BIOFUELS AND CHEMICALS FROM MIXED WASTE:
THE ENERKEM CONTRIBUTION TO SUSTAINABILITY

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THE ENERKEM SOLUTION
From Non-recyclable Waste To Sustainable Chemicals And Biofuels

FEEDSTOCK
- Solid Waste "Separated MSW"
- Mixed Plastic Waste
- Biomass Residues

PROCESS
- Proprietary Thermochemical technology

PRODUCTS
- Syngas
- Methanol
- Ethanol

MARKETS
- Plastics & Sustainable Chemicals
- Solvents & Coatings
- Transportation Fuels
TECHNOLOGY DEVELOPMENT
Rigorous Path To Commercialisation

- **LAB**
  - University of Sherbrooke

- **PILOT**
  - Sherbrooke

- **DEMONSTRATION**
  - Demonstration Facility Westbury

- **COMMERCIALISATION**
  - Enerkem Alberta Biofuels Facility

- **EXPANSION**
  - Deployment in Canada, USA, Europe, and China

**Timeline**
- **2000**
  - Lab Phase
- **2003**
  - Pilot Phase
- **2009**
  - Syngas
- **2011**
  - Methanol
- **2012**
  - Ethanol
- **2013 - 2017**
  - Construction & Development
- **2018 +**
  - Future Developments

**Investors**
- **FOUNDERS**
- **INITIAL INVESTORS**
THE ENERKEM PROCESS

- **Feedstock**
  - Wide range of feedstock acceptable
  - Target ‘non-recyclable’ fraction & reject from mechanical recycling

- **Fluidized bed gasification system**
  - Oxygen/steam mix as fluidising medium

- **Scrubbing system to remove contaminants**
  - Pure Syngas ready for conversion to finished products

- **Syngas, methanol & ethanol as current products**
  - Alternative pathways under development
ENGERKEM ALBERTA BIOFUELS (EAB)

1. **TYPE**
   One production line facility to Cellulosic Ethanol

2. **CAPACITY**
   100,000 dry US tons of waste per year

3. **FEEDSTOCK**
   Separated municipal solid waste

4. **OUTPUT**
   10M gallons / 33kt per year Cellulosic Ethanol

   (1 X standard Enerkem system)
ENERKEM ALBERTA BIOFUELS (EAB)
Commercial Scale MSW-to-biofuels Facility

- Ethanol Synthesis
- Methanol Synthesis
- Compressors
- Gasifier & Feeding
- Scrubbers as part of unit ops to produce clean syngas

International Sustainable Carbon Certification (ISSC)
British Columbia Carbon Intensity certification (in addition to Alberta and Canadian RFS certifications)
U.S. EPA approval to collect RIN’s for cellulosic ethanol produced at EAB
INTEGRATED PROCESSING & TRANSFER FACILITY
RECYCLING CENTER
COMPOSTING CENTER
ENERKEM BIOREFINERY
INTEGRATED WASTE MANAGEMENT
PROBLEMATIC MIXED WASTE = ABUNDANT FEEDSTOCK

Regional waste generation
US ton (millions)

2016 Waste Generation per capita, in lbs

5% OF 2030 GLOBAL WASTE PRODUCTION IS EQUIVALENT TO 350+ ENERKEM MODULAR PLANTS

Source: Financial Times, 2016
MUNICIPAL SOLID WASTE IN THE WORLD

2 BILLION TONNES
solid waste generated each year

1.4 BILLION TONNES
unrecoverable solid waste suitable for Enerkem

600 MILLION TONNES
recycled or composted

978 BILLION LITERS*
of biofuel or renewable chemicals transformed by Enerkem

* Average volume of production based on a second generation Enerkem facility with thermal reformer and hydrogen technology

Source: World Bank, 2018
MUNICIPAL SOLID WASTE IN THE USA

262 MILLION US TONS
solid waste generated each year

172 MILLION US TONS
unrecoverable solid waste suitable for Enerkem

90 MILLION US TONS
recycled or composted

28.5 BILLION GALLONS*
of biofuel or renewable chemicals transformed by Enerkem

* Average volume of production based on a second generation Enerkem facility with thermal reformer and hydrogen technology

Source: United States Environmental Protection Agency, 2018

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MUNICIPAL SOLID WASTE IN EUROPE

254 MILLION TONNES
solid waste generated each year

132 MILLION TONNES
unrecoverable solid waste suitable for Enerkem

122 MILLION TONNES
recycled or composted

92 BILLION LITERS*
of biofuel or renewable chemicals transformed by Enerkem

* Average volume of production based on a second generation Enerkem facility with thermal reformer and hydrogen technology

Source: Eurostat, European Commission, 2017
PROJECTS OVERVIEW
- Varennnes
- Rotterdam
- Tarragona
ENERKEM IN VARENNES, CANADA

1. TYPE
   One production line facility to Methanol
   (flexibility to transition to ethanol)

2. CAPACITY
   190kt of waste/biomass materials per year

3. FEEDSTOCK
   Non-recyclable waste from the institutional, commercial and industrial sectors, and biomass (Bark)

4. OUTPUT
   35M gallons / 110kt per year Bio Methanol
15

360ktpa waste

220ktpa MeOH

>300ktpa CO₂ saved

ENERKEM IN ROTTERDAM, NETHERLANDS

1. TYPE
   Two production line facility to Methanol

2. CAPACITY
   360kt of waste materials per year

3. FEEDSTOCK
   Non-recyclable waste from the municipal, industrial, commercial and institutional sectors

4. OUTPUT
   70M gallons / 220kt per year Bio & Circular Methanol
ENERKEM IN TARRAGONA, SPAIN

1. TYPE
   Two production line facility to Methanol

2. CAPACITY
   360kt of waste materials per year

3. FEEDSTOCK
   Non-recyclable waste from the municipal, industrial, commercial and institutional sectors

4. OUTPUT
   70M gallons / 220kt per year Bio & Circular Methanol
STRENGTHENING PARTNERSHIP WITH SUNCOR

- April 2019 – Suncor’s First Investment In Enerkem
  - Ongoing - Several months of technical, operational and commercial collaboration, including Operations support at Enerkem’s Commercial Facility (EAB), in Edmonton, Alberta

- October 2019 – Suncor makes additional CAD$50M additional equity investment in Enerkem

DOMINIQUE BOIES
Chief Executive Officer and Chief Financial Officer

« Through this additional investment, the confidence Suncor is showing us sends a clear signal that they strongly support and believe in the Enerkem technology, confirming our leadership in the advanced biofuels market.»
May 29th 2019

Enerkem is finalist of The Sky's the Limit Challenge led by Natural Resources Canada. The Sky's the Limit Challenge is part of a nationwide challenge to Canadians to develop the cleanest, most affordable and sustainable aviation fuel for the aviation sector to further reduce its carbon footprint and fight climate change.

« By expanding the range of biofuels and biochemicals enabled by our technology, Enerkem will be able to set new global standards in waste management, biofuels and renewable chemicals and be at forefront of the circular economy »

DOMINIQUE BOIES
Chief Executive Officer
and Chief Financial Officer
CONTRIBUTING TO MEET WASTE MANAGEMENT CHALLENGES