# Return On Equity

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# I. Introduction and Summary

**Q. Please state your name, occupation and relationship with Portland General Electric Company ("PGE").**

A. My name is Bente Villadsen and I am a principal at The Brattle Group (Brattle). My business address is The Brattle Group, 44 Brattle Street, Cambridge, MA 02138, USA. I have been asked by Portland General Electric Company (PGE) to estimate the cost of equity that PGE should be allowed an opportunity to earn on the equity portion of its rate base for the period after January 1, 2018.

My qualifications are included at the end of my testimony.

**Q. Please summarize your results.**

A. The results I arrived at are detailed in Table 1 below.[1]

**Table 1: Summary of ROE Estimates for PGE[2]**

| | Range of Estimates | Midpoint |
|---|---|---|
| DCF Models | 9.0% - 10.3% | 9.65% |
| Risk Premium Model | 9.9% -10.4% | 10.15% |
| Other Tests[3] | 9.3% - 10.2% | 9.75% |
| Range | 9.3% - 10.3% | n/a |
| Midpoint / Average | 9.8% | 9.85% |

[1] The Public Utilities Commission of Oregon (Commission) has, in the past, given no weight to the CAPM (Order 01-777, p. 32). Therefore, I use the CAPM as a check on the other estimates rather than a primary method in this matter.

[2] Data cited in Table 1 use all sample companies.

[3] I use the CAPM as a check, which results in an ROE of 9.2% to 10.2%. For 2016, the average allowed ROE for integrated electric utilities was 9.77% (excluding VA limited-issue Rider matters, which often involve generation incentives). See PGE Exhibits 1103 and 1105 for details. Source: Authorized ROE data from SNL Financial as of 1/9/2017.

I understand that the Commission in the past has relied primarily on the Discounted Cash Flow (DCF) model and in particular the multi-stage DCF model, which I estimate at 9.1% using a combination of the Office of Management and Budget (OMB) and Blue-Chip GDP long-term growth rate (and at 9.0% using Blue Chip alone).[4] Thus, the multi-stage DCF model results in estimates that are below the midpoint, but PGE's smaller market capitalization warrants a size premium of 60-70 basis points, which results in a multi-stage DCF result of 9.6% - 9.8%.[5] Other DCF models, the risk premium model, as well as other tests find a range of 9.0% to 10.4%. If I eliminate the highest and lowest estimate, my range is 9.3 to 10.3%, which includes PGE's requested ROE of 9.75%, which is slightly below both my estimated midpoint of 9.8% and the average of the midpoint estimates of 9.87%. I further note that once PGE's smaller size is considered, the multi-stage DCF fully supports PGE's request. Finally, I note that the average allowed ROE for integrated electric utilities in 2016 was 9.77%. Therefore, PGE's request is conservative.

**Q. How did you estimate the ROE for PGE?**

A. To assess the cost of capital for PGE, I start by selecting a sample of integrated electric utilities from Value Line's universe of electric utilities. The sample companies are selected to be comparable to PGE, so I include electric utilities that (i) have more than 50% regulated assets and (ii) own generation. In addition, the companies are screened based on financial

[4] I use the consensus forecast of the nominal GDP growth rate for 2023-2027 from the October 2016 Edition of Blue Chip Economic Indicators. In the 2017 Edition of Analytical Perspectives: Budget of the U.S. Government, the OMB forecasts an average nominal GDP growth rate of 4.3% from 2023-2026 (see page 12, Table 2-1). For the combination of Blue Chip and OMB GDP growth rates, I use 4.2% — the average of 4.1% and 4.3%.

[5] I note that according to Duff and Phelps / Ibbotson, "SBBI 2016 Classic Yearbook," (SBBI 2016) pp. 7-3, PGE's market capitalization makes it a decile 7 company, whereas the average of the comparable companies is decile 3-4 in terms of size. According to page 7-16, the size premium that is warranted for a company of PGE's size relative to the comparable companies is 60-70 basis points.

criteria such as credit ratings and on data availability. For each company, I then estimated the cost of equity using standard methods including two versions of the DCF model, the risk premium model, a review of recently allowed ROE, and as a test, two versions of the Capital Asset Pricing Model (CAPM). I ensure consistency between the capital structure used to derive the cost of equity estimates and PGE's regulatory capital structure and also evaluate critical risk factors that may differ between PGE and the sample. Specifically, I note that PGE is smaller than the majority of the sample companies and has just finished integrating a large amount of new generation (e.g., Carty and wind) into its supply mix. I also note that the average credit rating in my sample is BBB+ using Standard & Poor's (S&P) ratings, while S&P rates PGE BBB (Moody's rates PGE higher at A3).[6]

[6] Ratings cited in my work papers are S&P ratings as reported by Bloomberg.

# II. Cost of Capital Theory

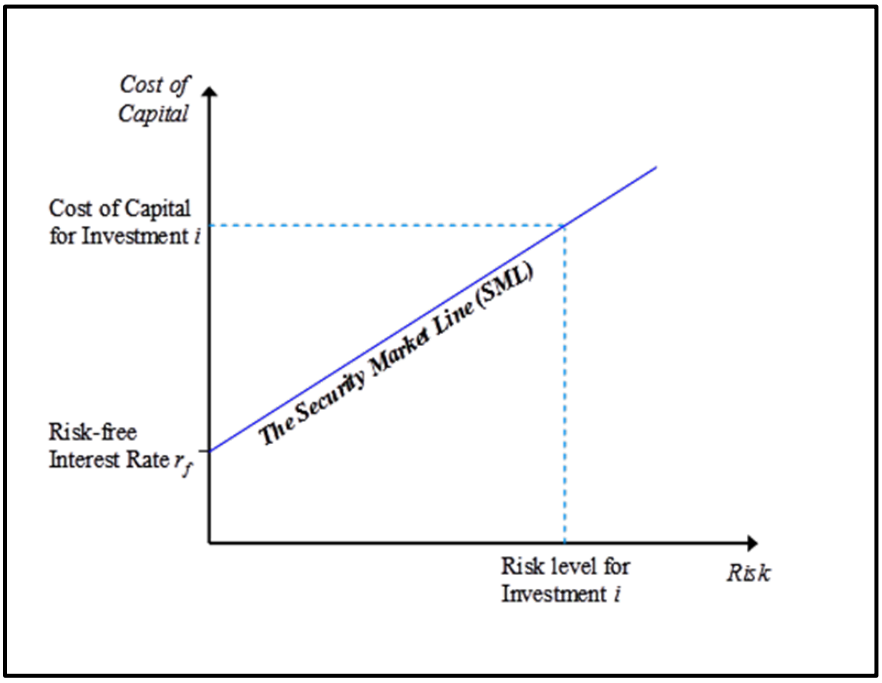
## A. Cost of Capital and Risk

**Q. How is the "cost of capital" defined?**

A. 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 1 below. The higher the risk, the higher the cost of capital required.

**Figure 1: The Security Market Line**




**Q. Why is the cost of capital relevant in rate regulation?**

A. As noted above, the "cost of capital" is the return that investors expect to earn on investments of comparable risk[7] and is viewed as consistent with the U.S. Supreme Court's opinions in *Bluefield Water Works & Improvement Co. v. Public Service Commission of West Virginia*, 262 U.S. 679 (1923), and *Federal Power Commission v. Hope Natural Gas Co.*, 320 U.S. 591 (1944) as well as with Oregon law, ORS ¶756.040, which, consistent with the Bluefield and Hope, holds that:

> Rates are fair and reasonable for the purposes of this subsection if the rates provide adequate revenue both for operating expenses of the public utility or telecommunications utility and for capital costs of the utility, with a return to the equity holder that is:
> (a) Commensurate with the return on investments in other enterprises having corresponding risks; and

[7] See Stewart C. Myers, "Application of Finance Theory to Public Utility Rate Cases," *Bell Journal of Economics & Management Science* 3:58-97 (1972).

(b) Sufficient to ensure confidence in the financial integrity of the utility, allowing the utility to maintain its credit and attract capital.[8]

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 efficiency investments 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

[8] 2015 ORS ¶ 756.040. Available at http://www.oregonlaws.org/ors/756.040.

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 electric utility industry), which feature systems that take a long time to decay. Such long-lived infrastructure assets cannot be repaired or replaced overnight, because of the time necessary to plan, permit, and construct the facilities. 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

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

A. First, I select my comparable sample to have as comparable business risks as possible to PGE. 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 PGE. Third, I consider any PGE-specific risk 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.

**Q. Why is capital structure important for the determination of the cost of equity for PGE?**

A. As shown by Professor Hamada,[9] shareholders in a company with more debt face more equity risk and the return on equity needs to increase. Commission Staff has in past proceedings acknowledged this principle.[10] One way to take the phenomena into account is to determine the after-tax weighted-average cost of capital for the entities and ensure that figure stays constant between the estimate obtained for the sample and the entity to which it is applied.[11] Other methods are more applicable to the CAPM and use the beta estimate.

**Q. Please explain how you calculate and implement the methodology.**

A. The after-tax weighted average cost of capital (ATWACC) is calculated as the weighted average of the after-tax cost of debt capital and the cost of equity. Specifically, the following equation pertains:[12]

$$ATWACC = r_D \times (1 - T_C) \times \%\ D + r_E \times \%\ E \qquad (1)$$

where $r_D$ = market cost of debt,

$r_E$ = market cost of equity,

$T_C$ = corporate income tax rate,

$\%D$ = % debt in the capital structure, and

$\%E$ = % equity in the capital structure

The ATWACC is commonly referred to as the WACC in financial textbooks and is used in investment decisions.[13] The return on equity, consistent with the sample's overall cost of capital estimate, the market cost of debt, the corporate income tax rate, and the

[9] Robert S. Hamada, "Portfolio Analysis, Market Equilibrium and Corporate Finance," *The Journal of Finance* 24: 13-31 (March 1969).
[10] See, for example, UE 283 Exhibit 200, p. 8.
[11] For other methods such as the CAPM, other methods are readily available and I discuss those in Exhibit PGE1103 and 1104.
[12] The equation is shown with only debt and common equity. If the capital structure has preferred equity, add the following term (rP × % P) to the right-hand side of the equation.
[13] See, for example, Brealey, Myers and Allen (2013*), Principles of Corporate Finance*, 11th Edition, p. 221.

amount of debt and common equity in the capital structure, can be determined by solving equation (1) for $r_E$ . Having determined the after-tax weighted-average cost of capital for the sample companies, I can determine what ROE I need to ensure the same after-tax weighted-average cost of capital is applied to PGE.[14]

**Q. Why is this relevant to this proceeding?**

A. The ATWACC is one of several procedures in my analysis; it is important because it allows a comparison between the sample companies' costs of capital estimates that are based on market data and the cost of capital for PGE, which is based on book value figures. Two otherwise identical companies with different capital structures will typically have different costs of equity because the risks to equity holders depend on financial leverage (i.e., the amount of debt in the capital structure of the company). This makes it difficult to compare cost-of-equity estimates among companies that have different capital structures. The effect of varying financial leverage on the risk-return tradeoffs of companies means that simply averaging individual cost-of-equity estimates across a sample generally does not provide meaningful information about an appropriate representative cost of capital for the industry. Thus, if the capital structure used to estimate the benchmark sample's cost of equity differs from the capital structure used to regulate PGE, it is necessary to consider the leverage impact.

**Q. Does this approach apply to the risk premium analysis?**

A. Yes, to the extent that there are differences between the capital structures of the companies used to determine the benchmark ROE and PGE, I need to consider whether I am comparing

[14] I refer to the ATWACC to distinguish it from the WACC used in regulatory proceedings, which is the weighted-average of the after-tax cost of equity and the pre-tax cost of debt instead of the after-tax cost of debt.

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.

**Q. What is the basis for the development of the method?**

A. The weighted-average cost of capital – as it is called in textbooks—is a fundamental method used by financial economists to measure the cost of capital. It is a standard topic taught in graduate level courses in corporate finance and is based upon the work of Professors Franco Modigliani and Merton Miller. Each separately won the Nobel Prize in Economics, in part, for developing the theories underlying the method. It is critical to keep in mind that the weighted average cost of capital method is one useful tool to assist in the analysis of the cost of capital. All cost of capital witnesses estimate the cost of equity using the DCF, risk premium, CAPM, and other models, and all must interpret the results relative to the risk of the regulated company at issue. The purpose of the method is to allow an "apples to apples" comparison of the results of the sample companies by adjusting for differences in financial risk due to differences in capital structure. It is consistent with the use of rate base measured on the basis of book value, and does not require a regulator to "rubber stamp" the current market value of the regulated company's stock.

**Q. Are there other PGE-specific risk factors?**

A. Yes, the majority of the publicly traded electric utilities in the U.S., as well as the companies, I select for my sample, are larger than PGE. For example, the market

capitalization for 15 of my 25 sample companies is above $10 billion. The average is more than 3.5 times larger than PGE's market capitalization of only $3.8 billion.[15]

**Q. Why does the size of PGE matter?**

A. Empirically, investors have required a higher premium to invest in smaller companies than in larger ones. For example, SBBI data indicate that small-cap companies on average have a return on equity that is 0.70% higher than that of mid-cap companies.[16] Therefore, empirical evidence suggests that investors in smaller and mid-cap companies require a higher return than do investors in larger companies. The majority of electric utilities (including my sample companies) are materially larger than PGE. Only four companies have a market cap below that of PGE, while 17 companies have a market cap that is more than twice that of PGE.[17] Thus, empirical evidence suggests that investors in PGE require a premium over and above that required for larger companies. Because the sample consists of both smaller and larger companies, the premium is best determined using the average or median of the size deciles provided by SBBI. Looking specifically to the size deciles reported in SBBI 2016, the data indicates that PGE's size merits a size premium of 0.60% to 0.70%.[18]

**Q. What other risks create a higher overall risk for PGE?**

A. PGE has in recent years undertaken substantial capital investment in generation, for example, the 440 MW natural gas Carty generating facility at a cost of about $637-$640 million, and expects to make additional capital expenditures in 2017 of about $604

[15] See Table 2 in Section IV (B) below for details.
[16] Roger G. Ibbotson, "*2016 SBBI Yearbook*," Duff & Phelps 2016 (SBBI 2016), p. 7-16.
[17] See Table 2 in Section IV (B) below for details.
[18] SBBI 2016, pages 7-3 and 7-16.

million.[19] Because PGE is substantially smaller than the average proxy company, and it has the need to integrate a large amount of new generation in its generation mix, it has a relatively high operating risk as measured by the addition of fixed costs.

**Q. What conclusions do you draw from the discussion above?**

A. Because there is a link between capital structure[20] and the size premium,[21] I formally adjust for the leverage, but do not adjust for the size albeit PGE could reasonably be placed in the upper end of the range I estimate for the sample.

[19] Portland General Electric, Investor Presentation December 2016. Available at http://files.shareholder.com/downloads/POR/3297335118x0x919464/ABED609B-D34E-4296-ABA3-3214FFD5858B/12-2016_PGE_Investor_Presentation_Wells_Fargo.pdf

[20] For example, K.C. Chan and N.-F. Chen, "Structural and Return Characteristics of Small and Larger Firms," *The Journal of Finance* 46, 1992, pp. 1467-1484 or Brealey, Myers, and Allen, "*Principles of Corporate Finance*," 11th edition, 2014, pp. 436 – 437.

[21] Morningstar / Ibbotson, *SBBI 2014 Classic Yearbook*, p. 109.

# III. Impact of the Economy and Markets on the Cost of Equity

## A. Interest Rates

**Q. What are the relevant developments regarding interest rates?**

A. Interest rates and especially government bond yields have been low, but have started to increase. The Federal Reserve (Fed) raised the target for the federal funds rate on December 14, 2016 and signaled that further increases are likely.[22] I also note that forecasting services such as Blue Chip Economic Indicators increased the forecasted yield on 10-year government bonds by 40 basis points between their October / November and the December issues.[23] Further, the spread between utility bond yields and government bond yields of the same maturity remains higher than they have been historically, thus indicating that the government bond yield remains suppressed or that investors' required premium to invest in securities that are not risk-free are elevated.

Figure 2 below shows the development in BBB rated utility and Government bond yields from 2002 to today.[24] It is evident that the yield spread (the difference between the yield on BBB rated utility bonds and government bonds) is higher than its historical average and higher than at the time of PGE's most recent rate case filing (UE 294).

Figure 3 shows the spread between A rated utility bonds and government bond yields along with the average spread prior to the financial crisis. Again, it is evident that the spread is

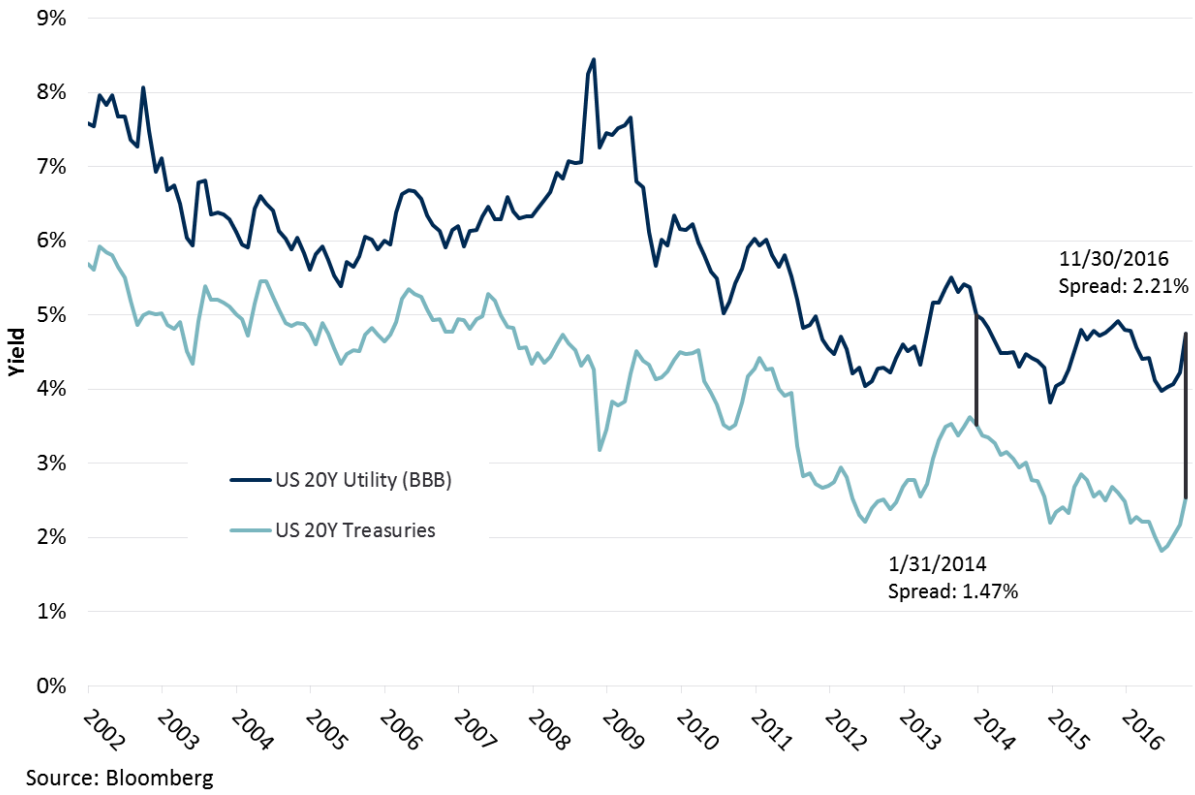
[22] The Federal Reserve increased the target for the federal funds rate from ¼ to a range of ½ to ¾ on December 14, 2016. Source: Federal Reserve Press Release December 14, 2016; https://www.federalreserve.gov/newsevents/press/monetary/20161214a.htm

[23] *Blue Chip Economic Indicators*, October 2016, November 2016, and December 2016.

[24] For clarity "BBB rated" refer to bonds in the range of BBB- through BBB+ and "A rated" reference bonds in the range of A- through A+. The majority of electric utilities are low A or high BBB rated.

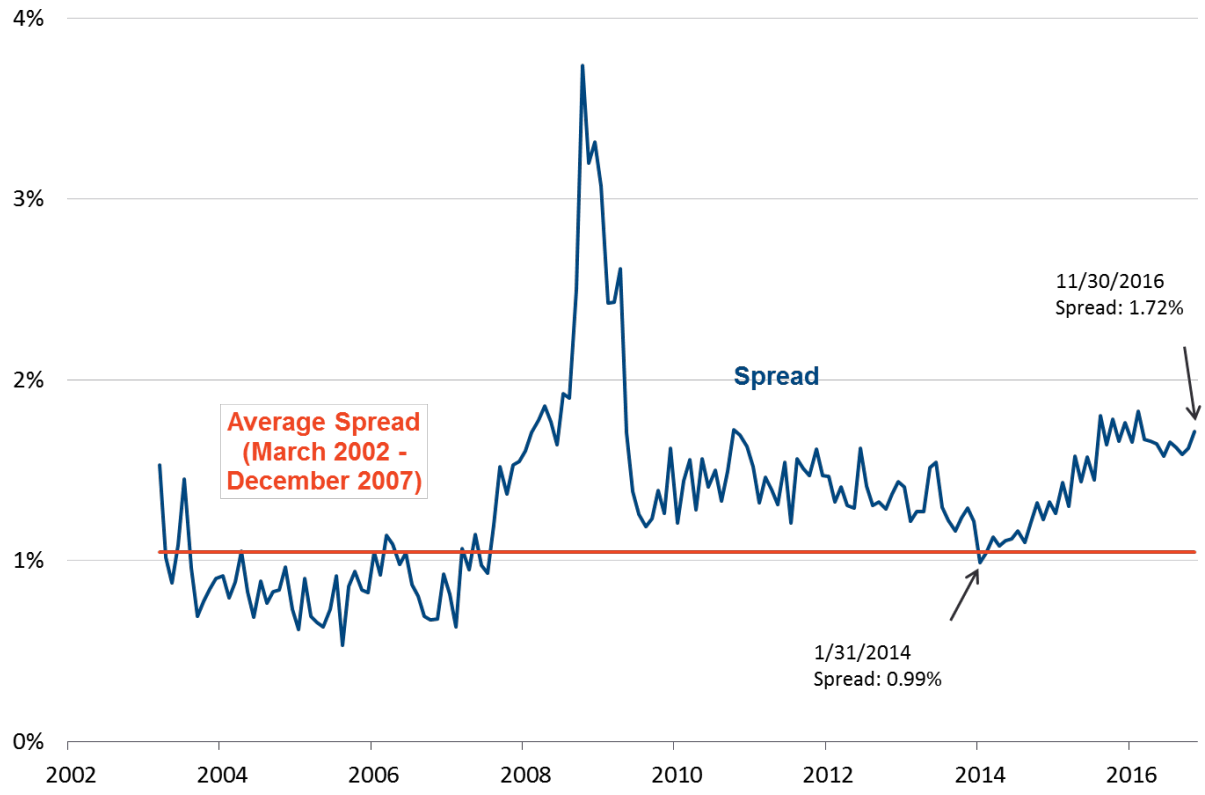
greater. Thus, a review of both BBB rated and A rated bonds clearly illustrates the increase in the spread between the utility bond yield and government bond yields.[25]

**Figure 2: BBB Utility Bond and Government Bond Yields: 2002 – November 2016**




[25] Bloomberg data summarized in Exhibit PGE 1106 shows that the average spread between A rated utility bond yields and government yields was 0.93% for the period 1991-2007 (before the financial crisis), whereas it increased dramatically during the financial crisis and has remained elevated. The same exhibit shows that the spread between BBB rated utility bond yields and government bond yields averaged 1.23% between 1991 and 2007 and was only slightly above 1% for the period 2002 to 2007.

**Figure 3: Spread between A Rated Utility and 20-Year Government Bond Yield**




Source: Bloomberg.

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

A. As shown in Figure 2 and Figure 3 above, the spread between BBB rated utility bond yields or between A rated utility bond yields and government bond yields is elevated. At the end of November 2016, the BBB spread stood at 2.21%, which is approximately 95 basis points higher than prior to the 2008-09 financial crisis. At the same time the A rated utility bond yield spread was 1.72% for an increase of about 55 basis points over the pre-crisis level. Not only is the yield spread increased relative to its pre-crisis levels, but it is also greater relative to the level in the more recent past as illustrated in the figures above.

**Q. What is the expected trend for interest rates?**

A. Blue Chip Economic Indicators expects that the yield on 10-year Treasury Notes will increase to 2.8% in 2018, or an increase of about 40 basis points over its yield at the end of November 2016. The publication forecasts additional increases for 2019 and beyond.[26] Comparably, the Congressional Budget Office predicts that the rate on 10-year treasury notes will increase to 4.1% by the second half of 2019.[27] These expectations are consistent with the current downward pressure on Government bond yields, which has in part been caused by the Federal Reserve's quantitative easing program and general stimuli of the U.S. economy.[28] As the downward pressure eases off, interest rates are expected to increase.

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

A. There are several ways in which the current interest rate environment affects the cost of equity analysis. First, it impacts the risk premium estimates through a lower government bond yield.

Second, if the spread between the yield on utility (or corporate) bonds and government bonds (the "yield spread") widens, it indicates that the premium that investors require for holding securities other than government bonds has increased. Thus, a higher than normal yield spread is one indication of the higher risk premiums currently prevailing in capital markets. Investors consider a risk-return tradeoff (like the one displayed in Figure 1 above) and select investments based upon the desired level of risk. Higher yield spreads reflect the fact that the return on corporate debt is higher relative to government bond yields than is normally the case, even for regulated utilities. Because equity is more risky than debt, this

[26] *Blue Chip Economic Indicators*, October 2016 and U.S. Department of The Treasury. Only the October and March issues of Blue Chip Economic Indicators provide long-term forecasts.

[27] Congressional Budget Office, "The Budget and Economic Outlook: 2016-2026," January 2016, p. 7.

[28] For a summary of the magnitude of the Federal Reserve's purchase program, see, for example, Bloomberg, "The Fed Eases Off," September 16, 2015.

means that the spread between the cost of equity and government bond yields must also be higher; i.e., the premium required to hold equity rather than government bonds has increased. If this fact is not recognized, then the traditional cost of capital estimation models will underestimate the cost of capital prevailing in the capital markets.

Third, in times of economic uncertainty (such as the present) investors seek to reduce their exposure to market risk. This precipitates a so-called "flight to safety,"[29] 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 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. Because utilities are considered necessary and subject to regulation, utility stocks may have experienced an inflow of capital that usually would have been invested elsewhere. Moving from more risky to less risky investments is often referred to as a "flight to safety" and utility stock may have experienced this phenomenon to a larger degree than other stock because they traditionally have paid a substantial portion of their earnings as dividends, so that investors' return is less dependent upon the development in markets in general.

One possible explanation of the current elevated level of the yield spread is that current and near-term expected levels of government bond yields are artificially depressed due to monetary policy.[30] I emphasize that the U.S. government bond yields (as well as that of many other western countries) is expected to increase substantially over the next several

[29] Sometimes referenced as "flight to quality."

[30] As of Q2, 2016, the Federal Reserve held approximately $1.8 trillion of mortgage-backed securities, whereas the magnitude was less than $0.5 trillion in mid-2009. Source: Bloomberg, "The Fed Eases Off," September 16, 2015 and Federal Reserve Bank, "Combined Quarterly Financial Report," June 30, 2016. Available at https://www.federalreserve.gov/monetarypolicy/files/quarterly-report-20160630.pdf

years.[31] An alternative explanation is that the return investors require to invest in securities that are not risk-free has increased, so that the risk premium investors require to hold equity is elevated.

The recent increase in government bond yields, the increase in the Federal Funds rate as well as the projected increase in government bond yields are indicators that the current yield on government bonds is below investor expectations for the next few years.[32]

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

A. The increase in the yield spread indicates that (i) the current long-term government bond yields are depressed relative to their normal levels and / or (ii) investors are demanding a premium higher than the historical premium to hold securities that are not risk free. Regardless of the interpretation, the consequence is that if cost of equity is estimated using the current risk-free rate and/or without regard to the elevation of the premium required to hold equity relative to government issued debt, then the cost of equity will be downward biased.

## B. Market Volatility

**Q. Why is the stock market's volatility important?**

A. Academic research has found that investors expect a higher risk premium during more volatile periods. The higher the risk premium, the higher the required return on equity. For

[31] If investors' believe the yield on government bonds will soon elevate, they may demand higher yields on corporate debt relative to the prevailing government bond yields, thus widening the yield spread.

[32] The expectation of increasing bond yields has been slower to materialize than most forecasting services have predicted over the last few years. Researchers from the Federal Reserve Bank of St. Louis found that forecasts of U.S. T-bill rates tended to under-predict the increase when yields were increasing and over-predict when yields were declining, so that the results were closer-to-normal prediction than what materialized. They found no evidence that expectations were systematically too high or too low. See R.W. Hafer and S.E. Hein. "Comparing Futures and Survey Forecasts of Near-Term Treasury Bill Rates." *Federal Reserve Bank of St. Louis Review.* May/June, (1989), 33-42.

example, French, Schwert & Stambaugh (1987) found a positive relationship between the expected market risk premium (MRP) and volatility:

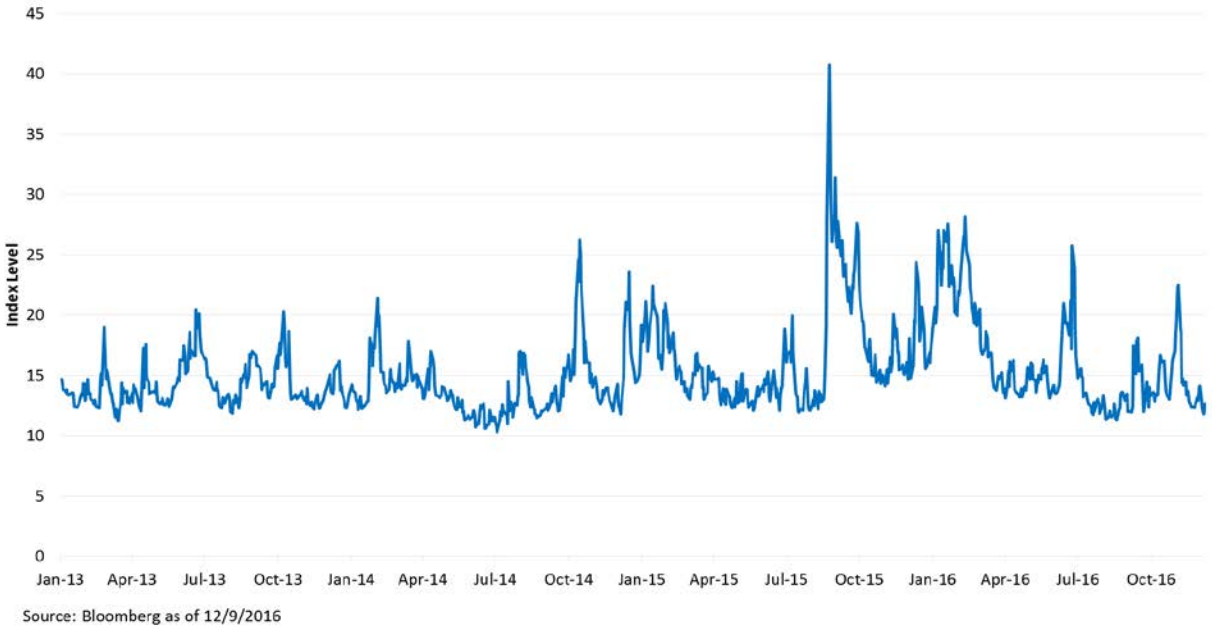
> We find evidence that the expected market risk premium (the expected return on a stock portfolio minus the Treasury bill yield) is positively related to the predictable volatility of stock returns. There is also evidence that unexpected stock returns are negatively related to the unexpected change in the volatility of stock returns. This negative relation provides indirect evidence of a positive relation between expected risk premiums and volatility.[33]

A measure of the market's expectations for volatility is the VIX index, which measures the 30-day implied volatility of the S&P 500 index. These indices are also referenced as the "investor fear gauge." While the long-term average for the VIX is a bit below 20, the VIX has been below its long-term average for a period, but increased substantially in mid to late June to reach about 26 on June 24, 2016.[34] As shown in Figure 4 below the VIX has since been at or below its historical level. Thus, the yield spread and the market volatility index are providing different signals about the current state of the economy.

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

[34] Bloomberg. It has since declined.

**Figure 4: Volatility Index**




**Q. Please explain "risk aversion."**

A. 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.

**Q. Do you have any evidence that the return premium demanded by investors for taking risk is higher than it was prior to the 2008-09 financial crisis?**

A. Yes. Looking to forecasted MRP, both academic research and financial data services such as Bloomberg have found an increase in the expected MRP compared to prior to the financial crisis. For example, Bloomberg's expected MRP currently stands at about 7.5% over 10-year bonds, while the historical arithmetic average MRP from 1926 to 2015 is 6.9%

over approximately 20-year bonds.[35] Thus, the Bloomberg forecast indicates that the MRP is slightly elevated, while the yield spread shown in Figure 3 indicates a substantial increase in the current MRP.

**Q. Are there other indications that the MRP has increased since the 2008-09 financial crisis?**

A. Yes. A recently updated analysis 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 recent years.

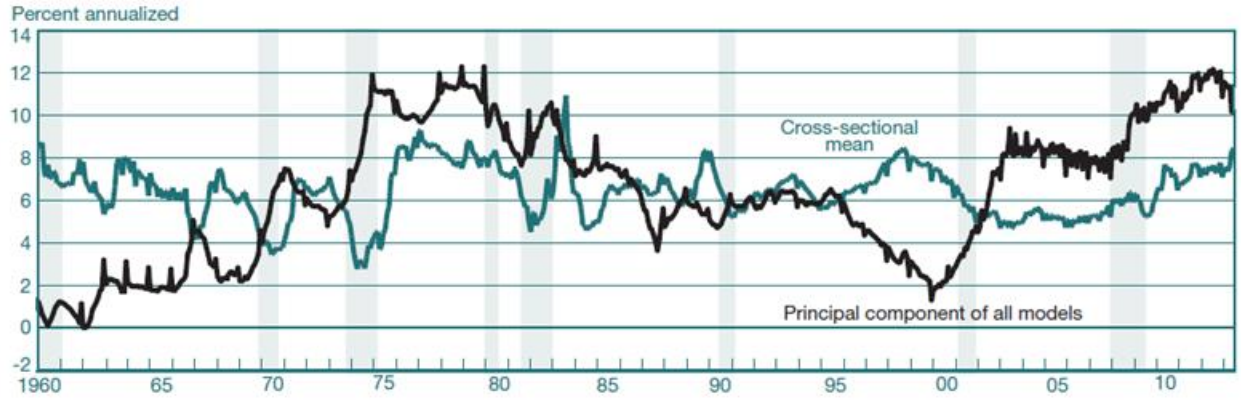
The analysis estimates the MRP that results from a range of models each year from 1960 through the present.[36] The analysis then reports the average as well as the first principal component of results.[37] The analysis then finds that the models used to determine the risk premium are converging to provide more comparable estimates and that the average annual estimate of the MRP was at an all-time high in 2013. These estimates are reasonably consistent with those obtained from Bloomberg and the consistent elevation of the MRP over the historical figure indicates that the elevated level is persistent. Figure 5 below shows Duarte and Rosa's summary results.

[35] Bloomberg and Duff & Phelps, "*2016 Valuation Handbook: Guide to Cost of Capital*," p. 3-24, respectively. For the purpose of determining the MRP, textbooks such as Stephen A. Ross, Randolph W. Westerfield, and Jeffrey Jaffe, "*Corporate Finance*," 10th Edition, 2013, p. 326. Recommend that the MRP estimate be based on as long a period as there are reliable data for.

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

[37] 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.

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




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

A. Yes, 2016 has seen a number of events that have or may affect financial markets. Notably, the U.K. decision to leave the European Union (Brexit) impacted markets, the impact of the change of leadership in the U.S. is unclear at this point, and the continued weakness in Europe may well impact financial markets going forward.

## C. Price to Earnings Ratio

**Q. Are there other features of financial markets that are currently unusual?**

A. Yes. The current level of many companies, including utilities, Price-to-Earnings (P/E) ratio is higher than what has been experienced historically. Empirically, the P/E ratio increases when interest rates decline. This is shown in Figure 6 below.

**Figure 6: Relationship Between Average Price / Earnings Ratio and 20-Year Treasury Bond Yield[38]**


Source: Bloomberg (using quarterly data from 1990 through Q3, 2016)

**Q. Please explain the relationship between the P/E ratio and the 20-year government bond yield of interest in your analysis.**

A. The dividend yield, which is calculated as Dividends divided by Price (D/P), is closely related to the P/E ratio as dividends are paid out of earnings. If the P/E ratio is very high (low), then the Earnings-to-Price ratio is low (high) and so is the dividend yield (D/P). The average electric utility pays approximately 60% of its earnings as dividends, so if the P/E ratio increases from, for example, 16 to 17 (6¼%), then the Earnings / Price ratios declines by about 0.37% (from 1/16% to 1/17%) and the dividend yield declines by 0.22% (60% × 0.37%). My statistical analysis found that the mean / median P/E ratio increases by 1.0 and 1.4, when the 20-year government bond yield decline by 1%. Using this range and a dividend payout ratio of 60%, I find that if the P/E ratio increases by, for example, 1.4 for each 1% decline in the government bond yield, then the E/P ratio declines by 0.71 (=1/1.4) for each 1% decline in the yield and if the dividend payout ratio is 60%, the dividend yield

[38] See Exhibit PGE 1107 provides the regression analysis as well as the approximate dividend payout.

would decline by about 43 basis points (=60% × 0.71). Therefore, if the 20-year government bond yield is artificially depressed and expected to increase, then the dividend yield is also artificially depressed and expected to increase. As a result, the results from the standard dividend discount models are likely to underestimate the cost of equity that will prevail going forward. While my estimates do not incorporate a quantification of the impact, the direction is clear – going forward, an increase in interest rates will likely lead to a higher dividend yield and, everything else equal, a higher estimated return on equity. This is especially true for the multi-stage DCF, where the growth rate originates from a mixture of company-specific growth and long-term GDP growth. The company-specific growth forecasts may have accounted for an expected decline in the P/E ratio, but there is no reason to believe the GDP growth rate takes this into account.

**Q. What do you conclude from this information?**

A. The increase in the spread between the yield on utility and government bonds indicates that the premium investors require to hold assets that are not risk-free has increased. Similarly, the forecasted MRP indicates an increase in investors risk premium. These factors point to investors' requiring a higher premium than historically to hold assets that are not risk-free. Similarly, the very low risk-free rate are likely to have led to higher P/E ratios due to the flight to quality discussed above and consequently a lower than "normal" dividend yields.

## D. Impact on ROE estimation

**Q. Please summarize how the economic developments discussed above have affected the return on equity and debt that investors require?**

A. Utilities rely on investors in capital markets to provide funding to support their capital expenditure program and efficient business operations, and investors consider the risk 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; including the plausible development in the risk-free rate and the current MRP.

These investors have been dramatically affected by the credit crisis and ongoing market volatility, so there are reasons to believe that their risk aversion remains elevated relative to pre-crisis periods.

Likewise, the effects of the Federal Reserve's monetary policy have artificially lowered the risk-free rate. As a result, yield spreads on utility debt, including top-rated instruments, have remained elevated. The evidence presented above demonstrates that the equity risk premium is higher today than it was prior to the crisis for all risky investments. This is true even for investments of lower-than-average risk, such as the equity of regulated utilities. As explained below my ROE estimates reflect this market evidence.

**Q. Does your analysis consider the current economic conditions?**

A. Yes. In implementing the risk premium model, I consider the impact of the downward bias in the current risk free rate as one scenario and also consider a scenario, which does not incorporate such bias. Similarly, I consider that the multi-stage DCF is likely downward biased and therefore recommend that weight be assigned to both the single-stage and multi-stage DCF.

# IV. Estimating the Cost of Capital

## A. Approach

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

A. First, I select a sample of electric utilities, whose characteristics resemble those of PGE. 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 assess PGE's specific risks to determine a reasonable range given the company's specific characteristics. Finally, I check my recommendation against other measures such as the allowed return on equity for U.S. electric utilities.

**Q. Please summarize each of the steps listed above.**

A. To select a comparable sample of electric utilities, I look to the universe of publicly traded electric utilities as classified by the Value Line Investment Survey.[39] This resulted in an initial group of 45 companies. From this group, I kept those that meet the following criteria: (1) have five years of data available for examination, (2) have an investment grade rating, (3) have substantial regulated assets, and (4) have sufficient size such that market data are meaningful. I exclude companies with unique circumstances that may bias the cost of capital estimation such as substantial merger or acquisitions, recent dividend cuts or other unique factors.[40]

[39] Value Line lists 48 companies as electric utilities, but 3 (AvanGrid, Wilmington Capital, ITC Holdings) do not operate electric distribution or generation. Thus, I examine only the 45 remaining companies.

[40] For example, I exclude both NextEra and Hawaiian Electric due to attempts by NextEra to acquire Hawaiian Electric.

To estimate the cost of equity for the sample, I rely on two versions of the Discounted Cash Flow (DCF) model and the risk premium model. I further confirm these figures by comparing the estimates to the recently allowed ROE for electric utilities and to estimates obtained from two versions of the Capital Asset Pricing Model (CAPM). Specifically, I calculate the DCF cost of equity using the standard (single-stage) Gordon growth model and a three-stage DCF model. Further, I implement the risk premium model using authorized 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). I can then use these figures to convert the sample's cost of equity estimate to an estimate for PGE using its 50-50 capital structure. I then look to PGE's level of risk relative to the sample and consider PGE's smaller size and need to integrate substantial new generation in its portfolio. PGE has in recent years substantially increased its wind generation, put the 440 MW Carty plant into service in 2016, and expects additional capital expenditure spending in 2017.[41]

Finally, I consider the reasonableness of the estimated cost of equity for PGE in light of recently allowed ROE for electric utilities and in the light of the changing electric industry. For example, the electric industry is facing significant risk of competition from self-generation and a substantial change in the generation fleet, which may mean that historical

[41] Portland General 2015 form 10-K, p. 15 shows a substantial increase in Portland General's wind generation and Portland General Electric, Investor Presentation December 2016.

measures of the cost of equity as reflected in a risk premium analysis may not be representative of the industry's cost of equity going forward.

## B. Sample Selection

**Q. Please describe how you selected your sample.**

A. To select a comparable sample of electric utilities, I began with the universe of publicly traded electric utilities as classified by Value Line.[42] This resulted in an initial group of 45 companies. From this group, I kept those that are Regulated (at least 80% of assets are regulated) or Mostly Regulated (50-79% of assets are regulated) as determined by EEI.[43] In addition, I require that the selected companies have five years of data available, an investment grade rating, and sufficient size that market data are meaningful. I exclude companies with unique circumstances that may bias the cost of capital estimation such as substantial merger or acquisitions, dividend cuts or other unique factors. Value Line companies that merged as well as entities with an acquisition or merger larger than 30% of their market capitalizations were excluded, as were entities that had announced dividend cuts or companies with non-investment grade bond ratings.

**Q. Please summarize the characteristics of your sample.**

A. The electric utilities sample is comprised of regulated companies whose primary source of revenues and majority of assets are in the regulated portion of the electric industry. The final sample consists of the 25 electric utilities listed in Table 2 below.

The 2015 annual revenue as well as the market cap were obtained from Bloomberg, as were the recent credit rating and growth estimates. Betas were obtained from Value Line.

[42] The 45 companies are from Value Line Investment Analyzer.
[43] *Edison Electric Institute* – Q2 2016 Rate Case Summary.

## Table 2: Electric Sample and Its Characteristics[44]

**U.S. Electric Sample**

| Company | DCF Subsample | Annual Revenues (USD million) | Regulated Assets | Market Cap. 2016 Q3 (USD million) | Betas | S&P Credit Rating (2016) | Long Term Growth Est. |
|---|---|---|---|---|---|---|---|
| | [2] | [3] | [4] | [5] | [6] | [7] | [8] |
| ALLETE | | $1,379 | M | $2,997 | 0.75 | BBB+ | 4.7% |
| Alliant Energy | * | $3,263 | R | $8,841 | 0.70 | A- | 6.3% |
| Amer. Elec. Power | * | $16,205 | R | $32,042 | 0.65 | BBB+ | 2.2% |
| Ameren Corp. | * | $6,028 | R | $12,115 | 0.65 | BBB+ | 5.7% |
| CenterPoint Energy | | $7,238 | M | $10,097 | 0.85 | A- | 6.6% |
| CMS Energy Corp. | * | $6,268 | R | $11,917 | 0.65 | BBB+ | 7.0% |
| Consol. Edison | * | $12,074 | R | $23,296 | 0.55 | A- | 2.4% |
| Dominion Resources | | $11,207 | M | $47,252 | 0.65 | BBB+ | 6.8% |
| DTE Energy | * | $10,243 | R | $16,898 | 0.65 | BBB+ | 5.9% |
| Edison Int'l | | $11,325 | R | $23,951 | 0.65 | BBB+ | 3.4% |
| El Paso Electric | * | $876 | R | $1,886 | 0.70 | BBB | 6.1% |
| Entergy Corp. | * | $10,706 | R | $14,147 | 0.65 | BBB+ | -6.5% |
| IDACORP Inc. | * | $1,254 | R | $3,961 | 0.75 | BBB | 3.9% |
| MGE Energy | | $537 | M | $1,975 | 0.70 | AA- | 6.5% |
| OGE Energy | * | $2,176 | R | $6,386 | 0.90 | A- | 5.2% |
| Otter Tail Corp. | * | $796 | R | $1,380 | 0.85 | BBB | 6.5% |
| PG&E Corp. | * | $17,120 | R | $31,566 | 0.65 | BBB+ | 6.7% |
| Pinnacle West Capital | * | $3,494 | R | $8,563 | 0.70 | A- | 4.7% |
| Portland General | * | $1,898 | R | $3,833 | 0.70 | BBB | 6.6% |
| PPL Corp. | * | $7,465 | R | $23,739 | 0.70 | A- | 1.5% |
| Public Serv. Enterprise | | $9,249 | M | $21,487 | 0.70 | BBB+ | 2.2% |
| SCANA Corp. | | $4,126 | M | $13,299 | 0.70 | BBB+ | 5.7% |
| Sempra Energy | | $10,014 | M | $26,864 | 0.80 | BBB+ | 9.5% |
| Vectren Corp. | * | $2,354 | R | $4,156 | 0.75 | A- | 5.5% |
| Xcel Energy Inc. | * | $10,958 | R | $21,240 | 0.60 | A- | 5.7% |
| **Full Sample Average** | | **$6,730** | | **$14,956** | **0.70** | | **4.8%** |
| **Subsample Average** | | **$6,657** | | **$13,292** | **0.69** | | **4.4%** |

Notes: R – Regulated (at least 80% of assets are regulated), M (50-79% of assets are regulated). S&P Credit Ratings are from Research Insight as of 2016 Q3. Research Insight does not report S&P credit ratings for MGE Energy. I use the S&P ratings of MGEE's subsidiary, Madison Gas and Electric Company.

**Q. How does the sample compare to PGE?**

A. The sample was selected to consist of companies with more than 50% of their assets dedicated to regulated activities. As can be seen from Table 2, the majority of the sample

[44] Sources: *Value Line Investment Survey* as of December 7, 2016, Bloomberg as of December 8, 2016, and *Edison Electric Institute* as of June 30, 2016. I note that relative to my prior testimony before the Commission, I have dropped Great Plains Energy and Westar Energy from my sample due to their merger announcement and have added PPL Corp., whose acquisition of Louisville Gas & Electric in 2010 by now should not influence data used in the estimation process.

companies are Regulated (meaning at least 80% of assets are rate regulated) as is PGE. The average credit rating is higher than that of PGE at an average of BBB+, while PGE maintains a BBB rating from S&P (A- from Moody's). The majority of the companies are materially larger than PGE and only four companies have a market cap below that of PGE, Measured by beta, a measure of systematic risk, PGE is similar to the average of the sample, but its growth rate is more than a percentage point higher.

## C. Capital Structure

**Q. What regulatory capital structure is PGE requesting in this proceeding?**

A. PGE has requested a regulatory capital structure consisting of 50% equity and 50% debt,[45] which was also the capital structure used in the UE 294 proceeding.[46] This capital structure is broadly consistent with the book value capital structures of the sample companies. The sample averages about 47% equity on a book basis. The highest percentage of book equity for the companies in the sample is 65% equity (MGE Energy Inc.) and the lowest is 29% equity (CenterPoint Energy).[47] However, the market based estimates of the cost of equity for the DCF are based on the market value capital structure, which include 59.5% equity as of Q3, 2016.[48] My recommended range for ROE is a function of the requested capital structure, the sample average cost of capital estimates and the relative risk of PGE compared to the sample.

[45] The calculation of the capital structure is available in PGE Exhibit 1000.
[46] Order 14-442, issued December 4, 2014, p. 3.
[47] See PGE Exhibit 1101.
[48] The CAPM would use a five-year average to be consistent with the beta estimate. The five-year average is lower at approximately 56% equity.

# V. Cost of Capital Estimates

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

A. As noted earlier, I employ three general methodologies: 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 by PGE. For the DCF estimates, I present two models: the standard Gordon growth model (or the single-stage DCF) and a three-stage DCF model. I implement the three-stage DCF model using two different long-term growth rates: the consensus Blue Chip forecast and an average of the estimate from OMB and Blue Chip. Further, I estimate the ROE from a version of the risk premium method: a regression analysis of allowed return on bond rates. Finally, I estimate two versions of the CAPM as a check on my results: the traditional CAPM and two versions of the Empirical CAPM.[49] 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.

## A. The DCF Based Estimates

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

[49] The CAPM is a commonly used cost of capital estimation model in corporate finance and I usually include it among my methods. However, the Commission has historically not relied upon the CAPM, so I present it only as a check on other results in this proceeding.

A. The DCF model takes the first approach to cost of capital estimation described above, i.e., to attempt to estimate the cost of capital in one step instead of estimating the cost of capital for the entire market and then determining the cost of capital for an individual investment. The DCF method 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 stream:

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

where "P" is the market price of the stock; "$D_i$" is the dividend cash flow expected at the end of period i; "r" is the cost of capital; and "T" is the last period in which a dividend cash flow is to be received. The formula just says that the stock price is equal to the sum of the expected future dividends, each discounted for the time and risk between now and the time the dividend is expected to be received.

The standard DCF application goes on to make the assumption that the growth rate remains constant forever, which simplifies the standard formula, so that it can be rearranged to estimate the cost of capital. Specifically, if investors expect a dividend stream that will grow forever at a steady rate, then the market price of the stock will be given by the formula,

$$P = \frac{D_1}{(r-g)} \qquad (3)$$

where "$D_1$" is the dividend expected at the end of the first period, "$g$" is the perpetual growth rate, and "$P$" and "$r$" are the market price and the cost of capital, as before. Equation (3) is a simplified version of equation (2) that can be solved to yield the well-known "DCF formula" for the cost of capital:

$$r = \frac{D_1}{P} + g = \frac{D_0 \times (1+g)}{P} + g \quad (4)$$

where "$D_0$" is the current dividend, which investors expect to increase at rate $g$ by the end of the next period, and the other symbols are defined as before. Equation (4) says that if equation (3) 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 Gordon DCF model.

**Q. Are there models other than the Gordon DCF model?**

A. 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).[50] One such alternative expands the Gordon DCF model to three stages.[51] 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.

**Q. What is your assessment of the DCF model?**

A. The DCF approach is grounded in solid financial theory. It is widely accepted by regulatory commissions and provides useful insight regarding the cost of capital based on forward-looking metrics. DCF estimates of the cost of capital complement those of the Risk Premium or CAPM because the methods rely on different inputs and assumptions. The DCF method is particularly valuable in the current economic environment, because of the effects

[50] 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.

[51] 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 only El Paso Electric has non-trivial share buybacks and including the amount would not affect the results. Therefore, I ignore this aspect for this proceeding.

on capital market conditions of the Fed's efforts to maintain interest rates at historically low levels which bias the Risk Premium (and CAPM-based) estimates downward.

However, I recognize that the DCF model, like most models, relies upon assumptions that do not always correspond to reality. This is why the reliance on multiple methods is important.

**Q. What growth rate information do you use?**

A. 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 electric sample. For the long-term growth rate for the final, constant-growth stage of the multistage DCF estimates, I use two estimates: (i) the most recent long-run GDP growth forecast from Blue Chip Economic Indicators and (ii) the average of the OMB and Blue Chip long-term estimate.[52]

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

A. 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.

**Q. Does the multistage DCF improve upon the simple DCF?**

[52] *Blue Chip Economic Indicators*, October 10, 2016 and the Fiscal Year 2017 Budget Forecast, March 2016. The latter has in the past been one of the estimates relied upon by Commission Staff.

A. 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 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.

**Q. What are your DCF estimates?**

A. Looking at the full sample, the ROE estimate is 10.3% for the Gordon (single-stage) DCF model and 9.1% for the multistage model using the average of the Blue Chip and OMB growth forecast. Table 3 below summarizes the results from the DCF models.

**Table 3: DCF Estimates on the Cost of Equity**

| | |
|---|---|
| Single-stage | 10.3% |
| Multi-stage using Blue Chip GDP growth: | 9.0% |
| Multi-stage using average of Blue Chip and OMB GDP growth: | 9.1% |

**Q. Do you have any comments on the DCF estimates?**

A. Yes. The multi-stage DCF estimates may well be downward biased as they rely on a combination of the long-term GDP growth and a contemporaneous price-earnings ratio. As indicated in Figure 6 above, the P/E ratio tends to decline as interest rates increase.

Therefore, given the expected increase in interest rates, the P/E ratio may be overstated and thus the dividend yield is understated. As shown above, the impact on the dividend yield of a 1% increase in the risk-free rate is approximately 43 basis points. As interest rates are expected to increase by more than 50 basis points, the dividend yield would increase by a bit more than 20 basis points.[53] Thus, the DCF estimates are likely too low and expected to increase going forward. This is especially true for the multi-stage DCF, where company-specific growth rates are not reflecting the current dividend yield, but the market as a whole.

**Q. What conclusions do you draw from the DCF analysis?**

A. The estimate from the multi-stage model using a combined Blue Chip or a combined Blue Chip and OMB growth rate is too low to be consistent with the cost of equity for 2018 and I recommend using a DCF measure that puts substantial weight on the Gordon growth model estimate or relying on the midpoint of all estimates. Regardless, I find that a reasonable DCF estimate for the sample is 9.7 to 9.9%, where the 9.7% is calculated as the midpoint of the single-stage and multi-stage DCF and the 9.9% is the midpoint plus 20 basis points, where the 20 basis points are calculated above. Noting that PGE is expecting larger growth than the average sample company, high capex, and is smaller than the average sample company, the DCF estimates are on the low end of what is reasonable for PGE.

## B. Risk Premium Methods

**Q. Do you estimate the Cost of Equity that result from risk premium analysis?**

[53] The Blue Chip forecasts the 10-year government bond yield at 2.8% for 2018. Adding the historical maturity premium of about 0.54% to that figure, the forecasted 20-year government bond yield is 3.34%. As the 15-day average 20-year bond yield as of December 6, 2016 was 2.71%, the increase is 0.63%. I rounded these figures downward in the calculation above.

A. Yes, I estimate the risk premium using a statistical regression approach. Specifically, I calculate the statistical relationship between the allowed ROE for electric utilities and the 20-year government bond rate using quarterly data. This results in an estimated ROE of 9.9 to 10.4% for 2018.

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

A. Using quarterly data from Regulatory Research Associates from Q1 1990 to Q3 2016,[54] 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 PGE Exhibit 1102). Using this approach, I estimate a risk premium of 6.54%, which is then added to the forecasted 20-year yield in 2018 as PGE's rates are expected to go into effect then. *I.e.,*

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

The forecasted 20-year yield is 3.34% if currently elevated yield spread is not taken into account and 3.89% if the elevated yield spread is assumed to remain.[55] Using these two forecasts for the risk-free rate, I obtain cost of equity estimates of 9.9 and 10.4%, respectively. Because it is plausible that the yield spread will moderate as the government bond yield increases, I consider the midpoint of 10.15% to be a reasonable point estimate. This estimate is also consistent with recently allowed ROEs once the likely increase in interest rates is considered. Electric utility authorized ROEs for the first three quarters

[54] SNL Financial as of December 12, 2016.
[55] *Blue Chip Economic Indicators Forecast,* October 2016.

averaged 9.91%[56] and if interest rates are expected to increase by about 40 basis points to 2018, plausibly allowed ROEs will also increase.[57]

**Table 4: Risk Premium Estimate on the Cost of Equity**

**Risk Premiums Determined by Relationship Between Authorized ROEs[1] and Long-term Treasury Bond Rates During the Period 1990-2016**

| Equity Cost Estimate for Vertically Integrated Electric | | Predicted Risk Premium | | Expected Treasury Bond Rate[2] | |
|---|---|---|---|---|---|
| **10.4%** | = | 6.54% | + | 3.89% | [3] |
| **9.9%** | = | 6.54% | + | 3.34% | [4] |

Sources and Notes:
[1]: Authorized ROE Data sourced from SNL Financial.
[2]: Blue Chip consensus forecast 2018 10-yr T-bill Yield plus maturity premium
[3]: Estimate with expected treasury bond rate normalized with 0.55% utility yield spread adjustment
[4]: Estimate without treasury bond rate normalization.
See regression results for derivation of regression coefficients $A_0$ and $A_1$.

**Q. Is this estimate consistent with PGE's regulatory capital structure of 50% equity and 50% debt?**

A. 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 generally contain 48% to 52% equity with an average of near 50% equity in the last few years.[58] Therefore, the estimated ROE is consistent with PGE's capital structure.

**Q. What conclusions do you draw from the analysis?**

[56] Regulatory Research Associates, "Major Rate Case Decisions – January – September 2016," October 14, 2016.
[57] During Q3, 2016, the average allowed ROE was 9.76% according to Regulatory Research Associates, "Major Rate Case Decisions – January – September 2016," October 14, 2016.
[58] SNL Financial as of December 12, 2016.

A. The risk premium analysis results in an ROE estimate that is consistent with the single-stage DCF results as well as with the upper end of my CAPM results. I therefore find that PGE's requested ROE of 9.75% is not just reasonable, but conservative.

**Q. Is there other relevant evidence regarding the current cost of equity for electric utilities?**

A. Yes, looking at the recently authorized ROE for regulated electric utilities, I find a range of 9.37 to 10.55% for 2016 if I ignore the generation incentives provided in Virginia. The average for all electric utilities was 9.91%, which is higher than PGE's request.[59] Finally, I estimate the cost of equity using the Capital Asset Pricing Model, which determines the cost of equity as follows:

$$r_S = r_f + \beta_S \times MRP$$

**where $r_s$ is the cost of capital for investment $S$; $r_f$ is the risk-free rate; $\beta_S$ is the beta risk measure for the investment $S$; and $MRP$ is the market risk premium. The CAPM relies on the empirical fact that investors price risky securities to offer a higher expected rate of return than safe securities. I estimate this model using Value Line betas, the risk-free rate that Blue Chip forecasts for 2018 (as in the risk-premium analyses above), and the historical MRP for the period 1926-2015 as reported by the 2016 Duff & Phelps Valuation Handbook.[60] I also implement two variations of the model that relies on the**

[59] Regulatory Research Associates, "Major Rate Case Decisions – January – September 2016," October 14, 2016.

[60] *Blue Chip Economic Indicators*, October 2016; Duff & Phelps, 2016 Valuation Handbook, Guide to Cost of Capital, page 3-24.

**empirical observation that the intercept in Figure 1 is higher than in the theoretical CAPM, but the slope is lower. The CAPM and the empirical CAPM results in cost of equity estimates in the range of 9.3% to 10.2% for the full sample and 9.2% to 10.1% for the subsample, which confirms that PGE's requested ROE of 9.75% is reasonable. The details of this model are in PGE Exhibits 1103 and 1104.**

## VI. Conclusions

**Q. Please summarize the evidence from the sample regarding the ROE for an electric utility of average risk?**

A. Tables 3 and 4 summarize the results of the analyses for the DCF and risk premium models for the sample of electric utilities. The results from the CAPM and risk premium models are within the range obtained from the DCF models. As a result, the overall range of cost of equity estimates is 9.3% to 10.3% using the full sample and ignoring the lowest and highest estimate, so that the midpoint is 9.8%. This range is consistent with the DCF results as well as with recently authorized ROEs for U.S. electric utilities

Overall, I believe PGE's request for an ROE of 9.75% is reasonable albeit conservative.

# VII. Qualifications

**Q. Dr. Villadsen, please state your educational background and experience.**

A. I hold a Ph.D. from Yale University's School of Management with a concentration in accounting. I have a joint degree in mathematics and economics (BS and MS) from University of Aarhus in Denmark. Prior to joining The Brattle Group, I was a Professor of Accounting at the University of Iowa, University of Michigan, and at Washington University in St. Louis where I taught financial and cost accounting. I have also taught graduate classes in econometrics and quantitative methods. I have worked as a consultant for Risoe National Laboratories in Denmark.

My work concentrates in the areas of regulatory finance and accounting. My recent work has focused on accounting issues, damages, cost of capital and regulatory finance. In the regulatory finance area, I have testified on cost of capital and accounting, analyzed credit issues in the utility industry, risk management practices as well the impact of regulatory initiatives such as energy efficiency and decoupling on cost of capital and earnings. I have been involved in accounting disclosure issues and principles including impairment testing, fair value accounting, leases, accounting for hybrid securities, accounting for equity investments, cash flow estimation as well as overhead allocation. I have estimated damages in the U.S. as well as internationally for companies in the construction, telecommunications, energy, cement, and rail road industry. I have filed testimony and testified in federal and state court, in international and U.S. arbitrations and before state and federal regulatory commissions. My testimonies and expert reports pertain to accounting issues, damages, discount rates and cost of capital for regulated entities.

**Q. Does this conclude your testimony?**

A. Yes.

# List of Exhibits

| PGE Exhibit | Description |
|---|---|
| 1101 | DCF Estimates |
| 1102 | Risk Premium Analysis |
| 1103 | The CAPM Description |
| 1104 | The CAPM Estimates |
| 1105 | Authorized ROE for Integrated Electric Utilities in 2016 |
| 1106 | Yield Spreads |
| 1107 | P/E and Payout Ratios |
| 1108 | Resume for Bente Villadsen |