Challenges in bringing new Technology to market
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)
• Developing similar facilities in North America and abroad
  • Several MOUs in China and EU
An efficient “carbon-recycling” process

<table>
<thead>
<tr>
<th>Feedstock preparation</th>
<th>Gasification</th>
<th>Cleaning and conditioning process</th>
<th>Catalytic synthesis and product purification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorting, shredding, drying (if required) and feeding</td>
<td>Conversion of carbon-rich residues into synthetic gas</td>
<td>Primary syngas purification</td>
<td>Conversion of chemical-grade syngas into final renewable products</td>
</tr>
</tbody>
</table>

100k MT of RDF

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

* Municipal solid waste
Bringing the model to reality

Rigorous path to commercialization

UNIVERSITY OF SHERBROOKE PILOT

SHERBROOKE

Laboratory

Pilot

Syngas Demo

Methanol Demo

Ethanol Demo

WESTBURY FACILITY

MODULAR COMMERCIAL BIOREFINERIES

Full-scale commercial production
Modular approach

- Modular manufacturing approach enabling global expansion
- 43 pre-fabricated modules for standard facility (e.g. Edmonton):
  - 15 process-driven modules
  - 28 structural modules
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
Part of an integrated waste management system

Recycled ➔ 20%
Composted ➔ 40%
Biofuels ➔ 30%
Landfill ➔ 10%

Waste diversion = 90%
Delivering new technology (1)

Key challenges Enerkem has overcome

• Scaling-up from pilot to demonstration to commercial plants
  • Iterative design improvements based on operational performance
  • Move from ‘custom’ to modular delivery

• Funding / financing demonstration facility and 1st commercial plant
  • 15 year development programme
  • Capital scarcity during economic downturn

• Project deliver challenges
  • Modularisation and transport of modules to site
  • Building a reliable and costs effective supply chain
  • Construction in the Albertan winter!
Delivering new technology (2)

Ongoing challenges…

• EU market – policy variability and uncertainty
  • 28 sets of member states’ biofuels policies – RED vs FQD?
  • Approach to 0.5% advanced sub-target?
  • Lack of clarity over policy post 2020 – all set to change?
  • Where are the highest value markets?

• Market ‘inertia’ – change to established practices
  • Healthy demand for biofuels but operational changes needed at refineries to accommodate
  • Certainty of delivery needed from some

• Addressing new areas of interest
  • **Upstream**: partner with innovative new waste processing technology?
  • **Process**: realise synergies with conventional EfW technology to deliver lowest cost process?
  • **Downstream**: demand for sustainable chemical feedstock for low carbon manufacturing
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:
Thank you

For more information:

Alex Miles

Director, Commercial Development (Europe)

amiles@enerkem.com

www.enerkem.com