Image above: The CETC-Ottawa gasifier is sectional in design allowing modification to meet client needs.

Image below: The gasifier is capable of running with a dry feed or a slurry feed.

Image above: Slag is separated from the syngas in the quench vessel.

Image below: Oxygen can be supplied to the gasifier at elevated temperatures in order to increase reactivity.

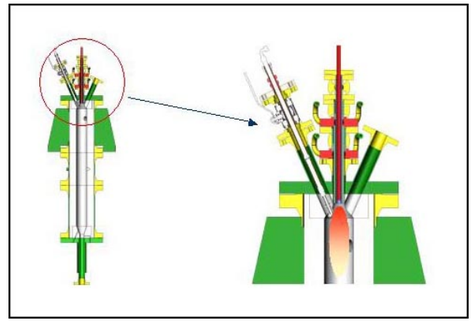
Natural Resources Canada | Ressources naturelles Canada

CETC CANMET ENERGY TECHNOLOGY CENTRE

FLUIDIZED BED COMBUSTION - GASIFICATION

GASIFICATION RESEARCH

The CANMET Energy Technology Centre-Ottawa (CETC-Ottawa) houses Canada's foremost R&D facility in the field of gasification. Gasification technologies represent the next generation of solid feedstock based energy production systems. 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.



The CETC-Ottawa Entrained Flow Gasifier in Cross-Sectional View with a Detail Illustrating the Construction of the Burner

CLEAN ENERGY TECHNOLOGIES

CETC-Ottawa's Research Services

CETC-Ottawa's research services are playing a leading role in the development of potential applications for gasification. CETC-Ottawa 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

CETC-Ottawa has been in the R&D business for over 80 years. Our staff offers 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 CETC-Ottawa. They can also be arranged at alternate sites in the national network of federal laboratories. CETC-Ottawa works closely with major stakeholders in the Canadian energy and R&D sectors. We can help to form strategic partnerships among technology developers, suppliers and users, and to form research consortia. Partners include private sector companies, utilities, federal government departments, other levels of government, universities and other research bodies. CETC-Ottawa also works collaboratively with international public and private sector organizations.

CETC-Ottawa has been involved in coal gasification for over 20 years, and played a leading role in the Canadian Coal Gasification Technical Committee. CETC-Ottawa is currently focusing its gasification research in two key areas:

Canada

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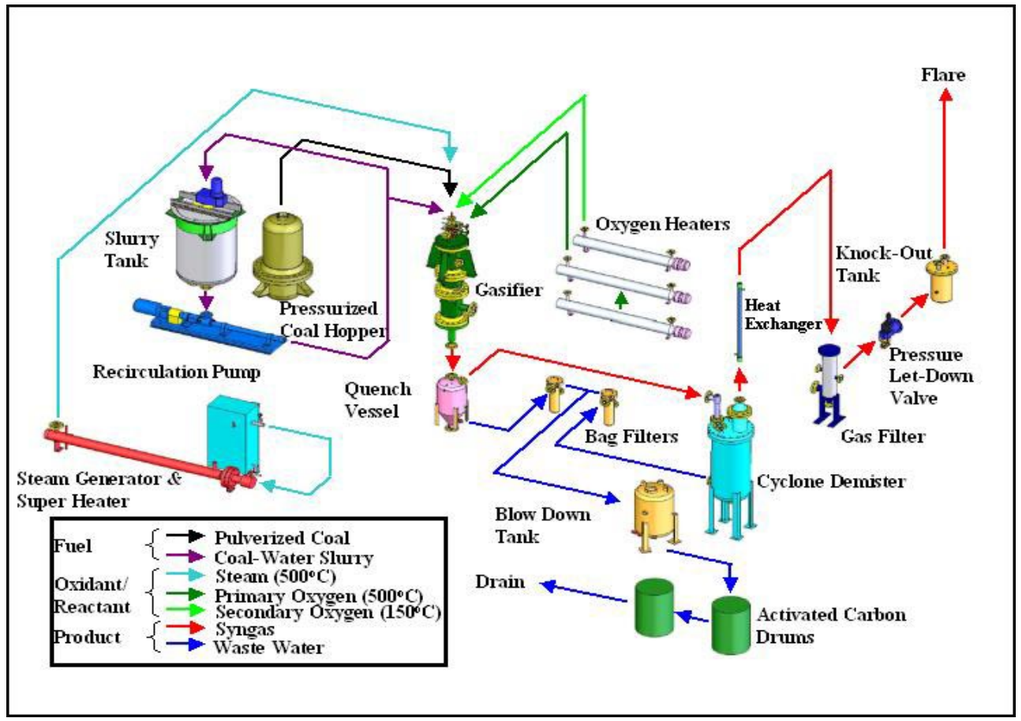

Figure 1. Flowsheet of CETC-Ottawa's Pressurized, Entrained-flow, Pilot-scale Gasification Facility

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

Simulation and Process Control

Gasification, syngas treating, and hydrogen production systems are simulated and optimized via the ASPEN Plus process simulator. Entrained flow gasifier performance tests are simulated to ensure realistic pilot plant results are obtained with reliable closure of mass and energy balances.

Business Plan Development & Feasibility Studies

Our staff is 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, CETC-Ottawa can assist companies in transferring processes and products to the marketplace.

Mathematical Modelling

Two- and three-dimensional computational fluid dynamics modelling of burner oxidant/fuel mixing, heat transfer, species identification and reactions (e.g., NO_x formation) 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.

R&D Facilities

Entrained Flow Gasification

The CETC-Ottawa entrained flow gasifier (12.7 cm ID, operating at up to 1500 kPa and 1600ºC) is capable of running as a dry feed or slurry feed gasifier. The reactor is sectional in design, allowing the addition or removal of sections to investigate alternate gasification geometries. 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, and fuel cells.

Gas analysis is performed using a mass spectrometer capable of measuring the concentrations of 16 different gases over a 20-second period. 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 1) is only one of many possible configurations feasible at CETC-Ottawa. Our in-house engineering design team can modify the pilot plant as required to meet client needs.

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

Solids

- Coal
- Petroleum Coke
- Biomass
- Waste

Liquids

- Refinery Residue
- Oils Sands Bitumen
- Spent Lubrication Oil
- Black Liquor
- Hazardous waste

Laser Optical Measurements

Gasifier operations rely on a combination of temperature measurement and cold gas composition analysis for reactor control. The development of in-situ composition analysis would reduce operational and maintenance costs, provide the necessary data to improve control of the gasification process, increase efficiency, and enhance reliability and availability of gasification systems. The CETC-Ottawa gasifier is ideally suited for the development and testing of gasification-related instrumentation.

Coal Reactivity

A 63 mm diameter x 2 m long entrained flow combustion reactor provides 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.

Analytical Standards

As part of CETC-Ottawa'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 combustion products, trace elements and leachates;
- Emissions such as Hg, NO_x, SO_x, CO and particulates; and
- Methods for analyzing trace contaminants such as polycyclic aromatic hydrocarbons (PAHs).

Characterization Laboratory

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

Collaborative Accomplishments

A variety of arrangements are available to assist industry in the application of this technology. At CETC-Ottawa, development of gasification technology is supported by in-house pilot-scale research, by contract research at both fundamental and pilot-scale levels, and by technical support of major demonstration projects.

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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