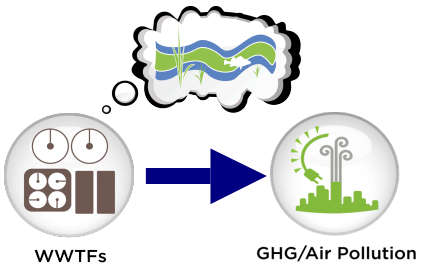
Resource Recovery
Generating Heat and Power from Biosolids

Target: Wastewater Treatment Facilities
Query: What's stopping you from using biogas?

Wastewater treatment facilities (WWTFs) are built to reduce impacts on nature, but they can be energy-intensive to operate and they produce greenhouse gas emissions and residuals that are costly to manage.

The Water Environment Research Foundation (WERF) and New York State Energy Research Development Authority (NYSERDA) have joined forces to research – and address – why more wastewater treatment facilities are not maximizing recovery of energy in their wastewater. They are working with a team from Brown and Caldwell, Black & Veatch, Hemenway Inc., and North East Biosolids & Residuals Association (NEBRA). **Please consider joining this inquiry.** Here is what you need to know.



Known Barriers to Biogas – Sound Familiar?

- Lack of financial incentives
- Capital investment perceived too high
- Technology seen as not appropriate for size/scale/processes of facility
- Cannot sell back to grid
- Lack of expertise on staff or on call
- Too expensive to buy, own/operate
- Cannot get CHP air permit, or CHP will require a Title V permit
- Payback not great enough

What's the problem?

Utilities worldwide are capturing and using energy and resources in wastewater and residuals. But many who can or want to, are not.

This research evaluates tradeoffs and barriers preventing many utilities from generating valuable heat and power (directly or as electricity) from biogas (biomethane), or from using it as a fuel or for sale in the methane/natural gas market.

The US Environmental Protection Agency (US EPA) reports that fewer than 20 percent of the larger WWTFs with anaerobic digestion operations produce combined heat and power (CHP). Thus, there must be actual or perceived barriers to broader use of these heat-capture or energy recovery technologies. Many anaerobic digesters funded by the Construction Grants Program (especially small facilities) in the '70s and '80s were abandoned or converted to storage tanks or other uses.

What's the goal?

This research thoroughly explores the barriers and disincentives for biogas production for **all size plants**. It also focuses on biogas generation and CHP recovery by small plants – processing less than 4.5 million gallons per day (MGD).

The study examines the extent of each barrier or disincentive regionally within sectors by factors such as facility size, treatment or solids process configurations, and organic constituent content. It also will identify and examine non-technological obstacles, which may include management decisionmaking, market conditions, electric utility practices, energy regulations and grid constraints, environmental regulations (legacy and proposed under climate change), and operator training and education.

The strategy is aimed at overcoming a significant technical barrier – reducing the size threshold of wastewater facilities that can economically produce biogas and recover energy in some form.

How can I participate?

Project researchers are requesting help and support from any US WWTF that has digestion but is not using biogas, has digestion and is using biogas, or does not have digestion but is interested in digesting and producing/using biogas. Here's what you can do to participate:

Contact Karen Durden, PE, Brown and Caldwell, 770-673-3671, KDurden@brwncald.com.

Plan to join a focus group with researchers at one of the following meetings (times to be confirmed):

- WEF Nutrient Recovery and Management 2011 in Miami, Sun 1/9/2011 from 1-5pm
- New York Water Environment Association Annual Conference in New York City, Wed 2/9/2011 from 1-5pm
- WEF Residuals and Biosolids 2011 in Sacramento, Wed 5/25/2011 from 1-5pm
- WEF Water and Energy 2011 in Chicago, Wed 8/3/2011 from 1-5pm

Take an online survey. Interested utilities contacting Karen Durden above will be informed when an online survey for relevant utility employees is posted.

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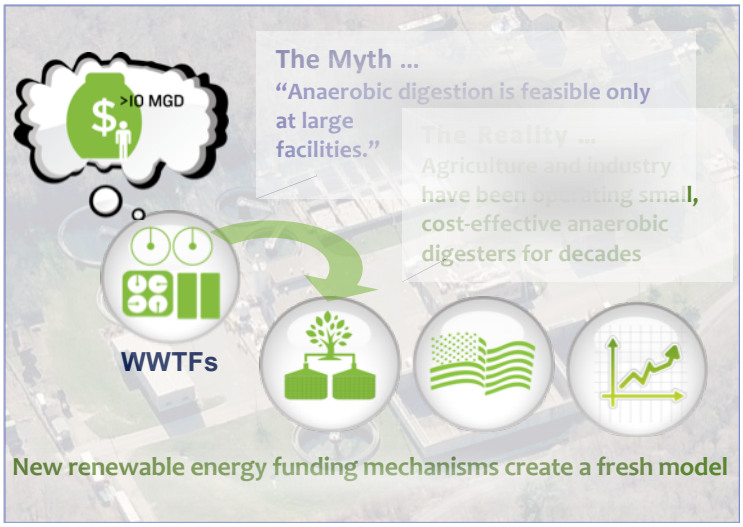
What are the benefits?

WERF subscribers and utility participants will benefit from this research by having access to the final comprehensive report with general recommendations. Perhaps more important, the reported information on barriers and disincentives will be shared with federal agencies (including US EPA and US Department of Energy) and state agencies that have the ability to remove barriers to the use of biogas for energy recovery and to increase implementation of these practices.



In addition, when significant technological barriers are identified, the project will address research needs and future technology gaps, ultimately advancing the wastewater sector towards energy self-sufficiency.

This project complements existing WERF tools and resources, such as Life Cycle Assessment Manager for Energy Recovery (LCAMER), and is part of WERF's Operation Optimization Challenge. The project involves collaboration from multiple stakeholders.

Background*

According to EPA, more than 16,500 publicly owned wastewater treatment works (POTWs) in the United States treat more than 40 billion gallons of wastewater each day, generating more than eight million dry tons of biosolids annually.

Anaerobic digestion (AD) of wastewater solids has been a dominant solids stabilization practice in the United States and around the world for decades. Traditional mesophilic AD, with operating temperatures of 30º–38º C, is well understood and, with proper attention to operational parameters, provides consistent and reliable reduction in the volume of solids while producing digester gas.

Historically, AD systems were installed as a way to stabilize solids and reduce their volume. But many facilities have tapped the energy potential in digester gas, and that is becoming a leading reason for new AD installations.

Over the past few years, there has been an explosion of interest in new anaerobic digestion and energy systems. An informative 2007 US EPA Combined Heat and Power Partnership (CHPP) primer on CHP opportunities at wastewater treatment facilities provides some perspective. CHPP estimates that if all 544 WWTFs in the United States that operate anaerobic digesters and have influent flow rates greater than 5 MGD were to install CHP, approximately 340 MW of clean electricity could be generated, offsetting 2.3 million metric tons of carbon dioxide emissions annually. These reductions are equivalent to planting about 640,000 acres of forest, or the emissions of some 430,000 cars.

If additional anaerobic digestion systems are installed and energy is recovered, the potential for energy generation and its associated benefits are even greater.

* Sources: US EPA (http://www.epa.gov/chp/); National Association of Clean Water Agencies (NACWA) *Renewable Energy Resources: Banking on Biosolids (2010-05-14).*

Energy available from biosolids and other energy sources:

1 pound of dry biosolids	8,000 Btu
1 kiloWatt hour of electricity	3,412 Btu
1 cubic foot of natural gas	1,028 Btu
1 cubic foot of biogas	600-700 Btu
1 cord of wood	20 million Btu

Unprocessed biosolids typically contain about 8,000 British thermal units per pound (Btu/lb) on a dry weight basis (2.3 kWh/lb), similar to the energy content of low-grade coal. For comparison, the average daily residential energy use in the U.S. is 31 kWh per home, which would require the energy equivalent of 13.4 lbs of biosolids. *Source: NACWA*

U.S. Biosolids Management Practices