Design of AgriPower 800 Series Biomass Combustion Systems

Overview
AgriPower, Inc. is currently expanding to a new line of biomass combustion systems. The 800 series is appropriately named for its 8 foot width. AgriPower asked the team to design the three units within this line that have outputs ranging from 44 to 66 MMBtu/hr in increments of 10 MMBtu/hr of capacity.

Objectives
- Create a specification sheet for the prospective 800 Series Biomass Combustion systems.
- Compare calculated values on specification document with those calculated by AgriPower Inc.
- Justify calculated values that show discrepancy between what was found by team members and that of AgriPower.
- Used confirmed values on specification document to create general arrangement drawings of 800 series biomass combustion systems.
- Model combustion system using three dimensional modelling software such as solidworks.

Approach
- Conference calls were held weekly with the sponsor to determine the design scope and to collect needed information.
- Research was done on combustion kinetics and biomass fuel properties, as well as designing a biomass combustion chamber.
- An ultimate analysis of the average biomass seen by AgriPower was utilized to calculate fuel flow, air flow, and flue gas flow rates.
- Linear optimization was then used to calculate the unit dimensions, while minimizing losses through the refractory.
- Combustion parameters were then analyzed by setting dimensions constant while varying the fuel flow rate.
- Values were reviewed for accuracy by AgriPower, and Solid Works software was utilized to create 3D models.
- General arrangement drawings were then extracted from the 3D model.

Outcomes
The design specifications calculated by the team were similar to the values previously determined by AgriPower. The sponsor will then use the results to validate their design to potential customers. Linear optimization minimized potential losses by reducing the surface area to volume ratio, while ensuring complete combustion. Costs are also reduced by standardizing many of the dimensions for all the units, promoting modular manufacturing.