Mesquite Lake Biomass Power Plant
Process Description

The Mesquite Lake Power Plant burns wood waste in a classical, well proven process of fluidized bed combustion with limestone addition, ash collection, hot gas thermal transfer, steam generation, SCR catalytic treatment of combustion gases and baghouse filters for particulate removal and finally exhaust stack emission monitoring to insure permit compliance. The plant is of traditional design with process water for steam generation and make-up being delivered from a skid mounted reverse osmosis plant, cooling water is delivered from a municipal supply to reservoir and then to the cooling towers. Combustion ash is stored on site with final disposal through a commercial contract. Electrical energy generation is derived from a steam turbine/generator set and sent through a sub-station step-up transformer which is tied to the area transmission system.

Note: The plant consists to two identical - parallel combustion, boiler, super-heater and economizer process lines. The lines are common at the front end fuel feed conveyor and at the back end with combustion gasses flowing to a common filter bag house. The process lines can operate independently or in parallel. This process description is based on both lines running at nominal design capacity. BACT (Best Available Control Technology) as defined in the permit is employed.

Select wood waste from municipal and commercial suppliers is delivered to open air storage areas or piles within the fence or property line of the power plant. The fuel storage area has a capacity in excess of forty thousand tons (40,000 tons) but nominally contains about half that amount. Typical wood fuel analysis is as follows:

Typical Wood Fuel Analysis

Carbon	36.25%
Hydrogen	3.99%
Nitrogen	0.14%
Sulfur	0.07%
Oxygen	26.88%
Water	30.00%
Ash	2.66%
Chlorine	0.00%

Wood material is moved from the storage areas to a feed hopper by conventional front end loader. The loader is rubber tired, diesel engine driven and is operated by the fuel yard attendant. Wood is transferred through the hopper to a feed grate which moves the fuel to the boiler feed conveyors. Limestone is added to the conveyors by a separate screw feeder from the limestone silo. Fuel feed rate to the boilers is nominally twenty tons per hour (20 TPH) which equivocates to three million seven hundred thousand tons per year (3,700,000 TPY).

The fuel is transferred into the conventional fluidized bed combustor by a traveling grate. Inside the combustor, oxidation is accelerated by the addition of both fluidizing air and re-circulated flue gas taken from the inlet to the bag house. Bed temperature inside the combustor is about 1600 degrees Fahrenheit. Ash from combustion is collected at the bottom of the furnace and the hot gasses are passed to a post combustion chamber and then through the boiler. Boiler heat input is nominally 237 MMBtu, with a net plant heat rate of 13,980 Btu/Kwh.

Boiler Design Performance

Gross Output	18,000 kw
Net Output	16,900 kw
Net Plant Heat Rate	13,980 Btu/kwh
Fuel Feed Rate	41,710 lbs/hr
Total Ash	0.55 tph
Bed Heat Release	553,000 Btu/hr/ft3
Bottom Bed Velocity	8.33

From the combustor, hot gases are routed through a post combustor which provides residence time which accomplishes more complete oxidation and additional particulate (ash) precipitation. Ash is collected at the bottom and combined with the combustor ash. The hot gasses then pass from the post combustor through the boiler and super heater for heat energy transfer. Counter-flow water from the economizer is converted to steam.

Steam is fed from the collecting steam drum to the turbine/generator. Inlet steam at the turbine is 900 degrees F at 750 psi. The turbine turns a generator through a reduction gear set. Generator speed is 5800 rpm and output is 18,000 kw. Outlet steam is condensed and routed through the cooling towers and then pumped to the economizer.

Hot gasses after having passed through the boiler and super heater are then routed through an economizer where residual heat is extracted and transferred to inlet water coming from the cooling tower. The gasses are then passed through a Selective Catalytic converter module for NOx reduction and then through a filter bag house for final particulate removal and finally through the exhaust stack. A flue gas recirculation system extracts some hot gas which is routed to the fluidized bed combustor.

Exhaust stack emissions are monitored through EPA/CARB certified continuous monitors. Emissions monitored include: NOx, SOx, CO, O2, opacity, flow rate, temperature, and ammonia inject rate.