Outline

- Overview of the Edmonton Waste Management Centre (EWMC)
- Edmonton’s Journey to Biofuels Production
- The Edmonton Biofuels Project
  - The Partnership (COE, EAB & AIEES)
  - The 3 Components
    1. Integrated Processing and Transfer Facility (IPTF)
    2. Waste to Biofuels Facility
    3. Advanced Energy Research Facility (AERF)
Edmonton Waste-to-Biofuels Project

Community Relations / Events

- School Grade 4 Tours / engaging the community
  (presentations to over 13,000 Students/year & 3,000 adults)
- EWMC Visitors
Eco Stations

>200,000 customers (in 2013)

- To collect HHW, paints, solvents, used oil, batteries, E-waste and small appliances, fluorescent tubes

1st South Eco Station opened
August, 1995

2nd NW Eco Station opened
December, 1999

New 3rd Southwest Eco Station
opened Fall, 2009
Edmonton Waste-to-Biofuels Project

• 550 acres
  • Twelve waste processing facilities
  • Two major research facilities
  • Closed Landfill
  • Sewage biosolids storage/recycling lagoons

• Nine contractors, partners, tenants
• Over 400 employed today and
• 500 by end of 2014
Edmonton Waste-to-Biofuels Project

Co-Composting Facility (for MSW & Biosolids)
Edmonton Waste-to-Biofuels Project

Materials Recovery Facility (MRF) for recyclables
Edmonton Waste-to-Biofuels Project

- >13 million tonnes of waste disposed between 1975-2009
- The Clover Bar landfill is now closed
- Gas recovery in operation 1992
- Leachate treatment plant in operation 1996
The City knew the landfill would be closing and that it would have to be hauling waste offsite (at higher costs!)

City has very established recycling and composting programs, so it had maximized the 3-Rs currently diverting 60% of the waste (wanting to process the remaining 75,000 tonnes/yr of Composting residuals and 5,000 tonnes/yr of MRF residuals)

Specific targets included:
- Increase Edmonton’s landfill diversion rate from 60% to 90%
- Reduce Edmonton’s need for landfilling, without going to traditional combustion systems
The Journey to Biofuels Production

- Starting Premise - There is a better solution than landfill
- Enerkem was chosen:
  - Flexible and innovative technology platform (low temp fluidized bed)
  - Demonstrated ability to produce clean syngas from waste feedstocks
  - Ready for commercialization
- Research / Pilot Project – confirm key performance parameters (2004-2006) Grant from AERI (1st Pelletization of RDF and then 2nd RDF fluff feeding system re-design)
- Grant Support (Alberta Innovates) (2006)

Project Officially Announced
The Journey Continues…

- Contractual Agreements & Environmental Permitting (2007-2008)
- Regulatory Approval (2009)
- Construction start - August 2010
- Commissioning in 2014
The Journey to Biofuels Production

- There is a better solution (than landfill or conventional incineration)
- Contractual Agreements & Environmental Permitting (2007-2008)
- Regulatory approval (2009)
- Construction start - August 2010
- Commissioning in 2014
Overview of the New Project – Three Components, Three Partners

<table>
<thead>
<tr>
<th>Facility</th>
<th>Primary Operator</th>
<th>Role</th>
<th>Cost</th>
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</thead>
<tbody>
<tr>
<td>Integrated Processing and Transfer Facility (IPTF)</td>
<td><strong>City</strong> owns and operates</td>
<td>§ Produces RDF (Feedstock)</td>
<td>$90 M</td>
</tr>
<tr>
<td>Waste-to-Biofuels Production Facility</td>
<td><strong>Enerkem</strong> owns and operates</td>
<td>§ Produces 38M litres of biofuels/year from provided feedstock</td>
<td>Approximately $105 M (construction)</td>
</tr>
</tbody>
</table>
| Advanced Energy Research Facility (AERF)          | City owns. City & **AIEES** will direct activities | § Ongoing R&D activities  
§ Higher value products  
§ Process optimization | $12.5 M               |

**AIEES** = **Alberta Innovates Energy and Environment Solutions**
INTEGRATED PROCESS AND TRANSFER FACILITY (IPTF)

Designed to optimize and enhance waste processing through mechanical and manual sorting:

- Waste transfer station
- Waste Pre-processing system
- Refuse Derived Fuel (RDF) plant

Owner/Operator: City of Edmonton
Edmonton Waste-to-Biofuels Project

IPTF with Tip Floor Pre-Processing and Refuse Derived Fuel Areas

Compost Facility Footprint: 38,690m$^2$
IPTF Footprint: 19,100m$^2$
Edmonton Waste-to-Biofuels Project

IPTF Functions and Phasing

March 2010
Pre-Processing Plant

August 2009
Transfer Station

Early 2012
RDF Plant
Edmonton Waste-to-Biofuels Project

Pre-Processing System

- **Tip Floor**
  - Pre-processed MSW
  - Large Items
    - Cardboard Recyclables
      - Material Recovery Facility (MRF)
    - Yard Waste
  - Manual Sorting
    - ECF Plant Tip Floor
      - Disc Screener
      - RDF Process
    - Magnet
      - Ferrous Material
      - >9" MSW
        - 5-9" MSW
      - <9" MSW
        - <5" MSW
  - Trommel Screener
    - <9" MSW
      - <2" MSW
        - Magnet
          - <2" MSW
        - Manual Sorting
          - >9" MSW
            - >9" MSW
  - Manual Sorting
    - Manual Sorting
      - >9" MSW
        - >9" MSW

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Edmonton Waste-to-Biofuels Project

IPTF Pre-Processing Area
Refuse Derived Fuel (RDF) Process

Residual waste → Primary Shred

Shred → Screen/Classify

Metals to recycling

Shred → Glass, stone, inerts to roadway aggregate or landfill

Fluff RDF
Edmonton Waste-to-Biofuels Project
ENERKEM OVERVIEW: WASTE-TO-BIOFUELS PROJECT
Edmonton Waste-to-Biofuels Project

Enerkem’s path to commercialization

1982-89
Biosyn Hydro Quebec

1990-2006
University of Sherbrooke
Initial work

2000
R&D lab

2003
Sherbrooke pilot plant
4.8 tonnes/day

2009
Westbury commercial
demonstration plant
48 tonnes/day

Edmonton and Mississippi commercial modules
350 tonnes/day

Future

2007- to date
Cellulosic Ethanol Chair
University of Sherbrooke
Edmonton Waste-to-Biofuels Project

Feedstock preparation
Sorting, shredding, drying (if required) and feeding

Gasification
Conversion of carbon-rich residues into synthetic gas

Cleaning and conditioning process
Primary syngas purification

Catalytic synthesis and product purification
Conversion of chemical-grade syngas into final renewable products

* Municipal solid waste
Edmonton Waste-to-Biofuels Project

The Advanced Energy Research Facility
Evaluate and test various feedstocks (including various biomass feedstocks, commercial/industrial waste streams and mixed plastics)

Assessment of new technology or new process configurations

R&D Catalytic Bench-scale systems for each synthesis step

Catalyst assessment

Yields, operating conditions, product purity, catalyst robustness

Innovative approaches to synthesis

Scientific Advisory Board referees research results & provides guidance
# Edmonton Waste-to-Biofuels Project

<table>
<thead>
<tr>
<th><strong>Type:</strong></th>
<th>300 kg per hour throughput pilot facility</th>
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</table>
| **Partnership:** | - City of Edmonton  
- Alberta Innovates – Energy and Environment Solutions (AIEES)  
- Enerkem *(provides its proprietary technology)* |
| **Status:** | Commissioning started in 2012 and completion in 2013. |
| **Location:** | Edmonton, Alberta, Canada  
*Adjacent to Enerkem’s Commercial facility* |
| **System:** | Fully integrated for gasification, gas conditioning and alcohol production |
| **Focus:** | - Feedstock Variety  
- Reforming optimization  
- New Pilot Processes: ATR, DMC, Membranes |
Edmonton Waste-to-Biofuels Project
The R&D Bench Scale Laboratory

Owner(s):
- City of Edmonton
- Government of Alberta (AIEES)

Activities:
Managed by Enerkem
EAB Analytical Support

Technology:
N/A

- Advanced catalytic and dry reforming
- Next Gen Bio-product research
- CO2 utilization and GHG reduction
- EAB Feedstock Evaluation
- To be used for U of A collaborative research
- Funded by Alberta Innovates
Edmonton Waste-to-Biofuels Project

Edmonton Composting Facility

Integrated Process and Transfer Facility

High Solids Anaerobic Digestion Facility
Edmonton Waste-to-Biofuels Project

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

90% WASTE DIVERSION
Thank you!

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