BIOGAS PRODUCTION, TREATMENT, AND UTILIZATION

Lee Enterprises Consulting, Inc.
Biogas Production, Treatment, and Utilization

- Candidate feeds and sites
- Potential volume
- Production *via* Anaerobic Digestion
- Impurities
- Cleanup
- Uses and Market Potential
Feedstocks for Biogas

- Ag waste
- Dairy and swine manure
- Municipal solid waste

- Wastewater treatment solids
- Food production wastes
- Energy crops
Candidate Farms for Biogas Production from Manure

Swine Farms

Dairy Farms
### Potential Amount of Biogas from Swine and Dairy Ops

#### Table 1.3 Potential for Biogas Recovery Systems at Swine and Dairy Operations

<table>
<thead>
<tr>
<th>Animal Sector</th>
<th>Candidate Farms</th>
<th>Energy Generating Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MW</td>
</tr>
<tr>
<td>Swine</td>
<td>5,596</td>
<td>804</td>
</tr>
<tr>
<td>Dairy</td>
<td>2,645</td>
<td>863</td>
</tr>
<tr>
<td>Total</td>
<td>8,241</td>
<td>1,667</td>
</tr>
</tbody>
</table>
Production of Biogas

Carbonaceous Wastes
- Bio-Waste
- Manure
- Agri-food
- Industrial residues
- Sewage sludge
- MSW

Biogas
* CH4 50–75
* CO2 25–50
* N2 0–10
* H2 0–1
* H2S 0–3
* O2 0–0.5

Digestate
- Nitrogen
- Phosphate
- Potash
- Trace Elements
Anaerobic Digestion

Typical Design of a Vertical Down-flow Wet Digester
Impurities in Biogas

- Moisture (Water)
- Dust or particulates
- H2S
- CO2
- Siloxane
- Hydrocarbons
- NH3
- O2/Air
- Halogens (Cl and F)
Biogas Cleanup System

Complete Gas Treatment System - San Jose, CA System Supplied by ESC Energy Systems, Redmond, WA
Uses of Biogas

Heat and Power, Renewable Natural Gas, Solid and Liquid Fertilizers
Anaerobic Digester Biogas Market Potential

“Biogas Opportunities Roadmap”, USDA/EPA, DOE, 2014
National Market Value of Anaerobic Digester Products, Informa Economics, February 2013
Detailed Biogas Studies Available

• Comprehensive, critical, up-to-date analyses of all aspects of Biogas industry
• Literature, patents, reports, presentations, annual reports evaluated
• Key technologies, companies, and economics assessed
• Authoritative, experienced authors – industry and academic

• https://lee-enterprises.com
• 501-833-8511

“Timeless & Timely”