ZOO SHARE BIOGAS
A FITEC ANAEROBIC DIGESTION SYSTEM
• Fitec designs, builds and operates Anaerobic Digestion Systems across North America

• Fitec currently provides operations support for 5 biogas plants totaling approx. 4MW of electrical output and over 100,000 tonnes/yr of organics processed.

• Fitec currently has 5 projects under various stages of design, construction and installation:
  - A BioSqueeze high solids contaminant separation system for commercial and municipal organic wastes
  - Zoo Share anaerobic digester-material handling, high TS pasteurizing and Fitec Self-Cleaning digester system
  - Escarpment Renewables-new receiving, material handling, high solids pasteurizing and in-fermenter plastics removal systems as well as control systems
  - Bromont, QC- Design and supply of a 45,000 tonne/yr AD system including Fitec receiving, pasteurizing and Fitec Self Cleaning digester system
  - Project feasibility for a 20,000 tonne/yr biogas system with RNG sales
About Zoo Share Biogas

• ZooShare Biogas Co-operative is a non-profit renewable energy cooperative, the Executive Director is Daniel Bida

• The biogas plant is 51% owned by the co-operative and its members and community bondholders

• 49% owned by EnerFORGE (formerly Oshawa Power), a local electrical distribution company

• Stonecrest Engineering is the site and civil firm on the project

• Fitec Environmental Technologies is the biogas system designer, process equipment supplier and technical supervisor to the project
Zoo Share Biogas by the numbers

- Zoo Share Biogas will be able to receive up to 17,000 tonnes of pre-treated or clean organic wastes
- Consists of one 2000m³ concrete digester with a concrete roof
- Has two receiving tanks, approx. 130m³ each
- One JMS 312 Jenbacher (633 kW) CHP
- 500 kW FIT contract
- 36m diameter digestate storage tank with double membrane gas holder
- Fitec is the process designer, process equipment supplier and technical advisor to the project
- Key Fitec equipment supplied:
  - Receiving tank agitation with Streisal agitators
  - High solids pasteurizing system including Fitec KV20 pumps and double tube heat exchangers
  - Fitec KV20 pumps also used for continuous digester feeding
  - Self Cleaning Digester system including in-vessel floor sweeper for continuous grit removal and in vessel skimmer for continuous plastics removal
UNDERSTANDING FEEDSTOCK IS KEY
Need to match the right solutions to the waste stream

Physical Composition

Municipal SSO TS: 25-35%; Contaminants up to 35% of the TS

Kitchens, restaurants & supermarkets TS: 20-30%; Contaminants up to 25% of the TS

Packaged & expired food wastes TS 20-35%; Contaminants up to 35% of the TS
Typical contaminants in food waste: glass, wood, sand, plates, cutlery, plastic bags, bones, egg shells, cardboard, cans etc.

All contaminants can ultimately be separated based on density differences into two categories: Light and heavy fractions.

### ORGANIC WASTE ANALYSIS

#### Biochemical Composition

<table>
<thead>
<tr>
<th>Organic waste type</th>
<th>Mass</th>
<th>TS delivered</th>
<th>oTS</th>
<th>oTSv</th>
<th>Protein</th>
<th>Fat</th>
<th>Biogas Yield</th>
<th>Methane content</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>tonne/Cd</td>
<td>%</td>
<td>%TS</td>
<td>%oTS</td>
<td>%</td>
<td>%</td>
<td>Nm³/t</td>
<td>%</td>
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<tr>
<td>Supermarket waste-clean</td>
<td>10</td>
<td>21.0</td>
<td>94</td>
<td>95</td>
<td>10.0</td>
<td>6.0</td>
<td>134</td>
<td>53.9</td>
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<tr>
<td>Source separated organics</td>
<td>9</td>
<td>21.0</td>
<td>85</td>
<td>93</td>
<td>16.0</td>
<td>6.0</td>
<td>124</td>
<td>55.1</td>
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<td>Food waste from restaurants</td>
<td>13</td>
<td>21.0</td>
<td>90</td>
<td>95</td>
<td>28.0</td>
<td>15.0</td>
<td>136</td>
<td>60.2</td>
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<tr>
<td>Supermarket waste-packaged goods</td>
<td>9</td>
<td>21.0</td>
<td>90</td>
<td>95</td>
<td>20.0</td>
<td>15.0</td>
<td>139</td>
<td>58.6</td>
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<tr>
<td>Solid Zoo Manure</td>
<td>5.5</td>
<td>45.0</td>
<td>78</td>
<td>73</td>
<td>16.0</td>
<td>0.0</td>
<td>87</td>
<td>53.0</td>
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<tr>
<td>Total Input</td>
<td>46.5</td>
<td>23.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>128.03</td>
<td>56.7</td>
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BIOTIP AD SIMULATION SOFTWARE

Determines the key AD process engineering parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Units</th>
<th>Operational Safe Limits</th>
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<tbody>
<tr>
<td>Digester Volume</td>
<td>1,963</td>
<td>m³</td>
<td></td>
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<tr>
<td>Organic load</td>
<td>4.3</td>
<td>kgoTS/m³/d</td>
<td>&lt; 4.0</td>
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<tr>
<td>TS Digester</td>
<td>5.5</td>
<td>%</td>
<td>&lt; 10 %</td>
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<tr>
<td>NH₄</td>
<td>4.6</td>
<td>g/l</td>
<td>&lt; 5.8</td>
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<tr>
<td>Average TS Input</td>
<td>23.8</td>
<td>%</td>
<td>&lt; 25 %</td>
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<tr>
<td>Biogas</td>
<td>6,420</td>
<td>Nm³/d</td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>56.7</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Energy output</td>
<td>613</td>
<td>KW</td>
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</tbody>
</table>
Eventually what goes in must come out

**Heavy Fraction-Sedimentation**

Even with pre-treatment residual contaminants remain & cause damage to equipment, accumulate in the digester and reduce digestate quality.

**Light Fraction-Floating Layer**
Self Cleaning Digester: Grit Removal Step 1

- Installations have been operating continuously for > 15 years.
- Makes half a turn every 2 hours and takes 20 sec to pump the grit as the scraper passes the sump.
- Utilizes a 0.55 kW motor and large reduction gearbox
- No scheduled maintenance
- Torque forces managed by concrete roof and mechanical supports.
- Sump in floor where grit is collected and pumped up to gravity separator.
- Agitator is specially designed to eliminate plastics wrapping around blades and shaft. Also large blades and slower speeds improves energy efficiency.
- Polypropylene liner in the gas zone.
Fine contaminant removal means the cleaning of all sinking material from the digester floor to avoid mechanical problems and shut down.

The floor cleaning system removes the final 2-3% of residual contaminants such as stones, sand, glass, egg shells.
In-Vessel plastics removal system

The system is designed to operate in a gas tight environment and skims the digester surface to remove the floating contaminants.

The skimmer operates in the top 20-30 cm of the digester.

The skimmer system typically operates 6-12 hrs per day depending on the level of plastics contamination.

Integrated 4 kW pump moves the skimmed material to a top mounted screw press with a 1 mm screen.

In the end all digestate leaving will be filtered through this system and is free of visible contamination.
PROCESS MORE ORGANICS AND AVOID COSTLY DOWNTIME