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IEPR Commissioner Workshop – H Cycle Waste to Hydrogen

July 2025

Mission Alignment: Waste Diversion and Clean Fuels Production

Addressing Two Unique Challenges With One Unified Solution

- H Cycle set out with a mission to address two critical industry and environmental challenges with one unified, scalable, Waste-to-Energy ("WTE") solution.

Challenges

Global Waste Crisis
Landfill capacity is shrinking while waste generation is rising, demanding sustainable alternatives.

Demand for Clean Fuels
Hard-to-decarbonize sectors like heavy-duty transit and industry driving long-term hydrogen demand.

Opportunities

California Target Market
Policy mandates and economic incentives position California as the ideal proving ground.

Converging Drivers
SB 1383[1] and Zero Emissions Vehicles ("ZEV") goals combine to support both organic waste diversion and hydrogen production.

H Cycle was founded to develop, own, and operate facilities that convert municipal solid waste ("MSW") to clean fuels – in the first instance, hydrogen.

1) California's SB 1383 is a statewide effort to reduce emissions of short-lived climate pollutants by mandating a 75% reduction in organic waste disposal by 2025, compared to 2014 levels.

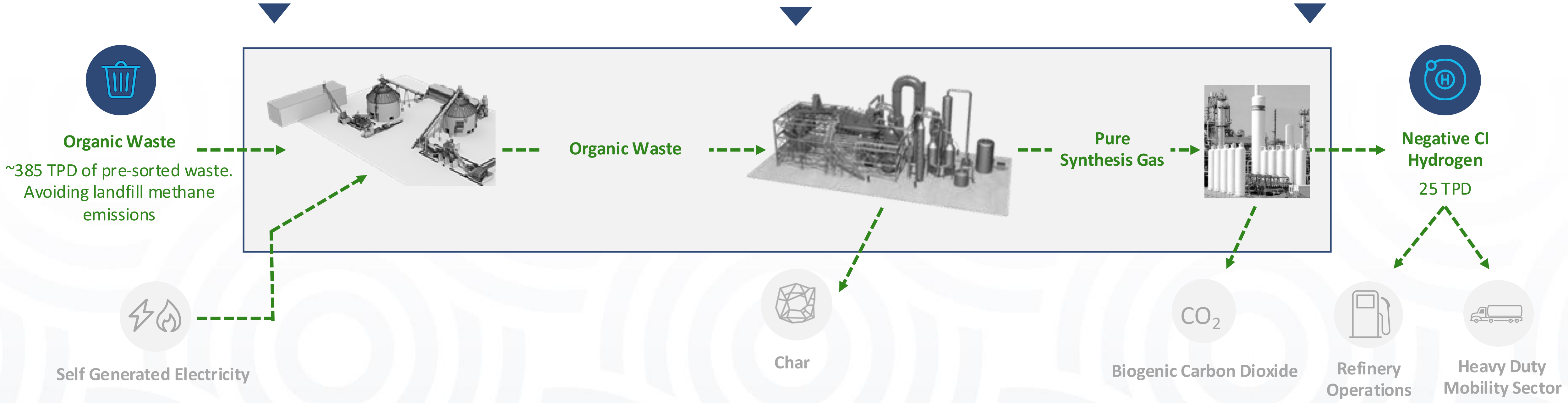
The H Cycle Process: An Innovative Use of Proven Industrial Processes

Highly Commercialized, Scalable Process for Cost-Effective Waste-to-Hydrogen Production

Waste Preparation Unit
Organic Waste is received, processed dried and shredded.

Waste Conversion Unit
Proven thermal conversion process converts organic waste feedstock to syngas.

Hydrogen Production Unit
H_2 is produced from syngas via standard equipment, followed by purification and liquefaction.



Waste Dilemma Highlights the Need for Sustainable Solutions

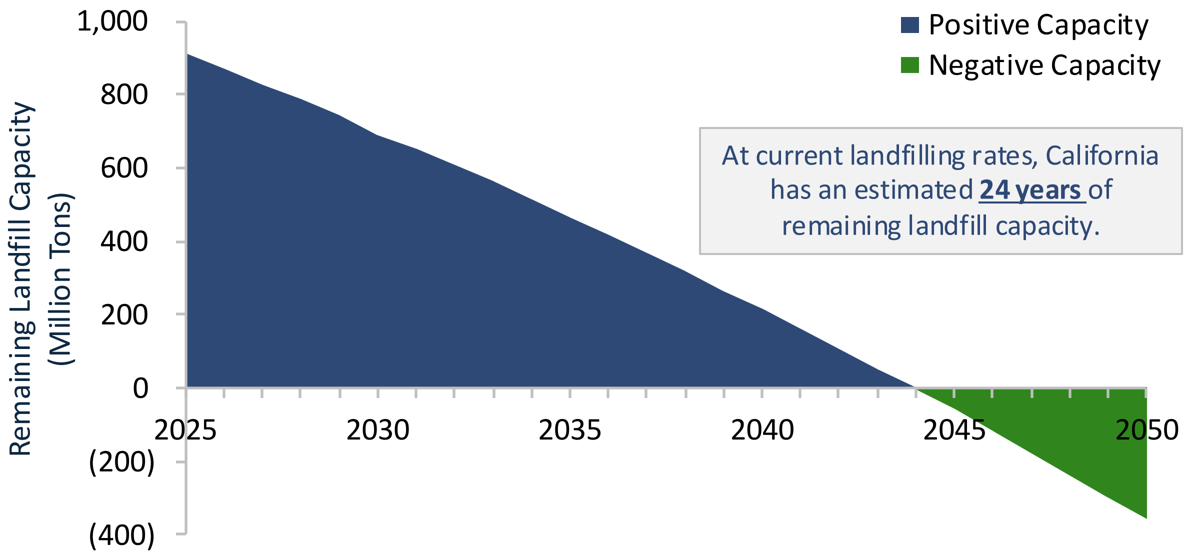
Fewer Landfills, More Waste, and a System Under Pressure

California's SB1383

- SB1383 is a statewide effort to reduce emissions of short-lived climate pollutants by reducing organic waste disposal to 50% by 2020 and 75% by 2025.

- Only a select group of methodologies are approved ways to process organic waste as of January 2024, H Cycle's process.
  - **The H Cycle process presents the lowest carbon intensity solution for landfill waste and highest product value out of all approved pathways.**

Remaining Landfill Capacity – California Forecast[1]



Comparison of Waste Diversion Methods

	Landfill	Incinerator	Compost	Anaerobic Digestion	H Cycle
Carbon Intensity[2] (kg CO_2e / t waste)	200	75	(200)	(325)	**(475)**[3]
Feedstock Flexibility	✓	✓	✗ (4)	✗ (4)	✓
SB1383 Compliant	✗	✗	✓	✓	✓
Product Value	✗	✗	✓	✓	✓

1) EPA's Landfill Methane Outreach Program (LMOP). Assumes no increase in waste generation and no additional landfill expansions.
2) The Carbon Intensity is calculated based on the EPA Waste Reduction Model and is the net of Gross Emissions and Product Displaced CO2. Gross Emissions refer to all fossil and anthropogenic emissions outside of the biocycle (e.g. NOx and CH4). Product displacement emissions represent stored carbon in landfills and avoided fossil fuel consumption by the final product.
3) Illustrative CI based on H Cycle's evaluation of technology alternatives.
4) Not able to process mixed MSW.

Adoption of Hydrogen is Critical to Reducing Emissions

Continued Use of Existing Fuel Mix Will Not Achieve Emission Reduction Goals

- The decarbonization of fuel supply **will not happen overnight** – it is a series of executable initiatives that enable the adoption of a fuel that is **economically feasible to supply** and has a **better emissions profile** than the next best alternative.

- With that in mind, the present realities faced by industries seeking to adopt hydrogen as a decarbonized fuel include:
  - **For near-term demand, hydrogen is only available from existing sources**, mainly from Steam Methane Reformers (grey hydrogen); blue and green hydrogen at any scale will not be available until demand and economics support incremental production facilities
  - Despite being derived from natural gas, grey hydrogen reduces CO_2 emissions when replacing diesel in trucks and heavy-duty equipment; accounting for the Energy Efficiency Ratio (EER) of Hydrogen Fuel Cell Electric Vehicles (FCEVs), **grey hydrogen can reduce CO_2 emissions by ~50% compared to diesel, while drastically reducing air pollutants**

High Level Comparison – Diesel vs. Hydrogen Production Methods[(1)(2)(3)]

	Diesel	**SMR** (Grey)	**ATR + CCS** (Blue)	**Electrolysis** (Green)	HCycle	HCycle (Including CCS)
Carbon Intensity (kg CO_2 / kg H_2)	20.4	12.0	2.8	0.4	-3.1	-15.0
		Lowest Cost	Moderate Cost	Highest Cost		
	Incumbent Fuel	*Current Alternative*			*Mid-Term Alternative*	
Low Air Pollutants (NOx / SOx)	✘	✓	✓	✓	✓	✓
Scaled Supply Available Today	✓	✓	✘	✘	✘	✘
Customer Infrastructure Available	✓	✘	✘	✘	✘	✘

1) International Energy Agency, Stanford University, and MIT Climate Portal. Electrolysis carbon intensity assumes renewable electricity is utilized.
2) "ATR" represents autothermal reforming, an alternative to steam methane reforming.
3) Assumes a 2 gal of diesel to 1 kg of hydrogen conversion (EER of 2.0x)