**Introduction:** One of the new technologies include use of biomass as renewable resource in thermal conversion processes such as co-firing and gasification to produce syngas. Due to high ash and high moisture contents of low quality biomass fuels, the heat value is reduced and hence direct firing results in combustion problems. The gasification is preferred technology for low grade fuels, e.g., Manure which include dairy manure or dairy biomass, DB, feedlot manure or feedlot biomass, FB, poultry manure or poultry biomass, PB, swine manure or swine biomass, SB etc.

**Gasification Facility.** A fixed bed counter flow gasifier (10 kW; 30,000BTU/hr) has been designed and fabricated under batch mode. The fuel enters the facility at the top while the oxidizing agent is supplied by the blower and can be preheated to 100 °C by the steam generator. The gases produced leave the gasifier at the top and are carried by a pipe to the chimney. The Oxidizing agent can be air, steam or an air-steam mixture. A vacuum pump is used to take the gas samples from the gasifier to a point where they are captured by the mass spectrometer to be analyzed. The samples are passed for a condenser and a filter system to remove the tar and the small particles before they enter the mass spectrometer (MS). The MS can yield composition of CH₄, C₂H₆, H₂, CO, CO₂ etc.

**Experimentation.** Gasification studies on coal and CB fuels yield low BTU gas mixtures (100-150 BTU/SCF). In the current studies DB and Coal/DB blends fuels are fired along with steam and air to produce H₂ rich mixture. The parameters investigated are (ER) equivalence ratio and (ASR) air-steam ratio. The bed profile temperature and the composition of gases will be measured. Further coal and CB fuels will be fired in order to obtain chlorinated and activated carbon for possible use in the capture of Hg in coal fired plants.

**Modeling and Analysis.** The composition of gases produced by DB is predicted using a) mass conservation and b) chemical equilibrium for adiabatic systems where heat produced by partial oxidation is used to strip H₂ from steam. A model is developed to estimate the ideal production of CH₄, H₂, CO, CO₂, N₂ and H₂S. Other compounds are assumed to be in trace amounts. The parameters investigated are equivalence ratio (1 to 10), air-steam ratio (0.1 to 1). With the predicted composition of gases, the HHV of gas mixtures and the energy conversion efficiency are estimated.