FETC SUCCESS
U.S. Department of Energy
Federal Energy Technology Center

CLEAN AFFORDABLE POWER

- [x] fossil energy
- [ ] environmental
- [ ] energy efficiency
- [ ] other

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Non-Cryogenic Oxygen Production

States Impacted:
Illinois, Ohio, Pennsylvania, Utah, West Virginia

Benefit Areas:
Energy Independence, Cost Reduction, Environmental Performance, Industrial Competitiveness

Participants:
Air Products and Chemicals, Inc.; Eltron Research, Inc.; Ceramatec; McDermott Technology; Texaco, Northern Research and Engineering Company; Pennsylvania State University

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Description

Researchers are developing a lower cost method of producing high-quality oxygen for (1) stand-alone air separation plants, (2) integration with future energy production technologies, and (3) other oxygen-intensive processes.

The Department's Vision 21 program targets low-cost oxygen separation as one of the key research goals for the next decade. Gas separation membranes can provide low-cost, high-quality oxygen for electrical power production (coal-fired utility boilers and oxygen-blown gasifiers) and production of transportation-grade fuels and premium chemicals. The membrane oxygen technology will be developed and scaled-up through a three-phase program to obtain the engineering, operating, and economic data necessary for technology demonstration and eventual full-scale commercialization.

In Phase I, Air Products and Chemicals, Inc., will develop and demonstrate a novel ceramic membrane-based technology for separating oxygen from air. This technology has the potential to separate the oxygen at much lower costs and higher energy efficiencies than conventional capital- and energy-intensive cryogenic processes.

Goals

The objective is to develop membrane-based, non-cryogenic technology for separation of oxygen from air at costs that are potentially one-third lower than the production costs of conventional cryogenic technologies.

Tangible Benefits

National: This technology will reduce the cost of new power production and lower the level of greenhouse gas and criteria pollutant emissions. Non-cryogenic oxygen production could also make the production of alternative fuels such as hydrogen from fossil-based technologies economically attractive. In addition, many oxygen-intensive major U.S. industries, such as, steel, glass, aluminum, paper and pulp, and chemicals, would realize productivity, efficiency, and cost gains as a result of this innovation.

Oxygen is the third largest bulk chemical produced in the United States, the market for pure oxygen is expected to grow significantly. The use of oxygen rather than air would advance electric power generating, pollution control, and other industrial processes beyond current benchmarks of performance and costs by reducing operational complexities and improving environmental performance. A significant source reduction of greenhouse gas emission can be achieved by using oxygen-carbon dioxide mixture as the combustion oxidant for coal-fired utility boilers. This power system modification is possible only if a low-cost oxygen source is available.

Regional: Coal is the primary fossil resource in the eastern Energy Corridor. Low-cost oxygen offers economic benefits for constructing new coal-fired, environmentally responsible, base-load electric power production facilities or modifying existing plants using oxygen-enriched combustion modes to comply with anticipated greenhouse gas regulations. These activities will stimulate the regional mining industry.

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