ARKANSAS STATE UNIVERSITY

OFFICE OF RESEARCH AND TECHNOLOGY TRANSFER

INTEGRATED REACTION CONDENSING HEAT EXCHANGER SYSTEM (IRCHX) FOR FOSSIL POWER PLANTS

THE CURRENT TECHNOLOGY IS PRIMARILY TARGETED TO REDUCE FRESH WATER CONSUMPTION, BOOST CONDENSATION EFFICIENCY UP TO 70%, AND LOWER CAPITAL COSTS IN POWER PLANTS

Key Features:

- **Up to 50% reduction of fresh water consumption** by using water recovery from flue gas exhausted by boilers/gas turbines
- **Up to 70% higher condensation efficiency** enabled by a unique, hybrid condensing heat exchanger (CHX) and closed loop cooling water storage tank
- **Flexible location of the IRCHX** in existing flue gas treatment systems: the module can be installed between the flue gas treatment system and the stack
- **Increased cooling effect** provided by hybrid internal and external tubing geometry
- **Longer life of equipment** due to less particulate accumulation and acidic corrosion in the mechanical components
- **Environmental impact:**
  - **Superior acid emission control** (NO_x, SO_x, Sulfuric Acid, Nitric Acid) due to two-step acid removal: primary separation with condensation and secondary separation with liquid-phase reactions
  - **Lower exhaust temperature** of flue gas at the stack
  - **Lower moisture contents** in exhaust flue gas at the stack.

Applications:

The IRCHX is specifically designed for and can be immediately implemented in **existing** and **new fossil-fuel power plants**:

- Coal-fired
- Natural gas-fired
- Oil-fired

The IRCHX system can also be used:

- for chemical plants
- for HVAC systems
- as backup equipment in case of acid scrubber system failure

Project Summary:

Arkansas State University (ASU) is seeking to license this novel (patent pending) condensing heat exchanger system for integration into fossil fuel power plants.

The IRCHX can be integrated into an existing flue gas treatment system and provides significant benefits for existing and new plants. Among other things, it is targeted to solve the issues of constrained water supply by reducing fresh water consumption theoretically to zero net amounts at steady state. For example, fresh water consumption may be reduced up to 100 million gallons per year in a 120MW combined cycle power plant and up to 320 million gallons per year in a 600MW coal-fired power plant. Furthermore, a pre-scrub condensation step in the system substantially reduces cost by reducing the scrubber capacity requirement. The IRCHX has higher condensation efficiency than a typical

	condensing heat exchanger, targeting 70% rather than current industry standards of 30%, due to novel tube configuration and closed loop cooling system. Additional IRCHX benefits include low temperature heat recovery after economizer, lower exhaust temperature, moisture contents, and acid emission in flue gas at the stack.
Potential Markets Overview:	**1. Existing U.S. power plants** According to the U.S. Energy Information Administration, most of the electricity in the United States is produced using fossil fuels. In 2011, coal and natural gas were the fuel for about 42% and 25% respectively of electricity generated in the United States. In 2011, the nationwide number of coal-, natural gas-, and petroleum- fired power plants numbered 589, 1646, and 1145 respectively. **2. New U.S. power plants** In 2012, U.S. Department of Energy reported a total of 48 coal-fired power plants under construction and at early stages of development. From 2011 through 2015, a total of 258 natural gas-fired power plants are expected to be built. The U.S. Energy Information Administration forecast 222 gigawatts of generating capacity to be added between 2010 and 2035 which equates to one-fifth of the current U.S. capacity. The largest share, 58%, will be fired by natural gas, followed by renewable sources, and coal at 8%. *Sources: U.S. Energy Information Administration, U.S. Department of Energy, The Wall Street Journal.*
Development Status:	R&D stage.
Patent Status:	Patent pending.
Commercialization Status:	Available to be licensed. Seeking funding/collaborations.

Arkansas State University – Jonesboro
Office of Research and Technology Transfer
P.O. Box 2760, State University, AR 72467
Phone: 870-972-2999
Fax: 870-972-2336
E-mail: brogers@astate.edu

ARKANSAS STATE UNIVERSITY