

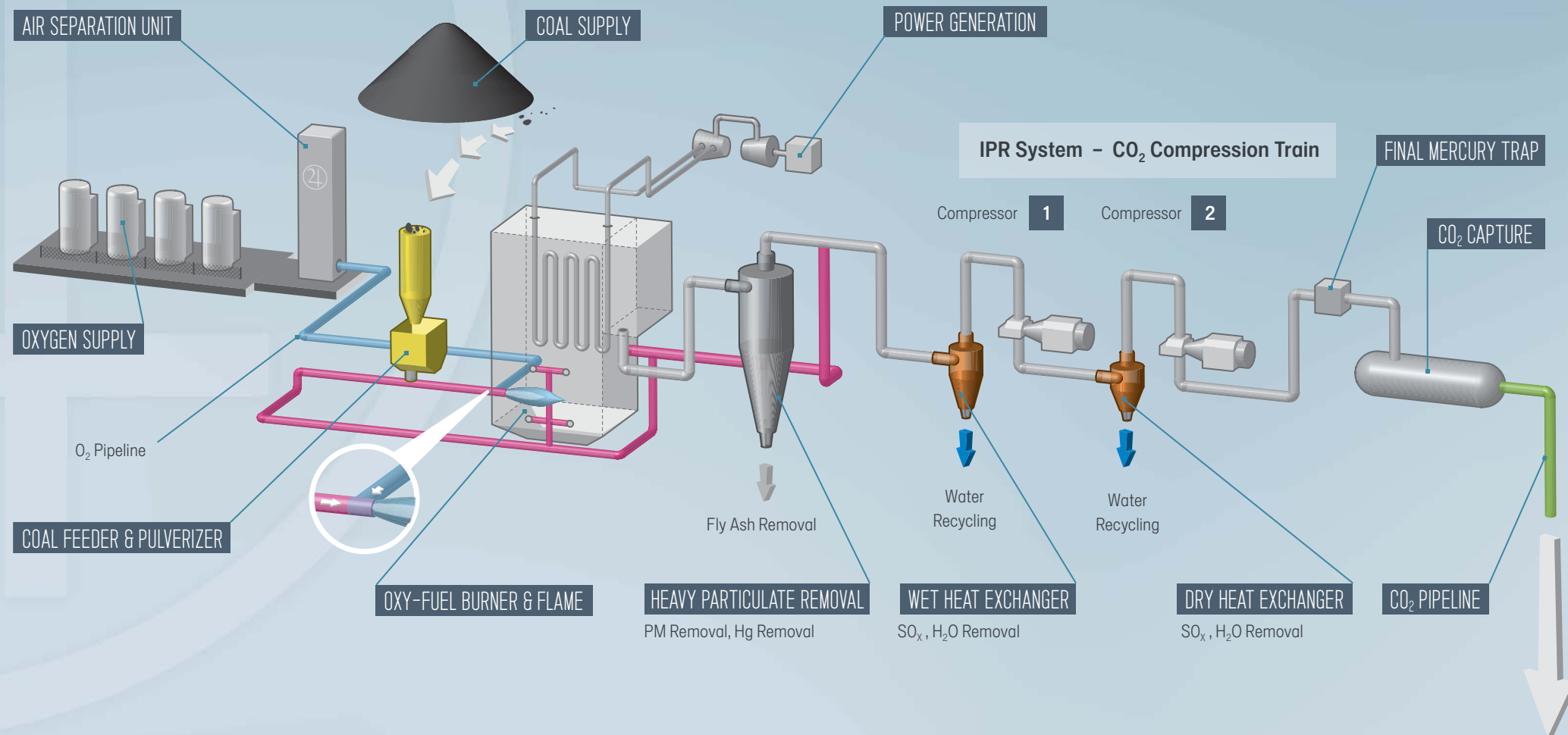
CLEAN TECHNOLOGY ON THE RISE

JUPITER OXY-FUEL RESEARCH CENTER
Leading the way in oxy-fuel technology application

WORLDWIDE

24 JOC OXY-FUEL IPR* SYSTEM DETAIL: CLEAN COAL POWER GENERATION

*Integrated Pollutant Removal (IPR™) System, NETL US DOE



REALIZE ULTRA LOW EMISSIONS FROM FOSSIL FUEL POWER PLANTS

Jupiter's patented **oxy-fuel technology** makes it possible *and* affordable!

RETROFIT STEPS

- A** Add oxygen plant or pipeline source
- B** Implement special oxy-fuel burners and oxy-fuel control system
- C** Install flue gas recirculation ducting if necessary
- D** Install Integrated Pollutant Removal (IPR™) with CO₂ capture train
- E** Connect to pipeline for underground storage or EOR

CO₂ Underground Storage and Use

- Specific Geological Formations
- Enhanced Oil Recovery (EOR)
- Enhanced Gas Recovery (EGR)
- Enhanced Coal-Bed Methane (ECBM) Recovery

The figure above is a pictorial representation of the Integrated Pollutant Removal (IPR™) System in the context of a complete oxy-combustion system. Various configurations are possible. In this version, bulk particulate removal is achieved in the first stage. Thus, the bulk of the ash is removed as a dry powder. Note that the bulk particulate removal operates on the full flue gas stream, which is split, after this bulk particulate removal, into a recycle stream and a product stream. The product stream is treated by IPR. Before the first stage of compression, a wet heat exchanger can be used with a caustic solution for SO₂ and fine particulate removal along with condensation

of flue gas moisture. The water from this process is sent to water treatment, which will generate a waste stream including any contaminants removed, excess reagents and reaction products. Subsequent stages of compression and wet or dry heat exchange will remove remaining contaminants with the condensed water and, in the last stage, with condensed CO₂ as well. Mercury salts will be removed in the aqueous phase. Mercury vapor may require an activated carbon trap or other device. The final product stream is supercritical CO₂, which can be pumped to supercritical conditions and delivered via pipeline for enhanced oil recovery or sequestration.

VISIONARY INNOVATION | SCIENTIFIC APPROACH | OPERATIONAL EXPERIENCE

Jupiter Oxygen's patented technology development, i.e., using a high flame temperature oxy-fuel combustion process for maximizing heat transfer in industrial furnaces and boilers, results in ultra low levels of key pollutants while removing the barriers for carbon capture. The technology provides the pathway for an environmentally friendly and economically sound power plant policy.



Our Unique Approach

- Undiluted high flame temperature
- Maximized heat transfer
- Improved efficiency of burner and boiler
- Advanced flame stability
- Achieved fuel & cost savings

Jupiter Oxygen's approach avoids replication of an air-fired equivalency through the introduction of recycled flue gas into the oxygen stream to the burner, that:

- Reduces flame temperature, thus reducing radiation quality and quantity
- Results in less energy available for heat transfer in the boiler



Research Center

- Located in Hammond, Indiana
- 30,000 square foot site
- 60,000 pound per hour super heated steam boiler
- 105 ton per day cryogenic plant
- Data collection system
- Integrated Pollutant Removal (IPR™) System
- Equipment to supply and control a variety of fuel sources:
 - Pulverized coal
 - Natural gas

Jupiter's Oxy-Fuel Technology is Key...

- No Air, No Nitrogen — Ultra-low NO_x without costly back-end control
- Less fuel used to produce steam
- Flue gas exhaust from the boiler is 1/4 of air-fired

...for Significant Emission Reduction

- 95% capture of CO₂ from coal combustion
- 99% sulfur reduction
- 90% mercury removal
- 99% removal of all particulates

PRACTICAL TECHNOLOGY

Fossil Fuel Carbon Capture • Increased Energy Efficiency • Greenhouse Gas Solution



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