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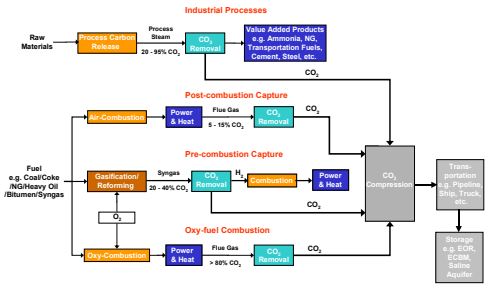
An Integrated Approach for Oxy-fuel Combustion with CO_2 Capture and Compression

Summary and Conclusions

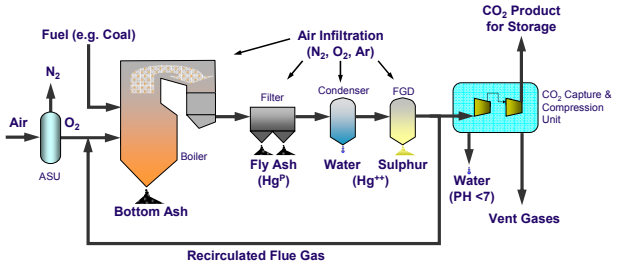
The capture and storage or reuse of carbon dioxide (CO_2) from the combustion of fossil fuels as well as industrial off gases represents an opportunity to achieve a significant reduction in anthropogenic greenhouse gas (GHG) emissions. Fossil fuel combustion is expected to dominate the energy structure in at least the next few decades. Unfortunately, given the current state of technology development, non-fossil fuel energy alternatives such as nuclear, biomass, solar or wind, are not feasible. Thus, in order to remain competitive and environmentally sustainable in the future global energy market, industry will need to incorporate CO_2 capture and storage option in the overall strategy for reducing their GHG emissions. Currently, there are three main approaches for capturing CO_2 from the combustion of fossil fuels: pre-combustion, post-combustion, and oxy-fuel combustion. Pre-combustion and post-combustion capture options use physical or chemical solvents to separate and capture CO_2, whereas in oxy-fuel combustion capture and compression are achieved using a physical separation process. This is due to the fact that oxy-fuel combustion uses oxygen instead of air, which theoretically eliminates nitrogen from the flue gas stream.

The Zero-Emission Technologies (ZET) Group of CANMET Energy Technology Centre in Ottawa (CETC-O) has developed an innovative separation process that captures CO_2 from flue gas streams with concentrations as low as about 50% (vol., dry) and delivers a CO_2 product stream with purity of more than 95%. Based on this process, a CO_2 capture and compression unit (CO_2CCU) has been design, which is slated to be installed and integrated with CETC-O's 0.3 MW_{th} oxy-fuel combustion facility in summer 2008. Once installed and commissioned, the integrated system – CO_2CCU and oxy-fuel combustion facility – will be a first of its kind in the world, providing a unique research platform for research and demonstration of CO_2 separation and compression in fossil fuel combustion processes. This platform will provide insight into CO_2 separation process, phase change and impurities behavior, leading to the creation of a unique database which will be indispensable to the large scale implementation of this integrated approach.

CO_2 Capture Technology Pathways

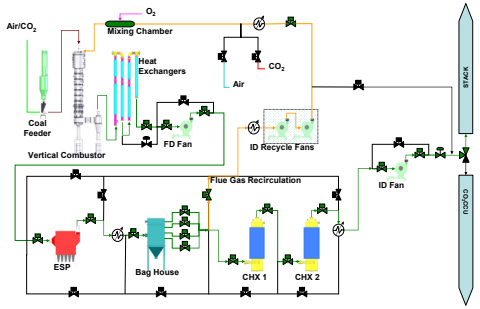


Oxy-Fuel Combustion



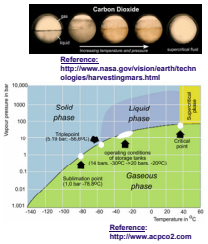
Vertical Combustor Research Facility (VCRF)

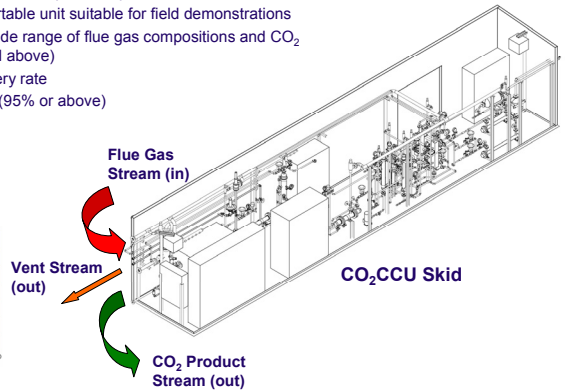
- Highly modular state-of-the-art air- and oxy-fired plant
- Nominal output of about 0.3 MW_{th}
- Natural gas, coal, coal slurry, heavy oil and bitumen can be burned in a controlled environment
- Can be used to develop novel integrated multi-pollutant control technologies, including NO_x, SO_x, and Hg with CO_2 capture
- Equipped with advanced process control and flue gas continuous monitoring systems

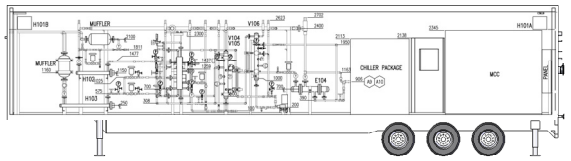


CO_2 Capture & Compression Unit (CO_2CCU)

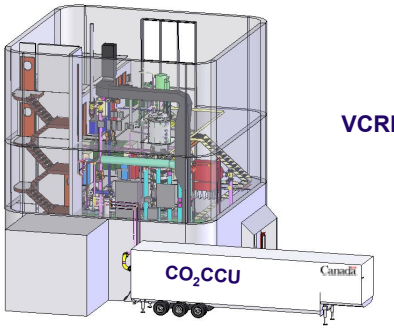
- Innovative CO_2 capture and compression process
- Trailer-mounted transportable unit suitable for field demonstrations
- Capable of handling a wide range of flue gas compositions and CO_2 concentrations (50% and above)
- High CO_2 product recovery rate
- High CO_2 product purity (95% or above)



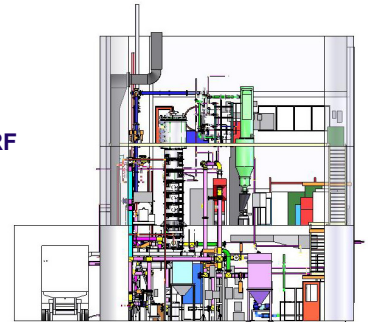




Trailer-Mounted CO_2CCU Skid



VCRF



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