Technical Memo

Kem C. Gardner Policy Institute
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To: David Landward, Regulatory Analyst, Dominion Energy Services
From: Juliette Tennert, Director of Economic and Public Policy Research
John Downen, Senior Research Analyst
Date: March 22, 2018
Subject: Economic Impacts of Worst-Case System Outage Scenarios

Dominion Energy Services contracted with the Kem C. Gardner Policy Institute to analyze the economic impacts of a temporary natural gas system outage during an unusually cold winter. This memo summarizes the assumptions, methodology, results, and limitations of our analysis.

We based our analysis on two scenarios provided by Dominion, which specified the duration of and number of residential and commercial customers along the Wasatch Front impacted by an outage during a rare extreme cold weather event. Our analysis does not address the probability of realizing these scenarios, nor does it address property damage or loss of life impacts.

Under the low scenario a total of 362,377 residential customers and 25,571 commercial customers are expected to be affected. Over 4,200 residential customers are without service for up to 19 days, while 22 commercial customers are without service for up to 28 days. The number of commercial customers affected represents 26 percent of total business establishments in the state, as well as 25 percent of the establishments in Salt Lake County, 3 percent of establishments in Tooele County, 15 percent in Utah County, and 76 percent in Box Elder, Weber, and Davis counties combined. The Gardner Policy Institute estimates that the state would lose almost $9.1 million in visitor spending during the month of January, when the outage is assumed to occur. The outage causes a reduction in economic output, which leads to a loss of 7,100 jobs and a decline in gross state product (GSP) of $1.4 billion. Personal income shrinks by $341.5 million (see Table 1).

Table 1: Economic Impacts of a Natural Gas System Outage
(Millions of 2017 Dollars)

	Low Scenario		High Scenario	
Category	**Absolute**	**Relative***	**Absolute**	**Relative***
Total Employment	–7,103	–0.36%	–11,586	–0.58%
Personal Income	–$341.5	–0.26%	–$556.9	–0.42%
Gross State Product	–$1,445.9	–0.85%	–$2,375.6	–1.39%

* Relative to 2017 baseline.
Source: Kem C. Gardner Policy Institute analysis of Dominion Energy data using the REMI PI+ v2.1.2 model.

Under the high scenario it is estimated that 603,816 residential customers lose service as well as 42,880 commercial customers. Over 13,000 residential customers are without gas service for up to 25 days and 24 commercial customers are without service for up to 28 days. Affected commercial customers represent 44 percent of total establishments in the state, as well as 55 percent of establishments in Salt Lake County, 25 percent of establishments in Tooele, 46 percent of Utah County establishments, and 73 percent of Box Elder, Weber, and Davis combined establishments. The Gardner Policy Institute estimates lost visitor spending of $9.7 million during the outage. The resulting decline in output leads to almost 11,600 lost jobs and a reduction in GSP of nearly $2.4 billion. Lost personal income amounts to more than $550 million.

Assumptions and Methodology

Dominion Energy Services provided outage "schedules" for a low and a high scenario, showing the number of residential and commercial customers without service for each day during the month of January. Dominion also provided the total number of residential and commercial customers affected in Salt Lake, Tooele, and Utah counties and in Box Elder, Weber, and Davis counties combined. To model the economic impacts of a natural gas supply outage we calculated the cumulative total commercial customer-days out of service, then divided this by the number of unique commercial customers affected to get an effective total days of lost output. This was then divided by 365 and by 260 to estimate the lost share of annual output, depending on whether businesses in a particular industry tend to operate seven days a week or five (–1.38 percent and –1.94 percent, respectively). We also divided the number of commercial customers affected in each county (Salt Lake, Tooele, Utah, and Box Elder–Davis–Weber) by the total number of business establishments in each county according to the Bureau of Labor Statistics. We then calculated the six affected counties' combined share of statewide employment in each industry, weighted by the share of establishments affected by the outage in each county. These weighted shares were multiplied by –0.0138 or –0.0194 to get the proportional reduction in statewide output by industry (see Table 2). All military establishments in the six-county region were assumed to be without gas for just one day in both the low and high scenarios, so their combined share of statewide military employment was multiplied by –0.0027 (1/365) to estimate lost output.

Table 2: Dominion System Outage, Low and High Scenario Inputs

	Low Case		High Case	
Industry Sector	**Affected Share**	**Output Loss**	**Affected Share**	**Output Loss**
Mining, quarrying, and oil and gas extraction	9.7%	–0.19%	18.1%	–0.35%
Utilities	18.7%	–0.26%	32.3%	–0.45%
Construction	27.5%	–0.53%	45.0%	–0.87%
Manufacturing	32.1%	–0.44%	48.3%	–0.67%
Wholesale trade	28.3%	–0.55%	49.5%	–0.96%
Retail trade	27.5%	–0.38%	45.0%	–0.62%
Transportation and warehousing	27.6%	–0.38%	46.4%	–0.64%
Information	23.0%	–0.32%	47.3%	–0.65%
Finance and insurance	28.4%	–0.55%	49.3%	–0.96%
Real estate and rental and leasing	26.5%	–0.37%	43.6%	–0.60%
Professional, scientific, and technical services	27.1%	–0.53%	47.5%	–0.92%
Management of companies and enterprises	26.7%	–0.52%	49.6%	–0.96%
Admin. and support and waste mgmt. and remediation	29.0%	–0.56%	49.6%	–0.96%
Educational services	25.7%	–0.50%	48.3%	–0.94%
Health care and social assistance	28.2%	–0.39%	45.8%	–0.63%
Arts, entertainment, and recreation	26.8%	–0.37%	42.4%	–0.58%
Accommodation and food services	24.9%	–0.35%	41.3%	–0.57%
Other services	21.0%	–0.41%	28.3%	–0.55%
Federal gov't, civilian	58.0%	–1.13%	68.3%	–1.32%
Federal gov't, military	84.5%	–0.23%	84.5%	–0.23%
State government	24.2%	–0.47%	46.0%	–0.89%
Local government	26.7%	–0.52%	42.0%	–0.81%
Lost Visitor Spending				
Retail trade*		–$719,742		–$771,471
Transportation and warehousing		–$2,117,600		–$2,269,795
Arts, entertainment, and recreation		–$285,673		–$306,205
Accommodation and food services		–$3,253,128		–$3,486,935
Other services		–$169,921		–$182,133

* Only the retail markup portion of retail spending is modeled, so visitor spending amounts will not sum to the totals in the text.
Source: Kem C. Gardner Policy Institute estimates and analysis of data from Dominion Energy, Bureau of Labor Statistics, and Bureau of Economic Analysis.

The Gardner Policy Institute also estimated lost visitor spending resulting from cancelled trips to the state under each scenario. This was modeled as lost sales in the retail; transportation; arts, entertainment, and recreation; accommodation and food services; and other services sectors.

Proportional output changes were entered into the REMI PI+ model for the state of Utah without direct employment, investment, or compensation effects on the assumption that this type of event would not necessarily lead to direct job losses at the affected establishments and would not influence firms' investment decisions. The employment losses that appear in Table 1 arise from the "multiplier" effects of a decline in output reducing firms' purchases of inputs from local suppliers and lowering workers' consumer spending.

This analysis does not address the potentially extensive property damage (due to burst water pipes, etc.) that could occur with a natural gas supply outage during an unusually cold winter. At least some of the damaged property would be insured, the reimbursement for which could increase economic activity in the state. Uninsured damages would simply cause spending patterns to shift temporarily from normal purchases and saving to repairing and replacing the damaged property. Loss of life due to the event is not addressed either.

Economic impacts typically arise when "new" money enters a region (e.g., a state or county) from outside. The recipient of these funds spends them to pay employees' salaries and to purchase goods and services from local vendors, who in turn use the new income to pay their employees and purchase inputs from their suppliers, and so on. These employees also spend their new earnings in the local economy to pay for housing, groceries, entertainment and other consumer goods. Some of the money will "leak" out of the region when goods or services are purchased from elsewhere. These rounds of spending within the region produce the multiplier effects, which are generally measured in terms of new jobs and income, and increased gross regional product. In the case of this analysis, an "external" event—the gas supply outage—causes a reduction in economic activity at the affected establishments that then ripples through the state's economy. Employment impacts count full- and part-time jobs equally. They are not an FTE measure of employment. Personal income comprises income an individual receives from all sources: wages and salaries, supplements to wages and salaries (employer contributions for pensions, insurance, and government social insurance), proprietors' income, rent, dividends, interest, and net transfer receipts. Gross state product is the value of goods and services produced for the use of households, governments, business investment and for export, less the cost of the goods and services used in the production process. What remains is the value added by employees and business owners.

Other Considerations

We did not model Dominion's estimated cost of service restoration: $6.3 million in the low case, and $10.4 million in the high. This would include bringing in utility crews from out of state and paying to house and feed them. In general, these are amounts that either would have been spent on other goods and services, or would have been spent at a later date but were spent now. In either case, to the extent that the spending is funded by Utah ratepayers, it would not result in economic impacts but simply a reallocation of spending.

We did not explicitly model the residential customers who lost service. To some extent they are captured through the lost wages and resulting reduction in household spending. The results presented here assume the affected businesses would not fire or lay off workers and would continue to pay wages during the outage. However, if 10 percent of affected businesses did not pay wages during the outage, the additional losses would include 377 jobs, $30.4 million in GSP, and $42.7 million in personal income for the low case, and 631 jobs, $50.8 million in GSP, and $71.3 million of income in the high case. If 25 percent of affected businesses did not pay wages during the outage, the additional losses would amount to 944 jobs, $76.0 million of GSP, and $106.8 million of income in the low case, and 1,576 jobs, $126.9 million of GSP, and $178.4 million of income in the high case.

The Gardner Policy Institute stands ready to assist with any further analysis and respond to questions about this analysis.