A Web-based Program for Locating Sources of Organic Wastes for Use as Renewable Energy Resources

Background

Management of organic wastes such as animal manure and food waste has become increasingly difficult and costly because of tightening environmental regulations as well as shrinking landfill space. However, by using appropriate technology such as anaerobic digestion (AD), organic wastes can be converted into biogas for energy while harvesting environmental and economic benefits. Since New York is the third largest dairy state and a host of many food-waste generators, there is a good potential for farm-based co-digestion of both manure and food waste.

Why is a Computer Tool Needed?

Strong interest in farm-based co-digestion exists among farmers, policy makers and energy-related businesses, but information and experience with co-digestion is limited. In particular, little is known about food waste as an energy resource. Thus, data and tools are needed to help identify, locate and evaluate such waste. Sources of organic waste are highly site-specific, and only for concentrated production sites is it practical to collect wastes for AD. The feasibility of a co-digestion project is greatly affected by proximity to waste sources, customers and the electric grid. Thus, for planning or designing AD projects, there is need for more detailed information, such as:

- Where are generating sources of animal manure located?
- Where are generating sources of food waste located?
- How many and what food processors are located within a certain radius of the digester site?

Authors

Jianguo Ma and Norman Scott
Dept. of Biological and Environmental Engineering
Cornell University
April 2007

An economic model or tool is desirable to assess the costs and benefits of potential on-farm co-digestion projects. To address these questions, a web-based spatial decision support system (SDSS) to identify organic waste sources will be an ideal tool to advance opportunities for co-digestion.

What is the Computer Tool?

The web-based SDSS was developed by integrating geographic information systems (GIS), the Internet, and modeling. This system consists of three modules: (1) Dynamic Mapping and Querying; (2) Food-Waste Estimator; and (3) Co-digestion Economic Analysis.

Module 1 is designed to help users interactively explore many resources by displaying, zooming in and out, and selecting any combination of information layers. Users can also create and print out customized maps. In addition, users can retrieve various data through queries that are helpful to their decision making. Module 2 is designed to estimate food waste production from a variety of generating sources. Module 3 is designed to provide a preliminary economic analysis for on-farm anaerobic digester systems.

What Can the Computer Tool Do?

A web site was developed as a platform for presenting information and accessing the tool. (http://wastetoenergy.bee.cornell.edu) Through menus, users can learn about the research project, the data used as well as other relevant information. A User's Guide, which provides help information and examples, can be viewed or downloaded.

Module 1

This module provides mapping and querying capabilities to help users identify and locate organic waste generating sources within New York State.

NYSERDA

The interface is composed of six sections: a tool bar, map, layer pane, legend, queries, and an area for querying results. The tool bar provides functions for displaying, creating and printing various maps. Under the tool bar is the map with dimensions of 480x360 pixels. The querying results are displayed as a table under the map. In the middle is a layer pane where users can select or deselect any information layer depending on their specific interest. An example of mapping would be to create a distribution map of CAFOs (concentrated animal feeding operations) in Cayuga County.

There are also a variety of queries to be used to identify and locate individual or certain groups of organic waste generating sources based on users' specifications (e.g. distance, size, waste type). An example would be searching for food processors around a specific farm within a radius of 25 miles.

Module 2
This module enables users to estimate food-waste production from a list of generating sources that produce large amounts of organic waste including: food-processing facilities, supermarkets, fast-food franchises, correctional facilities, restaurants, colleges/universities, K-12 public schools, hospitals and nursing homes. The interface provides a web form where users can enter inputs and the results will be displayed on the same page. The results are "best" estimates of the various waste resources that can serve as a starting point for following up with direct contact with food waste sources of interest.

Module 3
This module can help users to evaluate the costs and benefits of potential farm-based co-digestion projects. With users' inputs, this tool can estimate manure production, food-waste mixture, digester capacity, biogas production and electricity generation. It also can be used to estimate various costs (e.g. capital costs and operating costs) and benefits (e.g. electricity savings/sales, compost sales, and food-waste tipping fees). The economic model is based on field case studies of farm AD systems in the Northeast, especially two on-farm AD projects in New York State which have been operating for a long time with consistent performance.

Who are the Potential Users?
This study will help increase public awareness of various benefits of using animal manure and food wastes as feedstock for anaerobic digestion to produce renewable energy. The results will be useful to farmers, policy makers, bioenergy investors and food-waste generators. The tool enables policy makers to understand statewide distribution of organic waste resources. It will allow farmers, waste planners, haulers, entrepreneurs, and others to obtain combinations of information about commercially generated organic wastes in New York. It can be used to facilitate decisions about how to target wastes for collection, which generators to target, how to structure collection routes and infrastructure, and where to site AD projects.

Who to Contact

Norman Scott
Dept. of Biological and Environmental Engineering
Cornell University
Ithaca, NY 14853
nrs5@cornell.edu
607-255-4473

Jianguo Ma
Dept. of Geography
University of South Florida
Tampa, FL 33620
jma@cas.usf.edu
813-974-9490

www.manuremanagement.cornell.edu