



AI EES' Role in Renewable Energy

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Alberta Innovates – Energy and Environment Solutions

Seminar & Tour - Edmonton Waste Management Centre

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Co-presented by the Edmonton Waste Management Centre of Excellence

Presentation Outline

- Alberta Innovates: Energy and Environment Solutions (AIEES)
- Alberta's renewable energy resources and GHG reduction potential
- Drivers and challenges
- Project examples- AIEES and CCEMC
- Geothermal opportunities
- Biomass co-firing studies
- Summary

Alberta Innovates – Energy and Environment Solutions (AI-EES)

Who we are?

One of four corporations

Technology arm of the
Alberta Government in
energy and environment

What we do?

Position Alberta for the
future in energy and
environment

Identify, evaluate, select
technologies and partners

Invest in research &
technology with industry &
international collaborators

AI-EES Strategic Focus

Strategic areas



Energy
Technologies



Renewable &
Emerging Resources



Environmental
Management



Water Resources

Programs

- Recovery & Processing
 - Clean Carbon & Coal
 - Bitumen upgrading
-
- Renewable Energy
 - Emerging Resources
-
- Carbon Capture and Storage
 - Oil Sands Tailings
 - Enhanced Ecology
-
- Safe Drinking Water
 - Water for Healthy Ecosystem
 - Water for Economy

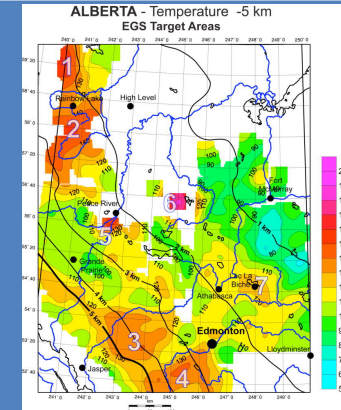
Alberta's Renewable Energy Resources

Bioenergy:

In 2009, Alberta produced 40+ million tonnes of grain and biomass from crops. Forest, Agricultural & Municipal Waste Biomass as 20 million tonnes per year

Geothermal:

Harvest heat from 400,000+ oil & gas wells



Solar:

*Sunny
Alberta*



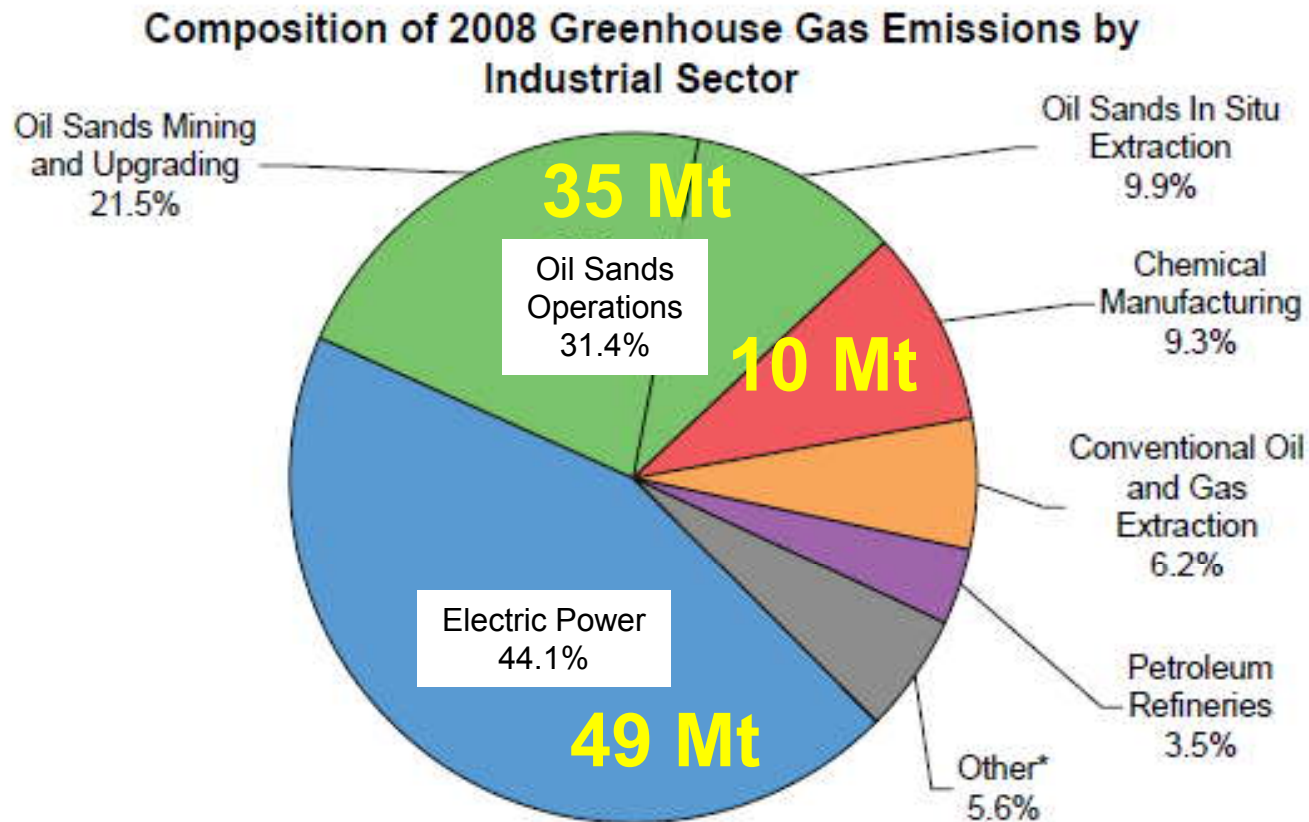
Wind:

500 MW + current
10,000 MW proposed



Potential to reduce GHG emissions
High cost of renewable energy remains a challenge

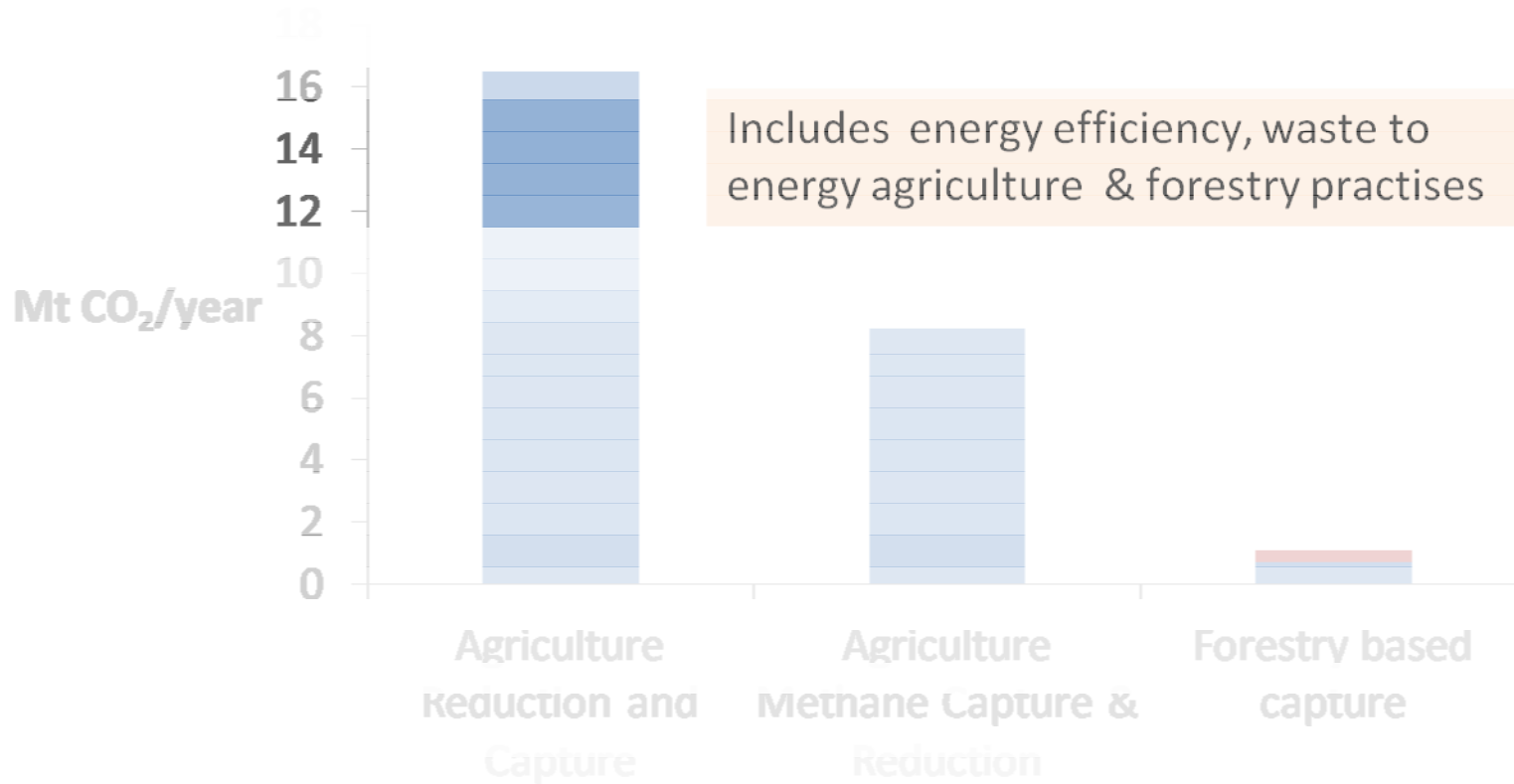
Alberta's Greenhouse Gas (GHG) Emissions



- Less than 5% of Canadian GHG emissions
- Less than 0.1 % of global GHG emissions
- Replacing some fossil fuel plants with renewables can reduce GHG emissions

From *Alberta Environment Report on 2008 Greenhouse Gas Emissions*, Government of Alberta, 2010

Potential for Biofuels to Replace Fossil Fuels and Reduce CO₂ emissions



Significant potential to reduce GHG emissions, but high cost are a barrier

Bioenergy Drivers and Challenges

Drivers

- Large resource
- C-Neutral Fuel status
 - Replace fossil fuels with high emission intensities
- Government programs
 - Renewable fuels standards
 - Bioenergy Grant Programs
 - Bioenergy Producer Credit Program
 - Climate Change and Emission Management Corporation
- AIEES investments in novel technologies

Challenges

- Sustainable supply
- Low energy density
- Lower energy efficiency
- Need for research and development to reduce costs renewables

Alberta Bioenergy Incentive Programs

Renewable Fuel Standard

- 5% ethanol in gasoline from renewable resources - bioethanol
- 2% diesel from renewable resources - biodiesel

Bioenergy Producer Credit Program

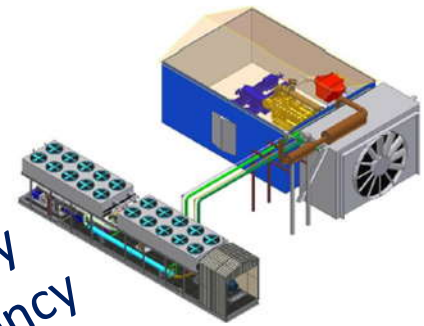
- Incentives for bioenergy products, renewable fuels, electricity and heat
- 2nd Gen. grain ethanol: \$0.9- 0.14 per litre
- Biodiesel & bio oil: \$0.09 - \$0.13 per litre
- Electricity from biomass
 - Biogas, synthetic gas or gasification: \$0.017-\$0.06 per kWh
 - Combustion: \$0.02 per kWh

Alberta Biorefining Commercialization, Market & Infrastructure Development Program

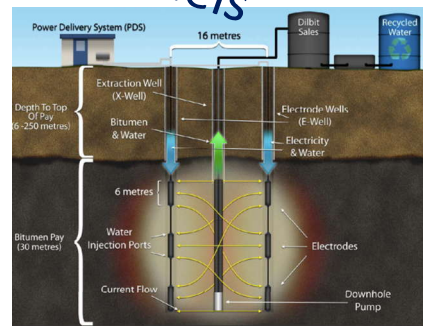
- Operated from 2007-2011
- Supported 86 projects: biofuels bioenergy, biowastes
- \$150 million over 4 years

Climate Change and Emission Management Corporation (CCEMC)

- Manages carbon tax funds collected by the Alberta Government from large industrial emitters
- Invests about \$60 million per year in GHG reduction projects
 - Cleaner energy production
 - Carbon capture and storage
 - Renewables



Renewables
Energy Efficiency
CCS
Greening fossil fuels



CCEMC Biofuels Projects- Examples

1. Enerkem: Reduction of GHG Emissions through Greening Biofuel Production and CO₂ Utilization

- Pilot gasification of wood & agriculture wastes to produce high value products. Utilize CO₂ to synthesize novel end products and reduce GHG's

2. Lethbridge Biogas Cogeneration Project

- Converts agricultural manures and food processing wastes into electricity and heat

3. Plasco Gasification Project

- Converts municipal waste into electricity

4. Lacombe Biorefinery

- Converts organic waste and animal products into heat & fertilizer

5. Slave Lake Pulp Bio-Methanation Project

- Bio-Methanation converts wood waste into biogas

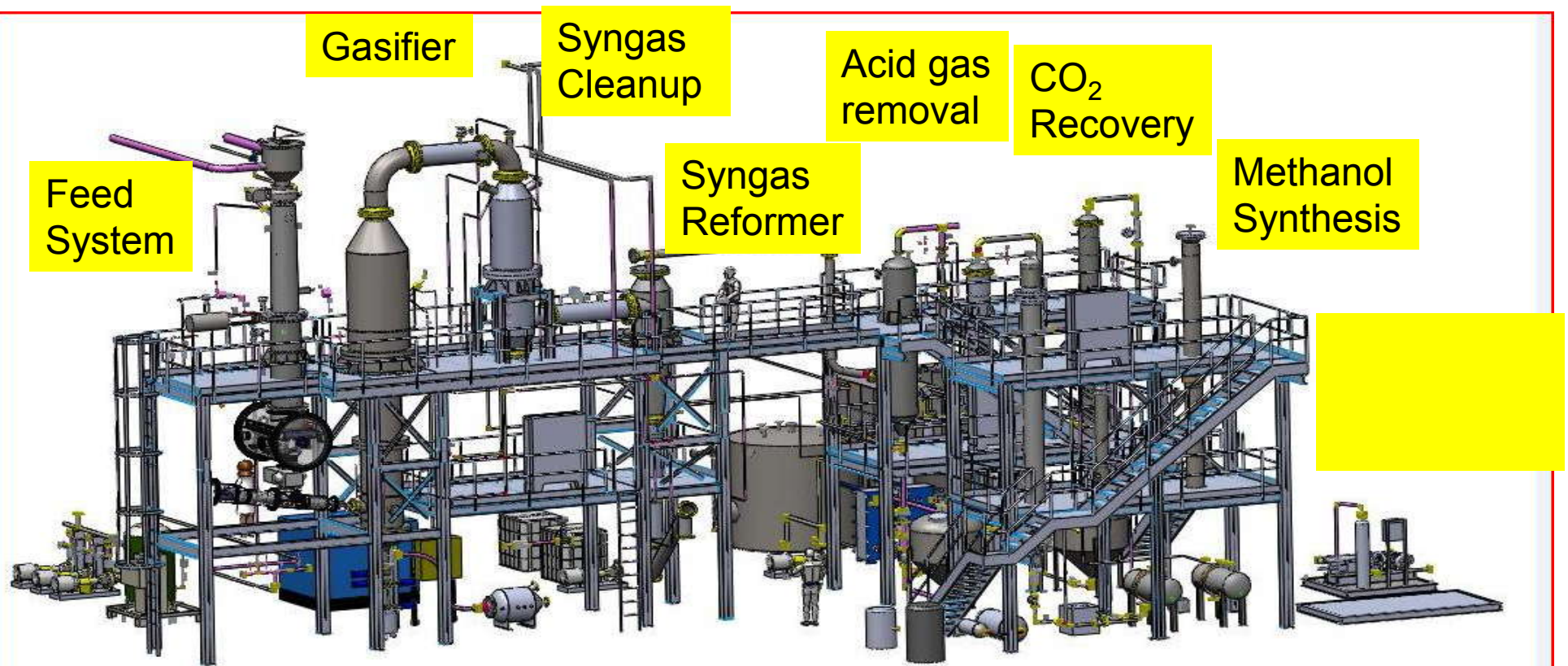
6. High North RTP Project

- Converts saw mill wood waste into pyrolysis oil used in a diesel generator

7. GPHH Integrated bioRefinery (TM).

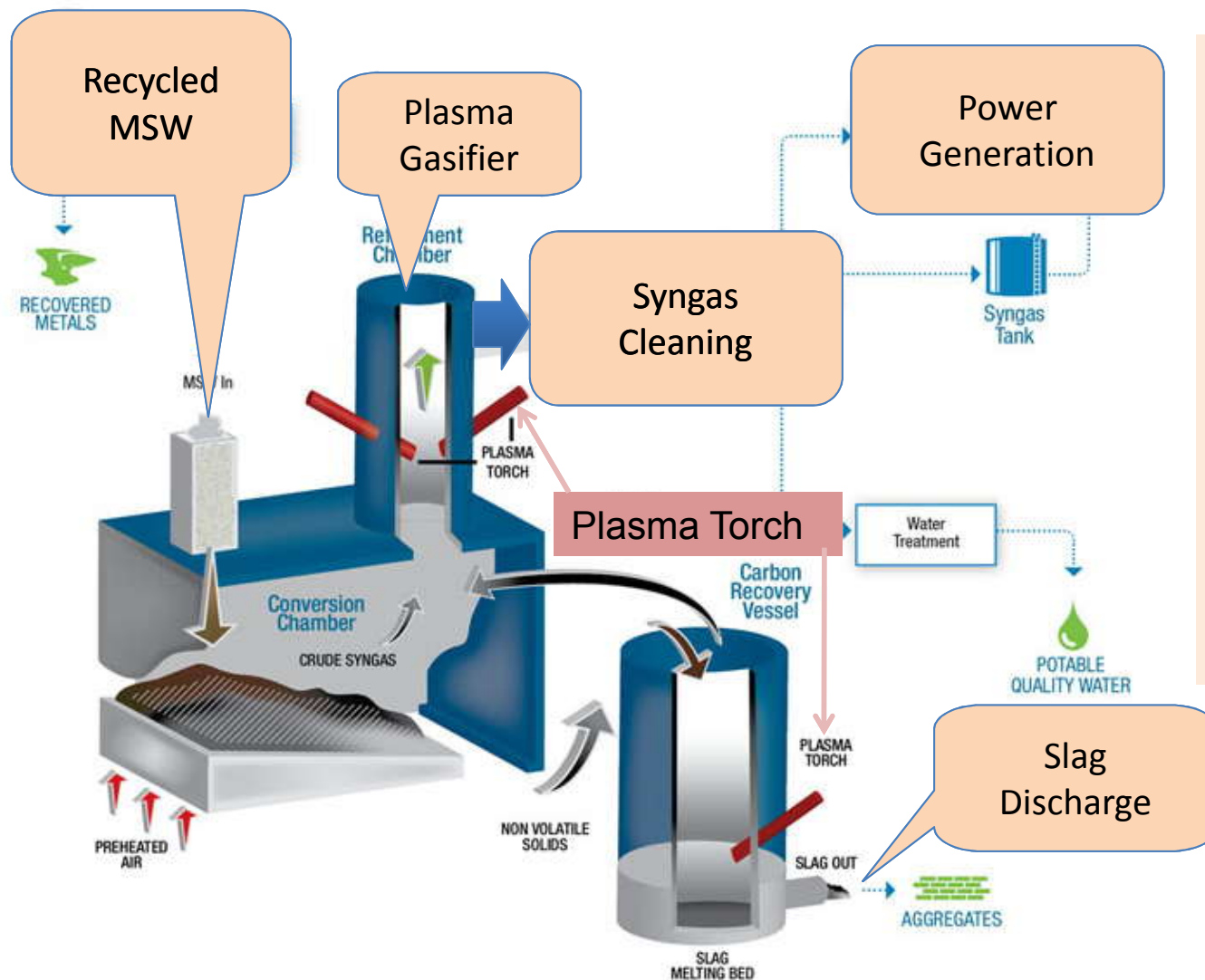
- Converts agriculture waste into ethanol & animal feed

Advanced Gasification & Syngas Pilot Facility



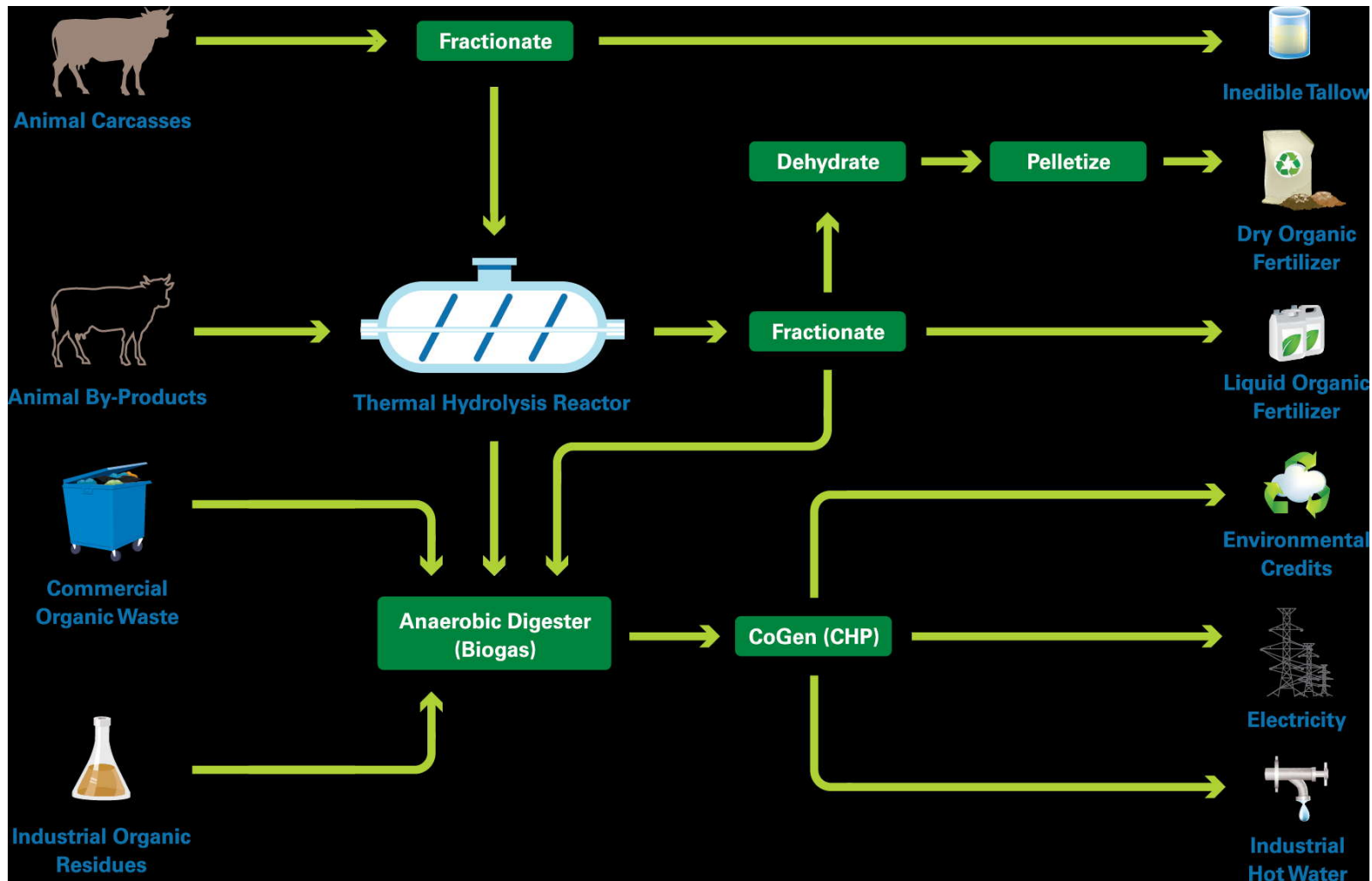
- City of Edmonton - AIEES R&D facility
- Test biofuels, coal, coke and fossil-biomass blends
- R&D on advanced syngas conversion processes
- First Project: Enerkem reduction of GHG emissions-greening biofuel production and CO₂ utilization

Plasco MSW Gasification Project



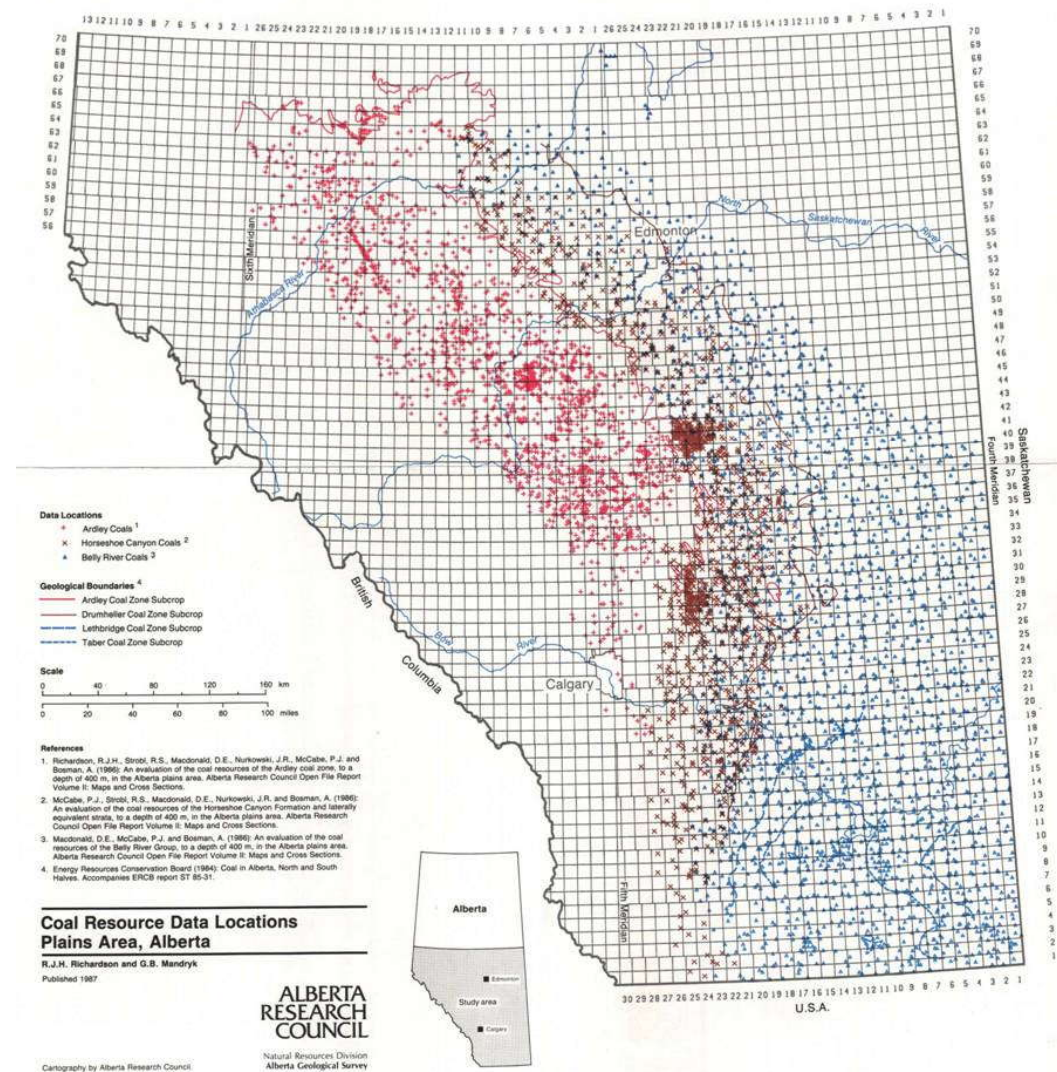
- Novel moving bed plasma gasifier
- Planned commercial plant at Red Deer County supported by CCEMC
- MSW Capacity: 112,000 tonnes per year
- Generate 107,000 MW baseload power
- Annual CO₂ reduction: 235,000 tonnes

Lacombe Biorefinery - Process Overview



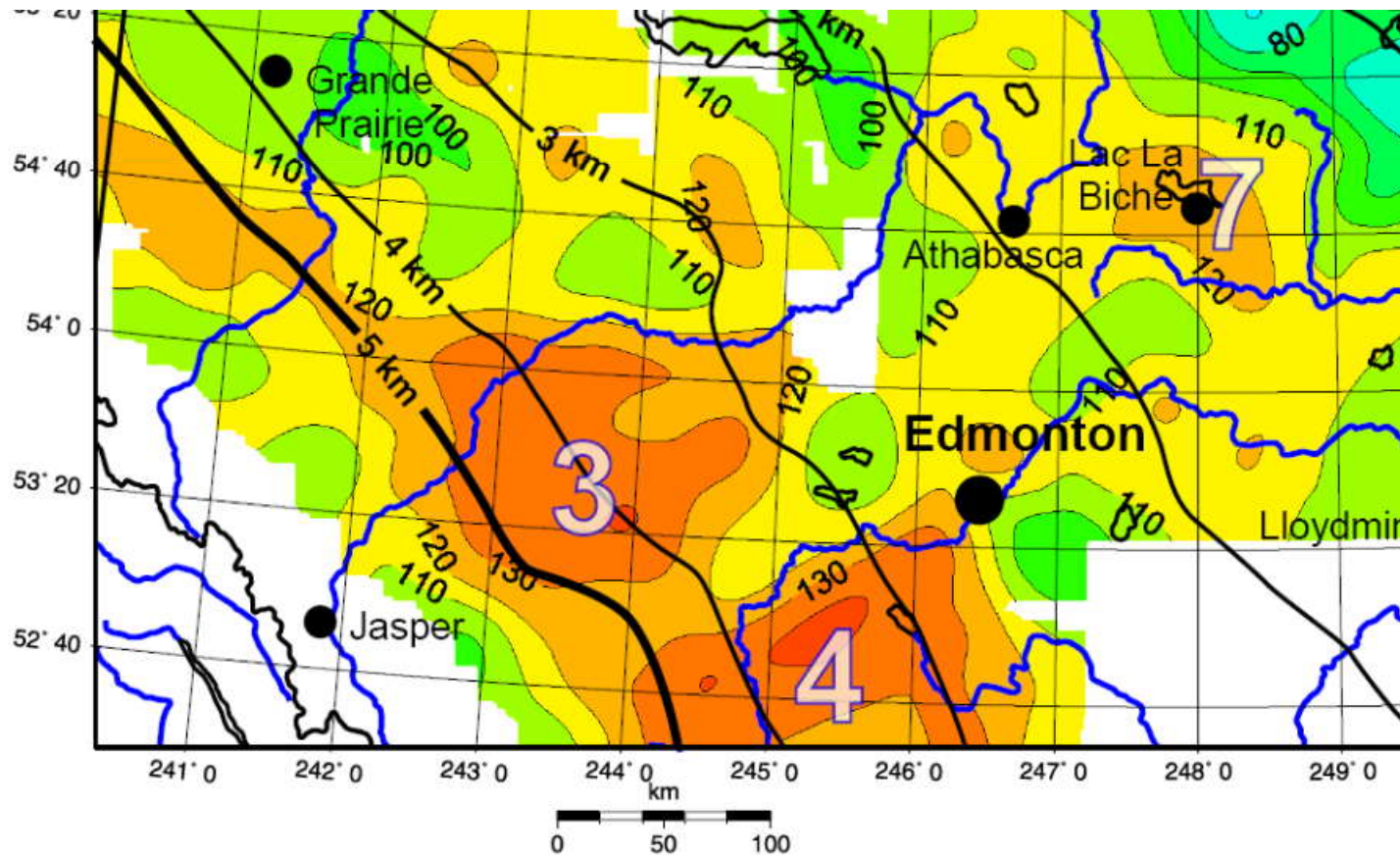
Geothermal Potential in Alberta

- Over 250,000 oil and gas wells
- Extensive pipeline and power grid infrastructure



Highest Ranked Geothermal Targets

- 130 to 150 C potential to 5km basement
 - AEUB data indicate potential for 120 C at 3 km
- 138 & 240kv access to grid



Coal-Biomass Co-firing to reduce CO₂ Emissions



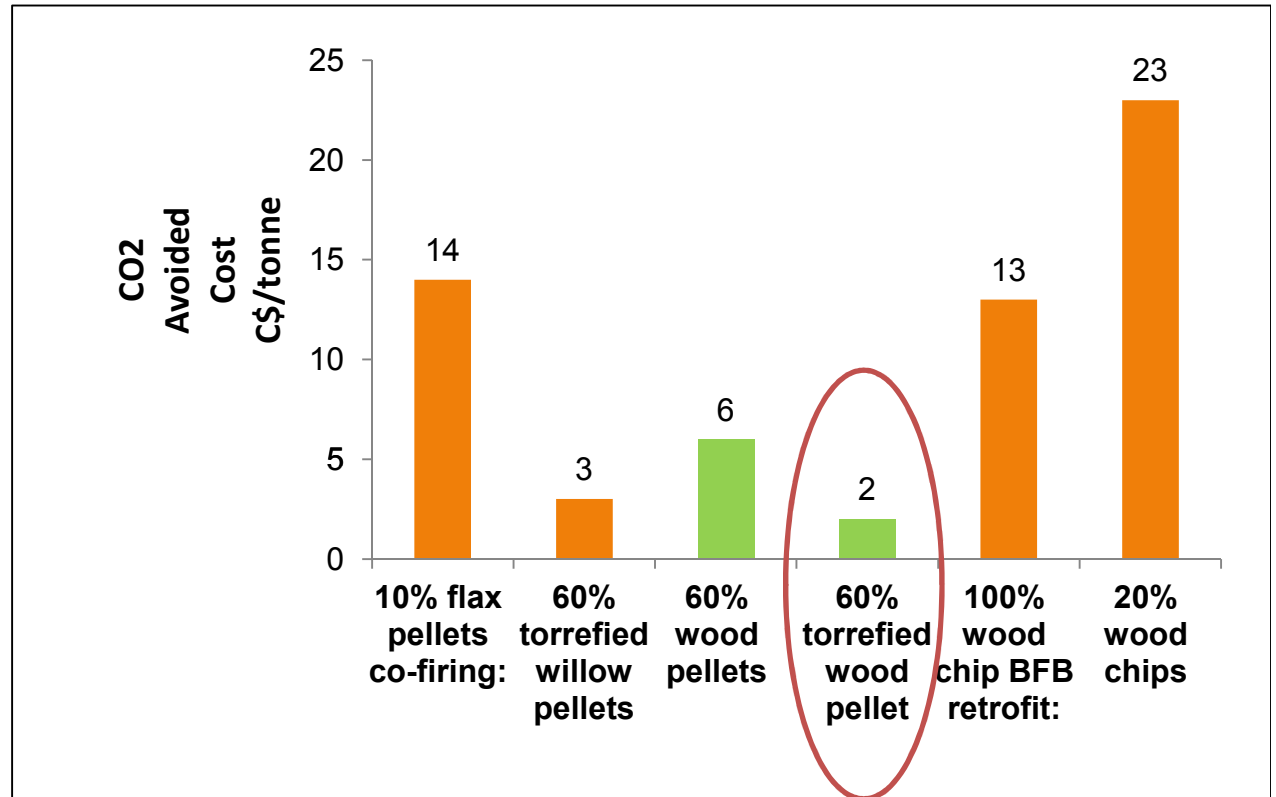
Wood Chips



Wood Pellets

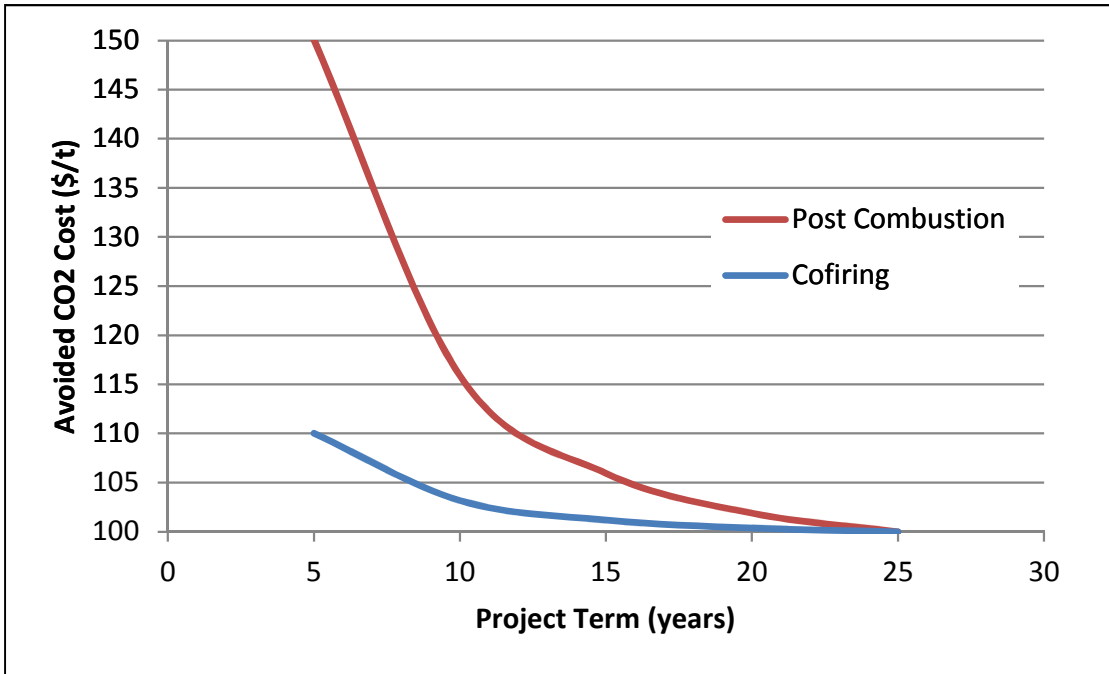


Torrefied Wood



- 60% torrefied wood - lowest capture costs
- But torrefaction not yet available in commercial capacities

Biomass Co-firing Niche Applications



Avoided CO₂ cost for biomass co-firing << post combustion capture cost especially for older plants with shorter economic lives

	Biofuel Cost		Capture Costs	
	Low	High	Low	High
Biomass Cost (\$/t)	130.0	182.0		
Net fuel cost (\$/GJ)	6.0	8.6		
Avoided Cost (\$/t)	70.5	97.8	100.0	150.0

60% biomass co-firing can reduce the emissions intensity of a coal plants from 1t CO₂/MWh to 0.4 t CO₂/MWh of a NGCC plant

Summary

- Large biomass resources - designated C-neutral
- Potential to convert these resources into clean energy and valuable products
- And to mitigate GHG emissions from fossil fuels sources
- Costs are high and projects require support through government strategies and programs
- Innovation and technology development are key to commercial deployment
- Significant technology advances being made through industry-government partnerships
- AIEES invests in a broad portfolio of technologies to accelerate commercial deployment of renewable energy projects

Positioning Alberta for the Future in Energy and Environment
Annual Report 2010-2011
www.ae-ees.ca

