WELCOME.

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THANK YOU!

Agenda

—Why choose an engine for biogas utilization? (compared to micro-turbines, etc.) - pros & cons

—Current options

—Greater Lawrence Sanitary District's experience with recently purchasing, permitting, & installing 2 engines

—Essex Junction's experience switching from micro-turbines to an engine, including start-up concerns & successes

—Operating & maintaining engines at Lewiston-Auburn WPCA

—Questions & Discussion

New engine at Essex Junction WWTF.

New WEF Fact Sheet

Search online for "WEF Fact Sheet Introduction to Funding"

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

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

New WEF Fact Sheet

Search online for “WEF Fact Sheet CHP Internal Combustion Engines”

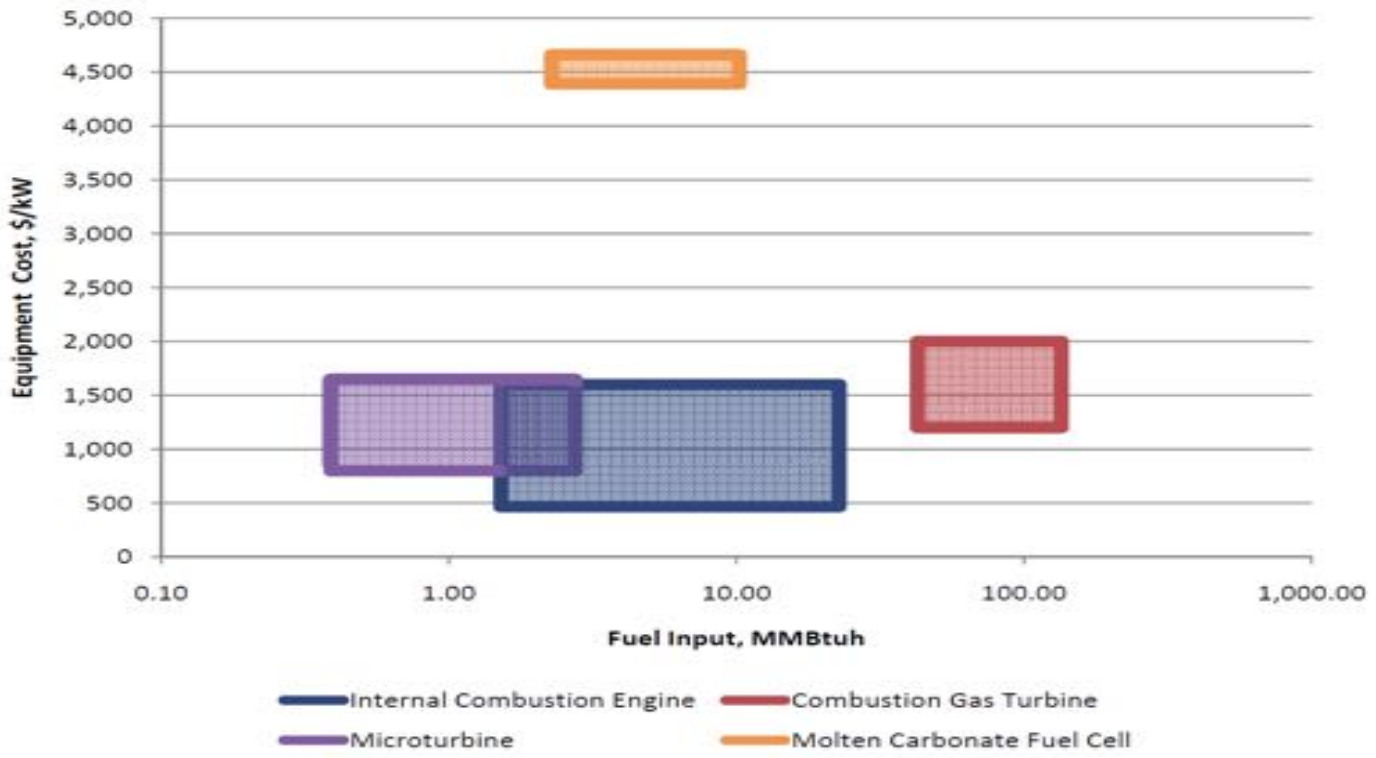
Slide courtesy of Brown and Caldwell

US Installations of CHP Technologies

CHP Technology	Number of Sites	Installed Capacity, MW
Engines	64	158
Gas Turbines	9	144
Microturbines	27	3
Fuel Cells	12	5
Boiler/Steam Turbine	3	151
Combined Cycle	1	28

Slide courtesy of Brown and Caldwell

Equipment Cost Comparison



GREATER LAWRENCE SANITARY DISTRICT
ORGANICS TO ENERGY PROJECT
The Next Step Towards Net Zero Operation

NE Digestion Roundtable

1/5/18

Cheri Cousens, Executive Director

Richard Weare, Capital Projects Manager

The audio recording of this webinar starts with the next slide.

CoGen Engine – Purchasing, Permitting & Installing

- Reciprocating internal combustion engines were determined to be best fit for GLSD
  - Turbines require a very clean continuous gas
  - Micro turbines are generally smaller in size and very finicky to operate
- Reciprocating engines are the most widespread, economical and efficient of all CHP technologies currently used for biogas cogeneration
- Air Quality Permit Required
  - Low Nox engine selected
  - Selective Catalytic Reduction – SCR on exhaust was determined to be necessary
- Digester gas treatment for H2S and Siloxane removal
- Most CoGen sized on lowest of demand of Electric or Heat requirements
- GLSD sizing – based on maximize digester gas production.

The audio recording of this webinar starts with this slide.

The Next Step Towards Net Zero Operation at GLSD

- One of two Caterpillar 1.6 MW CoGen engines during factory testing

CHP Engine Emissions Control

- Oxidation Catalyst (OC) technology to remove volatile organic carbons and carbon monoxide
- Selective Catalytic Reduction (SCR) technology to remove nitrogen oxides
- Best Available Control Technology (BACT) as determined by MassDEP

Installed Caterpillar CoGen Engine at GLSD

GLSD BIOGAS DATA

(Analysis of 2013 – 2016)

Oxygen:

02 1.2 %

Nitrogen:

N2 3.8%

Methane:

CH4 60%

Carbon Dioxide:

CO2 35%

Hydrogen Sulfide:

H2S 73 ppmv

w/ Ferric Chloride

BTU/CF 605

Sp. Gravity 0.9

Siloxanes 1110 ppbv

2 GENERATIONS OF CHP VILLAGE OF ESSEX JCT. VERMONT

JIM JUTRAS, WATER QUALITY SUPT.

DESIGN FLOW 3.3 MGD
CURRENT FLOW 1.8 MGD ANNUAL AVERAGE
REGIONAL SERVICE TO THREE COMMUNITIES

WHY THE CHANGE?

- 25 year WWTF rehabilitation project including the Digester Complex
- Core replacement challenges
- “Legacy product”
- Value of the building space vs. maintaining the legacy product
- Already received return on investment

WHY THE SWITCH FROM MICROTURBINES TO RECIPROCATING ENGINE?

Bid solicitation with basis on performance

Power production and heat production based on Gas production and quality.

Life cycle operation and maintenance costs provided as part of bid response.

Return in investment consideration as part of the bid evaluations

TWO GENERATIONS OF CHP

FULL ASSET UTILIZATION
SOLVING A DISPOSAL CHALLENGE WITH BENEFITS

GUIDING PRINCIPLES:

Process First!

***Run at capacity *Increase revenues**
***Address Environmental Regulations**

***Monitor Total Cost *Return on Investment**

***Assets in Hand *Staff time *Facilities in place**

***Age of assets and anticipated replacement (Opportunity)**

QUESTIONS?

James "Jim" Jutras, Water Quality Supt.

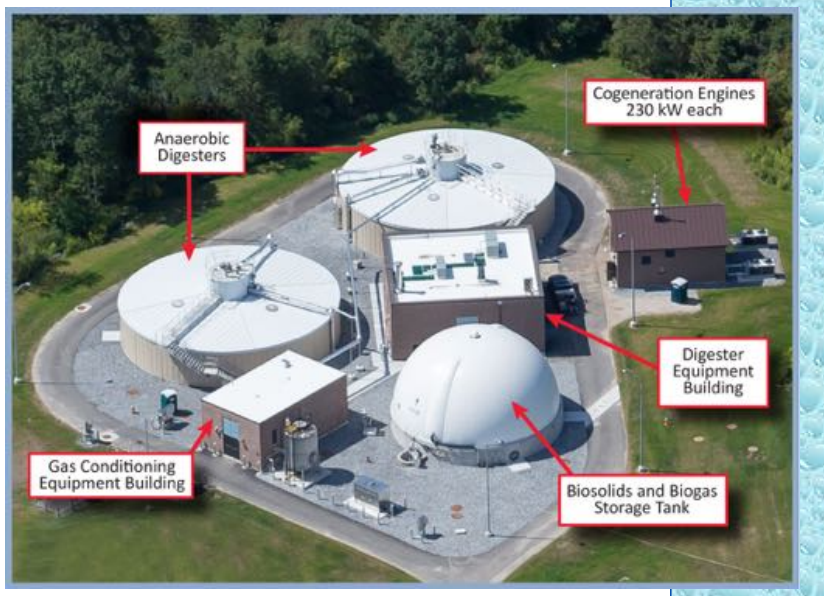
Village of Essex Junction

802-878-6943 ext 101

jim@essexjunction.org

LAWPCA Snapshot

- Operating since 1974 as a Wastewater Treatment Plant
- Receives flow from Lewiston and Auburn
- Wastewater treatment
  - 32 million gallons per day (mgd) facility peak capacity
  - 12 million gallons per day (mgd) average daily flow
  - 35,000+ domestic users
  - 23 significant Industrial users
  - 26 septic & holding tank waste communities
- Compost Facility in operation since 1993



Combined Heat and Power (CHP) System Selection

- Estimated biogas production = 170,000 ft^3/day
- Cogeneration systems considered
  - Microturbines
  - Reciprocating Engines
- Engines selected over microturbines based on:
  - Higher efficiencies
  - Life cycle costs
  - Track record/number of operating installations
- Two – 230 kW engines (received $330,000 Efficiency Maine Grant)

CHP System Selection (Continued)

- Electricity used on site:
  - Provides all power for new digestion equipment
  - Reduces amount of power purchased from the utility for WW treatment
- Heat Reclaimed from engines
  - Provides heat for anaerobic digesters
  - Supplemental heat provided by dual fuel boilers (natural gas/biogas)

Biogas Treatment

- Biogas Treatment System
  - Foam separator and condensate/sediment removal traps
  - H_2S removal using Iron Sponge or SulfaTreat media
  - Moisture removal and gas boosting skid
  - Siloxane removal system to be added in the future, if necessary

Engine failure

Engine failure

Cylinder Head 3

Piston cylinder 2

Rod Bearing Cylinder 3

Piston cylinder 4

Residues Exhaust Turbocharger

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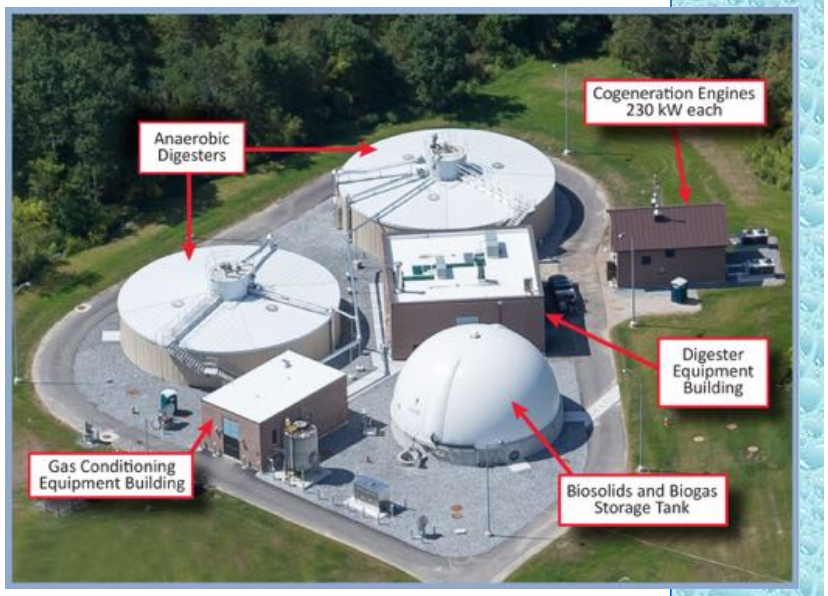

Thank you for joining in.

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