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August 24, 2022

Adam J. Teitzman, Commission Clerk
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, Florida 32399-0850

Re: Docket No. 20220067-GU

Dear Mr. Teitzman,

Please find enclosed for filing in the above referenced docket the Direct Testimony and Exhibits of David J. Garrett. This filing is being made via the Florida Public Service Commission's Web Based Electronic Filing portal.

If you have any questions or concerns; please do not hesitate to contact me. Thank you for your assistance in this matter.

Sincerely,

Richard Gentry
Public Counsel

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cc: All Parties of Record

CERTIFICATE OF SERVICE
DOCKET NO. 20220067-GU

I **HEREBY CERTIFY** that a true and correct copy of the foregoing has been furnished by electronic mail on this 24th day of August, 2022, to the following:

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BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Petition for rate increase by Florida
Public Utilities Company, Florida Division
of Chesapeake Utilities Corporation, Florida
Public Utilities Company – Fort Meade, and
Florida Public Utilities Company
Indiantown Division

DOCKET NO. 20220067-GU

DIRECT TESTIMONY

OF

DAVID J. GARRETT

ON BEHALF OF THE FLORIDA OFFICE OF PUBLIC COUNSEL

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I. INTRODUCTION

1 **Q. STATE YOUR NAME AND OCCUPATION.**

2 A. My name is David J. Garrett. I am a consultant specializing in public utility regulation. I
3 am the managing member of Resolve Utility Consulting PLLC.

4 **Q. SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL**
5 **EXPERIENCE.**

6 A. I received a B.B.A. with a major in Finance, an M.B.A., and a Juris Doctor from the
7 University of Oklahoma. I worked in private legal practice for several years before
8 accepting a position as assistant general counsel at the Oklahoma Corporation Commission
9 in 2011. At the commission, I worked in the Office of General Counsel in regulatory
10 proceedings. In 2012, I began working for the Public Utility Division as a regulatory
11 analyst providing testimony in regulatory proceedings. After leaving the commission, I
12 formed Resolve Utility Consulting PLLC, where I have represented various consumer
13 groups and state agencies in utility regulatory proceedings, primarily in the areas of cost of
14 capital and depreciation. I am a Certified Depreciation Professional with the Society of
15 Depreciation Professionals. I am also a Certified Rate of Return Analyst with the Society
16 of Utility and Regulatory Financial Analysts. A more complete description of my
17 qualifications and regulatory experience is included in my curriculum vitae.¹

¹ Exhibit DJG-1.

1 **Q. DESCRIBE THE PURPOSE AND SCOPE OF YOUR TESTIMONY IN THIS**
2 **PROCEEDING.**

3 A. I am testifying on behalf of the Florida Office of Public Counsel (“OPC”) in response to
4 the petition for rate increase by Florida Public Utilities Company-Gas Division, Florida
5 Division of Chesapeake Utilities Corporation, Florida Public Utilities Company – Fort
6 Meade, and Florida Public Utilities Company – Indiantown Division (collectively “FPUC”
7 or the “Company”). I address the cost of capital and fair rate of return for FPUC in response
8 to the direct testimony of Company witness Paul Moul. I also address the appropriate
9 proposed capital structure for the combined companies. I also address the Company’s
10 proposed depreciation rates in response to the direct testimony of Company witness
11 Patricia Lee, who sponsors the Company’s depreciation study.

12 **II. EXECUTIVE SUMMARY – COST OF CAPITAL**

13 **Q. PLEASE SUMMARIZE YOUR RECOMMENDATION TO THE COMMISSION.**

14 A. My cost of capital testimony can be distilled to the following recommendations:

- 15 • The Commission should reject the Company’s proposed return on equity
16 (“ROE”) of 11.25% as excessive and unsupported. An objective cost of
17 equity analysis shows that FPUC’s cost of equity is about 7.8%, based upon
18 review of the Company’s proxy group.

- 19 • The legal standards governing this issue do not mandate that the awarded
20 ROE equate to the result of a particular financial model, but rather that it be
21 reasonable under the circumstances. In my opinion, it is not appropriate to
22 consider an awarded ROE that is significantly higher than a regulated
23 utility’s cost of equity. Accordingly, I recommend the Commission award
24 FPUC an authorized ROE of 9.25%. Although 9.25% is still clearly above
25 FPUC’s market-based cost of equity estimate of 7.8%, it represents a
26 gradual yet meaningful move towards market-based cost of equity.

A. Overview

1 **Q. PLEASE EXPLAIN THE CONCEPT AND SIGNIFICANCE OF THE COST OF**
2 **CAPITAL.**

3 A. The term cost of capital, or Weighted Average Cost of Capital (WACC),⁴ refers to the
4 weighted average cost of the components within a company's capital structure, including
5 the costs of both debt and equity. The three primary components of a company's WACC
6 include the following:

- 7 1. Cost of Debt;
- 8 2. Cost of Equity; and
- 9 3. Capital Structure.

10 Determining the cost of debt is relatively straight-forward. Interest payments on bonds are
11 contractual, embedded costs that are generally calculated by dividing total interest
12 payments by the book value of outstanding debt. Determining the cost of equity, on the
13 other hand, is more complex. Unlike the known, contractual, and embedded cost of debt,
14 there is not any explicitly quantifiable "cost" of equity. Instead, the cost of equity must be
15 estimated through various financial models. Cost of capital is expressed as a weighted
16 average because it is based upon a company's relative levels of debt and equity, as defined
17 by the particular capital structure of that company. The basic WACC equation used in
18 regulatory proceedings is presented as follows:

⁴ The terms cost of capital and WACC are synonymous and used interchangeably throughout this testimony.

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**Equation 1:
Weighted Average Cost of Capital**

$$WACC = \left(\frac{D}{D + E} \right) C_D + \left(\frac{E}{D + E} \right) C_E$$

where: *WACC* = *weighted average cost of capital*
 D = *book value of debt*
 C_D = *embedded cost of debt capital*
 E = *book value of equity*
 C_E = *market-based cost of equity capital*

Companies in the competitive market often use their WACC as the discount rate to determine the value of capital projects, so it is important that this figure be estimated accurately.

Q. HOW DO EXPERTS AND REGULATORS TYPICALLY ASSESS THE ROES AWARDED TO UTILITIES AND THE CORRESPONDING OPPORTUNITY FOR SHAREHOLDERS?

A. Investors, company managers, and academics around the world have used models, such as the Capital Asset Pricing Model (“CAPM”) and Discounted Cash Flow (“DCF”) to closely estimate cost of equity for many years, and weigh the results achieved against the results from proxy groups. Each of these concepts will be discussed in more detail later in my testimony.

Q. HAVE YOU CONSIDERED THE EFFECTS OF INFLATION IN YOUR COST OF EQUITY ESTIMATE?

A. Yes. The recent increase in inflation has affected the entire U.S. market, including utility customers. Arguably the negative impacts of inflation disproportionately affect utility customers relative to utility shareholders. Regardless, I have taken an objective approach when considering the impacts of inflation on the cost of equity. Specifically, in cost of

1 equity modeling, we are primarily concerned with the yield on U.S. Treasury securities
2 (which can fluctuate given the Federal Reserve’s response to inflation) more directly than
3 the current level of inflation. I have directly considered the yields on 30-year Treasury
4 bonds as a proxy for the risk-free rate in my CAPM analysis, which is discussed in more
5 detail later in my testimony.

B. Recommendation

6 **Q. PLEASE SUMMARIZE YOUR ROE RECOMMENDATION TO THE FLORIDA**
7 **PUBLIC SERVICE COMMISSION (COMMISSION).**

8 A. Pursuant to the legal and technical standards guiding this issue, the awarded ROE should
9 be based on, or reflective of, the utility’s cost of equity. FPUC’s estimated cost of equity
10 is about 7.8%, when using reasonable inputs. However, legal standards do not mandate
11 the awarded ROE be set exactly equal to the cost of equity. Rather, in *Federal Power*
12 *Commission v. Hope Natural Gas Co.*, the U.S. Supreme Court found that, although the
13 awarded return should be based on a utility’s cost of equity, the “end result” should be just
14 and reasonable.⁵ Therefore, I recommend the Commission award FPUC an ROE of 9.25%.
15 In my opinion, an awarded ROE that is set too far above a regulated utility’s cost of equity
16 (which in this case is only about 7.8%) runs the risk of being at odds with the standards set
17 forth in *Hope*⁶ and *Bluefield Water Works & Improvement Co. v. Public Service*

⁵ See *Federal Power Commission v. Hope Natural Gas Co.*, 320 U.S. 591, 603 (1944). Here, the Court states that it is not mandating the various permissible ways in which the rate of return may be determined, but instead indicates that the end result should be just and reasonable. This is sometimes called the “end result” doctrine.

⁶ *Id.*

1 *Commission of West Virginia.*⁷ In other words, setting the awarded ROE far above the cost
2 of equity results in an excess transfer of wealth from customers to the utility, which is never
3 appropriate.

4 **Q. HOW DOES YOUR RECOMMENDED ROE IN THIS CASE COMPARE WITH**
5 **THE COMPANY’S CURRENT AUTHORIZED ROE?**

6 A. The average current pre-consolidation ROEs for Florida Public Utilities Company-Gas
7 Division (10.85%), Florida division of Chesapeake Utilities (10.8%), and Florida Public
8 Utilities Company- Indiantown (11.5%), is 11.0%.⁸ This pre-consolidation amount clearly
9 exceeds any reasonable estimate for the Company’s current cost of equity as a consolidated
10 Company under current market conditions (which is about 7.8%). Thus, a gradual, yet
11 meaningful move towards market-based cost of equity is appropriate in order to mitigate
12 the excess wealth transfer from customers to shareholders. An authorized ROE of 9.25%
13 represents a move of slightly more than halfway between the Company’s existing pre-
14 consolidation authorized ROEs and a post consolidation market-based cost of equity. In
15 that regard, it would be reasonable and appropriate for the Commission to authorize an
16 ROE of 9.25% for the Company in this case, when applied to the appropriate capital
17 structure reflecting an equity ratio of approximately 48.2%.

⁷ *Bluefield Water Works & Improvement Co. v. Public Service Commission of West Virginia*, 262 U.S. 679, 692–93 (1923).

⁸ See Florida Public Utilities Company’s Objections and Responses to Citizen’s First Set of Interrogatories, Interrogatory No. 1.

1 **III. EXECUTIVE SUMMARY – DEPRECIATION**

2 **Q. SUMMARIZE THE KEY POINTS OF YOUR TESTIMONY REGARDING**
3 **DEPRECIATION.**

4 A. In the context of utility ratemaking, “depreciation” refers to a cost allocation system
5 designed to measure the rate by which a utility may recover its capital investments in a
6 systematic and rational manner. There are two primary components of depreciation rates
7 that must be estimated and are often the most pertinent issues in regulatory proceedings –
8 service life and net salvage. Typically, the service lives proposed in depreciation studies
9 are based on voluminous amounts of historical data. Through a combination of actuarial
10 and simulated analysis, depreciation analysts can observe retirement patterns and trends in
11 the historical data in order to make reasonably accurate projections of remaining life. In
12 this case, however, FPUC did not provide the historical data required to conduct an
13 accurate, company-specific analysis of the service life of its assets. Instead, FPUC based
14 its service life proposals primarily on the approved service lives of other Florida utilities.
15 To the extent the approved service lives among the Florida peer group on which FPUC
16 relied were also based on a similar peer group comparison, it runs the risk of creating a
17 feedback loop that may not be adequately reflective of objective historical retirement data.

18 As discussed further in my testimony, the legal standards governing depreciation
19 rates require that the utility make a convincing showing that its proposed depreciation rates
20 are not excessive. Again, this showing is typically based on adequate amounts of historical
21 retirement data upon which reasonable service life estimates can be made. The fact that
22 FPUC has not provided such information in this case does not absolve it from its burden to

1 make a convincing showing that its proposed depreciation rates (including service lives)
 2 are reasonable.

3 Since FPUC did not provide adequate historical retirement data upon which to
 4 conduct an accurate service life analysis, a peer group comparison is an approach we can
 5 use to establish a relatively objective basis for service life estimates. My testimony not
 6 only discusses the service lives of other Florida utilities, but also looks at the approved
 7 service lives of other utilities over several other utilities in other jurisdictions. The
 8 approved service lives from the utilities outside of Florida were based on the type of
 9 actuarial analysis typically conducted to estimate service lives. It is important for the
 10 Commission to see the approved service lives of utilities that are not only in other regions,
 11 but that were also based on a thorough statistical analysis of voluminous amounts of
 12 historical retirement data. The costal utilities group provides a comparison of utilities in
 13 similar environmental conditions outside of Florida. The results of my peer group analyses
 14 are summarized in the table below.

15 **Figure 2:**
 16 **Peer Group Analysis Summary**

Acct	Description	FPUC	Liberty	NIPSCO	PNG	FCG	PGS
		Proposed					
3761	Mains - Plastic	75	71	85	65	55	75
3762	Mains - Steel	65	71	85	65	55	65
378	M&R Equip. - General	40	51	55	55	30	40
379	M&R Equip. - City Gate	40	51	55	55	35	50
3801	Services - Plastic	55	50	68	60	54	55
381	Meters	28	45	36	29	20	19
Average		51	57	64	55	42	51

1 As shown in this table, the approved lives from the outside peer group indicate slightly
2 longer lives for several of the accounts in dispute. This is information the Commission can
3 consider when setting fair depreciation rates in this case.

4 **Q. PLEASE SUMMARIZE YOUR RECOMMENDATION TO THE COMMISSION**
5 **REGARDING DEPRECIATION RATES.**

6 A. I recommend the Commission adopt the depreciation rates presented in Exhibit DJG-20.⁹
7 Adopting my proposed depreciation rates would result in an adjustment reducing the
8 Company's proposed annual depreciation accrual by \$671,930 when applied to the filed
9 plant and reserve balances as of the depreciation study date.¹⁰

⁹ OPC's adjustment to depreciation expense is presented in the direct testimony of Ralph Smith.

¹⁰ Exhibit DJG-18.

1 PART ONE: COST OF CAPITAL

2 IV. LEGAL STANDARDS

3 **Q. DISCUSS THE LEGAL STANDARDS GOVERNING THE AWARDED RATE OF**
4 **RETURN ON CAPITAL INVESTMENTS FOR REGULATED UTILITIES.**

5 A. In *Wilcox v. Consolidated Gas Co. of New York*, the U.S. Supreme Court first addressed
6 the meaning of a fair rate of return for public utilities.¹¹ The Court found that “the amount
7 of risk in the business is a most important factor” in determining the appropriate allowed
8 rate of return.¹² As referenced earlier, in two subsequent landmark cases, the Court set
9 forth the standards by which public utilities are allowed to earn a return on capital
10 investments. First, in *Bluefield*, the Court held:

11 A public utility is entitled to such rates as will permit it to earn a return on
12 the value of the property which it employs for the convenience of the public.
13 . . . but it has no constitutional right to profits such as are realized or
14 anticipated in highly profitable enterprises or speculative ventures. The
15 return should be reasonably sufficient to assure confidence in the financial
16 soundness of the utility and should be adequate, under efficient and
17 economical management, to maintain and support its credit and enable it to
18 raise the money necessary for the proper discharge of its public duties.¹³

19 Then, in *Hope*, the Court expanded on the guidelines set forth in *Bluefield* and stated:

¹¹ *Wilcox v. Consolidated Gas Co. of New York*, 212 U.S. 19 (1909).

¹² *Id.* at 48.

¹³ *Bluefield* at 692–93.

1 From the investor or company point of view, it is important that there be
2 enough revenue not only for operating expenses, but also for the capital
3 costs of the business. These include service on the debt and dividends on
4 the stock. By that standard, the return to the equity owner should be
5 commensurate with returns on investments in other enterprises having
6 corresponding risks. That return, moreover, should be sufficient to assure
7 confidence in the financial integrity of the enterprise, so as to maintain its
8 credit and to attract capital.¹⁴

9 The cost of capital models I have employed in this case are designed to be in accordance
10 with the foregoing legal standards.

11 **Q. IS IT IMPORTANT THAT THE AWARDED RATE OF RETURN BE BASED ON**
12 **THE COMPANY'S ACTUAL COST OF CAPITAL?**

13 A. Yes. The U.S. Supreme Court in *Hope* makes it clear that the allowed return should be
14 based on the actual cost of capital.¹⁵ Moreover, the awarded return must also be fair, just,
15 and reasonable under the circumstances of each case. Among the circumstances that must
16 be considered in each case are the broad economic and financial impacts to the cost of
17 equity and awarded return caused by market forces and other factors. As a starting point,
18 however, scholars agree that the actual cost of capital must be considered:

¹⁴ *Federal Power Commission v. Hope Natural Gas Co.*, 320 U.S. 591, 603 (1944) (emphasis added) (internal citations omitted).

¹⁵ The term "cost of capital" includes both debt and equity. The overall awarded rate of return should be based on the utility's cost of capital, which the awarded ROE should be based in the utility's cost of equity.

1 Since by definition the cost of capital of a regulated firm represents
2 precisely the expected return that investors could anticipate from other
3 investments while bearing no more or less risk, and since investors will not
4 provide capital unless the investment is expected to yield its opportunity
5 cost of capital, the correspondence of the definition of the cost of capital
6 with the court's definition of legally required earnings appears clear.¹⁶

7 The models I have employed in this case closely estimate the Company's true cost of
8 equity. If the Commission sets the awarded return based on my lower and more reasonable
9 rate of return, it will better comply with the U.S. Supreme Court's standards, allow the
10 Company to maintain its financial integrity, and achieve reasonable returns for its
11 investors. On the other hand, if the Commission sets the allowed rate of return much higher
12 than the true cost of capital, as requested by FPUC, it will result in an inappropriate transfer
13 of wealth from ratepayers to shareholders.¹⁷

14 **Q. WHAT DOES THIS LEGAL STANDARD MEAN FOR DETERMINING THE**
15 **AWARDED RETURN AND THE COST OF CAPITAL?**

16 A. The awarded return and the cost of capital are different but related concepts. On the one
17 hand, the legal and technical standards encompassing this issue require that the awarded
18 return reflect the true cost of capital. Yet on the other hand, the two concepts differ in that
19 the legal standards do not mandate that awarded returns exactly match the cost of capital.
20 Instead, awarded returns are set through the regulatory process and may be influenced by
21 various factors other than objective market drivers. By contrast, the cost of capital should

¹⁶ A Lawrence Kolbe, James A. Read, Jr. & George R. Hall, *The Cost of Capital: Estimating the Rate of Return for Public Utilities* 21 (The MIT Press 1984).

¹⁷ Roger A. Morin, *New Regulatory Finance* 23–24 (Public Utilities Reports, Inc. 2006) (1994) (“[I]f the allowed rate of return is greater than the cost of capital, capital investments are undertaken and investors’ opportunity costs are more than achieved. Any excess earnings over and above those required to service debt capital accrue to the equity holders, and the stock price increases. In this case, the wealth transfer occurs from ratepayers to shareholders.”).

1 be evaluated objectively and be closely tied to economic realities, such as stock prices,
2 dividends, growth rates, and, most importantly, risk. The cost of capital can be estimated
3 by financial models used by firms, investors, and academics around the world for decades.
4 The problem is, with respect to regulated utilities, there has been a trend in which awarded
5 returns fail to closely track with market-based cost of capital, as further discussed below.
6 To the extent this occurs, the results are detrimental to ratepayers and the state's economy.

7 **Q. DESCRIBE THE ECONOMIC IMPACT THAT OCCURS WHEN THE**
8 **AWARDED RETURN STRAYS TOO FAR FROM THE U.S. SUPREME COURT'S**
9 **COST OF EQUITY STANDARDS.**

10 A. When the awarded ROE is set far above the cost of equity, it runs the risk of violating the
11 U.S. Supreme Court's standards. This has the effect of diverting dollars from ratepayers
12 for their internal or business uses that would otherwise support the local or state economy
13 to the utility's shareholders at large. Moreover, establishing an awarded return that far
14 exceeds true cost of capital effectively prevents the awarded returns from changing along
15 with economic conditions. This is especially true given the fact that regulators tend to be
16 influenced by the awarded returns in other jurisdictions, regardless of the various unknown
17 factors influencing those awarded returns. If regulators rely too heavily on the awarded
18 returns from other jurisdictions, they can create a cycle over time that bears little relation
19 to the market-based cost of equity. In fact, this is exactly what we have observed since
20 1990. This is yet another reason why it is crucial for regulators to put more emphasis on
21 the target utility's actual cost of equity than on the awarded returns from other jurisdictions.
22 Awarded returns may be influenced by settlements and other political factors not based on

1 true market conditions. In contrast, the true cost of equity as estimated through objective
2 models is not influenced by these factors but is instead driven by market-based factors.

3 **Q. CAN YOU ILLUSTRATE AND PROVIDE A COMPARISON OF THE**
4 **RELATIONSHIP BETWEEN AWARDED UTILITY RETURNS AND MARKET**
5 **COST OF EQUITY SINCE 1990?**

6 A. Yes. As shown in the figure below, awarded returns for electric and gas utilities have been
7 above the average required market return since 1990.¹⁸ Because utility stocks are
8 consistently far less risky than the average stock in the marketplace, the cost of equity for
9 utility companies is less than the market cost of equity.

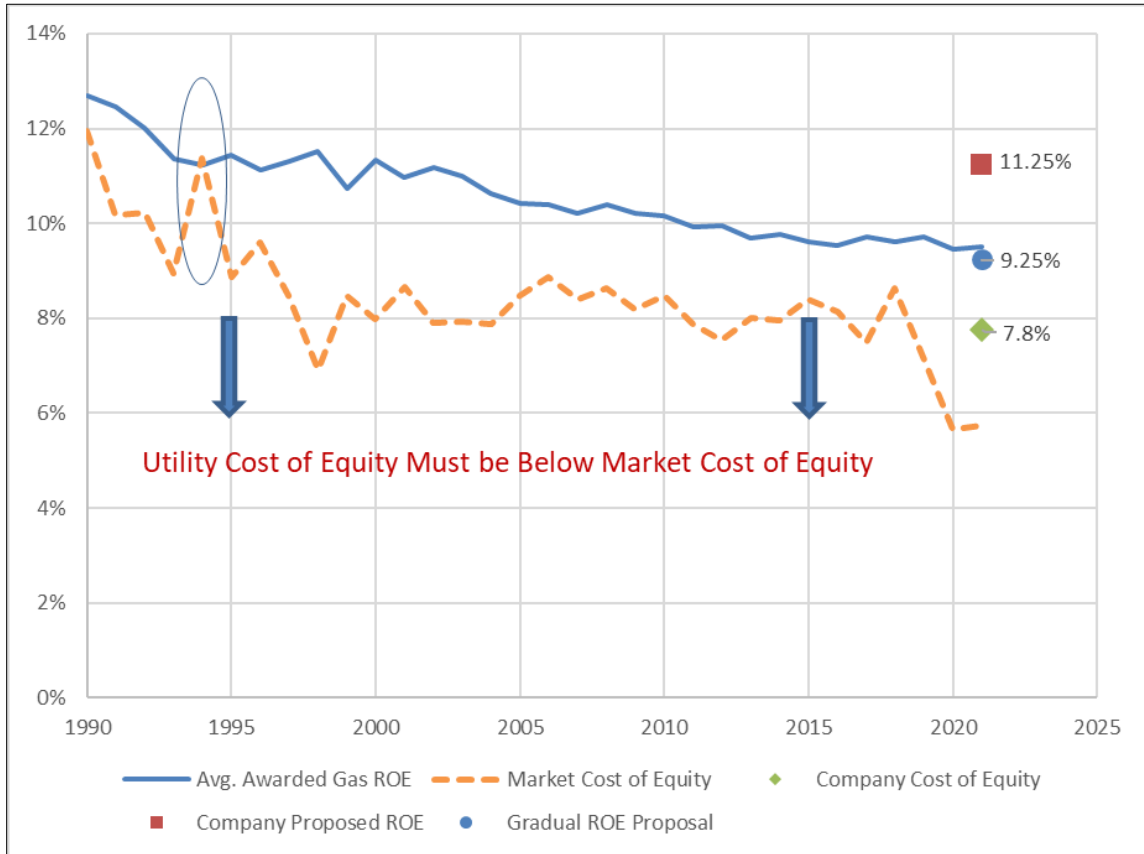
10 To illustrate this fact, the graph in the figure below shows three trend lines. The
11 top two line are the average annual awarded returns since 1990 for U.S. regulated electric
12 and gas utilities. The bottom line is the required market return over the same period. As
13 discussed in more detail later in my testimony, the required market return is essentially the
14 return that investors would require if they invested in the entire market and, as such, the
15 required market return is essentially the cost of equity of the entire market. It is undisputed
16 that utility stocks are less risky than the average stock in the market. Accordingly, the
17 utilities' cost of equity must be less than the market cost of equity.¹⁹ Thus, awarded returns
18 (the solid line) should generally be below the market cost of equity (the dotted line), since
19 awarded returns are supposed to be based on true cost of equity.

¹⁸ Exhibit DJG-13.

¹⁹ This fact can be objectively measured through a term called "beta," as discussed later in the testimony. Utility betas are less than one, which means utility stocks are less risky than the "average" stock in the market.

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**Figure 3:
Awarded ROEs vs. Market Cost of Equity**



3 Notwithstanding the data in this graph, awarded ROEs have been consistently above the
4 market cost of equity for many years. Also as shown in this graph, since 1990, there was
5 only one year in which the average awarded ROE was below the market cost of equity. In
6 1994, regulators awarded ROEs that were the closest to utilities' market-based cost of
7 equity. In my opinion, when awarded ROEs for utilities are below the market cost of
8 equity, regulators more closely conform to the standards set forth by *Hope* and *Bluefield*
9 and minimize the excess wealth transfer from ratepayers to shareholders.

1 **Q. HAVE OTHER ANALYSTS COMMENTED ON THIS NATIONAL**
2 **PHENOMENON OF AWARDED ROES EXCEEDING MARKET-BASED COST**
3 **EQUITY FOR UTILITIES?**

4 A. Yes. In his article published in Public Utilities Fortnightly in 2016, Steve Huntoon
5 observed that even though utility stocks are less risky than the stocks of competitive
6 industries, utility stocks have nonetheless outperformed the broader market.²⁰ Specifically,
7 Mr. Huntoon notes the following three points which lead to a problematic conclusion:

- 8 1. Jack Bogle, the founder of Vanguard Group and a Wall Street
9 legend, provides rigorous analysis that the long-term total return for
10 the broader market will be around 7 percent going forward. Another
11 Wall Street legend, Professor Burton Malkiel, corroborates that 7
12 percent in the latest edition of his seminal work, A Random Walk
13 Down Wall Street.
- 14 2. Institutions like pension funds are validating the first point by piling
15 on risky investments to try and get to a 7.5 percent total return, as
16 reported by the Wall Street Journal.
- 17 3. Utilities are being granted returns on equity around 10 percent.²¹

18 Other scholars have also observed that awarded ROEs have not appropriately
19 tracked with declining interest rates over the years, and that excessive awarded ROEs have
20 negative economic impacts. In a white paper issued in 2017, Charles S. Griffey stated:

²⁰ Steve Huntoon, “Nice Work If you can Get It,” Public Utilities Fortnightly (Aug. 2016).

²¹ *Id.*

1 The “risk premium” being granted to utility shareholders is now higher than
2 it has ever been over the last 35 years. Excessive utility ROEs are
3 detrimental to utility customers and the economy as a whole. From a societal
4 standpoint, granting ROEs that are higher than necessary to attract
5 investment creates an inefficient allocation of capital, diverting available
6 funds away from more efficient investments. From the utility customer
7 perspective, if a utility’s awarded and/or achieved ROE is higher than
8 necessary to attract capital, customers pay higher rates without receiving
9 any corresponding benefit.²²

10 It is interesting that both Mr. Huntoon and Mr. Griffey use the word “sticky” in their articles
11 to describe the fact that awarded ROEs have declined at a much slower rate than interest
12 rates and other economic factors resulting in a decline in capital costs and expected returns
13 on the market. It is not hard to see why this phenomenon of “sticky” ROEs has occurred.
14 Because awarded ROEs are often based primarily on a comparison with other awarded
15 ROEs around the country, the average awarded returns effectively fail to adapt to true
16 market conditions, and regulators seem reluctant to deviate from the average. Once utilities
17 and regulatory commissions become accustomed to awarding rates of return higher than
18 market conditions actually require, this trend becomes difficult to reverse. The fact is,
19 utility stocks are less risky than the average stock in the market, and thus, awarded ROEs
20 should be less than the expected return on the market. However, that is rarely the case.
21 My proposal assists the Commission in “see[ing] the gap between allowed returns and cost
22 of capital,”²³ and reconciling this issue in an equitable manner.

²² Charles S. Griffey, “When ‘What Goes Up’ Does Not Come Down: Recent Trends in Utility Returns,” White Paper (February 2017).

²³ Leonard Hyman & William Tilles, “Don’t Cry for Utility Shareholders, America,” Public Utilities Fortnightly (October 2016).

1 **Q. SUMMARIZE THE LEGAL STANDARDS GOVERNING THE AWARDED ROE**
2 **ISSUE.**

3 A. The Commission should strive to move the awarded return to a level more closely aligned
4 with the Company's actual, market-derived cost of capital while keeping in mind the
5 following two legal principles outlined below.

6 **1. Risk is the most important factor when determining the awarded return. The**
7 **awarded return should be commensurate with those returns on investments of**
8 **corresponding risk.**

9 The legal standards articulated in *Hope* and *Bluefield* demonstrate that the U.S. Supreme
10 Court understands one of the most basic, fundamental concepts in financial theory: the
11 more (or less) risk an investor assumes, the more (or less) return the investor requires.
12 Since utility stocks are low risk, the return required by equity investors should be relatively
13 low. I have used financial models to closely estimate the Company's cost of equity, and
14 these financial models account for risk. The cost of equity models confirm the industry
15 experiences relatively low levels of risk by producing relatively low cost of equity results.
16 In turn, the awarded ROE in this case should reflect FPUC's relatively low market risk.

17 **2. The awarded return should be sufficient to assure financial soundness and**
18 **integrity under efficient management.**

19 Because awarded returns in the regulatory environment have not closely tracked market-
20 based trends and commensurate risk, utility companies have been able to remain more than
21 financially sound, perhaps despite management inefficiencies. In fact, the transfer of
22 wealth from ratepayers to shareholders has been so far removed from actual cost-based
23 drivers that a utility could remain financially sound even under relatively inefficient
24 management. Therefore, regulatory commissions should strive to set utilities' returns

1 based on actual market conditions to promote prudent and efficient management and
2 minimize economic waste.

3 **V. GENERAL CONCEPTS AND METHODOLOGY**

4 **Q. DISCUSS YOUR APPROACH TO ESTIMATING THE COST OF EQUITY IN**
5 **THIS CASE.**

6 A. While a competitive firm must estimate its own cost of capital to assess the profitability of
7 competing capital projects, regulators determine a utility's cost of capital to establish a fair
8 rate of return. The legal standards set forth above do not include specific guidelines
9 regarding the models that must be used to estimate the cost of equity for utilities. Over the
10 years, however, regulatory commissions have consistently relied on several models. The
11 models I have employed in this case have been the two most widely used and accepted in
12 regulatory proceedings for many years. The specific inputs and calculations for these
13 models are described in more detail below.

14 **Q. PLEASE EXPLAIN WHY YOU USED MULTIPLE MODELS TO ESTIMATE THE**
15 **COST OF EQUITY.**

16 A. These models attempt to measure the return on equity required by investors by estimating
17 several different inputs. It is preferable to use multiple models because the results of any
18 one model may contain a degree of imprecision, especially depending on the reliability of
19 the inputs used at the time of conducting the model. By using multiple models, the analyst
20 can compare the results of the models and look for outlying results and inconsistencies.
21 Likewise, if multiple models produce a similar result, it may indicate a narrower range for
22 the cost of equity estimate.

1 **Q. PLEASE DISCUSS THE BENEFITS OF CHOOSING A PROXY GROUP OF**
2 **COMPANIES IN CONDUCTING COST OF CAPITAL ANALYSES.**

3 A. The cost of equity models in this case can be used to estimate the cost of capital of any
4 individual, publicly traded company. There are advantages, however, to conducting cost
5 of capital analysis on a proxy group of companies that are comparable to the target
6 company. First, it is better to assess the financial soundness of a utility by comparing it to
7 a group of other financially sound utilities. Second, using a proxy group provides more
8 reliability and confidence in the overall results because there is a larger sample size.
9 Finally, the use of a proxy group is often a pure necessity when the target company is a
10 subsidiary that is not publicly traded, as is the case here. This is because the financial
11 models used to estimate the cost of equity require information from publicly traded firms,
12 such as stock prices and dividends.

13 **Q. DESCRIBE THE PROXY GROUP YOU SELECTED IN THIS CASE.**

14 A. In this case, I chose to use the same proxy group used by Mr. Moul. There could be
15 reasonable arguments made for the inclusion or exclusion of a particular company in a
16 proxy group; however, the cost of equity results are influenced far more by the underlying
17 assumptions and inputs to the various financial models than the composition of the proxy
18 group.²⁴ By using the same proxy group, we can remove a relatively insignificant variable
19 from the equation and focus on the primary factors driving FPUC's cost of equity estimate.

²⁴ Exhibit DJG-2.

1 **VI. RISK AND RETURN CONCEPTS**

2 **Q. DISCUSS THE GENERAL RELATIONSHIP BETWEEN RISK AND RETURN.**

3 A. Risk is among the most important factors for the Commission to consider when
4 determining the allowed return. Thus, it is necessary to understand the relationship
5 between risk and return. There is a direct relationship between risk and return: the more
6 (or less) risk an investor assumes, the larger (or smaller) return the investor will demand.
7 There are two primary types of risk: firm-specific risk and market risk. Firm-specific risk
8 affects individual companies, while market risk affects all companies in the market to
9 varying degrees.

10 **Q. DISCUSS THE DIFFERENCES BETWEEN FIRM-SPECIFIC RISK AND**
11 **MARKET RISK.**

12 A. Firm-specific risk affects individual companies, rather than the entire market. For example,
13 a competitive firm might overestimate customer demand for a new product, resulting in
14 reduced sales revenue. This is an example of a firm-specific risk called “project risk.”²⁵
15 There are several other types of firm-specific risks, including: (1) “financial risk” – the risk
16 that equity investors of leveraged firms face as residual claimants on earnings; (2) “default
17 risk” – the risk that a firm will default on its debt securities; and (3) “business risk” – which
18 encompasses all other operating and managerial factors that may result in investors
19 realizing less than their expected return in that particular company. While firm-specific
20 risk affects individual companies, market risk affects all companies in the market to
21 varying degrees. Examples of market risk include interest rate risk, inflation risk, and the

²⁵ Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 62–63 (3rd ed., John Wiley & Sons, Inc. 2012).

1 risk of major socio-economic events. When there are changes in these risk factors, they
2 affect all firms in the market to some extent.²⁶

3 Analysis of the U.S. market in 2001 provides a good example for contrasting firm-
4 specific risk and market risk. During that year, Enron Corp.'s stock fell from \$80 per share
5 to its low when the company filed bankruptcy at the end of the year. If an investor's
6 portfolio had held only Enron stock at the beginning of 2001, this irrational investor would
7 have lost the entire investment by the end of the year due to assuming the full exposure of
8 Enron's firm-specific risk (in that case, imprudent management). On the other hand, a
9 rational, diversified investor who invested the same amount of capital in a portfolio holding
10 every stock in the S&P 500 would have had a much different result that year. The rational
11 investor would have been relatively unaffected by the fall of Enron because his or her
12 portfolio included about 499 other stocks. Each of those stocks, however, would have been
13 affected by various market risk factors that occurred that year. Thus, the rational investor
14 would have incurred a relatively minor loss due to market risk factors, while the irrational
15 investor would have lost everything due to firm-specific risk factors.

16 **Q. CAN EQUITY INVESTORS REASONABLY MINIMIZE FIRM-SPECIFIC RISK?**

17 A. Yes. A fundamental concept in finance is that firm-specific risk can be eliminated through
18 diversification.²⁷ If someone irrationally invested all his or her funds in one firm, he or she
19 would be exposed to all the firm-specific risk and the market risk inherent in that single
20 firm. Rational investors, however, are risk-averse and seek to eliminate risk they can

²⁶ See Zvi Bodie, Alex Kane & Alan J. Marcus, *Essentials of Investments* 149 (9th ed., McGraw-Hill/Irwin 2013).

²⁷ See John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 179–80 (3rd ed., South Western Cengage Learning 2010).

1 control. Investors can eliminate firm-specific risk by adding more stocks to their portfolio
2 through a process called “diversification.” There are two reasons why diversification
3 eliminates firm-specific risk.

4 First, each stock in a diversified portfolio represents a much smaller percentage of
5 the overall portfolio than it would in a portfolio of just one or a few stocks. Thus, any firm-
6 specific action that changes the stock price of one stock in the diversified portfolio will
7 have only a small impact on the entire portfolio.²⁸

8 The second reason why diversification eliminates firm-specific risk is that the
9 effects of firm-specific actions on stock prices can be either positive or negative for each
10 stock. Thus, in large, diversified portfolios, the net effect of these positive and negative
11 firm-specific risk factors will be essentially zero and will not affect the value of the overall
12 portfolio.²⁹ Firm-specific risk is also called “diversifiable risk” because it can be easily
13 eliminated through diversification.

14 **Q. IS IT WELL-KNOWN AND ACCEPTED THAT, BECAUSE FIRM-SPECIFIC**
15 **RISK CAN BE EASILY ELIMINATED THROUGH DIVERSIFICATION, THE**
16 **MARKET DOES NOT REWARD SUCH RISK THROUGH HIGHER RETURNS?**

17 A. Yes. Because investors eliminate firm-specific risk through diversification, they know they
18 cannot expect a higher return for assuming the firm-specific risk in any one company.
19 Thus, the risks associated with an individual firm’s operations are not rewarded by the
20 market. In fact, firm-specific risk is also called “unrewarded” risk for this reason. Market

²⁸ See Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 64 (3rd ed., John Wiley & Sons, Inc. 2012).

²⁹ See Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 64 (3rd ed., John Wiley & Sons, Inc. 2012).

1 risk, on the other hand, cannot be eliminated through diversification. Because market risk
2 cannot be eliminated through diversification, investors expect a return for assuming this
3 type of risk. Market risk is also called “systematic risk.” Scholars recognize the fact that
4 market risk, or systematic risk, is the only type of risk for which investors expect a return
5 for bearing:

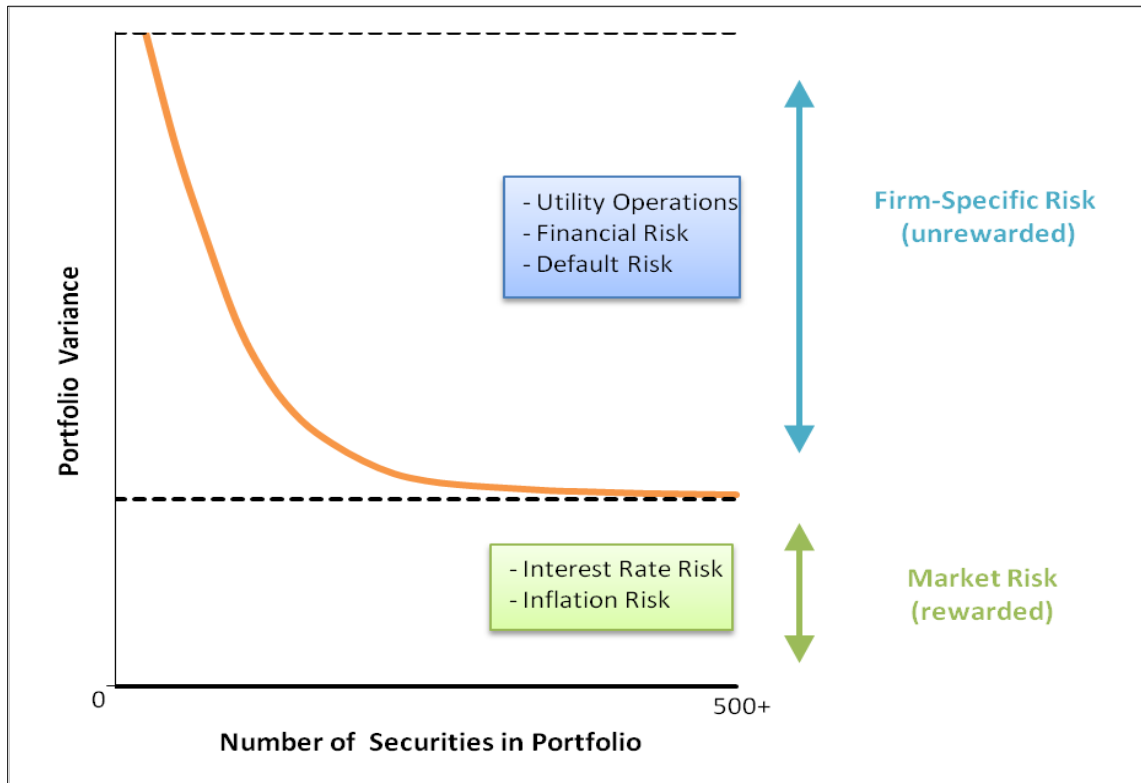
6 If investors can cheaply eliminate some risks through diversification, then
7 we should not expect a security to earn higher returns for risks that can be
8 eliminated through diversification. Investors can expect compensation only
9 for bearing systematic risk (i.e., risk that cannot be diversified away).³⁰

10 These important concepts are illustrated in the figure below. Some form of this figure is
11 found in many financial textbooks.
12

³⁰ See John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 180 (3rd ed., South Western Cengage Learning 2010) (emphasis added).

1
2

**Figure 4:
Effects of Portfolio Diversification**



3 This figure shows that as stocks are added to a portfolio, the amount of firm-specific risk
4 is reduced until it is essentially eliminated. No matter how many stocks are added,
5 however, there remains a certain level of fixed market risk. The level of market risk will
6 vary from firm to firm. Market risk is the only type of risk that is rewarded by the market
7 and is thus the primary type of risk the Commission should consider when determining the
8 allowed return.

9 **Q. DESCRIBE HOW MARKET RISK IS MEASURED.**

10 A. Investors who want to eliminate firm-specific risk must hold a fully diversified portfolio.
11 To determine the amount of risk that a single stock adds to the overall market portfolio,
12 investors measure the covariance between a single stock and the market portfolio. The

1 result of this calculation is called “beta.”³¹ Beta represents the sensitivity of a given
2 security to the market as a whole. The market portfolio of all stocks has a beta equal to
3 one. Stocks with betas greater than 1.0 are relatively more sensitive to market risk than the
4 average stock. For example, if the market increases (or decreases) by 1.0%, a stock with a
5 beta of 1.5 will, on average, increase (or decrease) by 1.5%. In contrast, stocks with betas
6 of less than 1.0 are less sensitive to market risk, such that if the market increases (or
7 decreases) by 1.0%, a stock with a beta of 0.5 will, on average, only increase (or decrease)
8 by 0.5%. Thus, stocks with low betas are relatively insulated from market conditions. The
9 beta term is used in the CAPM to estimate the cost of equity, which is discussed in more
10 detail later.³²

11 **Q. ARE PUBLIC UTILITIES CHARACTERIZED AS DEFENSIVE FIRMS THAT**
12 **HAVE LOW BETAS, HAVE LOW MARKET RISK, AND ARE RELATIVELY**
13 **INSULATED FROM OVERALL MARKET CONDITIONS?**

14 A. Yes. Although market risk affects all firms in the market, it affects different firms to
15 varying degrees. Firms with high betas are affected more than firms with low betas, which
16 is why firms with high betas are riskier. Stocks with betas greater than one are generally
17 known as “cyclical stocks.” Firms in cyclical industries are sensitive to recurring patterns
18 of recession and recovery known as the “business cycle.”³³ Thus, cyclical firms are
19 exposed to a greater level of market risk. Securities with betas less than one, on the other

³¹ See John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 180–81 (3rd ed., South Western Cengage Learning 2010).

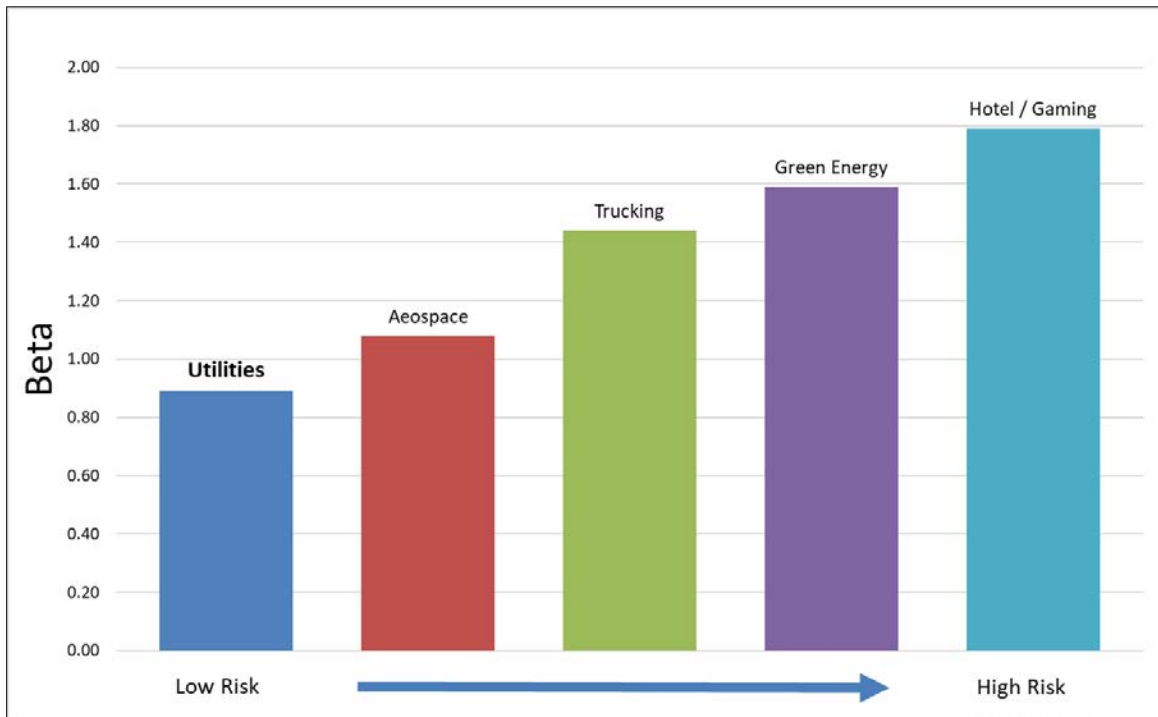
³² Though it will be discussed in more detail later, Exhibit DJG-8 shows that the average beta of the proxy group was less than 1.0. This confirms the well-known concept that utilities are relatively low-risk firms.

³³ See Zvi Bodie, Alex Kane & Alan J. Marcus, *Essentials of Investments* 382 (9th ed., McGraw-Hill/Irwin 2013).

1 hand, are known as “defensive stocks.” Companies in defensive industries, such as public
2 utility companies, “will have low betas and performance that is comparatively unaffected
3 by overall market conditions.”³⁴ In fact, financial textbooks often use utility companies as
4 prime examples of low-risk, defensive firms.³⁵ The figure below compares the betas of
5 several industries and illustrates that the utility industry is one of the least risky industries
6 in the U.S. market.³⁶

7
8

**Figure 5:
Beta by Industry**



³⁴ Zvi Bodie, Alex Kane & Alan J. Marcus, *Essentials of Investments* 383 (9th ed., McGraw-Hill/Irwin 2013).

³⁵ See e.g., Zvi Bodie, Alex Kane & Alan J. Marcus, *Essentials of Investments* 382 (9th ed., McGraw-Hill/Irwin 2013); see also Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 196 (3rd ed., John Wiley & Sons, Inc. 2012).

³⁶ See Betas by Sector (US) at <http://pages.stern.nyu.edu/~adamodar/>. The exact beta calculations are not as important as illustrating the well-known fact that utilities are low-risk companies. The fact that the utility industry is one of the lowest risk industries in the country should not change from year to year.

1 recorded data, while the growth rate projection must be estimated. I discuss each of these
2 inputs separately below.

3 **A. Stock Prices and Dividends**

4 **Q. HOW DID YOU DETERMINE THE STOCK PRICE INPUT OF THE DCF**
5 **MODEL?**

6 A. For the stock price (P_0), I used a 30-day average of stock prices for each company in the
7 proxy group.³⁷ Analysts sometimes rely on average stock prices for longer periods (e.g.,
8 60, 90, or 180 days). According to the efficient market hypothesis, however, markets
9 reflect all relevant information available at a particular time, and prices adjust
10 instantaneously to the arrival of new information.³⁸ Past stock prices, in essence, reflect
11 outdated information. The DCF Model used in utility rate cases is a derivation of the
12 dividend discount model, which is used to determine the current value of an asset. Thus,
13 according to the dividend discount model and the efficient market hypothesis, the value for
14 the “ P_0 ” term in the DCF Model should technically be the current stock price, rather than
15 an average.

16 **Q. WHY DID YOU USE A 30-DAY AVERAGE FOR THE CURRENT STOCK PRICE**
17 **INPUT?**

18 A. Using a short-term average of stock prices for the current stock price input adheres to
19 market efficiency principles while avoiding any irregularities that may arise from using a
20 single current stock price. In the context of a utility rate proceeding, there is a significant

³⁷ Exhibit DJG-3.

³⁸ See Eugene F. Fama, *Efficient Capital Markets: A Review of Theory and Empirical Work*, Vol. 25, No. 2 The Journal of Finance 383 (1970).

1 length of time from when an application is filed and testimony is due. Choosing a current
2 stock price for one particular day could raise a separate issue concerning which day was
3 chosen to be used in the analysis. In addition, a single stock price on a particular day may
4 be unusually high or low. It is arguably ill-advised to use a single stock price in a model
5 that is ultimately used to set rates for several years, especially if a stock is experiencing
6 some volatility. Thus, it is preferable to use a short-term average of stock prices, which
7 represents a good balance between adhering to well-established principles of market
8 efficiency while avoiding any unnecessary contentions that may arise from using a single
9 stock price on a given day. The stock prices I used in my DCF analysis are based on 30-
10 day averages of adjusted closing stock prices for each company in the proxy group.³⁹

11 **Q. DESCRIBE HOW YOU DETERMINED THE DIVIDEND INPUT OF THE DCF**
12 **MODEL.**

13 A. The dividend term in the DCF Model represents dividends per share (d_0). I obtained the
14 most recent quarterly dividend paid for each proxy company and annualized those
15 dividends.⁴⁰

16 **Q. ARE THE STOCK PRICE AND DIVIDEND INPUTS FOR EACH PROXY**
17 **COMPANY A SIGNIFICANT ISSUE IN THIS CASE?**

18 A. No. Although my stock price and dividend inputs are more recent than those used by Mr.
19 Moul, there is not a statistically significant difference between them because utility stock

³⁹ Exhibit DJG-3. Adjusted closing prices, rather than actual closing prices, are ideal for analyzing historical stock prices. The adjusted price provides an accurate representation of the firm's equity value beyond the mere market price because it accounts for stock splits and dividends.

⁴⁰ Exhibit DJG-4. Nasdaq Dividend History, <http://www.nasdaq.com/quotes/dividend-history.aspx>.

1 prices and dividends are generally quite stable. This is another reason that cost of capital
2 models such as the CAPM and the DCF Model are well-suited to be used for utilities. The
3 differences between my DCF Model and Mr. Moul's DCF Model are primarily driven by
4 differences in our growth rate estimates, which are further discussed below.

5 **B. Growth Rate**

6 **Q. SUMMARIZE THE GROWTH RATE INPUT IN THE DCF MODEL.**

7 A. The most critical input in the DCF Model is the growth rate. Unlike the stock price and
8 dividend inputs, the growth rate input (g) must be estimated. As a result, the growth rate
9 is often the most contentious DCF input in utility rate cases. The DCF model used in this
10 case is based on the sustainable growth valuation model. Under this model, a stock is
11 valued by the present value of its future cash flows in the form of dividends. Before future
12 cash flows are discounted by the cost of equity, however, they must be "grown" into the
13 future by a sustainable growth rate. As stated above, one of the inherent assumptions of
14 this model is that these cash flows in the form of dividends grow at a sustainable rate
15 forever. For young, high-growth firms, estimating the growth rate to be used in the model
16 can be especially difficult, and may require the use of multi-stage growth models. For
17 mature, low-growth firms such as utilities, however, estimating the sustainable growth rate
18 is more transparent. The growth term of the DCF Model is one of the most important, yet
19 apparently most misunderstood, aspects of cost of equity estimations in utility regulatory
20 proceedings. Therefore, I have devoted a more detailed explanation of this issue in the
21 following sections, which are organized as follows:

- 1 (1) The Various Determinants of Growth;
- 2 (2) Reasonable Estimates for Long-Term Growth;
- 3 (3) Quantitative vs. Qualitative Determinants of Utility Growth:
- 4 Circular References, “Flatworm” Growth, and the Problem with
- 5 Analysts’ Growth Rates; and
- 6 (4) Growth Rate Recommendation.

1. **The Various Determinants of Growth**

7 **Q. DESCRIBE THE VARIOUS DETERMINANTS OF GROWTH.**

8 A. Although the DCF Model directly considers the growth of dividends, there are a variety of
9 growth determinants that should be considered when estimating growth rates. It should be
10 noted that these various growth determinants are used primarily to determine the short-
11 term growth rates in multi-stage DCF models. For utility companies, it is necessary to
12 focus primarily on a long-term growth rate in dividends. This is also known as a
13 “sustainable” growth rate, since this is the growth rate assumed for the company’s
14 dividends in perpetuity. That is not to say that these growth determinants cannot be
15 considered when estimating sustainable growth; however, as discussed below, sustainable
16 growth must be constrained much more than short-term growth, especially for young firms
17 with high growth opportunities. Additionally, I briefly discuss these growth determinants
18 here because it may reveal some of the source of confusion in this area.

19 A. **Historical Growth**

20 Looking at a firm’s actual historical experience may theoretically provide a good
21 starting point for estimating short-term growth. However, past growth is not always a good
22 indicator of future growth. Some metrics that might be considered here are a historical
23 growth in revenues, operating income, and net income. Since dividends are paid from

1 earnings, estimating historical earnings growth may provide an indication of future
2 earnings and dividend growth. In general, however, revenue growth tends to be more
3 consistent and predictable than earnings growth because it is less likely to be influenced by
4 accounting adjustments.⁴¹

5 B. Analyst Growth Rates

6 Analyst growth rates refer to short-term projections of earnings growth published
7 by institutional research analysts such as Value Line and Bloomberg. A more detailed
8 discussion of analyst growth rates, including the problems with using them in the DCF
9 Model to estimate utility cost of equity, is provided in a later section.

10 C. Fundamental Determinants of Growth

11 Fundamental growth determinants refer to firm-specific financial metrics that
12 arguably provide better indications of near-term sustainable growth. One such metric for
13 fundamental growth considers the return on equity and the retention ratio. The idea behind
14 this metric is that firms with high ROEs and retention ratios should have greater
15 opportunities for growth.⁴²

16 **Q. DID YOU USE ANY OF THESE GROWTH DETERMINANTS IN YOUR DCF**
17 **MODEL?**

18 A. No. Primarily, these growth determinants discussed above would provide better
19 indications of short- to mid-term growth for firms with average to high growth
20 opportunities. Utilities, however, are mature, low-growth firms. While it may not be

⁴¹ See Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 279 (3rd ed., John Wiley & Sons, Inc. 2012).

⁴² Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 279 (3rd ed., John Wiley & Sons, Inc. 2012).

1 unreasonable on its face to use any of these growth determinants for the growth input in
2 the DCF Model, we must keep in mind that the stable growth DCF Model considers only
3 sustainable growth rates, which are constrained by certain economic factors, as discussed
4 further below.

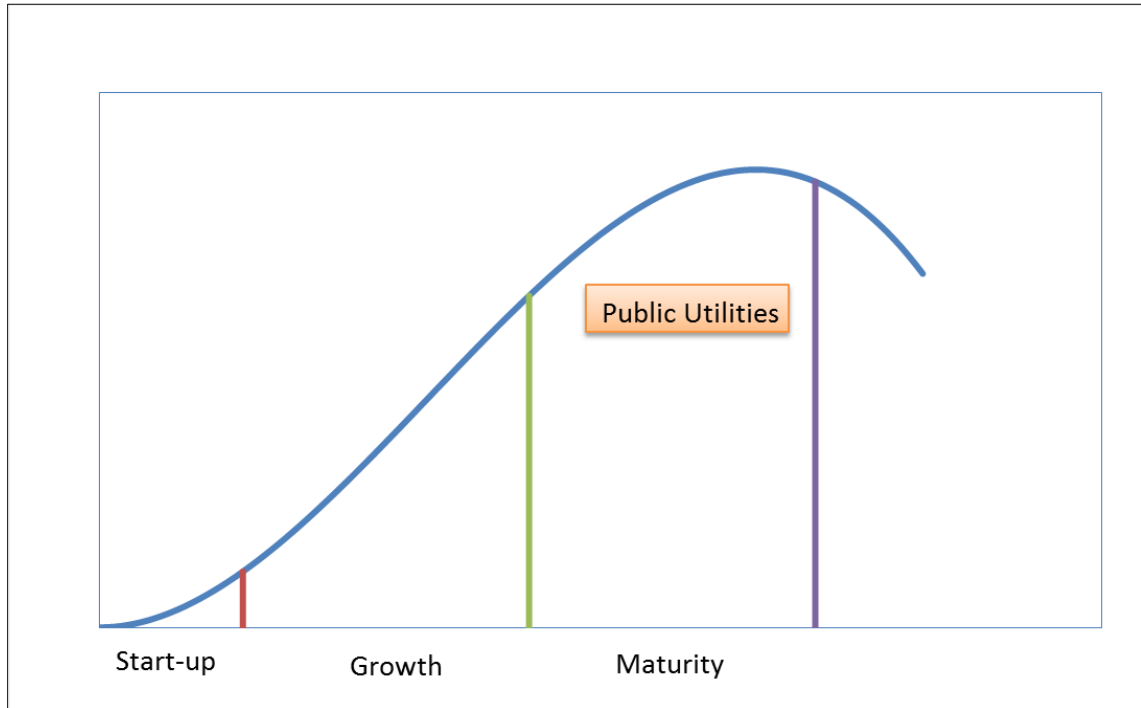
2. **Reasonable Estimates for Sustainable Growth**

5 **Q. DESCRIBE WHAT IS MEANT BY SUSTAINABLE GROWTH.**

6 A. In order to make the DCF Model a viable, practical model, an infinite stream of future cash
7 flows must be estimated and then discounted back to the present. Otherwise, each annual
8 cash flow would have to be estimated separately. Some analysts use “multi-stage” DCF
9 Models to estimate the value of high-growth firms through two or more stages of growth,
10 with the final stage of growth being sustainable. However, it is not necessary to use multi-
11 stage DCF Models to analyze the cost of equity of regulated utility companies. This is
12 because regulated utilities are already in their “sustainable,” low growth stage. Unlike
13 most competitive firms, the growth of regulated utilities is constrained by physical service
14 territories and limited primarily by ratepayer and load growth within those territories. The
15 figure below illustrates the well-known business/industry life-cycle pattern.

1
2

**Figure 6:
Industry Life Cycle**



3 In an industry's early stages, there are ample opportunities for growth and profitable
4 reinvestment. In the maturity stage however, growth opportunities diminish, and firms
5 choose to pay out a larger portion of their earnings in the form of dividends instead of
6 reinvesting them in operations to pursue further growth opportunities. Once a firm is in
7 the maturity stage, it is not necessary to consider higher short-term growth metrics in multi-
8 stage DCF Models; rather, it is sufficient to analyze the cost of equity using a stable growth
9 DCF Model with one sustainable, sustainable growth rate.

1 **Q. IS IT TRUE THAT THE SUSTAINABLE GROWTH RATE CANNOT EXCEED**
2 **THE GROWTH RATE OF THE ECONOMY, ESPECIALLY FOR A REGULATED**
3 **UTILITY COMPANY?**

4 A. Yes. A fundamental concept in finance is that no firm can grow forever at a rate higher
5 than the growth rate of the economy in which it operates.⁴³ Thus, the sustainable growth
6 rate used in the DCF Model should not exceed the aggregate economic growth rate. This
7 is especially true when the DCF Model is conducted on public utilities because these firms
8 have defined service territories. As stated by Dr. Damodaran: “[i]f a firm is a purely
9 domestic company, either because of internal constraints . . . or external constraints (such
10 as those imposed by a government), the growth rate in the domestic economy will be the
11 limiting value.”⁴⁴

12 In fact, it is reasonable to assume that a regulated utility would grow at a rate that
13 is less than the U.S. economic growth rate. Unlike competitive firms, which might increase
14 their growth by launching a new product line, franchising, or expanding into new and
15 developing markets, utility operating companies with defined service territories cannot do
16 any of these things to grow. Gross Domestic Product (“GDP”) is one of the most widely
17 used measures of economic production and is used to measure aggregate economic growth.
18 According to the Congressional Budget Office’s 2021 Long-Term Budget Outlook, the
19 long-term forecast for nominal U.S. GDP growth is 3.8%.⁴⁵

⁴³ See Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 306 (3rd ed., John Wiley & Sons, Inc. 2012).

⁴⁴ Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 306 (3rd ed., John Wiley & Sons, Inc. 2012).

⁴⁵ Congressional Budget Office, The 2021 Long-Term Budget Outlook, <https://www.cbo.gov/publication/56977>.

1 **Q. IS IT REASONABLE TO ASSUME THAT THE SUSTAINABLE GROWTH RATE**
2 **WILL NOT EXCEED THE RISK-FREE RATE?**

3 A. Yes. In the long term, the risk-free rate will converge on the growth rate of the economy.
4 For this reason, financial analysts sometimes use the risk-free rate for the sustainable
5 growth rate value in the DCF model.⁴⁶ I discuss the risk-free rate in further detail later in
6 this testimony.

7 **Q. PLEASE SUMMARIZE THE VARIOUS SUSTAINABLE GROWTH RATE**
8 **ESTIMATES THAT CAN BE USED AS THE SUSTAINABLE GROWTH RATE IN**
9 **THE DCF MODEL.**

10 A. The reasonable sustainable growth rate determinants are summarized as follows:

- 11 1. Nominal GDP Growth;
- 12 2. Real GDP Growth; and
- 13 3. Current Risk-Free Rate.

14 Any of the foregoing growth determinants could provide a basis for a reasonable input for
15 the sustainable growth rate in the DCF Model for a utility company, including FPUC.

3. **Qualitative Growth: The Problem with Analysts' Growth Rates**

16 **Q. DESCRIBE THE DIFFERENCES BETWEEN “QUANTITATIVE” AND**
17 **“QUALITATIVE” GROWTH DETERMINANTS.**

18 A. Assessing “quantitative” growth simply involves mathematically calculating a historic
19 metric for growth (such as revenues or earnings) or calculating various fundamental growth

⁴⁶ Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 307 (3rd ed., John Wiley & Sons, Inc. 2012).

1 determinants using certain figures from a firm's financial statements (such as ROE and the
2 retention ratio). However, any thorough assessment of company growth should be based
3 upon a "qualitative" analysis. Such an analysis would consider specific strategies that
4 company management will implement to achieve real sustainable growth in earnings.
5 Therefore, it is important to begin the analysis of FPUC's growth rate with this simple,
6 qualitative question: how is this regulated utility going to achieve a real sustained growth
7 in earnings? If this question were asked of a competitive firm, there could be several
8 answers depending on the type of business model, such as launching a new product line,
9 franchising, rebranding to target a new demographic, or expanding into a developing
10 market. Regulated utilities, however, cannot engage in these potential growth
11 opportunities. Generally, regulated utilities growth opportunities in their service areas are
12 limited to providing service to new customers in new or existing developments and
13 replacing or upgrading plant which I discuss in more detail below.

14 **Q. WHY IS IT ESPECIALLY IMPORTANT TO EMPHASIZE REAL,**
15 **QUALITATIVE GROWTH DETERMINANTS WHEN ANALYZING WHETHER**
16 **A GROWTH RATE IS FAIR FOR A REGULATED UTILITY?**

17 A. While qualitative growth analysis is important regardless of the entity being analyzed, it is
18 especially important in the context of utility ratemaking. This is because the rate base rate
19 of return model inherently possesses two factors that can contribute to distorted views of
20 utility growth when considered exclusively from a quantitative perspective. These two
21 factors are: (1) rate base and (2) the awarded ROE. I will discuss each factor further below.
22 It is important to keep in mind that the ultimate objective of this analysis is to provide a
23 foundation upon which to base the fair rate of return for the utility. Thus, we should strive

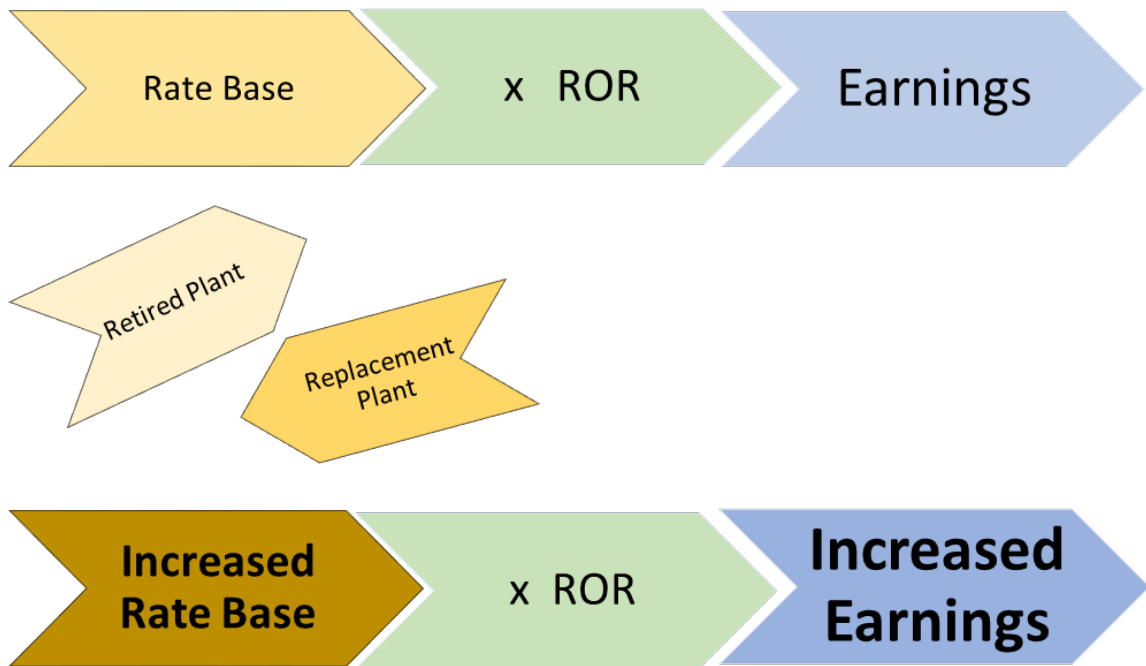
1 to ensure that each individual component of the financial models used to estimate the cost
2 of equity are also fair. If we consider only quantitative growth determinants, it may lead
3 to projected growth rates that are overstated and ultimately unfair, because they result in
4 inflated cost of equity estimates.

5 **Q. HOW DOES RATE BASE RELATE TO GROWTH DETERMINANTS FOR**
6 **UTILITIES?**

7 A. Under the rate base rate of return model, a utility's rate base is multiplied by its awarded
8 rate of return to produce the required level of operating income. Therefore, increases to
9 rate base generally result in increased earnings. Thus, utilities have a natural financial
10 incentive to increase rate base. In short, utilities have a financial incentive to increase rate
11 base regardless of whether such increases are driven by a corresponding increase in
12 demand. A good, relevant example of this is seen in the early retirement of old, but
13 otherwise functional coal plants in response to environmental regulations and replacing
14 them with new generation assets. Under these circumstances, utilities have been able to
15 increase their rate bases by a far greater extent than what any concurrent increase in demand
16 would have required. In other words, utilities grew their earnings by simply retiring old
17 assets and replacing them with new assets. This is not "real" or "sustainable" growth. If
18 the tail of a flatworm is removed and regenerated, it does not mean the flatworm actually
19 grew. Likewise, if a competitive, unregulated firm announced plans to close production
20 plants and replace them with new plants, it would not be considered a real determinant of
21 growth unless analysts believed this decision would directly result in increased market
22 share for the company and a real opportunity for sustained increases in revenues and
23 earnings. In the case of utilities, the mere replacement of "old plant" with "new plant"

1 does not increase market share, attract new ratepayers, create franchising opportunities, or
2 allow utilities to penetrate developing markets, but may result in short-term, quantitative
3 earnings growth. However, this “flatworm growth” in earnings was merely the quantitative
4 byproduct of the rate base rate of return model, and not an indication of real or qualitative
5 growth and, therefore, using that data alone to estimate a growth rate is not fair. The
6 following diagram in the figure below illustrates this concept.

7 **Figure 7:**
8 **Analysts’ Earnings Growth Projections: The “Flatworm Growth” Problem**



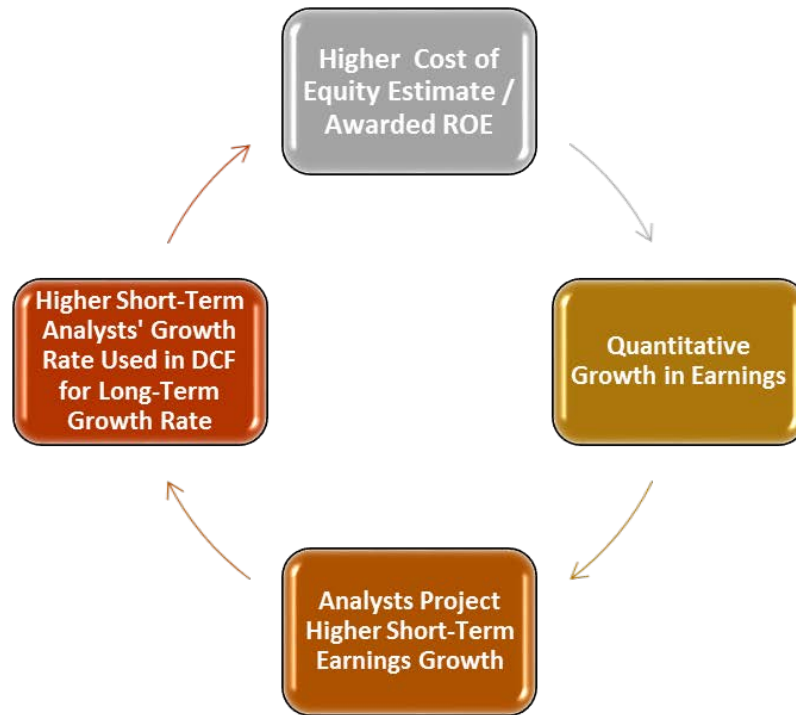
9 Of course, utilities might sometimes add “new plant” to meet a modest growth in ratepayer
10 demand. However, as the foregoing discussion demonstrates, it would be more appropriate
11 to consider load growth projections and other qualitative indicators, rather than mere
12 increases to rate base or earnings, to attain a fair assessment of growth.

1 **Q. PLEASE DISCUSS THE OTHER WAY IN WHICH ANALYSTS' EARNINGS**
2 **GROWTH PROJECTIONS DO NOT PROVIDE INDICATIONS OF REAL,**
3 **QUALITATIVE GROWTH FOR REGULATED UTILITIES.**

4 A. If we give undue weight to analysts' projections for utilities' earnings growth, it will not
5 provide an accurate reflection of real, qualitative growth because a utility's earnings are
6 heavily influenced by the ultimate figure that all this analysis is supposed to help us
7 estimate: the awarded return on equity. This creates a circular reference problem or
8 feedback loop. In other words, if a regulator awards an ROE that is above market-based
9 cost of capital (which is often the case, as discussed above), this could lead to higher short-
10 term growth rate projections from analysts. If these same inflated, short-term growth rate
11 estimates are used in the DCF Model (as they often are by utility witnesses), it could lead
12 to higher awarded ROEs; and the cycle continues, as illustrated in the figure below.

1
2

**Figure 8:
Analysts' Earnings Growth Projections: The "Circular Reference" Problem**



3 Therefore, it is not advisable to simply consider the quantitative growth projections
4 published by analysts, as this practice will not necessarily provide fair indications of real,
5 sustainable utility growth.

6 **Q. ARE THERE ANY OTHER PROBLEMS WITH RELYING ON ANALYSTS'**
7 **GROWTH PROJECTIONS?**

8 A. Yes. While the foregoing discussion shows two reasons why we cannot rely on analysts'
9 growth rate projections to provide fair, qualitative indicators of utility growth in a stable
10 growth DCF Model, the third reason is perhaps the most obvious and undisputable.
11 Various institutional analysts—such as Zacks, Value Line, and Bloomberg—publish
12 estimated projections of earnings growth for utilities. These estimates are short-term
13 growth rate projections, ranging from 3 to 10 years. However, many utility ROE analysts

1 inappropriately insert these short-term growth projections into the DCF Model as if they
2 were *long-term* growth rate projections. For example, assume that an analyst at Bloomberg
3 estimates that a utility's earnings will grow by 7% per year over the next 3 years. This
4 analyst may have based this short-term forecast on a utility's plans to replace depreciated
5 rate base (*i.e.*, "flatworm" growth) or on an anticipated awarded return that is above
6 market-based cost of equity (*i.e.*, the "circular reference" problem). When a utility witness
7 uses this figure in a DCF Model, however, it is the witness, not the Bloomberg analyst,
8 who is testifying to the regulator that the utility's earnings will qualitatively grow by 7%
9 per year over the long-term, which is an unrealistic assumption and a fundamentally
10 different conclusion than that of the Bloomberg analyst.

11 **Q. DO THE LIMITED GROWTH OPPORTUNITIES YOU DISCUSSED APPLY TO**
12 **BOTH ELECTRIC AND GAS UTILITIES?**

13 A. Yes. I have conducted cost of capital analyses on many gas and electric utilities, which
14 always include a growth rate analysis under the DCF model. In my experience, the growth
15 rates of firm-specific growth indicators, such as load growth and customer growth for both
16 gas and electric utilities, have annual growth rates that are typically less than 1%, and are
17 sometimes even negative.

4. **Sustainable Growth Rate Recommendation**

18 **Q. DESCRIBE THE GROWTH RATE INPUT USED IN YOUR DCF MODEL.**

19 A. I considered various qualitative determinants of growth for FPUC, along with the
20 maximum allowed growth rate under basic principles of finance and economics. The

1 following chart in the figure below summarizes the sustainable growth determinants
2 discussed in this section.⁴⁷

3 **Figure 9:**
4 **Sustainable Growth Rate Determinants⁴⁸**

Sustainable Growth Determinants	Rate
Nominal GDP	3.8%
Real GDP	1.8%
Risk Free Rate	3.2%
Highest	3.8%

5 For the sustainable growth rate in my DCF model, I selected the maximum, reasonable
6 sustainable growth rate of 3.8%, which means my model assumes that FPUC's qualitative
7 growth in earnings will qualitatively match the nominal growth rate of the entire U.S.
8 economy over the long run – a charitable assumption.

9 **Q. WHAT ARE THE RESULTS OF YOUR DCF MODEL USING A SUSTAINABLE**
10 **GROWTH RATE?**

11 A. Using a sustainable growth rate equal to long-term GDP growth projections, the DCF
12 indicates of cost of equity of 6.7% for FPUC.⁴⁹

⁴⁷ Exhibit DJG-5.

⁴⁸ Exhibit DJG-5.

⁴⁹ Exhibit DJG-6.

1 **Q. DID YOU ALSO CONDUCT A DCF ANALYSIS THAT CONSIDERS ANALYSTS’**
2 **SHORT-TERM GROWTH RATE ESTIMATES FOR THE SUSTAINABLE**
3 **GROWTH RATE INPUT?**

4 A. Yes. Despite my criticisms of using short-term analysts’ growth rate projections for the
5 sustainable growth rate input of the DCF Model, I also conducted a DCF analysis with such
6 an assumption in the event the Commission would like to understand the sensitivity impact
7 of this variable on the results.

8 **Q. WHAT ARE THE RESULTS OF YOUR DCF MODEL USING ANALYSTS’**
9 **SHORT-TERM GROWTH RATES?**

10 A. Using analysts’ unreasonably high short-term growth rates in the DCF model, I calculate a
11 result of 8.3% for information purposes only as I do not recommend this result should be
12 considered at all.⁵⁰

13 **C. Response to Mr. Moul’s DCF Model**

14 **Q. MR. MOUL’S DCF MODEL YIELDED A NOTABLY HIGHER RESULT. DID**
15 **YOU FIND ANY PROBLEMS WITH HIS ANALYSIS?**

16 A. Yes. Mr. Moul’s DCF Model produced cost of equity result of 11.65%, which includes a
17 “leverage adjustment” of 1.45%.⁵¹ As mentioned earlier, the results of Mr. Moul’s DCF
18 Model are overstated primarily because of a fundamental error regarding his growth rate
19 inputs and his leverage adjustment.

⁵⁰ Exhibit DJG-6.

⁵¹ Exhibit PRM-1, Sch. 1.

1 **Q. DESCRIBE THE PROBLEMS WITH MR. MOUL’S ASSUMED SUSTAINABLE**
2 **GROWTH INPUT.**

3 A. Mr. Moul assumes a sustainable growth rate of 6.75% in his DCF Model.⁵² This effectively
4 means that he assumes the Company’s earnings will grow at a rate of 6.75% per year, every
5 year, in perpetuity. In arriving at this aggregate growth rate input, Mr. Moul considered
6 growth rates as high as 10.5% for the proxy group,⁵³ which is more than two times the
7 projected annual long-term nominal U.S. GDP growth. This means Mr. Moul’s growth
8 rate assumption violates the basic principle that no company can grow at a greater rate than
9 the economy in which it operates *over the long-term*, especially a regulated utility company
10 with a defined service territory. Furthermore, Mr. Moul relies on short-term, quantitative
11 growth estimates published by analysts to support his assumptions. Mr. Moul
12 acknowledges that his growth rate projections cover only a five-year period.⁵⁴ This period
13 of time is not sufficient for a sustainable growth estimate. As discussed above, these
14 analysts’ estimates are inappropriate to use in the DCF Model as sustainable growth rates
15 because they are estimates for short-term growth. For example, Mr. Moul assumes a
16 sustainable growth rate estimate of 10.5% for NiSource Inc. (among other estimates), as
17 reported by Value Line Investment Survey.⁵⁵ This means that an analyst at Value Line
18 apparently thinks that NiSource’s earnings will quantitatively increase by 10.5% each year
19 over the next several years (*i.e.*, the short-term). However, it is Mr. Moul, not the

⁵² *Id.*

⁵³ Exhibit PRM-1, Sch. 9.

⁵⁴ Direct testimony of Paul R. Moul, pp. 29-30.

⁵⁵ Exhibit PRM-1, Sch. 9.

1 commercial analyst, who is suggesting to the Commission that (NiSource Inc.’) earnings
2 will increase by 10.5% (more than twice the level of projected U.S. GDP growth) each
3 year, every year, in perpetuity. Again, Mr. Moul is extrapolating the analyst’s conclusions
4 well beyond what the analyst actually projects. Furthermore, this assumption is simply not
5 realistic, and it contradicts fundamental concepts of sustainable growth. Many of Mr.
6 Moul’s other short-term growth rate estimates also exceed projected U.S. GDP growth.

7 **Q. PLEASE DESCRIBE MR. MOUL’S LEVERAGE ADJUSTMENT.**

8 A. According to Mr. Moul, a leverage adjustment is necessary when “the DCF return applies
9 to a capital structure used for ratemaking that is computed with book-value weighting
10 rather than market-value weighting.”⁵⁶

11 **Q. ARE YOU AWARE OF A WITNESS APPLYING A LEVERAGE ADJUSTMENT
12 LIKE THE ONE MR. MOUL IS PROPOSING?**

13 A. No. I have testified in numerous proceedings on the issue of cost of capital and other
14 regulatory issues and have reviewed extensive amounts of testimony from many witnesses
15 on cost of capital issues. Other than Mr. Moul’s proposed leverage adjustments in prior
16 cases, I cannot recall a witness applying a “leverage adjustment” in the way Mr. Moul
17 proposes. Mr. Moul is taking his base DCF cost of equity estimate and adding a significant
18 amount of basis points to it to account for “leverage,” but without a corresponding increase
19 in the Company’s ratemaking debt ratio (i.e., actual leverage). This means that essentially
20 all other ROE witnesses (representing both utilities and customers) are underestimating

⁵⁶ Direct testimony of Paul R. Moul, p. 31, lines 10-11.

1 their cost of equity estimates by the amount of a leverage adjustment, or consistent with
2 my experience Mr. Moul is overestimating his cost of equity estimate.

3 **Q. DOES THE ORIGINAL DCF MODEL HAVE AN INPUT FOR A LEVERAGE**
4 **ADJUSTMENT?**

5 A. No. The DCF model has been used by investors, analysts, managers, and academics for
6 decades to assist with pricing assets and estimate the cost of equity of various assets and
7 projects. I have not seen a variation of the DCF model in any financial textbook or other
8 reliable source that presents the model with a “leverage adjustment” input similar to the
9 way in which Mr. Moul presents the model in his testimony.

10 **Q. HAVE OTHER COMMISSIONS REJECTED MR. MOUL’S LEVERAGE**
11 **ADJUSTMENT IN PRIOR CASES?**

12 A. Yes, the Pennsylvania Commission has rejected Mr. Moul’s leverage adjustment in
13 multiple cases.⁵⁷ In PPL’s 2012 rate case, Mr. Moul proposed a substantially similar
14 leverage adjustment. The Pennsylvania Commission found that “[f]or the reasons
15 developed by the OCA and I&E, the Company’s leverage adjustment should be denied.”⁵⁸
16 In FPUC’s (no relation to the Florida Company) 2020 base rate case and PECO Gas’ 2020
17 base rate case, the Pennsylvania Commission allowed ROEs based upon DCF dividend
18 yield and growth rate inputs, without leverage adjustments.⁵⁹ In Aqua PA’s recent base

⁵⁷ *Pa. P.U.C. v. PPL Elec. Util. Corp.*, Docket No. R-2012-2290597, Order at 52 (Dec. 28, 2012),

⁵⁸ *Id.* at p. 52.

⁵⁹ *Pa. P.U.C. v. FPUC Gas of Pennsylvania, Inc.*, Docket No. R-2020-3018835, Order at 141 (Feb. 19, 2021) (FPUC 2020 Order). *Pa. P.U.C. v. PECO Energy – Gas Div.*, Docket No. R-2020-3018929, Order at 151-152 (June 22, 2021) (PECO 2020 Order).

1 rate case, the Pennsylvania Commission denied Aqua PA's request to include a leverage
2 adjustment as contrary to the public interest.⁶⁰

3 **Q. HAVE OTHER COMMISSIONS REJECTED MR. MOUL'S LEVERAGE**
4 **ADJUSTMENT?**

5 A. Yes. Recently, in the Application of Palmetto Wastewater Reclamation ("PWR"), the
6 Public Service Commission of South Carolina rejected Mr. Moul's leverage adjustment.⁶¹
7 Relying in part on my testimony in the PWR case, the South Carolina commission agreed
8 that "Mr. Moul's 0.97% leverage adjustment is not appropriate."⁶²

9 **Q. DO YOU AGREE WITH MR. MOUL'S LEVERAGE ADJUSTMENT?**

10 A. No. Mr. Moul's proposed leverage adjustment is entirely unnecessary and inappropriate,
11 and it has the effect of further inflating a DCF result that is already overestimated. Mr.
12 Moul's leverage adjustment is based on the Hamada formula, which is further discussed
13 below.

14 **Q. WHAT IS THE PREMISE OF THE HAMADA FORMULA?**

15 A. The Hamada formula can be used to analyze changes in a firm's cost of capital as it adds
16 or reduces financial leverage, or debt, in its capital structure by starting with an "unlevered"
17 beta and then "relevering" the beta at different debt ratios. As leverage increases, equity
18 investors bear increasing amounts of risk, leading to higher betas. Before the effects of
19 financial leverage can be accounted for, however, the effects of leverage must first be

⁶⁰ *Pa. P.U.C. v. Aqua Pennsylvania, Inc., et al.*, Docket Nos., R-2021-3027385, R-2021-3027386, Order at 166-167 (May 16, 2022) (Aqua 2021 Order).

⁶¹ *In re Application of Palmetto Wastewater Reclamation, Inc. for an Adjustment of Rates and Charges*, 2021 S.C. PUC LEXIS *1, *23 (Dec. 21, 2021).

⁶² *Id.*

1 removed, which is accomplished through the Hamada formula. The Hamada formula for
2 unlevering beta is stated as follows:⁶³

3 **Equation 2:**
4 **Hamada Formula**

$$\beta_U = \frac{\beta_L}{\left[1 + (1 - T_c) \left(\frac{D}{E}\right)\right]}$$

where: β_U = unlevered beta (or "asset" beta)
 β_L = average levered beta of proxy group
 T_c = corporate tax rate
 D = book value of debt
 E = book value of equity

5 Using this equation, the beta for the firm can be unlevered, and then "relevered" based on
6 various debt ratios (by rearranging this equation to solve for β_L).

7 **Q. DID MR. MOUL APPLY THE HAMADA FORMULA CORRECTLY?**

8 A. No. Mr. Moul's application of the Hamada formula is incorrect. I conducted the Hamada
9 Model and present my results in my exhibits.⁶⁴ Using the Company's proposed capital
10 structure and the levered betas published by Value Line, I calculate an unlevered beta of
11 0.51. When that beta is relevered to the proxy group debt ratio of 52%, I calculate a cost
12 of equity of 8.49% for illustration purposes.⁶⁵ The indicated cost of equity from the
13 financial models are necessarily connected to the capital structures of the proxy group. In
14 other words, the fact that FPUC has proposed a debt ratio that is lower than the average
15 debt ratio of the proxy group should not necessarily result in an increase in the Company's
16 indicated cost of equity when the proxy beta is "unlevered" based on FPUC's unreasonably

⁶³ Damodaran *supra* n. 18, at 197. This formula was originally developed by Hamada in 1972.

⁶⁴ See Exhibit DJG-16.

⁶⁵ *Id.*

1 low debt ratio, and then relevered to the debt ratio of the proxy group that was influencing
2 the other cost of equity model inputs relied upon. The indicated cost of equity should only
3 increase with leverage if we actually increase the Company's proposed debt ratio, as I have
4 demonstrated in the Hamada formula. The Commission should reject Mr. Moul's leverage
5 adjustment in this case, as it has done in prior cases.

6 **VIII. CAPM ANALYSIS**

7 **Q. DESCRIBE THE CAPM.**

8 A. The CAPM is a market-based model founded on the principle that investors expect higher
9 returns for incurring additional risk.⁶⁶ The CAPM estimates this expected return. The
10 various assumptions, theories, and equations involved in the CAPM are discussed further
11 in Exhibit DJG-23 - Appendix B. Using the CAPM to estimate the cost of equity of a
12 regulated utility is consistent with the legal standards governing the fair rate of return. The
13 U.S. Supreme Court has recognized that "the amount of risk in the business is a most
14 important factor" in determining the allowed rate of return,⁶⁷ and that "the return to the
15 equity owner should be commensurate with returns on investments in other enterprises
16 having corresponding risks."⁶⁸ The CAPM is a useful model because it directly considers
17 the amount of risk inherent in a business.

⁶⁶ William F. Sharpe, *A Simplified Model for Portfolio Analysis* 277-93 (Management Science IX 1963).

⁶⁷ *Wilcox*, 212 U.S. at 48.

⁶⁸ *Hope Natural Gas Co.*, 320 U.S. at 603.

1 **Q. DESCRIBE THE INPUTS FOR THE CAPM.**

2 A. The basic CAPM equation requires only three inputs to estimate the cost of equity: (1) the
3 risk-free rate; (2) the beta coefficient; and (3) the equity risk premium. Here is the CAPM
4 formula:

5 **Equation 3:**
6 **Basic CAPM**

7
$$\text{Cost of Equity} = \text{Risk-free Rate} + (\text{Beta} \times \text{Equity Risk Premium})$$

8 Each input is discussed separately below.

9 **A. The Risk-Free Rate**

10 **Q. EXPLAIN THE RISK-FREE RATE.**

11 A. The first term in the CAPM is the risk-free rate (R_F). The risk-free rate is simply the level
12 of return investors can achieve without assuming any risk. The risk-free rate represents the
13 bare minimum return that any investor would require on a risky asset. Even though no
14 investment is technically void of risk, investors often use U.S. Treasury securities to
15 represent the risk-free rate because they accept that those securities essentially contain no
16 default risk. The Treasury issues securities with different maturities, including short-term
17 Treasury bills, intermediate-term Treasury notes, and long-term Treasury bonds.

18 **Q. IS IT PREFERABLE TO USE THE YIELD ON LONG-TERM TREASURY BONDS**
19 **FOR THE RISK-FREE RATE IN THE CAPM?**

20 A. Yes. In valuing an asset, investors estimate cash flows over long periods of time. Common
21 stock is viewed as a long-term investment, and the cash flows from dividends are assumed
22 to last indefinitely. Thus, short-term Treasury bill yields are rarely used in the CAPM to
23 represent the risk-free rate. Short-term rates are subject to greater volatility and thus can

1 lead to unreliable estimates. Instead, long-term Treasury bonds are usually used to
2 represent the risk-free rate in the CAPM. I considered a 30-day average of daily Treasury
3 yield curve rates on 30-year Treasury bonds in my risk-free rate estimate, which resulted
4 in a risk-free rate of 3.2%.⁶⁹

5 **B. The Beta Coefficient**

6 **Q. HOW IS THE BETA COEFFICIENT USED IN THIS MODEL?**

7 A. As discussed above, beta represents the sensitivity of a given security to movements in the
8 overall market. The CAPM states that in efficient capital markets, the expected risk
9 premium on each investment is proportional to its beta. Recall that a security with a beta
10 greater (or less) than one is more (or less) risky than the market portfolio. An index such
11 as the S&P 500 Index is used as a proxy for the market portfolio. The historical betas for
12 publicly traded firms are published by various institutional analysts. Beta may also be
13 calculated through a linear regression analysis, which provides additional statistical
14 information about the relationship between a single stock and the market portfolio. As
15 discussed above, beta also represents the sensitivity of a given security to the market as a
16 whole. The market portfolio of all stocks has a beta equal to one. Stocks with betas greater
17 than 1.0 are relatively more sensitive to market risk than the average stock. For example,
18 if the market increases (or decreases) by 1.0%, a stock with a beta of 1.5 will, on average,
19 increase (or decrease) by 1.5%. In contrast, stocks with betas of less than 1.0 are less
20 sensitive to market risk. For example, if the market increases (or decreases) by 1.0%, a
21 stock with a beta of 0.5 will, on average, only increase (or decrease) by 0.5%.

⁶⁹ Exhibit DJG-7.

1 **Q. DESCRIBE THE SOURCE FOR THE BETAS YOU USED IN YOUR CAPM**
2 **ANALYSIS.**

3 A. I used betas recently published by Value Line Investment Survey. The average beta for
4 the proxy group is less than 1.0. Thus, this is an objective measure to prove the well-known
5 concept that utility stocks are generally less risky than the average stock in the market.
6 While there is evidence suggesting that betas published by sources such as Value Line may
7 actually overestimate the risk of utilities (and thus overestimate the CAPM), I used the
8 betas published by Value Line to be conservative.⁷⁰

9 **C. The Equity Risk Premium**

10 **Q. DESCRIBE THE EQUITY RISK PREMIUM (ERP).**

11 A. The final term of the CAPM is the ERP, which is the required return on the market portfolio
12 less the risk-free rate ($R_M - R_F$). In other words, the ERP is the level of return investors
13 expect above the risk-free rate in exchange for investing in risky securities. Many experts
14 would agree that “the single most important variable for making investment decisions is
15 the equity risk premium.”⁷¹ Likewise, the ERP is arguably the single most important factor
16 in estimating the cost of capital in this matter. There are three basic methods that can be
17 used to estimate the ERP: (1) calculating a historical average; (2) taking a survey of
18 experts; and (3) calculating the implied ERP. I will discuss each method in turn, noting
19 advantages and disadvantages of these methods.

⁷⁰ Exhibit DJG-8; *see also* Exhibit DJG-23 - Appendix B for a more detailed discussion of raw beta calculations and adjustments.

⁷¹ Elroy Dimson, Paul Marsh & Mike Staunton, *Triumph of the Optimists: 101 Years of Global Investment Returns* 4 (Princeton University Press 2002).

1. Historical Average

1 **Q. DESCRIBE THE HISTORICAL ERP.**

2 A. The historical ERP may be calculated by simply taking the difference between returns on
3 stocks and returns on government bonds over a certain period of time. Many practitioners
4 rely on the historical ERP as an estimate for the forward-looking ERP because it is easy to
5 obtain. However, there are disadvantages to relying on the historical ERP.

6 **Q. WHAT ARE THE LIMITATIONS OF RELYING SOLELY ON A HISTORICAL
7 AVERAGE TO ESTIMATE THE CURRENT OR FORWARD-LOOKING ERP?**

8 A. Many investors use the historic ERP because it is convenient and easy to calculate. What
9 matters in the CAPM model, however, is not the actual risk premium from the past, but
10 rather the current and forward-looking risk premium.⁷² Some investors may think that a
11 historic ERP provides some indication of the prospective risk premium; however, there is
12 empirical evidence to suggest the prospective, forward-looking ERP is actually lower than
13 the historical ERP. In a landmark publication on risk premiums around the world, *Triumph
14 of the Optimists*, the authors suggest through extensive empirical research that the
15 prospective ERP is lower than the historical ERP.⁷³ This is due in large part to what is
16 known as “survivorship bias” or “success bias” – a tendency for failed companies to be
17 excluded from historical indices.⁷⁴ From their extensive analysis, the authors make the
18 following conclusion regarding the prospective ERP: “[t]he result is a forward-looking,

⁷² See John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 330 (3rd ed., South Western Cengage Learning 2010).

⁷³ See John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 194 (3rd ed., South Western Cengage Learning 2010).

⁷⁴ Elroy Dimson, Paul Marsh & Mike Staunton, *Triumph of the Optimists: 101 Years of Global Investment Returns* 34 (Princeton University Press 2002).

1 geometric mean risk premium for the United States . . . of around 2½ to 4 percent and an
2 arithmetic mean risk premium . . . that falls within a range from a little below 4 to a little
3 above 5 percent.”⁷⁵ Indeed, these results are lower than many reported historical risk
4 premiums. Other noted experts agree:

5 The historical risk premium obtained by looking at U.S. data is biased
6 upwards because of survivor bias. . . . The true premium, it is argued, is
7 much lower. This view is backed up by a study of large equity markets over
8 the twentieth century (*Triumph of the Optimists*), which concluded that the
9 historical risk premium is closer to 4%.⁷⁶

10 Regardless of the variations in historic ERP estimates, many scholars and practitioners
11 agree that simply relying on a historic ERP to estimate the risk premium going forward is
12 not ideal. Fortunately, “a naïve reliance on long-run historical averages is not the only
13 approach for estimating the expected risk premium.”⁷⁷

14 **Q. DID YOU RELY ON THE HISTORICAL ERP AS PART OF YOUR CAPM**
15 **ANALYSIS IN THIS CASE?**

16 A. No. Due to the limitations of this approach, I relied on the ERP reported in expert surveys
17 and the implied ERP method discussed below.

2. Expert Surveys

18 **Q. DESCRIBE THE EXPERT SURVEY APPROACH TO ESTIMATING THE ERP.**

19 A. As its name implies, the expert survey approach to estimating the ERP involves conducting
20 a survey of experts including professors, analysts, chief financial officers, and other

⁷⁵ Elroy Dimson, Paul Marsh & Mike Staunton, *Triumph of the Optimists: 101 Years of Global Investment Returns* 194 (Princeton University Press 2002).

⁷⁶ Aswath Damodaran, *Equity Risk Premiums: Determinants, Estimation and Implications – The 2015 Edition* 17 (New York University 2015).

⁷⁷ See John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 330 (3rd ed., South Western Cengage Learning 2010).

1 executives around the country and asking them what they think the ERP is. The IESE
2 Business School conducts such a survey each year. Their 2022 expert survey reported an
3 average ERP of 5.6%.⁷⁸

3. Implied ERP

4 Q. DESCRIBE THE IMPLIED ERP APPROACH.

5 A. The third method of estimating the ERP is arguably the best. The implied ERP relies on
6 the stable growth model proposed by Gordon, often called the “Gordon Growth Model,”
7 which is a basic stock valuation model widely used in finance for many years.⁷⁹ This model
8 is a mathematical derivation of the DCF Model. In fact, the underlying concept in both
9 models is the same: the current value of an asset is equal to the present value of its future
10 cash flows. Instead of using this model to determine the discount rate of one company,
11 one can use it to determine the discount rate for the entire market by substituting the inputs
12 of the model. Specifically, instead of using the current stock price (P_0), one will use the
13 current value of the S&P 500 (V_{500}). Similarly, instead of using the dividends of a single
14 firm, one will consider the dividends paid by the entire market. Additionally, one should
15 consider potential dividends. In other words, stock buybacks should be considered in
16 addition to paid dividends, as stock buybacks represent another way for the firm to transfer
17 free cash flow to shareholders. Focusing on dividends alone without considering stock

⁷⁸ Pablo Fernandez, Pablo Linares & Isabel F. Acin, *Market Risk Premium used in 171 Countries in 2016: A Survey with 6,932 Answers*, at 3 (IESE Business School 2015), copy available at <http://www.valumonics.com/wp-content/uploads/2017/06/Discount-rate-Pablo-Fern%C3%A1ndez.pdf>. IESE Business School is the graduate business school of the University of Navarra. IESE offers Master of Business Administration (MBA), Executive MBA and Executive Education programs. IESE is consistently ranked among the leading business schools in the world.

⁷⁹ Myron J. Gordon and Eli Shapiro, *Capital Equipment Analysis: The Required Rate of Profit* 102–10 (Management Science Vol. 3, No. 1 Oct. 1956).

1 buybacks could understate the cash flow component of the model, and ultimately
 2 understate the implied ERP. The market dividend yield plus the market buyback yield
 3 gives us the gross cash yield to use as our cash flow in the numerator of the discount model.
 4 This gross cash yield is increased each year over the next five years by the growth rate.
 5 These cash flows must be discounted to determine their present value. The discount rate
 6 in each denominator is the risk-free rate (R_F) plus the discount rate (K). The following
 7 formula shows how the implied return is calculated. Since the current value of the S&P is
 8 known, one can solve for K : the implied market return.⁸⁰

9 **Equation 4:**
 10 **Implied Market Return**

11
$$V_{500} = \frac{CY_1(1+g)^1}{(1+R_F+K)^1} + \frac{CY_2(1+g)^2}{(1+R_F+K)^2} + \dots + \frac{CY_5(1+g)^5 + TV}{(1+R_F+K)^5}$$

where: V_{500} = current value of index (S&P 500)
 CY_{1-5} = average cash yield over last ten years (includes dividends and buybacks)
 g = compound growth rate in earnings over last five years
 R_F = risk-free rate
 K = implied market return (this is what we are solving for)
 TV = terminal value = $CY_5(1+R_F)/K$

12 The discount rate is called the “implied” return here because it is based on the current value
 13 of the index as well as the value of free cash flow to investors projected over the next five
 14 years. Thus, based on these inputs, the market is “implying” the expected return; or in
 15 other words, based on the current value of all stocks (the index price), and the projected
 16 value of future cash flows, the market is telling us the return expected by investors for
 17 investing in the market portfolio. After solving for the implied market return (K), one
 18 simply subtracts the risk-free rate from it to arrive at the implied ERP.

⁸⁰ See Exhibit DJG-9 for detailed calculation.

1 **Equation 5:**
2 **Implied Equity Risk Premium**

3
$$\text{Implied Expected Market Return} - R_F = \text{Implied ERP}$$

4 **Q. DISCUSS THE RESULTS OF YOUR IMPLIED ERP CALCULATION.**

5 A. After collecting data for the index value, operating earnings, dividends, and buybacks for
6 the S&P 500 over the past six years, I calculated the dividend yield, buyback yield, and
7 gross cash yield for each year. I also calculated the compound annual growth rate (g) from
8 operating earnings. I used these inputs, along with the risk-free rate and current value of
9 the index to calculate a current expected return on the entire market of 8.8%. I subtracted
10 the risk-free rate to arrive at the implied equity risk premium of 5.8%.⁸¹ Dr. Damodaran,
11 one of the world's leading experts on the ERP, promotes the implied ERP method discussed
12 above. He calculates monthly and annual implied ERPs with this method and publishes
13 his results. Dr. Damodaran's average ERP estimate for May 2022 using several implied
14 ERP variations was 5.5%.⁸²

15 **Q. WHAT ARE THE RESULTS OF YOUR FINAL ERP ESTIMATE?**

16 A. For the final ERP estimate I used in my CAPM analysis, I considered the results of the
17 ERP surveys along with the implied ERP calculations and the ERP reported by Kroll
18 (formerly Duff & Phelps).⁸³ The results are presented in the following figure:

⁸¹ Exhibit DJG-9.

⁸² Aswath Damodaran, *Implied Equity Risk Premium Update*, DAMODARAN ONLINE
<http://pages.stern.nyu.edu/~adamodar/>.

⁸³ Exhibit DJG-10.

1
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**Figure 10:
Equity Risk Premium Results**

IESE Business School Survey	5.6%
Kroll (formerly Duff & Phelps)	5.5%
Damodaran (average)	5.5%
Garrett	5.8%
Average	5.6%

3 The average ERP from these sources is 5.6%.

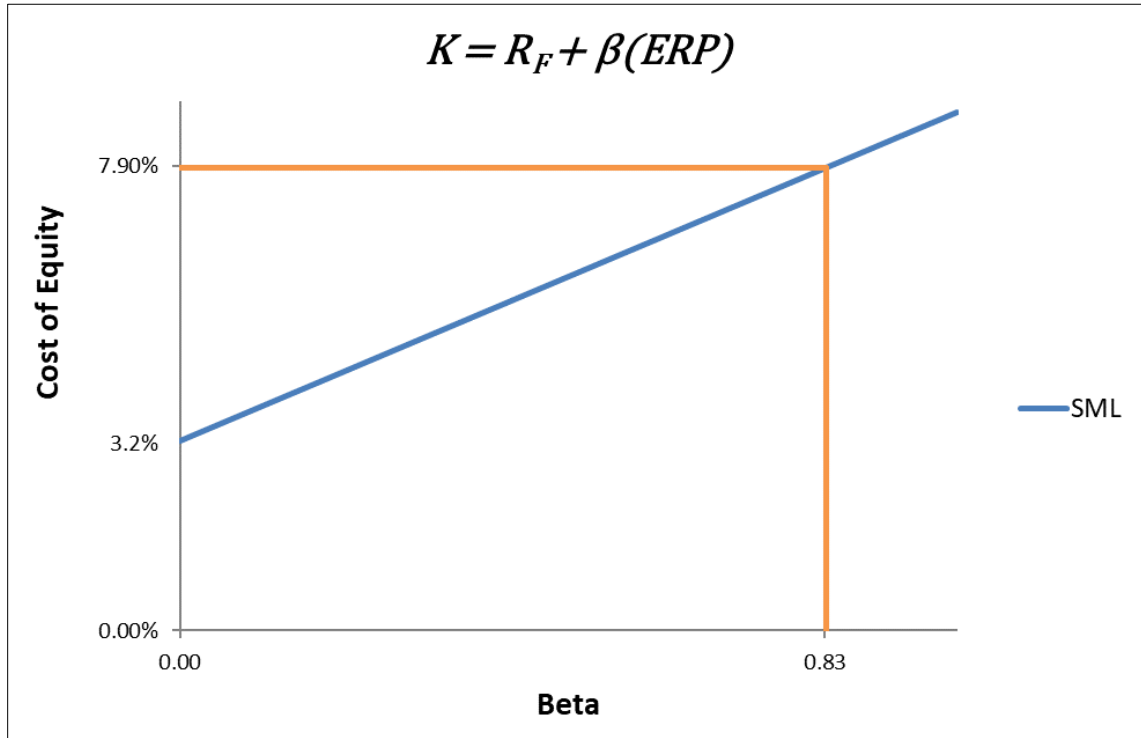
4 **Q. PLEASE EXPLAIN THE FINAL RESULTS OF YOUR CAPM ANALYSIS.**

5 A. Using the inputs for the risk-free rate, beta coefficient, and ERP discussed above, I estimate
6 that FPUC's CAPM cost of equity is 7.9%.⁸⁴ The CAPM may be displayed graphically
7 through what is known as the Security Market Line ("SML"). The following figure shows
8 the expected return (cost of equity) on the y-axis, and the average beta for the proxy group
9 on the x-axis. The SML intercepts the y-axis at the level of the risk-free rate. The slope
10 of the SML is the equity risk premium.

⁸⁴ Exhibit DJG-11.

1
2

**Figure 11:
CAPM Graph**



3 The SML provides the rate of return that will compensate investors for the beta risk of that
4 investment. Thus, at an average beta of 0.83 for the proxy group, the estimated CAPM
5 cost of equity for FPUC is 7.9%.

6 **D. Response to Mr. Moul's CAPM Analysis**

7 **Q. MR. MOUL'S CAPM ANALYSIS YIELDS NOTABLY HIGHER RESULTS. DID**
8 **YOU FIND SPECIFIC PROBLEMS WITH MR. MOUL'S CAPM ASSUMPTIONS**
9 **AND INPUTS?**

10 A. Yes, I did. Mr. Moul estimates a CAPM cost of equity of 14.41%.⁸⁵ Mr. Moul has
11 overestimated several inputs to the CAPM, including beta and the equity risk premium. He

⁸⁵ Exhibit PRM-1, Sch. 1.

1 also includes an inappropriate size premium in his model. Each of these problems is
2 discussed further below.

1. Beta

3 **Q. DESCRIBE MR. MOUL'S BETA INPUT TO THE CAPM.**

4 A. Mr. Moul used a beta of 1.04 in his CAPM.⁸⁶ This beta is much higher than the average
5 beta of Mr. Moul's proxy group as reported by Value Line, which is only 0.83.⁸⁷ The
6 difference between a beta of 0.83 and 1.04 is significant, especially considering the fact
7 that the beta of the entire market is 1.0. The betas reported by Value Line show that the
8 proxy group is less risky than the market average, while the inflated beta derived by Mr.
9 Moul would indicate the proxy group of utilities is riskier than the market average. Mr.
10 Moul is essentially suggesting that the betas published by Value Line, an objective and
11 widely-used source in utility regulation, are notably underestimated.

12 **Q. DO YOU AGREE WITH MR. MOUL'S BETA INPUT?**

13 A. No. By using a beta of 1.04, Mr. Moul is implying that FPUC is riskier than the market
14 portfolio of stocks in the U.S. market. Such a proposition contradicts any objective or
15 intuitive understanding of a regulated utility's position and operations. In fact, it is more
16 accurate to say that FPUC, and its utility peers, are among the least risky companies in the
17 world. FPUC is a regulated monopoly with a captive customer base who provides an
18 essential product with a relatively inelastic demand – operating under a regulatory
19 framework that would essentially prevent it from experiencing financial failure.

⁸⁶ *Id.*

⁸⁷ Exhibit DJG-8.

1 Competitive firms in the market do not enjoy the same risk-mitigating framework and
2 protections. I have also discussed my disagreement with Mr. Moul's beta input from a
3 technical perspective when I addressed his leverage adjustment above. In short, it is
4 inappropriate to use Value Line betas as a starting point and then increase them to account
5 for leverage. The Commission should reject Mr. Moul's CAPM results for his beta input
6 alone. However, his estimate for the ERP is also unreasonably high, as further discussed
7 below.

2. Equity Risk Premium

8 **Q. DID MR. MOUL RELY ON A REASONABLE MEASURE FOR THE ERP?**

9 A. No, he did not. Mr. Moul used an input of 10.23% for the ERP, which is not realistic.⁸⁸

10 The ERP is one of three inputs in the CAPM equation, and it is one of the most important
11 factors for estimating the cost of equity in this case. As discussed above, I used three
12 widely accepted methods for estimating the ERP, including consulting expert surveys,
13 calculating the implied ERP based on aggregate market data, and considering the ERPs
14 published by reputable analysts. The highest ERP found from my research and analysis is
15 only 5.8%.

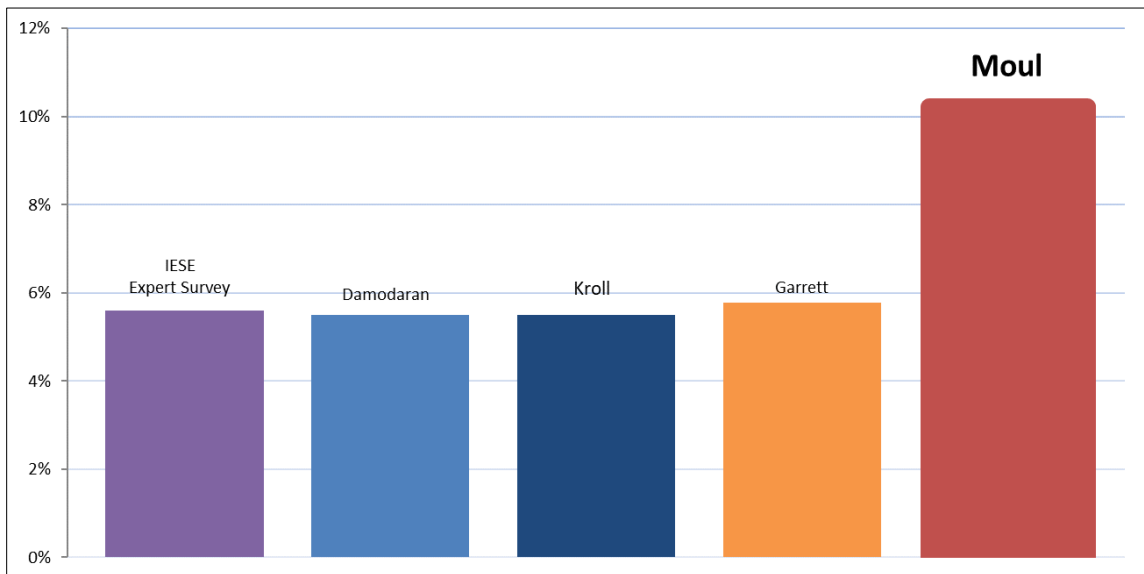
16 **Q. PLEASE DISCUSS AND ILLUSTRATE HOW MR. MOUL'S ERP COMPARES** 17 **WITH OTHER ESTIMATES FOR THE ERP.**

18 A. The 2022 IESE Business School expert survey reports an average ERP of 5.6%. Similarly,
19 Kroll (formerly Duff & Phelps) recently estimated an ERP of 5.5%. Dr. Damodaran, a

⁸⁸ Exhibit PRM-1, Sch. 1.

1 leading expert on the ERP, recently estimated an average ERP of only 5.5%.⁸⁹ The chart
2 in the following figure illustrates that Mr. Moul's ERP estimate is far out of line with other
3 reasonable, objective estimates for the ERP.⁹⁰

4 **Figure 12:**
5 **Equity Risk Premium Comparison**



6 When compared with other independent sources for the ERP, as well as my estimate, Mr.
7 Moul's ERP estimate is clearly not within the range of reasonableness. As a result, his
8 CAPM cost of equity estimate is overstated.

3. Size Premium

9 **Q. DESCRIBE MR. MOUL'S SIZE PREMIUM ADJUSTMENT TO HIS CAPM.**

10 A. Mr. Moul adds 1.02% to his CAPM on the basis that FPUC is smaller than the proxy
11 group.⁹¹

⁸⁹ Aswath Damodaran, *Implied Equity Risk Premium Update*, DAMODARAN ONLINE, <http://pages.stern.nyu.edu/~adamodar/>. Dr. Damodaran estimates several ERPs using various assumptions.

⁹⁰ The ERP estimated by Dr. Damodaran is the average of several ERP estimates using different assumptions.

⁹¹ Exhibit PRM-1, Sch. 1.

1 **Q. DO YOU AGREE WITH MR. MOUL’S SIZE PREMIUM?**

2 A. No. The “size effect” phenomenon arose from a 1981 study conducted by Banz, which
3 found that “in the 1936 – 1975 period, the common stock of small firms had, on average,
4 higher risk-adjusted returns than the common stock of large firms.”⁹² According to
5 Ibbotson, Banz’s size effect study was “[o]ne of the most remarkable discoveries of modern
6 finance.”⁹³ Perhaps there was some merit to this idea at the time, but the size effect
7 phenomenon was short lived. Banz’s 1981 publication generated much interest in the size
8 effect and spurred the launch of significant new small cap investment funds. However,
9 this “honeymoon period lasted for approximately two years. . . .”⁹⁴ After 1983, U.S. small-
10 cap stocks actually underperformed relative to large cap stocks. In other words, the size
11 effect essentially reversed. In *Triumph of the Optimists*, the authors conducted an extensive
12 empirical study of the size effect phenomenon around the world. They found that after the
13 size effect phenomenon was discovered in 1981, it disappeared within a few years:

14 It is clear . . . that there was a global reversal of the size effect in virtually
15 every country, with the size premium not just disappearing but going into
16 reverse. Researchers around the world universally fell victim to Murphy’s
17 Law, with the very effect they were documenting – and inventing
18 explanations for – promptly reversing itself shortly after their studies were
19 published.⁹⁵

20 In other words, the authors assert that the very discovery of the size effect phenomenon
21 likely caused its own demise. The authors ultimately concluded that it is “inappropriate to

⁹² Rolf W. Banz, *The Relationship Between Return and Market Value of Common Stocks* 3-18 (Journal of Financial Economics 9 (1981)).

⁹³ 2015 Ibbotson Stocks, Bonds, Bills, and Inflation Classic Yearbook 99 (Morningstar 2015).

⁹⁴ Elroy Dimson, Paul Marsh & Mike Staunton, *Triumph of the Optimists: 101 Years of Global Investment Returns* 131 (Princeton University Press 2002).

⁹⁵ *Id.* at 133.

1 use the term ‘size effect’ to imply that we should automatically expect there to be a small-
2 cap premium,” yet, this is exactly what utility witnesses often do in attempting to
3 artificially inflate the cost of equity with a size premium. Other prominent sources have
4 agreed that the size premium is a dead phenomenon. According to Ibbotson:

5 The unpredictability of small-cap returns has given rise to another argument
6 against the existence of a size premium: that markets have changed so that
7 the size premium no longer exists. As evidence, one might observe the last
8 20 years of market data to see that the performance of large-cap stocks was
9 basically equal to that of small cap stocks. In fact, large-cap stocks have
10 outperformed small-cap stocks in five of the last 10 years.⁹⁶

11 In addition to the studies discussed above, other scholars have concluded similar results.

12 According to Kalesnik and Beck:

13 Today, more than 30 years after the initial publication of Banz’s paper, the
14 empirical evidence is extremely weak even before adjusting for possible
15 biases. . . . The U.S. long-term size premium is driven by the extreme
16 outliers, which occurred three-quarters of a century ago. . . . Finally,
17 adjusting for biases . . . makes the size premium vanish. If the size premium
18 were discovered today, rather than in the 1980s, it would be challenging to
19 even publish a paper documenting that small stocks outperform large
20 ones.⁹⁷

21 For all of these reasons, the Commission should reject the arbitrary size premium proposed
22 by the Company.

23 **Q. HAVE OTHER COMMISSIONS RECENTLY REJECTED MR. MOUL’S SIZE**
24 **ADJUSTMENT?**

25 A. Yes. Recently, in the Application of Palmetto Wastewater Reclamation (“PWR”), the
26 Public Service Commission of South Carolina rejected Mr. Moul’s size premium

⁹⁶ 2015 Ibbotson Stocks, Bonds, Bills, and Inflation Classic Yearbook 112 (Morningstar 2015).

⁹⁷ Vitali Kalesnik and Noah Beck, *Busting the Myth About Size* (Research Affiliates 2014), available at https://www.researchaffiliates.com/Our%20Ideas/Insights/Fundamentals/Pages/284_Busting_the_Myth_About_Size.aspx (emphasis added).

1 adjustment.⁹⁸ Relying in part on my testimony in the PWR case, the South Carolina
2 commission agreed that “Mr. Moul’s 1.02% size adjustment is not appropriate.”⁹⁹

3 **IX. OTHER COST OF EQUITY ISSUES**

4 **Q. ARE THERE ANY OTHER ISSUES RAISED IN THE COMPANY’S TESTIMONY**
5 **TO WHICH YOU WOULD LIKE TO RESPOND?**

6 A. Yes. In his testimony, Mr. Moul suggests that certain firm-specific risks and other factors
7 should have an increasing effect on the cost of equity, apparently beyond that which is
8 indicated by the CAPM and DCF Model. Mr. Moul also relies on comparable and expected
9 earnings to support his cost of equity estimate. Finally, Mr. Moul also suggests that
10 flotation costs should have an increasing effect on FPUC’s authorized ROE.

11 **A. Firm-Specific Business Risks**

12 **Q. DESCRIBE MR. MOUL’S TESTIMONY REGARDING BUSINESS RISKS.**

13 A. In his Direct Testimony, Mr. Moul suggests that the Company is exposed to additional
14 risks beyond those inherent in the proxy group. According to Mr. Moul, such risks include
15 competition, economic regulation, and the business cycle, among other risks.¹⁰⁰

⁹⁸ Order issued December 21, 2021, Application of Palmetto Wastewater Reclamation, before the Public Service Commission of South Carolina, p. 24.

⁹⁹ *Id.*

¹⁰⁰ *See* Direct testimony of Paul R. Moul, pp. 9-12.

1 **Q. DO YOU AGREE WITH MR. MOUL THAT THESE FIRM-SPECIFIC RISK**
2 **FACTORS SHOULD INFLUENCE FPUC’S COST OF EQUITY OR AWARDED**
3 **ROE?**

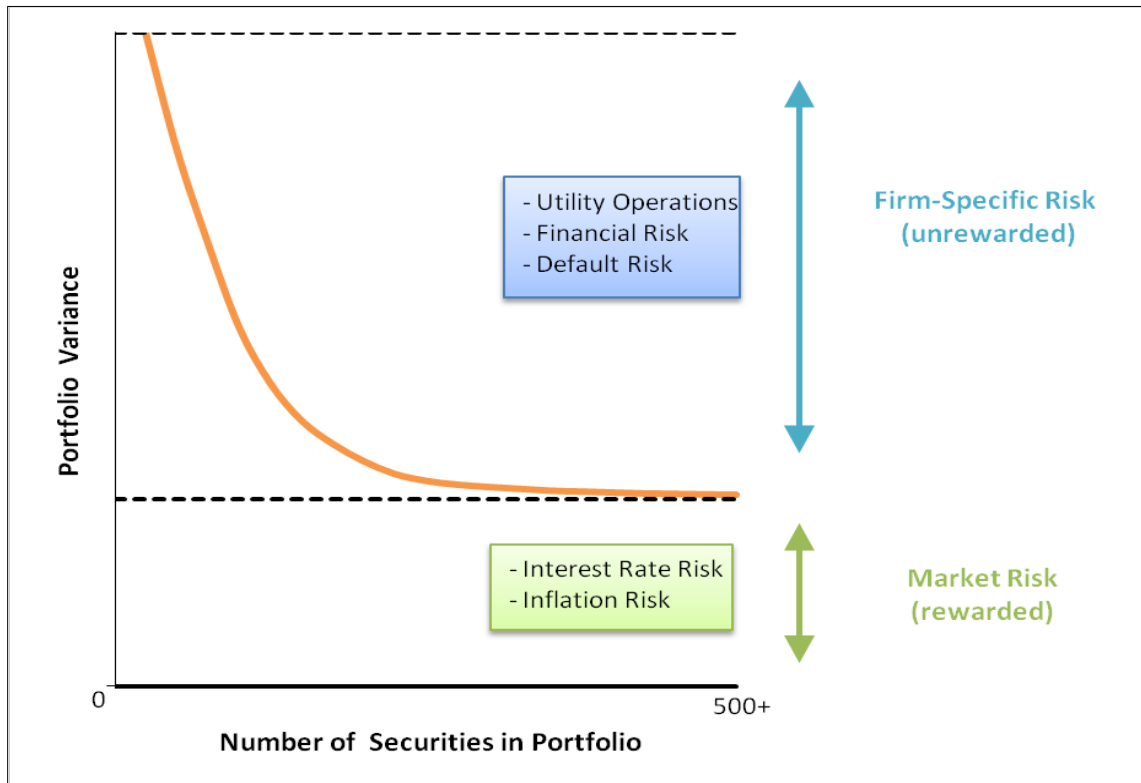
4 A. No. All companies face business risks, including the other utilities in the proxy group;
5 business risks are not unique to FPUC. As discussed above, it is a well-known concept in
6 finance that firm-specific risks are unrewarded by the market. This is largely because firm-
7 specific risk can be eliminated through portfolio diversification. Scholars widely recognize
8 the fact that market risk, or “systematic risk,” is the only type of risk for which investors
9 expect a return for bearing.¹⁰¹

10 Unlike market risks that affect all companies in the stock market, the risk factors
11 discussed by Mr. Moul are merely business risks are specific to FPUC. Investors do not
12 require an additional return for these firm-specific business risks. Another way to consider
13 this issue is to look at the CAPM and DCF Model. Neither model includes an input for
14 business risks due to the well-known truth that investors do not expect a return for such
15 risks. Therefore, the Company’s firm-specific business risks, while perhaps relevant to
16 other issues in the rate case, have no meaningful effect on the cost of equity estimate.
17 Rather, it is market risk that is rewarded by the market, and this concept is thoroughly
18 addressed in my CAPM analysis discussed above. Thus, the Commission should reject
19 any additional premium Mr. Moul has added to an already overstated cost of equity

¹⁰¹ See John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 180 (3rd ed., South Western Cengage Learning 2010).

1 estimate to account for any firm-specific risks. ¹⁰² These important concepts are again
2 illustrated in the figure below.

3 **Figure 13:**
4 **Effects of Portfolio Diversification**



5 The financial models presented in my testimony (particularly the CAPM) directly measure
6 market risk, which is the type of risk the Commission should focus on when determining a
7 fair authorized ROE.

¹⁰² See Section IV above.

1 **B. Comparable Earnings**

2 **Q. PLEASE SUMMARIZE MR. MOUL’S COMPARABLE EARNINGS APPROACH.**

3 A. Mr. Moul also analyzed the returns realized by non-regulated companies as an indication
4 of FPUC’s cost of equity.¹⁰³ The results of his comparable earnings approach indicate a
5 cost of equity for FPUC of 12.05%.¹⁰⁴

6 **Q. DO YOU AGREE WITH MR. MOUL’S ANALYSES?**

7 A. No. There are three notable problems with Mr. Moul’s comparable earnings approach: (1)
8 earned returns do not indicate the cost of equity; (2) using earned returns in a model used
9 to set the awarded ROE in regulatory proceedings creates an echo chamber, void of
10 technical value; and (2) there is no marginal value in analyzing competitive firms beyond
11 those of the utility proxy group in terms of assessing a comparable risk profile. First,
12 “earned” returns and “expected” returns are entirely different concepts. For example, we
13 might conduct a cost of equity analysis on ABC Corp’s stock and determine that, based on
14 the risk inherent in that investment, we should “expect” a 50% return on our investment
15 based on the (relatively high) risk assumed in the investment. Suppose, however, the ABC
16 Corp actually earns a return of only 2% in a particular period. This does not mean that the
17 2% return has any bearing on what investors actually “required” given the company’s risk
18 profile, or that they will not continue to require a 50% in their risky investment going
19 forward. In this example, it is also impossible for 2% to represent an expected return in
20 any risky asset since this return would be lower than the risk-free rate. Thus, Mr. Moul’s

¹⁰³ Direct testimony of Paul R. Moul, pp. 46-49.

¹⁰⁴ Exhibit PRM-1, Sch. 1.

1 analysis of earned returns does not add any value for assessing the cost of equity for FPUC
2 beyond the results of the CAPM and DCF Model.

3 The second problem with Mr. Moul's comparable earnings model is that it simply
4 creates an echo chamber that necessarily excludes the most critical component in
5 determining the Company's most fair authorized return on equity: the actual *cost* of equity.
6 If an earned return is particularly high in a given period, and that earned return is the
7 primary driver for setting the authorized ROE, it will result in an unfairly high ROE and
8 potentially lead to another inflated, earned return, which starts the cycle over again.
9 Moreover, none of these factors would relate to the utility's actual cost of equity, which is
10 most appropriately measured by the CAPM and DCF Model.

11 The final problem with Mr. Moul's comparable earnings approach is that it uses the
12 earned returns of non-regulated, non-utility companies as an indication of FPUC's cost of
13 equity. Despite the title of Mr. Moul's model, competitive, non-utility companies are
14 relatively *incomparable* to FPUC. Primarily, the risk profiles of competitive firms will
15 tend to be higher than those of low-risk utilities; thus, their cost of equity estimates will
16 generally be higher. Not surprisingly, the results of Mr. Moul's "comparable" earnings
17 approach are higher than those produced by some of his other cost of equity models.¹⁰⁵
18 There is simply no marginal value added to the process of estimating utility cost of equity
19 by using non-utility, non-regulated firms in a proxy group that should contain firms with
20 relatively similar risk profiles to the regulated utility being analyzed.

¹⁰⁵ Exhibit PRM-1, Sch. 1.

1 **C. Flotation Costs**

2 **Q. PLEASE SUMMARIZE MR. MOUL’S POSITION REGARDING FLOTATION**
3 **COSTS.**

4 A. Mr. Moul states that the cost of equity must also include an adjustment to cover flotation
5 costs.¹⁰⁶ Mr. Moul quantifies a flotation cost adjustment of 0.17% (or 17 basis points) to
6 his DCF Model.

7 **Q. DO YOU AGREE WITH MR. MOUL’S FLOTATION COST ADJUSTMENT?**

8 A. No. When companies issue equity securities, they typically hire at least one investment
9 bank as an underwriter for the securities. “Flotation costs” generally refer to the
10 underwriter’s compensation for the services it provides in connection with the securities
11 offering. Mr. Moul’s flotation cost allowance is inappropriate for several reasons, as
12 discussed further below.

1. Flotation costs are not actual “out-of-pocket” costs.

13 The Company has not experienced any out-of-pocket costs for flotation.
14 Underwriters are not compensated in this fashion. Instead, underwriters are compensated
15 through an “underwriting spread.” An underwriting spread is the difference between the
16 price at which the underwriter purchases the shares from the firm, and the price at which
17 the underwriter sells the shares to investors.¹⁰⁷ Furthermore, FPUC is not a publicly traded
18 company, which means it does not issue securities to the public and thus would have no
19 need to retain an underwriter. Accordingly, the Company has not experienced any out-of-

¹⁰⁶ Direct Testimony of Paul R. Moul, p. 38, lines 12-13.

¹⁰⁷ See John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 509 (3rd ed., South Western Cengage Learning 2010).

1 pocket flotation costs, and if it has, those costs should be included in the Company's
2 expense schedules.

2. The market already accounts for flotation costs.

3 When an underwriter markets a firm's securities to investors, the investors are well
4 aware of the underwriter's fees. In other words, the investors know that a portion of the
5 price they are paying for the shares does not go directly to the company, but instead goes
6 to compensate the underwriter for its services. In fact, federal law requires that the
7 underwriter's compensation be disclosed on the front page of the prospectus.¹⁰⁸ Thus,
8 investors have already considered and accounted for flotation costs when making their
9 decision to purchase shares at the quoted price. As a result, there is no need for FPUC'
10 shareholders to receive additional compensation to account for costs they have already
11 considered and agreed to. Similar compensation structures are in other kinds of business
12 transactions. For example, a homeowner may hire a realtor and sell a home for \$100,000.
13 After the realtor takes a six percent commission, the seller nets \$94,000. The buyer and
14 seller agreed to the transaction notwithstanding the realtor's commission. Obviously, it
15 would be unreasonable for the buyer or seller to demand additional funds from anyone after
16 the deal is completed to reimburse them for the realtor's fees. Likewise, investors of
17 competitive firms do not expect additional compensation for flotation costs. Thus, it would
18 not be appropriate for a commission standing in the place of competition to award a utility's
19 investors with this additional compensation.

¹⁰⁸ See Regulation S-K, 17 C.F.R. § 229.501(b)(3) (requiring that the underwriter's discounts and commissions be disclosed on the outside cover page of the prospectus). A prospectus is a legal document that provides details about an investment offering.

3. It is inappropriate to add any additional basis points to an awarded ROE proposal that is already far above the Company's cost of equity.

1 For the reasons discussed above, flotation costs should be disallowed from a
2 technical standpoint; they should also be disallowed from a practical standpoint. FPUC is
3 asking this Commission to award it a cost of equity that is more than 300 basis points above
4 its market-based cost of equity. Under these circumstances, it is especially inappropriate
5 to suggest that flotation costs should be considered in any way to increase an already
6 inflated ROE proposal.

7 **X. COST OF EQUITY SUMMARY**

8 **Q. PLEASE SUMMARIZE THE RESULTS OF THE CAPM AND DCF MODEL**
9 **DISCUSSED ABOVE.**

10 A. The following figure shows the cost of equity results from each model I employed in this
11 case.¹⁰⁹

¹⁰⁹ Exhibit DJG-12.

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**Figure 14:
Cost of Equity Summary**

Cost of Equity Model	Result
DCF (Sustainable Growth)	6.7%
DCF (Analyst Growth)	8.3%
Capital Asset Pricing Model	7.9%
Hamada (at proposed debt ratio)	8.5%
Average	7.8%
Highest	8.5%

3 The average cost of equity resulting from these various models is 7.8.

4 **Q. PLEASE SUMMARIZE THE RESULTS OF YOUR HAMADA MODEL**
5 **INCLUDED IN THE TABLE ABOVE.**

6 A. As discussed above in response to Mr. Moul’s inaccurate leverage adjustment to his DCF
7 analysis, a proper consideration of leverage (as an increasing factor to the cost of equity
8 estimate), would actually include an adjustment to increase FPUC’s ratemaking debt ratio.
9 In this case, I am proposing a debt-equity ratio of 1.08, which is based on the average debt
10 ratio of 52% for the proxy group. Since this represents an upward adjustment to FPUC’s
11 actual debt ratio, it is not unreasonable to consider its impact on the Company’s cost of
12 equity. This impact is most appropriately measured through the Hamada formula. Thus,
13 if the Commission were to authorize a debt-equity ratio of 1.08 for FPUC, then the CAPM

1 cost of equity indication for the Company would be about 8.5%, which is still significantly
2 lower than my authorized ROE recommendation of 9.25%.¹¹⁰ The capital structure issue
3 is discussed in more detail below.

4 **XI. CAPITAL STRUCTURE**

5 **Q. DESCRIBE IN GENERAL THE CONCEPT OF A COMPANY'S CAPITAL**
6 **STRUCTURE.**

7 A. "Capital structure" refers to the way a company finances its overall operations through
8 external financing. The primary sources of long-term, external financing are debt capital
9 and equity capital. Debt capital usually comes in the form of contractual bond issues that
10 require the firm to make payments, while equity capital represents an ownership interest in
11 the form of stock. Because a firm cannot pay dividends on common stock until it satisfies
12 its debt obligations to bondholders, stockholders are referred to as "residual claimants."
13 The fact that stockholders have a lower priority to claims on company assets increases their
14 risk and the required return relative to bondholders. Thus, equity capital has a higher cost
15 than debt capital. Firms can reduce their WACC by recapitalizing and increasing their debt
16 financing. In addition, because interest expense is deductible, increasing debt also adds
17 value to the firm by reducing the firm's tax obligation.

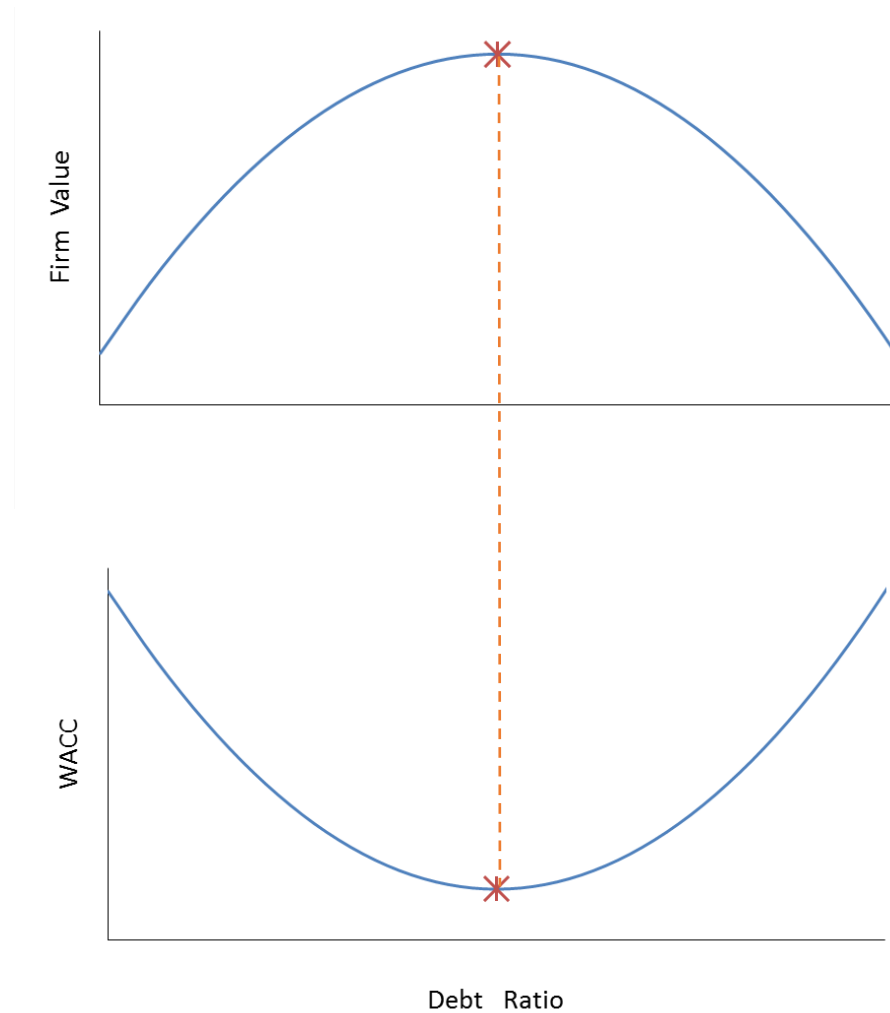
¹¹⁰ Exhibit DJG-16.

1 **Q. IS IT TRUE THAT, BY INCREASING DEBT, COMPETITIVE FIRMS CAN ADD**
2 **VALUE AND REDUCE THEIR WACC?**

3 A. Yes, it is. A competitive firm can add value by increasing debt. After a certain point,
4 however, the marginal cost of additional debt outweighs its marginal benefit. This is
5 because the more debt the firm uses, the higher interest expense it must pay, and the
6 likelihood of loss increases. This also increases the risk of non-recovery for both
7 bondholders and shareholders, causing both groups of investors to demand a greater return
8 on their investment. Thus, if debt financing is too high, the firm's WACC will increase
9 instead of decrease. The following figure illustrates these concepts.

1
2

**Figure 15:
Optimal Debt Ratio**



3 As shown in this figure, a competitive firm's value is maximized when the WACC is
4 minimized. In both graphs, the debt ratio is shown on the x-axis. By increasing its debt
5 ratio, a competitive firm can minimize its WACC and maximize its value. At a certain
6 point, however, the benefits of increasing debt do not outweigh the costs of the additional

1 risks to both bondholders and shareholders, as each type of investor will demand higher
2 returns for the additional risk they have assumed.¹¹¹

3 **Q. DOES THE RATE BASE RATE OF RETURN MODEL EFFECTIVELY**
4 **INCENTIVIZE UTILITIES TO OPERATE AT THE OPTIMAL CAPITAL**
5 **STRUCTURE?**

6 A. No. While it is true that competitive firms maximize their value by minimizing their
7 WACC, this is not the case for regulated utilities. Under the rate base rate of return model,
8 a higher WACC results in higher rates, all else held constant. The basic revenue
9 requirement equation is as follows:

10 **Equation 6:**
11 **Revenue Requirement for Regulated Utilities**

12
$$RR = O + d + T + r(A - D)$$

where:

<i>RR</i>	=	<i>revenue requirement</i>
<i>O</i>	=	<i>operating expenses</i>
<i>d</i>	=	<i>depreciation expense</i>
<i>T</i>	=	<i>corporate tax</i>
<i>r</i>	=	<i>weighted average cost of capital (WACC)</i>
<i>A</i>	=	<i>plant investments</i>
<i>D</i>	=	<i>accumulated depreciation</i>

13 As shown in this equation, utilities can increase their revenue requirement by increasing
14 their WACC, not by minimizing it. Thus, because there is no incentive for a regulated
15 utility to minimize its WACC, a commission standing in the place of competition must
16 ensure that the regulated utility is operating at the lowest reasonable WACC.

¹¹¹ See John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 440-41 (3rd ed., South Western Cengage Learning 2010).

1 **Q. CAN UTILITIES GENERALLY AFFORD TO HAVE HIGHER DEBT LEVELS**
2 **THAN OTHER INDUSTRIES?**

3 A. Yes. Because regulated utilities have large amounts of fixed assets, stable earnings, and
4 low risk relative to other industries, they can afford to have relatively higher debt ratios (or
5 “leverage”). As aptly stated by Dr. Damodaran:

6 Since financial leverage multiplies the underlying business risk, it stands to
7 reason that firms that have high business risk should be reluctant to take on
8 financial leverage. It also stands to reason that firms that operate in stable
9 businesses should be much more willing to take on financial leverage.
10 Utilities, for instance, have historically had high debt ratios but have not
11 had high betas, mostly because their underlying businesses have been stable
12 and fairly predictable.¹¹²

13 Note that the author explicitly contrasts utilities with firms that have high underlying
14 business risk. Because utilities have low levels of risk and operate a stable business, they
15 should generally operate with relatively high levels of debt to achieve their optimal capital
16 structure.

17 **Q. ARE THE CAPITAL STRUCTURES OF THE PROXY GROUP A SOURCE THAT**
18 **CAN BE USED TO ASSESS A PRUDENT CAPITAL STRUCTURE?**

19 A. Yes. Since we consider other metrics of the proxy group when estimating cost of equity,
20 it is also appropriate to consider the financing mix of these companies when assessing a
21 fair ratemaking debt ratio for FPUC.

¹¹² Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 196 (3rd ed., John Wiley & Sons, Inc. 2012) (emphasis added).

1 **Q. HOW CAN UTILITY REGULATORY COMMISSIONS HELP OVERCOME THE**
2 **FACT THAT UTILITIES DO NOT HAVE A NATURAL FINANCIAL INCENTIVE**
3 **TO MINIMIZE THEIR COST OF CAPITAL?**

4 A. While under the rate base rate of return model utilities do not have a natural financial
5 incentive to minimize their cost of capital, competitive firms, in contrast, can and do
6 maximize their value by minimizing their cost of capital. Competitive firms minimize their
7 cost of capital by including a sufficient amount of debt in their capital structures. They do
8 not do this because it is required by a regulatory body, but rather because their shareholders
9 demand it in order to maximize value. The Commission can provide this incentive to
10 FPUC by acting as a surrogate for competition and setting rates consistent with a capital
11 structure that is similar to what would be appropriate in a competitive, as opposed to a
12 regulated, environment.

13 **Q. PLEASE DESCRIBE HOW YOU ASSESSED THE REASONABLENESS OF**
14 **FPUC'S PROPOSED CAPITAL STRUCTURE IN THIS CASE.**

15 A. FPUC proposed capital structure consists of 39.4% long-term debt and 55.1% common
16 equity, which equates to a debt-equity ratio of only 0.72. In this case, I examined the
17 capital structures of the proxy group, as well as the capital structures observed in other
18 competitive industries to assess the overall reasonableness of my recommendation
19 compared to FPUC's proposed capital structure.

20 **Q. PLEASE DESCRIBE THE DEBT RATIOS OF THE PROXY GROUP.**

21 A. Again, Mr. Moul and I used the same proxy group of utilities for our cost of capital
22 analyses. The proxy group of utilities reported an average debt ratio of 52%, which equates

1 to a debt-equity ratio of 1.08. This is a significantly higher debt-equity ratio than the debt-
2 equity ratio of 0.72 proposed by the Company, which is only a debt ratio of 39.4%.¹¹³

3 **Q. DID YOU ALSO LOOK AT OTHER COMPETITIVE FIRMS AROUND THE**
4 **COUNTRY TO COMPARE THEIR DEBT RATIOS?**

5 A. Yes. In fact, there are currently nearly 2,000 firms in various industries across the country
6 with debt ratios of 50% or greater, with an average debt ratio of 61 percent.¹¹⁴ The
7 following figure shows a sample of these industries, with debt ratios of at least 56%.

¹¹³ Exhibit DJG-14.

¹¹⁴ Exhibit DJG-15.

1
2

**Figure 16:
Industries with Debt Ratios of 56% or Greater**

Industry	# Firms	Debt Ratio
Air Transport	21	85%
Hospitals/Healthcare Facilities	31	80%
Hotel/Gaming	66	77%
Brokerage & Investment Banking	31	76%
Retail (Automotive)	32	72%
Food Wholesalers	15	68%
Retail (Grocery and Food)	15	68%
Rubber& Tires	2	67%
Bank (Money Center)	7	67%
Advertising	49	67%
Computers/Peripherals	46	67%
Auto & Truck	26	66%
Real Estate (Operations & Services)	51	66%
Retail (Special Lines)	76	64%
Cable TV	11	63%
Oil/Gas Distribution	21	63%
Packaging & Container	26	62%
Telecom. Services	42	61%
Recreation	60	61%
Broadcasting	28	60%
Transportation (Railroads)	4	60%
R.E.I.T.	238	60%
Power	50	60%
Telecom (Wireless)	17	59%
Transportation	17	59%
Beverage (Soft)	32	58%
Utility (Water)	14	57%
Retail (Distributors)	68	57%
Office Equipment & Services	18	57%
Aerospace/Defense	73	57%
Household Products	118	56%
Computer Services	83	56%
Green & Renewable Energy	20	56%
Total / Average	1,408	64%

3 Many of the industries shown here, like public utilities, are generally well-established
4 industries with large amounts of capital assets. The shareholders of these industries demand

1 higher debt ratios in order to maximize their profits. There are several notable industries
2 that are relatively comparable to public utilities in some respects. These debt ratios, as well
3 as the average debt ratio of the utility proxy group, are notably higher than FPUC's
4 proposed debt ratio.

5 **Q. WHAT IS YOUR RECOMMENDATION REGARDING THE COMPANY'S**
6 **CAPITAL STRUCTURE?**

7 A. The analysis strongly indicates that FPUC's proposed long-term debt ratio of 39.4% for
8 the newly consolidated company is too low to be considered fair for ratemaking. An
9 insufficiently low debt ratio causes the weighted average cost of capital to be unreasonably
10 high. Based on my findings, I recommend the Commission impute a capital structure for
11 ratemaking purposes consisting of long-term debt of 52%, which adopts the proxy group's
12 debt-equity ratio of 1.08. Along with my proposed return on equity of 9.25%, this equates
13 to an overall awarded rate of return of 5.2%.¹¹⁵

¹¹⁵ Exhibit DJG-17.

1 PART TWO: DEPRECIATION

2 XII. LEGAL STANDARDS

3 **Q. DISCUSS THE STANDARD BY WHICH REGULATED UTILITIES ARE**
4 **ALLOWED TO RECOVER DEPRECIATION EXPENSE.**

5 A. In *Lindheimer v. Illinois Bell Telephone Co.*, the U.S. Supreme Court stated that
6 “depreciation is the loss, not restored by current maintenance, which is due to all the factors
7 causing the ultimate retirement of the property. These factors embrace wear and tear,
8 decay, inadequacy, and obsolescence.”¹¹⁶ The *Lindheimer* Court also recognized that the
9 original cost of plant assets, rather than present value or some other measure, is the proper
10 basis for calculating depreciation expense.¹¹⁷ Moreover, the *Lindheimer* Court found:

11 [T]he company has the burden of making a convincing showing that the
12 amounts it has charged to operating expenses for depreciation have not been
13 excessive. That burden is not sustained by proof that its general accounting
14 system has been correct. The calculations are mathematical but the
15 predictions underlying them are essentially matters of opinion.¹¹⁸

16 Thus, the Commission must ultimately determine if the Company has met its burden of
17 proof by making a convincing showing that its proposed depreciation rates are not
18 excessive.

¹¹⁶ *Lindheimer v. Illinois Bell Tel. Co.*, 292 U.S. 151, 169 (1934).

¹¹⁷ *Id.* Referring to the straight-line method, the *Lindheimer* Court stated that “[a]ccording to the principle of this accounting practice, the loss is computed upon the actual cost of the property as entered upon the books, less the expected salvage, and the amount charged each year is one year's pro rata share of the total amount.” The original cost standard was reaffirmed by the Court in *Federal Power Commission v. Hope Natural Gas Co.*, 320 U.S. 591, 606 (1944). The *Hope* Court stated: “Moreover, this Court recognized in [*Lindheimer*], supra, the propriety of basing annual depreciation on cost. By such a procedure the utility is made whole and the integrity of its investment maintained. No more is required.” (footnotes omitted).

¹¹⁸ *Id.* at 169.

1 **Q. SHOULD DEPRECIATION REPRESENT AN ALLOCATED COST OF CAPITAL**
2 **TO OPERATION, RATHER THAN A MECHANISM TO DETERMINE LOSS OF**
3 **VALUE?**

4 A. Yes. While the *Lindheimer* case and other early literature recognized depreciation as a
5 necessary expense, the language indicated that depreciation was primarily a mechanism to
6 determine loss of value.¹¹⁹ Adoption of this “value concept” would require annual
7 appraisals of extensive utility plant, and thus, is not practical in this context. Rather, the
8 “cost allocation concept” recognizes that depreciation is a cost of providing service, and
9 that in addition to receiving a “return on” invested capital through the allowed rate of
10 return, a utility should also receive a “return of” its invested capital in the form of recovered
11 depreciation expense. The cost allocation concept also satisfies several fundamental
12 accounting principles, including verifiability, neutrality, and the matching principle.¹²⁰
13 The definition of “depreciation accounting” published by the American Institute of
14 Certified Public Accountants (“AICPA”) properly reflects the cost allocation concept:

¹¹⁹ See Frank K. Wolf & W. Chester Fitch, *Depreciation Systems* 71 (Iowa State University Press 1994).

¹²⁰ National Association of Regulatory Utility Commissioners, *Public Utility Depreciation Practices* 12 (NARUC 1996).

1 Depreciation accounting is a system of accounting that aims to distribute
2 cost or other basic value of tangible capital assets, less salvage (if any), over
3 the estimated useful life of the unit (which may be a group of assets) in a
4 systematic and rational manner. It is a process of allocation, not of
5 valuation.¹²¹

6 Thus, the concept of depreciation as “the allocation of cost has proven to be the most useful
7 and most widely used concept.”¹²²

8 **Q. DESCRIBE WHY IT IS IMPORTANT NOT TO OVERESTIMATE**
9 **DEPRECIATION RATES.**

10 A. Under the rate base rate of return model, the utility is allowed to recover the original
11 cost of its prudent investments required to provide service. Depreciation systems are
12 designed to allocate those costs in a systematic and rational manner – specifically, over the
13 service life of the utility’s assets. If depreciation rates are overestimated (i.e., service lives
14 are underestimated), it encourages economic inefficiency. Unlike competitive firms,
15 regulated utility companies are not always incentivized by natural market forces to make
16 the most economically efficient decisions. If a utility is allowed to recover the cost of an
17 asset before the end of its useful life, this could incentivize the utility to unnecessarily
18 replace the asset in order to increase its rate base, which results in economic waste. Thus,
19 from a public policy perspective, it is preferable for regulators to ensure that assets are not
20 depreciated before the end of their true useful lives. While underestimating the useful lives
21 of depreciable assets could financially harm current ratepayers and encourage economic
22 waste, unintentionally overestimating depreciable lives (i.e., underestimating depreciation

¹²¹ American Institute of Accountants, *Accounting Terminology Bulletins Number 1: Review and Résumé 25* (American Institute of Accountants 1953).

¹²² Wolf *supra* n. 118, at 73.

1 rates) does not necessarily harm the Company financially. This is because if an asset's life
2 is overestimated, there are a variety of measures that regulators can use to ensure the utility
3 is not financially harmed. One such measure would be the use of a regulatory asset account.
4 In that case, the Company's original cost investment in these assets would remain in the
5 Company's rate base until they are recovered. Thus, the process of depreciation strives for
6 a perfect match between actual and estimated useful life. When these estimates are not
7 exact, however, it is better that useful lives are not underestimated for these reasons

8 **XIII. SERVICE LIFE ANALYSIS**

9 **Q. DESCRIBE THE ACTUARIAL PROCESS TYPICALLY USED TO ANALYZE A** 10 **UTILITY'S DEPRECIABLE PROPERTY.**

11 A. The study of retirement patterns of industrial property is derived from the actuarial process
12 used to study human mortality. Just as actuarial analysts study historical human mortality
13 data in order to predict how long a group of people will live, depreciation analysts study
14 historical plant data in order to estimate the average lives of property groups. The most
15 common actuarial method used by depreciation analysts is called the "retirement rate
16 method." In the retirement rate method, original property data, including additions,
17 retirements, transfers, and other transactions, are organized by vintage and transaction
18 year.¹²³ The retirement rate method is ultimately used to develop an "observed life table,"
19 ("OLT") which shows the percentage of property surviving at each age interval. This
20 pattern of property retirement is described as a "survivor curve." The survivor curve

¹²³ The "vintage" year refers to the year that a group of property was placed in service (aka "placement" year). The "transaction" year refers to the accounting year in which a property transaction occurred, such as an addition, retirement, or transfer (aka "experience" year).

1 derived from the observed life table, however, must be fitted and smoothed with a complete
2 curve in order to determine the ultimate average life of the group.¹²⁴ The most widely used
3 survivor curves for this curve fitting process were developed at Iowa State University in
4 the early 1900s and are commonly known as the “Iowa curves.”¹²⁵ A more detailed
5 explanation of how the Iowa curves are used in the actuarial analysis of depreciable
6 property is set forth in Exhibit DJG-23 - Appendix C. However, FPUC did not provide the
7 type of aged data required to conduct actuarial analysis and traditional Iowa curve fitting
8 techniques. As acknowledged by Ms. Lee in her testimony, “[s]urvivor curves were not
9 generated by statistical analysis for any account in the [depreciation] Study.”¹²⁶
10 Nonetheless, I describe the process typically used to conduct service life estimates because,
11 in the account-specific discussion below, I will illustrate this process using the actual OLT
12 curve and Iowa curves from another case to show how the Iowa curves selected by FPUC
13 are generally shorter than those of other utilities in my peer group for the accounts in
14 dispute.

15 **Q. GENERALLY DESCRIBE YOUR APPROACH IN ESTIMATING THE SERVICE**
16 **LIVES OF MASS PROPERTY WHEN ADEQUATE AGED DATA ARE**
17 **AVAILABLE.**

18 A. When adequate data is available, I use all of a utility’s aged property data to create an OLT
19 for each account. The data points on the OLT can be plotted to form a curve (the “OLT

¹²⁴ See Exhibit DJG-23 - Appendix C for a more detailed discussion of the actuarial analysis used to determine the average lives of grouped industrial property.

¹²⁵ See Exhibit DJG-23 - Appendix B for a more detailed discussion of the Iowa curves.

¹²⁶ Direct Testimony of Patricia Lee, p. 11, lines 12-13.

1 curve”). The OLT curve is not a theoretical curve, rather, it is actual observed data from
2 the Company’s records that indicate the rate of retirement for each property group. An
3 OLT curve by itself, however, is rarely a smooth curve, and is often not a “complete” curve
4 (i.e., it does not end at zero percent surviving). In order to calculate average life (the area
5 under a curve), a complete survivor curve is needed. The Iowa curves are empirically
6 derived curves based on the extensive studies of the actual mortality patterns of many
7 different types of industrial property. The curve-fitting process involves selecting the best
8 Iowa curve to fit the OLT curve. This can be accomplished through a combination of visual
9 and mathematical curve-fitting techniques, as well as professional judgment. The first step
10 of my approach to curve-fitting involves visually inspecting the OLT curve for any
11 irregularities. For example, if the “tail” end of the curve is erratic and shows a sharp decline
12 over a short period of time, it may indicate that this portion of the data is less reliable, as
13 further discussed below. After inspecting the OLT curve, I use a mathematical curve-
14 fitting technique which essentially involves measuring the distance between the OLT curve
15 and the selected Iowa curve in order to get an objective, mathematical assessment of how
16 well the curve fits. After selecting an Iowa curve, I observe the OLT curve along with the
17 Iowa curve on the same graph to determine how well the curve fits. I may repeat this
18 process several times for any given account to ensure that the most reasonable Iowa curve
19 is selected. I will illustrate this process further in the discussions below.

20 **Q. PLEASE SUMMARIZE YOUR SERVICE LIFE ADJUSTMENTS.**

21 A. Since FPUC did not provide the type of adequate aged data that is typically used for an
22 accurate service life analysis, we must rely on the approved service lives of other utilities

1 for some objective indication of an appropriate service life. The approved service lives I
 2 considered are summarized in the tables below.¹²⁷

3 **Figure 17:**
 4 **Peer Group Summary**

Acct	Description	Liberty	NIPSCO	PNG	FCG	PGS	Avg
378	M&R Equip. - General	51	55	55	30	40	46
379	M&R Equip. - City Gate	51	55	55	35	50	49
3801	Services - Plastic	50	68	60	54	55	57
381	Meters	45	36	29	20	19	30
	Average	49	54	50	35	41	46

5 I selected these in part because I was involved in the depreciation analysis in each case,
 6 and the depreciation studies in these cases included voluminous historical retirement data
 7 that was adequate for actuarial analysis. As shown in this figure, the approved service lives
 8 for these accounts are generally longer than those approved in Florida for the same
 9 accounts.¹²⁸

10 **Q. CAN YOU PROVIDE AN EXAMPLE OF THE ACTUARIAL ANALYSIS ON**
 11 **WHICH THE APPROVED SERVICE LIVES OF YOUR PEER GROUP WERE**
 12 **BASED?**

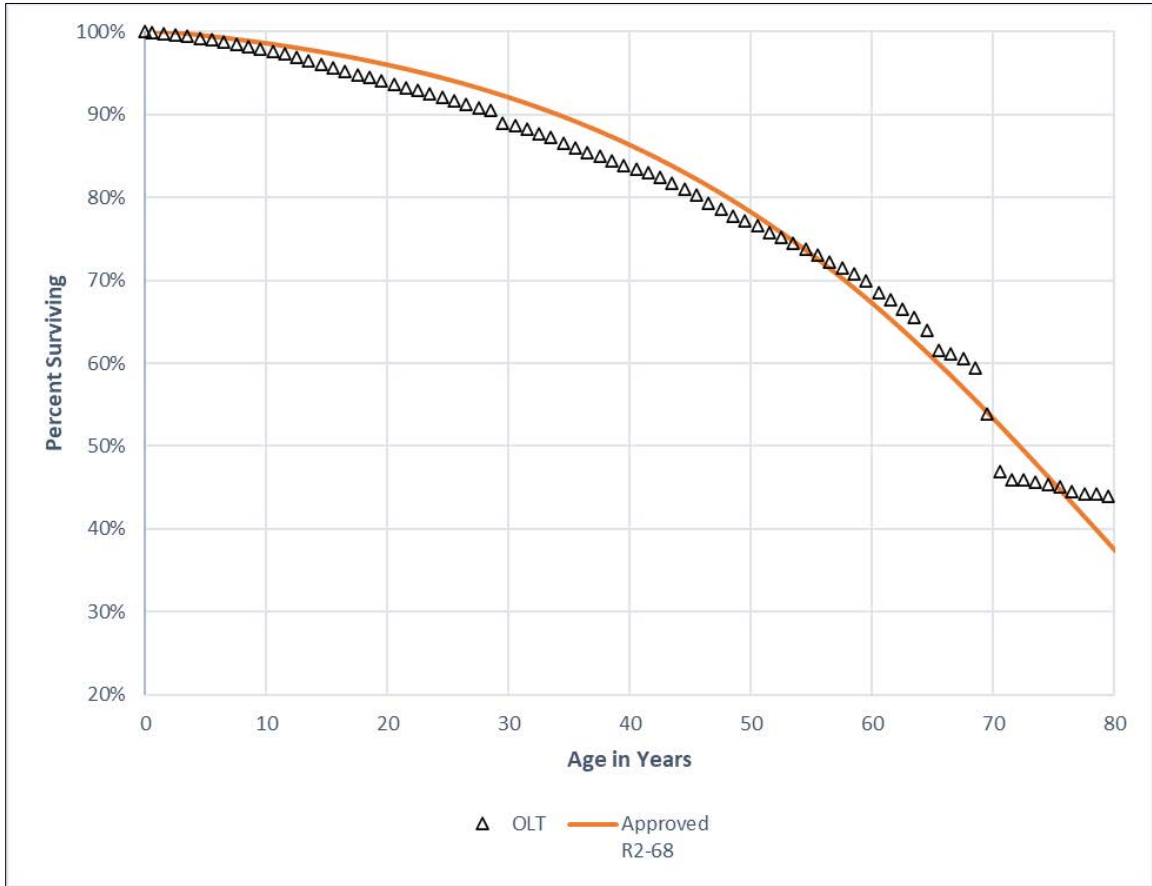
13 A. Yes. I will use Account 380 (Services) from the Northern Indiana Public Service Company
 14 (“NIPSCO”) case. The OLT curve derived from NIPSCO’s historical plant data is well-
 15 suited for conventional Iowa curve fitting techniques. That is, the OLT curve is relatively
 16 smooth, has adequate retirement experience (i.e., it is long enough), and follows a typical

¹²⁷ See Exhibit DJG-19 for more details.

¹²⁸ See Exhibits DJG-20 and DJG-21 for depreciation rate calculations and comparisons.

1 retirement pattern for utility property. The OLT curve is presented in the graph below,
2 along with the Iowa R2-68 curve that was ultimately approved for that account.

3 **Figure 18:**
4 **NIPSCO Account 380 - Services**



5 As shown in this graph, the R2-68 curve provided a relatively good fit to the historical
6 retirement pattern derived from the company's historical data as presented in the OLT
7 curve.¹²⁹

¹²⁹ See Exhibit DJG-22.

1 **Q. HAS FPUC MADE A CONVINCING SHOWING THAT ITS PROPOSED**
2 **DEPRECIATION EXPENSE FOR THIS ACCOUNT IS NOT EXCESSIVE?**

3 A. No, it has not. The Company proposes a 55-year service life for this account, Services –
4 plastics, and has not presented the type of evidence from which an adequate OLT curve
5 can be derived. As shown in my Figure 17, the Services-plastic has an average service life
6 of 57 years based on my peer group. Adopting FPUC proposed service life would
7 underestimate the Services-plastic service life by 2 years and result in overstated
8 depreciation rates. Thus, the Commission should consider the approved service lives
9 presented in my peer group.

10 **Q. WHAT IS YOUR RECOMMENDATION TO THE COMMISSION REGARDING**
11 **DEPRECIATION RATES?**

12 A. I recommend the Commission approve the depreciation rates presented in Exhibit DJG-
13 20.¹³⁰ These rates are based on the average of approved service life presented in my peer
14 group analysis.¹³¹

15 **Q. DOES THIS CONCLUDE YOUR TESTIMONY?**

16 A. Yes. I reserve the right to supplement this testimony as needed with any additional
17 information that has been requested from the Company but not yet provided. To the extent
18 I have not addressed an issue, method, calculation, account, or other matter relevant to the
19 Company's proposals in this proceeding, it should not be construed that I am in agreement
20 with the same.

21

¹³⁰ OPC's adjustment to depreciation expense is presented in the direct testimony of Ralph Smith.

¹³¹ See Exhibit DJG-19.

CERTIFICATE OF SERVICE
DOCKET NO. 20220067-GU

I **HEREBY CERTIFY** that a true and correct copy of the foregoing has been furnished by electronic mail on this 24th day of August, 2022, to the following:

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University of Oklahoma College of Law Juris Doctor Member, American Indian Law Review	Norman, OK 2007
University of Oklahoma Bachelor of Business Administration Major: Finance	Norman, OK 2003

PROFESSIONAL DESIGNATIONS

Society of Depreciation Professionals
Certified Depreciation Professional (CDP)

Society of Utility and Regulatory Financial Analysts
Certified Rate of Return Analyst (CRRA)

The Mediation Institute
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WORK EXPERIENCE

Resolve Utility Consulting PLLC <u>Managing Member</u> Provide expert analysis and testimony specializing in depreciation and cost of capital issues for clients in utility regulatory proceedings.	Oklahoma City, OK 2016 – Present
Oklahoma Corporation Commission <u>Public Utility Regulatory Analyst</u> <u>Assistant General Counsel</u> Represented commission staff in utility regulatory proceedings and provided legal opinions to commissioners. Provided expert analysis and testimony in depreciation, cost of capital, incentive compensation, payroll and other issues.	Oklahoma City, OK 2012 – 2016 2011 – 2012

Perebus Counsel, PLLC

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Represented clients in the areas of family law, estate planning, debt negotiations, business organization, and utility regulation.

Oklahoma City, OK
2009 – 2011

Moricoli & Schovanec, P.C.

Associate Attorney

Represented clients in the areas of contracts, oil and gas, business structures and estate administration.

Oklahoma City, OK
2007 – 2009

TEACHING EXPERIENCE

University of Oklahoma

Adjunct Instructor – “Conflict Resolution”

Adjunct Instructor – “Ethics in Leadership”

Norman, OK
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Rose State College

Adjunct Instructor – “Legal Research”

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Midwest City, OK
2013 – 2015

PUBLICATIONS

American Indian Law Review

“Vine of the Dead: Reviving Equal Protection Rites for Religious Drug Use”
(31 Am. Indian L. Rev. 143)

Norman, OK
2006

PROFESSIONAL ASSOCIATIONS

Oklahoma Bar Association

2007 – Present

Society of Depreciation Professionals

Board Member – President

Participate in management of operations, attend meetings, review performance, organize presentation agenda.

2014 – Present
2017

Society of Utility Regulatory Financial Analysts

2014 – Present

Utility Regulatory Proceedings

Docket No. 20220067-GU

FPUC Petition

Exhibit DJG-1

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Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Pennsylvania Public Utility Commission	Columbia Gas of Pennsylvania, Inc.	R-2022-3031211	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Public Service Commission of South Carolina	Piedmont Natural Gas Company	2022-89-G	Depreciation rates, service lives, net salvage	South Carolina Office of Regulatory Staff
Pennsylvania Public Utility Commission	UGI Utilities, Inc. - Gas Division	R-2021-3030218	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Public Utilities Commission of the State of California	Pacific Gas & Electric Company	A.21-06-021	Depreciation rates, service lives, net salvage	The Utility Reform Network
Pennsylvania Public Utility Commission	PECO Energy Company - Gas Division	R-2022-3031113	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Oklahoma Corporation Commission	Oklahoma Gas & Electric Company	PUD 202100164	Cost of capital, depreciation rates, net salvage	Oklahoma Industrial Energy Consumers
Massachusetts Department of Public Utilities	NSTAR Electric Company D/B/A Eversource Energy	D.P.U. 22-22	Depreciation rates, service lives, net salvage	Massachusetts Office of the Attorney General, Office of Ratepayer Advocacy
Michigan Public Service Company	DTE Electric Company	U-20836	Cost of capital, awarded rate of return, capital structure	Michigan Environmental Council and Citizens Utility Board of Michigan
New York State Public Service Commission	Consolidated Edison Company of New York, Inc.	22-E-0064 22-G-0065	Depreciation rates, service lives, net salvage, depreciation reserve	The City of New York
Pennsylvania Public Utility Commission	Aqua Pennsylvania Wastewater / East Whiteland Township	A-2021-3026132	Fair market value estimates for wastewater assets	Pennsylvania Office of Consumer Advocate
Public Service Commission of South Carolina	Kiawah Island Utility, Inc.	2021-324-WS	Cost of capital, awarded rate of return, capital structure	South Carolina Office of Regulatory Staff
Pennsylvania Public Utility Commission	Aqua Pennsylvania Wastewater / Willistown Township	A-2021-3027268	Fair market value estimates for wastewater assets	Pennsylvania Office of Consumer Advocate
Indiana Utility Regulatory Commission	Northern Indiana Public Service Company	45621	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Arkansas Public Service Commission	Southwestern Electric Power Company	21-070-U	Cost of capital, depreciation rates, net salvage	Western Arkansas Large Energy Consumers

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Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Federal Energy Regulatory Commission	Southern Star Central Gas Pipeline	RP21-778-002	Depreciation rates, service lives, net salvage	Consumer-Owned Shippers
Railroad Commission of Texas	Participating Texas gas utilities in consolidated proceeding	OS-21-00007061	Securitization of extraordinary gas costs arising from winter storms	The City of El Paso
Public Service Commission of South Carolina	Palmetto Wastewater Reclamation, Inc.	2021-153-S	Cost of capital, awarded rate of return, capital structure, ring-fencing	South Carolina Office of Regulatory Staff
Public Utilities Commission of the State of Colorado	Public Service Company of Colorado	21AL-0317E	Cost of capital, depreciation rates, net salvage	Colorado Energy Consumers
Pennsylvania Public Utility Commission	City of Lancaster - Water Department	R-2021-3026682	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Public Utility Commission of Texas	Southwestern Public Service Company	PUC 51802	Depreciation rates, service lives, net salvage	The Alliance of Xcel Municipalities
Pennsylvania Public Utility Commission	The Borough of Hanover - Hanover Municipal Waterworks	R-2021-3026116	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Maryland Public Service Commission	Delmarva Power & Light Company	9670	Cost of capital and authorized rate of return	Maryland Office of People's Counsel
Oklahoma Corporation Commission	Oklahoma Natural Gas Company	PUD 202100063	Cost of capital, awarded rate of return, capital structure	Oklahoma Industrial Energy Consumers
Indiana Utility Regulatory Commission	Indiana Michigan Power Company	45576	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Public Utility Commission of Texas	El Paso Electric Company	PUC 52195	Depreciation rates, service lives, net salvage	The City of El Paso
Pennsylvania Public Utility Commission	Aqua Pennsylvania	R-2021-3027385	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Public Service Commission of the State of Montana	NorthWestern Energy	D2021.02.022	Cost of capital, awarded rate of return, capital structure	Montana Consumer Counsel
Pennsylvania Public Utility Commission	PECO Energy Company	R-2021-3024601	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate

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New Mexico Public Regulation Commission	Southwestern Public Service Company	20-00238-UT	Cost of capital and authorized rate of return	The New Mexico Large Customer Group; Occidental Permian
Oklahoma Corporation Commission	Public Service Company of Oklahoma	PUD 202100055	Cost of capital, depreciation rates, net salvage	Oklahoma Industrial Energy Consumers
Pennsylvania Public Utility Commission	Duquesne Light Company	R-2021-3024750	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Maryland Public Service Commission	Columbia Gas of Maryland	9664	Cost of capital and authorized rate of return	Maryland Office of People's Counsel
Indiana Utility Regulatory Commission	Southern Indiana Gas Company, d/b/a Vectren Energy Delivery of Indiana, Inc.	45447	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Public Utility Commission of Texas	Southwestern Electric Power Company	PUC 51415	Depreciation rates, service lives, net salvage	Cities Advocating Reasonable Deregulation
New Mexico Public Regulatory Commission	Avangrid, Inc., Avangrid Networks, Inc., NM Green Holdings, Inc., PNM, and PNM Resources	20-00222-UT	Ring fencing and capital structure	The Albuquerque Bernalillo County Water Utility Authority
Indiana Utility Regulatory Commission	Indiana Gas Company, d/b/a Vectren Energy Delivery of Indiana, Inc.	45468	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Public Utilities Commission of Nevada	Nevada Power Company and Sierra Pacific Power Company, d/b/a NV Energy	20-07023	Construction work in progress	MGM Resorts International, Caesars Enterprise Services, LLC, and the Southern Nevada Water Authority
Massachusetts Department of Public Utilities	Boston Gas Company, d/b/a National Grid	D.P.U. 20-120	Depreciation rates, service lives, net salvage	Massachusetts Office of the Attorney General, Office of Ratepayer Advocacy
Public Service Commission of the State of Montana	ABACO Energy Services, LLC	D2020.07.082	Cost of capital and authorized rate of return	Montana Consumer Counsel
Maryland Public Service Commission	Washington Gas Light Company	9651	Cost of capital and authorized rate of return	Maryland Office of People's Counsel
Florida Public Service Commission	Utilities, Inc. of Florida	20200139-WS	Cost of capital and authorized rate of return	Florida Office of Public Counsel
New Mexico Public Regulatory Commission	El Paso Electric Company	20-00104-UT	Cost of capital, depreciation rates, net salvage	City of Las Cruces and Doña Ana County

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Public Utilities Commission of Nevada	Nevada Power Company	20-06003	Cost of capital, awarded rate of return, capital structure, earnings sharing	MGM Resorts International, Caesars Enterprise Services, LLC, Wynn Las Vegas, LLC, Smart Energy Alliance, and Circus Circus Las Vegas, LLC
Wyoming Public Service Commission	Rocky Mountain Power	20000-578-ER-20	Cost of capital and authorized rate of return	Wyoming Industrial Energy Consumers
Florida Public Service Commission	Peoples Gas System	20200051-GU 20200166-GU	Cost of capital, depreciation rates, net salvage	Florida Office of Public Counsel
Wyoming Public Service Commission	Rocky Mountain Power	20000-539-EA-18	Depreciation rates, service lives, net salvage	Wyoming Industrial Energy Consumers
Public Service Commission of South Carolina	Dominion Energy South Carolina	2020-125-E	Depreciation rates, service lives, net salvage	South Carolina Office of Regulatory Staff
Pennsylvania Public Utility Commission	The City of Bethlehem	2020-3020256	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Railroad Commission of Texas	Texas Gas Services Company	GUD 10928	Depreciation rates, service lives, net salvage	Gulf Coast Service Area Steering Committee
Public Utilities Commission of the State of California	Southern California Edison	A.19-08-013	Depreciation rates, service lives, net salvage	The Utility Reform Network
Massachusetts Department of Public Utilities	NSTAR Gas Company	D.P.U. 19-120	Depreciation rates, service lives, net salvage	Massachusetts Office of the Attorney General, Office of Ratepayer Advocacy
Georgia Public Service Commission	Liberty Utilities (Peach State Natural Gas)	42959	Depreciation rates, service lives, net salvage	Public Interest Advocacy Staff
Florida Public Service Commission	Florida Public Utilities Company	20190155-El 20190156-El 20190174-El	Depreciation rates, service lives, net salvage	Florida Office of Public Counsel
Illinois Commerce Commission	Commonwealth Edison Company	20-0393	Depreciation rates, service lives, net salvage	The Office of the Illinois Attorney General
Public Utility Commission of Texas	Southwestern Public Service Company	PUC 49831	Depreciation rates, service lives, net salvage	Alliance of Xcel Municipalities
Public Service Commission of South Carolina	Blue Granite Water Company	2019-290-WS	Depreciation rates, service lives, net salvage	South Carolina Office of Regulatory Staff

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Railroad Commission of Texas	CenterPoint Energy Resources	GUD 10920	Depreciation rates and grouping procedure	Alliance of CenterPoint Municipalities
Pennsylvania Public Utility Commission	Aqua Pennsylvania Wastewater / East Norriton Township	A-2019-3009052	Fair market value estimates for wastewater assets	Pennsylvania Office of Consumer Advocate
New Mexico Public Regulation Commission	Southwestern Public Service Company	19-00170-UT	Cost of capital and authorized rate of return	The New Mexico Large Customer Group; Occidental Permian
Indiana Utility Regulatory Commission	Duke Energy Indiana	45253	Cost of capital, depreciation rates, net salvage	Indiana Office of Utility Consumer Counselor
Maryland Public Service Commission	Columbia Gas of Maryland	9609	Depreciation rates, service lives, net salvage	Maryland Office of People's Counsel
Washington Utilities & Transportation Commission	Avista Corporation	UE-190334	Cost of capital, awarded rate of return, capital structure	Washington Office of Attorney General
Indiana Utility Regulatory Commission	Indiana Michigan Power Company	45235	Cost of capital, depreciation rates, net salvage	Indiana Office of Utility Consumer Counselor
Public Utilities Commission of the State of California	Pacific Gas & Electric Company	18-12-009	Depreciation rates, service lives, net salvage	The Utility Reform Network
Oklahoma Corporation Commission	The Empire District Electric Company	PUD 201800133	Cost of capital, authorized ROE, depreciation rates	Oklahoma Industrial Energy Consumers and Oklahoma Energy Results
Arkansas Public Service Commission	Southwestern Electric Power Company	19-008-U	Cost of capital, depreciation rates, net salvage	Western Arkansas Large Energy Consumers
Public Utility Commission of Texas	CenterPoint Energy Houston Electric	PUC 49421	Depreciation rates, service lives, net salvage	Texas Coast Utilities Coalition
Massachusetts Department of Public Utilities	Massachusetts Electric Company and Nantucket Electric Company	D.P.U. 18-150	Depreciation rates, service lives, net salvage	Massachusetts Office of the Attorney General, Office of Ratepayer Advocacy
Oklahoma Corporation Commission	Oklahoma Gas & Electric Company	PUD 201800140	Cost of capital, authorized ROE, depreciation rates	Oklahoma Industrial Energy Consumers and Oklahoma Energy Results
Public Service Commission of the State of Montana	Montana-Dakota Utilities Company	D2018.9.60	Depreciation rates, service lives, net salvage	Montana Consumer Counsel and Denbury Onshore

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Indiana Utility Regulatory Commission	Northern Indiana Public Service Company	45159	Depreciation rates, grouping procedure, demolition costs	Indiana Office of Utility Consumer Counselor
Public Service Commission of the State of Montana	NorthWestern Energy	D2018.2.12	Depreciation rates, service lives, net salvage	Montana Consumer Counsel
Oklahoma Corporation Commission	Public Service Company of Oklahoma	PUD 201800097	Depreciation rates, service lives, net salvage	Oklahoma Industrial Energy Consumers and Wal-Mart
Nevada Public Utilities Commission	Southwest Gas Corporation	18-05031	Depreciation rates, service lives, net salvage	Nevada Bureau of Consumer Protection
Public Utility Commission of Texas	Texas-New Mexico Power Company	PUC 48401	Depreciation rates, service lives, net salvage	Alliance of Texas-New Mexico Power Municipalities
Oklahoma Corporation Commission	Oklahoma Gas & Electric Company	PUD 201700496	Depreciation rates, service lives, net salvage	Oklahoma Industrial Energy Consumers and Oklahoma Energy Results
Maryland Public Service Commission	Washington Gas Light Company	9481	Depreciation rates, service lives, net salvage	Maryland Office of People's Counsel
Indiana Utility Regulatory Commission	Citizens Energy Group	45039	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Public Utility Commission of Texas	Entergy Texas, Inc.	PUC 48371	Depreciation rates, decommissioning costs	Texas Municipal Group
Washington Utilities & Transportation Commission	Avista Corporation	UE-180167	Depreciation rates, service lives, net salvage	Washington Office of Attorney General
New Mexico Public Regulation Commission	Southwestern Public Service Company	17-00255-UT	Cost of capital and authorized rate of return	HollyFrontier Navajo Refining; Occidental Permian
Public Utility Commission of Texas	Southwestern Public Service Company	PUC 47527	Depreciation rates, plant service lives	Alliance of Xcel Municipalities
Public Service Commission of the State of Montana	Montana-Dakota Utilities Company	D2017.9.79	Depreciation rates, service lives, net salvage	Montana Consumer Counsel
Florida Public Service Commission	Florida City Gas	20170179-GU	Cost of capital, depreciation rates	Florida Office of Public Counsel

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Washington Utilities & Transportation Commission	Avista Corporation	UE-170485	Cost of capital and authorized rate of return	Washington Office of Attorney General
Wyoming Public Service Commission	Powder River Energy Corporation	10014-182-CA-17	Credit analysis, cost of capital	Private customer
Oklahoma Corporation Commission	Public Service Co. of Oklahoma	PUD 201700151	Depreciation, terminal salvage, risk analysis	Oklahoma Industrial Energy Consumers
Public Utility Commission of Texas	Oncor Electric Delivery Company	PUC 46957	Depreciation rates, simulated analysis	Alliance of Oncor Cities
Nevada Public Utilities Commission	Nevada Power Company	17-06004	Depreciation rates, service lives, net salvage	Nevada Bureau of Consumer Protection
Public Utility Commission of Texas	El Paso Electric Company	PUC 46831	Depreciation rates, interim retirements	City of El Paso
Idaho Public Utilities Commission	Idaho Power Company	IPC-E-16-24	Accelerated depreciation of North Valmy plant	Micron Technology, Inc.
Idaho Public Utilities Commission	Idaho Power Company	IPC-E-16-23	Depreciation rates, service lives, net salvage	Micron Technology, Inc.
Public Utility Commission of Texas	Southwestern Electric Power Company	PUC 46449	Depreciation rates, decommissioning costs	Cities Advocating Reasonable Deregulation
Massachusetts Department of Public Utilities	Eversource Energy	D.P.U. 17-05	Cost of capital, capital structure, and rate of return	Sunrun Inc.; Energy Freedom Coalition of America
Railroad Commission of Texas	Atmos Pipeline - Texas	GUD 10580	Depreciation rates, grouping procedure	City of Dallas
Public Utility Commission of Texas	Sharyland Utility Company	PUC 45414	Depreciation rates, simulated analysis	City of Mission
Oklahoma Corporation Commission	Empire District Electric Company	PUD 201600468	Cost of capital, depreciation rates	Oklahoma Industrial Energy Consumers
Railroad Commission of Texas	CenterPoint Energy Texas Gas	GUD 10567	Depreciation rates, simulated plant analysis	Texas Coast Utilities Coalition

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Arkansas Public Service Commission	Oklahoma Gas & Electric Company	160-159-GU	Cost of capital, depreciation rates, terminal salvage	Arkansas River Valley Energy Consumers; Wal-Mart
Florida Public Service Commission	Peoples Gas	160-159-GU	Depreciation rates, service lives, net salvage	Florida Office of Public Counsel
Arizona Corporation Commission	Arizona Public Service Company	E-01345A-16-0036	Cost of capital, depreciation rates, terminal salvage	Energy Freedom Coalition of America
Nevada Public Utilities Commission	Sierra Pacific Power Company	16-06008	Depreciation rates, net salvage, theoretical reserve	Northern Nevada Utility Customers
Oklahoma Corporation Commission	Oklahoma Gas & Electric Co.	PUD 201500273	Cost of capital, depreciation rates, terminal salvage	Public Utility Division
Oklahoma Corporation Commission	Public Service Co. of Oklahoma	PUD 201500208	Cost of capital, depreciation rates, terminal salvage	Public Utility Division
Oklahoma Corporation Commission	Oklahoma Natural Gas Company	PUD 201500213	Cost of capital, depreciation rates, net salvage	Public Utility Division

Proxy Group Summary

Company	Ticker	Market Cap. (\$ millions)	Market Category	Value Line Safety Rank	Financial Strength
Atmos Energy Corp	ATO	15,700	Large Cap	1	A+
Chesapeake Utilities Corp	CPK	2,300	Mid Cap	2	A
New Jersey Resources Corporation	NJR	4,300	Mid Cap	2	A+
NiSource Inc	NI	12,400	Large Cap	3	B+
Northwest Natural Holding Company	NWN	1,600	Small Cap	3	A
ONE Gas Inc	OGS	4,600	Mid Cap	2	B++
Southwest Gas Holdings Inc	SWX	6,100	Mid Cap	3	A
Spire Inc.	SR	3,900	Mid Cap	2	B++

Value Line Investment Survey

DCF Stock and Index Prices

Ticker	^GSPC	ATO	CPK	NJR	NI	NWN	OGS	SWX	SR
30-day Average	3862	110.73	125.90	44.00	28.96	52.89	81.26	87.52	73.25
Standard Deviation	127.2	3.69	4.25	1.31	1.34	1.30	3.06	2.99	2.49
06/03/22	4109	116.11	132.81	45.76	31.42	55.18	87.15	93.82	76.93
06/06/22	4121	116.76	134.36	46.31	31.76	55.45	87.44	93.25	77.59
06/07/22	4161	117.43	133.54	46.48	31.77	55.32	88.16	93.50	77.98
06/08/22	4116	115.22	129.92	46.06	31.03	54.70	86.53	92.21	77.01
06/09/22	4018	112.95	128.47	45.66	30.23	53.42	85.00	91.65	75.99
06/10/22	3901	111.97	128.75	45.66	30.05	54.09	85.11	91.89	76.96
06/13/22	3750	107.01	123.76	43.67	28.54	51.51	80.16	88.18	73.66
06/14/22	3735	105.54	119.96	42.61	27.60	50.81	78.82	87.04	72.97
06/15/22	3790	106.09	120.78	42.92	27.72	50.81	79.00	86.31	72.26
06/16/22	3667	104.58	120.29	42.35	27.17	50.86	78.08	84.00	71.69
06/17/22	3675	103.51	119.00	41.33	26.66	51.69	77.44	82.49	70.67
06/21/22	3765	105.47	120.96	42.21	26.98	51.76	78.42	84.51	71.89
06/22/22	3760	105.66	120.57	42.69	27.39	52.08	78.38	84.93	71.93
06/23/22	3796	107.04	120.81	42.67	27.81	52.12	78.19	86.70	72.13
06/24/22	3912	109.24	120.53	43.71	28.62	52.39	78.46	88.07	73.25
06/27/22	3900	110.75	126.59	44.56	29.16	53.48	81.10	89.52	74.99
06/28/22	3822	110.65	126.55	44.72	29.35	53.14	80.93	87.46	74.39
06/29/22	3819	110.90	126.45	44.20	29.46	52.95	80.81	86.14	74.19
06/30/22	3785	112.10	129.55	44.53	29.49	53.10	81.19	87.08	74.37
07/01/22	3825	115.15	132.06	45.49	30.05	54.58	84.15	88.00	76.32
07/05/22	3831	110.61	125.79	43.12	28.55	51.85	79.30	85.78	72.36
07/06/22	3845	113.00	128.09	43.96	29.07	52.96	80.85	86.47	72.81
07/07/22	3903	112.34	125.81	43.86	28.50	52.72	80.31	86.39	71.90
07/08/22	3899	112.05	125.32	43.70	28.47	52.06	79.67	86.34	71.39
07/11/22	3854	112.12	125.48	43.79	28.80	52.44	79.82	86.63	70.98
07/12/22	3819	111.85	124.85	43.48	28.68	52.15	79.79	85.31	70.37
07/13/22	3802	111.08	125.81	43.53	28.61	52.58	80.02	86.15	69.97
07/14/22	3790	110.92	126.28	43.51	28.71	53.23	80.40	85.62	69.81
07/15/22	3863	111.90	127.79	44.06	28.78	54.05	81.86	85.45	70.71
07/18/22	3831	111.90	126.21	43.35	28.39	53.16	81.25	84.76	70.16

All prices are adjusted closing prices reported by Yahoo! Finance, <http://finance.yahoo.com>

DCF Dividend Yields

		[1]	[2]	[3]	[4]
Company	Ticker	Quarterly Dividend	Annualized Dividend	Stock Price	Dividend Yield
Atmos Energy Corp	ATO	0.680	2.720	110.73	2.5%
Chesapeake Utilities Corp	CPK	0.535	2.140	125.90	1.7%
New Jersey Resources Corporation	NJR	0.363	1.452	44.00	3.3%
NiSource Inc	NI	0.235	0.940	28.96	3.2%
Northwest Natural Holding Company	NWN	0.482	1.928	52.89	3.6%
ONE Gas Inc	OGS	0.620	2.480	81.26	3.1%
Southwest Gas Holdings Inc	SWX	0.620	2.480	87.52	2.8%
Spire Inc.	SR	0.685	2.740	73.25	3.7%
Average		\$0.53	\$2.11	\$75.56	3.0%

[1] 2022 Q2 reported quarterly dividends per share. Nasdaq.com

[2] = [1] * 4

[3] Average stock price from Exhibit DJG-3

[4] = [2] / [3]

DCF Sustainable Growth Rate Determinants

<u>Sustainable Growth Determinants</u>	<u>Rate</u>	
Nominal GDP	3.8%	[1]
Real GDP	1.8%	[2]
<u>Risk Free Rate</u>	<u>3.2%</u>	[3]
Highest	3.8%	

[1],[2] CBO, The 2021 Long-Term Budget Outlook, p. 34

[3] From Exhibit DJG-7

DCF Results

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		[1]	[2]	[3]	[4]	[5]
Company	Ticker	Dividend Yield	Analyst Growth	Sustainable Growth	DCF Result (Analyst Growth)	DCF Result (Sustainable Growth)
Atmos Energy Corp	ATO	2.5%	7.0%	3.8%	9.6%	6.4%
Chesapeake Utilities Corp	CPK	1.7%	8.5%	3.8%	10.3%	5.6%
New Jersey Resources Corporation	NJR	3.3%	5.0%	3.8%	8.5%	7.3%
NiSource Inc	NI	3.2%	4.5%	3.8%	7.9%	7.2%
Northwest Natural Holding Company	NWN	3.6%	0.5%	3.8%	4.2%	7.5%
ONE Gas Inc	OGS	3.1%	6.5%	3.8%	9.8%	7.1%
Southwest Gas Holdings Inc	SWX	2.8%	5.5%	3.8%	8.5%	6.8%
Spire Inc.	SR	3.7%	5.0%	3.8%	8.9%	7.7%
Average		3.0%	5.3%	3.8%	8.3%	6.7%

[1] Dividend Yield from Exhibit DJG-4

[2] Forecasted dividend growth rates - Value Line

[3] Sustainable growth rate from Exhibit DJG-5

[4] Annual Compounding DCF = $D_0 (1 + g) / P_0 + g$ (using sustainable growth rate)

[5] Annual Compounding DCF = $D_0 (1 + g) / P_0 + g$ (using analyst growth rate)

CAPM Risk-Free Rate

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<u>Date</u>	<u>Rate</u>
06/03/22	3.1%
06/06/22	3.2%
06/07/22	3.1%
06/08/22	3.2%
06/09/22	3.2%
06/10/22	3.2%
06/13/22	3.4%
06/14/22	3.5%
06/15/22	3.4%
06/16/22	3.4%
06/17/22	3.3%
06/21/22	3.4%
06/22/22	3.3%
06/23/22	3.2%
06/24/22	3.3%
06/27/22	3.3%
06/28/22	3.3%
06/29/22	3.2%
06/30/22	3.1%
07/01/22	3.1%
07/05/22	3.1%
07/06/22	3.1%
07/07/22	3.2%
07/08/22	3.3%
07/11/22	3.2%
07/12/22	3.1%
07/13/22	3.1%
07/14/22	3.1%
07/15/22	3.1%
07/18/22	3.1%
Average	3.2%

*Daily Treasury Yield Curve Rates on 30-year T-bonds, <http://www.treasury.gov/resources-center/data-chart-center/interest-rates/>

CAPM Beta Coefficient

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Company	Ticker	Beta
Atmos Energy Corp	ATO	0.80
Chesapeake Utilities Corp	CPK	0.75
New Jersey Resources Corporation	NJR	0.95
NiSource Inc	NI	0.85
Northwest Natural Holding Company	NWN	0.80
ONE Gas Inc	OGS	0.80
Southwest Gas Holdings Inc	SWX	0.90
Spire Inc.	SR	0.80
Average		0.83

Betas from Value Line Investment Survey

CAPM Implied Equity Risk Premium Estimate

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Year	Market Value	Operating Earnings	Dividends	Buybacks	Earnings Yield	Dividend Yield	Buyback Yield	Gross Cash Yield
2011	11,385	877	240	405	7.70%	2.11%	3.56%	5.67%
2012	12,742	870	281	399	6.83%	2.20%	3.13%	5.33%
2013	16,495	956	312	476	5.80%	1.89%	2.88%	4.77%
2014	18,245	1,004	350	553	5.50%	1.92%	3.03%	4.95%
2015	17,900	885	382	572	4.95%	2.14%	3.20%	5.33%
2016	19,268	920	397	536	4.77%	2.06%	2.78%	4.85%
2017	22,821	1,066	420	519	4.67%	1.84%	2.28%	4.12%
2018	21,027	1,282	456	806	6.10%	2.17%	3.84%	6.01%
2019	26,760	1,305	485	729	4.88%	1.81%	2.72%	4.54%
2020	31,659	1,019	480	520	3.22%	1.52%	1.64%	3.16%
2021	40,356	1,739	511	882	4.31%	1.27%	2.18%	3.45%

Cash Yield	4.74%	[9]
Growth Rate	7.09%	[10]
Risk-free Rate	3.22%	[11]
Current Index Value	3,862	[12]

	[13]	[14]	[15]	[16]	[17]
Year	1	2	3	4	5
Expected Dividends	196	210	225	241	258
Expected Terminal Value					4605
Present Value	180	177	174	171	3161
Intrinsic Index Value	3862	[18]			
Required Return on Market	9.0%	[19]			
Implied Equity Risk Premium	5.8%	[20]			

[1-4] S&P Quarterly Press Releases, data found at <https://us.spindices.com/indices/equity/sp-500> (additional info tab) (all dollar figures are in \$ billions)

[1] Market value of S&P 500

[5] = [2] / [1]

[6] = [3] / [1]

[7] = [4] / [1]

[8] = [6] + [7]

[9] = Average of [8]

[10] = Compound annual growth rate of [2] = (end value / beginning value)¹⁰-1

[11] Risk-free rate from DJG risk-free rate exhibit

[12] 30-day average of closing index prices from DJG stock price exhibit

[13-16] Expected dividends = [9]*[12]*(1+[10])ⁿ; Present value = expected dividend / (1+[11]+[19])ⁿ

[17] Expected terminal value = expected dividend * (1+[11]) / [19]; Present value = (expected dividend + expected terminal value) / (1+[11]+[19])ⁿ

[18] = Sum([13-17]) present values.

[19] = [20] + [11]

[20] Internal rate of return calculation setting [18] equal to [12] and solving for the discount rate

CAPM Equity Risk Premium Results

IESE Business School Survey	5.6%	[1]
Kroll (formerly Duff & Phelps)	5.5%	[2]
Damodaran (average)	5.5%	[3]
Garrett	<u>5.8%</u>	[4]
Average	5.6%	

CAPM Final Result

[1]	[2]	[3]	[4]
Risk-Free Rate	Proxy Beta	Risk Premium	CAPM Result
3.22%	0.831	5.6%	7.9%

[1] From DJG-7, risk-free rate exhibit

[2] From DJG-8, beta exhibit (avg. beta of proxy group)

[3] From DJG-10, equity risk premium exhibit

[4] = [1] + [2] * [3]

Cost of Equity Summary

Cost of Equity Model	Result
DCF (Sustainable Growth)	6.7%
DCF (Analyst Growth)	8.3%
Capital Asset Pricing Model	7.9%
Hamada (at proposed debt ratio)	8.5%
Average	7.8%
Highest	8.5%

Market Cost of Equity vs. Awarded Returns

Year	[1]		[2]		[3]		[4]	[5]	[6]	[7]
	Electric Utilities		Gas Utilities		Total Utilities		S&P 500	T-Bond	Risk	Market
	ROE	#	ROE	#	ROE	#	Returns	Rate	Premium	COE
1990	12.70%	38	12.68%	33	12.69%	71	-3.06%	8.07%	3.89%	11.96%
1991	12.54%	42	12.45%	31	12.50%	73	30.23%	6.70%	3.48%	10.18%
1992	12.09%	45	12.02%	28	12.06%	73	7.49%	6.68%	3.55%	10.23%
1993	11.46%	28	11.37%	40	11.41%	68	9.97%	5.79%	3.17%	8.96%
1994	11.21%	28	11.24%	24	11.22%	52	1.33%	7.82%	3.55%	11.37%
1995	11.58%	28	11.44%	13	11.54%	41	37.20%	5.57%	3.29%	8.86%
1996	11.40%	18	11.12%	17	11.26%	35	22.68%	6.41%	3.20%	9.61%
1997	11.33%	10	11.30%	12	11.31%	22	33.10%	5.74%	2.73%	8.47%
1998	11.77%	10	11.51%	10	11.64%	20	28.34%	4.65%	2.26%	6.91%
1999	10.72%	6	10.74%	6	10.73%	12	20.89%	6.44%	2.05%	8.49%
2000	11.58%	9	11.34%	13	11.44%	22	-9.03%	5.11%	2.87%	7.98%
2001	11.07%	15	10.96%	5	11.04%	20	-11.85%	5.05%	3.62%	8.67%
2002	11.21%	14	11.17%	19	11.19%	33	-21.97%	3.81%	4.10%	7.91%
2003	10.96%	20	10.99%	25	10.98%	45	28.36%	4.25%	3.69%	7.94%
2004	10.81%	21	10.63%	22	10.72%	43	10.74%	4.22%	3.65%	7.87%
2005	10.51%	24	10.41%	26	10.46%	50	4.83%	4.39%	4.08%	8.47%
2006	10.32%	26	10.40%	15	10.35%	41	15.61%	4.70%	4.16%	8.86%
2007	10.30%	38	10.22%	35	10.26%	73	5.48%	4.02%	4.37%	8.39%
2008	10.41%	37	10.39%	32	10.40%	69	-36.55%	2.21%	6.43%	8.64%
2009	10.52%	40	10.22%	30	10.39%	70	25.94%	3.84%	4.36%	8.20%
2010	10.37%	61	10.15%	39	10.28%	100	14.82%	3.29%	5.20%	8.49%
2011	10.29%	42	9.92%	16	10.19%	58	2.10%	1.88%	6.01%	7.89%
2012	10.17%	58	9.94%	35	10.08%	93	15.89%	1.76%	5.78%	7.54%
2013	10.03%	49	9.68%	21	9.93%	70	32.15%	3.04%	4.96%	8.00%
2014	9.91%	38	9.78%	26	9.86%	64	13.52%	2.17%	5.78%	7.95%
2015	9.85%	30	9.60%	16	9.76%	46	1.38%	2.27%	6.12%	8.39%
2016	9.77%	42	9.54%	26	9.68%	68	11.77%	2.45%	5.69%	8.14%
2017	9.74%	53	9.72%	24	9.73%	77	21.61%	2.41%	5.08%	7.49%
2018	9.64%	37	9.62%	26	9.63%	63	-4.23%	2.68%	5.96%	8.64%
2019	9.66%	67	9.71%	32	9.68%	99	31.22%	1.92%	5.20%	7.12%
2020	9.44%	43	9.46%	34	9.45%	77	18.01%	0.93%	4.72%	5.65%
2021	9.40%	55	9.52%	29	9.44%	84	18.01%	1.51%	4.24%	5.75%

[1], [2], [3] Average annual authorized ROE for electric and gas utilities, RRA Regulatory Focus: Major Rate Case Decisions; EEI Rate Review

[3] = [1] + [2]

[4], [5], [6] Annual S&P 500 return, 10-year T-bond Rate, and equity risk premium published by NYU Stern School of Business

[7] = [5] + [6] ; Market cost of equity represents the required return for investing in all stocks in the market for a given year

Proxy Company Debt Ratios

Docket No. 20220067-GU

FPUC Petition

Exhibit DJG-14

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Company	Ticker	Debt Ratio
Atmos Energy Corp	ATO	38%
Chesapeake Utilities Corp	CPK	42%
New Jersey Resources Corporation	NJR	57%
NiSource Inc	NI	57%
Northwest Natural Holding Company	NWN	53%
ONE Gas Inc	OGS	61%
Southwest Gas Holdings Inc	SWX	58%
Spire Inc.	SR	53%
Average		52%

Debt ratios from Value Line Investment Survey - Year End 2021

Competitive Industry Debt Ratios

Docket No. 20220067-GU

FPUC Petition

Exhibit DJG-15

Page 1 of 1

Industry	# Firms	Debt Ratio
Air Transport	21	85%
Hospitals/Healthcare Facilities	31	80%
Hotel/Gaming	66	77%
Brokerage & Investment Banking	31	76%
Retail (Automotive)	32	72%
Food Wholesalers	15	68%
Retail (Grocery and Food)	15	68%
Rubber& Tires	2	67%
Bank (Money Center)	7	67%
Advertising	49	67%
Computers/Peripherals	46	67%
Auto & Truck	26	66%
Real Estate (Operations & Services)	51	66%
Retail (Special Lines)	76	64%
Cable TV	11	63%
Oil/Gas Distribution	21	63%
Packaging & Container	26	62%
Telecom. Services	42	61%
Recreation	60	61%
Broadcasting	28	60%
Transportation (Railroads)	4	60%
R.E.I.T.	238	60%
Power	50	60%
Telecom (Wireless)	17	59%
Transportation	17	59%
Beverage (Soft)	32	58%
Utility (Water)	14	57%
Retail (Distributors)	68	57%
Office Equipment & Services	18	57%
Aerospace/Defense	73	57%
Household Products	118	56%
Computer Services	83	56%
Green & Renewable Energy	20	56%
Chemical (Diversified)	4	55%
Trucking	34	55%
Farming/Agriculture	36	54%
Environmental & Waste Services	58	54%
Apparel	39	54%
Paper/Forest Products	11	54%
Retail (Online)	60	53%
Chemical (Basic)	35	53%
Real Estate (Development)	19	52%
Business & Consumer Services	160	52%
Coal & Related Energy	18	52%
Construction Supplies	48	51%
Total / Average	1,930	61%

Hamada Model

Docket No. 20220067-GU

FPUC Petition

Exhibit DJG-16

Page 1 of 1

Unlevering Beta

Proposed Debt Ratio	45%	[1]
Proposed Equity Ratio	55%	[2]
Debt / Equity Ratio	82%	[3]
Tax Rate	21%	[4]
Equity Risk Premium	5.6%	[5]
Risk-free Rate	3.2%	[6]
Proxy Group Beta	0.83	[7]
Unlevered Beta	0.51	[8]

[9] [10] [11] [12]

Relevered Betas and Cost of Equity Estimates

Debt Ratio	D/E Ratio	Levered Beta	Cost of Equity
0.0%	0%	0.505	6.04%
20.0%	25%	0.605	6.60%
30.0%	43%	0.676	7.00%
45.0%	82%	0.831	7.87%
52.0%	108%	0.938	8.46%
55.0%	122%	0.993	8.78%
60.0%	150%	1.104	9.40%

[1] Company proposed debt ratio

[2] Company proposed equity ratio

[3] = [1] / [2]

[4] Tax rate

[5] Equity risk premium from Exhibit DJG-11

[6] Risk-free rate from Exhibit DJG-11

[7] Average proxy beta from Exhibit DJG-11

[8] = [7] / (1 + (1 - [4]) * [3])

[9] Various debt ratios (Garrett proposed highlighted)

[10] = [9] / (1 - [9])

[11] = [8] * (1 + (1 - [4]) * [10])

[12] = [6] + [11] * [5]

Weighted Average Rate of Return Proposal

Adjusted Ratios From Exhibit No. PRM-1, Sch. 1

OPC Proposed				Company Proposed			
Capital Component	Proposed Ratio	Cost Rate	Weighted Cost	Capital Component	Proposed Ratio	Cost Rate	Weighted Cost
Long-Term Debt	43.1%	3.46%	1.49%	Long-Term Debt	39.4%	3.46%	1.36%
Short-Term Debt	5.5%	3.30%	0.18%	Short-Term Debt	5.5%	3.30%	0.18%
Common Equity	51.4%	9.25%	4.75%	Common Equity	55.1%	11.25%	6.19%
Total	100.0%		6.43%	Total	100.0%		7.74%

Adjusted Ratios From Schedule G-3

OPC Proposed				Company Proposed			
Capital Component	Proposed Ratio	Cost Rate	Weighted Cost	Capital Component	Proposed Ratio	Cost Rate	Weighted Cost
Common Equity	39.670%	9.25%	3.67%	Common Equity	45.143%	11.25%	5.08%
Long Term Debt	38.130%	3.48%	1.33%	Long Term Debt	32.660%	3.48%	1.14%
Short Term Debt	4.570%	3.28%	0.15%	Short Term Debt	4.570%	3.28%	0.15%
Customer Deposits	2.370%	2.37%	0.06%	Customer Deposits	2.370%	2.37%	0.06%
Deferred Taxes	9.270%			Deferred Taxes	9.270%		
Deferred Tax Common	0.020%			Deferred Tax Common	0.020%		
Regulatory Tax Liability	5.980%			Regulatory Tax Liability	5.980%		
Reg Tax Liability Common	0.010%			Reg Tax Liability Common	0.010%		
Total	100.0%		5.20%	Total	100.0%		6.42%

**Summary Depreciation
Accrual Adjustment**

Plant Function	Plant Balance	FPUC Proposed Accrual	OPC Proposed Accrual	OPC Accrual Adjustment
Distribution	534,592,291	10,963,200	10,291,269	(671,930)
General	37,760,361	2,052,150	2,052,150	-
Total Plant Studied	\$ 572,352,652	\$ 13,304,917	\$ 12,632,987	\$ (671,930)

Based on depreciation rates developed in Exhibit DJG-6

Peer Group Detailed Parameter Comparison

Acct	Description	[1] FPUC Proposed	[2] Liberty	[3] NIPSCO	[4] PNG	[5] FCG	[6] PGS	[7] Group Avg	[8] Avg Less FPUC
378	M&R Equip. - General	40	51	55	55	30	40	46	6
379	M&R Equip. - City Gate	40	51	55	55	35	50	49	9
3801	Services - Plastic	55	50	68	60	54	55	57	2
381	Meters	28	45	36	29	20	19	30	2
Average		41	49	54	50	35	41	46	5

[1] FPUC's proposed service lives in this docket

[2] Final Order, Application of Liberty Utilities (Peach State Natural Gas), Docket No. 42959, before the Georgia Public Service Commission (July 30, 2020).

[3] Final Order, Petition of Northern Indiana Public Service Company, Cause No. 45621, before the Indiana Utility Regulatory Commission (April 1, 2022).

[4] Final Order, Petition of Piedmont Natural Gas Company, Docket No. 2019-191-G, before the Public Service Commission of South Carolina (August 14, 2019).

[5] Final Order, Petition of Florida City Gas, Docket No. 20170179-GU, before the Florida Public Service Commission (April 20, 2018).

[6] Final Order, Petition of Peoples Gas System, Docket No. 20200166-GU, before the Florida Public Service Commission (December 10, 2020).

[7] = Average of [2] through [6]

[8] = [7] - [1]

*All figures are rounded to the nearest whole number

Detailed Rate Comparison

Account No.	Description	[1]	[2]		[3]		[4]	
		Plant Balance	FPUC Proposal		OPC Proposal		Difference	
			Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
DISTRIBUTION PLANT								
3741	Land Rights	33,410	1.20%	401	1.20%	410	0.00%	9
375	Structures & Improvements	1,572,719	2.80%	44,036	2.80%	43,591	0.00%	-445
3761	Mains - Plastic	125,006,731	1.60%	2,000,108	1.50%	1,854,620	-0.10%	-145,488
3762	Mains - Steel	61,810,864	2.10%	1,298,028	1.70%	1,025,066	-0.40%	-272,962
376G	Mains - GRIP	146,879,318	1.60%	2,350,069	1.70%	2,475,808	0.10%	125,739
378	Measuring and Regulating Equip. - General	6,890,853	2.70%	186,053	2.30%	155,077	-0.40%	-30,976
379	Measuring and Regulating Equip. - City Gate	14,603,999	2.50%	365,100	1.90%	277,660	-0.60%	-87,440
3801	Services - Plastic	69,786,805	2.50%	1,744,670	2.20%	1,534,026	-0.30%	-210,644
3802	Services - Other	1,327,469	3.50%	46,461	3.60%	48,054	0.10%	1,592
380G	Services - GRIP	48,993,831	2.50%	1,224,846	2.50%	1,229,371	0.00%	4,525
381	Meters	23,268,059	3.70%	860,918	3.40%	796,197	-0.30%	-64,721
3811	Meters - AMR Equipment	2,303,034	2.20%	50,667	2.30%	53,144	0.10%	2,477
382	Meter Installations	18,239,922	2.60%	474,238	2.60%	475,347	0.00%	1,109
3821	Meter Installations - MTU/DCU	593,040	2.20%	13,047	2.20%	12,976	0.00%	-71
383	House Regulators	6,859,108	2.00%	137,182	2.00%	138,086	0.00%	904
384	House Regulator Installations	1,081,399	2.40%	25,954	2.50%	27,439	0.10%	1,486
385	Indus. Meas. & Reg. Station Equip	1,883,028	2.00%	37,661	2.20%	41,141	0.20%	3,480
387	Other Equipment	3,458,702	3.00%	103,761	3.00%	103,257	0.00%	-504
Total Distribution Plant		534,592,291	2.05%	10,963,200	1.93%	10,291,269	-0.13%	-671,930
GENERAL PLANT								
390	Structures & Improvemts.	14,092,184	2.30%	324,120	2.30%	324,120	0.00%	0
3910	Office Equipment	2,294,441	7.10%	163,889	7.10%	163,889	0.00%	0
3912	Computer Hardware	374,792	10.00%	37,479	10.00%	37,479	0.00%	0
3913	Office Furniture	758,651	5.00%	37,933	5.00%	37,933	0.00%	0
3914	Computer Software	7,283,950	10.00%	728,395	10.00%	728,395	0.00%	0
3921	Transportation - Cars	298,594	4.60%	13,735	4.60%	13,735	0.00%	0
3922	Transportation - Light Trucks & Vans	6,692,224	5.80%	388,149	5.80%	388,149	0.00%	0
3923	Transportation - Heavy Trucks	0	8.20%	0	8.20%	0	0.00%	0
3924	Transportation - Other	63,465	1.80%	1,142	1.80%	1,142	0.00%	0
393	Stores Equipment	29,458	3.80%	1,133	3.80%	1,133	0.00%	0
394	Tools, Shop & Garage Equipment	1,366,809	6.70%	91,121	6.70%	91,121	0.00%	0
395	Laboratory Equipment	0	5.00%	0	5.00%	0	0.00%	0
396	Power Operated Equipment	1,785,842	3.50%	62,504	3.50%	62,504	0.00%	0
397	Communication Equipment	2,351,047	7.70%	180,850	7.70%	180,850	0.00%	0

Detailed Rate Comparison

Account No.	Description	[1]	[2]		[3]		[4]	
		Plant Balance	FPUC Proposal		OPC Proposal		Difference	
			Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
398	Miscellaneous Equipment	368,904	5.90%	21,700	5.90%	21,700	0.00%	0
399	Miscellaneous Tangible	0	20.00%	0	20.00%	0	0.00%	0
Total General Plant		37,760,361	5.43%	2,052,150	5.43%	2,052,150	0.00%	0
Revised General Plant Amortization				289,567		289,567		0
TOTAL PLANT STUDIED		\$ 572,352,652	2.32%	\$ 13,304,917	2.21%	\$ 12,632,987	-0.12%	\$ (671,930)

[1], [2] From depreciation study

[3] From Exhibit DJG-21

[4] = [3] - [2]

Depreciation Rate Development

Account No.	Description	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]		[10]
		Plant Balance	lowa Curve Type AL	Net Salvage	Depreciable Base	Book Reserve	Future Accruals	Age (Years)	Remaining Life	Accrual	Rate	
DISTRIBUTION PLANT												
3741	Land Rights	33,410	SQ - 75	0.0%	33,410	10,455	22,955	19.2	56.0	410	1.20%	
375	Structures & Improvements	1,572,719	S4 - 40	0.0%	1,572,719	352,170	1,220,549	11.7	28.0	43,591	2.80%	
3761	Mains - Plastic	125,006,731	S3 - 75	-25.0%	156,258,414	31,998,891	124,259,523	8.1	67.0	1,854,620	1.50%	
3762	Mains - Steel	61,810,864	S3 - 65	-40.0%	86,535,210	30,156,556	56,378,654	10.3	55.0	1,025,066	1.70%	
376G	Mains - GRIP	146,879,318	S3 - 75	-25.0%	183,599,148	17,720,021	165,879,127	8.1	67.0	2,475,808	1.70%	
378	Measuring and Regulating Equip. - General	6,890,853	R3 - 46	-10.0%	7,579,938	1,687,017	5,892,921	8.0	38.0	155,077	2.30%	
379	Measuring and Regulating Equip. - City Gate	14,603,999	R3 - 49	-10.0%	16,064,399	5,790,981	10,273,418	12.7	37.0	277,660	1.90%	
3801	Services - Plastic	69,786,805	S3 - 57	-30.0%	90,722,847	15,555,576	75,167,271	8.7	49.0	1,534,026	2.20%	
3802	Services - Other	1,327,469	S2 - 60	-130.0%	3,053,179	1,419,351	1,633,828	26.3	34.0	48,054	3.60%	
380G	Services - GRIP	48,993,831	S3 - 57	-30.0%	63,691,980	3,452,806	60,239,174	8.7	49.0	1,229,371	2.50%	
381	Meters	23,268,059	R3 - 30	0.0%	23,268,059	7,344,116	15,923,943	9.9	20.0	796,197	3.40%	
3811	Meters - AMR Equipment	2,303,034	R3 - 28	0.0%	2,303,034	1,452,731	850,303	12.1	16.0	53,144	2.30%	
382	Meter Installations	18,239,922	S2 - 45	-20.0%	21,887,906	5,250,750	16,637,156	10.2	35.0	475,347	2.60%	
3821	Meter Installations - MTU/DCU	593,040	S2 - 45	-20.0%	711,648	283,446	428,202	12.5	33.0	12,976	2.20%	
383	House Regulators	6,859,108	R4 - 40	0.0%	6,859,108	3,130,791	3,728,317	13.1	27.0	138,086	2.00%	
384	House Regulator Installations	1,081,399	S3 - 45	-20.0%	1,297,679	694,012	603,667	23.0	22.0	27,439	2.50%	
385	Indus. Meas. & Reg. Station Equip	1,883,028	R3 - 38	0.0%	1,883,028	1,224,779	658,249	22.3	16.0	41,141	2.20%	
387	Other Equipment	3,458,702	S3 - 30	0.0%	3,458,702	1,496,820	1,961,882	10.9	19.0	103,257	3.00%	
Total Distribution Plant		534,592,291		-25.5%	670,780,407	129,021,269	541,759,138		52.6	10,291,269	1.93%	
GENERAL PLANT												
390	Structures & Improvements	14,092,184	R3 - 40	10.0%	12,682,966	1,099,778	11,583,188		35.0	324,120	2.30%	
3910	Office Equipment	2,294,441	SQ - 14	0.0%	2,294,441	458,888	1,835,553		11.2	163,889	7.10%	
3912	Computer Hardware	374,792	SQ - 10	0.0%	374,792	247,363	127,429		3.4	37,479	10.00%	
3913	Office Furniture	758,651	SQ - 20	0.0%	758,651	189,663	568,988		15.0	37,933	5.00%	
3914	Computer Software	7,283,950	SQ - 10	0.0%	7,283,950	4,588,889	2,695,061		3.7	728,395	10.00%	
3921	Transportation - Cars	298,594	S2 - 12	10.0%	268,735	144,313	124,422		9.1	13,735	4.60%	
3922	Transportation - Light Trucks & Vans	6,692,224	S2 - 12	20.0%	5,353,779	2,879,435	2,474,344		6.4	388,149	5.80%	
3923	Transportation - Heavy Trucks	0	SQ - 11	10.0%	0	0	0		11.0	0	8.20%	
3924	Transportation - Other	63,465	S4 - 27	0.0%	63,465	50,523	12,942		11.6	1,142	1.80%	
393	Stores Equipment	29,458	SQ - 26	0.0%	29,458	9,064	20,394		18.0	1,133	3.80%	
394	Tools, Shop & Garage Equipment	1,366,809	SQ - 15	0.0%	1,366,809	464,715	902,094		9.9	91,121	6.70%	
395	Laboratory Equipment	0	SQ - 20	0.0%	0	0	0		20.0	0	5.00%	
396	Power Operated Equipment	1,785,842	S2 - 20	5.0%	1,696,550	1,053,468	643,082		10.2	62,504	3.50%	
397	Communication Equipment	2,351,047	SQ - 13	0.0%	2,351,047	1,030,934	1,320,113		7.3	180,850	7.70%	
398	Miscellaneous Equipment	368,904	SQ - 17	0.0%	368,904	247,387	121,517		5.6	21,700	5.90%	
399	Miscellaneous Tangible	0	SQ - 5	0.0%	0	0	0		20.0	0	20.00%	
Total General Plant		37,760,361		7.6%	34,893,546	12,464,420	22,429,126		10.9	2,052,151	5.43%	
Revised General Plant Amortization										289,567		
TOTAL PLANT STUDIED		\$ 572,352,652		-23.3%	\$ 705,673,953	\$ 141,485,689	\$ 564,188,264		44.7	\$ 12,632,987	2.21%	

[1] From depreciation study

[2] Average life for adjusted accounts based on average of approved lives in Exhibit DJG-19

Depreciation Rate Development

		[1]	[2]		[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Account No.	Description	Plant Balance	<u>Iowa Curve</u>		Net Salvage	Depreciable Base	Book Reserve	Future Accruals	Age (Years)	Remaining Life	<u>Total</u>	
			<u>Type</u>	<u>AL</u>							<u>Accrual</u>	<u>Rate</u>

[3] Mass net salvage rates developed through statistical analysis and professional judgment
 [4] = [1]*[1]-[3]
 [5] From depreciation study
 [6] = [4] - [5]
 [7] Company calculated ages from depreciation study
 [8] Composite remaining life based on Iowa curve in [2]
 [9] = [6] / [8]
 [10] = [9] / [1]

Account 380 Curve Fitting Example

[1]	[2]	[3]	[4]
Age (Years)	Exposures (Dollars)	Observed Life Table (OLT)	Approved R2-68
0.0	491,101,104	100.00%	100.00%
0.5	468,280,249	99.93%	99.93%
1.5	436,423,251	99.79%	99.79%
2.5	405,604,263	99.59%	99.63%
3.5	385,175,815	99.42%	99.48%
4.5	363,213,179	99.23%	99.31%
5.5	355,487,188	98.97%	99.13%
6.5	354,879,499	98.73%	98.95%
7.5	347,794,576	98.47%	98.76%
8.5	341,301,723	98.19%	98.56%
9.5	340,166,998	97.89%	98.35%
10.5	342,550,181	97.61%	98.12%
11.5	346,620,918	97.27%	97.89%
12.5	340,646,764	96.86%	97.65%
13.5	338,473,155	96.48%	97.40%
14.5	334,825,069	96.10%	97.14%
15.5	327,697,390	95.70%	96.86%
16.5	326,639,871	95.24%	96.57%
17.5	320,790,910	94.82%	96.27%
18.5	316,006,135	94.45%	95.96%
19.5	310,227,178	94.06%	95.63%
20.5	302,294,197	93.71%	95.29%
21.5	289,564,685	93.28%	94.94%
22.5	278,940,323	92.91%	94.57%
23.5	268,879,276	92.50%	94.19%
24.5	257,968,750	92.13%	93.79%
25.5	247,948,435	91.70%	93.37%
26.5	237,912,934	91.26%	92.94%
27.5	229,214,447	90.85%	92.49%
28.5	219,019,704	90.45%	92.03%
29.5	210,327,833	89.02%	91.54%
30.5	202,050,213	88.62%	91.04%
31.5	193,019,524	88.18%	90.52%
32.5	181,777,722	87.71%	89.98%
33.5	169,118,895	87.27%	89.41%
34.5	157,753,187	86.61%	88.83%
35.5	148,846,925	85.98%	88.23%
36.5	140,457,490	85.45%	87.60%
37.5	131,769,312	84.99%	86.95%
38.5	121,950,791	84.40%	86.28%
39.5	109,996,346	83.89%	85.59%
40.5	103,140,200	83.47%	84.87%
41.5	92,831,434	82.99%	84.12%
42.5	83,721,194	82.39%	83.35%
43.5	75,841,611	81.78%	82.56%
44.5	68,294,698	81.05%	81.73%
45.5	60,895,401	80.26%	80.89%
46.5	53,484,618	79.35%	80.01%
47.5	46,887,875	78.53%	79.10%
48.5	41,227,144	77.69%	78.17%
49.5	37,237,846	77.15%	77.21%
50.5	33,599,283	76.59%	76.21%
51.5	29,555,752	75.82%	75.19%
52.5	25,753,629	75.18%	74.14%
53.5	22,334,129	74.46%	73.06%
54.5	19,066,532	73.80%	71.94%
55.5	16,183,028	73.10%	70.80%
56.5	13,787,686	72.15%	69.63%
57.5	11,188,085	71.48%	68.42%
58.5	8,724,834	70.76%	67.19%
59.5	6,552,055	69.93%	65.92%
60.5	4,776,210	68.58%	64.62%
61.5	3,853,342	67.64%	63.30%
62.5	3,200,501	66.47%	61.94%
63.5	2,941,157	65.55%	60.56%

Account 380 Curve Fitting Example

[1]	[2]	[3]	[4]
Age (Years)	Exposures (Dollars)	Observed Life Table (OLT)	Approved R2-68
64.5	2,469,374	63.95%	59.15%
65.5	2,105,556	61.62%	57.72%
66.5	1,409,689	61.14%	56.26%
67.5	1,201,715	60.55%	54.77%
68.5	957,404	59.36%	53.27%
69.5	696,525	53.88%	51.74%
70.5	464,965	46.90%	50.20%
71.5	350,133	45.99%	48.64%
72.5	255,867	45.90%	47.06%
73.5	217,106	45.63%	45.47%
74.5	177,299	45.35%	43.88%
75.5	158,125	45.06%	42.27%
76.5	170,665	44.59%	40.66%
77.5	154,890	44.27%	39.06%
78.5	132,353	44.21%	37.45%
79.5	98,786	43.97%	35.85%
80.5	83,537	43.64%	34.25%
81.5	62,650	43.35%	32.67%
82.5	29,685	25.54%	31.10%
83.5	24,932	25.48%	29.55%
84.5	2,068	18.70%	28.02%
85.5	1,215	14.47%	26.52%
86.5	1,545	14.47%	25.04%
87.5	1,193	11.17%	23.59%
88.5	1,440	10.15%	22.18%
89.5	555	9.49%	20.80%
90.5	522	9.15%	19.46%
91.5	522	9.15%	18.17%
92.5	522	9.15%	16.91%
93.5	463	8.12%	15.70%
94.5	463	8.12%	14.53%
95.5	442	7.80%	13.41%
96.5	442	7.80%	12.34%
97.5	439	7.80%	11.32%
98.5	439	7.80%	10.35%
99.5	439	7.80%	9.43%
100.5	439	7.80%	8.55%
101.5	357	6.34%	7.73%
102.5	356	6.32%	6.95%
103.5	356	6.32%	6.22%
104.5	356	6.32%	5.54%
105.5	356	6.32%	4.90%
106.5	356	6.32%	4.31%
107.5	356	6.32%	3.76%
108.5	356	6.32%	3.26%
109.5	356	6.32%	2.80%
110.5	356	6.32%	2.38%
111.5	356	6.32%	1.99%
112.5	356	6.32%	1.65%
113.5			1.35%

[1] Age in years using half-year convention

[2] Dollars exposed to retirement at the beginning of each age interval

[3] Observed life table based on NIPSCO's property records.

[4] Approved Iowa Curve

APPENDIX A:

DISCOUNTED CASH FLOW MODEL THEORY

The Discounted Cash Flow (“DCF”) Model is based on a fundamental financial model called the “dividend discount model,” which maintains that the value of a security is equal to the present value of the future cash flows it generates. Cash flows from common stock are paid to investors in the form of dividends. There are several variations of the DCF Model. In its most general form, the DCF Model is expressed as follows:¹

**Equation 1:
General Discounted Cash Flow Model**

$$P_0 = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \dots + \frac{D_n}{(1+k)^n}$$

where: P_0 = current stock price
 $D_1 \dots D_n$ = expected future dividends
 k = discount rate / required return

The General DCF Model would require an estimation of an infinite stream of dividends. Since this would be impractical, analysts use more feasible variations of the General DCF Model, which are discussed further below.

The DCF Models rely on the following four assumptions:

1. Investors evaluate common stocks in the classical valuation framework; that is, they trade securities rationally at prices reflecting their perceptions of value;
2. Investors discount the expected cash flows at the same rate (K) in every future period;

¹ See Zvi Bodie, Alex Kane & Alan J. Marcus, *Essentials of Investments* 410 (9th ed., McGraw-Hill/Irwin 2013).

3. The K obtained from the DCF equation corresponds to that specific stream of future cash flows alone; and
4. Dividends, rather than earnings, constitute the source of value.

The General DCF can be rearranged to make it more practical for estimating the cost of equity. Regulators typically rely on some variation of the Constant Growth DCF Model, which is expressed as follows:

**Equation 2:
Constant Growth Discounted Cash Flow Model**

$$K = \frac{D_1}{P_0} + g$$

where:

<i>K</i>	=	<i>discount rate / required return on equity</i>
<i>D₁</i>	=	<i>expected dividend per share one year from now</i>
<i>P₀</i>	=	<i>current stock price</i>
<i>g</i>	=	<i>expected growth rate of future dividends</i>

Unlike the General DCF Model, the Constant Growth DCF Model solves directly for the required return (K). In addition, by assuming that dividends grow at a constant rate, the dividend stream from the General DCF Model may be essentially substituted with a term representing the expected constant growth rate of future dividends (g). The Constant Growth DCF Model may be considered in two parts. The first part is the dividend yield (D_1/P_0), and the second part is the growth rate (g). In other words, the required return in the DCF Model is equivalent to the dividend yield plus the growth rate.

In addition to the four assumptions listed above, the Constant Growth DCF Model relies on four additional assumptions as follows:²

² *Id.* at 254-56.

1. The discount rate (K) must exceed the growth rate (g);
2. The dividend growth rate (g) is constant in every year to infinity;
3. Investors require the same return (K) in every year; and
4. There is no external financing; that is, growth is provided only by the retention of earnings.

Because the growth rate in this model is assumed to be constant, it is important not to use growth rates that are unreasonably high. In fact, the constant growth rate estimate for a regulated utility with a defined service territory should not exceed the growth rate for the economy in which it operates.

APPENDIX B:
CAPITAL ASSET PRICING MODEL THEORY

The Capital Asset Pricing Model (“CAPM”) is a market-based model founded on the principle that investors demand higher returns for incurring additional risk.³ The CAPM estimates this required return. The CAPM relies on the following assumptions:

1. Investors are rational, risk-adverse, and strive to maximize profit and terminal wealth;
2. Investors make choices based on risk and return. Return is measured by the mean returns expected from a portfolio of assets; risk is measured by the variance of these portfolio returns;
3. Investors have homogenous expectations of risk and return;
4. Investors have identical time horizons;
5. Information is freely and simultaneously available to investors.
6. There is a risk-free asset, and investors can borrow and lend unlimited amounts at the risk-free rate;
7. There are no taxes, transaction costs, restrictions on selling short, or other market imperfections; and,
8. Total asset quality is fixed, and all assets are marketable and divisible.⁴

³ William F. Sharpe, *A Simplified Model for Portfolio Analysis* 277-93 (Management Science IX 1963); see also John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 208 (3rd ed., South Western Cengage Learning 2010).

⁴ *Id.*

While some of these assumptions may appear to be restrictive, they do not outweigh the inherent value of the model. The CAPM has been widely used by firms, analysts, and regulators for decades to estimate the cost of equity capital.

The basic CAPM equation is expressed as follows:

**Equation 3:
Capital Asset Pricing Model**

$$K = R_F + \beta_i(R_M - R_F)$$

where: K = required return
 R_F = risk-free rate
 β = beta coefficient of asset i
 R_M = required return on the overall market

There are essentially three terms within the CAPM equation that are required to calculate the required return (K): (1) the risk-free rate (R_F); (2) the beta coefficient (β); and (3) the equity risk premium ($R_M - R_F$), which is the required return on the overall market less the risk-free rate.

Raw Beta Calculations and Adjustments

A stock's beta equals the covariance of the asset's returns with the returns on a market portfolio, divided by the portfolio's variance, as expressed in the following formula:⁵

**Equation 4:
Beta**

$$\beta_i = \frac{\sigma_{im}}{\sigma_m^2}$$

where: β_i = beta of asset i
 σ_{im} = covariance of asset i returns with market portfolio returns
 σ_m^2 = variance of market portfolio

⁵ John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 180-81 (3rd ed., South Western Cengage Learning 2010).

Betas that are published by various research firms are typically calculated through a regression analysis that considers the movements in price of an individual stock and movements in the price of the overall market portfolio. The betas produced by this regression analysis are considered “raw” betas. There is empirical evidence that raw betas should be adjusted to account for beta’s natural tendency to revert to an underlying mean.⁶ Some analysts use an adjustment method proposed by Blume, which adjusts raw betas toward the market mean of one.⁷ While the Blume adjustment method is popular due to its simplicity, it is arguably arbitrary, and some would say not useful at all. According to Dr. Damodaran: “While we agree with the notion that betas move toward 1.0 over time, the [Blume adjustment] strikes us as arbitrary and not particularly useful.”⁸ The Blume adjustment method is especially arbitrary when applied to industries with consistently low betas, such as the utility industry. For industries with consistently low betas, it is better to employ an adjustment method that adjusts raw betas toward an industry average, rather than the market average. Vasicek proposed such a method, which is preferable to the Blume adjustment method because it allows raw betas to be adjusted toward an industry average, and also accounts for the statistical accuracy of the raw beta calculation.⁹ In other words, “[t]he Vasicek adjustment seeks to overcome one weakness of the Blume model by not applying the same adjustment to every security; rather, a security-specific adjustment is made depending on the

⁶ See Michael J. Gombola and Douglas R. Kahl, *Time-Series Processes of Utility Betas: Implications for Forecasting Systematic Risk* 84-92 (Financial Management Autumn 1990).

⁷ See Marshall Blume, *On the Assessment of Risk*, Vol. 26, No. 1, The Journal of Finance 1 (1971).

⁸ See Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 187 (3rd ed., John Wiley & Sons, Inc. 2012).

⁹ Oldrich A. Vasicek, *A Note on Using Cross-Sectional Information in Bayesian Estimation of Security Betas* 1233-1239 (Journal of Finance, Vol. 28, No. 5, December 1973).

statistical quality of the regression.”¹⁰ The Vasicek beta adjustment equation is expressed as follows:

**Equation 5:
Vasicek Beta Adjustment**

$$\beta_{i1} = \frac{\sigma_{\beta_{i0}}^2}{\sigma_{\beta_0}^2 + \sigma_{\beta_{i0}}^2} \beta_0 + \frac{\sigma_{\beta_0}^2}{\sigma_{\beta_0}^2 + \sigma_{\beta_{i0}}^2} \beta_{i0}$$

where:

β_{i1}	=	<i>Vasicek adjusted beta for security i</i>
β_{i0}	=	<i>historical beta for security i</i>
β_0	=	<i>beta of industry or proxy group</i>
$\sigma_{\beta_0}^2$	=	<i>variance of betas in the industry or proxy group</i>
$\sigma_{\beta_{i0}}^2$	=	<i>square of standard error of the historical beta for security i</i>

The Vasicek beta adjustment is an improvement on the Blume model because the Vasicek model does not apply the same adjustment to every security. A higher standard error produced by the regression analysis indicates a lower statistical significance of the beta estimate. Thus, a beta with a high standard error should receive a greater adjustment than a beta with a low standard error. As stated in Ibbotson:

¹⁰ 2012 Ibbotson Stocks, Bonds, Bills, and Inflation Valuation Yearbook 77-78 (Morningstar 2012).

While the Vasicek formula looks intimidating, it is really quite simple. The adjusted beta for a company is a weighted average of the company's historical beta and the beta of the market, industry, or peer group. How much weight is given to the company and historical beta depends on the statistical significance of the company beta statistic. If a company beta has a low standard error, then it will have a higher weighting in the Vasicek formula. If a company beta has a high standard error, then it will have lower weighting in the Vasicek formula. An advantage of this adjustment methodology is that it does not force an adjustment to the market as a whole. Instead, the adjustment can be toward an industry or some other peer group. *This is most useful in looking at companies in industries that on average have high or low betas.*¹¹

Thus, the Vasicek adjustment method is statistically more accurate, and is the preferred method to use when analyzing companies in an industry that has inherently low betas, such as the utility industry. The Vasicek method was also confirmed by Gombola, who conducted a study specifically related to utility companies. Gombola concluded that “[t]he strong evidence of autoregressive tendencies in *utility* betas lends support to the application of adjustment procedures such as the . . . adjustment procedure presented by Vasicek.”¹² Gombola also concluded that adjusting raw betas toward the market mean of 1.0 is *too high*, and that “[i]nstead, they should be adjusted toward a value that is less than one.”¹³ In conducting the Vasicek adjustment on betas in previous

¹¹ *Id.* at 78 (emphasis added).

¹² Michael J. Gombola and Douglas R. Kahl, *Time-Series Processes of Utility Betas: Implications for Forecasting Systematic Risk* 92 (Financial Management Autumn 1990) (emphasis added).

¹³ *Id.* at 91-92.

cases, it reveals that utility betas are even lower than those published by Value Line.¹⁴ Gombola's findings are particularly important here, because his study was conducted specifically on utility companies. This evidence indicates that using Value Line's betas in a CAPM cost of equity estimate for a utility company may lead to overestimated results. Regardless, adjusting betas to a level that is *higher* than Value Line's betas is not reasonable, and it would produce CAPM cost of equity results that are too high.

¹⁴ See e.g. Responsive Testimony of David J. Garrett, filed March 21, 2016 in Cause No. PUD 201500273 before the Corporation Commission of Oklahoma (the Company's 2015 rate case), at pp. 56 – 59.

APPENDIX C: THE DEPRECIATION SYSTEM

A depreciation accounting system may be thought of as a dynamic system in which estimates of life and salvage are inputs to the system, and the accumulated depreciation account is a measure of the state of the system at any given time.¹⁵ The primary objective of the depreciation system is the timely recovery of capital. The process for calculating the annual accruals is determined by the factors required to define the system. A depreciation system should be defined by four primary factors: 1) a *method* of allocation; 2) a *procedure* for applying the method of allocation to a group of property; 3) a *technique* for applying the depreciation rate; and 4) a *model* for analyzing the characteristics of vintage groups comprising a continuous property group.¹⁶ The figure below illustrates the basic concept of a depreciation system and includes some of the available parameters.¹⁷

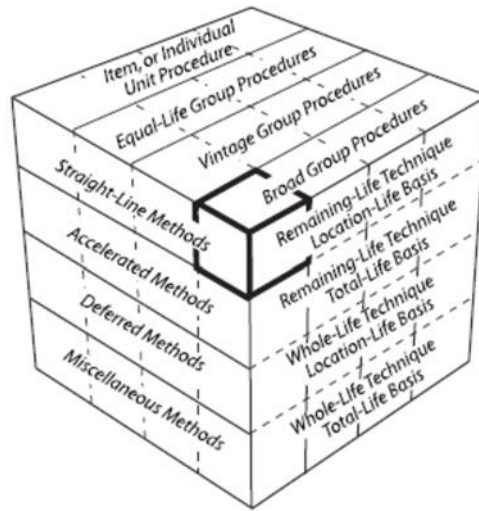
There are hundreds of potential combinations of methods, procedures, techniques, and models, but in practice, analysts use only a few combinations. Ultimately, the system selected must result in the systematic and rational allocation of capital recovery for the utility. Each of the four primary factors defining the parameters of a depreciation system is discussed further below.

¹⁵ See Frank K. Wolf & W. Chester Fitch, *Depreciation Systems* 69-70 (Iowa State University Press 1994).

¹⁶ *Id.* at 70, 139-40.

¹⁷ Edison Electric Institute, *Introduction to Depreciation* (inside cover) (EEI April 2013). Some definitions of the terms shown in this diagram are not consistent among depreciation practitioners and literature due to the fact that depreciation analysis is a relatively small and fragmented field. This diagram simply illustrates the some of the available parameters of a depreciation system.

**Figure 1:
The Depreciation System Cube**



1. Allocation Methods

The “method” refers to the pattern of depreciation in relation to the accounting periods. The method most commonly used in the regulatory context is the “straight-line method” — a type of age-life method in which the depreciable cost of plant is charged in equal amounts to each accounting period over the service life of plant.¹⁸ Because group depreciation rates and plant balances often change, the amount of the annual accrual rarely remains the same, even when the straight-line method is employed.¹⁹ The basic formula for the straight-line method is as follows:²⁰

**Equation 6:
Straight-Line Accrual**

$$\text{Annual Accrual} = \frac{\text{Gross Plant} - \text{Net Salvage}}{\text{Service Life}}$$

¹⁸ National Association of Regulatory Utility Commissioners, *Public Utility Depreciation Practices* 56 (NARUC 1996).

¹⁹ *Id.*

²⁰ *Id.*

Gross plant is a known amount from the utility's records, while both net salvage and service life must be estimated in order to calculate the annual accrual. The straight-line method differs from accelerated methods of recovery, such as the "sum-of-the-years-digits" method and the "declining balance" method. Accelerated methods are primarily used for tax purposes and are rarely used in the regulatory context for determining annual accruals.²¹ In practice, the annual accrual is expressed as a rate which is applied to the original cost of plant in order to determine the annual accrual in dollars. The formula for determining the straight-line rate is as follows:²²

**Equation 7:
Straight-Line Rate**

$$\text{Depreciation Rate \%} = \frac{100 - \text{Net Salvage \%}}{\text{Service Life}}$$

2. Grouping Procedures

The "procedure" refers to the way the allocation method is applied through subdividing the total property into groups.²³ While single units may be analyzed for depreciation, a group plan of depreciation is particularly adaptable to utility property. Employing a grouping procedure allows for a composite application of depreciation rates to groups of similar property, rather than excessively conducting calculations for each unit. Whereas an individual unit of property has a single life, a group of property displays a dispersion of lives and the life characteristics of the group must be described statistically.²⁴ When analyzing mass property categories, it is important that

²¹ *Id.* at 57.

²² *Id.* at 56.

²³ Wolf *supra* n. 15, at 74-75.

²⁴ *Id.* at 74.

each group contains homogenous units of plant that are used in the same general manner throughout the plant and operated under the same general conditions.²⁵

The “average life” and “equal life” grouping procedures are the two most common. In the average life procedure, a constant annual accrual rate based on the average life of all property in the group is applied to the surviving property. While property having shorter lives than the group average will not be fully depreciated, and likewise, property having longer lives than the group average will be over-depreciated, the ultimate result is that the group will be fully depreciated by the time of the final retirement.²⁶ Thus, the average life procedure treats each unit as though its life is equal to the average life of the group. In contrast, the equal life procedure treats each unit in the group as though its life was known.²⁷ Under the equal life procedure the property is divided into subgroups that each has a common life.²⁸

3. Application Techniques

The third factor of a depreciation system is the “technique” for applying the depreciation rate. There are two commonly used techniques: “whole life” and “remaining life.” The whole life technique applies the depreciation rate on the estimated average service life of a group, while the remaining life technique seeks to recover undepreciated costs over the remaining life of the plant.²⁹

In choosing the application technique, consideration should be given to the proper level of the accumulated depreciation account. Depreciation accrual rates are calculated using estimates of service life and salvage. Periodically these estimates must be revised due to changing

²⁵ NARUC *supra* n. 119, at 61-62.

²⁶ *See* Wolf *supra* n. 15, at 74-75.

²⁷ *Id.* at 75.

²⁸ *Id.*

²⁹ NARUC *supra* n. 119, at 63-64.

conditions, which cause the accumulated depreciation account to be higher or lower than necessary. Unless some corrective action is taken, the annual accruals will not equal the original cost of the plant at the time of final retirement.³⁰ Analysts can calculate the level of imbalance in the accumulated depreciation account by determining the “calculated accumulated depreciation,” (a.k.a. “theoretical reserve” and referred to in these appendices as “CAD”). The CAD is the calculated balance that would be in the accumulated depreciation account at a point in time using *current* depreciation parameters.³¹ An imbalance exists when the actual accumulated depreciation account does not equal the CAD. The choice of application technique will affect how the imbalance is dealt with.

Use of the whole life technique requires that an adjustment be made to accumulated depreciation after calculation of the CAD. The adjustment can be made in a lump sum or over a period of time. With use of the remaining life technique, however, adjustments to accumulated depreciation are amortized over the remaining life of the property and are automatically included in the annual accrual.³² This is one reason that the remaining life technique is popular among practitioners and regulators. The basic formula for the remaining life technique is as follows:³³

³⁰ Wolf *supra* n. 15, at 83.

³¹ NARUC *supra* n. 119, at 325.

³² NARUC *supra* n. 119, at 65 (“The desirability of using the remaining life technique is that any necessary adjustments of [accumulated depreciation] . . . are accrued automatically over the remaining life of the property. Once commenced, adjustments to the depreciation reserve, outside of those inherent in the remaining life rate would require regulatory approval.”).

³³ *Id.* at 64.

**Equation 8:
Remaining Life Accrual**

$$\text{Annual Accrual} = \frac{\text{Gross Plant} - \text{Accumulated Depreciation} - \text{Net Salvage}}{\text{Average Remaining Life}}$$

The remaining life accrual formula is similar to the basic straight-line accrual formula above with two notable exceptions. First, the numerator has an additional factor in the remaining life formula: the accumulated depreciation. Second, the denominator is “average remaining life” instead of “average life.” Essentially, the future accrual of plant (gross plant less accumulated depreciation) is allocated over the remaining life of plant. Thus, the adjustment to accumulated depreciation is “automatic” in the sense that it is built into the remaining life calculation.³⁴

4. Analysis Model

The fourth parameter of a depreciation system, the “model,” relates to the way of viewing the life and salvage characteristics of the vintage groups that have been combined to form a continuous property group for depreciation purposes.³⁵ A continuous property group is created when vintage groups are combined to form a common group. Over time, the characteristics of the property may change, but the continuous property group will continue. The two analysis models used among practitioners, the “broad group” and the “vintage group,” are two ways of viewing the life and salvage characteristics of the vintage groups that have been combined to form a continuous property group.

The broad group model views the continuous property group as a collection of vintage groups that each has the same life and salvage characteristics. Thus, a single survivor curve and a

³⁴ Wolf *supra* n. 15, at 178.

³⁵ See Wolf *supra* n. 15, at 139 (I added the term “model” to distinguish this fourth depreciation system parameter from the other three parameters).

single salvage schedule are chosen to describe all the vintages in the continuous property group. In contrast, the vintage group model views the continuous property group as a collection of vintage groups that may have different life and salvage characteristics. Typically, there is not a significant difference between vintage group and broad group results unless vintages within the applicable property group experienced dramatically different retirement levels than anticipated in the overall estimated life for the group. For this reason, many analysts utilize the broad group procedure because it is more efficient.

APPENDIX D: IOWA CURVES

Early work in the analysis of the service life of industrial property was based on models that described the life characteristics of human populations.³⁶ This explains why the word “mortality” is often used in the context of depreciation analysis. In fact, a group of property installed during the same accounting period is analogous to a group of humans born during the same calendar year. Each period the group will incur a certain fraction of deaths / retirements until there are no survivors. Describing this pattern of mortality is part of actuarial analysis and is regularly used by insurance companies to determine life insurance premiums. The pattern of mortality may be described by several mathematical functions, particularly the survivor curve and frequency curve. Each curve may be derived from the other so that if one curve is known, the other may be obtained. A survivor curve is a graph of the percent of units remaining in service expressed as a function of age.³⁷ A frequency curve is a graph of the frequency of retirements as a function of age. Several types of survivor and frequency curves are illustrated in the figures below.

1. Development

The survivor curves used by analysts today were developed over several decades from extensive analysis of utility and industrial property. In 1931 Edwin Kurtz and Robley Winfrey used extensive data from a range of 65 industrial property groups to create survivor curves representing the life characteristics of each group of property.³⁸ They generalized the 65 curves

³⁶ Wolf *supra* n. 15, at 276.

³⁷ *Id.* at 23.

³⁸ *Id.* at 34.

into 13 survivor curve types and published their results in *Bulletin 103: Life Characteristics of Physical Property*. The 13 type curves were designed to be used as valuable aids in forecasting probable future service lives of industrial property. Over the next few years, Winfrey continued gathering additional data, particularly from public utility property, and expanded the examined property groups from 65 to 176.³⁹ This resulted in 5 additional survivor curve types for a total of 18 curves. In 1935, Winfrey published *Bulletin 125: Statistical Analysis of Industrial Property Retirements*. According to Winfrey, “[t]he 18 type curves are expected to represent quite well all survivor curves commonly encountered in utility and industrial practices.”⁴⁰ These curves are known as the “Iowa curves” and are used extensively in depreciation analysis in order to obtain the average service lives of property groups. (Use of Iowa curves in actuarial analysis is further discussed in Exhibit DJG-23, Appendix E.)

In 1942, Winfrey published *Bulletin 155: Depreciation of Group Properties*. In Bulletin 155, Winfrey made some slight revisions to a few of the 18 curve types, and published the equations, tables of the percent surviving, and probable life of each curve at five-percent intervals.⁴¹ Rather than using the original formulas, analysts typically rely on the published tables containing the percentages surviving. This is because absent knowledge of the integration technique applied to each age interval, it is not possible to recreate the exact original published table values. In the 1970s, John Russo collected data from over 2,000 property accounts reflecting

³⁹ *Id.*

⁴⁰ Robley Winfrey, *Bulletin 125: Statistical Analyses of Industrial Property Retirements* 85, Vol. XXXIV, No. 23 (Iowa State College of Agriculture and Mechanic Arts 1935).

⁴¹ Robley Winfrey, *Bulletin 155: Depreciation of Group Properties* 121-28, Vol XLI, No. 1 (The Iowa State College Bulletin 1942); see also Wolf *supra* n. 15, at 305-38 (publishing the percent surviving for each Iowa curve, including “O” type curve, at one percent intervals).

observations during the period 1965 – 1975 as part of his Ph.D. dissertation at Iowa State. Russo essentially repeated Winfrey’s data collection, testing, and analysis methods used to develop the original Iowa curves, except that Russo studied industrial property in service several decades after Winfrey published the original Iowa curves. Russo drew three major conclusions from his research:⁴²

1. No evidence was found to conclude that the Iowa curve set, as it stands, is not a valid system of standard curves;
2. No evidence was found to conclude that new curve shapes could be produced at this time that would add to the validity of the Iowa curve set; and
3. No evidence was found to suggest that the number of curves within the Iowa curve set should be reduced.

Prior to Russo’s study, some had criticized the Iowa curves as being potentially obsolete because their development was rooted in the study of industrial property in existence during the early 1900s. Russo’s research, however, negated this criticism by confirming that the Iowa curves represent a sufficiently wide range of life patterns, and that though technology will change over time, the underlying patterns of retirements remain constant and can be adequately described by the Iowa curves.⁴³

Over the years, several more curve types have been added to Winfrey’s 18 Iowa curves. In 1967, Harold Cowles added four origin-modal curves. In addition, a square curve is sometimes used to depict retirements which are all planned to occur at a given age. Finally, analysts

⁴² See Wolf *supra* n. 15, at 37.

⁴³ *Id.*

commonly rely on several “half curves” derived from the original Iowa curves. Thus, the term “Iowa curves” could be said to describe up to 31 standardized survivor curves.

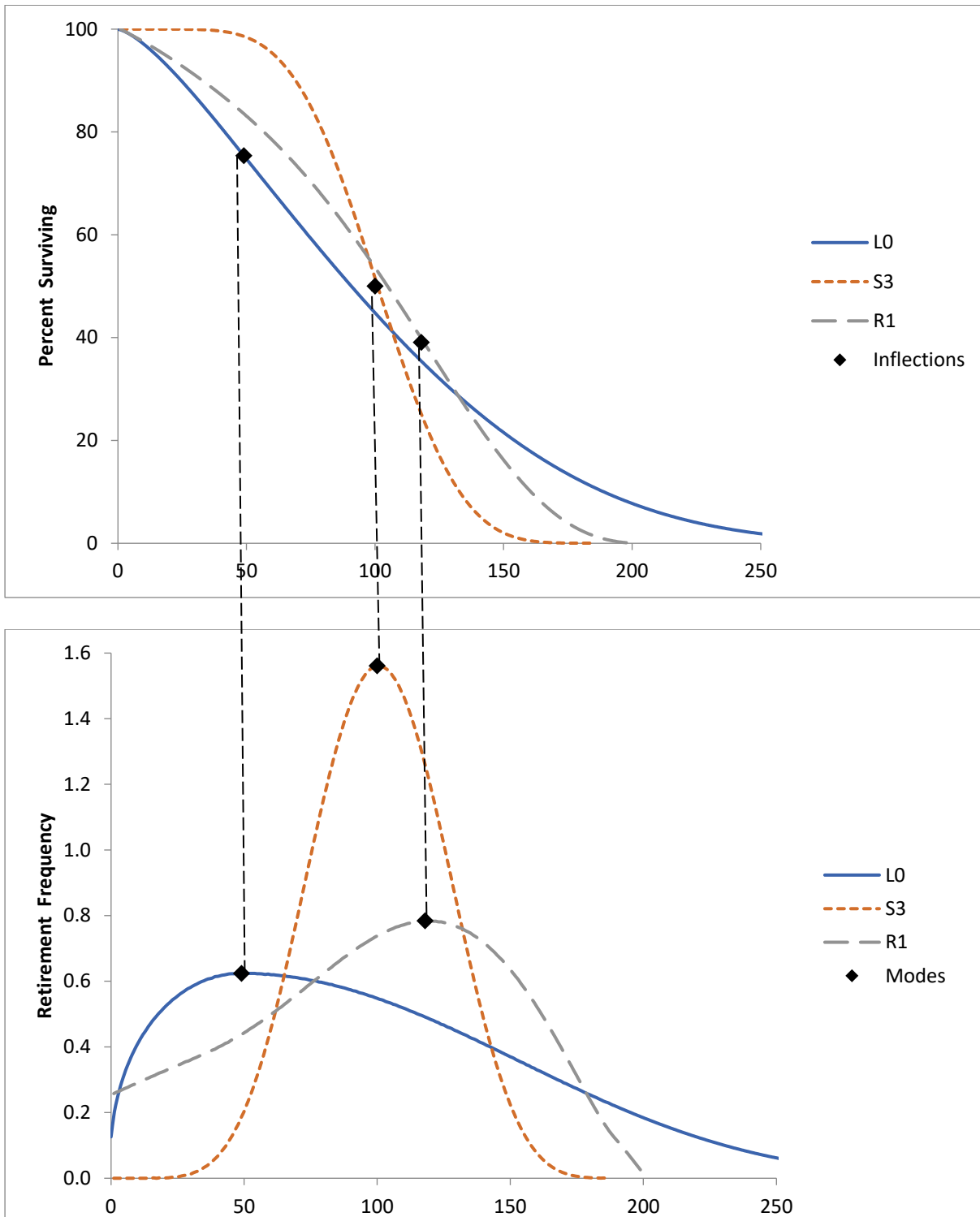
2. Classification

The Iowa curves are classified by three variables: modal location, average life, and variation of life. First, the mode is the percent life that results in the highest point of the frequency curve and the “inflection point” on the survivor curve. The modal age is the age at which the greatest rate of retirement occurs. As illustrated in the figure below, the modes appear at the steepest point of each survivor curve in the top graph, as well as the highest point of each corresponding frequency curve in the bottom graph.

The classification of the survivor curves was made according to whether the mode of the retirement frequency curves was to the left, to the right, or coincident with average service life. There are three modal “families” of curves: six left modal curves (L0, L1, L2, L3, L4, L5); five right modal curves (R1, R2, R3, R4, R5); and seven symmetrical curves (S0, S1, S2, S3, S4, S5, S6).⁴⁴ In the figure below, one curve from each family is shown: L0, S3 and R1, with average life at 100 on the x-axis. It is clear from the graphs that the modes for the L0 and R1 curves appear to the left and right of average life respectively, while the S3 mode is coincident with average life.

⁴⁴ In 1967, Harold A. Cowles added four origin-modal curves known as “O type” curves. There are also several “half” curves and a square curve, so the total amount of survivor curves commonly called “Iowa” curves is about 31 (see NARUC supra n. 119, at 68).

**Figure 2:
Modal Age Illustration**



The second Iowa curve classification variable is average life. The Iowa curves were designed using a single parameter of age expressed as a percent of average life instead of actual age. This was necessary in order for the curves to be of practical value. As Winfrey notes:

Since the location of a particular survivor on a graph is affected by both its span in years and the shape of the curve, it is difficult to classify a group of curves unless one of these variables can be controlled. This is easily done by expressing the age in percent of average life.”⁴⁵

Because age is expressed in terms of percent of average life, any particular Iowa curve type can be modified to forecast property groups with various average lives.

The third variable, variation of life, is represented by the numbers next to each letter. A lower number (e.g., L1) indicates a relatively low mode, large variation, and large maximum life; a higher number (e.g., L5) indicates a relatively high mode, small variation, and small maximum life. All three classification variables – modal location, average life, and variation of life — are used to describe each Iowa curve. For example, a 13-L1 Iowa curve describes a group of property with a 13-year average life, with the greatest number of retirements occurring before (or to the left of) the average life, and a relatively low mode. The graphs below show these 18 survivor curves, organized by modal family.

⁴⁵ Winfrey *supra* n. 166, at 60.

Figure 3:
Type L Survivor and Frequency Curves

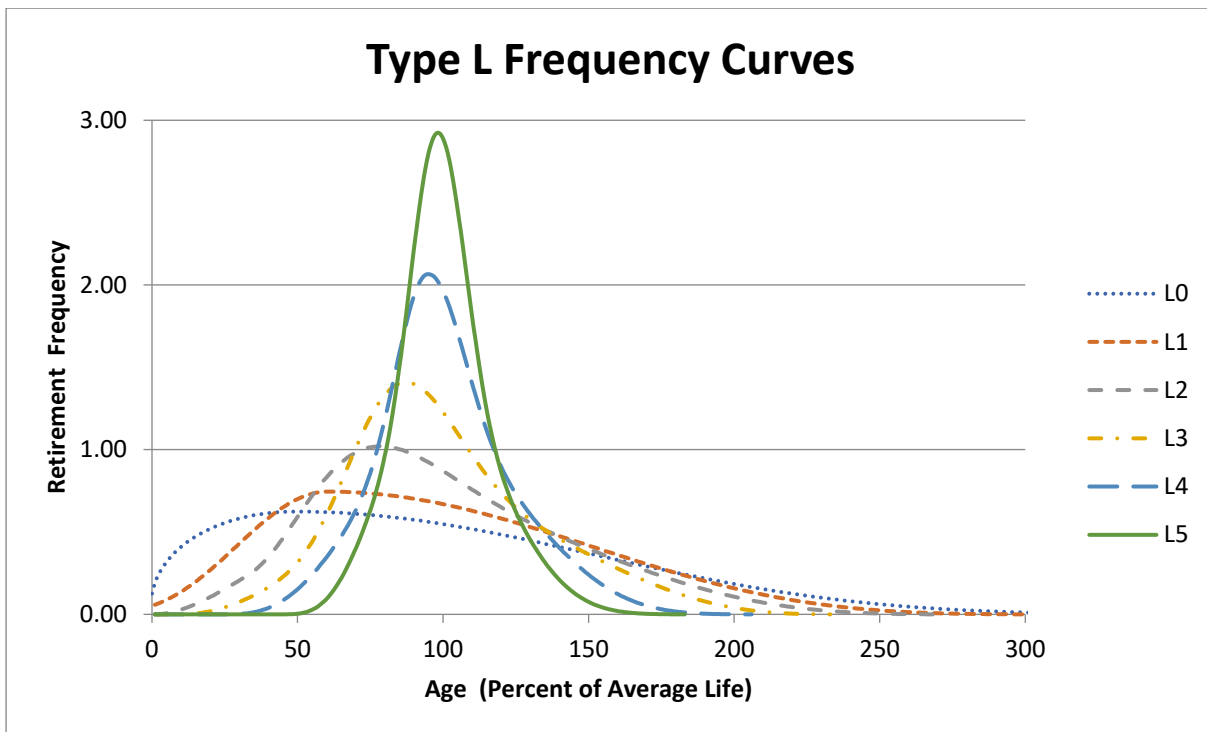
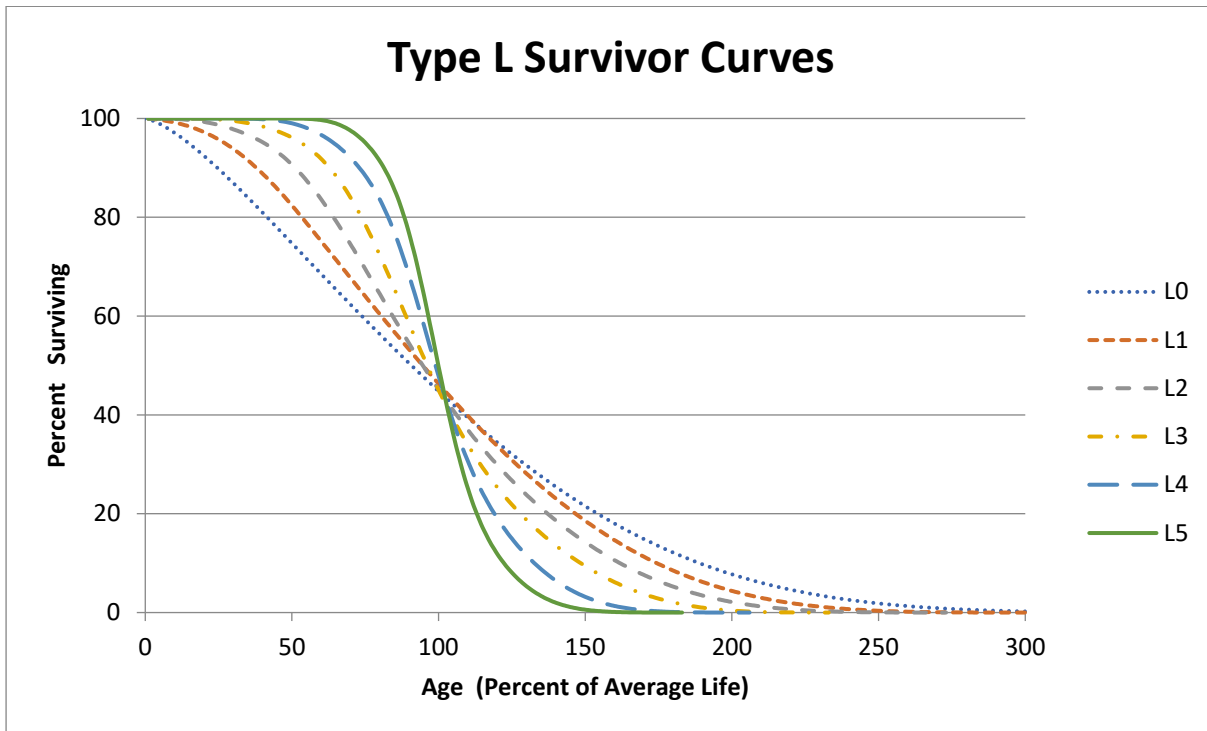


Figure 4:
Type S Survivor and Frequency Curves

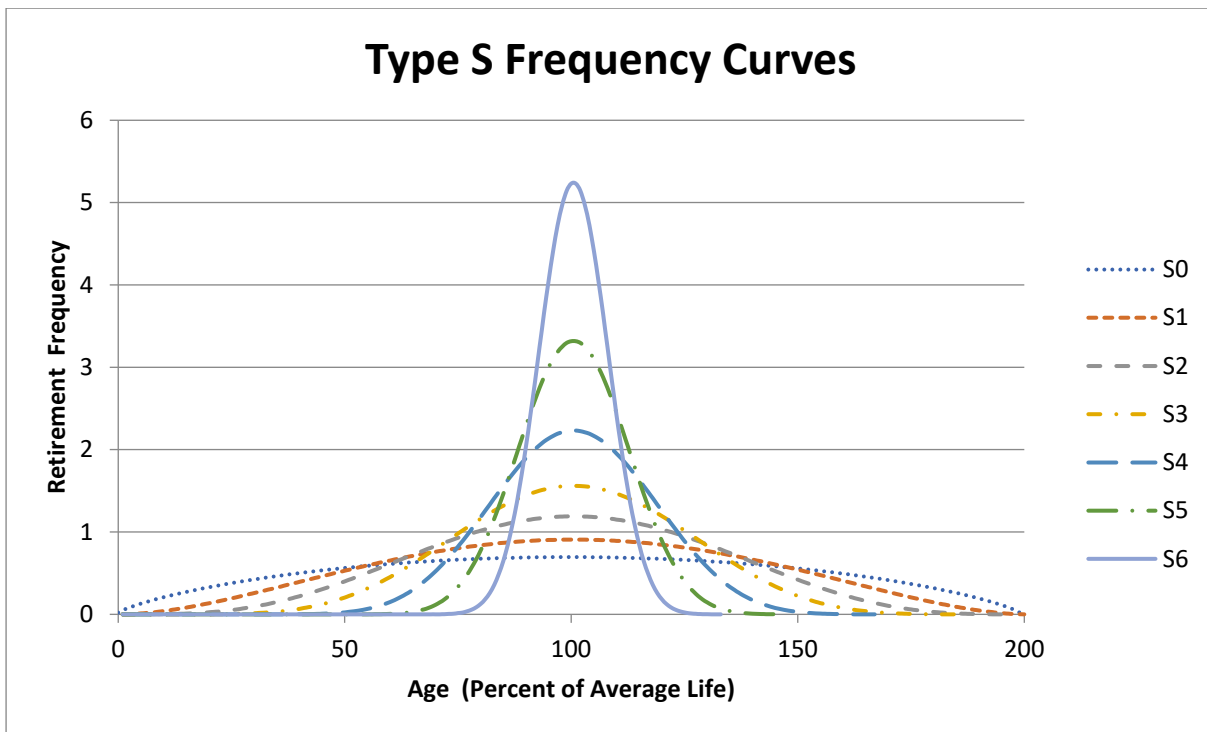
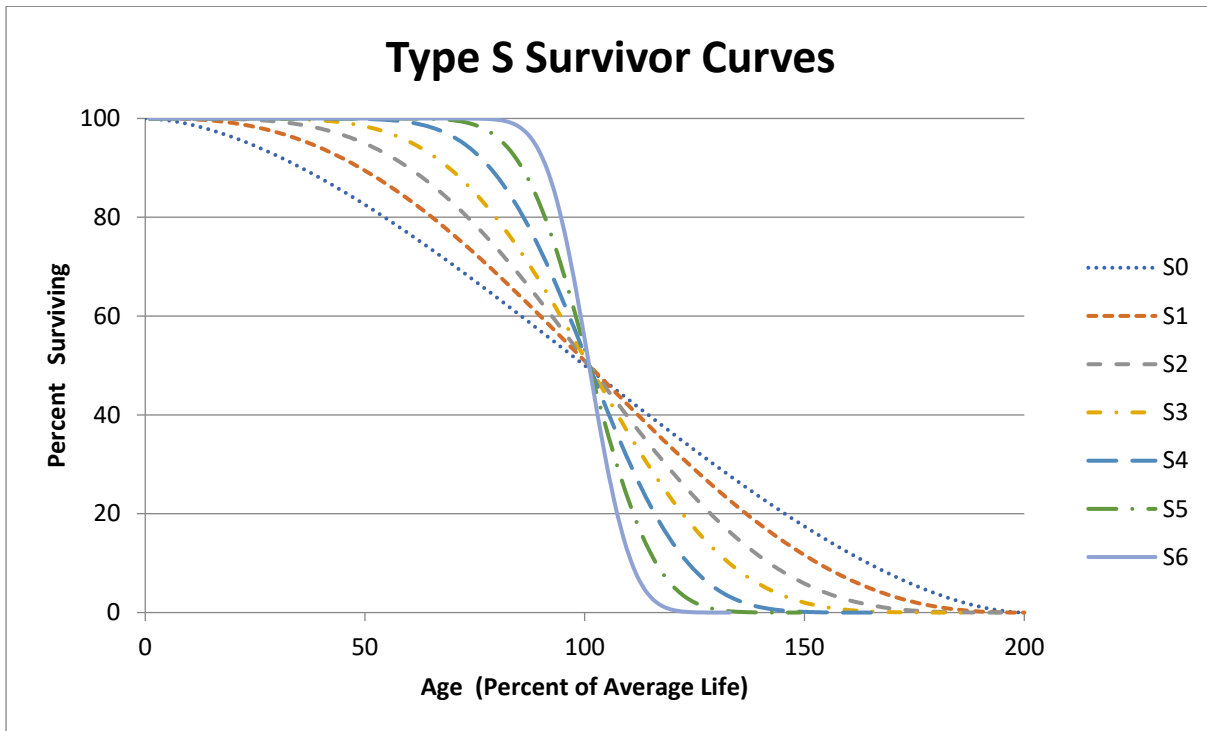
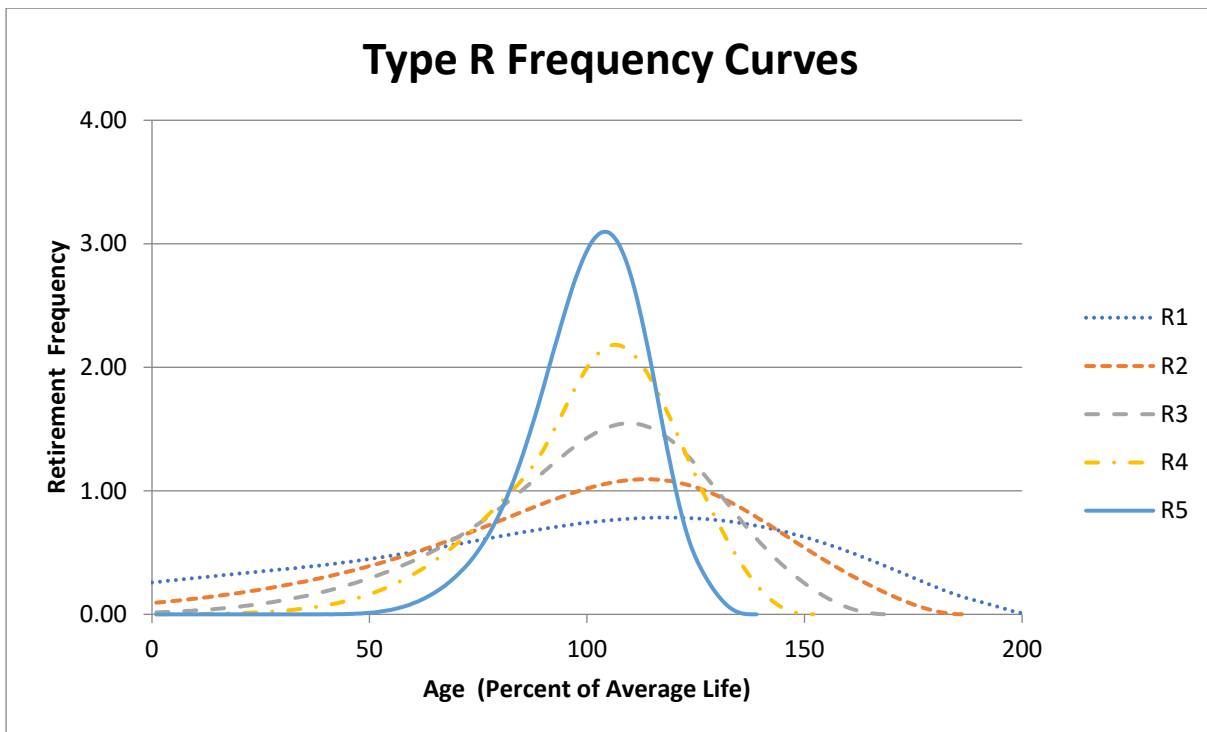
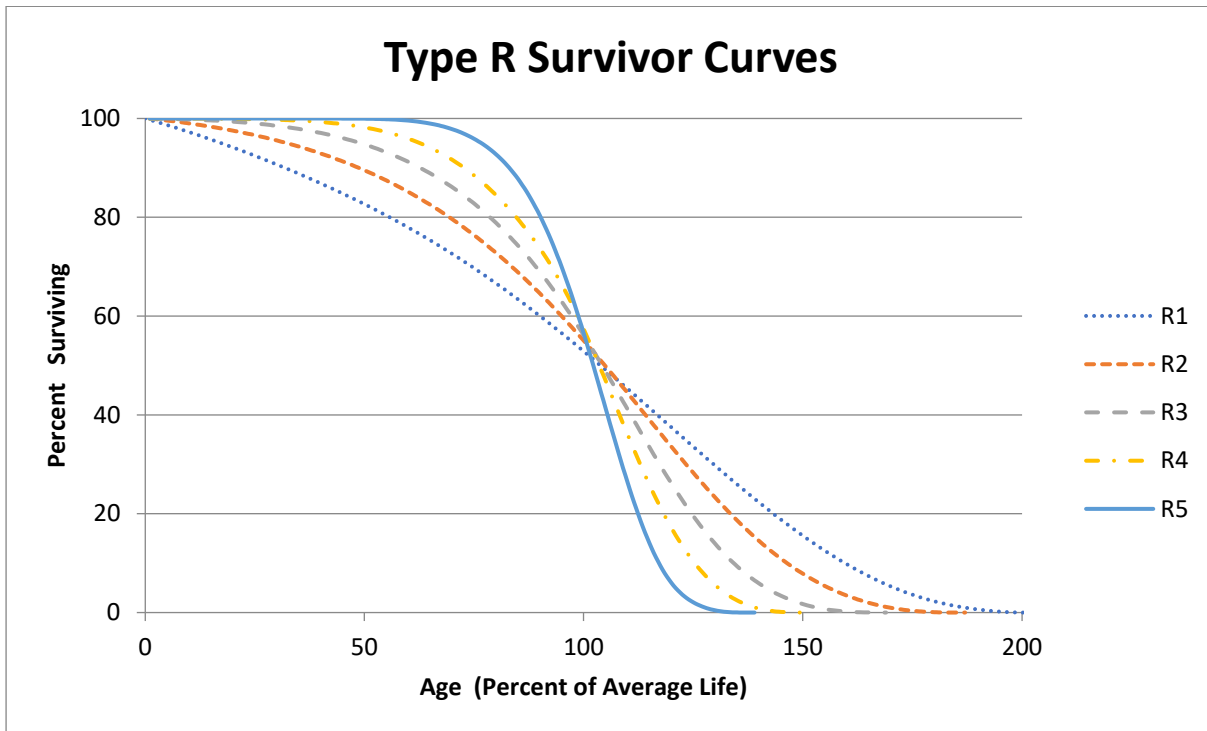


Figure 5:
Type R Survivor and Frequency Curves



As shown in the graphs above, the modes for the L family frequency curves occur to the left of average life (100% on the x-axis), while the S family modes occur at the average, and the R family modes occur after the average.

3. Types of Lives

Several other important statistical analyses and types of lives may be derived from an Iowa curve. These include: 1) average life; 2) realized life; 3) remaining life; and 4) probable life. The figure below illustrates these concepts. It shows the frequency curve, survivor curve, and probable life curve. Age M_x on the x-axis represents the modal age, while age AL_x represents the average age. Thus, this figure illustrates an “L type” Iowa curve since the mode occurs before the average.⁴⁶

First, average life is the area under the survivor curve from age zero to maximum life. Because the survivor curve is measured in percent, the area under the curve must be divided by 100% to convert it from percent-years to years. The formula for average life is as follows:⁴⁷

**Equation 9:
Average Life**

$$\text{Average Life} = \frac{\text{Area Under Survivor Curve from Age 0 to Max Life}}{100\%}$$

Thus, average life may not be determined without a complete survivor curve. Many property groups being analyzed will not have experienced full retirement. This results in a “stub” survivor

⁴⁶ From age zero to age M_x on the survivor curve, it could be said that the percent surviving from this property group is decreasing at an increasing rate. Conversely, from point M_x to maximum on the survivor curve, the percent surviving is decreasing at a decreasing rate.

⁴⁷ See NARUC *supra* n. 119, at 71.

curve. Iowa curves are used to extend stub curves to maximum life in order for the average life calculation to be made (see Exhibit DJG-23, Appendix E).

Realized life is similar to average life, except that realized life is the average years of service experienced to date from the vintage's original installations.⁴⁸ As shown in the figure below, realized life is the area under the survivor curve from zero to age RL_x . Likewise, unrealized life is the area under the survivor curve from age RL_x to maximum life. Thus, it could be said that average life equals realized life plus unrealized life.

Average remaining life represents the future years of service expected from the surviving property.⁴⁹ Remaining life is sometimes referred to as "average remaining life" and "life expectancy." To calculate average remaining life at age x , the area under the estimated future portion of the survivor curve is divided by the percent surviving at age x (denoted S_x). Thus, the average remaining life formula is:

**Equation 10:
Average Remaining Life**

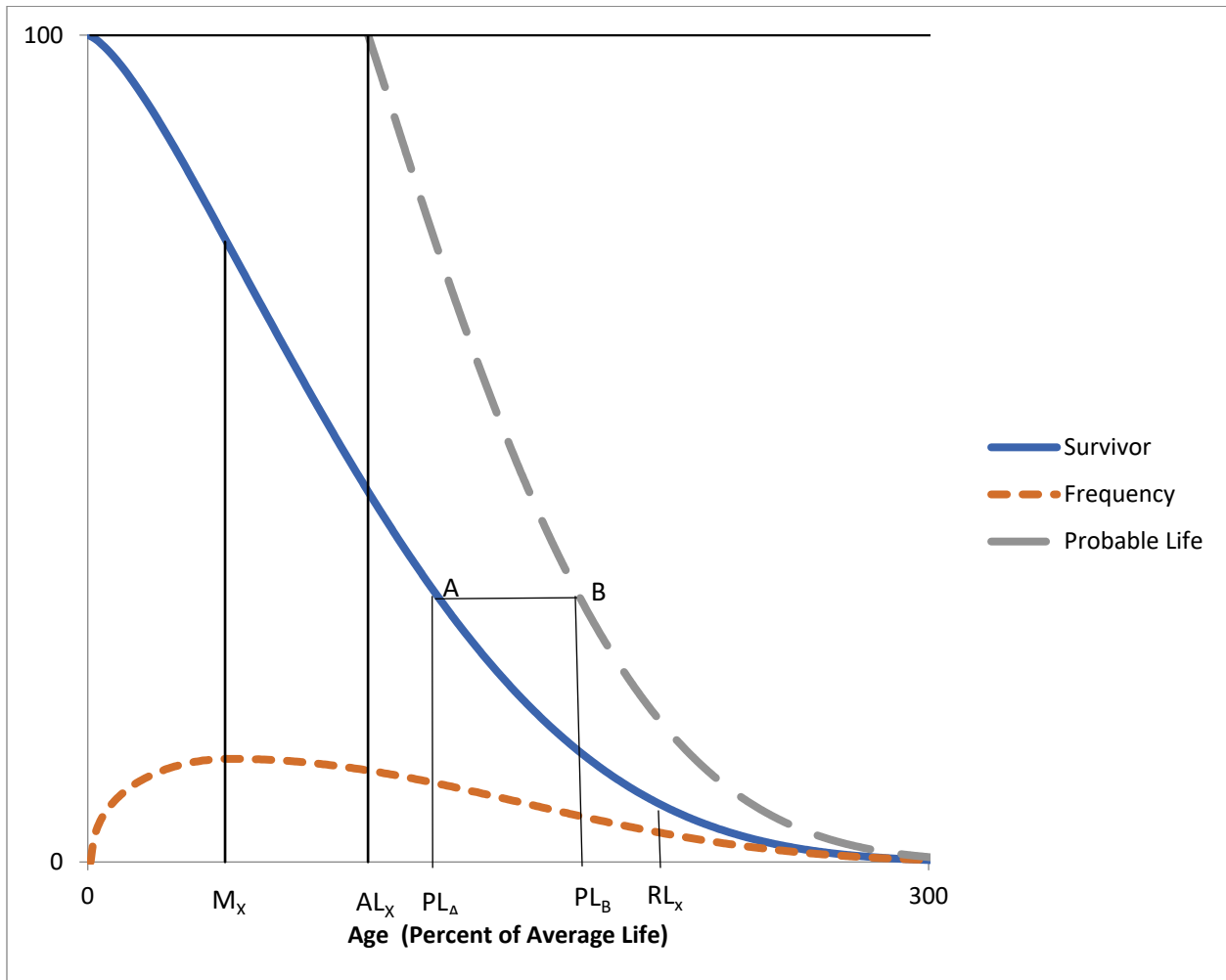
$$\text{Average Remaining Life} = \frac{\text{Area Under Survivor Curve from Age } x \text{ to Max Life}}{S_x}$$

It is necessary to determine average remaining life in order to calculate the annual accrual under the remaining life technique.

⁴⁸ *Id.* at 73.

⁴⁹ *Id.* at 74.

**Figure 6:
Iowa Curve Derivations**



Finally, the probable life may also be determined from the Iowa curve. The probable life of a property group is the total life expectancy of the property surviving at any age and is equal to the remaining life plus the current age.⁵⁰ The probable life is also illustrated in this figure. The probable life at age PL_A is the age at point PL_B . Thus, to read the probable life at age PL_A , see the corresponding point on the survivor curve above at point “A,” then horizontally to point “B” on

⁵⁰ Wolf *supra* n. 15, at 28.

the probable life curve, and back down to the age corresponding to point “B.” It is no coincidence that the vertical line from AL_x connects at the top of the probable life curve. This is because at age zero, probable life equals average life.

APPENDIX E:
ACTUARIAL ANALYSIS

Actuarial science is a discipline that applies various statistical methods to assess risk probabilities and other related functions. Actuaries often study human mortality. The results from historical mortality data are used to predict how long similar groups of people who are alive will live today. Insurance companies rely of actuarial analysis in determining premiums for life insurance policies.

The study of human mortality is analogous to estimating service lives of industrial property groups. While some humans die solely from chance, most deaths are related to age; that is, death rates generally increase as age increases. Similarly, physical plant is also subject to forces of retirement. These forces include physical, functional, and contingent factors, as shown in the table below.⁵¹

Figure 7:
Forces of Retirement

<u>Physical Factors</u>	<u>Functional Factors</u>	<u>Contingent Factors</u>
Wear and tear Decay or deterioration Action of the elements	Inadequacy Obsolescence Changes in technology Regulations Managerial discretion	Casualties or disasters Extraordinary obsolescence

While actuaries study historical mortality data in order to predict how long a group of people will live, depreciation analysts must look at a utility’s historical data in order to estimate the average lives of property groups. A utility’s historical data is often contained in the Continuing Property Records (“CPR”). Generally, a CPR should contain 1) an inventory of property record

⁵¹ NARUC *supra* n. 119, at 14-15.

units; 2) the association of costs with such units; and 3) the dates of installation and removal of plant. Since actuarial analysis includes the examination of historical data to forecast future retirements, the historical data used in the analysis should not contain events that are anomalous or unlikely to recur.⁵² Historical data is used in the retirement rate actuarial method, which is discussed further below.

The Retirement Rate Method

There are several systematic actuarial methods that use historical data in order to calculate observed survivor curves for property groups. Of these methods, the retirement rate method is superior, and is widely employed by depreciation analysts.⁵³ The retirement rate method is ultimately used to develop an observed survivor curve, which can be fitted with an Iowa curve discussed in Exhibit DJG-23, Appendix D in order to forecast average life. The observed survivor curve is calculated by using an observed life table (“OLT”). The figures below illustrate how the OLT is developed. First, historical property data are organized in a matrix format, with placement years on the left forming rows, and experience years on the top forming columns. The placement year (a.k.a. “vintage year” or “installation year”) is the year of placement of a group of property. The experience year (a.k.a. “activity year”) refers to the accounting data for a particular calendar year. The two matrices below use aged data — that is, data for which the dates of placements, retirements, transfers, and other transactions are known. Without aged data, the retirement rate actuarial method may not be employed. The first matrix is the exposure matrix, which shows the

⁵² *Id.* at 112-13.

⁵³ Anson Marston, Robley Winfrey & Jean C. Hempstead, *Engineering Valuation and Depreciation* 154 (2nd ed., McGraw-Hill Book Company, Inc. 1953).

exposures at the beginning of each year.⁵⁴ An exposure is simply the depreciable property subject to retirement during a period. The second matrix is the retirement matrix, which shows the annual retirements during each year. Each matrix covers placement years 2003–2015, and experience years 2008–2015. In the exposure matrix, the number in the 2009 experience column and the 2003 placement row is \$192,000. This means at the beginning of 2012, there was \$192,000 still exposed to retirement from the vintage group placed in 2003. Likewise, in the retirement matrix, \$19,000 of the dollars invested in 2003 was retired during 2012.

**Figure 8:
Exposure Matrix**

Placement Years	Experience Years								Total at Start of Age Interval	Age Interval
	Exposures at January 1 of Each Year (Dollars in 000's)									
	2008	2009	2010	2011	2012	2013	2014	2015		
2003	261	245	228	211	192	173	152	131	131	11.5 - 12.5
2004	267	252	236	220	202	184	165	145	297	10.5 - 11.5
2005	304	291	277	263	248	232	216	198	536	9.5 - 10.5
2006	345	334	322	310	298	284	270	255	847	8.5 - 9.5
2007	367	357	347	335	324	312	299	286	1,201	7.5 - 8.5
2008	375	366	357	347	336	325	314	302	1,581	6.5 - 7.5
2009		377	366	356	346	336	327	319	1,986	5.5 - 6.5
2010			381	369	358	347	336	327	2,404	4.5 - 5.5
2011				386	372	359	346	334	2,559	3.5 - 4.5
2012					395	380	366	352	2,722	2.5 - 3.5
2013						401	385	370	2,866	1.5 - 2.5
2014							410	393	2,998	0.5 - 1.5
2015								416	3,141	0.0 - 0.5
Total	1919	2222	2514	2796	3070	3333	3586	3827	23,268	

⁵⁴ Technically, the last numbers in each column are “gross additions” rather than exposures. Gross additions do not include adjustments and transfers applicable to plant placed in a previous year. Once retirements, adjustments, and transfers are factored in, the balance at the beginning of the next account period is called an “exposure” rather than an addition.

**Figure 9:
Retirement Matrix**

Placement Years	Experience Years								Total During Age Interval	Age Interval
	Retirements During the Year (Dollars in 000's)									
	2008	2009	2010	2011	2012	2013	2014	2015		
2003	16	17	18	19	19	20	21	23	23	11.5 - 12.5
2004	15	16	17	17	18	19	20	21	43	10.5 - 11.5
2005	13	14	14	15	16	17	17	18	59	9.5 - 10.5
2006	11	12	12	13	13	14	15	15	71	8.5 - 9.5
2007	10	11	11	12	12	13	13	14	82	7.5 - 8.5
2008	9	9	10	10	11	11	12	13	91	6.5 - 7.5
2009		11	10	10	9	9	9	8	95	5.5 - 6.5
2010			12	11	11	10	10	9	100	4.5 - 5.5
2011				14	13	13	12	11	93	3.5 - 4.5
2012					15	14	14	13	91	2.5 - 3.5
2013						16	15	14	93	1.5 - 2.5
2014							17	16	100	0.5 - 1.5
2015								18	112	0.0 - 0.5
Total	74	89	104	121	139	157	175	194	1,052	

These matrices help visualize how exposure and retirement data are calculated for each age interval. An age interval is typically one year. A common convention is to assume that any unit installed during the year is installed in the middle of the calendar year (i.e., July 1st). This convention is called the “half-year convention” and effectively assumes that all units are installed uniformly during the year.⁵⁵ Adoption of the half-year convention leads to age intervals of 0-0.5 years, 0.5-1.5 years, etc., as shown in the matrices.

The purpose of the matrices is to calculate the totals for each age interval, which are shown in the second column from the right in each matrix. This column is calculated by adding each number from the corresponding age interval in the matrix. For example, in the exposure matrix, the total amount of exposures at the beginning of the 8.5-9.5 age interval is \$847,000. This number was calculated by adding the numbers shown on the “stairs” to the left (192+184+216+255=847).

⁵⁵ Wolf *supra* n. 15, at 22.

The same calculation is applied to each number in the column. The amounts retired during the year in the retirements matrix affect the exposures at the beginning of each year in the exposures matrix. For example, the amount exposed to retirement in 2008 from the 2003 vintage is \$261,000. The amount retired during 2008 from the 2003 vintage is \$16,000. Thus, the amount exposed to retirement in 2009 from the 2003 vintage is \$245,000 ($\$261,000 - \$16,000$). The company's property records may contain other transactions which affect the property, including sales, transfers, and adjusting entries. Although these transactions are not shown in the matrices above, they would nonetheless affect the amount exposed to retirement at the beginning of each year.

The totaled amounts for each age interval in both matrices are used to form the exposure and retirement columns in the OLT, as shown in the chart below. This chart also shows the retirement ratio and the survivor ratio for each age interval. The retirement ratio for an age interval is the ratio of retirements during the interval to the property exposed to retirement at the beginning of the interval. The retirement ratio represents the probability that the property surviving at the beginning of an age interval will be retired during the interval. The survivor ratio is simply the complement to the retirement ratio ($1 - \text{retirement ratio}$). The survivor ratio represents the probability that the property surviving at the beginning of an age interval will survive to the next age interval.

**Figure 10:
Observed Life Table**

Age at Start of Interval	Exposures at Start of Age Interval	Retirements During Age Interval	Retirement Ratio	Survivor Ratio	Percent Surviving at Start of Age Interval
A	B	C	D = C / B	E = 1 - D	F
0.0	3,141	112	0.036	0.964	100.00
0.5	2,998	100	0.033	0.967	96.43
1.5	2,866	93	0.032	0.968	93.21
2.5	2,722	91	0.033	0.967	90.19
3.5	2,559	93	0.037	0.963	87.19
4.5	2,404	100	0.042	0.958	84.01
5.5	1,986	95	0.048	0.952	80.50
6.5	1,581	91	0.058	0.942	76.67
7.5	1,201	82	0.068	0.932	72.26
8.5	847	71	0.084	0.916	67.31
9.5	536	59	0.110	0.890	61.63
10.5	297	43	0.143	0.857	54.87
11.5	131	23	0.172	0.828	47.01
Total	23,268	1,052			38.91

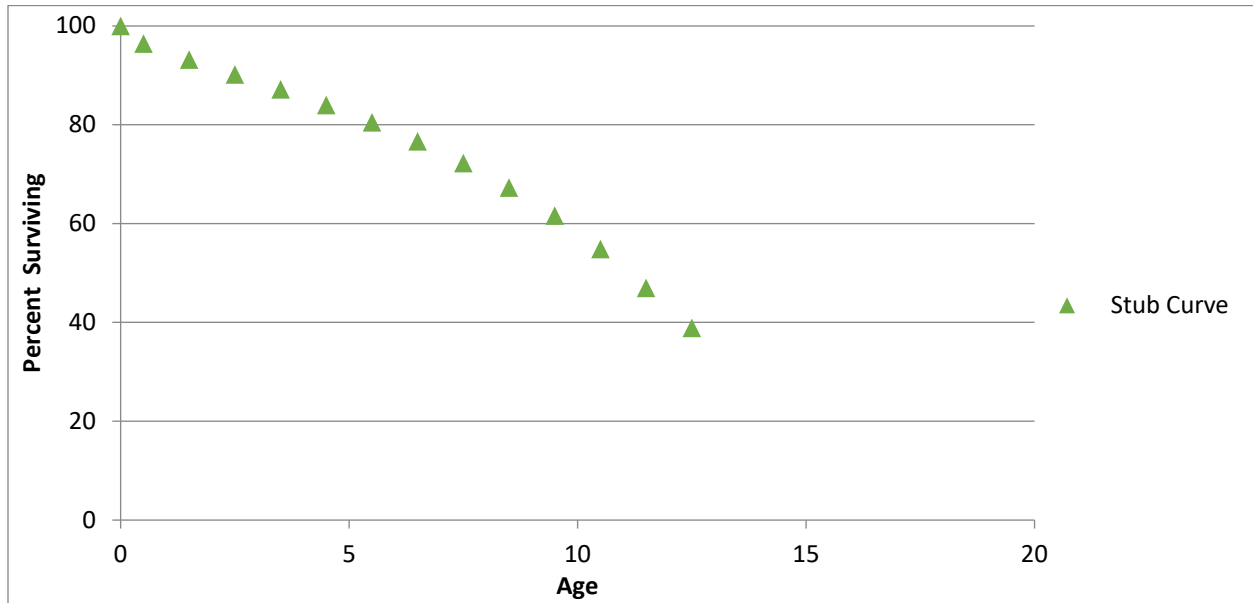
Column F on the right shows the percentages surviving at the beginning of each age interval. This column starts at 100% surviving. Each consecutive number below is calculated by multiplying the percent surviving from the previous age interval by the corresponding survivor ratio for that age interval. For example, the percent surviving at the start of age interval 1.5 is 93.21%, which was calculated by multiplying the percent surviving for age interval 0.5 (96.43%) by the survivor ratio for age interval 0.5 (0.967)⁵⁶.

The percentages surviving in Column F are the numbers that are used to form the original survivor curve. This particular curve starts at 100% surviving and ends at 38.91% surviving. An

⁵⁶ Multiplying 96.43 by 0.967 does not equal 93.21 exactly due to rounding.

observed survivor curve such as this that does not reach zero percent surviving is called a “stub” curve. The figure below illustrates the stub survivor curve derived from the OLT table above.

**Figure 11:
Original “Stub” Survivor Curve**



The matrices used to develop the basic OLT and stub survivor curve provide a basic illustration of the retirement rate method in that only a few placement and experience years were used. In reality, analysts may have several decades of aged property data to analyze. In that case, it may be useful to use a technique called “banding” in order to identify trends in the data.

Banding

The forces of retirement and characteristics of industrial property are constantly changing. A depreciation analyst may examine the magnitude of these changes. Analysts often use a technique called “banding” to assist with this process. Banding refers to the merging of several years of data into a single data set for further analysis, and it is a common technique associated

with the retirement rate method.⁵⁷ There are three primary benefits of using bands in depreciation analysis:

1. Increasing the sample size. In statistical analyses, the larger the sample size in relation to the body of total data, the greater the reliability of the result;
2. Smooth the observed data. Generally, the data obtained from a single activity or vintage year will not produce an observed life table that can be easily fit; and
3. Identify trends. By looking at successive bands, the analyst may identify broad trends in the data that may be useful in projecting the future life characteristics of the property.⁵⁸

Two common types of banding methods are the “placement band” method and the “experience band” method.” A placement band, as the name implies, isolates selected placement years for analysis. The figure below illustrates the same exposure matrix shown above, except that only the placement years 2005-2008 are considered in calculating the total exposures at the beginning of each age interval.

⁵⁷ NARUC *supra* n. 119, at 113.

⁵⁸ *Id.*

**Figure 12:
Placement Bands**

Placement Years	Experience Years								Total at Start of Age Interval	Age Interval
	Exposures at January 1 of Each Year (Dollars in 000's)									
	2008	2009	2010	2011	2012	2013	2014	2015		
2003	261	245	228	211	192	173	152	131		11.5 - 12.5
2004	267	252	236	220	202	184	165	145		10.5 - 11.5
2005	304	291	277	263	248	232	216	198	198	9.5 - 10.5
2006	345	334	322	310	298	284	270	255	471	8.5 - 9.5
2007	367	357	347	335	324	312	299	286	788	7.5 - 8.5
2008	375	366	357	347	336	325	314	302	1,133	6.5 - 7.5
2009		377	366	356	346	336	327	319	1,186	5.5 - 6.5
2010			381	369	358	347	336	327	1,237	4.5 - 5.5
2011				386	372	359	346	334	1,285	3.5 - 4.5
2012					395	380	366	352	1,331	2.5 - 3.5
2013						401	385	370	1,059	1.5 - 2.5
2014							410	393	733	0.5 - 1.5
2015								416	375	0.0 - 0.5
Total	1919	2222	2514	2796	3070	3333	3586	3827	9,796	

The shaded cells within the placement band equal the total exposures at the beginning of age interval 4.5–5.5 (\$1,237). The same placement band would be used for the retirement matrix covering the same placement years of 2005 – 2008. This of course would result in a different OLT and original stub survivor curve than those that were calculated above without the restriction of a placement band.

Analysts often use placement bands for comparing the survivor characteristics of properties with different physical characteristics.⁵⁹ Placement bands allow analysts to isolate the effects of changes in technology and materials that occur in successive generations of plant. For example, if in 2005 an electric utility began placing transmission poles with a special chemical treatment that extended the service lives of the poles, an analyst could use placement bands to isolate and analyze the effect of that change in the property group’s physical characteristics. While placement

⁵⁹ Wolf *supra* n. 15, at 182.

bands are very useful in depreciation analysis, they also possess an intrinsic dilemma. A fundamental characteristic of placement bands is that they yield fairly complete survivor curves for older vintages. However, with newer vintages, which are arguably more valuable for forecasting, placement bands yield shorter survivor curves. Longer “stub” curves are considered more valuable for forecasting average life. Thus, an analyst must select a band width broad enough to provide confidence in the reliability of the resulting curve fit yet narrow enough so that an emerging trend may be observed.⁶⁰

Analysts also use “experience bands.” Experience bands show the composite retirement history for all vintages during a select set of activity years. The figure below shows the same data presented in the previous exposure matrices, except that the experience band from 2011 – 2013 is isolated, resulting in different interval totals.

⁶⁰ NARUC *supra* n. 119, at 114.

**Figure 13:
Experience Bands**

Placement Years	Experience Years								Total at Start of Age Interval	Age Interval
	Exposures at January 1 of Each Year (Dollars in 000's)									
	2008	2009	2010	2011	2012	2013	2014	2015		
2003	261	245	228	211	192	173	152	131		11.5 - 12.5
2004	267	252	236	220	202	184	165	145		10.5 - 11.5
2005	304	291	277	263	248	232	216	198	173	9.5 - 10.5
2006	345	334	322	310	298	284	270	255	376	8.5 - 9.5
2007	367	357	347	335	324	312	299	286	645	7.5 - 8.5
2008	375	366	357	347	336	325	314	302	752	6.5 - 7.5
2009		377	366	356	346	336	327	319	872	5.5 - 6.5
2010			381	369	358	347	336	327	959	4.5 - 5.5
2011				386	372	359	346	334	1,008	3.5 - 4.5
2012					395	380	366	352	1,039	2.5 - 3.5
2013						401	385	370	1,072	1.5 - 2.5
2014							410	393	1,121	0.5 - 1.5
2015								416	1,182	0.0 - 0.5
Total	1919	2222	2514	2796	3070	3333	3586	3827	9,199	

The shaded cells within the experience band equal the total exposures at the beginning of age interval 4.5–5.5 (\$1,237). The same experience band would be used for the retirement matrix covering the same experience years of 2011 – 2013. This of course would result in a different OLT and original stub survivor than if the band had not been used. Analysts often use experience bands to isolate and analyze the effects of an operating environment over time.⁶¹ Likewise, the use of experience bands allows analysis of the effects of an unusual environmental event. For example, if an unusually severe ice storm occurred in 2013, destruction from that storm would affect an electric utility’s line transformers of all ages. That is, each of the line transformers from each placement year would be affected, including those recently installed in 2012, as well as those installed in 2003. Using experience bands, an analyst could isolate or even eliminate the 2013 experience year from the analysis. In contrast, a placement band would not effectively isolate the

⁶¹ *Id.*

ice storm's effect on life characteristics. Rather, the placement band would show an unusually large rate of retirement during 2013, making it more difficult to accurately fit the data with a smooth Iowa curve. Experience bands tend to yield the most complete stub curves for recent bands because they have the greatest number of vintages included. Longer stub curves are better for forecasting. The experience bands, however, may also result in more erratic retirement dispersion making the curve fitting process more difficult.

Depreciation analysts must use professional judgment in determining the types of bands to use and the band widths. In practice, analysts may use various combinations of placement and experience bands in order to increase the data sample size, identify trends and changes in life characteristics, and isolate unusual events. Regardless of which bands are used, observed survivor curves in depreciation analysis rarely reach zero percent. This is because, as seen in the OLT above, relatively newer vintage groups have not yet been fully retired at the time the property is studied. An analyst could confine the analysis to older, fully retired vintage groups in order to get complete survivor curves, but such analysis would ignore some the property currently in service and would arguably not provide an accurate description of life characteristics for current plant in service. Because a complete curve is necessary to calculate the average life of the property group, however, curve fitting techniques using Iowa curves or other standardized curves may be employed in order to complete the stub curve.

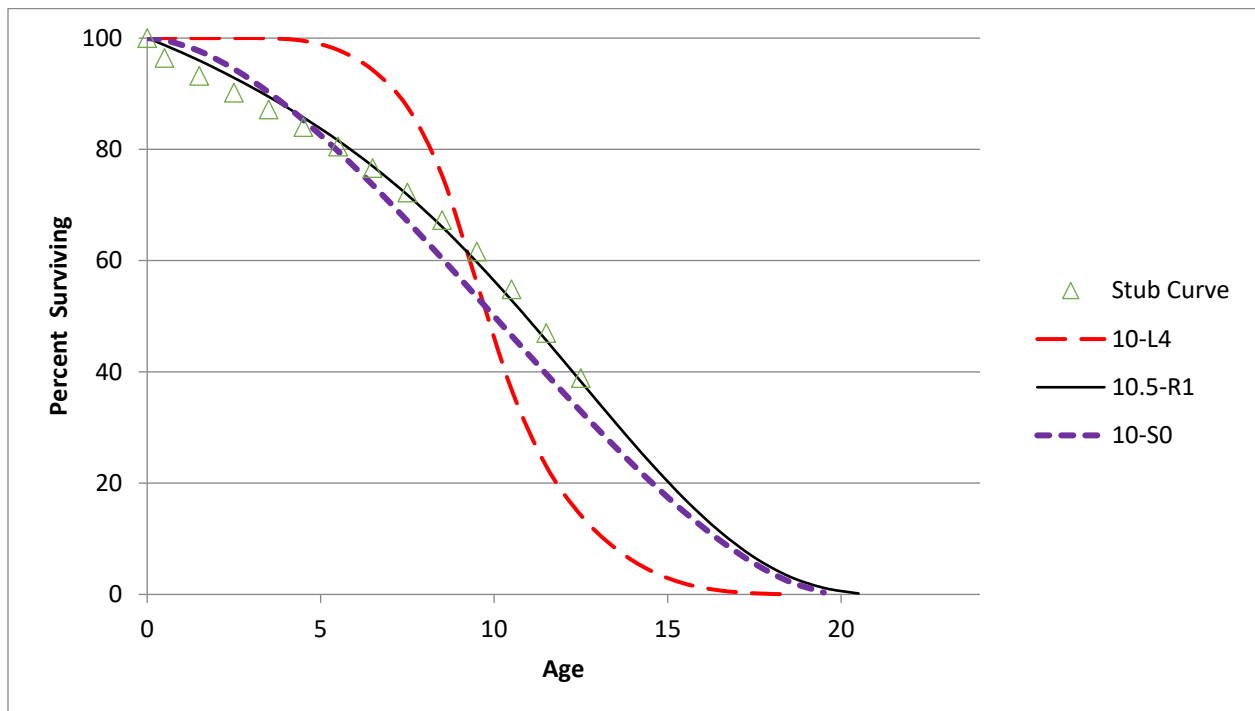
Curve Fitting

Depreciation analysts typically use the survivor curve rather than the frequency curve to fit the observed stub curves. The most commonly used generalized survivor curves used in the curve fitting process are the Iowa curves discussed above. As Wolf notes, if "the Iowa curves are

adopted as a model, an underlying assumption is that the process describing the retirement pattern is one of the 22 [or more] processes described by the Iowa curves.”⁶²

Curve fitting may be done through visual matching or mathematical matching. In visual curve fitting, the analyst visually examines the plotted data to make an initial judgment about the Iowa curves that may be a good fit. The figure below illustrates the stub survivor curve shown above. It also shows three different Iowa curves: the 10-L4, the 10.5-R1, and the 10-S0. Visually, it is clear that the 10.5-R1 curve is a better fit than the other two curves.

**Figure 14:
Visual Curve Fitting**



In mathematical fitting, the least squares method is used to calculate the best fit. This mathematical method would be excessively time consuming if done by hand. With the use of

⁶² Wolf *supra* n. 15, at 46 (22 curves includes Winfrey’s 18 original curves plus Cowles’s four “O” type curves).

modern computer software however, mathematical fitting is an efficient and useful process. The typical logic for a computer program, as well as the software employed for the analysis in this testimony is as follows:

First (an Iowa curve) curve is arbitrarily selected. . . . If the observed curve is a stub curve, . . . calculate the area under the curve and up to the age at final data point. Call this area the realized life. Then systematically vary the average life of the theoretical survivor curve and calculate its realized life at the age corresponding to the study date. This trial and error procedure ends when you find an average life such that the realized life of the theoretical curve equals the realized life of the observed curve. Call this the average life.

Once the average life is found, calculate the difference between each percent surviving point on the observed survivor curve and the corresponding point on the Iowa curve. Square each difference and sum them. The sum of squares is used as a measure of goodness of fit for that particular Iowa type curve. This procedure is repeated for the remaining 21 Iowa type curves. The “best fit” is declared to be the type of curve that minimizes the sum of differences squared.⁶³

Mathematical fitting requires less judgment from the analyst and is thus less subjective. Blind reliance on mathematical fitting, however, may lead to poor estimates. Thus, analysts should employ both mathematical and visual curve fitting in reaching their final estimates. This way, analysts may utilize the objective nature of mathematical fitting while still employing professional judgment. As Wolf notes: “The results of mathematical curve fitting serve as a guide for the analyst and speed the visual fitting process. But the results of the mathematical fitting should be checked visually and the final determination of the best fit be made by the analyst.”⁶⁴

In the graph above, visual fitting was sufficient to determine that the 10.5-R1 Iowa curve was a better fit than the 10-L4 and the 10-S0 curves. Using the sum of least squares method, mathematical fitting confirms the same result. In the chart below, the percentages surviving from

⁶³ Wolf *supra* n. 15, at 47.

⁶⁴ *Id.* at 48.

the OLT that formed the original stub curve are shown in the left column, while the corresponding percentages surviving for each age interval are shown for the three Iowa curves. The right portion of the chart shows the differences between the points on each Iowa curve and the stub curve. These differences are summed at the bottom. Curve 10.5-R1 is the best fit because the sum of the squared differences for this curve is less than the same sum of the other two curves. Curve 10-L4 is the worst fit, which was also confirmed visually.

**Figure 15:
Mathematical Fitting**

Age Interval	Stub Curve	Iowa Curves			Squared Differences		
		10-L4	10-S0	10.5-R1	10-L4	10-S0	10.5-R1
0.0	100.0	100.0	100.0	100.0	0.0	0.0	0.0
0.5	96.4	100.0	99.7	98.7	12.7	10.3	5.3
1.5	93.2	100.0	97.7	96.0	46.1	19.8	7.6
2.5	90.2	100.0	94.4	92.9	96.2	18.0	7.2
3.5	87.2	100.0	90.2	89.5	162.9	9.3	5.2
4.5	84.0	99.5	85.3	85.7	239.9	1.6	2.9
5.5	80.5	97.9	79.7	81.6	301.1	0.7	1.2
6.5	76.7	94.2	73.6	77.0	308.5	9.5	0.1
7.5	72.3	87.6	67.1	71.8	235.2	26.5	0.2
8.5	67.3	75.2	60.4	66.1	62.7	48.2	1.6
9.5	61.6	56.0	53.5	59.7	31.4	66.6	3.6
10.5	54.9	36.8	46.5	52.9	325.4	69.6	3.9
11.5	47.0	23.1	39.6	45.7	572.6	54.4	1.8
12.5	38.9	14.2	32.9	38.2	609.6	36.2	0.4
SUM					3004.2	371.0	41.0