Electrochemical Membrane (ECM) for Combined CO_2 Separation, Power Generation, and NO_x Destruction

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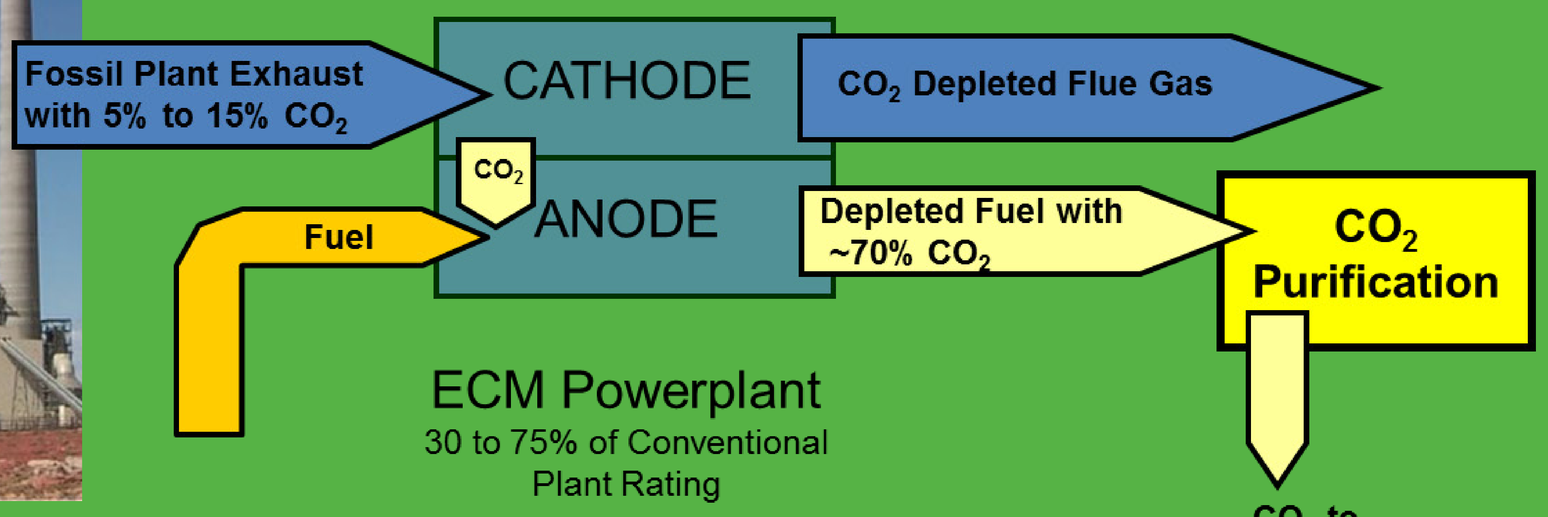
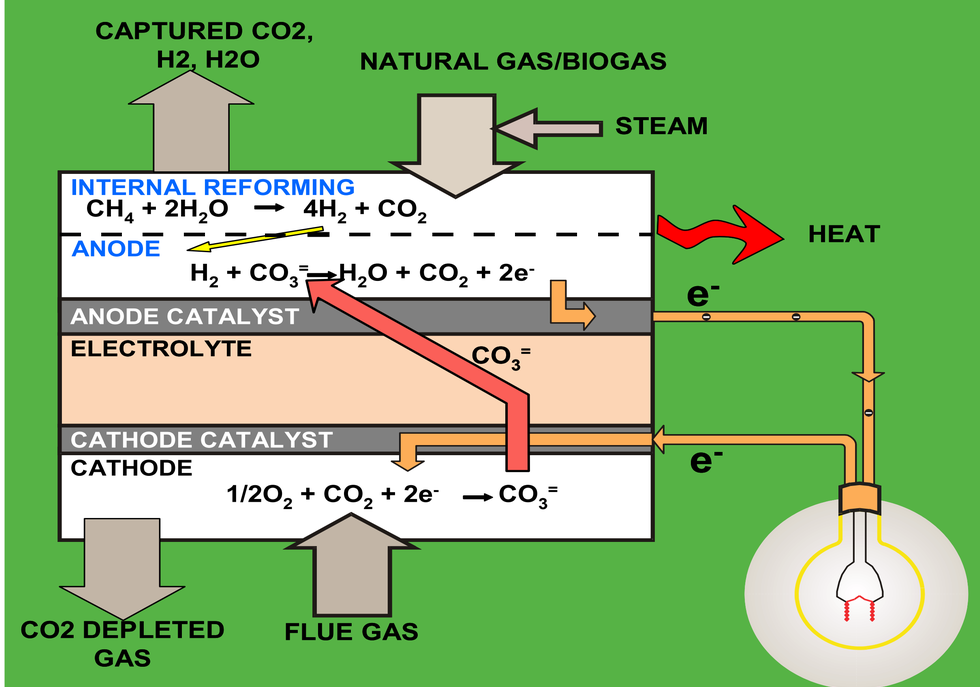
Application of ECM-Based Combined Electric Power and CO_2 Separation (CEPACS) System

Conventional Natural Gas or Coal Plant



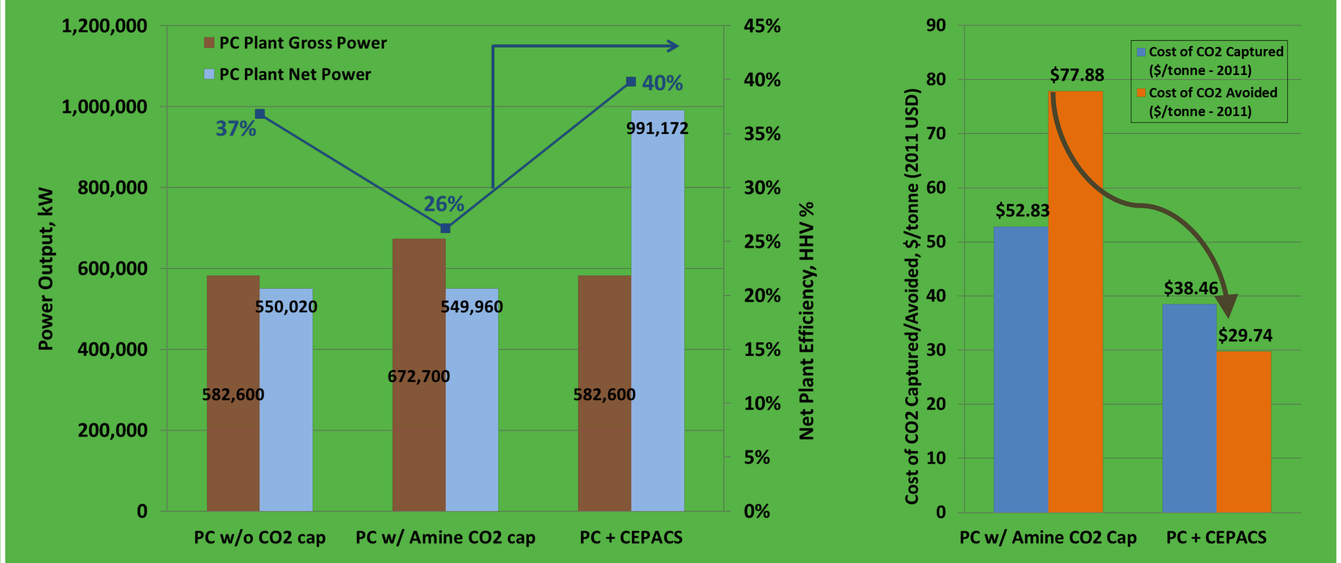
Simultaneous *Power Production* and *CO_2 Separation* from Flue Gas of an Existing Facility

ECM Operating Principle



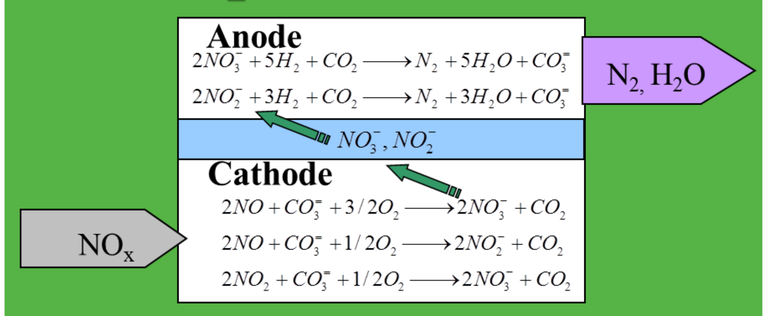
ECM Operation Results in Carbon Dioxide Transfer across the Electrolyte Matrix while Generating DC Power Using a Supplemental Fuel

Case Study: Application of ECM-Based CEPACS System to 550MW PC Plant for 90% CO_2 Capture

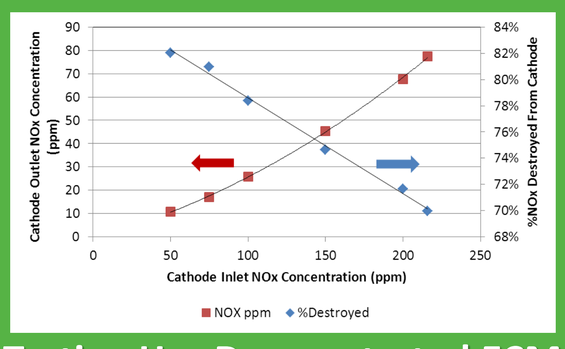


- ECM-Based CEPACS System Increases Plant Net Output and Efficiency while Capturing 90% of CO_2
- ECM-Based CEPACS System Has Significant Cost Benefit Compared to CO_2 Amine Scrubbers

ECM NO_X Destruction Co-Benefit



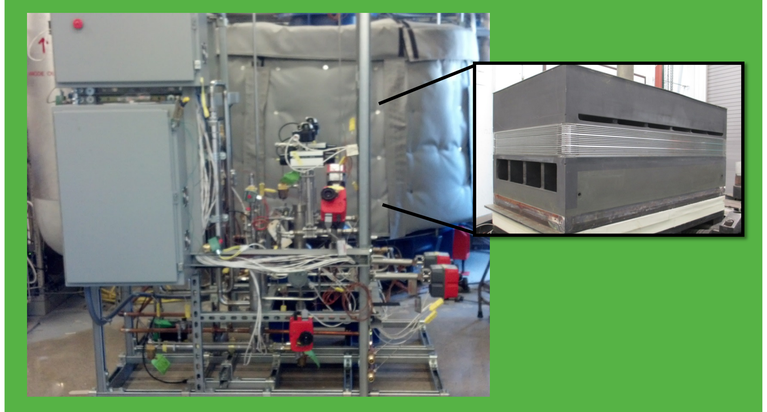
NOx is Removed from the Flue Gas (Cathode), Transferred to the Anode with CO_2, and Destroyed



Testing Has Demonstrated ECM Capability to Destroy > 70% of NOx

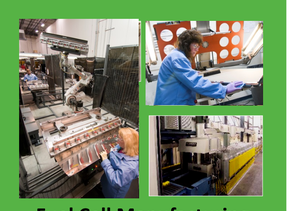
Bench-Scale ECM System Demonstration

- Operations Began July, 2014
- Captures 90% of CO_2 from Simulated PC Plant Flue Gas
- Produces 100 tons/year Liquid CO_2
- Generates ~8 kW of Electricity



Summary and Next Steps

- ECM, Utilizing Commercially Proven Direct FuelCell® Technology, is a Compelling Alternative for CO_2 Capture that is Efficient and Cost Effective
- ECM Commercialization Potential is Benefiting from Higher Production Volumes of Direct FuelCells
- Next Step: MW-Scale Demonstration Capturing CO_2 from Flue Gas Slipstream



Fuel Cell Manufacturing Facility, Torrington, CT

Bridgeport, CT 14.9 MW Fuel Cell System

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