



Hydrogen: Opportunity and Role for SoCalGas

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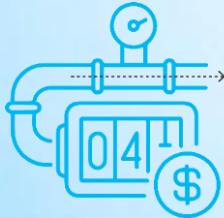


SoCalGas Overview

SoCalGas is the largest natural gas distribution utility in the U.S.



Natural Gas Service
Provided to
22 MILLION
CUSTOMERS



6 MILLION
METERS
273,111 Non-Residential
5,755,780 Residential



20,000
SQ. MILES
Of Service
Territory

103,477
MILES

Of Distribution
Mains & Service Lines

- 50,541 Miles of Services
- 52,936 Miles of Main



3,385
MILES

Of Transmission Pipeline



1 TRILLION

Cubic Feet of Natural Gas
Delivered Annually



5%
Of U.S. Gas
Deliveries

Climate Commitment

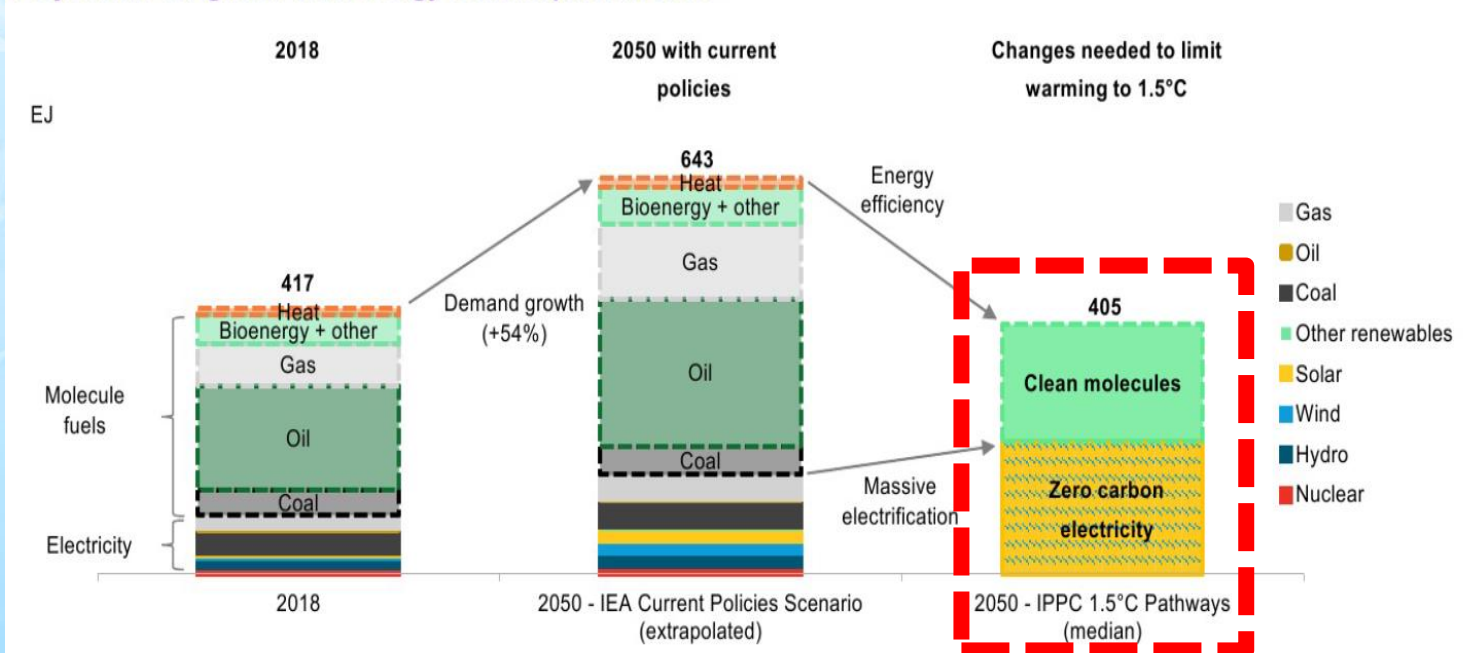
- Achieve net zero greenhouse gas emissions in operations and delivery of energy by 2045.
- Largest gas utility in North America to set a net zero target that includes scopes 1, 2 and 3 GHG emissions.
- Eliminate SoCalGas' direct emissions, in addition to those generated by our customers' energy delivered via our infrastructure.



Clean Molecules are Essential for Successful Global Decarbonization

- In a scenario limiting global warming to 1.5 degrees, nearly half of global energy demand in 2050 is projected to be met with clean molecules

Projections for global final energy consumption in 2050



Source: BloombergNEF, IEA, IPCC. Note: The IEA's Current Policies Scenario is extrapolated using data from 2030 and 2040 to approximate final energy consumption in 2050. The 1.5°C compatible pathway is the median value for the 53 pathways analysed by the IPCC limiting global warming below 1.5°C, or 1.5°C with limited overshoot.

Hydrogen could play a critical role in the future of energy supply

Today

Most of the current production of hydrogen uses natural gas via Steam Methane Reforming (SMR) that generates CO₂ emissions. Emissions free technologies are ramping up but requires further support for large scale adoption.

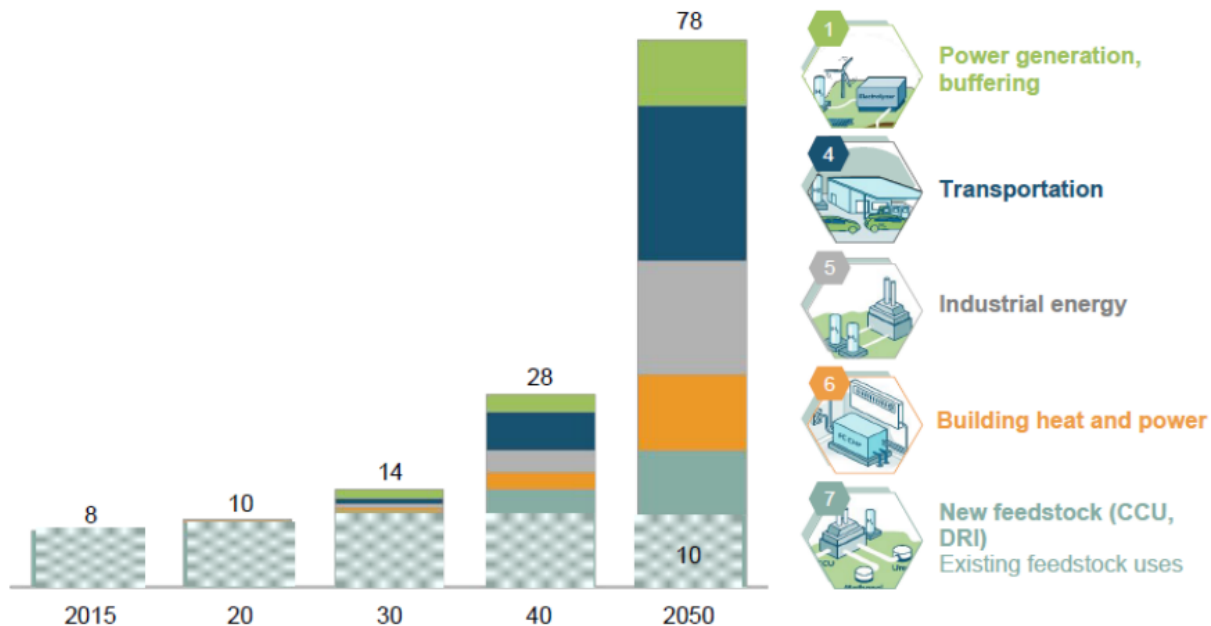


Tomorrow

A balance portfolio of optimized zero emissions production technologies such as electrolysis and SMR with CCUS/RNG are the long-term solution to produce green hydrogen

In a 2-Degree World, Hydrogen Could Supply ~18% of Demand

Potential global energy demand supplied with hydrogen, Exajoule (EJ)





Innovative.

SoCalGas Hydrogen Vision

Hydrogen supports our mission to build the cleanest, safest and most innovative energy company in America, delivering reliable, resilient and affordable energy to 22 million Californians.

Importance of Hydrogen & Role of Gas Utilities

- Hydrogen is an essential decarbonization tool, complementary to renewables
- Existing infrastructure enables rapid scaling-up
- Gas utilities can support through blended hydrogen and repurposed, dedicated hydrogen pipelines

Priority sectors:

- Power – Dispatchable clean molecules
- Manufacturing – Industrial clean heat
- Heavy Duty Transportation – Weight & range



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Injection of Hydrogen into Natural Gas Grid

Process of blending clean hydrogen into the natural gas pipeline

- *Regions that allow direct injection only allow small amounts of hydrogen...for now*
 - Need to upgrade metal pipes to plastic due to embrittlement and leakage
 - Codes and standards are lacking in many regions
 - Some regions are piloting higher percentage blend of hydrogen
 - Research in Italy and Canada shows that 5% (volumetric) can be injected
 - Germany allows 5 – 10% injection; a German pilot project will test up to 20%
 - French project in Dunkirk is safely injecting 10% and planning to go to 20%

- *California utilities currently do not have injection specifications for injecting hydrogen into their natural gas pipelines*
 - AB 491 (Rubio, 2019) would require the CPUC to adopt injection standards after a safety and feasibility study from the CA Council on Science and Technology
 - Stalled during legislative process, likely to reappear this year



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Global Hydrogen Initiatives

Examples of flowing hydrogen blends in gas pipelines

- **European Hydrogen Backbone** – Growing group of 23 European gas infrastructure companies, working together to plan a pan-European dedicated hydrogen transport infrastructure based primarily on repurposed existing gas infrastructure
- **Hy4Heat** – UK initiative; mission is to safely replace natural gas with hydrogen in residential and commercial buildings
- **Snam** – Italy initiative; goal is to transport entirely decarbonized gas including hydrogen in its pipelines by 2050
- **Hawaii Gas** – approximately 12% of the gas in their pipeline today on Oahu is hydrogen – highest concentration of any U.S. gas utility

European Hydrogen Backbone Vision: 70% of hydrogen pipeline infrastructure is based on repurposed existing natural gas pipelines

Report Highlights:

- Dedicated hydrogen pipeline infrastructure is needed to help integrate large amounts of renewable energy and to create a liquid, cross-border market for renewable and low-carbon hydrogen
- European Hydrogen Backbone demonstrates a technically and economically plausible vision for such a dedicated hydrogen infrastructure
- 12 European gas TSOs from 11 European countries have joined the initiative and the 2040 backbone has almost doubled in length compared to last year's report
- European Hydrogen Backbone can be created at an affordable cost



HyDeal Los Angeles

Architecting the Green Hydrogen Ecosystem For a Deeply Decarbonized LA

Image Source: Josh Miller, Unsplash

Steering Committee Funders



HyDeal LA Vision: Become North America's first green hydrogen industrial hub at scale

LA will be the first in North America to...



Achieve 100% renewable electricity affordably and reliably



Decarbonize fuel refining and move to renewable fuels



Provide green hydrogen and its derivatives for shipping/aviation fuel and fertilizer

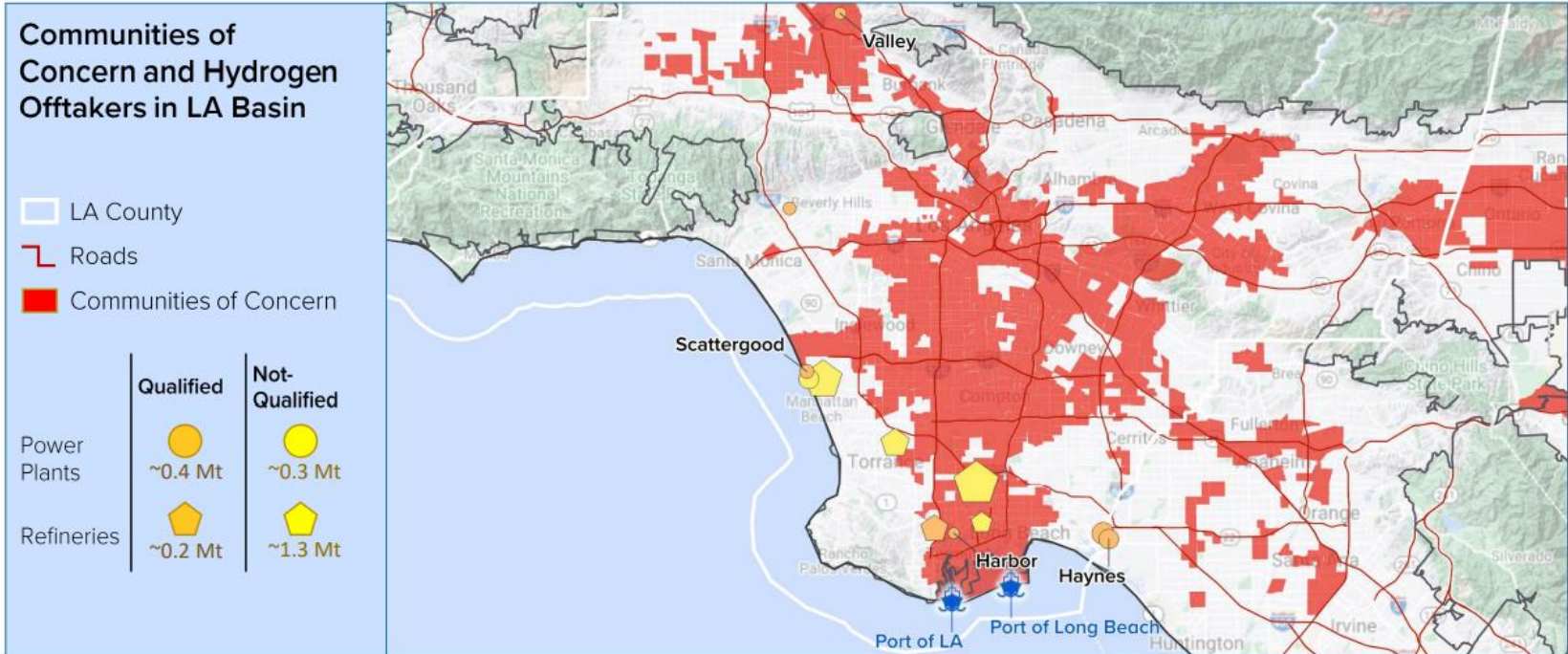


Demonstrate green hydrogen fuel cell passenger flight (e.g. Long Beach Airport to Sacramento)



Export low-cost green hydrogen at scale

Access to low-cost green hydrogen in the LA basin will accelerate the transition away from diesel, reducing emissions for communities who suffer the most



Qualified demand from power generation and oil refining are key to scaling near term (0.6-2.2 MT/year)

Source: Strategen

Key drivers for low *delivered* cost to the LA Basin



Production



Transportation



Storage



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Key Takeaways

- California is in strong position to embrace an ambitious hydrogen strategy
- Hydrogen can complement increasing levels of renewable energy in California
 - Capture excess renewable energy for hydrogen production and avoid curtailments
 - Provide a long duration storage solution with Power-to-Gas and Power-to-Gas-to Power solutions
- California has one of the largest transportation markets in the country
 - Hydrogen has a great opportunity for adoption by all players of the transportation sector: light and heavy duty, rail, maritime, aerospace
 - Ports present a unique opportunity for hydrogen supply/demand cluster
- California has strong track record of forward-looking and progressive legislation and regulatory framework