



# ZERO-EMISSION TECHNOLOGIES

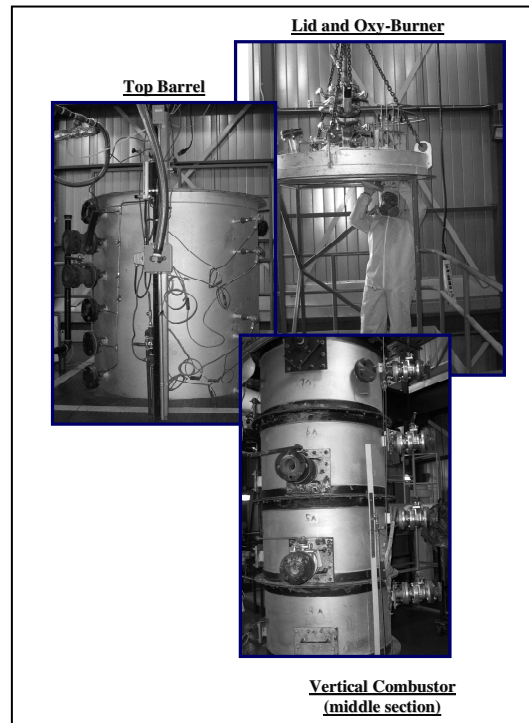
CLEAN ENERGY TECHNOLOGIES

## OXY-FUEL COMBUSTION WITH CARBON DIOXIDE (CO<sub>2</sub>) CAPTURE

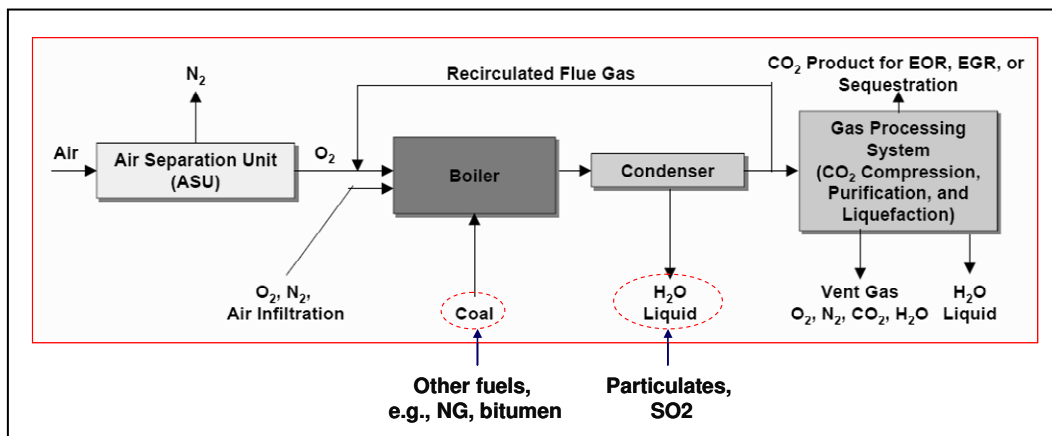
CETC-Ottawa's innovative and collaborative program on oxy-fuel combustion tackles the burning of carbon-based fuels in the most cost effective and energy-efficient way. The program helps industry to determine the most economic options for reducing greenhouse gases (in particular CO<sub>2</sub>), mercury, SO<sub>x</sub> and NO<sub>x</sub> emissions, and the disposition of combustion products.

### Background

Increasingly, public concern over global climate change has focused on man-made emissions of greenhouse gases, particularly the release of CO<sub>2</sub> during the combustion of fossil fuels. Oxy-fuel combustion with flue gas recycling offers a means of burning fossil fuels in an oxygen-enriched environment and capturing CO<sub>2</sub> by direct physical compression and cooling techniques, such as cryogenic separation. CETC-Ottawa's Oxy-Fuel Combustion Program enables industrial clients to examine new equipment design principles and process configurations for advanced oxy-fuel combustion systems with CO<sub>2</sub> capture, that will determine the most cost-effective approach for commercial deployment of these systems.



CETC-Ottawa's Pilot-Scale Vertical Combustor Oxy-Fuel Research Facility



Oxy-Fuel Combustion Process with CO<sub>2</sub> Capture and Flue Gas Recycle

## Oxy-Fuel Combustion Applications

The diagram illustrates the application of oxy-fuel technology with flue gas recycle option for new-plant or retrofit situations. The technology yields better energy efficiency when plant burning natural gas or gas-derived applied to a combined-cycle from coal gasification. In this case a gas turbine uses CO<sub>2</sub> as the primary working fluid and combustion occurs in a CO<sub>2</sub>/O<sub>2</sub> medium. The use of flue gas recycling combined with a molten carbonate fuel cell is another efficient approach to power generation. Natural gas or synthetic gas from coal gasification is oxidized at the cell anode while the spent gas is burnt in oxygen to provide a CO<sub>2</sub>-rich flue gas for use at the cathode.

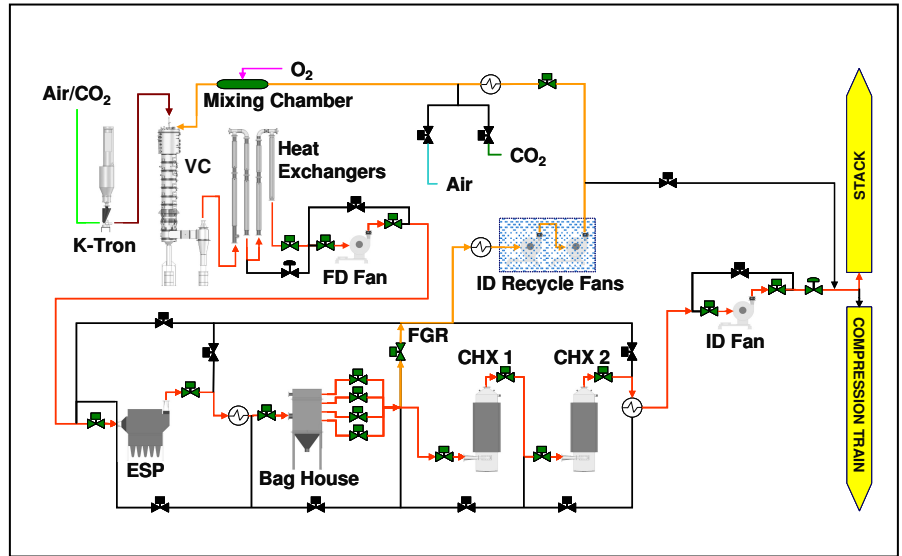
## CETC-Ottawa's Capability

CETC-Ottawa's research facilities include expert staff, pilot plant facilities, state-of-the-art modelling and simulation tools and an extensive analytical capability. Recently the program successfully renewed its registration to ISO 9001:2000.

CETC-Ottawa tests oxy-fuel combustion processes in its pilot-scale Vertical Combustor facility (see process flow diagram). The facility provides an advanced platform for the development of near-zero emission fossil fuel technologies and oxy-fuel combustion research. It is being used to develop advanced burners and combustors, integrated multi-pollutant processes, CO<sub>2</sub> capture and compression processes, as well as testing and validation of concepts, processes, prototypes and models related to near-zero emission combustion systems.

## Pilot Plant Features

Built in 1994, the 0.3 MW<sub>t</sub> (1 million BTU/h) Vertical Combustor is a highly modular and flexible state-of-the-art air- and oxy-fired pilot scale research facility. The facility is capable of firing natural gas, oil, coal, coal slurry, bitumen and emulsion in a controlled environment. The effect of variable oxygen purity on the composition of the flue gas can be simulated. Gas flow rate, heat flux and temperature can be measured through several measuring ports. Entrained fly-ash can be withdrawn for analysis at all critical points. On-line gas analysis and advanced continuous emission monitors for mercury (total and species) and other gases are also available.



Process Flow Diagram of CETC-Ottawa's Pilot-Scale Oxy-Fuel Combustion Facility and Flue Gas Treatment Units



## 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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