

# Potential Customers and Demand

*Prepared by Strategen Consulting  
August 31, 2021*

## Introduction

Strategen's scope for this project includes provision of advice and guidance on diverse potential SoCalGas territory offtakers for the renewably produced hydrogen. These opportunities include evaluating four natural gas electric generation plants that may be re-purposed as natural/gas hydrogen blend plants or 100% hydrogen gas plants, as well as refineries, ports, airports, hydrogen blending in the natural gas pipeline, hydrogen fueling stations, industrial feedstocks, and others.

This scope established two deliverables, for which Strategen provides an update in this interim report:

- Green hydrogen volumes and flow rates required for the equivalent capacity output repowering of Valley, Scattergood, Harbor, and Haynes for scenarios of [REDACTED]
- Green hydrogen estimated volumes and flow rates for particular offtakers that the SPEC team agrees are strong candidates based on proximity to hydrogen pipeline and green hydrogen market considerations

## Overview of Results

Working together with the broader SPEC team, Strategen developed and proposed three demand cases, "Low", "Medium", and "High" to reflect different hypothetical cases for potential demand, depending upon the customer segment and percentage capture of customers within each segment. There were seven different scenarios generated, that looked at varying scenarios of annual hydrogen volumes for identified sectors: Power, Transportation, Refinery, Residential blend, Commercial, and Industrial.

SPEC submitted the information provided by Strategen to SoCalGas to facilitate their consideration of all information and specification of the desired demand cases to include in the study. SoCalGas prepared and approved the following scenario as the basis of the study:

| LOW CASE                   |                      |  |
|----------------------------|----------------------|--|
|                            | VOLUME, Tons H2/Year | DESCRIPTION                              |
| POWER                      | [REDACTED]           | Valley, Haynes, Scattergood, Harbor Only |
| TRANSPORTATION             |                      | [REDACTED]                               |
| REFINERY                   |                      | [REDACTED]                               |
| RESI BLEND                 |                      | [REDACTED]                               |
| COMMERCIAL                 |                      | [REDACTED]                               |
| INDUSTRIAL                 |                      | [REDACTED]                               |
| TOTAL DEMAND, Tons H2/Year |                      | [REDACTED]                               |
| Requested Range            | [REDACTED]           | [REDACTED]                               |
| MEDIUM CASE                |                      |  |
|                            | VOLUME, Tons H2/Year | DESCRIPTION                              |
| POWER                      | [REDACTED]           | Four LADWP Plants + Other Major          |
| TRANSPORTATION             |                      | [REDACTED]                               |
| REFINERY                   |                      | [REDACTED]                               |
| RESI BLEND                 |                      | [REDACTED]                               |
| COMMERCIAL                 |                      | [REDACTED]                               |
| INDUSTRIAL                 |                      | [REDACTED]                               |
| TOTAL DEMAND, Tons H2/Year |                      | [REDACTED]                               |
| Requested Range            | [REDACTED]           | [REDACTED]                               |
| HIGH CASE                  |                      |  |
|                            | VOLUME, Tons H2/Year | DESCRIPTION                              |
| POWER                      | [REDACTED]           | All Served Power Generation              |
| TRANSPORTATION             |                      | [REDACTED]                               |
| REFINERY                   |                      | [REDACTED]                               |
| RESI BLEND                 |                      | [REDACTED]                               |
| COMMERCIAL                 |                      | [REDACTED]                               |
| INDUSTRIAL                 |                      | [REDACTED]                               |
| TOTAL DEMAND, Tons H2/Year |                      | [REDACTED]                               |
| Requested Range            | [REDACTED]           | [REDACTED]                               |

## Methodology, Assumptions, and Information Sources

### *Estimate of hydrogen demand: LA basin*

To estimate hydrogen demand, drawing upon our HyDeal resources and publicly available data, we identified key sectors with likely green hydrogen offtake needs. At the beginning of the study, there were identified potential customers:

- LADWP’s Valley, Scattergood, Harbor, and Haynes electric generation facilities
- Ports of Los Angeles and Long Beach
- Hydrogen fueling stations along key transportation corridors
- Oil and Gas refineries
- 

By adding in consideration of existing SoCalGas residential, commercial, and industrial customers, Strategen identified 6 key sectors: power generation, transportation, refineries, residential blending, commercial blending, and industrial (100% H2). By pulling in historic utilization data from numerous sources, Strategen developed low, medium, and high hydrogen demand cases based

on the assumption that green hydrogen could be used to replace natural gas, diesel and grey hydrogen.

### ***Estimates, Assumptions, and Information Sources by Sector***

1. **Power generation:** Assuming hydrogen as energy to substitute natural gas in electricity production, the low case included the four LADWP plants (Valley, Haynes, Scattergood, and Harbor), for which 2019 MWh generation data was used to estimate tons of hydrogen per year. The medium case added on other plants in the LA Basin with capacity of >50MW. The high case included all served power generation. The estimates provided by Strategen indicate the volume of green hydrogen offtake that would be required in order to allow for plants to replicate historical annual generation while combusting hydrogen rather than natural gas.
  - a. To get a better understanding of current natural gas demand characteristics including a general load shape and seasonal trends, we provided one year of hourly data for 2019. These numbers are not intended to provide a forecast of demand for flexible dispatchable capacity from natural gas or from hydrogen-based power plants. These numbers represent estimates of hydrogen demand needed to replace historical power generation. Future need for flexible dispatchable energy will be dependent on a variety of factors, including type and magnitude of renewable resources; customer demand for new energy end uses, including transport and building electrification; and availability of other flexible resources on the system, such as energy storage.
  - b. **Sources:**
    - i. IPA Engineering Team, LADWP, based on [REDACTED]
    - ii. Engineering Toolbox
    - iii. MHPS J Series M501 JAC Specifications
    - iv. Energy Information Administration
    - v. 2020 California Gas Report Joint Utility Biennial Comprehensive Filing, Page 143
2. **Transportation:** Assuming hydrogen is used to power fuel cell vehicles, this sector looked at all vehicle classes, including School Buses, Passenger Cars, and all classes of Trucks: T1-T2 (Light Duty Truck) T3 (Medium Duty Truck), T4-T5 (Light Heavy Duty Truck), T6 (Medium Heavy Duty Truck), and T7 (Class 8 Heavy Heavy Duty Truck) converted to H2. 2019 vehicle volume was pulled from the vehicle registration database via the California Air Resources Board, and the average fuel economy for each class was used to estimate the amount of annual hydrogen required to power the vehicles. The low case assumed [REDACTED] conversion of [REDACTED] trucks, the medium case assumed [REDACTED] conversion of [REDACTED] trucks, and the high case assumed [REDACTED] conversion of [REDACTED] classes. This assessment is not intended to represent a forecast of expected vehicles in the region, nor of future vehicle utilization. Rather, this represents the hydrogen demand that would be required to supply portions of the historical vehicle fleet should it convert to hydrogen fuel cells.
  - a. **Sources:**
    - i. CARB Fleet Web Database, 2019
    - ii. U.S. DOE Alternative Fuels Data Center – Avg. Annual Vehicle Miles Traveled by Major Vehicle Category, 2020
    - iii. U.S. DOE Alternative Fuels Data Center – Avg. Fuel Economy by Major Vehicle Category, 2020

3. **Refinery:** Assuming green hydrogen could replace grey hydrogen for refinery applications, this sector assumed all refineries would adopt [REDACTED] green hydrogen. Currently Air Products supplies grey hydrogen for all refineries in California, with the exception of Phillips 66. [REDACTED]  
[REDACTED]
  - a. Source: Air Products, Self-Reported
4. **Residential, Commercial, Industrial:** Assuming hydrogen to replace natural gas for end-user combustion, numbers for these sectors were drawn from the 2020 California Gas Report Joint Utility Biennial Comprehensive Filing.
  - a. **Source:** 2020 California Gas Report Joint Utility Biennial Comprehensive Filing, Page 143

***Request for a 5, 10, 20 year forecast.***

The demand cases Strategen provided are based on historical data (2019) and are intended to be used as predictors of future demand for hydrogen needed to meet state or other decarbonization targets. Strategen did not predict what hydrogen offtake will be required to meet those objectives, nor how other energy sector transformations will affect existing fossil fuel end use and future hydrogen demand. These numbers are not meant to project future hydrogen demand; rather, these are initial data points in a more in-depth study of what future hydrogen demand profiles may look like.