

Simultaneous Waste Heat and Water Recovery from Power Plant Flue Gases for Advanced Energy System



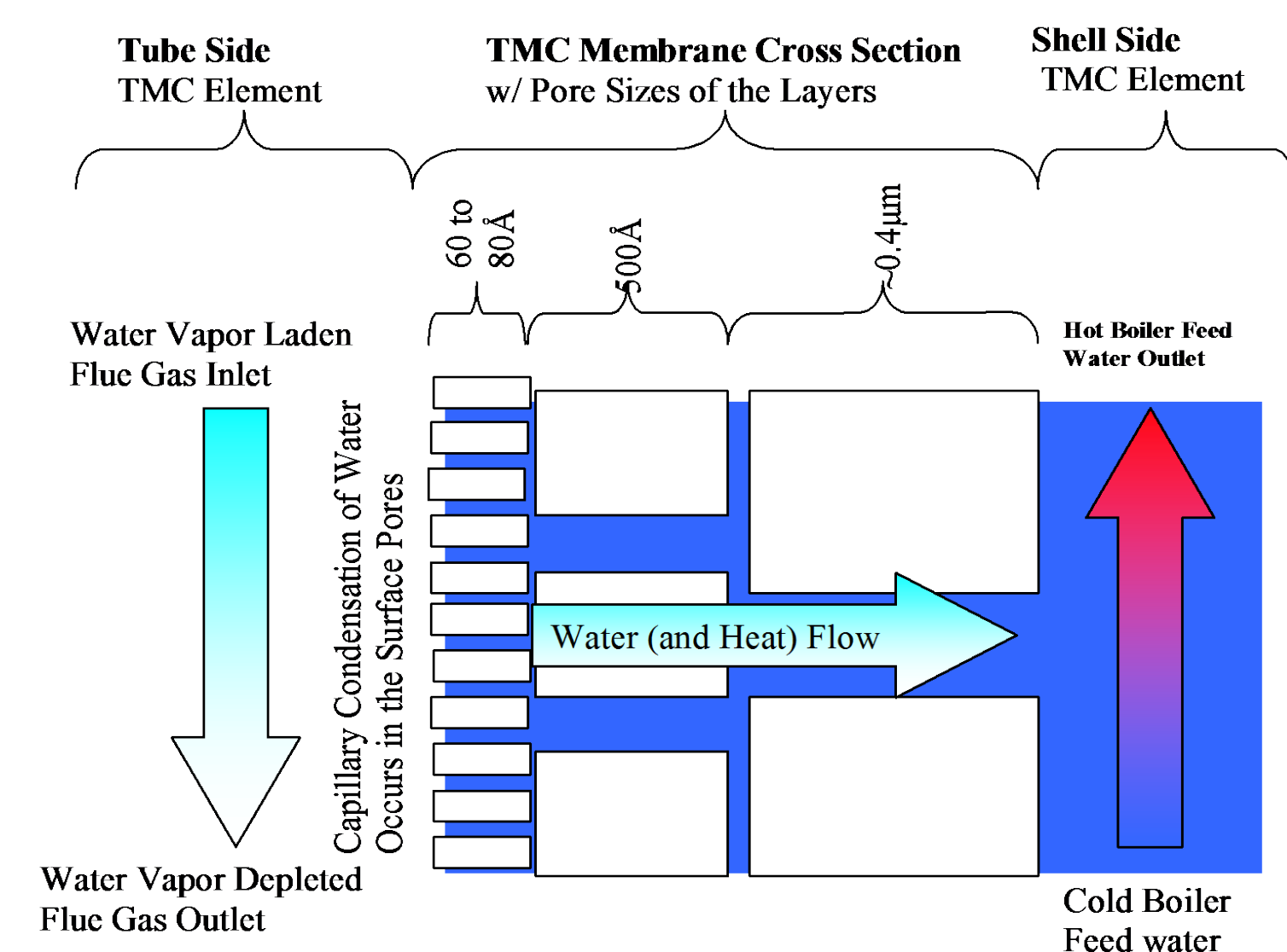
NETL Cross-Cutting Project | DE-FE0024092

2015 DOE Crosscutting Technology Research Review Meeting, Pittsburgh, PA, April 27-30, 2015.

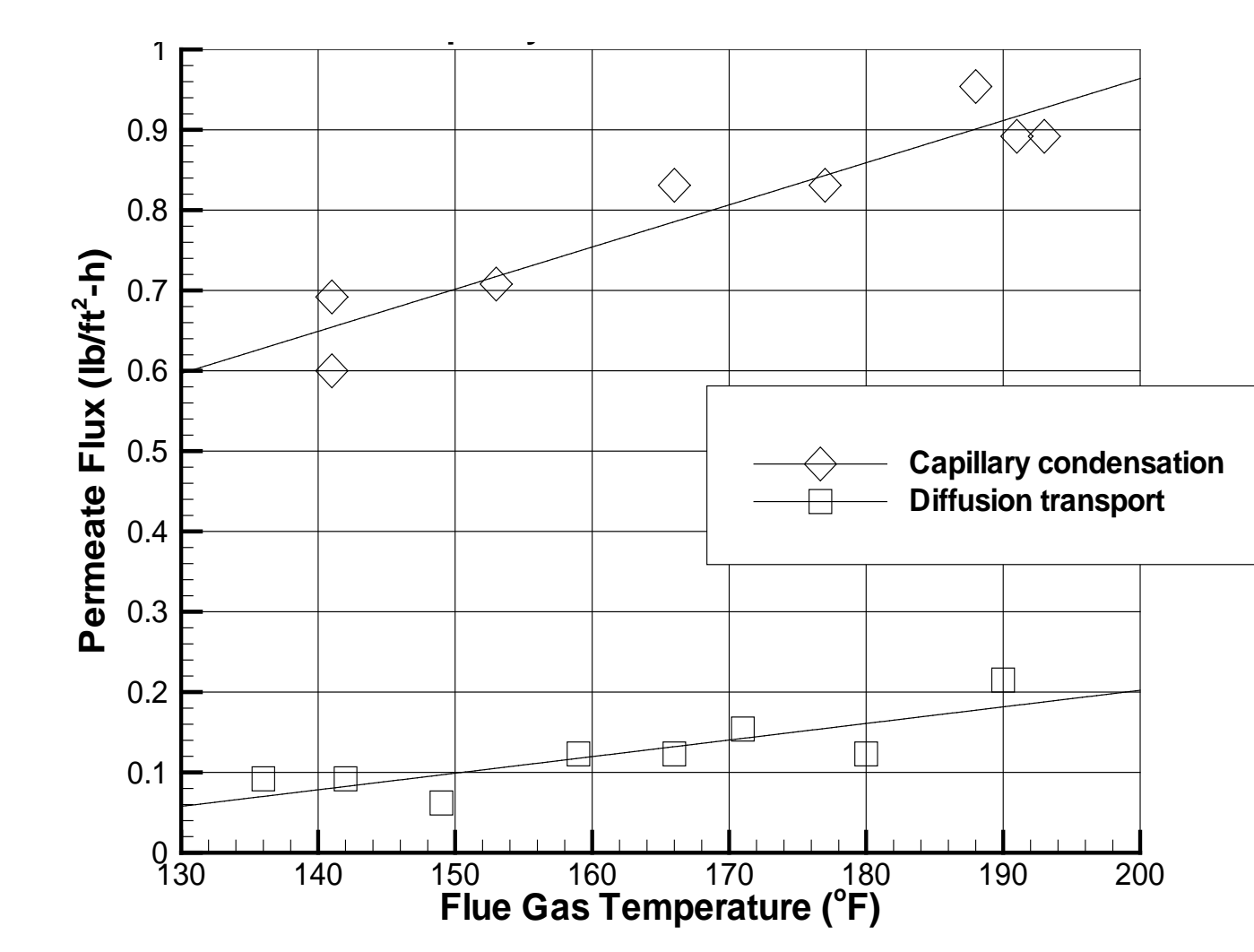
Project Goal

Develop a Transport Membrane Condenser (TMC) technology for recovering waste heat and water from power plant flue gases, to greatly enhance plant efficiency and save water. The current stage of work focuses on greatly improving the TMC technology efficiency, and providing low cost design for future commercialization.

Technology Development Background

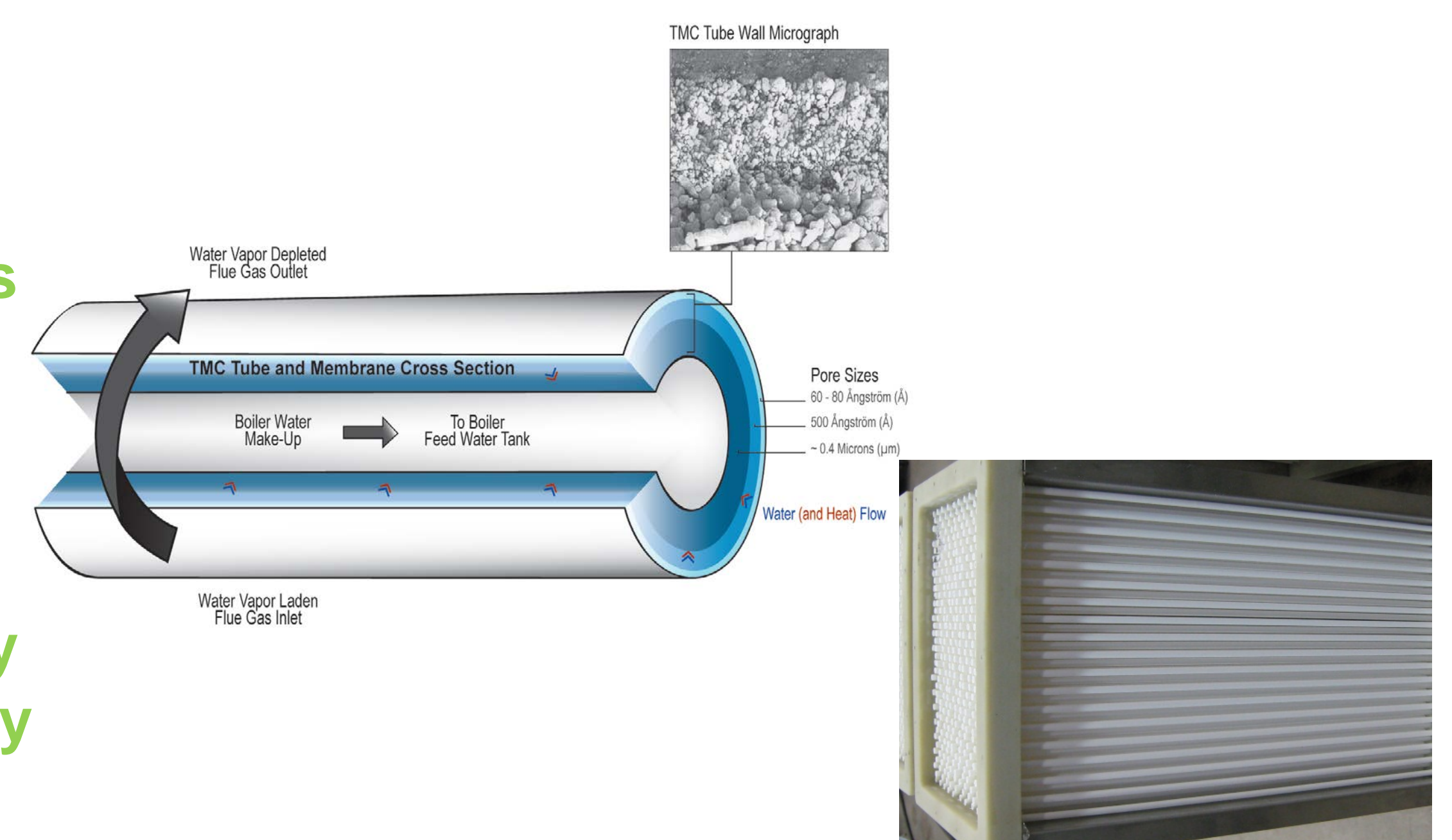


TMC working mechanism



Porous membrane water vapor transport study

Working mode of porous membrane is critical for water vapor transportation. High permeate flux and high separation ratio can only be achieved in a capillary condensation mode.



Porous ceramic membrane tube and TMC module

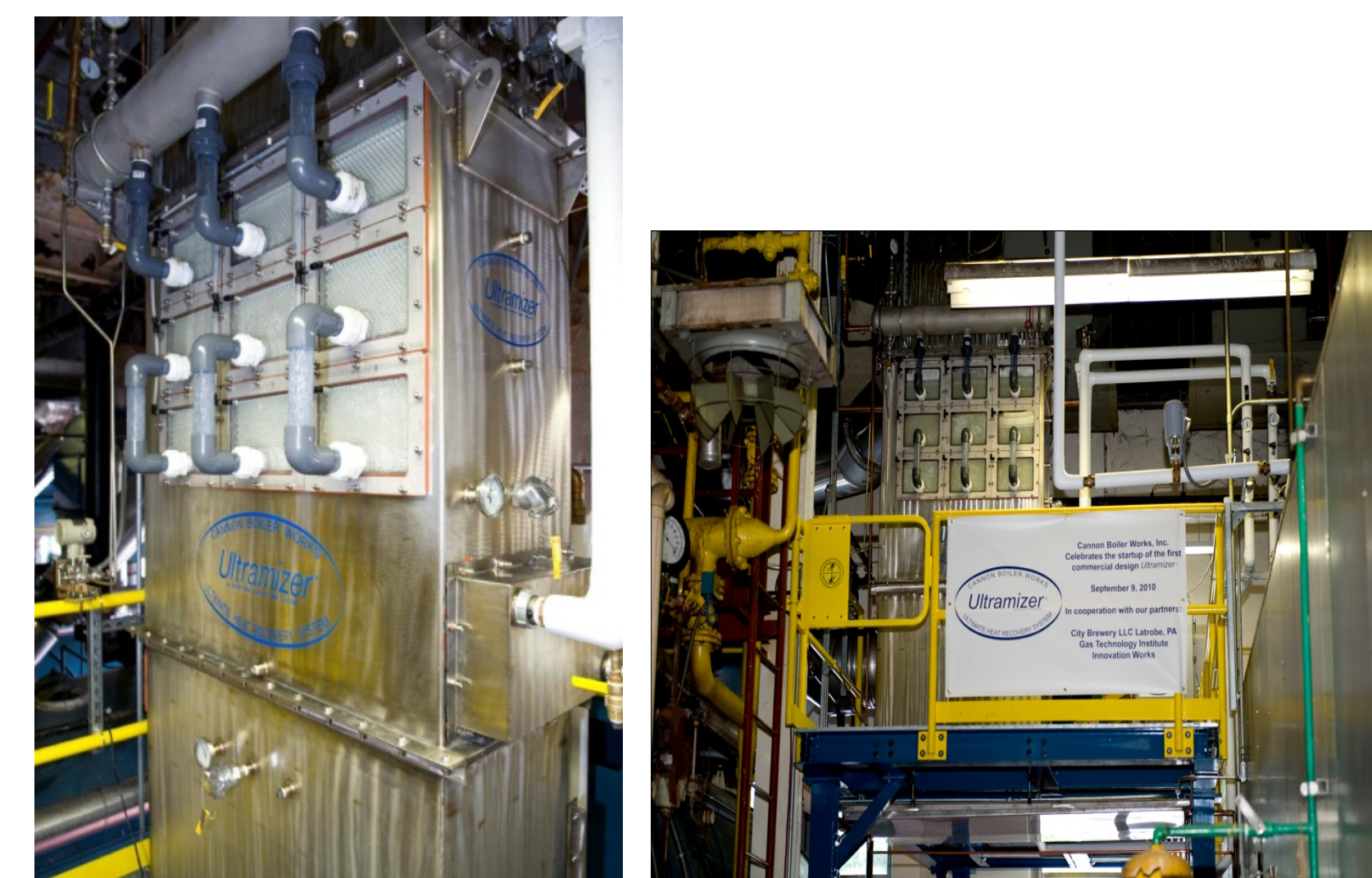
Technology Demonstrations for Industrial Applications, and Expansion for Coal Power Plants



TMC Field Demo for Industrial Steam Boilers



TMC Field Demo for L&N Steam Tunnel

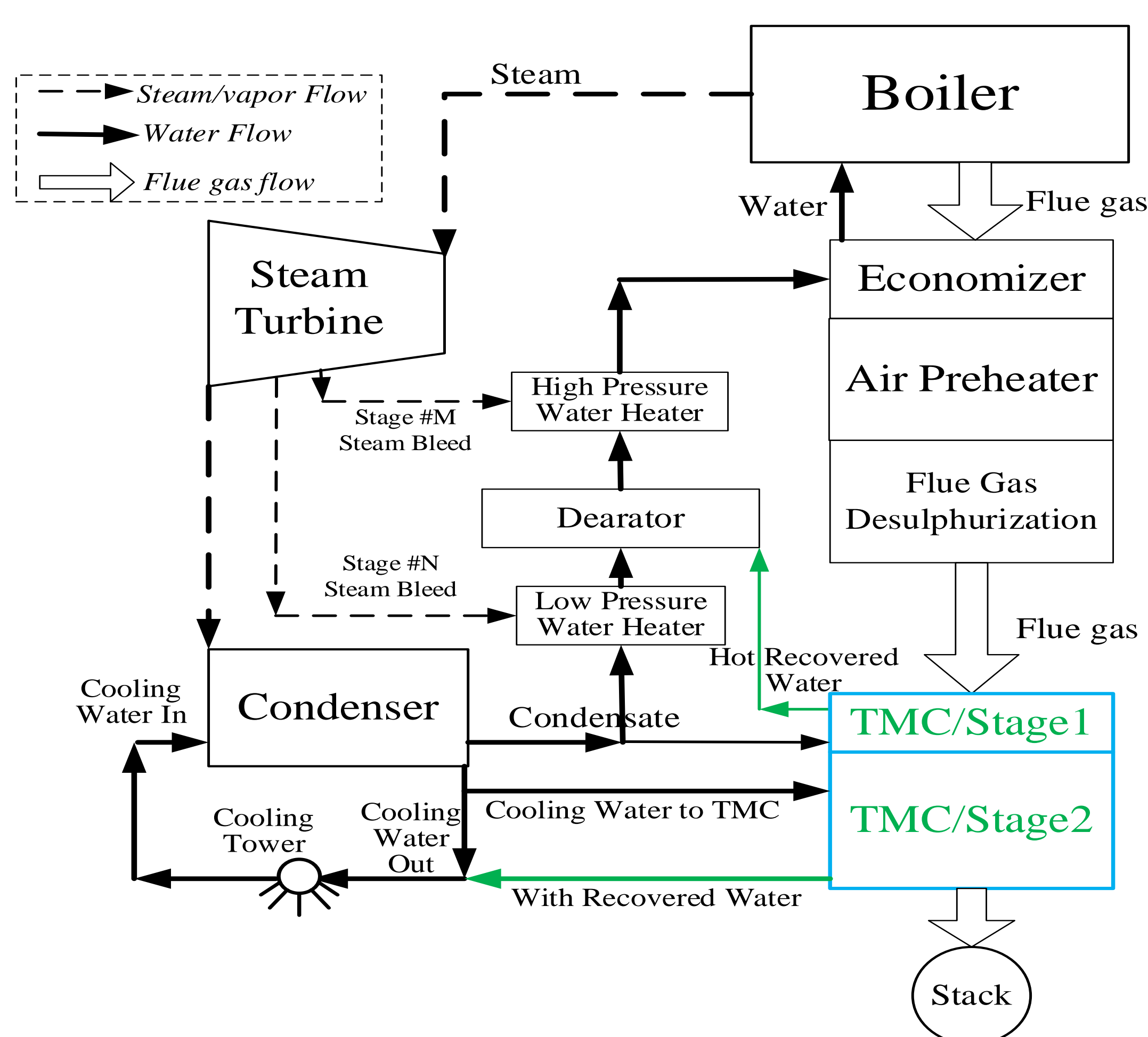


TMC Commercial Installations: Ultramizer®



TMC Field Demo for Coal Power Plant

TMC Power Plant Integration and Impacts



Flue Gas Water/Heat Recovery with a Two-stage TMC Preliminary Aspen study shows, if the TMC/stage1 is integrated into the steam cycle, it can increase the cycle efficiency by 0.72% from a baseline 36.3%, save 2% makeup water which is 500kg/min for a 550MW unit. TMC/stage2 can recover about 3,506 kg/min water for cooling water makeup.

Current Project Focus

- Greatly improve TMC water vapor transport flux and system efficiency, ready for high moisture content flue gases from future advanced power generation system, and evaluate membranes for low PH value flue gas applications,
- Explore low cost TMC unit fabrication and control methods to reduce capital and installation costs.

Benefits for the Energy Industry

- Recover mineral-free water for boiler makeup and other plant uses, and reduce waste water disposal.
- Recover waste heat from flue gases to greatly enhance the energy system efficiency. Will be more significant for high moisture content flue gases from future advanced power generation system, which has much more latent heat available and easy to capture.
- Reduce water vapor emission to the environment to meet power plant regulations, and improve plant heat rate.

Team

Gas Technology Institute	Media and Process Technology, Inc.	SmartBurn, Inc.	Florida International University
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