Field Demonstration Study for Heat and Water Recovery at a Coal Fired Power Plant

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Introduction

Southern Company, EPRI, and AECOM are conducting an engineering study as a prelude to a field demonstration of low-grade heat-recovery for reducing water usage rates and/or improving efficiency in a coal-fired power plant. The key objectives to be achieved are:

- Interview the coal-fired power industry to evaluate needs
- Compare emerging heat-recovery and heat-use technologies to commercially available technologies for recovering heat from low-temperature flue gas
- Assess the compatibility of heat-recovery technologies with the heat/temperature requirements of various heat-use applications
- Develop a technology recommendation and determine the costs for a proposed field test of a combined heat-recovery/use process at a Southern Company facility

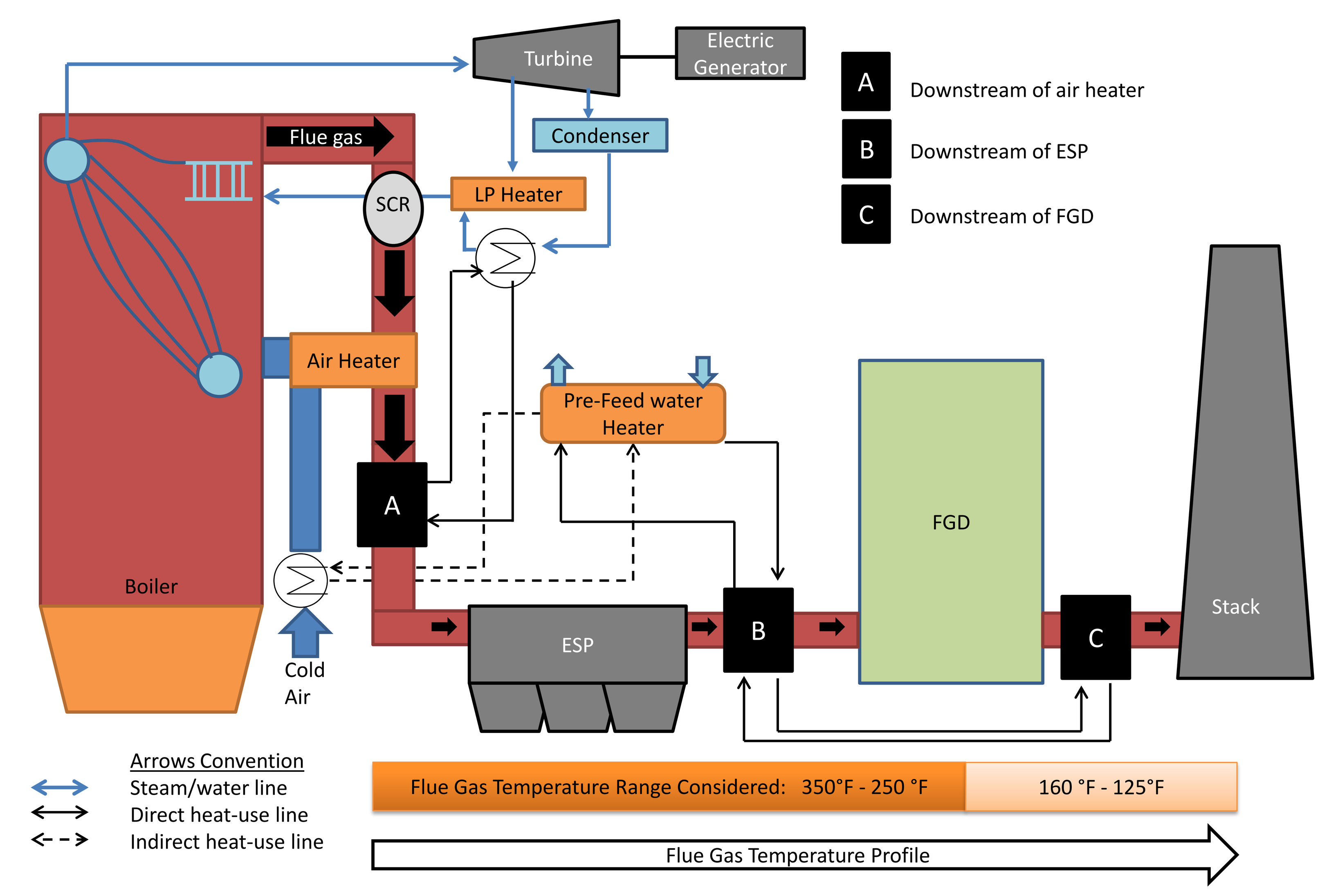

Figure 1. Example of heat-recovery and heat-use in a coal-fired power plant. The black boxes (A,B,C) represent potential waste-heat sources.

Additional Potential of Waste-Heat Recovery

- Most of the water consumed in a coal-fired power plant is due to evaporative losses (Cooling Towers (CT) 90%, wet Flue Gas Desulfurization (FGD) systems 10%)[1] and experience shows that a 75°F reduction in flue gas temperature has the potential to reduce FGD evaporation by about one-third.[2]
- Some of the additional benefits from waste-heat recovery are: fuel savings, reduced water consumption, improved Electrostatic Precipitator (ESP) performance, etc.

Survey of Heat-Recovery and Heat-Use Technologies and Industry Requirements

Surveys are currently being performed to assess the status, maturity, performance, and cost of both commercial and emerging heat-recovery/use technologies. Figure 2 shows a brief summary of current technologies being considered and the location where they can be used to recover waste-heat in relation to the heat sources in Figure 1.

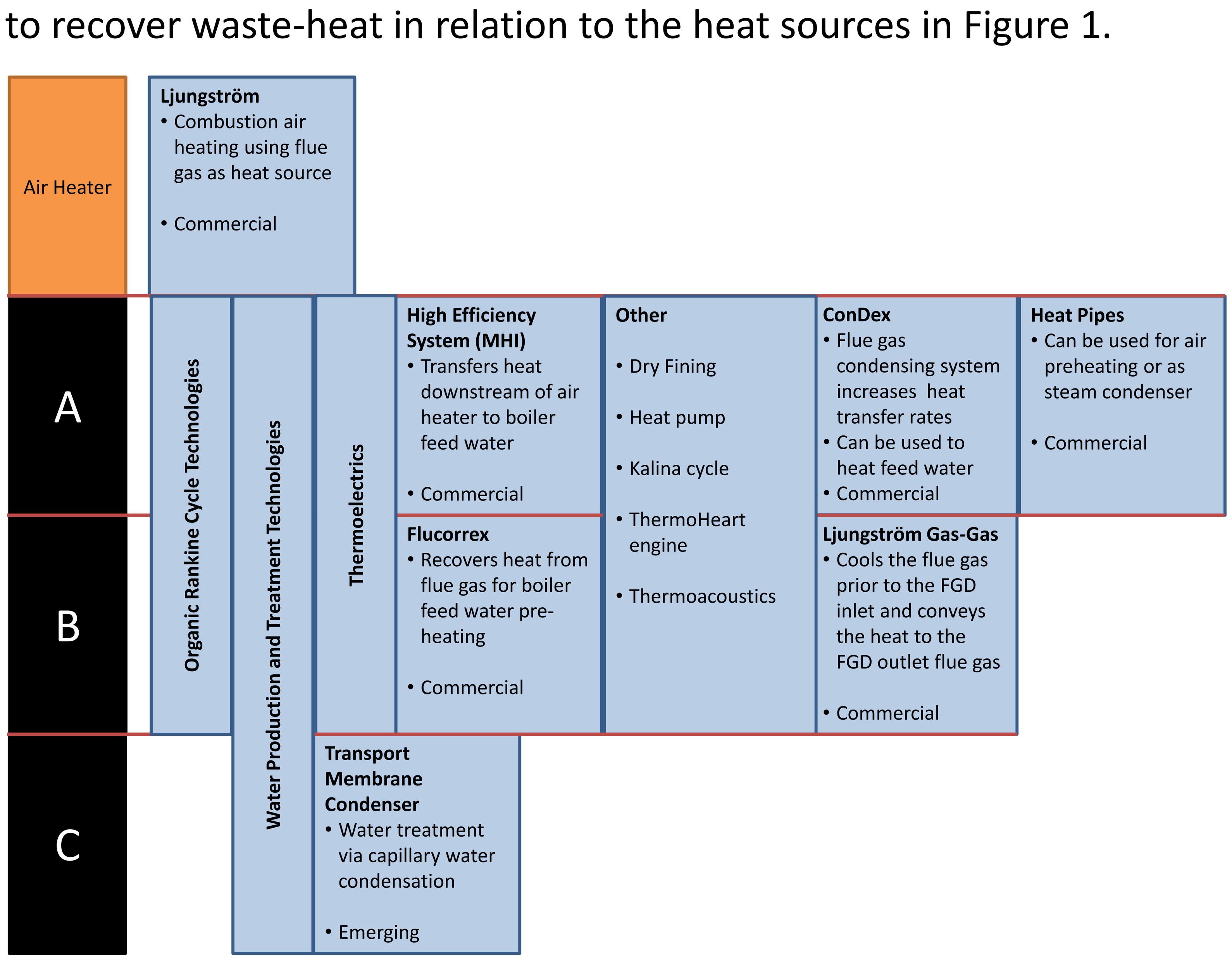

Figure 2. Heat-recovery/use technologies under consideration. The black boxes (A,B,C) represent potential waste-heat source locations identified in Figure 1.

Selected vendors are being contacted to determine the commercial status of their technologies and to assess the viability for the coal-fired application. Selected U.S. coal power generation companies are being interviewed to obtain information on need/value for low-temperature heat-recovery.

Coal Power Industry Survey

The participants in this project's coal-fired power industry survey have the following characteristics.

- Majority of plants use Bituminous coal
- Majority of plants are base load or operating on daily shift cycles
- Most plants have wet FGD scrubbers
- Nearly 90% of plants have significant spatial constraints on the site, making new equipment difficult to accommodate.

Anticipated Future of Plants in Survey

- Figure 3 shows that in the near-term (<5 years) most plants expect to maintain the same Capacity Factor (CF) or increase CF
- Beyond 5 years CF is expected to decrease for most plants
- No new build plants for the next 20 years; very unlikely that any new coal-fired power plant would be built before 2035, even after 2035 expectation of new build is weak

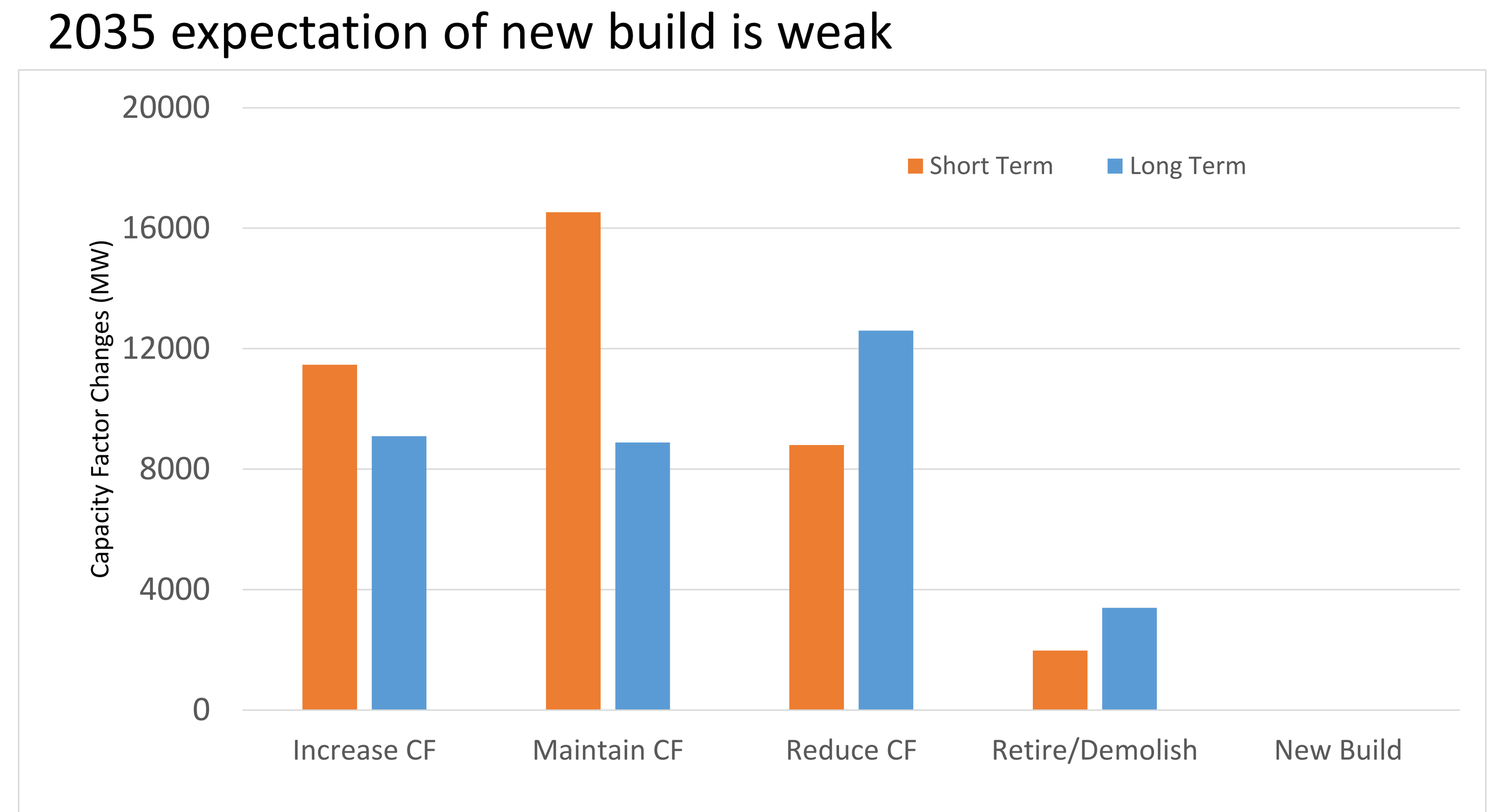

Figure 3. Planned Capacity Factor (CF) changes for coal power industry.

Efficiency Improvements

- All respondents have implemented steam turbine upgrades
- Most have carried out feed water heater upgrades and cooling system upgrade (condenser or tower)
- Only one example of low temperature heat-recovery (used to feed coal drying process for lignite fuel)

Barriers to Implementing Heat-Recovery Technologies

- New Source Reviews (NSR) seen as a major obstacle, as there are legal implications for the operator
- Planned reductions in Capacity Factor will make investments harder to justify
- Most sites do not have space to accommodate new processes
- Ambient Air Quality Standards – reducing the final temperature of the flue gases will impact plume dispersion
- No district heating opportunities identified in survey; there were some limited industrial possibilities
- Respondents are generally not water constrained; however, reducing FGD or CT makeup could be of interest

Conclusions and Future Work

The project is in its initial steps and the team is currently in the process of conducting technology surveys. The next steps will include the analysis of technologies to determine the best combination of heat-recovery and heat-use systems based on projected performance and costs, ease of installation and operation, and overall benefit in terms of reduced water usage, improved efficiency, and economics. A weighting methodology will be used to rank the various technology combinations, of which up to three will be selected for detailed analysis. Ultimately a recommendation will be provided for a selection of heat-recovery/heat-use system for a field demonstration. A summary will be submitted to the DOE-NETL for review. After the DOE-NETL review is completed, an engineering analysis will be conducted to develop a conceptual design and indicative costs for the combined technology selection at both a pilot and a full-scale power plant.

References

1. Owen M., "Reduction of water use in wet FGD systems", URS Corporation, NETL Project DE-FC26-06NT42726
2. AECOM, "Water balance at a coal-fired power plant", Internal report