

Energy Conservation & Design of System to Convert Agricultural Waste to Energy

The Project.

A facility is dedicated to processing raw cottonseeds, using them to produce useable cottonseed oil. However, this facility, like numerous others, is also producing large quantities of agricultural wastes, which can present serious disposal problems. Seeking a way to solve its waste disposal issues and to explore alternative sources of energy, the facility contracted Conversion Technology, Inc. (CTI) to examine the potential of using the wastes as a renewable source of fuel for the facility. CTI's engineers carried out a thorough evaluation, investigating the technology required and the feasibility of converting the cotton seed hulls into energy for the plant. The final design solution employed aided in solving the waste disposal challenges at the facility while creating a new source of energy that significantly reduced energy costs for the plant.

The Analysis.

CTI performed an analysis of the full scope of processes at the plant, determining the key points of energy consumption and examining numerous potential solutions. CTI's analysis included:

- Calculating the plant's steam and fuel consumption, both overall for the entire facility and for each process utilized in the production of the cottonseed oil.
- Determining the fuel value of the waste cottonseed hulls in order to establish their viability as a fuel source for the facility.
- Researching alternative technologies and equipment to convert the waste cottonseed hulls at the facility into steam energy.
- Performing an economic analysis of the alternatives in order to determine the best system to implement.

The Solution.

CTI's goal was to determine the feasibility of using the facility's own wastes to generate energy for the processes at the plant. The optimal solution arrived at by CTI's engineers was to design a system that would convert the waste cottonseed hulls into steam energy for the facility. CTI's design solution included:

- Selecting a fluidized bed system as the most suitable alternative for energy conversion, in which the cottonseed hulls are combusted as fuel.
- The heat generated from the combustion system is directed into a boiler where steam is generated at 200 psi, supplying energy to the plant's processes, as well as preheating the combustion air and the feedwater for the system (see Figure 1 below).
- The fully automatic system was designed to combust bark, wood trimmings, and other cotton waste, as well as the cottonseed hulls which are the primary combustion materials.

The Results.

CTI's system design for the facility led to significant savings in fuel usage and energy costs:

- The total investment cost for the new system was approximately \$5 million.
- All facility use of No. 6 fuel oil for steam production was replaced by the cottonseed hulls – amounting to 9,500 tons of fuel per year. This use of alternate fuel led to an annual savings of approximately \$2.5 million in fuel costs.
- The annual cost of disposal for the waste cottonseed hulls (30,000 tons/year) was eliminated.

CASE STUDY

- The steam from the new system provided 90% of the energy needed to operate the 400 HP turbine air fan.
- The significant energy savings incurred allowed the system to pay for itself at the facility within 2 years.

The Final Word.

The implications of projects such as these are potentially far-reaching: reducing dependence on conventional fuel sources, providing an efficient and productive means of waste disposal, cutting energy costs, and thereby lowering overall production costs at the facility. CTI's work in designing a system to convert facility waste into energy provides a model for any number of industrial facilities to follow – exploring the potential of closed-loop cycles for increasing plant efficiency and drastically reducing energy costs.

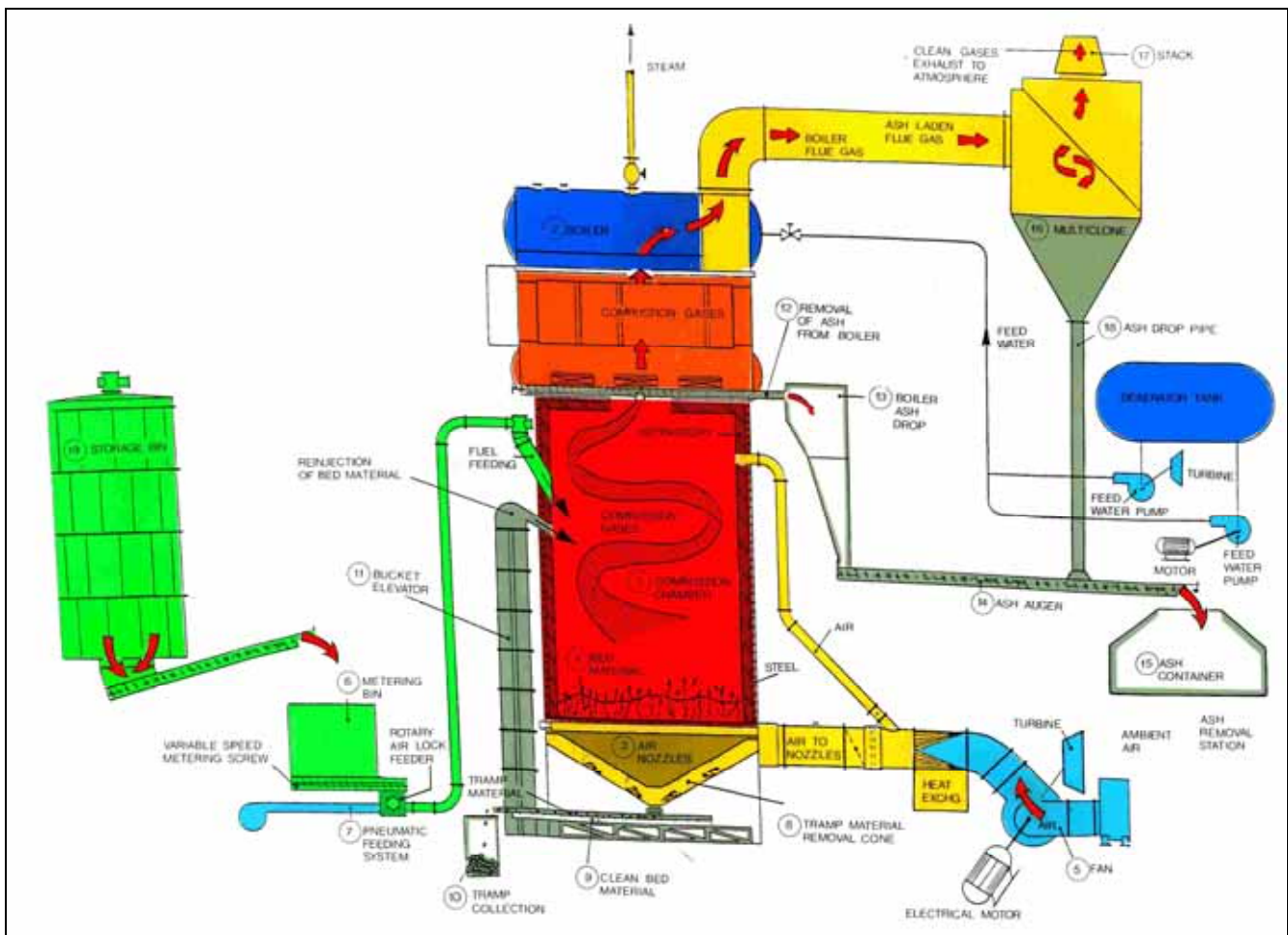


Figure 1: System designed by CTI to convert waste cottonseed hulls into usable energy for the facility.