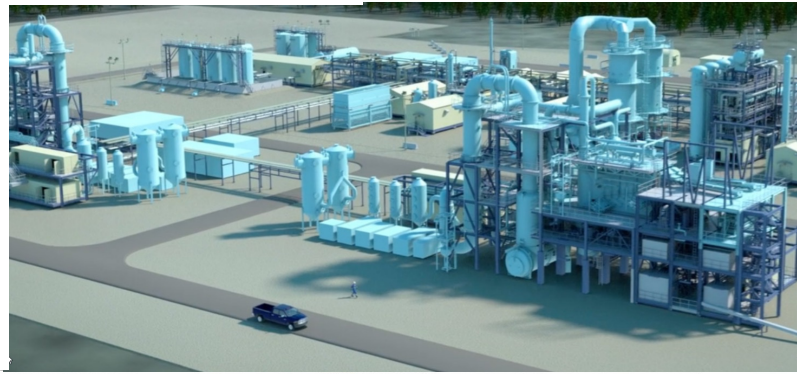




EXPANDER ENERGY

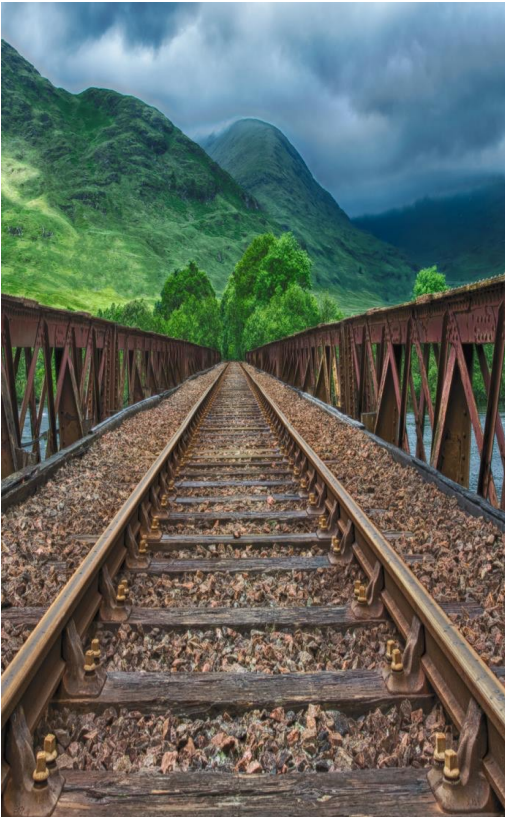


Gasification and F-T Conversion of used railway ties into Renewable Synthetic Paraffinic Diesel and Jet

Global Syngas Technology Council, October 2024

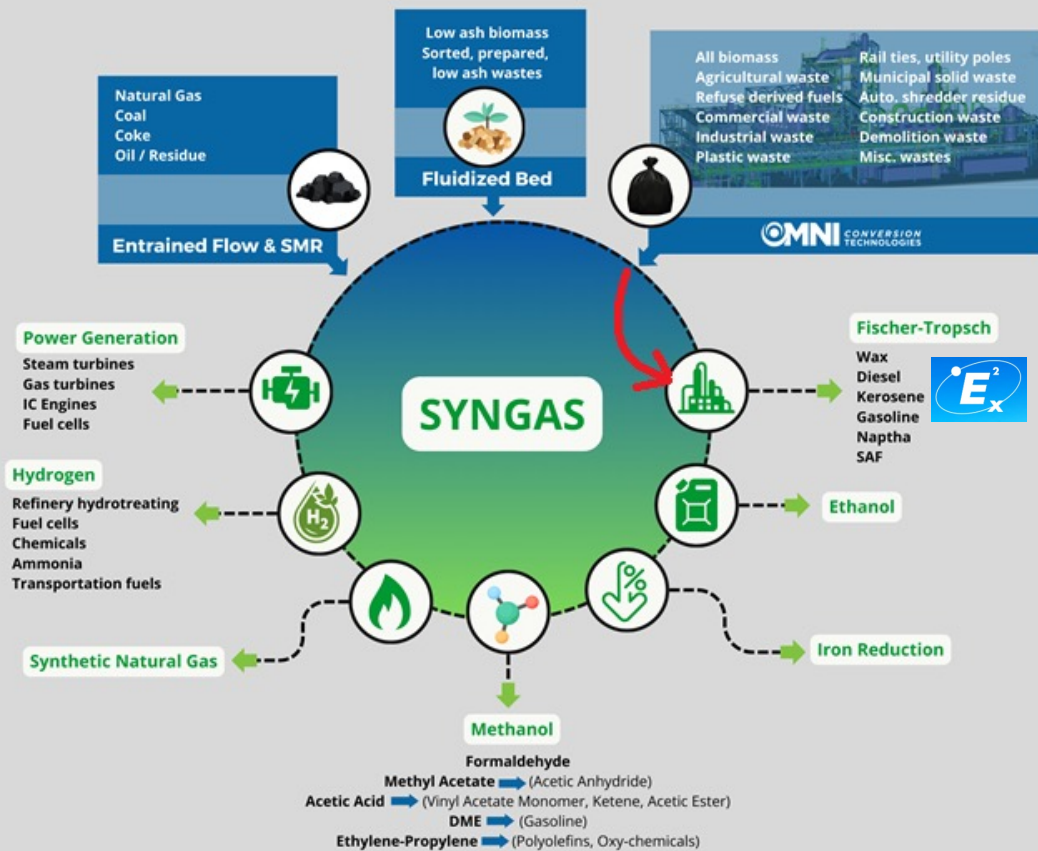


Used Railway Ties: Lots of energy, but difficult to extract it.



- In the U.S. and Canada, 17 to 23 million wooden railway ties are replaced or discarded every year. There are 2600-2700 ties per km, each with a 20-50 year life.
- Ties are made of oak, Douglas fir, or pine, infused with coal tar creosote or creosote/borate as a preservative. In the past, arsenic was used as well.
- Typical weight 100-150kg/tie, including 10%-15% of creosote.
- Energy content averages 2350 MJ/tie, or 47,000 TJ of energy per year from 20 million ties.
- The current preferred method of disposal is combustion above 850°C in incinerators or cement kilns. Scrubbers, baghouses, and activated carbon are used to clean the flue gas, along with means of treating NO_x. Fly ash must be disposed of as hazardous waste.
- Most gasifiers have difficulty processing used ties due to variability.
 - Variability of wood species
 - Ash agglomeration
 - varying amounts of creosote
 - Potential heavy metals like arsenic.

The OMNI + Expander Solution: Convert used rail ties to liquid fuels



• OMNI200

- Designed from the Ground Up for Maximum Waste Flexibility, with Minimal Preparation
- No emissions to atmosphere during conversion
- Heavy metals fully sequestered in a vitrified slag
- High cold gas efficiency
- No char discharge: fixed carbon converted to syngas
- Combination of POx, plasma catalysis, long residence time, subcooling results in extremely low tars, while maintaining high cold gas efficiency.
- Demonstrated at 135 tpd

• Expander: Enhanced Biomass to Liquids (EBTL™)

- A patented process to integrate gasification, hydrogen generation and Fischer-Tropsch conversion of biomass to produce "Fossil Free" Renewable and Net Zero Carbon Intensity Fuel.
- **Independent 3rd Party Verification Using ISO 14040 / GHGenius:** Life Cycle Carbon Intensity can be as low as - 44 gCO₂e/MJ through application of Expander's patented technologies.

The OMNI Difference – Feedstock Advantage

Others



Waste preparation for typical fluidized bed gasifier

*Sorting, shredding, removal of all metals and hard particles,
drying, sizing*

OMNI



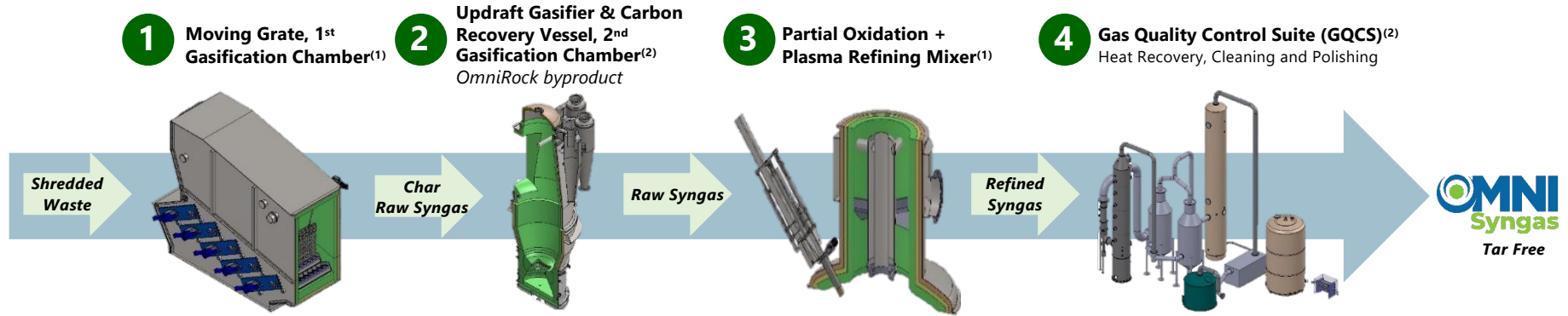
Minimally prepared "black bag" waste on input conveyor at demonstration plant in Ottawa

*No sorting, one stage of shredding to 100mm,
one magnet, no rejects*

OMNI has developed differentiated technology, which is purpose built and designed to deal with minimally prepared garbage as a feedstock

The OMNI Difference – Purpose-built, very low tars, 100% diversion from landfill

A Unique Integration of Mature and Proven Technologies



- Converter dries waste and drives off volatiles
- Hot gases injected into waste as it steps down the grate
- Solids are gasified and exit from above
- Remaining char falls to Stage 2
- Moving grates are common in incineration with proven robust performance

- Very hot gases injected into char
- Extracts energy from fixed carbon
- Remaining ash melts and discharged out the bottom as OmniRock
- Updraft gasifiers are mature technologies with an extensive history

- Partial oxidation and plasma catalysis at long residence time breaks down tars
- Plasma and plasma torches are very mature technologies
- Plasma is not used in the gasification process

- Syngas is cooled and cleaned by a series of wet scrubbers, WESPs, and related equipment
- OMNI uses industry-standard equipment in a patented multi-step sequence to achieve best-in-class syngas conditioning tailored to end use

✓ Staged gasification with unparalleled process control

- Two distinct gasification chambers enable treatment of heterogeneous feedstock, including MSW, with minimal pre-processing
- Positions OMNI as a cost leader in gasification

✓ Best-in-class refining

- Highly efficient breakdown of tar and hazardous compounds by plasma catalysis
- Removes 99.95% of tars at 300-400°C less than without plasma
- Reduces gas cleaning CAPEX and OPEX

✓ Proven efficiency and commercial use

- ~80% energy efficiency
- High cold gas efficiency, low electrical demand, and significant heat recovery for drying, making steam, or other uses
- Integrated, modular system from receipt of waste to syngas production

1. Technical readiness level (TRL) 8 denotes technology completed and qualified through test and demonstration.
2. TRL 9 denotes technology in commercial use.

OmniRock Environmental Testing and Uses

OmniRock Overview

- OmniRock is a non-leachable vitrified slag produced by the Omni200's Solid Residue Melter unit after gasification. This substance contains heavy metals and other items not gasified
- OmniRock's extremely low leachability allows it to be used for a variety of commercial uses; it can, but does not need to be disposed of in a landfill
 - The product has tested well within regulation levels of leachability and toxic composition

Uses of OmniRock⁽¹⁾



Abrasive Blasting Medium



Asphalt additive



Cement Substitute or Aggregate



Precursor to rock wool

OmniRock Leachability Testing⁽²⁾

Test	Regulation Level	Slag Leachate	Result
Arsenic	2.5	ND	✓
Barium	100	0.065	✓
Boron	500	ND	✓
Cadmium	0.5	ND	✓
Chromium	5	ND	✓
Lead	5	0.015	✓
Mercury	0.1	ND	✓
Selenium	1	ND	✓
Silver	5	ND	✓

ND denotes "Not Detected" in sample.

OmniRock's non-leachable character enables multiple commercial uses

1. OmniRock residues have not been modeled as upside in materials provided.
 2. Mg/liter – fully crushed sample, water granulated.



EXPANDER ENERGY INC.
INNOVATIVE ENERGY SOLUTIONS

Patented technologies for **Fossil Free NET-ZERO Carbon Intensity**
bio-synthetic diesel and jet fuel

Expanders **Bio-SynDiesel™** fuel product is:

- FOSSIL FREE NET-ZERO CARBON INTENSITY
 - DROP-IN DIESEL REPLACEMENT
 - LOW COST CELLULOSE FEEDSTOCK
- LOWER AIRSHED IMPACT AND BIODEGRADABLE
 - NO FOOD COMPETITION





Synthetic Fuels

- Synthetic Paraffinic Diesel (SPD) and Synthetic Paraffinic Kerosene (FT-SPK) fuels are “Drop In” – direct replacement for petroleum fuels. Compatible with existing engines and infrastructure.
- Synthetic Diesel has been produced since 1930’s using Fischer-Tropsch (FT) process and coal or natural gas feedstock. Currently global production of FT fuels is approximately 230,000 BPD (14 billion liters/year).
- Zero sulphur, high cetane content and improved stability
- Biodegradable
- Clean burning with lower emissions and reduced airshed impact

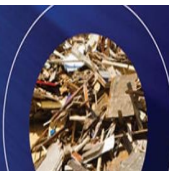


Fossil Diesel / Synthetic Diesel

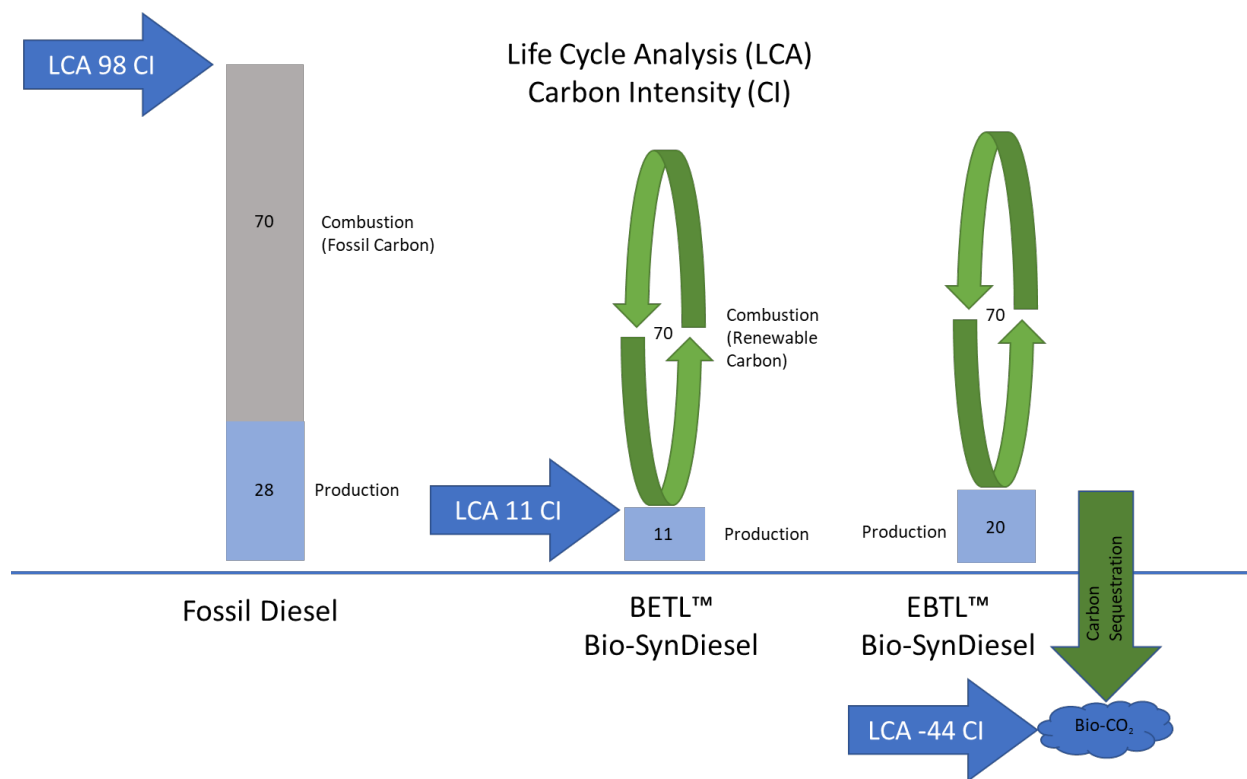
the future is today
revolutionary engineered fuels

CLEAN FUELS

TO POWER THE FUTURE EXPANDER ENERGY



Bio-SynDiesel™ Carbon Intensity



EXPANDER ENERGY INC.

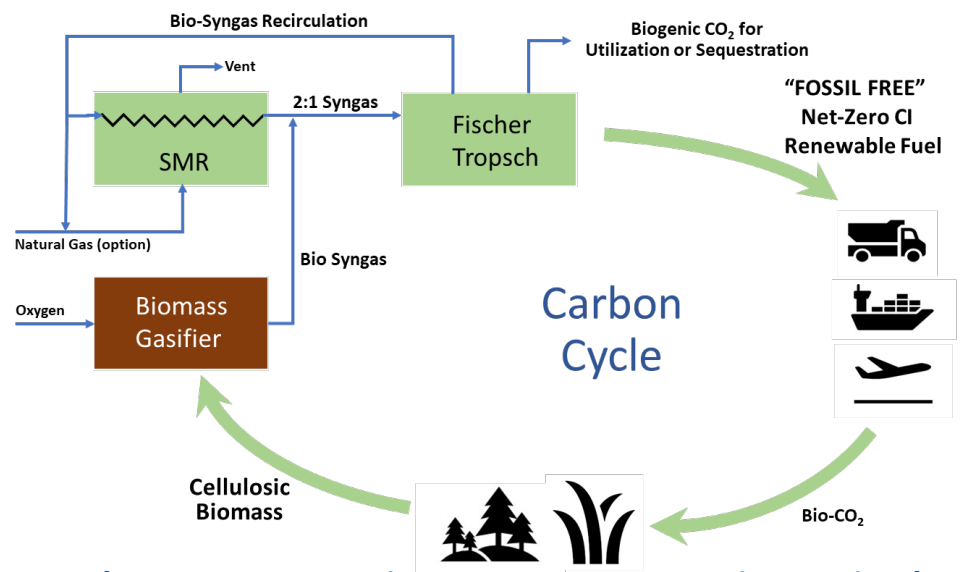
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CLEAN FUELS

TO POWER THE FUTURE EXPANDER ENERGY



“FOSSIL FREE” Enhanced Biomass to Liquids (EBTL™)



Expanders Patented EBTL™ process - Biomass to Net-Zero CI Bio-SynDiesel™ and Bio-SynJet™

3rd Party Verified using ISO 14040 / GHGenius: Life Cycle Carbon Intensity - 44 gCO₂e/MJ

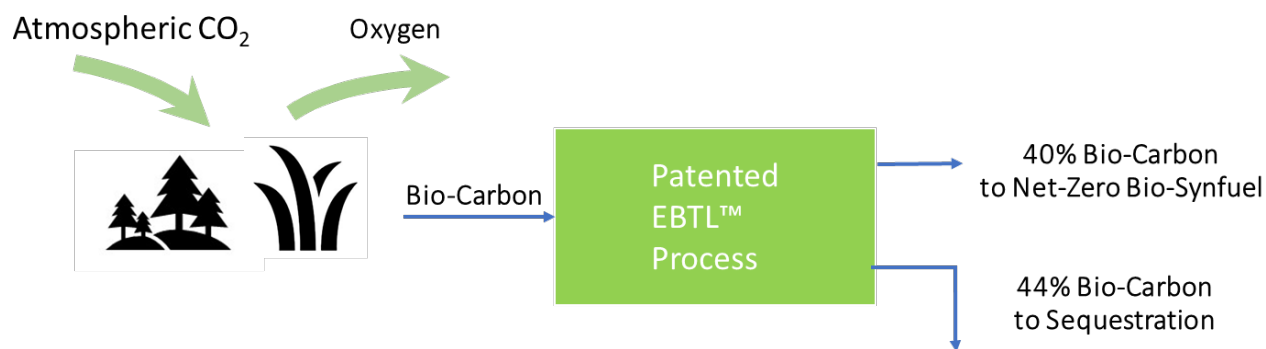
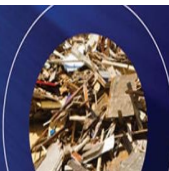
NO FOOD COMPETITION

EXPANDER ENERGY INC.

the future is today
revolutionary engineered fuels

CLEAN FUELS

TO POWER THE FUTURE EXPANDER ENERGY



44% is sequestered reducing GHG in Atmosphere

40% is converted to Bio-SynDiesel which displaces Fossil Diesel

the future is today
revolutionary engineered fuels

CLEAN FUELS
TO POWER THE FUTURE EXPANDER ENERGY



Rocky Mountain GTL – Canada's First Operating FT Diesel facility near Calgary Alberta



EXPANDER ENERGY INC.

Carseland Facility Expansion in 3 phases



- 1. Carseland 0 (“CA0”)** – Acquisition of the existing processing facility for future expansion. *Anticipated Closing: October 2024.*
- 2. Carseland 1 (“CA1”)** – Install a biomass downdraft gasifier with isomerization unit and other processing equipment. This will increase efficiency and allow the facility to use construction wood waste as feedstock which decreases the input cost and enhances the sustainable nature. *Timing: 2024 -2026.*
- 3. Carseland 2 (“CA2”)** – Install an OMNI Gasifier, bio CO2 capture and sequestration facility. The completion of CA2 allows for the processing of railway ties into Bio-SynDiesel® and Bio-SynJet® fuels and completes the expansion to utilize 100 percent of the capacity that was acquired from RMCFI. *Timing: 2024 -2027.*

All equipment modularized offsite as much as possible

Project Overview: Feedstock and Offtake

Feedstock & Inputs

Natural Gas

- RMCFI currently has an agreement for the supply of natural gas.

Construction Wood Debris

- Signed long-term firm-price contract with local recycler to supply the entire biomass requirement for the CA1 Carseland Biomass Project.

Railway Ties

- Long-term fixed price contract for the disposal of used railway ties with Canadian Pacific.

Phase	Time Period	Input
CA0	October 2024 – October 2026	<ul style="list-style-type: none"> ▪ 1.6 megawatts (“MW”) of net electricity imported from the Alberta grid. ▪ 4100 gigajoules (“GJ”) of natural gas per day.
CA1	October 2026 – August 2027	<ul style="list-style-type: none"> ▪ 2.6 MW of net electricity imported from the Alberta grid. ▪ 4009 GJ of natural gas per day. ▪ 24 tonnes per day of oxygen. ▪ 78 bone dry ton (“BDT”) per day of construction wood debris.
CA2	September 2027 and forward	<ul style="list-style-type: none"> ▪ 6.5 MW of net electricity imported from the Alberta grid. ▪ 3481 GJ of natural gas per day. ▪ 133 tonnes per day of oxygen. ▪ 78 BDT per day of construction debris. ▪ 176 BDT per day of railway ties.

Current Offtake & Outputs

Unnamed customer 1

- Signed LOI agreeing to buy 6 million gallons per year of ASTM D975 specification partially renewable diesel. Customer will be responsible for the delivery and transport of the product. The intent is to market and sell synthetic diesel into BC market to take advantage of the BC Low Carbon Fuel Credits.

Unnamed customer 2

- Proposed terms for a potential offtake agreement to purchase 100% of SynDiesel® production (at the time, expected to be approx. 500 bpd). This was subject to rolling production schedules, agreeing to minimum production volumes, the product meeting all advertised renewable / non-renewable / tech specifications, etc. Both parties signed this letter of intent.

Discussions with Leading Energy Companies

- Considering a strategic partnership with leading energy companies and/or strategic offtake partners.

Phase	Time Period	Output
CA0	October 2024 – October 2026	<ul style="list-style-type: none"> ▪ 10.6 million litres/year of fossil SynDiesel®. ▪ 3.6 million litres/year synthetic naphtha (non-stabilized). ▪ 1,159 tonnes/year of wax.
CA1	October 2026 – August 2027	<ul style="list-style-type: none"> ▪ 6.7 million litres/year of fossil SynDiesel®. ▪ 4.7 million litres/year synthetic naphtha (non-stabilized). ▪ 1,623 tonnes / year of wax. ▪ 4.2 million litres/year Bio-SynDiesel®. ▪ 4.2 million litres/year Bio-SynJet®.
CA2	September 2027 and forward	<ul style="list-style-type: none"> ▪ 1.0 million litres/year fossil SynDiesel®. ▪ 7.8 million litres/year bio-naphtha. ▪ 2,482 tonnes / year of bio-wax. ▪ 10.5 million litres/year Bio-SynDiesel®. ▪ 10.5 million litres/year Bio-SynJet®. ▪ 92,050 tons per year (“TPY”) sequestered CO₂ (net 49,700 TPY Bio CO₂ sequestered), which is potentially eligible for BECCS credits.

The key to unlocking value from rail ties: project partners with strong complimentary offerings demonstrated at commercial scale.

- OMNI: Purposely designed to efficiently convert a wide variety of minimally prepared variable wastes to a pristine syngas suitable for making power, fuels, hydrogen, and chemicals.
- Expander: Proven EBTL™ technology generates high quality, low carbon intensity product with high availability and very good financial returns in small to medium scale F-T plants.
- Multiple similar facilities planned after the Carseland expansion.



Gord Crawford, P. Eng.

**Thank you for listening
and for your
questions**



Marc Bacon, P. Eng.

