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Resource Recovery Opportunities at America's Water Resource Recovery Facilities

By

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Biomass 2014: Growing the Future Bioeconomy

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CH2MHILL Today

We are an industry leader in program management, construction management, engineering, procurement, and operations.

- Operations on all continents
- Approximately 28,000 employees
- 100 percent owned by our employees
- Broadly diversified across multiple business sect
- US$7 billion in revenue

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Our integrated solutions address the total water cycle and we consistently rank among the best

- Water resources
- Drinking water
- Wastewater
- Reuse
- Stormwater and flood control
- Conveyance and tunneling
- Ecosystem management
- Climate change adaptation
- Greenhouse gas mitigation
- Utility and asset management

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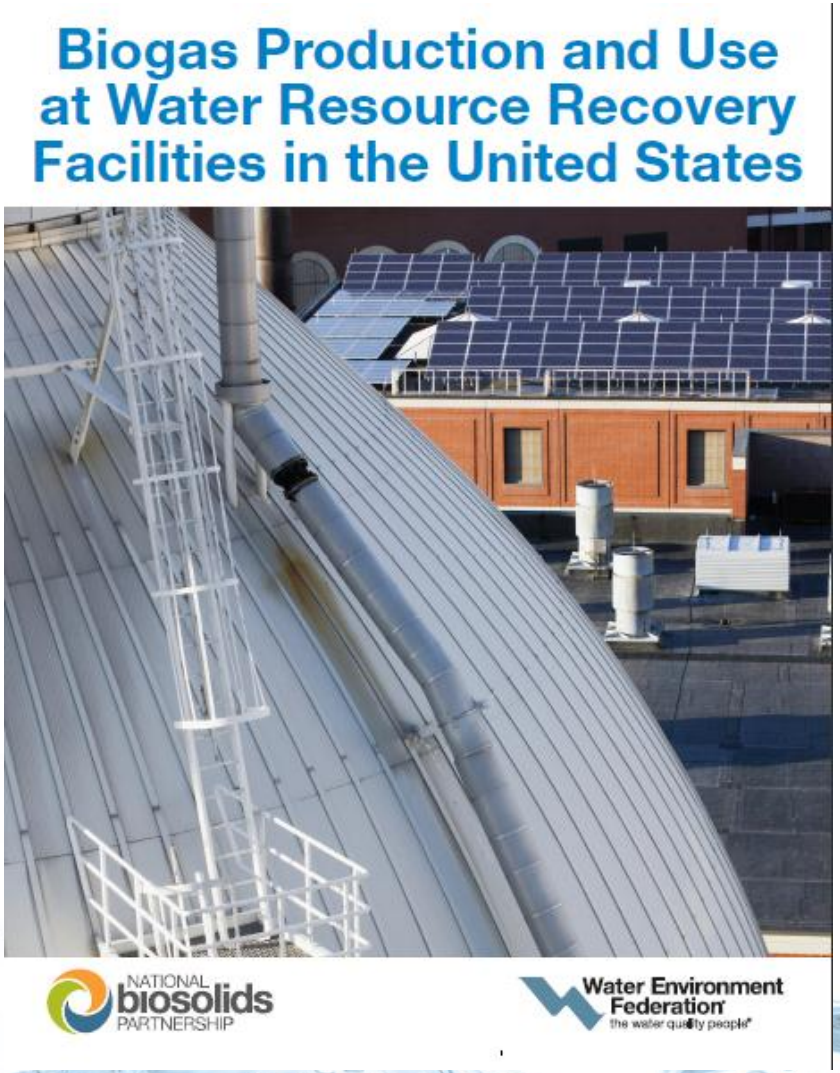
WEF/NBP Study Released in July 2013



- About half of all wastewater is processed using anaerobic digestion
- 5127 Water Resource Recovery Facilities (WRRF) were surveyed, majority above 1 MGD (about 1/3 of all)
- What does this have to do with 3-1-1?
- Remember 3-3-6!

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3-3-6!

- 3 Times as many WRRF's are without Anaerobic Digestion (AD) as those with AD
- 3 Times as many WRRF's with AD do not generate power or drive plant equipment as those that do
- 6 Times as many WRRF's do not import FOG or high strength waste to feed digesters as those that do
- Plenty of opportunity exists for development of energy recovery at WRRF's in the next decade

Biogas with Addition of Fats, Oil & Grease (FOG)

50 dry tons/day solids ≥ 600,000 ft^3/day of biogas → $4,800/day energy value

55,000 gal/day FOG @ 5% solids + 50 dry tons/day solids ≥ 952,000 ft^3/day of biogas → $7,600/day energy value

+ $1,022,000/yr energy value with FOG

F. Wayne Hill WRC, Gwinnett County, Georgia

50% of Plant Power Needs Met

Douglas L. Smith Middle Basin Facility
Johnson County, Kansas

The Resource Recovery Model

Organic Wastes

Food Waste

Fats, Oils, and Grease

Wastewater

Wastewater Treatment Plant

Renewable Electricity

Nutrient Harvesting

Biodiesel

Biosolids Fertilizer

Recycled Water

Renewable Energy Expansion

Original Facility (3 engines)

- Installed in 1985
- Meet 40-50% of demand (2-2.5 MW net gen)
- Frequent flaring of excess biogas

Expansion (+1 turbine)

- Meet 100-200% of demand (5-10 MW net gen)
- Sell excess green energy
- Reduce air and GHG emissions
- Increase operational reliability

First WWTP in U.S. to Become a Net Electricity Provider

Net Electricity Provider

Electrical Grid

Wastewater Treatment Plant

2013

Generation:	6MW
Demand:	5MW
Net Sales =	1MW

Process Schematic of DC Water's New Biosolids Program with THP and CHP

Gravity Thickeners
DAFTs
R
R
Power
Emissions
Biogas Treatment and CHP
Steam
Biogas
Blend Tank
Screening and Pre-Dewatering
R
Cambi™ THP
Mesophilic Anaerobic Digestion
Final Dewatering
Loadout
Recycle Processing
R
Class A
Lime
Dewatering
R
Mix
Store & Loadout
Class B

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DC Water Program Benefits

Reduce biosolids quantities by more than 50%

Improve product quality (Class A)

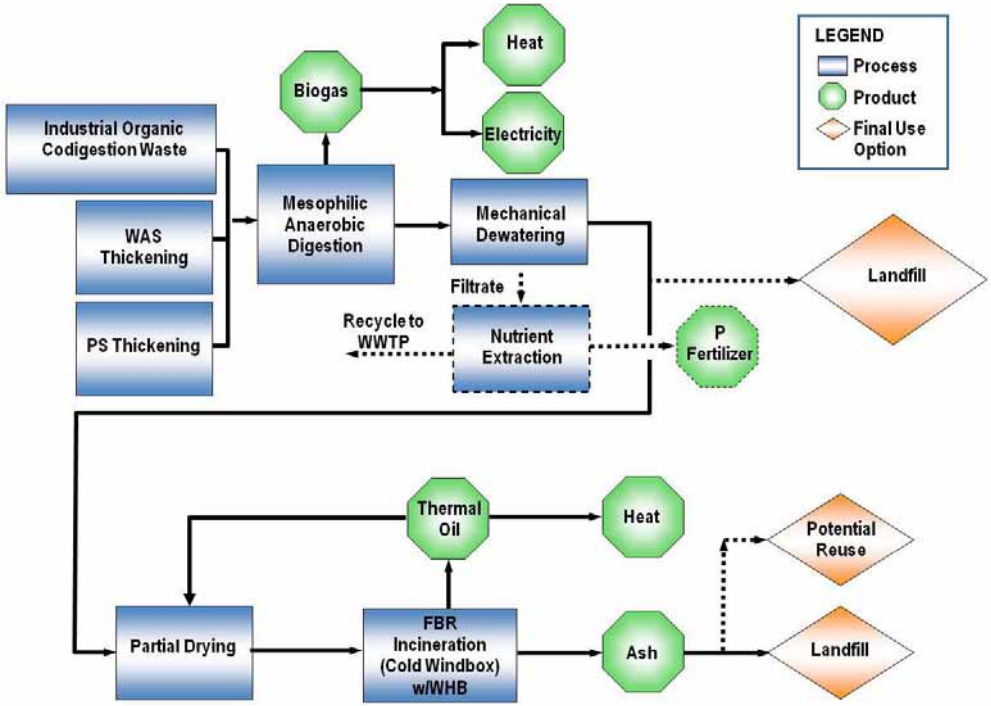
Generate 13 MW (net 10 MW, or ~40% of total grid draw) of clean, renewable power

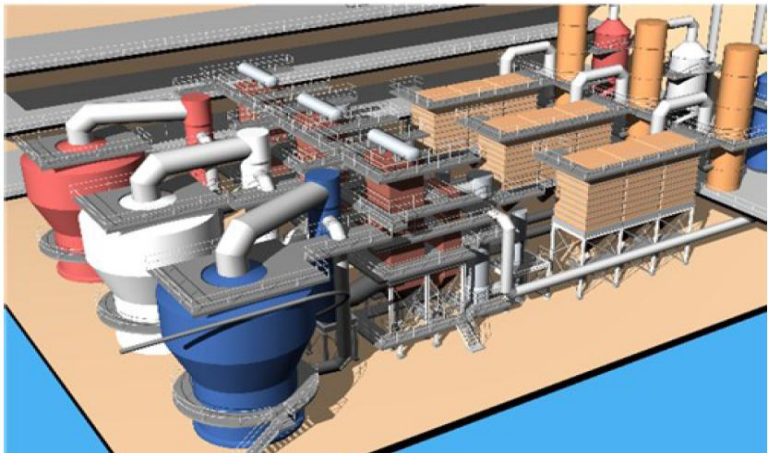
Cut GHG emissions by a third

Save millions of dollars annually when the facility begins operating in late 2014

dc water is life

Green Bay Resource Recovery and Electrical Energy (R2E2) Project





R2E2 will generate 70% to 75% of overall facility power and heating requirements

Hamilton, Ontario Combined Heat and Power (CHP) and Biogas Purification (BP) Systems

1. Biogas production was enhanced by increasing digester solids residence time and improving digester control.

2. Biogas production rates to increase from 17,150 m^3/day (2010) to 36,900 m^3/day (2031).

3. Existing 1600 kW combined heat and power unit utilizes 15,300 m^3/day.

Hamilton, Ontario Combined Heat and Power (CHP) and Biogas Purification (BP) Comparison

4. Value of excess biogas utilized by CHP or BP was compared
5. NPV is function of electricity and natural gas rates.
6. Premium is available for renewable energy in Hamilton.
7. New CHP and BPU have a positive NPV at both market and renewable energy rates so BPU was installed.

What is the Future of Energy Recovery at WRRF's?

- Technology Drivers and Trends
  - Better technologies to facilitate use of biogas
  - Better technologies to recover and use waste heat
  - Carbon footprint reduction
- Operational Drivers and Trends
  - Focus on solids and WRRF's as a resource and recovery facilities
  - Increase in collaboration with outside entities
  - Increase in focus on sustainability and environmental stewardship
- Communication Drivers
  - Demand for better public outreach and education
  - Leverage multi-organizational communications and outreach
  - Research findings inside and outside of the WRRF sector

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