FUNDING OPPORTUNITIES

Introduction to Funding Opportunities: Bioenergy and GHG Reducing Projects

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The Need for Funding

With rising energy costs, depleting fossil fuel supplies, and increasing concerns of climate change, the use of bioenergy and the reduction of greenhouse gases (GHGs) has gained interest within the wastewater industry. While water resource recovery facilities (WRRFs) operating anaerobic digesters can utilize digester gas to generate clean renewable energy, capital costs for these systems can be tremendous for a municipality, which is a barrier for the implementation of these systems. This fact sheet will provide the various funding programs and mechanisms that can ease or alleviate the financial burden incurred with the installation of these systems. Options include low interest loans, partial funding via grants, revenue generation or partnerships with developers.

Implementation of bioenergy and GHG reduction projects provide several benefits. Based on a Congressional Research Service study, WRRFs can account for 30%-40% of the energy costs of a municipality. As noted in the study, energy is the second-highest budget cost item after labor cost; therefore, installation of energy recovery facilities can provide annual costs savings to municipalities.

In addition to costs savings, implementation of these facilities will reduce GHGs. According to Accelerating Resource Recovery: Biosolids Innovations and Opportunities, there are currently 1,269 WRRFs with biogas systems in the U.S.. If all the WRRFs that treat more than 5 million gallons per day (MGD) install an energy recovery facility, annual carbon dioxide emissions could be reduced by an estimated 2.3 million metric tons. This is equal to the annual emissions from 430,000 passenger vehicles.

Funding Programs

Federal Public Programs

- Energy Efficiency Block Grants (DOE)

These grants can be used for energy efficiency and conservation programs and projects communitywide, as well as renewable energy installations on government buildings. Availability varies from year to year and, depending on the timing, this funding may or may not be available.

- Clean Water State Revolving Fund – Green Project Reserve (EPA)

The Green Project Reserve, or GPR, requires all Clean Water State Revolving Fund (CWSRF) programs to direct a portion of their capitalization grant toward projects that address green infrastructure, water efficiency, energy efficiency, or other environmentally innovative activities.

- Renewable Fuel Standard (RFS) Program (EPA) *Renewable Identification Numbers (RIN's)*.

As of July 2014, the EPA's RFS program now allows digester biogas from municipal WRRF digesters to be used as a transportation fuel feedstock. The biogas is designated as a "cellulosic" (D3) feedstock, thereby conferring the greatest possible value for the associated RIN's; the value of a D3 RIN is worth the sum of the values of a D3 RIN, a D5 RIN, a D6 RIN and the cellulosic waiver credit. To qualify for RIN credits, the fuel must be in the form of compressed natural gas (CNG) or liquefied natural gas (LNG), or it must be used to produce electricity used to power electric vehicles. RIN credits are expressed in gallons of gasoline equivalents (GGE) which are determined as the equivalent amount of gasoline offset by the fuel; using 115,000 Btu/gallon for gasoline. Third-parties are often hired that specialize in

RIN verification for the EPA and brokering of RIN's throughout the United States (see: WEF RIN Fact Sheet).

- Renewable Energy Credits (REC's):

REC's, also known as Green tags, Renewable Electricity Certificates, or Tradable Renewable Certificates (TRCs), are tradable, non-tangible energy commodities in the United States that represent proof that 1 megawatt-hour (MWh) of electricity was generated from an eligible renewable energy resource (renewable electricity) and was fed into the shared system of power lines which transport energy. REC's provide a mechanism for the purchase of renewable energy that is added to and pulled from the electrical grid.
These certificates can be sold and traded or bartered, and the owner of the REC's can claim to have purchased renewable energy. According to the DOE's Green Power Network, REC's represent the environmental attributes of the power produced from renewable energy projects and are sold separately from commodity electricity. While traditional carbon emissions trading programs use penalties and incentives to achieve established emissions targets, REC's simply incentivize carbon-neutral renewable energy by providing a production subsidy to electricity generated from renewable sources.
A certifying agency gives each REC a unique identification number to make sure it doesn't get double-counted. The green energy is fed into the electrical grid (by mandate) and the accompanying REC's can be sold on the open market.
REC values vary from state to state and fluctuate over time. REC's allow for purchasers to support renewable energy generation, attain RFS goals, and allow the economic forces of supply and demand to spur the further development of renewable energy generation.
The link below explains the REC program for the state of Colorado: Colorado REC Program

- Grants for buses and bus facilities

The 49 United States Code 5339 provides federal funding for replacement, rehabilitation and purchase of buses (and related equipment). Federal funding currently provides 80% of the cost of new CNG buses providing that a minimum 12-year vehicle service life is met.

- Alternative Fuel Excise Tax Credit

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (PL 109-59, § 11113, 26 USC § 6426, § 6427) provides an incentive for CNG and LNG when used as a "motor vehicle" fuel. This federal tax incentive provides $0.50 per gasoline gallon equivalent. It originally took effect in October 2006 and has been extended several times, often retrospectively. The latest extension ended in 31-Dec-2016.

- US Department of Energy (DOE) Southwest Combined Heat and Power (CHP) Technical Assistance Partnership

The DOE recently started providing technical assistance for entities and consultants evaluating CHP systems for anaerobic digestion of wastewater biosolids, food waste and other miscellaneous substrates. The technical assistance is provided at no charge and includes the following services:

Screening and Preliminary Analysis:
The Screening and Preliminary Analysis includes a high-level quick screening survey with a payback calculator.

Feasibility Analysis:
During the Feasibility Analysis Phase, DOE estimates annual energy savings, installation costs, simple paybacks, equipment sizing and prime mover type.

Investment Grade Analysis:
The Investment Grade Analysis includes third-party review of Engineering Analysis and equipment sizing and selections.

Procurement, Operations, Maintenance, and Commissioning:
This last phase includes Review of RFP bids and specifications, as well as a limited operational analysis.

State and Local Public Programs

While there is not an official database that includes information on all the state and local energy efficiency/generation, the following link takes you to a fairly comprehensive list with links to individual programs for state/local incentives for renewables and energy efficiency: DsireUSA
There are currently 17 states that have incentives for producing CNG from digester biogas. Several examples of state-level programs offered by California follow:

- Energy Conservation Assistance Act (ECAA)

The California Energy Commission (CEC) offers a low interest loan program for cities and schools to implement energy efficiency and renewable energy projects.

- Self-Generation Incentive Program (SGIP)

The California Public Utilities Commission's (CPUC's) - SGIP provides incentives to support existing, new, and emerging distributed energy resources. Qualifying technologies include wind turbines, waste heat to power technologies, pressure reduction turbines, internal combustion engines, microturbines, gas turbines, fuel cells, and advanced energy storage systems. This program has been extended through at least the end of 2019 and provides significant funding for renewably fueled engine generator alternatives as well as for other similar cogeneration technologies.

- Air Quality Improvement Program

This is an incentive program administered by the Air Resources Board to fund clean vehicle and equipment projects, research on biofuels production and the air quality impacts of alternative fuels, and workforce training.

- Carl Moyer Memorial Air Quality Standards Attainment Program

The program provides grants for engines and equipment that produce cleaner air emissions than required by regulations. Grants are administered by local air districts.

- Proposition 39 – Clean Energy Job Creation Fund

The Governor's May 2013 budget revision continued to direct the funds from the Clean Energy Job Creation Fund (Prop 39) entirely into schools. The California Legislative Analyst's Office (LAO) analysis states that this goes against the language in the bill, and indicates an opportunity for someone to litigate if this is how the Fund ends up being spent. The bill indicated that at least some of the funds would be available for energy efficiency and renewable energy projects at municipal buildings and facilities. While these funds may not be available much longer, they may also be redirected into renewable energy project programs that could be utilized in the next several years.

- Low Carbon Fuel Standard (LCFS) Program

As of June 2014, the California Air Resources Board (CARB) has a LCFS program, which now includes biomethane from mesophilic anaerobic digestion of wastewater sludge; fats, oils and grease (FOG), food waste and other high strength substrates at a wastewater treatment plant. The biomethane produced must be used as vehicle fuel and could be dispensed on-site through a compressed gas vehicle fueling station (for example, a CNG fueling station for transit buses or refuse hauling vehicles), or may be injected into the natural gas pipeline system ("common carrier pipeline") for dispensing at an off-site compressed gas vehicle fueling station. Each metric ton of carbon dioxide equivalent (MT CO_2e) emission from vehicle fuel that is offset represents one LCFS credit. These credits are in addition to the EPA's RFS RIN's described above. The value and marketability of LCFS credits depend upon demand and typically vary throughout a given year. As with the RFS RIN program, third parties are often hired that specialize in RIN verification for the EPA and brokering of RIN's throughout the United States and LCFS credits in CA. If the pipeline the gas is injected into can be connected to a location in CA, LCFS can apply.

- California Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program

The Alternative and Renewable Fuel and Vehicle Technology Program was established by Assembly Bill 118 (AB 118) and administered by the CEC and is also part of the state's strategy to meet the 2020 and 2050 GHG reduction goals. Through this program, CEC provides up to $100 million per year toward the development and deployment of low-carbon alternative fuels, fueling infrastructure, and advanced vehicle technologies, including biogas to CNG projects at WRRFs. Not only do these projects produce a renewable fuel with low carbon content, they also offset the use of and dependence on fossil fuel consumption and reduce emissions of GHGs and local air pollutants.

- Energy Incentive Programs

The Federal Energy Management Program's (FEMP) Energy Incentive Program has put together a database of state funding for energy incentive programs. Information about each state's available resources for federal agencies and utilities is available at the above link.

Alternative Delivery Mechanisms

Performance Contracting

Bioenergy projects provide a sustainable avenue for a WRRF to turn its solids commodity into energy that can be used onsite to offset facility energy demands or be sold back to the power grid, generating an additional stream of revenue. Energy Service Performance Contracting (ESPC, or PC for short) provides a turn-key procurement mechanism to achieve these projects with marginal risk to the Owner/Municipality by providing a performance guarantee and a positive cashflow. Each state has PC legislation for use in local government and can be found on the National Conference of State Legislators website or the Oak Ridge National Laboratory website . In addition, the DOE has released an ESPC Toolkit that outlines the process of picking an Energy Service Company (ESCO) and entering into a contract.

ESCOs act as a qualified provider offering performance contracting to achieve needed improvements serving as a design-build contractor that guarantees that the costs of the improvements (capital, operations & maintenance, loan interest costs, etc.) will be paid through energy savings and/or other operational savings, typically between 10 to 20 years, or as allowed by legislation. ESCOs provide Measurement and Verification (M&V) Services under the guidelines of the International Performance Measurement and Verification Protocol (IPMVP) that confirm that the deemed energy or operational savings are met. Should the energy savings not meet requirements and a shortfall exists, the Owner is financially compensated by

the ESCO for the difference. Example: A WRRF is considering a bioenergy project that entails capturing its biogas (i.e. digester gas) and creating energy to offset its own use. A performance contract will identify the energy savings or revenue enhancement arising from using the digester gas for fuel. This could be achieved by using an internal combustion engine(s), combustion turbine(s), microturbine(s), fuel cell(s), processing the digester gas into vehicle fuel as CNG or any other technology that the Owner considers for implementation. The performance contractor will comprehensively provide the design-engineering, guarantee terms, financing alternatives, bid documents, bidding process, construction/installation schedule, project management, training and M&V of the bioenergy project.

Depending on the economics, many of these projects can be budget-neutral (fully self-funded through savings), or partially funded through performance contracting. In a partially funded ESCO project, the operational savings pay for a portion of the capital costs while the entity funds the difference between the projected savings over the project life cycle and the project costs. While the ESCO provides the performance guarantee, they are typically not the financier of the project but assist the Owner in formulating the plan for third-party financing. The third-party financial entities typically will look upon a PC project as insurance and may be able to provide better financing options than non-guaranteed projects.

It is in the best interest of the Owner to perform due diligence in utilizing performance contracting by reviewing its state PC legislation and reaching out to its State Energy Office, if available, for information on the PC process. A common first step towards selecting a performance contractor is to prepare and issue a Request for Qualifications (RFQ) to select the best qualified ESCO for the proposed improvement project.

Public Private Partnerships

Since there is no universally accepted definition of a public–private partnership (P3, PPP or 3P), this document will focus on a widely accepted categorization: P3s refer to a government service or private business venture that is funded and operated through a partnership of government and one or more private sector companies. In a P3, the private partner provides a public service or project and assumes substantial financial, technical and operational risk in the project.

Well managed P3s result in significant benefits for the community as well as the private entities. P3s should provide equal or greater value for money than a 100 percent public sector approach. The list below describes key elements of a typical P3:

- Contractual or institutional arrangements between public and private party sectors for the private delivery of public infrastructure
- Private partner funds, in whole or in part, the project infrastructure and related components
- Risks are strategically distributed between the public and private partners (the greater the risk accepted by the private partner, the greater return on investment the private partner should expect to receive)
- P3s typically involve "bundled" services (i.e. design, finance, construct, operate, maintain) in order to maximize synergies and discourage low-capital/high operating cost proposals
- In infrastructure P3s, payment is contingent on private service providers delivering services to an agreed upon performance standard.
    - The private partner:
        - Maintains ownership of the assets
        - Controls management of the assets
        - Establishes user rates

The term P3 is a broad categorization that includes numerous types of contractual arrangements such as Management Contracts; Performance Contracts; Concessions; Design-Build-Finance-Operate (DBFO); Build, Lease, Transfer (BLT); Divestiture; Power Purchase Agreements, etc. Some benefits of P3s include:

- Shorter infrastructure project implementation schedule
- Optimal risk sharing
- Higher energy efficiency and cost savings
- Investment opportunities and private sector development
- Budget leveraging/additional capital
- High level of customer service
- Generation of additional revenues

While results vary, a common driver behind P3 is the reduction in rates to consumers. It is important to understand that P3s are different than privatization, in that the assets shift ownership from public to the private party in the case of privatization. Often these terms are interchanged which can result in unrealistic expectations for the project and confusion to consumers.

Lease Purchase Agreements

A lease purchase agreement is commonly used as a funding mechanism to lower upfront costs by leveraging future savings. Typically, a long-term lease agreement will be signed which will provide the funds for renewable

energy or energy efficient equipment. Once the contract expires, the entity assumes ownership of the equipment.

Power Purchase Agreements

In a power purchase agreement, an entity will enter into an agreement with a developer to install a renewable energy system on their property and in exchange, the entity will agree to purchase power generated from the system typically at a lower cost than the local utility rate. The developer owns, operates and maintains the system but is guaranteed repayment for the installation. As a result, risks are lowered as there are minimal up-front capital costs, no worry about operation or maintenance of the system and a consistent, known energy source with a pre-determined price. Care must be taken when developing the contract terms and conditions.

Case Studies

Grand Junction, CO – CNG Facility

Project Phase	Phase 1	Phase 2
Wastewater utility	City of Grand Junction	City of Grand Junction
Wastewater facility	Persigo Wastewater Treatment Plant	Persigo Wastewater Treatment Plant
Location	Grand Junction, CO	Grand Junction, CO
Population served	60,000	60,000
Average flow	8.2 MGD	8.2 MGD
Funding source	City of Grand Junction, Colorado Energy Office & others	Colorado Department of Local Affairs
Funding program	Varied	Varied
Project type	CNG Fueling Station	Biogas to CNG
Total project cost	$1.4 million	$2.8 million
Funding obtained	$1.4 million	$500,000
Project date	Spring 2011	April 2015

In 2006, the city of Grand Junction, CO began a two-step process to utilize their Persigo WRRF to generate biogas for a vehicle fuel system, a project fully realized 10 years later. The 8.2 million gallons per day (MGD) facility has a two-stage anaerobic digestion process that treats sludge and produces biogas. The digesters produce approximately 120,000 cubic feet of methane gas per day which was previously flared off. The city planned to first install a CNG fueling station (while simultaneously purchasing municipal CNG vehicles) that ran on public utility natural gas before sending their own fuel generated on site to the filling station to supply the vehicles.

The fueling station was built at the Municipal Services Campus in Grand Junction, CO and was designed to include 10 slow fill stations for use by the City vehicles and a single publicly available fast-fill station. The overall cost of the project was $1.4 million and funding came from the City of Grand Junction, Colorado Energy Office (CEO) CNG Initiative, Colorado Department of Local Affairs/CEO New Energy Communities Initiative, U.S. Department of Energy, EECBG and a private contribution from a Colorado natural gas producer, Encana. A variety of CNG operated municipal vehicles including solid waste trucks, utility trucks, pickup trucks and dump trucks were bought by the city.

The second part of the plan was to capture and convert the biogas coming from their on-site anaerobic digesters to vehicle-grade natural gas fuel. The City of Grand Junction enlisted the help of BioCNG, LLC to install their patent pending BioCNG 100 biogas conditioning system. This system can make up to 500 gallons of gasoline equivalents (GGEs) a day which is then piped in a newly constructed 5.7-mile-long pipeline to the fueling station. BioCNG undertook the building of the gas capture system, pipeline construction and startup of the project at the cost of $2.8 million. $500,000 of the project came from the Colorado Department of Local Affairs. The renewable natural gas (RNG) being produced will cost less than gasoline or diesel and will generate D5 and D3 renewable identification number (RIN) credits, resulting in a payback period of 9 years. Additionally, the project eliminates the consumption of the equivalent of 168,000 gallons of gasoline and diesel fuel annually and eliminates the emission of 3 million pounds of CO_2 into the atmosphere annually.

Charlotte-Mecklenburg Utilities - Charlotte, NC

Wastewater utility	Charlotte Water (CLTW)
Wastewater facility	McAlpine Wastewater Management Facility
Location	Charlotte, NC
Population served	246,000+ households
Average flow	64 MGD
Funding source	Federal Clean Water Act Program
Funding program	State Revolving Fund Loan
Project type	Combined heat and power (CHP)
Total project cost	$4.6 million
Funding obtained	$4.6 million (20 year loan)
Project date	2017

Charlotte Water (CLTW) operates five WRRF's, four of which have anaerobic digestion. The CLTW WRRFs have a total permitted capacity of 123 MGD that serve 776,000 customers in Charlotte, North Carolina.

In 2011, CLTW considered a combined heat and power (CHP) system at the McAlpine Wastewater Management Facility (WWMF), which has the largest gas production of the CLTW WRRF's. The McAlpine plant is a tertiary treatment facility with a treatment capacity of 64 MGD. The plant provides biological and chemical nutrient removal and produces approximately 70,000 wet tons of Class B biosolids per year. The biogas is used for process heating and excess gas is flared.

At the time, CLTW did not have funds set aside for the project and delayed the project for a few years to search for financing options. CLTW considered alternative delivery methods and grants; however, those options were not viable. To move the project forward, CLTW pre-procured an engine at a discounted rate and got a 0% State Revolving Fund Loan from the state. CLTW completed building the 1 MW CHP system with gas cleaning at the McAlpine WWMF in 2017.

Clean Water Services Rock Creek Facility - Rock Creek, OR

Wastewater utility	Clean Water Services (CWS)
Wastewater facility	Rock Creek Wastewater Treatment Facility
Location	Hillsboro, OR
Population served	250,000
Average flow	39 MGD
Funding source	Oregon Department of Energy
Funding program	Business Energy Tax Credit Program
Project type	Energy savings from nutrient recycling
Total project cost	$4.475 Million
Funding obtained	$1.1 Million
Project date	Completed Nov 2011

Funding opportunities may also be available for indirectly reducing energy use and greenhouse gas emissions beyond the conventional site boundary. An example of this is the funding obtained in 2011 by Clean Water Services (CWS) for an Ostara nutrient recovery facility at their Rock Creek Wastewater Treatment Facility. CWS made the case that recovering nutrients from wastewater offsets the energy used to extract, process, and transport mineral fertilizers.
The Rock Creek project consisted of installation of two Ostara Pearl 2000 reactors with a total production capacity of more than 500 tons of struvite fertilizer per year. This fertilizer contains about 142,000 pounds per year of Phosphorus (P) and 64,300 lb/yr of Nitrogen (N). To produce P and N fertilizer conventionally requires extracting and processing mineral phosphorus, synthesizing ammonia using natural gas and transporting fertilizer from the east coast to Willamette valley all of which are energy intensive processes. The figure below compares the energy required to produce conventional fertilizer to the energy used to recover an equivalent amount of P and N from wastewater. Recovering struvite from wastewater results in an 86% savings compared to conventional fertilizer production. It saves 3,182 Btu/lb of fertilizer, which for the Rock Creek project amounts to 3,200 million Btu/yr of energy savings.

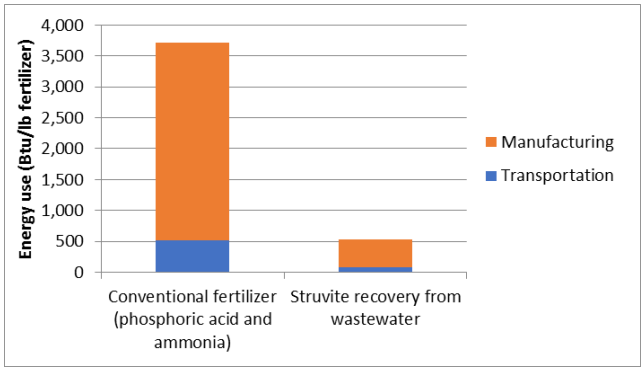

Figure 1: Analysis of the energy required to produce conventional fertilizer versus recovering N and P from wastewater

Funding was available for recycling projects from the Oregon Department of Energy Business Energy Tax Credit Program. CWS obtained $1.1 million of funding, covering 25% of project costs for the $4.475 million nutrient recovery facility at Rock Creek. As of 2012, this funding is no longer available.

Ithaca, NY

Wastewater utility	City of Ithaca
Wastewater facility	Ithaca Area Wastewater Treatment Facility
Location	Ithaca, NY
Population served	50,000+
Average flow	7 MGD
Funding source	ESCO Johnson Controls, Inc.
Funding program	Performance Contract
Project type	Energy savings from increased efficiency
Total project cost	$8.2 million
Funding obtained	$8.2 million
Project date	2012

The Ithaca Area Wastewater Treatment Facility (IAWWTF) is located in Ithaca NY in the Finger Lakes region of New York State. The WRRF serves the greater Ithaca area of the City of Ithaca, the Town of Ithaca and Town of Dryden, NY with a general population in excess of 50,000. The advanced WRRF has a rated capacity of 13.1 MGD with an average daily flow of 7 MGD. Through the implementation of the performance contract, the facility has been transformed from an energy consuming facility to one of energy reduction through employing a mix of traditional energy efficient measures and new industry leading energy technologies. Ithaca engaged in a P3 through the Performance Contract approach with an ESCO, enabling legislation of New York State Energy Law Article 9.

The WWRF has lowered its GHG's by approximately 961 tons per year as well as enhancing prospects of economic development within the greater Ithaca, NY region. In the performance contract project, efficiency measures were installed and paid for over time from contractually guaranteed energy savings. Ithaca's performance contract for the facility included $8.2 M in projects and guarantees of $9 M in savings over 20 years.

Components of the Performance Contract scope included the following:

- Anaerobic digester cleaning
- Anaerobic digester linear motion mixers
- Modification of the two (2) digester floating covers to fixed covers for the 1.4-million-gallon capacity digesters
- High efficiency aeration blower upgrades with Dissolved Oxygen (DO) control
- Fine bubble diffusers
- Digester feed pump replacement
- Installation of a biogas pretreatment system
- Installation of a 35,000-cubic foot biogas storage sphere enabling the volume of gas to fluctuate without allowing air to enter
- Installation of four (4) 65 kW Microturbines replacing two (2) 100 kW internal combustion dual fuel boilers. The microturbines are small gas turbines that burn methane from the digester gas to generate electricity and the waste heat is recovered.
- Lighting and lighting control upgrades
- Building envelope and HVAC improvements
- Engines including heat recovery

Prior to the Performance Contract project, the facility energy usage was approximately 2.9 MM kWh annually. Today after these improvements, the facility generates approximately 119,000 kWh monthly from 2.8 million ft^3 of biogas providing about 60% of the facility's energy needs.

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Further Reading

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Willis, J., Stone, L., Durden, K., Beecher, N., Hemenway, C., & Greenwood, R. (2012). Barriers to Biogas Use for Renewable Energy. WERF OWSO11C10.

Additional Resources

- Biogas Data: http://www.resourcerecoverydata.org/
- Water Environment Federation
- National Biosolids Partnership
- Combined Heat and Power: Internal Combustion Engines (2017)
- Renewable Identification Numbers: A Guideline for Water Resource Recovery Facilities (2016)
- Biogas to Renewable Natural Gas (RNG): A Guideline for Water Resource Recovery Facilities (2016)
- Air Quality Permitting Fact Sheet (2015)
- Biogas Utilization: A Regional Snapshot in Understanding Factors that Affect Water Resource Recovery Facilities (2015)

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