



CLEAR COVE

CLEAN ENERGY. CLEAN WATER.

**Northeast Residuals
and Biosolids
Symposium 2015**

**Towards Net-Zero Energy in
Wastewater: Demonstration of
ClearCove's Harvester
Technology**

Wastewater as a Renewable Energy Resource

- It is time to place energy as a top priority in wastewater treatment.
- Resource Recovery Facilities as economic drivers for their communities.
- End goal to drive facilities not to net-zero but to net-positive energy.



New Economics of Wastewater

Opportunity in US:

20,000 WWTPs

1,400 WWTPs w/ digesters over 1 MGD flow*



\$2.0b/year or \$48b over 20 years in electricity

\$3.9b/year or \$97b over 20 years in CNG

*US EPA "Opportunities for Combined Heat and Power at Wastewater Treatment Facilities: Market Analysis and Lessons from the Field."



Enhanced Primary Treatment

- Enhanced removal of organics and solids in the primary treatment stage
- Divert more biodegradable material to anaerobic digester for energy generation
- Reduce organics going to aeration, reduced aeration energy consumption

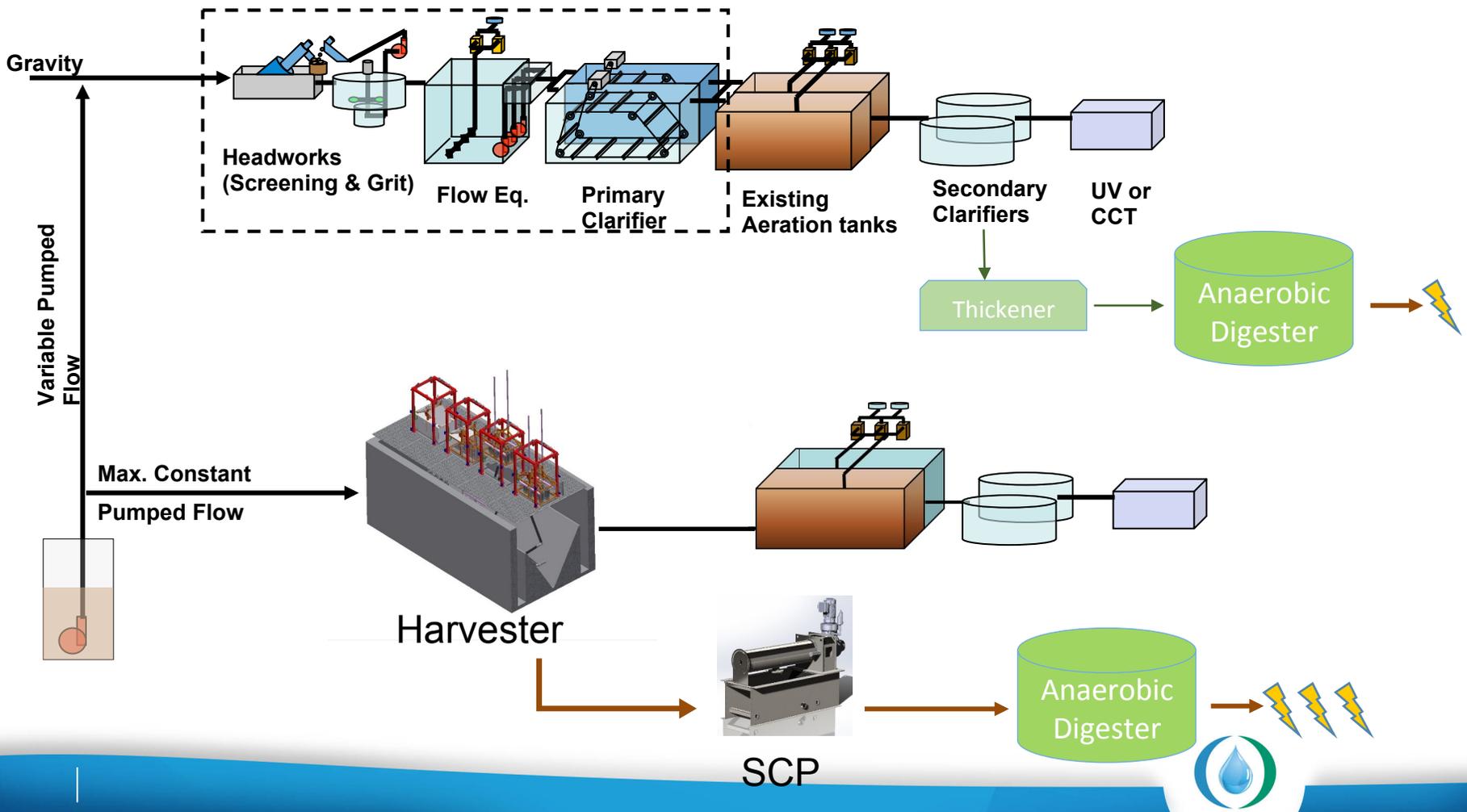


Harvester Enhanced Primary Treatment

- Primary purpose of harvesting organics for energy generation
- Complete headworks and primary treatment solution providing:
 - Grit Removal
 - Flow Equalization
 - Fine Screening
 - Primary Clarification
- Can be operated with or without chemicals

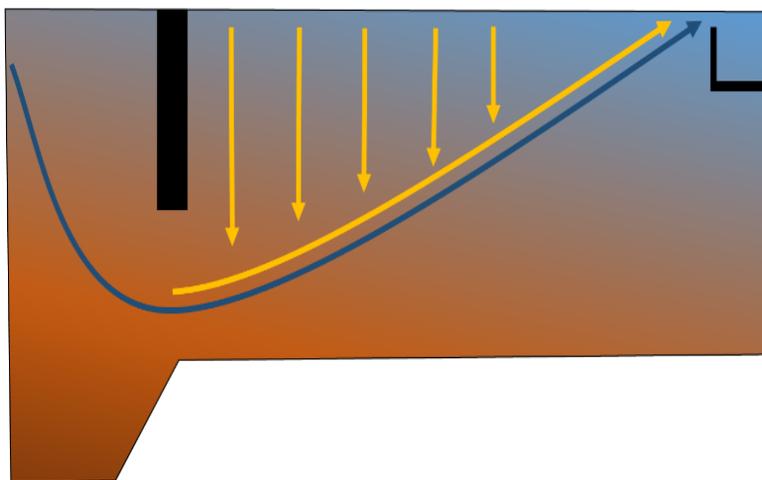


Conventional Process Train



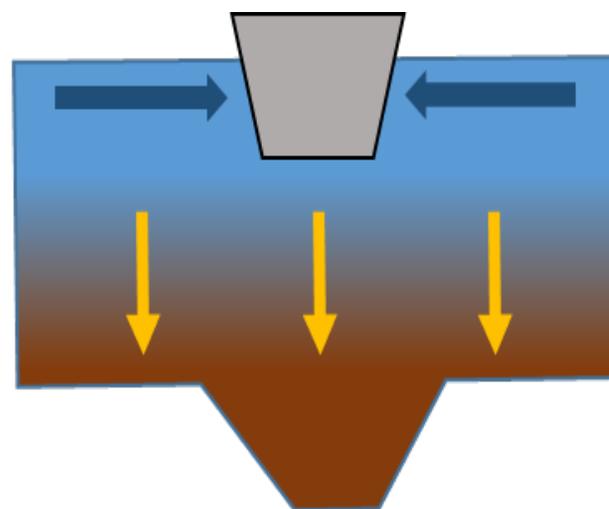
ClearCove Harvester

Conventional Primary Clarifier



- Organics

ClearCove Harvester



- Effluent Flow



NYSERDA Demonstration

Demonstration project goals:

- **Increased biogas generation**
 - Result of enhanced primary sludge capture
- **Aeration energy savings**
 - Result of enhanced BOD removal
- **Relative capacity increase of the digesters**
 - Result of increased sludge biodegradability and improved inorganics removal
- **Improved sludge processing**
 - Result of higher percent solids and improved ratio PS:WAS
- **Similar plant chemical usage/costs**
 - Compared to current chemical usage/costs



Ithaca Area Wastewater Treatment Facility



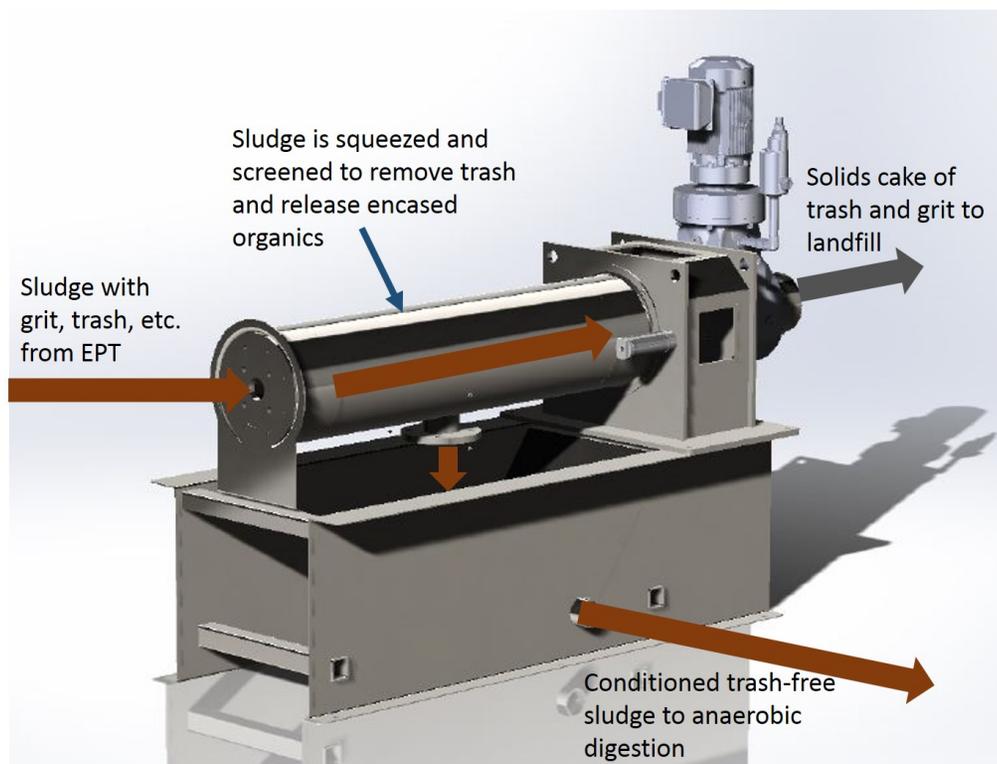
Pilot Equipment



ClearCove Systems Harvester Pilot



Sludge Classifying Press (SCP)



- **Sludge** from the Harvester unit is processed through SCP
- SCP “cleans” sludge, **removing** inorganic solids and **releasing** encased organics
- Organically richer **primary sludge** sent to anaerobic digestion



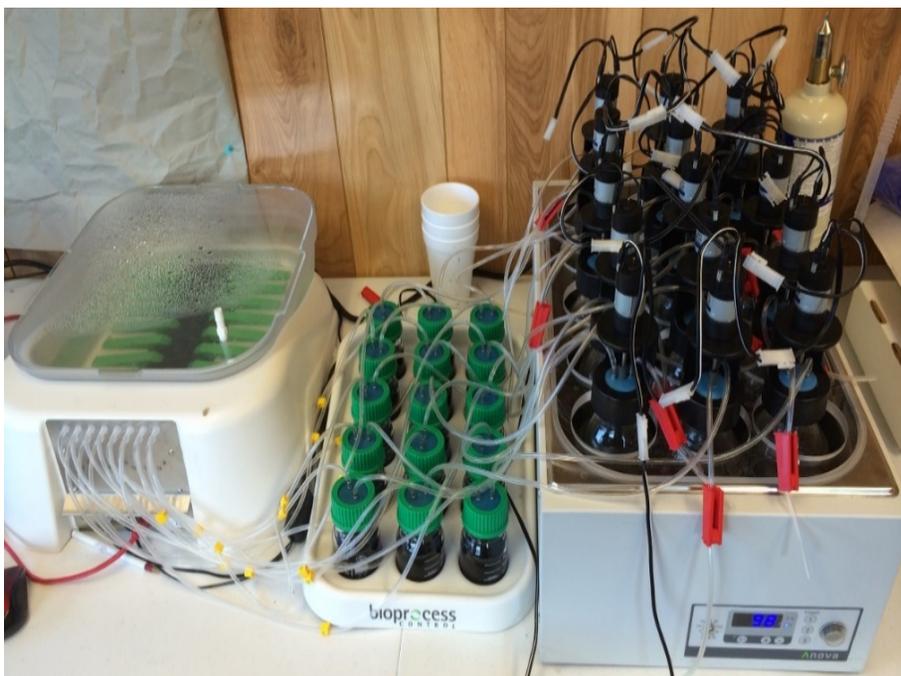
Pilot Digesters



- 4 Fixed Volume Anaerobic Reactors
 - 300-gallon, cone bottom
 - 100-gallon operating volume
- Hydraulic Mixing
- Heating using IAWWTF hot water
- Data logging for biogas flow and digester temperature
 - Measurements recorded every 10 seconds
 - Over 1 million readings over the course of the project

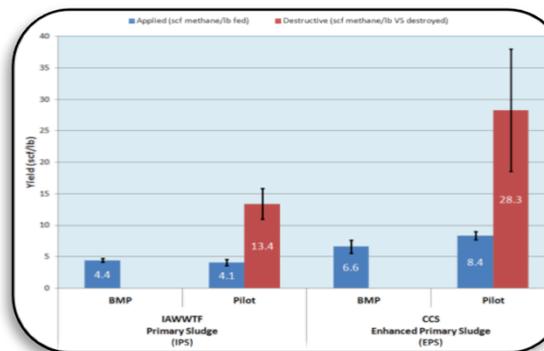
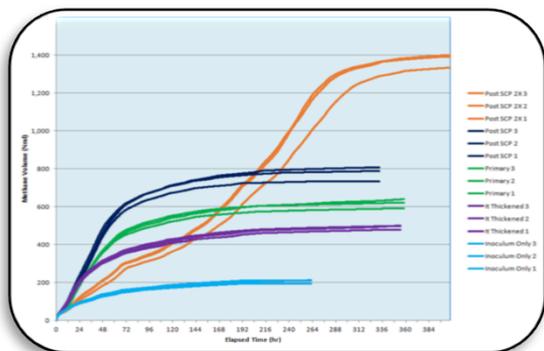
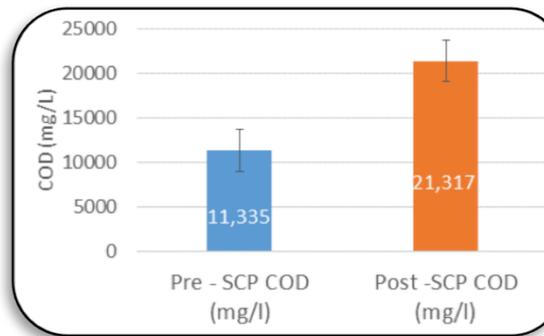
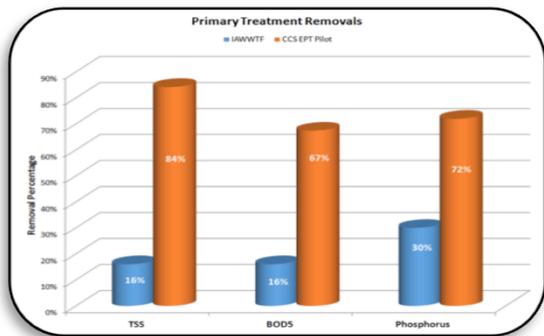


Biochemical Methane Potential (BMP)



- Bioprocess Control
 - Automatic Methane Potential Test System (AMPTS II)
- Fifteen (15) 640 ml reactors
 - Temperature controlled water bath
- CO₂ scrubbing
- Gas volume measurement and recording
- To validate and correlate the digester pilot data





DEMONSTRATION RESULTS

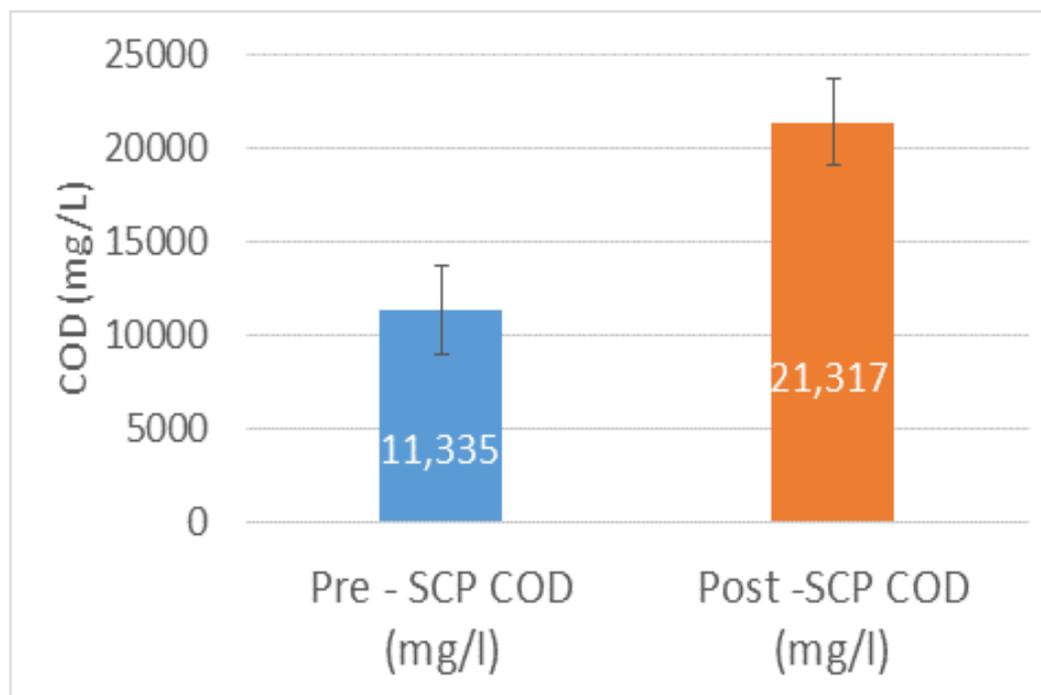


Harvester Removal Rates

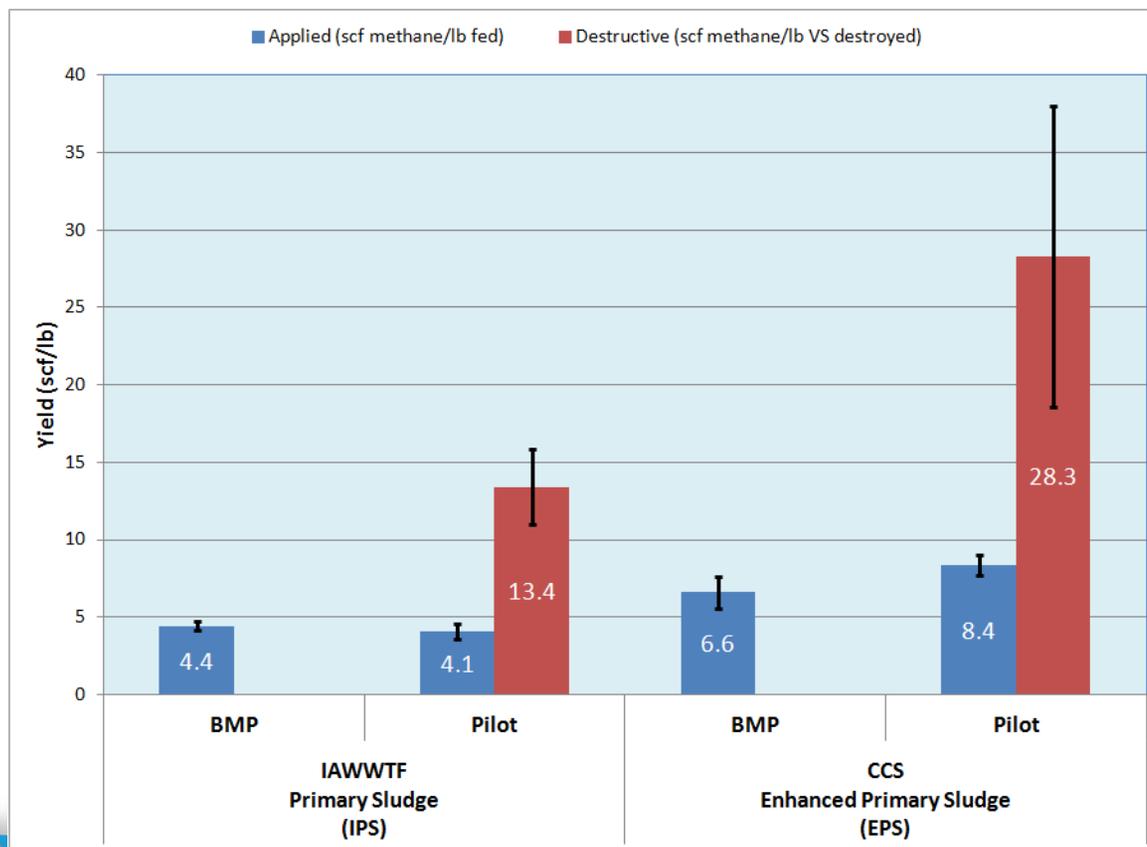
	BOD	SBOD	TSS	VSS	COD	TP	TKN
Harvester w/ Chemical	67%	25%	84%	85%	62%	72%	26%
Harvester – No Chemical	55%	12%	71%	68%	26%	31%	21%
Conv. Primary Clarifier	30%		58%		30%		



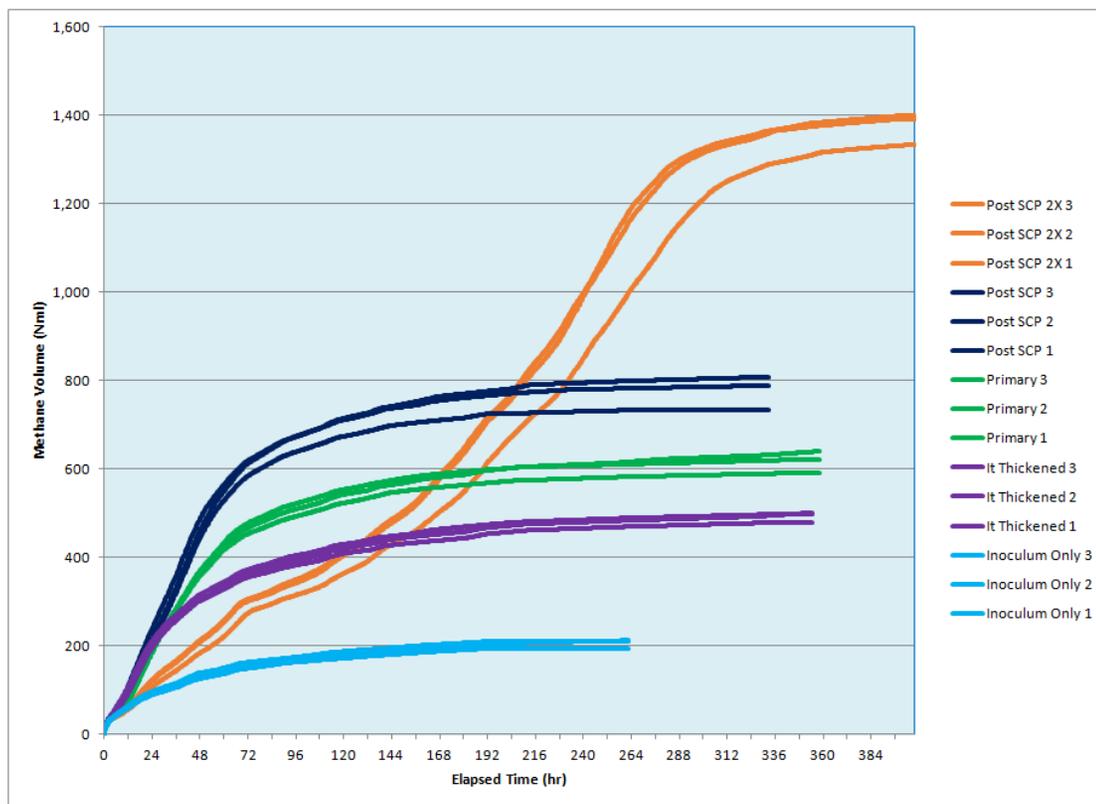
SCP Results



Pilot Digester Results



BMP Tests





Aeration

Parameter	Units	Existing	With EPT
BOD removal in aeration	lb/d	5,700	2,670
Air required for BOD _R	scfm	2,090	1,040
Energy consumption	kWh/lb	0.55	0.55
Daily aeration energy	kWh/d	3,100	1,500
Annual savings	\$/yr	\$0	\$56,000

9.5 cents/kWh



Anaerobic Digestion

Parameter	Units	Existing	EPT with SCP
VS load	lb/d	13,000	9,000
VS destroyed	lb/d	7,400	6,300
Methane	scfd	57,100	184,600
Microturbine generation potential	kWh/d	2,500	8,200



Full Plant Energy Considerations

Parameter	Units	Current	EPT with SCP	CNG Equivalent (GGE)
Energy consumption	kWh/yr	3,300,000	2,700,000	
Energy Production	kWh/yr	2,200,000	7,000,000	530,000
Energy Savings	\$/yr	\$0	\$56,000	\$56,000
Energy Production	\$/yr	\$210,000	\$665,000	\$1.3M
Total Energy Value	\$	\$210,000	\$721,000	\$1.36M

9.5 cents/kWh
\$2.50/GGE



IAWWTF Net Energy Position



IAWWTF as a Renewable Energy Resource

- Opportunity for electricity and heat usage in municipal buildings.
- Biogas can be converted to CNG, approx. 530,000 GGE/year or \$1.3m/year, to fuel municipal vehicles.





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Questions?

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