Gas Conversion Considerations
Mill Creek 1, 2 and Brown 3

PPL companies

E.W. Brown Station
Mill Creek Station
Generation Engineering

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Gas Conversion Study Driver

Bridge the generation gap between coal unit retirements and construction of new generation by converting Brown 3, Mill Creek 1 and/or Mill Creek 2 from coal to natural gas fuel.

Gas Conversion Considerations

- Gas Supply
  - Piping System Capacity
  - Gas Burner Design and Installation
- NFPA Review
  - Required modifications
- Unit Capacity and Efficiency Impacts
- Impact of Steam Conditions on the Turbine
- Impact to Emissions
- Impact to O&M Costs
- Capital Costs

Gas Supply Considerations

Brown 3

- Gas Supply
  - Piping System Capacity
    - Branch from existing pipeline to plant
    - High pressure regulating, metering and heating station, low pressure regulating station
  - Gas Burner Design and Installation
    - NFPA compliant gas supply piping system at the boiler

Mill Creek 1 and 2

- Gas Supply
  - Piping System Capacity
    - Current capacity is 1,327 Mcfh @ lowest inlet gas transmission pressure
    - Changing orifice plate size will permit 2,400 Mcfh
    - Gas regulation equipment capacity is 3,000 Mcfh
    - Mill Creek 1 and 2 require 3,000 Mcfh each to convert to natural gas (not considering startup gas for Units 3&4)
  - Gas Burner Design and Installation
    - NFPA compliant gas supply piping system at the boiler

Gas Conversion Impact to Performance

Brown 3

- Capacity and Efficiency Impacts
  - 23.7 MW reduction in full load capacity with no increase in fuel burn rate
  - Boiler efficiency reduction of 3%
  - Unit Net Heat Rate Increase of 390 Btu/kWh
  - Increased turndown
- Impact of Steam Conditions on Turbine
  - Main steam temperature decrease of 52°F
  - Hot reheat steam temperature decrease of 87°F

EW Brown Unit 3		
	Coal	Gas
Target Gross Turbine Generator Load, MW	448.03	448.03
Turbine Derate, MW	0	23.7
Turbine Derate, %	NA	5.3
Maximum Gross Turbine Output, MW	448.03	424.33
Boiler Efficiency, % (HHV)	87.36	84.36
Net Plant Heat Rate, Btu/kWh	10696	11086
Boler Heat Input, Mbtu/hr	4562.77	4820.68
Coal Flow Rate, ton/hr	202.57	
Natural Gas Flow Rate, kcfm		75.5
Main Steam Outlet Temperature, °F	968	916
Hot Reheat Steam Outlet Temperature, °F	997	910
Economizer Flue Gas Outlet Temperature, °F	746.5	714.8
Air Heater Flue Gas Outlet Temperature, °F	317.2	292.1

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Gas Conversion Impact to Performance

Mill Creek 1 and 2

- Capacity and Efficiency Impacts
  - Potential reduction in full load capacity with no increase in fuel burn rate
  - Boiler efficiency reduction
  - Unit Net Heat Rate Increase
  - Increased turndown
- Impact of Steam Conditions on Turbine
  - Main steam temperature decrease
  - Hot reheat steam temperature decrease

Gas Conversion Impacts to Emissions

Brown 3

- Emissions of SO_2 and particulate matter will decrease, permitting the unit to operate without the WFGD or PJFF.
- NOx emission rate exiting boiler will decrease, permitting operation of the SCR at a lower removal efficiency, with less ammonia.
- CO_2 emissions will decrease.
- CO emissions will increase. Potentially requiring CO catalyst, which could be installed in the existing SCR
- MATS will no longer apply
- NSR – Increased CO and VOC could result in NSR requirements. If generation increases, NOx tons may increase, resulting in NSR requirements.

EW Brown Unit 3		
	Coal	Gas
CO_2, lb/hr	927,437	563,200
CO, lb/Mbtu	*	0.15
NOx, lb/Mbtu	0.04	0.08 - 0.12 [1]
*Baseline emissions were based on an emission factor of 0.5 lb-CO per ton coal burned		
1) Based on natural gas burners with overfire air, no SCR.		

Gas Conversion Impacts to Emissions

Mill Creek 1 and 2

- Emissions of SO_2 and particulate matter will decrease, permitting the unit to operate without the WFGD or PJFF.
- NOx emission rate exiting boiler will decrease, unclear if this will comply with NAAQS regulations going forward
- CO_2 emissions will decrease.
- CO emissions will increase.
- MATS will no longer apply
- NSR – Increased CO and VOC could result in NSR requirements. If generation increases, NOx tons may increase, resulting in NSR requirements.