6 Conclusions

This project was proposed to demonstrate technical and economical feasibility of integrated biomass gasification and co-firing applications. The primary focus for the project was to utilize poultry waste as cofiring fuel, although any other biomass that is readily available can be used. Two sites – WKE's Reid plant and TXU's Monticello plants were selected for the feasibility studies. Primary objectives of the Phase I of the study were:

- To foster commercialization of a biomass co-firing technology that utilizes biomass, agricultural waste and farm animal wastes in an environmentally benign, technically practical in an economical application.
- To conduct an evaluation of the technical, regulatory, environmental and economic impacts of gasification based co- firing on existing fossil fuel fired boilers located in the vicinity of significant sources of animal waste and agricultural biomass.
- To identify the potential modifications, if any, required in the proposed gasification, boiler or other integral ancillary systems, to enable effective utilization of the biomass fuels considered.
- To evaluate these factors specifically for the TXU Energy in order to develop engineering cost and schedule estimates for implementing such biomass facilities.
- To implement such a facility at a later date, if the cost estimates and economic evaluations indicate that a useful demonstration of the proposed biomass gasification and co-firing technology can be carried out and replicated at multiple facilities.

The technical evaluations showed the following potential project benefits:

- Environmentally more acceptable renewable and premium power
- Reduced landfill and runoff into waterways
- Potential for reduced fuel cost
- Potential for fertilizer from ash (P/K)
- Gasification external to the boiler offer flexibility in biomass fuels

Gasification-based co-firing has numerous inherent advantages and merits of the proposed projects can be outlined as follows.

- It increases the market potential of biomass co-firing by creating a more attractive gaseous fuel
- The low Btu gas can be used in various types of boilers including HRSG
- A wide range of different fuels can be gasified
- Biomass co-firing substitutes for coal or other fossil fuels and thereby reduces the net amount of CO2 emissions to the atmosphere.

However, even though advantages of biomass gasification process is well recognized, and gasification based cofiring does offer a low cost alternative to a stand alone gasification plant, the current economic model is not attractive enough for utilities to consider this option. The primary hurdle in this process is required initial capital cost. From power generator's perspective, new capital investment does not offer any additional kW. Although, gasification based cofiring provides least intrusive alternate fuel for the existing boiler, it does not add to net generation from the plant, and probably may reduce the net efficiency slightly.

For the two cases examined here, the following observations can be made.

In case of WKE, it was more attractive and least cost option to install natural gas fired burners to the existing boiler that provided alternate fuel. The cleaner natural gas offered flexibility in operation during NOx mitigation season from May through October, and lowered overall plant NOx and SO2, and particulate emissions on annual basis. Although, biomass cofiring also offered year round reduction in NOx, SO2, and particulate emissions, the reductions that would have been achieved could not be documented as substantial. This is due to low level of cofiring, i.e. 5-10% of boiler heat input v/s up to 100% natural gas firing is feasible. The fuel price advantage of biomass fuel over natural gas was mitigated by procuring natural gas at low price during low demand period – the summer months – which also offered most environmental benefits during high NOx season. The other advantage that biomass gasification offered – a renewable resource with no net emissions of green house gases – would be a compelling advantage, provided there was a penalty in the form of carbon tax for utilities relying on fossil fuels.

In case of TXU, there are no plans for fuel substitution in the form of natural gas. With the size of the unit – over 500 MW, natural gas firing will be difficult to justify on cost basis. This also played against the cofiring, as heat input from biomass was insignificant, less than 1%. This also negated any environmental benefits from cofiring, as it would be insignificant and cannot be quantified accurately. The other factors outlined for WKE's case were also applicable to TXU case.

In conclusion, gasification based cofiring is practical and technically feasible, but under the present economic model cannot be justified. If there are economic incentives, i.e., substantial government participation in the project, carbon tax consequences, or tax incentives for green and renewable power, utilities and

power producers will look into gasification based cofiring with more interest in the future. If there is carbon tax for utilities burning fossil fuels for power generation then the biomass based fuel will have some appeal, and biomass cofiring can become an option for further considerations.