Multiple Fuel-use Strategies— A Way to Handle Volatile Natural Gas Costs

Henry Manczyk, CPE, CEM
Director of Facilities Management
Monroe County, New York

ABSTRACT

Changing regulations, economic growth, and increasing competition in the energy industry have brought increased volatility in energy demand, supply, and prices. If you depend today on a single fuel for heating or power generation, you risk losing competitive advantage. An ability to use multiple fuels gives the facility operator greater flexibility to operate successfully in the uncertain new economic environment. Multiple fuel optimization is a strategic tool to maintain your competitive edge.

NATURAL GAS PRICE INCREASES

Natural gas has become the fuel of choice for convenience, favorable price, and clean and efficient operation. On July 17, 2000, the average spot market prices of this key fuel were $4.63 per 1000 cubic feet, nearly double the price from a year before. By December 27th the price had risen to a record high of $10.10 per 1000 cubic feet, approximately four times the price of a year before. When this article was written, the spot market price was $5.41 (February 20, 2001), illustrating the continuing volatility of natural gas prices. What has happened to cause these skyrocketing prices? How can a strategy of using multiple fuels help facility operators?

A variety of events has happened in our economy at large and in the energy sector itself that contributed to these price increases. For example:

- Production has declined since 1997 because relatively low gas prices have provided little incentive for producers to drill;
- Concern has grown nationwide over low gas storage levels, down 14% from the 5-year average;
- Many industries are using more natural gas as a result of higher fuel oil prices;
- More natural gas-fired electric generation plants are being built, 3% over 1999;
- The weather has been unusually cold in comparison to the last 3 years;
- The strong US economy of the past 7-8 years has increased the demand for all forms of energy, particularly in the industrial sector, which consumes about 40% of natural gas used in the US.

The rising US demand for natural gas, lower-than-normal gasoline and heating fuel oil inventories, OPEC production policies, volatile world oil markets, and other recent events have combined to push up current fuel prices and make predictions of future prices more uncertain.

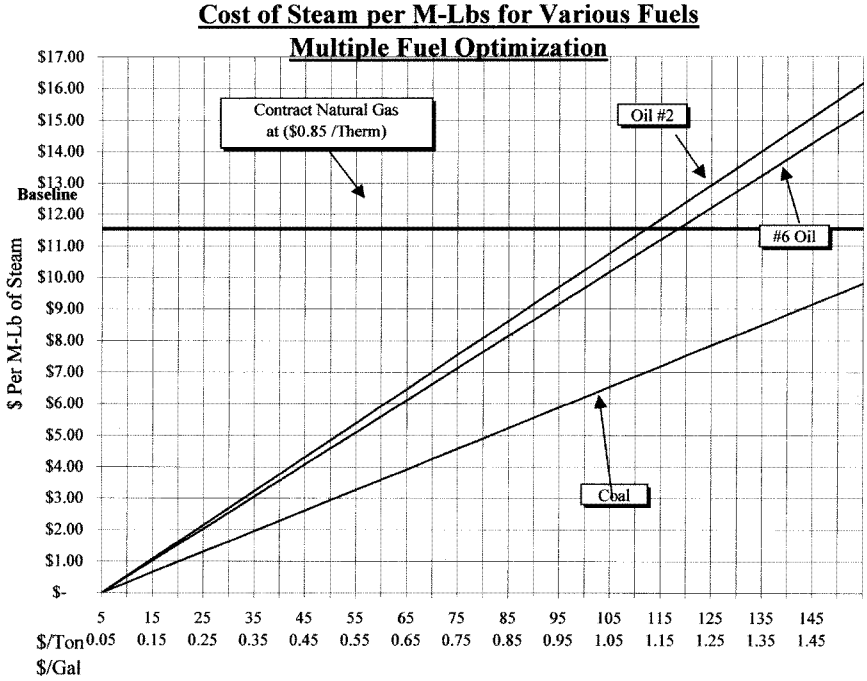
MULTIPLE FUEL OPTIMIZATION

In the face of fluctuating fuel prices and uncertain supply, a strategy of using multiple fuels such as natural gas, fuel oil, and coal can help a facility operator ensure the ability of the facility to meet its users' needs.

Multiple fuel users are plants that can switch their operations from natural gas to fuel oil or coal for a certain number of days per year. A multiple fuel plant can minimize its costs by constantly monitoring the gas and oil markets and the prices it pays to see when to switch to a less expensive fuel or when to lock in the lowest available fuel cost.

The accompanying chart shows cost curves for different fuels based on a range of prices. Given a specific price for natural gas, one can determine whether the price of coal or fuel oil would make one of these fuels a less expensive choice. The Fuel Optimization Chart was constructed based on the cost of producing a thousand pounds of steam with different fuels during the month of February 2001 in the northeast

region of the US. It was based on a price of $12.28 per thousand pounds of steam for natural gas; $11.32/M-lbs for fuel oil #2; $9.07/M-lbs for fuel oil #6; and $3.82/M-lbs for coal.



Fuel Selection Chart

The above chart is based on the following formula:

$$C_m = \frac{1}{B_e}\left[\frac{Q_s \times 1{,}000}{Q_f} \times C_f\right]$$

Where:
- Cm = Cost of Steam per M-Lb
- Be = Boiler Fuel Efficiency
- Qs = Btu's/Lb of Steam - 1193 at 120 p.s.i.
- Qf = Btu's per Unit of Fuel
- Cf = Cost of Fuel per Unit of Fuel
- M-Lb = 1000 Lbs of Steam at 120 p.s.i.

- Boiler fuel efficiency is 80% burning oil or gas fuel
- Boiler fuel efficiency is 70% burning coal fuel
- Steam pressure is 120 p.s.i. (1,193,000 Btu's/M-Lb)
- Ratings of fuel are: Natural gas103,000 Btu's/Therm #2 Oil-138,000 Btu's/Gallon
  Coal-26,000,000 Btu's/Ton (avg.) #6 Oil-146,000 Btu's/Gallon

Coal continues to be a viable fuel option, providing that its heating value content is high and the SO_2 is low. It is commonly available and can be friendly to the environment if utilized properly. In Central and Eastern Europe "clean coal" technologies have permitted upgrades and environmentally sound use of existing facilities. These include coal desulphurization, flue gas scrubbers, atmospheric and pressurized fluidized bed combustion boilers, low NO_x emission burners, and electrostatic precipitators

Environmental regulations and operating permit requirements must be considered in the fuel optimization strategy. The costs and penalties of exceeding permit thresholds can offset fuel price savings. Use of coal, for instance, might be practical during high boiler load periods when the system works at highest efficiency, but undesirable when low loads result in excessive particulate emissions. Likewise, the choice of which boiler to operate might depend on the size of the boiler and its efficiency given the load at a particular time of day.

STRATEGIES TO CONTAIN OVERALL COSTS

"Tried and true" cost management methods remain appropriate and valuable. We cannot control the weather or the cost of fuels, but we can take steps to stop heat loss and use energy wisely.

Energy Conservation

Facility users can turn off lights and office equipment during unoccupied periods; discontinue the use of personal or room electric heaters whenever practical; and keep maintenance staff advised of any energy inefficiencies.

Facility operators and maintenance staff should maintain all building systems, HVAC equipment and lighting systems at maximum efficiency; cycle off systems during non-operational hours; and replace older equipment with energy-efficient equipment.

Supply and storage strategies

The facility operator should secure long range contracts for various fuels. This helps avoid spikes in spot market prices when demand is high and supply is scarce. On-site storage for fuel oil or coal should be

sufficient to avoid the need for re-supply during extended cold spells or unforeseen interruptions.

Plant management should also secure a reliable contractor that delivers fuels on time and at the quantity and quality specified in the contract. The natural gas supply contract should guarantee an uninterruptible supply for the facility's base demand for natural gas; the balance of demand would be filled by an interruptible supply that is supplemented by the facility's multiple fuel capability.

Capital improvements

When an operator has the opportunity to upgrade or replace facilities, multiple fuel optimization should be included in the planning. Primary boilers should be sized to meet seasonal base loads, with supplemental boilers sized to meet variable loads. Each should have multiple fuel capability. On-site storage of fuel oil and coal should be sized to reduce the facility's vulnerability to spot market price fluctuations of natural gas and fuel oil.

CONCLUSION

The ability to use multiple fuels gives the facility operator greater operating and financial flexibility. Multiple fuel optimization is a strategic tool to maintain your competitive edge and your ability respond to the dramatic changes in the energy industry.

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ABOUT THE AUTHOR

Henry Manczyk has served as director of facilities management for Monroe County, New York, since 1987. He worked previously for the City of Rochester, New York, as manager of HVAC and energy. Manczyk has earned several professional certifications as energy manager and plant engineer, and has been recognized by numerous professional engineering organizations for his application of state-of-the-art technologies and operating practices in municipal facilities. Since 1985, when he first participated in a technical exchange with colleagues in Krakow, Poland, Manczyk has written and consulted on that country's energy issues. His most recent visits to Poland took him to Gliwice in 1998 where he lectured on district heating and energy conservation at Silesia's Technical University, and to Lviv in the Ukraine in 2000 where he presented a technical seminar for energy engineers. He also toured the Black Triangle's Turow Power Plant. In 1999 Henry was selected the AEE International Energy Manager of the Year.

Monroe County Department of Facilities Management, City Place, 50 West Main Street, Suite 4150, Rochester, NY 14614-1239; (t) 716-428-4906; (f) 716-428-9035; hmanczyk@mc.rochester.lib.ny.us.