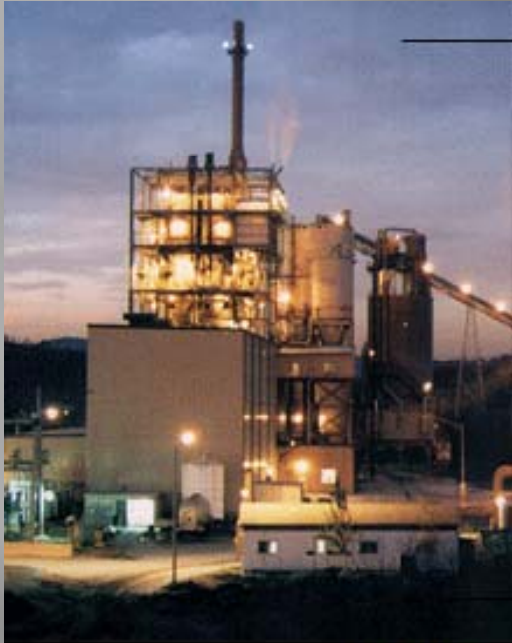



# PEI POWER CORPORATION



Two Landfills  
and  
32 miles of pipe

*A Subsidiary of*  Southern Union Company

# Presentation Overview

- ▣ Review existing plant and opportunity for expansion
- ▣ Understand owner's maintenance and operation considerations
- ▣ Identify & discuss technical challenges
- ▣ Review equipment selection
- ▣ Start-up and current operation
- ▣ Questions and discussion

# Review of Existing Plant

- ▣ Existing plant consists of a coal fired boiler matched to a condensing steam turbine
- ▣ In 1998, a 12 mile landfill gas pipeline was installed and the boiler was converted to burn LFG and natural gas
- ▣ The steam turbine produced approximately 8 MWe from landfill gas alone
- ▣ A 50MWe GE LM6000 was added as a peaking unit and evaluated for use with landfill gas, however removing siloxane at the required gas flow had not been done before

# Plant Expansion

- ▣ Unique opportunity to bring 8,000 cfm of gas from a second landfill 20 miles away
- ▣ Goal was to develop a plant to maximize electrical output and run time while meeting M&O requirements
- ▣ Plan for future generating capacity
- ▣ Plan for heat recovery steam generators
  - Offset steam currently extracted at low and intermediate pressures from the steam turbine

# Maintenance and Operation Goals

- ▣ New plant area will double the total area but has to be operated by the same number of engineers
- ▣ Integrate new plant controls into the existing system to permit remote operation to the site
- ▣ Perform single point of failure analysis and address areas of potential failure to maximize plant uptime
- ▣ Maintain safe, reliable, cost effective operation over the life of the plant

# Technical Challenges

- ▣ Available real estate was limited, had large retention ponds and was on unstable soil
- ▣ Gas will be supplied at different pressures from separate landfills
- ▣ Noise levels from new equipment may affect the community
- ▣ Address Wobbe Index, oil and condensate content of fuel
- ▣ Removal of siloxane had to meet equipment specifications

# Design Approach

- ▣ Plant area was excavated and regraded, with 22,000 cu yds removed and 16,000 cu yds hauled in
- ▣ Regulator station was installed to balance gas flows
- ▣ Gas compression, monitoring and processing systems needed to operate across the range of flows and inlet pressures
- ▣ Conducted noise study to determine impact and specified sound attenuation measures

# New Plant Layout



- ▣ Two Solar combustion turbines totaling 9.2 MWe
- ▣ Electrical interconnect to the PJM grid
- ▣ Truck and maintenance access to the equipment

# Equipment Selection - Power Generation



- ▣ Two Solar Mercury 50 recuperated gas turbines rated at 4.6 MWe ISO
- ▣ 38.5% electrical efficiency
- ▣ Guaranteed NO<sub>x</sub> emissions of 22 ppm for air quality permitting
- ▣ First operation on low BTU gas (480 WI)

# Equipment Selection – Gas Conditioning

- ▣ Parker-Hannifin siloxane removal passive adsorption media filter system
- ▣ Dual vessels per gas train for continuous operation
- ▣ Dessicant media requires regeneration, which is combusted in a flare



## Equipment Selection – Gas Conditioning (Continued)

- ▣ Vessel purge requires instrument quality air
- ▣ Siloxane removal performance of 5 mg/nm<sup>3</sup>
- ▣ Relatively low inline pressure loss
- ▣ Pre and After coalescing filters remove particulate and vapor

# Equipment Selection – Gas Compression



- ▣ J.J. Crewe packaged oil-flooded landfill gas compressors
- ▣ Low noise radiator fans and valve trim
- ▣ Designed for outdoor operation in Class 1, Div 2 area

# Electrical & Controls Design

- ▣ Modular packaging approach to house generator breakers
- ▣ Modules were elevated to minimize foundation interference with conduit routing
- ▣ Outdoor switchgear enabled phased installation to match plant shutdown periods
- ▣ Controls data concentration hub acted to organize all safety and operating parameters to send to the control room

# Construction Highlights

- ▣ PEI self-performed the construction management
- ▣ Plant remained fully operational through out the construction period
- ▣ Engineering packages were released in phases to coordinate with the existing plant's scheduled shutdown periods
- ▣ One year from beginning of design to beneficial operation with pre-purchase of long lead turbines
- ▣ Nine months from beginning of construction to first fire
- ▣ First fire to full load within one week

# Project Summary

- ▣ The new plant is comprised of two Solar Mercury 50 turbines that operate with the existing Rankine cycle plant
- ▣ Two pipelines from separate landfills totaling 32 miles in length deliver 12,000 cfm of gas to the site
- ▣ Total generation from the combustion turbines totals 9.2 MWe ISO
- ▣ Total site generation exceeds 25 MWe fueled by landfill gas

# Benefits of LFG to Energy at PEI

- ▣ On site turbine emissions were measured to be 7 ppm (0.08 g/bhp-hr) NO<sub>x</sub> and 3 ppm (0.02 g/bhp-hr) CO @ 15% O<sub>2</sub>
- ▣ Compared to traditional flare emissions, PEI produces less than 10% of NO<sub>x</sub> and less than 5% of CO in the turbines
- ▣ The total electricity generated by landfill gas offsets 133,000 tons of CO<sub>2</sub> annually, or the equivalent of removing approximately 18,000 cars

# Questions / Discussion

