



nexterra



Nexterra Gasification Technology for IEA Bioenergy
Vancouver, August 25, 2009

Agenda

1. Introduction
2. Gasification Technology
3. Projects
4. BC Carbon Tax and Carbon Policies
5. IC Engine Program Overview

INTRODUCTION

Overview



- Supplier of small-scale biomass gasification solutions that generate heat & power
- Inside-the-fence applications at public institutions & industrial facilities
- Enables customers to reduce energy costs, reliance on fossils & GHG emissions
- Technology is cleaner, lower cost, more versatile and more efficient than combustion

Strategic Alliances



GE
Energy

Advanced power systems



Channel partner institutions

Honeywell

Channel partner institutions



PRISTINE
POWER INC.

BC Bioenergy Network



Municipal WWTP partner

Ownership

- Majority owned & financed by Calgary-based ARC Financial
 - ARC is one of the largest energy focused private equity cos.
 - Over \$1.9 billion of capital under management,
 - Nexterra has strong balance sheet - over \$20 MM equity invested
- Strong support from federal and Provincial programs

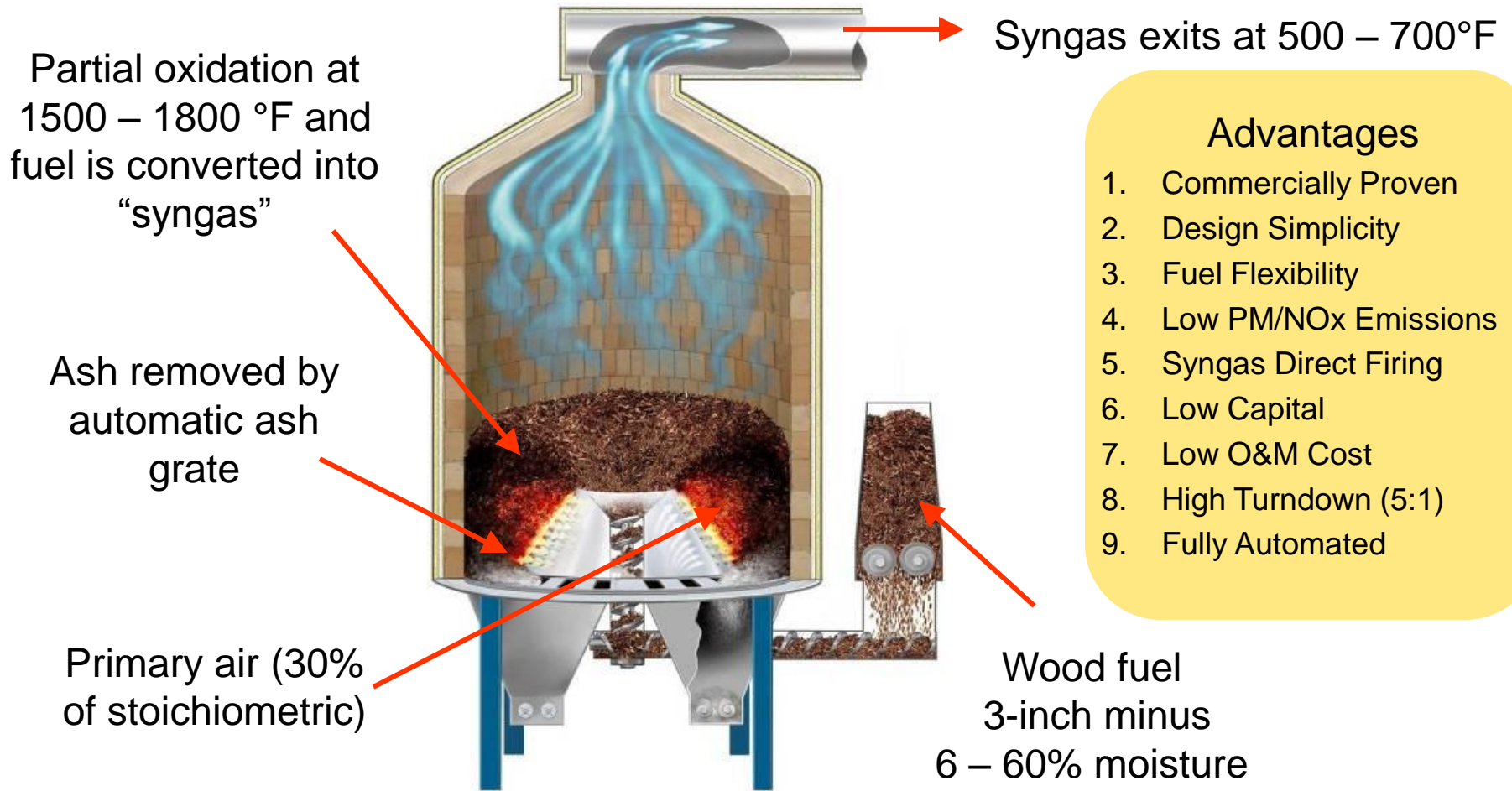


GASIFICATION TECHNOLOGY

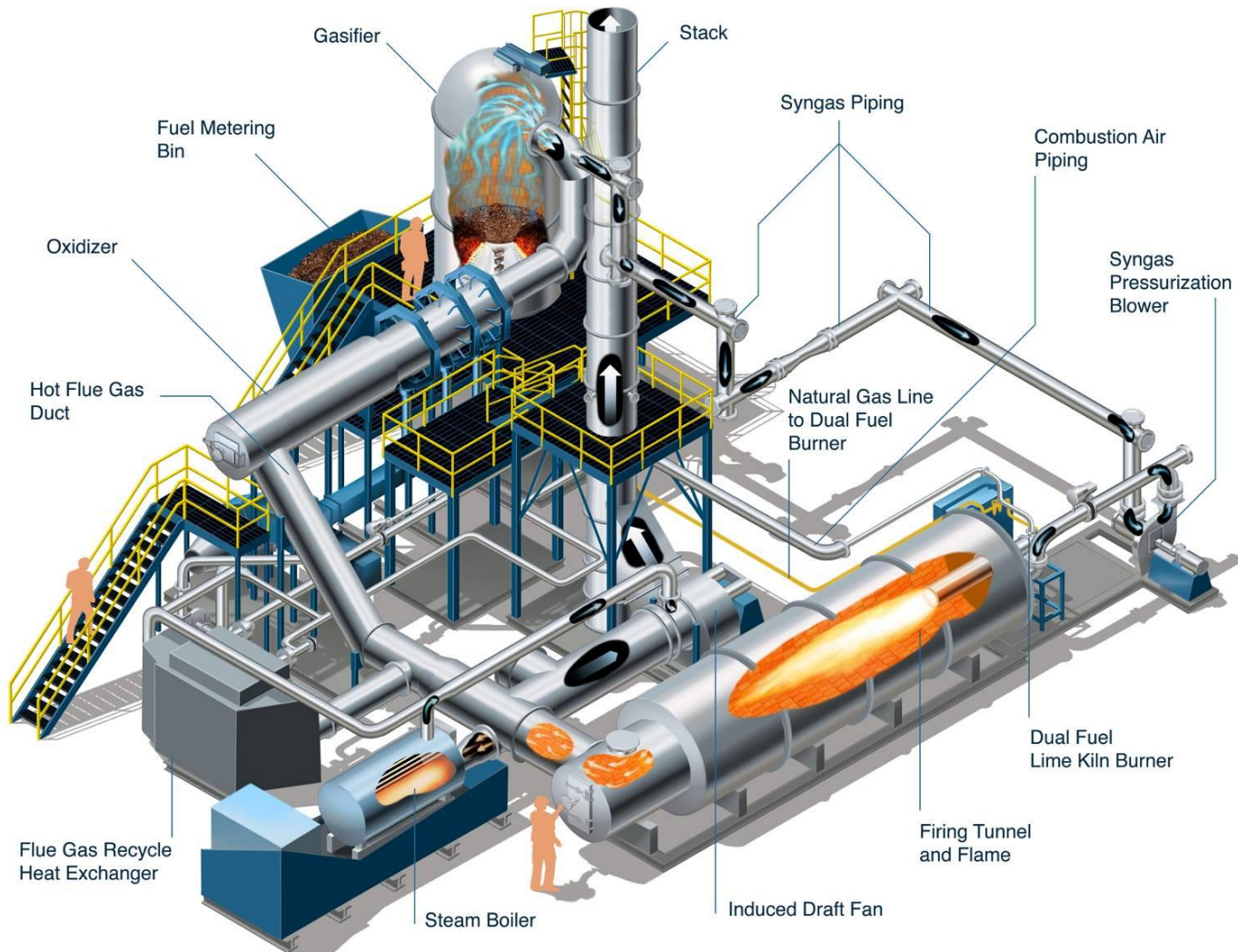
Gasification vs. Combustion

- **Cleaner** – lower PM and NOx emissions
- **Fuel Flexibility** – wet/dry fuels, low ash melting temp.
- **Higher Efficiency** – power generation with IC engines
- **Syngas Versatility** – direct firing boilers, kilns, IC engines, syngas upgrading to liquid fuels & chemicals

Nexterra's Gasification Technology



Product Development Centre

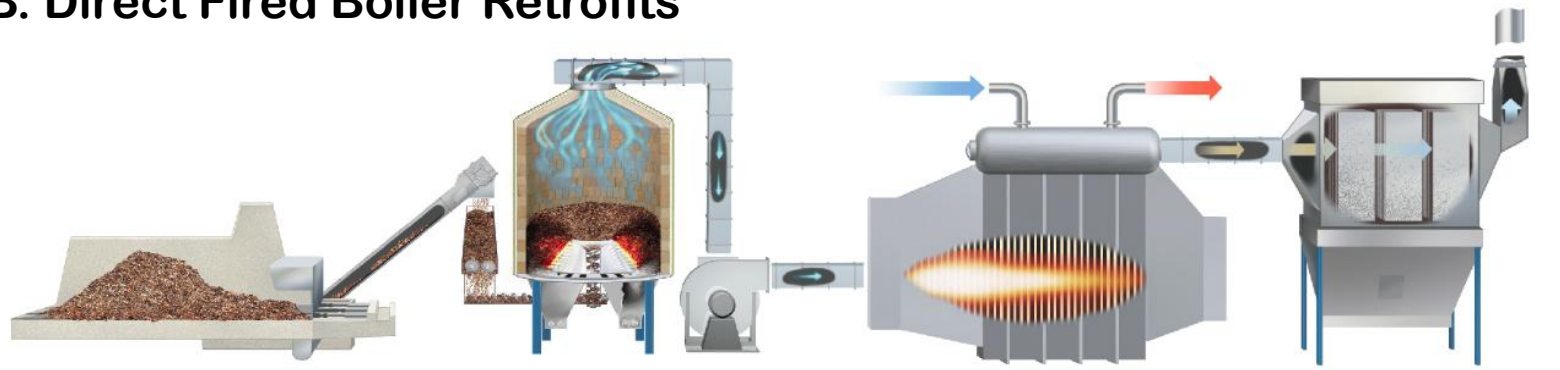


1st and 2nd Generation Thermal Heating System

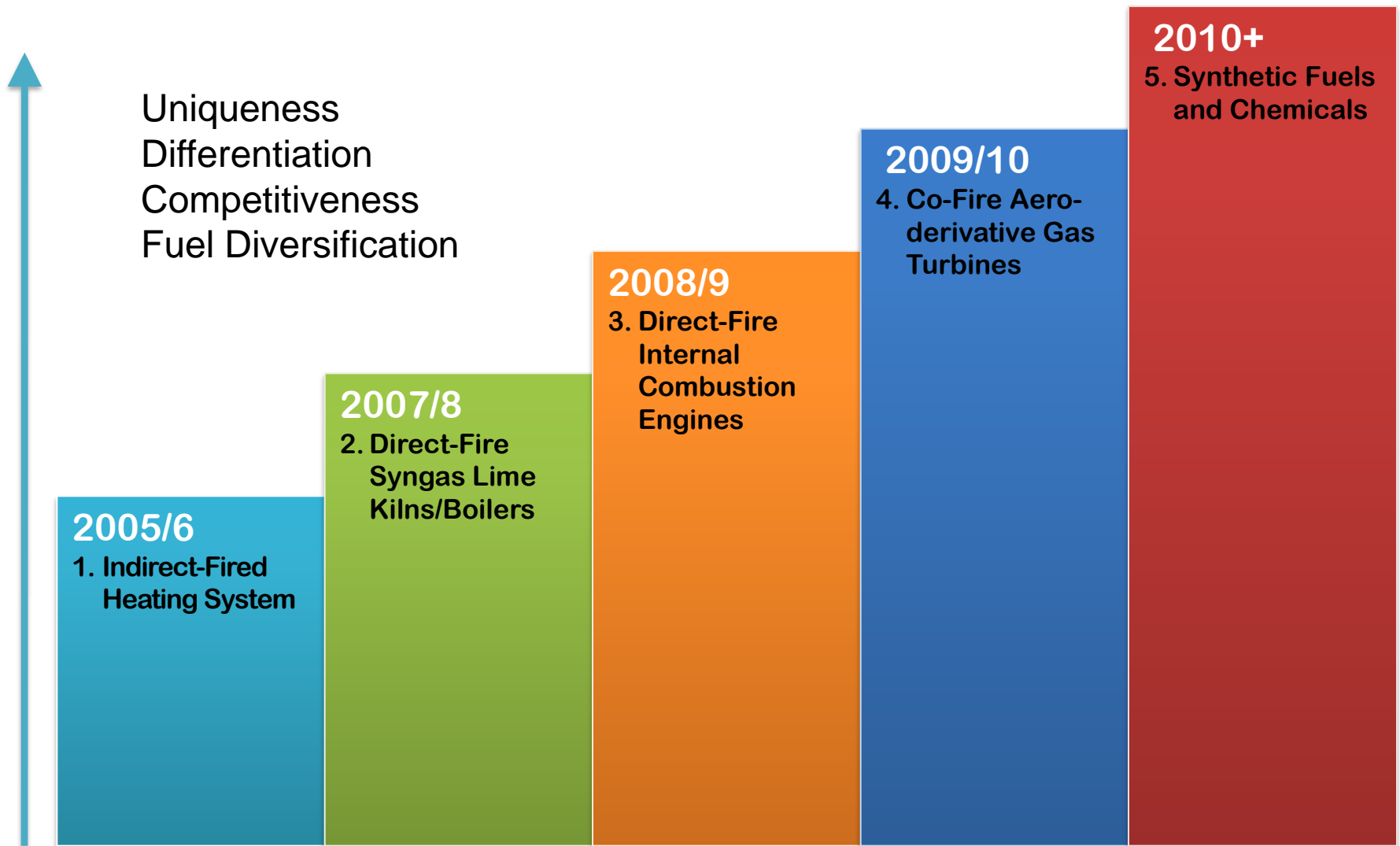
A. Indirect Fired Greenfield



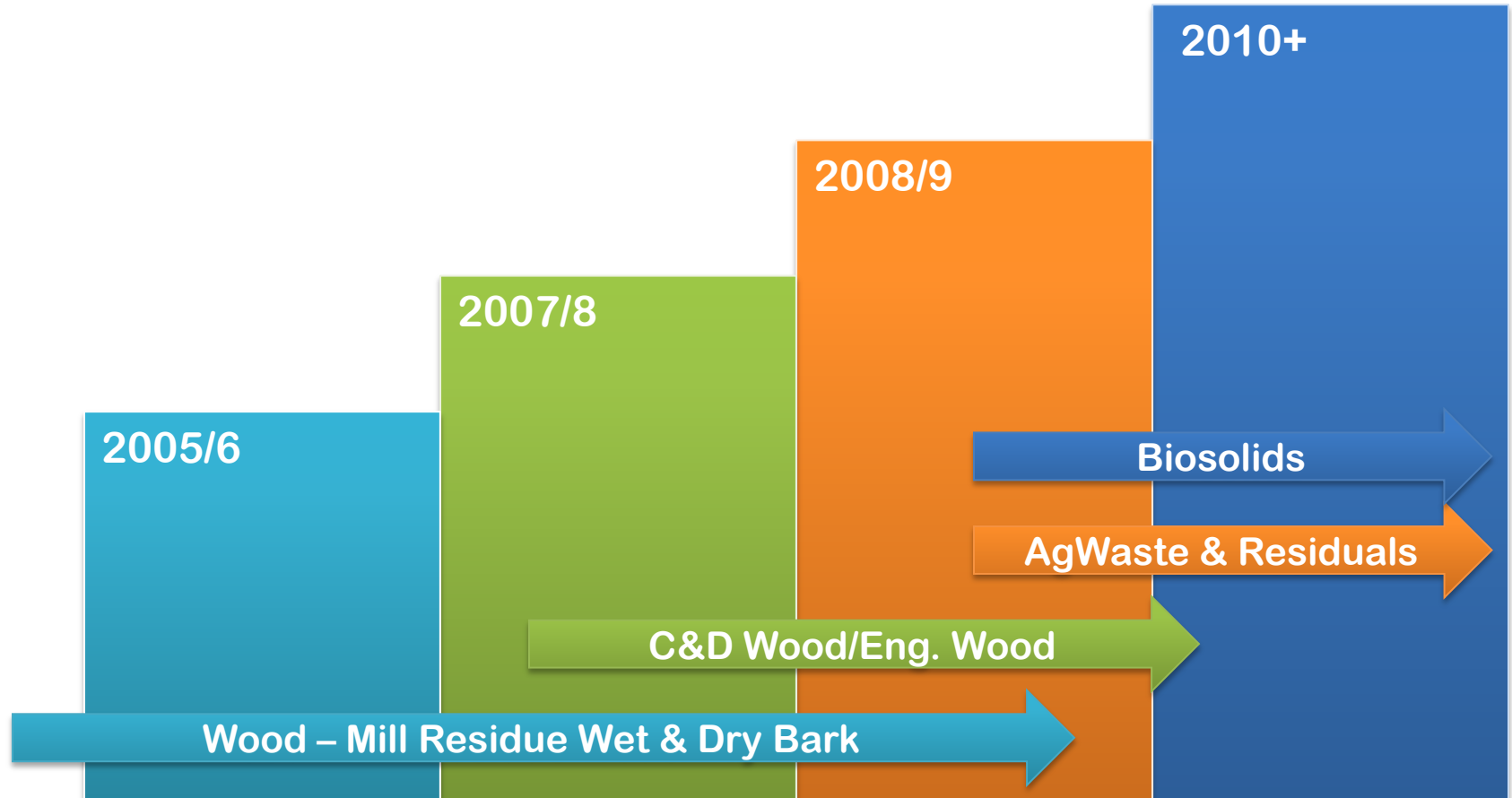
B. Direct Fired Boiler Retrofits



Application Roadmap



Biomass Fuel Development



PROJECTS

Tolko – Heffley Creek

- Plywood mill dryer/HW
- 3 years of operation
- 96% availability
- Savings: \$1.5 MM/yr
- GHG Red: 12,000 tpy





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- \$20 MM heat and power plant
- Supplies 85% of USC thermal load
- Annual Savings: \$2 - 3 MM/yr
- GHG Reduction: 20,000 tpy



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Raw Emission Data from USC system testing

	Run #1	Run #2	Run #3	Average
Opacity (%)	0	0	0	0
PM (mg/Nm ³)	2.1	3.2	2.2	2.5
PM10 (mg/Nm ³)	0.5	1.9	1.5	1.3
Condensable (mg/Nm ³)	16.9	23.7	13.1	17.9
CO (ppm)	5.0	7.2	43.9	18.7
NOx (ppm)	110	102	86	99
VOC (ppm)	0.02	0.4	9.8	3.4
SO ₂ (ppm)	25.5	21.9	26.3	24.6

System capacity: 60,000 pph of superheated steam, 650 psi, 750 degF
Dry ESP installed for PM emission control

Filter After 1st Particles Emission Run



Average PM emission for 3 tests was about 2mg/NM3 – equivalent to natural gas emissions

Dockside Green

- Heating & Hot Water
- Urban Wood Waste
- 2 MW thermal









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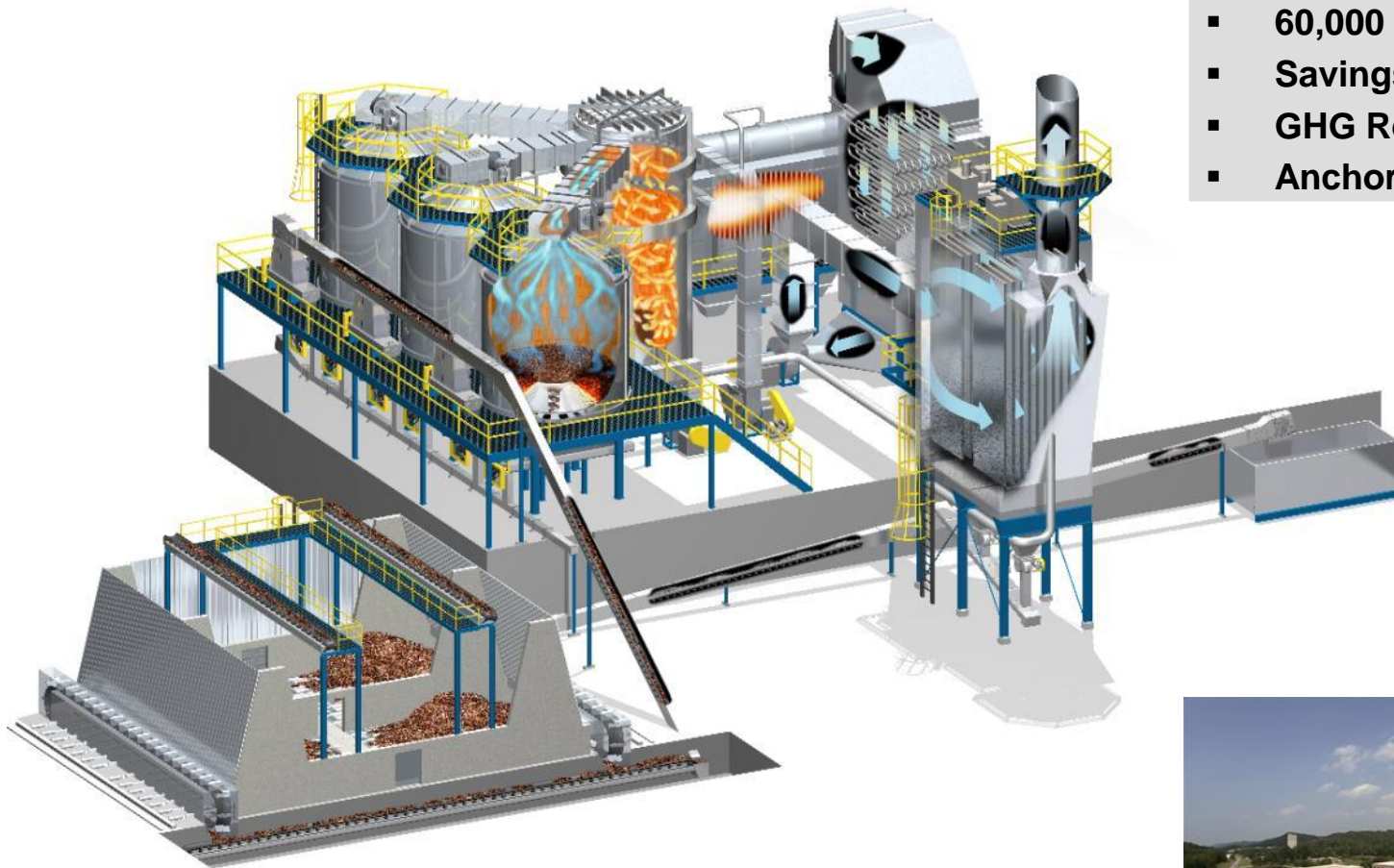
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US DOE Oak Ridge National Labs



- Central heating plant
- 60,000 lbs/hr steam
- Savings: \$6.5 MM/yr
- GHG Red: 22,000 tpy
- Anchored \$89 MM PC

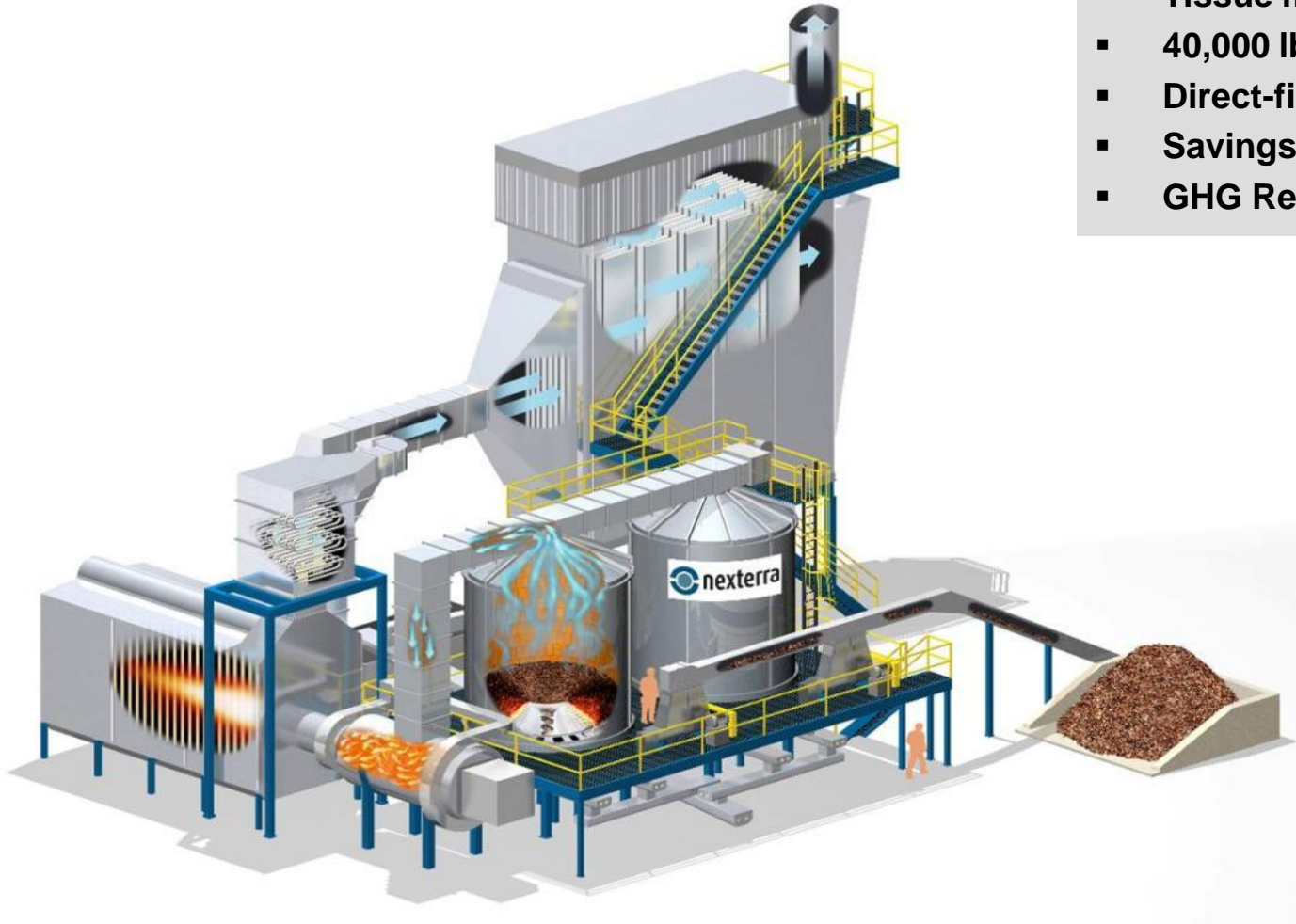


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Kruger Direct-Fired Boiler

- Tissue mill
- 40,000 lb/hr steam
- Direct-firing new boiler
- Savings: \$2.8 MM/yr
- GHG Red: 22,000 tpy





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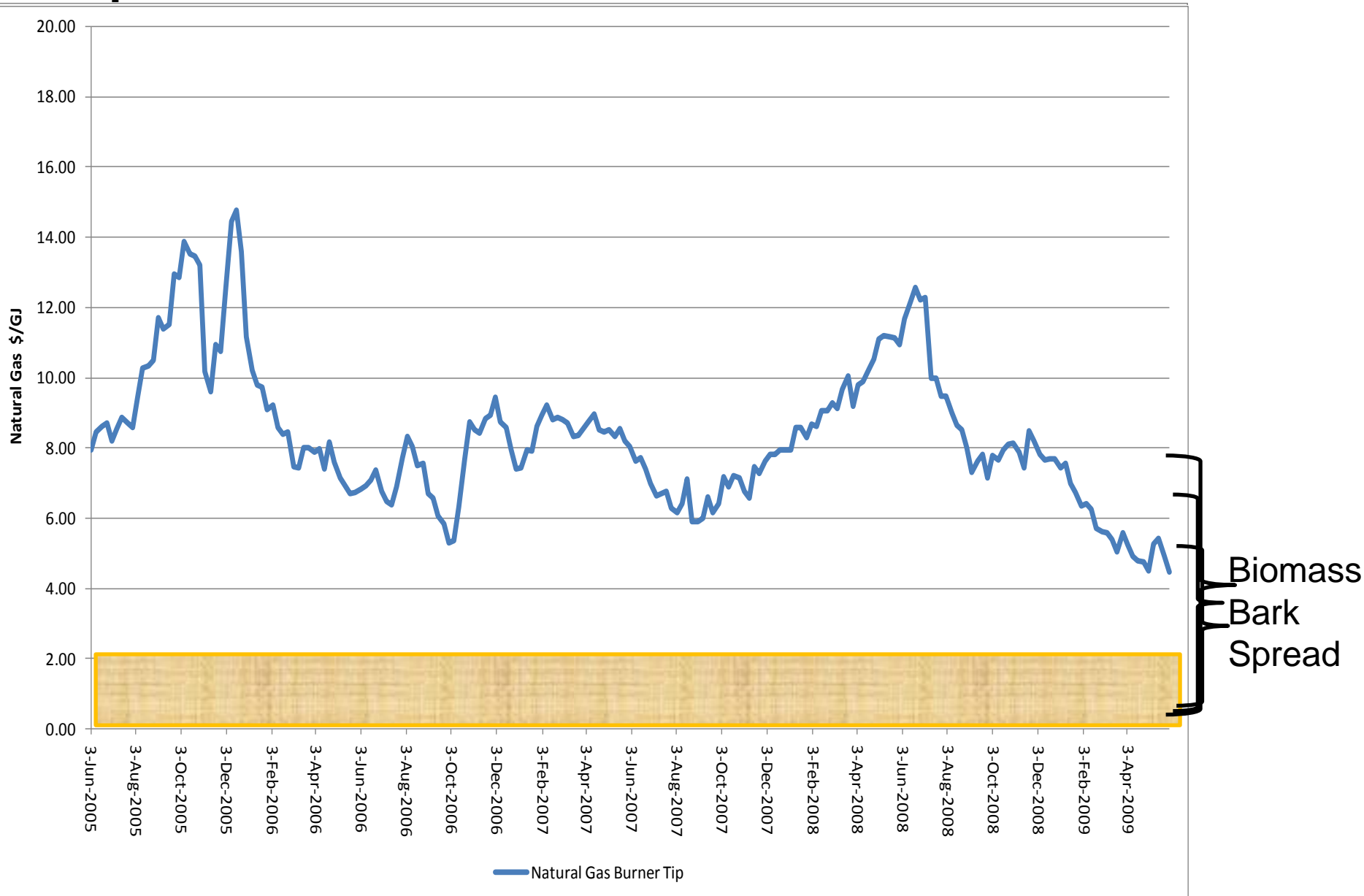
BC CARBON TAX & CARBON POLICIES

BC's 2008 Climate Action Plan

- Highlights
 - GHG reduction targets of 33% by 2020 and 80% by 2050
 - Carbon tax - \$10/tonne in 2008 rising to \$30/tonne in 2012
 - Requirement for BC public sector to be carbon neutral by 2010
 - Pacific Carbon Trust to sell carbon offsets at \$25/tonne
- Impact to Natural Gas Consumers
 - Public sector –\$55/tonne for CO₂ or increase in natural gas by \$2.75/GJ
 - Private sector – \$30/tonne for CO₂ or increase in NG \$1.5/GJ + value of carbon offsets \$10 - \$20/tonne

Natural Gas vs. Biomass Fuel Costs

Impact of the Carbon Tax on BC Public Sector



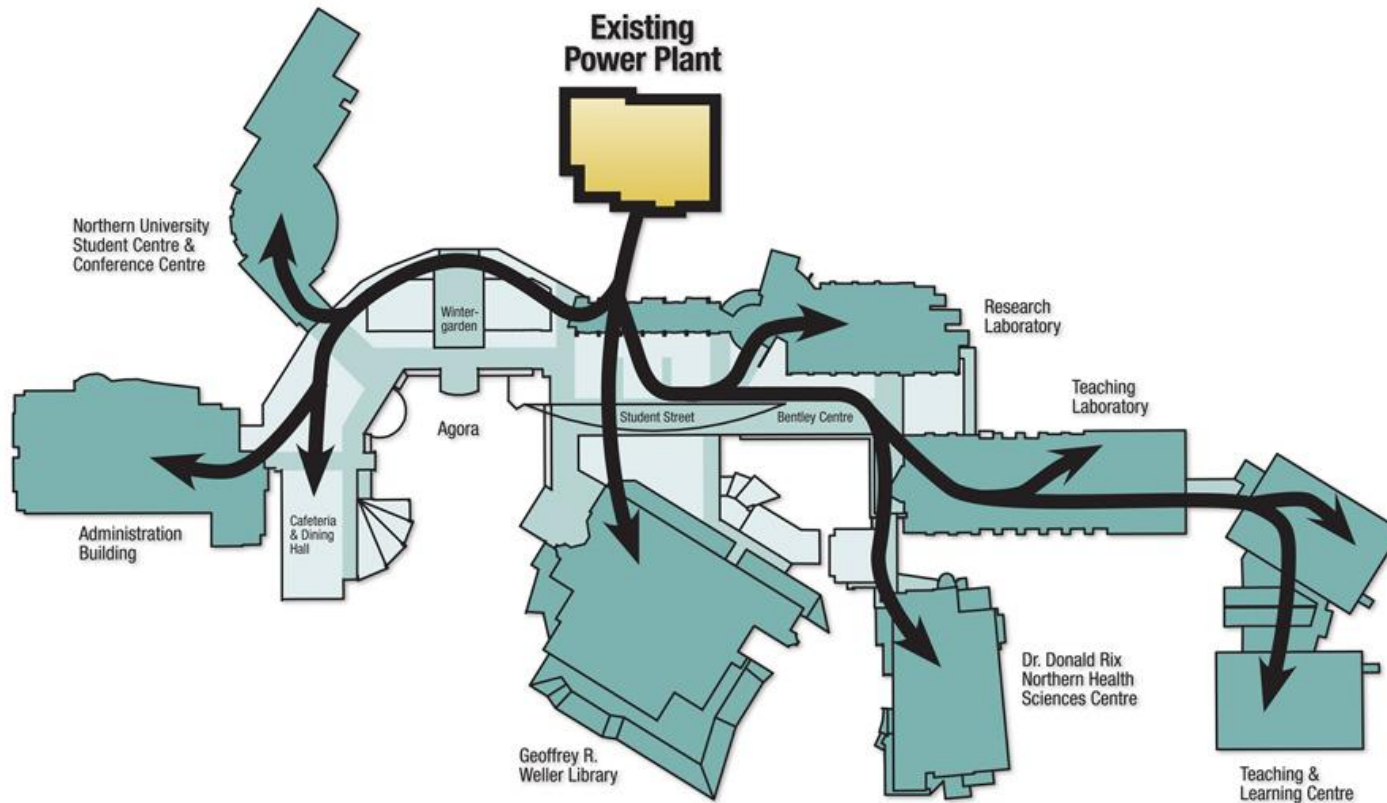
Case Study:

UNIVERSITY OF NORTHERN BRITISH COLUMBIA



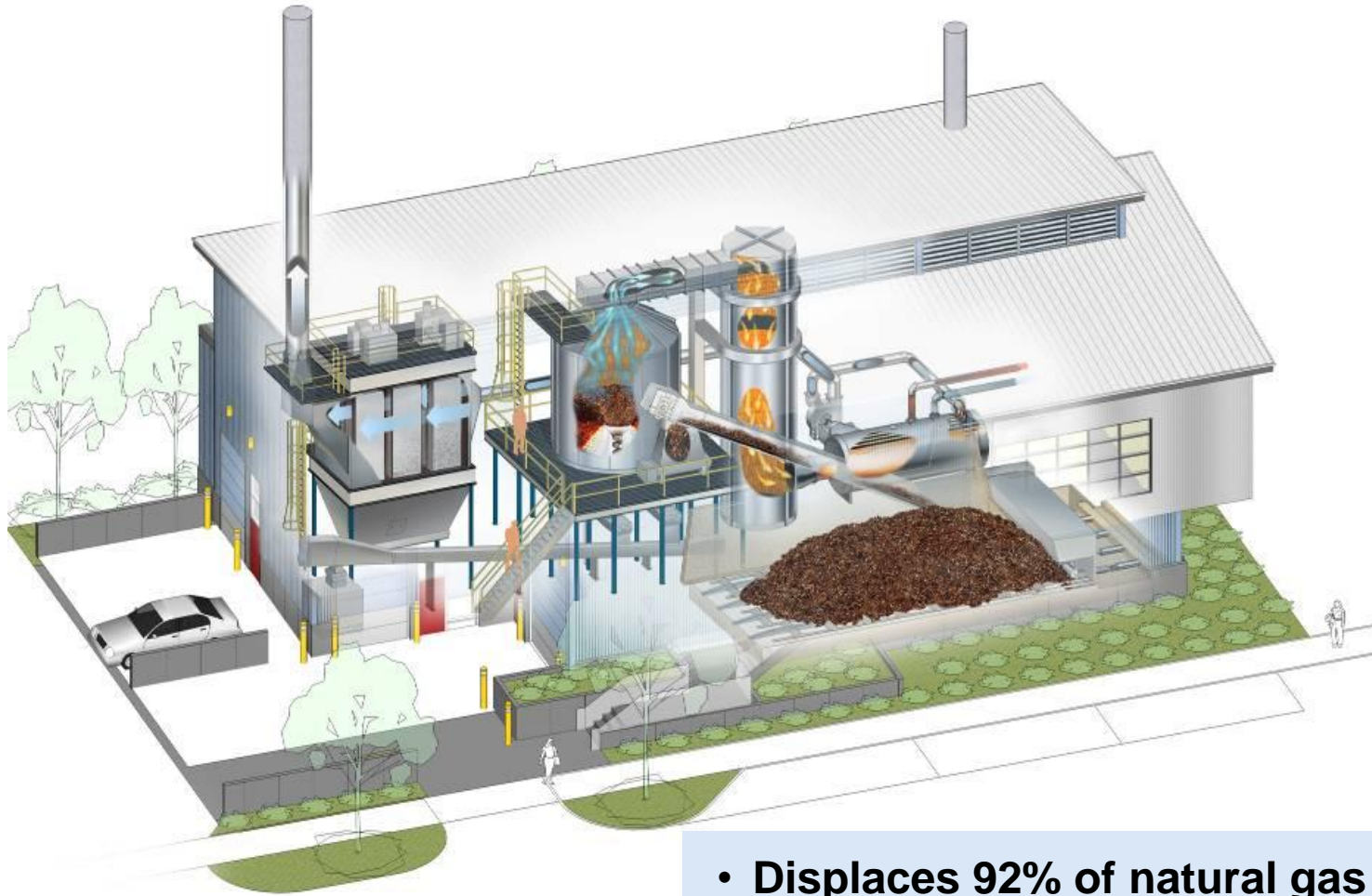


UNBC Fossil Fuel Consumption



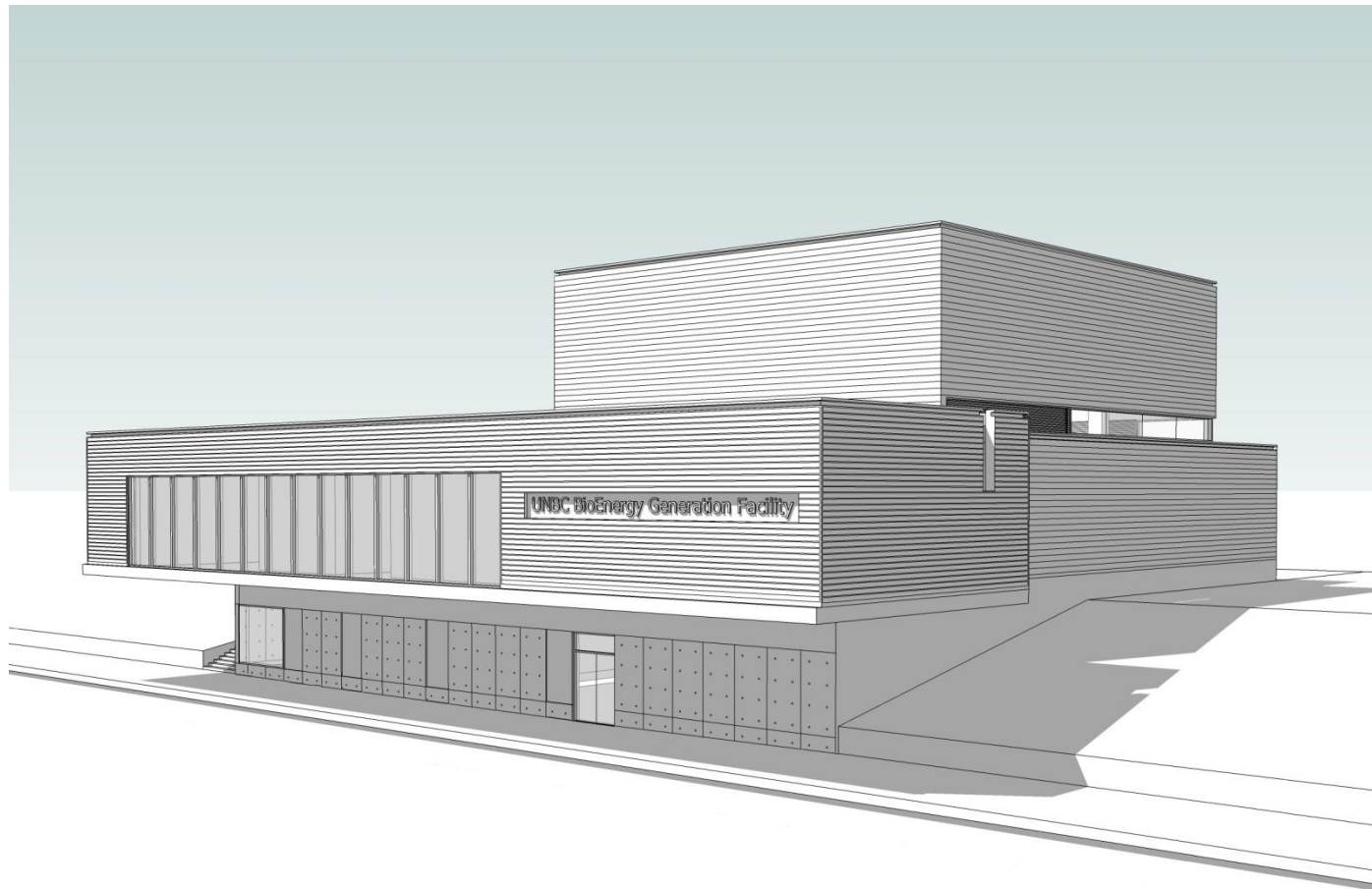
- 84,000 GJ/year of natural gas
- \$840,000/year to purchase gas
- 4,000 tonnes/years of CO₂
- Carbon liability \$220,000/yr in 2012

UNBC – Biomass Gasification System



- Displaces 92% of natural gas
- Lowers GHGs by 3,500 tonnes/yr
- \$600 K in annual natural gas savings
- \$190,000/yr avoided carbon taxes/offsets

UNBC Bio Energy System Main Entrance

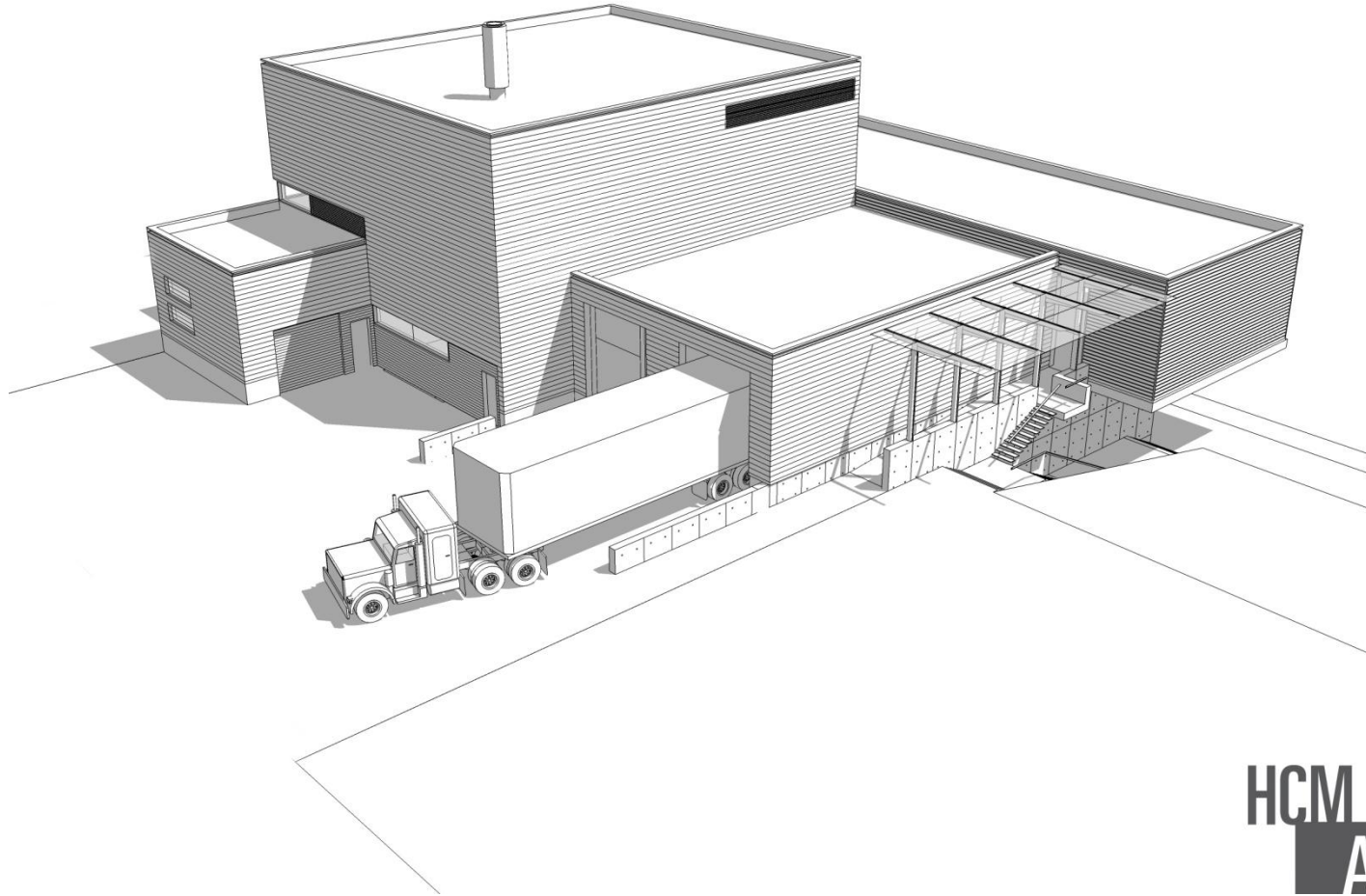


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Fuel Loading and Ash Removal



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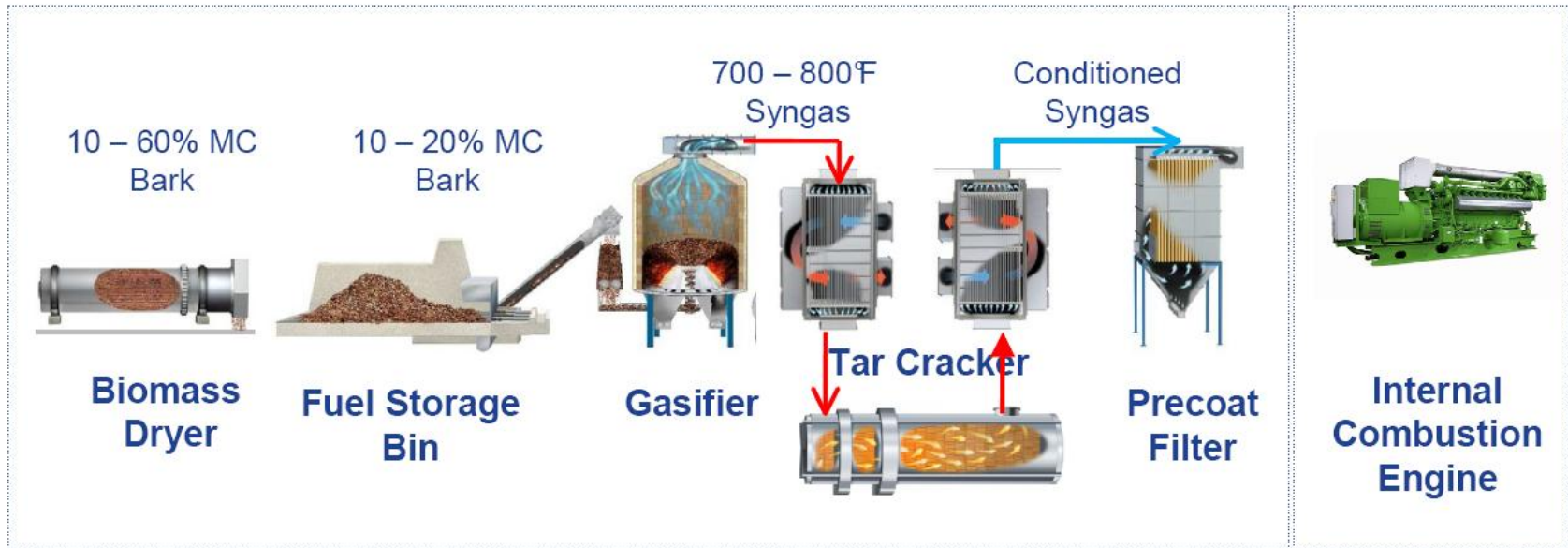
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IC ENGINE PROGRAM OVERVIEW

Future of Biomass Power: Gasification + IC Engine

NEXTERRA SCOPE OF SUPPLY

GE JENBACHER



- Electrical Efficiency: 24 – 26% - I.C. engine only
- Electrical Efficiency maximized: 30% - I.C. engine & ORC system
- Cogen System Efficiency: 60% - I.C. engine with district heating system
- Typical Scale: 2 - 10 MW^{el}

Syngas fired IC Engines - Technical Barriers

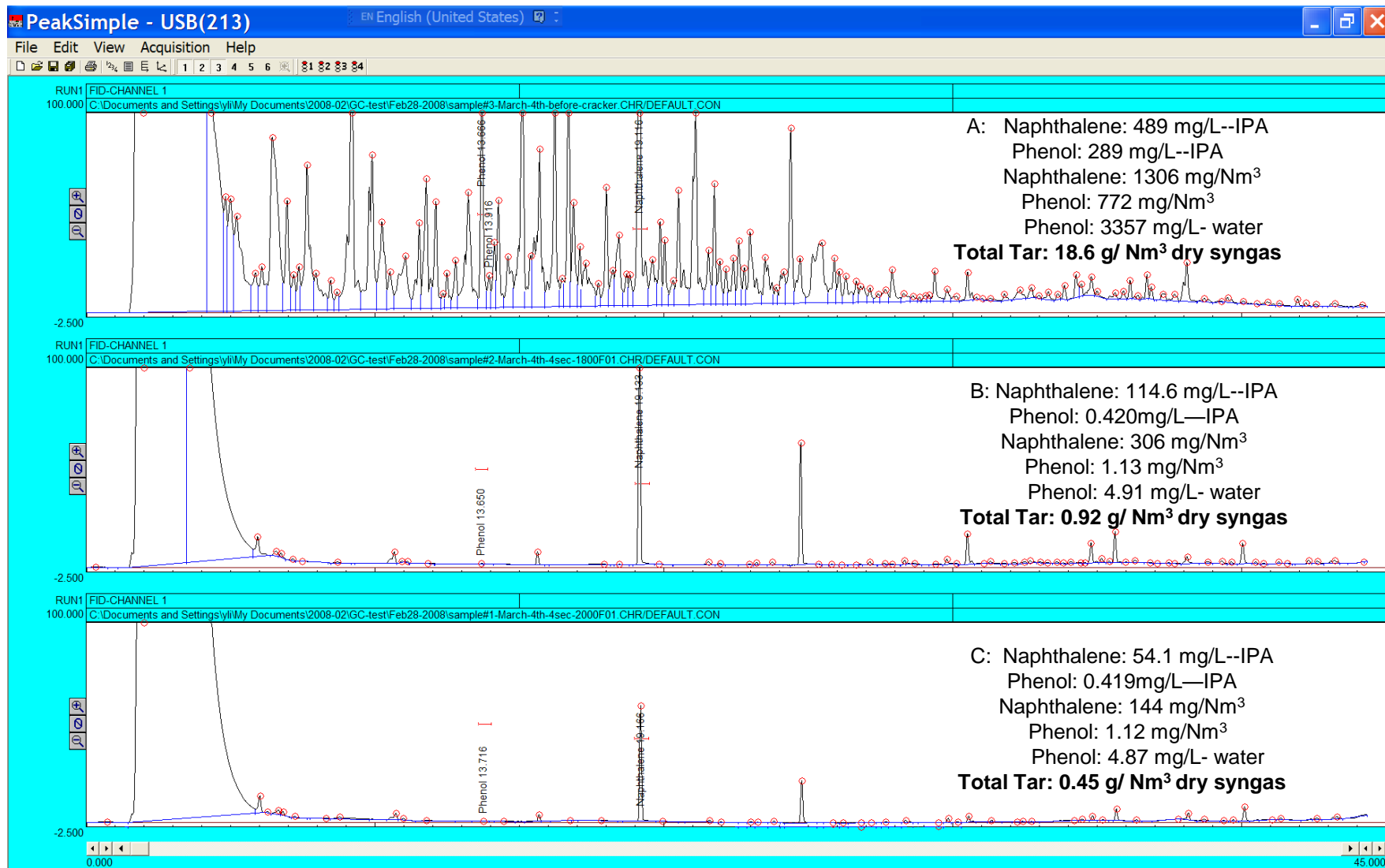
- Raw Syngas from Biomass Gasification:
 - Contains non-condensable components providing the energy to drive the engine
 - Also contains condensable “tar” components which create technical problems



Preliminary Cracking Process Results

Cracking time: xxx seconds, Dry shavings fuel (15%)

A: Raw tar; B: Cracking at yyy°F; C: Cracking at zzz°F



Nexterra PDC upgrades – fuel feed system



Nexterra PDC upgrades – syngas clean-up



Nexterra PDC upgrades – syngas conditioning



GE Jenbacher – model 208 (240 KW)



2 MW^{el} Gasifier to IC Engine CHP

Performance Summary

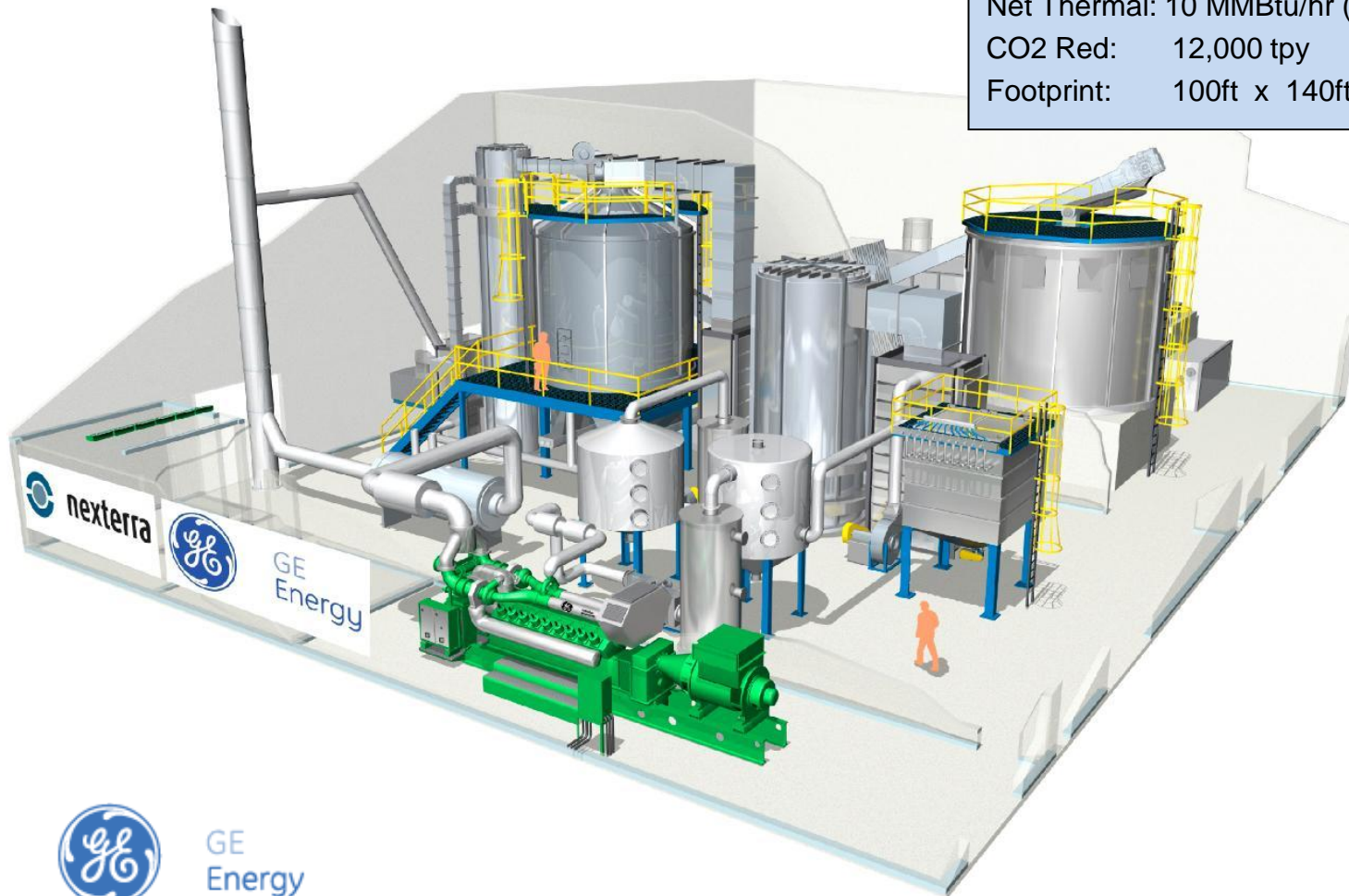
Fuel Req'd: 12,000 BDMT/year (2-3 trucks/day)

Net Power: 1.6 MW^{el}

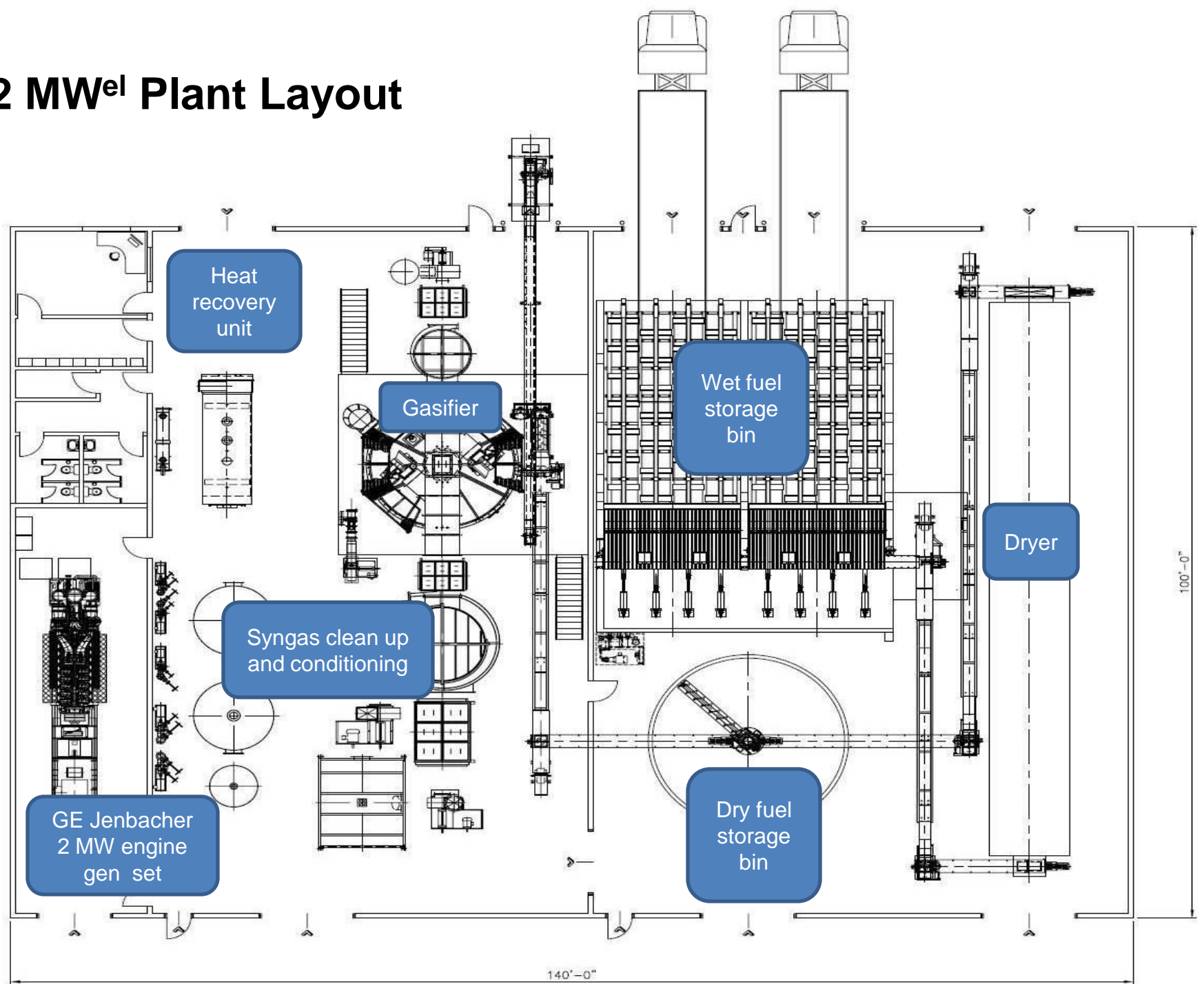
Net Thermal: 10 MMBtu/hr (80,000 MMBtu/yr)

CO₂ Red: 12,000 tpy

Footprint: 100ft x 140ft



2 MW^{el} Plant Layout



UBC site location: corner of Agronomy & Lower Mall



UBC site location: Architect's rendering



Thank you