



# CanmetENERGY

*Leadership in ecoInnovation*

## Gasification Research

*Gasification breaks down virtually any carbon based feedstock into its basic constituents. This enables the separation of pollutants and greenhouse gases to produce clean gas for efficient electricity generation, production of chemicals, hydrogen and clean liquid fuels. CanmetENERGY houses Canada's foremost R&D facility in the field of gasification.*

### CanmetENERGY's Research Services

CanmetENERGY's research services are playing a leading role in the development of potential applications for gasification. CanmetENERGY offers these specialized services to assist utilities and other industrial groups with:

- Developing gasification, syngas treating, and hydrogen production technologies;
- Testing gasification-related instrumentation;
- Validating mathematical models with pilot-scale gasification tests;
- Generating gasification performance data;
- Performing feasibility studies for the application of gasification technologies; and
- Determining chemical species partitioning in effluent streams.

### Expertise

#### ***Technology Development***

CanmetENERGY has been in the R&D business for over 80 years. Our staff offer a broad range of knowledge and experience, supported by world-class research facilities. Services and support for technology development and commercialization, whether privately or under consortia, are available at CanmetENERGY. CanmetENERGY works collaboratively or for fee with international, public, and private sector organizations.

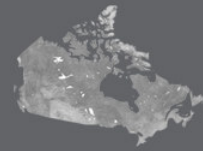


CanmetENERGY has been involved in coal gasification for over 20 years. CanmetENERGY is currently focusing its gasification research in two key areas:

- Enabling gasification technology in Canada
- Developing advanced combined cycle gasification plants with integrated carbon dioxide capture

#### ***Business Plan Development & Feasibility Studies***

Our staff are able to provide technical support and, where required, laboratory services at every stage of the technology development cycle, from feasibility studies and basic R&D, to field-testing and incremental technology improvements, to market studies and evaluation services. Once a technology becomes market-ready, CanmetENERGY can assist companies in transferring processes and products to the marketplace.



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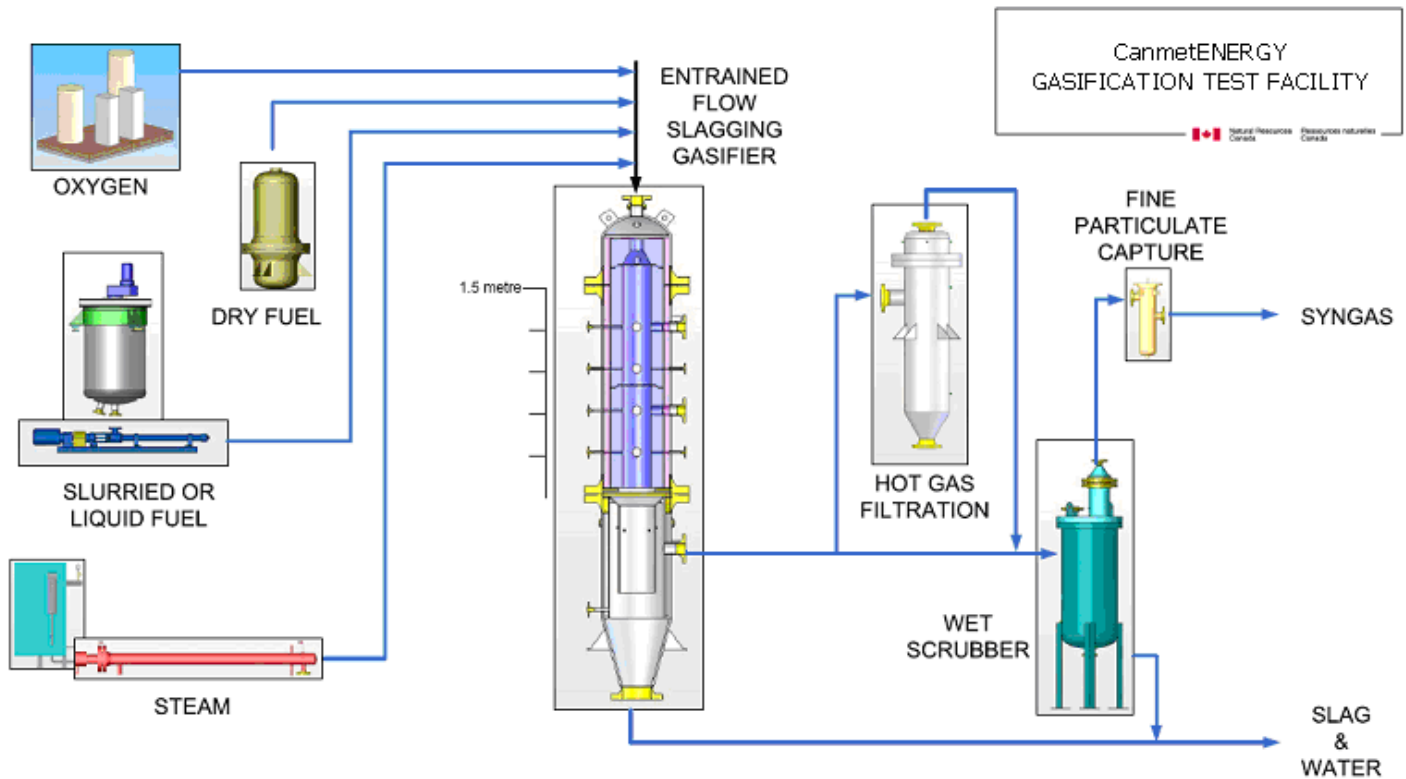


Figure 2: Flowsheet of CanmetENERGY's Pressurized, Entrained-flow, Pilot-scale Gasification

## R&D Facilities

### **Entrained Flow Gasification**

The CanmetENERGY entrained flow slagging gasifier (Figure 1, 25.4 cm ID, operating at up to 1500 kPa and 1650°C) is capable of operating with dry feed or with a slurry feed. The reactor is refractory lined with many ports for gas and solids sampling. Samples can be taken at various axial and radial positions with radial position controlled by a servo motor table accurate to within 100 microns. The reactor is sectional in design, allowing the addition or removal of sections to investigate alternate gasification geometries. The quench system is capable of fully or partially quenching the syngas. The gas treating section of the gasification pilot plant has been designed to allow the integration of third-party technologies such as advanced shift reactors,

hot gas clean-up facilities, high-pressure membrane H<sub>2</sub> separation, CO<sub>2</sub> capture and fuel cells.

Gas analysis is performed using an on-line gas chromatograph capable of measuring CO, CO<sub>2</sub>, CH<sub>4</sub>, H<sub>2</sub>, O<sub>2</sub>, COS, H<sub>2</sub>S and N<sub>2</sub> once every three minutes. Other gases, liquids, and solids can be analyzed by the in-house characterization laboratory. System control and data acquisition are performed by an industrial distributed control system, Freelance 2000 by ABB.

The gasification pilot plant configuration (depicted in Figure 2) is only one of many possible configurations feasible at CanmetENERGY. Our in-house engineering team can modify the pilot plant as required to meet client needs as has been done for companies such as ConocoPhillips and Pratt & Whitney Rocketdyne.



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There are a number of suitable feedstocks for the entrained flow gasifier pilot plant including:

## Solids

- Coal
- Petroleum Coke
- Biomass
- Waste

## Liquids

- Refinery Resid
- Oils Sands Bitumen
- Spent Lubrication Oil
- Biomass

## Process Simulation & Evaluation

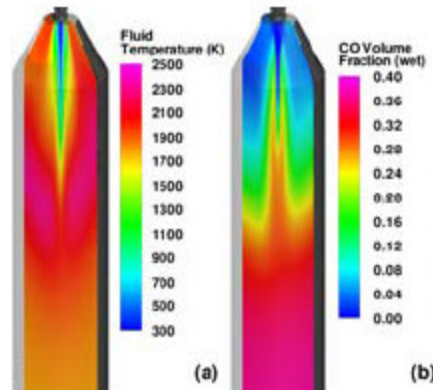
Gasification, syngas treatment, hydrogen production, IGCC and polygeneration systems are simulated and optimized via commercial process simulators. Entrained flow gasifier performance tests are simulated to ensure realistic pilot plant results are obtained with reliable closure of mass and energy balances.

## Computational Fluid Dynamics

Two- and three-dimensional computational fluid dynamics modelling of burner oxidant/fuel mixing, heat transfer, species identification and reactions can be applied to improve equipment availability, reduce emissions and optimize costs. Field and laboratory measurements are conducted to verify and refine the models developed.

## Coal Reactivity

A high pressure (7.0 MPa) thermogravimetric analyzer with variable gas and steam composition can provide time/temperature histories of coal devolatilization and char burnout. The data generated is used in mathematical models for validation and is used to develop new models for evaluating gasification processes.



*Cross-section plots of temperature and CO fraction of CanmetENERGY slagging gasifier*

## Analytical Standards

As part of CanmetENERGY's contribution to standards development by ISO, ASTM and IUPAC, extensive work is being done in three major areas:

- Protocols for analyzing coal and ash, solid products, trace elements and leachates;
- Methods for analyzing trace contaminants, such as Hg and PAHs.

## Characterization Laboratory

The Characterization Laboratory specializes in the analysis of process-derived chemicals, fuels, fuel-related products and by-products in solid, liquid or gaseous state. The laboratory provides clients with physical, chemical, elemental, spectroscopic, chromatographic, and molecular characterization data and their interpretation.



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## Your Invitation to Work With Us

We are interested in collaborating with you. Please contact the Business Office to discuss your particular needs.

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