
Assessment of South Carolina Natural Gas Pipeline Capacity

A Skipping Stone Report

August 2018



Prepared for the Southern Environmental Law Center

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Executive Summary

Skipping Stone was retained by the Southern Environmental Law Center to evaluate the current state of natural gas pipeline capacity in South Carolina, assessing: 1) whether additional natural gas capacity is necessary to meet projected electric demand from South Carolina Gas & Electric Company (SCE&G) customers following the abandonment of two nuclear generating units at V.C. Summer station that were expected to come online in 2020; and 2) anecdotal claims that commercial and industrial growth in the Pee Dee region of the state has been stymied by insufficient interstate or within-state pipeline capacity.

Due to recent developments regarding pipeline capacity within and serving South Carolina, Skipping Stone concludes that there is ample pipeline capacity to serve the needs of SCE&G through at least the winter of 2027-2028. There is sufficient interstate pipeline capacity available on Dominion Carolina Gas Transmission (DCGT)—the pipeline serving the vast majority of SCE&G's gas-fired electric generation and gas distribution¹—to meet SCE&G's forecasted needs. While there is no additional (year-round) capacity on interstate pipeline Southern Natural Gas (SONAT) to feed DCGT, interstate pipeline Transcontinental Gas Pipe Line (Transco) has several billion cubic feet per day (Bcf/d) of capacity. This Transco capacity is well in excess of aggregate DCGT demand levels. As will be discussed in detail below, the "path capacity"² passing through South Carolina (whether from south to north or from north to south) is often held by entities that do not have a customer base in need of additional natural gas to meet electricity demands, and as a result sell their gas in the competitive market at locations all along the Transco pipeline.

Skipping Stone also concludes that to the extent the Pee Dee region in eastern and northeastern South Carolina may be currently un- or underserviced by natural gas, this situation is not a result of any interstate natural gas supply shortage. Instead, sparse population density and the high penetration of electric heating have contributed to the limited natural gas distribution infrastructure. It is not currently economical to build the miles of gas distribution line required to access the load in this region. If it were cost-effective to expand local natural gas distribution capacity in the Pee Dee area, SCE&G and/or DCGT could be expanded to serve this region without any need for additional out-of-state interstate natural gas supply.

This analysis is especially timely given media reports that the developers of the Atlantic Coast Pipeline (ACP) have expressed a desire to extend the pipeline into South Carolina, claiming they

¹ With the exception of one gas-fired generator in Aiken County, all of SCE&G's gas-fired generation and gas distribution for residential and commercial customers is served by DCGT.

² Path capacity is the capacity under contract to shippers from the shippers' receipt point(s) to their delivery point(s). Under federal rules governing pipelines, a shipper may pick-up (i.e., receive); and drop-off (i.e., deliver) gas at multiple locations along the "path" between their primary receipt and primary delivery locations a process referred to as segmentation, provided they do not overlap their capacity usage along their path such that they exceed their total path capacity.

"could bring in almost a billion cubic feet (28 million cubic meters) a day" into the state.³ The ACP is a proposed new \$5 billion – \$6.5 billion interstate gas pipeline that would transport gas extracted from the Marcellus shale into the Southeast, including Virginia and North Carolina. The ACP is being developed by Atlantic Coast Pipeline, LLC (Atlantic)—a joint venture of Dominion Energy, Duke Energy and Southern Company—which asserts that the pipeline is needed to meet demand for natural gas to generate electricity and to supply natural gas distribution utilities in the Southeast. Current plans have the ACP dead ending in Lumberton, North Carolina, 12 miles from the South Carolina border. Dominion Energy is currently in the process of acquiring SCANA, the parent company of SCE&G, which owns a network of distribution pipelines across South Carolina. Earlier this year, Dominion Chief Executive Tom Farrell described SCANA as a "natural fit" for Dominion, stating that the "combination can open new expansion opportunities, including the Atlantic Coast Pipeline that is now under development. . . ."⁴

Skipping Stone's analysis demonstrates that the ACP is not needed to serve forecasted demand in SCE&G territory or to supply gas in the Pee Dee region of the state.

Additional Interstate Pipeline Capacity Is Not Necessary to Meet SCE&G's Forecasted Demand

All natural gas consumed in South Carolina comes into the state from interstate pipelines or as liquefied natural gas delivered to the Elba Island, Georgia facility of Southern LNG (SLNG, a.k.a. the Elba Island LNG facility).⁵ There are four interstate natural gas pipelines that deliver natural gas from out-of-state sources: Dominion Carolina Gas Transmission (DCGT), Elba Express Company (EEC),⁶ Southern Natural Gas (SONAT),⁷ and Transcontinental Pipeline (Transco).⁸ DCGT owns and operates the interstate pipeline system with the widest geographic coverage in South Carolina; DCGT's system delivers natural gas to SCE&G, municipal gas distributors, government entities, as well as direct connected power plants and industrial facilities. Most of

³ Sarah Rankin, *Disputed East Coast Pipeline Likely to Expand* (Sept. 29, 2017, 10:47 AM), <https://www.usnews.com/news/business/articles/2017-09-29/apnewsbreak-disputed-east-coast-pipeline-likely-to-expand>.

⁴ Meg Kinnard, *Shareholders of Troubled SC Utility Approve Merger Plan* (July 31, 2018, 11:23 AM), <https://www.usnews.com/news/best-states/south-carolina/articles/2018-07-31/shareholders-of-troubled-sc-utility-to-vote-on-merger-plan>

⁵ LNG is liquefied natural gas. LNG is chilled natural gas where natural gas volume is reduced 1/600th of its volume in a gaseous state. SLNG is owned in part and operated by Kinder Morgan.

⁶ Elba Express Company is an interstate pipeline that is owned and operated by Kinder Morgan. It runs between the Elba Island LNG Terminal operated by SLNG and Transco at the Georgia – South Carolina border.

⁷ SONAT is owned in part and operated by Kinder Morgan.

⁸ Transco is owned and operated by Williams.

DCGT's facilities are within South Carolina,⁹ and served by other interstate pipelines (Transco, SONAT, and EEC) or SLNG¹⁰ and the SCE&G-owned-and-operated liquid natural gas (LNG) facilities referred to as the Bushy Park and Salley facilities.

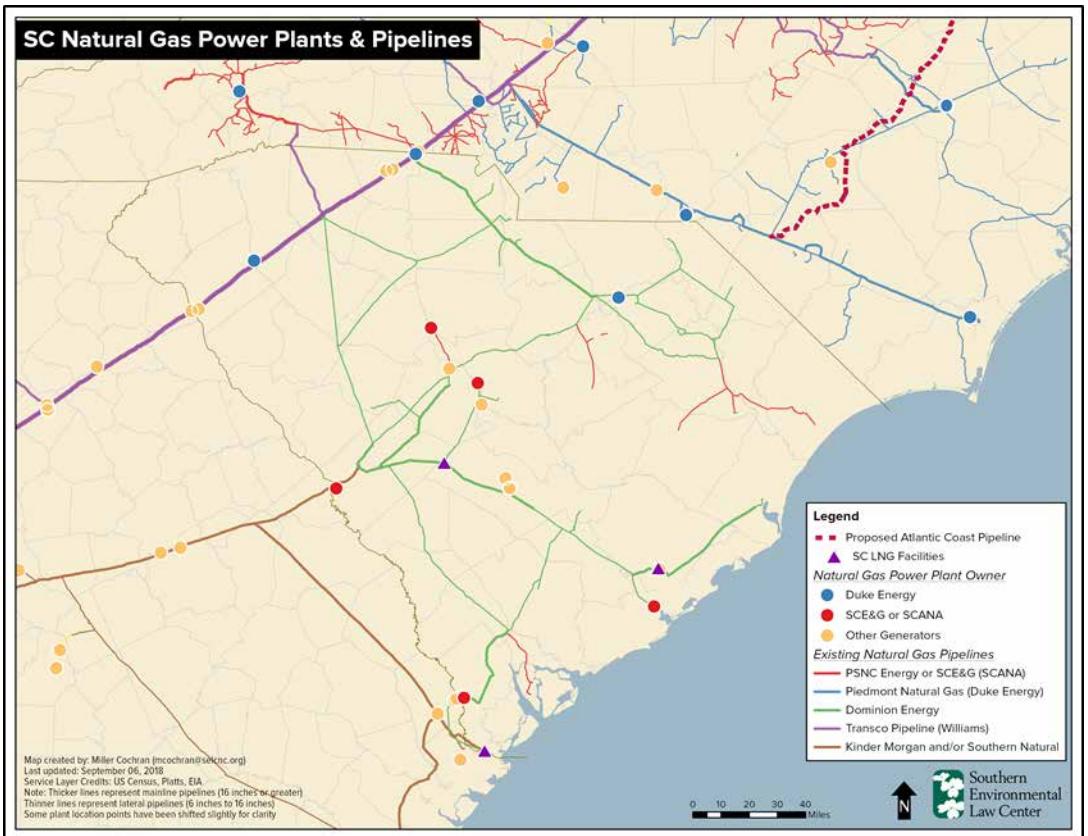


Figure 1: South Carolina natural gas pipelines

In this section, Skipping Stone explains its analysis of scheduled flow data and firm contracted capacity data¹¹ for DCGT, SONAT, Transco, SLNG, and Elba Express Company, as well as of peak and annual load information for SCE&G's electric generation and gas distribution operations.¹² Skipping Stone set out to determine whether existing natural gas capacity is

⁹ DCGT extends a short distance into Georgia where it interconnects with the EEC and SLNG.

¹⁰ The SLNG facilities associated with the Elba Island LNG Terminal are considered federally-regulated interstate facilities.

¹¹ This data is publicly available for pipelines and storage companies that are regulated by the Federal Energy Regulatory Commission. The data can be obtained from the companies' Informational Postings, and from automated, computer to computer electronic data interchange.

¹² SCE&G's 2017 Integrated Resource Plan (covering SCE&G's electric side) estimates future peak and annual loads. SCE&G's 2017 Purchased Gas Adjustment filings with the South Carolina Public Service Commission (covering SCE&G's gas distribution side) provides recent historic loads and the resources it utilizes to meet those loads.

sufficient to meet projected SCE&G electric demand. First, Skipping Stone considered the pipeline capacity available on DCGT, since that pipeline serves the vast majority of SCE&G's gas-fired electric generation and gas distribution.¹³ Second, Skipping Stone considered the pipeline capacity available on the interstate pipelines and other facilities that feed into DCGT.

DCGT Capacity is Sufficient to Meet SCE&G's Forecasted Needs

As of January 1, 2018, DCGT had 819,678 dekatherms per day (Dthd) of contracted firm delivery capacity (see Appendix A), up from 611,657 Dthd of contracted capacity in November 2006. Over the 2006 to 2016 period, DCGT grew its capacity primarily by increasing compression rather than by laying new pipe.¹⁴ An additional 80,000 Dthd of capacity was added when the Charleston expansion came fully into service in March 2018; bringing the total contracted DCGT capacity to about 900,000 Dthd (0.90 Billion cubic feet per day (Bcf/d)).

To determine whether DCGT has excess capacity, Skipping Stone plotted total daily deliveries to all delivery locations of DCGT between November 1, 2016 and January 21, 2018 against January 1, 2018 firm DCGT contracted delivery capacity, based on DCGT scheduled flow data (DCGT's daily deliveries to all of its locations).

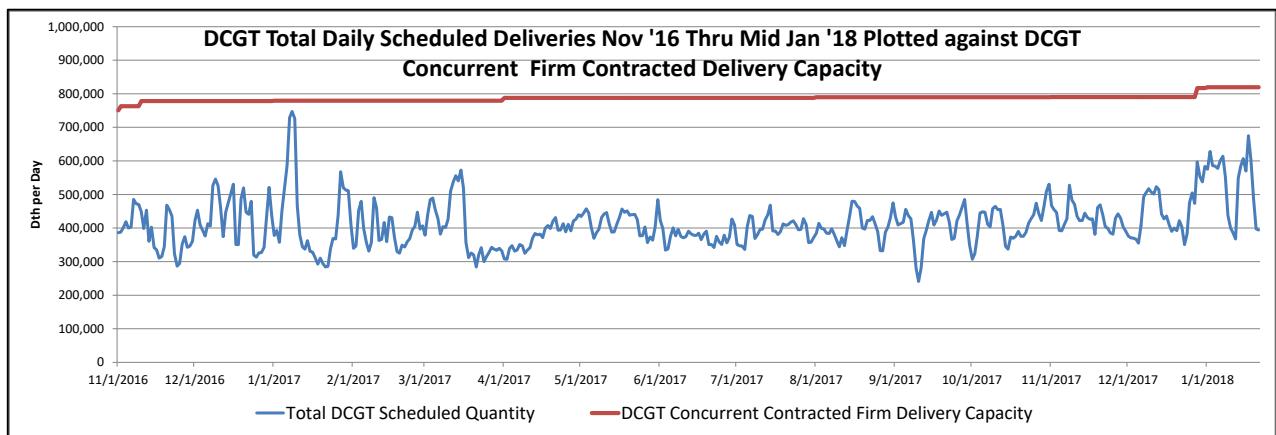


Figure 2: DCGT total daily scheduled deliveries November 2016 through mid-January 2018 plotted against DCGT concurrent firm contracted delivery capacity

Figure 2, above, shows that DCGT has excess capacity that is not generally being utilized. While in January 2017 DCGT approached delivery of an amount of gas nearly equivalent to its contracted firm obligation, DCGT generally only delivers around 50% of maximum contracted

¹³ With the exception of one gas-fired generator in Aiken County, all of SCE&G's gas-fired generation and gas distribution for residential and commercial customers is served by DCGT.

¹⁴ Between pipe and compression, pipe is the relatively more expensive way to increase capacity until the system can no longer increase capacity by means of compression, (i.e., the system is "fully powered-up"). Given that the Charleston Project involved installation of pipe and compression, it is likely that prior to this project DCGT was fully powered-up with respect to its then-existing facilities.

capacity. Skipping Stone also plotted total DCGT deliveries to all SCE&G locations, including utility-owned power plants and the Columbia Energy Center, as shown in Figure 3.

Figure 3 shows that SCE&G is the primary recipient of gas deliveries from DCGT.

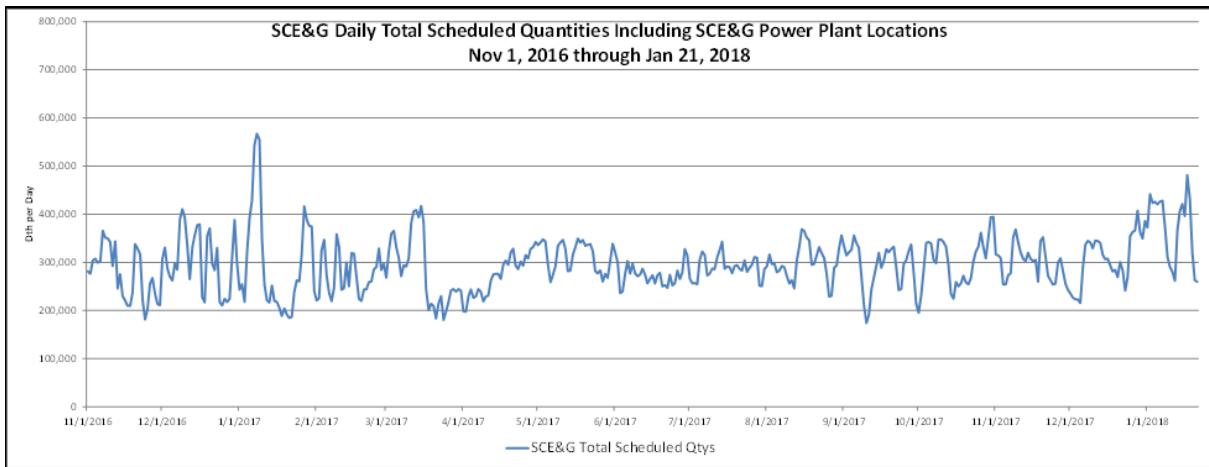


Figure 3: SCE&G daily total scheduled quantity including SCE&G power plants plus Columbia Energy Center deliveries, November 1, 2016 through January 21, 2018

The scale used in Figure 3 approximates the total firm contracted delivery capacity of DCGT at the end of 2017.¹⁵

In Figure 4 below, Skipping Stone plotted the SCE&G scheduled quantity data for November 2016 through October 2017 used in Figure 3 (the flowing gas and contracted firm delivery capacity SCE&G obtained from interstate pipelines) as a load duration curve. The load duration curve displays scheduled delivery data from highest quantities to lowest over the gas year.¹⁶ Load duration curves indicate the load factor of a system, and help illustrate the magnitude and duration of the system's peak load compared to average load conditions. When resources to meet that load are plotted against a load duration curve, the observer can deduce the sufficiency of those existing and planned resources. Figure 4 also features the resources (capacity contracts and LNG) that comprise SCE&G's portfolio of DCGT capacity, and SCE&G's actual vaporization of LNG for the 2016 / 2017 gas year.¹⁷ The DCGT capacity contracts to serve SCE&G locations include all of SCE&G's contracted quantities, the firm quantities of Columbia Energy Center contracts, and SCANA Energy Marketing's (SEMI's) firm delivery capacity to SCE&G's Jasper County plant.

¹⁵ Federal regulation requires that the interstate gas companies it regulates post data related to all firm contracts, including: the shipper, their primary receipt and delivery locations, associated point quantities, total transportation capacity, and start and end dates of contracts.

¹⁶ A "gas year" runs from November 1, of one year to October 31, of the following year.

¹⁷ LNG vaporization involves gasification of the LNG stored in the insulated holding tanks. LNG which is natural gas chilled to -260 degrees Fahrenheit is ~1/600th the volume of natural gas in its gaseous state. 1 cubic foot of LNG = ~600 cubic feet of natural gas and 12.1 gallons of LNG = 1,000 cubic feet or 1 Mcf of natural gas.

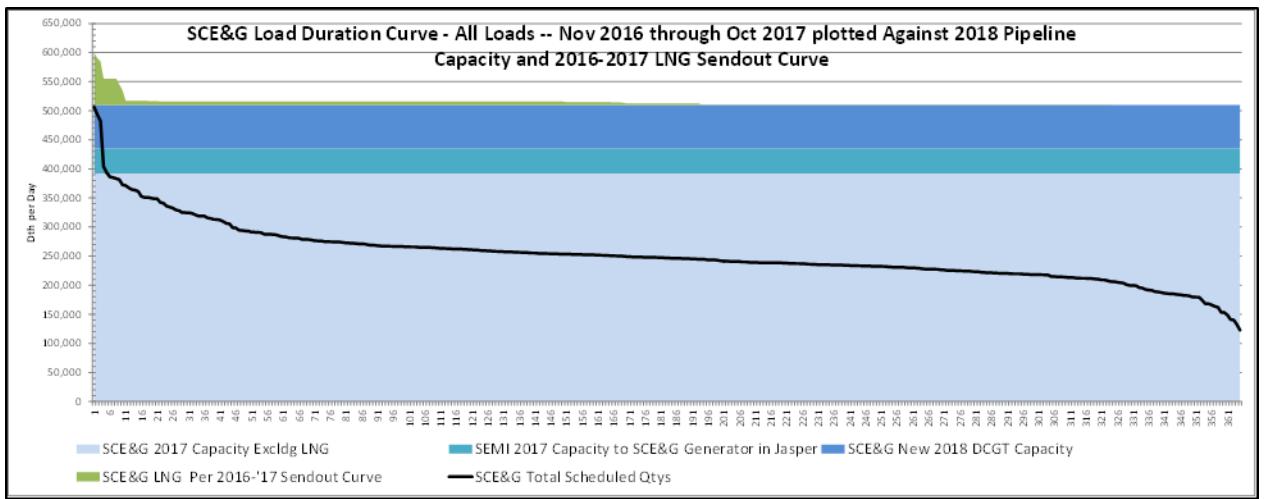


Figure 4: SCE&G load duration curve – all loads – November 1, 2016 through October 31, 2017 plotted against 2018 contracted pipeline capacity and 2016-2017 SCE&G LNG sendout curve

As can be seen in Figure 4, SCE&G's gas peak is "needle" in nature and lasts only about six to ten days.¹⁸ In addition, it is notable that the actual dispatch (vaporization) of LNG from SCE&G's two LNG terminals was nearly 100,000 Dthd at peak. This 100,000 Dthd is two-thirds of the peak rated send-out capability of those terminals according to data filed with the Federal Department of Transportation's Pipeline and Hazardous Materials Safety Agency, which registers the combined vaporization capacity at 154,000 Dthd.

Below, in Figure 5, Skipping Stone plotted DCGT's deliveries to SCE&G's distribution company locations (i.e., those locations other than SCE&G's DCGT-connected power plants) over the winter of 2016-2017. As seen from the full gas year load duration curve in Figure 4, and the full year daily scheduled quantity presented in Figure 3, the important part of the year for capacity sufficiency is the winter period. Demand for natural gas is highest in winter due to the combination of demand for heating with natural gas and demand for heating with electricity generated by gas-fired turbines and boilers. The peak daily sendouts of DCGT during the two highest non-coincident winter demand days for SCE&G's electric and gas demand in the past five years were 205,886 Dth per day and 361,241 Dth per day respectively. On these two days, SCE&G logged its two highest peak hours of electric demand (i.e., load). Skipping Stone's analysis of SCE&G peak demands¹⁹ indicates SCE&G's highest absolute demand hours were in winter—a time when demand for gas for domestic heating is also highest.

¹⁸ In any given gas year these 6 to 10 days are generally bunched together in groups of 1 to 3 over the 60 to 90 day period of December through February.

¹⁹ Peak demand information was provided in responses to data requests regarding the 2017 Integrated Resource Plan.

Given the significance of the winter period, Figure 5 focuses on the load duration curve over the winter period. In addition, Skipping Stone estimated SCE&G gas division's growth in peak demand to 2027-2028 from 2016-2017, based upon the same growth rate that SCE&G projected its electric load would grow in 2017 (i.e., 0.9% per year). This number should be considered conservative. SCE&G has since revised its winter peak demand growth projection down to 0.8% per year in its 2018 Integrated Resource Plan.²⁰

Then, Skipping Stone plotted just the 2018 contracted DCGT delivery capacity of SCE&G²¹ that was contracted to its gas service locations (again, those locations other than SCE&G's DCGT-connected power plants). The purpose of this analysis is to present a picture of how sufficient existing (i.e., post-Charleston expansion) 2018 capacity of SCE&G's gas division would be in meeting the forecasted winter load duration curve ten years from now, in 2027-2028. Note that in Figure 5 below, any day that the available resources (the horizontal bars) exceed the black load duration lines, there is excess gas capacity held by SCE&G. On those days, the excess capacity is available for others served by DCGT.²² On the few days where there is no excess gas capacity held by SCE&G, SCE&G is able to meet gas demand through sendout of stored LNG.

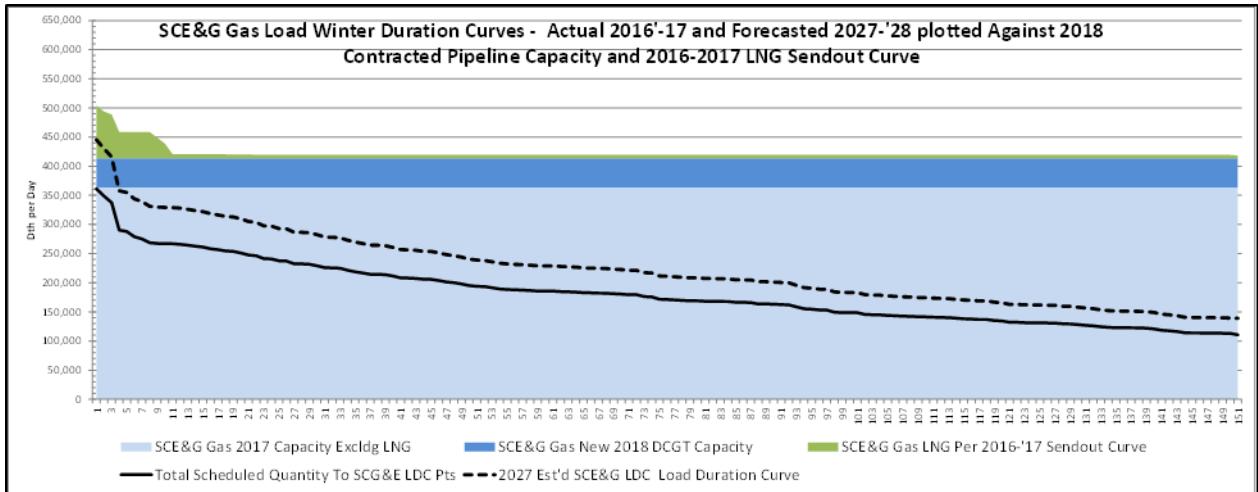


Figure 5: SCE&G gas load winter duration curves – actual 2016-2017 and forecasted 2027-2028 plotted against SCE&G gas contracted pipeline capacity and winter 2016-2017 LNG sendout curve

As was done for SCE&G's gas-only loads, Skipping Stone also plotted the load duration curve for SCE&G's electric loads. Figure 6 shows SCE&G's load duration curves in megawatt hours (MWh)²³ from the winters of 2012-2013, 2013-2014, 2014-2015, as well as a 2027-2018

²⁰ <http://www.energy.sc.gov/files/view/2018%20SCE%26G%20IRP.pdf> at 3.

²¹ 2018 capacity includes the capacity associated with the Charleston expansion, which adds an additional 50,000 Dthd for the gas side of SCE&G.

²² This "excess" can be made available by the holders of the capacity through sales (a.k.a. releases) of that capacity to others or by DCGT through sales of interruptible transportation. Both releases and interruptible transportation are considered the secondary market.

²³ A megawatt hour is 1 million watt hours or 1,000 kilowatt hours (kWh).

forecasted load curve. The 2027-2028 forecasted curve was developed by taking the highest winter peak hourly load (the 2014-2015 load of 4,970 MWh), growing that peak hourly load out to the winter of 2027-2028 using a 0.9% annual growth rate,²⁴ then developing a curve with that forecasted peak hour to match the 2014-2015 winter load shape.

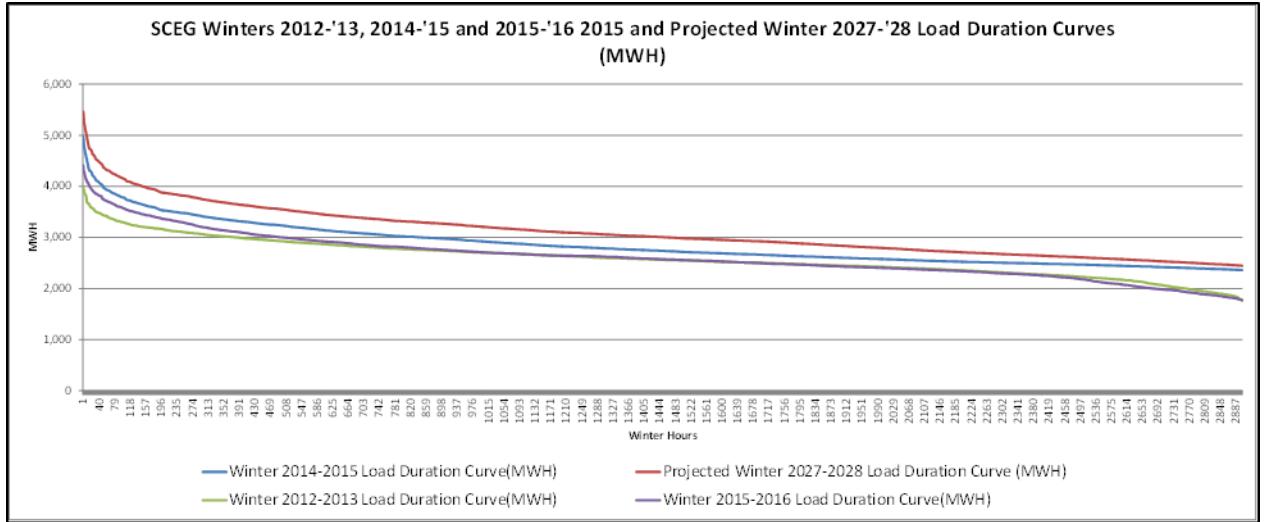


Figure 6: SCE&G 2012-2013, 2014-2015, and 2015-2016 winter load duration curves and 2027-2028 projected winter load duration curve

Finally, Figure 7 shows that existing generating resources are adequate to meet peak demand projected for the winter of 2027-2028 given planned 2018 DCGT upgrades. In Figure 7, Skipping Stone analyzed the electric generation resources SCE&G presented in its 2017 Integrated Resource Plan (IRP)²⁵ as being available in 2027, with adjustments to remove the cancelled nuclear plant and insert the Columbia Energy Center recently purchased by SCE&G. Then, for SCE&G's gas fired resources Skipping Stone used heat rates estimates (the amount of gas energy required to make a MWh of electricity)²⁶ to determine how many MW of generating capacity could be served by the SCE&G-electric's portfolio of pipeline capacity.

²⁴ This 0.9% this growth rate from SCE&G's 2017 IRP should be considered conservative as SCE&G has since revised its growth rate over this period down to 0.8%

²⁵ As this report was being finalized, SCE&G submitted its 2018 IRFP which anticipates an additional 540 MW combined cycle unit in 2023, which would nominally consume ~75,00 Dthd of natural gas. As discussed below, with respect to capacity on DCGT, this unit, depending on its location within SC will potentially require an upgrade or expansion of DCGT; however, as also discussed in this report, there is sufficient capacity on Transco to supply this quantity of gas to DCGT. In addition, SCE&G noted in its 2018 IRP that it anticipates participating in Transco's Southeastern Trail expansion, which will increase capacity on Transco from the interconnect with Dominion's Cove Point LNG pipeline to South Carolina and Alabama. This project would make additional gas available to DCGT, but again DCGT would have to increase capacity to serve the proposed 2023 540 MW plant, depending on specific location of the plant.

²⁶ Skipping Stone analyzed Federal Energy Information Agency data on generated MWh and associated fuel use by plant.

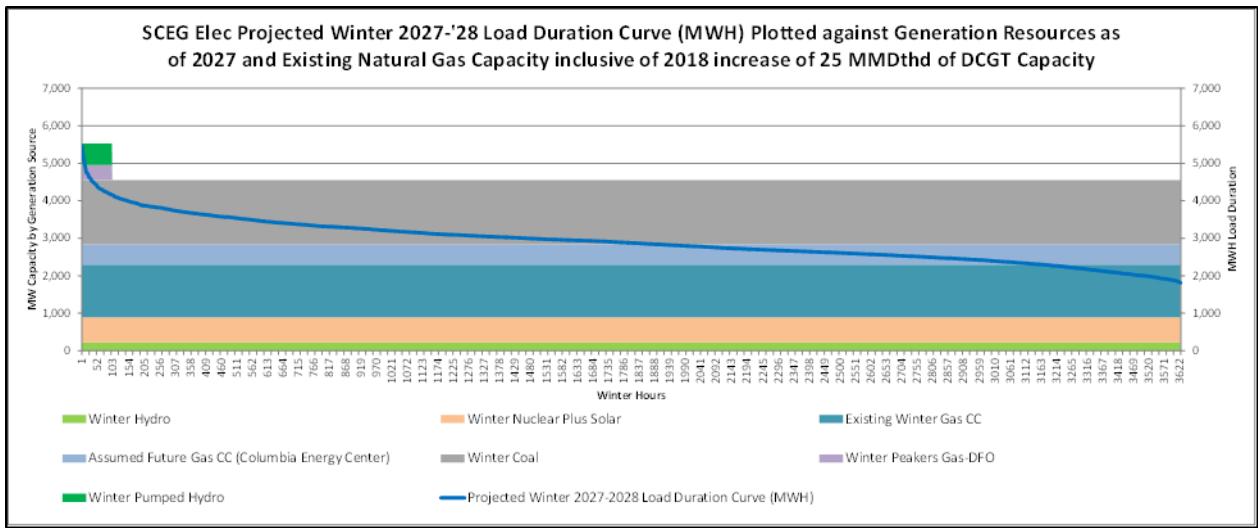


Figure 7: SCE&G electric 2027-2028 projected winter load duration curve (MWh) plotted against generation resources as of 2027²⁷ and existing natural gas capacity of SCE&G-electric generation, including the 25 MMDthd increase of DCGT capacity in 2018²⁸

As can also be seen in Figure 7, current natural gas capacity is sufficient to power SCE&G's generation resources for the next decade. As with Figure 5, when the horizontal bars (the resources) are greater than the load duration line, there exist resources in excess of demand. Here, SCE&G's peaking resources – pumped hydro and natural gas plants – remain adequate to meet projected peak demand through 2027. Notably, Skipping Stone assumed gas-fired resources would be run prior to coal-fired resources. In addition, given that SCE&G's fleet of Peakers can be fired with either diesel fuel oil or gas, should gas supplies (e.g., LNG) be preferred, that source could replace diesel fuel oil as the fuel used by the Peakers. In other words, there is enough capacity to meet SCE&G's projected generation needs over the next decade *and* transition the Company's Peaker plants to natural gas.

²⁷ This does not include the 2018 SCE&G proposed 2023 540 MW plant described above. Development of that new generating resource would provide additional capacity on top of the existing resources and the Columbia Energy Center, which are already adequate to meet projected electric demand.

²⁸ In Figure 7 electric load is charted in hours—the ~3,600 in the 151 days of a gas year's winter. To chart the electric-side hours against the gas industry convention of days, Skipping Stone divided SCE&G's daily gas capacity by 24 and used that hourly capacity to calculate the hourly production of electricity possible with that hourly capacity of gas. It should be noted that except for the coldest days of winter, when pipelines generally require their shippers to keep hourly takes at 1/24th of daily capacity, pipelines generally permit power plants to ramp (i.e., take gas) at rates greater than 1/24th and de-ramp to rates of take lesser than 1/24th of daily scheduled capacity.

Discussion of In-State Natural Gas Capacity Issues

DCGT does not have capacity that is available to be sold to customers within the state on a firm basis without first making an expansion. DCGT is currently expanding its system by approximately 9%, with completion expected before the end of summer 2018. That expansion was facilitated by customers signing up for 10- to 20-year contracts sufficient to pay for construction of the new facilities in South Carolina.

In general, to reserve pipeline capacity, potential customers, such as local distribution companies, municipalities, power generators, and industrial users, contract with the pipeline company to pay fixed reservation charges for the right to use the pipeline as well as to reserve pipeline capacity.

To further expand DCGT within South Carolina, SCE&G is likely a necessary customer. As discussed below, there is plenty of capacity to the state on Transco; however, firm capacity within the areas of the state covered solely by DCGT is more problematic. Because it has existing customers to whom it can pass the costs of expansion or extension prior to getting new customers to absorb those costs, SCE&G is the most likely entity to subscribe to further expansion(s) of DCGT. SCE&G also has LNG which it can use to meet peaks in demand until new DCGT capacity can catch up. And, finally, SCE&G is most likely to be able to both identify (and reveal to regulators) potential new loads on the system.

Skipping Stone's analysis indicates that to the extent additional firm demand, un-forecasted by SCE&G were to materialize within South Carolina, DCGT would likely need to expand its in-state pipeline facilities to serve that demand on a firm year-round basis. These two points are evidenced by the most recent expansion of DCGT where SCE&G's gas and electric divisions separately subscribed to 50,000 Dthd and 25,000 Dthd respectively. Two industrial customers also subscribed to an additional 5,000 Dthd of firm capacity on DCGT's "Charleston" project. However, in spite of this 80,000 Dthd expansion of service by these customers on the DCGT system, there is no evidence that any of these DCGT expansion shippers subscribed to any capacity on Transco or SONAT to feed their new DCGT capacity. Skipping Stone will show, below, that this lack of commensurate subscription to expansion capacity on Transco (or SONAT) is a sensible strategy, given the abundance of capacity available to South Carolina on Transco.

While evidence shows that there is ample capacity available on Transco to serve consumers in South Carolina, none of that capacity is currently un-contracted. This means that customers in the state with capacity on DCGT will buy gas delivered by Transco from one or more of the holders of capacity on Transco. As discussed below, this ample capacity on Transco is in part due to the ability of Transco shippers to segment their Transco capacity, enabling them to physically receive and deliver more gas than their stated contracted capacity. However, should industrial, municipal, or other shippers on DCGT want their own capacity on Transco, as opposed to buying gas competitively from those shippers on Transco able to deliver to South Carolina, then such customers would need to subscribe to Transco capacity, likely for a term of 20 years.

In sum, industrial customers or others in South Carolina that want firm delivery service through SCE&G have to first get firm on SCE&G. Then, if they also want "Firm" service for gas

from Transco, they have several choices: 1) they could arrange with a Seller with firm service on Transco to buy gas on a "firm basis" whether for a short or long term – to be negotiated, 2) they could get a shipper with capacity to serve South Carolina to release some of their capacity to them (i.e., capacity release); or 3) they could subscribe to an expansion of Transco.

Gas users in South Carolina have anecdotally indicated to Skipping Stone that their "Firm Service" now gets cut often because there is no excess pipeline capacity to serve existing loads during periods of high demand. This is a complicated truth. First, service for most gas users in South Carolina is provided by SCE&G, which under its in-state "Firm Service" tariff can "cut off" gas service within all or parts of their service area to ensure adequate gas is available to meet "essential needs," such as residential customers, hospitals, police stations, and schools. However, with respect to "Firm Service" on an interstate pipeline (like DCGT, SONAT, Elba Express or Transco), shippers scheduling gas up to their Maximum Contract Quantity cannot get cut by these interstate pipelines. From the end users' perspective, this difference may seem unimportant. But from a planning perspective, it is essential to understanding what infrastructure improvements may be required to eliminate such periodic curtailments in service.

For SCE&G to provide "Firm Service" at all times to all gas users in the state, SCE&G may have to both expand its system and subscribe to an expansion of the DCGT system. In both cases, this would be an economic decision by SCE&G which may also have regulatory implications as to cost allocation of such expansion(s) among SCE&G ratepayers. Factors like access to water, electricity, roads, rails, and population with skills will no doubt influence whether and where future industrial development is likely to occur, and thereby where in-state gas infrastructure may need to be expanded or extended. In sum, to the extent that there may be regional shortages of firm capacity, these are the result of in-state constraints on the DCGT system and not due to any capacity shortage on the existing interstate pipeline system. Expansion of in-state distribution capacity depends on regional economic factors, such as population density and industrial capacity, that are largely unaffected by the overall interstate natural gas supply to South Carolina.

Capacity on Other Interstate Pipelines is Sufficient to Supply DCGT

Because DCGT is served by other interstate pipelines and LNG facilities, Skipping Stone also analyzed the sufficiency of capacity of the pipelines and LNG sources serving DCGT and found existing and soon-to-be-existing capacity was substantially more than sufficient to serve the requirements that DCGT will have in order to meet SCE&G's demands through at least the winter of 2027-2028. Holders of capacity on DCGT seldom have more than relatively small percentages of their DCGT capacity holding(s) on the pipelines serving DCGT, especially DCGT shippers whose primary receipts onto their DCGT contracts are at Transco interconnects. Skipping Stone specifically analyzed available contracted capacity and scheduled flows during this winter's "bomb cyclone" period of extreme weather and persistent high demand and found that interstate pipelines were not only sufficient to meet experienced demand, they had additional capacity that could have fed DCGT capacity. LNG resources also could have met even higher demand.

As discussed above, DCGT — the interstate pipeline whose facilities are almost wholly within South Carolina²⁹ — is served by other interstate pipelines or federally regulated interstate facilities.³⁰ Those pipelines are SONAT, Transco, and EEC. In addition, DCGT is served by SLNG, and the SCE&G owned and operated LNG facilities referred to as the Bushy Park and Salley facilities. While SLNG is soon to also become an LNG export terminal, it retains its LNG vaporization capability and capacity.³¹ The map below, Figure 8, presents the pipeline and LNG facilities in and serving South Carolina.

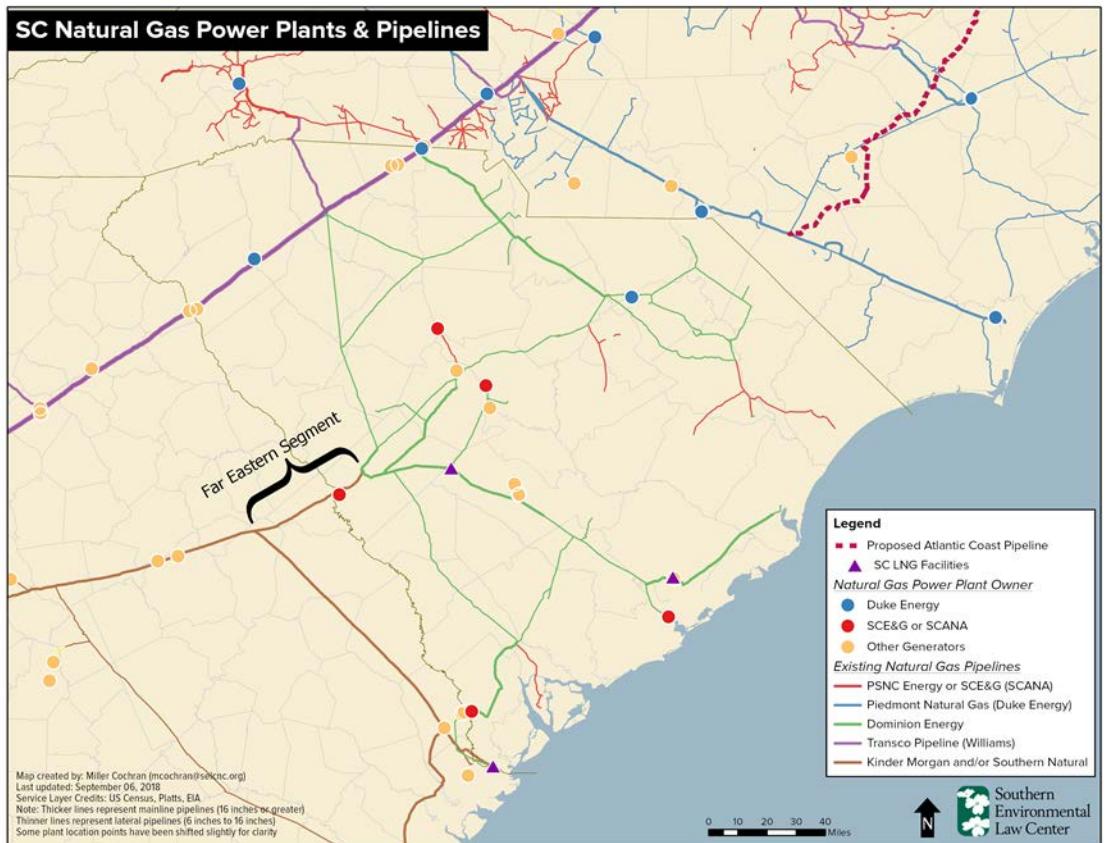


Figure 8: 2017 Map of Natural Gas Pipelines, LNG facilities, SCE&G Gas-Fired Power Plants, and Duke Gas-fired Power Plant

²⁹ DCGT extends a short distance into Georgia where it interconnects with the EEC and SLNG.

³⁰ The Southern LNG facilities associated with the Elba Island LNG Terminal are considered federally regulated interstate facilities.

³¹ SLNG's storage capacity is about 11.9 Bcf and its vaporization capacity is rated at 1.7 Billion cubic feet per day (Bcf/d). The SCE&G LNG facilities are capable of storing LNG equivalent to about 1.9 Bcf and vaporizing 154,500 Dth per day. One Dth equals 1 Million British Thermal Units (Btu). One Million BTUs is the energy it takes to turn 100 pints of water (each a pound) into steam. One Dth is approximately the amount of energy in 1,000 cubic feet of natural gas. One thousand cubic feet is denoted as 1 Mcf. There are 1,000,000 Mcf in a Bcf.

To assess interstate capacity available to South Carolina and its utilization, Skipping Stone looked at all the pipelines serving the state, collected the contracted capacity of the lines that contributed to natural gas infrastructure, and plotted those contracted capacities against recent flow history.

SONAT

SONAT, the Kinder Morgan/Southern Company pipeline shown in Figure 8, extends from East Texas through Louisiana, Mississippi, Alabama, Georgia, South Carolina, and parts of northern Florida. Skipping Stone has labeled the east west line that runs from the north-south line into South Carolina and terminates in or around Aiken, South Carolina the Far Eastern segment of the SONAT system (as labeled in the map above).

Appendix B presents Skipping Stone's analysis of capacity and scheduled deliveries (i.e., daily utilization) along the Far Eastern segment of SONAT. The analysis demonstrates that SONAT rarely flows (schedules) more than its contracted firm capacity on this Far Eastern segment, indicating that the line is fully subscribed and there is little operationally available capacity in excess of contracted capacity. In addition, Skipping Stone analyzed the contracted firm capacity and scheduled flows at the two locations relevant for SCE&G: DCGT, which receives gas from SONAT at the terminus of the Far Eastern segment, and for which SCE&G holds nearly 70% of all delivery capacity; and at the SCE&G power plant location in Aiken County, South Carolina. The sum of flows to the two locations exceeds contracted firm delivery capacity, often by more than 50,000 Dthd or 120% of contracted firm capacity. Clearly the level of demand being expressed at these two locations is greater than the contracted firm delivery capacity on SONAT to these two locations, whether due to price, demand, or a combination of the two. As a result, it appears that the whole SONAT Far Eastern segment and the northwestern portion of DCGT, especially as it relates to deliveries to DCGT for onward delivery elsewhere in South Carolina, are likely constrained. Because DCGT lies at the far eastern end of the SONAT system, SONAT cannot deliver more gas on a firm, year-round basis to DCGT without an expansion.

TRANSCO

The other main pipeline serving South Carolina, and the largest pipeline by capacity in the United States, is Transco. Transco runs from South Texas to New York, with another line—the Leidy Line—running from northern New Jersey to north central Pennsylvania. The Leidy Line was built to connect storage fields in Pennsylvania with the Transco south to north mainline running from Texas. Since the development of the Marcellus shale, the Leidy Line now also carries gas from the Marcellus to New York, the greater Northeast area, and all the way to the Gulf Coast. In effect, Transco is now a bi-directional line³² that contractually moves gas both from the Gulf Coast to the New York market and from the prolific Marcellus to the Gulf Coast.

³² In fact, Transco may now be considered a 1,000+ mile long pressure vessel with gas coming in and going out all along its extent. The net northward, net southward or null point (i.e., neither northward nor southward) flows changes daily or sub-daily with the particular mixtures of supplies and markets attached to the system.

Transco has 6 zones. Texas, Louisiana, and Mississippi are in Zones 1, 2, and 3. Alabama and Georgia are in Zone 4. South Carolina, North Carolina, and Virginia are in Zone 5. And Maryland, Pennsylvania, New Jersey, and New York are in Zone 6.

Appendix C presents Skipping Stone's analysis of capacity and scheduled deliveries (i.e., daily utilization) from Transco to DCGT and points in South Carolina. The analysis demonstrates that there is excess capacity available in Transco Zone 5. Specifically, the analysis shows that while firm contracted capacity on Transco to DCGT and to South Carolina points is much less than demanded capacity—as demonstrated by the fact that quantities of gas delivered by Transco to DCGT and South Carolina points usually exceed, and often greatly exceed, contracted capacity³³—there is more than enough available capacity to serve all South Carolina points.

Skipping Stone plotted the balance of deliveries to all Zone 5 locations against available capacity into and through Zone 5 to illustrate that this is true even in times of extremely high demand for natural gas.

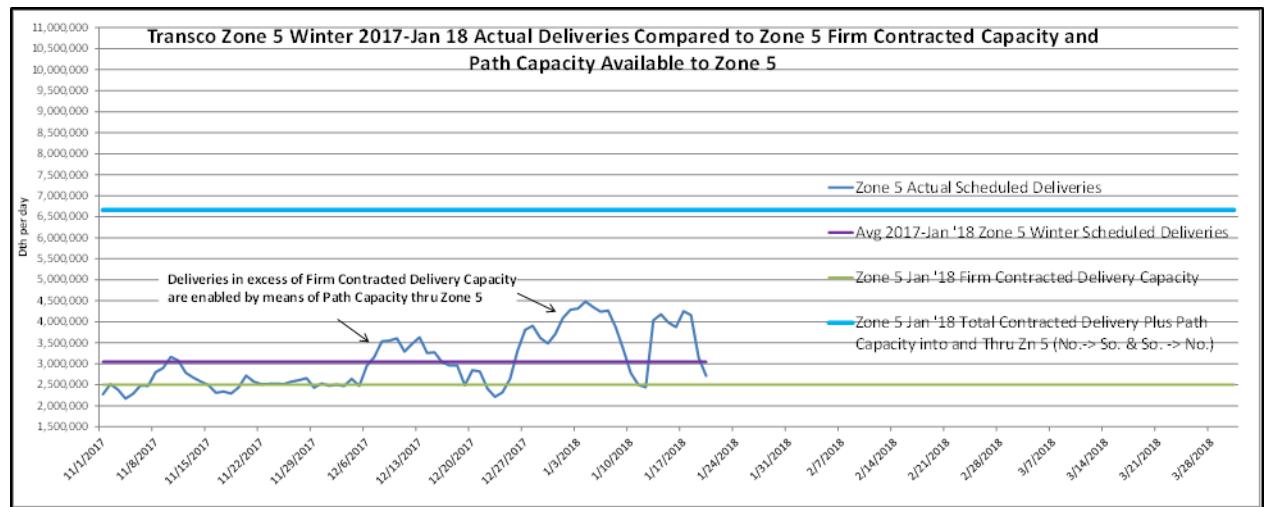


Figure 9: Transco Zone 5 winter 2017 through January 2018 actual deliveries compared to Zone 5 firm contracted capacity and path capacity available to Zone 5

Figure 9 shows that there was excess available capacity in Zone 5 this past winter. Even during the "bomb cyclone" event in early January 2018 when actual deliveries reached 4.5 Bcf/d, there was still another 2.0 Bcf/d of available capacity. There is more than 6.5 Bcf/d available at Zone 5 delivery points, even though there is only 2.5 Bcf/d of subscribed Transco delivery capacity at these points (including approximately 0.29 Bcf/d of firm South Carolina delivery point capacity).

³³ Firm contracted capacity on Transco to DCGT in 2018 is about 150,000 Dthd. Deliveries to DCGT from Transco routinely throughout the year exceed the contracted capacity amount by 50,000 Dthd (about 130%), and often by 100,000 Dthd (about 160%). Firm contracted capacity on Transco to South Carolina locations in 2018 is about 300,000 Dthd (287,433 Dthd). Deliveries to South Carolina locations peaked at 500,000 Dthd (0.5 Bcf/d) higher than contracted and were routinely twice the amount of contracted firm capacity (i.e., 600,000 Dthd).

The reason so much more gas can be delivered than the quantity of firm delivery point capacity is that holders of capacity on DCGT that require more gas from Transco than their firm contracted Transco quantities can buy gas from shippers on Transco that have capacity "past" DCGT. For instance, a shipper with receipt capacity in Zones 1, 2, 3, or 4 with delivery capacity in Zones 5 or 6 can deliver gas to DCGT in Zone 5 even if the DCGT point is not on their contract. Likewise, a shipper with receipt capacity in Zones 5 or 6 with delivery capacity in Zones 4 or 5 can deliver gas to DCGT in Zone 5, again, even if the DCGT point is not on their contract. This sort of capacity is called "path capacity." Shippers holding path capacity can make sales (i.e., deliveries) to the South Carolina and other Zone 5 points without consuming the totality of their path capacity.

A simple way to think about path capacity is by analogy to buying a seat on a train from Florida to New York. A ticket holder can get on in Florida, get off in South Carolina, race to North Carolina, get on the train again, get off in Southern Virginia, get back on in Northern Virginia and finally get off in New York. As long as there are never "two ticket holders" in the seat at any given time, this is permitted in the gas pipeline business so long as the pipeline in question is "pathed."³⁴

The fact that Transco is bi-directional greatly expands the available capacity of the system, without the addition of new pipes in the ground. For this reason, path capacity on Transco includes: (1) north to south passing South Carolina, (2) south to north capacity passing South Carolina, and (3) the contracted delivery capacity to South Carolina points. Extra deliveries are possible because capacity owners can schedule multiple receipts and deliveries along their "contracted paths." Shippers have rights to the "path" between their contracted receipt and delivery points and can segment this capacity and use it to deliver gas throughout that capacity in a myriad of ways. Imagine a line that runs from south to north; and, as shown in Figure 10, from the receipt point at "A" to a delivery point at "F."

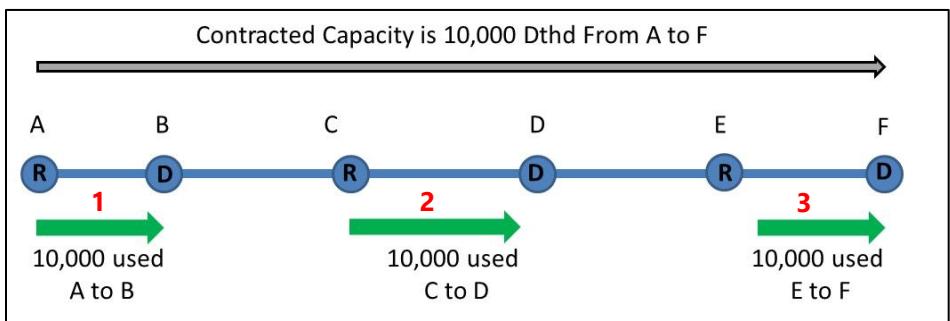


Figure 10: Segmentation path capacity depiction³⁵

³⁴ While both Transco and SONAT are "path pipelines," because SONAT's points along the far Eastern segment are "at the end of its line," as a practical matter gas on SONAT moves only to the Far Eastern segment. While SONAT has contracts to move gas from the east to the west –in particular from SLNG in the east to the west – the Far Eastern segment does not physically (or have the firm contractual obligation to) receive gas that moves to the west.

³⁵ "R" refers to capacity received and "D" refers to capacity delivered. The numbered green arrows represent separate transactions.

Imagine that in Figure 10 "A" is in Zone 4; "B," "C," and "D" are in Zone 5; and "E" and "F" are in Zone 6. The shipper with 10,000 Dthd from "A" to "F" can first receive gas in Zone 4 to deliver in Zone 5, then obtain additional gas in Zone 5 to drop off further along in Zone 5, then pick up additional gas (e.g., at point "E" in Zone 6), and finally deliver the remaining gas to point "F" further along in Zone 6. In this example, segmentation enabled a 10,000 Dthd path to be used to move 30,000 Dthd—three times the contracted path capacity. This strategy allows for multiple deliveries within and across Zones as long as no more than 10,000 Dthd is used along any segment; no overlapping is permitted.

This example actually underestimates the amount of gas that could be moved because it shows path "A to F" (south to north), but does not show the "F to A" (north to south) paths of capacity which can be scheduled simultaneously with "A to F" (south to north) paths of capacity. The reversed path ("F to A") is possible on Transco due to capacity expansion projects that recently came into service, and another 1.3 Bcf/d can be reversed when additional projects come into service later in 2018. Pathing ("A to F" and "F to A") enables the current approximately 6.5 Bcf/d of capacity available to Zone 5, as seen in Figure 9, to grow to about 7.3 Bcf/d on a once-through basis. Even greater quantities will be possible with segmentation once the final phase of Transco's Atlantic Sunrise project comes into service, expanding the Transco system and allowing increased deliveries from Pennsylvania gas fields to the mid-Atlantic and southeastern states.

In addition to segmentation, bidirectional flow also enables "delivery by backhaul" or "delivery by displacement." This is the ability of a customer to deliver gas to a pipeline at or near that pipeline's point of demand and for that customer to request the same quantity at or near a location along the path over which that demand location is being served. Thus, while gas would not be physically transported upstream in the pipeline system (i.e. north to south historically), gas could be effectively transported upstream by taking gas out upstream (in the South) and delivering the same quantity of gas to the pipeline downstream (in the North).

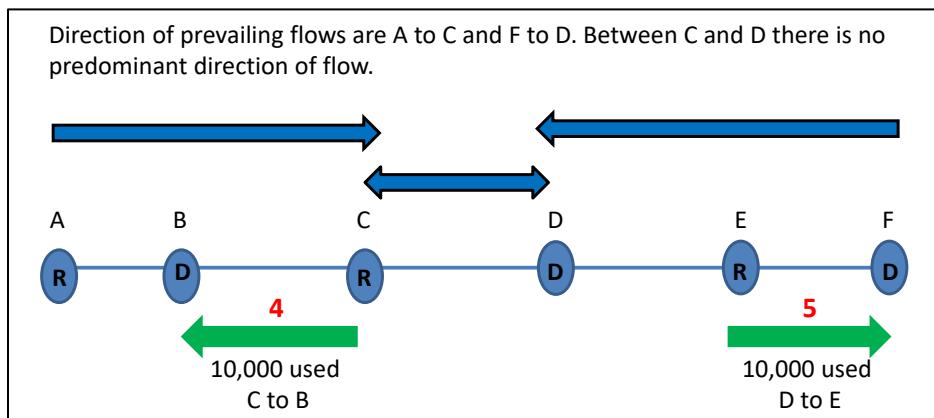


Figure 11: Backhaul / delivery by displacement path capacity depiction³⁶

³⁶ "R" refers to capacity received and "D" refers to capacity delivered. The numbered green arrows represent separate transactions.

Transactions 4 and 5 in Figure 11 are “backhaul” or “delivery by displacement” transactions. Where the prevailing flows presented in this Figure coexist with the contracted capacity in Figure 10, all 5 green arrow transactions characterized in Figures 10 and 11 (i.e., 50,000 Dthd of transactions) can occur on a contracted path of 10,000 Dthd.³⁷

Most of the new capacity added to Transco over the last five years that is available to South Carolina is not capacity that is slated for any particular end user. Of the 3.3 Bcf/d of year-round capacity added to Transco since 2013, 2.307 Bcf/d is not held by utilities for their power plants or distribution systems. Instead, it is held by companies that produce gas, market gas, or function as asset managers³⁸ for other entities that have transportation agreements with pipelines. Collectively, these companies are known as producer-marketer-asset manager companies or PMAs. Unlike electric utilities or local gas distribution companies, PMAs do not have a franchised service territory to which they must direct their capacity in order to serve their own power plants or distribution utilities (i.e., native load). Rather, PMAs contract with all types of buyers to deliver gas at competitive market prices using the pipeline capacity the PMAs have signed up for and/or control. In other words, 2.307 Bcf/d of the new capacity into Transco Zone 5 is available at market prices for any end user, gas distributor, or marketer that is using, distributing, or selling gas in South Carolina.

In addition to the 2.307 Bcf/d of added year-round non-utility capacity, local gas distribution companies hold another 0.527 Bcf/d of year-round capacity to or through Zone 5 (as part of the overall new capacity). Due to the particularities of the markets served by local distribution companies, which do not need capacity during the off-peak period (including summer); this additional capacity would be available to electric generators needing supply in the summer. This brings the total new (since 2013) off-peak / summer capacity that is held by PMAs and local distribution companies to and through Zone 5 to a whopping 2.834 Bcf/d. To put this recently added, largely unspoken for, 2.834 Bcf/d of added capacity in perspective, this capacity is equal to nearly ten times the Transco firm contracted delivery capacity to South Carolina points of Transco. Also notably, referring to Figure 3, this 2.834 Bcf/d of added capacity is five times the peak usage shown in Figure 3 and nearly 9.6 times the average flow over the period depicted in Figure 3.

Skipping Stone’s analysis shows that there is 2.0 Bcf/d of additional capacity available on Transco to DCGT and South Carolina points in the most high-demand periods of winter, and much more available capacity in the summer, including 2.834 Bcf/d just from PMAs and local distribution companies. With substantial capacity remaining on DCGT sufficient to meet SCE&G’s projected demands, the Transco-to-DCGT path is viable for meeting SCE&G’s projected future demands.

³⁷ For instance, this segmentation allows gas to enter Transco in Zone 5 from TCO, East Tennessee Natural Gas (ETNG), DTI, EEC (from Elba Island, Dominion Cove Point(from Cove Point LNG), and Piedmont LNG. Plus, gas can enter into Zone 6 from Texas Eastern, Tennessee, Transco LNG, TCO and DTI (Storage).

³⁸ Asset managers can be any company, including producers or marketers, which contracts with holders of pipeline capacity to market gas through the holder’s pipeline capacity when the original holder has no need for the capacity.

Elba Express Company

The EEC interconnects with Transco at the border of Transco's Zone 4 (Georgia) and Transco's Zone 5 (South Carolina). The EEC's original purpose was to receive up to 1.1 Bcf/d of vaporized LNG from the Elba Island import facility operated by SLNG and deliver that vaporized LNG north and west to Transco for onward delivery on Transco. EEC still has a firm contract to receive nearly 1 Bcf/d of vaporized gas from SLNG and deliver it to Transco. However, EEC can now operate bi-directionally, receiving gas at Transco and delivering to SONAT (for delivery across the SONAT system), to SLNG (the Elba Island facilities) for delivery to DCGT, and to a power plant in Effingham County, Georgia. Once the Elba Island LNG facility becomes an LNG Export facility, the main annual purpose of EEC will be to move gas from Transco to Elba Island for liquefaction and export.

EEC currently receives the overwhelming majority of its gas from Transco. In 2017, deliveries by Transco to EEC were pretty evenly divided between Georgia and South Carolina. EEC then delivered a slight majority of the gas it received from Transco to SONAT, which takes the gas to SONAT markets in Georgia and Florida; and delivered the other half of the supply it received from Transco to DCGT through the SLNG facilities³⁹. Skipping Stone therefore decided to count deliveries by Transco to South Carolina—including deliveries to EEC in South Carolina—as supplies available to South Carolina in its analysis of Transco described above. The other half of EEC receipts from Transco that were made in Georgia (i.e., Zone 4 Transco) were not counted as South Carolina-available supplies. EEC ultimately neither contributes to, nor detracts from, capacity available to South Carolina because the quantity of gas EEC gets from Transco in South Carolina is approximately the same as the quantity of gas that goes from EEC through SLNG to DCGT.

Southern LNG – The Elba Island LNG Facility

Since 1974 the Elba Island Import Facility has alternated between being active and inactive with changes in regulation and economic factors. In 2003, 2006, and 2010, the facility expanded until its storage capacity reached about 11.5 Bcf and its vaporization capacity reached 1.7 Bcf/d. In 2013, the owners decided to add liquefaction capability to allow the facility to both import and export, as well as to liquefy and vaporize.

SLNG vaporized gas this winter—about 5.7 Bcf between December 1, 2017 and January 21, 2018. Its peak vaporization was 684,000 Bcf/d on January 17, 2018. It is possible that all 1.7 Bcf/d of SLNG's vaporized gas could be moved to market through SONAT, DCGT, and EEC. That said, for either SONAT or DCGT to take all that SLNG could provide, the demand on their respective systems would need to be higher to absorb the gas.⁴⁰

³⁹ Notably, the gas that DCGT receives from SLNG by this means can serve DCGT markets in its limited Zone 2 geographical area; currently, there is limited transfer capability on the DCGT system between its Zone 2 and its predominant, Zone 1 geographical service area.

⁴⁰ In other words, it would have to either be really cold with associated heating and gas-fired generation demand, or really hot with air-conditioning demand met by gas-fired generation.

Liquefaction capability is expected to begin in the latter half of 2018. The liquefaction capability will be approximately 0.3 Bcf/d. With about 11 Bcf of cycle-able LNG Storage and 0.3 Bcf/d of liquefaction capability, the facility would be able to fill all storage tanks to optimum levels in about 28 days, and to fill a tanker every 10 days.⁴¹ However, because the entities that own the liquefaction and vaporization capability are in the business of making money, it is likely that the SLNG facility would provide a significant benefit to South Carolina in addition to supplying tankers for export. This winter, for example, spot prices encouraged vaporization of LNG and most LNG terminals hooked into interstate pipelines vaporized gas this winter.

Elba Island could provide as much as 2.0 Bcf/d of surge supply to South Carolina in the years to come. As a storage and vaporization terminal, Elba and the entities with capacity on pipelines to deliver gas for liquefaction could respond to price signals as follows. The entities shipping gas to Elba could divert their approximately 0.3 Bcf/d to markets along Transco (including in South Carolina) and sell the gas in the United States rather than liquefying that particular quantity. Then, the party(ies) with LNG in the storage tanks can vaporize LNG and inject it into the pipelines serving South Carolina (i.e., DCGT, SONAT for delivery to its Far Eastern segment as well as potentially back into Transco via EEC). In this way, if the demand was sufficient, as much as 2.0 Bcf/d of surge supply could be made available to South Carolina markets (0.3 Bcf/d of diverted supply plus as much as 1.7 Bcf/d of vaporized supply for a total of 2.0 Bcf/d). Moreover, depending on contracting structures, buying LNG to meet the needle peaks like those observed in SCE&G's load duration curves, can be far more economical than incurring the fixed costs associated with a pipeline expansion. This remains true to the extent that the LNG comes into the respective system(s) at locations where the LNG meets demand and frees up other supplies to meet other markets, all with the same existing pipe capacity. As Skipping Stone will discuss below, if there are local constraints or lack of facilities within South Carolina (as opposed to there being a lack of facilities to South Carolina), then addressing those local, in-state constraints is fundamentally a matter of economics, not of physics or hydraulic capacity.

Additional Interstate Natural Gas Capacity Is Not Necessary to Meet Demand in Underserviced Regions of South Carolina

Skipping Stone interviewed several representatives of commercial and industrial entities concerned about the sufficiency of South Carolina's current natural gas infrastructure to serve continued economic growth in the eastern and northeastern counties of the state. These representatives related their perception that South Carolina gas infrastructure is constrained and that there is no available year-round firm natural gas capacity for industrial use.

Skipping Stone reiterates what was noted above — *there is ample pipeline capacity to DCGT and to South Carolina as a general matter.* To the extent that industrial users have difficulty obtaining firm contracts from DCGT's dominant customer, SCE&G, this is not due to inadequate interstate pipeline capacity to South Carolina; rather it is due to insufficient pipeline (and

⁴¹ Most LNG tankers have about 3 Bcf of tankage range. This rate of storage would be possible if no gas is stored for later vaporization.

distribution—i.e., SCE&G) capacity within South Carolina. This section explores why the eastern and northeastern counties in South Carolina are currently underserved by natural gas local distribution companies and why wholesale gas pipeline service expansion into this region is not dependent on additional interstate capacity being brought into South Carolina.

Expansion of Local Gas Distribution Service vs. Expansion of Wholesale Gas Pipeline Service

To begin, it is important to understand that the economics, allocation of risk, and contract structure of local gas distribution service extensions and interstate pipeline expansions are very different.

In the local gas distribution business, extensions are done on a "build it and believe they will come" basis. In areas of existing construction, gas mains are laid down and gas company personnel and heating contractors sell conversion to gas packages to homeowners and businesses. This arrangement puts most of the risk on the local distribution company because ratepayers are typically shielded by regulatory rules that dictate the extension cost per new service location that can be automatically put into rates. Thus, an extension into an un-serviced region is made based on market research, polling, and possibly pre-selling activities. The company must determine—through an evaluation of potential service sales and adoption penetration rates—if the extension will eventually generate enough new service hook-ups to generate a profit. There is no guarantee that customers will take service once the distribution lines are built and there is no guarantee of a customer-originating revenue stream. Profits are only realized, if at all, long after the costs of extension are sunk.

In the interstate pipeline business, by contrast, extensions are done on "contract to pay me for ten to twenty years to cover my costs and profits and I will build it" basis. This means that allocation of risk is established prior to construction. Construction proceeds only once the party making the investment and the party receiving service and paying for the investment reach agreement and execute a contract that covers investment costs, level of service obligation, and the payment stream to the pipeline company over time.

Local Distribution Company Expansion is Not Inhibited by Lack of Interstate Pipeline Capacity

To gauge the potential size of areas of South Carolina that are un- or underserved by gas distribution companies and the markets they serve,⁴² and assess why those areas may be un- or underserved, Skipping Stone performed a simplified desktop analysis to identify their population density and heating characteristics.

Of the 99 postal zip codes⁴³ in the 12 eastern and northeastern South Carolina counties (the Pee Dee region) anecdotally noted as un/underserved, 32 are wholly or partially served by

⁴² Local distribution companies serve all their customers, residential, commercial and, for the most part, including their industrial customers as well, with the same facilities.

⁴³ These 99 zip codes corresponded to physical routes. An additional 12 zip codes were P.O. boxes in those counties.

SCE&G and 67 are not served by SCE&G.⁴⁴ SCE&G is the only local distribution company operating in the eastern and northeastern areas of South Carolina. Gas service is available to about 64% of the total population in these 12 counties (about 533,000 people of the total population of 834,000). In areas where gas service is available, population density is much higher — 104 postal locations (dwellings and businesses) per mi² in serviced areas compared to 42 postal locations per mi² in un-serviced areas.⁴⁵

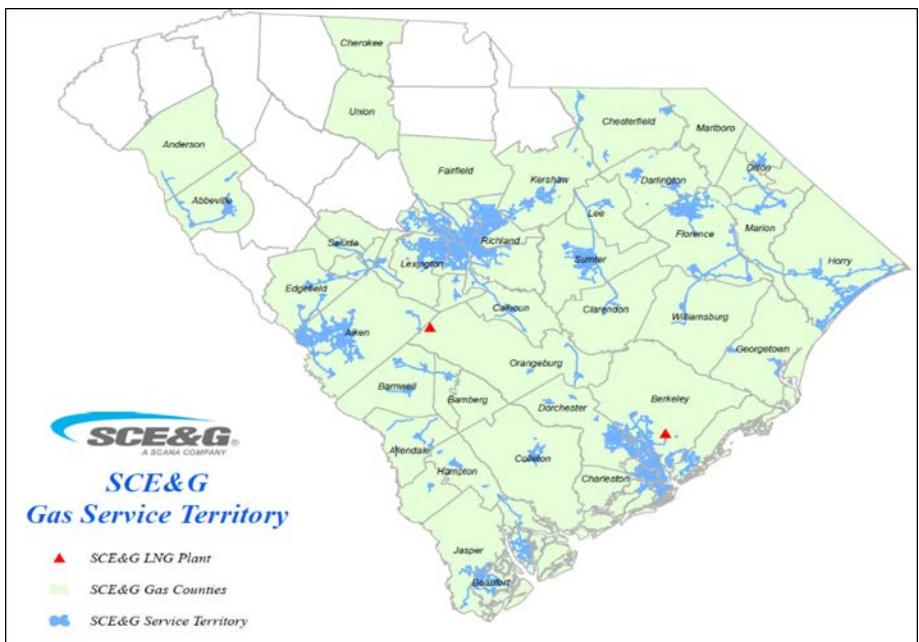


Figure 12: SCE&G service territory⁴⁶

Postal locations in un-serviced areas are, on average, 14 acres apart.⁴⁷ Locations are not evenly spaced on a grid, but even so this density is extremely sparse.

Skipping Stone also examined census data for the same 12 eastern and northeastern counties to determine the penetration of natural gas heating in these areas.

⁴⁴ Skipping Stone located no SCE&G gas-service in these codes after sampling four to six disparate areas within each code using the SCE&G gas availability tool:
<https://www.sceg.com/for-my-home/start-my-service/gas-availability>.

⁴⁵ The 32 zip codes with gas service have a total area of 3,291 mi² and have ~342,000 postal locations. The 67 zip codes with no gas service have a total area of 5,788 mi² and have ~244,000 postal locations.

⁴⁶ <http://www.energy.sc.gov/files/view/SC%20Natural%20Gas%20Infrastructure%202nd%20DRAFT%203-28-16.pdf> at 12.

⁴⁷ There are 640 acres in a square mile.

Table 1: 2016 countywide penetration of natural gas heating versus other heating sources

Geography	Occupied housing units; Estimate;	Occupied housing units; Estimate; HOUSE HEATING FUEL - Utility gas (pctg)	Gas Penetration	Occupied housing units; Estimate; HOUSE HEATING FUEL - Bottled, tank, or LP gas (pctg)	Propane Penetration	Occupied housing units; Estimate; HOUSE HEATING FUEL - Fuel oil, kerosene, etc. (pctg)	Fuel Oil Penetration	Occupied housing units; Estimate; HOUSE HEATING FUEL - Electricity (pctg)	Electricity Penetration
Berkeley County, South Carolina	70,482	12.1%	8,528	2.1%	1,480	0.5%	352	84.3%	59,416
Chesterfield County, South Carolina	18,172	8.9%	1,617	8.6%	1,563	2.2%	400	77.2%	14,029
Clarendon County, South Carolina	13,282	1.5%	199	10.3%	1,368	2.5%	332	83.7%	11,117
Darlington County, South Carolina	26,407	7.7%	2,033	6.6%	1,743	2.2%	581	81.4%	21,495
Dillon County, South Carolina	11,133	6.2%	690	10.2%	1,136	2.7%	301	79.2%	8,817
Florence County, South Carolina	51,749	11.1%	5,744	5.2%	2,691	1.1%	569	81.6%	42,227
Georgetown County, South Carolina	24,379	6.5%	1,585	2.9%	707	1.0%	244	88.4%	21,551
Horry County, South Carolina	122,125	3.6%	4,397	2.7%	3,297	0.4%	489	92.6%	113,088
Lee County, South Carolina	6,400	6.6%	422	9.8%	627	2.0%	128	79.3%	5,075
Marion County, South Carolina	12,090	7.5%	907	8.6%	1,040	1.9%	230	81.3%	9,829
Sumter County, South Carolina	40,815	9.6%	3,918	4.8%	1,959	1.7%	694	82.3%	33,591
Williamsburg County, South Carolina	12,035	4.0%	481	11.1%	1,336	2.7%	325	80.4%	9,676
Totals	409,069	7.5%	30,523	4.6%	18,947	1.1%	4,644	85.5%	349,912

Overall penetration of natural gas for heating is very low across all 12 counties. In addition, oil and propane penetration in these underserviced counties is very low—in the 2-10% range (about 5% on average) range, compared to an electric heat penetration average of 86%.

Based on the population density and natural gas heating penetration in underserviced areas, SCE&G is extremely unlikely to find it profitable to run miles and miles of new natural gas lines to capture new services in these areas. The penetration of electric heating is too high and the population density is too low.

Electric heating penetration poses a significant challenge to gas service expansion because it makes it less economical for households and businesses to take natural gas service once the local distribution lines have been extended. If a gas main line is extended into a new area, it does not mean potential customers there will take the service. Oil and propane users often switch to natural gas when their existing heating system needs to be replaced, and occasionally switch to realize cost savings.⁴⁸ It is much more expensive for electric heating users to switch to natural gas. Electric resistance heating installations (i.e., heating with baseboard or floor units) are not conducive to gas conversion absent very pervasive ducting or plumbing work throughout the structure. Even where forced hot air heat pumps are installed, adding a natural gas-fired supplemental firing unit costs about \$2,400 on average (not including the cost to run a gas line from the street to the house). This expense is justified only where there are savings over time—which is unlikely unless the cost savings per unit of gas versus electricity is high and the frequency and severity of cold spells that would trigger the natural gas fired supplement to an

⁴⁸ An oil-fired forced hot air furnace can be retrofitted with a gas burner. Boilers usually must be completely replaced when the fuel is changed. Conversions before replacement is necessary have been observed in the northeast, where oil and propane penetrations dominate in the areas where gas service has not historically been available.

existing heat pump installation are high as well.⁴⁹ Given the high electric heating penetration in underserviced areas of South Carolina and the economic challenges of penetrating that market, local distribution companies are unlikely to invest in service extensions into those areas absent substantial long-term incentives or revenue guarantees.

Low population density also poses a significant challenge to gas service expansion because it limits the number of potential services per mile of distribution main. Even with a 25% penetration rate—the rate in SCE&G's more penetrated areas (i.e., not the 12 counties identified above)—the services per mile would still be so small in the un/underserviced 12 counties that typical profitability would be elusive.⁵⁰ Similarly, there is likely insufficient industrial activity and associated industrial demand for natural gas to make extension of service into these rural areas cost-effective and profitable.

For all of these reasons, is most likely that service extension within South Carolina faces economic challenges unrelated to availability of sufficient natural gas transportation to South Carolina.

In-State Pipeline Expansion is Also Not Inhibited by Lack of Interstate Pipeline Capacity

The conclusion that expansion of natural gas infrastructure to underserviced areas of South Carolina is unrelated to availability of sufficient natural gas service into the state also holds true for in-state interstate pipeline expansion, as is independently borne out in slides prepared by DCGT in 2009 and 2017.

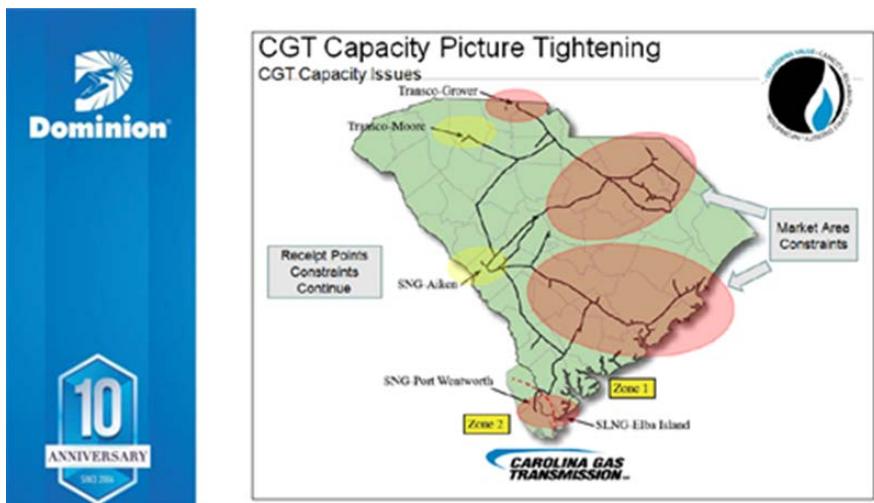


Figure 13: 2009 presentation slide depicting areas of system constraints

⁴⁹ It is especially difficult to make the economics of a switch to natural gas work when twelve months of fixed monthly customer charges are spread over a limited number of months (and possibly days) of heating use.

⁵⁰ The only way to make the extension profitable would be to raise rates for all gas customers to cover the costs of the otherwise uneconomic extensions.

In 2009, DCGT stated that its system was "tightening" at receipt points into its system and at delivery points in certain market areas. Receipt point constraints relate to DCGT's ability to receive gas into its system due to limitations on their side of the interconnect with the delivering pipeline. Market area constraints relate to DCGT's ability to deliver the gas it can receive at its receipt points to certain delivery points. By 2017, DCGT stated that it had to make modifications at its receipt points to receive more gas and at segments of its system between receipt and delivery locations to deliver the received gas.

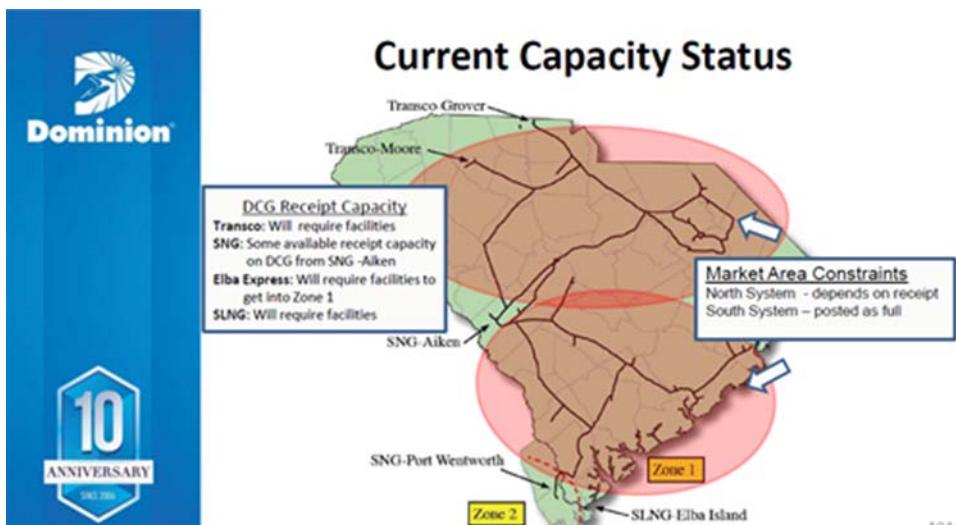


Figure 14: 2017 presentation slide depicting areas of system constraints

The 2009 and 2017 slides both indicate that constraints are on DCGT's system within South Carolina, not to its system from outside the state. In-state facilities at the South Carolina receipt locations of DCGT are required to receive additional gas into the DCGT system.

This on-system DCGT constraint fact is further borne out by another slide in the 2017 presentation.

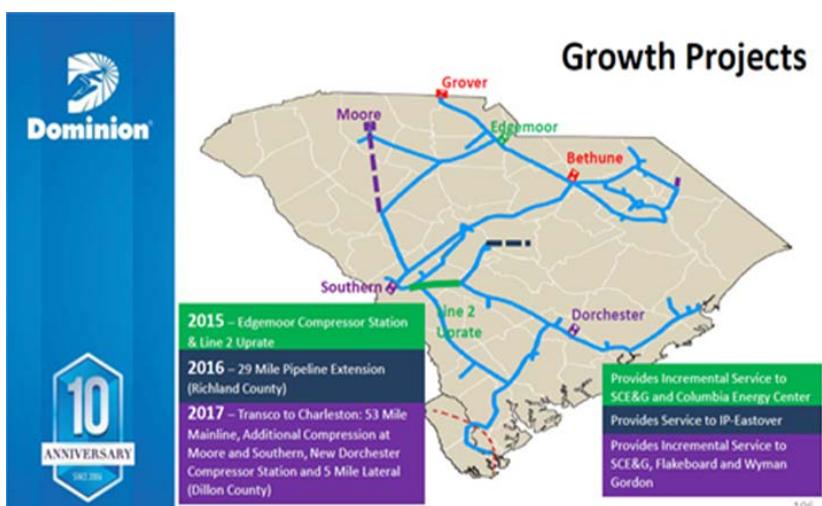


Figure 15: 2017 presentation slide of projects to increase receipt capacity and enable increased delivery service

The 2015 project cites compression on the receipt line from Transco at the Grover receipt point plus a DCGT line uprate to enable incremental service to SCE&G and the Columbia Energy Center. Likewise, the 2016 project cites that a line to International Paper will enable service to that location. Finally, the 2017 project indicates that an additional 53-mile line connecting (and enabling additional receipts from) Transco at Moore to be delivered to SCE&G, Flakeboard, and Wyman Gordon.

Again, these slides and the fact that none of these expansions resulted in the DCGT shipper taking on the same level of expansion on either of SONAT or Transco⁵¹ as represented by their DCGT contract, indicates that subscriptions to service on DCGT (as well as on SONAT or Transco) are independent decisions. Available evidence indicates that they are in no way co-dependent decisions.

Conclusion

If there are natural gas capacity constraints affecting expanded or extended natural gas service in South Carolina, *the constraints are within the State of South Carolina not to the state*. To solve these constraint issues, shippers desiring (or requiring) year-round firm natural gas service will have to subscribe to: one or more expansions of DCGT's ability to receive gas at receipt points, extensions of DCGT's to bring gas to the desired service location(s), and/or an arrangement with SCE&G to extend and reinforce its system to bring gas service to the desired location(s).

⁵¹ SCE&G did subscribe to 40,000 Dthd of capacity on Transco from Transco's Zone 6 (the Marcellus region) to Transco's Zone 4A (in Alabama and enabling deliveries to pipelines serving Florida) that became effective on January 5, 2016. In December 2015, an 18,498 Dthd contract on DCGT with receipts at Transco Grover to SCE&G's Columbia area went into effect.

Appendix A: DCGT Contracted Capacity and Other 2006 to 2016 Metrics

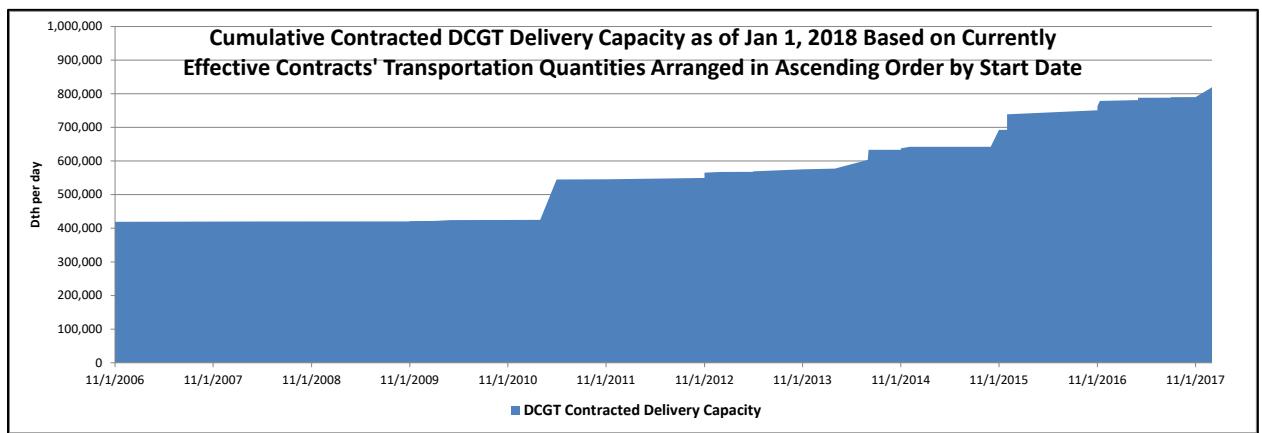


Figure A1. Cumulative contracted DCGT delivery capacity as of January 1, 2018 based on currently-effective contracts' transportation quantities arranged in ascending order by start date

While Figure A1 indicates that in November of 2006 DCGT had only about 400,000 Dthd contracted, it likely had closer to about 611,000 Dthd contracted (see Figure A2 below). Figure A1 does not show the approximately 200,000 Dthd of contracts that were effective in November 2006 and later replaced with other contracts between 2006 and today.⁵²

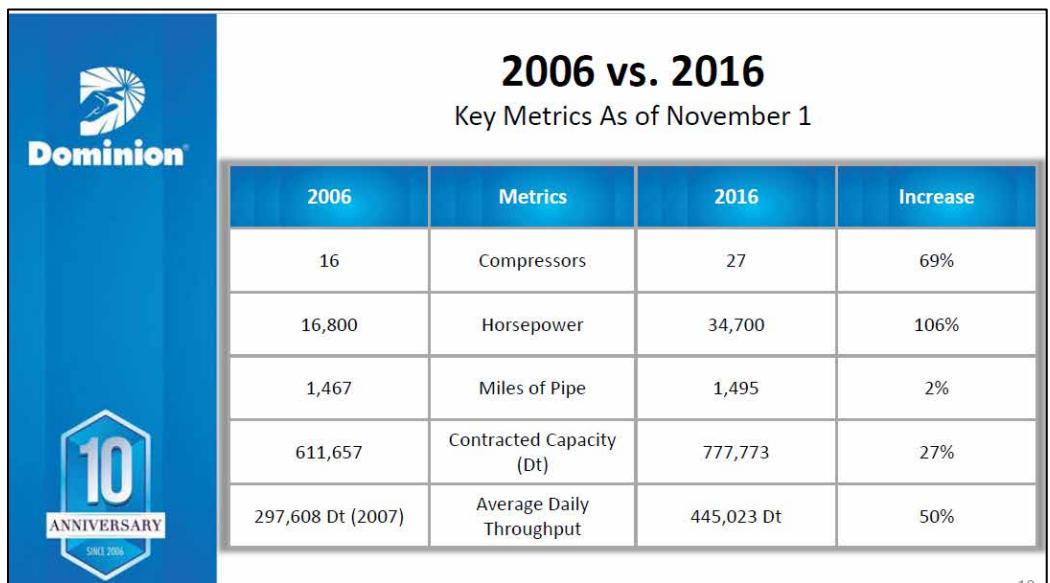


Figure A2. DCGT slide on key metrics from 2006 to 2016⁵³

⁵² The effective dates in the January 1, 2018 postings are the effective dates of the contracts. Some of the later-dated contracts could be reformations of earlier contracts or replacement contracts using capacity that existed prior to the current effective date of the contracts.

⁵³ This slide was prepared by DCGT for a 2017 presentation to its customers in which it reviewed the prior ten gas years (November 2006 to November 2016).

Appendix B: SONAT Contracted Capacity and Scheduled Flow Data

Figure B1 displays the SONAT contracted capacity along the Far Eastern segment, as well as scheduled deliveries (i.e., daily utilization) along that segment.⁵⁴ This Figure aggregates all contracted delivery capacity and all scheduled deliveries to provide an overview of pipeline capacity in this region prior to examining the delivery points most relevant for understanding SCE&G's capacity situation.

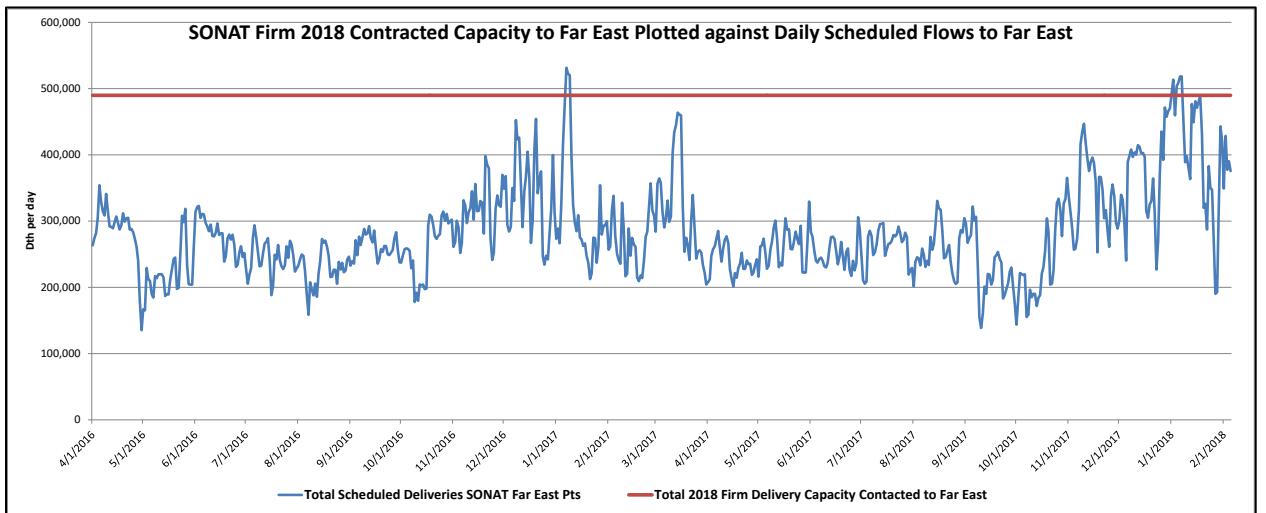


Figure B1: SONAT firm 2018 contracted delivery capacity on the Far Eastern segment plotted against daily scheduled flows, April 2016 through January 2018

SONAT rarely flows (schedules) more than its contracted firm capacity on this Far Eastern segment—a clear indication that the line is not only fully subscribed, but that there is little operationally available capacity in excess of contracted capacity.

Flows to individual locations along this segment of SONAT relative to those locations' contracted firm delivery capacity are presented in Figure B2 and Figure B3 below. Figure B2 presents the contracted firm SONAT capacity (of shippers on SONAT) to DCGT and the scheduled flows to DCGT. DCGT receives gas from SONAT at the terminus of the Far Eastern segment.

⁵⁴ At present, there are no listed "receipt points" into SONAT on this Far Eastern segment.

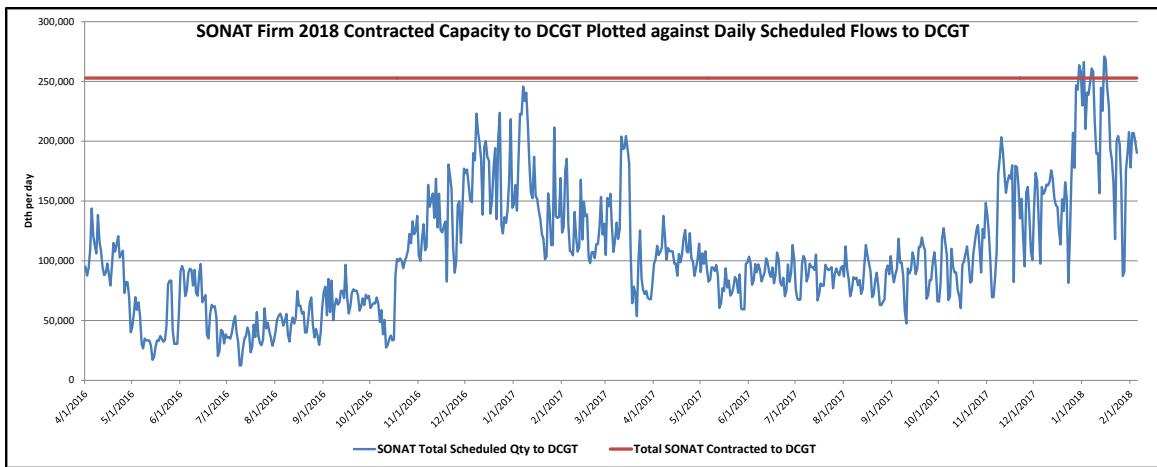


Figure B2: SONAT firm 2018 contracted delivery capacity to DCGT plotted against daily scheduled flows to DCGT, April 2016 through January 2018

Again, as with the picture presented in Figure B1, seldom has SONAT flowed (scheduled) more than its contracted firm capacity to DCGT. This is another clear indication that the line is not only fully subscribed, but that, in the aggregate, there is little operationally available capacity in excess of contracted capacity. DCGT is not a shipper with capacity on SONAT.⁵⁵ 96% of SONAT's firm capacity to DCGT is held by local distribution companies, municipal gas distributors, industrial end-users, and government entities; only 4% is held by marketing entities.

Figure B3 presents deliveries to SCE&G's Urquhart power plant and other SCE&G loads located off of the SONAT Far Eastern segment in Aiken County, South Carolina.

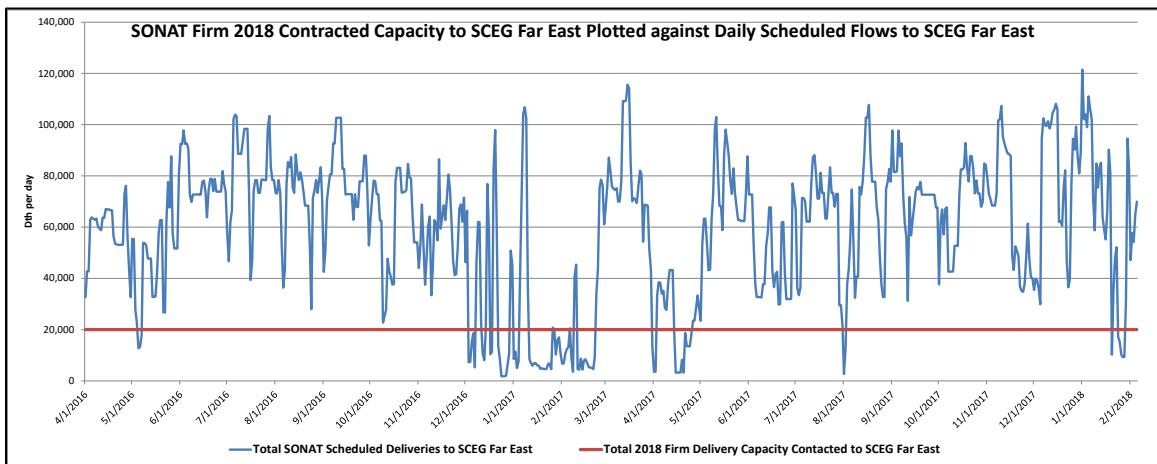


Figure B3: SONAT firm contracted capacity to SCE&G location on SONAT's Far Eastern segment plotted against daily scheduled flows to the SCE&G location

⁵⁵ Pipelines are rarely shippers on other pipelines. The exception to this general statement is when pipeline A contracts with pipeline B so that A can get gas from one part of its system to another by means of pipeline B, or when pipeline A leases capacity on pipeline B so that A's shippers can seamlessly schedule gas on A that moves through B in order to bring gas to pipeline A's markets.

As can be seen in Figure B3, the flows to the SCE&G location in Aiken County, South Carolina often exceed by 500% to 600% SCE&G's contracted firm to this location. Notably, these flows generally occur outside of the winter periods, which is likely when other shippers are utilizing their firm capacity to make winter deliveries along this segment.

While the scheduled quantities to the SCE&G location in Aiken County, South Carolina as presented above indicate deliveries in excess of firm contracted delivery capacity⁵⁶ to the location during non-winter periods, Figure B4 below tells a different story. In Figure B4, Skipping Stone combined the scheduled deliveries to DCGT (Figure B2) with the scheduled deliveries to the SCE&G Aiken County location (Figure B3). SCE&G holds 43% of the delivery capacity on SONAT's Far Eastern segment, including nearly 70% of all delivery capacity to DCGT. Deliveries to either (and both) of these locations consume capacity on the Far East Segment of the SONAT system, and the combination of these two amounts helps clarify the capacity picture for SONAT locations that are particularly important for SCE&G.

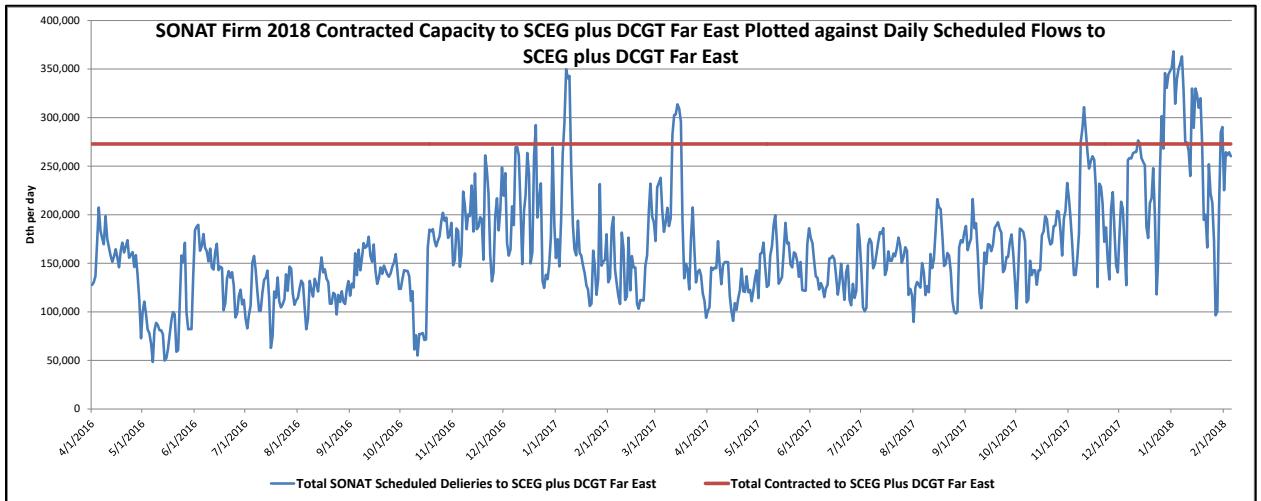


Figure B4: SONAT firm contracted capacity to SCE&G Aiken County location plus firm contracted capacity to DCGT Far Eastern segment plotted against daily scheduled flows to both locations

In Figure B4, the sum of flows to the two locations exceeds contracted firm delivery capacity, often by more than 50,000 Dthd or 20% of contracted firm capacity. Exceedances occur predominantly during the winter-time. While deliveries to the Far East segment of SONAT seldom exceed contracted firm delivery capacity, deliveries to these two locations taken together often do. Whether such deliveries are made by capacity holders on the SONAT Far Eastern segment to locations other than their primary locations (i.e., on a secondary basis), are made by means of contract overruns by holders of capacity to the subject locations, or are made by means of interruptible contract capacity is not known. Whatever the reason, it is clear that the level of demand being expressed at these two locations is greater than the contracted firm

⁵⁶ The scheduled quantity data obtained from pipelines does not give any information as to the shippers or contracts that are being scheduled to (in the case of deliveries) or from (in the case of receipts) the locations. The gas could be being delivered on a shipper's contract on a secondary basis (i.e., to a location other than their primary point(s) or under an interruptible contract.

delivery capacity on SONAT to these two locations, whether due to price, demand, or a combination of the two. An effect of this may be the perception that the whole SONAT Far Eastern segment of SONAT and the northwestern portion of DCGT, especially as it relates to deliveries to DCGT for onward delivery elsewhere in South Carolina, are constrained.

Appendix C: Transco Contracted Capacity and Scheduled Flow Data

Figure C1 displays Transco 2018 firm contracted capacity to DCGT plotted against scheduled flows on Transco to DCGT.

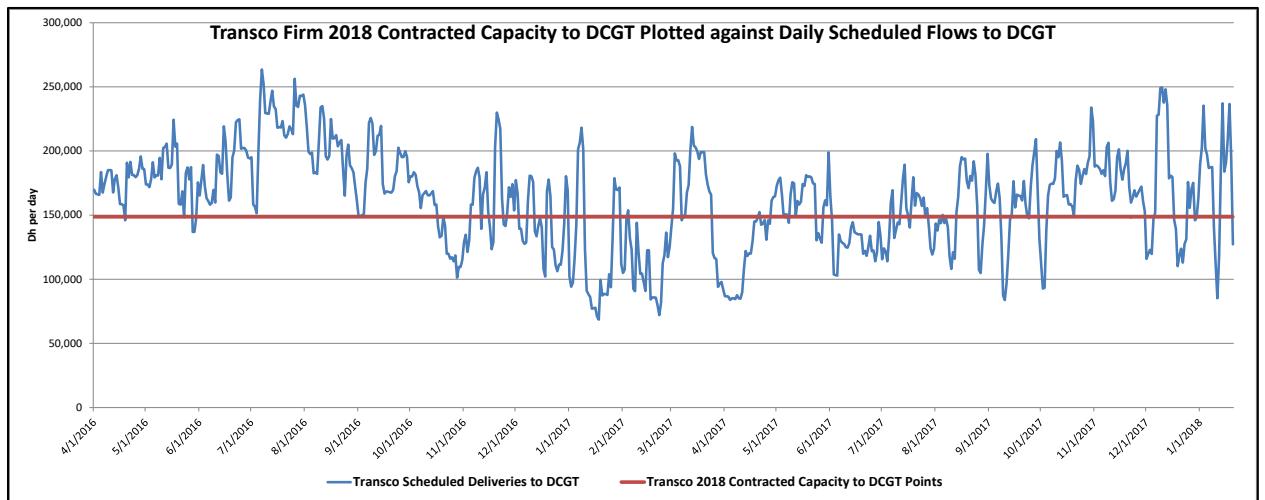


Figure C1: Transco firm 2018 contracted capacity to DCGT plotted against daily scheduled flows to DCGT

The contracted capacity on Transco to DCGT is about 150,000 Dthd.⁵⁷ As can be readily seen in Figure C1, Transco's scheduled deliveries to DCGT often exceed Transco's contracted capacity to DCGT points. Thus, Transco delivers substantially more gas to DCGT than shippers on Transco⁵⁸ have contracted capacity to deliver to DCGT on a primary basis. Deliveries to DCGT from Transco routinely throughout the year exceed the contracted capacity amount by 50,000 Dthd (about 30%), and often by 100,000 Dthd (about 60%).

In Figure C2, below, Skipping Stone presents all 2018 contracted Transco delivery capacity to all South Carolina points and plots that against scheduled flows to all South Carolina locations off of Transco.

⁵⁷ This compares to about 268,000 Dthd contracted on SONAT to DCGT. The total contracted firm delivery capacity directly to DCGT between SONAT and Transco is about 420,000 Dthd. This compares to nearly 900,000 Dthd contracted on DCGT as of mid-2018.

⁵⁸ As with SONAT, DCGT is not a shipper on Transco.

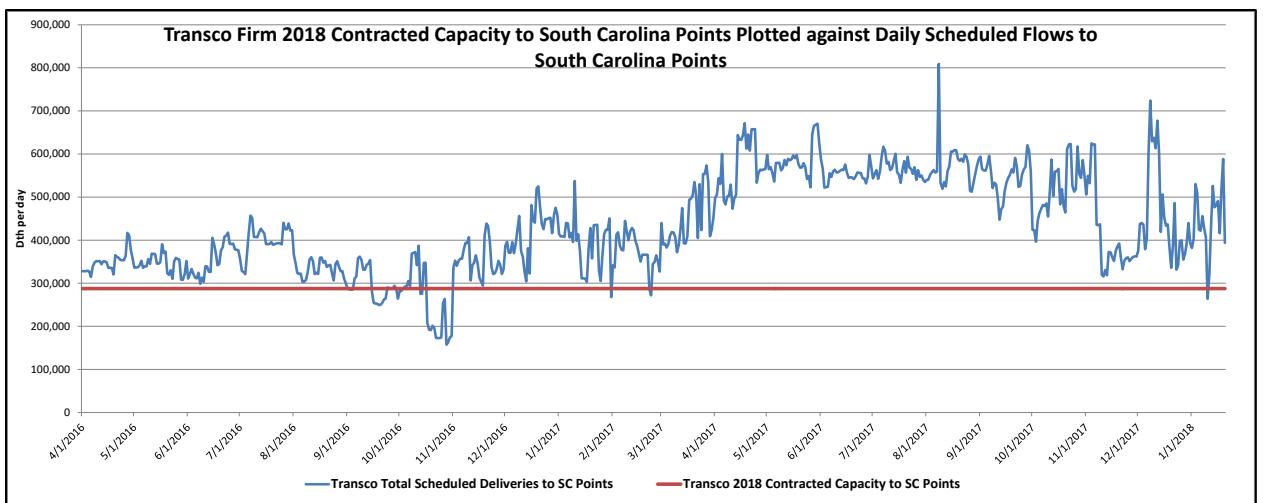


Figure C2: Transco firm 2018 contracted delivery capacity to South Carolina points plotted against daily scheduled flows to South Carolina points

As was seen in Figure C1, Figure C2 shows that the quantities of gas delivered by Transco to South Carolina points usually exceed, and often greatly exceed, contracted firm quantities to South Carolina points. In fact, deliveries to South Carolina locations peaked at 500,000 Dthd (0.5 Bcf/d) higher than contracted and were routinely twice the amount of contracted firm capacity (i.e., 300,000 Dthd in excess of about 300,000 Dthd of contracted capacity). At first blush this appears to be a very large quantity of delivered gas in excess of firm capacity. However, Figure C3 puts this quantity in perspective as it relates to the full Transco capacity available to South Carolina.

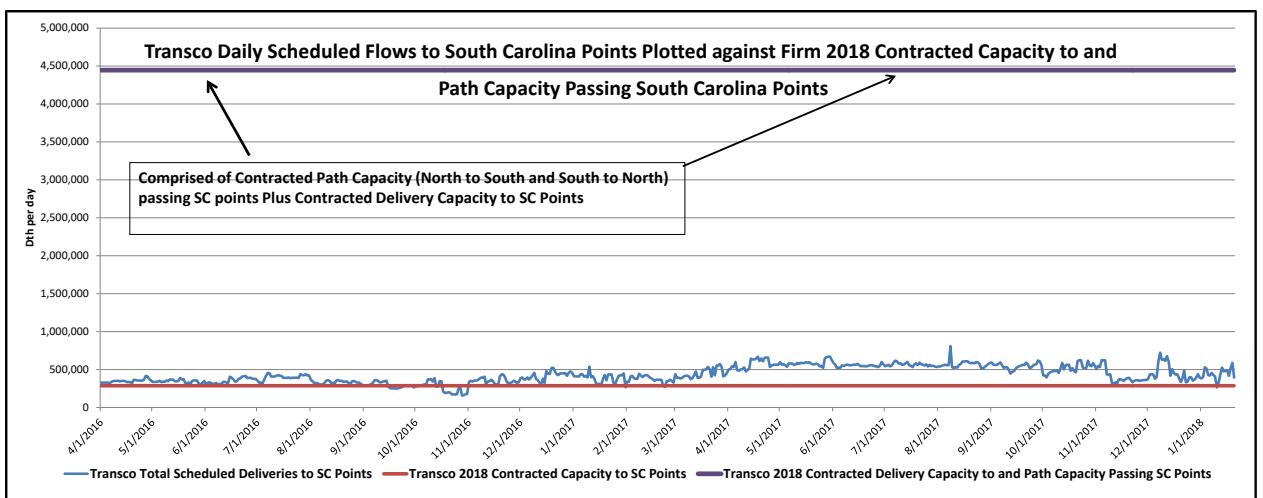


Figure C3: Transco daily scheduled flows to South Carolina points plotted against firm contracted capacity to and path capacity passing South Carolina points

Figure C3 plots the same data presented in Figure C2, but plots it on the scale of capacity available to serve all South Carolina points. In other words, it shows the path capacity: (north to south and south to north) passing South Carolina points as well as the contracted delivery capacity to South Carolina points. As can readily be seen, although firm contracted capacity to South Carolina (or DCGT) on Transco is much too small to accommodate daily deliveries and this makes it appear that South Carolina faces constraints (owing to subscribed firm versus demand), South Carolina is actually in a great position with regard to Transco and South Carolina demands.

To ensure that Figure C3 does not misrepresent South Carolina's position in Transco Zone 5 (the Zone covering South Carolina, North Carolina, and Virginia) and does not miss other demands in Zone 5 that would alter the amount of total subscribed capacity available, Skipping Stone also plotted the balance of deliveries to all Zone 5 locations against available capacity into and through Zone 5. This analysis is presented below in Figure C4.

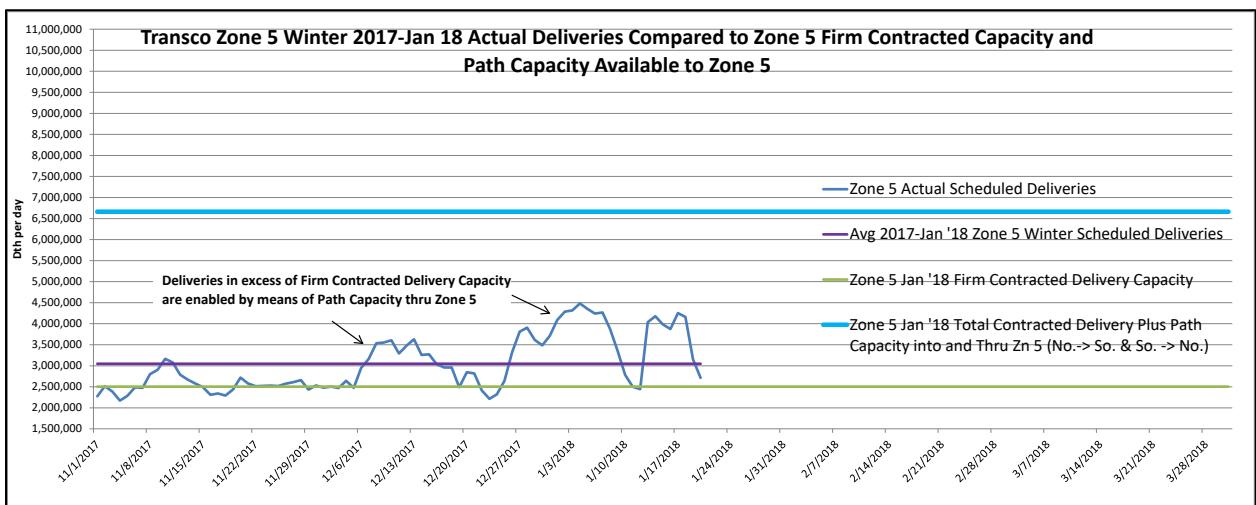


Figure C4: Transco Zone 5 winter 2017 through January 2018 actual deliveries compared to Zone 5 firm contracted capacity and path capacity available to Zone 5

In Figure C4, the green horizontal line represents the total subscribed Transco delivery capacity to points in Zone 5. There is about 2.5 Bcf/d of subscribed Transco delivery capacity at these points (inclusive of South Carolina's approximately 0.29 Bcf/d of firm delivery point capacity). The purple horizontal line represents the average deliveries per day of about 3.0 Bcf/d; the squiggly blue line presents the daily scheduled flows to all Zone 5 points; and the blue horizontal line represents all the path capacity plus delivery point capacity in Zone 5. Figure C4 shows that there was excess available capacity in Zone 5 this winter. Even during the "bomb cyclone" event in early January when actual deliveries reached 4.5 Bcf/d, there was still another 2.0 Bcf/d of available capacity.