Team 10’s long term solution is designing a complete mix anaerobic digester system for a farm of 3000 head of cattle. An anaerobic digester uses bacteria to break down livestock waste, producing biogas and a solid-liquid effluent. Biogas is rich in methane and can be used to produce heat and electricity. Dried digested sludge can be used as bedding for the farm animals. The long term solution minimizes the volume of waste to be land applied and eliminates the E. coli levels.

The manure collection pit is a storage container for the agricultural waste that is directly removed from the farm facility. The manure pit is sized for one 24-hour period of waste collection. At 3000 head of cattle, the manure pit is sized for 40,000 gallons.

The water dilution tank adds water to reduce the solid content of the agricultural waste from 15% to 13% for optimal biogas production. The tank is positioned just after the manure pit and before the digester. A 6,000 gallon poly storage water tank.

The mechanical room combines the slurry that comes from the manure pit and the dilution water from the water tank before the slurry enters each digester. The room allows access to the check and gate valves and is used as an electrical or mechanical control room.

The long term design system includes three digesters, two digesters in operation, and the third for redundancy. The total volume of each digester is 536,000 gallons. The volume was calculated based on the total volume of slurry produced each day and a retention time of 18 days.

The heat supplied to the digester is used to raise the incoming manure slurry up to 95°F and to offset the heat losses through the walls, roof, and floor of the digester. Heat is supplied by burning a portion of the biogas produced by the digestion process and dissipating the heat to the slurry through heat exchangers.

The slurry agitation is the method of mixing within the anaerobic digestion tanks. The design of slurry agitation mixes the contents uniformly while conserving as much energy as possible. The slurry agitation design is three submerged mechanical mixers: a scum buster, a blender, and a solids eliminator.

The pumps in the manure pit and slurry tank are hydraulic submersible pumps. A standard centrifugal series pump will be used to pump water into the system.

A solids separation system will be located directly following the digester slurry outlet. Some of the water removed from the processed slurry will be used as dilution water for fresh manure input, and the remaining water will be stored in a nearby lagoon for land application, depending on the farm’s needs the solids removed during separation will be dried down and used for animal bedding. The biogas collected from the digester system will be burned in the boilers to heat the digester tanks and used elsewhere to power the digester system or the farm.