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August 10, 2018

<u>VIA ELECTRONIC FILING</u>

Mr. Joel H. Peck, Clerk
c/o Document Control Center
State Corporation Commission
Tyler Building – First Floor
1300 East Main Street
Richmond, Virginia 23219

RE: Virginia Electric and Power Company – Integrated Resource Plan filing for 2018 pursuant to Va. Code § 56-597 et seq.

Case No. PUR-2018-00065

Dear Mr. Peck:

Attached for filing in the above-referenced matter is the Direct Testimony and exhibits of Gregory Lander on behalf of Appalachian Voices ("Environmental Respondents"). This filing is being completed electronically, pursuant to the Commission's electronic document filing system.

If you should have any questions regarding this filing, please do not hesitate to contact me at (434) 977-4090.

Regards,

William C. Cleveland

cc: Parties on Service List
Commission Staff

COMMONWEALTH OF VIRGINIA
STATE CORPORATION COMMISSION

APPLICATION OF VIRGINIA ELECTRIC AND POWER COMPANY	)	
	)	Case No. PUR-2018-00065
In re: Virginia Electric and Power Company's Integrated Resource Plan filing pursuant to Va. Code § 56-597 et. seq.	)	

Direct Testimony of
Gregory M. Lander

On Behalf of
Environmental Respondents

August 10, 2018

Summary of Testimony of Gregory M. Lander

My name is Gregory M. Lander. I am head of Skipping Stone, Inc.'s Energy Logistics practice. The purpose of my testimony today is to describe two areas of missing or inadequate analysis in the Company's 2018 IRP that relate to the IRP's consideration of costs of the Atlantic Coast Pipeline and raise significant concerns about whether the Company has, in fact, identified a reasonable least-cost generation scenario. First, I will testify that the Company did not study or present an analysis of the cause, frequency, duration or magnitude of natural gas price spikes. Analyzing four scenarios for forward-looking basis projections between different pricing locations, I calculated the **avoidable**, **net cost** to Company ratepayers of new pipeline capacity like the Atlantic Coast Pipeline to be as high as $3 billion over the next 20 years. The second area of missing or incomplete analysis that my testimony will address is that the Company has not performed a comparative analysis of all-in fuel cost, as it should be required to do as part of the least-cost planning exercise of the 2018 IRP. The load factor of a short-term peak caused by extreme winter weather is so low that meeting such demands with gas-fired only units, which require costly long-term pipeline capacity, is not prudent.

The Company's 2018 IRP embeds the costs of the Atlantic Coast Pipeline into each of the generation scenarios it presents. In essence, the IRP asks the Commission to accept that the Atlantic Coast Pipeline is built and that ratepayers should pay for it without ever explaining to the Commission what those costs are and why they are justified in a least-cost planning exercise. Absent comparative analysis of viable alternative fueling logistics and their respective associated all-in costs that would be the product of these analyses, it is unlikely in the extreme that the Company's IRP has achieved the objective of identifying a reasonable, least-cost generation scenario.

Q. Please state your name and address.

A. My name is Gregory M. Lander. My business address is 83 Pine Street, Suite 101, West Peabody, MA 01960, and my email address is glander@skippingstone.com.

Q. What is the purpose of your testimony?

A. The purpose of my testimony today is to describe two areas of missing or inadequate analysis in the Company's 2018 IRP that relate to the IRP's consideration of costs of the Atlantic Coast Pipeline and raise significant concerns about whether the Company has, in fact, identified a reasonable least-cost generation scenario. First, I will testify that the Company did not study or present an analysis of the cause, frequency, duration or magnitude of natural gas price spikes and did not assess what infrastructure developments are already underway and under development that could reduce, if not eliminate, the frequency, duration, and magnitude of such price spikes. Analyzing four scenarios for forward-looking basis projections between different pricing locations, I calculated the **avoidable**, **net cost** to Company ratepayers of new pipeline capacity like the Atlantic Coast Pipeline to be as high as $3 billion over the next 20 years. I corroborated my analysis using natural gas price data provided by the Company, which showed a net cost to Company ratepayers of the Atlantic Coast Pipeline to be $2.5 billion over the next twenty years when compared to the costs of using existing infrastructure. In sum, Company ratepayers will experience no net value from paying for the path connecting Dominion South Point to Transco Zone 5 as the Atlantic Coast Pipeline would. Additionally, because the IRP does not include the price spike analysis that I recommend in my testimony, it does not present reasonable, least-cost generation scenarios.

Q. What is the second area of missing or incomplete analysis that your testimony will cover?

A. The second area of missing or incomplete analysis that my testimony will address is that the Company has not performed a comparative analysis of all-in fuel cost, as it should be required to do as part of the least-cost planning exercise of the 2018 IRP. Had the Company analyzed its load serving requirements with demand duration curves as part of its least-cost planning, it would see that the load factor of a short-term peak caused by extreme winter weather is so low that meeting such demands with gas-fired only units is not prudent from a fixed-cost incurrence perspective. Multiple options, such as building dual fuel CTs or purchasing energy from PJM, can satisfy a short-term winter peak, should one occur, without burdening ratepayers with the high fixed costs of new gas pipeline capacity.

Q. Based on your analyses, what are your overall conclusions regarding the Company's 2018 IRP?

A. The Company's 2018 IRP embeds the costs of the Atlantic Coast Pipeline into each of the generation scenarios it presents. However, the Company does not quantify these costs or justify them anywhere in the IRP; it has not properly costed–out the all-in cost of increasing, beyond its current pipeline capacity portfolio, the costs associated with the level of pipeline capacity it intends to obtain on the Atlantic Coast Pipeline. In essence, the IRP asks the Commission to accept that the Atlantic Coast Pipeline is built and that ratepayers should pay for it without ever explaining to the Commission what those costs are and why they are justified in a least-cost planning exercise. My analysis demonstrates that an analysis of price spike information and an analysis of load duration curves could significantly improve the IRP's function as a tool intended to identify the least-cost generation scenario; keeping in mind that least-cost generation measurements should include the costs of associated necessary fuel logistics for generation assets consuming fuel. Absent comparative analysis of viable alternative fueling logistics and their respective associated all-in costs that would be the product of these analyses, it is unlikely in the extreme that the Company's IRP has achieved this objective.

Qualifications

Q. What is your occupation and by whom are you employed?

A. I am President of Skipping Stone, LLC ("Skipping Stone").

Q. What is your educational and professional background?

A. I graduated from Hampshire College in Amherst, Massachusetts, in 1977, with a Bachelor of Arts degree. In 1981, I began my career in the energy business at Citizens Energy Corporation in Boston, Massachusetts ("Citizens Energy"). I became involved in the natural gas business of Citizens Energy in 1983. Between 1983 and 1989, I served as Manager, Vice President, President and Chairman of Citizens Gas Supply Corporation (a subsidiary of Citizens Energy). I started and ran an energy consulting firm, Landmark Associates, from 1989 to 1993, during which time I consulted on numerous pipeline open access matters, a number of Federal Energy Regulatory Commission ("FERC") Order No. 636 rate cases, pipeline certificate cases, fuel supply and gas transportation issues for independent power generation projects, international arbitration cases involving renegotiation of pipeline gas supply contracts, and natural gas market information requirements cases (FERC Order Nos. 587 et seq.). In 1993, I founded TransCapacity LP, a software and natural gas information services company. Since 1994, I have also been a Services Segment board member of the Gas Industry Standards Board ("GISB") and its successor organization, the North American Energy Standards Board ("NAESB"). During the period 1994 to 2002, I served as a Chairman of the Business Practices Subcommittee, the Interpretations Committee, the Triage Committee, and several GISB/NAESB Task Forces. I am currently a Board Member of NAESB and have served continuously in that capacity since 1997. Skipping Stone, Inc. acquired TransCapacity in 1999, and since that time I have headed up Skipping Stone's Energy Logistics practice, where my specialization has been interstate pipeline capacity issues, information, research, pricing, acquisition due diligence and planning. In 2001, Skipping Stone launched CapacityCenter.com, a pipeline capacity information service. In 2004, Skipping Stone was acquired by Commerce Energy Group, a national retail energy services provider. In 2005, I was appointed President of Skipping Stone, which operated as a wholly owned subsidiary of Commerce Energy Group. In 2008, I purchased substantially all of the assets of Skipping Stone and now operate essentially the same business as before the Commerce Energy transaction as Skipping Stone, LLC.

From 1984 to present, I have maintained a deep familiarity with a wide range of pipeline transportation issues, beginning with access to pipeline capacity to make competitive sales, resolution of the pipeline take-or-pay contracting regime, pipeline affiliate marketer concerns, restructuring of the pipelines from merchants to transporters and thereafter, and definitions of what constituted a pipeline capacity "right" for the purposes of formulating the then newly commenced capacity release and capacity rights trading business process. I continue to be involved in nearly all facets of the capacity information and trading business as part of my duties at Skipping Stone. In addition, I have been the lead principal on all 50+ pipeline and storage mergers and acquisitions transactions as well as all pipeline and storage facility expansion projects for which Skipping Stone has been retained by potential purchasers and project sponsors to provide economic due diligence consulting and market analysis.

Q. Have you filed testimony in regulatory proceedings previously?

A. I have filed testimony in several proceedings including FERC Docket No. RP04-251-000, which was an El Paso Natural Gas Company ("EPNG") proceeding regarding pathing and segmentation. In FERC Docket No. RP08-426-000, (also an EPNG proceeding), I sponsored answering and supplemental answering testimony. I also filed testimony in FERC Docket No. RP10-1398, the first fully litigated EPNG Rate case in more than three decades. In addition, I have filed testimony in Massachusetts Department of Public Utilities Case Nos. 13-157, 15-34, 15-48, 15-39; Maine Public Utilities Commission Case No. 2014-00071; Virginia Corporation Commission Case No. PUR-2017-00051; Missouri Public Service Case GR-2017-0215; GR-2017-0216; California Public Utilities Commission Cases 17-10-007 and 17-10-008 (Consolidated) Applications of San Diego Gas & Electric (U902M) and Southern California Gas Company (U 338-E) for Authority, Among Other Things, to Update its Electric and Gas Revenue Requirement and Base Rates Effective on January 1, 2019; Virginia Corporation Commission Case No. PUR-2018-00067 Application of Virginia Electric and Power Company to revise its fuel factor pursuant to § 56-249.6 of the Code of Virginia; and California Public Utilities Commission Application No. 17-10-002 Application of Southern California Gas Company (U 904 G) and San Diego Gas & Electric Company (U 902 G) Regarding

Feasibility of Incorporating Advanced Meter Data Into the Core Balancing Process.. Please refer to Exhibit ER-01, which contains a full list of case names and docket numbers as well as my current CV.

Q. On whose behalf are you testifying in this proceeding?

A. I am submitting testimony on behalf of the Environmental Respondents.

Q. How is your testimony organized?

A. First, I discuss the frequency, magnitude and duration of price spikes in natural gas market prices, particularly as they occur in Transcontinental Gas Pipe Line Corporation's (Transco's) market areas, as well as their causes and what developments are underway that will address the cause of these observed price spikes. In this regard, I also discuss that while the Company refers to price spikes and volatility in its IRP, it undertakes no quantitative or qualitative analysis of these price spikes or any analysis as to the costs of alternative means of addressing the impacts from such price spikes on Company ratepayers.

Second, I discuss that the Company should have examined its load duration curves and then matched resources – including fuel source – to match to the curves on a least-cost basis. In this regard, I also discuss how very low load factor utilization of resources (generation and associated fuel logistics assets) can greatly impact ratepayer costs depending on the "plan" identified to fuel such resources. The Company appears to have: 1) undertaken no quantitative or qualitative analysis of either load duration or load factor; 2) provided no analysis as to the costs of alternative means of addressing the load duration or low load factor realities they face and will face; nor 3) assessed and presented for review the impacts on ratepayers of the available alternatives.

Q. Are you submitting attachments with your testimony?

A. Yes. They are:

1. Lander 1
2. Lander 2
3. ER 8-11(b)
4. ER 7-3(c)
5. Staff 7-92(a)
6. Staff 3-31 (Attachment Staff Set 3-31 (KS).xlsx)
7. Staff 9-107(f)

Q. Let's begin with your testimony about natural gas price spikes. Are there any forms of analysis that you found missing from the Company's IRP?

A. Yes. I found that in its discussion of price spikes and their impact on Company ratepayers it did not analyze a number of things as part of addressing this situation.

Q. Please elaborate.

A. The Company: (1) did not study nor present any analysis of price spike cause, frequency, duration or magnitude; and (2) did not assess what developments are already underway and under development that might address the fundamental cause of price spikes nor how those developments will impact and reduce, if not eliminate, the frequency, duration, and magnitude of such price spikes. Note that when price spike frequencies, durations and magnitudes are reduced, the relative value (i.e., benefit) relative to associated costs of addressing the remaining estimated frequency, duration and magnitude change and change dramatically. In short, as the value of any "benefit" diminishes while "costs" to achieve that benefit do not, net benefit can vanish and instead yield net cost.

Q. As an initial matter, where are the Company's generation stations located?

A. Transco Zone 5.

Q. Can you provide some background on what causes price spikes to occur in Zone 5, the Zone that the Company's generation stations are located in?

A. Yes. First Zone 5 is one of 6 rate Zones that are present on the Transco system. In addition, while Transco charges the same rates based upon these 6 Zones[1], Transco distinguishes its capacity contracting within Zone 6 into two what I will call sub-zones for capacity pathing purposes, but not for transportation recourse rate purposes.

Q. What are those two sub-zones for capacity pathing purposes?

A. They are Zone 6 NY-PA (commonly referred to as Zone 6 Non-NY in the price publication journals) and Zone 6 NY City (commonly referred to as Zone 6 NY in the price publication journals). The Zone 6 NY-PA Zone for capacity pathing purposes of Transco includes the states of Maryland, Delaware, Pennsylvania and New Jersey, but excluding, in New Jersey, delivery points in the counties of Union and Bergen (counties adjacent to NY) and one location in Middlesex County that is right on the Union County-Middlesex County border. The Transco capacity contracts with Zone 6 NY City-denominated delivery points, for capacity pathing purposes, include the delivery points in the New Jersey counties I just discussed, plus all delivery points in the counties of

[1] Transco's rate design is a matrix rate design where shippers pay reservation charges based upon their reserved path quantities from Receipt Zone to Delivery Zone without regard to sub-zone pricing locations which may characterize prices of natural gas delivered to one or more geographical or virtual location(s) within a rate zone.

Richmond, NY (i.e., Staten Island), Kings or New York, NY (i.e., Manhattan), Queens, and Nassau counties of New York state.

Q. Please explain the significance of this specificity of Transco's capacity pathing as it relates to these two sub-zones.

A. The sum of Zone 6 contracted delivery capacity in Zone 6 Non-NY (i.e., Zone 6 NY-PA) and Zone 6 NY City combined is just over 6 Bcfd (6,003,245 Dthd as reported in Transco's April 1, 2018 Index of Customers). However, within that 6 Bcfd of rate Zone 6 capacity, only approximately 2.3 Bcfd (2,273,019 Dthd), or less than 40% of the total, have Zone 6 NY City delivery points. In addition, on August 20, 2018, a total of 1.7 Bcfd of additional capacity through Zones 6 and 5 and to Zone 4 will come into service with the completion Transco's Atlantic Sunrise. Note also that none of Atlantic Sunrise's increase of Transco capacity increases delivery capacity to Zone 6 NY City.

Q. Please explain the significance of these facts.

A. First I have to describe the way that the daily market in Transco Zone 6 operates. Within Zone 6 there is a pooling point available to every shipper with Zone 6 capacity, regardless of whether that capacity is to deliver in Zone 6 Non-NY or Zone 6 NY City. That pooling point is at a virtual location called Station 210. Transco identifies (for capacity pathing purposes) Station 210 as being just east of where the Transco Leidy Line intersects with the main north-south trunk line of Transco in New Jersey. See map below and the Station 210 Circle.

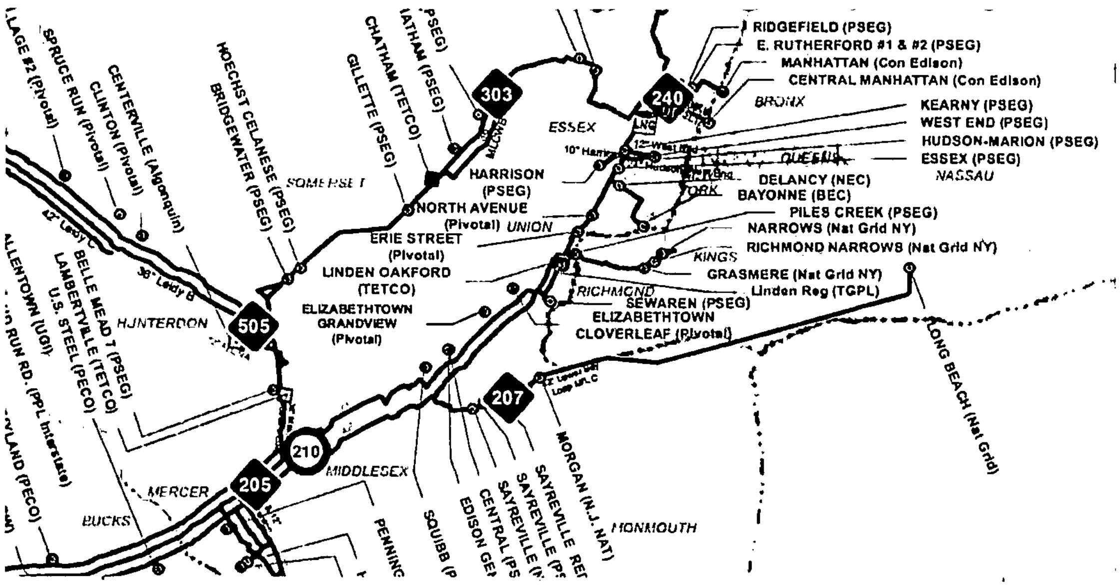

Figure 1

Q. How does Station 210 work?

A. The way a pooling point operates is as follows. Think of the pool as a virtual bucket. Gas on a contract with rate Zone 6 capacity can deliver gas into the shipper's account at the pool. When the gas leaves the transportation contract and goes into the bucket, it loses the transportation agreement identifier, but retains the shipper identifier (i.e., it's the shipper's bucket within the larger Station 210 bucket). Then the shipper can transfer title to gas, from their pool account, to either another shipper's pool account or to a shipper's transportation agreement (either one of their own transportation agreements or that of a different shipper with rate Zone 6 capacity). Generally speaking, the most common transfer is from one shipper's pool account (bucket) to another shipper's pool account (bucket). The importance of this fact is that when shippers with gas delivered into a Station 210 pool account transfer their gas to another shipper's pool account, the selling shipper does not know where the buying shipper will take the gas that the selling shipper just sold.

Q. **Please explain why this understanding of how the pool works is important to the discussion of how the Company did not examine the cause, frequency, duration or magnitude of natural gas price spikes.**

A. First, let me explain what happens to prices in New York City on a very cold day. New York is a retail access state. This means that much of the load in NY City is served by marketers and not by the ConEd or the National Grid (Brooklyn Union Gas or BUG) local distribution companies (LDCs). Under the retail access rules, ConEd and BUG impose penalties on marketers on any very cold day to the extent the marketer fails to deliver enough gas to cover the loads of their customers. The penalty that they will impose is a charge equal to the journal published daily price ***plus*** $10.00 Per Dth.

Q. **What is the effect of this penalty on the Station 210 pool?**

A. The effect of this $10.00 above highest price in the market penalty level is that on days when not enough pipeline gas can get into New York City, the marketers and suppliers with gas at Station 210 want the highest price for their sales. They act this way because they know they can get this price from those wanting to avoid paying $10.00 more than that highest price. Now, here is where the operation of the pool comes into play. Because, as I said above, the sellers don't know if their gas is going to try to get into New York City, or might be flipped from their buyer to a shipper wanting to go into New York City. For that reason, the sellers with gas in their Station 210 bucket all charge the same price-spiked price.

Q. **OK, that explains what's going on at the Station 210 pool, but how does that impact gas prices in Zone 5 where the Company accesses gas to run its generation facilities?**

A. Well, Zone 5 also has a pool. That pool is Station 165. Station 165 operates the same way that Station 210 operates. Moreover, shippers with capacity that can get to Zone 6 from Zones 3, 4 and/or 5 can insist on getting the same, or nearly the same price as the Station 210 price, for gas they can instead sell at Zone 5's Station 165[2]. Thus, because their gas; that they can put into the Station 210 pool, could instead be put into the Zone 5 pool, they will sell at the Zone 5 pool at Station 165 only if they can get the same or nearly the same price as that available to them at the Zone 6 pool at Station 210. Likewise, because shippers with capacity that can get gas to Zones 4 or 5 from Zone 6 (i.e., from the Leidy line and the Marcellus producing region) can also sell into the Zone 6 pool or the Zone 5 pool, they too insist on getting the same high price without regard to which pool they sell at. Finally, these prices spikes in Zone 5 and Zone 6 happen because not enough gas can actually get into New York City on the very coldest days.

Q. How frequent are the price spikes that you have described occurring because not enough gas can actually get into New York City?

A. Not that frequent. For these purposes I define a price spike as greater than $35.00 per Dth, or greater than the Dth equivalent of $4.00 per gallon of No. 2 oil (diesel). I picked this threshold because at that price, given the higher heat rate of generating electricity from fuel oil versus natural gas (~13.5 Dth/MW vs. 11.2 Dth/MW) means that a $4.00 gallon of oil turns into a $4.82 per gallon for the usable Dth[3]. Thus at $35.00 gas, fuel switching between natural gas and diesel for combustion turbines can come into play

[3] Diesel fuel oil has 138,600 Btu/gallon; thus requiring 7.21 gallons to equal 1 MMBtu (1 Dth). $4.00/gallon times 7.21 equals $28.86/Dth. Combustion Turbine diesel versus natural gas heat rate adjusted $28.86 becomes ~$34.78/Dth.

even in extreme diesel price situations. In the chart below I show the frequency of price spikes in Zone 6 Non-NY since August 2004 through June 30th, 2018.

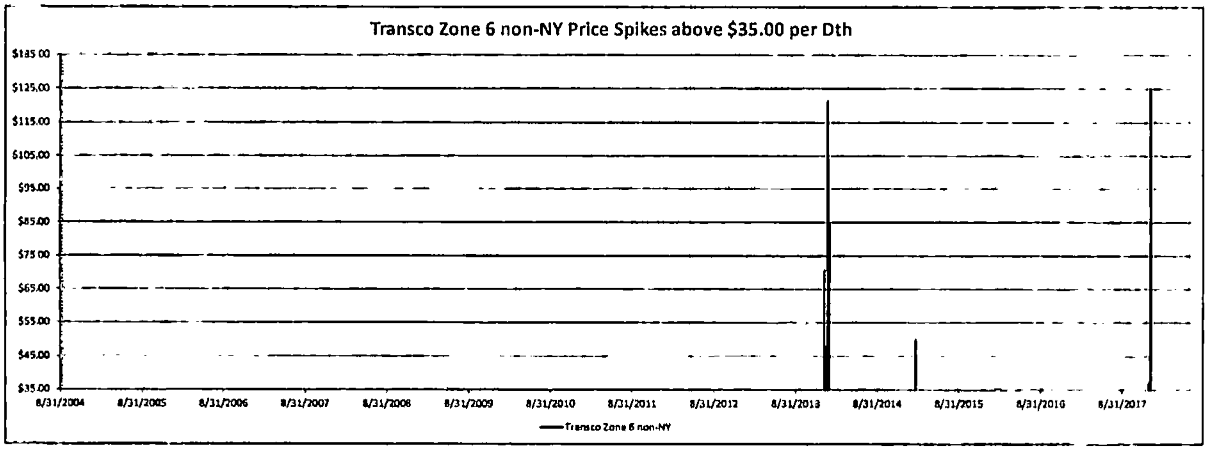

Chart 1

As can be seen in the chart above, there have been 5 separate price spikes over the 13 years and 10 months covered by the chart. The 13 years and 10 months is how long Zone 5 prices have been published by Natural Gas Intelligence (NGI).

Q. What does that tell you?

A. It tells me the price spikes in Zone 5 and Zone 6 are infrequent.

Q. What about their duration and magnitude?

A. With respect to duration, one price spike continued for 7 days, one for 4 days, two were for 2 days and one was for 1 day. In total there were only 16 days in the 13 years and 10 months in which Zone 5 and Zone 6 experienced a price spike above $35.00 per Dth. With respect to magnitude, averaging the daily price for each of the 5 price spike periods, the highest average magnitude over the consecutive days was $86.59 which was for the 2-day price spike this past winter. Over the 16 days total duration, the average cost per Dth was $68.26. The durations in some cases persisted over weekends and my calculations take account of that. In the 13 years and 10 months there were 5,052 days.

This means that less than 0.33% of the time prices in Zone 6 Non-NY spiked. If one only looked at the period between the first spike (January 6, 2014) and June 30, 2018, that extent of time was 1,636 days. Over this shorter period, prices spiked only 1% of the time.

Q. Can adding more capacity and/or gas to either or both of Zones 6 or 5 address these spikes?

A. No, adding capacity or gas to either of these zones will not address spikes caused by New York City constraints—that is constraints between Station 210 and the boroughs of New York City.

Q. Is there any infrastructure or other changes that can address the constraints between Station 210 and the boroughs of New York City?

A. Yes, and just such a project is slated for completion and in-service for the winter of 2019/2020 (the winter after the coming one). Transco's Northeast Supply Enhancement project, a.k.a NESE, will increase capacity into New York City by 400,000 Dthd.

Q. Will the NESE help alleviate the New York City driven price spikes in Zone 5 and Zone 6?

A. Yes.

Q. Please explain why.

A. There are two pipelines that deliver into the boroughs of New York City and to the pricing location known as Zone 6 NY. They are Texas Eastern Transmission (TETCO) and Transco. TETCO can deliver 1.9 Bcfd (1,904,468 Dthd). Transco can deliver the 2.27 Bcfd discussed above. The total of these two is just over 4.1 Bcfd (4,177,487 Dthd). The 400,000 Dthd of additional capacity created by the NESE project increases total NY

City pipeline delivery capacity to 4,577,487 Dthd, an increase of 9.6%. This is also an increase of Transco's New York City delivery capacity of 17.6%. This latter number is the more significant for Transco Zone 5 and Zone 6 non-NY pricing because 17.6% more Transco demand can be served from Station 210, which is the origin point for the NESE capacity. In other words, the increased capacity created by NESE will mean fewer days in which gas deliveries into New York City are constrained.

Q. **Is it your conclusion then that the NESE project will have an impact on the frequency, duration and magnitude of potential future price spikes?**

A. Yes. The NESE project will certainly reduce duration and with that the average magnitude (which is directly related to duration) of price spikes, and it certainly won't increase, and will likely decrease, their frequency.

Q. **So, if we ignore the effect of the NESE project and prices continue to only spike one percent of the time, as you've shown has been the pattern since 2014, are there ways the Company can avoid the impacts of those spikes on ratepayers?**

A. Yes, when it comes to an electric generator avoiding those spikes, the generator can generate electricity with back-up dual fuel (i.e., diesel), or it can buy pipeline capacity connecting their generators to a supply area receipt location. The choice between these two options, should, in my opinion, be made on the basis of least-cost.

Q. **Did you do any comparative analysis between these two options as they would affect the Company?**

A. Yes. I provide that analysis below when I discuss Company load factors and appropriate planning based upon load duration analysis and associated load factors.

Q. OK, my next questions focus on the second option you mention, purchasing new pipeline capacity. What are the options if the Company wanted to get cheaper gas than Zone 5 gas is currently priced?

A. Prices in Zone 5 will change as new pipeline capacity into Zone 5 becomes operational. Specifically, the Atlantic Sunrise and its additional 1.7 Bcfd of capacity into Zones 6, 5 and 4 in 2018 will have a depressing effect on Zone 5 prices during all periods of the year, except the 1% price spike periods.

Q. Please explain.

A. As a result of the Atlantic Sunrise project, more gas will be available to be traded at the Zone 6 and 5 pools. And, because Atlantic Sunrise reaches all the way down to Zone 4, a traditional supply area Zone of Transco, prices in Zones 4, 5 and 6 will equilibrate; that is, they will converge.

Q. Why will prices converge across all three zones?

A. If Zone 4 becomes cheaper than Zone 5, the gas will sell in Zone 5, bringing down the Zone 5 price and bringing up the Zone 4 price; likewise if gas becomes cheaper in Zone 5 than Zone 6, it will sell in Zone 6 (bringing down the Zone 6 price) and the Zone 5 price will equilibrate upward to attract supply to meet demand. The effect of this shift will bring all 3 prices into relative parity. This is to the benefit of Zone 5, which can be supplied from both Zone 6 and Zone 4. In addition, the supply area portion of Zone 6, the Marcellus, will have 1.7 Bcfd more takeaway capacity as a result of Atlantic Sunrise which will have an additional price depressing effect on both of Zone 6's and 5's pools. In essence these pools, except on price spike days (which may still occur 1% of the time to the extent New York City demand served by Transco still has demand which can't be met by pipeline supply that has increased 17.6% as a result of the NESE project), will converge to prices close to those in the supply area.

Q. So in light of the effect of the Atlantic Sunrise project on prices in Zone 5, how would the Company obtain gas at prices even lower than the likely future Zone 5 prices with new pipeline capacity?

A. To the extent a generator wanted prices of gas to generate electricity that were even lower than future Zone 5 prices will be, it would have to look at two things. First, it would have to find a location where historically and currently, prices for supply were less than the sources that will bring down the Zone 5 prices as part of the Atlantic Sunrise project (i.e., the Marcellus). Second, it would have to look at the all-in cost of accessing those supplies; in order to achieve an overall reliable supply on a least-cost ***to ratepayers*** basis.

Q. How does the analysis that you've recommended relate to the IRP?

A. It is getting the ***overall least-cost to ratepayers***, that this proceeding, and the planning that should be conducted in this proceeding, should be concerned with. I understand that Virginia law requires that the Company's IRP identify the electric generation supply that will "provide reliable service at reasonable prices over the long term." In my opinion, in order to determine whether the proposed IRP meets this standard, the Company must perform comparative analysis of fuel logistics (oil and gas) considering all costs of its pipeline capacity portfolio, fixed and variable, versus alternatives, to arrive at all-in costs, which can be justified as "reasonable".

Q. Have you done an analysis of whether the Company could obtain gas at prices lower than the future price of Zone 5?

A. Yes. The Company has suggested that Dominion South Point (DOM SP), the pool at which shippers with Dominion Transmission (DTI) capacity can access supply, is advantageous—i.e. gas prices are lower, relative to other supply sources. Notably, while the Company now has a 15-year agreement that can access the Marcellus, as part of the Atlantic Sunrise project, discussed above, the Company did not seek capacity on Atlantic Sunrise during either of the Open Seasons held by Transco for Atlantic Sunrise. For the reason that these two supply areas, Leidy on Transco and Dominion South Point on DTI are also published supply price locations, I performed analysis comparing those two locations' historical pricing relationships. In this case a pricing relationship measures the basis differential between the two locations to ascertain which is priced more favorably than the other. That chart is below.

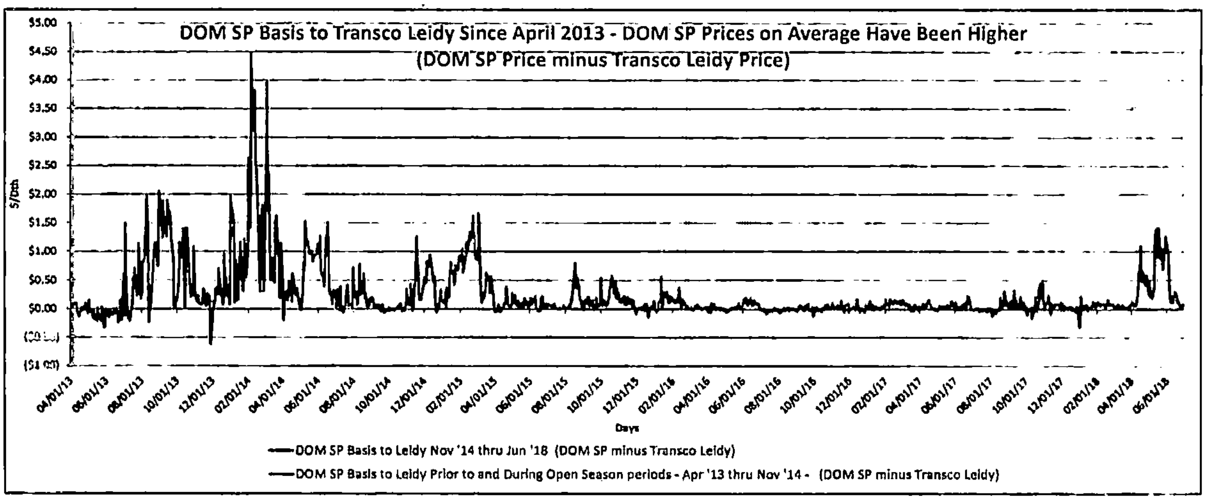

Chart 2

Q. What is this chart telling us?

A. This chart is constructed by looking at the difference in price between the two locations. The values you see are the price at Dominion South Point minus the price at Transco Leidy (the Marcellus supply area). A positive value (i.e., when the line is above zero) in the chart means that Dominion South Point was priced above that of Transco Leidy and conversely a negative value (i.e., when the line goes below zero, Dominion South Point is priced below Transco Leidy. As you can see, Dominion South Point is and almost always has been priced higher than Leidy.

Q. **I see that, but the prices at these hubs are very close, at least currently, so doesn't that mean that there is equivalence between Dominion South Point and Leidy as supply points for the Company?**

A. No. The answer to that question depends on how much it would cost to add access to that supply.

Q. **Please explain.**

A. Unless and until the Company could get access to more of the Dominion South Point gas, it can't incrementally benefit from lower gas prices at that hub, assuming a lower price exists. In order to gain such access, a new line, or an expansion of an existing line to Dominion South Point connecting the Company's plants to that Dominion South Point supply point would be the only way to gain increased access. That new line, or expansion of an existing line, costs money. Pipelines are only built or expanded if the pipeline developer signs contracts for 15-20 years guaranteeing them recovery of costs to build such facilities. That recovery of costs comes by means of payment by the shipper subscribing to capacity on that line of fixed reservation charges for the 15-20 year period.

Q. **What are those costs?**

A. Well, for the proposed Atlantic Coast Pipeline, which as planned would connect Dominion South Point to Zone 5, the FERC-approved maximum rate is currently $1.75 per Dthd of reserved capacity. I have estimated that anchor shippers, those whose subscriptions would enable the pipeline to be financed, might be as low as $1.40 per Dthd. However, in response to ER 8-11 (b), the Company stated that it is assuming such cost to be $1.70 per Dthd.

Q. Does that mean that the price of gas at Dominion South Point would have to be $1.40 to $1.75 cheaper than the price of gas at Transco Leidy to build the pipeline with no significant effect on the fuel costs passed through to Company ratepayers?

A. No, the above chart showed that Transco Leidy was preferable to Dominion South Point (i.e. gas prices were generally lower at Leidy) as a supply source based upon historic price relationships. To show the indifference point for Company ratepayers, whose electricity would otherwise be generated by Zone 5 priced gas, one would compare Dominion South Point to Transco Zone 5 prices historically, as well as assess what future prices at both Dominion South Point and Zone 5 are predicted to be based upon active futures trading involving the two locations or locations that would be the determiners of Zone 5 prices.

Q. Did you do that analysis?

A. Yes. However, first I need to provide a little background on the concept of "basis": how it is developed, how it is used in the gas market, and then, how basis figures into pipeline expansions and new pipeline construction. Simply put, basis is the difference in price of gas at two locations. Price is set at a location when a seller sells and a buyer buys, and that transaction is either recorded (like on an exchange) or is reported to price reporting journals. In North America, and increasingly across the world, the price of gas at the Henry Hub, where the largest exchanges trade futures, is the benchmark for gas prices. Then prices at other locations can be compared to the benchmark and a "basis" between the Henry Hub and that location is formed. In addition, basis can be calculated between two locations connected to each other on a given pipeline. In this situation, the basis is a proxy for the value of holding capacity on that pipeline to transport between these two locations. Finally, the difference between the prices at two locations not connected (or not sufficiently connected) by a pipeline can indicate the potential value of building an expansion, or new pipeline, to create (or increase) a capacity "path" that would connect these two locations.

Q. **How did you use this basis concept to compare the costs of Dominion South Point and Zone 5 and identify the indifference point for Company ratepayers?**

A. So, to analyze the potential value, and identify an indifference point for Company ratepayers, I looked at historic relationships between Dominion South Point prices and Transco Zone 5 prices. Note that for all charts depicting Zone 5 basis from Dominion South Point, the price reporting journal used was Natural Gas Intelligence (NGI), which began reporting Zone 5 prices on the August 31, 2004 trading day (for gas to be delivered September 1, 2004); and also note that on July 1, 2016, NGI broke out Zone 5 Prices into Zone 5 North (i.e., VA), Zone 5 South (i.e., NC and SC) as well as continuing to report an overall Zone 5 price. From and after NGI began reporting Zone 5 North as a separate pricing location, all my charts use the Zone 5 North prices, as they more accurately represent the Company's cost of gas purchased in Zone 5 for generation of electricity. A chart and analysis of what the Zone 5 basis has been is below.

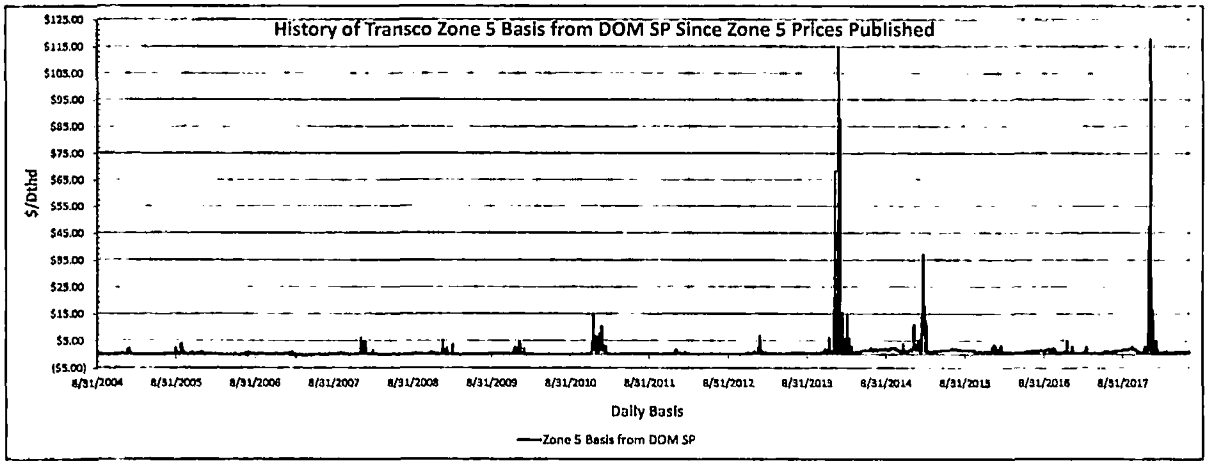

Chart 3

Q. What does this chart tell you?

A. As can be readily seen, with the exception of basis blow-outs (which show up as spikes on the chart), on this scale the basis of Zone 5 from Dominion South Point appears very low and largely consistent. In other words, the Dominion South Point and the Zone 5 prices are relatively close to one another over time. To get a closer view and see other relationships, the next chart changes the scale in order to get a more granular view of the basis relationships, (i.e., daily, average seasonal and average annual comparisons) between Transco Zone 5 and Dominion South Point since Transco Zone 5 prices have been published.

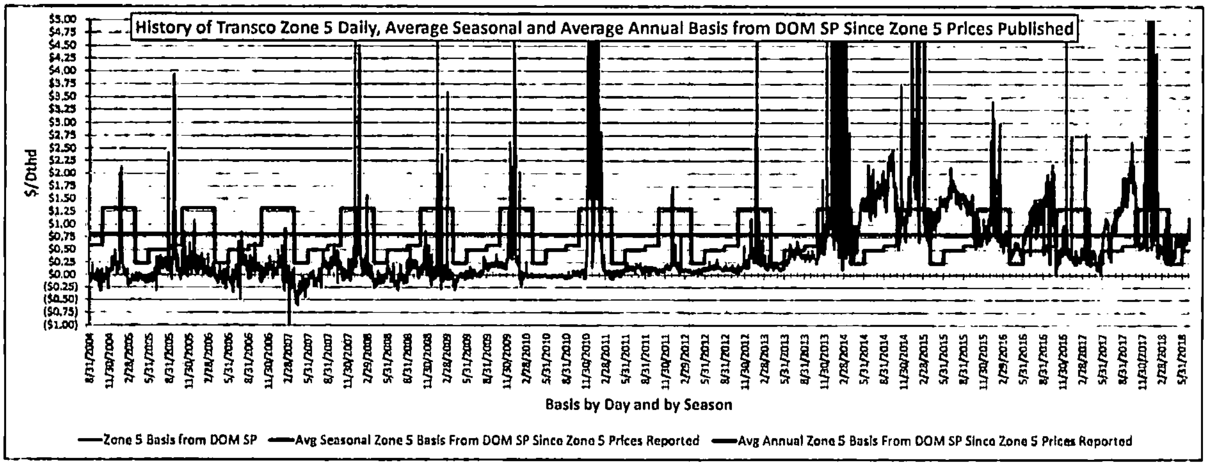

Chart 4

Q. What does this second chart tell you?

A. As can be seen in the above chart, which clips out basis blow-outs above $5.00, for the most part, the basis of Transco Zone 5 from Dominion South Point has had a particular seasonal pattern until recently. In the above, the seasons are the generally acknowledged seasons of the natural gas business. In the above, winter is November through March, the spring shoulder is April and May, the summer is June through August, and the fall shoulder is September and October. These average seasonal basis relationships are presented in red. The average annual basis across this period is the green line and the value is $0.81 over the 13 years and 10 months used in this chart. In other words, Dominion South Point gas prices have been, on average, $0.81 lower than Transco Zone 5 prices. Note also that the winter average basis has been approximately $1.30.

Q. Has this relationship changed over the last 5 years?

A. Yes. Now, taking a look at just the past five years, one sees a different relationship developing. Below in Chart 5, which is at the same scale as Chart 4, one sees the 3 periods of basis blow-outs (i.e., those periods where basis differential exceeds $35.00 per

Dthd). Note that these basis blow-out periods are directly related to the price spikes stemming from capacity constraints into New York City on the very coldest days.

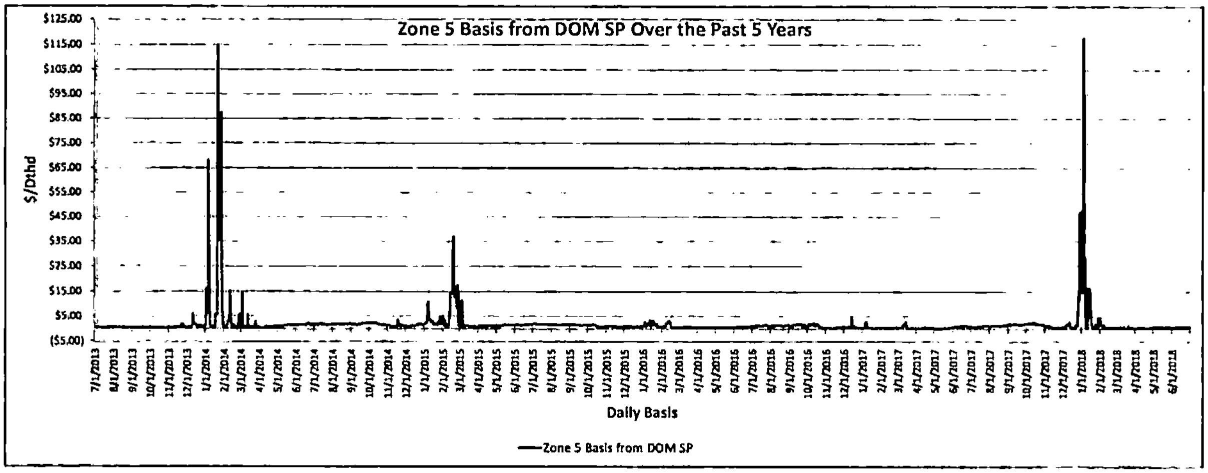

Chart 5

And, again to see a greater granularity, and observe the seasonal and annual relationship over the past 5 years, I present the below Chart 6, which is at the same scale as Chart 4.

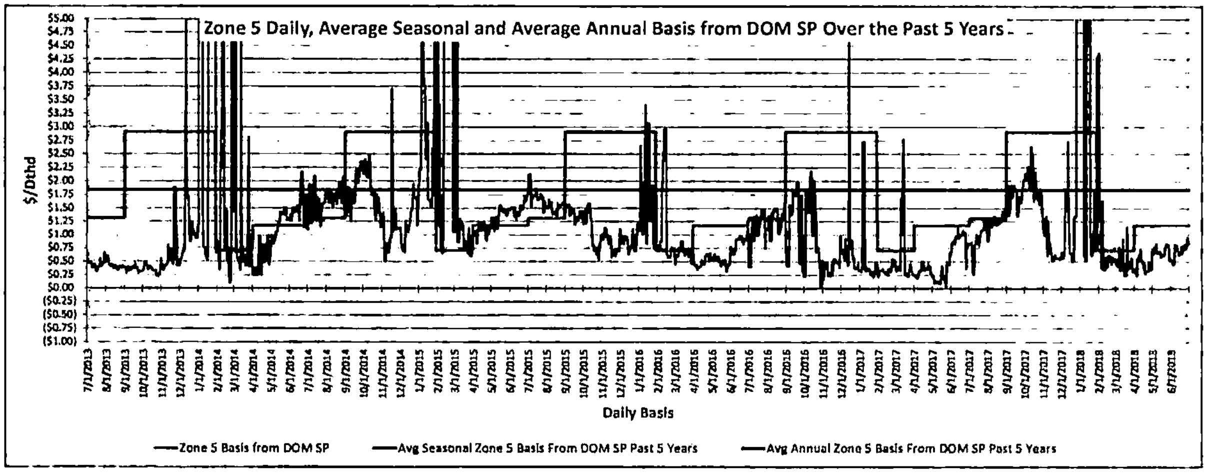

Chart 6

Q. This Chart 6 appears to show that the Annual Average Basis of Zone 5 from Dominion South Point exceeds $1.75 over the past 5 years. Is that the case and, if so,

wouldn't that indicate that creating a new path connecting Dominion South Point to Transco Zone 5 might make sense?

A. Not necessarily. In my opinion, this is where least-cost planning and further analysis is warranted. First, as the Company is generating electricity with a fuel, it has to consider alternate fuels (for example, fuel oil) as a means of avoiding the price spikes in the natural gas market. Second, from a least-cost planning perspective, the Company should also look to the future before undertaking and saddling ratepayers with the 15-20 year cost of a proposed new "path connecting Dominion South Point to Transco Zone 5." A prudent steward of ratepayer interests has to consider what other changes to capacity on Transco serving Zone 5, and influencing Transco Zone 6 Non-NY, are coming into play over the same time horizon to evaluate the prudency of a potential new path, like the Atlantic Coast Pipeline, between Dominion South Point and Transco Zone 5.

Q. **Did you do this analysis?**

A. Yes. I examined what the Zone 5 basis, from a Company ratepayer perspective, might be if the Company avoided the past 5 years' price spikes in natural gas by instead using fuel oil (and not buying gas) on the 12 occasions over the past 5 years that Zone 5 prices exceeded $35.00 (as discussed above $35.00 /Dth gas is the cross-over point where $4.00 per gallon fuel oil is less costly to generate electricity from than natural gas). A chart of the same type as Chart 6 with this means of addressing price spikes and the remaining prices is presented below.

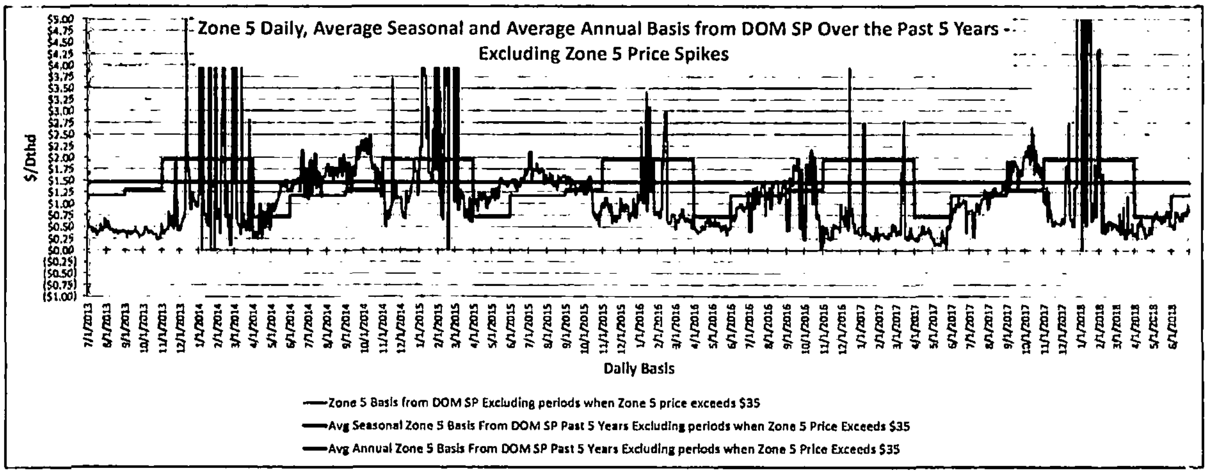

Chart 7

Q. What does this Chart 7 show you?

A. As can be determined from Chart 7, eliminating those 12 days when Zone 5 prices exceeded $35.00/Dth, drops the average annual basis along a path connecting Dominion South Point to Zone 5 to $1.45 per Dthd. Thus, prudent fuel source management eliminates nearly $0.40 per Dthd of value on average over the whole entire 5 years.

Q. But $1.45 is still greater than the low-end estimate of $1.40 that you estimated would be the negotiated rate that the Company might pay for a proposed new path connecting Dominion South Point to Transco Zone 5. Doesn't that mean that the new path would be a reasonable expenditure from the perspective of the Company's ratepayers?

A. No. In my opinion, before a least-cost planning utility like the Company embarks on pursuing a 15-20 year fixed cost commitment of ratepayer dollars for a new path, the level of diligence a prudent economic actor would undertake would be to look ahead, not just behind, and evaluate known recent and coming developments. Here I am referring specifically to what the natural gas market is saying about future prices and resultant future basis along the potential Dominion South Point to Zone 5 path.

Q. How does the natural gas market predict the basis will change along the Dominion South Point to Zone 5 path in the future?

A. Today, the organized over-the-counter futures markets and organized futures exchange markets trade and develop prices and basis at more than 70 pricing locations in North America. Among those are Dominion South Point and Transco Zone 6 Non-NY. Transco Zone 5 is listed as a trading location, but there are no trades currently listed for Transco Zone 5, nor have there been in the last 10 years. Anecdotally, this is in part due to the liquidity and close seasonal correlation historically between Zone 6 Non-NY pricing and Zone 5 pricing in the daily and monthly markets. A chart depicting the daily basis as well as average seasonal basis values relationship over the 13 years and 10 months of since Zone 5 prices have been published is set forth below.

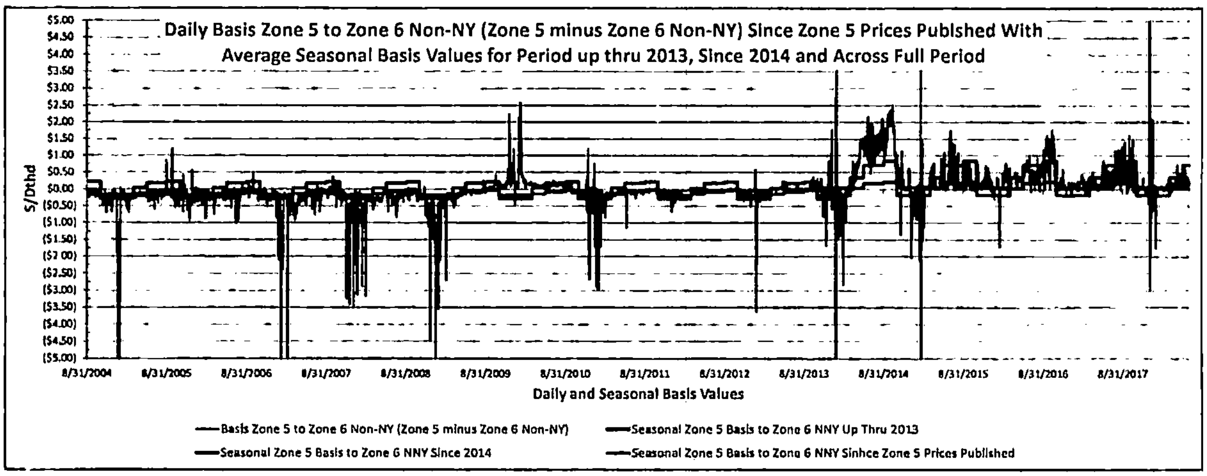

Chart 8

Q. What is the purpose of the comparison in Chart 8?

A. The purpose of deriving seasonal basis values is to apply those seasonal basis values to forward Zone 6 Non-NY prices to impute a forward Zone 5 price. This, in turn, allows a derivation of a forward value of the potential Dominion South Point to Transco Zone 5 Path. In Chart 8, one can see the daily basis with the scale truncated at plus and minus $5.00 (note, however, that the values were not truncated for average seasonal value calculation purposes). In the above, a positive value means that Zone 5 is more expensive than Zone 6 Non-NY; while a negative value presents that Zone 5 gas is less expensive than Zone 6 Non-NY. Historically, Zone 5 prices tended to be less expensive than Zone 6 Non-NY prices. That historic relationship demonstrably changed around the beginning of 2014. The red line above is the average seasonal basis of Zone 5 to Zone 6 Non-NY up through 2013. The purple line depicts the average seasonal basis since 2014. The green line depicts the average seasonal basis of Zone 5 to Zone 6 Non-NY since Zone 5 prices have been published.

Q. What was the next step of your analysis after deriving these seasonal basis values?

A. After deriving these seasonal basis values, I generated 4 cases projecting the Forward Value of a potential Dominion South Point to Transco Zone 5 Path. Below I describe each case and present the associated chart.

Q. Please explain Case 1.

A. Case 1 shows the forward value of the potential path as it looked in November 2014, a time when the Company was involved in pursuing the Atlantic Coast Pipeline; and, as a diligent least-cost planning utility would (or at least should) have assessed what the value to ratepayers of such an undertaking looked like at that time (i.e., a risk/reward assessment on behalf of ratepayers). In Case 1, I used the prior 2 years (to November

2014) average seasonal Zone 5 to Zone 6 Non-NY basis to apply to the forward period. The two years prior to November 2014 were those over which both the Dominion South Point basis was blowing-out to the negative and the Zone 5 Basis to Zone 6 Non-NY was also increasing to the positive. Below is Chart 9.

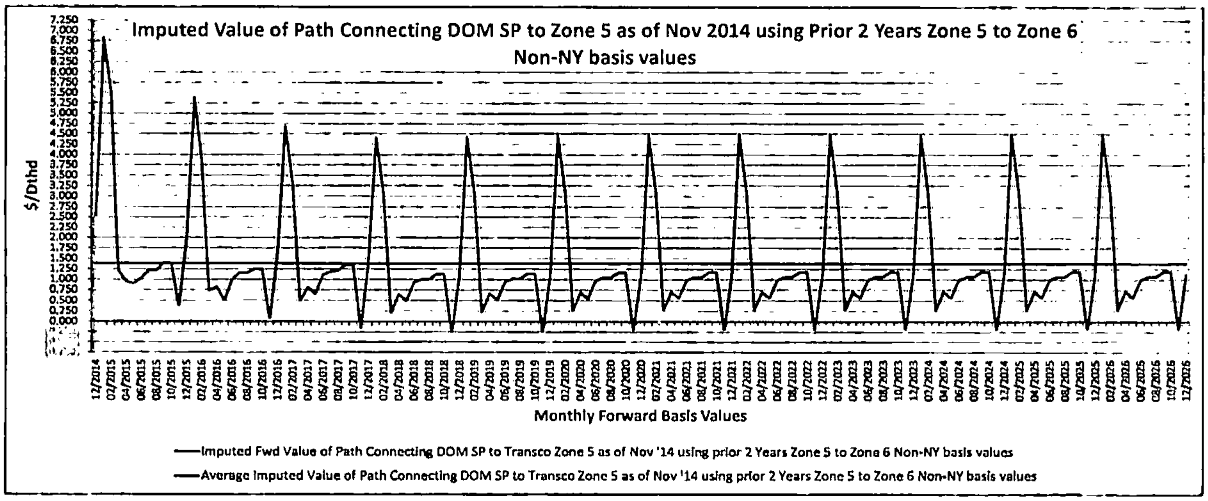

Chart 9

Q. What does this chart tell you?

A. As can be seen in Chart 9, using the preceding two years' basis relationship between Dominion South Point and Transco Zone 5, the presented Forward Value of a potential Path connecting Dominion South Point to Transco Zone 5 varied by season and would have had an average annual value of $1.386/Dthd. In other words, the trend of prices in November 2014 (based on the immediate prior two years' experience) predict that Dominion South Point prices would be $1.386/Dthd lower than Zone 5 prices, a difference that is a fraction lower than the lowest likely transportation cost of the Company's capacity reservation on the Atlantic Coast Pipeline. In this scenario, Dominion South Point gas prices plus fixed costs at 100% load factor and Zone 5 all-in variable costs are approximately equivalent from the perspective of Company ratepayers[4]. However, Case 1 ignores the very likely impact of contemporaneously known future developments impacting Zone 6 Non-NY as well as Zone 5. That is why a prudent and diligent least-cost planning utility wouldn't stop at only assessing the risk/reward for ratepayers associated with Case 1.

Q. What does Case 2 show?

A. Like Case 1, Case 2 also shows the forward value of the potential path as it looked in November 2014 (i.e., when the Company was involved in pursuing the Atlantic Coast Pipeline). However, unlike Case 1, Case 2 accounts for the effects of other pipeline projects with binding precedent agreements for capacity targeting Zone 5 by using the historic basis relationship between Dominion South Point and Transco Zone 5 (i.e., a history that covers when the two pricing areas did not demonstrate a depressed Dominion South Point supply area price which has recently developed and would be relieved by a new pipeline). In my opinion, a diligent least-cost planning utility would (or at least should) have assessed what the value to ratepayers of an undertaking like the Atlantic Coast Pipeline would look like after taking into account other projects with binding precedent agreements for capacity targeting the same Zone 5 (as well as the Zone 6 Non-NY extent of Transco) as is the Atlantic Coast Pipeline (for example, Atlantic Sunrise with 1.7 Bcfd and Mountain Valley with another at least 1.7 Bcfd). To take account of such developments, the Company should have also assessed what the potential Forward Value of a new Dominion South Point to Zone 5 Path might be if the forward Zone 5 basis to Zone 6 Non-NY returned to the same relationship as the Average Seasonal and

[4] Note this is only true with the assumption that the Atlantic Coast Pipeline, which makes the Dominion South Point to Transco path, was to be utilized at 100% capacity 365 days per year for the full period of the Contract.

Average Annual basis that had been true since Zone 5 Prices were reported up through October of 2014. After all, adding 3.4 Bcfd to Transco (let alone nearly 5 Bcfd if the Atlantic Coast Pipeline were included) would certainly change things from what they had been when looking at basis relationships only during the most recent basis blow-out period.

Q. Did you do this analysis?

A. Yes. The Chart taking into account such market reactions and return to more historic basis relationships is set forth in Chart 10 below.

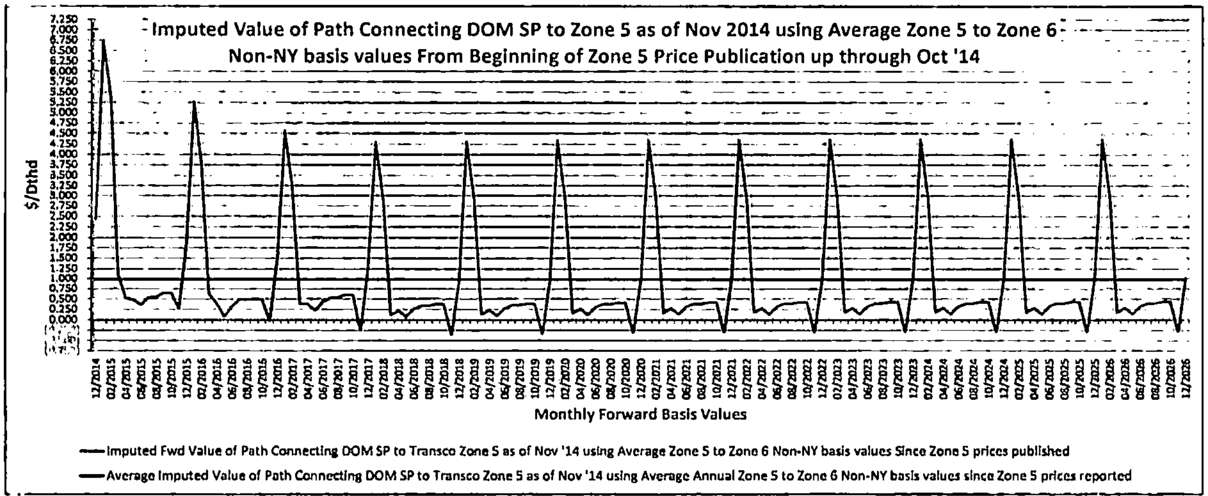

Chart 10

Q. What does Chart 10 tell you?

A. As can be seen in Chart 10, the annual average basis—that is value of a potential path connecting Dominion South Point to Transco Zone 5—changes dramatically. This November 2014 analysis (which includes price spike and basis blow-out periods) shows that the potential value of the potential path drops in value to ratepayers from \$1.386/Dthd to \$0.978/Dthd, a drop of more than \$0.40 per Dthd. Stated another way, this risk, which was knowable in November of 2014, was that ratepayers would potentially pay, on average, \$0.40/Dthd more on 300,000 Dthd every day for 20 years – or \$876,000,000 over that period. I will discuss below, in my conclusions, the apparent lack in this or last year's IRPs of any discussion of justification, or discussion of risk mitigation associated with the Company's obligation to undertake both least-cost planning as well as anticipate and plan for mitigating potential knowable likely risks to ratepayers.

Q. Please explain Case 3.

A. In Case 3, I depict what the current Forward Value of the potential Dominion South Point to Zone 5 Path looks like today based upon current (June 29, 2018) forward market values of Transco Zone 6 Non-NY basis, current (also June 29, 2018) forward market values for Dominion South Point and an assumed (although unlikely) forward basis relationship between Zone 5 and Zone 6 Non-NY staying as it has been since the beginning of 2014 (i.e., over the past 4 and a half years relative basis depression of Dominion South Point coupled with the relative basis elevation of Zone 5 relative to Zone 6 Non-NY). This Case 3 is set forth in Chart 11 below.

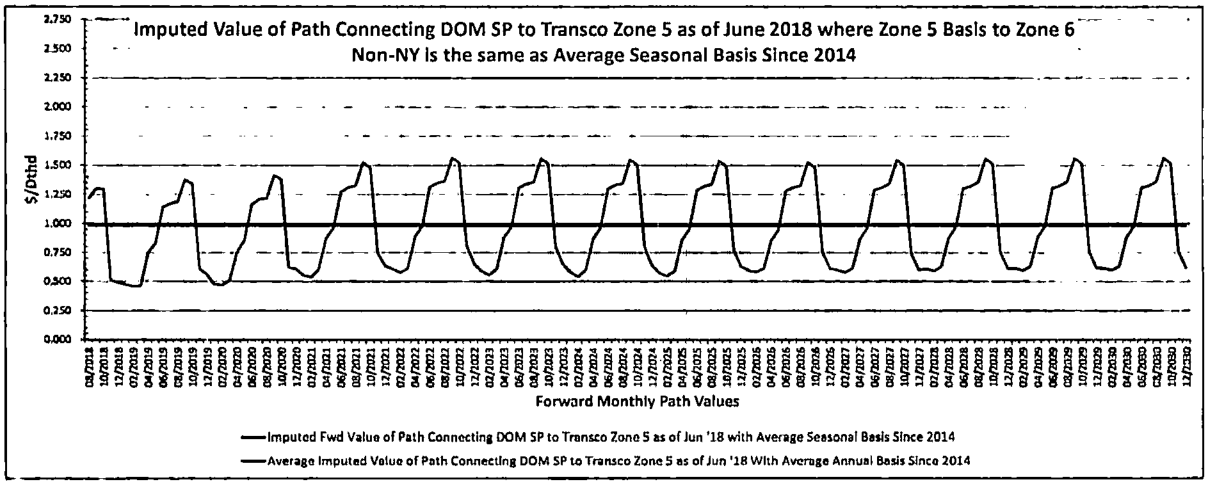

Chart 11

Q. What does Chart 11 tell you?

A. As can be seen in this Case 3, even with the assumption that average seasonal Zone 5 to Zone 6 Non-NY basis relationships remain the same in the future as they have been since 2014 (i.e. the same as they have been during the recent blow-out period), the annual average value of the potential path connecting Dominion South Point to Transco Zone 5 is less than $1.00/Dthd, well below the $1.40/Dthd to $1.75/Dthd necessary to offset the transportation costs of capacity reservations on the proposed Atlantic Coast Pipeline. While this Case 3 is instructive, in my opinion, a diligent least-cost planner should, from at least a risk assessment point of view, perform analysis similar to that I make available below in Case 4.

Q. Please explain Case 4.

A. Case 4 (Chart 12) depicts what the current Forward Value of the potential Dominion South Point to Zone 5 Path looks like today based upon current (June 29, 2018) forward market values of Transco Zone 6 Non-NY basis, current (also June 29, 2018) forward market values for Dominion South Point and what the current Forward Value of the potential Path is should the forward basis relationship between Zone 5 and Zone 6 Non-NY be the same as the average seasonal value since Zone 5 prices have been published.

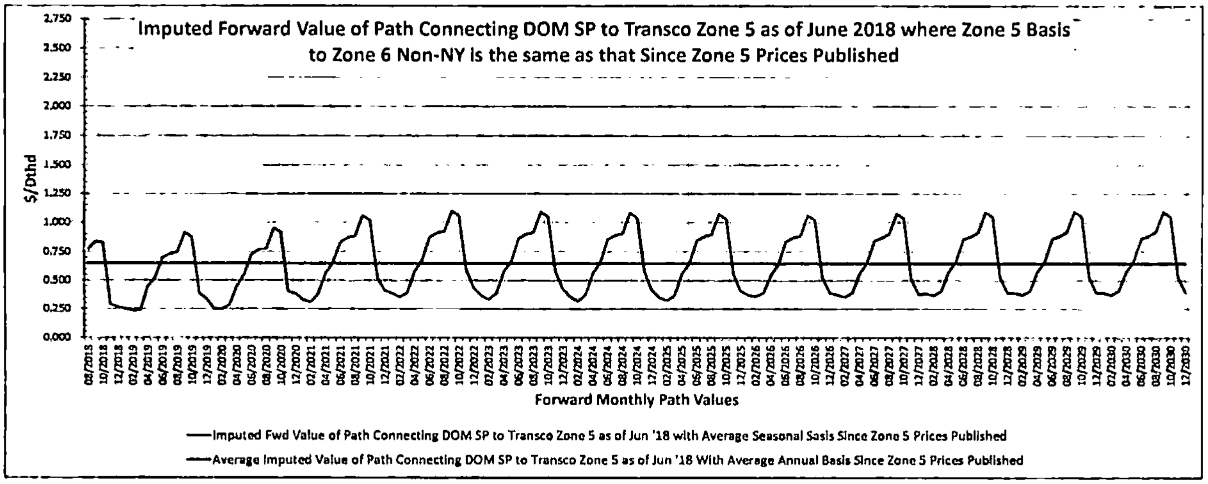

Chart 12

Q. What does Chart 12 tell you?

A. As can be seen in the above depiction of the Forward Value of the potential path connecting Dominion South Point to Transco Zone 5, when Average Seasonal and Average Annual basis relationships between Zone 5 and Zone 6 Non-NY (i.e., those that reflect the averages across the full period since Zone 5 prices began to be published—since Sept 2004—which notably include the 2014 to present period of depressed Dominion South Point basis and elevated Zone 5 basis relative to Zone 6 Non-NY) are used, the value to ratepayers plummets to less than $0.70 per Dthd. The implications of this analysis are that ratepayers are exposed to paying at least $0.70/Dthd ***more* than the value of the path** (assuming the most favorable $1.40 rate per Dthd for transportation on the proposed Atlantic Coast Pipeline applies) every day for 20 years. This amounts to a ratepayer exposure of over $1.53 billion in costs in excess of value. Moreover, should the potential Atlantic Coast Pipeline rate of $1.75 apply, or the $1.70 rate provided in the data response cited earlier apply, ***ratepayer excess cost*** over value rises to between $2.19

billion (in the $1.70 per Dthd case) and nearly $3 billion ($2.999 billion in the $1.75 per Dthd case) over 20 years.

Q. Of the four cases you have presented, which is the most likely to occur?

A. In my opinion, Case 4 presents the most likely depiction of the Forward Value of a potential Dominion South Point to Transco Zone 5 path.

Q. Did the Company provide any data from which you could make similar charts and assess the value and cost of a potential path from Dominion South Point to Transco Zone 5?

A. While the Company provided no analysis similar to what I have done above, it did provide data in two data responses from which I have made a similar forward-looking chart to those above. Those two responses were ER 8-11 (b) and ER 7-3 (c).

Q. Were you able to perform an analysis using these responses?

A. Yes. In ER 7-3 (c) the Company provided its forward prices for Dominion South Point and Transco Zone 5. From that response, I took the prices for the December 2019 through November 2039 period: the 20-year period of a potential contract for the potential path connecting Dominion South Point to Transco Zone 5. The prices I took were for Dominion South Point and Transco Zone 5, and I calculated a basis for that path by subtracting the Dominion South Point price from the Transco Zone 5 price to identify the basis—that is the value that such a path would have across the forward looking 20-year period. Then, from the Company's response to ER 8-11 (b), I took the cost that the Company is using for the creation of that path. That response indicated that the cost would be $1.70 per Dthd. Below is the chart generated from the Company's data.

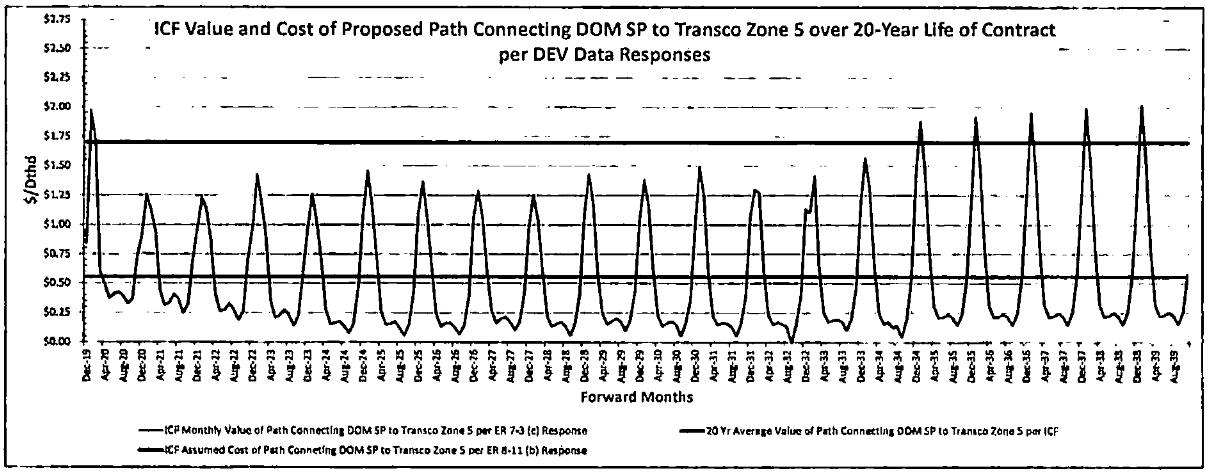

Chart 13

Q. What does Chart 13 tell you?

A. It tells me from the Company's own data that over the 20-year life of the contract, ratepayers will experience no net value from paying for the path connecting Dominion South Point to Transco Zone 5. In fact, the Company sets the average annual value at $0.55 per Dthd, while the cost to ratepayers, according to the Company, will be $1.70 per Dthd. Using the Company's data, the ***net cost***, as of its December 29, 2017 study date, is calculated to be $1.15 per Dthd. Applying this to a 300,000 Dthd subscription for 365 days per year for 20 years brings the 20-year ***excess of cost to value*** amount to $2.5 billion. On average, that is greater than $100 million per year.

Q. Moving on to the second area of your testimony, you stated that the Company should have, as part of its 2018 Plan, undertaken an evaluation of load duration curves for the purpose of identifying what resources and fuels would be the least-cost resources and fuels on an all-in cost basis to meet such load curves. Please elaborate on this point.

A. In my opinion, the Company should have examined its load duration curves and then matched resources – including fuel source – to match to the curves on a least-cost basis. Only in this way can the Company ensure that it is identifying the best matched resources, as well as the most reasonable means of fueling those resources based upon the expected load factor at which those resources will be utilized, taking into consideration minimization of fixed costs, where variable all-in fuel costs are more reasonable than (those all-in fuel costs are) when fixed and variable fuel costs are considered at projected load factors.

Q. Why does that matter?

A. Given the Company's increasing reliance on natural gas, as described in its 2018 Plan, and its apparent lack of explicit planning to provide for dual fuel capability at both its combined cycle and combustion turbine facilities, Company ratepayers are faced with potentially very high fixed costs to power units like the generic CTs identified in the Plan that will have very low load factors, i.e., these facilities will run very infrequently. This low-load factor reality makes the all-in cost per unit of natural gas actually used to generate electricity very high indeed.

Q. Did you generate indicative load duration curves in your analysis?

A. Yes. The first such curve that I generated based upon the Company's data was a recently experienced, maximum hourly load/demand curve.

Q. What is a Maximum Hourly Load curve?

A. Based upon data provided by the Company to Staff of hourly demand of DOM LSE for the years 2014, 2015, 2016, 2017 and 2018 year-to-date, I lined up every hourly Load/Demand table in calendar date and hour order. I eliminated the leap day in 2016.

Then I took the maximum demand expressed over that period in each hour of the period, and then with that max hourly demand I sorted from highest to lowest demand. Next, I plotted this Max Hourly Demand curve against existing round-the-clock generating resources. To gauge the steepness of this derived demand duration curve, I display only the highest 720 hours (i.e., equivalent of 30 days). Below is a chart depicting the results of the above exercise.

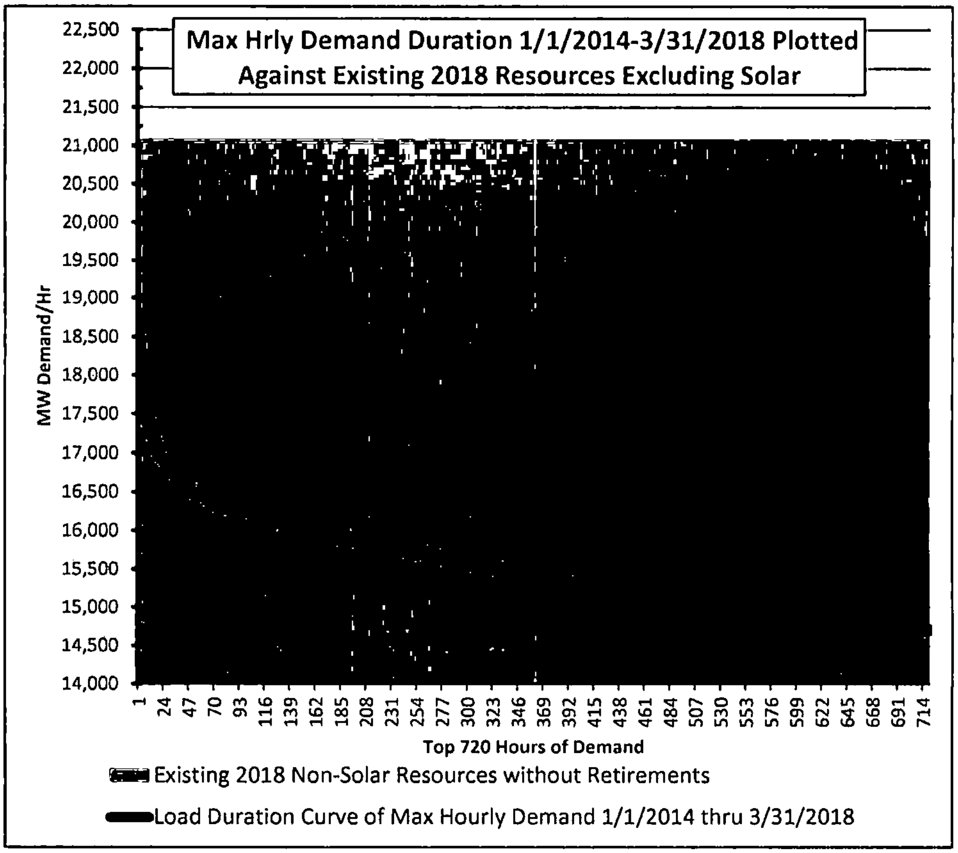

Chart 14

Q. Why did you do this?

A. What this sort of analysis allows you to determine is whether there has been a particular time of day and season of the year in which peak demand has occurred. Earlier in my testimony, I identified several basis blow-out periods beginning in 2014. Based on my understanding of the mechanics behind these blow-out periods, I thought it was likely that the Company would have experienced demand peaks during these same periods.

Q. What did you find?

A. I found that in recent years, the Company has experienced short-term demand spikes during winter early morning corresponding with extreme cold weather events like the Polar Vortex and the Bomb Cyclone. In addition, I found that 321 of the top 720 demand hours were winter hours. The range of demand in the top 720 hours, sorted in the manner described above, ran from a high of 18,434 MW on February 20, 2014 at 8:00 AM down to 14,704 MW on January 1, 2014 at 5:00 AM. This also means that for 8,040 hours, sorting the max demand expressed in any hour of the January 2014 thru March 31, 2018 period, the maximum demand was less than the 14,704 MW/hr., according to the data supplied by the Company.

Q. What is the significance of these findings?

A. A couple of things are significant. First, it is clear from this sort of demand duration analysis that the resources required to meet the top hours of expressed maximum demand have a very low load factor utilization. Second, given the hours of peak demand that have been expressed during extreme winter weather in 2014 and 2018, the addition of substantial solar will not address these "winter morning hours" demand coverage requirements.

Q. What is the problem the Company faces?

A. The problem that the Company faces, and one that it makes no mention of in the 2018 Plan, is that sometime in post 2022, with the planned retirement of its Yorktown 3 and Possum Point 5 (heavy oil peaking units), at between 5:00 AM and 9:00AM – with a heavy concentration around 8:00 AM on some winter day during an extreme weather event like the Polar Vortex or Bomb Cyclone, the Company will need to call on a resource to either add supply or subtract demand. The Company will need this resource for a few hours in any of the years between 2023 and at least 2028 (10 years from now) and will need it for at most an estimated 220 -225 hours per year out of 8,760 hours per year. In other words, the resources (both generation and associated fuel logistics resources) needed to meet a short, winter demand spike caused by an extreme weather event will be utilized at a very low load factor, i.e. they will operate very infrequently.

Q. How will the Company meet such an electric demand spike according to its 2018 IRP?

A. According to the IRP, the Company intends to rely on CTs to meet this demand.

Q. In your opinion, how should the Company address this problem?

A. In my opinion, the Company has multiple options that it should consider in the 2018 IRP. First, it should evaluate whether to keep online its 2 Peaker Heavy Oil units (total ~1,500 MW winter) because extreme weather demand spikes can most economically be met by those units. For instance, without retirements, the Company has 21,087 of Day-Round (i.e., non-solar) generating capacity versus 18,434 MW of load which was its highest winter hourly demand in 2014 (note 18,434 MW was also highest DOM LSE hourly demand). Thus, by keeping the 21,087 MW of existing generation, this level is projected to satisfy (absent anything else like demand response leading to demand reduction) projected requirements for an extreme winter weather event until winter of 2025/2026. Keeping the heavy oil-fired units available is also keeping the generation (plus fuel) that is the most economical on an all-in cost basis, because it does not require any additional pipeline capacity beyond that held today, to fuel generation to meet the demand.

Q. What about the Company's proposed CTs?

A. A second option for the Company would be to make all of its proposed CTs dual fueled so that they can run on diesel. The benefit of dual fueled CTs is that given the prevalence of electricity import capability from the rest of PJM, the option value of the dual fueled resource derives from the fact that not only may the dual fired CTs not be called on (when import capability exists), but the Company can also sell that dual-fueled resource in PJM's capacity performance market without having to commit to expensive long-term pipeline capacity. In other words, the reason for the Company to have dual fuel capability at its CTs is to avoid burdening Company ratepayers with the cost of additional pipeline capacity that has to be paid for 365 days a year but used only infrequently.

Q. Isn't installing dual fuel capability expensive?

A. Not on a comparative, all-in cost basis.

Q. What does all-in cost mean in this context?

A. By all-in cost, I mean the all-in cost per increment of solution to close the gap of unmet demand caused by an extreme winter weather event that could exist in the future. Let's use a hypothetical scenario. Assume for a moment that new pipeline capacity costs $1.40 per Dthd. That means to reserve such capacity it costs $511.00 per year to reserve 1 Dthd. Further, assume that this capacity is fully used 360 hours in a year, or the equivalent of 15 days per year. The all-in cost of the capacity when used is more than $36.00 per Dth used ($511.00 divided by 15 days). Add to that a winter time gas cost in

2029 of $3.97, and the total becomes nearly $40.00 per Dth actually used to make electricity.

Q. How does that cost, i.e., the cost of new pipeline capacity and gas, compare with the cost of fuel oil projected by the Company in the Plan?

A. The Company projects that fuel oil cost will be $18.00 per Dth (MMBtu) in 2026. Therefore, the cost of fueling the CTs in the winter using firm pipeline capacity plus the gas is projected to be fully twice the cost of using fuel oil ($40.00 per Dth vs. $18.00 per Dth). This is the reason I recommend that the Company evaluate fueling the CT units, and even any CC unit (beyond the one able to be accommodated with existing capacity) with fuel oil during the peak demand portions of future winter periods. As set forth in the table below, I calculated the relative cost (based upon Company estimates) of building oil-backup fueling facilities (including sufficient storage to hold four run days of fuel) sufficient to power a Combustion Turbine with a winter rating of 188 MW with oil during peak demand periods versus subscribing to capacity on the Atlantic Coast Pipeline to provide the same energy during peak periods. In this comparison, I also use Company estimates for cost of oil and cost of gas to arrive at an all-in cost comparison.

Modeling Comparative Cost of Dual Fuel Back up versus New Firm Pipeline Capacity

$/Kw Installation of Dual Fuel Storage 1/	kw/MW	Winter MW of Generating Unit 2/	Cost of Installing Dual Fuel Back-up	Heat Rate (Dth NG /MW) 3/	Dth/Hr	Dthd of Pipeline Capacity to Achieve Hourly Fuel Delivery	Cost/Dthd Subscription to New PL Capacity 4/	Days	Annual Cost of Firm Pipeline Capacity
$24.00	1,000	188	$4,512,000	11.2	2,106	50,534	$1.40	365	$25,823,078

Hours Run per Year	Equiv. Days Run per Year	Oil Cost per Dth 5/	Dth Oil Used	Cost Oil Used	Dth Gas Used	Gas Cost per Dth 6/	Cost Gas Used		Fuel Cost Differential (Oil Cost minus Gas Cost)	Years	Savings of Dual Fuel over Life of New PL Capacity Contract
218.0	9.1	$18.00	553,284	$9,959,112	459,021	$3.97	$1,821,548		$8,137,564		
							Annual Savings/Yr over PL Cost		[redacted]	20	[redacted]
							Simple Payback of Installation of Dual Fuel Capability in Yrs		0.26		

11.2 Gas Heat Rt
13.5 Oil Heat rate
1.21 Heat Rate Ratio of Oil Dth to Gas Dth
https://www.eia.gov/electricity/annual/html/epa_08_02.html

1/ From Company Response to Staff Set 9-107 (f)
2/ Winter rating of a CT equivalent to Remington 3 Unit per Company Data
3/ Personal knowledge of latest generation Combined Cycle Plants
4/ Based upon estimated Foundation Shipper Rate on ACP as a proxy @ 80% of $1.75 ACP Recourse Rate
5/ No.2 Fuel Oil Cost Estimate per Company Projections 2026
6/ Winter Month (Dec-Feb Avg) based upon Company Projections of DOM SP in 2029 Shaped per CME 2026 Futures

Table 1

Q. What does Table 1 show?

A. As can be seen from this comparison, the annual cost of pipeline capacity subscription to supply a 188 MW CT is $25.8 million. While the annual cost of firing with oil for an estimated 218 winter hours that such unit may be called upon to run is $8.2 million higher than the 218 hours of natural gas, there is an annual savings (even with a higher fuel oil cost) of $17.7 million. This means that the cost of installation is paid back in simple payback terms in less than a third of a year. This relative cost savings over a 20 year term of pipeline capacity subscription would mean that *<u>for every 188 MW CT the Company proposes to install ratepayers are at least $350 million better off with the dual fuel option.</u>* In addition, with respect to run time, I should note that not all CTs would run as many hours based upon the demand duration curve, thus leading to an even wider cost differential and ratepayer savings. I picked 2026 as the reference point for this comparison as it represents approximately the mid-point in time between 2019 and 2034.

Q. Are there any other attributes to dual fuel capability that the Company should consider in its 2018 IRP?

A. Yes. With the optionality that installed dual fuel capability gives, the Company could opportunistically avail itself of vaporized LNG from either of Cove Point, Elba Island or Piedmont (including Piedmont's planned addition of a 1 Bcfd vaporization facility). This opportunistic purchase and scheduling of LNG from either of these locations is possible because depending on the flow direction of Transco on any given winter day, such receipts would be delivered by displacement. In the gas business, displacement means the following: if net physical flow on Transco is north to south and a power plant is between the north and south points (i.e., is in Zone 5 between the northerly Zone 6 and the southerly Zone 4) then injecting gas at the bottom of Zone 5 (where Elba Island is located) means that the Elba Island gas goes to the south to Zone 4 while gas that would otherwise have to traverse Zone 6 and Zone 5 would be delivered to the Zone 5 plant(s). Likewise, should the net flow be from Zone 4 to the north, injecting gas at Cove Point into the Cove Point LNG pipeline and delivering that gas to Transco at the top of Zone 5 means that gas traversing Zone 5 on the way north to Zone 6, would be delivered to the plant(s) in Zone 5 while the Cove Point gas would go to the north. In either event, it means that no new firm pipeline capacity would be needed to obtain such supplies.

Q. Are there any other options that the Company should evaluate in its 2018 IRP?

A. Yes. I alluded to two options above that warrant some additional explanation. First, it is very likely that the Company could purchase energy from PJM to meet demand spikes caused by extreme winter weather. Nothing in the IRP suggests that PJM, a summer peaking regional transmission organization, would not have excess energy available during the winter months. In addition, demand response programs could sufficiently dampen the demand effect of an extreme weather event such that additional resources are not necessary. Finally, battery storage is another option that warrants consideration. The Company has not evaluated any of these options in the 2018 IRP.

Q. **Overall what is your recommendation about how the Company can meet the demand spikes identified by your load duration analysis?**

A. My overall recommendation is, in short, that the Company should meet demand spikes driven by extreme winter weather in the most reasonable, least-cost manner, which requires that the Company balance resources, their fuel requirements and the Company's load duration curves. In my opinion, in light of the presence of low load / utilization factors, the Company should minimize fixed costs associated with both the generating asset itself and the associated fuel and fuel logistics. The steeper the decline in demand from peak hours to less peak hours, the more a right-sized means of addressing those spikes is essential and new pipeline capacity will be a costly, burdensome option for ratepayers. And from what I have read in the 2018 Plan, the Company has done none of the balancing that I recommend.

Q. **Going back to your observation of the extreme weather-related demand spikes in 2014 and 2018, what else does your analysis show?**

A. It shows that when a 5:00 AM to 8:00 AM winter hours' demand spike hits (and the heavy oil plants are retired), not even the Atlantic Coast Pipeline will be able to address the need to fuel generation to meet the demand, because the Atlantic Coast Pipeline does not serve the plants that need the gas, i.e. it does not have a connection to the CT plant or plants that will be used to meet this peak winter early morning demand. It's that simple.

Q. Please explain what you mean and why that is important?

A. It is important because if the Company wants to fuel power plants at that precise time of the day, i.e. the 5:00 AM to 8:00 AM period on winter mornings during an extreme weather event, it has to have fuel. If the CT plant intended to meet this demand gap is only gas fired, the Company has to have firm pipeline capacity to run that CT plant, and if the Company has to have firm winter capacity, utility ratepayers will be asked to pay for it 365 days a year[5]. If the plant can be fired by natural gas or light fuel oil, like diesel generally, then the Company does not have to have firm natural gas pipeline capacity and it saves that fixed cost expense and, importantly, utility ratepayers do not have to pay that fixed cost expense.

Q. What are the conclusions of your testimony?

A. <u>First</u>, the Company did not study or present any analysis of the cause, frequency, duration or magnitude of natural gas price spikes and did not assess what infrastructure developments are already underway and under development that could reduce, if not eliminate, the frequency, duration, and magnitude of such price spikes. In my opinion, such an analysis is necessary for the Company to identify a reasonable least-cost planning scenario in its 2018 IRP.

<u>Second</u>, analyzing four scenarios for forward looking basis projections, two related to what those projections would have looked like in 2014 and two related to what

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[5] In the natural gas pipeline business it is widely recognized that aside from Florida and southernmost California pipelines' system demands peak in the November through March (i.e., winter) period. As a result, in order to reserve winter pipeline capacity, especially on fully subscribed pipelines, shippers have to agree to reserve and pay for 365 day per year service.

projections look like today, for the basis between different pricing locations, I calculated the *net cost* to Company ratepayers, (a net cost that is avoidable), of new pipeline capacity connecting Dominion South Point to Transco Zone 5 where the Company's generation facilities are located, i.e. the same path as the proposed Atlantic Coast Pipeline, to be as high as $3 billion over the next 20 years. I corroborated my analysis using natural gas price data provided by the Company which showed a net cost to Company ratepayers of the Atlantic Coast Pipeline to be $2.5 billion over the next twenty years. Based on these analyses, Company ratepayers will experience no net value from paying for the path connecting Dominion South Point to Transco Zone 5 as the Atlantic Coast Pipeline would.

Third, the Company presented no evidence that it examined either generation or associated fuel logistics load factors in its assessment of what is the least-cost generation scenario in its 2018 IRP. In my opinion, an examination of generation and associated fuel logistics load factors should be a required element of the Company's 2018 IRP.

Fourth, the Company did not present a cost justification for retirement of at least two of its units proposed to be retired totaling 1,597 MW (winter rating) of peaking capacity. The Company also fails to explicitly articulate, as part of its 2018 Plan, a plan for having dual fuel capability at all under-construction and planned future Natural Gas CC and CT units. Each of these options could eliminate the need to add any costly firm, pipeline capacity. In my opinion, a consideration of cost justification for retirement and consideration of the costs of dual fuel capability should be required elements of the 2018 IRP.

Fifth, the Company failed to assess the availability of vaporized LNG as a reasonable source of supply which could be delivered through existing lines on peak demand hours and days; thereby avoiding the fixed costs of additional pipeline capacity. In my opinion, the consideration of vaporized LNG delivered through existing lines on peak demand hours and days should be a required element of the 2018 IRP.

Sixth, had the Company analyzed its load serving requirements and projected load serving requirements with demand duration curves as part of their least-cost planning, it would see that the load factor of its projected demands is so low that meeting such demands with gas-fired only units is not prudent from a fixed-cost incurrence perspective. Multiple other alternatives are available to the Company, including not retiring certain heavy oil units, installing dual fueled CTs, power purchases from PJM, demand response, and battery storage that would provide a cost advantage over investment in new pipeline capacity to serve new gas-fired generation. In my opinion, consideration of these other alternatives to meet demand during peak hours and days should be a required element of the 2018 IRP.

Seventh, given the apparent failure of Company to identify the above enumerated costly risks to ratepayers and the_lack in this or last year's IRPs of any discussion of cost justification, or discussion of risk mitigation associated with these costly risks, the Company's has failed to fulfill its obligation to undertake both least-cost planning as well as to anticipate and plan for mitigating both known and knowable financial risks to ratepayers; as well as for planning for mitigating both known and knowable potential and likely financial risks to ratepayers.

Finally, based on my analysis of the Company's load duration curves, it is my opinion that the Company has sufficient pipeline capacity today to run both its existing and under construction Natural Gas CC units plus one generic Natural Gas CC unit.

Q. Does that conclude your testimony?

A. Yes.

Attachments

1. List of Prior Expert Testimony of Gregory Lander
2. Biography of Gregory Lander
3. Company Response to ER 8-11(b)
4. Company Response to ER 7-3(c)
5. Company Response to Staff 7-92(a)
6. Company Response to Staff 3-31 (Attachment to Staff 3-31 (KS).xlsx)
7. Staff 9-107(f)

Schedule EDF-01: Expert Testimony of Gregory M. Lander

Name of Case	Jurisdiction	Docket Number	Date
El Paso Natural Gas Company	Federal Energy Regulatory Commission	RP04-251-000	May 3, 2004 (Testimony)
El Paso Natural Gas Company	Federal Energy Regulatory Commission	RP08-426-000	May 19, 2009 (Answering Testimony) June 2, 2010 (Supplemental Answering Testimony)
El Paso Natural Gas Company	Federal Energy Regulatory Commission	RP10-1398-000	June 28, 2011 (Answering Testimony) March 4, 2014 (Answering Testimony)
Petition of Boston Gas Company and Colonial Gas Company, each d/b/a National Grid for Approval by the Department of Public Utilities for a Firm Transportation Contract with Algonquin Gas Transmission Company	Massachusetts Department of Public Utilities	13-157	December 12, 2013 (Direct Testimony)
Petition of Boston Gas Company d/b/a National Grid for Approval by the Department of Public Utilities of a twenty-year Firm Transportation Agreement with Tennessee Gas Pipeline Company, involving an expansion of Tennessee's interstate	Massachusetts Department of Public Utilities	15-34	June 5, 2015 (Direct Testimony)

pipeline running from Wright, New York to Dracut, Massachusetts, known at the Northeast Energy Direct Project			
Petition of Bay State Gas Company d/b/a Columbia Gas of Massachusetts for Approval by the Department of Public Utilities of a twenty-year Firm Transportation Agreement with Tennessee Gas Pipeline Company, involving an expansion of Tennessee's interstate pipeline running from Wright, New York to Dracut, Massachusetts, known at the Northeast Energy Direct Project	Massachusetts Department of Public Utilities	15-39	June 5, 2015 (Direct Testimony)
Petition of The Berkshire Gas Company for Approval of a Precedent Agreement with Tennessee Gas Pipeline Company, LLC, pursuant to G.L. c. 164, § 94A	Massachusetts Department of Public Utilities	15-48	June 5, 2015 (Direct Testimony)
Investigation of Parameters for Exercising Authority Pursuant to Maine Energy Cost Reduction Act, 35-A M.R.S.A. Section 1901	Maine Public Utilities Commission	2014-00071	July 11, 2014 (Direct Testimony)
Virginia Electric and Power Company's Integrated Resource Plan filing pursuant to Va. Code § 56-597 *et seq.*	Virginia Corporation Commission	PUR-2017-00051	August 11, 2017 (Direct Testimony)
In the Matter of the Laclede Gas Company's Request to Increase Its Revenues for Gas	Missouri Public Service Commission	**File No. GR-2017-0215**	September 8, 2017 (Direct Testimony)

Service In the Matter of the Laclede Gas Company d/b/a Missouri Gas Energy's Request to Increase Its Revenues for Gas Service		<u>**File No. GR-2017-0216**</u>	Consolidated and November 21, 2017 (Surrebuttal Testimony) Consolidated
Application of San Diego Gas & Electric Company (U902M) for Authority, Among Other Things, to Update its Electric and Gas Revenue Requirement and Base Rates Effective on January 1, 2019. Application of Southern California Gas Company (U904G) for Authority, Among Other Things, to Update its Gas Revenue Requirement and Base Rates Effective on January 1, 2019.	California Public Utilities Commission	Application 17-10-007 Application 17-10-008	Consolidated Direct Testimony May 14, 2018 Rebuttal Testimony June 8, 2018
Application of Virginia Electric and Power Company to revise its fuel factor pursuant to § 56-249.6 of the Code of Virginia	Virginia State Corporation Commission	PUR-2018-00067	Direct Testimony June 14, 2018
Application of Southern California Gas Company (U 904 G) and San Diego Gas & Electric Company (U 902 G) Regarding Feasibility of Incorporating Advanced Meter Data Into the Core Balancing Process	California Public Utilities Commission	Application 17-10-002	Direct Testimony July 2, 2018

SkippingStone

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Greg Lander, President
Skipping Stone LLC

Professional Summary:

As President of Skipping Stone Inc., Greg Lander is responsible for Strategic Consulting in the mergers and acquisition arena with numerous clients within the energy industry. Generally recognized in the energy industry as an expert, he has advised and/or given testimony at numerous Federal Energy Regulatory Commission (FERC), State, arbitration, and legal proceedings on behalf of clients and has advised as well as initiated standards formation before the Gas Industry Standards Board (GISB) (predecessor to the North American Energy Standards Board (NAESB)). As Founder, President, and Chief Technology Officer of TransCapacity Limited Partnership, he was responsible for conceiving, planning, managing, and designing Transaction Coordination Systems utilizing Electronic Data Interchange (EDI) between trading partners. As a founding member of GISB, he assisted in establishing protocols and standards within the Business Practices, Interpretations and Triage Subcommittees.

Professional Accomplishments:

- Handled all Due Diligence for purchaser (Loews Corp) in acquisitions of two interstate pipelines, one natural gas storage complex, and ethylene distribution and transmission systems (Texas Gas Transmission, Gulf South Pipeline, Petal Storage, Petrologistics, and Chevron Ethylene Pipeline) most in excess of $1 Billion. Developed purchaser's business case model, including rate/revenue models, forward contract renewal models, export basis modeling and revenue models, and operating cost and capex models. Coordinated Engineering and Environmental Due Diligence Teams integrating findings and assessments into final Diligence Reports.
- Assisted major electric retailer in 9 states with business case development for entry into North Eastern U.S. Commercial &Industrial natural gas marketing business. Identified market share of incumbents; retail registration process, billing processes; utility data exchange rules and procedures and developed estimates of addressable market by utility.
- Handled all economic Due Diligence for purchaser of large minority stake in Southern Star Gas Pipeline. Developed purchaser's business case model, including rate/revenue models and forward contract renewal models, assessed potential competitive by-pass of asset located in "pipeline alley", developed revenue models and operating cost and capex models. Coordinated Engineering, Pipeline Integrity, and Environmental Due Diligence Teams integrating findings and assessments into final Diligence Reports.
- Developed post-acquisition integration plans for inter-operability and alterations to system operations to take advantage of opportunities presented by

synergistic facilities' locations and functions and complimentary contractual requirements. Implementation of plan resulted in fundamental changes to systems operations and improvement in systems, net revenues, capacity capabilities, and facilities utilization.

- Handled all economic analysis, modeling, and systems capability due diligence for potential purchaser in several preliminary or completed yet un-consummated pre-transaction investigations involving Panhandle Eastern, Northern Border, Bear Paw, Florida Gas, Transwestern, Great Lakes, Guardian, Midwestern, Viking, Southern Star, Columbia Gas, Midla, Targa (No. Texas), Ozark, ANR, Falcon Gas Storage, Tres Palacios, Rockies Express, Norse Pipelines, Southern Pines, Leaf River, LDH (Mont Belvieu), Kinder Morgan Interstate, Trailblazer, Rockies Express and South Carolina Gas Transmission.
- Post Texas Gas Transmission and Gulf South Pipe Line acquisitions, assisted with all investigations involving assessments and proposals for realizing potential synergies with/from asset portfolio; rate case strategy development and alternate case development; and strategies around contract renewal challenges.
- Headed up due diligence team in acquisition of multi-state retail (residential) natural gas and electric book by Commerce Energy.
- Headed up due diligence team in acquisition of multi-state retail (C&I) natural gas book by Commerce Energy.
- Served as lead consultant for consortium of end-users, Local Distribution Companies, Power Generators, and municipalities in several major FERC Rate Cases, service restructuring, and capacity allocation proceedings involving a major Southwestern U.S. Pipeline.
- Served as lead consultant and expert witness for consortium of end-users, Local Distribution Companies, Power Generators, and municipalities in major FERC rate case under litigation involving decades-long disputes over service levels, cost allocation, and rate levels.
- Served as lead consultant for consortium of end-users and municipalities in major FERC rate case involving implementation of proposed rate design, cost allocation, and rate level changes.
- Developed and critiqued Rate Case Models for several pipeline proceedings and proposed proceedings (as consultant variously to both pipeline and shippers). Activities included modeling (and critiquing) new services' rates, costs, and revenues; responsibilities included development of various alternative cost allocation/rate designs and related service delivery scenarios.
- Handled all market assessment, forward basis research, and transportation competition modeling for several proposed major pipelines and laterals, including two $1 Billion+ Greenfields projects that went into construction and operation providing new outlets for growing southwestern shale production. (Gulf Crossing and Fayetteville Lateral).

- Assessed supply and demand balance for Southwestern US (OK, TX, Gulf Coast and LA) including assessment of future demand and supply displacement associated with West Texas wind power development and its likely impact on pipeline export capacity from region.
- Assessed supply and demand balance for Northeast to Gulf Coast capacity additions including assessment of Gulf Coast demand and export growth and its likely impact on forward basis.
- Assessed start-up gas supply needs for Appalachian coal fired power plant, resulting in installation of on-site LNG storage and gasification to address lack of enough firm pipeline capacity to meet need.
- Assessed installed and projected wind-turbine capacity in ERCOT and its eventual impact on Texas electric market as wind power output approaches minimum ERCOT load levels.
- Designed and developed EDI based data collection system, data warehouse and web-based delivery system (www.capacitycenter.com) for delivering capacity data collected from pipelines to shippers, marketers, traders, and others interested in capacity information to support business operations and risk-management requirements.
- Designed pipeline capacity release deal integrating settlement system for firm users, including design and development for information services delivery on a transaction fee basis.
- Assisted client in developing proposals to increase pipeline capacity responsiveness and proposed market fixes that would create price signals around sub-day non-ratable flows, including rate proposals, sub-day capacity release markets, and measures to address advance reservation of capacity for electric generation fuel to meet sub-day generation demands.
- Developed "universal capacity contract" data model for storage of all interstate capacity contract transactions from all 60 major interstates in single database.
- Led design effort culminating in FERC-mandated datasets defining pipeline capacity rights, (including receipt capacity, mainline capacity, delivery capacity, segmentation rights, in and out of path capacity rights), Operationally Available Capacity, Index of Customers, and Transactional Capacity Reports (through GISB).
- Assembled consortium of utilities to investigate and develop large high-deliverability salt storage cavern in desert southwest (Desert Crossing). As LLC's Acting Manager, was responsible for developing business case and economic models; handling all partner issues and reporting; coordinating all field engineering, facilities design, planning and siting; and managing all environmental, legal, engineering and regulatory activities. Wrote FERC Tariff. Brought project to NEPA Pre-Filing Stage and conducted non-binding Open Season, as well as assisted with prospective shipper negotiations. Project

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cancelled due to 2001 "California Energy Crisis" and contemporaneous Enron and energy trading sector implosions.

- Designed comprehensive retail energy transaction and customer acquisition data model, process flow, and transaction repository for web-based customer acquisition and customer enrollment intermediary.
- Experienced in negotiation and drafting (from both seller side and buyer side) of firm supply, firm transportation, firm storage, and power supply and capacity agreements for numerous entities including project financed IPPs and for new greenfields pipeline and expansion of storage system.
- Provided market entry assessment for large international manufacturing and service company seeking to enter U.S. micro-grid, combined heat and power, and integrated solar, gas & battery markets.
- Conducted interstate pipeline capacity utilization analysis for New England following winter of 2013/2014 price fly-up.
- Conducted PJM East interstate gas pipeline capacity utilization and comparative analysis between pipelines with standard NAESB nominating cycles versus those with near hourly scheduling practices.
- Conducted requirements analysis for several firms pursuing software selection of energy transaction systems.
- Instrumental in the formation of the GISB. Member of industry team that lead the development of the proposal for and bylaw changes related to the formation of NAESB.
- Provided support to numerous clients and clients' attorneys in disputes involving capacity contracts, capacity rights allocations, tariffs, rate cases, intellectual property rights cases, and supply contract proceedings as both up-front and behind the scenes expert.

<u>Associations and Affiliations:</u>

Longest serving Member of Board of Directors for NAESB and prior to that GISB - ~~20~~ years.

GISB Committees: Former Chairman, Business Practices Subcommittee – drafted approximately 450+ initial industry standards that are now codified FERC regulations (Order 567); Former Chairman, Interpretations Subcommittee – drafted and led adoption process for first 50+ standards interpretations; Former Chairman, Triage Subcommittee; Title Transfer Tracking Task Force; Order 637 GISB Action Subcommittee; and industry Common Codes Subcommittee. Currently member of NAESB Wholesale Gas Quadrant Executive Committee and of NAESB Parliamentary Committee

Past and Affiliations and Associated Accomplishments:

1981-1989: One of five initial employees of Citizens Energy Corporation, Boston Mass. Responsible for starting and growing Citizens Gas Supply, one of the first independent gas marketers of the early 1980's, into $200MM+ annual operation. Successfully lobbied for pipeline Open Access (Orders 436 and 636), introduction of pipeline Affiliated Marketer rules of conduct (Order 497), and Open Access to pipeline operational information (Order 563).

1989-1993: Independent Consultant - Natural Gas Projects, Pipeline Rate Cases, Project Financed Contract negotiations, and Independent Power markets

1993 – 1999: Founder and President, TransCapacity Service Corp – Software products and services related to pipeline capacity trading, nomination, and contracting. Raised $17 MM from industry player to establish TransCapacity. Successfully lobbied for Pipeline restructuring and formation of capacity release market (Order 636). Sold to Skipping Stone.

1999 – 2004: Principal and Partner, Skipping Stone – Energy market consultants

2004 – 2008: President of Skipping Stone following purchase of Skipping Stone by Commerce Energy, Inc.

2008: Repurchased Skipping Stone from Commerce Energy, Reformulated Skipping Stone as LLC with Peter Weigand

2008 to Present: President and Partner, Skipping Stone. In addition to handling book of clients, responsible for all Banking, Accounting, Operations, Risk Management and contract matters for Skipping Stone.

Education:

1977: Hampshire College, Amherst, MA; Bachelor of Arts

Publication:

2013: Synchronizing Gas & Power Markets - Solutions White Paper

Virginia Electric and Power Company
Case No. PUR-2018-00065
Environmental Respondents
Eighth Set

The following response to Question No. 11 of the Eighth Set of Interrogatories and Requests for Production of Documents Propounded by the Environmental Respondents received on July 11, 2018 has been prepared under my supervision.

Maria F. Scheller
Vice President and Director
ICF

Question No. 11

Please reference the Company's response to Staff Set 8-103.

a) Why did the Company not include the Mountain Valley Pipeline or its "generic" equivalent in its planning assumptions?

b) Please provide the firm transportation cost assumptions for the "West Virginia to Virginia and North Carolina Generic" pipeline addition that traverses the Atlantic Coast Pipeline route.

c) Please clarify whether the Company's planning assumptions included ***both*** the actual Atlantic Coast Pipeline ***and*** the "West Virginia to Virginia and North Carolina Generic" pipeline addition that traverses the Atlantic Coast Pipeline route or ***only*** the "West Virginia to Virginia and North Carolina Generic" pipeline addition that traverses the Atlantic Coast Pipeline route.

Response:

(a) As of October 2017 when the assumptions for the analysis were finalized, neither the Mountain Valley Pipeline nor the Atlantic Coast Pipeline (ACP) met the criteria for inclusion as identified in the response to ER Set 3-1 and as such, neither were included. However, ICF's gas market simulation analysis identified a need for pipeline expansion in the area. In particular, the ICF simulations indicated the greatest benefits would be from a route leading into the Carolinas. In such situations where a known pipeline project does not meet inclusion criteria but a need is identified, ICF will rely on market information to the extent possible to reflect a generic pipeline addition. As the ACP concluded in the Carolinas while Mountain Valley ended in Virginia, the routing for ACP was identified by ICF as preferable for representation of a generic project at that time.

(b) ICF assumed a firm transportation tariff of $1.70/MMBtu from West Virginia to North Carolina for the "West Virginia to Virginia and North Carolina Generic" pipeline addition when the project comes online.

(c) The ACP project did not meet criteria for inclusion in the gas market simulation analysis as of October 2017 and was therefore not included. A generic pipeline addition that traversed the ACP route ("West Virginia to VA and NC") was included.

Virginia Electric and Power Company
Case No. PUR-2018-00065
Environmental Respondents
Seventh Set

The following response to Question No. 3 (c) of the Seventh Set of Interrogatories and Requests for Production of Documents Propounded by the Environmental Respondents received on July 3, 2018 has been prepared under my supervision.

Steven Jones
Manager, Energy Market Analysis
Dominion Energy Services, Inc.

Question No. 3

Request 7-3. Refer to DOM VA's response to ER 3-19 where the Company states "No." [*sic*] The PLEXOS model uses gas commodity prices based on each gas-fired generating resource access to supply points." Please answer the following questions and provide the requested information:

C) Please identify the source of the pricing provided in response to part b.

Response:

(c) The source of the pricing provided in response to subpart (b) of this request is the natural gas price forecast used in analysis of the 2018 Plan. The forecast relies on forward market prices as of December 29, 2017, for the first 18 months of the Study Period and then blend the forward prices with ICF estimates for the next 18 months. Beyond the first 36 months, the Company used the ICF commodity price forecast exclusively. The price forecast are provided in Attachment ER Set 7-3 (c) (SJ).

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Market Date 28-Dec-17

				2	3	4	5	6	7	8	9	10	11	13	14	15	16
Month	% Market	% ICF		Henry Hub	Dom GP	TCO Pool	ZONNY	Zone 6	Leidy	Zone 4	Dom GP Deld	TCO Pool Deld	ZONNY Deld	Zone 6 Deld	Leidy Deld	Zone 4 Deld	Tetco M2 Deld
1	100%	0%	Jan-18	$2.05	[illegible]	[illegible]	$2.73	$2.81	[illegible]	[illegible]	$2.40	$2.74	$3.99	$5.48	$2.45	$2.84	$2.32
2	100%	0%	Feb-18	$2.05	[illegible]	[illegible]	$3.40	$3.20	[illegible]	[illegible]	$2.57	$2.73	$3.33	$5.15	$2.48	$2.84	$2.40
3	100%	0%	Mar-18	$2.81	[illegible]	[illegible]	$0.70	$0.80	[illegible]	[illegible]	$2.81	$2.67	$3.81	$3.77	$2.41	$2.88	$2.46
4	100%	0%	Apr-18	$2.75	[illegible]	[illegible]	[illegible]	$0.04	[illegible]	[illegible]	$2.32	$2.60	$2.67	$2.78	$2.20	$2.73	$2.24
5	100%	0%	May-18	$2.74	[illegible]	[illegible]	[illegible]	$0.18	[illegible]		$2.27	$2.51	$2.50	$2.93	$2.18	$2.71	$2.12
6	100%	0%	Jun-18	$2.77	[illegible]	[illegible]	[illegible]	$0.10	[illegible]		$2.25	$2.52	$2.59	$2.88	$2.17	$2.72	$2.09
7	100%	0%	Jul-18	$2.80	[illegible]	[illegible]	[illegible]	$0.02	[illegible]	[illegible]	$2.29	$2.83	$2.73	$2.83	$2.14	$2.75	$2.11
8	100%	0%	Aug-18	$2.81	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$2.23	$2.48	$2.69	$2.71	$2.10	$2.78	$1.97
9	100%	0%	Sep-18	$2.79	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$2.07	$2.46	$2.38	$2.71	$1.95	$2.74	$1.79
10	100%	0%	Oct-18	$2.81	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$2.17	$2.48	$2.40	$2.78	$2.08	$2.78	$1.85
11	100%	0%	Nov-18	$2.47	[illegible]	[illegible]	[illegible]	$0.15		[illegible]	$2.29	$2.59	$2.84	$3.01	$2.23	$2.83	$2.25
12	100%	0%	Dec-18	$3.00	[illegible]	[illegible]	$0.72	$0.78	[illegible]	[illegible]	$2.83	$2.69	$3.72	$3.77	$2.44	$2.97	$2.44
13	100%	0%	Jan-19	$3.08	[illegible]	[illegible]	$2.57	$2.53	[illegible]	[illegible]	$2.70	$2.78	$5.65	$5.61	$2.87	$3.04	$2.67
14	100%	0%	Feb-19	$3.08	[illegible]	[illegible]	$2.30	$2.33	[illegible]	[illegible]	$2.67	$2.78	$5.45	$5.38	$2.58	$3.02	$2.62
15	100%	0%	Mar-19	$3.00	[illegible]	[illegible]	$0.42	$0.31	[illegible]		$2.56	$2.70	$3.41	$3.31	$2.48	$2.94	$2.42
16	100%	0%	Apr-19	$2.88	[illegible]	[illegible]	[illegible]	$0.14	[illegible]	[illegible]	$2.30	$2.36	$2.81	$2.83	$2.23	$2.87	$2.40
17	100%	0%	May-19	$2.87	[illegible]	[illegible]	[illegible]	$0.14	[illegible]	[illegible]	$2.23	$2.31	$2.23	$2.80	$2.14	$2.84	$2.28
18	100%	0%	Jun-19	$2.88	[illegible]	[illegible]	[illegible]	$0.03	[illegible]	[illegible]	$2.18	$2.30	$2.24	$2.72	$2.06	$2.85	$2.12
19	83%	0%	Jul-19	$2.78	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$2.18	$2.28	$2.81	$2.58	$2.07	$2.72	$1.99
20	80%	11%	Aug-19	$2.70	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$2.18	$2.23	$2.84	$2.81	$2.03	$2.77	$2.00
21	84%	16%	Sep-19	$2.80	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$1.99	$2.17	$2.33	$2.72	$1.90	$2.77	$1.88
22	70%	21%	Oct-19	$2.63	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$2.10	$2.22	$2.44	$2.88	$2.02	$2.83	$1.95
23	74%	26%	Nov-19	$2.94	[illegible]	[illegible]	$0.01	[illegible]	[illegible]	[illegible]	$2.82	$2.47	$2.85	$2.88	$2.24	$2.82	$2.27
24	80%	27%	Dec-19	$3.18	[illegible]	[illegible]	$0.73	$0.28	[illegible]	$0.00	$2.57	$2.65	$3.88	$3.41	$2.40	$3.18	$2.81
25	63%	37%	Jan-20	$3.18	[illegible]	[illegible]	$3.32	$1.40		$0.00	$2.88	$2.54	$5.48	$4.58	$2.47	$3.17	$2.50
26	58%	42%	Feb-20	$3.14	[illegible]	[illegible]	$2.00	$1.14		$0.00	$2.57	$2.82	$5.13	$4.27	$2.40	$3.14	$2.49
27	53%	47%	Mar-20	$3.08	[illegible]	[illegible]	$0.48	[illegible]	[illegible]	[illegible]	$2.46	$2.40	$3.56	$3.00	$2.38	$3.07	$2.40
28	47%	53%	Apr-20	$2.94	[illegible]	[illegible]	$0.02	[illegible]	[illegible]	$0.01	$2.40	$2.34	$2.86	$2.89	$2.31	$2.85	$2.48
29	42%	58%	May-20	$3.05	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.01	$2.47	$2.42	$2.78	$2.88	$2.38	$3.07	$2.47
30	37%	63%	Jun-20	$3.18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$2.81	$2.60	$2.88	$2.91	$2.42	$3.19	$2.47
31	32%	68%	Jul-20	$3.31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.00	$2.57	$2.80	$3.28	$2.98	$2.48	$3.43	$2.48
32	26%	74%	Aug-20	$3.37	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.11	$2.57	$2.50	$3.22	$2.97	$2.47	$3.48	$2.48
33	21%	79%	Sep-20	$3.34	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$2.34	$2.36	$2.74	$2.87	$2.22	$3.85	$2.23
34	16%	84%	Oct-20	$3.40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.03	$2.84	$2.57	$3.20	$2.81	$2.43	$3.42	$2.47
35	11%	89%	Nov-20	$3.78	[illegible]	[illegible]	$0.63	[illegible]	[illegible]	$0.02	$2.98	$2.98	$4.27	$3.71	$2.88	$3.77	$2.83
36	0%	95%	Dec-20	$3.86	[illegible]	[illegible]	$1.29	$0.17	[illegible]	$0.06	$3.22	$3.21	$5.25	$4.13	$3.10	$4.01	$3.17
37	0%	100%	Jan-21	$4.11	[illegible]	[illegible]	$2.97	$0.28	[illegible]	$0.06	$3.14	$3.10	$7.08	$4.40	$2.84	$4.17	$3.09
38	0%	100%	Feb-21	$4.02	[illegible]	[illegible]	$2.15	$0.17	[illegible]	$0.05	$3.06	$3.01	$6.17	$4.18	$2.87	$4.07	$2.99
39	0%	100%	Mar-21	$3.88	[illegible]	[illegible]	$0.94	$0.08	[illegible]	$0.03	$3.02	$3.00	$4.81	$3.86	$2.98	$3.91	$2.98
40	0%	100%	Apr-21	$3.48	[illegible]	[illegible]	$0.04	[illegible]	[illegible]	$0.04	$2.64	$2.62	$3.53	$3.08	$2.57	$3.83	$2.58
41	0%	100%	May-21	$3.40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$2.61	$2.48	$3.03	$2.83	$2.38	$3.44	$2.45
42	0%	100%	Jun-21	$3.45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$2.49	$2.48	$2.94	$2.83	$2.83	$3.52	$2.41
43	0%	100%	Jul-21	$3.52	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.11	$2.64	$2.61	$3.39	$3.05	$2.48	$3.63	$2.57
44	0%	100%	Aug-21	$3.53	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.12	$2.62	$2.58	$3.29	$2.98	$2.43	$3.66	$2.85
45	0%	100%	Sep-21	$3.38	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.08	$2.03	$1.94	$2.34	$2.28	$1.78	$3.40	$1.83
46	0%	100%	Oct-21	$3.48	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$2.42	$2.37	$3.05	$2.74	$2.20	$3.53	$2.34
47	0%	100%	Nov-21	$3.08	[illegible]	[illegible]	$0.63	[illegible]	[illegible]	$0.02	$2.73	$2.68	$4.32	$3.42	$2.50	$3.73	$2.85
48	0%	100%	Dec-21	$3.77	[illegible]	[illegible]	$1.60	$0.12	[illegible]	$0.06	$2.81	$2.60	$3.57	$3.88	$2.68	$3.82	$2.84
49	0%	100%	Jan-22	$3.88	[illegible]	[illegible]	$3.70	$0.18	[illegible]	$0.04	$2.83	$2.78	$7.58	$4.07	$2.57	$3.93	$2.78
50	0%	100%	Feb-22	$3.83	[illegible]	[illegible]	$2.66	$0.11	[illegible]	$0.03	$2.79	$2.78	$6.48	$3.83	$2.49	$3.86	$2.72
51	0%	100%	Mar-22	$3.67	[illegible]	[illegible]	$1.06	[illegible]	[illegible]	$0.02	$2.76	$2.72	$4.72	$3.84	$2.82	$3.63	$2.60
52	0%	100%	Apr-22	$3.61	[illegible]	[illegible]	$0.12	[illegible]	[illegible]	$0.03	$2.66	$2.63	$3.63	$3.07	$2.45	$3.54	$2.50
53	0%	100%	May-22	$3.58	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.03	$2.63	$2.50	$3.09	$2.89	$2.42	$3.60	$2.50
54	0%	100%	Jun-22	$3.63	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.06	$2.59	$2.58	$2.96	$2.88	$2.81	$3.67	$2.80
55	0%	100%	Jul-22	$3.96	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.13	$2.45	$2.81	$3.48	$3.16	$2.53	$4.00	$2.76
56	0%	100%	Aug-22	$3.96	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.11	$2.73	$2.88	$3.27	$3.01	$2.40	$4.06	$2.64
57	0%	100%	Sep-22	$3.80	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.08	$1.87	$1.89	$2.21	$2.18	$1.89	$3.53	$1.85
58	0%	100%	Oct-22	$3.74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$2.56	$2.52	$3.11	$2.82	$2.18	$3.78	$2.47
59	0%	100%	Nov-22	$4.03	[illegible]	[illegible]	$0.81	[illegible]	[illegible]	$0.03	$2.83	$2.93	$4.84	$3.64	$2.02	$4.00	$2.65
60	0%	100%	Dec-22	$4.05	[illegible]	[illegible]	$1.90	$0.12	[illegible]	$0.04	$3.18	$3.23	$5.96	$4.17	$2.73	$4.10	$3.12
61	0%	100%	Jan-23	$3.98	[illegible]	[illegible]	$3.96	$0.24	[illegible]	$0.06	$2.80	$2.78	$7.05	$4.23	$2.18	$4.04	$2.71
62	0%	100%	Feb-23	$3.96	[illegible]	[illegible]	$3.78	$0.15	[illegible]	$0.04	$2.83	$2.88	$6.74	$4.11	$2.80	$4.00	$2.85
63	0%	100%	Mar-23	$3.84	[illegible]	[illegible]	$1.84	[illegible]	[illegible]	$0.03	$2.90	$2.88	$4.88	$3.80	$2.42	$3.87	$2.83
64	0%	100%	Apr-23	$3.78	[illegible]	[illegible]	$0.12	[illegible]	[illegible]	$0.04	$2.85	$2.93	$3.88	$3.32	$2.70	$3.73	$2.89
65	0%	100%	May-23	$3.78	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$2.79	$2.71	$3.14	$2.80	$2.45	$3.73	$2.67
66	0%	100%	Jun-23	$3.78	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$2.84	$2.62	$3.18	$3.07	$2.82	$3.83	$2.77
67	0%	100%	Jul-23	$3.80	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.14	$2.79	$2.78	$3.32	$3.07	$2.35	$4.04	$2.71
68	0%	100%	Aug-23	$3.80	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.14	$2.67	$2.64	$3.11	$2.80	$2.18	$4.04	$2.58
69	0%	100%	Sep-23	$3.78	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.08	$2.18	$2.08	$2.31	$2.30	$1.81	$3.81	$2.04
70	0%	100%	Oct-23	$3.98	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.05	$2.89	$2.88	$3.38	$3.11	$2.45	$4.03	$2.80
71	0%	100%	Nov-23	$4.13	[illegible]	[illegible]	$0.77	[illegible]	[illegible]	$0.03	$3.00	$3.12	$4.42	$3.59	$2.09	$4.13	$3.01
72	0%	100%	Dec-23	$4.24	[illegible]	[illegible]	$1.19	$0.18	[illegible]	$0.03	$3.43	$3.45	$5.38	$4.40	$2.84	$4.23	$3.37
73	0%	100%	Jan-24	$4.47	[illegible]	[illegible]	$2.98	$0.23	[illegible]	$0.05	$3.44	$3.41	$7.09	$4.70	$2.69	$4.52	$3.37
74	0%	100%	Feb-24	$4.33	[illegible]	[illegible]	$1.66	$0.18	[illegible]	$0.05	$3.47	$3.44	$6.22	$4.40	$2.70	$4.35	$3.40
75	0%	100%	Mar-24	$4.00	[illegible]	[illegible]	$0.79	[illegible]	[illegible]	$0.03	$3.29	$3.28	$4.82	$4.00	$2.74	$4.09	$3.22
76	0%	100%	Apr-24	$4.18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$3.32	$3.31	$4.04	$3.60	$2.56	$4.23	$3.28
77	0%	100%	May-24	$3.46	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$2.80	$2.49	$2.78	$2.65	$2.18	$3.80	$2.43
78	0%	100%	Jun-24	$4.08	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.09	$3.45	$3.46	$3.62	$3.81	$2.84	$4.78	$3.38
79	0%	100%	Jul-24	$4.10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.18	$2.62	$2.60	$2.84	$2.80	$2.05	$4.29	$2.51
80	0%	100%	Aug-24	$3.90	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.14	$2.31	$2.28	$2.57	$2.44	$1.76	$4.13	$2.19
81	0%	100%	Sep-24	$3.88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.08	$2.18	$2.12	$2.30	$2.27	$1.72	$3.95	$2.03
82	0%	100%	Oct-24	$3.45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$2.22	$2.20	$2.95	$2.37	$1.73	$3.52	$2.13
83	0%	100%	Nov-24	$3.94	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.03	$2.61	$2.88	$3.87	$3.08	$1.97	$3.99	$2.51
84	0%	100%	Dec-24	$4.09	[illegible]	[illegible]	$1.82	$0.10	[illegible]	$0.06	$3.08	$3.08	$3.27	$4.16	$2.29	$4.10	$2.99
85	0%	100%	Jan-25	$4.06	[illegible]	[illegible]	$3.12	$0.21	[illegible]	$0.03	$2.84	$2.78	$7.21	$4.30	$2.12	$4.13	$2.74
86	0%	100%	Feb-25	$3.98	[illegible]	[illegible]	$2.12	$0.13	[illegible]	$0.03	$2.83	$2.88	$6.09	$4.09	$2.02	$4.00	$2.85
87	0%	100%	Mar-25	$3.72	[illegible]	[illegible]	$0.80	[illegible]	[illegible]	$0.03	$2.67	$2.62	$4.41	$3.40	$2.01	$3.74	$2.58
88	0%	100%	Apr-25	$4.37	[illegible]	[illegible]	$0.00	[illegible]	[illegible]	$0.04	$3.84	$3.83	$4.36	$3.91	$3.33	$4.41	$3.80
89	0%	100%	May-25	$3.80	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$3.00	$3.00	$3.25	$3.14	$2.38	$3.96	$2.82
90	0%	100%	Jun-25	$4.77	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.06	$3.70	$2.71	$3.85	$3.66	$3.25	$4.83	$3.62
91	0%	100%	Jul-25	$4.07	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.14	$2.81	$2.79	$3.14	$2.98	$2.31	$4.21	$2.71
92	0%	100%	Aug-25	$4.23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.14	$2.62	$2.59	$2.83	$2.74	$1.98	$4.37	$2.50
93	0%	100%	Sep-25	$4.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.03	$2.40	$2.42	$2.54	$2.55	$1.91	$4.45	$2.35
94	0%	100%	Oct-25	$3.91	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.03	$2.65	$2.84	$3.50	$2.80	$2.07	$3.96	$2.50
95	0%	100%	Nov-25	$4.37	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.03	$3.02	$3.03	$4.29	$3.43	$2.85	$4.43	$2.92
96	0%	100%	Dec-25	$4.53	[illegible]	[illegible]	$1.19	$0.07	[illegible]	$0.04	$3.48	$3.48	$5.72	$4.88	$2.78	$4.54	$3.41
97	0%	100%	Jan-26	$4.38	[illegible]	[illegible]	$2.90	$0.24	[illegible]	$0.05	$3.18	$3.11	$7.25	$4.53	$2.38	$4.54	$3.08
98	0%	100%	Feb-26	$4.18	[illegible]	[illegible]	$2.00	$0.18	[illegible]	$0.05	$3.30	$3.25	$6.18	$4.38	$2.60	$4.24	$3.23
99	0%	100%	Mar-26	$3.90	[illegible]	[illegible]	$0.06	[illegible]	[illegible]	$0.03	$3.08	$3.05	$4.82	$3.71	$2.58	$3.99	$3.02
100	0%	100%	Apr-26	$4.04	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$3.07	$3.80	$4.50	$3.85	$3.53	$4.58	$3.79
101	0%	100%	May-26	$4.34	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.06	$3.44	$3.42	$3.70	$3.67	$3.11	$4.30	$3.37
102	0%	100%	Jun-26	$4.67	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.08	$3.84	$3.94	$4.15	$4.10	$3.60	$4.85	$3.87
103	0%	100%	Jul-26	$3.88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.18	$2.90	$2.58	$2.90	$2.77	$2.11	$4.04	$2.61
104	0%	100%	Aug-26	$4.08	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.17	$2.58	$2.54	$2.81	$2.71	$2.04	$4.23	$2.48
105	0%	100%	Sep-26	$4.08	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$2.70	$2.60	$2.74	$2.77	$2.10	$4.64	$2.50
106	0%	100%	Oct-26	$3.98	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.03	$2.63	$2.63	$2.95	$2.80	$2.11	$4.00	$2.88
107	0%	100%	Nov-26	$4.80	[illegible]	[illegible]	$0.04	[illegible]	[illegible]	$0.04	$3.51	$3.49	$4.63	$3.60	$2.90	$4.64	$3.43
108	0%	100%	Dec-26	$4.72	[illegible]	[illegible]	$0.06	$0.07	[illegible]	$0.04	$3.73	$3.70	$5.68	$4.78	$3.00	$4.77	$3.60
109	0%	100%	Jan-27	$5.07	[illegible]	[illegible]	$2.82	$0.27	[illegible]	$0.08	$4.84	$4.02	$7.58	$5.33	$2.80	$5.12	$3.98
110	0%	100%	Feb-27	$4.81	[illegible]	[illegible]	$1.70	$0.20	[illegible]	$0.06	$4.05	$4.00	$6.61	$5.11	$2.98	$4.87	$3.99
111	0%	100%	Mar-27	$4.24	[illegible]	[illegible]	$0.20	[illegible]	[illegible]	$0.05	$3.60	$3.61	$5.13	$4.23	$2.97	$4.82	$3.56
112	0%	100%	Apr-27	$4.62	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$3.73	$3.73	$4.44	$3.90	$3.54	$4.67	$3.67
113	0%	100%	May-27	$4.43	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.06	$3.49	$3.50	$3.81	$3.65	$3.27	$4.43	$3.42
114	0%	100%	Jun-27	$4.98	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.09	$3.98	$4.01	$4.25	$4.18	$3.75	$5.05	$4.00
115	0%	100%	Jul-27	$3.95	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.17	$2.80	$2.80	$3.31	$3.10	$2.43	$4.11	$2.80
116	0%	100%	Aug-27	$4.04	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.17	$2.71	$2.71	$3.04	$2.88	$2.42	$4.11	$2.61
117	0%	100%	Sep-27	$3.80	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$2.82	$2.79	$2.90	$2.83	$2.51	$4.57	$2.70
118	0%	100%	Oct-27	$3.98	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$2.98	$2.98	$3.06	$2.83	$2.28	$3.60	$2.87
119	0%	100%	Nov-27	$4.31	[illegible]	[illegible]	$0.06	[illegible]	[illegible]	$0.03	$3.17	$3.18	$4.40	$3.98	$2.90	$4.38	$3.08
120	0%	100%	Dec-27	$4.43	[illegible]	[illegible]	$1.20	$0.11	[illegible]	$0.04	$3.25	$3.57	$5.62	$4.64	$3.21	$4.47	$3.48
121	0%	100%	Jan-28	$4.84	[illegible]	[illegible]	$3.03	$0.28	[illegible]	$0.06	$3.84	$3.80	$7.87	$5.10	$3.40	$4.90	$3.77
122	0%	100%	Feb-28	$4.70	[illegible]	[illegible]	$1.96	$0.15	[illegible]	$0.04	$3.82	$3.79	$6.08	$4.98	$3.50	$4.75	$3.78
123	0%	100%	Mar-28	$4.38	[illegible]	[illegible]	$0.08	[illegible]	[illegible]	$0.03	$3.46	$3.48	$4.93	$4.08	$3.21	$4.41	$3.42
124	0%	100%	Apr-28	$4.08	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$3.83	$3.61	$4.64	$4.06	$3.63	$4.72	$3.76
125	0%	100%	May-28	$4.70	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$3.85	$3.80	$3.80	$3.74	$3.37	$4.74	$3.63
126	0%	100%	Jun-28	$5.08	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.08	$4.40	$4.40	$4.72	$4.03	$4.34	$5.66	$4.41
127	0%	100%	Jul-28	$4.47	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.14	$3.14	$3.14	$3.40	$3.31	$2.84	$4.63	$3.04
128	0%	100%	Aug-28	$4.51	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.17	$2.95	$2.90	$3.23	$3.07	$2.61	$4.69	$2.83
129	0%	100%	Sep-28	$4.68	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$2.62	$2.64	$2.71	$2.68	$2.28	$4.78	$2.47
130	0%	100%	Oct-28	$4.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.03	$2.66	$2.59	$2.87	$2.78	$2.29	$4.05	$2.50
131	0%	100%	Nov-28	$4.29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$2.88	$2.90	$4.12	$3.29	$2.58	$4.33	$2.78
132	0%	100%	Dec-28	$4.43	[illegible]	[illegible]	$1.01	[illegible]	[illegible]	$0.05	$3.33	$3.33	$5.44	$4.42	$2.94	$4.47	$3.25
133	0%	100%	Jan-29	$4.65	[illegible]	[illegible]	$2.62	$0.29	[illegible]	$0.08	$3.48	$3.48	$7.47	$4.83	$3.10	$4.71	$3.42
134	0%	100%	Feb-29	$4.62	[illegible]	[illegible]	$1.60	$0.18	[illegible]	$0.08	$3.63	$3.50	$6.32	$4.70	$3.17	$4.67	$3.48
135	0%	100%	Mar-29	$4.25	[illegible]	[illegible]	$0.43	[illegible]	[illegible]	$0.03	$3.20	$3.17	$4.80	$3.78	$2.89	$4.23	$3.12
136	0%	100%	Apr-29	$4.73	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$3.80	$3.88	$4.58	$4.13	$3.70	$4.77	$3.63
137	0%	100%	May-29	$4.73	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.05	$3.78	$3.77	$4.07	$3.91	$3.54	$4.78	$3.60
138	0%	100%	Jun-29	$5.07	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.05	$4.04	$4.05	$5.18	$5.11	$4.71	$5.06	$4.86
139	0%	100%	Jul-29	$4.85	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.18	$3.65	$3.69	$4.03	$3.80	$3.30	$5.03	$3.58
140	0%	100%	Aug-29	$4.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.18	$3.88	$3.88	$3.88	$3.73	$3.27	$5.10	$3.45
141	0%	100%	Sep-29	$3.50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.08	$3.34	$3.29	$3.50	$3.44	$3.04	$5.07	$3.22
142	0%	100%	Oct-29	$4.23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.08	$3.05	$3.08	$3.51	$3.23	$2.78	$4.28	$2.98
143	0%	100%	Nov-29	$4.82	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$3.39	$3.30	$4.78	$3.82	$3.14	$4.89	$3.30
144	0%	100%	Dec-29	$4.68	[illegible]	[illegible]	$1.25	$0.11	[illegible]	$0.04	$3.73	$3.80	$5.81	$4.78	$3.40	$4.72	$3.88
145	0%	100%	Jan-30	$4.90	[illegible]	[illegible]	$2.81	$0.33	[illegible]	$0.07	$3.85	$3.83	$7.71	$5.23	$3.53	$4.97	$3.77
146	0%	100%	Feb-30	$4.78	[illegible]	[illegible]	$1.79	$0.19	[illegible]	$0.08	$3.89	$3.80	$6.87	$4.97	$3.53	$4.84	$3.75
147	0%	100%	Mar-30	$4.80	[illegible]	[illegible]	$0.04	[illegible]	[illegible]	$0.08	$3.57	$3.98	$6.04	$4.19	$3.30	$4.54	$3.50
148	0%	100%	Apr-30	$4.57	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.06	$3.65	$3.65	$4.87	$3.87	$3.44	$4.81	$3.58
149	0%	100%	May-30	$4.63	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$3.57	$3.57	$3.89	$3.71	$3.34	$4.68	$3.60
150	0%	100%	Jun-30	$3.92	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$3.63	$3.63	$4.67	$4.70	$4.37	$5.81	$4.84
151	0%	100%	Jul-30	$4.86	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.08	$3.38	$3.36	$3.72	$3.55	$3.00	$5.08	$3.26
152	0%	100%	Aug-30	$5.10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.21	$3.44	$3.41	$3.73	$3.58	$3.11	$5.32	$3.31
153	0%	100%	Sep-30	$5.32	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.08	$3.14	$3.14	$3.32	$3.28	$2.87	$5.47	$3.00
154	0%	100%	Oct-30	$4.48	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.05	$3.05	$3.04	$3.44	$3.21	$2.74	$4.54	$2.94
155	0%	100%	Nov-30	$4.79	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$3.31	$3.32	$4.83	$3.80	$3.03	$4.82	$3.30
156	0%	100%	Dec-30	$4.94	[illegible]	[illegible]	$0.96	$0.13	[illegible]	$0.04	$3.74	$3.81	$5.89	$4.73	$3.33	$4.98	$3.65
157	0%	100%	Jan-31	$4.89	[illegible]	[illegible]	$3.14	$0.31	[illegible]	$0.08	$3.74	$3.70	$8.06	$5.23	$3.42	$5.08	$3.88

19	83%
20	80%
21	84%
22	70%
23	74%
24	80%
25	63%
26	58%
27	53%
28	47%

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158	0%	100%	Feb-31	$4.88	[illegible]	[illegible]	$1.90	$0.19	[illegible]	$0.00	$3.60	$3.77	$6.80	$5.04	$3.81	$4.90	$3.73
159	0%	100%	Mar-31	$4.98	[illegible]	[illegible]	$0.48	[illegible]	[illegible]	$0.03	$3.48	$3.48	$5.03	$4.05	$3.22	$4.81	$3.41
160	0%	100%	Apr-31	$4.88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.05	$3.69	$3.69	$4.41	$3.91	$3.49	$4.67	$3.62
161	0%	100%	May-31	$4.86	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.05	$3.88	$3.88	$4.19	$4.02	$3.64	$5.03	$3.79
162	0%	100%	Jun-31	$3.73	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.10	$4.51	$4.02	$4.74	$4.67	$4.25	$5.82	$4.42
163	0%	100%	Jul-31	$4.79	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.20	$3.17	$3.19	$3.49	$3.32	$2.85	$4.80	$3.04
164	0%	100%	Aug-31	$6.14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.22	$3.29	$3.28	$3.86	$3.42	$2.95	$5.36	$3.18
165	0%	100%	Sep-31	$6.79	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.08	$3.81	$3.53	$3.71	$3.67	$3.20	$3.88	$3.45
166	0%	100%	Oct-31	$4.88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.08	$3.25	$3.24	$3.84	$3.41	$2.95	$4.74	$3.14
167	0%	100%	Nov-31	$6.08	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$3.54	$3.53	$4.78	$3.92	$3.23	$6.10	$3.42
168	0%	100%	Dec-31	$6.34	[illegible]	[illegible]	$0.06	[illegible]	[illegible]	$0.08	$4.01	$4.00	$6.20	$5.00	$3.87	$5.30	$3.80
169	0%	100%	Jan-32	$6.13	[illegible]	[illegible]	$3.05	$0.08	[illegible]	$0.08	$3.90	$3.90	$8.18	$5.20	$3.55	$5.10	$3.81
170	0%	100%	Feb-32	$6.08	[illegible]	[illegible]	$1.67	$0.20	[illegible]	$0.08	$4.03	$3.99	$7.00	$5.29	$3.71	$5.14	$3.86
171	0%	100%	Mar-32	$4.81	[illegible]	[illegible]	$0.44	[illegible]	[illegible]	$0.04	$3.66	$3.65	$5.25	$4.28	$3.39	$4.83	$3.80
172	0%	100%	Apr-32	$4.66	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.05	$3.69	$3.67	$4.41	$3.91	$3.47	$4.73	$3.01
173	0%	100%	May-32	$6.22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.06	$4.01	$4.01	$4.31	$4.16	$3.76	$6.23	$3.82
174	0%	100%	Jun-32	$6.68	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.11	$4.80	$4.81	$4.72	$4.67	$4.22	$5.99	$4.40
175	0%	100%	Jul-32	$4.80	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.23	$2.76	$2.75	$3.06	$2.93	$2.41	$5.03	$2.83
176	0%	100%	Aug-32	$6.10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.24	$3.05	$3.00	$3.31	$3.18	$2.87	$6.34	$2.80
177	0%	100%	Sep-32	$6.96	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.18	$2.67	$2.73	$2.90	$2.87	$2.43	$6.05	$2.84
178	0%	100%	Oct-32	$4.70	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.06	$3.02	$3.00	$3.39	$3.17	$2.88	$4.82	$2.80
179	0%	100%	Nov-32	$6.18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.04	$3.54	$3.35	$4.83	$3.74	$2.98	$5.21	$3.20
180	0%	100%	Dec-32	$6.38	[illegible]	[illegible]	$0.77	[illegible]	[illegible]	$0.06	$3.64	$3.88	$8.18	$4.98	$3.28	$5.45	$3.78
181	0%	100%	Jan-33	$6.42	[illegible]	[illegible]	$2.88	[illegible]	[illegible]	$0.07	$4.07	$4.02	$8.30	$5.19	$3.84	$5.48	$3.67
182	0%	100%	Feb-33	$6.37	[illegible]	[illegible]	$1.83	$0.33	[illegible]	$0.06	$4.19	$4.18	$7.31	$5.61	$3.81	$6.44	$4.10
183	0%	100%	Mar-33	$6.08	[illegible]	[illegible]	$0.43	[illegible]	[illegible]	$0.04	$3.67	$3.85	$5.50	$4.51	$3.54	$6.10	$3.78
184	0%	100%	Apr-33	$4.94	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.05	$3.06	$3.06	$4.38	$3.91	$3.48	$4.88	$3.60
185	0%	100%	May-33	$6.17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.06	$4.16	$4.18	$4.82	$4.35	$3.95	$6.23	$4.10
186	0%	100%	Jun-33	$6.88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.12	$4.61	$4.83	$5.08	$6.00	$4.56	$6.10	$4.72
187	0%	100%	Jul-33	$9.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.25	$3.37	$3.38	$3.72	$3.67	$3.06	$5.24	$3.28
188	0%	100%	Aug-33	$6.21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.27	$3.80	$3.09	$3.91	$3.77	$3.27	$5.47	$3.48
189	0%	100%	Sep-33	$6.14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.10	$4.36	$4.30	$4.50	$4.46	$4.03	$6.24	$4.23
190	0%	100%	Oct-33	$4.88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.06	$3.80	$3.81	$4.03	$3.80	$3.31	$4.84	$3.80
191	0%	100%	Nov-33	$6.30	[illegible]	[illegible]	$0.09	[illegible]	[illegible]	$0.04	$4.05	$4.07	$3.40	$4.87	$3.77	$5.35	$3.06
192	0%	100%	Dec-33	$6.83	[illegible]	[illegible]	$1.21	$0.18	[illegible]	$0.07	$4.52	$4.58	$8.75	$3.71	$4.15	$5.80	$4.44
193	0%	100%	Jan-34	$6.96	[illegible]	[illegible]	$3.20	$0.48	[illegible]	$0.08	$4.48	$4.45	$8.78	$6.04	$4.12	$5.86	$4.38
194	0%	100%	Feb-34	$6.93	[illegible]	[illegible]	$1.90	$0.23	[illegible]	$0.07	$4.47	$4.45	$7.82	$5.78	$4.15	$5.80	$4.30
195	0%	100%	Mar-34	$6.19	[illegible]	[illegible]	$0.50	[illegible]	[illegible]	$0.04	$4.18	$4.20	$5.90	$4.84	$3.88	$5.23	$4.11
196	0%	100%	Apr-34	$4.48	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.05	$3.44	$3.43	$4.17	$3.89	$3.21	$4.63	$3.30
197	0%	100%	May-34	$6.27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.06	$4.00	$4.00	$4.31	$4.15	$3.73	$5.32	$3.90
198	0%	100%	Jun-34	$8.21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.11	$4.70	$4.71	$4.81	$4.67	$4.40	$6.32	$4.59
199	0%	100%	Jul-34	$6.10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.24	$2.62	$2.56	$2.88	$2.74	$2.21	$3.34	$2.43
200	0%	100%	Aug-34	$6.30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.27	$3.25	$3.20	$3.50	$3.39	$2.86	$6.57	$3.09
201	0%	100%	Sep-34	$6.48	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.11	$3.86	$3.74	$3.82	$3.90	$3.44	$6.57	$3.89
202	0%	100%	Oct-34	$6.01	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$3.49	$3.49	$3.94	$3.69	$3.18	$5.07	$3.36
203	0%	100%	Nov-34	$6.44	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.05	$3.67	$3.92	$8.40	$4.40	$3.46	$5.49	$3.76
204	0%	100%	Dec-34	$6.66	[illegible]	[illegible]	$1.18	$0.12	[illegible]	$0.09	$4.35	$4.33	$6.06	$5.80	$3.87	$5.76	$4.25
205	0%	100%	Jan-35	$6.60	[illegible]	[illegible]	$3.57	$0.88	[illegible]	$0.00	$4.70	$4.67	$6.27	$5.58	$4.28	$5.90	$4.61
206	0%	100%	Feb-35	$5.86	[illegible]	[illegible]	$1.90	$0.30	[illegible]	$0.08	$4.71	$4.69	$7.81	$6.18	$4.30	$5.94	$4.62
207	0%	100%	Mar-35	$5.47	[illegible]	[illegible]	$0.40	[illegible]	[illegible]	$0.04	$4.34	$4.33	$6.03	$5.08	$4.01	$5.02	$4.36
208	0%	100%	Apr-35	$4.30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.05	$3.47	$3.48	$4.20	$3.77	$3.26	$4.36	$3.40
209	0%	100%	May-35	$4.96	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.06	$4.01	$4.04	$4.39	$4.22	$3.78	$5.02	$3.94
210	0%	100%	Jun-35	$6.90	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.13	$5.57	$5.40	$5.66	$5.68	$5.11	$6.03	$5.28
211	0%	100%	Jul-35	$6.96	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.23	$4.03	$4.07	$4.41	$4.20	$3.71	$5.02	$3.93
212	0%	100%	Aug-35	$6.75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.27	$4.34	$4.36	$4.66	$4.60	$4.02	$5.02	$4.24
213	0%	100%	Sep-35	$6.79	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.12	$6.24	$5.31	$5.41	$5.36	$4.91	$6.81	$5.12
214	0%	100%	Oct-35	$4.83	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$3.65	$3.60	$4.11	$3.68	$3.35	$4.90	$3.56
215	0%	100%	Nov-35	$6.43	[illegible]	[illegible]	$0.20	[illegible]	[illegible]	$0.05	$4.32	$4.36	$5.83	$4.86	$4.04	$5.48	$4.24
216	0%	100%	Dec-35	$6.74	[illegible]	[illegible]	$1.27	$0.27	[illegible]	$0.00	$4.87	$4.93	$7.02	$6.02	$4.45	$5.84	$4.78
217	0%	100%	Jan-36	$6.10	[illegible]	[illegible]	$3.43	$0.60	[illegible]	$0.00	$4.88	$4.88	$9.53	$6.78	$4.45	$6.10	$4.78
218	0%	100%	Feb-36	$6.06	[illegible]	[illegible]	$1.90	$0.31	[illegible]	$0.06	$4.88	$4.66	$8.04	$6.36	$4.50	$6.13	$4.60
219	0%	100%	Mar-36	$6.66	[illegible]	[illegible]	$0.47	[illegible]	[illegible]	$0.04	$4.80	$4.49	$6.12	$5.27	$4.17	$5.70	$4.42
220	0%	100%	Apr-36	$4.47	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.05	$3.60	$3.61	$4.34	$3.90	$3.38	$4.53	$3.53
221	0%	100%	May-36	$6.13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.00	$4.18	$4.18	$4.84	$4.37	$3.93	$5.10	$4.09
222	0%	100%	Jun-36	$6.72	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.13	$5.57	$5.03	$5.83	$3.78	$5.30	$6.05	$5.48
223	0%	100%	Jul-36	$6.60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.25	$4.18	$4.22	$4.87	$4.42	$3.86	$5.61	$4.08
224	0%	100%	Aug-36	$6.66	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.27	$4.51	$4.53	$4.85	$4.72	$4.18	$6.22	$4.40
225	0%	100%	Sep-36	$7.02	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.12	$5.44	$5.41	$5.81	$5.58	$5.11	$7.14	$5.32
226	0%	100%	Oct-36	$4.86	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$3.79	$3.83	$4.28	$4.03	$3.49	$5.00	$3.69
227	0%	100%	Nov-36	$6.62	[illegible]	[illegible]	$0.20	[illegible]	[illegible]	$0.05	$4.49	$4.52	$5.62	$5.03	$4.19	$5.80	$4.40
228	0%	100%	Dec-36	$6.94	[illegible]	[illegible]	$1.29	$0.29	[illegible]	$0.08	$5.00	$5.10	$7.23	$6.21	$4.62	$6.03	$4.93
229	0%	100%	Jan-37	$6.30	[illegible]	[illegible]	$3.40	$0.70	[illegible]	$0.08	$5.06	$5.03	$9.80	$7.01	$4.62	$6.39	$4.98
230	0%	100%	Feb-37	$4.38	[illegible]	[illegible]	$2.05	$0.31	[illegible]	$0.08	$5.07	$5.04	$8.26	$6.56	$4.67	$6.34	$4.98
231	0%	100%	Mar-37	$6.64	[illegible]	[illegible]	$0.44	[illegible]	[illegible]	$0.05	$4.67	$4.66	$6.32	$5.45	$4.33	$5.80	$4.58
232	0%	100%	Apr-37	$4.62	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.08	$3.73	$3.79	$4.49	$4.04	$3.61	$4.86	$3.66
233	0%	100%	May-37	$6.39	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$4.32	$4.35	$4.70	$4.53	$4.08	$5.30	$4.24
234	0%	100%	Jun-37	$6.84	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.13	$3.77	$3.80	$6.00	$5.99	$3.80	$7.08	$3.68
235	0%	100%	Jul-37	$6.74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.28	$4.34	$4.38	$4.74	$4.58	$4.02	$8.00	$4.24
236	0%	100%	Aug-37	$8.14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.27	$4.68	$4.70	$5.03	$4.90	$4.34	$6.42	$4.57
237	0%	100%	Sep-37	$7.28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.12	$3.64	$5.61	$5.82	$5.70	$5.31	$7.07	$5.52
238	0%	100%	Oct-37	$6.18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$3.93	$3.97	$4.42	$4.19	$3.63	$6.23	$3.84
239	0%	100%	Nov-37	$6.60	[illegible]	[illegible]	$0.21	[illegible]	[illegible]	$0.05	$4.06	$4.09	$6.01	$5.21	$4.35	$5.85	$4.67
240	0%	100%	Dec-37	$6.13	[illegible]	[illegible]	$1.32	$0.25	[illegible]	$0.08	$5.18	$5.29	$7.46	$6.42	$4.80	$6.23	$5.10
241	0%	100%	Jan-38	$6.61	[illegible]	[illegible]	$3.58	$0.72	[illegible]	$0.08	$5.25	$5.21	$10.07	$7.23	$4.80	$6.01	$5.18
242	0%	100%	Feb-38	$6.46	[illegible]	[illegible]	$2.07	$0.32	[illegible]	$0.08	$5.25	$5.23	$8.52	$6.78	$4.88	$6.80	$5.18
243	0%	100%	Mar-38	$6.04	[illegible]	[illegible]	$0.48	[illegible]	[illegible]	$0.06	$4.65	$4.84	$6.53	$5.64	$4.50	$6.08	$4.78
244	0%	100%	Apr-38	$4.77	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.08	$3.87	$3.88	$4.84	$4.19	$3.66	$4.83	$3.80
245	0%	100%	May-38	$6.47	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$4.47	$4.50	$4.87	$4.60	$4.23	$5.94	$4.40
246	0%	100%	Jun-38	$7.17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.14	$5.98	$6.01	$6.27	$6.20	$5.71	$7.31	$5.80
247	0%	100%	Jul-38	$6.88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.28	$4.51	$4.55	$4.81	$4.78	$4.18	$6.19	$4.40
248	0%	100%	Aug-38	$6.30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.28	$4.80	$4.88	$5.22	$5.08	$4.62	$6.63	$4.75
249	0%	100%	Sep-38	$7.48	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.13	$5.86	$5.82	$6.03	$6.01	$5.51	$7.62	$5.73
250	0%	100%	Oct-38	$5.93	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$4.08	$4.12	$4.57	$4.33	$3.77	$5.40	$3.90
251	0%	100%	Nov-38	$6.00	[illegible]	[illegible]	$0.21	[illegible]	[illegible]	$0.05	$4.63	$4.67	$5.21	$5.59	$4.52	$6.05	$4.74
252	0%	100%	Dec-38	$6.34	[illegible]	[illegible]	$1.34	$0.29	[illegible]	$0.10	$5.38	$5.48	$7.86	$6.85	$4.98	$6.43	$5.20
253	0%	100%	Jan-39	$6.73	[illegible]	[illegible]	$3.62	$0.73	[illegible]	$0.09	$5.44	$5.41	$10.35	$7.48	$4.90	$6.82	$5.34
254	0%	100%	Feb-39	$6.07	[illegible]	[illegible]	$2.10	$0.32	[illegible]	$0.08	$5.44	$5.43	$8.78	$7.00	$5.04	$6.78	$5.25
255	0%	100%	Mar-39	$6.24	[illegible]	[illegible]	$0.50	[illegible]	[illegible]	$0.05	$5.03	$5.01	$6.73	$5.83	$4.67	$6.29	$4.93
256	0%	100%	Apr-39	$4.88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.06	$4.01	$4.02	$4.80	$4.33	$3.78	$4.90	$3.94
257	0%	100%	May-39	$6.88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$4.64	$4.67	$5.04	$4.88	$4.30	$5.72	$4.56
258	0%	100%	Jun-39	$7.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.14	$6.19	$6.22	$6.48	$6.42	$5.92	$7.88	$6.10
259	0%	100%	Jul-39	$6.13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.27	$4.68	$4.72	$5.08	$4.93	$4.34	$6.30	$4.57
260	0%	100%	Aug-39	$6.68	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.29	$5.04	$5.08	$5.40	$5.27	$4.88	$6.64	$4.93
261	0%	100%	Sep-39	$7.74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.13	$6.07	$6.04	$6.25	$6.23	$5.73	$7.87	$5.95
262	0%	100%	Oct-39	$6.81	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$4.23	$4.28	$4.74	$4.40	$3.93	$5.86	$4.14
263	0%	100%	Nov-39	$6.19	[illegible]	[illegible]	$0.21	[illegible]	[illegible]	$0.05	$5.00	$5.04	$6.41	$5.87	$4.80	$6.25	$4.91
264	0%	100%	Dec-39	$6.88	[illegible]	[illegible]	$1.37	$0.29	[illegible]	$0.10	$5.50	$5.67	$7.91	$6.84	$5.16	$6.65	$5.48
265	0%	100%	Jan-40	$6.86	[illegible]	[illegible]	$3.60	$0.74	[illegible]	$0.10	$5.83	$5.80	$10.64	$7.69	$5.17	$7.04	$5.54
266	0%	100%	Feb-40	$6.68	[illegible]	[illegible]	$2.14	$0.33	[illegible]	$0.09	$5.64	$5.62	$9.03	$7.22	$5.23	$6.86	$5.53
267	0%	100%	Mar-40	$6.44	[illegible]	[illegible]	$0.50	[illegible]	[illegible]	$0.05	$5.21	$5.20	$6.96	$6.03	$4.84	$6.49	$5.11
268	0%	100%	Apr-40	$6.09	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.06	$4.18	$4.17	$4.96	$4.48	$3.92	$5.15	$4.08
269	0%	100%	May-40	$6.64	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$4.80	$4.83	$5.21	$5.03	$4.65	$5.91	$4.73
270	0%	100%	Jun-40	$7.66	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.14	$6.42	$6.44	$6.72	$6.65	$6.13	$7.80	$6.32
271	0%	100%	Jul-40	$6.38	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.27	$4.85	$4.90	$5.27	$5.11	$4.51	$6.60	$4.74
272	0%	100%	Aug-40	$6.77	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.29	$5.23	$5.25	$5.60	$5.46	$4.87	$7.00	$5.12
273	0%	100%	Sep-40	$7.99	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.13	$6.30	$6.28	$6.48	$6.45	$5.94	$8.12	$6.17
274	0%	100%	Oct-40	$6.60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$4.39	$4.43	$4.90	$4.65	$4.07	$6.76	$4.29
275	0%	100%	Nov-40	$6.40	[illegible]	[illegible]	$0.22	[illegible]	[illegible]	$0.05	$5.16	$5.23	$6.62	$5.77	$4.87	$6.45	$5.09
276	0%	100%	Dec-40	$6.76	[illegible]	[illegible]	$1.39	$0.30	[illegible]	$0.10	$5.75	$5.87	$8.15	$7.06	$5.35	$6.86	$5.08
277	0%	100%	Jan-41	$7.19	[illegible]	[illegible]	$3.75	$0.76	[illegible]	$0.10	$5.88	$5.82	$10.95	$7.95	$5.50	$7.20	$5.76
278	0%	100%	Feb-41	$7.14	[illegible]	[illegible]	$2.16	$0.34	[illegible]	$0.09	$5.88	$5.84	$9.31	$7.47	$5.44	$7.20	$5.77
279	0%	100%	Mar-41	$6.67	[illegible]	[illegible]	$0.51	[illegible]	[illegible]	$0.05	$5.41	$5.40	$7.18	$6.25	$5.04	$6.72	$5.32
280	0%	100%	Apr-41	$5.27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.06	$4.32	$4.33	$5.13	$4.65	$4.06	$5.31	$4.20
281	0%	100%	May-41	$6.04	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$4.99	$5.02	$5.41	$5.22	$4.73	$6.11	$4.81
282	0%	100%	Jun-41	$7.93	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.14	$6.66	$6.69	$6.97	$6.90	$6.37	$8.07	$6.57
283	0%	100%	Jul-41	$6.66	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.27	$5.05	$5.09	$5.47	$5.31	$4.70	$6.83	$4.94
284	0%	100%	Aug-41	$7.01	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.30	$5.44	$5.46	$5.82	$5.66	$5.08	$7.31	$5.33
285	0%	100%	Sep-41	$8.27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.13	$6.55	$6.51	$6.74	$6.71	$6.19	$8.41	$6.42
286	0%	100%	Oct-41	$4.60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$4.57	$4.61	$5.09	$4.83	$4.24	$5.96	$4.47
287	0%	100%	Nov-41	$6.62	[illegible]	[illegible]	$0.22	[illegible]	[illegible]	$0.05	$5.39	$5.43	$6.63	$5.96	$5.07	$6.66	$5.28
288	0%	100%	Dec-41	$7.00	[illegible]	[illegible]	$1.41	$0.30	[illegible]	$0.10	$5.97	$6.09	$8.42	$7.31	$5.56	$7.10	$5.90
289	0%	100%	Jan-42	$7.44	[illegible]	[illegible]	$3.82	$0.77	[illegible]	$0.10	$6.08	$6.05	$11.28	$8.21	$5.61	$7.84	$5.98
290	0%	100%	Feb-42	$7.38	[illegible]	[illegible]	$2.22	$0.34	[illegible]	$0.09	$6.09	$6.05	$9.60	$7.73	$5.66	$7.46	$5.99
291	0%	100%	Mar-42	$6.80	[illegible]	[illegible]	$0.52	[illegible]	[illegible]	$0.05	$5.62	$5.61	$7.42	$6.47	$5.25	$6.95	$5.53
292	0%	100%	Apr-42	$5.46	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.06	$4.49	$4.50	$5.31	$4.82	$4.25	$5.52	$4.41
293	0%	100%	May-42	$6.26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$5.18	$5.22	$5.61	$5.41	$4.92	$6.33	$5.10
294	0%	100%	Jun-42	$6.30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.15	$6.92	$6.95	$7.23	$7.18	$6.62	$8.35	$6.82
295	0%	100%	Jul-42	$6.79	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.28	$5.25	$5.30	$5.68	$5.52	$4.00	$7.00	$5.14
296	0%	100%	Aug-42	$7.28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.30	$5.66	$5.06	$6.04	$5.90	$5.28	$7.28	$5.54
297	0%	100%	Sep-42	$6.50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.14	$6.81	$6.77	$7.00	$6.97	$6.44	$8.70	$6.68
298	0%	100%	Oct-42	$6.10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$4.76	$4.80	$5.28	$5.02	$4.42	$6.17	$4.65
299	0%	100%	Nov-42	$6.86	[illegible]	[illegible]	$0.53	[illegible]	[illegible]	$0.05	$5.60	$5.64	$7.09	$6.20	$5.27	$6.91	$5.50
300	0%	100%	Dec-42	$7.38	[illegible]	[illegible]	$1.44	$0.31	[illegible]	$0.10	$6.20	$6.32	$8.69	$7.55	$5.78	$7.35	$6.12
301	0%	100%	Jan-43	$7.78	[illegible]	[illegible]	$3.90	$0.78	[illegible]	$0.10	$6.32	$6.28	$11.59	$8.49	$5.83	$7.80	$6.21
302	0%	100%	Feb-43	$7.64	[illegible]	[illegible]	$3.28	$0.35	[illegible]	$0.10	$6.32	$6.28	$9.90	$7.99	$5.89	$7.74	$6.22
303	0%	100%	Mar-43	$7.14	[illegible]	[illegible]	$0.53	[illegible]	[illegible]	$0.05	$5.84	$5.83	$7.67	$6.70	$5.46	$7.19	$5.74
304	0%	100%	Apr-43	$6.06	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.06	$4.68	$4.67	$5.50	$5.00	$4.41	$5.71	$4.58
305	0%	100%	May-43	$6.47	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.07	$5.38	$5.41	$5.81	$5.62	$5.11	$6.54	$5.30
306	0%	100%	Jun-43	$6.48	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.16	$7.18	$7.21	$7.50	$7.42	$6.86	$8.63	$7.08
307	0%	100%	Jul-43	$7.02	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.28	$5.48	$5.50	$5.90	$5.73	$5.10	$7.30	$5.34
308	0%	100%	Aug-43	$7.81	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.31	$5.98	$5.80	$6.27	$6.12	$5.91	$7.81	$5.76
309	0%	100%	Sep-43	$6.88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.14	$7.07	$7.03	$7.27	$7.24	$6.70	$9.00	$6.94
310	0%	100%	Oct-43	$6.81	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.08	$4.84	$4.98	$5.48	$5.21	$4.60	$6.33	$4.83
311	0%	100%	Nov-43	$7.08	[illegible]	[illegible]	$0.23	[illegible]	[illegible]	$0.09	$5.81	$5.80	$7.32	$6.43	$5.48	$7.15	$5.72
312	0%	100%	Dec-43	$7.80	[illegible]	[illegible]	$1.47	$0.51	[illegible]	$0.11	$6.43	$6.56	$8.06	$7.81	$6.01	$7.80	$6.36

Dominion ICF Federal CO2 Commodity Forecast

Source:	ICF 2	ICF 3	ICF 4	ICF 5	ICF 6	ICF 7	ICF 8	ICF 9	ICF 10	ICF 11	ICF 12	ICF 13	ICF 14	ICF 15	ICF 16	ICF 17	
	Henry Hub	Dom SP	TCO Pool	Z6NNY	Zone 5 (Downstream of 180)	Leidy	Zone 4	Dom SP Deld	TCO Pool Deld	Z6NNY Deld	Dom Zone Deld	Zone 5 (Downstream of 180) Deld	Leidy Deld	Zone 4 Deld	Transco Blend-Basis	Transco Blend - Deld	Tetco M2
Jan-17	3.40	($0.20)	($0.20)	$0.61	$0.28	($0.34)	($0.08)	3.11	3.20	4.01		3.68	3.06	3.32	$0.13	$3.52	3.09
Feb-17	2.89	[illegible]	($0.19)	$0.28	($0.02)	($0.34)	($0.07)	2.57	2.70	3.15		2.87	2.55	2.82	[illegible]	$2.81	2.55
Mar-17	2.91	($0.25)	($0.14)	$0.80	$0.35	($0.27)	($0.03)	2.66	2.77	3.81		3.26	2.64	2.88	$0.19	$3.10	2.64
Apr-17	3.15	($0.33)	($0.12)	($0.35)	($0.08)	($0.40)	($0.08)	2.77	3.03	2.79		3.07	2.74	3.09	($0.13)	$3.02	2.74
May-17	3.20	($0.40)	($0.15)	($0.34)	($0.11)	($0.43)	($0.06)	2.80	3.05	2.87		3.09	2.77	3.14	($0.15)	$3.05	2.77
Jun-17	3.00	($0.93)	($0.18)	($0.97)	($0.17)	($1.00)	($0.09)	2.07	2.82	2.03		2.83	2.00	2.94	($0.29)	$2.71	2.00
Jul-17	3.03	($0.92)	($0.15)	($0.75)	($0.14)	($0.99)	($0.05)	2.10	2.88	2.28		2.89	2.03	2.97	($0.27)	$2.76	2.03
Aug-17	2.94	($1.11)	($0.12)	($1.30)	($0.14)	($1.19)	($0.03)	1.83	2.82	1.64		2.80	1.75	2.91	($0.29)	$2.65	1.75
Sep-17	3.02	($1.61)	($0.15)	($1.78)	($0.16)	($1.73)	($0.03)	1.41	2.86	1.23		2.85	1.29	2.99	($0.39)	$2.62	1.29
Oct-17	2.91	($0.94)	($1.11)	($0.08)	($0.44)	($1.00)	$0.06	1.97	1.80	2.82		2.46	1.90	2.96	($0.45)	$2.45	1.90
Nov-17	3.00	($0.81)	($0.97)	$0.51	$0.10	($0.88)	$0.04	2.19	2.02	3.51		3.09	2.12	3.03	($0.07)	$2.93	2.12
Dec-17	3.19	[illegible]	($0.90)	$1.26	$0.21	($0.71)	$0.06	2.53	2.29	4.45		3.41	2.49	3.25	$0.04	$3.24	2.48
Jan-18	3.49	[illegible]	($1.24)	$2.57	$0.49	($0.94)	$0.10	2.83	2.25	6.06		3.98	2.55	3.59	$0.20	$3.69	2.57
Feb-18	3.50	($0.67)	($1.19)	$2.30	$0.31	($0.95)	$0.08	2.83	2.31	5.80		3.81	2.55	3.58	$0.08	$3.57	2.57
Mar-18	3.31	[illegible]	($0.96)	$1.42	$0.17	($0.76)	$0.06	2.58	2.35	4.74		3.48	2.52	3.37	($0.09)	$3.31	2.53
Apr-18	3.18	($0.64)	($0.82)	$0.35	($0.17)	($0.70)	$0.04	2.54	2.36	3.54		3.02	2.49	3.22	($0.22)	$2.96	2.49
May-18	3.23	($0.80)	($0.96)	($0.16)	($0.47)	($0.87)	$0.06	2.43	2.27	3.05		2.76	2.36	3.29	($0.45)	$2.78	2.37
Jun-18	3.27	($0.69)	($0.86)	($0.16)	($0.40)	($0.75)	$0.09	2.56	2.41	3.11		2.87	2.52	3.36	($0.38)	$2.90	2.53
Jul-18	3.41	($0.76)	($0.94)	$0.05	($0.38)	($0.82)	$0.15	2.65	2.47	3.45		3.03	2.59	3.56	($0.36)	$3.04	2.60
Aug-18	3.42	($0.80)	($0.98)	$0.03	($0.41)	($0.87)	$0.17	2.62	2.44	3.44		3.01	2.55	3.59	($0.39)	$3.03	2.56
Sep-18	3.30	($1.17)	($1.30)	($0.74)	($0.92)	($1.27)	$0.08	2.13	2.00	2.56		2.38	2.03	3.38	($0.81)	$2.48	2.04
Oct-18	3.35	($0.90)	($1.06)	($0.22)	($0.59)	($0.97)	$0.05	2.45	2.29	3.13		2.76	2.38	3.40	($0.55)	$2.80	2.39
Nov-18	3.47	($0.70)	($0.84)	$0.58	($0.24)	($0.76)	$0.03	2.76	2.63	4.05		3.22	2.70	3.50	($0.28)	$3.18	2.71
Dec-18	3.56	($0.74)	($0.90)	$1.17	$0.15	($0.82)	$0.06	2.82	2.66	4.73		3.71	2.74	3.62	($0.02)	$3.54	2.76
Jan-19	3.92	($0.95)	($1.17)	$3.00	$0.31	($1.05)	$0.08	2.97	2.75	6.92		4.23	2.87	4.00	$0.06	$3.98	2.90
Feb-19	3.78	($0.95)	($1.16)	$2.09	$0.19	($1.05)	$0.06	2.83	2.62	5.87		3.97	2.73	3.84	($0.03)	$3.75	2.76
Mar-19	3.64	($0.77)	($0.95)	$1.03	$0.07	($0.84)	$0.03	2.87	2.69	4.67		3.72	2.80	3.68	($0.08)	$3.56	2.81
Apr-19	3.28	($0.74)	($0.91)	$0.31	($0.36)	($0.81)	$0.03	2.54	2.37	3.59		2.92	2.47	3.31	($0.37)	$2.91	2.48
May-19	3.26	($0.81)	($0.96)	($0.17)	($0.53)	($0.88)	$0.04	2.45	2.30	3.09		2.73	2.38	3.30	($0.50)	$2.76	2.39
Jun-19	3.27	($0.85)	($1.01)	($0.25)	($0.54)	($0.93)	$0.09	2.42	2.26	3.02		2.73	2.34	3.36	($0.50)	$2.77	2.36
Jul-19	3.31	($0.84)	($1.01)	$0.03	($0.45)	($0.91)	$0.14	2.47	2.30	3.34		2.86	2.39	3.45	($0.43)	$2.88	2.41
Aug-19	3.29	($0.93)	[illegible]	($0.06)	($0.55)	($1.00)	$0.16	2.36	2.21	3.23		2.75	2.29	3.46	($0.51)	$2.79	2.31
Sep-19	3.28	($1.16)	($1.29)	($0.65)	($0.85)	($1.27)	$0.07	2.12	1.99	2.63		2.39	2.00	3.35	($0.79)	$2.48	2.03
Oct-19	3.28	($0.98)	($1.14)	($0.22)	($0.63)	($1.07)	$0.05	2.30	2.14	3.06		2.65	2.20	3.33	($0.60)	$2.69	2.23
Nov-19	3.40	($0.79)	($0.82)	$0.65	($0.16)	($0.87)	$0.02	2.61	2.57	4.04		3.23	2.52	3.42	($0.24)	$3.15	2.55
Dec-19	3.65	($0.81)	($0.94)	$1.48	$0.13	($0.91)	$0.06	2.85	2.82	5.13		3.78	2.75	3.72	($0.04)	$3.61	2.79
Jan-20	3.40	[illegible]	($1.04)	$2.76	$0.27	($0.90)	$0.07	2.52	2.35	6.16		3.67	2.41	3.47	$0.04	$3.44	2.46
Feb-20	3.32	($0.81)	($0.98)	$2.05	$0.17	($0.91)	$0.05	2.51	2.34	5.37		3.49	2.41	3.37	($0.07)	$3.30	2.45
Mar-20	3.23	($0.77)	($0.92)	$0.85	$0.00	($0.87)	$0.03	2.45	2.31	4.08		3.23	2.36	3.26	($0.13)	$3.10	2.40
Apr-20	3.17	($0.75)	($0.79)	$0.20	($0.29)	($0.71)	$0.03	2.53	2.38	3.38		2.88	2.47	3.20	($0.31)	$2.87	2.48
May-20	3.34	($0.69)	($0.79)	($0.12)	($0.41)	($0.76)	$0.04	2.65	2.55	3.22		2.93	2.58	3.36	($0.39)	$2.94	2.59
Jun-20	3.42	($0.70)	($0.76)	($0.16)	($0.36)	($0.77)	$0.08	2.72	2.66	3.26		3.04	2.66	3.51	($0.37)	$3.05	2.67
Jul-20	3.58	($0.80)	($0.82)	$0.00	($0.40)	($0.80)	$0.15	2.78	2.76	3.58		3.18	2.70	3.74	($0.39)	$3.19	2.72
Aug-20	3.59	($0.88)	($0.93)	($0.13)	($0.52)	($0.98)	$0.16	2.71	2.68	3.46		3.07	2.61	3.75	($0.49)	$3.11	2.64
Sep-20	3.50	($1.05)	($1.10)	($0.39)	($0.78)	($1.16)	$0.07	2.46	2.40	2.90		2.72	2.33	3.56	($0.70)	$2.79	2.38
Oct-20	3.59	($0.95)	($0.97)	($0.21)	($0.60)	($1.05)	$0.05	2.66	2.62	3.39		2.99	2.54	3.64	($0.57)	$3.02	2.59
Nov-20	3.86	($0.78)	($0.82)	$0.62	($0.02)	($0.89)	$0.03	3.08	3.04	4.48		3.84	2.98	3.90	($0.15)	$3.71	3.02
Dec-20	4.01	($0.74)	($0.76)	$1.35	$0.17	($0.87)	$0.06	3.26	3.24	5.35		4.17	3.14	4.07	($0.02)	$3.99	3.21
Jan-21	4.11	($0.97)	($1.01)	$2.97	$0.28	($1.17)	$0.06	3.14	3.10	7.08		4.40	2.94	4.17	$0.02	$4.13	3.06
Feb-21	4.02	($0.96)	($1.01)	$2.15	$0.17	($1.14)	$0.05	3.06	3.01	6.17		4.19	2.87	4.07	($0.03)	$3.98	2.99
Mar-21	3.88	($0.85)	($0.92)	$0.94	$0.08	($1.00)	$0.03	3.02	3.00	4.81		3.96	2.88	3.91	($0.10)	$3.78	2.96
Apr-21	3.48	($0.84)	($0.87)	$0.04	($0.40)	($0.96)	$0.04	2.64	2.62	3.53		3.08	2.52	3.53	($0.42)	$3.07	2.58
May-21	3.40	($0.89)	($0.92)	($0.37)	($0.57)	($1.01)	$0.04	2.51	2.48	3.03		2.63	2.38	3.44	($0.64)	$2.85	2.45
Jun-21	3.45	($0.94)	($1.00)	($0.91)	($0.62)	($1.12)	$0.07	2.49	2.45	2.94		2.82	2.33	3.52	($0.69)	$2.85	2.41
Jul-21	3.52	($0.94)	($0.91)	($0.13)	($0.47)	($1.03)	$0.11	2.64	2.61	3.39		3.05	2.49	3.63	($0.47)	$3.05	2.57
Aug-21	3.53	($0.92)	($0.95)	($0.24)	($0.65)	($1.08)	$0.12	2.62	2.58	3.29		2.98	2.45	3.66	($0.53)	$3.00	2.55
Sep-21	3.35	($1.31)	($1.40)	($1.01)	($1.07)	($1.59)	$0.06	2.03	1.94	2.34		2.28	1.76	3.40	($0.97)	$2.37	1.93
Oct-21	3.49	($1.07)	($1.12)	($0.44)	($0.75)	($1.30)	$0.04	2.42	2.37	3.05		2.74	2.20	3.53	($0.71)	$2.78	2.34
Nov-21	3.69	($0.97)	($1.01)	$0.63	($0.27)	($1.19)	$0.02	2.73	2.68	4.32		3.42	2.50	3.72	($0.37)	$3.32	2.65
Dec-21	3.77	($0.86)	($0.88)	$1.80	$0.12	($1.10)	$0.05	2.91	2.89	5.57		3.88	2.66	3.82	($0.09)	$3.60	2.84
Jan-22	3.89	($1.05)	($1.10)	$3.70	$0.18	($1.32)	$0.04	2.83	2.79	7.58		4.07	2.57	3.93	($0.08)	$3.80	2.76
Feb-22	3.83	($1.05)	($1.08)	$2.66	$0.11	($1.34)	$0.03	2.79	2.75	6.48		3.93	2.49	3.86	($0.14)	$3.69	2.72
Mar-22	3.67	($0.91)	($0.95)	$1.06	($0.03)	($1.15)	$0.02	2.76	2.72	4.72		3.64	2.52	3.69	($0.20)	$3.40	2.09
Apr-22	3.51	($0.85)	($0.88)	$0.12	($0.44)	($1.06)	$0.03	2.66	2.63	3.63		3.07	2.45	3.54	($0.47)	$3.05	2.59
May-22	3.56	($0.93)	($0.96)	($0.47)	($0.67)	($1.15)	$0.03	2.63	2.59	3.09		2.89	2.42	3.60	($0.63)	$2.93	2.56
Jun-22	3.62	($1.03)	($1.06)	($0.65)	($0.76)	($1.31)	$0.06	2.58	2.55	2.96		2.86	2.31	3.67	($0.77)	$2.90	2.50
Jul-22	3.96	($1.11)	($1.15)	($0.48)	($0.70)	($1.43)	$0.13	2.85	2.81	3.48		3.18	2.53	4.09	($0.74)	$3.22	2.76
Aug-22	3.95	($1.22)	($1.27)	($0.68)	($0.94)	($1.55)	$0.11	2.73	2.68	3.27		3.01	2.40	4.06	($0.87)	$3.08	2.64
Sep-22	3.50	($1.53)	($1.61)	($1.28)	($1.34)	($1.91)	$0.05	1.97	1.89	2.21		2.16	1.58	3.55	($1.21)	$2.29	1.86
Oct-22	3.74	($1.18)	($1.22)	($0.63)	($0.92)	($1.55)	$0.04	2.56	2.52	3.11		2.82	2.19	3.78	($0.87)	$2.88	2.47
Nov-22	4.03	($1.10)	($1.10)	$0.61	($0.39)	($1.41)	$0.03	2.93	2.93	4.84		3.64	2.62	4.06	($0.49)	$3.54	2.85
Dec-22	4.05	($0.86)	($0.83)	$1.90	$0.12	($1.32)	$0.04	3.19	3.23	5.95		4.17	2.73	4.10	($0.12)	$3.93	3.12
Jan-23	3.98	($1.17)	($1.24)	$3.96	$0.24	($1.61)	$0.06	2.80	2.75	7.95		4.23	2.18	4.04	($0.11)	$3.87	2.71
Feb-23	3.95	($1.03)	($1.07)	$2.78	$0.15	($1.63)	$0.04	2.93	2.88	6.74		4.11	2.32	4.00	($0.15)	$3.81	2.85
Mar-23	3.84	($0.94)	($0.98)	$1.04	($0.04)	($1.42)	$0.03	2.90	2.86	4.88		3.80	2.42	3.87	($0.25)	$3.59	2.83
Apr-23	3.76	($0.80)	($0.83)	$0.12	($0.44)	($1.05)	$0.04	2.95	2.93	3.88		3.32	2.70	3.79	($0.46)	$3.29	2.89
May-23	3.75	($1.00)	($1.03)	($0.61)	($0.78)	($1.30)	$0.04	2.75	2.71	3.14		2.98	2.45	3.79	($0.74)	$3.01	2.67
Jun-23	3.78	($0.94)	($0.96)	($0.60)	($0.71)	($1.26)	$0.07	2.84	2.82	3.18		3.07	2.52	3.85	($0.67)	$3.11	2.77
Jul-23	3.90	($1.10)	($1.12)	($0.57)	($0.83)	($1.55)	$0.14	2.79	2.78	3.32		3.07	2.35	4.04	($0.79)	$3.11	2.71
Aug-23	3.90	($1.23)	($1.26)	($0.79)	($1.00)	($1.72)	$0.14	2.67	2.64	3.11		2.90	2.18	4.04	($0.93)	$2.96	2.58
Sep-23	3.75	($1.59)	($1.65)	($1.44)	($1.45)	($2.14)	$0.06	2.16	2.09	2.31		2.30	1.61	3.81	($1.32)	$2.43	2.04
Oct-23	3.96	($1.07)	($1.09)	($0.57)	($0.85)	($1.50)	$0.05	2.88	2.86	3.39		3.11	2.45	4.00	($0.81)	$3.15	2.80
Nov-23	4.15	($1.06)	($1.03)	$0.27	($0.48)	($1.49)	$0.03	3.09	3.12	4.42		3.68	2.66	4.18	($0.55)	$3.60	3.01
Dec-23	4.24	($0.81)	($0.70)	$1.15	$0.16	($1.40)	$0.05	3.43	3.45	5.39		4.40	2.84	4.29	($0.11)	$4.13	3.37
Jan-24	4.47	($1.03)	($1.06)	$2.58	$0.23	($1.78)	$0.05	3.44	3.41	7.05		4.70	2.69	4.52	($0.12)	$4.35	3.37
Feb-24	4.33	($0.57)	($0.89)	$1.88	$0.16	($1.63)	$0.05	3.47	3.44	6.22		4.49	2.70	4.38	($0.10)	$4.18	3.40
Mar-24	4.08	($0.79)	($0.79)	$0.76	($0.06)	($1.32)	$0.03	3.28	3.28	4.82		4.00	2.74	4.09	($0.26)	$3.81	3.22
Apr-24	4.18	($0.86)	($0.87)	($0.14)	($0.58)	($1.20)	$0.04	3.32	3.31	4.04		3.60	2.98	4.23	($0.58)	$3.60	3.26
May-24	3.48	($0.98)	($0.97)	($0.67)	($0.81)	($1.30)	$0.04	2.50	2.49	2.79		2.65	2.16	3.50	($0.75)	$2.71	2.43
Jun-24	4.68	($1.23)	($1.21)	($1.03)	($1.07)	($1.74)	$0.08	3.45	3.46	3.62		3.61	2.94	4.76	($0.99)	$3.69	3.36
Jul-24	4.10	($1.48)	($1.50)	($1.16)	($1.30)	($2.05)	$0.16	2.62	2.60	2.94		2.80	2.05	4.26	($1.10)	$2.91	2.51
Aug-24	3.98	($1.67)	($1.72)	($1.41)	($1.54)	($2.23)	$0.14	2.31	2.26	2.57		2.44	1.76	4.13	($1.38)	$2.60	2.19
Sep-24	3.89	($1.70)	($1.77)	($1.59)	($1.62)	($2.17)	$0.06	2.19	2.12	2.30		2.27	1.72	3.95	($1.44)	$2.45	2.06
Oct-24	3.48	($1.26)	($1.28)	($0.90)	($1.10)	($1.73)	$0.04	2.22	2.20	2.58		2.37	1.75	3.52	($1.02)	$2.46	2.12
Nov-24	3.94	($1.33)	($1.27)	($0.07)	($0.65)	($1.97)	$0.03	2.61	2.66	3.87		3.08	1.97	3.96	($0.89)	$3.05	2.51

Dec-24	4.06	($1.08)	($0.93)	$1.22	$0.10	($1.77)	$0.04	3.06	3.08	5.27		4.16	2.29	4.10	($0.21)	$3.85	2.98
Jan-25	4.08	($1.24)	($1.30)	$3.12	$0.21	($1.63)	$0.05	2.84	2.78	7.21		4.30	2.12	4.13	($0.16)	$3.92	2.74
Feb-25	3.86	($1.04)	($1.00)	$2.12	$0.13	($1.94)	$0.04	2.93	2.88	6.08		4.09	2.02	4.00	($0.21)	$3.75	2.85
Mar-25	3.72	($1.05)	($1.09)	$0.69	($0.32)	($1.71)	$0.02	2.67	2.62	4.41		3.40	2.01	3.74	($0.49)	$3.23	2.59
Apr-25	4.37	($0.73)	($0.74)	$0.00	($0.47)	($1.05)	$0.04	3.84	3.83	4.38		3.91	3.33	4.41	($0.40)	$3.89	3.58
May-25	3.95	($0.99)	($0.04)	($0.69)	($0.86)	($1.35)	$0.04	3.00	3.00	3.25		3.14	2.59	3.96	($0.70)	$3.19	2.92
Jun-25	4.77	($1.09)	($1.03)	($0.88)	($0.91)	($1.52)	$0.06	3.70	3.71	3.88		3.86	3.25	4.83	($0.89)	$3.62	3.62
Jul-25	4.07	($1.27)	($1.29)	($0.93)	($1.09)	($1.77)	$0.14	2.81	2.79	3.14		2.98	2.31	4.21	($1.00)	$3.07	2.71
Aug-25	4.23	($1.62)	($1.66)	($1.41)	($1.60)	($2.25)	$0.14	2.62	2.58	2.83		2.74	1.98	4.37	($1.36)	$2.88	2.50
Sep-25	4.41	($1.82)	($1.85)	($1.67)	($1.83)	($2.50)	$0.06	2.49	2.42	2.54		2.55	1.91	4.46	($1.65)	$2.75	2.35
Oct-25	3.91	($1.26)	($1.27)	($0.63)	($1.11)	($1.65)	$0.04	2.65	2.64	2.96		2.80	2.07	3.96	($1.05)	$2.87	2.56
Nov-25	4.37	($1.35)	($1.34)	($0.09)	($0.82)	($1.82)	$0.03	3.02	3.03	4.29		3.45	2.55	4.40	($0.91)	$3.46	2.92
Dec-25	4.52	($1.03)	($1.06)	$1.19	$0.07	($1.74)	$0.04	3.49	3.46	5.72		4.59	2.78	4.56	($0.22)	$4.30	3.41
Jan-26	4.29	($1.13)	($1.18)	$2.96	$0.24	($1.61)	$0.05	3.16	3.11	7.25		4.53	2.36	4.34	($0.14)	$4.15	3.08
Feb-26	4.19	($0.99)	($1.03)	$2.00	$0.16	($1.60)	$0.05	3.30	3.26	6.19		4.35	2.60	4.24	($0.14)	$4.05	3.23
Mar-26	3.96	($0.86)	($0.91)	$0.66	($0.23)	($1.40)	$0.03	3.08	3.05	4.62		3.71	2.56	3.99	($0.30)	$3.57	3.02
Apr-26	4.54	($0.77)	($0.74)	($0.04)	($0.49)	($0.95)	$0.04	3.82	3.80	4.50		4.05	3.55	4.58	($0.49)	$4.06	3.76
May-26	4.34	($0.98)	($0.92)	($0.64)	($0.77)	($1.28)	$0.05	3.44	3.42	3.70		3.57	3.11	4.39	($0.71)	$3.63	3.37
Jun-26	4.87	($0.93)	($0.83)	($0.72)	($0.77)	($1.27)	$0.08	3.94	3.94	4.15		4.10	3.60	4.95	($0.71)	$4.16	3.87
Jul-26	3.86	($1.27)	($1.30)	($0.98)	($1.11)	($1.77)	$0.16	2.60	2.58	2.90		2.77	2.11	4.04	($1.01)	$2.88	2.51
Aug-26	4.06	($1.48)	($1.52)	($1.25)	($1.35)	($2.02)	$0.17	2.59	2.54	2.81		2.71	2.04	4.23	($1.21)	$2.85	2.48
Sep-26	4.56	($1.69)	($1.64)	($1.62)	($1.76)	($2.41)	$0.07	2.70	2.62	2.74		2.77	2.16	4.64	($1.59)	$2.97	2.58
Oct-26	3.95	($1.29)	($1.31)	($1.00)	($1.14)	($1.63)	$0.05	2.66	2.63	2.95		2.80	2.11	4.00	($1.06)	$2.88	2.56
Nov-26	4.60	($1.09)	($1.10)	$0.04	($0.70)	($1.69)	$0.04	3.51	3.49	4.63		3.90	2.90	4.64	($0.74)	$3.86	3.42
Dec-26	4.72	($0.99)	($1.02)	$0.96	$0.07	($1.65)	$0.05	3.73	3.70	5.68		4.79	3.06	4.77	($0.21)	$4.51	3.85
Jan-27	5.07	($1.04)	($1.05)	$2.52	$0.27	($1.20)	$0.06	4.04	4.02	7.58		5.33	2.86	5.12	($0.16)	$4.90	3.96
Feb-27	4.91	($0.87)	($0.88)	$1.70	$0.20	($1.03)	$0.06	4.04	4.03	6.61		5.11	2.98	4.97	($0.17)	$4.75	3.98
Mar-27	4.56	($0.94)	($0.87)	$0.55	($0.35)	($1.61)	$0.04	3.63	3.61	5.13		4.23	2.97	4.62	($0.48)	$4.09	3.56
Apr-27	4.52	($0.80)	($0.79)	($0.08)	($0.53)	($0.89)	$0.05	3.73	3.73	4.44		3.99	3.54	4.57	($0.51)	$4.01	3.67
May-27	4.43	($1.04)	($0.93)	($0.62)	($0.78)	($1.16)	$0.05	3.49	3.50	3.81		3.65	3.27	4.48	($0.71)	$3.72	3.42
Jun-27	4.99	($1.01)	($0.98)	($0.74)	($0.81)	($1.24)	$0.09	3.98	4.01	4.25		4.16	3.75	5.08	($0.74)	$4.25	3.90
Jul-27	3.85	($1.05)	($1.04)	($0.64)	($0.85)	($1.31)	$0.17	2.88	2.90	3.31		3.10	2.63	4.11	($0.76)	$3.18	2.80
Aug-27	4.04	($1.33)	($1.33)	($1.00)	($1.16)	($1.62)	$0.17	2.71	2.71	3.04		2.88	2.42	4.21	($1.04)	$3.02	2.61
Sep-27	4.50	($1.81)	($1.71)	($1.54)	($1.59)	($1.09)	$0.07	2.83	2.79	2.96		2.83	2.51	4.57	($1.47)	$3.13	2.70
Oct-27	3.86	($1.20)	($1.18)	($0.01)	($1.03)	($1.46)	$0.04	2.66	2.68	3.05		2.83	2.38	3.90	($0.93)	$2.93	2.57
Nov-27	4.31	($1.15)	($1.13)	$0.08	($0.73)	($1.43)	$0.03	3.17	3.19	4.40		3.58	2.89	4.35	($0.72)	$3.59	3.08
Dec-27	4.43	($0.99)	($0.96)	$1.20	$0.11	($1.22)	$0.04	3.55	3.57	5.63		4.54	3.21	4.47	($0.12)	$4.31	3.49
Jan-28	4.84	($1.00)	($1.04)	$3.03	$0.26	($1.39)	$0.05	3.84	3.80	7.87		5.10	3.49	4.90	($0.04)	$4.81	3.77
Feb-28	4.70	($0.95)	($0.91)	$1.98	$0.15	($1.20)	$0.04	3.82	3.79	6.69		4.86	3.50	4.75	($0.00)	$4.62	3.75
Mar-28	4.39	($0.90)	($0.93)	$0.56	($0.29)	($1.16)	$0.03	3.48	3.46	4.95		4.09	3.21	4.41	($0.39)	$4.00	3.42
Apr-28	4.68	($0.84)	($0.07)	($0.14)	($0.63)	($1.09)	$0.04	3.83	3.81	4.54		4.06	3.62	4.72	($0.09)	$4.09	3.76
May-28	4.70	($1.05)	($1.10)	($0.60)	($0.85)	($1.33)	$0.05	3.61	3.60	3.90		3.74	3.37	4.74	($0.86)	$3.84	3.53
Jun-28	5.58	($1.09)	($1.03)	($0.85)	($0.93)	($1.33)	$0.08	4.49	4.49	4.72		4.65	4.24	5.65	($0.93)	$4.74	4.41
Jul-28	4.47	($1.35)	($1.34)	($0.98)	($1.10)	($1.63)	$0.16	3.14	3.14	3.49		3.31	2.84	4.63	($1.03)	$3.45	3.04
Aug-28	4.51	($1.58)	($1.01)	($1.20)	($1.44)	($1.80)	$0.17	2.93	2.80	3.23		3.07	2.61	4.68	($1.26)	$3.25	2.82
Sep-28	4.89	($2.09)	($2.15)	($1.87)	($2.00)	($2.42)	$0.07	2.62	2.54	2.71		2.88	2.28	4.78	($1.74)	$2.95	2.47
Oct-28	4.00	($1.40)	($1.41)	($1.03)	($1.24)	($1.71)	$0.05	2.60	2.59	2.97		2.76	2.29	4.05	($1.11)	$2.89	2.50
Nov-28	4.29	($1.41)	($1.39)	($0.18)	($1.00)	($1.73)	$0.04	2.89	2.90	4.12		3.29	2.56	4.33	($0.95)	$3.34	2.78
Dec-28	4.42	($1.09)	($1.10)	$1.01	$0.00	($1.40)	$0.05	3.33	3.33	5.44		4.42	2.94	4.47	($0.21)	$4.19	3.25
Jan-29	4.65	($1.15)	($1.19)	$2.82	$0.28	($1.55)	$0.06	3.50	3.46	7.47		4.93	3.10	4.71	($0.05)	$4.60	3.42
Feb-29	4.52	($0.99)	($1.04)	$1.80	$0.18	($1.35)	$0.05	3.53	3.50	6.32		4.70	3.17	4.57	($0.08)	$4.44	3.48
Mar-29	4.25	($1.00)	($1.00)	$0.43	($0.47)	($1.37)	$0.03	3.20	3.17	4.69		3.78	2.89	4.28	($0.53)	$3.72	3.12
Apr-29	4.73	($0.84)	($0.84)	($0.15)	($0.55)	($1.03)	$0.05	3.89	3.88	4.59		4.13	3.70	4.77	($0.56)	$4.17	3.83
May-29	4.73	($0.97)	($0.97)	($0.66)	($0.82)	($1.19)	$0.05	3.76	3.77	4.07		3.91	3.54	4.78	($0.74)	$3.99	3.69
Jun-29	5.97	($1.03)	($1.02)	($0.78)	($0.86)	($1.20)	$0.09	4.94	4.95	5.18		5.11	4.71	6.06	($0.77)	$5.20	4.86
Jul-29	4.85	($1.10)	($1.17)	($0.81)	($0.93)	($1.40)	$0.19	3.65	3.68	4.03		3.86	3.39	5.03	($0.88)	$3.97	3.56
Aug-29	4.90	($1.25)	($1.33)	($1.02)	($1.10)	($1.63)	$0.20	3.56	3.56	3.88		3.73	3.27	5.10	($1.03)	$3.88	3.45
Sep-29	5.00	($1.65)	($1.70)	($1.50)	($1.56)	($1.05)	$0.08	3.34	3.29	3.50		3.44	3.04	5.07	($1.36)	$3.64	3.22
Oct-29	4.23	($1.19)	($1.17)	($0.72)	($1.00)	($1.45)	$0.05	3.05	3.06	3.51		3.23	2.78	4.29	($0.90)	$3.33	2.96
Nov-29	4.52	($1.13)	($1.12)	$0.24	($0.70)	($1.33)	$0.04	3.39	3.40	4.76		3.82	3.14	4.56	($0.60)	$3.83	3.30
Dec-29	4.66	($0.93)	($0.65)	$1.25	$0.11	($1.27)	$0.06	3.73	3.80	5.91		4.78	3.40	4.72	($0.12)	$4.55	3.66
Jan-30	4.90	($1.05)	($1.03)	$2.81	$0.33	($1.37)	$0.07	3.85	3.83	7.71		5.23	3.53	4.97	$0.01	$4.92	3.77
Feb-30	4.78	($0.96)	($0.98)	$1.79	$0.19	($1.25)	$0.06	3.82	3.80	6.57		4.97	3.53	4.84	($0.06)	$4.72	3.75
Mar-30	4.50	($0.93)	($0.94)	$0.54	($0.32)	($1.20)	$0.03	3.57	3.56	5.04		4.19	3.30	4.54	($0.40)	$4.10	3.50
Apr-30	4.57	($0.92)	($0.83)	($0.20)	($0.09)	($1.12)	$0.04	3.65	3.63	4.37		3.87	3.44	4.61	($0.64)	$3.92	3.58
May-30	4.62	($1.04)	($1.04)	($0.73)	($0.81)	($1.27)	$0.04	3.57	3.57	3.89		3.71	3.34	4.66	($0.82)	$3.60	3.50
Jun-30	5.62	($1.19)	($1.19)	($0.83)	($1.03)	($1.45)	$0.09	4.63	4.63	4.87		4.79	4.37	5.91	($0.92)	$4.90	4.54
Jul-30	4.88	($1.50)	($1.58)	($1.10)	($1.33)	($1.82)	$0.20	3.38	3.38	3.72		3.55	3.08	5.08	($1.16)	$3.72	3.26
Aug-30	5.10	($1.67)	($1.69)	($1.37)	($1.52)	($2.00)	$0.21	3.44	3.41	3.73		3.58	3.11	5.32	($1.32)	$3.78	3.31
Sep-30	5.39	($2.17)	($2.25)	($2.07)	($2.11)	($2.62)	$0.08	3.23	3.14	3.32		3.28	2.87	5.47	($1.83)	$3.56	3.06
Oct-30	4.49	($1.44)	($1.45)	($1.06)	($1.29)	($1.75)	$0.05	3.05	3.04	3.44		3.21	2.74	4.54	($1.14)	$3.35	2.94
Nov-30	4.78	($1.47)	($1.47)	($0.26)	($1.12)	($1.76)	$0.04	3.31	3.32	4.52		3.66	3.02	4.82	($1.04)	$3.75	3.20
Dec-30	4.94	($1.20)	($1.13)	$0.95	($0.21)	($1.61)	$0.06	3.74	3.81	5.89		4.73	3.33	4.99	($0.30)	$4.55	3.65
Jan-31	4.92	($1.17)	($1.22)	$3.14	$0.31	($1.60)	$0.06	3.74	3.70	8.06		5.23	3.42	4.98	($0.08)	$4.90	3.65
Feb-31	4.85	($1.04)	($1.07)	$1.98	$0.19	($1.34)	$0.06	3.80	3.77	6.80		5.04	3.51	4.90	($0.08)	$4.77	3.73
Mar-31	4.58	($1.03)	($1.12)	$0.46	($0.53)	($1.30)	$0.03	3.49	3.46	5.03		4.05	3.22	4.61	($0.07)	$4.01	3.41
Apr-31	4.63	($0.94)	($0.93)	($0.21)	($0.72)	($1.14)	$0.05	3.69	3.68	4.41		3.91	3.49	4.67	($0.66)	$3.97	3.62
May-31	4.98	($1.10)	($1.10)	($0.78)	($0.86)	($1.34)	$0.05	3.88	3.88	4.19		4.02	3.64	5.03	($0.80)	$4.12	3.79
Jun-31	5.73	($1.21)	($1.21)	($0.90)	($1.08)	($1.47)	$0.10	4.51	4.52	4.74		4.67	4.25	5.82	($0.94)	$4.79	4.42
Jul-31	4.79	($1.64)	($1.83)	($1.20)	($1.46)	($1.93)	$0.20	3.17	3.16	3.49		3.32	2.85	4.99	($1.27)	$3.51	3.04
Aug-31	5.14	($1.84)	($1.88)	($1.57)	($1.71)	($2.19)	$0.22	3.29	3.26	3.56		3.42	2.95	5.38	($1.48)	$3.66	3.16
Sep-31	5.78	($2.17)	($2.25)	($2.07)	($2.11)	($2.62)	$0.09	3.61	3.53	3.71		3.67	3.26	5.86	($1.87)	$3.95	3.45
Oct-31	4.68	($1.43)	($1.44)	($1.04)	($1.27)	($1.73)	$0.06	3.25	3.24	3.64		3.41	2.95	4.74	($1.13)	$3.55	3.14
Nov-31	5.06	($1.52)	($1.51)	($0.28)	($1.14)	($1.83)	$0.04	3.54	3.55	4.78		3.92	3.23	5.10	($1.06)	$4.00	3.42
Dec-31	5.24	($1.23)	($1.19)	$0.96	($0.15)	($1.67)	$0.06	4.01	4.06	6.20		5.09	3.57	5.30	($0.30)	$4.88	3.92
Jan-32	5.13	($1.23)	($1.27)	$3.05	$0.08	($1.58)	$0.06	3.90	3.86	8.18		5.20	3.65	5.10	($0.19)	$4.94	3.81
Feb-32	5.09	($1.05)	($1.09)	$1.97	$0.20	($1.38)	$0.06	4.03	3.99	7.06		5.29	3.71	5.14	($0.07)	$5.01	3.95
Mar-32	4.81	($1.14)	($1.16)	$0.44	($0.53)	($1.43)	$0.04	3.68	3.65	5.25		4.28	3.39	4.85	($0.58)	$4.23	3.59
Apr-32	4.68	($1.00)	($1.01)	($0.27)	($0.77)	($1.22)	$0.05	3.68	3.67	4.41		3.91	3.47	4.73	($0.71)	$3.97	3.61
May-32	5.22	($1.21)	($1.21)	($0.91)	($1.06)	($1.46)	$0.08	4.01	4.01	4.31		4.16	3.76	5.28	($0.99)	$4.28	3.92
Jun-32	5.85	[illegible]	($1.34)	($1.13)	($1.18)	($1.63)	$0.11	4.50	4.51	4.72		4.67	4.22	5.98	($1.05)	$4.80	4.40
Jul-32	4.80	($2.04)	($2.03)	($1.72)	($1.87)	($2.39)	$0.23	2.78	2.75	3.08		2.93	2.41	5.03	($1.62)	$3.18	2.63
Aug-32	5.10	($2.05)	($2.00)	($1.79)	($1.92)	($2.43)	$0.24	3.05	3.00	3.31		3.18	2.67	5.34	($1.65)	$3.44	2.90
Sep-32	5.95	[illegible]	($3.22)	($3.05)	($3.06)	($3.52)	$0.10	2.87	2.73	2.90		2.87	2.43	6.05	($2.04)	$3.31	2.64
Oct-32	4.76	($1.74)	($1.75)	($1.37)	($1.56)	($2.03)	$0.06	3.02	3.00	3.39		3.17	2.68	4.82	($1.40)	$3.36	2.89
Nov-32	5.18	($1.84)	($1.83)	($0.85)	($1.44)	($2.20)	$0.04	3.34	3.35	4.63		3.74	2.98	5.23	($1.33)	$3.86	3.20
Dec-32	5.39	($1.55)	($1.53)	$0.77	($0.41)	($2.11)	$0.06	3.84	3.86	6.16		4.98	3.28	5.45	($0.81)	$4.76	3.73
Jan-33	5.42	($1.35)	($1.40)	$2.88	($0.24)	($1.78)	$0.07	4.07	4.02	8.30		5.18	3.64	5.49	($0.44)	$4.98	3.97
Feb-33	5.37	($1.10)	($1.22)	$1.93	$0.23	($1.56)	$0.06	4.19	4.18	7.31		5.61	3.81	5.44	($0.06)	$5.29	4.10
Mar-33	5.06	($1.19)	($1.22)	$0.43	($0.56)	($1.52)	$0.04	3.87	3.85	5.50		4.51	3.54	5.10	($0.61)	$4.45	3.76
Apr-33	4.54	($0.88)	($0.88)	($0.16)	($0.63)	($1.08)	$0.05	3.66	3.66	4.38		3.91	3.46	4.59	($0.60)	$3.95	3.60
May-33	5.17	($1.00)	($0.98)	($0.65)	($0.82)	($1.22)	$0.06	4.18	4.19	4.52		4.35	3.95	5.23	($0.76)	$4.43	4.10
Jun-33	5.99	($1.17)	($1.16)	($0.82)	($0.99)	($1.43)	$0.12	4.81	4.83	5.06		5.00	4.56	6.10	($0.88)	$5.10	4.72
Jul-33	5.00	($1.82)	($1.62)	($1.28)	($1.43)	($1.93)	$0.25	3.37	3.38	3.72		3.57	3.05	5.24	($1.24)	$3.75	3.25

	Aug-33	5.21	($1.61)	($1.02)	($1.30)	($1.44)	($1.63)	$0.27	3.60	3.59	3.91		3.77	3.27	5.47	($1.24)	$3.97	3.48
	Sep-33	6.14	($1.7[illegible])	($1.83)	($1.64)	($1.67)	($2.16)	$0.10	4.38	4.30	4.50		4.46	4.03	6.24	($1.4[illegible])	$4.68	4.23
	Oct-33	4.88	($1.2[illegible])	($1.28)	($0.04)	($1.03)	($1.67)	$0.06	3.60	3.61	4.03		3.80	3.31	4.94	($0.0[illegible])	$3.90	3.50
	Nov-33	5.30	($1.23)	($1.23)	$0.09	($0.79)	($1.53)	$0.04	4.05	4.07	5.40		4.52	3.77	5.35	($0.77)	$4.53	3.96
	Dec-33	5.53	($1.01)	($0.99)	$1.21	$0.18	($1.39)	$0.07	4.52	4.58	6.75		5.71	4.16	5.60	($0.0[illegible])	$5.45	4.44
	Jan-34	5.68	($1.10)	($1.13)	$3.20	$0.46	($1.49)	$0.08	4.48	4.45	8.78		6.04	4.12	5.66	$0.09	$5.67	4.39
	Feb-34	5.83	($1.06)	($1.09)	$1.99	$0.25	($1.38)	$0.07	4.47	4.45	7.52		5.78	4.15	5.60	($0.04)	$5.49	4.39
	Mar-34	5.19	($1.01)	($0.97)	$0.50	($0.39)	($1.31)	$0.04	4.18	4.20	5.89		4.84	3.88	5.23	($0.44)	$4.75	4.11
	Apr-34	4.49	($1.04)	($1.05)	($0.32)	($0.00)	($1.27)	$0.05	3.44	3.43	4.17		3.69	3.21	4.53	($0.74)	$3.75	3.30
	May-34	5.27	($1.27)	($1.27)	($0.5[illegible])	($1.11)	($1.53)	$0.06	4.00	4.00	4.31		4.15	3.73	5.32	($0.[illegible])	$4.27	3.90
	Jun-34	6.21	($1.50)	($1.50)	($1.29)	($1.33)	($1.80)	$0.11	4.70	4.71	4.91		4.87	4.40	6.32	($1.18)	$5.03	4.50
	Jul-34	5.10	($2.40)	($2.34)	($2.22)	($2.26)	($2.89)	$0.24	2.62	2.58	2.88		2.74	2.21	5.34	($2.0[illegible])	$3.07	2.43
	Aug-34	5.30	($2.06)	($2.10)	($1.80)	($1.92)	($2.45)	$0.27	3.25	3.20	3.50		3.38	2.86	5.57	($1.65)	$3.69	3.00
	Sep-34	6.46	($2.00)	($2.72)	($2.95)	($2.90)	($3.02)	$0.11	3.88	3.74	3.92		3.90	3.44	6.57	($2.21)	$4.25	3.60
	Oct-34	5.01	($1.52)	($1.52)	($1.07)	($1.32)	($1.04)	$0.07	3.49	3.49	3.94		3.69	3.16	5.07	($1.10)	$3.83	3.38
	Nov-34	5.44	($1.53)	($1.57)	($0.04)	($1.05)	($1.07)	$0.05	3.87	3.92	5.40		4.40	3.46	5.49	($1.02)	$4.42	3.76
	Dec-34	5.69	($1.33)	($1.34)	$1.16	$0.12	($1.02)	$0.08	4.35	4.35	6.65		5.60	3.87	5.76	($0.70)	$5.49	4.25
	Jan-35	5.90	($1.20)	($1.23)	$3.37	$0.68	($1.F2)	$0.09	4.70	4.67	9.27		6.58	4.28	5.99	$0.22	$6.12	4.61
	Feb-35	5.85	($1.14)	($1.17)	$1.98	$0.30	($1.52)	$0.08	4.71	4.69	7.81		6.16	4.33	5.94	($0.0[illegible])	$5.63	4.62
	Mar-35	5.47	($1.13)	($1.14)	$0.46	($0.36)	($1.49)	$0.04	4.34	4.33	5.93		5.09	4.01	5.52	($0.49)	$4.99	4.26
	Apr-35	4.33	($0.0[illegible])	($0.04)	($0.13)	($0.56)	($1.07)	$0.05	3.47	3.48	4.20		3.77	3.26	4.38	($0.[illegible])	$3.78	3.40
	May-35	4.96	($0.[illegible])	($0.92)	($0.57)	($0.74)	($1.18)	$0.08	4.01	4.04	4.39		4.22	3.78	5.02	($0.6[illegible])	$4.28	3.94
	Jun-35	6.50	($1.13)	($1.11)	($0.05)	($0.02)	($1.33)	$0.13	5.37	5.40	5.65		5.56	5.11	6.63	($0.0[illegible])	$5.67	5.28
	Jul-35	5.38	($1.[illegible])	($1.31)	($0.87)	($1.12)	($1.67)	$0.25	4.03	4.07	4.41		4.28	3.71	5.62	($0.90)	$4.39	3.93
	Aug-35	5.75	($1.41)	($1.35)	($1.07)	($1.30)	($1.74)	$0.27	4.34	4.38	4.68		4.55	4.02	6.02	($1.05)	$4.70	4.24
	Sep-35	6.79	($1.55)	($1.53)	($1.38)	($1.41)	($1.88)	$0.12	5.24	5.21	5.41		5.38	4.91	6.91	($1.24)	$5.55	5.12
	Oct-35	4.83	($1.19)	($1.19)	($0.72)	($0.85)	($1.40)	$0.07	3.65	3.69	4.11		3.88	3.35	4.90	($0.87)	$3.96	3.56
	Nov-35	5.43	($1.11)	($1.07)	$0.20	($0.58)	($1.40)	$0.05	4.32	4.36	5.63		4.88	4.04	5.48	($0.61)	$4.83	4.24
	Dec-35	5.74	($0.92)	($0.82)	$1.27	$0.27	($1.29)	$0.09	4.82	4.93	7.02		6.02	4.45	5.84	($0.01)	$5.74	4.75
	Jan-36	6.10	($1.23)	($1.25)	$3.43	$0.69	($1.65)	$0.09	4.88	4.85	9.53		6.79	4.45	6.19	$0.22	$6.32	4.78
	Feb-36	6.05	($1.17)	($1.19)	$1.99	$0.31	($1.65)	$0.08	4.88	4.86	8.04		6.36	4.50	6.13	($0.03)	$6.02	4.80
	Mar-36	5.66	($1.15)	($1.16)	$0.47	($0.39)	($1.49)	$0.04	4.50	4.49	6.12		5.27	4.17	5.70	($0.49)	$5.16	4.42
	Apr-36	4.47	($0.07)	($0.8[illegible])	($0.13)	($0.67)	($1.09)	$0.05	3.60	3.61	4.34		3.90	3.38	4.53	($0.55)	$3.92	3.63
	May-36	5.12	($0.9[illegible])	($0.63)	($0.58)	($0.70)	($1.20)	$0.06	4.16	4.19	4.54		4.37	3.93	5.19	($0.[illegible])	$4.43	4.09
	Jun-36	6.72	($1.13)	($1.11)	($0.07)	($0.04)	($1.47)	$0.13	5.57	5.59	5.85		5.78	5.30	6.85	($0.04)	$5.88	5.48
	Jul-36	5.56	($1.37)	($1.34)	($0.93)	($1.14)	($1.70)	$0.25	4.18	4.22	4.57		4.42	3.86	5.81	($1.00)	$4.55	4.08
	Aug-36	5.95	($1.44)	($1.42)	($1.05)	($1.22)	($1.77)	$0.27	4.51	4.53	4.85		4.72	4.18	6.22	($1.07)	$4.87	4.40
	Sep-36	7.02	($1.5[illegible])	($1.61)	($1.41)	($1.43)	($1.91)	$0.12	5.44	5.41	5.61		5.58	5.11	7.14	($1.25)	$5.76	5.32
	Oct-36	4.99	($1.21)	($1.17)	($0.73)	($0.97)	($1.91)	$0.07	3.79	3.83	4.26		4.03	3.49	5.06	($0.[illegible])	$4.11	3.69
	Nov-36	5.62	($1.13)	($1.09)	$0.20	($0.59)	($1.42)	$0.05	4.49	4.52	5.82		5.03	4.19	5.68	($0.62)	$5.00	4.40
	Dec-36	5.94	($0.94)	($0.83)	$1.29	$0.28	($1.31)	$0.09	5.00	5.10	7.23		6.21	4.62	6.03	($0.01)	$5.93	4.93
	Jan-37	6.30	($1.24)	($1.27)	$3.49	$0.70	($1.68)	$0.09	5.06	5.03	9.80		7.01	4.62	6.39	$0.22	$6.53	4.98
	Feb-37	6.25	($1.19)	($1.21)	$2.03	$0.31	($1.53)	$0.09	5.07	5.04	8.28		6.56	4.67	6.34	($0.0[illegible])	$6.23	4.98
	Mar-37	5.84	($1.17)	($1.10)	$0.48	($0.39)	($1.51)	$0.05	4.67	4.66	6.32		5.45	4.33	5.89	($0.50)	$5.34	4.58
	Apr-37	4.62	($0.09)	($0.87)	($0.13)	($0.53)	($1.11)	$0.06	3.73	3.75	4.49		4.04	3.51	4.68	($0.5[illegible])	$4.06	3.66
	May-37	5.29	($0.9[illegible])	($0.9[illegible])	($0.69)	($0.77)	($1.22)	$0.07	4.32	4.35	4.70		4.53	4.08	5.36	($0.71)	$4.59	4.24
	Jun-37	6.94	($1.17)	($1.15)	($0.83)	($0.95)	($1.44)	$0.13	5.77	5.80	6.06		5.99	5.50	7.08	($0.8[illegible])	$6.08	5.68
	Jul-37	5.74	($1.40)	($1.39)	($1.01)	($1.10)	($1.73)	$0.26	4.34	4.38	4.74		4.59	4.02	6.00	($1.07)	$4.72	4.24
	Aug-37	6.14	($1.45)	($1.44)	($1.11)	($1.24)	($1.80)	$0.27	4.68	4.70	5.03		4.90	4.34	6.42	($1.09)	$5.05	4.57
	Sep-37	7.25	($1.60)	($1.64)	($1.43)	($1.46)	($1.94)	$0.12	5.64	5.61	5.82		5.79	5.31	7.37	($1.20)	$5.97	5.62
	Oct-37	5.16	($1.23)	($1.13)	($0.74)	($0.99)	($1.53)	$0.07	3.93	3.97	4.42		4.18	3.63	5.23	($0.[illegible])	$4.26	3.84
	Nov-37	5.80	($1.16)	($1.11)	$0.21	($0.60)	($1.45)	$0.05	4.65	4.69	6.01		5.21	4.35	5.85	($0.6[illegible])	$5.17	4.57
	Dec-37	6.13	($0.98)	($0.85)	$1.32	$0.28	($1.34)	$0.09	5.18	5.29	7.45		6.42	4.80	6.23	($0.01)	$6.13	5.10
	Jan-38	6.51	($1.27)	($1.30)	$3.56	$0.72	($1.71)	$0.09	5.25	5.21	10.07		7.23	4.80	6.61	$0.23	$6.74	5.15
	Feb-38	6.46	($1.21)	($1.23)	$2.07	$0.32	($1.61)	$0.09	5.25	5.23	8.52		6.78	4.85	6.55	($0.0[illegible])	$6.43	5.16
	Mar-38	6.04	($1.19)	($1.20)	$0.49	($0.40)	($1.54)	$0.05	4.85	4.84	6.53		5.64	4.50	6.08	($0.51)	$5.53	4.76
	Apr-38	4.77	($0.98)	($0.90)	($0.13)	($0.55)	($1.13)	$0.06	3.87	3.88	4.64		4.19	3.65	4.83	($0.57)	$4.20	3.80
	May-38	5.47	($1.00)	($0.97)	($0.60)	($0.78)	($1.24)	$0.07	4.47	4.50	4.87		4.69	4.23	5.54	($0.72)	$4.75	4.40
	Jun-38	7.17	($1.19)	($1.17)	($0.90)	($0.97)	($1.47)	$0.14	5.98	6.01	6.27		6.20	5.71	7.31	($0.07)	$6.30	5.89
	Jul-38	5.93	($1.42)	($1.38)	($1.02)	($1.16)	($1.70)	$0.26	4.51	4.55	4.91		4.76	4.18	6.19	($1.04)	$4.89	4.40
	Aug-38	6.35	($1.49)	($1.47)	($1.13)	($1.27)	($1.83)	$0.28	4.86	4.88	5.22		5.06	4.52	6.63	($1.11)	$5.24	4.75
	Sep-38	7.49	($1.63)	($1.67)	($1.46)	($1.46)	($1.93)	$0.13	5.86	5.82	6.03		6.01	5.51	7.62	($1.31)	$6.18	5.73
	Oct-38	5.33	($1.25)	($1.21)	($0.76)	($1.00)	($1.56)	$0.07	4.08	4.12	4.57		4.33	3.77	5.40	($0.92)	$4.41	3.99
	Nov-38	6.00	($1.17)	($1.13)	$0.21	($0.61)	($1.48)	$0.05	4.83	4.87	6.21		5.39	4.52	6.05	($0.64)	$5.35	4.74
	Dec-38	6.34	($0.97)	($0.85)	$1.34	$0.29	($1.35)	$0.10	5.36	5.48	7.68		6.63	4.98	6.43	($0.01)	$6.33	5.29
	Jan-39	6.73	($1.29)	($1.32)	$3.62	$0.73	($1.74)	$0.09	5.44	5.41	10.35		7.46	4.99	6.82	$0.23	$6.96	5.34
	Feb-39	6.67	($1.23)	($1.25)	$2.10	$0.32	($1.63)	$0.09	5.44	5.42	8.78		7.00	5.04	6.76	($0.03)	$6.65	5.35
	Mar-39	6.24	($1.21)	($1.22)	$0.50	($0.41)	($1.57)	$0.05	5.02	5.01	6.73		5.83	4.67	6.26	($0.52)	$5.72	4.93
	Apr-39	4.93	($0.92)	($0.91)	($0.13)	($0.60)	($1.15)	$0.06	4.01	4.02	4.80		4.33	3.78	4.99	($0.5[illegible])	$4.35	3.94
	May-39	5.65	($1.03)	($0.98)	($0.61)	($0.80)	($1.28)	$0.07	4.64	4.67	5.04		4.86	4.39	5.72	($0.73)	$4.92	4.56
	Jun-39	7.41	($1.20)	($1.19)	($0.92)	($0.99)	($1.50)	$0.14	6.19	6.22	6.49		6.42	5.92	7.55	($0.09)	$6.52	6.10
	Jul-39	6.13	($1.45)	($1.41)	($1.04)	($1.20)	($1.76)	$0.27	4.68	4.72	5.09		4.93	4.34	6.39	($1.06)	$5.07	4.57
	Aug-39	6.56	($1.51)	($1.50)	($1.16)	($1.29)	($1.85)	$0.29	5.04	5.06	5.40		5.27	4.69	6.84	($1.13)	$5.43	4.93
	Sep-39	7.74	($1.68)	($1.70)	($1.48)	($1.51)	($2.01)	$0.13	6.07	6.04	6.25		6.23	5.72	7.87	($1.30)	$6.41	5.95
	Oct-39	5.51	($1.29)	($1.23)	($0.77)	($1.02)	($1.59)	$0.07	4.23	4.28	4.74		4.49	3.92	5.58	($0.94)	$4.57	4.14
	Nov-39	6.19	($1.19)	($1.15)	$0.21	($0.62)	($1.50)	$0.05	5.00	5.04	6.41		5.57	4.69	6.25	($0.65)	$5.54	4.91
	Dec-39	6.55	($0.99)	($0.86)	$1.37	$0.29	($1.35)	$0.10	5.56	5.67	7.91		6.84	5.16	6.65	($0.01)	$6.54	5.48
	Jan-40	6.95	($1.31)	($1.35)	$3.69	$0.74	($1.77)	$0.10	5.63	5.60	10.64		7.69	5.17	7.04	$0.24	$7.18	5.54
	Feb-40	6.89	($1.25)	($1.28)	$2.14	$0.33	($1.65)	$0.09	5.64	5.62	9.03		7.22	5.23	6.98	($0.03)	$6.80	5.56
	Mar-40	6.44	($1.24)	($1.25)	$0.50	($0.42)	($1.60)	$0.05	5.21	5.20	6.95		6.03	4.84	6.49	($0.53)	$5.91	5.11
	Apr-40	5.09	($0.94)	($0.92)	($0.14)	($0.61)	($1.17)	$0.06	4.16	4.17	4.96		4.48	3.92	5.15	($0.55)	$4.50	4.08
	May-40	5.84	($1.05)	($1.00)	($0.62)	($0.01)	($1.29)	$0.07	4.80	4.83	5.21		5.03	4.55	5.91	($0.75)	$5.09	4.73
	Jun-40	7.65	($1.24)	($1.21)	($0.93)	($1.01)	($1.52)	$0.14	6.42	6.44	6.72		6.65	6.13	7.80	($0.91)	$6.75	6.32
	Jul-40	6.33	($1.43)	($1.43)	($1.06)	($1.22)	($1.82)	$0.27	4.85	4.90	5.27		5.11	4.51	6.60	($1.08)	$5.25	4.74
	Aug-40	6.77	($1.54)	($1.53)	($1.17)	($1.31)	($1.90)	$0.29	5.23	5.25	5.60		5.46	4.87	7.06	($1.15)	$5.62	5.12
	Sep-40	7.99	($1.63)	($1.73)	($1.51)	($1.54)	($2.05)	$0.13	6.30	6.26	6.48		6.45	5.94	8.12	($1.35)	$6.64	6.17
	Oct-40	5.69	($1.30)	($1.25)	($0.79)	($1.04)	($1.62)	$0.07	4.39	4.43	4.90		4.65	4.07	5.76	($0.9[illegible])	$4.73	4.29
	Nov-40	6.40	($1.21)	($1.17)	$0.22	($0.63)	($1.53)	$0.05	5.18	5.23	6.62		5.77	4.87	6.45	($0.67)	$5.73	5.09
	Dec-40	6.76	($1.01)	($0.89)	$1.39	$0.30	($1.41)	$0.10	5.75	5.87	8.15		7.06	5.35	6.86	($0.01)	$6.76	5.68
	Jan-41	7.19	($1.34)	($1.37)	$3.75	$0.76	($1.81)	$0.10	5.86	5.82	10.95		7.95	5.39	7.29	$0.24	$7.43	5.76
	Feb-41	7.14	($1.27)	($1.30)	$2.18	$0.34	($1.63)	$0.09	5.86	5.84	9.31		7.47	5.44	7.23	($0.01)	$7.11	5.77
	Mar-41	6.67	($1.26)	($1.27)	$0.51	($0.42)	($1.63)	$0.05	5.41	5.40	7.18		6.25	5.04	6.72	($0.54)	$6.13	5.32
	Apr-41	5.27	($0.95)	($0.94)	($0.14)	($0.62)	($1.19)	$0.06	4.32	4.33	5.13		4.65	4.08	5.33	($0.56)	$4.67	4.25
	May-41	6.04	($1.05)	($1.02)	($0.64)	($0.62)	($1.31)	$0.07	4.99	5.02	5.41		5.22	4.73	6.11	($0.76)	$5.28	4.91
	Jun-41	7.93	($1.26)	($1.23)	($0.99)	($1.02)	($1.55)	$0.14	6.66	6.69	6.97		6.90	6.37	8.07	($0.93)	$7.00	6.57
	Jul-41	6.55	($1.50)	($1.45)	($1.03)	($1.24)	($1.85)	$0.27	5.05	5.09	5.47		5.31	4.70	6.83	($1.10)	$5.46	4.94
	Aug-41	7.01	($1.57)	($1.55)	($1.20)	($1.34)	($1.93)	$0.30	5.44	5.46	5.82		5.68	5.06	7.31	($1.17)	$5.84	5.33
	Sep-41	8.27	($1.72)	($1.76)	($1.54)	($1.57)	($2.03)	$0.13	6.55	6.51	6.74		6.71	6.19	8.41	($1.39)	$6.90	6.42
	Oct-41	5.89	($1.32)	($1.28)	($0.80)	($1.05)	($1.65)	$0.07	4.57	4.61	5.09		4.83	4.24	5.96	($0.97)	$4.92	4.47
	Nov-41	6.62	($1.24)	($1.19)	$0.22	($0.64)	($1.56)	$0.05	5.39	5.43	6.85		5.98	5.07	6.68	($0.68)	$5.95	5.29
	Dec-41	7.00	($1.03)	($0.91)	$1.41	$0.30	($1.44)	$0.10	5.97	6.09	8.42		7.31	5.56	7.10	($0.01)	$6.99	5.90
	Jan-42	7.44	($1.26)	($1.39)	$3.82	$0.77	($1.84)	$0.10	6.08	6.05	11.26		8.21	5.61	7.54	$0.25	$7.69	5.98
	Feb-42	7.38	($1.30)	($1.33)	$2.22	$0.34	($1.72)	$0.09	6.09	6.06	9.60		7.73	5.66	7.48	($0.03)	$7.36	5.99
	Mar-42	6.90	($1.23)	($1.29)	$0.52	($0.43)	($1.68)	$0.05	5.62	5.61	7.42		6.47	5.25	6.95	($0.55)	$6.35	5.53

	Apr-42	5.48	($0.97)	[illegible]	($0.14)	($0.63)	($1.21)	$0.06	4.49	4.50	5.31		4.82	4.25	5.52	($0.61)	$4.84	4.41
	May-42	6.25	($1.07)	($1.04)	($0.65)	[illegible]	($1.33)	$0.07	5.18	5.22	5.61		5.41	4.92	6.33	($0.77)	$5.48	5.10
	Jun-42	8.20	[illegible]	($1.29)	($0.87)	($1.04)	($1.58)	$0.15	6.92	6.95	7.23		7.16	6.62	8.35	($0.94)	$7.26	6.82
	Jul-42	6.78	[illegible]	($1.49)	($1.10)	($1.26)	($1.89)	$0.28	5.25	5.30	5.68		5.52	4.90	7.08	($1.12)	$5.67	5.14
	Aug-42	7.26	[illegible]	($1.58)	($1.22)	[illegible]	($1.97)	$0.30	5.68	5.88	6.04		5.90	5.29	7.56	[illegible]	$6.08	5.54
	Sep-42	8.56	[illegible]	($1.70)	($1.56)	[illegible]	($2.12)	$0.14	6.81	6.77	7.00		6.97	6.44	8.70	($1.40)	$7.16	6.68
	Oct-42	6.10	[illegible]	($1.30)	($0.81)	($1.00)	($1.68)	$0.07	4.75	4.80	5.28		5.02	4.42	6.17	[illegible]	$5.11	4.65
	Nov-42	6.85	($1.74)	($1.21)	$0.23	($0.65)	($1.60)	$0.05	5.60	5.64	7.08		6.20	5.27	6.91	[illegible]	$6.17	5.50
	Dec-42	7.25	[illegible]	[illegible]	$1.44	$0.31	($1.46)	$0.10	6.20	6.32	8.68		7.55	5.78	7.35	($0.01)	$7.24	6.12
	Jan-43	7.70	[illegible]	($1.42)	$3.89	$0.78	($1.87)	$0.10	6.32	6.28	11.59		8.48	5.83	7.80	$0.25	$7.95	6.21
	Feb-43	7.64	[illegible]	($1.35)	$2.26	$0.35	($1.75)	$0.10	6.32	6.29	9.90		7.99	5.88	7.74	($0.03)	$7.61	6.22
	Mar-43	7.14	[illegible]	($1.31)	$0.53	($0.44)	($1.68)	$0.05	5.84	5.83	7.67		6.70	5.46	7.19	[illegible]	$6.58	5.74
	Apr-43	5.65	[illegible]	($0.97)	($0.14)	($0.64)	($1.23)	$0.06	4.66	4.67	5.50		5.00	4.41	5.71	($0.02)	$5.02	4.68
	May-43	6.47	[illegible]	($1.06)	[illegible]	($0.65)	($1.38)	$0.07	5.38	5.41	5.81		5.62	5.11	6.54	($0.70)	$5.68	5.30
	Jun-43	8.46	($1.51)	($1.20)	($0.99)	[illegible]	($1.61)	$0.15	7.18	7.21	7.50		7.42	6.88	8.63	[illegible]	$7.53	7.08
	Jul-43	7.02	[illegible]	($1.51)	($1.12)	($1.29)	($1.93)	$0.28	5.46	5.50	5.80		5.73	5.10	7.30	($1.14)	$5.88	5.34
	Aug-43	7.51	($1.63)	($1.61)	($1.24)	($1.39)	($2.00)	$0.31	5.88	5.90	6.27		6.12	5.51	7.81	($1.21)	$6.29	5.78
	Sep-43	8.86	[illegible]	($1.62)	($1.59)	($1.62)	($2.16)	$0.14	7.07	7.03	7.27		7.24	6.70	8.00	($1.41)	$7.43	6.94
	Oct-43	6.31	($1.37)	($1.32)	[illegible]	($1.10)	($1.71)	$0.08	4.94	4.98	5.48		5.21	4.60	6.38	($1.01)	$5.30	4.83
	Nov-43	7.09	[illegible]	($1.24)	$0.23	($0.67)	($1.61)	$0.06	5.81	5.86	7.32		6.43	5.48	7.16	($0.70)	$6.39	5.72
	Dec-43	7.50	[illegible]	($0.94)	$1.47	$0.31	($1.45)	$0.11	6.43	6.55	8.96		7.81	6.01	7.60	($0.01)	$7.49	6.35

Market Date 29-Dec-17

		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		Henry Hub	Dom SP	TCO Pool	Z6NNY	Transco Z5	Leidy	Transco Zone 4	Dom SP Deld	TCO Pool Deld	Z6NNY Deld	DOM ZONE	Transco Z5 Deld	Leidy Deld	Zone 4 Deld	Transco Blend-Basis	Transco Blend - Deld	Tetco M2 Basis	Tetco M2 Delivered
2018	Jan-18	$2.95	($0.47)	[illegible]	$2.73	$2.51	[illegible]	($0.01)	$2.49	$2.74	$5.66	$5.00	$5.46	$2.45	$2.94	$1.62	$4.60	[illegible]	$2.39
2018	Feb-18	$2.95	[illegible]	[illegible]	$3.40	$3.20	($0.47)	($0.01)	$2.57	$2.73	$6.35	$5.52	$6.15	$2.48	$2.94	$2.10	$5.05	[illegible]	$2.40
2018	Mar-18	$2.91	[illegible]	[illegible]	$0.70	$0.86	[illegible]	($0.03)	$2.51	$2.67	$3.61	$3.39	$3.77	$2.41	$2.88	$0.50	$3.41	[illegible]	$2.46
2018	Apr-18	$2.78	[illegible]	[illegible]	[illegible]	$0.04	[illegible]	($0.02)	$2.32	$2.50	$2.67	$2.62	$2.78	$2.20	$2.73	($0.07)	$2.68	[illegible]	$2.24
2018	May-18	$2.74	[illegible]	[illegible]	[illegible]	$0.18	[illegible]	($0.03)	$2.27	$2.51	$2.59	$2.56	$2.92	$2.16	$2.71	$0.02	$2.77	[illegible]	$2.12
2018	Jun-18	$2.77	[illegible]	[illegible]	($0.10)	$0.10	[illegible]	[illegible]	$2.26	$2.52	$2.59	$2.56	$2.88	$2.17	$2.72	[illegible]	$2.74	($0.70)	$2.06
2018	Jul-18	$2.80	[illegible]	[illegible]	[illegible]	$0.02	[illegible]	($0.06)	$2.29	$2.53	$2.73	$2.67	$2.83	$2.14	$2.75	($0.10)	$2.70	[illegible]	$2.11
2018	Aug-18	$2.81	[illegible]	[illegible]	[illegible]	[illegible]	($0.71)	[illegible]	$2.23	$2.49	$2.69	$2.63	$2.71	$2.10	$2.70	[illegible]	$2.62	($0.04)	$1.97
2018	Sep-18	$2.79	[illegible]	[illegible]	($0.41)	[illegible]	[illegible]	[illegible]	$2.07	$2.46	$2.38	$2.38	$2.71	$1.95	$2.74	($0.10)	$2.60	($1.60)	$1.79
2018	Oct-18	$2.81	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$2.17	$2.48	$2.49	$2.46	$2.78	$2.06	$2.78	($0.14)	$2.67	[illegible]	$1.65
2018	Nov-18	$2.87	[illegible]	[illegible]	[illegible]	$0.15	[illegible]	($0.04)	$2.26	$2.59	$2.64	$2.77	$3.01	$2.23	$2.83	($0.01)	$2.66	[illegible]	$2.25
2018	Dec-18	$3.00	[illegible]	[illegible]	$0.72	$0.78	[illegible]	[illegible]	$2.53	$2.69	$3.72	$3.48	$3.77	$2.44	$2.97	$0.43	$3.43	[illegible]	$2.44
2019	Jan-19	$3.08	[illegible]	($0.30)	$2.57	$2.53	[illegible]	($0.04)	$2.70	$2.78	$5.65	$5.01	$5.61	$2.67	$3.04	$1.63	$4.71	[illegible]	$2.87
2019	Feb-19	$3.06	[illegible]	[illegible]	$2.39	$2.33	[illegible]	[illegible]	$2.67	$2.76	$5.45	$4.85	$5.89	$2.56	$3.02	$1.60	$4.66	[illegible]	$2.02
2019	Mar-19	$3.00	($0.44)	[illegible]	$0.42	$0.31	[illegible]	[illegible]	$2.56	$2.70	$3.41	$3.25	$3.31	$2.48	$2.94	$0.12	$3.12	[illegible]	$2.42
2019	Apr-19	$2.69	[illegible]	[illegible]	[illegible]	$0.14	[illegible]	[illegible]	$2.30	$2.36	$2.51	$2.47	$2.63	$2.23	$2.67	$0.02	$2.71	[illegible]	$2.40
2019	May-19	$2.67	[illegible]	[illegible]	[illegible]	$0.14	[illegible]	($0.03)	$2.23	$2.31	$2.23	$2.25	$2.60	$2.14	$2.64	$0.00	$2.07	[illegible]	$2.28
2019	Jun-19	$2.69	[illegible]	[illegible]	[illegible]	$0.03	[illegible]	($0.04)	$2.16	$2.30	$2.24	$2.25	$2.72	$2.05	$2.65	[illegible]	$2.00	[illegible]	$2.12
2019	Jul-19	$2.72	[illegible]	[illegible]	[illegible]	($0.16)	($0.07)	($0.04)	$2.15	$2.27	$2.46	$2.41	$2.58	$2.06	$2.68	[illegible]	$2.50	[illegible]	$1.07
2019	Aug-19	$2.72	[illegible]	($0.43)	[illegible]	($0.13)	($0.70)	($0.04)	$2.12	$2.24	$2.45	$2.40	$2.60	$2.02	$2.68	[illegible]	$2.52	($0.70)	$1.06
2019	Sep-19	$2.70	($0.74)	[illegible]	($0.43)	$0.08	($0.02)	($0.04)	$1.96	$2.20	$2.28	$2.25	$2.76	$1.68	$2.66	[illegible]	$2.02	[illegible]	$1.85
2019	Oct-19	$2.73	[illegible]	[illegible]	[illegible]	($0.04)	[illegible]	($0.09)	$2.05	$2.25	$2.27	$2.26	$2.69	$1.97	$2.70	[illegible]	$2.66	[illegible]	$1.88
2019	Nov-19	$2.76	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$2.22	$2.44	$2.56	$2.52	$2.76	$2.15	$2.74	[illegible]	$2.08	[illegible]	$2.17
2019	Dec-19	$2.92	[illegible]	[illegible]	$0.36	$0.32	[illegible]	($0.03)	$2.44	$2.56	$3.30	$3.13	$3.24	$2.32	$2.80	$0.12	$3.04	[illegible]	$2.38
2020	Jan-20	$3.02	[illegible]	[illegible]	$2.08	$2.07	[illegible]	($0.04)	$2.63	$2.66	$5.06	$4.49	$5.09	$2.51	$2.99	$1.32	$4.34	[illegible]	$2.63
2020	Feb-20	$3.00	[illegible]	[illegible]	$1.96	$1.84	[illegible]	[illegible]	$2.61	$2.65	$4.96	$4.39	$4.84	$2.50	$2.97	$1.16	$4.17	[illegible]	$2.62
2020	Mar-20	$2.95	[illegible]	($0.37)	$0.16	[illegible]	($0.61)	[illegible]	$2.47	$2.59	$3.10	$2.97	$2.91	$2.34	$2.90	($0.14)	$2.62	[illegible]	$2.39
2020	Apr-20	$2.68	($0.43)	[illegible]	($0.19)	$0.22	[illegible]	[illegible]	$2.25	$2.28	$2.49	$2.44	$2.90	$2.14	$2.66	$0.06	$2.74	[illegible]	$2.48
2020	May-20	$2.67	[illegible]	[illegible]	[illegible]	$0.07	[illegible]	($0.05)	$2.23	$2.25	$2.13	$2.16	$2.73	$2.12	$2.64	[illegible]	$2.02	[illegible]	$2.31
2020	Jun-20	$2.69	[illegible]	[illegible]	[illegible]	$0.01	($0.07)	($0.04)	$2.14	$2.24	$2.25	$2.24	$2.70	$2.02	$2.65	($0.11)	$2.56	[illegible]	$2.14
2020	Jul-20	$2.72	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	($0.04)	$2.12	$2.26	$2.57	$2.49	$2.60	$2.01	$2.68	[illegible]	$2.52	[illegible]	$1.99
2020	Aug-20	$2.74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	($0.04)	$2.18	$2.24	$2.55	$2.47	$2.68	$2.07	$2.70	[illegible]	$2.57	[illegible]	$2.00
2020	Sep-20	$2.74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	($0.04)	$1.90	$2.23	$2.15	$2.15	$2.50	$1.80	$2.70	[illegible]	$2.42	[illegible]	$1.79
2020	Oct-20	$2.77	[illegible]	[illegible]	[illegible]	($0.23)	($0.34)	[illegible]	$1.92	$2.27	$2.22	$2.22	$2.48	$1.82	$2.74	[illegible]	$2.42	[illegible]	$1.83
2020	Nov-20	$2.83	[illegible]	[illegible]	[illegible]	($0.14)	($0.71)	[illegible]	$2.22	$2.47	$2.52	$2.49	$2.69	$2.12	$2.60	($0.21)	$2.62	[illegible]	$2.24
2020	Dec-20	$2.96	[illegible]	($0.37)	$0.20	$0.35	($0.01)	($0.03)	$2.44	$2.61	$3.17	$3.03	$3.33	$2.37	$2.05	$0.14	$3.11	[illegible]	$2.44
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Virginia Electric and Power Company
Case No. PUR-2018-00065
Virginia State Corporation Commission Staff
Seventh Set

The following response to Question No. 92 (a) of the Seventh Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on June 11, 2018 has been prepared under my supervision.

Christopher C. Hewett
Supervisor, PJM Energy Settlement & Demand Response
Virginia Electric and Power Company

Question No. 92

Please provide the following load data for the Dominion LSE as an excel spreadsheet with all formulas intact:

a) Historic hourly load data for Dominion LSE for the period 2014 to present.

Response:

a) The historical hourly load data for Dominion Energy LSE for the period 2014 to present is provided in Attachment Staff Set 7-92(a) (CH). Please note that no load data is available past March 2018 because final settlement is not available until 60 days following the end of the respective month.

Attachment to Staff 3-31 (KS).xlsx
2015 Plan

Zonal Peak Demand (MW)

Year	Winter	Summer
2015	17,369	19,974
2016	17,672	20,487
2017	17,916	20,777
2018	18,064	21,216
2019	18,307	21,749
2020	18,587	22,157
2021	18,854	22,378
2022	19,195	22,626
2023	19,327	22,883
2024	19,457	23,354
2025	19,789	23,666
2026	20,011	23,970
2027	20,329	24,175
2028	20,703	24,344
2029	20,722	24,651
2030	20,977	25,067

[illegible]

Year	Winter	Summer
2015	14,969	17,475
2016	15,230	17,925
2017	15,441	18,179
2018	15,569	18,563
2019	15,778	19,031
2020	16,020	19,388
2021	16,251	19,582
2022	16,545	19,799
2023	16,659	20,024
2024	16,771	20,437
2025	17,057	20,710
2026	17,250	20,977
2027	17,524	21,156
2028	17,847	21,305
2029	17,863	21,574
2030	18,084	21,938

Zonal Energy (MWh)

Year	Annual
2015	98,610,915
2016	101,617,815
2017	103,144,719
2018	104,809,517
2019	106,208,204
2020	108,016,494
2021	109,098,925
2022	110,578,961
2023	112,047,122
2024	113,783,095
2025	114,919,028
2026	116,357,933
2027	117,822,765
2028	119,624,145
2029	120,812,885
2030	122,176,377

[illegible]

Year	Annual
2015	86,386,004
2016	89,026,738
2017	90,369,190
2018	91,830,703
2019	93,059,127
2020	94,644,395
2021	95,596,338
2022	96,895,656
2023	98,184,447
2024	99,706,544
2025	100,705,324
2026	101,968,339
2027	103,254,246
2028	104,833,598
2029	105,878,883
2030	107,075,705

Attachment to Staff 3-31 (KS).xlsx
2016 Plan

Zonal Peak Demand (MW)

Year	Winter	Summer
2016	18,090	20,127
2017	18,418	20,562
2018	18,601	20,995
2019	18,919	21,418
2020	19,192	21,847
2021	19,453	22,263
2022	19,807	22,546
2023	20,005	22,792
2024	20,136	23,260
2025	20,523	23,566
2026	20,776	23,792
2027	21,164	24,016
2028	21,555	24,201
2029	21,588	24,482
2030	21,874	24,919
2031	22,162	25,249

[illegible]

Year	Winter	Summer
2016	15,612	17,620
2017	15,896	18,001
2018	16,053	18,379
2019	16,328	18,750
2020	16,563	19,125
2021	16,788	19,490
2022	17,094	19,738
2023	17,265	19,952
2024	17,378	20,362
2025	17,712	20,630
2026	17,931	20,828
2027	18,265	21,024
2028	18,603	21,186
2029	18,631	21,432
2030	18,878	21,814
2031	19,127	22,103

Zonal Energy (MWh)

Year	Annual
2016	98,867,586
2017	100,350,600
2018	101,956,210
2019	103,638,487
2020	105,547,819
2021	107,257,694
2022	109,102,526
2023	110,897,263
2024	112,546,305
2025	114,121,953
2026	115,719,660
2027	117,316,592
2028	118,900,366
2029	120,497,198
2030	122,105,835
2031	123,899,542

[illegible]

Year	Annual
2016	86,684,220
2017	87,986,035
2018	89,393,640
2019	90,868,776
2020	92,540,891
2021	94,042,310
2022	95,660,142
2023	97,233,692
2024	98,677,848
2025	100,060,913
2026	101,462,481
2027	102,862,755
2028	104,249,852
2029	105,651,684
2030	107,062,486
2031	108,635,619

Attachment to Staff 3-31 (KS).xlsx
2017 Plan

Zonal Peak Demand (MW)

Year	Winter	Summer
2017	17,478	20,014
2018	17,702	20,442
2019	17,959	20,848
2020	18,232	21,208
2021	18,541	21,440
2022	18,932	21,795
2023	19,069	21,957
2024	19,243	22,364
2025	19,470	22,607
2026	19,642	22,888
2027	19,950	23,235
2028	20,245	23,402
2029	20,314	23,694
2030	20,466	24,065
2031	20,704	24,371
2032	20,945	24,681

[illegible] Demand (MW) [illegible] DSM [illegible]

Year	Winter	Summer
2017	15,044	17,501
2018	15,236	17,875
2019	15,457	18,230
2020	15,692	18,545
2021	15,958	18,747
2022	16,295	19,058
2023	16,413	19,200
2024	16,563	19,555
2025	16,758	19,768
2026	16,905	20,013
2027	17,171	20,317
2028	17,424	20,463
2029	17,484	20,718
2030	17,615	21,042
2031	17,820	21,310
2032	18,027	21,581

Zonal Energy (MWh)

Year	Annual
2017	99,257,947
2018	100,972,224
2019	102,386,452
2020	103,946,181
2021	105,229,243
2022	107,520,997
2023	108,759,501
2024	110,285,465
2025	111,254,957
2026	112,449,671
2027	113,756,829
2028	115,445,882
2029	116,505,454
2030	117,582,065
2031	119,041,105
2032	120,518,380

[illegible] (MWh) [illegible]

Year	Annual
2017	86,940,039
2018	88,441,217
2019	89,679,779
2020	91,043,449
2021	92,169,352
2022	94,177,075
2023	95,261,777
2024	96,596,390
2025	97,447,466
2026	98,493,944
2027	99,639,080
2028	101,116,447
2029	102,046,530
2030	102,989,795
2031	104,268,071
2032	105,562,327

Attachment to Staff 3-31 (KS).xlsx
2018 Plan

Zonal Peak Demand (MW)

Year	Winter	Summer
2018	18,666	19,938
2019	18,974	20,282
2020	19,291	20,568
2021	19,748	20,867
2022	20,191	21,161
2023	20,517	21,477
2024	20,862	22,010
2025	21,175	22,381
2026	21,534	22,757
2027	22,024	23,006
2028	22,394	23,228
2029	22,597	23,567
2030	22,696	23,960
2031	22,935	24,230
2032	23,161	24,422
2033	23,608	24,610

[illegible]

Year	Winter	Summer
2018	16,019	17,417
2019	16,283	17,718
2020	16,555	17,968
2021	16,947	18,229
2022	17,328	18,486
2023	17,607	18,762
2024	17,904	19,227
2025	18,172	19,551
2026	18,480	19,880
2027	18,901	20,097
2028	19,218	20,292
2029	19,341	20,587
2030	19,477	20,931
2031	19,682	21,167
2032	19,876	21,334
2033	20,260	21,499

Zonal Energy (MWh)

Year	Annual
2018	100,808,907
2019	102,300,136
2020	103,775,877
2021	105,331,462
2022	107,059,853
2023	108,813,922
2024	110,882,650
2025	112,457,008
2026	114,293,786
2027	116,024,848
2028	118,013,726
2029	119,286,564
2030	120,701,635
2031	122,203,981
2032	124,001,871
2033	124,944,836

[illegible]

Year	Annual
2018	88,148,095
2019	89,451,104
2020	90,738,445
2021	92,100,640
2022	93,611,295
2023	95,144,326
2024	96,950,823
2025	98,328,935
2026	99,934,689
2027	101,448,275
2028	103,185,105
2029	104,300,158
2030	105,537,663
2031	106,851,106
2032	108,420,559
2033	109,248,032

Virginia Electric and Power Company
Case No. PUR-2018-00065
Virginia State Corporation Commission Staff
Ninth Set

The following response to Question No. 107(f) of the Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff (**Corrected** Staff Interrogatory No. 9-107) received on June 29, 2018 has been prepared under my supervision.

Bradley Hanks
Supervisor, Regulatory and Data Support
Dominion Energy Services, Inc.

Corrected Question No. 107

The Commission has the constitutional and statutory duty to ensure that Virginians receive a reliable supply of electricity at just and reasonable rates. As such, it is important that an integrated resource plan address both system reliability and costs. Please answer the following questions with regard to system reliability.

(f) Please estimate the cost of adding a 30-day back-up fuel capability at the Company's Brunswick, Warren County, and Greensville gas-fired combined cycle units.

Response:

(f) The cost of adding approximately four days of #2 oil backup capability, as modeled for the IRP, on a greenfield, generic, 3x1 combined cycle facility, with a peak summer capacity of approximately 1,600 MW, is $24/kW in overnight costs.

CERTIFICATE OF SERVICE

I hereby certify that the following have been served with a true and accurate copy of the foregoing via first-class mail, postage pre-paid:

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DATED: August 10, 2018