Challenges in Methane Pyrolysis

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Our Vision

Build the world's leading clean hydrogen and materials company.

Green Hydrogen is a key pillar of de-carbonization

Renewable energy*

Key markets served:

- Electricity Market

*Renewable/Carbon-Free Electricity

Battery innovation

Key markets served:

- Short Term Electricity Storage
- Med/Light Duty Transportation

Green hydrogen**

Key markets served:

- Heavy Duty Transportation
- Marine & Air Transportation
- Steel Industries
- Chemical Industries
- Agriculture
- Long Term Electricity Storage

*****Green hydrogen has broadest reach given unique ability to eliminate hard-to-abate CO_2 emissions***

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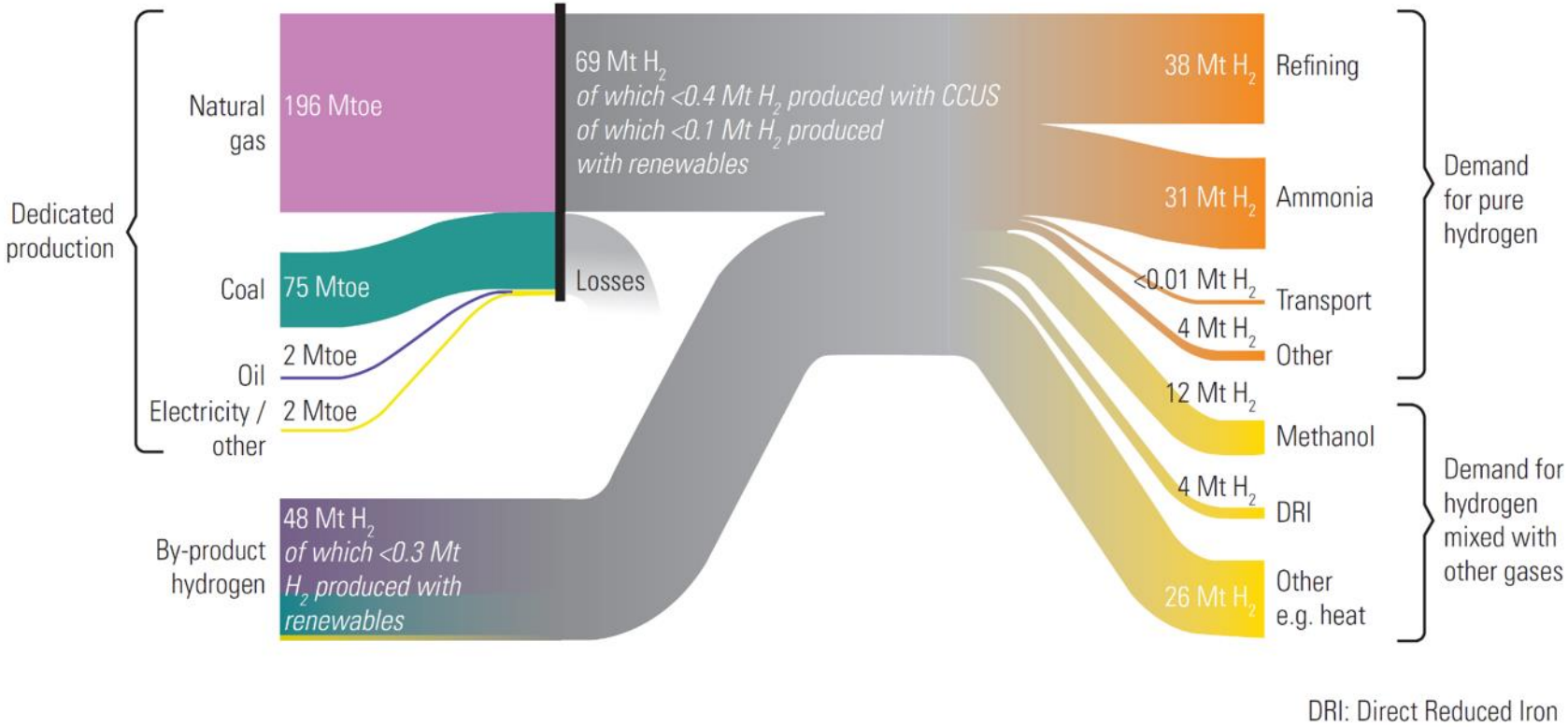
Global Hydrogen Market

Global hydrogen market is nearly ***US$130 billion*** and expected to grow 7+% per year [1]

Hydrogen production results in nearly ~830 MtCO2e (***2% global CO2 emissions***) [2]



(1)(Figure) United States Department of Energy Office of Fossil Energy. "Hydrogen Strategy Enabling a Low-Carbon Economy," July 2020.
(2) Kearney Energy Transition Institute. "Hydrogen Factbook: Applications and Business Models," June 2020.

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Green Hydrogen from electricity and natural gas

monolith

Protected Methane Pyrolysis Technology

Renewable/ Carbon-free electricity

Natural gas (CH_4) (renewable or pipeline)

Olive Creek I (OC1)

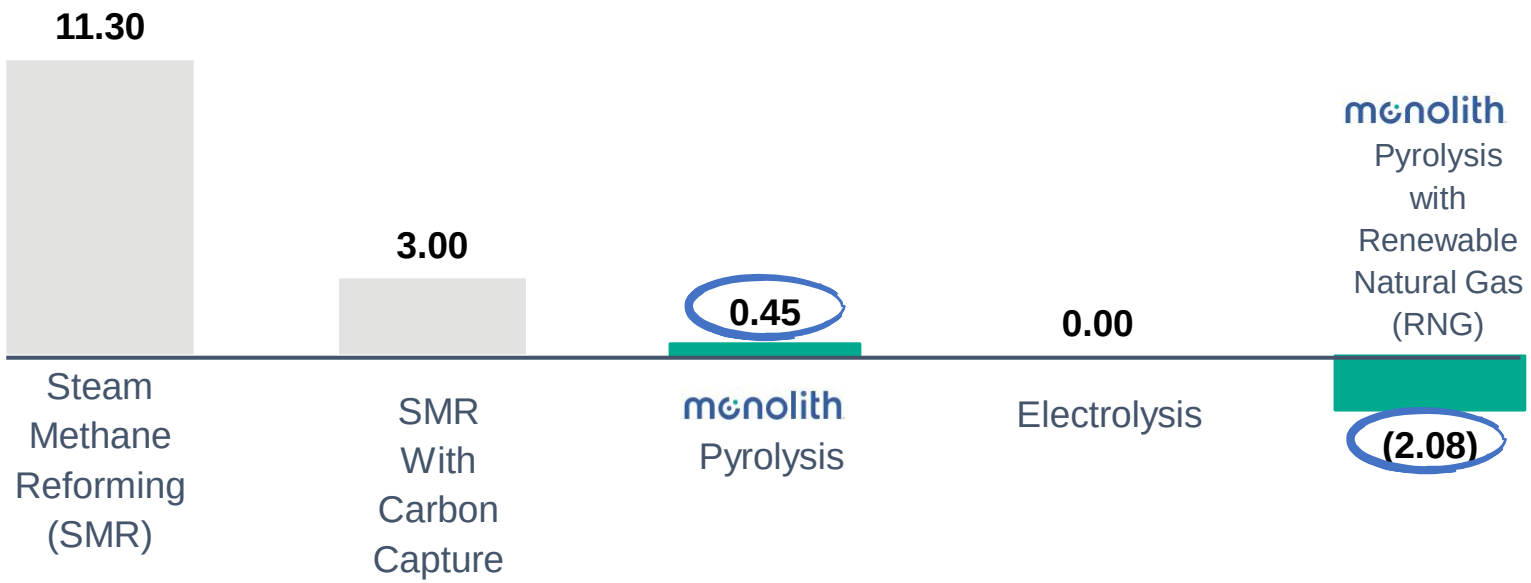
H_2

Green hydrogen

High value solid carbon

Potential for lowest hydrogen carbon intensity

Carbon Intensity Of Hydrogen Production – Well To Gate (kg CO_2e / kg H_2)



Note: Electrolysis and pyrolysis assume 100% renewable energy

Sources: NREL Hydrogen Analysis (H2A) Production Models, Version 3.2108, Central SMR without CCUS; NREL Hydrogen Analysis (H2A) Production Models, Version 3.2108, Central SMR with CCUS; Based on third party study using GREET1_2020 and AR5 GWP (CO2, N2O, CH4); NREL Hydrogen Analysis (H2A) Production Models, Version 3.2108, Central Electrolysis (Process emissions only); Based on third party study using GREET1_2020 and AR5 GWP (CO2, N2O, CH4)

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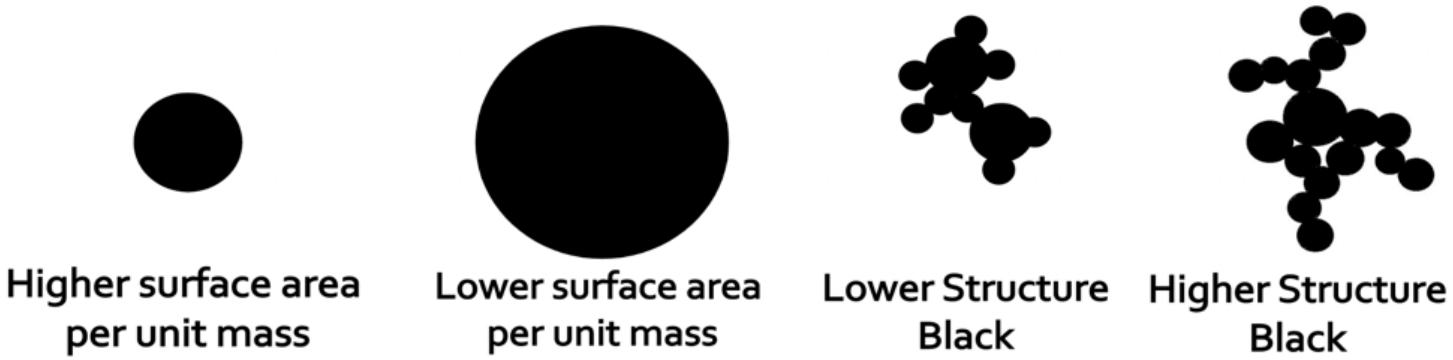
What is Carbon Black?

- A very fine, very black powder
- Has a molecular and crystalline structure similar to graphite, but with many curved and amorphous regions
- Consists of primary particles (typically 10-50 nm) welded together into aggregates (typically 50-250 nm)



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Carbon Black Applications

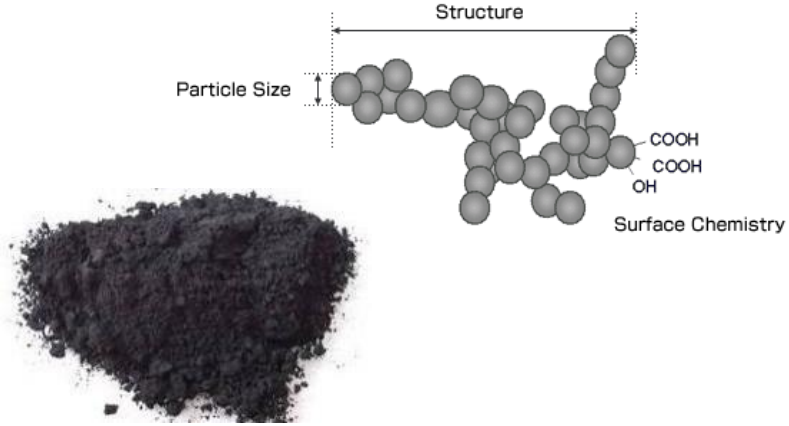
Mature global market with prevalent and diverse end-uses

100-year-old commodity product with diversified and ubiquitous end uses/markets

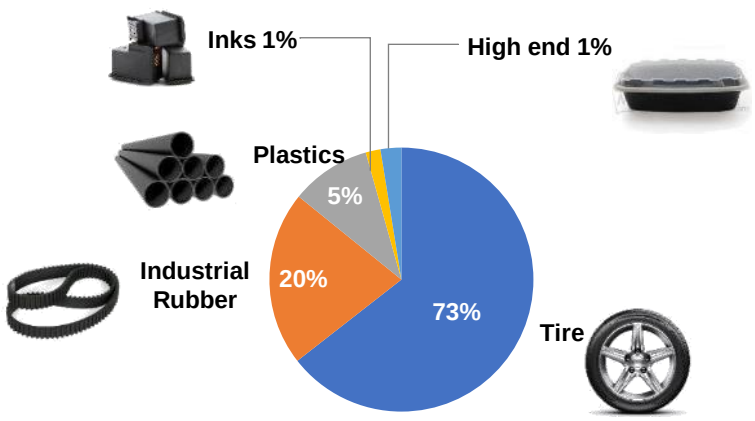
- among the top 50 industrial chemicals worldwide (by volume)
- Growing about 2-3% CAGR

Widely used as a heat conductor or for pigmentation in belts, hoses, and specialties (electronics, inks, etc.)

- Unique properties ideal for rubber and plastics applications
- Structure and surface properties help reinforce and color rubbers and plastics



Market Breakdown by Application (% share value)



Source: Notch Consulting

Tires

~$11 bn/yr

Industrial Rubber

~$4 bn/yr

Specialty (~$2 bn/yr)

Inks/Toners

Plastics

High End (Coatings, Paints, FDA)

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2021 News

Renewables Now

News Events Press Releases Research Advertising

Solar

Nebraska's NPPD to source 2 TWh of wind, solar for Monolith Materials

January 5 (Renewables Now) - Nebraska Public Power District (NPPD) plans to launch a request for proposals (RFP) in March 2021 in order to procure renewable energy generation for chemicals and hydrogen company Monolith Materials Inc.

The Olive Creek 1 (OC1) plant in Hall Nebraska. Source: Monolith Materials

The two parties have entered into a letter of intent (LoI) that outlines Monolith's plan to buy 2 million MWh of renewable power a year from wind and solar parks, alongside energy storage. The signing of power purchase agreements (PPAs) is expected to occur by September 1, 2021, and commercial operations to start by the end of 2025 at the late

"The approximately two million megawatt-hours of generation would create a sufficient number of renewable energy credits (RECs) to meet 100 percent of Monolith's average

DISTRIBUTED ENERGY RESOURCES

NextEra Energy, SK Invest in Hydrogen Firm

June 3, 2021

Lincoln, Nebraska-based Monolith Materials won new investments from a consortium of investors led by SK Inc. and includes NextEra Energy Resources, LLC and Perry Creek Capital.

ENR

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Materials

Hydrogen, Carbon Black Plant Gets Conditional $1B DOE Loan for Cleaner Technology

Materials producer Monolith plans commercial-scale expansion at Nebraska plant

l its Clive Creek plant in Hallam, Neb. for commercial-scale clean hydrogen and carbon black production.

Rendering courtesy of Monolith

News

Monolith Enters Into Agreement to Scale Clean Hydrogen and Carbon Black Technology Internationally

By FuelCellWorks | October 13, 2021 | 3 min read (537 words)

Lincoln-based Monolith announces plans to hire 200 people

Matt Olberding Sep 1, 2021 Updated Jan 3, 2022 0

CAR AND DRIVER

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Goodyear Reveals Sustainable Tire Concept and Tests Airless Tire

Goodyear has shown a tire made 70 percent from eco-friendly materials and announced a testing program for a non-pneumatic tire.

BY CALEB MILLER JAN 6, 2022

GOODYEAR CORPORATE

Media | News Releases

GOODYEAR COLLABORATES WITH MONOLITH ON CARBON BLACK; INITIAL TESTING DEMONSTRATES REDUCED EMISSIONS

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Methane Pyrolysis Scale-Up

Lab to Commercial Scale

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Continuous learning from successful technology scale-up

2021 Focus

GREEN HYDROGEN PRODUCTION

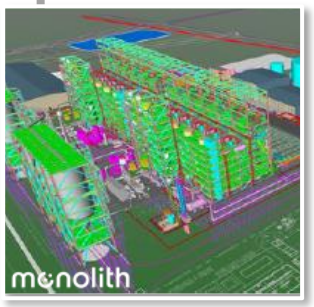
0.3 kg/hr | **3 kg/hr** | **30 kg/hr** | **300 kg/hr** | **Commercialization completed**

LAB 1
Laboratory Scale
up to 0.3 kg/hr
2016 – 2018

MINES ParisTech
Pilot Scale
0.3 – 2 kg/hr
2018 – Present

Seaport 1
Demonstration Scale
12 – 18 kg/hr
2014 – 2018

Olive Creek 1
Commercial Scale
540 – 620 kg/hr
2020 – Present



Olive Creek 2
Commercial Scale
6,390 – 7,440 kg/hr
2024

Replicate Rx 12 Times
No technology scaling required

Demonstrated ability to scale-up *patent protected*, *commercially viable* technology

Note: Assumes 0.31kg of hydrogen is produced for every kg of carbon black

Continuous learning from successful technology scale-up

2022 And Beyond

GREEN HYDROGEN PRODUCTION

0.3 kg/hr | **3 kg/hr** | **30 kg/hr** | **300 kg/hr** | **Commercialization completed**

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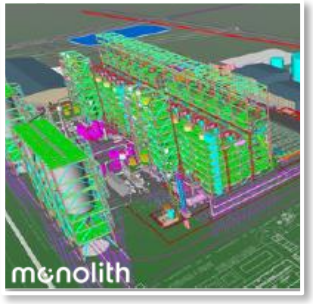

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Olive Creek 1 Facility

Olive Creek I (OC1)	
Reactor / Train	1 / 1
Carbon Black	14,000 tonnes/yr.
Hydrogen	4,500 tonnes/yr.
Completion	June 2020
Location	Hallam, Nebraska, U.S.
Energy	100% Renewable Electricity

OC1 is the first commercial scale, greenfield, carbon black production facility built in the U.S. in over 50 years, and the largest CO_2 free stand-alone Hydrogen plant in the country.

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Monolith Expansion (Olive Creek 2)

Olive Creek 2	
Additional Reactor/ Train[1]	12 / 2
Carbon Black	180,000 tonnes/yr. + 14,000 tpy (OC1)
Ammonia	275,000 tonnes/yr
Completion (Target)	2024
Location	Hallam, Nebraska, U.S.
Energy	100% Renewable Electricity

Monolith's Expansion Will Create the Largest Green Hydrogen Plant in the US

Key Takeaways

- Monolith has built upon previous work and taken Methane Pyrolysis from Lab to Commercial Scale
- Planned OC2 expansion will produce clean ammonia and carbon black eliminating nearly ***1,000,000 tCO2e per year***
- Cost-competitive, large-scale production of clean hydrogen will be an essential pillar to reducing global emissions
- Monolith is the only company currently producing clean hydrogen and cleanly made carbon black cost-effectively
- Monolith is using a modular approach to scale its technology to meet global demand
- Monolith has a robust project pipeline with several opportunities across North America and worldwide.

Thank You

monolith-corp.com