Hull & associates, inc.

Consortium for Energy, Economics, & the Environment at Ohio University

Steve E. Giles, Vice President - Alternative Energy

March 4, 2014
OUR MARKET AREAS

- Shale Oil & Gas
- Brownfields
- Alternative Energy
- Environmental
- Waste Management

PROJECT DEVELOPMENT AND CONSULTING
Landfill Gas-to Energy

All energy projects begin with the fuels source.

- Why do landfills install gas collection systems?
  - Clean Air Act Regulations - New Source Performance Standards
    - Capacity: design capacity greater than or equal to 2.5 Mg and 2.5 million cubic meters.
    - Emissions: annual NMOC emission rate greater than or equal to 50 Mg.
  - EPA orders to control gas migration, or odors etc…
- Passive versus Active Systems
- Efficient collection systems are critical to successful LFG projects.
- It can be difficult to economically justify a LFG energy project on landfills that do not have a collection system.
Measuring Landfill Gas

- Not all landfills are the same. The quantity and quality of waste placed in the landfill will impact gas production.
- The landfill design and cap can also impact gas production.
- Weather, moisture and barometric pressure will impact gas production.
- Gas production will decline 3-4% per year after it reaches its peak production, which is normally 5-7 years after the waste has been placed.
- To determine the gas quality and quantity, we perform actual testing and also utilize a LandGEM model to create a gas supply curve.
Hardy Road Landfill Gas-to-Energy Project

- The Hardy Rd Landfill is located in Akron.
- It was closed in 2002 and utilizes 103 acres.
- During its operation, it took in about 2,100 tons of MSW per day.
- A collection system was installed in 2006 primarily to deal with gas migration issues.
- The gas collection system consists of 42 wells and two miles of collection pipes.
- The cap is 5 1/2 feet thick and consists of clay/dirt and a synthetic liner.
The landfill produces between 300 scfm and 540 scfm of landfill gas.
The methane content of the ranges from 46% to 52%.
The gas is reasonably low in H2S and siloxanes.
Hull installed a gas conditioning skid to remove moisture.
Hull installed a 4,000 foot pipeline to transport the gas to Akron's Water Pollution Control Facility.
Hardy Rd LFG Project Site
Overview
1,100 KW GenSet Installed
Project Summary

- Project cost was approximately $2.7 million
- System capacity is 1,100 kilowatts
- Produces 8,400,000 kWh per year – enough to provide approximately 40% of the electric energy needs of the water pollution control facility of power to about 700 homes.
- Hull raised all of the capital for the project so the City of Akron had no out-of-pocket expense and purchases the energy produced at a rate 5% below its primary service supply.
Greenhouse Gas Summary

- The LFG collection system would capture and destroy methane through the flaring process.
- By using the LFG as a fuel source incremental GHG benefits occur due to offsetting fossil fuel generation.
- A metric ton of methane is equivalent to 21 tons of CO2 emissions.
## Emission Reductions and Environmental and Energy Benefits for Landfill Gas Energy Projects

For electricity generation projects, enter megawatt (MW) capacity: 1.10

For direct-use projects, enter landfill gas utilized by project: \[ \text{million standard cubic feet per day (mmscfd)} \]

OR

\[ \text{standard cubic feet per minute (scfm)} \]

### Direct Equivalent Emissions Reduced

<table>
<thead>
<tr>
<th>MMTCO₂ E/yr</th>
<th>tons CH₄/yr</th>
<th>tons CO₂/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0417</td>
<td>2,191</td>
<td></td>
</tr>
</tbody>
</table>

Equivalent to any one of the following annual benefits:

- Carbon sequestered annually by \( _{ \text{acres}} \) acres of U.S. forests: 34,218
- CO₂ emissions from burning \( _{ \text{railcars}} \) short tons of coal: 179
- CO₂ emissions from \( _{ \text{gallons}} \) gallons of gasoline consumed: 4,680,076

### Avoided Equivalent Emissions Reduced

<table>
<thead>
<tr>
<th>MMTCO₂ E/yr</th>
<th>tons CH₄/yr</th>
<th>tons CO₂/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0046</td>
<td>5,037</td>
<td></td>
</tr>
</tbody>
</table>

Equivalent to any one of the following annual benefits:

- Carbon sequestered annually by \( _{ \text{acres}} \) acres of U.S. forests: 37,964
- CO₂ emissions from burning \( _{ \text{railcars}} \) short tons of coal: 199
- CO₂ emissions from \( _{ \text{gallons}} \) gallons of gasoline consumed: 5,192,382

### Total Equivalent Emissions Reduced

<table>
<thead>
<tr>
<th>MMTCO₂ E/yr</th>
<th>tons CH₄/yr</th>
<th>tons CO₂/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0463</td>
<td>2,191</td>
<td>5,037</td>
</tr>
</tbody>
</table>

Equivalent to any one of the following annual benefits:

- Carbon sequestered annually by \( _{ \text{acres}} \) acres of U.S. forests: 37,964
- CO₂ emissions from burning \( _{ \text{railcars}} \) short tons of coal: 199
- CO₂ emissions from \( _{ \text{gallons}} \) gallons of gasoline consumed: 5,192,382

### Energy Benefits (based on project size entered):

- Powering \( _{ \text{homes}} \) houses: 658
