Enerkem biorefineries: setting a new global standard in biofuels, chemicals and waste management
Enerkem at a glance

• Biofuels and renewable chemicals from garbage
• Proprietary clean technology developed in-house
• Private company founded in 2000; 200 employees
• First full-scale commercial biorefinery beginning operations in Edmonton
  • 2 facilities in Québec (pilot and demonstration)
• $300 million invested to date to move from R&D to commercial stage
• Developing similar facilities in North America and abroad
  • Several MOUs in China and EU
Cost-competitive and sustainable solution

Municipality:
- Supplies 100,000-400,000 tons of MSW per year (long-term contract)
- Pays tipping fee – attractive compared to status quo
- Suggests sites

Enerkem:
- Invests approx. $100M to build, own and operate the biorefinery
- Converts RDF into 38 to 152 MLPY of biofuels/biochemicals
- Works with the city to optimize MSW sorting into commodities and for site selection
- Manages business risks incl. sale of final product
- Creates high-quality jobs:
  - 600 direct/indirect during construction
  - 150 direct/indirect (permanent) during operation (for 1 X standard Enerkem system of 10 MGY)
- Generates $C65M/year in net economic benefits in the region (for 1 X standard Enerkem system of 10 MGY)
Bringing the model to reality

Rigorous path to commercialization

- UNIVERSITY OF SHERBROOKE PILOT
  - Laboratory
  - Pilot

- WESTBURY FACILITY
  - Syngas Demo
  - Methanol Demo
  - Ethanol Demo

- MODULAR COMMERCIAL BIOREFINERIES
  - Full-scale commercial production
ENERKEM ALBERTA BIOFUELS

Capacity: 38 million litres per year (i.e. 1 X standard Enerkem system)
Feedstock: 25-year agreement with City of Edmonton for 100,000 dry tonnes of MSW per year
Products: Biomethanol, cellulosic ethanol

World’s first commercial MSW-to-biofuels and chemicals facility
Unique partnership with the City of Edmonton

• Leader in waste management practices
• Edmonton Waste Management Centre
  • North America’s largest collection of modern, sustainable waste processing and research facilities
  • 233-hectare site
• Enerkem selected as part of a thorough selection process involving over 100 technology providers
City of Edmonton’s Integrated Waste Management Centre

- Recycled: 20%
- Composted: 40%
- Biofuels: 30%
- Landfill: 10%

Waste diversion = 90%
Benefits of Enerkem’s advanced biorefineries

• Helps transition to a greener and circular economy
• Diversifies energy and increases domestic energy production
• Stimulates economy. Each Enerkem facility:
  • Creates high-quality jobs: 150 direct and indirect permanent jobs
  • Increases net annual economic spending in the local area by $65 million
  • Creates 610 jobs during construction (incl. manufacturing jobs)
• Solves a waste problem and avoids methane emissions from landfilling
• Is a socially-accepted solution for non-recyclable/non-compostable garbage
• Smooth permitting process
• Expands ethanol feedstock opportunities beyond corn/wheat/sugar cane
• Reduces GHG emissions by > 60% when compared to gasoline
• Does not have any land use impact
An efficient “carbon-recycling” process

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100k MT of RDF

Sorted MSW, residual biomass and other non-homogeneous waste feedstocks

Air/Oxygen

Solids/inerts to market for aggregates and construction materials

Bubbling fluidized bed gasifier

Heat recovery

PRIMARY SYNGAS

Scrubbing towers

Water treatment

Separation of residues

ULTRA CLEAN SYNGAS (CO, H₂)

Catalytic reactions

Product purification

Biofuels

Chemicals

43k MT per year of methanol
10mm gpy of ethanol

* Municipal solid waste
Biofuels from waste increase energy diversity and reduce GHG emissions
Sustainable waste management
Benefits of using waste as feedstock

ENVIRONMENTAL

• Reduces GHG emissions
• No land use impact
• Does not compete with food sources
• Sustainable alternative to landfiling
• Complementary to recycling
• Fuel produced close to point of consumption/feedstock (reduced transportation)

ECONOMIC

• Most inexpensive feedstock (typically no cost)
• Abundant resource
• Readily available and collected
• Available in all regions (urban and rural)
Large market potential

**MSW IN NORTH AMERICA**

- **168 MILLION**
  - Metric tons of MSW suitable for Enerkem’s technology platform

- **529 MILLION**
  - Metric tons of MSW generated per year

- **THE POTENTIAL:**
  - **63 BILLION**
    - Litres/16 B Gallons using Enerkem


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Renewable chemicals from waste help transition to a circular economy
Renewable chemicals for everyday products

**Chemical building blocks in our syngas**

- CO
- H₂

**Product Family**

- Alcohols
- Acrylates

**Applications**

- Transportation fuels
- Solvents for pesticides and coatings
- Pharmaceuticals
- Polymers
- Cosmetic products
- Plastics
- Textiles
- Architectural and industrial coatings
- Plastics
- Adhesives

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VANERCO
First advanced biofuels facility in Canada to be co-located with a conventional biofuels production facility

Capacity: 38 million litres
Feedstock: Urban waste (industrial, commercial, institutional, construction, etc.)
Status: Pre-construction work started
Using **waste as feedstock** for the chemical industry

Fourteen partners have joined forces to assess the use of waste for the production of chemicals in the Netherlands.

The public-private partnership will study the options for setting up Europe’s first plant, either in Rotterdam or Delfzijl.

Other partners involved in the initiative:
Legislative Support

Key to drive private investments in this emerging sector

• Strong and stable federal public policies:
  • Strong federal RFS
  • Renewal of federal tax incentives for cellulosic biofuels
• State incentives:
  • Few states RFS/LCFS
• Few incentives for renewable chemicals
• Favorable regulatory framework for permitting modern waste conversion technologies
• Green cities programs, green municipal bonds
Thank you

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