



# **Module 10: State and federal regulation of AD**

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This curriculum is adapted from: eXtension Course 3: AD, University of Wisconsin



# ***Federal regulation of AD***

# AD regulation



Because AD involves the handling, storage and transportation of waste streams it has the potential to affect **public and environmental health and safety**.

At the state and local level, regulation has developed independently and is therefore not consistent across the country. **State regulation** occurs via agencies designed to regulate:

- Solid waste;
- Wastewater;
- Agriculture;
- Hazardous waste;
- Composting; and
- Utilities.

It's important to note that AD regulatory process is **evolving**. Operators must be careful to check their state's rules.

Evolution of regulation is being driven by the push to increase renewable energy and to divert organics from landfills in order to recycle nutrients.

# Federal regulation: categories



Federal standards govern the following areas related to AD.

- Surface water quality and pollution
- Groundwater quality and pollution
- Air quality
- Regulated emissions
- Nutrient management planning
- AD design, construction and operation
- Fire protection
- Greenhouse gas emissions
- Right to know about chemical emergencies

# Federal regulation: NRCS codes (1)



Federal standards often guide the development of state regulations.

**National Resource Conservation Service (NRCS)** provides national standards for design and construction of AD systems.

- Through NRCS, USDA develops national technical standards called Field Operation Technical Guides (FOTG).
- States usually adapt and enforce these technical guidelines.

**Anaerobic Digester code 336** outlines AD design criteria.

- AD design
- AD operation
- Waste collection & handling systems
- Biogas collection and handling systems
- Compliance standards
- Safety procedures

This code has not yet been adopted by states.

# Federal regulation: NRCS codes (2)



**NRCS Wastewater Facility code 313** outlines storage design criteria for basins and holding areas used for feedstock pre-and post-digestion, and dictates minimum design criteria for AD structure.

**NRCS Nutrient Management code 590** regulates the application of manure, digester effluent (digestate), fertilizers and other sources of nutrients.

# AD construction practices



Voluntary construction practice standards are outlined by the **American National Standards Institute (ANSI)**.

Depending on materials, AD construction standards are created by:

- The **American Concrete Institute**; and
- The **American Institute of Steel Construction**.

Electrical components and work must comply with the **National Electric Code**.

All design components must conform to **National Fire Protection Association (NFPA)** standards.

- Gas collection & storage
- Gas transportation
- Safety and fire protection
- Proper ventilation
- Explosion-proof construction
- Gas detection & alarm systems
- Flame arresters

# Clean Water Act



## **Clean Water Act of 1972 (CWA):**

- Regulates discharge into waterways;
- Sets industry wastewater standards;
- Sets industry maximum pollution levels in waterways; and
- Requires states to adopt water quality standards.

AD leaks, spills, runoff and leachate are subject to regulation.

- AD feedstock contain high oxygen demand, nutrients, pathogens and sediment that impact and reduce water quality when spilled.



**National Pollution Discharge Elimination System (NPDES)** regulates point-source pollution discharged to navigable waters from industrial, municipal, and agricultural sources.

CWA Section 319 requires states to develop federally approved assessment and management programs for discrete discharges.

- States typically regulate and enforce.

**Agricultural requirements** for NPDES include:

- Voluntary or mandatory (for large or high-risk) programs;
- Irrigation and storm water are generally permit exempt except for CAFOs;
- Collection and storage of waste before, during, and after AD is regulated;
- Installation of AD often triggers NPDES regulation;
- Spreading of digestate is often regulated as an ag waste and requires; and
- Comprehensive Nutrient Management Plans and extensive record keeping.



**Non-agricultural requirements** for NPDES apply for to **biosolids** that are regulated by EPA permitting under 40 CFR.

- Land application of biosolids is regulated by part 503.
- Biosolids must be designated class A or B prior to land application.
  - Regulation of class A is more stringent than class B and considers:
    - Pathogens;
    - Vector attraction;
    - Heavy metals concentrations;
    - Site restrictions;
    - Crop harvesting restrictions; and
    - Extensive record keeping and reporting.
- Without this classification, bio-solids must be landfilled



**Non-agricultural requirements** for NPDES apply to **hazardous wastes** that are regulated by EPA through the RCRA permit under 40 CFR, part 270

**Resource Conservation and Recovery Act of 1976 (RCRA)** set standards for:

- Hazardous and non-hazardous waste management;
- Waste production;
- Waste collection;
- Waste transportation;
- Waste facilities;
- Waste treatment; and
- Waste disposal.

# SWDA and CAA regulations



The EPA regulates groundwater quality through the **Safe Drinking Water Act of 1974 (SWDA)**.

- Location of waste storage and AD systems is restricted by setback distances to wells, wetlands and other ground and surface water features
- Best management practices (BMPs) are often required.

**The Clean Air Act of 1970 (CAA)** regulates emission prevention, control and permitting. Federal regulations apply to:

- Nitrous oxides (NO<sub>x</sub>);
- Particulate matter (PM);
- Carbon monoxide (CO);
- Sulfur oxides (SO<sub>x</sub>);
- Lead; and
- Volatile organic compounds (VOCs).

# Federal Title V



**Federal Title V** permits are required for air emissions exceeding 100 ton per year for primary emissions sources.

**Hazardous air pollutants (HAPs)** require Title V permitting when over 25 tons per year for all HAPs or 10 tons per year for any single HAP.

HAPs are not associated with agricultural AD, but may become a factor if certain co-substrates are used.

See a complete list of HAPs requiring permits at:

*<http://www.epa.gov/ttn/atw/188polls.html>*

# Mandatory GHG reporting



In 40 CFR part 98, US EPA has **mandated the reporting of greenhouse gases (GHG)**: gases implicated in global climate change (aka global warming):

- Carbon dioxide (CO<sub>2</sub>)
  - Nitrous oxide (N<sub>2</sub>O)
  - Methane (CH<sub>4</sub>)
- GHGs produced by AD

See 40 CFR 98 Subpart A Table A-3 for a list of all facilities that must comply:

- Manure management facilities with combined CH<sub>4</sub> / N<sub>2</sub>O emissions of  $\geq 25,000$  metric tons of CO<sub>2</sub> equivalents / year [This includes AD]
- However, if the maximum input capacity for all fuel combustion equipment is  $< 30$  million Btu / hour, it is assumed that carbon output will be less than 25,000 metric tons / year and the facility is exempt
- When reporting is required, the method of calculation and categories of emission and reporting are specified!

# Emergency planning & right to know



The Federal Emergency Planning and Community Right to Know Act of 1976 (EPCRA) covers **planning requirements for chemical emergencies.**

Any hazardous chemicals above threshold limits must be reported to state and local authorities to facilitate emergency planning.

- Chemicals are listed in 40 CFR Part 302, Table 302.4/
- Any emissions or spills into air or water of > 100 lb in 24 hours must be reported to state, local and the National Response Center.

For AD systems, chemicals of concern include:

- Ammonia ( $\text{NH}_3$ )                      5,000-gallon spill @ 2,400 mg/L
- Hydrogen sulfide ( $\text{H}_2\text{S}$ )              50,000 cubic yards of biogas > 100 ppm



# ***State regulation of AD***

# Who regulates AD at the state level?



The agency responsible for regulating AD at the state level varies state-to-state.

The regulatory agency is sometimes determined by the nature of feedstock used at the AD facility:

- On-farm AD with farm-derived feedstock is often covered by NPDES permits.
- Feedstock derived from municipal & industrial solid waste is often regulated by solid waste and wastewater agencies.
- Multiple feedstock streams may result in regulation by multiple agencies or one agency may take greater responsibility.
- Change of feedstock can result in rapid changes in regulation.
- Percentages of off-farm feedstock are often limited for on-farm AD regulated by agricultural agencies.

# NPDES permits usually granted by the state



**NPDES permit conditions are usually state-specific** and regulated by state agencies. With a goal of limiting transportation and release of environmental pollutants and ensuring safe work environments, NPDES permits may specify:

- AD system design;
- AD siting; and
- AD operation & maintenance.

In addition to feedstock, NPDES regulations are also concerned with:

- AD digestate; and
- AD air emissions.

# State regulation of digestate & emissions



**Transportation of digestate** is often regulated by state solid waste and / or transportation agencies and may require:

- Vehicle design and leak protection; and
- Licensing requirements.

**Land application of digestate** is typically regulated by state environmental or agricultural agencies in terms of:

- Storage of digestate prior to spreading;
- Application rates & timing; and
- Setback distances to water sources.

State regulation of **air emissions** are often based on the Federal Clean Air Act.

- Usually regulated by environmental agencies.
- Some states exempt agricultural operations, but not solid waste.
- In states where air quality does not meet federal standards (CA), federal regulations trump any state regulation of NO<sub>x</sub>, SO<sub>x</sub> and particulates.
- State and local authorities may also regulate odor emissions.



# ***Federal vs. state regulatory roles***

# Universal recycling law: Act 148 of 2012



In 2012, the Vermont Legislature passed **Act 148, the Universal Recycling Law**.

This law mandates diversion of all **recyclables** and **organic wastes** from landfills by 2020:

- To ensure the reuse of these materials; and
- Eliminate the need for new landfill construction.

Collection facilities and haulers:

- Must offer all services: trash collection, collection of recyclables and organic'
- Cannot charge separate fees for residential collection of waste streams; but
- Facilities can charge a separate fee for commercial haulers.

ANR will oversee facilities and rate structures.

<http://www.anr.state.vt.us/dec/wastediv/solid/Act148.htm>

# Universal recycling law timeline



The mandate to divert recyclables & organics is phased in over a six-year period.

## Timeline for food scraps diversion:

- Generators of 104 tons/year must separate/manage material by July 1, 2014.
- Generators of 52 tons/year must separate/manage material by July 1, 2015.
- Generators of 26 tons/year must separate/manage material by July 1, 2016.
- Generators of 18 tons/year must separate/manage material by July 1, 2017.
- Must be managed by facilities by July 1, 2017
- Must be collected by haulers by July 1, 2017
- Are banned from the landfill by July 1, 2020

# Hierarchy for food scrap management



The Universal Recycling Law includes a hierarchy of food scrap management that embodies highest-and-best use of organic wastes.

1. Reduction of generation of food scraps
2. Rescue quality food for people
3. Diversion for agricultural use, including food for animals
4. Composting, nutrient management and anaerobic digestion
5. Energy recovery

It seems that 'energy recovery' refers to incineration and that 'digestion' is grouped with composting because, although it does recover energy, it also recovers nutrients.

In fact, anaerobic digestion could be viewed as the best of both worlds.



# ***Local regulation of AD***

# Local regulation can be very effective



Town, county or regional **planning commissions** may require:

- Building plans;
- Grading plans & site plan review;
- Water systems; and
- Floodplain development.

Local **zoning** may include nuisance ordinances that regulate a project's effects on noise, odor and traffic.

Other **local authorities** may impact AD development:

- Local building codes
- Road commissions
- Fire codes and fire districts
- Sanitation districts

AD developers should contact regional and local authorities during the **planning phase** of AD projects!



# ***Occupational health & safety***



The U.S. Department of Labor (DOL) Occupational Safety and Health Administration (**OSHA**) establishes and enforces standards that related to AD including:

- **29 CFR 1928** agricultural standards; and
- **29 CFR 1910** general industry standards.

Twenty two states' OSHA plans are at least as stringent as federal OSHA standards. State OSHA should be applied to AD where it exists.

The Occupational Safety and Health Act of 1970, Section 5, A.1:

*“requires each employer to furnish each of his employees employment and a place of employment free from recognized hazards that are causing or likely to cause death or serious physical harm to his employees”*

### **Largest OSHA concerns:**

- Confined space hazards
- Hazard communications
- General working conditions

# Confined space hazards



AD presents workers with **several confined space hazards**: spaces that employees can enter and have limited ventilation that can cause the accumulation of toxic or flammable gases. Biogas components can asphyxiate workers and pose explosive hazards.

- Atmospheric hazards
- Ventilation
- Fall potential
- Hazardous energy
- Engulfment hazards
- Mechanical hazards

Engineering design can minimize these hazards. For example:

- Place equipment needing maintenance outside of tanks and confined spaces

Entry of employees into confined spaces requires permits and planning under OSHA 29 CFR 1910.146.

- Written plans must exist & include rescue considerations.
- Workers must be trained and aware of their rights.

# Hazard communications



AD worker safety is addressed in 1910.1200 Hazard Communications because biogas includes components that are hazardous to human health.

**Permissible exposure limits (PEL)** are listed below.

| gas              | 8 hour TWA (ppm) | ceiling (ppm) | notes  |
|------------------|------------------|---------------|--|
| ammonia          | 50               |               |  |
| carbon dioxide   | 5000             |               |  |
| hydrogen sulfide |                  | 20            | A 50 ppm peak above ceiling levels is acceptable for 10 min if it occurs only once |
| methane          |                  |               | No exposure limits but O <sub>2</sub> levels must be kept above 19.5%              |

- Ventilation must be used to maintain these levels.
- Atmospheric respirators must be used if ventilation is not sufficient.
  - Air-supplied or self-contained breathing apparatus (SCBA).

# Additional safety concerns



Working surfaces at different levels that pose **fall hazards** require evaluation and safety measures like guard rails where necessary.

**Electrical and power hazards** should be made safer using a lockout/tagout program.

**Warning signs** should be used wherever needed.

**Safety procedures** should be developed and disseminated to workers prior to AD system operation.



# ***Case Study: Permitting Vermont Tech's AD***

***'Don't avoid permits,  
design to avoid environmental impact.'***

- Mary O'Leary

# Federal, State & local permits required



## **Federal** permits required:

- NEPA from EPA

## **State** permits required:

- ANR (Agency of Natural Resources):
  - Storm water & air quality
  - Solid Waste facility
- AAFM (Agency of Agriculture, Food & Markets): MFO
- NRCS (Natural Resources Conservation Service): BMP
- PSB (Public Service Board)
- Department of Public Safety
- State Fire Division

## **Local** permits required:

- Town Plan
- SWIP (Solid Waste Implementation Plan)
- Fire Advisory Board

# Working in a shifting regulatory landscape



In 2010, the regulatory hurdles to more widespread development of AD in Vermont included:

- Lack of incentives for the production & use of renewable heat;
- Lack of clarity about the permits required to accept food waste;
- Ambiguity about the necessity of pasteurizing food waste;
- No specific regulations governing land application of digester effluent as a soil amendment;
- Ambiguity concerning a farm's ability to sell separated solids if food waste feedstock included beef as the prions that cause bovine spongiform encephalopathy ('mad cow disease') are not inactivated by Pasteurization; and
- Lack of incentives for capture and mitigation of methane (or other greenhouse gases) and for recycling of waste nutrients back into the agricultural production cycle.

# Seven years of change



Between VTCAD's **feasibility** (2007 – 2010) and **implementation** phases (2012 – 2015) attitudes and regulations concerning organic residuals, renewable energy and nutrient recycling have shifted dramatically.

The general public is now more aware of the benefits of organic recycling and renewable energy, new regulations have gone into effect forcing the beneficial use of organic residuals, and while there is still some fear of implications of re-using food wastes, the idea is acceptable not repugnant as it once was to many.

- That said, a good deal of time and effort has been spent to communicate with local Randolph Center residents, understand their concerns and try to improve both construction plans and AD operations.
- College staff met regularly with legislators and officials of Vermont's regulatory agencies during feasibility and implementation stages.

We believe the development of VTCAD has contributed to the evolution of AD regulations in Vermont and we hope to continue to be part of the process.

# Renewable energy: SPEED vs RESET



Vermont's Comprehensive Energy Plan calls for the shift to **90% renewable energy by 2050**.

VTCAD has a 20-year contract for electricity via Vermont's **Sustainably Priced Energy Enterprise Development** program (SPEED).

- Our SPEED price is about \$0.14 per kilowatt-hour.
- AD projects are allowed to keep and sell renewable energy credits (RECs). But, the market for Vermont RECs is limited by concerns about 'double dipping': sale of renewable energy and associated RECs to different customers.
- SPEED requires on-farm AD to use at least 51% on-farm feedstock. Biomass AD facilities may use more than 49% off-farm feedstock, and are now compensated at a rate of up to \$0.21/kWh. This is a challenge to the future success of on-farm AD.

In 2017, new legislation (**RESET**) replaces SPEED. RESET is similar to renewable energy policy in the other New England states and will allow Vermont's renewable energy producers to expand regional sales of RECs.

# Improved communication & clarity



In recent years, the water quality problems in Lake Champlain have resulted in **increased and improved communication and coordination** between Vermont's Agency of Natural Resources (ANR) and Agency of Agriculture, Food and Markets (AAFAM).

- Improved communication will facilitate more effective regulation of organic residuals and nutrients, including regulation of anaerobic digestion and other forms of organic recycling.

In Vermont, facilities producing electricity must receive a **Certificate of Public Good (Act 248)** from Vermont's Public Service Board (PSB).

- In July of 2012, the legislature passed Act 88, clearly delineating the PSB's regulatory authority: the PSB may regulate electric generation, but regulation of manure handling, nutrient recycling and agricultural issues is the purview of the Agency of Natural Resources and Agency of Agriculture, Food and Markets.

# Regulation of food waste as feedstock



During the development of VTCAD, Vermont's ANR released a set of solid waste regulations that included some specific guidelines for anaerobic digesters accepting non-farm organic residuals that the agency classifies as **solid waste**.

- We believe the agency should consider a new regulatory category for food residuals collected in a clean stream (without inorganic contaminants so not part of the municipal solid waste stream) rather than as solid waste.
- We note that ANR distinguishes between composting and anaerobic digestion, and that the agency appears to favor composting. While composting and anaerobic digestion use the same organic residuals as feedstock, the agency maintains a web site devoted to composting. This may be a matter of experience rather than intent; Vermont has an active composting advocacy group and but no similar group promoting AD.

# Regulation of AD effluent



When we began our feasibility study, Vermont ANR's Wastewater Division required farmers to comply with the 1999 rules for 'land application of dairy waste' when using AD effluent as a field amendment.

By the time we began our implementation phase, they consider AD effluent to be manure and effluent **is now regulated by conventional comprehensive nutrient management planning.**

- The Wastewater Division now works with the AAFM to ensure that organizations operating with mandated nutrient management plans (i.e. all on-farm AD facilities) have the capacity to accept nutrients before approving that facility as a destination for organic residuals on indirect discharge permits issued to generators the organic residuals (breweries, cheese producers, dairy processors).

# Remaining regulatory ambiguity



Some regulatory ambiguities remain. For example:

- The Agency of Agriculture advocates for **pasteurization of food waste** prior to use as AD feedstock. And they discourage sale of AD separated solids as dairy bedding to other farms if AD feedstock contains any beef.
  - The agency has expressed concern that the beef could contain the prion that causes **bovine spongiform encephalopathy** (aka 'mad cow disease'). The prion cannot be inactivated by Pasteurization, and dairy cows occasionally ingest bedding and might thus contract the disease.
  - However, neither recommendation exists in writing. Since AD regulation is still in its nascent stages, AD developers may be taking a risk if they do not install expensive Pasteurization equipment and rely on income from the sales of separated solids to other dairies.

# Universal recycling law



In July of 2012, the Vermont Legislature passed Act 148, now known as the **Universal Recycling Law**, that bans landfilling of:

- recyclables (metal, glass, some plastics and paper/cardboard) by **July 1, 2015**;
- leaf and yard debris and clean wood by **July 1, 2016**; and
- food scraps by **July 1, 2020**.

This law also requires solid waste haulers and facilities to collect these 'banned' materials.

VTCAD was planned and designed prior to passage of this law, though with the same intent. However, in part because of VTCAD, anaerobic digestion is increasingly seen as a productive and beneficial means of organics management that can help Vermont comply with the new law.

# Permitting timeline



# What are the permits for?



Permits can generally be categorized as follows:

1. Required for **construction**;
2. Required for **operation**; and
3. Require **reporting** during construction, or more likely, during operations

# Permits for construction & operation



## Construction:

- National Environmental Policy Act (NEPA) → federal
- Certificate of Public Good (248) → *reporting*
- Construction General Permit 3-9020
- Air Pollution Control Permit
- Public Safety Permit
- Power interconnection agreement
- SPEED contract
- Solid waste implementation plan → local

## Operation & reporting: [all state]

- Medium Farm Operation Certificate → *reporting*
  - Comprehensive Nutrient Management Plan → *reporting*
  - Certified farm waste storage facilities
- Solid Waste Certificate → *reporting*
  - Wastewater Indirect Discharge Permits

# Agency of Natural Resources (1)



Vermont's ANR regulates many activities with the potential to have environmental impact.

**Air quality:** ANR felt that their concerns about generator emissions from the AD project were covered by our existing permit for the college's central heating plant and parking lots. So no additional permitting was required.

**Storm water:** The AD project needed a storm water construction permit. However, a storm water operational permit was not required because the AD site has less than an acre of impervious surface.

**Construction General permit:** ...Required for AD construction

# Agency of Natural Resources (2)



**Solid waste:** In order for the AD project to accept pre- and post-consumer food residuals as feedstock the college must be a permitted Solid Waste Facility.

- The permit required is substantial.
- Quarterly reporting is required.
- This permit will regulate all waste received, including liquid food processing residuals.

**Wastewater:** The college does not require permits from this office. However, food processors who generate liquid residuals must have Indirect Discharge permits in order to dispose of this organic material. The permit must list all destinations / facilities that receive the waste.

- Adding the our AD facility to the permit requires permit amendment.
- That amendment must be approved by ANR Wastewater, and...
- ... by AAFM to be sure that we have the capacity to land apply additional nutrients contained in the residuals.

# Vermont Public Service Board



The **PSB** regulates all electric generators in Vermont under Act 248, a variant of Act 250. The 248 permit is also known as a '**Certificate of Public Good**'.

The college and its law firm did not have experience with this permit and could have done a better job with the application. As a result, the application stalled & was held up over several issues, particularly:

- The effluent pond; and
- The cNMP.

This led to frayed nerves, as the college had already purchased the genset because it had to be ordered well in advance of delivery.

- Permit approval required 2-years (CPG issued in April 2013), causing a one-year construction delay.
- Legal costs ballooned from the \$25K estimate to >\$100K.
- The permit was issued with 20 conditions, and many were unrelated to electric generation.

# Saved by Act 88!



In July of 2013, the Vermont Legislature passed **Act 88**. This new legislation retroactively limited the scope of the Certificate of Public Good to regulation of electric generation.

Regulation of farm issues, manure management, nutrient management, green house gas generation etc, was returned to the state agencies concerned with those matters. Thus, Act 88 clarified regulatory responsibility and authority and reporting for permit holders.

# Vermont AAFM and NRCS



The **Agency of Agriculture, Food and Markets** is the department of Vermont's executive branch of government that regulates farming, food production and sale.

The **Natural Resource Conservation Service** (NRCS) is part of the federal United States Department of Agriculture (USDA). NRCS has offices in each of the fifty states and those local offices support local agriculture and state departments of agriculture.

**Medium Farm Operations** (MFO) are those farms with 200 – 699 mature dairy cows. The college farmstead and the Abdie herd, combined, have 160 mature cows. But, the construction of the AD plant requires us to operate as an MFO. MFOs must use comply with two practices.

- **Comprehensive nutrient management plans** (CNMPs) [code 509]
- **Best management practices** (BMPs) [code 309/313]

Both require annual reporting and updating.

# MFO reporting



The 2012 MFO reporting form requires pretty basic information for the last 12-month period.

- Number of animals of each type
- Volume of “manure or waste” in gallons and / or tons
- Acres in the NMP
- Acres spread during the last 12 months
- Summary of (accidental) discharges
- Status of the NMP
- Preparer of the NMP

The term “manure or waste” is not very specific, but conversations with VAAFM make it clear that this means total volume of all on-farm and off-farm feedstock handled, managed and / or spread by the MFO. For Vermont Tech, this means anything used as digester feedstock.

# VTCAD's 1<sup>st</sup> 12-months' feedstock data



The first VTCAD MFO report covered 1 Mar 2014 – 27 March 2015

| date    | total volume  |               | total volume<br>gallons/month | avg volume<br>gallons/day | on-farm |       | off-farm |  |
|---------|---------------|---------------|-------------------------------|---------------------------|---------|-------|----------|--|
|         | gallons/month | gallons/month |                               |                           | %       | %     |          |  |
| 3/1/14  | 196,000       | 13,600        | 209,600                       | 6,987                     | 93.51   | 6.49  |          |  |
| 4/1/14  | 73,250        | 2,100         | 75,350                        | 2,512                     | 97.21   | 2.79  |          |  |
| 5/1/14  | 382,000       | 19,500        | 401,500                       | 13,383                    | 95.14   | 4.86  |          |  |
| 6/1/14  | 373,100       | 8,840         | 381,940                       | 12,731                    | 97.69   | 2.31  |          |  |
| 7/1/14  | 487,413       | 33,969        | 521,382                       | 17,379                    | 93.48   | 6.52  |          |  |
| 8/1/14  | 365,684       | 17,964        | 383,648                       | 12,788                    | 95.32   | 4.68  |          |  |
| 9/1/14  | 365,846       | 21,907        | 387,753                       | 12,925                    | 94.35   | 5.65  |          |  |
| 10/1/14 | 368,600       | 37,693        | 406,293                       | 13,543                    | 90.72   | 9.28  |          |  |
| 11/1/14 | 247,225       | 25,457        | 272,682                       | 9,089                     | 90.66   | 9.34  |          |  |
| 12/1/14 | 294,600       | 31,181        | 325,781                       | 10,859                    | 90.43   | 9.57  |          |  |
|         | -             | -             | -                             | -                         |         |       |          |  |
| 1/1/15  | 250,425       | 73,157        | 323,582                       | 10,786                    | 77.39   | 22.61 |          |  |
| 2/1/15  | 210,725       | 81,506        | 292,231                       | 9,741                     | 72.11   | 27.89 |          |  |
| 3/1/15  | 194,080       | 184,205       | 378,285                       | 12,610                    | 51.31   | 48.69 |          |  |
|         |               |               | <b>2014</b>                   | 3,365,928                 |         |       |          |  |
|         |               |               | <b>total</b>                  | 4,360,026                 |         |       |          |  |

# Types of feedstock, Mar '14-'15



| date    | on-farm feedstock (gallons/month) |                 |                  |                     |        |         |          |                 |                 |                  | off-farm feedstock (gallons/month) |          |         |       |
|---------|-----------------------------------|-----------------|------------------|---------------------|--------|---------|----------|-----------------|-----------------|------------------|------------------------------------|----------|---------|-------|
|         | Vermont<br>Abdie                  | Vermont<br>Tech | heifer<br>manure | silage /<br>haylage | grass  | leaves  | effluent | goat<br>bedding | paper<br>shreds | garden<br>refuse | brewery                            | glycerol | GTW     | FeCl3 |
| 3/1/14  | 40,000                            | 156,000         | -                | -                   | -      | -       | -        | -               | -               | -                | 9,600                              | -        | 4,000   | -     |
| 4/1/14  | -                                 | 73,250          | -                | -                   | -      | -       | -        | -               | -               | -                | 2,100                              | -        | -       | -     |
| 5/1/14  | 312,000                           | 70,000          | -                | -                   | -      | -       | -        | -               | -               | -                | 19,500                             | -        | -       | -     |
| 6/1/14  | 231,800                           | 131,300         | 10,000           | -                   | -      | -       | -        | -               | -               | -                | 8,400                              | 440      | -       | -     |
| 7/1/14  | 348,000                           | 125,100         | 3,688            | 2,875               | 5,250  | -       | 2,500    | -               | -               | -                | 12,350                             | -        | 21,500  | 119   |
| 8/1/14  | 168,024                           | 189,400         | -                | 750                 | 7,375  | -       | -        | -               | -               | 135              | 11,725                             | 2,140    | 4,000   | 99    |
| 9/1/14  | 160,000                           | 169,500         | -                | 3,000               | 9,125  | 22,000  | -        | -               | -               | 2,221            | 11,575                             | 1,700    | 8,500   | 132   |
| 10/1/14 | 116,000                           | 115,100         | 4,000            | 5,625               | -      | 2,375   | 125,500  | -               | -               | -                | 12,900                             | 4,050    | 19,800  | 943   |
| 11/1/14 | 16,000                            | 117,900         | 13,750           | 2,375               | 11,000 | 86,200  | -        | -               | -               | -                | 10,950                             | 545      | 13,500  | 462   |
| 12/1/14 | 36,600                            | 114,300         | 11,700           | 5,000               | -      | 127,000 | -        | -               | -               | -                | 13,025                             | 6,610    | 11,200  | 346   |
| 1/1/15  | 50,600                            | 116,200         | 12,500           | 2,125               | -      | 69,000  | -        | -               | -               | -                | 49,225                             | 6,265    | 17,300  | 367   |
| 2/1/15  | 54,800                            | 90,000          | 16,520           | 1,375               | -      | 48,000  | -        | 30              | -               | -                | 40,000                             | 9,150    | 31,500  | 856   |
| 3/1/15  | 47,800                            | 105,000         | 21,625           | 3,125               | -      | 16,500  | -        | 30              | -               | -                | 42,975                             | 24,000   | 116,000 | 1,230 |

liquid  
dairy manure

VTCAD  
liquid  
effluent

yeast  
sludge

dilute  
restaurant  
grease-trap

by-product  
of biodiesel  
production

# SPEED Program



Vermont's **Sustainably Priced Energy Enterprise Development** program was enacted by the legislature in 2005 in order to increase development of renewable energy projects. SPEED aimed to boost renewable energy production to 20% by 2017.

The college buys electricity from Green Mountain Power at a commercial rate of ¢11/kWh (depending on peak power use). SPEED grants the college a 20-year contract for electricity produced by the anaerobic digester as a Farm Methane project for ¢13.86/kWh and allows the college to sell the corresponding renewable energy credits (RECs).

This long-term contract for renewable electricity provided a secure source of revenue for renewable energy developers that would allow them to make the significant investments necessary to increase implementation of renewable electricity.

# SPEED prices for RE technologies



SPEED contracts offer prices for renewable electricity that depend on the nature of the RE technology:

| RE technology      | \$ / kWh    |
|--------------------|-------------|
| Solar photovoltaic | 0.24 - 0.30 |
| Wind               | 0.12 – 0.21 |
| Hydropower         | 0.125       |
| Wood biomass       | 0.12        |
| Farm methane       | 0.13 – 0.16 |
| Biomass methane    | 0.21 ?      |
| Landfill methane   | 0.12        |

The rationale appears to be the permitting, development, and capital costs of each RE technology.

While VTCAD is considered farm methane, our technology is appropriate for biomass methane & has higher capital and O&M costs than most farm methane.

# VTCAD Permitting References



## **AgSTAR's guide to federal (and state) permitting of AD**

<http://www.epa.gov/agstar/tools/permitting.html>

## **Certificate of Public Good (Act 248)**

<http://legislature.vermont.gov/statutes/section/30/005/00248>

## **PSB's Guide to CPG Application**

<http://psb.vermont.gov/sites/psb/files/publications/Citizens%27%20Guide%20to%20248%20February%2014%202012.pdf>  
<http://psb.vermont.gov/sites/psb/files/publications/Citizens%27%20Guide%20to%20248%20February%2014%202012.pdf>

## **NRCS (336) anaerobic digestion**

[http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs143\\_026149.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_026149.pdf)

## **NRCS (509) nutrient management**

[http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/stelprdb1046177.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1046177.pdf)

## **Vermont Agency of Natural Resources – permitting**

<http://www.anr.state.vt.us/dec/permits.htm>

## **Vermont Agency of Agriculture Food and Markets – land use & water quality**

[http://agriculture.vermont.gov/protecting\\_lands\\_waters](http://agriculture.vermont.gov/protecting_lands_waters)