Monhegan Plantation Power District

Combined Heat and Power/Hybrid Project

Chris Smith, Operations Manager
Monhegan Island- 12 miles off shore
Monhegan Island Facts

• ~600 acres
• 2/3 In Land Trust
• Year round population- 69
• Summer population- ~250
• One room schoolhouse, K-8.
Two Industry Town
Lobstering and Tourism
Monhegan Plantation Power Grid Facts

- Granted Power To serve 1999
- 150~ customers
- Generate at 480volt/3 Phase
- Distribute at 4160volt/3 phase
- 10K~ feet 5Kv Cable
- 20 Step Down Transformers To 120/208/240
A Tale of Two Loads

Winter 2017
A Tale of Two Loads

Summer 2016

Graph: MonheganPower - Watts, 3-Ph total

Data for Aug 2016
Monhegan Plantation Power District

• Original Plant Brought Online 1999/2000

• 2X 120 Kw & 1X 80 Kw Kohlers with John Deere Diesels

• Remote Radiator Cooling

• Custom built Analog/Proprietary Switchgear

• Power Station Designed for Future PV Install
Legacy Issues

- Switchgear Prone to Fault Shutdowns
- Engine Rebuilds @ <15K Hours
- Engines Met Tier Zero Emission Standards
- Waste Oil is a continuous problem.
- High maintenance/rebuild costs.
Planned Power Plant Upgrades

- 4X Kohler Units With Tier III John Deere Engines
- Customized Remote Cooling System
- Switchgear Built into ECU
WHAT IS A MICRO TURBINE?

In layman's terms, “A miniature jet engine that runs at speeds up to 96,000 rpm and generates electricity and heat.

- Highly Reliable
- Ultra Low Emissions
- Simple/Cost Effective Design
- Very Low Maintenance

*Courtesy of Vergent Power*
*Courtesy of Vergent Power
Microturbine Technology

- Simple design and architecture
- Single moving part
- Fuel flexibility
- Environmental sustainability
- Scalable and modular

- Rotor group is high speed (Example: 96,000rpm for Capstone 65kW)
- Variable speed, variable output

*TCourtesy of Vergent Power*
Air Bearing Technology

- The Capstone microturbine uses air bearing technology
- Generator shaft is supported by foil bearings that create no friction
- Benefits:
  - No oil
  - Low maintenance
  - High reliability
  - Clean emissions
Benefits:

- Auto-synchronization – no need for external switchgear.
- Consistent Voltage and HZ
- Built-in protective relays

*Courtesy of Vergent Power*
## Microturbines VS. Internal Combustion Engine

<table>
<thead>
<tr>
<th>Capstone Microturbine</th>
<th>Traditional ICE</th>
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<tbody>
<tr>
<td>• Ultra Low Emissions</td>
<td>• Exhaust Cleanup/Treatment required</td>
</tr>
<tr>
<td>• Low Maintenance (6 hours/year average)</td>
<td>• High Maintenance (Oil, Coolant, Injectors- 160 scheduled maintenance periods/ 5 Years.</td>
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<tr>
<td>• Modular Components</td>
<td>May require External Equipment</td>
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<tr>
<td>• Built-in Protective Relays</td>
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Combined Heat and Power

- 4-C65 Capstone Microturbines
- 2 Units Equipped with Heat Recovery Modules
- Up to 400K BTU’s/Unit In Available Waste Heat
- Ongoing Work to Provide Heat/Dehumidification To Mohegan Museum
- Possible Future Domestic Hot Water Loop To Village
PV Component

- 40-275 Watt Q Cell Panels
- 20-Solar Edge Power Optimizers
- 10 KW Solar Edge 480 V/ 3 Phase Inverter
- Estimated Yearly Production: ~11000 KwH
PV Monthly Production
Summary

- Kwh To Date
  ~260,000KwH

- PV Production To Date ~
  2,790 KwH Meets ~2% of Load

- Fuel Increase ~15
  Gals/Day
  Winter/Offseason

- Fuel Increase ~30
  Gals/Day
  Summer/Peak Season