Impact of Power Generation Gas Demand on Natural Gas Local Distribution Companies

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Growth in the amount of gas used for power generation has the potential to affect natural gas markets and natural gas industry operating practices in a number of fundamental ways. Indeed, the use of gas in power generation has already contributed to unprecedented gas price volatility and capital budget planning. One need only review the experiences of the gas markets in California to understand the potential magnitude of the impacts of power generation gas use.

Market price volatility is, however, only one aspect of the changes that power generation gas use will bring to the gas industry. Power generation demand growth could impact operating conditions on the natural gas pipeline network in ways that have the potential to affect LDC operations. The objective of this report is to consider the wide range of potential impacts of the growth in this segment on natural gas Local Distribution Companies (LDCs).

The impact of growth in power generation demand is not the same for all regions of the country and for all LDCs. This analysis is designed to identify factors that could contribute to the impacts between different companies in different regions and different market conditions.

Future Gas Use for Power Generation

There is a growing need for new electricity generation capacity in a number of regions of the country. While electricity markets in California and the Northeast have received the most attention from federal policy makers, markets in the Southeast, Midwest, Florida, and the Gulf Coast all require that substantial generation be added over the next five years with requirements continuing to grow through the remainder of the decade.

In response to these requirements, a very large number of power generation projects are being planned, announced, and built. As much as 240 GWs of capacity has been announced publicly in press releases and public filings. Of these more than 85 percent of the capacity is gas-fired. While all of the announced projects may not be built, the majority of the capacity will be needed by the end of the decade.

Energy and Environmental Analysis, Inc. (EEA) is projecting Lower-48 natural gas demand for power generation to almost double within the next ten years, reaching nearly

8 Tcf in 2010, up from a little over 4 Tcf in 2000. With an average growth rate of 4.2 percent per year, gas demand for power generation is expected to increase faster than gas demand growth in any other sector. Figure 2-1 shows the projected growth of power generation gas consumption relative to gas demand in other end-use sectors. The power generation share of the total natural gas market is projected to increase to 24 percent in 2005, and 27 percent in 2010 compared with 18 percent in 2000.

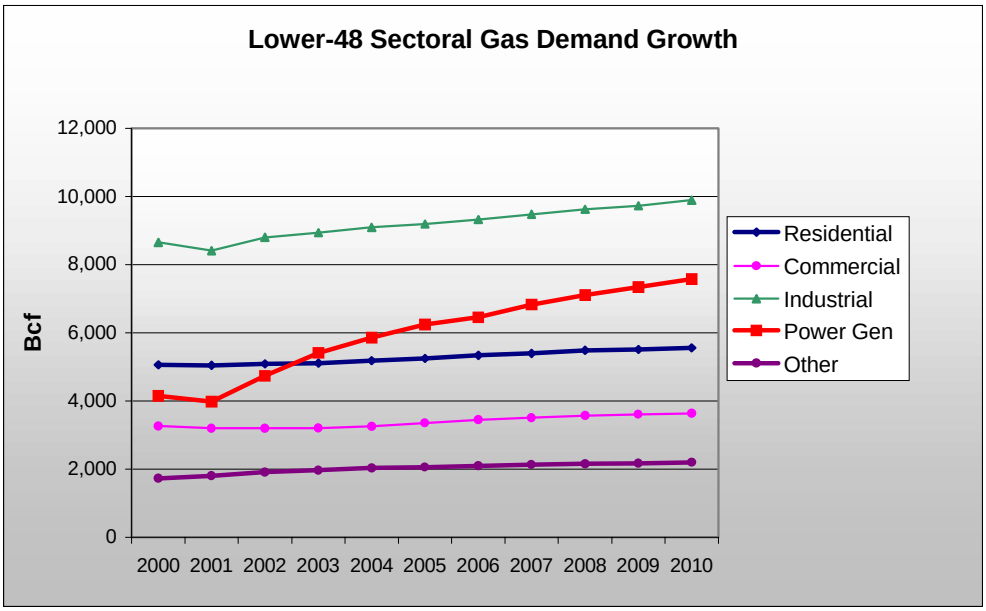

Figure ES-1

Incremental electricity demand is satisfied with increases in both gas/oil-fired and coal generation. Gas-fired generation is expected to account for 68 percent of the increase in total generation. By 2010, gas-fired generation grows to 24 percent of total generation, versus 13 percent in 2000. Most of this growth occurs in new gas-fired generating capacity.

Characteristics of Gas-fired Generation

There are two basic, distinctively different, types of gas-fired generation units:

- Base and intermediate load units, and
- Peaking units.

Base and intermediate load units are designed to operate at a relatively high annual capacity factor – 40 to 70 percent. New base and intermediate load units are generally combined-cycle units (CC) – a gas turbine unit that operates in conjunction with steam cycle generation driven by the hot exhaust gases for the turbine – because of the fuel efficiency advantage of these units that result in lower average generating costs.

A base-load combined-cycle is generally built with the intention of running on a regular schedule. For example, a unit may be designed to operate for 16 hours per day, seven days a week. In almost all instances, the base-load gas-fired generators will be pulled "off-line" during the late night and early morning hours, coming back "on-line" in the early morning.

Peaking load units are designed to run many fewer hours in the year. In the extreme, some units may only operate less than 50 hours per year during periods of peak electricity demand. Despite the low annual utilization, merchant peaking units can operate profitably by selling power during periods when the marginal electricity price is very high. However, to capture these opportunities, generators must be ready to come "on-line" quickly, often with little advanced notification. If a peaking generator misses an opportunity to capture extremely high marginal electricity prices on even a few occasions, the project's profit potential for the year may be lost.

Ramp-up and Ramp-down

Gas turbines can operate in a range of zero to 100 percent of the peak capacity rating, but efficiency levels begin falling rapidly when the turbine is operated below 80 percent of the rated capacity. The relationship between capacity utilization and efficiency means that, even though gas turbines are often used for load following purposes, or are kept online as spinning reserve, the desired mode of operation generally results in a rapid startup. Since the majority of gas turbine power stations include more than one turbine, plant startup can be staged to follow load by staging the operation of the various available turbines. A simple cycle gas turbine can be brought to full speed and peak natural gas consumption within 15 to 25 minutes of startup. The startup time for a combined cycle unit depends on the design of the unit. Steam turbines take significantly longer to bring to full power than a gas turbine, and typically require a staged startup process.

Moreover, a power plant may have relatively little advance knowledge that the unit will be dispatched. In a number of regions, the Independent System Operator (ISO) may require units to ramp–up to replace units that are experiancing unanticitpated outages.

Pipeline Service Requirements

As a result of these characteristics, power generation load exhibits more variability within each day than traditional pipeline customers. As pipeline customers, power plants will require services that allow them to manage the hourly swings in gas consumption.

Pipelines routinely have to adjust operating practices to meet the challenges of maintaining system pressure and adjusting to changes in rate gas consumption and gas flow patterns. Power plants amplify these changes because the fluctuation in consumption volumes is large and the rate of change is larger for power plants than for any other class of customers. The gas industry has served power plants for years – the unprecedented increase in gas demand for this sector, however, points to operational challenges.

To meet these challenges, pipelines may have to add facilities and/or change operating practices to compensate for the more volatile pressure conditions. For example:

- A pipeline may be able to add compression to respond to changes in operating conditions.
- A pipeline may be able to add looping upstream of the power generation facility to allow for additional gas flow and to decrease the magnitude of the pressure decline that accompanies power plant ramp-up.
- A pipeline could add flow control devices at key locations and at power plant delivery points to manage system operations.
- A pipeline could enhance system monitoring to insure that pressure changes are addressed efficiently.
- A pipeline could utilize state-of-the-art and dynamic flow modeling to evaluate operational scenarios and significantly reduce the risk of operational disruptions.

In addition, LDCs and other shippers may have assets and facilities that can be employed to address the operating changes. LDC assets that could support power generation include:

- Utility owned storage facilities that could increase the supply available in proximity to a power plant.

- Peakshaving facilities that could be operated to displace pipeline gas.
- Storage injections into contract storage that could be managed on a daily or hourly basis to support pipeline linepack.
- The ability to adjust and balance gas deliveries between multiple city-gate delivery points serving the LDC.

Communication between the generator, the pipeline and other pipeline shippers is important to effectively utilize LDC and other shippers' assets to manage and protect the operational integrity of the pipeline system. Shippers with assets that are available to maintain pressure and gas flow to generators must be aware that the opportunity exists in the marketplace. When these services are marketed to generators, the communication protocols could help to assure that the assets are being utilized in a similar manner.

Likewise, regulatory structures that allow shippers to effectively compete with pipelines are also important. To utilize existing assets efficiently, LDCs must not be restricted from utilizing their portfolios in a manner that meets the needs of the generator. In addition, competition between the pipeline and shippers can help assure that cost of services that require new facilities is minimized.

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INTRODUCTION

Growth in the amount of gas used for power generation has the potential to affect natural gas markets and natural gas industry operating practices in a number of fundamental ways. Indeed, the use of gas in power generation has already contributed to unprecedented gas price volatility, pipeline expansion proposals and capital budget planning. The objective of this report is consider the wide range of potential impacts of the growth in this segment of the market and discuss the implications of these impacts on natural gas Local Distribution Companies (LDC).

Gas use for power generation is a major opportunity for companies in the gas industry. By most estimates, gas use for power generation will account for more than half of the total growth in gas markets over the next ten years on a volumetric basis. Connecting new power plants will require investment in new infrastructure and provide an opportunity to offer services such as gas procurement, balancing and load management. While many of the new power plants will likely be connected directly to an interstate pipeline, LDCs want to compete for the growing power generation market by constructing facilities and using their portfolio of assets to serve the fuel service needs of generators. Moreover, many LDCs are pursuing business models that include power generation and power marketing as part of their core portfolio of energy products.

Market price volatility and market growth opportunities are not the only changes that gas use for generation will bring. Power generation demand growth will dramatically affect operating conditions on the natural gas pipeline network in ways that have the potential to affect LDC operations. Because of the large number of power plants slated for several regions of the country and the large amount of gas consumed at a power plant and the rapid and sometimes unanticipated changes in the hourly rate of consumption, gas-fired power plants have the potential to cause significant swings in the operating pressures on a pipeline. The principal operational concern expressed by LDCs is that pressure drops at the LDC's city-gate that could accompany the ramp-up of one or more power plants could disrupt and reduce the rate of gas flow through the LDC's meter station and into the distribution facilities. Pipelines, shippers and regulators will need to utilize "state of the art" analytic and communication tools to ensure that traditional customers as well as power generation applications receive the quality of service needed to meet gas consumers' needs.

The impact of growth in power generation demand is not the same for all regions of the country and for all LDCs. This analysis is designed to identify factors that could contribute to differences in impacts of power sector demand for gas between different companies in different regions and different market conditions.