BEFORE THE

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION Complainant, v. NORTHWEST NATURAL GAS COMPANY, Respondent.	DOCKET UG-18___

NORTHWEST NATURAL GAS COMPANY

Direct Testimony of Dr. Bente Villadsen

RATE OF RETURN ON EQUITY

EXH. BV-1T

December 31, 2018

DIRECT TESTIMONY OF DR. BENTE VILLADSEN

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I. INTRODUCTION AND SUMMARY

Q1. Please state your name, occupation and relationship with NW Natural Gas Company ("NWN Gas Co.").

A1. My name is Bente Villadsen and I am a principal at The Brattle Group (Brattle). My business address is The Brattle Group, One Beacon St., Suite 2600, Boston, MA 02108. I have been asked by Northwest Natural Gas Company ("NWN Gas Co.") to estimate the cost of equity that NW Natural's Washington natural gas Local Distribution Company ("LDC") – subsequently NWN Washington – should be allowed an opportunity to earn on the equity portion of its rate base for the period after December 1, 2019.

Q2. Please summarize your professional qualifications.

A2. I have 20 years of experience working with regulated utilities on cost of capital and related matters. My practice focuses on cost of capital, regulatory finance, and accounting issues. I have testified or filed expert reports on cost of capital in Alaska, Arizona, California, Illinois, New Mexico, and Oregon, as well as before the Bonneville Power Administration, the Surface Transportation Board, the Alberta Utilities Commission, and the Ontario Energy Board. I have provided white papers on cost of capital to the British Columbia Utilities Commission, the Canadian Transportation Agency as well as to European and Australian regulators on cost of capital. I recently co-authored the book, "Risk and Return for Regulated Industries"[1] and frequently speak or write on cost of capital related issues. I have testified or filed

[1] "Risk and Return for Regulated Industries" by Bente Villadsen, Michael J. Vilbert, Dan Harris, and A. Lawrence Kolbe, Academic Press 2017.

testimony on regulatory accounting issues before the Federal Energy Regulatory Commission ("FERC"), the Michigan Public Service Commission, the Texas Public Utility Commission as well as in international and U.S. arbitrations and regularly provide advice to utilities on regulatory matters as well as risk management. I have worked as an advisor on regulatory matters in more than 30 U.S. states including Washington. I hold a Ph.D. from Yale University and a BS/MS from University of Aarhus, Denmark. Exh. BV-2 contains more information on my professional qualifications as well as a list of my prior testimonies.

Q3. What do you conclude regarding NWN Washington's cost of capital?

A3. Based on the cost of equity for a sample of comparable gas LDCs and NWN Washington's business risks, I conclude that a reasonable cost of equity capital for NWN Washington is in the range of 10 to 10¾ percent along with a capital structure including 49.5 percent equity.[2] I recommend NWN Washington be allowed an ROE of 10.3 percent along with its requested capital structure including 49.5% equity.

Q4. Please summarize the results.

A4. The results for the sample companies are summarized in Figure 1 below.

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[2] I understand that NW Natural is applying for a capital structure including 49.5% equity, 49.5% long-term debt, and 1% short-term debt.

Figure 1
Summary of ROE Results for Comparable Samples

		Sample Results	Reasonable Range
DCF	[a]	8.6% - 12.1%	10.1% - 10.4%
CAPM	[b]	10.1% - 11.5%	10.1% - 10.8%
Implied Risk Premium Model	[c]	10.3%	10.30%

Sources and Notes:
[a]: Table No. BV-4.
[b]: Table No. BV-15.
[c]: See Figure 16.

I determine the allowed ROE for NWN Washington using versions of the DCF, CAPM, and implied risk premium models. I explain each of these models and their inputs in more detail in Sections IV and V below. I position NWN Washington relative to the sample companies based on NWN Washington's business risks, which I discuss in Section VI.

I use both a single-stage and a multi-stage DCF based model and apply the models to the full sample of comparable companies as well as to the a smaller subsample, which excludes companies that have contemplated or engaged in some level of merger activity over the past five years. The range from the DCF-based models is very wide, but the midpoint of the range is reasonable. I also implement two versions of the CAPM and apply the models to both the full sample and subsample, which result in average ROEs for the samples between 10.1 - 11.5 percent; this range I narrow by excluding a high outlier. Finally, I implement an implied risk premium model, which looks to the historical risk premium required over and above the prevailing treasury yield and determine an ROE of 10.3 percent. Overall, the ROE results across models

falls within the range of 8.6 - 12.0 percent. However, both the low end and the upper end of this range are outliers, so I narrow the range by (i) looking to the midpoint estimates for my two DCF models and (ii) excluding a high-end outlier from the CAPM estimates. I then look to the central tendency of the estimates with are in the range of 10.2 to 10.4 percent – all estimation methods have ROE results in that range. The midpoint of that range is 10.3 percent. NWN Washington is smaller than the sample companies, need substantial capital investment over the next several years, and may be negatively impacted by the tax reform of 2017, which will increase volatility in earnings and have an adverse effect on credit metrics. Therefore, an ROE of 10.3 percent and 49.5% equity are fully supported by my results.

Lastly, I note that NWN Washington is applying for a decoupling mechanism similar to that currently in place for other Washington State gas utilities. As the majority of the sample companies have a decoupling mechanism in place, any impact on the cost of equity capital is already captured in my results.

Q5. How did you estimate the ROE for NWN Washington?

A5. NWN Washington as well as its parent company, NWN Gas Co, are natural gas LDCs owned by NW Natural Holding Company. To assess the cost of capital for NWN Washington, I start by selecting a sample of gas LDCs from *Value Line's* universe of gas LDCs. To ensure comparability, I then eliminate companies that have less than 50 percent of their assets dedicated to regulated gas operations. Next, I eliminate companies that do not have an investment grade credit rating, companies with dividend

cuts or substantial merger activity over the relevant estimation window.[3] I further discuss my sample selection method in Section IV.B below.

Then, for each company in my selected sample, I determine the cost of equity using standard methods including two versions of the DCF model, two versions of the Capital Asset Pricing Model (CAPM), the risk premium model, as well as a review of recently allowed ROEs. I ensure consistency between the capital structure used to derive the cost of equity estimates and NWN Washington's regulatory capital structure and also evaluate business specific risk factors that may differ between NWN Washington and the sample.

Q6. How is the remainder of your testimony organized?

A6. Section II formally defines the cost of capital and explains the techniques for estimating it in the context of utility rate regulation. Section III discusses conditions and trends in capital markets, recent policy initiatives such as the tax reform and the impact on the cost of capital. Section IV explains my approach and Section V presents the results for my analysis. Section VI discusses the business risk characteristics of Northwest Natural as relevant to my recommended allowed ROE for the Company and also discuss the impact of implementing a decoupling mechanism. Section VII summarizes my results and conclusions. Finally, Section VIII presents the list of Exhibits that I use for my testimony.

[3] As described in Sections V.A and V.B respectively, the DCF relies on current market data while the CAPM requires five years of historical data.

II. COST OF CAPITAL THEORY

A. COST OF CAPITAL AND RISK

Q7. How is the "cost of capital" defined?

A7. The cost of capital is defined as the expected rate of return in capital markets on alternative investments of equivalent risk. In other words, it is the rate of return investors require based on the risk-return alternatives available in competitive capital markets. The cost of capital is a type of opportunity cost: it represents the rate of return that investors could expect to earn elsewhere without bearing more risk. "Expected" is used in the statistical sense: the mean of the distribution of possible outcomes. The terms "expect" and "expected," as in the definition of the cost of capital itself, refer to the probability-weighted average over all possible outcomes.

The definition of the cost of capital recognizes a tradeoff between risk and return that can be represented by the "security market risk-return line" or "Security Market Line" for short. This line is depicted in Figure 2 below. The higher the risk, the higher the cost of capital required.

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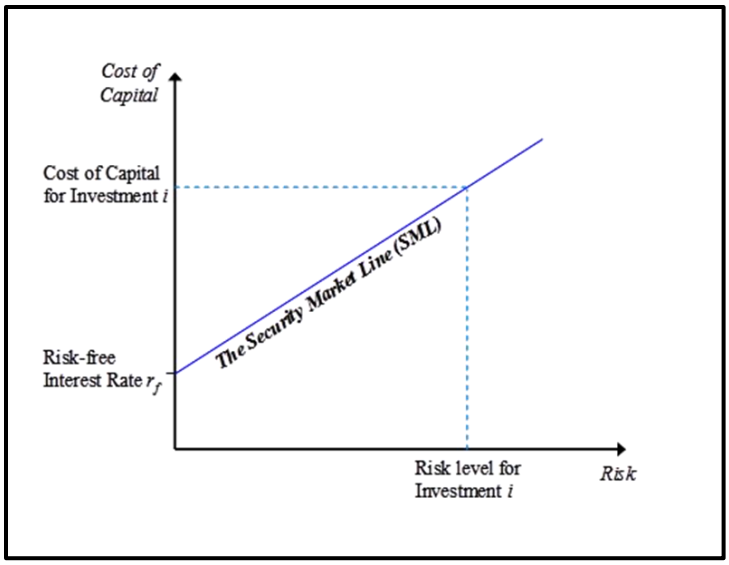
Figure 2
The Security Market Line



Q8. What are the guiding standards that define a just and reasonable allowed rate of return on rate-regulated utility investments?

A8. The seminal guidance on this topic was provided by the U.S. Supreme Court in the Hope and Bluefield cases,[4] which found that:

- The return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks;[5]
- The return should be reasonably sufficient to assure confidence in the financial soundness of the utility; and

[4] *Bluefield Water Works & Improvement Co. v. Public Service Com'n of West Virginia*, 262 U.S. 679 (1923) ("Bluefield"), and *Federal Power Com'n v. Hope Natural Gas Co.*, 320 U.S. 591 (1944) ("*Hope*").

[5] *Hope*, 320 U.S. at 603.

- The return should be adequate, under efficient and economical management for the utility to maintain and support its credit and enable it to raise the money necessary for the proper discharge of its public duties.[6]

Q9. How does the standard for just and reasonable rate of return relate to the cost of capital?

A9. The first component of the Hope and Bluefield standard, as articulated above, is directly aligned with the financial concept of the opportunity cost of capital.[7] The cost of capital is the rate of return investors can expect to earn in capital markets on alternative investments of equivalent risk.[8]

By investing in a regulated utility asset, investors are tying up some capital in that investment, thereby foregoing alternative investment opportunities. Hence, the investors are incurring an "opportunity cost" equal to the returns available on those alternative investments. If the allowed return on the utility investment is not at least as high as the expected return offered by alternative investments of equivalent risk, investors will choose these alternatives instead, and the utility's ability to raise capital and adequately fund its operations will be adversely impacted or even prevented. This is a fundamental concept in cost of capital proceedings for regulated utilities such as NWN Washington.

[6] *Bluefield*, 262 U.S. at 680.

[7] A formal link between the opportunity cost of capital as defined by financial economics and the proper expected rate of return for utilities is set forth by Stewart C. Myers, "Application of Finance Theory to Public Utility Rate Cases," *Bell Journal of Economics & Management Science* 3:58-97 (1972).

[8] The opportunity cost of capital is also referred to as simply the "cost of capital," and can be equivalently described in terms of the "required return" needed to attract investment in a particular security or other asset (*i.e.*, the level of expected return at which investors will find that asset at least as attractive as an alternative investment).

Q10. What does this mean from an economic perspective?

A10. From an economic perspective, rate levels that give investors a fair opportunity to earn the cost of capital are the lowest levels that compensate investors for the risks they bear. Over the long run, an expected return above the cost of capital makes customers over pay for service. Regulatory commissions normally try to prevent such outcomes unless there are offsetting benefits (e.g., from incentive regulation that reduces future costs). At the same time, an expected return below the cost of capital does a disservice not just to investors but, importantly, to customers as well. Such a return denies the company the ability to attract capital, to maintain its financial integrity, and to expect a return commensurate with that of other enterprises attended by corresponding risks and uncertainties.

More important for customers, however, are the broader economic consequences of providing an inadequate return to the company's investors. In the short run, deviations from the expected rate of return on the rate base from the cost of capital may seemingly create a "zero-sum game"— investors gain if customers are overcharged, and customers gain if investors are shortchanged. But in fact, in the short term, a return below the cost of capital may adversely affect the utility's ability to provide stable and favorable rates because some potential investments that could reduce cost or otherwise be beneficial to customers may be delayed and the company may be forced to file more frequent rate cases.

Moreover, in the long run, inadequate returns are likely to cost customers—and society generally—far more than may be saved in the short run. Inadequate returns lead to inadequate investment, whether for maintenance or for new plant and

equipment. Without access to investor capital, the company may be forced to forgo opportunities to maintain, upgrade, and expand its systems and facilities in ways that decrease long run costs. Indeed, the cost to consumers of an undercapitalized industry can be far greater than any short-run gains from shortfalls in the cost of capital. This is especially true in capital-intensive industries (such as the gas LDC industry), which feature systems that continually need to be replaced or upgraded. Thus, it is in customers' interest not only to make sure the return investors expect does not exceed the cost of capital, but also to make sure that the return does not fall short of the cost of capital.

The cost of capital cannot be estimated with perfect certainty, and other aspects of the way the revenue requirement is set may mean investors expect to earn more or less than the cost of capital, even if the authorized rate of return exactly equals the cost of capital.

B. THE IMPACT OF RISK ON THE COST OF CAPITAL

Q11. Please summarize how you consider risk when estimating the cost of capital.

A11. First, I select my comparable sample to have as comparable business risks as possible to NWN Washington. Second, as the cost of equity depends on the leverage of the company to which it is applied, I consider the difference in leverage between the data from which I estimate the cost of equity and NWN Washington. Third, I consider the effect of recent capital market developments and any NWN Washington specific business risks that may help me place the Company within the range of my estimated cost of equity or if unique circumstances dictate it, above or below the range.

Q12. Why is capital structure important for the determination of the cost of equity?

A12. As shown by Hamada (1969),[9] shareholders in a company with more debt face more equity risk and the return on equity needs to increase. There are several manners in which the impact of financial risk can be taken into account. The manner in which Professor Hamada took this into account is he unlevered the beta estimates in the CAPM to obtain a so-called all-equity or assets beta and then relevered the beta to determine the beta associated with the target company's capital structure. This requires an estimate of the systematic risk associated with debt (i.e., the debt beta), which is usually quite small. See NWN Washington Exh. BV-3, Technical Appendix, Section III for further technical details related to methods to account for financial risk when estimating the cost of capital. Another way to take the phenomenon into account is to determine the average overall cost of capital for the sample companies and let that figure be constant between the estimate obtained for the sample and the entity to which it is applied. This assumes that the average overall cost of capital is constant for a range that spans the capital structures used to estimate the cost of equity and the regulatory capital structure – usually a range that avoids extreme levels of debt or equity.

Q13. Are differences in financial leverage important to the estimation of the cost of equity?

A13. Yes. The market based models (CAPM, DCF) I use rely on market data to estimate the cost of equity for the sample companies, so the results reflect the value of the capital that investors hold during the estimation period (market values). The allowed ROE is

[9] Robert S. Hamada, "Portfolio Analysis, Market Equilibrium and Corporate Finance," *The Journal of Finance* 24: 13-31 (March 1969).

applied to NWN Washington's rate base, which could be financed with a different portion of debt than the sample companies. Taking differences in financial leverage into consideration does not change the value of the rate base, but it does consider the fact that the more debt a company has, the higher is the financial risk associated with an equity investment. To see this I constructed a simple example below, where only the financial leverage of a company varies. I assumed the return on equity is 11 percent at a 50 percent equity capital structure and determine the return on equity that would result in the same overall return if the percentage of equity in the capital structure were reduced to 45 percent.

Figure 3
Illustration of Impact of Financial Risk on ROE

		Company A (50% Equity)	Company B (45% Equity)
Rate Base	[a]	$1,000	$1,000
Equity	[b]	$500	$450
Debt	[c]	$500	$550
Total Cost of Capital (8%)	[d] = [a] × 8%	$80.0	$80.0
Cost of Debt (5%)	[e] = [c] × 5%	$25.0	$27.5
Equity Return	[f] = [d] - [e]	$55.0	$52.5
Rate of Return on Equity (ROE)	**[g] = [f] / [b]**	**11.00%**	**11.67%**

The figure above illustrates how financial risk affects returns and also the ROE. The overall return remains the same for Company A and B at $80. But Company B with the lower equity share and higher financial leverage must earn a higher percentage ROE in order to maintain the same overall return. This higher percentage allowed ROE represents the increased risk to equity investors caused by the higher degree of financial leverage.

The principle illustrated in the figure above is exemplary of one type of financial risk calculation I perform to account for differences in financial risk when conducting estimates of the cost of equity applicable to NWN Washington.

Q14. Does this approach apply to the risk premium analysis?

A14. Yes, to the extent that there are differences between the capital structures of the companies used to determine the benchmark ROE and NWN Washington, I need to consider whether I am comparing apples to apples. However, because the allowed ROE usually is applied to book value capital structures, it is the book value capital structure that is relevant for the risk premium method.

Q15. Why do you rely on multiple models to inform your cost of equity analysis and ROE recommendation?

A15. There is no one perfect model for estimating the cost of equity, and the various models and estimation approaches I employ each have different strengths and sensitivities. For example, the CAPM is relies on an explicit measurement of systematic risk (beta) for which the cost of equity capital must compensate investors, but this parameter must be measured using historical data,[10] and thus changes more slowly in response to changes in industry risk characteristics. Conversely, the DCF models incorporate current market prices and the most recent dividends, enabling them to capture shifts over time. However, this also makes the DCF sensitive to short-term market phenomena that may

[10] I note that *Value Line* applies an empirical adjustment (the Blume adjustment) that converts the beta derived from historical return data into a better indicator of forward-looking systematic risk (i.e., a better predictor of beta going forward).

or may not be representative of the capital market conditions and required investor returns that will prevail during the future period at issue.

The Commission apparently agrees with this sentiment, as the Commission in past orders have noted that it determines "a range of *reasonable returns* on equity considering all cost of capital testimony in the record."[11] The Commission's order goes on to explicitly mention the CAPM, DCF, Risk Premium, and Comparable Earnings method as having been presented.[12] It is also noteworthy that the Federal Energy Commission in a recent order endorsed the use of multiple methods (to determine the ROE for electric transmission) including the CAPM, the DCF, the risk premium, and an expected earnings model.[13]

Q16. What do you cover in section III below?

A16. This section focuses on how recent changes in capital market conditions and ongoing volatility in equity and debt markets impact the cost of equity and its estimation. I also discuss how the Tax Cut and Jobs Act (TCJA) impact the cost of capital. Specifically, this section addresses (i) macroeconomic developments–specifically the interest rate, inflation, and GDP–and the impact on cost of equity, (ii) the development in utility credit spreads and research attempting to explain such developments, (iii) investor perceptions of the market risk premium, (iv) market volatility and the impact on cost of capital as well as (v) the impact of the TCJA on cost of equity and credit metrics for utilities.

[11] Washington Utilities and Transportation Commission, Order 07 (Dockets UE-170485 and UG-170486), April 26, 2018 (Avista), ¶59.

[12] *Ibid*, ¶60.

[13] 165 FERC ¶ 61,030 "Order Directing Briefs," in Docket EL11-66-001 et al., October 16, 2018.

III. CAPITAL MARKET CONDITIONS AND TAX REFORM

A. INTEREST RATES, INFLATION, AND GDP GROWTH

Q17. What are the relevant developments regarding interest rates?

A17. Interest rates, including the long-term government bond yields that are typically used to represent the risk-free rate in the context of regulated utility ratemaking have been low since the 2008-2009 financial crisis. However, yields have increased substantially over the past year and are forecasted to continue on their upward trajectory in coming years. For example, the average yield on the 20-Year Treasury note was 2.6 percent in November 2017 but had increased by 67 basis points to 3.3 percent in November 2018. Furthermore, the consensus from Blue Chip Economic Indicators—which surveys more than 50 institutional market analysts and participants, including major banks, academic finance departments, credit rating agencies, institutional investors, and Fortune 500 companies—is that the yield on 10-year Treasury bonds will increase from the current 3.1 percent[14] to 3.6 percent[15] by 2020 and continue to increase in 2021 and beyond. Figure 4 below plots the historical and forecasted 10-year Treasury bond yield.

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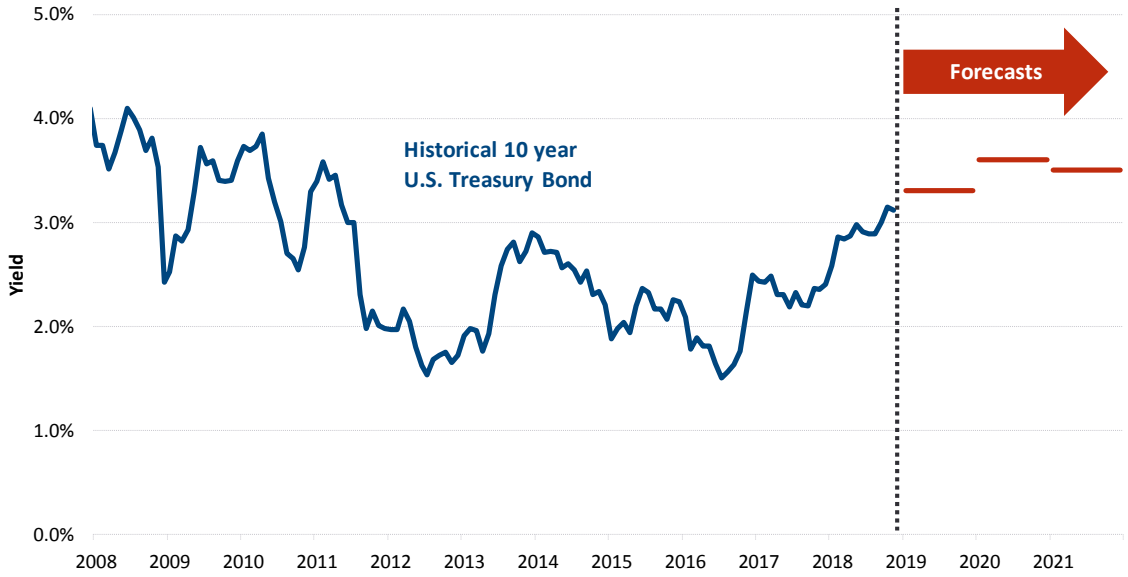
[14] Average monthly 10-year Treasury yield as of November 30, 2018, accessed from Bloomberg.

[15] Forecast by Blue Chip Economic Indicators, Edition – October 2018.

Figure 4
Historical and Projected 10 year Treasury Bond Yields



Source: Historical data from Bloomberg. Forecasts from Blue Chip Economic Indicators Oct. 2018 issue.

Q18. What explains the very low interest rates over the decade following the financial crisis of 2008-09?

A18. The monetary policy actions of the Federal Reserve (the "Fed") in response to the financial crisis were a key driver of the low interest rates. Traditionally, the Fed's Federal Open Market Committee ("FOMC") undertakes market actions to influence interest rates—especially the so-called "federal funds rate"[16]—subject to its statutory mandate to maximize employment and keep inflation under control. In response to the financial crisis, the FOMC drastically reduced its target federal funds rate from 5¼ percent in August 2007 to 0 - ¼ percent starting in December 2008.[17] The Fed's zero

[16] The federal funds rate is the rate at which large banks lend and borrow funds in the short term. It is therefore influential in determining market interest rates throughout the economy.

[17] *See* FOMC Statements issued August 7th, 2007 and December 16th, 2008 accessed at https://www.federalreserve.gov/monetarypolicy/fomc_historical.htm

interest rate policy remained in effect for the next 7 years, ending in December 2015, when the FOMC finally raised its federal funds target to ¼ - ½ percent.[18]

Concurrent with its sustained monetary policy actions related to the short term federal funds rate, the Fed also implemented several unprecedented policy interventions with the explicit goal of reducing interest rates on *long-term* borrowing instruments. This "quantitative easing" program of long-term government bonds served to keep Treasury yields at very low levels for an extended period of time. And importantly, even after the FOMC ceased *buying* securities, it maintained trillions of dollars' worth of Treasuries and government-backed MBSs on its balance sheet, continuing to reinvest the principle when the assets expired.[19]

Q19. Global economic conditions also contributed to the unprecedented low rates on U.S. government debt. What could explain the current increase in interest rates?

A19. As shown in Figure 4, U.S. Treasury bond yields have been on a clear increasing trend since their low point in mid-2016. This is consistent with the Fed's recognition that the economy has strengthened, employment conditions remain strong, and inflation—while still below its 2 percent target—has begun to increase. The FOMC has responded by increasing the target federal funds rate eight times since ending the zero interest rate policy in December 2015, including at its last six quarterly meetings. The most recent hike announced at the FOMC's December 19, 2018 meeting, after which the federal

[18] *See* FOMC Statement, December 16th, 2015 accessed at https://www.federalreserve.gov/monetarypolicy/fomccalendars.htm

[19] As of October 4, 2018, the Fed's long-term Treasury and Agency securities balance was at $4.0 trillion. *See* Board of Governors of the Federal Reserve System, Credit and Liquidity Programs and the Balance Sheet, accessed at https://www.federalreserve.gov/releases/h41/20181004/.

funds target rate stands at 2¼- 2 1/2 percent.[20] Additionally, in the March meeting, The Fed signaled the possibility of accelerating the rate of increases over the next few years[21] and as recently as in its September 2018 meeting indicated that additional increases were likely.[22]

Thus, Fed policy is supportive of a gradual increase in interest rates, which is consistent with the Blue Chip forecast.

Q20. What are the relevant developments regarding inflation and GDP?

A20. Both current and projected inflation and real GDP (RGDP) growth rates have increased since the start of this year. In January 2018, the year-over-year inflation, as measured by the Consumer Price Index ("CPI"), was 2.1 percent.[23] Since then, the CPI consistently increased until it reached a six-year high of 2.9 percent in July 2018. Real GDP growth has increased from an annual rate of 2.2 percent in the first quarter of 2018 to 4.2 percent (well over 6 percent nominally) in the second quarter of 2018[24] and by 3.5 percent real (over 5 percent nominally) in Q3, 2018.[25]

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[20] *See* FOMC Statement, December 19, 2018, accessed at https://www.federalreserve.gov/newsevents/pressreleases/monetary20181219a1.htm

[21] *See* FOMC Minutes, March 20-21, 2018, accessed at https://www.federalreserve.gov/monetarypolicy/fomcminutes20180321.htm

[22] The next meeting of the Federal Open Market Committee is slated for Dec. 18-19, 2018 at which point any additional increases in the federal funds rate for 2018 would be announced.

[23] CPI - All Urban Consumers, Bureau of Labor Statistics, accessed 10/25/2018 at https://data.bls.gov/timeseries/CUUR0000SA0?output_view=pct_12mths.

[24] Real GDP, Bureau of Economic Analysis, accessed 10/25/2018 at https://www.bea.gov/news/2018/gross-domestic-product-3rd-quarter-2018-advance-estimate.

[25] Bureau of Economic Analysis at https://www.bea.gov/data/gdp/gross-domestic-product

Additionally, projected inflation and real GDP growth rates have also increased. The 2019 CPI forecast has increased from 2.2 percent[26] in January 2018 to 2.3 percent[27] in October 2018. Likewise, the 2019 real GDP forecast has increased from 2.4 percent[28] to 2.6 percent[29] over the same period of time. A real GDP of 2.6 percent corresponds to a nominal GDP of approximately 4.9 percent.

Q21. How do these developments impact the cost of equity analysis?

A21. Because analysts use the yield on government debt as a proxy for the risk-free rate, the expected increase in the yield on government debt will also lead to an increase in cost of equity. As growth impact the DCF-based cost of equity, an increase in growth will lead to higher cost of equity. Thus, current expectations to an increase in the yield on risk-free securities and growth rates suggest the cost of equity capital will also increase, so that the allowed return on equity for gas LDCs should also rise over time.

B. MARKET RISK PREMIUM AND YIELD SPREADS

Q22. What is the Market Risk Premium?

A22. In general, a risk premium is the amount of "excess" return—above the risk-free rate of return—that investors require to compensate them for taking on risk. As illustrated above in Figure 2, the riskier the investment, the larger the risk premium investors will require.

[26] Forecast by *Blue Chip Economic Indicators*, Edition – January 2018.
[27] Forecast by *Blue Chip Economic Indicators*, Edition – October 2018.
[28] Forecast by *Blue Chip Economic Indicators*, Edition – January 2018.
[29] Forecast by *Blue Chip Economic Indicators*, Edition – October 2018.

The Market Risk Premium (MRP) is the risk premium associated with investing in the market as a whole. Since the so-called "market portfolio" embodies the maximum possible degree of diversification for investors,[30] the Market Risk Premium is a highly relevant benchmark indicating the level of risk compensation demanded by capital market participants.[31]

Q23. Is there evidence that the MRP has been elevated since the time of the 2008 financial crisis?

A23. Yes. A December 2015 report by Duarte and Rosa of the Federal Reserve of New York aggregates the results of many models of the required MRP in the U.S. and tracks them over time. This analysis finds a very high MRP in years following the financial crisis. The analysis estimates the MRP that results from a range of models each year from 1960 through 2014.[32] The analysis then reports the average as well as the first principal component of results.[33] The analysis finds that the models used to determine the risk premium are converging to provide more comparable estimates and that the average annual estimate of the MRP was at an all-time high in 2013. These estimates are

[30] In finance theory, the "market portfolio" describes a value-weighted combination of *all* risky investment assets (including stocks, bonds, real estate, etc…) that can be purchased in markets. In practice, academics and financial analysts nearly always use a broad-based stock market index—such as the S&P 500—to represent the overall market.

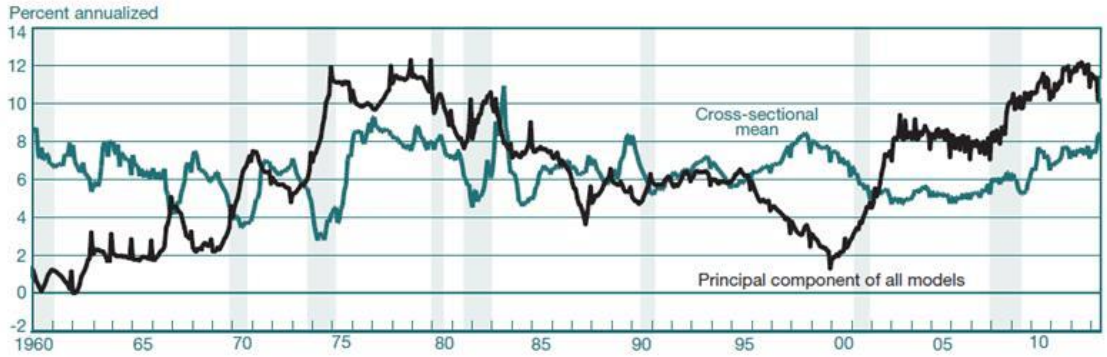
[31] Indeed, in risk-positioning models such as the CAPM, the risk premium for an asset is estimated in relation to the Market Risk Premium by "positioning" the asset's systematic risk (as measured by market beta) relative to the risk of the market portfolio (which, by definition, has a beta of 1).

[32] Fernando Duarte and Carlo Rosa, "The Equity Risk Premium: A Review of Models," Federal Reserve Bank of New York, December 2015 (Duarte & Rosa 2015).

[33] Duarte & Rosa emphasize the "first principal component" of the 20 models. This means that the authors used statistics to compute the weighted average combination of the models that captures the most variability among the 20 models over time.

reasonably consistent with those obtained from Bloomberg and the consistent elevation of the MRP over the historical figure indicates that the elevated level has persisted. Figure 5 below shows Duarte and Rosa's summary results.

Figure 5
Duarte and Rosa's Chart 3
One-Year Ahead MRP and Cross-Sectional Mean of Models



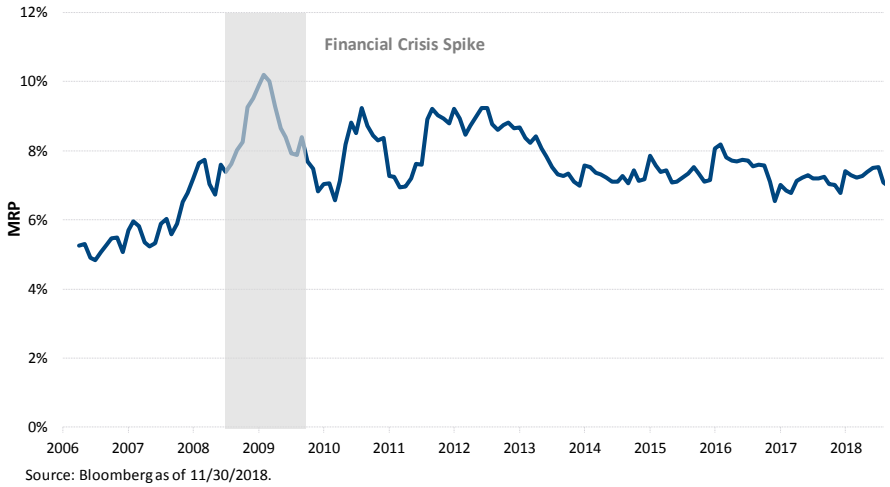
Q24. Do you have any data how estimates of the MRP have evolved over the more recent past?

A24. Yes. Bloomberg publishes a forward-looking estimate of the MRP based on market prices and expected dividends for U.S. stocks.[34] Figure 6 displays the development of Bloomberg's forecasted MRP since 2006. Consistent with the results of the Duarte and Rosa study, the Bloomberg MRP increased substantially with the onset of the financial crisis and has remained elevated relative to pre-crisis levels. Though the August 2018

[34] Bloomberg's calculation of the expected market return is based on an implementation of a multi-stage DCF model (see Section V.A.1 below) applied to all dividend paying stocks in the S&P 500 index; Bloomberg calculates the MRP by subtracting the current 10-year Treasury bond yield from the estimated expected market return.

average forward looking MRP reported by Bloomberg is in line with the long-term historical average MRP,[35] the average since the 2008 financial crisis was 7.8 percent.[36]

Figure 6
Bloomberg Forward looking MRP (2006-2018)



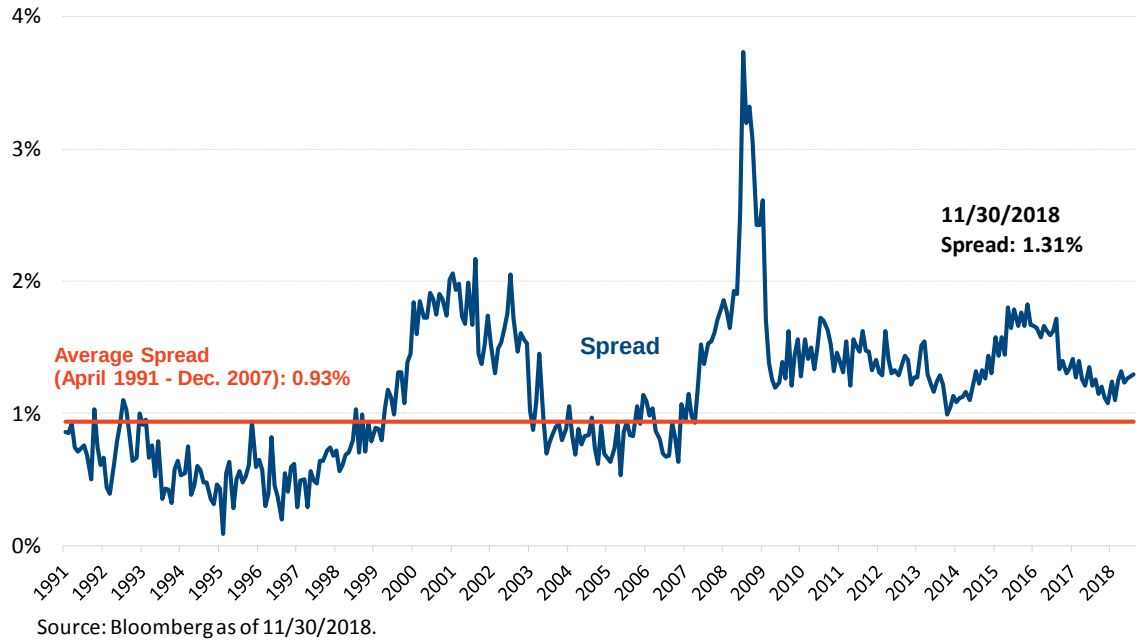
Q25. Is there any other market evidence concerning risk premiums?

A25. Yes. One observable risk premium is the spread between yields on risk-free Treasury bonds and the yields on corporate bonds of the same maturity. Unlike U.S. government bonds, debt instruments issued by corporate entities come with some probability of default and have some associated level of systematic risk. To compensate for this risk, corporate bonds—including utility bonds—offer higher expected returns (as measured by the market yield) than do government bonds. Figure 7 plots the yield spread for A-rated utility bonds compared to Treasury bonds for the longest period of available data. As the figure shows, utility yield spreads spiked dramatically with the onset of the financial crisis and have remained elevated to their pre-crisis average level.

[35] As noted below, Duff & Phelps calculates the historical average MRP at 7.07 percent.

[36] Average of Bloomberg forecasted MRP for the U.S. from January 2009 - August 2018. Bloomberg as of 8/31/2018.

Figure 7
Spread between A-rated Utility Bond and 20-year Government Bond Yield



Source: Bloomberg as of 11/30/2018.

Q26. How does the current spread between utility and government bond yields compare to the historical spread?

A26. As shown in Figure 7 above, the spread between A-rated utility bond yields and government bond yields is elevated. Based on available data from 1990 through the end of 2007, the average spread was 0.93 percent prior to the financial crisis. In contrast, the average spread over the last 15-trading days leading up to my study date of November 30, 2018 was 38 bps higher at 1.31 percent.

Q27. What are the implications of elevated yield spreads to the cost of equity?

A27. The yield spread is simply one form of risk premium, albeit for assets (corporate bonds) that are relatively lower risk compared to equity securities (*i.e.*, stock). Academic research suggests that the premium for systematic risk is one factor affecting the level

of corporate bond yield spreads.[37] Consequently, one explanation for the elevated yield spread is that investors are requiring a higher premium to take on market risk than they did on average prior to the financial crisis. Since corporate bonds have relatively lower betas compared to the stock market, this explanation would indicate a proportionally higher degree of elevation in the MRP for any given degree of elevation in the utility bond spread.[38]

An alternative explanation for the elevated yield spread is that the yield on Treasury bills remains "artificially" low due to the lingering after-effects of Fed's unprecedented monetary policy. Under this explanation, the yield spread would be expected to return to its historical average level as the risk free rate returns to more "normal" levels.

Regardless of which interpretation is correct, the consequence is that if the cost of equity is estimated using the current risk-free rate and a historical average market risk premium, the estimate will be downward biased. Hence, it is necessary to "normalize" the risk-free rate in CAPM model inputs, which I have done be utilizing a forecast for what government bond yields will be for 2020, which is a reasonable representation of the expected yield when rates will be in effect.

[37] "Explaining the Rate Spread on Corporate Bonds," Edwin J. Elton, Martin J. Gruber, Deepak Agarwal, and Christopher Mann, *The Journal of Finance*, February 2001, pp. 247-277.

[38] See the technical appendix to this testimony (Exh. BV-3) for further discussion of how the elevation in the yield spread can be used to infer a benchmark level of elevation in the MRP.

C. MARKET VOLATILITY

Q28. Why does stock market's volatility matter for cost of capital?

A28. Academic research has found that investors expect a higher risk premium during more volatile periods. The higher the risk premium, the higher the required ROE. For example, French, Schwert & Stambaugh (1987) found a positive relationship between the expected MRP and volatility:

> We find evidence that the expected market risk premium (the expected return on a stock portfolio minus the Treasury bill yield) is positively related to the predictable volatility of stock returns. There is also evidence that unexpected stock returns are negatively related to the unexpected change in the volatility of stock returns. This negative relation provides indirect evidence of a positive relation between expected risk premiums and volatility.[39]

One implication of this finding is that the MRP tends to increase when market volatility is high, even when investors' level of risk aversion remains unchanged.

Q29. What is the current evidence regarding market volatility?

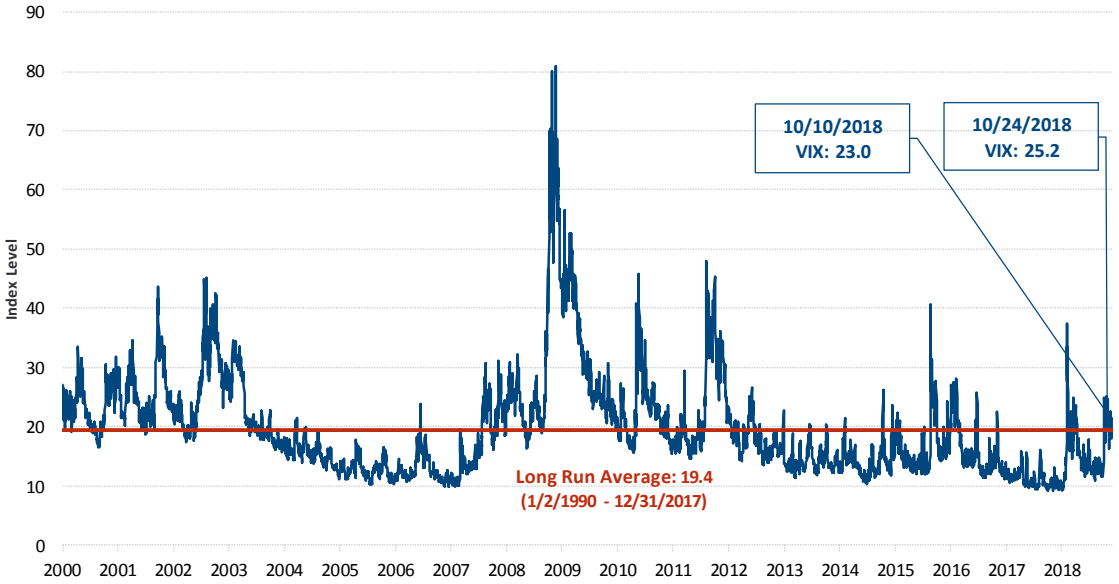
A29. A measure of the market's expectations for volatility is the VIX, which measures the 30-day implied volatility of the S&P 500 index. This index is also referenced as the "investor fear gauge"[40] in that it provides a market indication how investors in stock index options perceive the likelihood of large swings in the stock market within the next month. While the VIX has recently been trading substantially below its long term historical average of approximately 19.26, it spiked substantially above that level on October 10th and 24th, concurrent with a significant drop in the stock market. The fact

[39] K. French, W. Schwert and R. Stambaugh (1987), "Expected Stock Returns and Volatility," Journal of Financial Economics, Vol. 19, p. 3.

[40] See Rachel Koning Beals, Stock market 'fear gauge' VIX remains up over 20% in wake of latest North Korean action, MarketWatch, August 29, 2017.

that the VIX quickly move well above its long-term average indicates that stock markets are volatile.

Figure 8
Historical VIX Levels

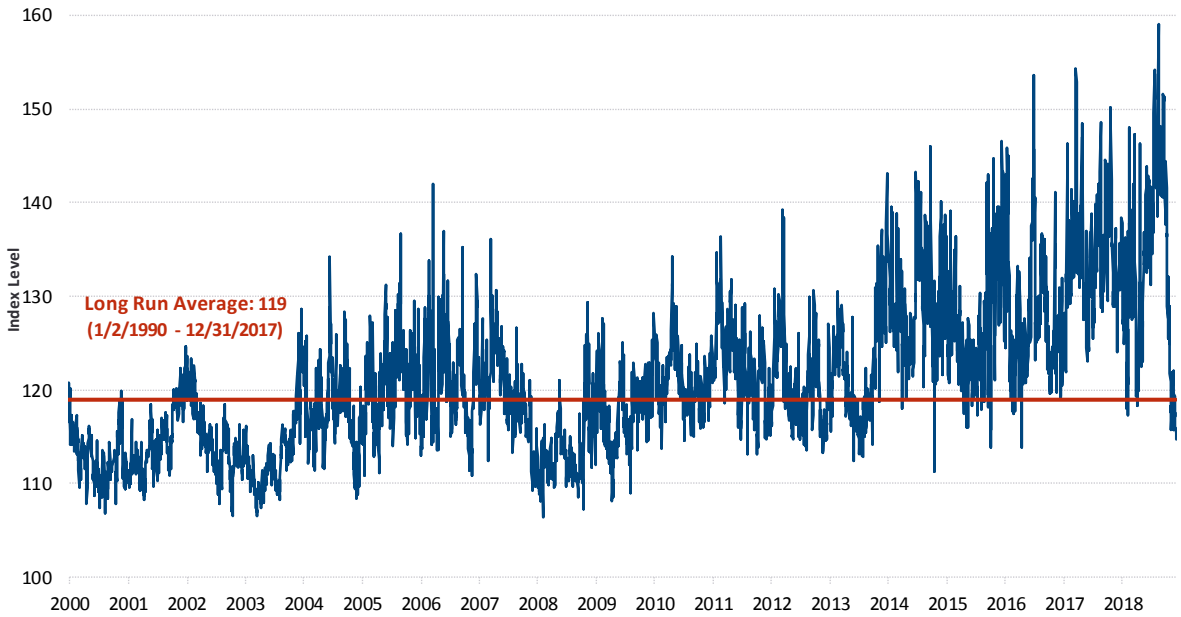


Source: Bloomberg as of 11/30/2018

Q30. Do you look at any other indexes regarding market volatility?

A30. Yes. The SKEW index, which measures the market's willingness to pay for protection against negative "black swan" stock market events (i.e., sudden substantial downturns), offers a reason to be cautious of interpreting recent low VIX levels as an indicator of improved capital market certainty over the long term. A SKEW value of 100 indicates outlier returns are unlikely, but as the SKEW increases, the probability of outlier returns become more significant. Figure 9 shows that the SKEW currently stands at almost 132, while the index has averaged 119 over the last 15 years. This indicates that investors are willing to pay for protection against downside risk and thus are exhibiting signs of elevated risk aversion concerns of downside tail risk.

Figure 9
Historical SKEW Levels



Source: Bloomberg as of 11/30/2018

Q31. Are there reasons why capital markets may continue to exhibit higher than historical volatility?

A31. Yes. A few contributing reasons to capital market volatility recently include higher interest rates, escalating trade disputes between the United States and China, challenging negotiations occurring in the European Union regarding finalization of the exit of Great Britain, which has very recently become even more challenging,[41] and the newly minted agreement (labelled USMCA) replacing the North American Free Trade Agreement (NAFTA). Finally, there is the potential for a US federal government shut down in 2019.

[41] See, for example, "May urges EU to help Brexit 'over the line'," by Gabriela Baczynska, Elizabeth Piper, Reuters, Dec. 13, 2018. Available at https://www.reuters.com/article/uk-britain-eu/may-urges-eu-to-help-get-brexit-over-the-line-idUSKBN1OC0QP.

Higher interest rates further increase economic uncertainty through stock price volatility as higher bond yields attract investors away from stocks. On October 10, the S&P 500 fell for the fifth day in a row, representing the longest losing-streak since November of 2016.[42] Also on October 10, the Dow Jones Industrial Average (Dow) declined by more than 800 basis points, or 3.1 percent. Even more recently, on October 24, the S&P 500 and Dow both fell to negative returns for the year.[43] These are relatively volatile developments.

Additionally, the full impact of the Tax Cut and Jobs Act has yet to be seen – for utilities, the regulatory impact is not fully understood. Thus, both market volatility and policy initiatives have resulted in economic uncertainty.

Q32. What is meant by the term "risk aversion"?

A32. Risk aversion is the recognition that investors dislike risk, which means that for any given level of risk, investors must expect to earn an appropriate return to be induced to invest. An increase in risk aversion means that investors now require a higher return for that same level of risk.

In times of economic uncertainty, investors seek to reduce their exposure to market risk. This precipitates a so-called "flight to safety," wherein demand for low-risk government bonds rises at the expense of demand for stocks. If yields on bonds are extraordinarily low, however, any investor seeking a higher expected return must

[42] *See* "Stocks close sharply lower as Doc sinks over 800 points in worst day since February," Marketwatch, accessed 10/25/2018 at https://www.marketwatch.com/story/stock-futures-fall-sp-500-could-notch-longest-losing-streak-since-november-2016-2018-10-10.

[43] *See* "U.S. Stocks Fall Sharply as Markets Extend Rocky Stretch," The Wall Street Journal, accessed 10/25/2018 at https://www.wsj.com/articles/european-stocks-rise-after-volatile-day-on-wall-street-1540367863.

choose alternative investments such as stocks, real estate, gold or collectibles. Of course, all of these investments are riskier than government bonds, and investors demand a risk premium (perhaps an especially high one in times of economic uncertainty) for investing in them.

But short of accepting meager returns, investors simply have few alternatives to returning to the stock market. Utility stocks may have experienced the "flight to safety" phenomenon to a larger degree than other stock because they traditionally have paid a substantial portion of their earnings as dividends. Therefore, investors who have sought income from their investments and found government bonds too unattractive may have accepted a higher risk and invested in utility stock with the goal of receiving periodic dividend payments.

D. TCJA AND THE COST OF CAPITAL

Q33. Why do you discuss the Tax Cut and Jobs Act here?

A33. The TCJA reduced the corporate tax rate from 35 percent to 21 percent for corporate entities.[44] There are multiple impacts on regulated utilities, but for a cost of capital perspective, there are two direct effects. First, as the tax rate is reduced, the cash recovered in rates is lower and to the degree there is a delay between the collection and payment of taxes, the utility has less cash on hand. Less cash on hand means lower credit ratios and potentially lower credit metrics. Second, income taxes act as a cushion when revenues or earnings before taxes change, so that a change has less impact on

[44] The Tax Cut and Jobs Act passed in December 2017 also changed the treatment of carry-forwards and for non-utilities, interest rate deductions.

utility net income under a 35 percent tax rate than under a 21 percent tax rate.[45] Overall, the impact is that while the revenue requirement is reduced, the cost of both equity and debt capital may increase. The impact of the federal tax reform is expected to increase rate case activity.[46]

Q34. Please explain why the cost of debt capital may increase.

A34. As noted above and by credit rating agencies such as Moody's, the TCJA will reduce cash flow and hence ratios such as the cash flow to debt or cash flow to interest. According to Moody's Investor Service, the average reduction in the ratio of cash flow to debt for utilities due to the TCJA is 150-250 basis points.[47] The magnitude of the impact vary by utility, but for some utilities, including NWN Washington's parent NWN Gas Co., the impact was sufficient for Moody's to place the utility on outlook for a downgrade. Clearly, a lower credit rating is likely to translate to a higher cost of debt capital (or the need for a lower level of debt).

Q35. Why might the cost of equity capital increase?

A35. The effect is most easily illustrated using an example. In the example below Utility A and Utility B have a rate base of $1,000 and a capital structure of 50-50. They both earn a ROE of 10 percent for a net income of $50 in the base case. However, Utility A has an income tax rate of 35 percent, while Utility B has a tax rate of 21 percent. The example illustrates how a decrease of 10 percent in EBITDA affect the two utilities.

[45] There are also non-trivial changes to treatment of deferred income taxes and rate base, which I shall not discuss here.

[46] Regulatory Research Associates, Major Rate Case Decision – January – September 2018, October 11, 2018.

[47] Moody's Investor Service, "Moody's Changes Outlook on 25 US Regulated Utilities Primarily Impacted by Tax Reform," January 19, 2018. The average reflect bonus depreciation and the impact on cash flow and financing of both new and pre-existing assets.

Figure 10
Illustration of TCJA on Utility Income

		Base Case 35% Tax	10% Lower EBITDA	Change	Base Case 21% Tax	10% Lower EBITDA	Change
EBITDA	[a]	$135.3	$121.8	-$13.5	$121.6	$109.4	-$12.2
Depreciation	[b]	$33.3	$33.3	$0.0	$33.3	$33.3	$0.0
EBIT	[c]=[a]-[b]	$102.0	$88.5	-$13.5	$88.3	$76.1	-$12.2
Interest	[d]	$25.0	$25.0	$0.0	$25.0	$25.0	$0.0
Pre-Tax Income	[e]=[c]-[d]	$77.0	$63.5	-$13.5	$63.3	$51.1	-$12.2
Taxes	[f]=Base Case Tax Rate*[e]	$27.0	$22.2	-$4.7	$13.3	$10.7	-$2.6
Net Income	[g]: [e]-[f]	$50.1	$41.3	-$8.8	$50.0	$40.4	-$9.6
ROE	[h]	10%	8.25%		10%	8.08%	
Change in Earnings	[i]		**17.6%**			**19.2%**	

Notes & Sources:
[h]: Assumes a 10% ROE in Base Case.
[i]: Percent Difference between Base Base net income and 10% Lower EBITDA net income.

Clearly the earnings impact is larger for Utility B which has a tax rate of 21 percent. The example simply illustrate that income taxes serve as a cushion for earnings volatility, so that the reduction in the tax rate led to larger income volatility. Because volatility impact the return investors require to provide capital, a higher volatility will all else equal increase the cost of equity capital. Thus, the reduction in tax rates will cause lower taxes to be collected but may have an increasing effect on the cost of debt and equity capital.[48]

E. IMPACT ON ROE ESTIMATION

Q36. Please summarize how the economic developments and policy initiatives affect the cost of capital.

A36. Utilities rely on investors in capital markets to provide funding to support their capital expenditure programs and efficient business operations, and investors consider the risk

[48] For additional discussion of the impact of the TCJA on utilities, see, for example, Bob Mudge, Bente Villadsen and Mike Tolleth, "Six Implications of the New Tax Law for Regulated Utilities," The Brattle Group, January 2018.

return tradeoff in choosing how to allocate their capital among different investment opportunities. It is therefore important to consider how investors view the current economic conditions. Current and projected economic conditions increase the cost of capital. Conceptually, the combination of increased volatility, higher interest rates, inflation, and economic growth leads investors to expect a higher return on capital. Current and projected economic conditions increase the DCF and CAPM model ROE estimates through multiple mechanisms, most notably through higher expected dividend yields, dividend growth rate, elevated risk free rate, and MRP. Higher interest rates and GDP increase the DCF ROE estimates, all else equal. This is because in a higher interest rate environment, dividend yields would be expected to increase in order to remain competitive with higher bond yields. Indeed, long-term government bond yields have increased substantially over the past year and are forecasted to continue on their upward trajectory in coming years, as shown in Figure 4 above.

Additionally, higher interest rates increase the CAPM ROE estimates, all else equal. Higher interest rates increase the yield on long-term government bonds used to represent the risk-free rate in the CAPM model. Additionally, the MRP continues to remain elevated above historical levels, as demonstrated by the elevated spread between the yield on utility and US Treasury Bonds. The consequence of an elevated yield spread is that if the ROE is estimated using the current risk-free rate and a historical average MRP, the estimate will be downward biased. Therefore, I consider that the multi-stage DCF is likely downward biased and therefore recommend using a combination of the single and multi-stage results (and supported by alternative methods).

Lastly, the TCJA of 2017 has led to an increase in the cost of equity as the cushion against earnings volatility is lower. As a result, the cost of equity is higher all else equal or a higher equity thickness is needed. A higher equity ratio would serve two purposes: (i) improve credit quality and (ii) leave the cost of equity unaffected or less affected by the TCJA.

Q37. Can you provide some examples of higher equity ratios being awarded due to the tax reform?

A37. Yes. The Georgia Public Utilities Commission increased Atlanta Gas Light Co's common equity ratio from 51 percent to 55 percent[49] and also increased the equity thickness for Georgia Power.[50] Similarly, Alabama Power is expected to increase its equity percentage by an additional 3.76% by 2023.[51] Likewise, PSE&G in New Jersey has requested an increase in equity thickness due to the tax reform.[52] More broadly, Alabama, Georgia, and Texas have increased the regulatory equity thickness for their jurisdictional utilities as an offset to the TCJA.[53] This is consistent with Moody's cautioning of a decline in funds from operations ("FFO") coverage and expectation of a substantial amount of equity issuances in 2019.[54] The equity issuance is confirmed by Thompson Reuther's data, which show that utilities have been issuing a larger

[49] See GA PUC, Docket D-40828.

[50] Southern Company, "Investor Presentation," Nov. 7, 2018.

[51] Julien Dumoulin-Smith, "Southern Company: Reflecting the Latest: Earnings Sharing and Higher Equity Ratio," Bank of America / Merill Lynch, December 7, 2018.

[52] Julie Lieberman, "*Tax Reform and the Regulated Distribution Utility: A Regulatory Summary*," Concentric Economics, October 11, 2018.

[53] Moody's Investor Service, "Outlook 2019 – Regulated Utilities U.S.," November 8, 2018.

[54] *Ibid*.

volume of stocks than at any time since the financial crisis.[55] Consequently, there is evidence that both the regulatory and actual equity percentage of utilities is increasing.[56]

IV. ESTIMATING THE COST OF CAPITAL

A. APPROACH

Q38. Please explain the process you used to estimate the cost of equity capital?

A38. First, I select a sample of gas LDCs, whose characteristics resemble those of NWN Washington. Second, I estimate the cost of equity for the sample using several estimation methods to ensure that my measure reasonably reflects investor expectations. Third, I determine a reasonable range given the specifics of the estimation and the company's specific characteristics. Finally, I check my recommendation against other measures such as the allowed return on equity for U.S. gas LDCs.

Q39. Please summarize each of the steps listed above.

A39. To select a comparable sample of gas LDCs, I look to the universe of publicly traded gas utilities as classified by the Value Line Investment Survey. From this group, I kept those that meet the following criteria: (1) have sufficient enough data such that the Value Line reports a beta, (2) have an investment grade rating, (3) have more than 50 percent of assets being subject to regulation, and (4) have sufficient size such that

[55] Reuters Business News, "US tax reform reenergizes equity markets for utility companies," June 12, 2018.

[56] I note that other utilities may issue equity for a multitude of reasons including the reduction of short-term debt, tax reform, or financing capital expenditures.

market data are meaningful. This selection criteria resulted in a sample selection of nine companies, which I further discuss in Section IV.B below.

To estimate the cost of equity for the sample, I rely on two versions of the Discounted Cash Flow (DCF) model, two versions of the CAPM and the risk premium model. I further confirm these figures by comparing the estimates to the recently allowed ROE for gas LDCs. Specifically, I calculate the DCF cost of equity using the standard (single-stage) Gordon growth model and a three-stage DCF model. I also calculate the standard CAPM as well as a version of the Empirical CAPM (ECAPM). Further, I implement the risk premium model using authorized equity returns.

As noted above, the cost of equity capital for a company depends on its financial leverage. As the sample's DCF (and CAPM) measures of cost of equity were estimated using the sample companies' market value capital structure I determine the current capital structure (and the five-year average capital structure in the case of the CAPM). I can then use these figures to convert the sample's cost of equity estimate to an estimate for NWN Washington using its requested 49.5 percent equity. I then look to NWN Washington's level of risk relative to the sample. Finally, I consider the reasonableness of the estimated cost of equity for NWN Washington in light of recently allowed ROE for gas LDCs.

B. SAMPLE SELECTION

Q40. Please describe how you selected your sample.

A40. To select a comparable sample of gas LDCs, I began with the universe of publicly traded gas LDCs as classified by Value Line.[57] From this group, I kept those that are Regulated (meaning that at least 80 percent of assets are regulated) or Mostly Regulated (50 - 79 percent of assets are regulated) based on the companies' 10-K filings. In addition, I require that the selected companies have sufficient data available that Value Line can provide a beta estimate, have an investment grade rating, and sufficient size or trading volume that market data are meaningful.

Additionally, I exclude companies with unique circumstances such as dividend cuts and merger activity. I exclude companies with dividend cuts because the announcement of a cut may create disturbances in the stock prices and growth rate expectations in addition to potentially being a signal of financial distress. I generally eliminate companies with significant M&A activities because such events typically affect a company's stock price in ways that are not representative of how investors perceive its business and financial risk characteristics. These selection criteria returned a sample of five companies, Atmos Energy, Chesapeake Utilities, Northwest Natural Gas, ONE Gas, and Southwest Gas. I refer to the set of five companies that meet all selection criteria as the subsample. I note that the "Northwest Nat. Gas" in the sample selection refers to NW Natural Holding Company (the consolidated entity) and not the

[57] The companies are from Value Line Investment Analyzer.

Washington-regulated gas LDC, NWN Washington, which is a very small part of NW Natural Holding Company.

To form more statistically robust estimates, I relax my criteria for dividend cuts and M&A activity, which allowed for the inclusion of four additional companies, NiSource, Spire Inc., South Jersey Industries, and New Jersey Resources. This expands my sample to nine companies, which I refer to as the full sample.

The four companies included in the full sample (but excluded from the subsample) have had dividend cuts or significant M&A activity within the last five years, and thus would be eliminated using my standard criteria. However, I use them as a control group to test my results for the subsample and note that there is no issue using these companies in the DCF models as the dividend cuts and M&A pertains to a period not used in the estimation.

Q41. Please summarize the characteristics of your sample.

A41. Figure 11 reports the sample companies' annual revenues for the trailing twelve months ended September 2018[58] and the percentage of their assets devoted to regulated activities. It also displays each company's Market Capitalization and S&P Credit Rating as of Q3, 2018 as well as its Value Line beta and the company's growth rate. The latter is the weighted average long-term earnings growth rate estimate from Thomson Reuters IBES and Value Line. The average sample company devotes over 80 percent of its assets to regulated activities, which are primarily related to the local

[58] Data extends through June 2018.

distribution of natural gas. Therefore, these sample companies are nearly pure-plays in the natural gas distribution industry.

Figure 11
Gas Sample and Its Characteristics

Company	Annual Revenues (USD million)	Regulated Assets	Market Cap. 2018 Q3 (USD million)	Beta	S&P Credit Rating (2018)	Long Term Growth Est.
	[1]	[2]	[3]	[4]	[5]	[6]
Atmos Energy *	$3,136	R	$10,419	0.60	A	6.92%
Chesapeake Utilities*	$683	R	$1,423	0.70	A-	7.66%
Northwest Nat. Gas*	$718	R	$1,957	0.65	A+	6.89%
ONE Gas Inc.*	$1,641	R	$4,277	0.65	A	6.71%
Southwest Gas*	$2,759	R	$3,943	0.75	BBB+	6.24%
NiSource	$5,043	R	$9,400	0.55	BBB+	6.53%
Spire Inc.	$1,985	R	$3,778	0.65	A-	3.32%
South Jersey Industries	$1,322	M	$2,999	0.75	BBB+	9.92%
New Jersey Resources	$2,804	M	$4,094	0.70	A-	6.00%
Full Sample Average	$2,232		$4,699	0.67		6.69%
Subsample Average	$1,787		$4,404	0.67		6.88%

Sources and Notes:
[1]: Bloomberg as of 09/30/2018.
[2]: Company 10-Ks. See Table No. BV-2.
R - Regulated (at least 80% of assets are regulated), M (50%-70% of assets are regulated.)
[3]: See Table No. BV-3 Panels A through I.
[4]: See Supporting Schedule # 1 to Table No. BV-10.
[5]: S&P Credit Ratings from Research Insight as of 2018 Q3. S&P Credit Ratings are from Research Insight as of 2017 Q3. NJR's credit rating based off of New Jersey Gas Co.'s rating reported by SNL. Chesapeake Utilities is given the average Credit Rating of the rest of the sample.
[6]: See Table No. BV-5.
* Denotes company is part of the subsample

Q42. How does the sample compare to NWN Washington?

A42. As can be seen from Figure 11 above, the majority of the sample companies are Regulated (80 percent or more of assets are rate regulated) as is NWN Washington. The average credit rating is slightly lower than that of NWN Washington at an average of A- while NWN Washington maintains an A+ rating from S&P.[59] However, all are

[59] Ratings cited in my work papers are S&P ratings as reported by Bloomberg as of September 30, 2018.

BBB+ or better and the majority are into the A range. NWN Washington, as well as its parent, NWN Gas Co., are smaller than the average sample company as measured by revenue and market cap. The full sample average annual revenue of $2,232 million is over thirty times greater than NWN Washington's revenue of $67.6 million over the same period.[60]

C. CAPITAL STRUCTURE

Q43. What regulatory capital structure is NWN Washington requesting in this proceeding?

A43. NWN Washington has requested a regulatory capital structure consisting of 49.5 percent equity and 50.5 percent debt,[61] which is slightly below the equity percentage reported for the parent company.[62] This capital structure is broadly consistent with the book value capital structures of the sample companies. The full sample averages approximately 49.0 percent equity on a book basis. The highest percentage of book equity for the companies in the sample is 61.0 percent equity (ONE Gas) and the lowest is 32.0 percent equity (South Jersey Industries) as of Q3 2018.[63] However, the market value capital structure includes an average of about 66.3 percent equity as of Q3 2018.[64] My recommended range for ROE is a function of the requested capital structure, the

[60] NWN Washington annual revenue as of 9/30/2018, provided by the company.

[61] The debt consists of 49.5 percent long-term debt and 1 percent short-term debt.

[62] Value Line, "NW Natural," August 31, 2017 report a common equity ratio of 52.1% for 2017.

[63] See Exh. BV-4C, Table No. BV-3, Panels A to I.

[64] See Exh. BV-4C, Table No. BV-4, Column [1]. Note that the CAPM uses a five-year average equity ratio to be consistent with the beta estimate time horizon. The five-year average equity ratio for the full sample is lower at approximately 63.0% equity.

sample average cost of capital estimates and the relative risk of NWN Washington compared to the sample.

V. COST OF CAPITAL ESTIMATES

Q44. How do you estimate the sample companies' costs of equity?

A44. As noted earlier, I use three methods: Discounted Cash Flow (DCF), Capital Asset Pricing Models (CAPM), and risk premium models. All methods are commonly used in U.S. state regulatory proceedings and have been presented to the Commission previously.[65] For the DCF estimates, I present two models: the standard Gordon growth model (or the single-stage DCF) and a multi-stage DCF model. I implement the multi-stage DCF model using the consensus Blue Chip forecast for the long-term GDP growth rate. I estimate two versions of the CAPM: the traditional CAPM and the Empirical CAPM. Further, I estimate the ROE from the risk premium method: a regression analysis of allowed return on bond rates. Because the cost of equity cannot be measured precisely, it is important to consider more than one method. Further, each method has its strengths and weaknesses, which may be more or less prevalent at any given time. It is therefore necessary to evaluate the estimated cost of equity in the light of the prevalent market conditions and the relative strengths and weaknesses of the model to take these factors into account. I also cross-check my estimates against recently allowed ROEs in other jurisdictions, although I do not use this as an input to my recommendation.

[65] See footnote 11 above.

A. THE DCF BASED ESTIMATES

1. Single and Multi-Stage DCF Models

Q45. Please describe the discounted cash flow approach to estimating the cost of equity.

A45. The DCF model attempts to estimate the cost of capital for a given company directly, rather than based on its risk relative to the market as the CAPM does. The DCF method simply assumes that the market price of a stock is equal to the present value of the dividends that its owners expect to receive. The method also assumes that this present value can be calculated by the standard formula for the present value of a cash flow—literally a stream of expected "cash flows" discounted at a risk-appropriate discount rate. When the cash flows are dividends, that discount rate is the cost of equity capital:

$$\boldsymbol{P_0} = \frac{\boldsymbol{D_1}}{\boldsymbol{1+r}} + \frac{\boldsymbol{D_2}}{\boldsymbol{(1+r)^2}} + \frac{\boldsymbol{D_3}}{\boldsymbol{(1+r)^3}} + \cdots + \frac{\boldsymbol{D_T}}{\boldsymbol{(1+r)^T}} \qquad (1)$$

where $\boldsymbol{P_0}$ is the current market price of the stock;

$\boldsymbol{D_t}$ is the dividend cash flow expected at the end of period $\boldsymbol{t}$;

$\boldsymbol{T}$ is the last period in which a dividend cash flow is to be received; and

$\boldsymbol{r}$ is the cost of equity capital

Importantly, this formula implies that if the current market price and the pattern of expected dividends are known, it is possible to "solve for" the discount rate r that makes the equation true. In this sense, a DCF analysis can be used to estimate the cost of equity capital implied by the market price of a stock and market expectations for its future dividends.

Many DCF applications make the assumption the growth rate lasts into perpetuity, so the formula can be rearranged algebraically to directly estimate the cost

of capital. Specifically, the implied DCF cost of equity can then be calculated using the well-known "DCF formula" for the cost of capital:

$$\boldsymbol{r = \frac{D_1}{P_0} + g = \frac{D_0}{P_0} \times (1 + g) + g} \qquad (2)$$

where $\boldsymbol{D_0}$ is the current dividend, which investors expect to increase at rate $\boldsymbol{g}$ by the end of the next period, and over all subsequent periods into perpetuity.

Equation (2) says that if equation (1) holds, the cost of capital equals the expected dividend yield plus the (perpetual) expected future growth rate of dividends. I refer to this as the single-stage DCF model; it is also known as the Gordon Growth model, in honor of its originator Professor Myron J Gordon of the University of Toronto.

Q46. Are there versions of the DCF model that does not rely on the Gordon Growth method?

A46. Yes. There are many alternatives, notably, (i) multi-stage models and (ii) models that use cash flow rather than dividends or combinations of (i) and (ii).[66] One such alternative expands the Gordon DCF model to three stages.[67] In the multistage model, earnings and dividends can grow at different rates, but must grow at the same rate in the final, constant growth rate period.

[66] The Surface Transportation Board uses a cash flow based model with three stages. See, for example, Surface Transportation Board, "Ex Parte No. 664 (Sub-No. 1)," Issued January 23, 2009. Confirmed in EP 664 (Sub-No. 2), issued October 31, 2016.

[67] I note that because investors are interested in cash flow, it is technically important to include all cash flow that is distributed to shareholders. Notably, many companies distribute cash through share buybacks in addition to dividends and therefore, I would include this type of distribution. However, among the comparable companies share buybacks is not a large. Therefore, I ignore this aspect for this proceeding.

2. DCF Inputs and Results

Q47. What growth rate information do you use?

A47. The first step in my DCF analysis (either constant growth or multistage formulations) is to examine a sample of investment analysts' forecasted earnings growth rates from Bloomberg and from Value Line for companies in the gas LDC sample. For the long-term growth rate for the final, constant-growth stage of the multi-stage DCF estimates, I use the most recent long-run GDP growth forecast from Blue Chip Economic Indicators.[68]

Q48. How do these growth rates correspond to the theoretical criteria you discuss above?

A48. The constant-growth formulation of the DCF model, in principle, requires forecasted growth rates, but it is also necessary that the growth rates used extend far enough into the future so that it is reasonable to believe that investors expect a stable growth path afterwards. Under current economic conditions, I believe the forecasted growth rates of investment analysts provide the best available representation of the longer term, steady-state growth rate expectations of investors.

Q49. Does the multistage DCF improve upon the simple DCF?

A49. Potentially, but the multistage method assumes a particular smoothing pattern and a long-term growth rate afterwards. These assumptions may not be a more accurate representation of investor expectation than those of the simple DCF. The smoother growth pattern, for example, might not be representative of investor expectations, in

[68] *Blue Chip Economic Indicators*, October 2018.

which case the multistage model would not increase the accuracy of the estimates. Indeed, amidst uncertainty in capital markets, assuming a simple constant growth rate may be preferable to attempting to model growth patterns in greater detail over multiple stages. While it is difficult to determine which set of assumptions comprises a closer approximation of the actual conditions of capital markets, I believe both forms of the DCF model provide useful information about the cost of capital.

Q50. What are your DCF estimates?

A50. Looking at the full sample, the ROE estimate is 11.6 percent for the Gordon (single-stage) DCF model and 8.7 percent for the multistage model using the Blue Chip forecast. For the subsample, the ROE estimate is 12.1 percent and 8.7 percent for the single-stage and multi-stage DCF models, respectively. Figure 12 below summarizes the results from the DCF models.

Figure 12
DCF Estimates on the Cost of Equity

Subsample	[1]
Single-Stage	12.11%
Multi-Stage	8.66%
Expanded Sample	
Single-Stage	11.55%
Multi-Stage	8.70%

Sources & Notes:
[1]: Table No. BV-8, column [6].

Q51. What conclusions do you draw from the DCF analysis?

A51. The estimates from the DCF models have a wide range, so that it is difficult to recommend an ROE from the figure above. However, the midpoint of the range: 10.4

percent for the subsample and 10.1 percent for the full sample are in line with my expectations and with the results I obtain from other models. Thus, a reasonable range based on the DCF analysis is 10 - 10½ percent.

B. THE CAPM BASED ESTIMATES

Q52. Please briefly explain the CAPM.

A52. The CAPM posits a risk-return relationship known as the Security Market Line (see Figure 2), in which the required expected return on an asset is proportional to that asset's relative risk as measured by that asset's beta.

More precisely, the CAPM states that the cost of capital for an investment, S (e.g., a particular common stock), is given by the following equation:

$$\boldsymbol{r_s = r_f + \beta_s \times MRP} \quad (3)$$

- $\boldsymbol{r_S}$ is the cost of capital for investment S;
- $\boldsymbol{r_f}$ is the risk-free interest rate;
- $\boldsymbol{\beta_S}$ is the beta risk measure for the investment S; and
- $\boldsymbol{MRP}$ is the market equity risk premium.

The CAPM is a "risk-positioning model," which operates on the principle (corroborated by empirical data) that investors price risky securities to offer a higher expected rate of return than safe securities. It says that an investment whose returns do not vary relative to market returns should receive the risk-free interest rate (that is the return on a zero-risk security, the y-axis intercept in Figure 2), whereas investments of the same risk the overall market (*i.e.*, those that by definition have average systematic market risk) are priced so as to expect to return the risk-free rate plus the MRP. Further,

it says that the risk premium of a security over the risk-free rate equals the product of the beta of that security and the MRP.

1. Inputs to the CAPM

Q53. What inputs does your implementation of the CAPM require?

A53. As shown in equation (3), the cost of equity for a given company requires a measure of the risk-free rate of interest and the MRP, as well as a measurement of the stock's beta (or systematic risk). There are several choices and sources of data that can be used and I discuss my selection below. (Additional technical detail, along with a discussion of the finance theory underlying the CAPM is provided in Exh. BV-3.)

Q54. What value did you use for the risk-free rate of interest?

A54. I used the yield on a 20-year U.S. Treasury bond as the risk-free asset for purposes of my analysis. Recognizing the fact that the cost of capital set in this proceeding will be in place over the next several years, I rely on a forecast of what Treasury bond yields will be in 2020. Specifically, *Blue Chip Economic Indicators* projects that the yield on a 10-year Government Bond will be 3.6 percent by 2020.[69] I adjust this value upward by 50 basis points, which is my estimate of the representative maturity premium for the 20-year over the 10- year Government Bond. Thus, I use 4.10 percent as an estimate of the risk-free rate.

Q55. What value did you use for the MRP?

A55. Like the cost of capital itself, the MRP is a forward-looking concept. It is by definition the premium above the risk-free interest rate that investors can *expect* to earn by

[69] *Blue Chip Economic Indicators*, October 2018, p. 14.

investing in a value-weighted portfolio of all risky investments in the market. The premium is not directly observable, and must be inferred or forecasted based on known market information. One commonly used method for estimating the MRP is to measure the historical average premium of market returns over the income returns on government bonds over some long historical period. *Duff and Phelps* performs such a calculation of the MRP. The average market risk premium from 1926 to the present (2017) is 7.07 percent.[70] I use this value of the MRP in my CAPM analyses.

I also note that Bloomberg's average forward-looking market-implied MRP for year to date is 7.23 percent (when expressed relative to 20-year bond yields), which is above the 7.07 percent long-term historical average. The fact that recent forward-looking estimates of the MRP exceed the historical average level is consistent with the broader body of evidence that risk premiums have remained elevated relative to their pre-financial crisis levels. Therefore, I believe the 7.07 percent long-term historical average MRP value I rely on is a reasonable and conservative estimate of what the market risk premium will be during the period at issue in this proceeding.

Q56. What betas did you use for the companies in your sample?

A56. I used Value *Line* betas, which are estimated using the most recent five years of weekly historical returns data.

[70] Duff & Phelps, Ibbotson SBBI 2018 Valuation Yearbook 10-21.

2. The Empirical CAPM

Q57. What other equity risk premium model do you use?

A57. Empirical research has long shown that the CAPM tends to overstate the actual sensitivity of the cost of capital to beta: low-beta stocks tend to have higher risk premiums than predicted by the CAPM and high-beta stocks tend to have lower risk premiums than predicted.[71] A number of variations on the original CAPM theory have been proposed to explain this finding, but the observation itself can also be used to estimate the cost of capital directly, using beta to measure relative risk by making a direct empirical adjustment to the CAPM.

The second variation on the CAPM that I employ makes use of these empirical findings. It estimates the cost of capital with the equation,

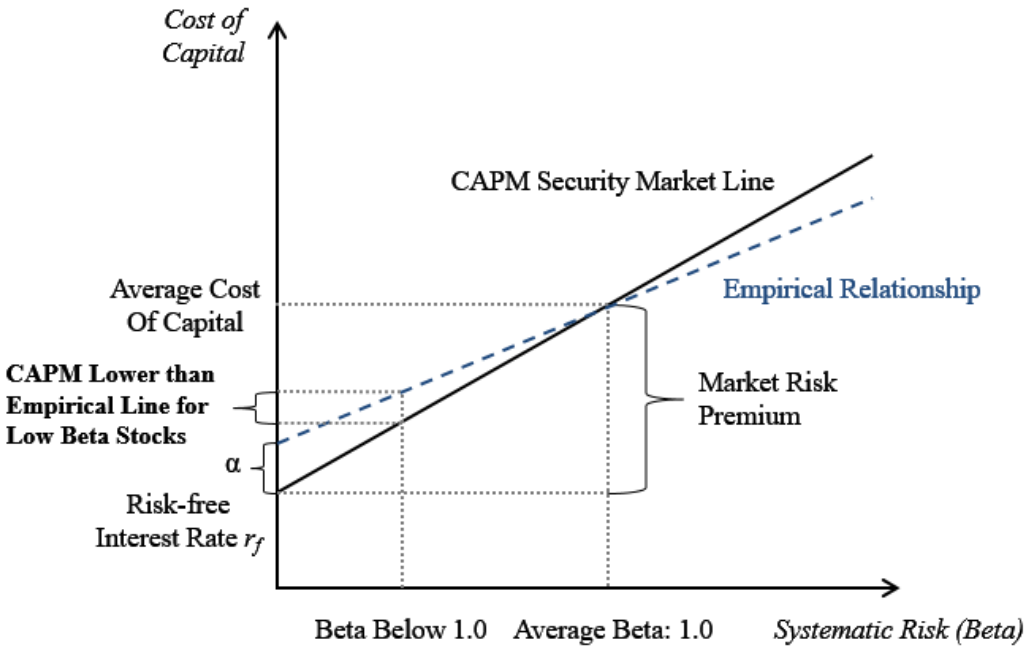
$$\boldsymbol{r_S = r_f + \alpha + \beta_S \times (MRP - \alpha)} \qquad (4)$$

where $\boldsymbol{\alpha}$ is the "alpha" adjustment of the risk-return line, a constant, and the other symbols are defined as for the CAPM (see equation (4) above).

I label this model the Empirical Capital Asset Pricing Model, or "ECAPM." The alpha adjustment has the effect of increasing the intercept but reducing the slope of the Security Market Line in Figure 2, which results in a Security Market Line that more closely matches the results of empirical tests. This adjustment is portrayed in Figure 13 below. In other words, the ECAPM produces more accurate predictions of eventual realized risk premiums than does the CAPM.

[71] See Exh. BV-3 Section IIC for references to relevant academic articles.

Figure 13
The Empirical Security Market Line



Q58. Why do you use the ECAPM?

A58. Academic research finds that the CAPM has not generally performed well as an empirical model. One of its short-comings is directly addressed by the ECAPM, which recognizes the consistent empirical observation that the CAPM underestimates the cost of capital for low beta stocks. In other words, the ECAPM is based on recognizing that the actual observed risk-return line is flatter and has a higher intercept than that predicted by the CAPM. The alpha parameter (α) in the ECAPM adjusts for this fact, which has been established by repeated empirical tests of the CAPM. Exh. BV-3 Section IIC discusses the empirical findings that have tested the CAPM and also provides documentation for the magnitude of the adjustment, α.

3. Results from the CAPM Based Models

Q59. Please summarize the results of the CAPM-based models.

A59. The results of CAPM and ECAPM estimation for gas LDC samples are presented in Figure 14 below. The ranges of results for each model (CAPM and ECAPM) reflect the application of different specific versions of the textbook formulas used to account for the impact of different financial leverage on financial risk.

Figure 14
CAPM Summary: Gas LDC Subsample

		CAPM	ECAPM (α = 1.5%)
Overall CoC Constant	[a]	10.87%	11.54%
Hamada Adjustment Method (with taxes)	[b]	10.12%	10.34%
Hamada Adjustment Method (without taxes)	[c]	10.43%	10.58%

Sources & Notes:
[a]: Table No. BV-12
[b]-[c]: Table No. BV-15
Long-Term Risk Free Rate of 4.10%, Long-Term Market Risk Premium of 7.07%.

Q60. How do you interpret the results of your CAPM and ECAPM Analyses?

A60. In my opinion, the central tendency of the estimates are in the range of 10.1 to 10.8 percent (or 10 – 11 percent if rounded to the nearest ¼ percent), which is within the range generated by the DCF-based methods albeit a much narrower range.

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C. RISK PREMIUM ESTIMATES

Q61. Please explain the implementation and data underlying your risk premium analysis.

A61. Using quarterly data from Regulatory Research Associates from Q1 1990 to Q3 2018[72] I estimate the equation:

$$\text{Risk Premium} = A_0 + (A_1 \times \text{Treasury Bond Yield})$$

The equation is estimated using ordinary least squares and the parameters are statistically significant (details are in Exh. BV-5C). Using this approach, I estimate a risk premium, which is then added to the forecasted 20-year yield in 2020 as NWN Washington's rates are expected to go into effect in near the end of 2019. *I.e.,*

$$\text{Estimated ROE} = \text{Forecast Risk-Free Rate} + \text{Risk Premium}$$

The forecasted 20-year yield is 4.10 percent and the risk premium is 6.17 percent. I obtain cost of equity estimates of 10.27 percent. This estimate is also consistent with recently allowed ROEs once the likely increase in interest rates is considered. Gas LDC authorized ROEs over the past year have averaged 9.63 percent (see Exh. BV-5C)[73] and government bond yields are expected to increase by about 80 basis points[74] over the next two years.

[72] SNL Financial, as of September 2018.

[73] SNL Financial as of 10/22/2018.

[74] The 20-Year Treasury Note yield was 3.3% in November 2018 (Bloomberg) and is forecast to increase to 4.10% by 2020 (Blue Chip, October 2018), representing an almost 80 basis point increase.

Figure 15
Risk Premium Estimate on the Cost of Equity

Risk Premium = A_0 + (A_1 x Treasury Bond Rate)				
R Squared	0.852			
Estimate of Intercept (A_0)	8.41%			
Estimate of Slope (A_1)	-0.547			
Predicted Risk Premium	**+**	**Exp. Treasury Bond Rate**	**=**	**Est. Cost of Equity for Gas LDCs**
6.17%		4.10%		10.27%

Sources and Notes:
[1]: Authorized ROE Data from SNL financial as of 10/22/2018.
[2]: Blue Chip consensus forecast 2018 10 year T-bill yield + maturity premium between 10 year and 20 year U.S. Government bonds + utility yield spread adjustment.
See SS1-Regression Results for derivation of regression coefficients A_0 and A_1

Q62. Is this estimate consistent with NWN Washington's regulatory capital structure of 49.5 percent equity and 50.5 percent debt?

A62. Yes, the authorized ROE pertains to the regulated capital structure of the entities for which state regulatory commissions allowed an ROE. The regulatory capital structures have on average been close to 50 percent equity since 2003 (the first year for which RRA reports the equity percentage in its recent publication).[75] Therefore, the estimated ROE is consistent with NWN Washington's capital structure.

Q63. What conclusions do you draw from the analysis?

A63. The risk premium analysis ROE estimate of 10.3 percent is consistent with the midpoint of my DCF and my range of CAPM estimates. While the risk premium model based

[75] SNL Financial, RRA Regulatory Focus, October 22, 2018. Except in 2004, RRA reports average capital structures with equity percentages between 47.2 and 52.5 percent.

on historical allowed returns are not underpinned by fundamental finance principles in the manner of the CAPM or DCF models, I believe that this analysis, when properly designed and executed and placed in the proper context, can provide useful benchmarks for evaluating whether the estimated ROE is consistent with recent practice. My risk premium model cost of equity estimates demonstrate that the results of my DCF and CAPM analyses are in line with the allowed return of utility regulators. Because the risk premium analysis as implemented takes into account the interest rate prevailing during the quarter the decision was issued, it provides a useful benchmark for the cost of equity in any interest environment.

VI. BUSINESS RISK DISCUSSION

Q64. Are there Washington specific risks that impact NWN Washington?

A64. Yes. There is significant uncertainty about Washington's climate policy, which would affect NWN Washington. Specifically, the State of Washington has initiatives to significantly reduce carbon dioxide (CO_2 emissions). Currently, CO_2 reduction target aims to reduce carbon emissions to 1990 levels by 2020; 25 percent below 1990 levels by 2035, and 50 percent below 1990 levels by 2050.[76] In recent years, numerous state policy initiatives have aimed to reduce Washington's CO_2. These initiatives include The Washington Carbon Pollution Reduction and Clean Energy Action,[77] The Clean

[76] Washington's Carbon Reduction Targets, accessed at https://ecology.wa.gov/Air-Climate/Climate-change/Carbon-reduction-targets.

[77] Executive Order 14-04: Washington Carbon Pollution Reduction and Clean Energy Action, accessed at https://www.governor.wa.gov/issues/issues/energy-and-climate/carbon-pollution-executive-order.

Power Plan,[78] The Clean Air Rule,[79] and Carbon Tax proposal.[80] The state's climate initiatives affects NWN Washington's fundamental business operations as burning natural gas releases CO_2 into the atmosphere and therefore initiatives to reduce the consumption of natural gas in Washington would affect NWN Washington's sales. Ultimately, the climate initiatives could reduce the reliance on natural gas to a level where it creates stranded cost risks for NWN Washington. Such risks are asymmetric in nature in that NWN Washington faces downside risks but has no equivalent upside potential. Importantly, asymmetric risks are not measure in the standard cost of capital estimation and therefore needs to be considered separately – ideally through a decoupling mechanism and the assurance of full recovery of invested capital.

Q65. Do any of the companies in your sample have revenue decoupling mechanisms?

A65. Yes. All of the companies in my full sample and subsample have decoupling mechanisms in at least one state of operation, as shown in Figure 16.[81] Revenue decoupling means that these companies benefit from regulatory provisions allowing them to recover their fixed costs independently of volumetric charges. Thus, if the utilities' customers use less natural gas than was forecast, the decoupling mechanism improves the probability that the utilities can recover their costs despite the decrease in

[78] Washington's Clean Power Plan, accessed at https://ecology.wa.gov/Air-Climate/Air-quality/Business-industry-requirements/Clean-Power-Plan.

[79] The Clean Air Rule, accessed at https://ecology.wa.gov/Air-Climate/Climate-change/Carbon-reduction-targets/Clean-Air-Rule.

[80] Washington Voters to Consider a Carbon Tax, accessed at https://taxfoundation.org/washington-consider-carbon-tax.

[81] See Regulatory Research Associates (S&P Global Market Intelligence), Updated September 28, 2018 for a compilation of decoupling mechanisms by company and state.

revenues. Specifically, decoupling policies enable utilities to offset the effect of volumes (and therefore revenues) of customer participation in energy efficiency programs, deviations from average temperature patterns, and economic conditions in their territories.[82] Notably, NWN Washington has no decoupling mechanisms.[83] NWN Washington is the only utility in Washington that does not have any decoupling mechanisms.[84]

Q66. What is the effect of decoupling on the cost of capital?

A66. Brattle has studied the effect of decoupling on the cost of capital[85] and found a lack of statistical support for the hypothesis that the adoption of decoupling results in a decrease in the cost of capital; however, the test does not provide the reason. The paper offers two possible explanations. One is that decoupling primarily affects diversifiable risk, which is the kind of risk that does not affect the cost of capital because investors can eliminate diversifiable risk through formation of a portfolio. The second possible explanation is that decoupling merely offsets the increased risk from economic circumstances, such as Washington's CO_2 reduction initiatives, that favor energy conservation. If the second explanation is the correct one, then companies that face

[82] A "full" decoupling mechanism adjusts for all three of these factors, whereas a "partial" decoupling mechanism addresses only one or two of these factors.

[83] Regulatory Research Associates (S&P Global Market Intelligence), September 28, 2018, p. 15.

[84] *Ibid*.

[85] "Effect on the Cost of Capital of Ratemaking that Relaxes the Linkage between Revenue and kWh Sales: An Updated Empirical Investigation of the Electric Industry," Michael J. Vilbert, Joseph B. Wharton, Shirley Zhang, and James Hall, *The Brattle Group*, November 2016. "The Impact of Revenue Decoupling on the Cost of Capital for Electric Utilities: An Empirical Investigation," by Michael J. Vilbert, Joseph B. Wharton, Charles Gibbons, Melanie Rosenberg, Yang Wei Neo of *The Brattle Group* on behalf of The Energy Foundation, March 20, 2014.

declining energy consumption without the benefit of a decoupling mechanism would indeed face higher systematic risk than their peers that can rely on such a mechanism.

Figure 16
Sample Selection Decoupling Mechanisms

Company		State	Revenue Decoupling Mechanism
Spire	[1]	Alabama	Partial: weather normalization
		Missouri	None
Southwest Gas	[2]	Arizona	Partial: delivery charge adjustment
		California	Full
		Nevada	Partial: revenue adjustment to counteract the difference between actual bad debt expenses and base rate levels
ONE Gas	[3]	Kansas	Partial: weather normalization
		Oklahoma	Partial: weather normalization and revenue adjustment to counteract the impact of energy efficiency programs on consumption
		Texas	Partial: weather normalization and purchased gas cost adjustment clauses
Northwest Natural Gas	[4]	Oregon	Partial: weather normalization and revenue adjustment to counteract the impact of conservation efforts on consumption
		Washington	None
Chesapeake Utilities	[5]	Delaware	None
		Florida	None
		Maryland	Partial: weather normalization for residential heating and smaller commercial heating customers; in addition, its subsidiary, Sandpiper, has revenue normalization mechanism
Nisource	[6]	Indiana	None
		Kentucky	Partial: recovery of net lost revenues and shared savings, subject to commission approval
		Massachusetts	Full
		Maryland	Partial: weather normalization for all customers, revenue normalization adjustment mechanisms for residential customers
		Ohio	None
		Pennsylvania	Partial: weather normalization for residential customers
		Virginia	Partial: weather normalization
South Jersey Industries	[7]	New Jersey	Full
New Jersey Resources	[8]	New Jersey	Full
Atmos	[9]	Colorado	Partial: recovery of net lost revenues associated with customer participation in demand-side management programs
		Kansas	Partial: weather normalization
		Kentucky	Partial: weather normalization and revenue adjustment to counteract the impact of energy efficiency programs on consumption
		Louisiana	Partial: weather normalization and energy efficiency (EE) riders through which the utility recovers costs associated with EE programs
		Mississippi	Partial: weather normalization for months November - April and revenue adjustment to counteract the impact of energy efficiency programs on consumption
		Tennessee	Partial: weather normalization
		Texas	Partial: weather normalization

Source: 'Adjustment Clauses, A State-by-State Overview', September 28, 2018, S&P Global, SNL Regulatory Research Associates – Regulatory Focus, RRA Topical Special Report. Report available through SNL Financial LC license.
For Chesapeake Utilities, see Chesapeake Utilities, 2017 10-K.

Notes:
The RRA report states whether an utility has partial, full, or no decoupling in a state, and provides details where deemed relevant. Details from the report for partial decoupling mechanisms are included here.
Full decoupling is the adjustment mechanism under which rates are adjusted to reflect any differences between authorized revenues and actual revenues on a per customer basis.
Partial decoupling is the adjustment mechanism under which rates are adjusted to reflect differences between authorized revenues and actual revenues due to specific events (eg. weather, energy efficiency programs).

Q67. Do any of the companies in your sample have capital adjustment clauses?

A67. Yes, all of the companies in my full sample, except for NWN Washington, have some form of capital adjustment clause in at least one state of operation, as shown in Figure 17. Capital adjustment clauses allow utilities to recover capital expenditures through rates, which have contributed to steady earnings growth.[86] Similar to decoupling mechanisms, capital adjustment clauses allow utilities to shift from shareholders to customers through rates. More specifically, the risk of capital expansion is shifted from shareholders to customers because capital adjustment clauses allow utilities to change their rates to recover costs on a current basis, without the expense and delay of a rate case filing. Given that NWN Washington does not have capital adjustment clauses, it is relatively riskier than the companies in the sample selection.

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[86] Regulatory Research Associates (S&P Global Market Intelligence), September 28, 2018, p. 1.

Figure 17
Sample Selection Capital Trackers

Company		State	Capital Tracker Mechanism
Spire	[1]	Alabama	No
		Missouri	Yes: infrastructure system replacement rider to recover costs associated with certain gas distribution system replacement projects
Southwest Gas	[2]	Arizona	Yes: the utility recovers costs for replacing distribution pre-1970 vintage steel pipelines
		California	No
		Nevada	Yes: the utility recovers costs associated with their gas infrastructure replacement projects
ONE Gas	[3]	Kansas	Yes: gas system reliability surcharge (GSRS) to recover costs associated with gas distribution system replacement projects between base rate proceedings
		Oklahoma	Yes: a rider to recover costs related to lost, used and unaccounted-for gas
		Texas	Yes: an annual cost-of-service adjustment mechanism
Northwest Natural Gas	[4]	Oregon	No
		Washington	No
Chesapeake Utilities	[5]	Delaware	No
		Florida	Yes: a rider that is adjusted annually for recovery of the costs associated with accelerating the replacement of cast iron and bare steel distribution pipes on its system
		Maryland	No
NiSource	[6]	Indiana	Yes: a rider to recover costs associated with certain government-mandated investments
		Kentucky	Yes: a rider to facilitate recovery of certain costs associated with gas distribution infrastructure replacement programs
		Massachusetts	No
		Maryland	Yes: a rider to recover costs associated with approved accelerated infrastructure replacement programs
		Ohio	Yes: a rider for infrastructure replacement programs
		Pennsylvania	Yes: distribution system improvement charges
		Virginia	Yes: a rider for select investment in natural gas facility replacement programs
South Jersey Industries	[7]	New Jersey	Yes: a variety of cost recovery mechanisms to incentivize the development of infrastructure modernization plans
New Jersey Resources	[8]	New Jersey	Yes: a variety of cost recovery mechanisms to incentivize the development of infrastructure modernization plans
Atmos	[9]	Colorado	No
		Kansas	Yes: gas system reliability surcharge (GSRS) to recover costs associated with gas distribution system replacement projects between base rate proceedings
		Kentucky	Yes: a rider to facilitate recovery of certain costs associated with gas distribution infrastructure replacement programs
		Louisiana	No
		Mississippi	No
		Tennessee	No
		Texas	Yes: surcharge mechanisms for gas reliability infrastructure program costs

Source: 'Adjustment Clauses, A State-by-State Overview', September 28, 2018, S&P Global, SNL Regulatory Research Associates – Regulatory Focus, RRA Topical Special Report. Report available through SNL Financial LC license.

Notes:
The RRA report states whether an utility has capital trackers in a state, and provides details where deemed relevant. Details from the report are included here.

Q68. What is NWN Washington's size relative to the sample companies?

A68. The majority of the publicly traded gas LDCs in the U.S., as well as the companies I select for my sample, are larger than NWN Washington's as well as its parent NWN Gas Co. For example, the average market capitalization of my full sample (including NWN Gas Co.) is $4.70 billion, which is more than twice that of the parent's, NWN

Gas Co., market capitalization of $1.96 billion.[87] Additionally, the full sample has average revenue of $2.23 billion over the twelve months ended September 30, 2018, which is over three times greater than NWN Gas Co.'s revenue of $718 million over the same period. If I were to consider only NWN Washington only, which had revenue of $67.6 million over the same period, the difference would be even larger.[88]

Q69. Why does the size of NWN Washington matter?

A69. Empirically, investors have required a higher premium to invest in smaller companies than in larger ones. For example, SBBI data indicate that NWN Washington's parent utility company, NWN Gas Co., has a market capitalization in the 3rd size decile, while the average company in the sample falls in the 2nd size decile. Companies in the 3rd size decile on average have a return on equity that is 0.8 percent higher than companies in the 2nd size decile.[89] Therefore, empirical evidence suggests that investors in smaller companies require a higher return than do investors in larger companies. The majority of gas LDCs (including my sample companies) are materially larger than NWN Washington. Therefore, NWN Washington directionally requires a higher ROE than an average size gas LDC.

Q70. What conclusions do you draw from the discussion above?

A70. NWN Washington is of greater business risk than the average gas LDC in the sample. NWN Washington does not have regulatory mechanisms in place, such as decoupling, to mitigate variations in volume and thereby does not have the opportunity to offset

[87] See Figure 11 in Section IV.B above for details.

[88] NWN Washington annual revenue as of 9/30/2018, provided by the company.

[89] Roger G. Ibbotson, "*2018 SBBI Yearbook*," Duff & Phelps 2018 (SBBI 2018), p. 7-13.

potential increases in risk due to economic circumstances that favor energy consumption. However, NWN Washington is applying for such a mechanism and my estimates assume the mechanism is granted. Additionally, NWN Washington is smaller than the sample companies in terms of market capitalization and revenue. NWN Washington's smaller size suggests it is relatively riskier than the companies in the sample selection.

VII. CONCLUSIONS

Q71. Please summarize your conclusion regarding NWN Washington's ROE.

A71. The estimated ranges are summarized in Figure 12 (DCF), Figure 14 (CAPM) and Figure 15 (Risk Premium). Overall the range is wide from 8.6 percent - 12.0 percent, but I focus on the central tendency of the data, which is much narrower and in the range of 10 to 10¾ percent. This range included the midpoint from the DCF estimates which constitute both the highest and lowest results. Given NWN Washington's size and need for capital investments, I consider a point estimate of 10.3 percent reasonable. My recommendation assumes that NW Natural will obtain a decoupling mechanism going forward.

Q72. Does this conclude your testimony?

A72. Yes.

VIII. LIST OF EXHIBITS

Exh. BV-2	Resume for Bente Villadsen
Exh. BV-3	Technical Appendix: Details of DCF, CAPM, and Leverage
Exh. BV-4C	Cost of Capital Estimate Tables and Workpapers (Confidential and Redacted)
Exh. BV-5C	Implied Risk Premium Estimate (Confidential and Redacted)
Exh. BV-6C	Authorized ROE for Gas LDCs Utilities in 2018 (Confidential and Redacted)