Biomass in Food and Energy Production

USEID Networking Event
Devens, MA
September 12-14, 2012
How it Began:

In October 2008, an inter-disciplinary Project Team of local stakeholders and regional renewable energy experts began discussing the possibility of transforming the Silver Bay Business Park into an Eco-Industrial Business Park.
Sustainable Industrial Development

• A Minnesota Pollution Control Agency grant for "Sustainable Industrial Development" was applied for and received in June 2009. The MPCA Grant assesses two elements. First, the ability to use wind, biomass and biodiesel to generate heat and power to make the park self-sustainable using renewable energy. Second, using industrial ecology and industrial clustering to achieve the ideology of "zero waste - zero emissions".
2 Concepts

• Industrial ecology is achieved by designing clusters of businesses and industries to network with each so that one industry's waste becomes another nearby industry's feedstock.

• The goal of the park is to be self sustainable, i.e., off the grid and powered by renewable energy production systems that are locally owned. It is strongly believed that the park is an ideal location for integrating three types of renewable energy (wind, biomass, biodiesel).
Cluster Based Economic Development

- Cluster based economic development refers to similar manufacturing processes or infrastructure needs, related feedstocks or resources that are typically positioned in a defined geographical area.
  - Reduces waste and pollution
  - Provides for resource conservation
  - Reduces transportation costs
  - Greater efficiency within related manufacturing processes.
Clusters Identified and Placed

• Energy Cluster
• Office Cluster
• Education Cluster
• Retail Cluster
• Tourism Cluster
• Biofuel – Food Cluster
Economic Development Tool

Businesses will be attracted to locate within the park as they will benefit from predictable renewable, sustainable energy costs. In addition, the need for fossil fuel consumption will be eliminated, which ultimately results in reductions in greenhouse gas emission, reductions in carbon footprint and reductions in waste.
The Victus System

1. Water starts in one 3000 gallon fish tank. Fish waste is filtered through a sump filter. Filtered water is transferred to the growout tanks. The sump filter removes suspended solids that accumulate in the fish tanks.

2. Once the suspended solids are removed, the water flows to three fish tanks. The fish tanks control pH and ionic balance as a biological reactor.

3. From the three tanks, the flow converges into a mixing tank. The mixing tank mixes between the nutrients and evenly distributes the mixture before feeding to the plants.

4. Only mixed, the water flows to the four growth tanks where the plants and algae absorb the nutrients and remove solids from the water. The solids are then returned to the fish tanks.

5. The water is continuously recycled. It will take each drop of water approximately three hours to make the full trip.
PHASE 2 QUALIFIED
U.S. Environmental Protection Agency
Hydronic Heater Program

Phase 2 Qualified models are cleaner and pollute less than those models that have not met this emission level. Exposure to smoke has been associated with respiratory illness and other health problems. Models that have lower smoke emissions may reduce your risk.

For more information go to www.epa.gov/burnwise

HYDROIC HEATERS
SMOKE EMISSIONS RANGE

<table>
<thead>
<tr>
<th>Emissions Level</th>
<th>Lower Emissions</th>
<th>Higher Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA Phase 2</td>
<td>0.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Entire Product</td>
<td>0.32</td>
<td></td>
</tr>
<tr>
<td>This Model</td>
<td>0.04</td>
<td></td>
</tr>
</tbody>
</table>

Heaters with lower emissions produce less smoke when installed and operated properly.

MANUFACTURER:
Northwest Manufacturing, Inc. (Woodmiser)

MODEL NUMBER:
Flex-Fuel 52kw Indoor/Outdoor

6-HOUR OUTPUT RATING:
219,931 BTU/hr (99% heat, 1% stack)

5-HOUR HEATING EFFICIENCY:
99% (99% during heating cycle)

PARTICLE EMISSIONS:
0.04 lb/hr per million BTU Input
0.04 lb/hr per million BTU Output
0.04 lb/hr per million BTU Output
Greenhouse Production System

- Wind
- Solar
- Biodiesel

Rain water & Lake Superior

Filter
Settling Basin
Energy
Alg Fish Food
H₂O
Biodiesel
Revenue
Fish Meat
Revenue
Produce
Revenue
Plant Material
Algae Cellulose Inputs

Biodiesel emissions

Water loss, plant uptake and evaporation

Fish
Fish
Settling Basin

Ext Feed Revenue

Fish compost for soil

Nutrient water

Clean water

Fish Meat Revenue

Fertilizer Revenue

Plant Material Algae Cellulose Inputs

Wind
Solar
Biodiesel

Energy

Nutrient water

Nutrient water

Nutrient water

Nutrient water

Nutrient water

Nutrient water