

Biogas Purification for the UC Davis Biodigester

Location: Davis, CA

In-Country Partner Organization/Client: UC Davis, Utilities

Project Background: UC Davis owns and operates an anaerobic biodigester that converts food waste into biogas. The University owns a retired landfill at the same location which produces landfill gas. The biogas contains methane, CO₂, and nitrogen. CO₂ and nitrogen do not provide any useful heat when the gas is burned so it is beneficial to remove them from the gas (this is called upgrading). The gas streams are combined and contain approximately 50% methane with the balance being carbon dioxide and nitrogen. The heating value (or methane content) of the gas produced at the UC Davis facility is too low for it to be widely useful, to increase the utilization of the biogas, upgrades to the facility must be made. Depending on the ultimate end use of the gas, the extent to which CO₂ and nitrogen must be removed differs. For example: burning gas in a steam boiler requires only minimal upgrading, compressing the gas to use as a transportation fuel requires moderate upgrading, and compressing the gas to inject into PG&E natural gas pipeline: requires substantial upgrading. UC Davis wishes to upgrade the gas so that it could be burned to produce steam, used as a vehicle fuel, or injected into a local natural gas pipeline.

Project Problem Statement: The Utilities department has identified a way to upgrade the gas, however it has not been determined to what quality it should be upgraded. We hope to implement a solution in 1-2 years. Internally, we are still trying to determine which of these routes we should take. Depending on the route chosen, various upgrading technologies could be employed. These include: water scrubbing, chemical solvent scrubbing, physical solvent scrubbing, membrane filtration, pressure swing adsorption, and cryogenic separation.

Project Goals and Objectives:

1. Feasibility Study
 - a. Investigate existing biogas upgrade technologies
2. Conceptual Design
 - a. Conduct prior art research on technologies of interest and utilization scenarios
 - b. Work with the client to determine design criteria
 - c. Make recommendations for D-Lab
3. Design; Build; Test (D-Lab II)

