NATIONAL ENERGY TECHNOLOGY LABORATORY

Water Management in Thermoelectric Power Generation

Crosscutting Research Division

Strategic Center for Coal

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U.S. DEPARTMENT OF ENERGY

Water-Energy Management Research and Development

DE-FOA-00001095

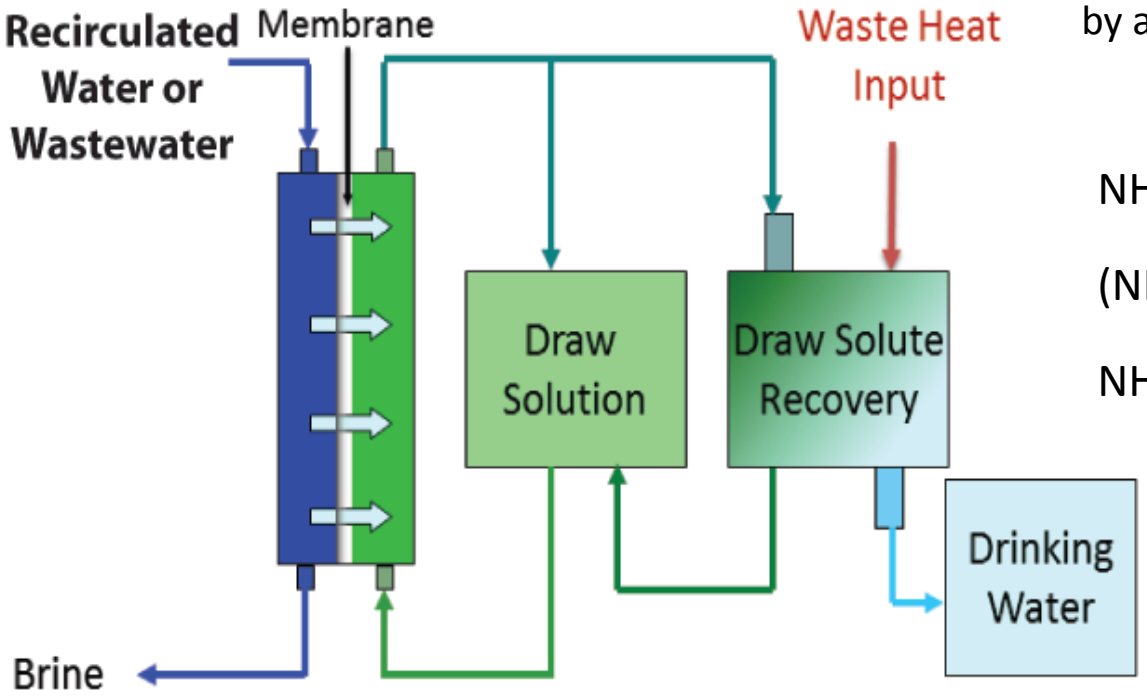
Area of Interest 1

"Innovative Concepts for Managing Water in Fossil Fuel Based Energy Systems "

Subtopic 1-A "Utilization of Low Grade Heat within Existing Power Generation System"

Projects started October, 2014

Forward Osmosis (FO) Process Utilizing Low Grade Heat: Applications in Power Plants Carnegie Mellon University



Generalized FO system design

Draw solute--thermolytic salts created by ammonia and carbon dioxide

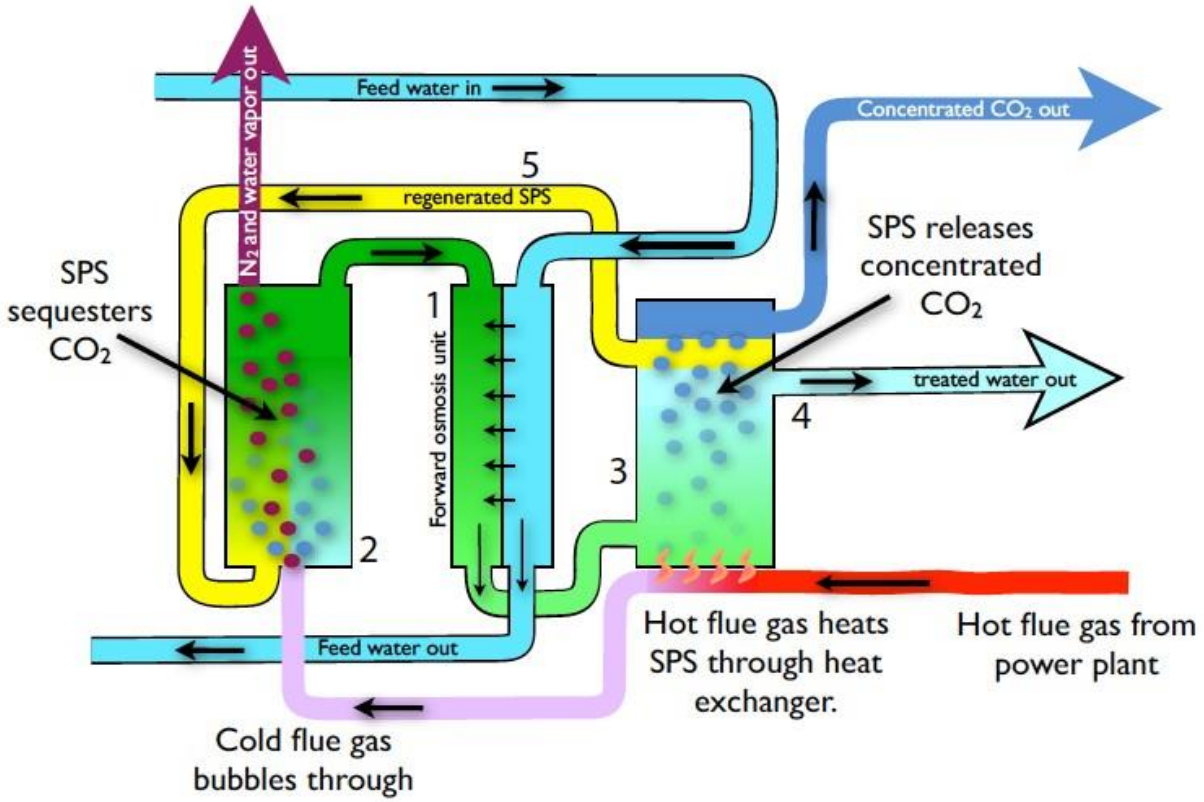
NH_4HCO_3

$(NH_4)_2CO_3$ $\leftrightarrow$ NH_3 + CO_2

$NH_2CO_2NH_4$

Establish rigorous models of the temperature and heat duty of the draw solute recovery system integrated with power plant waste heat to determine FO feasibility.

The COHO (CO_2-- H_2O) – Utilizing Low-Grade Heat and CO_2 at Power Plants for Water Treatment - Porifera



Osmotic pressure drives water across membrane

Draw solution removes CO_2 from flue gas (miscible)

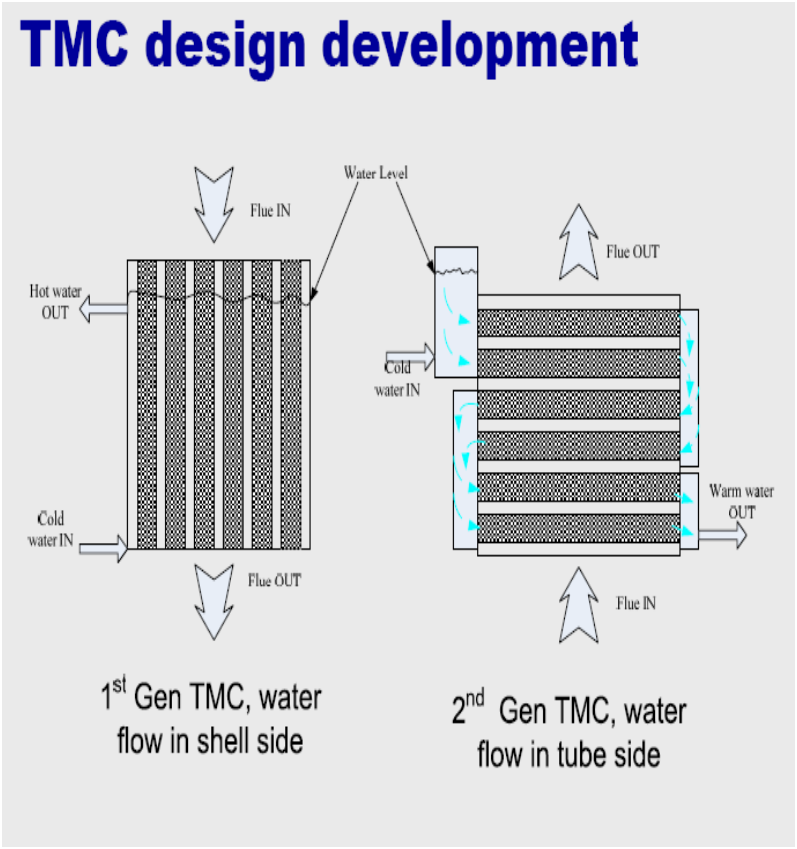
SPS=switchable polarity solvent water miscibility (60 wt%) to immiscibility (>2000 ppm)

CO_2 released with heat (immiscible)

Waste heat used to treat degraded water and capture CO_2 from flue gas.

Simultaneous Waste Heat and Water Recovery from Power Plant Flue Gases

Institute of Gas Technology



Transport Membrane Condenser (TMC)

Media & Process Technology ceramic nanoporous membrane to remove waste heat and water from flue gas.

Development of a Field Demonstration for Cost-Effective Low-Grade Heat Recovery and Use Technology Designed to Improve Efficiency and Reduce Water Usage Rates for a Coal-Fired Power Plant

Southern Company Services, Inc. , Electric Power Research Institute, URS Group

Develop system-level concept that integrates and utilizes waste heat and improves heat transfer.

Addresses the viability of deploying innovative conversion concepts to large-scale power generation systems.

Addresses innovative concepts for utilization of low-grade heat, including facilitation of water treatment, bottoming cycles, and low-cost refrigeration.

Reduces water intake relative to current power practices.

Develops a cost-benefit analysis for large-scale power generation.

A technology recommendation will be made and costs will be developed for a field test of a combined heat-recovery / use process at a Southern Company facility.

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Subtopic 1-B "Low Cost Treatment of Produced Waters "

concentrated brine solution, total dissolved solids level of up to 320,000 parts per million (ppm), 180,000 ppm as an average

Projects started October, 2014 and January 1, 2015