

AD model

Improving a Model of On-Farm Anaerobic Digestion for Integration with Manure Processing

Cornell PRO-DAIRY is part of a project funded by the Rapid Advancement in Process Intensification Deployment (RAPID) Manufacturing Institute, to evaluate the economic and technical feasibility of a system using biorefineries in NY State, combining anaerobic digestion (AD), hydrothermal liquefaction (HTL), and a Biomethanation Power to Grid (P2G) systems to process agricultural and food wastes. This becomes important with the newly passed food scraps donation and upcycling bill in NYS that requires producers that generate more than two tons of food waste per week to divert its wastes from being landfilled if they are within 25 miles of appropriate waste handling facilities. These wastes would be viewed as a resource for energy and nutrient recovery and can be harnessed through a combination of process technologies that can produce a range of renewable bio-products such as renewable natural gas (RNG), biocrude oil and hydrochar. The sale of co-products provide revenue streams, which can be used to offset the capital costs of purchasing and installing the biorefinery system.

One important aspect of this work will be to include further development of the dairy manure and co-digestion AD model, Cornell Digester Greenhouse Synergy Simulation Software (CDGSSS), previously developed by PRO-DAIRY, that can be used independently. This CDGSSS model upgrade will include: utilizing the outputs of the CNCPS dairy nutrition model as inputs, including volatile solid and nutrient transformations during manure collection and storage prior to digestion, adding more sophisticated biogas prediction based on co-digestion of food wastes, the potential for thermophilic digestion, show both the mass, energy and nutrient outputs of the digestion process, include an engine generation selection function, a renewable natural gas cleanup option, a nationwide weather (and potential climate change) option, to provide the GHG footprint compared to the milk production and put the output in a form that any other process model can easily use as inputs to add a total manure processing system.

In addition other engineers will work to develop practical strategies for locating and deploying a statewide system of biorefineries for treating dairy and food wastes. The project also will evaluate the economic and technical feasibility of the integrated AD-HTL-P2G distributed system and discuss the environmental implications of using the biorefinery system as related to NYS's overall strategy to reach its climate and energy goals. We will also provide a set of recommendations for NY state policies and regulations needed to achieve NYS' goals. The delivery of this information will take place through direct communication, PRO-DAIRY e-alerts, fact sheets, and case studies on the PRO-DAIRY website, conferences/workshops, and on-farm tours and demonstrations.

