Spencer Fackler
Joseph Violetti

Abstract

The Heybeli Digester project originated with Sema Alptekin in her personal research and was incorporated into a Senior Project opportunity at California Polytechnic State University, San Luis Obispo. The aim of this project was to select and design a plan for the use of a digester for the island of Heybeli, Turkey. The objective of this plan was to incorporate economic, social, and environmental justifications to evaluate if a digester would be a benefit to the community.

Systems Engineering analysis is a vital tool when working with complicated projects that include multiple systems interfacing with one another. Through the use of Systems Engineering analysis, requirements were formed that were then used to generate alternatives using current viable digester technologies. The feasibility of each alternative was determined by a number of factors deemed necessary to make a viable and responsible digester system: cost, environmental effect, and the social effect.

The main deliverables of this project was a digester model that incorporated gas use and fertilizer allocation. Additionally, a cost analysis of the different alternatives is presented along with environment impact in determining the optimal solution. The cost analysis takes into account material cost, maintenance cost, logistics cost, and operational cost. While the environmental impact is broken down into captured kilograms of greenhouse gases saved from entering the atmosphere.

There are five alternatives that are formulated in order to determine the best digester system. A variety of information is presented in this project for the reasons in coming up with each of the solid alternatives. They are shown through a cost breakdown and in a discussion of the positive and negative points of each. There are several assumptions in the creation of these alternatives. First, that the animal waste supply will be a stable for the next 15 years which is the proposed life cycle of the project. Second, the volatile solid amount of the animal waste meets the standard averages of horses around the world, which would need to be confirmed with a test on the island.

The selected alternative was a full scale Plug Flow Digester that uses the gas for a generator that converts the gas to electricity. The electricity use assumed to cover the use of heating and lighting the local stables which the horses are kept with the substantial overflow being left to the determination of the local community. The cost of this system is $168,579 with payback time of seven and a half years and IRR of 10.5%. The environmental benefit is 120,000 kg of greenhouse gas that is being preventive from being released into the atmosphere.