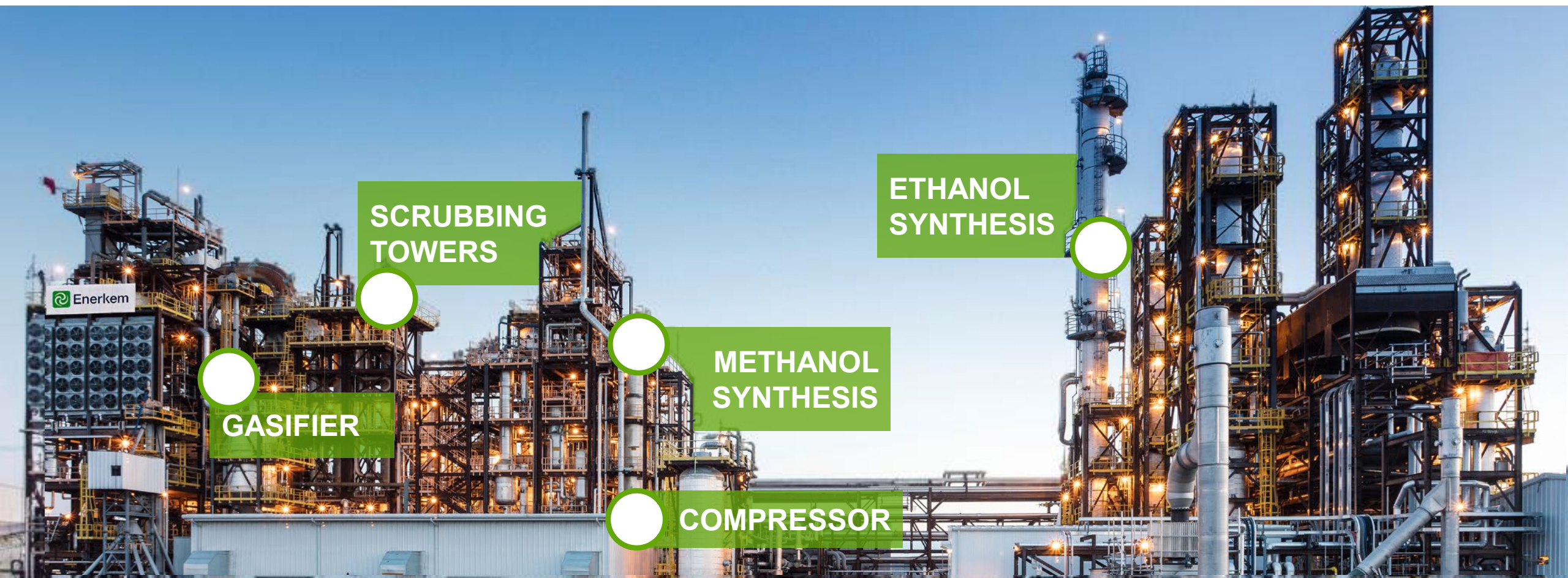




FEEDSTOCK CO-PRODUCT DEVELOPMENT OPPORTUNITY

Charles Tremblay, Eng
VP, Project Delivery



SCRUBBING
TOWERS

ETHANOL
SYNTHESIS

METHANOL
SYNTHESIS

GASIFIER

COMPRESSOR



Enerkem

ENERKEM'S TECHNOLOGY VALIDATION

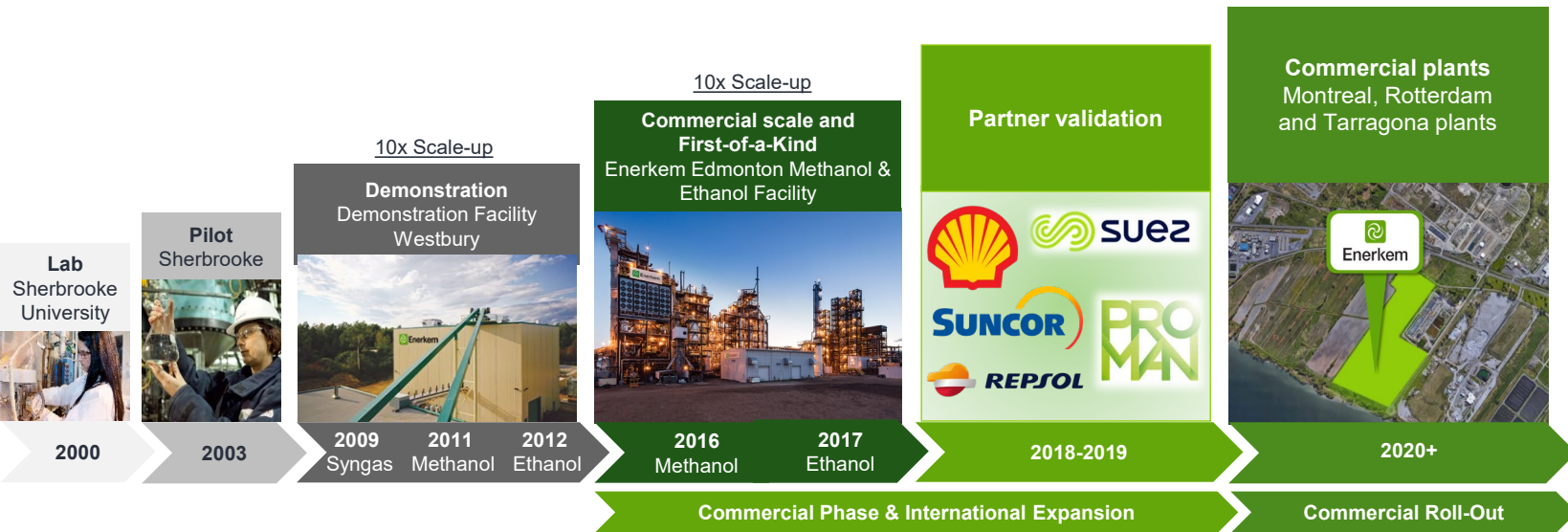
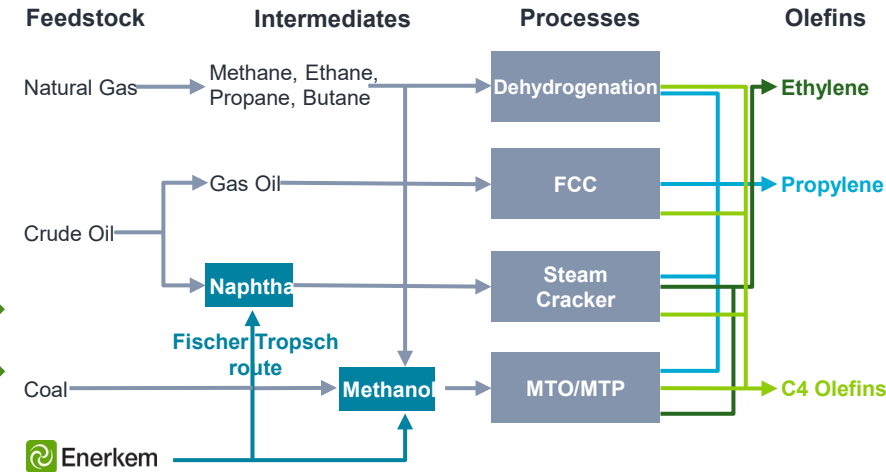
Gasification can complement mechanical recycling because it produces (near) virgin-grade polymers from after-use plastics

Organization ready for continued commercial scale-up for cellulosic Biofuel & Renewable Chemicals

Chemicals: Olefin's production pathways

Enerkem's circular syngas can replace 2 out of 4 routes:

- Naphtha can be produced using the Fischer Tropsch route (F-T)
- Methanol can be produced and used in current MTO infrastructure



Proven technology through Edmonton plant

- Feedstock Flexibility: demonstrated ability to produce stable clean syngas from wide range of feedstocks:
 - Mixed solid waste (MSW), contaminated biomass, and 100% plastics
- IMPCA grade Methanol and Ethanol
 - Obtained ISCC certification in 2015 for low CI methanol into chemicals
 - Ethanol sold into British Columbia LCFS market
- Foundation of future plant design

Opportunity

- Low plastics recycling rate globally (12%)
- Surge of interest from polymer and specialty chemical industry
- No clear alternatives for surplus of waste plastics

Waste To Syngas & Conversion Technologies

- Uniquely positioned to offers a solution with syngas to MeOH, EtOH or Fisher Tropcsh platform
- F-T, MTO, and MTP are well established processes in practice for several decades





BIOFUEL MARKET IS GROWING MARKET INCENTIVE FOR CARBON RECYCLING ARE NEXT

While plastics packaging contribute to sustainability by keeping products fresh and reducing wastage, plastic is difficult to recover and recycle. Breaking down waste and plastics into their molecular building blocks with system like Enerkem allows the perspective of achieving zero waste



WASTE ARE RICH IN CARBON

Typical Composition of MSW

- 50-60% biogenic (Organics, paper packaging, cardboard, Organic textile)
- 40-50% Fossil base carbon (plastic, textile, etc.)



DRIVERS OF WASTE CARBON RECYCLING

- Fuel Blend (E10-E15) (RFS)
- Low Carbon Fuel Standard (LCFS)
- Landfill Ban or Tax (Tipping fees)
- Demand for Carbon Recycling Content in chemicals or and other fuels (maritime, SAF)



PRODUCT INCENTIVES

- Biofuel (incentives 250-500 \$/Mt of CO2) push the focus for biogenic
- Plastics and other Fossil base waste generate more yield in the conversion process to address demand renewable chemicals' market

CARBON RECYCLING - DOWNSTREAM CONSIDERATIONS

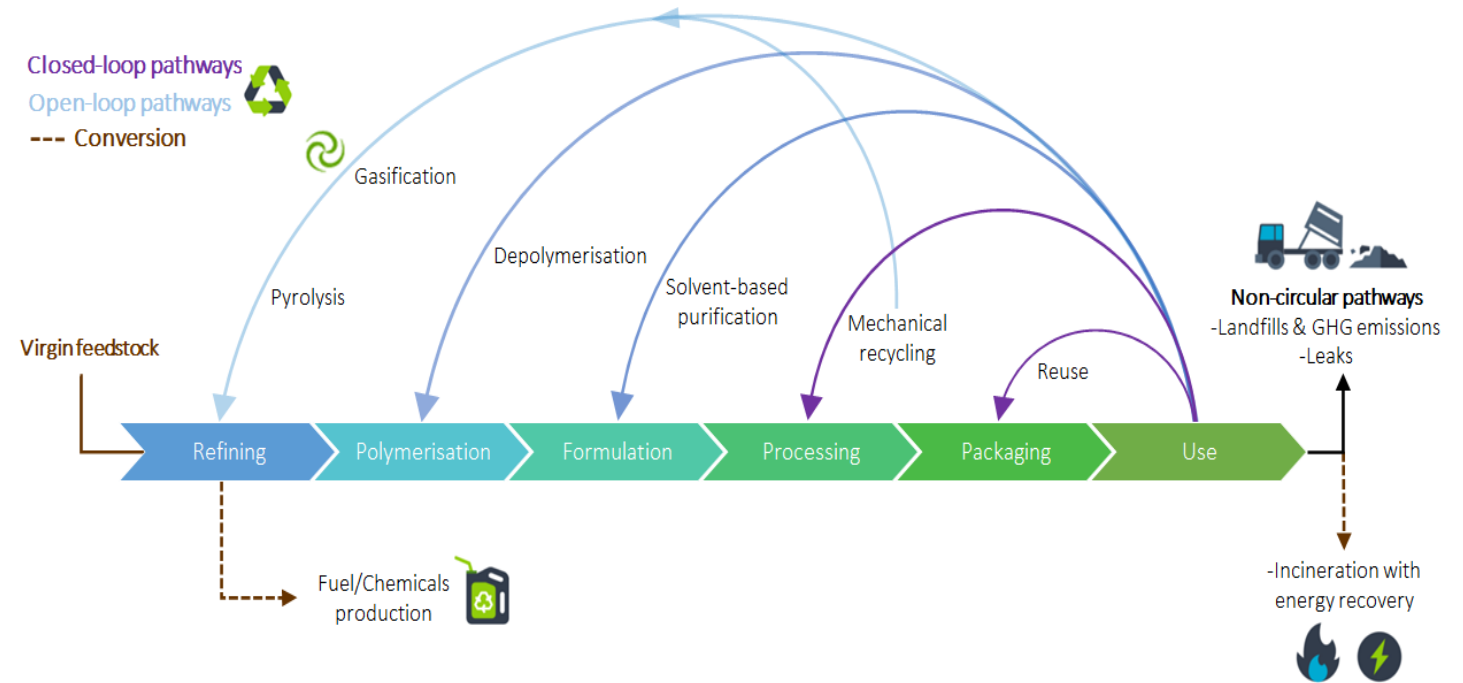
Moving from a linear to a circular model through carbon recycling from gasification

Companies are under immense pressures to reduce their carbon footprint

- Major players are allocating significant resources and capital toward these goals
- This carbon reduction goal is a defining industry shift – not just a short-term trend
- Increasing costs for non-compliance are going to further incentivize players to invest in carbon reduction efforts

Companies need scalable solutions given the massive endeavor

Regulation is different from jurisdiction to jurisdiction, however trend in increasing targets is consistent



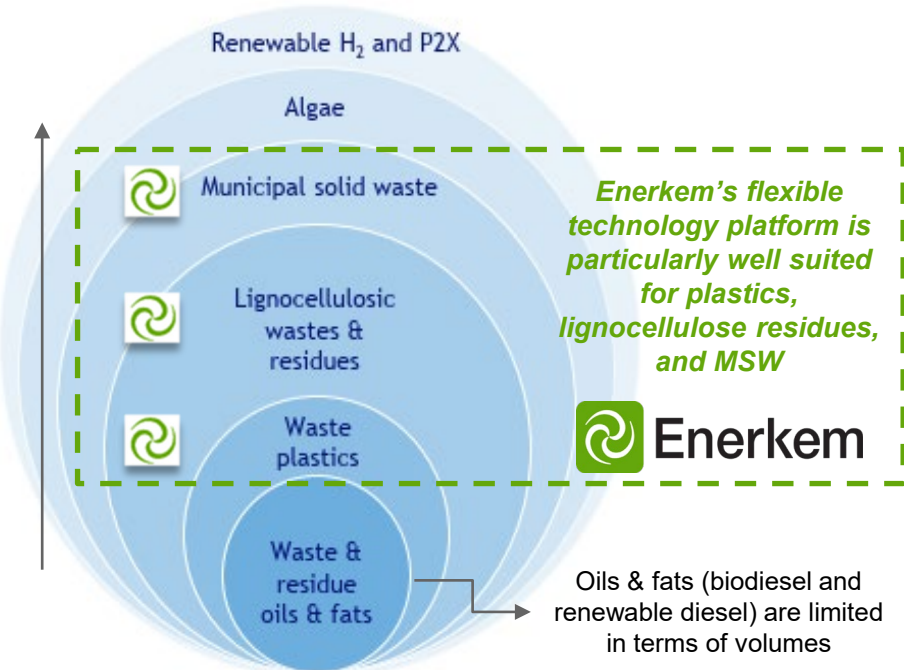
Market	Market Size (in gallons)
Transportation fuel Market ¹	186.6B
Sustainable Aviation Fuel ³	81.0B
Low Transportation Fuel Alternative Market ⁴	6.4B
Renewable Chemical Market ⁵ (Ethylene)	183.0M(Mt) ²

¹Source: US, Canada Europe and UK motor gasoline consumption; FuelsEurope, Statistical Report 2018; Government of the United Kingdom; United States Environmental Protection Agency; Statistics Canada.
²Unless otherwise specified. Renewable Chemicals Market (Ethylene) expressed in metric tons
³Source: U.S Department of Energy, Sustainable Aviation Fuel Review of Technical Pathways 2020
⁴Source: US, Canada Europe and UK motor gasoline consumption; FuelsEurope, Statistical Report 2018; Government of the United Kingdom; United States Environmental Protection Agency; Statistics Canada.
⁵Source: Gulf Petrochemicals & Chemical Association, Executive Summary Ethylene: A Litmus Test for the Chemical Industry, November 2019

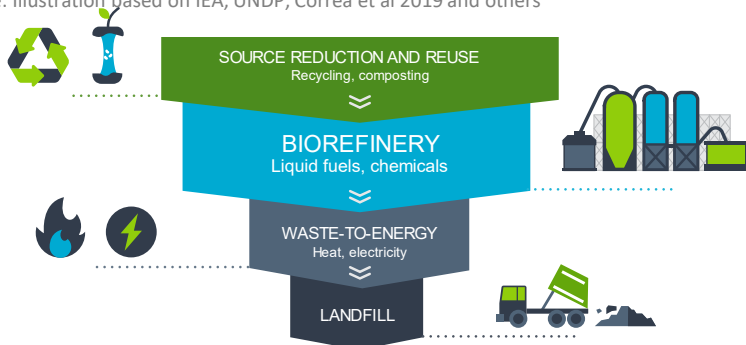
FEEDSTOCK REQUIREMENT & FLEXIBILITY

Enerkem Technology converts waste into clean fuels and renewable chemicals

Evolution of the Feedstock Pool via New Technologies¹



Source: Illustration based on IEA, UNDP, Correa et al 2019 and others



KEY DRIVERS	IMPACT ON PRODUCT	UNIT
CALORIC VALUE (HHV)	The amount of heat released by combusting the material. This is directly correlated with syngas & product yield (CHONS)	GJ / mT
INERTS	The quantity of ashes remaining after combustion. A higher inert content will reduce yield	% on a dry basis
MOISTURE	The quantity of water in feedstock. If moisture is not removed by drying & heat recovery, yield will be lowered	% on a wet basis
DENSITY	Feedstock density is the weight by m ³ . A low-density feedstock will increase processing costs and reduce ability to convert CO ₂ into product	Kg / m ³
BIOGENICITY	The biogenicity content is the % of Carbon in feedstock that is coming from an organic source drive most of the premium price for Low Carbon Fuel	% in end product
CHLORINE, SULFUR AND HEAVY METALS WILL IMPACT OUR COST RELATED MANAGEMENT AND WATER TREATMENT		

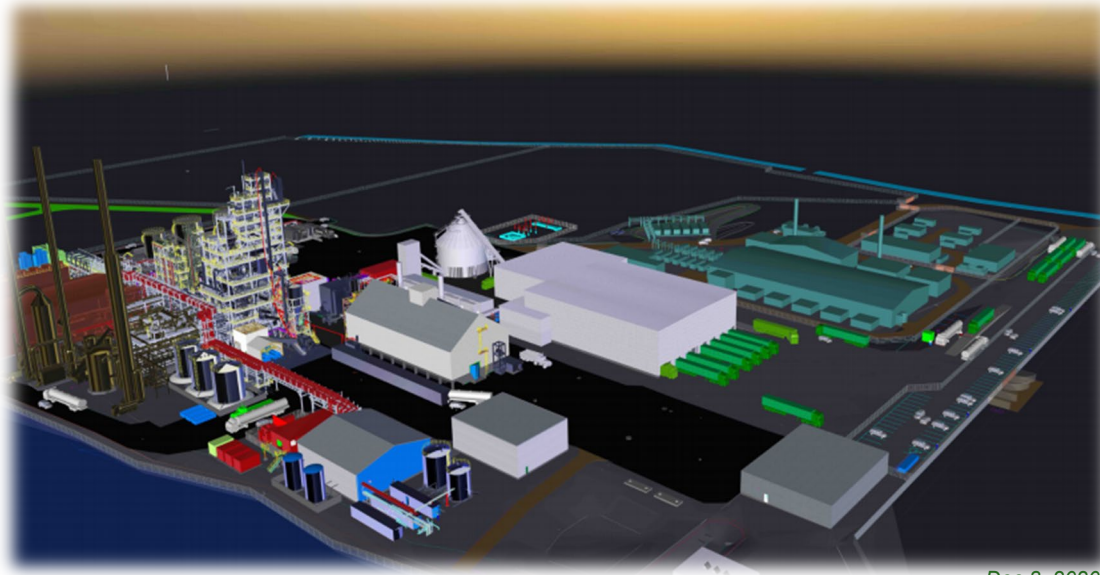
Waste is an abundant and scalable source of 'next progression' carbon-rich feedstock



Enerkem

ENERKEM MONTREAL – \$875MCAD PLANT FULLY-FUNDED AND IN CONSTRUCTION

World’s Largest Waste to Methanol & Ethanol Facility – Located near Montreal, Canada



Dec 8, 2020

Ownership structure

Biorefinery		Ownership
Shell	Global Upstream & Downstream Oil & Gas company; leader in refined products and chemicals	
Quebec Government	Acts as a catalyst in funding and project facilitator	
Enerkem	Technology provider & project execution	
Suncor	Leading Canadian Oil & Gas company	
Proman	Global leader in natural gas derived products and services	
Total		100%

Electrolyser		Ownership
Hydro-Quebec	Clean, renewable energy sources, Will play a central role in the emergence of a low-carbon economy	
Total		100%

World-class partners



Key Highlights

- More than 200,000 tonnes of non-recyclable waste & residual biomass converted into annual production of nearly 125mm litres of biofuels (MeOH)
- Green hydrogen & oxygen supplied by a 88 MW electrolyser, one of the world’s largest leveraging on Quebec’s green electricity
- GHG reduction equivalent to taking 50,000 vehicles off the road annually – 160,000 tons of CO₂ / yr – Biogenic carbon intensity of -6 g/MJ
- One production line Methanol and Ethanol facility – 35mm gallons of methanol / 25mm gallons of ethanol per year
 - Flexibility to drop in gasoline
- Construction began in 2020, to be completed Summer 2023

Note: FX rate of 1 CAD / 0.79 USD