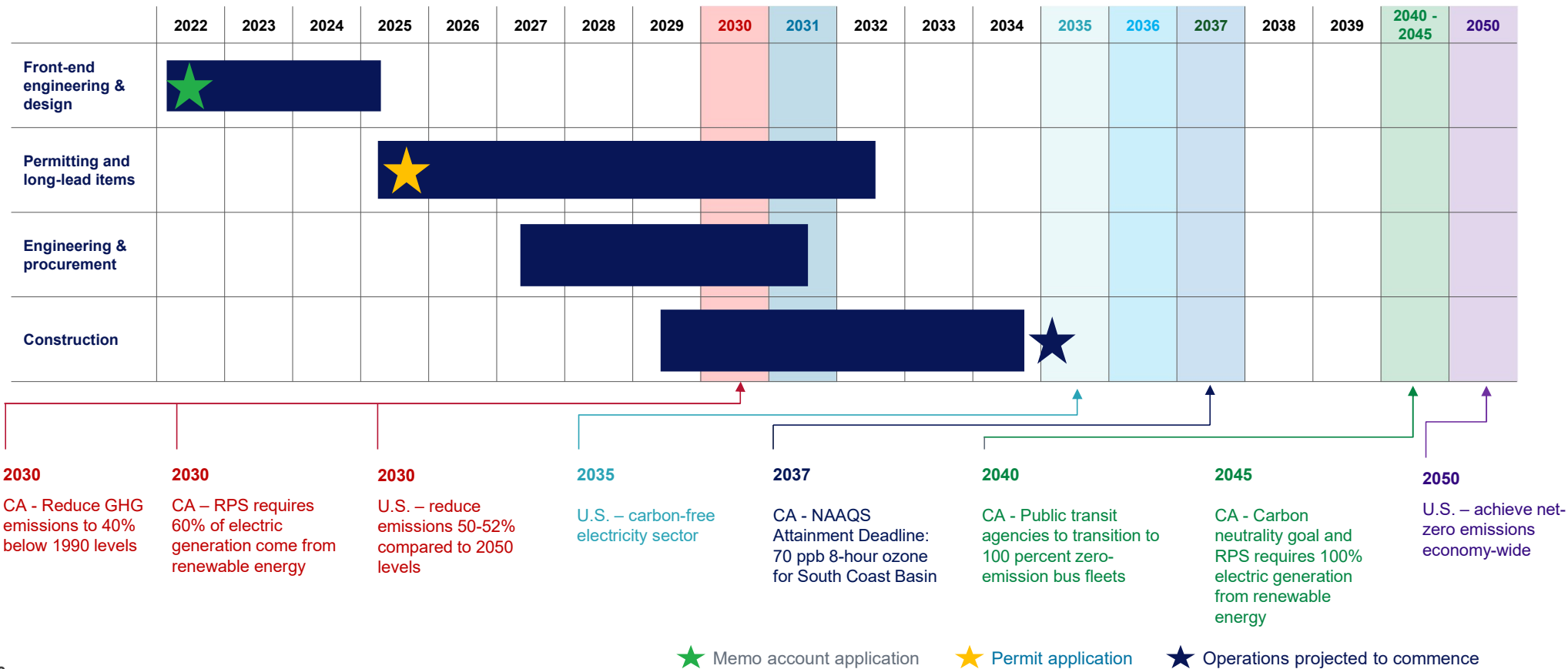
Reliable and scalable
delivery of green hydrogen
as demand grows

Focuses on large emitters
such as electric generation,
aviation, cement, chemical
manufacturing, shipping
and trucking



Indicative Project Development Timeline

Project well-timed to help U.S. and California achieve ambitious climate goals



Commitment to Stakeholder Engagement

- Commitment to **establish a Planning Advisory Group** for technical advice and collaboration on Project design and development, including on environmental justice issues
- Commitment to **hold public workshops** as the Project proceeds, including at the end of each phase and once preferred routes are identified
- Commitment to **submit interim reports** to the Commission and the public regarding Project status and updates
- Pledge to do an **evaluation of hydrogen leakage** assessments in Phase 1
- **Commitment to release information** to the public even if Phase 1 results indicate that the project is infeasible
- Statement that **SoCalGas will not support relaxation** of current NOx emissions standards
- Commitment to **provide technical assistance** on hydrogen combustion and air quality research
- Commitment that activities undertaken as part of the Memo Account would be **consistent with the goals of the Commission's Environmental and Social Justice Action Plan**

Party Concerns

CONCERNS	SoCalGas RESPONSES
There is No Identified Green Hydrogen Demand	State and local agencies have identified the necessity of green hydrogen to meet the State's climate goals . Studies show green hydrogen demand in the LA Basin could be between 1.6-3.2 million metric tons by 2040.
Project Should Be Undertaken by Non-Regulated Affiliate	Assigned Commissioner scoping memo states issue is premature to address and outside the scope of this proceeding . Issue before Commission is simply a request to establish a memorandum account .
Project Will Unfairly Compete with Unregulated Businesses	The Project will be dedicated to public use and does not constitute an unregulated line of business. Excluding public utilities from California's clean energy transition would undermine the State's ambitious climate goals.
The Memorandum Account is Not Caused By an Event of Exceptional Nature	No event more exceptional than climate change.
Costs Are Speculative	SoCalGas has demonstrated that the existence of costs to be recorded in the Memorandum Account is certain , even though the ultimate amount is unknown at this time.
The Costs Were Foreseeable So SoCalGas Should Have Included Them in 2019 GRC	Costs could not have been included in TY 2019 GRC because the Angeles Link project was not reasonably foreseeable at the time of filing in 2017.
SoCalGas Should Include These Costs in 2024 GRC	It does not benefit ratepayers or the public to wait until the TY 2024 GRC.
Ratepayers Will Not Benefit from Memorandum Account	A Memorandum Account will enable stakeholder engagement through the tracking and monitoring of preliminary Project activities and costs throughout the process. The Commission has cited "increasing utility transparency" as a benefit to ratepayers when approving memo accounts.
Project Will Result in Cross-Subsidies	SoCalGas is not seeking any cross-subsidies because SoCalGas is not seeking any rate recovery in this Memorandum Account.
Cost Recovery	Commission should not address cost recovery in a stand-alone Memo Account proceeding ; any future request for cost recovery would be subject to reasonableness review .

Angeles Link Supporters

Environmental

- Natural Resources Defense Council (party) ⁺
- Environmental Defense Fund (party) ⁺
- Energy Independence Now

Labor

- Utility Workers Union of America (party)
- California State Pipe Trades Council (party)
- Coalition of California Utility Employees (party)
- Los Angeles County Federation of Labor
- Southern California Council of Laborers (12 locals)

Ports, Trucking and Transit Agencies

- Port of Long Beach (party)
- Port of Los Angeles
- Harbor Trucking Association
- All Major Southern California Transit Agencies (LA, OC, Ventura, Riverside, San Bernardino, San Diego, Imperial County)

Academia

- U. C. Irvine - Jack Brouwer
- U. C. Los Angeles - Tim Fisher, Mechanical & Aerospace Engineering
- U. C. Davis - Lew Fulton, Director Sustainable Pathways
- Columbia University - Jason Bordoff, Climate School Dean

Technology Companies

- Bloom Energy (party)
- Mote, Inc (carbon capture)

Chambers of Commerce / Business Councils

- Los Angeles
- Long Beach
- Orange County
- San Fernando Valley
- South Bay
- Inland Empire
- San Pedro
- Santa Clarita
- San Gabriel Valley
- Torrance
- Harbor Association
- Valley Industry and Commerce
- Industry Business Council

Energy Producers / Electric Generation

- Southern CA Generation Coalition (party)
- Independent Energy Producers Association (party)
- LA Department of Water and Power

Industry Associations

- Green Hydrogen Coalition (party)
- California Asphalt Pavement Association
- CA Hydrogen Business Council
- CA Restaurant Association

⁺qualified





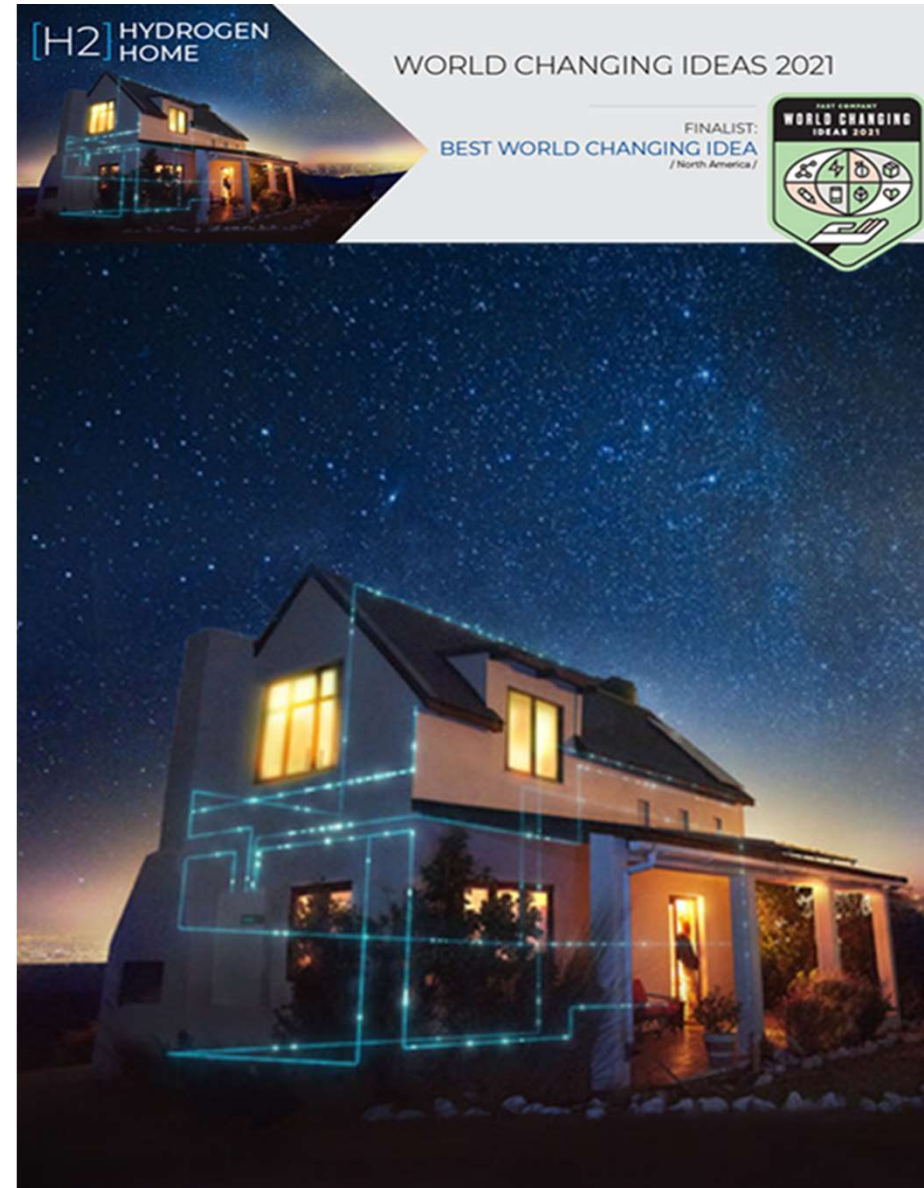
SoCalGas [H2] Innovation Experience Project

In Downey, CA

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[H2] Innovation Experience Project

- » **WHAT?** State-of-the-art hydrogen demo project that will showcase the role hydrogen will play in attaining California's goal of achieving carbon neutrality
- » **WHY?** Investigate the role of hydrogen and hydrogen blends in the diverse energy mix and demonstrate a safe and efficient integration into our existing natural gas distribution system
- » **HOW?** Developing an on-site energy facility that includes a microgrid solution enabled by hydrogen and blended gas technology

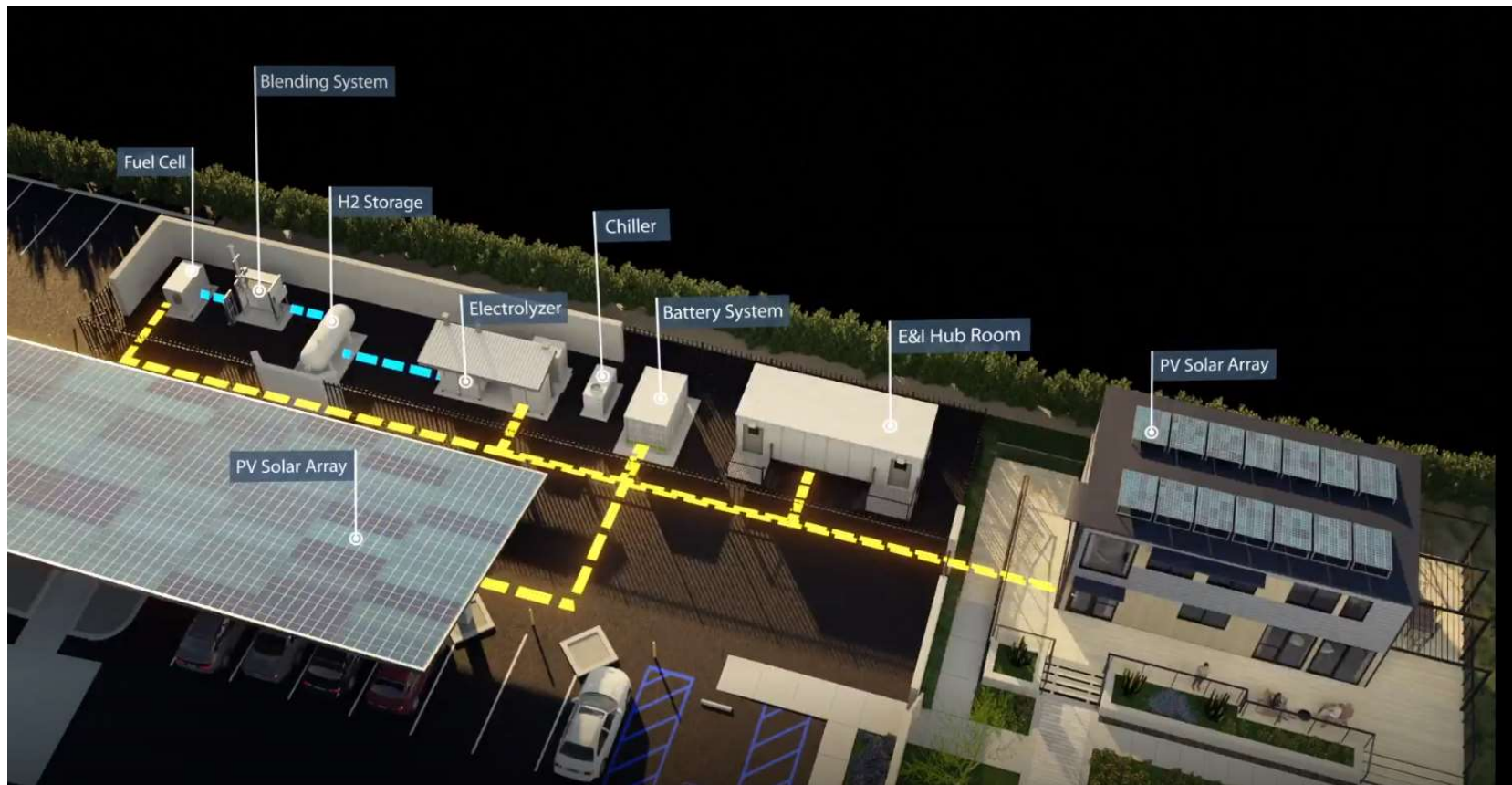


SoCalGas [H2] Innovation Experience

- » SoCalGas's [H2]IE is located at SoCalGas' Energy Resource Center in Downey, California
- » Pre-fabricated modular home (1920 ft²) was installed in the back parking lot of the facility
- » Uses solar panels to create a microgrid to ensure the home is independent of the grid
- » Hydrogen generation through electrolysis
- » 1-20% Hydrogen to Natural Gas blend will fuel the gas appliances in the home
- » Hydrogen fuel cell for power generation



[H2] Innovation Experience Project – *Design*



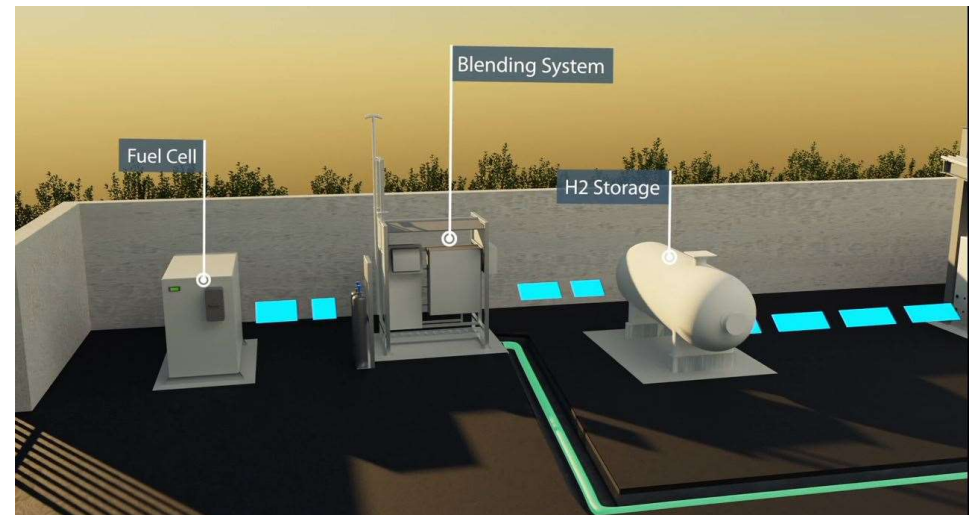
SoCalGas [H2] Innovation Experience – Electrolyzer

- » Hydrogen produced from electrolyzer using solar PV energy and excess energy is stored in batteries
- » City water passes through deionizer to produce deionized water
- » Deionized water passes through electrolysis stack in the heart of the electrolyzer
- » Current runs through the stack to break the H_2 and O_2 molecules
- » H_2 is stored in the storage vessel and O_2 is vented to a safe location



SoCalGas [H2] Innovation Experience – Hydrogen Usage

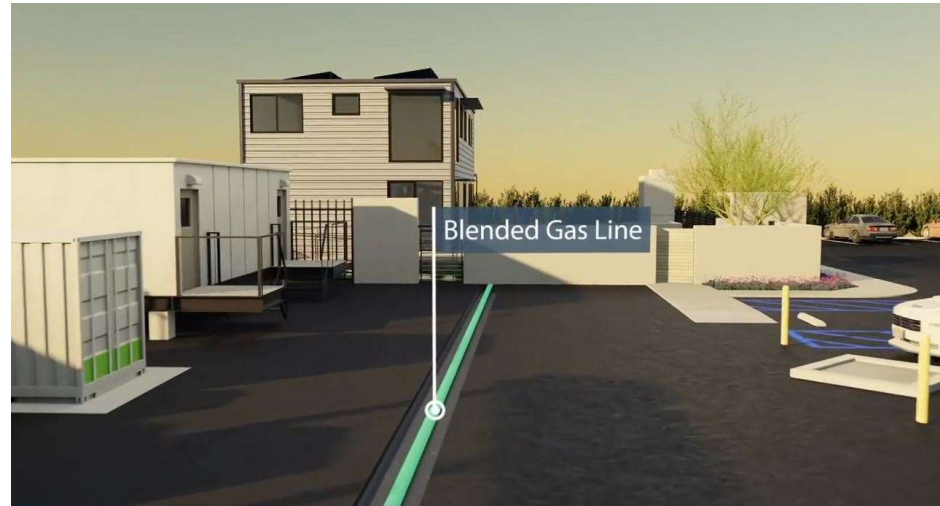
- » 100% Hydrogen is stored on site for multiple uses
- » Pure hydrogen is used by the fuel cell to generate electricity to provide power during times when solar power is not available
- » Hydrogen is blended with Natural Gas in the blending system to be used by the modular home appliances
 - A 0-20% hydrogen blend is being piloted for the home with the possibility of testing higher blends in the future



SoCalGas [H2] Innovation Experience – Blended Gas

» Blended Gas used for:

- Tankless Water Heater
- Clothes Dryer
- Gas Stove
- Gas BBQ
- Fireplace – Indoor
- Fireplace - Outdoor



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BLENDING INITIATIVES:

Why Blend Hydrogen into Natural Gas Infrastructure



Supports **decarbonization** of gas grid



Establishing a **California Hydrogen Blending Standard** could accelerate decarbonization of broader energy system



Achieving **cost reductions** for hydrogen through delivery at-scale



Providing a **Just Transition** for workers



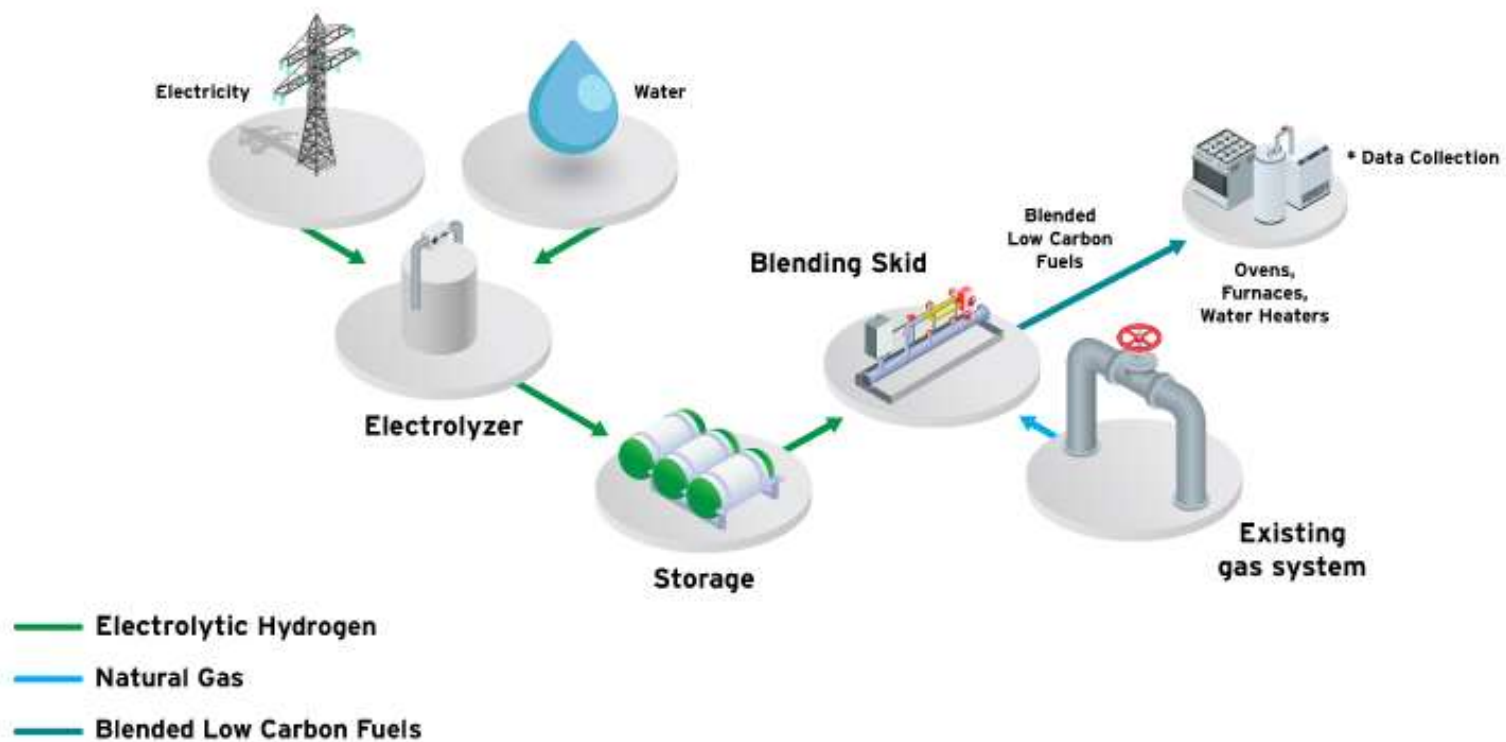
Enabling hydrogen compatibility for infrastructure and appliances



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BLENDING INITIATIVES:

H2/NG Blending Process Overview



BLENDING INITIATIVES:

H2/NG Blending Areas of Focus



- Leakage rates
- Leak detection
- Odorant compatibility

Safety



- Plastic and steel compatibility
- AGS/UGS assessment
- End user considerations

System
Integrity



- Operations and system impacts
- Pipeline Facilities
- Compressors, turbines & engines

System
Reliability



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[H2] PROQUAL AND LIVING LAB PROJECTS:

Phase 1 & 2 H2 Blending Testing



- **Phase 1 [H2] PROQUAL:** Blending up to 20 vol% H2
- Pipeline material impacts
- Common residential meter set
- Gas monitoring and leak detection tools/equipment
- Testing common residential appliances; focus on “vintage” equipment
- **Phase 2 H2 Living Lab:** collaboration with NYSEARCH
- 2-year demonstration project to simulate hydrogen blending in a high pressure and medium pressure system; blend 25 to 35 vol% H2
- Investigation on pipeline and pipeline equipment material and performance impacts on polyethylene pipe, steel pipe, gaskets, elastomers, fittings, regulators, valves, compressor
- Periodic removal of pipe and components to examine material changes
- Test new leak survey/detection/quantification technologies as they become available



Assess the need and extent for new safety training



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BLENDING INITIATIVES:

H2/NG Blending Proposed Demonstration Projects



Utility	Pilot Location	Material	Summary
SoCalGas	UC Irvine	Mixed (steel and plastic)	Project will gather and analyze field-testing data using increasing concentrations of blended hydrogen in a medium-pressure steel and plastic distribution pipeline system
SDG&E	UC San Diego	Polyethylene plastic (PE)	SDG&E's project will collect the same data as SoCalGas' project but will specifically help determine hydrogen blending standards applicable to PE plastic distribution systems
Southwest Gas	Truckee, CA	Polyethylene plastic (PE)	Southwest Gas' project will blend increasing concentrations of hydrogen into a PE plastic distribution system and will assess performance and safety at high elevation in extreme weather conditions such as those experienced in Northern California



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The SDG&E Hydrogen Pilots: Palomar and Borrego

	Multi-Use H2 Demonstration @ Palomar Energy Center	H2 as long-duration storage @ Borrego Springs Microgrid
Completion	2023	2023
Use cases	<ul style="list-style-type: none"> Power-to-gas H2 fuel blending Generator H2 cooling Light-duty vehicle H2 fueling 	<ul style="list-style-type: none"> Long duration H2 storage demonstration H2 as a CAISO market participant H2 as a resiliency asset
Equipment	<ul style="list-style-type: none"> Solar canopies Electrolyzer with H2 compressors H2 storage H2 vehicle fueling system Fuel blending skid 	<ul style="list-style-type: none"> Electrolyzer with H2 compressors H2 storage Fuel cell
Conceptual layout	<p>The diagram illustrates the conceptual layout for the Palomar Energy Center. It starts with solar canopies providing power to a 1.25 MW PEM electrolyzer. The electrolyzer has an anode where H₂O is split into H⁺ and O₂, and a cathode where H₂ is produced. The H₂ is then stored in a tank. From the storage tank, H₂ is distributed to three main applications: Generator Cooling (represented by a fan icon), an H₂ Fueling Station (represented by a pump icon), and H₂ Blending (represented by a mixing tank icon).</p>	<p>The diagram illustrates the conceptual layout for the Borrego Springs Microgrid. It starts with a 1 MW PEM electrolyzer powered by solar canopies. The electrolyzer has an anode where H₂O is split into H⁺ and O₂, and a cathode where H₂ is produced. The H₂ is then stored in a tank for 16 hours. From the storage tank, H₂ is fed into a 250 kW Fuel Cell. The fuel cell has an anode where H₂ is oxidized and a cathode where O₂ is reduced to produce H₂O. The fuel cell also generates heat, which is shown being dissipated.</p>

The background of the slide is a dark, atmospheric photograph of a forest at night or in low light. A river flows through the center, reflecting the surrounding trees. Overlaid on the bottom right of the image is a glowing network diagram consisting of several nodes connected by thin lines. The text "Q&A and THANK YOU" is centered in the upper half of the image in a white, sans-serif font.

Q&A and
THANK YOU