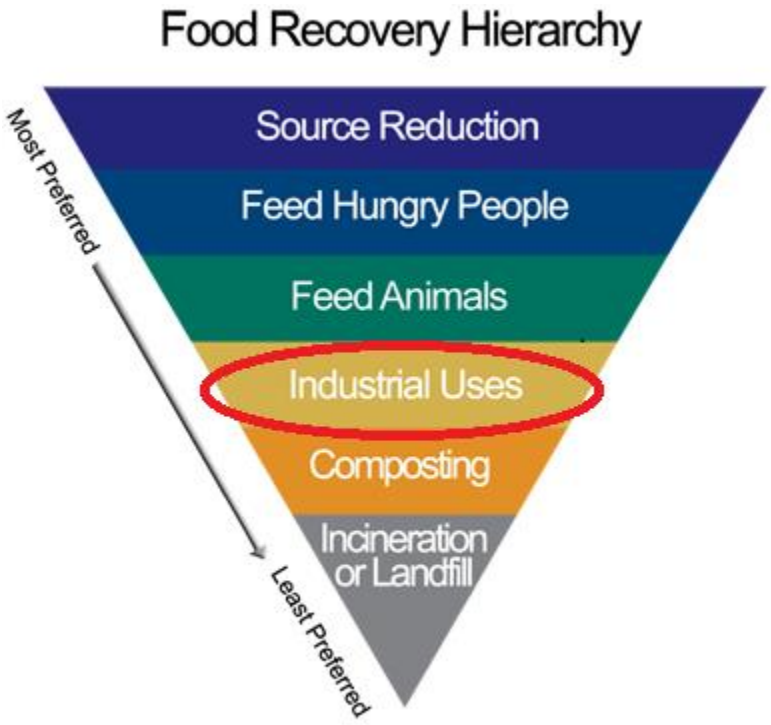
Anaerobic Digestion of Food Waste in New England
Summer 2013 Report*



Lily Fitzgerald, College Intern
Assistance & Pollution Prevention
EPA Region 1

*NOTE CORRECTION ON PAGE 3 MADE ON 2-9-2015

Introduction

Anaerobic Digestion (AD) is a controlled process that allows microbes to break down organic waste in an environment devoid of oxygen while capturing the methane byproduct, which can later be used as an energy source. AD systems may vary in their specific mechanics such as operational temperature, water input, and separation of digestion stages.[1] While this technology has existed for decades and is prevalent abroad, it is only beginning to take hold in the United States.

Currently, AD is used in three different types of facilities. Wastewater treatment plants (WWTP) or water pollution control facilities (WPCF) may use AD to break down sewage sludge. Farms may use AD to digest cow, horse, poultry, or pig manure. Finally, stand-alone facilities that were built specifically for AD may digest a variety of organic wastes.

Food waste constitutes approximately 21 percent of the municipal solid waste stream. Each year, nearly 34 million tons of food gets wasted in the United States. Once disposed of, this food waste is brought to landfills, where it decomposes and emits methane (CH_4), a powerful greenhouse gas. The economic and environmental implications of food waste disposal have driven local, state, and national interests to actively explore diversion methods. Food scraps and fats, oils, and grease (FOG) can be valuable inputs to an AD system, as they yield large amounts of methane when digested. As food waste generators look for more cost effective and environmentally responsible methods of disposal, managers of existing AD facilities may be looking to increase their energy output. The coupling of this energy-rich organic waste with new and existing AD facilities in New England is an important step towards sustainable managing of resources in this region.

This report examines the current state of anaerobic digestion of food waste in New England. It lists the current facilities that accept food waste into their AD stream and describes proposed stand-alone facilities by their current phase in development and projected output. State and federal legislation and regulation relevant to the construction and operation of these facilities is then presented, as well as available incentive and funding sources and educational efforts. Finally, the report illustrates the current obstacles that inhibit AD of food waste and suggests opportunities for facilitating AD of food waste in New England.

---

[1] For more information on AD technology, consult the following reports:

- Food Scrap Recycling: US Environmental Protection Agency report for understanding large-scale food scrap recycling technologies including AD
- Technical Document on Municipal Solid Waste Organics Processing: Environment Canada document describing AD technology in detail, including system types

Existing Facilities

The following facilities use AD to process food waste or FOG. Some use combined heat and power (CHP) systems which utilize the biogas produced to simultaneously generate electricity and heat.

I. Wastewater treatment facilities with AD that accept food waste or FOG:

> *NOTE 2-9-2015: The original report listed
> Clinton, MA
> Fairhaven, MA
> Pittsfield, MA
> Rockland, MA as Wastewater treatment facilities that accept food waste—while they have the capability the facilities do not actively accept food waste or FOG

Brattleboro, VT
Essex Junction, VT

II. Dairy Farms with AD that accept food waste or FOG:

Longview Farm/AGreen Energy, LLC, Hadley, MA
Jordan Farms/AGreen Energy, LLC, Rutland, MA
Barway Farm/AGreen Energy, LLC, South Deerfield MA
Stonyvale Farm/Exeter Agri-Energy LLC, Exeter, ME
Green Mountain Dairy, LLC, Sheldon, VT
Chaput Family Farms, North Troy, VT
Maxwell Farm / Neighborhood Energy, LLC, Coventry, VT
Gervais Family Farm, Enosburg Falls, VT
Maplehurst Farm, Greenboro, VT

III. Operational or under-construction, stand-alone AD facilities that digest food waste:

Ken's Steakhouse, Framingham MA: This steakhouse and salad dressing manufacturer operates a private AD facility that processes both pre and post consumer food scraps.

Garelick Farms/Dean Foods, Franklin and Lynn, MA: Both of these wastewater treatment facilities have a 5 million gallon capacity and use CHP. They digest byproducts of milk production.

Kraft Foods Atlantic Gelatin, Peabody MA: This food processing plant is currently constructing an AD facility to process their waste.

Anheuser-Busch Brewery, Merrimack, NH: An AD was added to this brewery's wastewater pretreatment system in 2006. The CHP, high-rate system treats 500,000 to 700,000 gallons of wastewater from the brewery

Red Hook Brewery, Portsmouth, NH: More than 90,000 gallons of wastewater, beer labels, and spent yeast sent through AD before going to towns WWTP. The methane produced is currently being burned off, but the company is looking to move to CHP.

Central Vermont Recovered Biomass Facility Anaerobic Digester, Randolph, VT: Construction of CVRBFAD broke ground April 2013. The facility will process food waste and manure. Lipp technology by Bio-Methatech will transfer electricity to VT's electrical grid and heat to Vermont Technical College at their Randolph campus.

Magic Hat Brewery, South Burlington, VT: This brewery added a high solids digester in 2010. The digester was constructed and is owned and operated by Purpose Energy from Waltham, MA. It processes the brewery's wastewater, spent yeast, and spent grain. Using CHP, Purpose Energy sells the electricity produced to the brewery.

Proposed Facilities

The following list of proposed facilities has been composed based on media coverage, town government documents, and interviews with permitting agencies. The list includes all proposals that could be identified, and may include projects that have since been abandoned. The descriptions that follow provide all relevant information available about the current progress of the proposed facilities, collected largely from developers' web pages.

Ansonia, CT: Developed by Greenpoint Energy Partners. Construction could begin mid 2013 and open mid 2014. Initiative from city's Energy Improvement District Board. Plans to process up to 45,000 tons of food waste per year and sell up to 18,000 tons of digestate as compost per year. Plans to accept food waste from grocery stores, manufacturers, distributors. The company is currently seeking permits from the local building department, CT DEEP, CT Siting Council, and the Army Corp of Engineers.

Southington, CT: Supreme Industries with B&R Corporation has submitted a proposal to CT DEEP.

Bourne, MA: Harvest Power proposed. Pannone Lopes Devereaux & West is representing the town's Board of Health in the site-assessment work. Plans to process 300 to 400 tons food waste per day, but without plans to sell electricity to town.

Dartmouth, MA: Proposed site is already home to a gas-to-energy facility. Awarded two grants totaling $400,000 from Mass Clean Energy Results Program (CERP). Pilot program would process food scraps (50%), FOG (25%) and sewage (25%). Pilot to process up to 12 tons of waste/day and produce up to 650,000 kWh/yr. If pilot is successful, expansion is likely.

Franklin, MA: Initiative from Economic Development committee to lease former sewer bed land for facility construction and operation by private company. In June, City Council tabled proposed amendment to zoning laws due to a number of concerned citizens, preventing town from fielding requests for proposal. Planning board voted to not recommend to the city council.

Hamilton, MA: Facility location would be on former landfill site. CDM Smith Inc. is the town's consulting firm for project. The feasibility study is complete and now the town is looking for grants, after which time they may field requests for proposal. Construction could start early to mid 2015. Town already collects source separated organic material (SSOM) at the curb.

Lexington, MA: Facility proposed at the Hartwell Ave Landfill site where a leaf & yard waste composting facility already exists. Camp Dresser & McKee Inc. is consulting for the town on the project. Plans to process up to 145,000 tons yard and food waste per year.

Brunswick, ME: Village Green Ventures plans to produce 750 kW to 1MW from septic and eventually food waste.

Aquidneck Island, RI: In 2011, Portsmouth town administration was seeking funding for a feasibility study due to limited space remaining in the island's landfill. Rhode Power initiated a proposal, but has not since moved forward. HADS (see Educational Efforts section below) is targeting this area as a potential AD location.

Johnston, RI: Orbit Energy is the probable contender to build. The company was awarded a power purchase agreement with National Grid. They are currently looking for food scraps from institutions such as colleges and universities, grocery stores, businesses, and hope to have a 125 tons food waste/day processing capacity. Their timeline is dependent on finding food sources, but they suggest a possible completion date of mid 2014.

Relevant Legislation & Regulation

The legislation relevant to the construction and operation of facilities that use anaerobic digestion to break down food waste, while varying among municipalities and states, fall under four general categories: zoning laws and permitting, demand for biogas, net metering, and access to source separated organic materials (SSOM).

Some of this legislation is currently under review. Much of the legislation does not mention or categorize AD facilities directly, so the rules that apply to constructing such a facility had to be inferred.

I. Zoning Laws and Permitting:

Municipal

Each town's zoning laws restrict the location of any proposed waste facility. Specific legislation depends on the proposed location, for example, if the facility is to be built in commercial or residential zones.

Connecticut

Solid Waste Facilities Permitting (RCSA, 22a-208a-1 and 22a-209-1 through 22a-209-17): regulates all activities related to solid waste disposal and waste processing facilities for proper planning, construction, operation, monitoring, and maintenance. The regulations include landfills, composting facilities, incinerators, etc. The statutes for solid waste management can be found in Title 22a, Chapter 446d – Solid Waste Management.

Maine

Solid Waste Management Rules, Processing Facilities (38 MRSA§1306 ch. 409): applies to AD, must obtain permit that considers flood plan and proximity to natural resources, water supplies, public roads, etc.

Massachusetts

Mass Environmental Policy Act and Regulations (301 CMR 11.00, MEPA): in some cases, projects would have to submit an Environmental Impact Report for parameters including impact to wetlands, endangered species, conservation land, air quality emissions, etc.
Site Assignment Regulations for Solid Waste Facilities (310 CMR 16.00): proposed facilities must go through permit process to determine whether a piece of land is suitable for a solid waste facility. The regulations include exemptions for smaller recycling, composting, and conversion facilities, and separate permitting for larger recycling, composting, and conversion facilities. Manufacturing or industrial facilities that handle organic materials do not require a site assignment or any permit. Such facilities must only not discharge unpermitted pollutants, not create a public nuisance, and not present a significant threat to public health, safety, and the environment.
Massachusetts Contingency Plan (310 CMR 40.0000, MCP): proposed facilities need a licensed site professional to evaluate impact on human health, safety, and the environment

New Hampshire

Solid Waste Permitting and Design Review (RSA 149-M and the NH Solid Waste Administrative Rules (Env-Sw 100-2000)): applies to all facilities that accept 30 tons of waste/day or more, including composting facilities, recycling facilities, landfills, incinerators, etc.

Rhode Island

Rules and Regulations for Composting and Landfill Facilities (DEM OWM-SW04-01) pertains to the operation of transfer stations, landfills, incinerators, composting facilities, etc.

Vermont

Solid Waste Certifications & Permitting, Vermont Solid Waste Management Rules §6-1113 applies to digesters that use any amount of food or non-farm food processing waste as feedstock. Digesters may accept any amount of food waste on a trial basis without permit, as long as food waste is less than 5% of capacity and trial is not longer than 12 weeks.

***II. Demand for Biogas*:**

Connecticut

Renewable Portfolio Standards (RPS)-require electricity providers to obtain a minimum percentage of their retail load by using renewable energy. Definitions do not explicitly include AD.

CT Department of Public Utility Control issued a declaratory ruling in 2008 stating that methane from manure and organic waste in an anaerobic digester (docket 07-06-22) and an AD generation facility that uses food waste to make methane (docket 08-09-04) both qualify as a **Class I renewable energy source**.

Massachusetts

Renewable Energy Portfolio Standard (REPS)- requires a percentage of the state's electricity to come from renewable energy. Alternative Energy Portfolio Standard (APS) provides requirements and incentives for alternative electricity technologies

M.G.L. c. 25A, Section 11F (b) includes biomass conversion technologies from organic sources including food waste as a **Class I Renewable Energy Source**

Vermont

Sustainably Priced Energy Development (SPEED) Program: Enacted by Vermont Legislature in June 2005 by 30 V.S.A. § 8005 and § 8001. By January 1, 2017, 20% of statewide electrical retail sales must be generated by renewable energy sources. All farm AD facilities on above list on SPEED projects list.

III. Net Metering:

Connecticut

Gen. Statutes Ch 283, Sec. 16-243h regulates credit to customers who generate electricity from Class I renewable energy sources. Net metering allowed up to 2MWh

Massachusetts

220 CMR 18.00 governs net metering in MA. In 2008, the amount of net metering allowed

increased from 60 kWh to 2MWh per facility, the value of credits of energy created by AD facilities increased to nearly retail value, and net metering customers were granted allowance to allocate net metering credits. In Aug 2012, AD CHP systems were specifically included.

Rhode Island
Gen. Laws § 39-26.2-1, Distributed Generation Standard Contracts Act: facilitates and promotes grid-connected generation from renewable energy sources. Definitions include biogas from AD.

IV. Access to Source Separated Organic Materials (SSOM)
Connecticut.
Public Act No. 11-217 amended by Section 4 of P.A. 13-285 requires that on and after January 1, 2014 each commercial food wholesaler or distributor, industrial food manufacturer or processor, supermarket, resort or conference center that is located not more than twenty miles from an authorized source-separated organic material composting facility and that generates an average projected volume of not less than one hundred four tons per year of source-separated organic materials, separate such materials from other solid waste and ensure they are recycled at any authorized composting facility that has available capacity and that will accept such material.

Massachusetts
MassDEP's Final **2020 Solid Waste Master Plan** includes adding an organic waste landfill ban for commercial sources that produce more than one ton of organic waste per week, to take effect in July 2014. Currently, the waste ban has gone to public comment for review.

Vermont
Act 148 institutes a ban on disposal of food residuals for all waste generators, including residential generators, to be enforced by 2020 and mandates that solid waste processers offer services for processing food residuals by 2017 and that haulers must offer curbside collection of food residuals by 2017.

Incentives and Sources of Funding for AD facilities

The funding sources available for the advancement of AD facilities are most frequently found at the state level, although federal and local options are often available. The following sources support the construction or expansion of AD at farms and wastewater treatment facilities, as well the creation of stand-alone AD facilities.

Connecticut

Connecticut's Clean Energy Finance and Investment Authority (CEFIA)'s Anaerobic Digestion Pilot Program: 3-year, $5M program for on-site AD, released in June 14, 2013. This RFP is soliciting applications from eligible entities for grants, loans, loan enhancements or power purchase incentives for projects in the development phase. Facilities must not exceed 3MW, lie within National Grid or Connecticut Light & Power territories, and be base-loaded systems. Funding not to exceed $450/kWh generated. Deadline for applications is February 27, 2015. Information about the program can be found at Energize Connecticut.

Maine

Community-based Renewable Energy Pilot Program: established in 2009 by (Act), P.L. 2009, ch. 329. Part A. Administered by the Maine Public Utility Commission (MPUC) to provide incentives for the development of community-based renewable projects, with "qualified local owners" owning 51% or more of the facility, which does not exceed 10 MW/year of electrical production.

Massachusetts

AgEnergy/Agriculture Environmental Enhancement Program (AEEP): renewable energy grant program for Massachusetts farms, with a typical max of $30,000 to mitigate or prevent negative impacts to environment from farming

Commonwealth Organics-to-Energy program (OtE): Mass Clean Energy Center (CEC)'s program offers technical assistance for grants for public entities, and design and construction grants for public and private entities. Eligible technologies are those that "convert source-separated organic materials into electricity or heat with minimal liquid or solid byproducts requiring disposal", and AD is principally supported technology

Community Energy Strategies: Mass CEC and Department of Energy Resources (DERC)'s pilot program will assist up to five municipalities or regional planning agencies to identify and develop clean energy projects best suited to the community. AD projects qualify.

Recycling Loan Fund (RLF): provides flexible lending programs for working capital to aid with the purchase of machinery and equipment for projects that process organic material. The fund now includes $3M specifically for AD.

State revolving loan funds for clean water (CWSRF): offers 2% interest loans for planning and construction of projects, which can include AD at WWTPs

Sustainable Materials Recovery Program (SMRP): offers funding to cities, towns, and regional entities, and the non-profit organizations that service them for recycling, composting, reuse and source reduction activities.

New Hampshire

No current laws or grant programs pertain to AD directly, but the 2009 NH Climate Action Plan seeks to "Encourage the Use of Biogenic Waste Sources for Energy Generation (AFW 2.4)" including food waste, FOG, other organic wastes and AD as a method. The plan mentions future incentives including loan programs and modifying existing municipal funding mechanisms to cover higher initial costs of projects.

Vermont

Clean Energy Development Fund: established by Act 74 (30 V.S.A. § 8015) in 2005, awards funds which apply to AD biogas facilities and especially promote CHP systems. From funds appropriated from the Vermont PSD and Entergy Nuclear VT. In FY2012, no funding was given towards AD projects, however in previous years AD projects have consumed roughly 2% of the annual awards.

Green Mountain Power's Cow Power program: this local electric utility allows customers to voluntarily pay an extra 4¢/kWh for farm digester gas.

Federal:

EPA/USDA **AgSTAR:** outreach and educational program promotes on-farm digesters.

EPA **Global Methane Initiative**: to reduce CH_4 emissions and advance abatement, recovery and reuse of CH_4. Creates and international network to remove barriers for project development.

Qualified Energy Conservation bonds (QECB): funding from American Recovery and Reinvestment Act of 2009, tax credit bonds to promote investment in qualified (by job creation and feasibility) renewable energy projects.

USDA **Advanced Biofuel Payment Program (ABPP):** provides payments to producers and sellers of biofuels from non- corn kernel starch sources.

USDA **Rural Energy for America Program (REAP):** provides assistance to rural agricultural producers via loan guarantees and grants to install renewable energy systems.

Educational Efforts

Most United States citizens are unfamiliar with AD technology. Like most new technologies, AD's introduction is often met with confusion and resistance. Most developers attempt to educate the communities in which they intend to build, however more broadly-based efforts may help the advancement of AD in New England. The following programs have been established with strong education-based agendas, and may serve as valuable models for future efforts.

- **Hadley Anaerobic Digestion Solutions**: Established in January 2012, this consulting business holds the philosophy that "education is the first step to Rhode Island understanding how food waste can create renewable energy." Phil Hadley's Zero Waste curriculum targets students, farmers, community members, unions, legislatures, lawmakers & professionals. The business mentions plans for a local educational radio program as well as meetings with colleges and universities, local city officials, and organizations. One of its specific goals is to bring AD to Aquidneck Island.
  HADS website for more information: http://hads.co/About.html

- **Anaerobic Digestion Research and Education Center, Michigan State University**: MSU ADREC researches, develops, and evaluates AD technologies, and conducts outreach initiatives that emphasize cost effectiveness and efficiency. The outreach is targeted to small and medium size dairy farms.
  ADREC website for more information: http://researchgroups.msu.edu/adrec/about

Obstacles to the creation of AD food waste facilities

The large investment of money and time to plan, construct, and operate a stand-alone AD facility, as well as a lack of familiarity with AD as a technology cause careful consideration before initiating such a project. Tipping fees are generally insufficient to fund an AD, and obtaining all necessary permits can be cumbersome or impossible. Beyond this initial resistance, project proposers will almost certainly encounter further difficulties. While the challenges of creating a stand-alone AD facility will be distinct in each location, most proposals will struggle with the following topics:

I. Access to source separated organic material (SSOM): while food waste generators (residential or commercial) are nearby any proposed AD site, obtaining high-quality organic waste that is separated at the source of generation can prove difficult. Only a small minority of New England municipalities has introduced a mandated separation of organic waste and curbside pick-up. Most residents have neither the incentive to separate organics from their waste nor access to SSOM collection. Connecticut and Vermont have created a source of SSOM with their food waste bans (see above), and MassDEP plans to institute similar legislation for 2014.

II. Community Objection: Few examples of operational stand-alone AD facilities exist in the United States. Town residents often incompletely understand or misunderstand AD technology, causing opposition as municipalities consider proposals. Furthermore, many residents express concern over odors and noise from the facility, as well as additional traffic from the import of SSOM and the export of digestate. While most developers attempt to educate communities before they begin the permitting process, these efforts vary widely in their breath and effectiveness.

III. Markets for Biogas and Digestate: To be a profitable operation, an AD facility must find customers for its products. The ability to net meter, or sell excess electricity back to the electrical grid, is indispensably important in making these facilities profitable. The digestate product of the AD process can be a valuable compost or pre-compost material. However, concerns about the quality of the product (ie, completeness of the pathogen elimination and level of contamination) require a certain level of assurance. There is some resistance to compost created with mixed biosolids and source separated organics. Partnerships with farms that are consistently able to use the digestate as fertilizer could be mutually beneficial.

Additionally, existing AD facilities at WWTP/WPCF and farms that are considering adding food scraps or FOG to their input stream may face obstacles. While additional energy output is generally desirable, the facility manager must consider the current capacity of the digester and their ability to profitably manage the extra CH_4. This is especially true for facilities that do not have a combined heat and power (CHP) system. While adding FOG to the input stream is more common and generally less complicated, many facility managers have justified concerns about the effect of grease on the system's mechanics.

Conclusions

Food waste makes up a significant portion of the municipal solid waste stream. As landfills reach capacity and awareness of global warming limits the acceptance of solid waste incineration, more demand for sustainable uses of waste will build. Anaerobic digestion is one means of diverting food waste from incineration or landfill.

AD technology involves high investment cost and a lengthy approval process. These initial struggles are made more cumbersome by lack of direct legislation pertaining to AD (ie, classifying with compositing facilities or with landfills). Furthermore, proposals for new AD facilities are often met with public opposition due to lack of understanding.

In order for AD to become a viable technology in New England, significant efforts to educate the general public, large overhauls of permitting and electricity legislation to update and include this technology, and more robust incentive plans will have to be enacted.

The EPA New England Regional Office is actively encouraging food waste diversion through the Food Recovery Challenge and other efforts within Sustainable Materials Management. To help advance AD of food waste in New England, the EPA could showcase successful food AD projects. Through webinars, case studies, or educational videos, the EPA could connect wastewater facilities, farms, and communities considering food AD with strong examples of how such projects can work using different technologies and adapting to unique local circumstances. Beyond this, any encouragement of legislation and regulation streamlining as well as facilitating interstate communication would be valuable.

Sources

All information on the existing wastewater treatment facilities and farms came directly from each institution's web page. All legislative information came from state or federal web pages. The information presented in the obstacles section was compiled based on phone conversations with facility operators, minutes from open town meetings, and consulting firms' evaluative reports to local governments.

The proposal facilities were identified by location using local newspapers and municipal town documents including meeting minutes, while further information was gathered from developers' web pages and interviews with permitting agencies.

Many individuals contributed to this report. Jason Turgeon (EPA Region 1)'s Summary of Biogas Activity in Northeast States and personal expertise provided the foundation for this report. The managers and workers of many different wastewater treatment facilities and farms gave invaluable information on their systems and experience. The following individuals provided input on the state level: KC Alexander (CT DEEP), Sumner Martinson (MA DEP), Mark King (ME DEP), Doug Kemp (NH DES), Chris Shafer (RI DEM), and Dennis Fekert (VT DEP).

The following sources were extremely helpful in gathering general information on AD in New England:

1. Biogas data's web page allows viewers to search for WWTPs with AD. This was important preliminary information to gather early on in the report draft, and it was by searching each WWTP with AD in the region that those that accept food waste or FOG were identified.
   URL: http://www.biogasdata.org/facilities/search
2. American Biogas Council has provided a map that identifies WWTPs, farms, and landfills that capture biogas. This was important preliminary information, as it provided a list from which farms that use AD could be searched for food waste or FOG acceptance into the waste stream.
   URL: http://www.americanbiogascouncil.org/biogas_maps.asp
3. Vermont Agency of Agriculture, Foods and Markets published the report Vermont's Experience with the Adoption of Anaerobic Digestion on Farms in 2007. The report provided valuable information on the process of AD advancement in the state, helping to identify not only the waste sources for farms in VT but also challenges faced by farms attempting to adopt AD.
   URL: http://epa.gov/agstar/documents/conf07/scruton.pdf