Snohomish Basin Biogas Partnership and Feasibility Study

The Tulalip Tribes  
Lower Skykomish Conservation Group  
The Clark Group  
RCM Digesters
Biogas Feasibility Study

- Biomass Inventory and Assessment
- Technology Review
- Financial and Business Plan
- Implementation Strategy
Biomass Inventory

- Identify Biomass Resources
  - Dairy Farms – 38 assessed
  - Other Sources of Organics - 15 under consideration

- Identify Biomass Locations
  - Monroe Area – Skykomish Basin
  - Snohomish Area – Snohomish River Basin
  - Arlington Area – Upper Stiliguamish Basin
  - Stanwood Area – Lower Stiliguamish Basin
Dairy Cow Waste

- A typical production animal can weigh 1,400 to 1,500 pounds.
- Such an animal produces about 15 gallons or 135 pounds of waste per day.
- Smaller animals produce less waste, so size matters!
Dairy Cow Waste

- As deposited in the barns and walkways, the waste is about 18% solid and 82% water.
- It can become diluted with wash water or rain.
- Dilution is an important factor in digester design and operation.
Manure is pulled to a pit using a rubber tire
Collection is once or more per day
High concentration of digestible solids
Only slightly diluted
Pumpable – handled as liquid
Manure Handling by Flushing

- Manure is cleaned from lanes by high volume water flow
- Water is recycled from the storage lagoon
- Automatic – once or more per day
- Low concentration of digestible solids
Manure Volume Comparison
One Day Basis

Scraping One Cow’s Manure

Flushing One Cow’s Manure
Survey Areas

- Monroe
- Stanwood
- Snohomish
- Arlington
- Monroe
- Snohomish
- Arlington
- Stanwood
## Manure Handling Practice

<table>
<thead>
<tr>
<th>Location</th>
<th>Flushed</th>
<th>Scraped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monroe</td>
<td>1,170</td>
<td>1,100</td>
</tr>
<tr>
<td>Snohomish</td>
<td>2,200</td>
<td>985</td>
</tr>
<tr>
<td>Arlington</td>
<td>700</td>
<td>1,900</td>
</tr>
<tr>
<td>Stanwood</td>
<td>525</td>
<td>1,535</td>
</tr>
</tbody>
</table>
Monroe Area

- Five-Mile Radius From Honor Farm
- More Than 80 Tons/Month Food Waste
- Flush Dairies 681,000 gal/day
- Scrape Dairies 10,283 gal/day

- Honor Farm
- Fairgrounds
- Prison

Map showing the Monroe Area with a five-mile radius from Honor Farm, and nearby locations such as Fairgrounds and Prison.
Stanwood Area

- 525 Cows Flushed
- 1,535 Cows Scraped
- Food Waste Undefined
- Flush Dairies 200,000 gal/day
- Scrape Dairies 23,025 gal/day
Non-Dairy Waste

- Reformatory – 80 tons per month
  - Constant, low or no contamination
- Fairgrounds
  - Manure, fall seasonal surge, offers some offset for school
- Edmonds School District
  - Seasonal, 1,170 gallons per day well-sorted
- Red Hook Ale Brewery
  - 8,200 gallons week
  - Constant, no contamination
- Chicken/egg producers
  - Reluctant to offer details, but could be significant
Bio-waste Survey Status To Date

- All listed dairy farms have been contacted.
- 69% of the dairies expressed some level of interest in the digester project.
- Non-dairy sources are interested if they can lower disposal fees and transport costs.
- Industrial/Institutional organizations like the positive public relations when their waste is turning into energy.
Technology Review

- Identification of known technologies
  - 7 types
  - Review of past applications and performance
  - Operating characteristics
- Match up with biomass sources
- Operating characteristics and constraints
- Selection of most feasible technology
<table>
<thead>
<tr>
<th>Type of Digester</th>
<th>Level of Technology</th>
<th>Influent Solids Concentration</th>
<th>Solids Allowable</th>
<th>Supplemental Heat</th>
<th>HRT (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packed Reactor (2)</td>
<td>Medium</td>
<td>0.1 - 2%</td>
<td>Soluble</td>
<td>Yes</td>
<td>2+</td>
</tr>
<tr>
<td>Upflow Anaerobic Sludge Blanket</td>
<td>High</td>
<td>0.1 - 2%</td>
<td>Soluble</td>
<td>Yes</td>
<td>2+</td>
</tr>
<tr>
<td>Ambient Temperature Covered Lagoon</td>
<td>Low</td>
<td>0.1 - 2%</td>
<td>Fine</td>
<td>No</td>
<td>40+</td>
</tr>
<tr>
<td>Complete Mix</td>
<td>Medium</td>
<td>2.0 - 10%</td>
<td>Coarse</td>
<td>Yes</td>
<td>15+</td>
</tr>
<tr>
<td>Plug Flow</td>
<td>Low</td>
<td>11.0 - 13%</td>
<td>Coarse</td>
<td>Yes</td>
<td>15+</td>
</tr>
<tr>
<td>Anaerobic Sequencing Batch reactor (2)</td>
<td>Experimental</td>
<td>0.5 - 8%</td>
<td>Coarse</td>
<td>Yes</td>
<td>2+</td>
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<tr>
<td>High solids</td>
<td>Experimental</td>
<td>20 - 35%</td>
<td>Coarse</td>
<td>Yes</td>
<td>15+</td>
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</tbody>
</table>

(1) HRT = Hydraulic Retention Time = digester volume/daily influent volume
(2) Attached growth reactors
Remaining Tasks

- Match up with our biomass sources
- Identification of haul routes and costs
- Tipping fees
- Compost/mulch/bedding market
- Construction and operation
- Final feasibility assessment – Spring 2004