UTILITY

Economic Clean Hydrogen from Water without Electricity

Cost-effective smallest-footprint decentralized H2 production with negative carbon intensity

Utility

Owners, Projects and Company Presence

Owners

Ara Built to Decarbonize.™

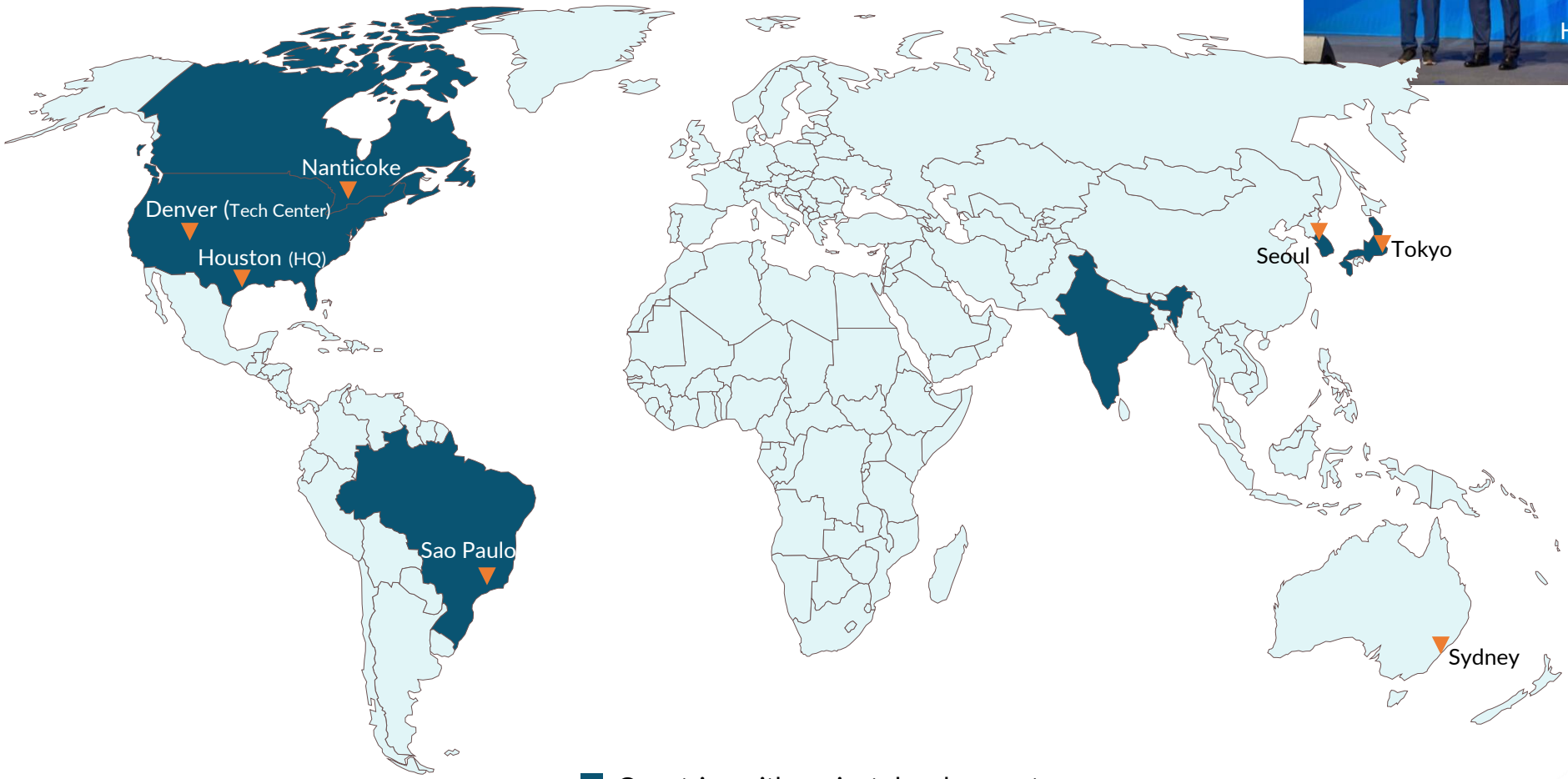
aramco

ArcelorMittal

SAMSUNG

ONTARIO POWER GENERATION

SAINT-GOBAIN



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Utility Can Decarbonize over 20% of Global Emissions

Market Focus: Strategic Hard-to-Abate Industries

	FOCUS MARKETS		FUTURE GROWTH		
	STEEL	MOBILITY	CHEMICALS	REFINERIES	OIL & GAS (Upstream)
					
% of Total Emissions	**7%** Coal & Gas feedstock-driven emissions	**5%** Biogas from landfills, wastewater, agriculture	**4%** Feedstock-driven emissions	**3%** Feedstock-driven emissions	**2%** Gas flared during oil production
Market Size	$225 Billion	$870 Billion	$200 Billion	$100 Billion	$9 Billion

Examples of companies representing the markets

ArcelorMittal, STELCO, TATA STEEL, thyssenkrupp, JFE, CLIFFS, posco

REPUBLIC SERVICES, TOYOTA, HYUNDAI, WM, CAL BIO GAS

LYB, OXY, Chevron Phillips Chemical Company LP, DUPONT, Celanese

aramco, TOTAL, eni, ExxonMobil, Marathon, ConocoPhillips

aramco, bp, Chevron, ExxonMobil, TOTAL

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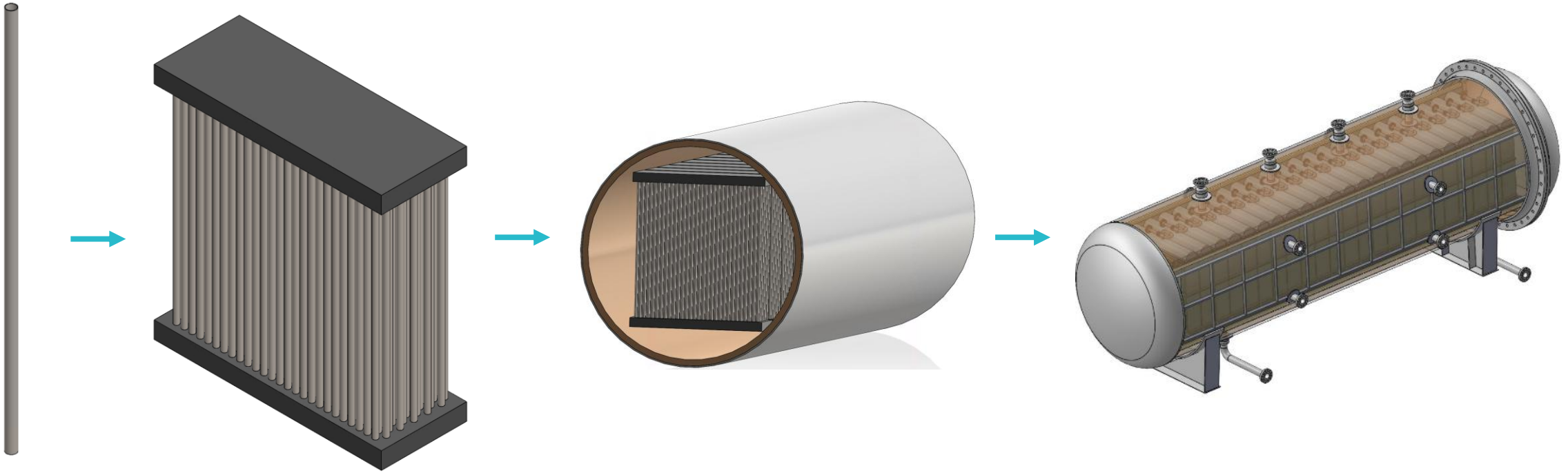
First Project (in Canada)

Modular, factory manufactured, scalable, small footprint (40-foot-long ISO container)

H2Gen® Reactor Design



Single Cell (tube)

Cell Pack

Cell Packs Slide into Pressure Vessel (e.g., ISO container)

H2Gen Reactor (nominally 40 ft long)

Reactor capacity depends on the electrochemical energy in the gases

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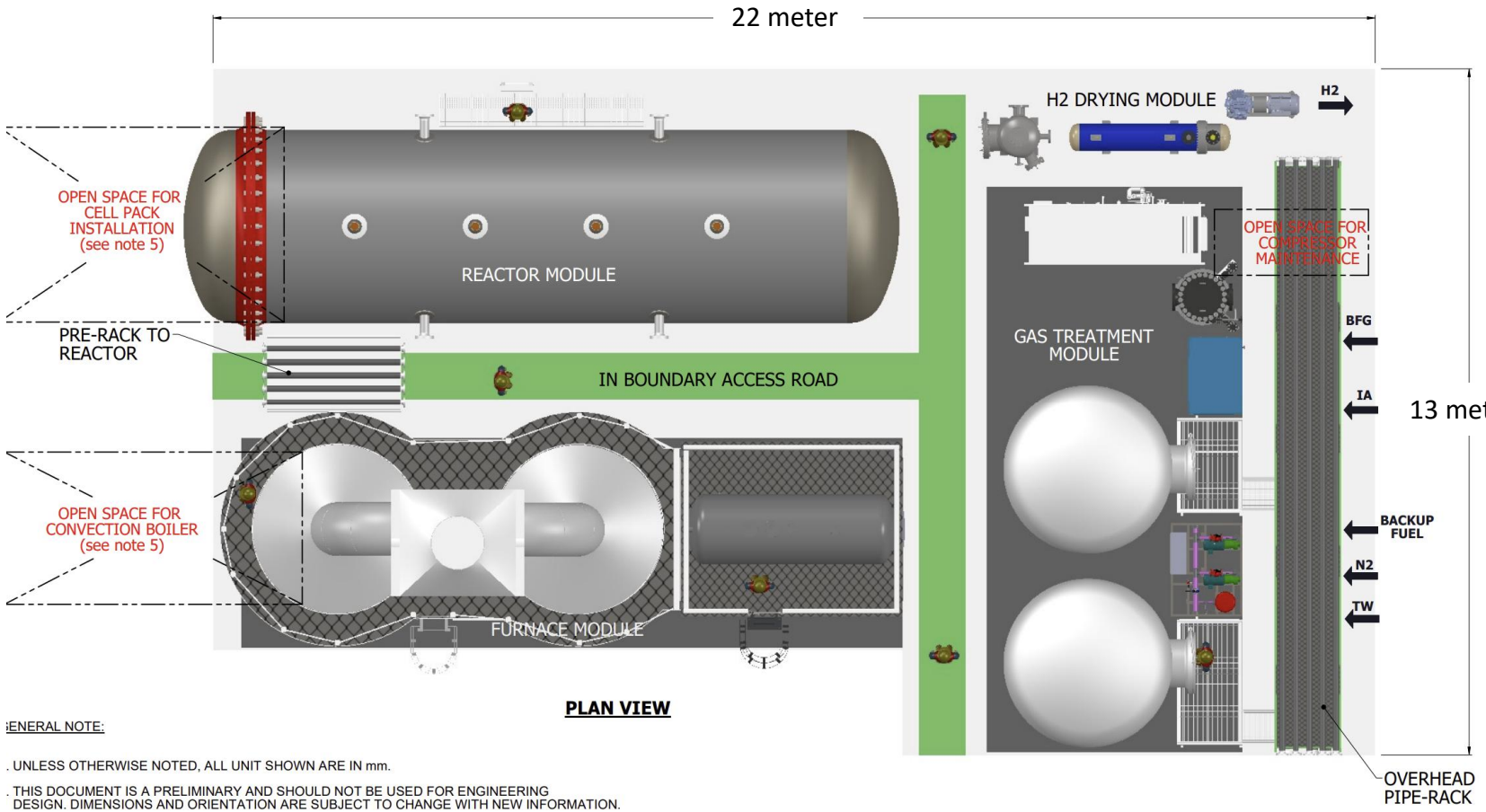
Single Reactor Plant – Biogas to Mobility & Small Commercial Installations

Up to 4 Ton Per Day (TPD) H2Gen® System

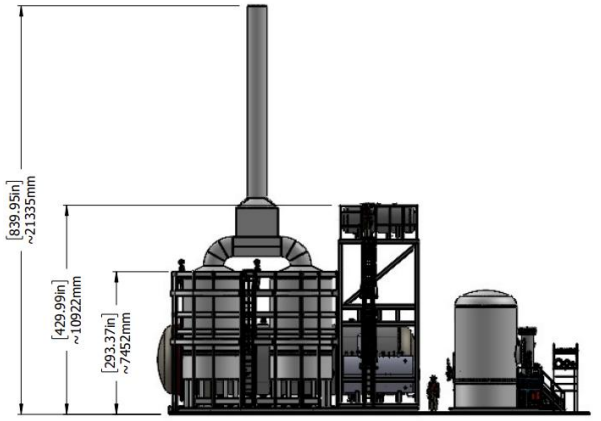


PLAN VIEW

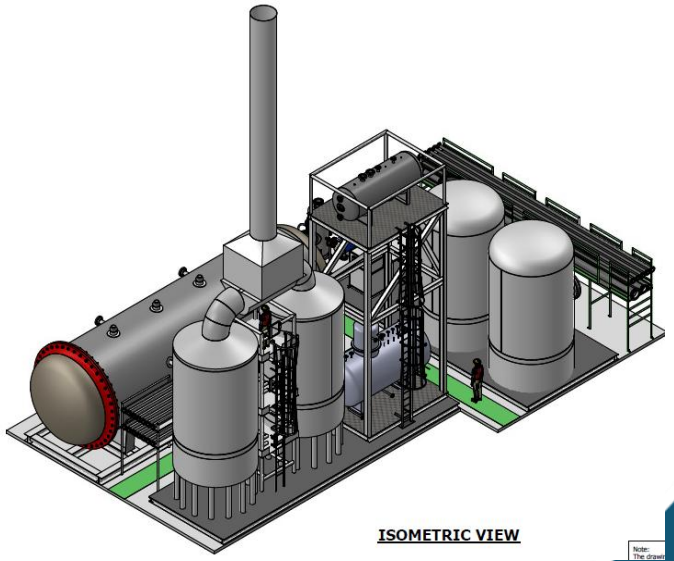
ENERAL NOTE:

. UNLESS OTHERWISE NOTED, ALL UNIT SHOWN ARE IN mm.

. THIS DOCUMENT IS A PRELIMINARY AND SHOULD NOT BE USED FOR ENGINEERING DESIGN. DIMENSIONS AND ORIENTATION ARE SUBJECT TO CHANGE WITH NEW INFORMATION.



FRONT VIEW



ISOMETRIC VIEW

UTILITY

Decarbonizing Mobility with Decentralized H_2 Production using Biogas

H2Gen® Low-cost Solution Enables Distributed H_2 Production for Mobility

Biogas Sources

- Wastewater Treatment Plants
- MSW Landfills
- Dairy Farms / Ag Waste
- Food / Green Waste

Decentralized H_2 Production for Mobility

- Buses
- Trucks

Utility's Hydrogen Advantages

- Energy source: **landfills, wastewater plants, dairy farms, food waste** and other biogases
- H2Gen plants are highly **reliable, affordable, modular, providing distributed, on-site, low-to-negative CI H_2**
- **Low capex, opex and footprint** Hydrogen **without requiring expensive RNG upgrading and PSA gas separation**
- **High project certainty** - no power needed for hydrogen production (no power-gen infrastructure & permits)

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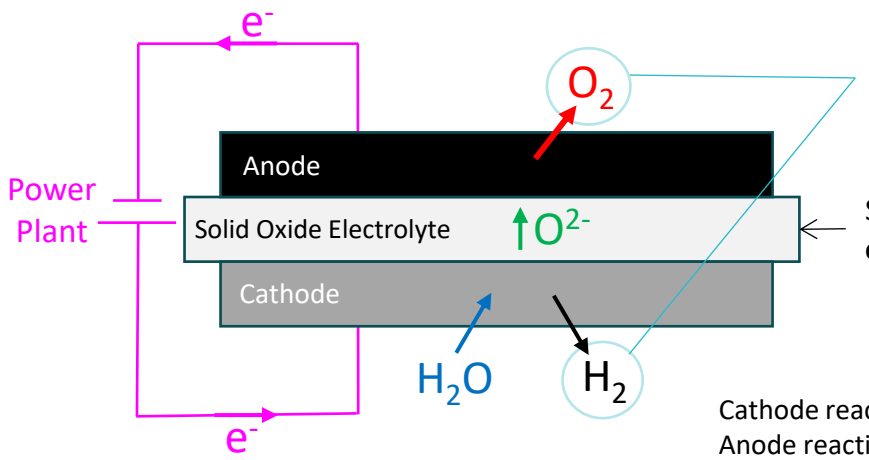
Technology Fundamentals: Hydrogen from Water without Electricity

CONVENTIONAL ELECTROLYSIS



Products: ***pure H_2*** and ***pure O_2*** streams

SOEC electrolyte is **only O^{2-} conducting**

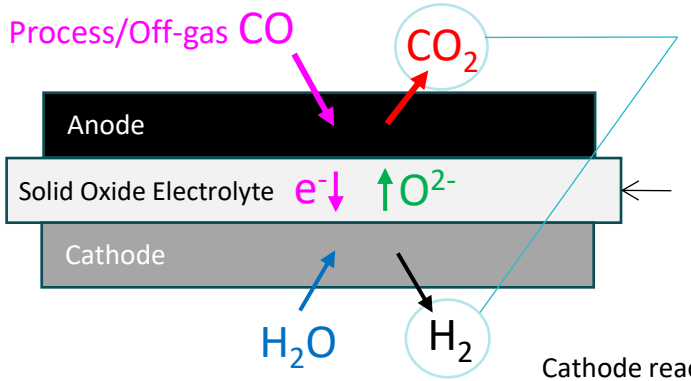
Cathode reaction: $H_2O + 2e- \rightarrow H_2 + O^{2-}$
Anode reaction: $O^{2-} \rightarrow {}^1/_2O_2 + 2e-$

SOEC

Solid Oxide Electrolysis Cell

- H_2 production from H_2O using **electricity**
- **Needs new electric infrastructure**
  - **high cost**
  - **limited scale**
  - **accelerated performance degradation**
  - **large physical footprint**

UTILITY PROPRIETARY



Products: ***pure H_2*** and ***concentrated CO_2*** streams

eXERO electrolyte is both **e^- and O^{2-} conducting**

Cathode reaction: $H_2O + 2e- \rightarrow H_2 + O^{2-}$
Anode reaction: $CO + O^{2-} \rightarrow CO_2 + 2e-$

H2Gen®

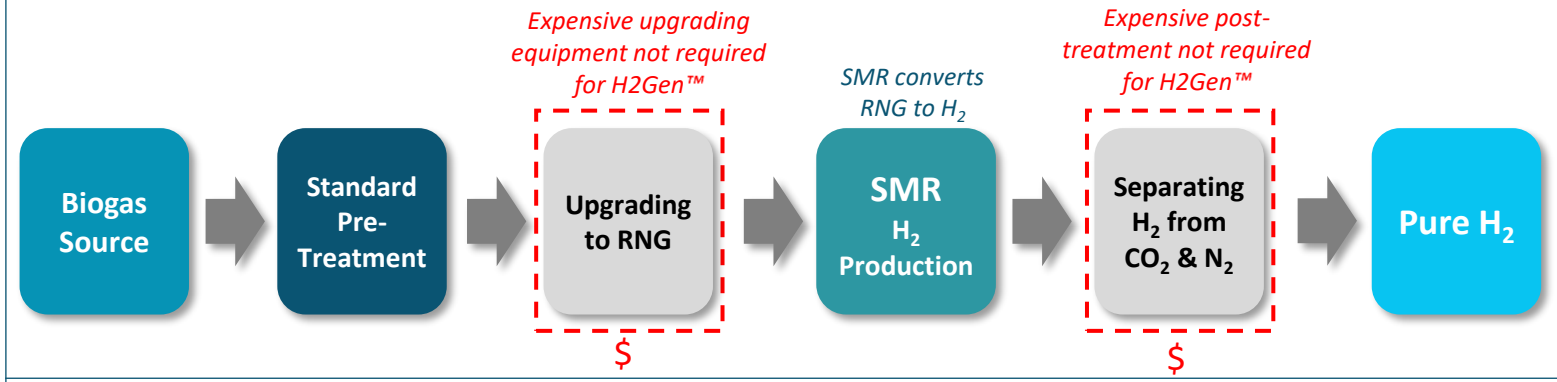
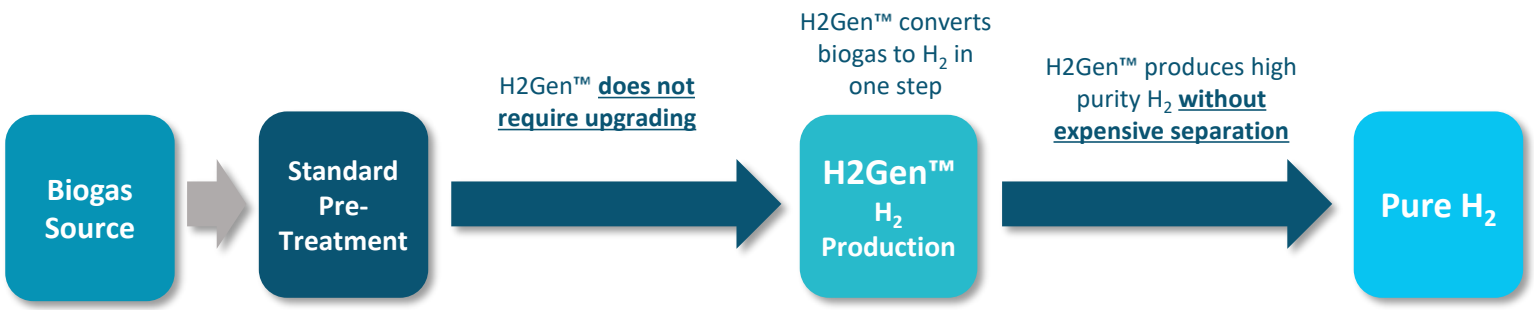
H_2 from H_2O without Electricity

- H_2 production from H_2O using **electrochemical energy** in gases
- **Integrates with existing industrial assets**
  - **Low cost**
  - **low-to-negative carbon intensity**
  - **no electricity**
  - **small footprint**

UTILITY

Biogas to Mobility Comparison: H2Gen® vs. Steam Methane Reforming

Lower Hydrogen Cost and Zero Carbon Intensity

Conversion Process	CI Score (kg CO_2e / kg H_2)	Key Takeaways
SMR (Steam Methane Reforming) 	6.9	**SMR** ▪ **Requires RNG plant** as it can only convert high-methane content gas streams ▪ RNG plant adds additional step with **complexity and cost** to process ▪ Upgrading to RNG **increases CI** due to required power and associated emissions ▪ Process requires **separating H2** from process gas mixture, which **adds cost** ▪ Due to methane leakage, the RNG+SMR route does **not qualify for the PTC**
Proprietary H2Gen™ 	~0[1]	**UTILITY H2Gen™** ▪ H2Gen™ can **maximize the PTC** at $3/kg ▪ Operationally simple, **standard pre-treatment** step for H2Gen™ ▪ **Small footprint** of H2Gen nondisruptive to existing infrastructure, **~1/3 footprint of an SMR** ▪ **Significant savings** from reduces complexity and smaller size ▪ **Reduced capex** compared to SMR

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H2Gen™ offers a significantly simpler, lower cost option with less emissions than an SMR

[1] Analysis done for landfill gas. For dairy gas, the carbon intensity score is deeply negative

Utility Provides Affordable Carbon-Negative Solution for Heavy Duty Mobility

Biogas to Hydrogen Ecosystem

FLEET OPERATORS

amazon · FedEx · Ryder · Walmart · UPS · MAERSK

DISTRIBUTION & DISPENSING

Pilot Flying J · Iwatani · Clean Energy · MESSER Gases for Life

UTILITY

Reliable, Affordable, Distributed, Low Capex, Low CI

OEMs

HYUNDAI · TOYOTA · Cummins · Peterbilt · DAIMLER · KENWORTH · VOLVO

Regulatory Mandates

BIOGAS SUPPLIERS

GH Hanwha · WM · Republic Services · GFL · CAL BIO GAS · AEMETIS · MAAS Energy Works

Wastewater Plants

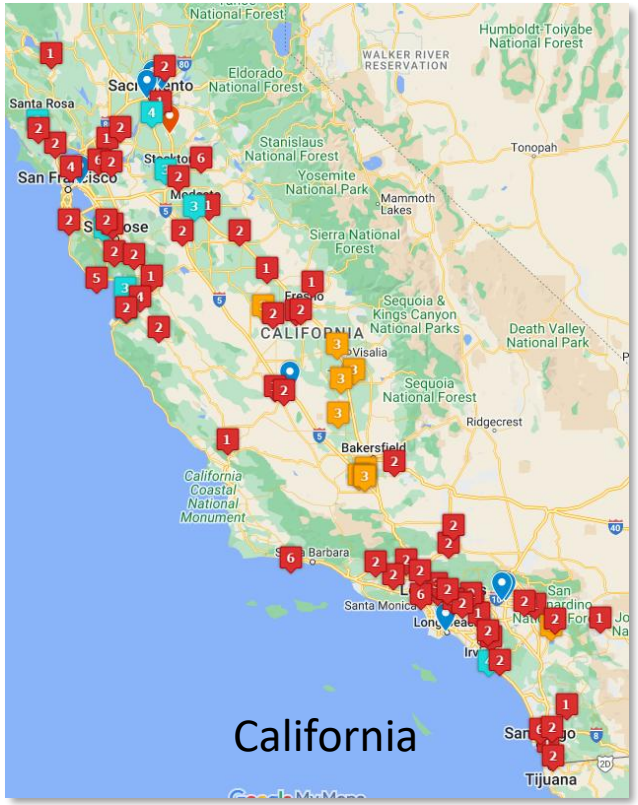
Landfill Owners

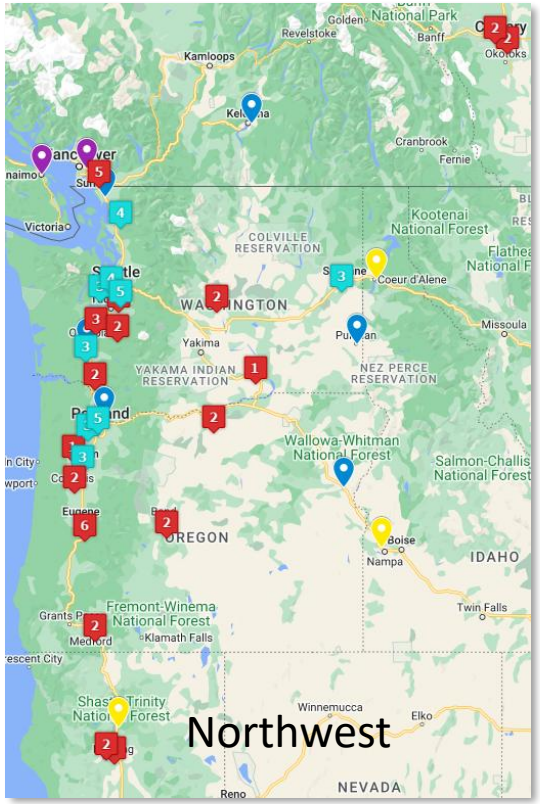
Agricultural Producers

Western U.S. Market Biogas Sources

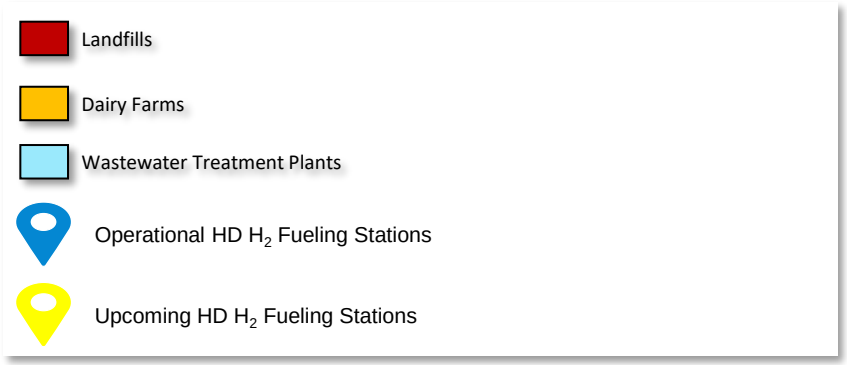
130 Sites Targeted Today with ~1,750 Additional Future Sites

Biogas Sites & Heavy-duty (HD) H_2 Fueling Stations)





Market Opportunity for Utility in the U.S. (CA, OR, and WA)



Example of Key Biogas Source Operators in California, Oregon & Washington

Operator name	Biogas collection (Nm^3/day)	End-use
Company 1	706,527	Flared
Company 2	102,563	Flared
Company 3	398,386	Flared
Company 4	80,561	Flared
Company 5	62,325	Flared

- Focused on biogas sources that are underutilized (i.e., flared) and not a good fit for RNG
- Targeting sites that support 2 to 4 TPD of H2 production and are along trucking corridors
- 2 tons per day (TPD) can support ~ 40 to 50 trucks

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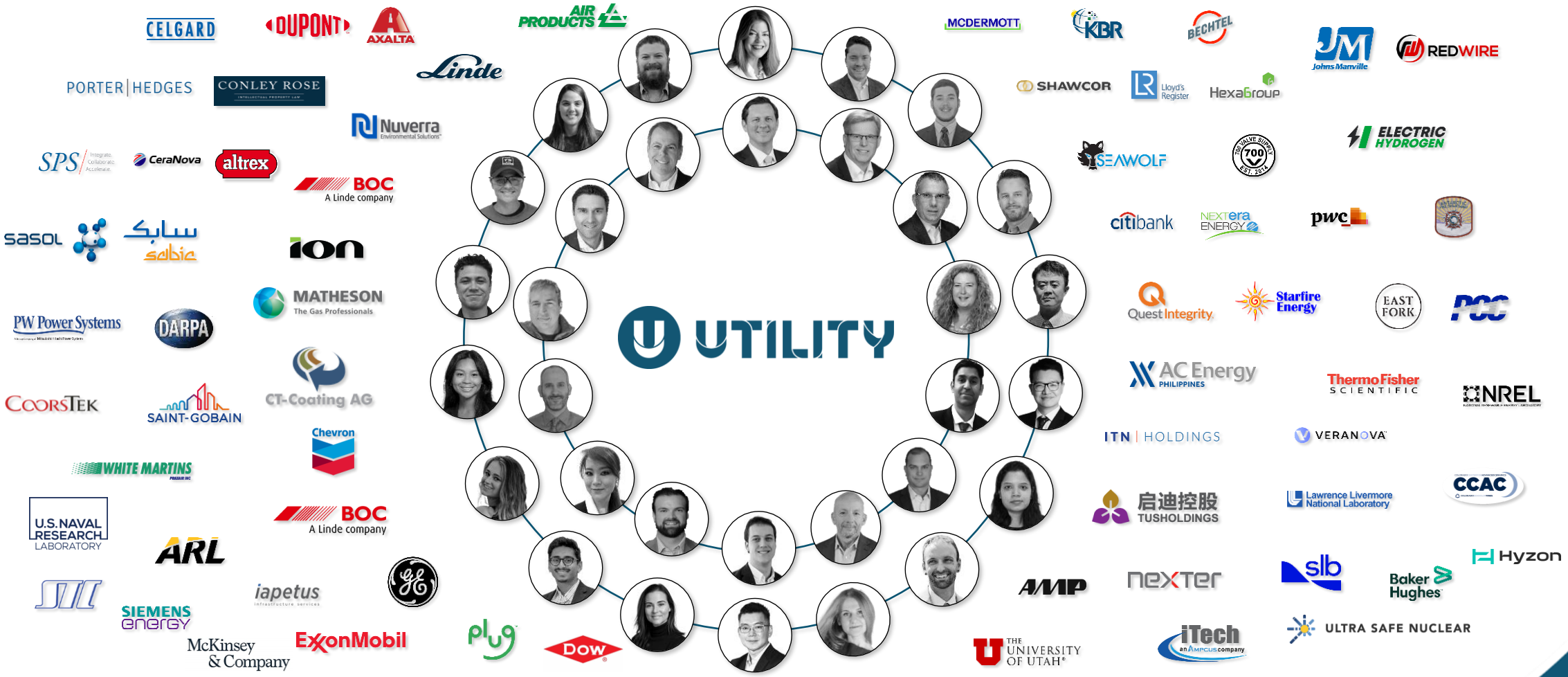
Entrepreneurial Culture with Experience in **Capital Projects Execution & Technology Commercialization**

Disciplines in Manufacturing, Project Execution, Engineering, Ceramics, Electrochemistry, Multi-Physic Simulations



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Thank You

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Appendix

Economic Clean Hydrogen: Scale-up and First Project Videos

Scale Up within Industrial Locations with Limited Space

- https://www.youtube.com/watch?v=2oOuhq1jFTg

First Steel Project in Canada

- https://www.youtube.com/watch?v=Gi9G_E3kdQ4

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