

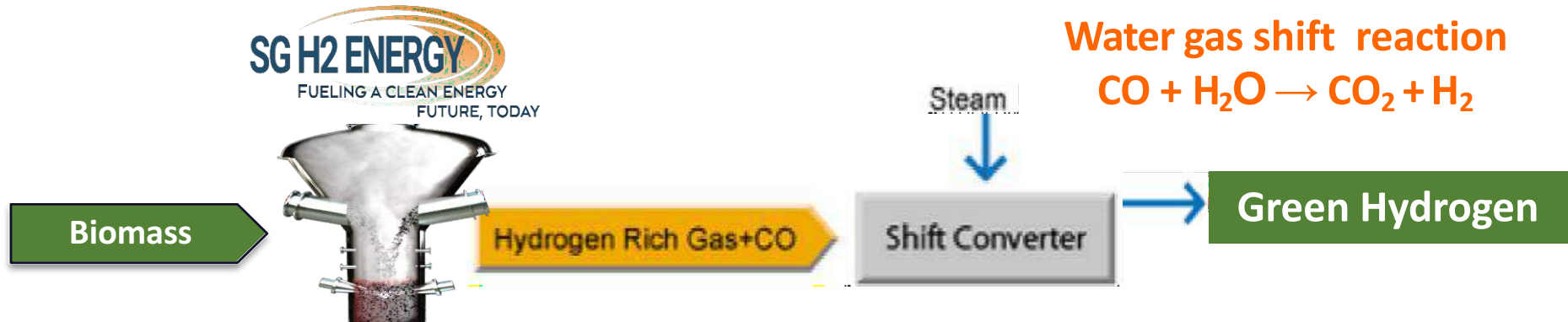
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**CLEANER THAN  
GREEN:  
SGH2  
CARBON NEGATIVE  
HYDROGEN**



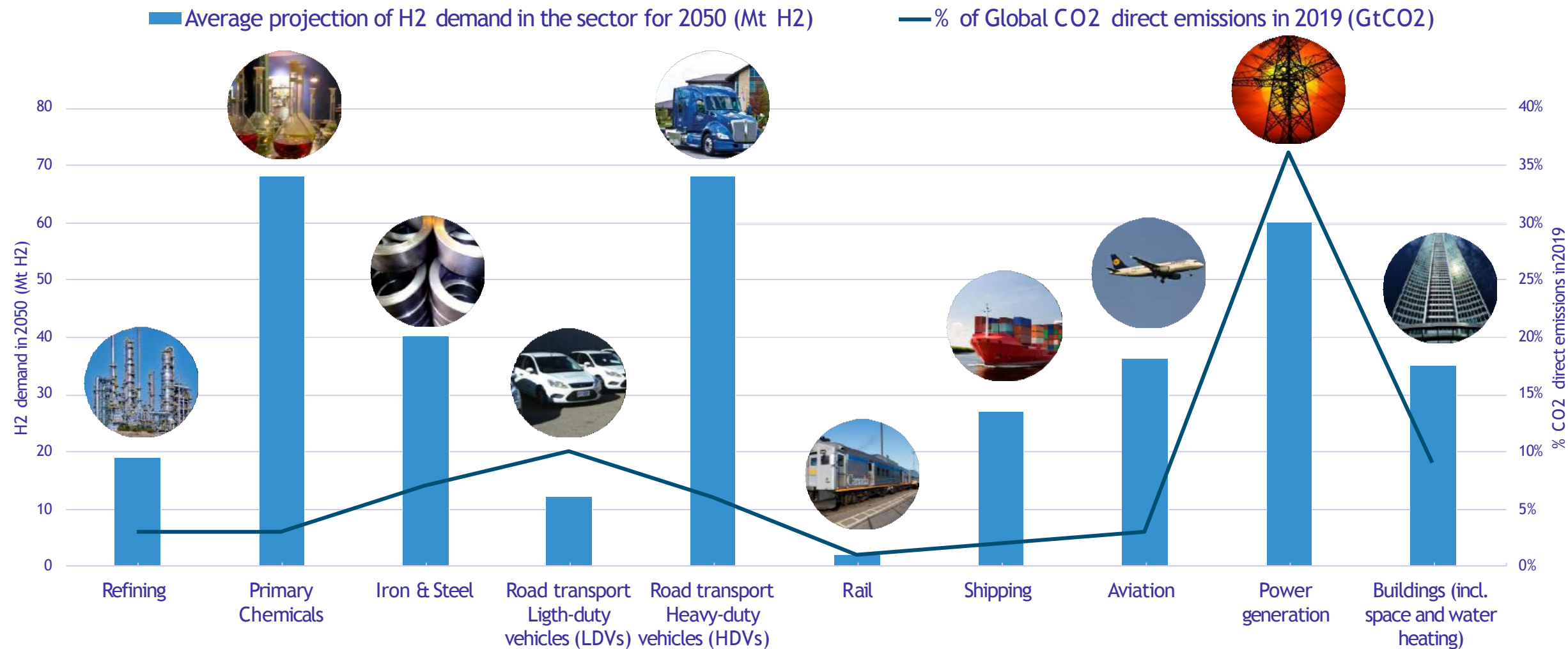
# GREEN HYDROGEN FROM BIOMASS IS A RENEWABLE ALTERNATIVE TO HYDROGEN PRODUCED FROM FOSSIL FUELS

Today, gray and brown H<sub>2</sub> dominate the world hydrogen market, together producing more GHG than India and Britain combined. At present, 95% of America's H<sub>2</sub> is produced from natural gas.



**Thermo-conversion of Biomass**

# GLOBAL HYDROGEN DEMAND IS GROWING, CREATING URGENT NEED FOR CLEANER GREENER HYDROGEN



\*Source: Goldman Sachs Global Investment Research 2022



# URGENCY, GRAVITY, OPPORTUNITY

Waterborne transport and ports account for 90% of global trade and 15% of global GHG emissions. Global municipal waste accounts for 5% of global GHG emissions. **SGH2 technology** offers a critical opportunity to meet urgent and growing climate and energy security needs.

## Waterborne transport and Ports

- 90% global trade
- 1 Gt GHG
- 15% global GHG emissions
- Over 4% of Europe & US GHG total

## Aviation

- 1 GT GHG
- 18% global GHG emission
- T GHG
- 18% global GHG emission



## Global Municipal Waste

- Over 2 billion tons annually
- By 2050, 3.4 billion tons GHG annually
- 5% of global GHG emissions



**SG H2 ENERGY**

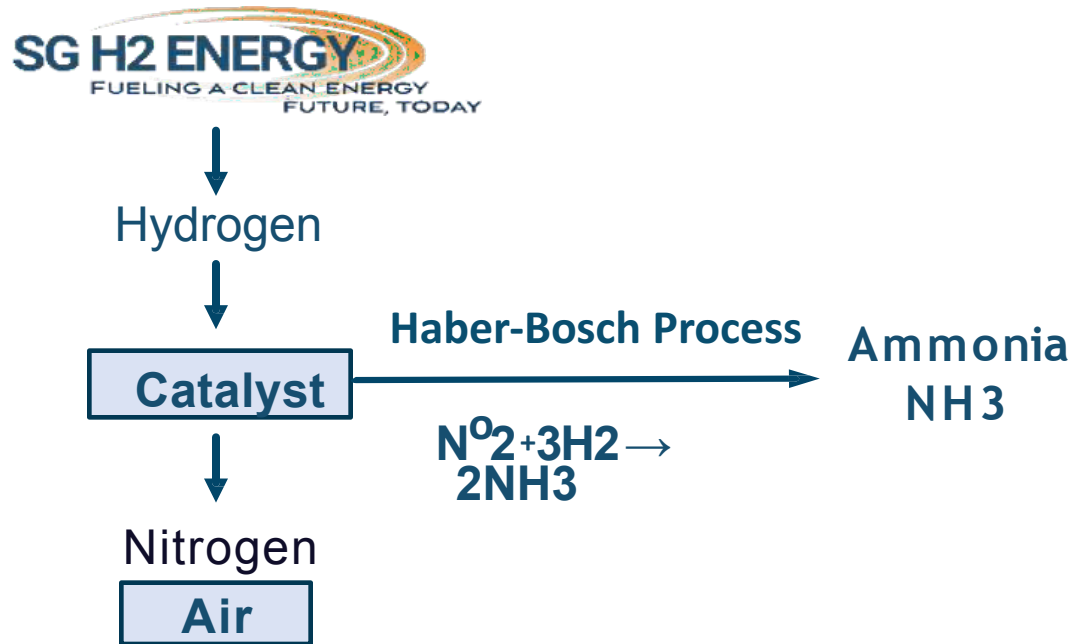
FUELING A CLEAN ENERGY  
FUTURE, TODAY

# CLEANER THAN GREEN HYDROGEN TO X

Promising Maritime Fuels Free of Sulfur & Carbon

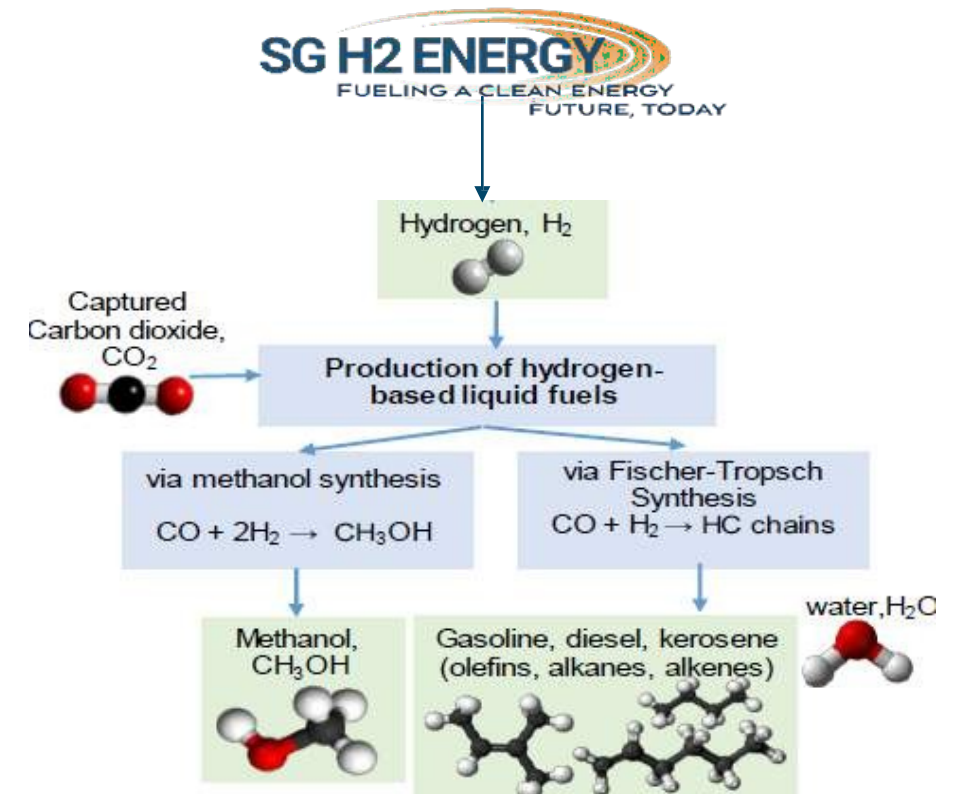
## Green Ammonia

- Needed in huge quantities to produce fertilizers and chemicals.
- Easily storable and transportable enabling export options from areas where regenerative energy is abundantly available.
- Can be used either as is or thermally decomposed to generate hydrogen.



## Synthetic Methanol

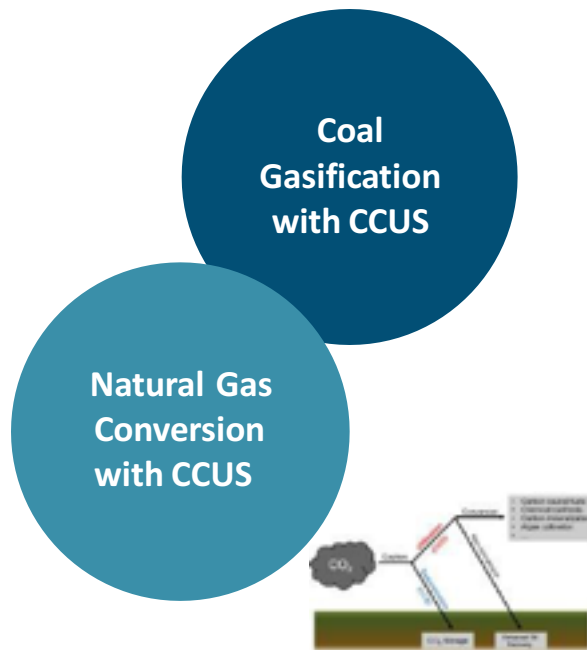
- 80% higher energy density than hydrogen
- Production route from syngas (through hydrogen) is well developed commercially.
- Synthetic diesel or kerosene is the result of a reaction occurring between carbon monoxide (CO) and hydrogen.



# HOW WILL CLEAN/GREEN H2 DEMAND BE MET?

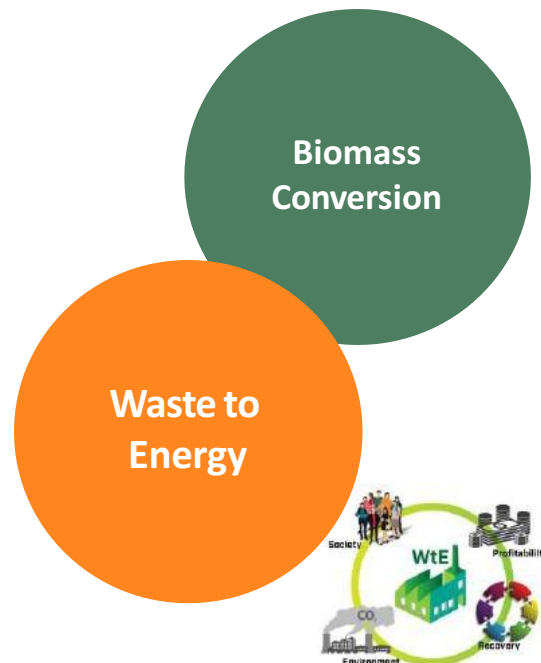
## FOSSIL W/ CCUS

- Low-cost large-scale with CCUS
- Byproducts such as solid carbon



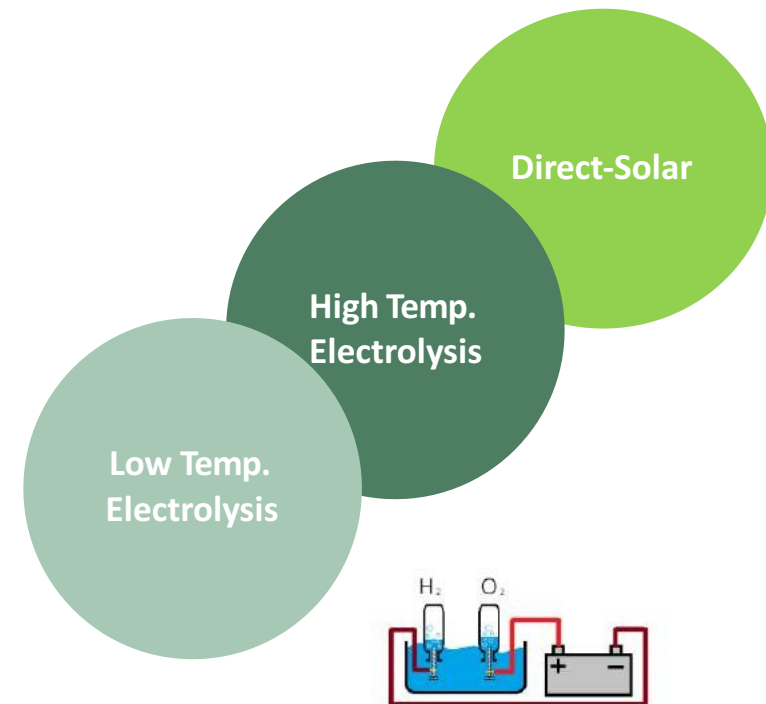
## BIOMASS/WASTE

- Includes biogas reforming & fermentation of wastestreams
- Benefits: clean water, electricity and chemicals



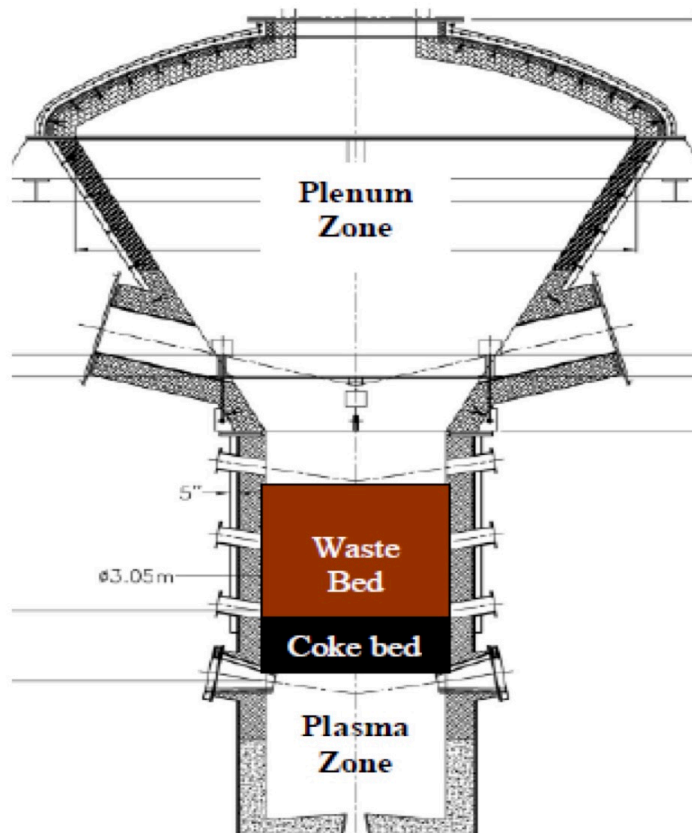
## WATER SPLITTING

- Electrolysers can be grid tied, or directly coupled with renewables
- New direct water splitting options offer long-term sustainable hydrogen









# SGH2 CLEANER THAN GREEN HYDROGEN: HOW IT WORKS

## SPEG Technology



# SGH2 CLEANER THAN GREEN HYDROGEN VS. GREEN HYDROGEN BY ELECTROLYSIS

Per 3,850 tons Clean Hydrogen Per Year

		SGH2 CLEANER THAN GREEN HYDROGEN	ELECTROLYSIS	
Water		20,000 m <sup>3</sup> /year	57,000 m <sup>3</sup> /year	2.8x Less
Electricity		25,000 MWh /year	205,000 MWh /year	8x less
Cost		\$2 - 3 /Kg H <sub>2</sub>	\$8 / Kg H <sub>2</sub>	3-4x less
Waste Avoided		- 42,000 ton /year		
Plot Space		5 acres	1,500 acres	200x less
Carbon Intensity		- 188 gCO <sub>2</sub> e / MJ	0 gCO <sub>2</sub> e /MJ	

	HYDROGEN TYPES	CARBON INTENSITY ( gCO <sub>2</sub> eq/MJ)	PRODUCTION \$ /Kg H <sub>2</sub>
GREEN HYDROGEN	<b>SGH<sub>2</sub></b> Cleaner than Green Hydrogen	<b>-188 gCO<sub>2</sub>eq/MJ</b> (avoiding 29 Kg of CO <sub>2</sub> per Kg of H <sub>2</sub> )	<b>\$2-\$3</b>
	Green Hydrogen (Electrolysis)	0 gCO <sub>2</sub> eq/MJ	\$10- \$13
HYDROGEN FROM FOSSIL FUELS	Grey Hydrogen from NatGas	+12 KgCO <sub>2</sub> /KgH <sub>2</sub>	\$2 -\$6 (cost of natural gas)
	Brown Hydrogen from Gasification of Coal	+20 KgCO <sub>2</sub> /KgH <sub>2</sub>	\$2 -\$3
BLUE HYDROGEN WITH CARBON CAPTURE & SEQUESTRATION	Grey Hydrogen	+12 KgCO <sub>2</sub> / KgH <sub>2</sub> with CCS	\$5 -\$9
	Brown Hydrogen	+20 KgCO <sub>2</sub> /KgH <sub>2</sub> with CCS	\$5 -\$6



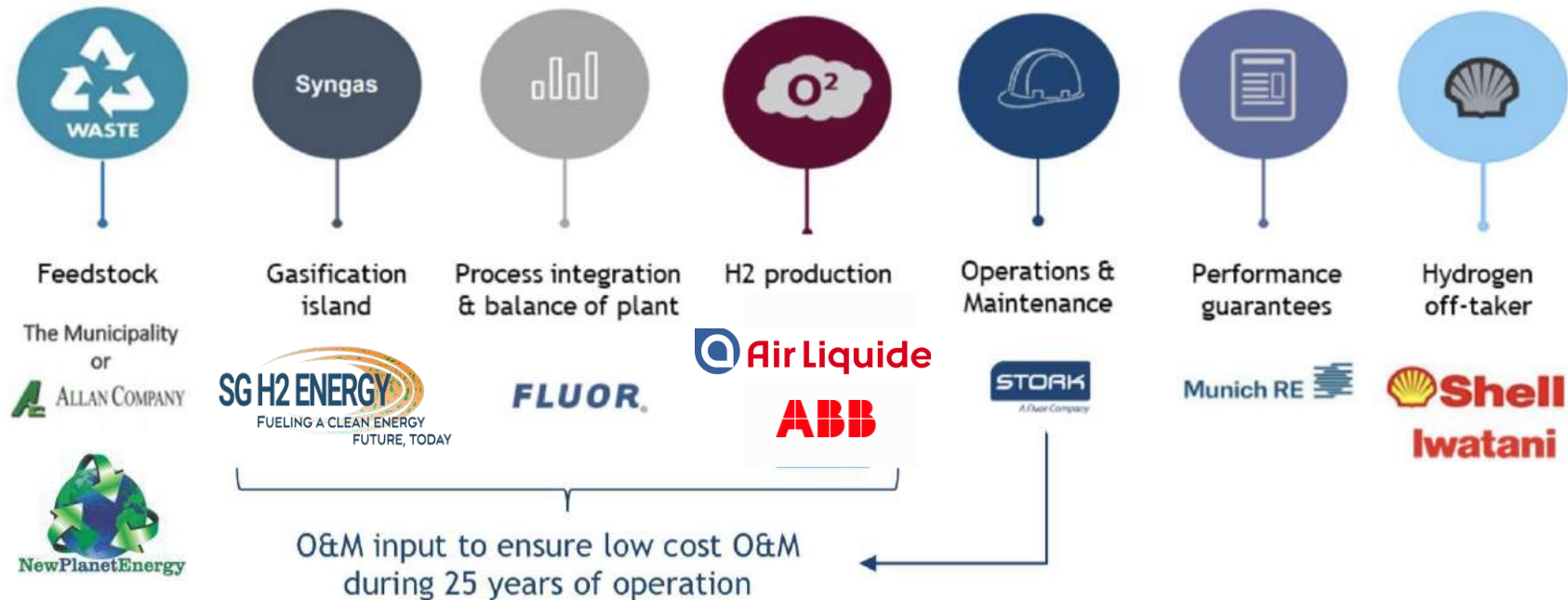
# SGH2 CLEANER THAN GREEN HYDROGEN

- Exclusive rights to state-of-the-art Solena Plasma Enhanced Gasifier (SPEG) technology
- Successfully demonstrated at a full-size project in US and torch facility in Czech Republic
- Cost competitive with the cheapest most carbon-intensive hydrogen made from fossil fuels.
- Projected to be US\$2- \$3 per Kg of clean green hydrogen
- Displaces 23-31 tons of carbon per Kg, according to Lawrence Berkeley National Lab
- 13 to 19 tons more carbon dioxide per Kg avoided than other green hydrogen processes



# WORLD'S LARGEST CLEAN/GREEN HYDROGEN FACILITY: SGH2 LANCASTER CALIFORNIA

- Take 120 tons/day of unrecyclable waste paper as feedstock
  - Converts it into 11 tons of 99.9999% pure green H<sub>2</sub>/day
- Designed to operate 24/7 for 335 days a year (~8.000 hours/year)





# WORLD'S LARGEST CLEAN/GREEN HYDROGEN FACILITY: SGH2 LANCASTER CALIFORNIA



- Lancaster City
- US Senate & Congress (CA)
- SG H2 Energy
- Iwatani
- Fluor
- Stork
- ABB
- Marubeni
- Chart Industries
- Sempra Infrastructure
- Mitsubishi
- Toyota North America
- Sojitz

# SGH2 LANCASTER

- 10 year off-take contracts with the leading hydrogen fueling station operators to supply 90 of the 120 new HRS by 2025
- Public - Private Partnership with the City of Lancaster using 42000 T of unrecyclable mixed paper waste
- Awarded \$3 Million CEC grant
- Permitting and CEQA by Q2/2022
- EPC 16 -18 months
- Operational Q4 2023





## SGH2 RENEWABLE LIQUID HYDROGEN PARADISE, CA

- Forest residue waste provided by Butte County Fire Safe /Forest Service
- Chart Industries systems and logistics to liquify hydrogen
- Expected long term off-take contract with Iwatani
- 11 T/day of Liquid H<sub>2</sub> delivery
- Operational Q3/4 2024





# THE AGE OF CLEAN H2 IS HERE.

[www.SGH2Energy.com](http://www.SGH2Energy.com)

**SG H2 ENERGY**

FUELING A CLEAN ENERGY  
FUTURE, TODAY.