Bioenergy Optimization Program Demonstration Project Presentation

BIOCLEANTECH Forum In Ottawa ON

Grid Stability, Remote Communities, and Air Quality

Biopower Session on November 3, 2016

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Biosystems Engineering Section

- Develop and deliver bioenergy initiatives to customer end use applications as a Utility demand side management measure.

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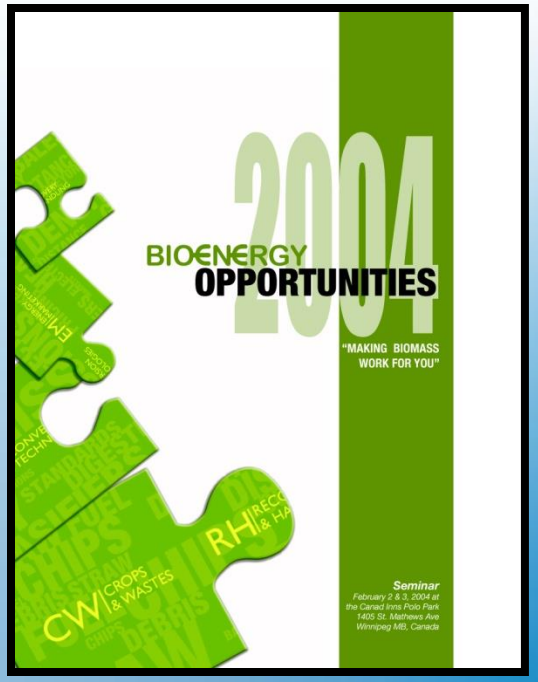
Biomass Related Activities At Manitoba Hydro

2002

2016

- Education, Awareness & Training
- Technology Monitoring & Review
- Research & Development Initiatives
- Industry Networking
- Capacity Building
- Technical & Economic Assessments
- Demonstration Projects
- Power Smart Programs



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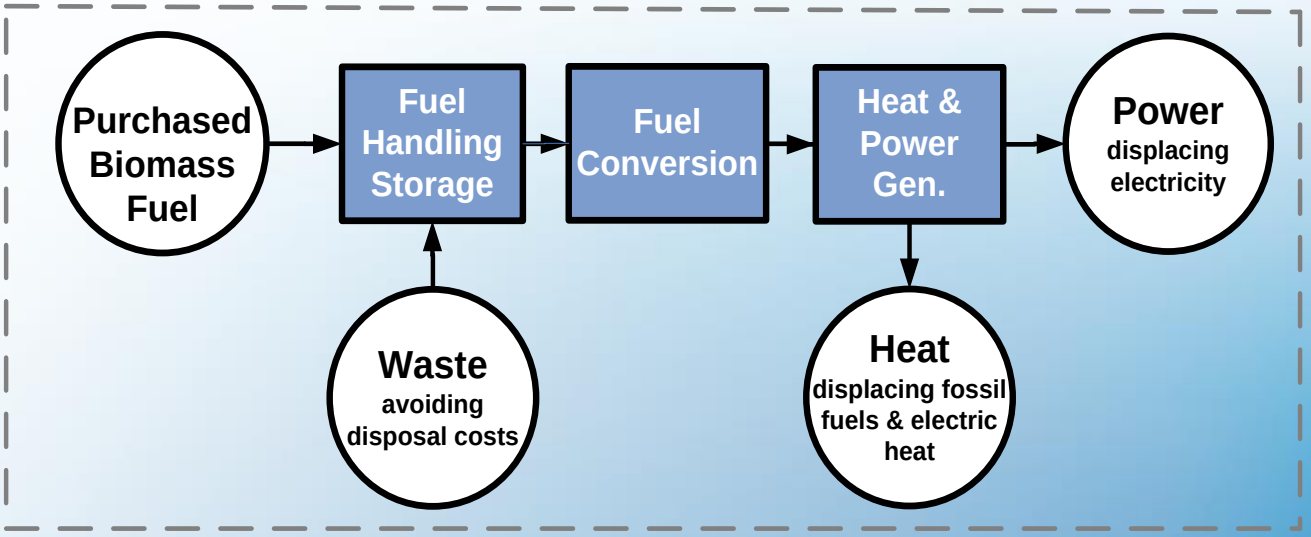
Power Smart Program Concept; Customer View



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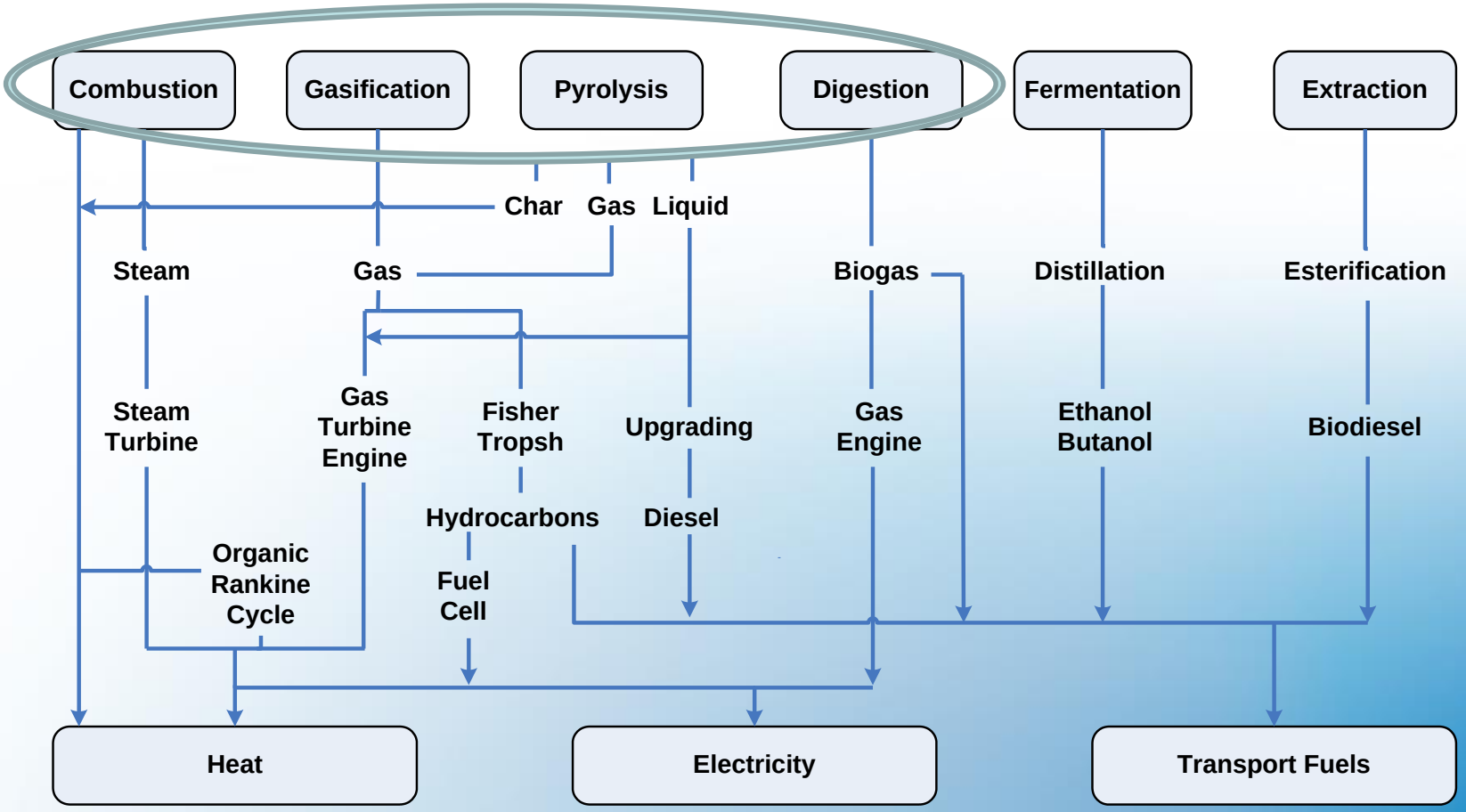

Conversion Pathways

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Demonstration Project Components

- **Pyrolysis Oil** (***low moisture content, solid biomass to liquid fuel to CHP***)
- **Syngas** (***low moisture content solid, biomass to combustible gas to CHP***)
- **Waste Heat** (***medium moisture content, solid biomass to thermal energy to CHP***)
- **Biogas** (***high moisture content, solid biomass to combustible gas to CHP***)
- **Biocarbon** (***low moisture content, solid biomass to char to CHP***)
- **Remote Community** ***(syngas)***

Co-funding Support provided by the Government of Canada's Clean Energy Fund and the participating hosts sites

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Pyrolysis Oil Component
Biomass → Pyrolysis Oil → CHP

Replacement of heavy fuel oil with pyrolysis oil to fuel a 15 MWe boiler & steam turbine CHP system.

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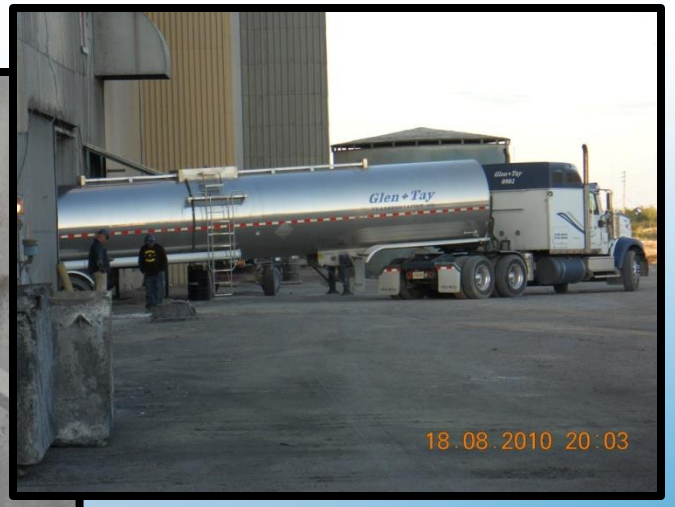
Pyrolysis Oil Component
Biomass → Pyrolysis Oil → CHP



Fuel arrival via tanker & fuel pumping skid.

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Syngas Component
Biomass → Syngas → CHP

Gasification of wood wastes to fuel a 100 kWe internal combustion engine driven CHP system.

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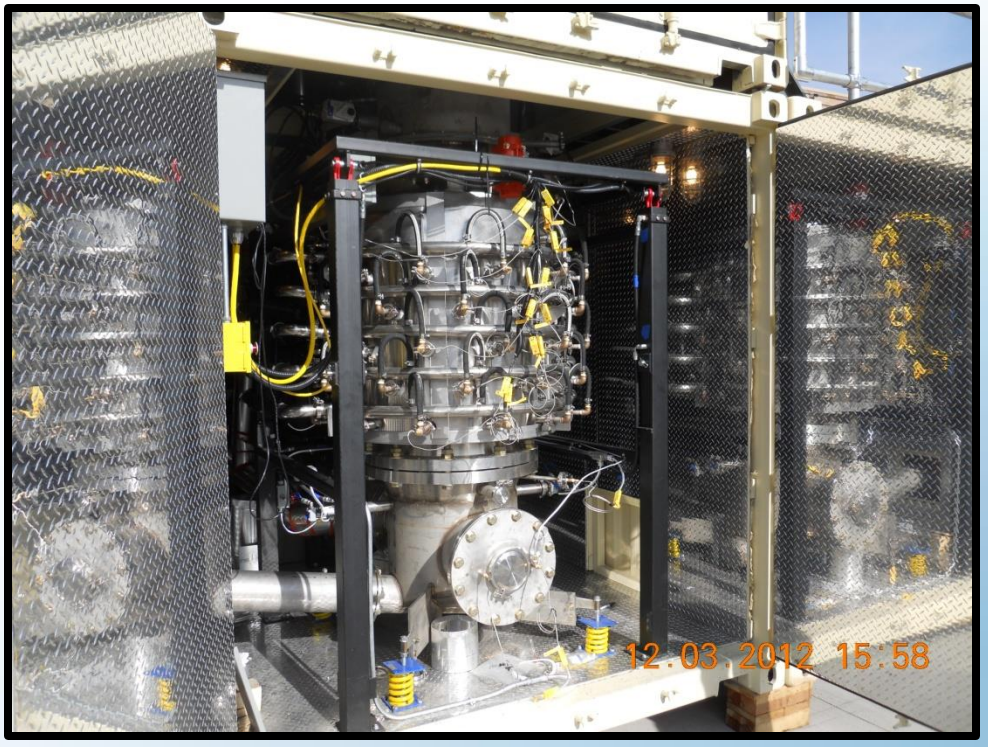
Syngas Component
Biomass → Syngas → CHP



Downdraft micro-gasifier.

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Waste Heat Component
Biomass → Thermal Energy → CHP

Combustion of wood wastes and recovery of heat to fuel a 100 kWe Organic Rankine Cycle (ORC) CHP system.

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Waste Heat
Thermal Energy → Power

CEATI Technical Brief T102700-0529
Waste Heat Inventory and Potential for Conversion to Power

Sector	Inventory (MW thermal)		Power Potential (MW power)	
	US	Can	US	Can
Manufacturing	52,598	9,116	8,764	1,143
Pipelines			800	900
NUG	2,175	82	384	14
Buildings	5,720	365	471	30

Quality

- High grade ≥600 C
- Medium grade 200 C to 600 C
- Low grade ≤200 C

Sources

- Stack losses
- Steam losses
- Process gas
- Liquid losses

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Biogas Component
Biomass → Biogas → CHP

Production of biogas via the anaerobic digestion of organic wastes to fuel a 70 kWe internal combustion engine driven CHP system.

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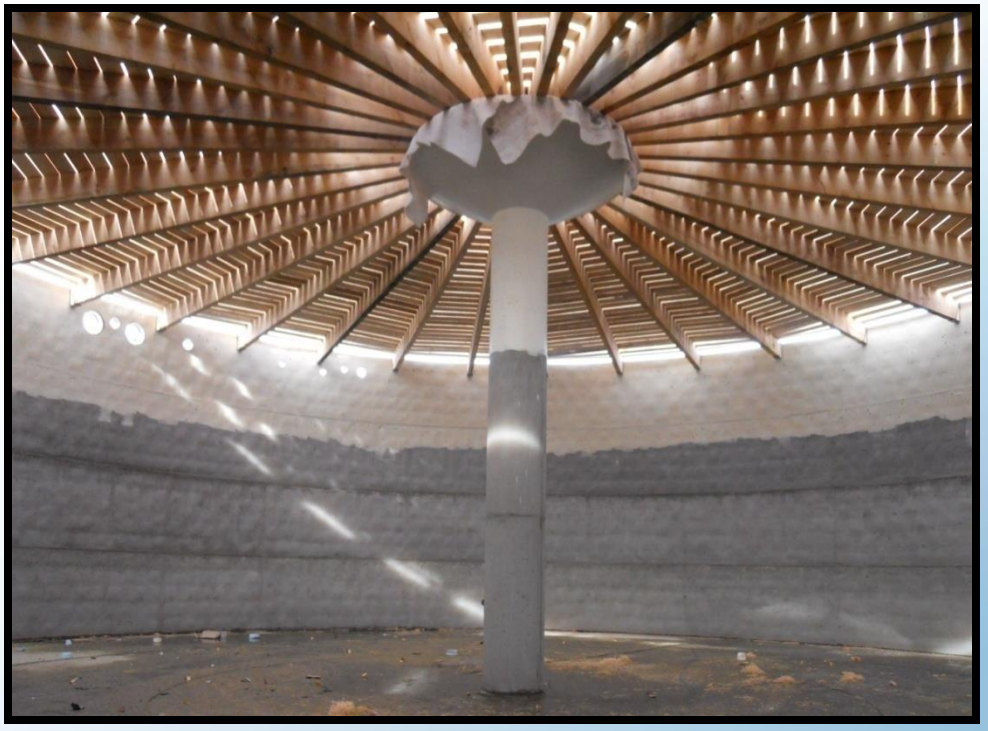
Biogas Component
Biomass → Biogas → CHP



Interior of anaerobic digester. Overhead frame work supports bacteria that feed on hydrogen sulfide.

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Biocarbon Component
Biomass → Char → CHP

Carbonization of wood chips to fuel separate solid fuel combustors and utilization of residual carbonizer heat via 400 kWt waste heat boiler.

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Biocarbon Component
Biomass → Char → CHP

Biocarbon combustion trial.

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Remote Community Component (Syngas)

- **Demonstrate alternatives to traditional diesel engine generated power capable of deployment to a remote community in the future.**

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What was learned

- **Technical**
  - Standards & grading for feedstocks.
  - Designs to address climatic conditions.
  - Government sponsorship development of standards.
  - Better education of stakeholders.
- **Regulatory**
  - Significant barrier based on business as usual scenarios.
  - Government must update/modernize regulations, procedures, and practices.
- **Market**
  - Reliable and affordable biomass feedstocks.
  - Establish markets for pyrolysis oil and biocarbon.
  - Government support for small companies.

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Questions

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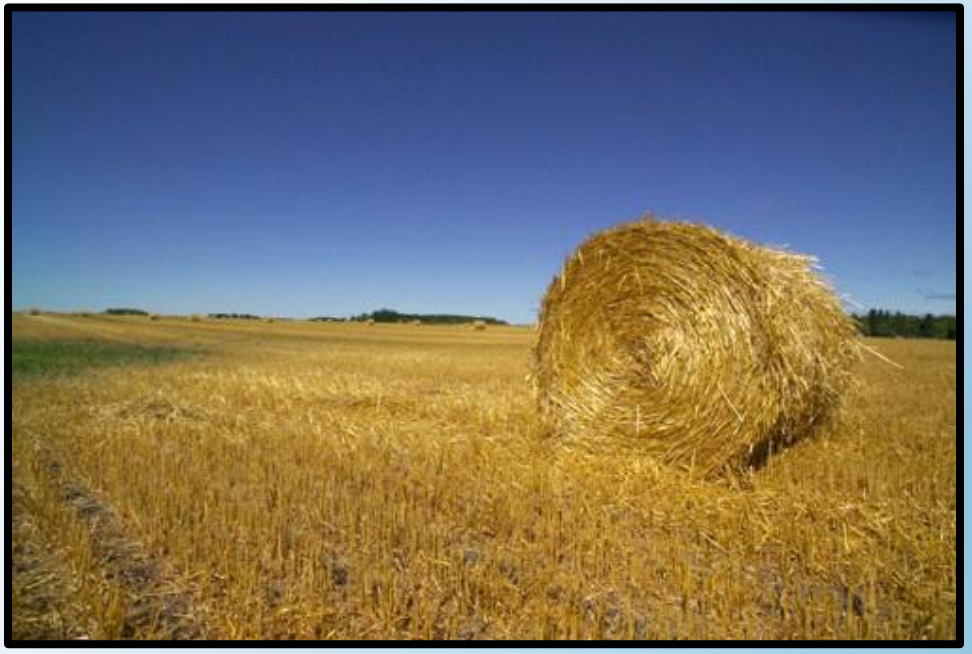

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