Monolith Materials | January 2021 Taking Methane Pyrolysis from Concept to Industrial Plant



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Unique Business Plan

Renewable Hydrogen from Renewable Electricity & Natural Gas



Monolith is the most sustainable and lowest-cost producer of hydrogen in the world, as its proprietary process unlocks significant value from carbon sequestration and its differentiated go-tomarket strategy generates substantial cash flows under both existing and expanding markets

Monolith History & Development Path





Kv/ERNER Karbomont, Canada Commissioned: 1999 H₂ Reactor Scale: 400kg/hr Capacity: 20KT Carbon Black



MONOLITH Seaport, California Commissioned: 2014 H₂ Reactor Scale: 20kg/hr Capacity: 700T Carbon Black

MONOLITH Olive Creek I (OCI), Nebraska Commissioned: 2020 H₂ Reactor Scale: 600kg/hr Capacity: 14kT Carbon Black



MON()LITH Olive Creek II (OCII), Nebraska Commissioned: 2023 (planned) H₂ Reactor Scale: 600kg/hr Capacity: 180kT Carbon Black (12 x 16kT Reactors)

Olive Creek 2: Clear Environmental Advantages



Monolith's Olive Creek facilities will reduce greenhouse gas emissions by ~26 MT over its life

Monolith's Four Orders of Methane Pyrolysis



Demonstrated ability to scale-up commercially viable technology

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Operational History at Demonstration Scale (Seaport)

Monolith surpassed previous Plasma Pyrolysis results at demonstration scale. In addition, through over 3,700 hours of operation Monolith demonstrated substantially better yield, higher reliability, and carbon product quality control. Past experience and operational data gave confidence that our commercial plant, Olive Creek 1, will perform as predicted.



Cumulative Operating Hours – Seaport Plant

Challenges Overcome at Seaport (Demo Scale)

Carbon Fouling.

Carbon has propensity for depositing/sticking to surfaces. Addressed simultaneously with both design and process conditions.

- At small scale fouling must be addressed to produce definitive (scalable) conclusions.
- At larger scale fouling is key reliability concern.

Creating Carbon Value

Required significant run time to develop *scalable* process levers & systems understanding to control final product quality necessary for our customers.

Combination of Engineering Disciplines

Materials selection, reactor design and flow measurements are challenging due to combo of carbon, hydrogen and high temperature. Required range of experts working closely together.

"Learning" requires getting all parts correct

Any one problem can cause bad data. Reactor design, experimental methods, process understanding and operations.... all must be perfect.



MP: Methane Pyrolysis

Olive Creek Project

Olive Creek I Facility at Mechanical Completion

Olive C	reek I (OC1) Facility
Capacity	Hydrogen Production: ~5 ktpa Carbon Sequestration: ~15 ktpa
Completion	2021
Location	Nebraska, United States
Technology Level	Full commercial scale (TRL 9)
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OC1 is the first commercial-scale methane pyrolysis facility built in the U.S.

Key Takeaways

- The state of our technology has surpassed our previous Methane Pyrolysis Partners (Kvaerner)
- Our work at Seaport (Demo Scale) overcame major challenges posed by Methane Pyrolysis
 - Carbon Fouling was controlled through a combination of design and process conditions
 - Demonstrated (scalable) levers to control our product quality and produce high value Carbon Black.
 - Showed that Monolith team has the right combination of skill, expertise, and "elbow-grease"
- We have incorporated our past experience into the OC-1 design for the final scale up step.
- We are starting to demonstrate our Reactor technology at Commercial scale (TRL 9)

THANK YOU

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