Becoming a Utility of the Future
Achieving Energy Neutrality Through Codigestion

Mike Maringer
Municipal Development Manager
Our Company at a Glance

MUNICIPAL | INDUSTRIAL | AGRICULTURAL
ANAEROBIC DIGESTION SYSTEMS

1.6 MILLION TONS of organic waste

18 Anaerobic Digesters Complete/Under Construction

FEASIBILITY/PROJECT DEVELOPMENT DESIGN CONSTRUCT/RETROFIT COMMISSION OPERATION & MAINTENANCE

Sustainable technology solutions . . .
The Utility of the Future

“The Utility of the Future transforms itself into a manager of valuable resources, a partner in local economic development, and a member of the watershed community seeking to deliver maximum environmental benefits at the least cost to society.”

It does this by:
- reclaiming and reusing water
- extracting and finding commercial uses for nutrients
- capturing heat and latent energy in biosolids

The Water Resources Utility of the Future: A Blueprint for Action - NACWA, WERF, and WEF
New opportunities in an old industry

• Treatment plants are facing capital, technical, and regulatory challenges.
• Federal funding to address these challenges continues to decrease\(^1\)
  • State and local governments account for 96% of all public spending on water and wastewater utilities\(^2\).
• During the same period, wastewater utility rates have more than doubled.\(^1\)
• Treatment plants consume 4% of the total US energy demand\(^5\).
• Biosolids have the potential to produce 12% of the US electric demand!\(^1\)

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2. Source: Environmental Finance Center  “Four Trends in Government Spending on Water and Wastewater Utilities”
3. Source: Cleveland Plain Dealer  “Regional Sewer District Discussing 9.5% Annual Rate Hikes”
4. Source: Cleveland Plain Dealer  “Akron Water Bill too High?”

Note: 4% covers both water and wastewater treatment
Infrastructure Upgrades

• 1960’s and 1970’s infrastructure investments in 1950’s stabilization technologies are nearing the end of their useful life
  - $105.3 billion\(^1\) needs to be invested in these facilities over the next 20 years
• ADS w/codigestion can provide a solution to the CAPx required via self-funding mechanisms including;
  - ROI through self generation of electric
  - tipping fees from outside biomass (new customer base)
• A complete analysis of the treatment plant’s existing infrastructure, the energy potential of on-site biosolids, and the availability of outside regional feedstocks needs to be completed to determine if codigestion is appropriate.

1. Source: USEPA Clean Watersheds Needs Survey
Codigestion Methodology

- Codigestion presents a significant solution for many wastewater treatments to improve infrastructure without increasing rate payer costs.
- Increased energy generation can lead to net neutrality
- Access to a new revenue stream to offset capital costs
- Economic development tool
- Lowers volume of local waste being sent to landfills
Value of Codigestion

- Enhanced energy production; can take the WWTP off the grid
- Tipping fees supports the operational budget of the WWTP
- Supports land-fill footprint reduction
- Provides local businesses with a sustainable waste management solution

<table>
<thead>
<tr>
<th></th>
<th>Facility A</th>
<th>Facility B</th>
<th>Facility C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Annual Volume (wet tons)</td>
<td>31,468</td>
<td>41,884</td>
<td>31,560</td>
</tr>
<tr>
<td>Tip Fee ($/ton)</td>
<td>36</td>
<td>32</td>
<td>50</td>
</tr>
<tr>
<td>Total Tip Fee Revenue</td>
<td>$1,132,848</td>
<td>$1,340,288</td>
<td>$1,690,560</td>
</tr>
<tr>
<td>Energy Generated (kW)*</td>
<td>550</td>
<td>730</td>
<td>550</td>
</tr>
<tr>
<td>Energy Value ($/kW)</td>
<td>$0.08</td>
<td>$0.08</td>
<td>$0.08</td>
</tr>
<tr>
<td>Energy Revenue</td>
<td>$385,440</td>
<td>$511,584</td>
<td>$385,440</td>
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<tr>
<td>Total Revenue</td>
<td>$1,518,288</td>
<td>$1,851,872</td>
<td>$2,076,000</td>
</tr>
</tbody>
</table>

* The chart assumes an electric generator efficiency of 38%.
Comparison of Biosolids, FOG and Food Waste

- The energy potential per dry ton of material is significantly higher for food waste and FOG compared to biosolids.

- High strength material, such as food waste and FOG can increase the energy production of an on-site digester to an output that can offset a greater portion of the WWTP’s demand.

- The higher volatile solids rate indicates that a greater portion of the solid fraction of the material is available to be broken down during anaerobic digestion.

- The high gas potential illustrates that, on a per pound of volatile solids basis, more gas can be produced from these feedstock.

* The chart assumes an electric generator efficiency of 38%.
Upgrade with a Class A System

• Incorporates a thermal process prior to digestion that reduces pathogens and vector attraction to meet US EPA 40 CFR Part 503 regulations.
• It produces a Class A digester effluent where biosolids are present.
• Minimizes disposal challenges for biosolids
• Batch process utilizes waste heat where possible, minimizing operational cost.
Two more Ohio wastewater treatment plants have adopted the codigestion model to upgrade aging infrastructure, expand capacity and achieve energy neutrality without increasing costs to the community.

**Eastern Ohio Regional Wastewater Authority (EORWA) – Bellaire, Ohio**

**Lucas County Water Resource Recovery Facility – Waterville, Ohio**
Case Study I: (EORWA) Bellaire, Ohio

Planning for the Future

- 4MGD flow WWTP with an existing operational egg-shaped digester
- Biogas produced on-site was generating only 70kW, covering only a fraction of the plant’s parasitic load
- Existing infrastructure is operating successfully.

Long Term Sustainability Goals

- EORWA entered into a design-build contract to develop a contingency plan for a failure of the egg-shaped digester and to meet a sustainability goal of net-zero energy consumption.
- Codigestion as an opportunity to fund capital improvements thought utility savings and tip fees instead of increasing rates.
Case Study I: (EORWA) Bellaire, Ohio

Scope of project:

• Project started as a full codigestion project to make plant energy neutral
• Feedstocks include regional municipal plant biosolids and regional food waste and FOG
• Installation/Construction of New:
  • Microturbine to make plant energy neutral
  • Flexible membrane roofs
  • Solids/liquids receiving
  • Mixing, flare, heat exchangers
  • Process piping, electrical, etc.
  • Front end Class A process (Currently produces Class B)

Long term, quasar will be contracted by EORWA to manage the incoming biomass to the plant.
Case Study I: (EORWA) Bellaire, Ohio

Biomass Feasibility Study:

- 75 mile radius from the existing facility (gray circle)
- Alternative disposal outlets evaluated as competition
- Regional food processors, FOG generators, WWTPs were evaluated
- Identification of possible “anchor tenants” for long term contacts, potentials include:
  - 2 large WWTPs
  - 1 large bacon production facility
  - 1 large soup production facility
  - 40 small WWTPs over 1 MGD
  - Food waste and FOG generators
Case Study I: (EORWA) Bellaire, Ohio

Feedstock recipe developed from regional biomass to meet EORWA’s average electric demand when combined with the existing egg shaped digester.

<table>
<thead>
<tr>
<th>Customer / Biomass Inputs per Day</th>
<th>Wet Tons</th>
<th>%TS</th>
<th>%VS</th>
<th>Dry Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside Biosolids</td>
<td>41</td>
<td>19%</td>
<td>70%</td>
<td>8.0</td>
</tr>
<tr>
<td>Soap wash</td>
<td>5</td>
<td>4%</td>
<td>81%</td>
<td>0.2</td>
</tr>
<tr>
<td>Vegetable Based industrial oil</td>
<td>3</td>
<td>15%</td>
<td>93%</td>
<td>0.5</td>
</tr>
<tr>
<td>FOG Hauler Material</td>
<td>6</td>
<td>3%</td>
<td>93%</td>
<td>0.2</td>
</tr>
<tr>
<td>Merchant FOG</td>
<td>7</td>
<td>3%</td>
<td>93%</td>
<td>0.2</td>
</tr>
<tr>
<td>Wastewater Plant Dilution</td>
<td>13</td>
<td>0%</td>
<td>0%</td>
<td>0.0</td>
</tr>
<tr>
<td>Total Blended Biomass</td>
<td>75.65</td>
<td>12.0%</td>
<td>72.5%</td>
<td>9</td>
</tr>
</tbody>
</table>

High energy density recipe
Case Study I: (EORWA) Bellaire, Ohio

Projected Outcome:

Once complete, the new **energy neutral** EORWA digester will

- Combined, the existing egg shaped digester and the new system can generate 333 kW – achieving energy neutrality for EORWA!
- Provide the plant with a contingency plan for biosolids processing
- Save over $145,000 per year in energy costs
- Generate $570,000 in revenue from tipping fees
- Have an estimated payback period of 7.5 years
- Keep utility rates stable

### Electric Cost Savings

<table>
<thead>
<tr>
<th>Month</th>
<th>Current ($)</th>
<th>Projected ($)</th>
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</thead>
<tbody>
<tr>
<td>Month 1</td>
<td>$17,133</td>
<td>$3,267</td>
</tr>
<tr>
<td>Month 2</td>
<td>$17,723</td>
<td>$3,190</td>
</tr>
<tr>
<td>Month 3</td>
<td>$17,996</td>
<td>$3,216</td>
</tr>
<tr>
<td>Month 4</td>
<td>$17,367</td>
<td>$3,356</td>
</tr>
<tr>
<td>Month 5</td>
<td>$16,763</td>
<td>$3,009</td>
</tr>
<tr>
<td>Month 6</td>
<td>$14,285</td>
<td>$2,837</td>
</tr>
<tr>
<td>Month 7</td>
<td>$12,538</td>
<td>$2,855</td>
</tr>
<tr>
<td>Month 8</td>
<td>$13,073</td>
<td>$3,450</td>
</tr>
<tr>
<td>Month 9</td>
<td>$15,386</td>
<td>$3,328</td>
</tr>
<tr>
<td>Month 10</td>
<td>$13,264</td>
<td>$3,078</td>
</tr>
<tr>
<td>Month 11</td>
<td>$14,297</td>
<td>$3,221</td>
</tr>
<tr>
<td>Month 12</td>
<td>$14,155</td>
<td>$3,213</td>
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<tr>
<td>Total</td>
<td>$183,980</td>
<td>$38,010</td>
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<tr>
<td>Projected Annual Savings</td>
<td></td>
<td><strong>$145,969</strong></td>
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</tbody>
</table>
Case Study II: Lucas County, OH

Project Size: $16.9 million
Total digestion Capacity: 3,000,000 gallons; 0.029 Pounds Volatile Solids/Ft$^3$

Averages 15.0 MGD; 32,870 KWH’s/Day

Original goal of the project was to complete required digester maintenance. However, after seeing the income potential of codigestion, Lucas County decided to install advanced anaerobic digestion technology.
Case Study II: Lucas County, OH

**Scope of project:**

- Project started as digester upgrades, evolved to full codigestion project to make plant energy neutral (1.5 MW)
- Feedstocks include Lucas Co. biosolids and regional food waste, biosolids and FOG
- Installation/Construction of New:
  - Centrifuges and centrifuge building
  - Sludge storage building
  - Flexible membrane roofs
  - Solids/liquids receiving
  - Mixing, flare, heat exchangers, and CHPs
  - Process piping, electrical, etc.
  - Front end Class A process (Lucas Co. currently produces Class B)

*Long term, quasar will be contracted by Lucas Co. to manage the incoming biomass to the plant.*
Case Study II: Lucas County, Ohio

Tons Per Day
Planned vs Identified

Regional Organic Waste

Original Projection
Identified Material
Biosolids  Foodwaste/FOG

Lucas County WRRF  WWTPs
FOG Haulers  Food Manufacturers
## Customer/Biomass Inputs per Day

<table>
<thead>
<tr>
<th></th>
<th>Wet Tons</th>
<th>%TS</th>
<th>%VS</th>
<th>Dry Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lucas Biosolids</td>
<td>233.6</td>
<td>4%</td>
<td>68%</td>
<td>9.1</td>
</tr>
<tr>
<td>Outside Biosolids</td>
<td>127.3</td>
<td>21%</td>
<td>58%</td>
<td>26.7</td>
</tr>
<tr>
<td>FOG and Septage</td>
<td>43.1</td>
<td>11%</td>
<td>92%</td>
<td>4.5</td>
</tr>
<tr>
<td>Food &amp; Processing Waste</td>
<td>51.5</td>
<td>22%</td>
<td>81%</td>
<td>11.3</td>
</tr>
<tr>
<td>Lucas Biosolids</td>
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<td>11%</td>
<td>92%</td>
<td>4.5</td>
</tr>
<tr>
<td>Total Blended Biomass</td>
<td>455.5</td>
<td>11%</td>
<td>68%</td>
<td>51.6</td>
</tr>
</tbody>
</table>

### Biogas Production by Feedstock

- **FOG**: 9.5%
- **Food Waste**: 11.2%
- **Outside Biosolids**: 28%
- **Lucas Biosolids**: 51.3%

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**High energy density recipe**
Case Study II: Lucas County, Ohio

Projected Outcome:

Once complete, the new energy neutral Lucas County digester will

- Provide the plant with a contingency plan for biosolids processing,
- Save over $700,000 per year in energy costs,
- Produce $128,000 worth of sellable RECs annually
- Generate $1,240,000 in revenue from tipping fees, and...
- Estimated payback period of 7.5 years
THANK YOU.
QUESTIONS?