



Fueling a Sustainable Future

Hydrogen Roundtable / Legislative Council Bureau / May 2024

GTI Energy – Hydrogen Blending Pilot

Hydrogen Blend



- End-Use Performance Demonstration
- Safety Field Demonstration
- Funded by 19 UTD members
- 36-month duration
- Coordinated with Hydrogen Tech Center

GTI Energy – Production, Storage, Distribution

GTI Energy Performance and Safety Goals

- Measure
 - Performance
 - Emissions
 - Efficiency
 - Decarbonization Potential
- Develop
 - Best Practices (Field)
- Trade Allies

SMR Hydrogen produced from Renewable Natural Gas is Carbon-Neutral or Carbon-Negative

Advanced Fueling Stations Near-Term Opportunities

1. Make industrial ports the nerve centers for scaling up the use of clean hydrogen.
2. Build on existing infrastructure.
3. Expand hydrogen in transport through fleets, freight and corridors
4. Launch the hydrogen trade's first international shipping routes.

Clean H2

4 kgCO₂e/kgH₂

For Life Cycle Defined As "Well-to-gate"
(Clean Hydrogen Production Standard)

Fossil H2

10-12 kgCO₂e/kgH₂

Steam Methane Reforming without Carbon
Capture

H2 Production Project Companies



Gas utility supplying CNG for the SMR to create Hydrogen, CNG for Virtual Pipeline and Public Fueling Station.

Hydrogen technology company producing Hydrogen from RNG/CNG using Steam Methane Reforming (SMR)

Hydrogen and CNG transportation of gas by truck trailer (Virtual Pipeline)

Engineering, Procurement, Construction, Maintenance, Operations, Point-of-Sale, and EV Charging

Making 1kg H2

Production Efficiency

Electrolysis

SOEC (Solid Oxide)

>95% Heated Efficiency

>85% Non-Heated Efficiency

Heated 39.4 kWh

Non Heated 43.8kWh

2.4 Gallons of Water Used

PEM (Proton Exchange Membrane)

>75% Efficiency

49.9 kWh

2.6 Gallons of Water Used

AEM (Anion Exchange Membrane)

>70% Efficiency

53.3 kWh

2.6 Gallons of Water Used

SMR

Steam Methane Reformation

>85% Thermal Efficiency

2.15 kWh

2.6 Gallons of Water Used in Process

1.25 Gallons Recovered

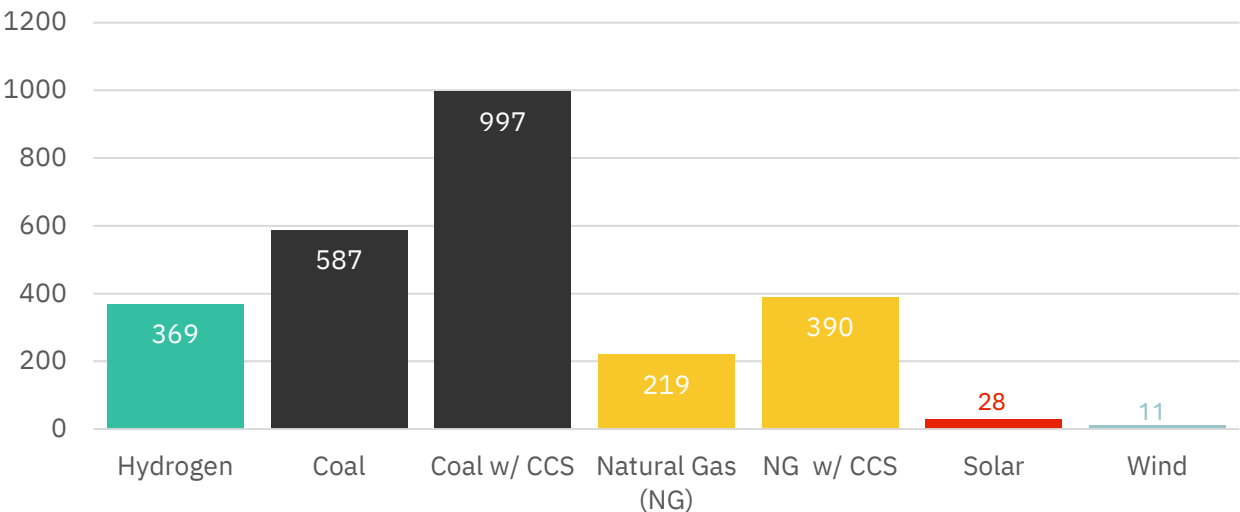
1.35 Gallons Evaporated Locally

Nevada H2 Production

Life Cycle Water Usage

Electrical Generation Comparisons

Gallons/MWh



1kg of H2
142 MJ/kg
39.44 kWh/kg

1gal Gasoline
120 MJ/kg
33.33 kWh/kg

Figure: life cycle water consumption for various generation options (*CCS Represents carbon capture and sequestration). Hydrogen in the diagram is produced by electrolysis using renewable energy.

Hydrogen Electricity Generation and Water Consumption Comparisons — Interim Report 2022: EGI at The University of Utah, Dr Milind Deo, Dr Eiichi Setoyama, Julie Sieving P.E. C.E.M.

California Joint Hydrogen Application



SOUTHWEST GAS

California Joint Hydrogen Application - Scope

Hydrogen Blending Safety	System Integrity	System Reliability	Additional Research
<ul style="list-style-type: none">• Leakage rates• Leakage detection• Odorant compatibility	<ul style="list-style-type: none">• Material compatibility• Gas storage assessment• End-user considerations & NGV• Gas quality considerations	<ul style="list-style-type: none">• Operations and system impacts• Facilities (Regulators, etc.)• Compressors, turbines, engines• Backbone system supply	<ul style="list-style-type: none">• Impacts to steel pipe• Underground storage• Measurement & leak detection• Expanded appliance testing
01	02	03	04

California Joint Hydrogen Application Utility Proposals

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

Southwest Gas Demonstration

Truckee, California

- Electrolyzer
 - Electric Grid H2 Production
- Distribution
 - 1-mile Polyethylene
- Service
 - 18 Customers
 - Southwest Gas Operations