STATE OF FLORIDA
OFFICE OF PUBLIC COUNSEL

C/O THE FLORIDA LEGISLATURE
111 WEST MADISON ST.
ROOM 812
TALLAHASSEE, FLORIDA 32399-1400
1-800-342-0222

EMAIL: OPC_WEBSITE@LEG.STATE.FL.US
WWW.FLORIDAOPC.GOV

JOE NEGRON
President of the Senate

J.R. KELLY
Public Counsel

RICHARD CORCORAN
Speaker of the House of Representatives

February 1, 2018

Ms. Carlotta Stauffer, Commission Clerk
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, Florida 32399-0850

Re: Docket No. 20170179-GU

Dear Ms. Stauffer:

Please find enclosed for filing in the above referenced docket the Direct Testimony and Exhibits of **David J. Garett**. 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,

/s/Virginia Ponder
Virginia Ponder
Associate Public Counsel

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Petition for rate increase by Florida City Gas.	DOCKET NO. 20170179-GU DATED: February 1, 2018

DIRECT TESTIMONY

OF

DAVID J. GARRETT

ON BEHALF OF THE FLORIDA OFFICE OF PUBLIC COUNSEL

J. R. Kelly
Public Counsel

Office of Public Counsel
c/o The Florida Legislature
111 West Madison Street
Room 812
Tallahassee, FL 32399-1400

Attorney for the Citizens
of The State of Florida

TABLE OF CONTENTS

Part Two: Depreciation

APPENDICES

LIST OF EXHIBITS

PART ONE: COST OF CAPITAL

PART TWO: DEPRECIATION

I. INTRODUCTION

Q. STATE YOUR NAME AND OCCUPATION.

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

Q. SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.

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

[1] Exhibit DJG-1.

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

A. I am testifying on behalf of the Florida Office of Public Counsel ("OPC") in response to the Petition for Rate Increase by Florida City Gas ("FCG" or the "Company"). Specifically, I address the cost of capital and fair rate of return for FCG in response to the Direct Testimony of Dr. James Vander Weide. I also address the Company's proposed depreciation rates in response to the Direct Testimony and depreciation study of Dane A. Watson. Because these two issues are voluminous, I have separated the executive summary and body of the testimony by issue: cost of capital and depreciation.

II. <u>EXECUTIVE SUMMARY</u>

A. <u>Part One: Cost of Capital</u>

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY REGARDING COST OF CAPITAL?

A. The purpose of my testimony is to present evidence and provide the Florida Public Service Commission ("Commission") with recommendations regarding: (1) FCG's awarded return on equity ("ROE"), and (2) the appropriate capital structure that the Commission should impute for ratemaking purposes to arrive at an appropriate cost of capital for FCG.

Q. EXPLAIN THE WEIGHTED AVERAGE COST OF CAPITAL, AND HOW THE COMPANY'S ROE AND ITS CAPITAL STRUCTURE AFFECT THIS EQUATION.

A. The term "cost of capital" refers to the weighted average cost of all types of components within a company's capital structure, including debt and equity. Determining the cost of debt is relatively straight-forward. Interest payments on bonds are contractual, "embedded costs" that are generally calculated by dividing total interest payments by the book value of outstanding debt. Determining the cost of equity, on the other hand, is more complex. Unlike the known, contractual cost of debt, there is no explicit "cost" of equity; the cost of equity must be estimated through various financial models. Thus, the overall weighted average cost of capital ("WACC"), includes the cost of debt and the estimated cost of equity. It is a "weighted average," because it is based upon the Company's relative levels of debt and equity, or "capital structure." 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 closely estimated. The basic WACC equation used in regulatory proceedings is presented as follows:[2]

[2] *See* Roger A. Morin, *New Regulatory Finance* 449-450 (Public Utilities Reports, Inc. 2006) (1994). The traditional practice uses current market returns and market values of the company's outstanding securities to compute the WACC, but in the ratemaking context, analysts usually employ a hybrid computation consisting of embedded costs of debt from the utilities books, and a market-based cost of equity. Additionally, the traditional WACC equation usually accounts for the tax shield provided by debt, but taxes are accounted for separately in the ratemaking revenue requirement.

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*

Thus, the three components of the weighted average cost of capital include the following:

1. Cost of Equity
2. Cost of Debt
3. Capital Structure

The term "cost of capital" is necessarily synonymous with the "weighted average cost of capital," and the terms are used interchangeably throughout this testimony.

Q. DESCRIBE THE RELATIONSHIP BETWEEN THE COST OF EQUITY, REQUIRED ROE, EARNED RETURN ON EQUITY, AND AWARDED RETURN ON EQUITY.

A. While "cost of equity," "required return on equity," "earned return on equity," and "awarded return on equity" are interrelated factors and concepts, they are all technically different. The financial models presented in this case were created as tools for estimating the "cost" of equity, which is synonymous to the "required return" that investors expect in exchange for giving up their opportunity to invest in other securities, or postponing their own consumption, given the level of risk inherent in the equity investment. In other words, the *cost* of equity from the company's perspective equals the *required return* from the investor's perspective.

The "earned" ROE is a historical return that is measured from a company's accounting statements, and it is used to measure how much shareholders earned for investing in a company. A company's earned ROE is not the same as the company's cost of equity, or an investor's required return. For example, an investor who invests in a risky firm may *require* a return on investment of 10%. If the company has used the same estimates as the investor, then the company will estimate that its *cost* of equity is also 10%. If the company performs poorly and the investor *earns* a return of only 3%, this does not mean that the investor required only 3%, or that the investor will not still require a 10% return the following period. Thus, the cost of equity is not the same as the earned ROE. If by chance the company in this example achieves a 10% return on equity, then it will have exactly satisfied the return required by its shareholders.

Finally, the "awarded" return on equity is unique to the regulatory environment; it is the return authorized by a regulatory commission pursuant to legal guidelines. As discussed later in this testimony, the awarded ROE should be based on the utility's cost of equity. The relationship between the terms and concepts discussed thus far could be summarized in the following sentence: If the awarded ROE reflects a utility's cost of equity, then it should allow the utility to achieve an earned ROE that is sufficient to satisfy the required return of its equity investors.

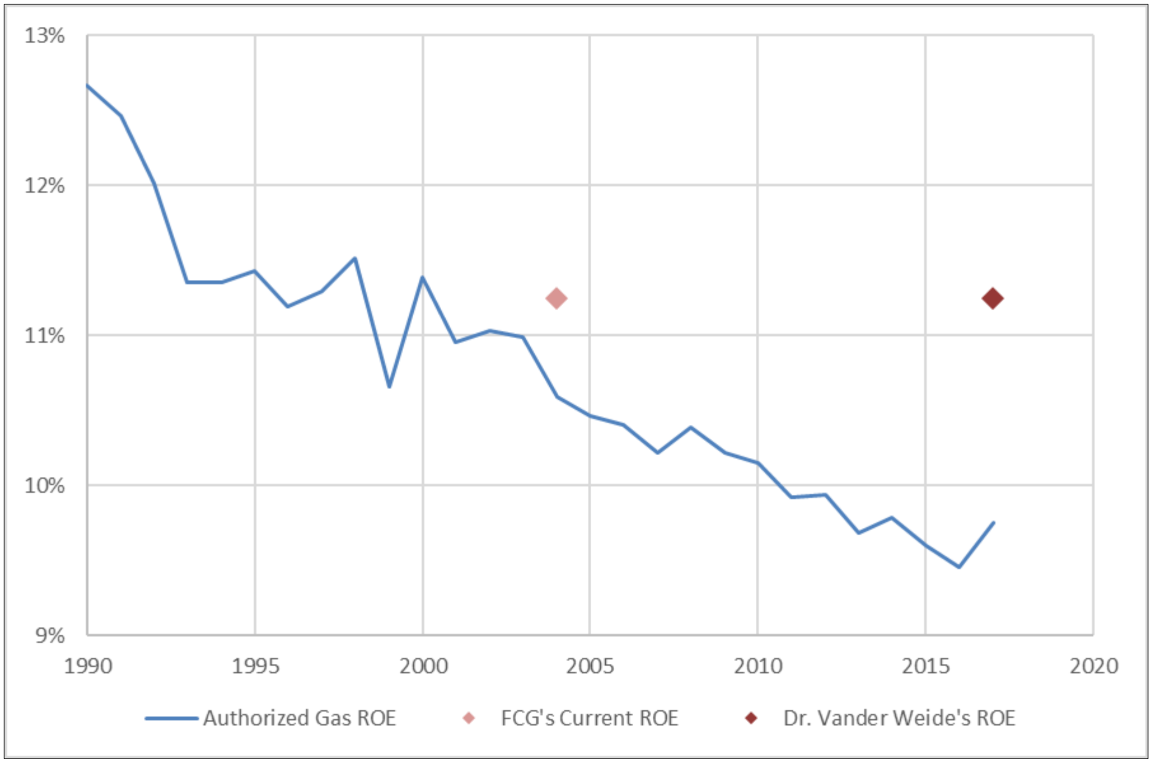
Q. DESCRIBE FCG'S POSITION REGARDING THE AWARDED RATE OF RETURN IN THIS CASE.

A. In this case, FCG proposes an awarded return on equity of 11.25% through the testimony of Dr. Vander Weide. Dr. Vander Weide's recommendation is both unusual and unreasonable for several reasons. First, Dr. Vander Weide's recommended ROE is exactly the same as FCG's current authorized ROE of 11.25%. This does not appear to be a mere coincidence. Moreover, this recommendation is problematic in part because FCG's current ROE was set in 2004. Since that time, there have been substantial changes in the U.S. economy, including interest rates falling to historically low levels. Likewise, awarded ROEs around the country for electric and gas utilities have also decreased substantially since that time. While strong arguments could be made for the proposition that an awarded return of 11.25% would have exceeded FCG's market-based cost of equity in 2004, there is no doubt that it does in today's economic environment. This point is closer to fact than opinion, as illustrated below.

Q. PLEASE ILLUSTRATE THE HISTORIC TREND IN AWARDED ROES FOR GAS UTILITIES.

A. The graph below shows a trend in the annual awarded returns for gas utilities from 1990 to 2017.

Figure 1:
Historic Awarded ROEs for Gas Utilities



As shown in the graph, FCG's awarded return of 11.25% in 2004 was notably above the national average of 10.59% at the time.[3] Since 2004, the average annual awarded ROE for gas utilities has decreased nearly 100 basis points to 9.75%. This makes the discrepancy between Dr. Vander Weide's recommendation and the current awarded ROEs for gas utilities even greater. Moreover, as discussed later in the testimony, there is ample evidence suggesting that current awarded ROEs should be even lower than they are currently. In other words, even if Dr. Vander Weide had recommended the average awarded ROE of 9.75%, it would have still been too high. Thus, it appears Dr. Vander

[3] *See* Exhibit DJG-15.

Weide is simply trying to maintain FCG's obsolete ROE, when today's undisputable economic realities indicate it should be considerably lower.

Q. ARE YOU SUGGESTING THAT THE COMMISSION, OR REGULATORS IN GENERAL, SHOULD SIMPLY SET ROES ACCORDING TO A NATIONAL AVERAGE OF AWARDED ROES?

A. No. As discussed further in my testimony, there is strong evidence suggesting that regulators consistently award ROEs that are notably higher than utilities' actual cost of equity. This is likely due to the fact that over the past 20 years, interest rates have declined rather quickly to historically low levels, and the actual cost of utility equity has declined accordingly. To the extent regulators have been persuaded to conform to a national average of awarded ROEs when making their decisions in a particular case, it has contributed to a lag in awarded returns effectively tracking with falling interest rates. In other words, whether objective market indicators influencing cost of equity are rising or falling, simply reverting to a national mean of awarded ROEs will effectively prevent those ROEs from properly rising and falling with those market indicators, such as interest rates. In today's economic environment, if a regulator awards an ROE that is equivalent to the national average, that awarded ROE will almost certainly be above market-based cost of equity for any particular utility. In this case, however, FCG's current cost of equity is so far above the national average, it is important for the Commission to see that maintaining FCG's current ROE of 11.25% would be well outside of industry norms.

Q. SUMMARIZE YOUR ANALYSES AND CONCLUSIONS REGARDING FCG'S COST OF EQUITY.

A. In formulating my recommendation, I performed thorough, independent analyses to estimate FCG's cost of equity. To do this, I selected a proxy group of companies that represents a relevant sample with asset and risk profiles. Based on this proxy group, I evaluated the results of the two most widely-used and widely-accepted financial models for calculating cost of equity in utility rate case proceedings: (1) the Discounted Cash Flow ("DCF") model; and (2) the Capital Asset Pricing Model ("CAPM"). Applying reasonable inputs and assumptions to these models reveals that FCG's estimated cost of equity is 7.0%.

Q. SUMMARIZE YOUR AWARDED RETURN RECOMMENDATION.

A. Pursuant to the legal and technical standards guiding this issue, the awarded ROE should be based on, or reflective of, the utility's <u>cost</u> of equity. FCG's estimated cost of equity is about 7.0%. However, these legal standards do not mandate the awarded ROE be set exactly equal to the cost of equity. Rather, in *Federal Power Commission v. Hope Natural Gas Co*., the U.S. Supreme Court found that, although the awarded return should be based on a utility's cost of capital, it is also indicated that the "end result" should be just and reasonable.[4] If the Commission were to award a return on equity reflective of FCG's actual cost of equity of 7.0% it would represent an abrupt change in FCG's awarded return, which is currently 11.25%. One of the primary reasons FCG's cost of equity is low is

[4] *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.

because it is a very low-risk asset. In general, utility stocks are low-risk investments because movements in their prices are not volatile. If the Commission were to make a significant, sudden change in the awarded ROE, however, it could have an increasing effect in the Company's risk profile. Thus, pursuant to the *Hope* Court's "end result" doctrine, I recommend an awarded return on equity that is higher than FCG's actual cost of equity. Specifically, I recommend that the Commission award a return on equity of 9.25%. This recommendation represents a good balance between the Court's indications that awarded ROEs should be based on cost, while also recognizing that the end result must be reasonable under the circumstances. In some sense, a move from 11.25% to 9.25% could be seen as rather substantial. However, this is mitigated by the fact that FCG has reaped the benefits over the past 13 years of having an awarded ROE that is well above its market-based cost of equity.

Q. PLEASE PROVIDE AN OVERVIEW OF THE PROBLEMS YOU HAVE IDENTIFIED WITH THE COMPANY'S COST OF CAPITAL ESTIMATE.

A. As set forth above, Dr. Vander Weide proposes a return on equity of 11.25%. Dr. Vander Weide's recommendations are based on the CAPM, DCF Model, and other risk premium models. However, several of his key assumptions and inputs to these models violate fundamental, widely-accepted tenants in finance and valuation, while other assumptions and inputs are simply unrealistic. In the sections below, I will discuss my concerns regarding the Company's requested cost of capital in further detail. However, the key areas of concern are summarized as follows:

1. In his DCF Model, Dr. Vander Weide's long-term growth rate applied to FCG exceeds the long-term growth rate for the entire U.S. economy. It is a fundamental concept in finance that, in the long run, a company cannot grow at a faster rate than the aggregate economy in which it operates; this is especially true for a regulated utility with a defined service territory. Thus, the results of Dr. Vander Weide's DCF Model are based on unrealistic assumptions and are not reflective of market conditions.[5]

2. Dr. Vander Weide's estimate for the equity risk premium ("ERP"), the single most important factor in estimating the cost of equity, is significantly higher than the estimates reported by thousands of experts across the country. This is because Dr. Vander Weide has inappropriately considered the arithmetic mean total market returns dating as far back as 1926. It is widely-accepted in the finance community that the current and forward-looking equity risk premium is lower than the historical risk premium (especially when calculated through the arithmetic mean).[6]

3. Dr. Vander Weide's estimate for the risk-free rate considers in part the rate of risky assets. It is not appropriate to consider risky assets in estimating the risk-free rate.

3. Dr. Vander Weide's estimates for beta for the proxy companies in the CAPM are significantly higher than the betas reported by institutional financial analysts, and are overstated due to faulty assumptions.

---

[5] *See* Dr. Vander Weide's workpapers in FCG's response to OPC POD No. 2, worksheet "Schedule 1."

[6] *Id*. at worksheet "Schedule 6."

4. Dr. Vander Weide's own risk premium model is also unrealistic, as it produces cost of equity results for a utility that exceeds any reasonable estimate of the required return on the market portfolio.

In short, the assumptions employed by Dr. Vander Weide skew the results of his financial models such that they do not reflect the economic realities of the market upon which cost of equity recommendations should be based. In the testimony below, I demonstrate how correcting the various erroneous assumptions in the DCF and CAPM financial models results in appropriate ROE recommendations which better align with current market conditions and FCG's low risk profile.

Q. DESCRIBE THE HARMFUL IMPACT TO THE STATE'S ECONOMY AND TO RESIDENTIAL AND COMMERCIAL CUSTOMERS IF THE COMMISSION WERE TO ADOPT FCG'S INFLATED ROE RECOMMENDATION.

A. When the awarded return is set significantly above the true cost of equity, it results in an inappropriate and excess transfer of wealth from ratepayers to shareholders beyond that which is required by law. This outflow of funds from Florida's economy would not benefit its businesses or citizens. Instead, Florida businesses in FCG's service territory would be less competitive with businesses in surrounding states, and individual ratepayers will receive inflated costs for basic goods and services, along with higher utility bills.

B. Part Two: Depreciation

Q. SUMMARIZE THE KEY POINTS OF YOUR TESTIMONY REGARDING DEPRECIATION.

A. In the context of utility ratemaking, "depreciation" refers to a cost allocation system designed to measure the rate by which a utility may recover its capital investments in a systematic and rational manner. I employed a well-established depreciation system and used actuarial analysis and comparative analysis to analyze the Company's depreciable assets in order to develop reasonable depreciation rates in this case. In this case, I propose adjustments to the service lives and net salvage rates for several of FCG's distribution accounts. For each of these accounts, I propose a longer average remaining life, which results in lower depreciation rates and expense. My proposed adjustments would reduce FCG's proposed depreciation expense by $1,045,843.[7]

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

A. Under the rate base rate of return model, the utility is allowed to recover the original cost of its prudent investments required to provide service. Depreciation systems are designed to allocate those costs in a systematic and rational manner – specifically, over the service life of the utility's assets. If depreciation rates are overestimated (i.e., service lives are underestimated), it encourages economic inefficiency. Unlike competitive firms, regulated

[7] *See* Exhibit DJG-19.

utility companies are not always incentivized by natural market forces to make the most economically efficient decisions. If a utility is allowed to recover the cost of an asset before the end of its useful life, this could incentivize the utility to unnecessarily replace the asset in order to increase its rate base, which results in economic waste. Thus, from a public policy perspective, it is preferable for regulators to ensure that assets are not depreciated before the end of their true useful lives. While underestimating the useful lives of depreciable assets could financially harm current ratepayers and encourage economic waste, unintentionally overestimating depreciable lives (i.e., underestimating depreciation rates) does not necessarily harm the Company financially. This is because if an asset's life is overestimated, there are a variety of measures that regulators can use to ensure the utility is not financially harmed. One such measure would be the use of a regulatory asset account. In that case, the Company's original cost investment in these assets would remain in the Company's rate base until they are recovered. Thus, the process of depreciation strives for a perfect match between actual and estimated useful life. When these estimates are not exact, however, it is better that useful lives are not underestimated for these reasons.

Q. SUMMARIZE THE PROBLEMS WITH FCG'S PROPOSED DEPRECIATION RATES.

A. As discussed further in the testimony, the utility bears the burden of proof to show that its proposed depreciation rates and expense are not excessive. Ideally, utilities might meet this burden in part by basing their proposed service lives on adequate, historical plant data. By using actuarial analysis along with well-established Iowa curve fitting techniques, analysts can develop reasonable positions on average life and depreciation rates that are based on objective, unbiased data. In this case, however, I do not believe the Company has met its burden of proof to make a convincing showing that its proposed depreciation rates and expense for several accounts are not excessive. Specifically, FCG did not provide sufficient aged data to support its positions from an objective, statistical standpoint. Rather, the Company's primary support for its positions on many of these accounts is simply derived from the subjective feelings and beliefs of the Company's personnel regarding the service lives of their assets. FCG is the applicant in this case who is requesting to charge ratepayers $14 million per year in depreciation expense. Utilities have an incentive to recover its capital investments through depreciation at a higher rate in order to increase cash flow, reduce risk, and provide sooner opportunities to replace depreciated assets to boost rate base and earnings. Therefore, if the Commission is to base proposed service lives on the subjective beliefs of FCG's personnel, it should expect those proposals to be underestimated, leading to a higher proposed depreciation expense, which is what occurred in this case for several accounts.

<u>PART ONE: COST OF CAPITAL</u>

III. <u>LEGAL STANDARDS AND THE AWARDED RETURN</u>

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

A. In *Wilcox v. Consolidated Gas Co. of New York*, the U.S. Supreme Court first addressed the meaning of a fair rate of return for public utilities.[8] The Court found that "the amount of risk in the business is a most important factor" in determining the appropriate allowed rate of return.[9] Later in two landmark cases, the Court set forth the standards by which public utilities are allowed to earn a return on capital investments. In *Bluefield Water Works & Improvement Co. v. Public Service Commission of West Virginia*, the Court held:

> A public utility is entitled to such rates as will permit it to earn a return on the value of the property which it employs for the convenience of the public. . . but it has no constitutional right to profits such as are realized or anticipated in highly profitable enterprises or speculative ventures. The return should be reasonably sufficient to assure confidence in the financial soundness of the utility and should be adequate, under efficient and economical management, to maintain and support its credit and enable it to raise the money necessary for the proper discharge of its public duties.[10]

In *Federal Power Commission v. Hope Natural Gas Company*, the Court expanded on the guidelines set forth in *Bluefield* and stated:

---

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

[9] *Id*. at 48.

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

> From the investor or company point of view it is important that there be enough revenue not only for operating expenses *__but also for the capital costs of the business__*. These include service on the debt and dividends on the stock. By that standard the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital.[11]

The cost of capital models I have employed in this case are in accord with all of the foregoing legal standards.

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

A. Yes. The U.S. Supreme Court in *Hope* makes it clear that the allowed return should be based on the actual cost of capital. Under the rate base rate of return model, a utility should be allowed to recover all its reasonable expenses, its capital investments through depreciation, and a return on its capital investments sufficient to satisfy the required return of its investors. The "required return" from the investors' perspective is synonymous with the "cost of capital" from the utility's perspective. Scholars agree that the allowed rate of return should be based on the actual cost of capital:

[11] *Federal Power Commission v. Hope Natural Gas Co*., 320 U.S. 591, 603 (1944) (emphasis added).

> Since by definition the cost of capital of a regulated firm represents precisely the expected return that investors could anticipate from other investments while bearing no more or less risk, and since investors will not provide capital unless the investment is expected to yield its opportunity cost of capital, the correspondence of the definition of the cost of capital with the court's definition of legally required earnings appears clear.[12]

The models I have employed in this case closely estimate the Company's true cost of equity. If the Commission sets the awarded return based on my lower, and more reasonable rate of return, it will comply with the U.S. Supreme Court's standards, allow the Company to maintain its financial integrity, and satisfy the claims of its investors. On the other hand, if the Commission sets the allowed rate of return much *higher* than the true cost of capital, it arguably results in an inappropriate transfer of wealth from ratepayers to shareholders.

> [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.[13]

Thus, it is important to understand that the *awarded* return and the *cost* of capital are different but related concepts. The two concepts are related in that the legal and technical standards encompassing this issue require that the awarded return reflect the true cost of capital. On the other hand, the two concepts are different in that the legal standards do not mandate that awarded returns exactly match the cost of capital. Awarded returns are set through the regulatory process and may be influenced by a number of factors other than objective market drivers. The cost of capital, on the other hand, should be evaluated

---

[12] 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).

[13] Roger A. Morin, *New Regulatory Finance* 23-24 (Public Utilities Reports, Inc. 2006) (1994).

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

Q. DESCRIBE THE ECONOMIC IMPACT THAT OCCURS WHEN THE AWARDED RETURN STRAYS TOO FAR FROM THE U.S. SUPREME COURT'S COST OF EQUITY STANDARD.

A. As discussed further in the sections below, Dr. Vander Weide's recommended awarded ROE is much higher than FCG's actual cost of capital based on objective market data. When the awarded ROE is set far above the cost of equity, it runs the risk of violating the U.S. Supreme Court's standards directing that the awarded return should be *based on the cost of capital*. Specifically, if the Commission were to adopt the Company's position in this case, it would be permitting an excess transfer of wealth from Florida customers to Company shareholders. Moreover, establishing an awarded return that far exceeds true cost of capital effectively prevents the awarded returns from changing along with economic conditions. This is especially true given the fact that regulators tend to be influenced by the awarded returns in other jurisdictions, regardless of the various unknown factors influencing those awarded returns. This is yet another reason why it is crucial for regulators to focus on the target utility's actual *cost* of equity, rather than awarded returns from other jurisdictions. Awarded returns may be influenced by settlements and other political factors not based on true market conditions. In contrast, the true cost of equity as estimated through objective models is not influenced by these factors, but is instead driven by market-based factors. If regulators rely too heavily on the awarded returns from other jurisdictions, it can create a cycle over time that bears little relation to the market-based cost of equity. In fact, this is exactly what we have observed since 2000.

Q. ILLUSTRATE AND COMPARE THE RELATIONSHIP BETWEEN AWARDED UTILITY RETURNS AND MARKET COST OF EQUITY SINCE 1990.

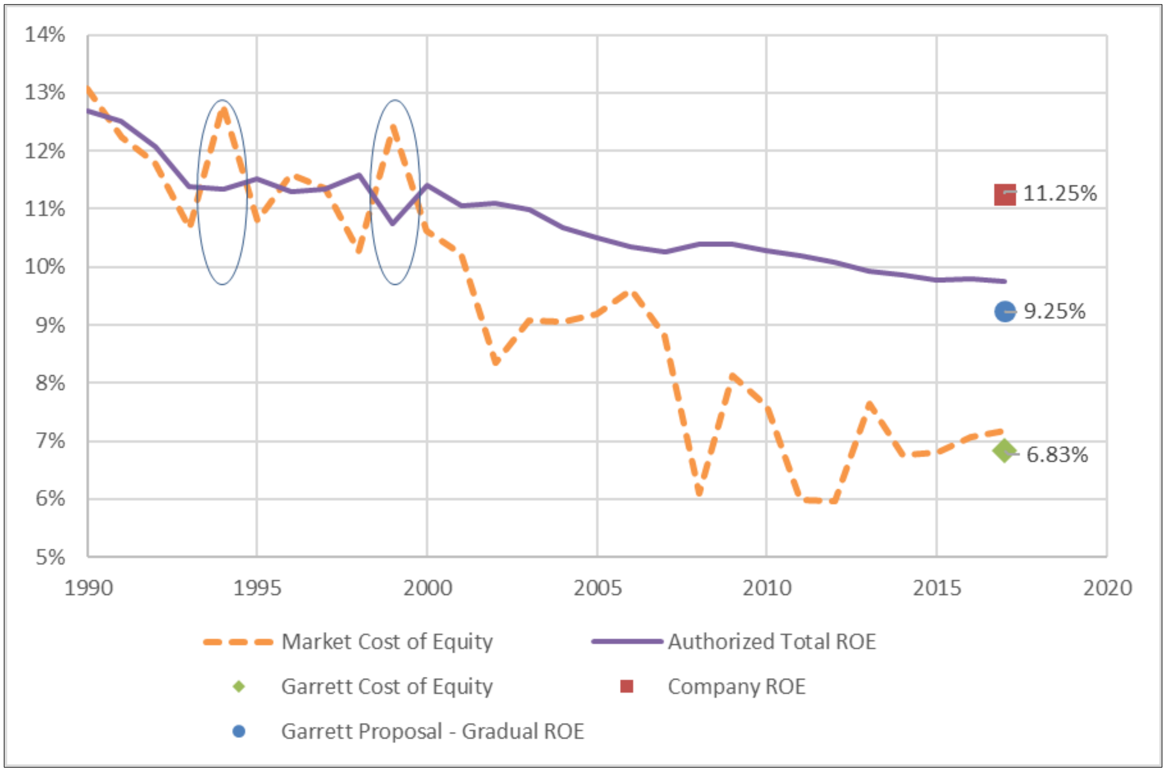
A. As shown in the figure below, awarded returns for public utilities have been above the average required market return since 2000.[14] Due to the fact that utility stocks are consistently far less risky than the average stock in the marketplace, the cost of equity for utility companies are *less* than the required return on the market. The graph below shows two trend lines. The top line is the average annual awarded returns since 1990 for U.S. regulated utilities. The bottom line is the required market return over the same period. As discussed in more detail later in my testimony, the required market return is essentially the return that investors would require if they invested in the entire market. In other words, the required market return is essentially the cost of equity of the entire market. Since it is undisputed (even by utility witnesses) that utility stocks are less risky than the average stock in the market, then the utilities' cost of equity must be less than the market cost of

---

[14] *See* Exhibit DJG-15.

equity.[15] Thus, awarded returns (the solid line) should generally be below the market cost of equity (the dotted line), since awarded returns are supposed to be based on true cost of equity.

Figure 2:
Awarded ROEs vs. Market Cost of Equity



As shown in the graph, since 1990, there were only two years in which awarded ROEs were notably below the market cost of equity – 1994 and 1999. In these two years, regulators awarded ROEs that were the closet to utilities' market-based cost of equity than any other year since 1990. In my opinion, when awarded ROEs for utilities are below the market cost of equity, they more closely conform to the standards set forth by *Hope* and

---

[15] 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.

Bluefield and minimize the excess wealth transfer from ratepayers to shareholders. The graph also shows the discrepancy between awarded ROEs and market cost of equity in 2017, along with the various positions in this case. In this case, Dr. Vander Weide's proposal of 11.25% is more than 100 basis points above the national average, and arguably more than 400 basis points above FCG's actual cost of equity. My recommendation of 9.25% is slightly below the current national average, but still well above FCG's cost of equity. As discussed previously, my recommendation represents a gradual move towards actual cost, is reasonable under the circumstances, and in accordance with the decisions of the U.S. Supreme Court.

It is not hard to see why this trend of inflating awarded returns has occurred since 2000. Because awarded returns have at times been based in part on a comparison with other awarded returns, the average awarded returns effectively fail to adapt to true market conditions. Once utility companies and regulatory commissions become accustomed to awarding rates of return higher than market conditions actually require, this trend becomes difficult to reverse. The fact is, utility stocks are *less risky* than the average stock in the market. As such, the required returns (cost of equity) on utility stocks should be less than the average required returns on the market. However, that is often not the case. What we have seen instead is a disconnect from the market-based cost of equity. For these reasons, the Commission should strive to move the awarded return to a level more closely aligned with the Company's actual, market-derived cost of capital while keeping in mind the following legal principles:

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

The legal standards articulated in *Hope* and *Bluefield* demonstrate that the Court understands one of the most basic, fundamental concepts in financial theory: the more (less) risk an investor assumes, the more (less) return the investor requires. Since utility stocks are very low risk, the return required by equity investors should be relatively low. I have used financial models in this case to closely estimate the Company's cost of equity, and these financial models account for risk. The public utility industry is one of the least risky industries in the entire country. The cost of equity models confirm this fact in that they produce relatively low cost of equity results. In turn, the awarded ROE in this case should reflect the fact that FCG is a low-risk firm.

2. The awarded return should be sufficient to assure financial soundness under efficient management.

Because awarded returns in the regulatory environment have not closely tracked market-based trends and commensurate risk, utility companies have been able to remain more than financially sound, perhaps despite management inefficiencies. In fact, the transfer of wealth from ratepayers to shareholders has been so far removed from actual cost-based drivers, that even under relatively inefficient management a utility could remain financially sound. Therefore, regulatory commissions should strive to set the awarded return to a regulated utility at a level based on accurate market conditions to promote prudent and efficient management and minimize economic waste.

IV. GENERAL CONCEPTS AND METHODOLOGY

Q. DISCUSS YOUR GENERAL APPROACH IN ESTIMATING THE COST OF EQUITY IN THIS CASE.

A. While a competitive firm must estimate its own cost of capital to assess the profitability of competing capital projects, regulators determine a utility's cost of capital to establish a fair rate of return. The legal standards set forth above do not include specific guidelines regarding the models that must be used to estimate the cost of equity. Over the years, however, regulatory commissions have consistently relied on several models. The models I have employed in this case have been the two most widely used and accepted in regulatory proceedings for many years. These models are the Discounted Cash Flow Model ("DCF Model") and the Capital Asset Pricing Model ("CAPM"). The specific inputs and calculations for these models are described in more detail below.

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

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

V. <u>THE PROXY GROUP</u>

Q. PLEASE EXPLAIN THE BENEFITS OF CHOOSING A PROXY GROUP OF COMPANIES IN CONDUCTING COST OF CAPITAL ANALYSES.

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

Q. DESCRIBE THE PROXY GROUP YOU SELECTED.

A. In this case, I chose to use the same proxy group used by Dr. Vander Weide. There could be reasonable arguments made for the inclusion or exclusion of a particular company in a proxy group; however, the cost of equity results are influenced far more by the underlying assumptions and inputs to the various financial models than the composition of the proxy groups.[16]

---

[16] *See* Exhibit DJG-3.

VI. <u>RISK AND RETURN CONCEPTS</u>

Q. DISCUSS THE GENERAL RELATIONSHIP BETWEEN RISK AND RETURN.

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

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

A. Firm-specific risk affects individual companies, rather than the entire market. For example, a competitive firm might overestimate customer demand for a new product, resulting in reduced sales revenue. This is an example of a firm-specific risk called "project risk."[17] There are several other types of firm-specific risks, including: (1) "financial risk" – the risk that equity investors of leveraged firms face as residual claimants on earnings; (2) "default risk" – the risk that a firm will default on its debt securities; and (3) "business risk" – which encompasses all other operating and managerial factors that may result in investors realizing less than their expected return in that particular company. While firm-specific

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

risk affects individual companies, market risk affects all companies in the market to varying degrees. Examples of market risk include interest rate risk, inflation risk, and the risk of major socio-economic events. When there are changes in these risk factors, they affect all firms in the market to some extent.[18]

Analysis of the U.S. market in 2001 provides a good example for contrasting firm-specific risk and market risk. During that year, Enron Corp.'s stock fell from $80 per share and the company filed bankruptcy at the end of the year. If an investor's portfolio had held only Enron stock at the beginning of 2001, this irrational investor would have lost the entire investment by the end of the year due to assuming the full exposure of Enron's firm-specific risk – in that case, imprudent management. On the other hand, a rational, diversified investor who invested the same amount of capital in a portfolio holding every stock in the S&P 500 would have had a much different result that year. The rational investor would have been relatively unaffected by the fall of Enron, because his portfolio included 499 other stocks. Each of those stocks, however, would have been affected by various *market* risk factors that occurred that year, including the terrorist attacks on September 11th. Thus, the rational investor would have incurred a relatively minor loss due to market risk factors, while the irrational investor would have lost everything due to firm-specific risk factors.

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

Q. CAN INVESTORS EASILY MINIMIZE FIRM-SPECIFIC RISK?

A. Yes. A fundamental concept in finance is that firm-specific risk can be eliminated through diversification.[19] If someone irrationally invested all of their funds in one firm, they would be exposed to all of the firm-specific risk <u>and</u> the market risk inherent in that single firm. Rational investors, however, are risk-averse and seek to eliminate risk they can control. Investors can eliminate firm-specific risk by adding more stocks to their portfolio through a process called "diversification." There are two reasons why diversification eliminates firm-specific risk. First, each stock in a diversified portfolio represents a much smaller percentage of the overall portfolio than it would in a portfolio of just one or a few stocks. Thus, any firm-specific action that changes the stock price of one stock in the diversified portfolio will have only a small impact on the entire portfolio.[20]

The second reason why diversification eliminates firm-specific risk is that the effects of firm-specific actions on stock prices can be either positive or negative for each stock. Thus, in large diversified portfolios, the net effect of these positive and negative firm-specific risk factors will be essentially zero and will not affect the value of the overall portfolio.[21] Firm-specific risk is also called "diversifiable risk" because it can be easily eliminated through diversification.

---

[19] *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).

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

[21] *Id*.

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

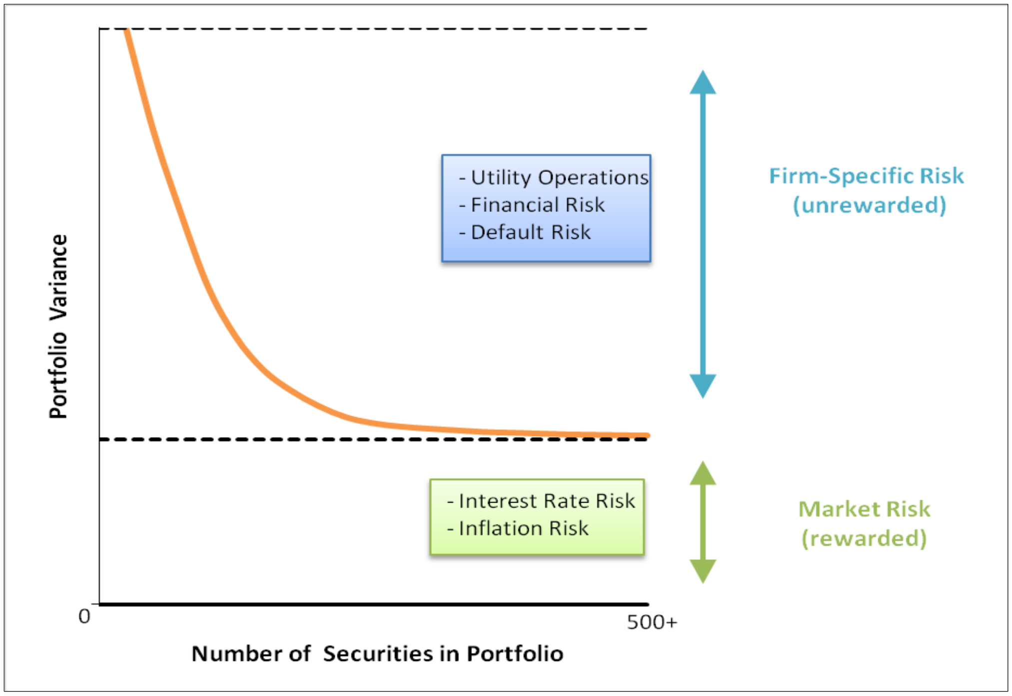
A. Yes. Because investors eliminate firm-specific risk through diversification, they know they cannot expect a higher return for assuming the firm-specific risk in any one company. Thus, the risks associated with an individual firm's operations are not rewarded by the market. In fact, firm-specific risk is also called "unrewarded" risk for this reason. Market risk, on the other hand, cannot be eliminated through diversification. Because market risk cannot be eliminated through diversification, investors expect a return for assuming this type of risk. Market risk is also called "systematic risk." Scholars recognize the fact that market risk, or "systematic risk," is the only type of risk for which investors expect a return for bearing:

> If investors can cheaply eliminate some risks through diversification, then we should not expect a security to earn higher returns for risks that can be eliminated through diversification. Investors can expect compensation <u>only</u> for bearing systematic risk (i.e., risk that cannot be diversified away).[22]

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

[22] *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).

Figure 3:
Effects of Portfolio Diversification



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

Q. DESCRIBE HOW MARKET RISK IS MEASURED.

A. Investors who want to eliminate firm-specific risk must hold a fully diversified portfolio. To determine the amount of risk that a single stock adds to the overall market portfolio, investors measure the covariance between a single stock and the market portfolio. The result of this calculation is called "beta."[23] Beta represents the sensitivity of a given security to the market as a whole. The market portfolio of all stocks has a beta equal to one. Stocks with betas greater than one are relatively more sensitive to market risk than the average stock. For example, if the market increases (decreases) by 1.0%, a stock with a beta of 1.5 will, on average, increase (decrease) by 1.5%. In contrast, stocks with betas of less than one are less sensitive to market risk, such that if the market increases (decreases) by 1.0%, a stock with a beta of 0.5 will, on average, only increase (decrease) by 0.5%. Thus, stocks with low betas are relatively insulated from market conditions. The beta term is used in the Capital Asset Pricing Model to estimate the cost of equity, which is discussed in more detail later.[24]

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

A. Yes. Although market risk affects all firms in the market, it affects different firms to varying degrees. Firms with high betas are affected more than firms with low betas, which is why firms with high betas are riskier. Stocks with betas greater than one are generally known as "cyclical stocks." Firms in cyclical industries are sensitive to recurring patterns of recession and recovery known as the "business cycle."[25] Thus, cyclical firms are

---

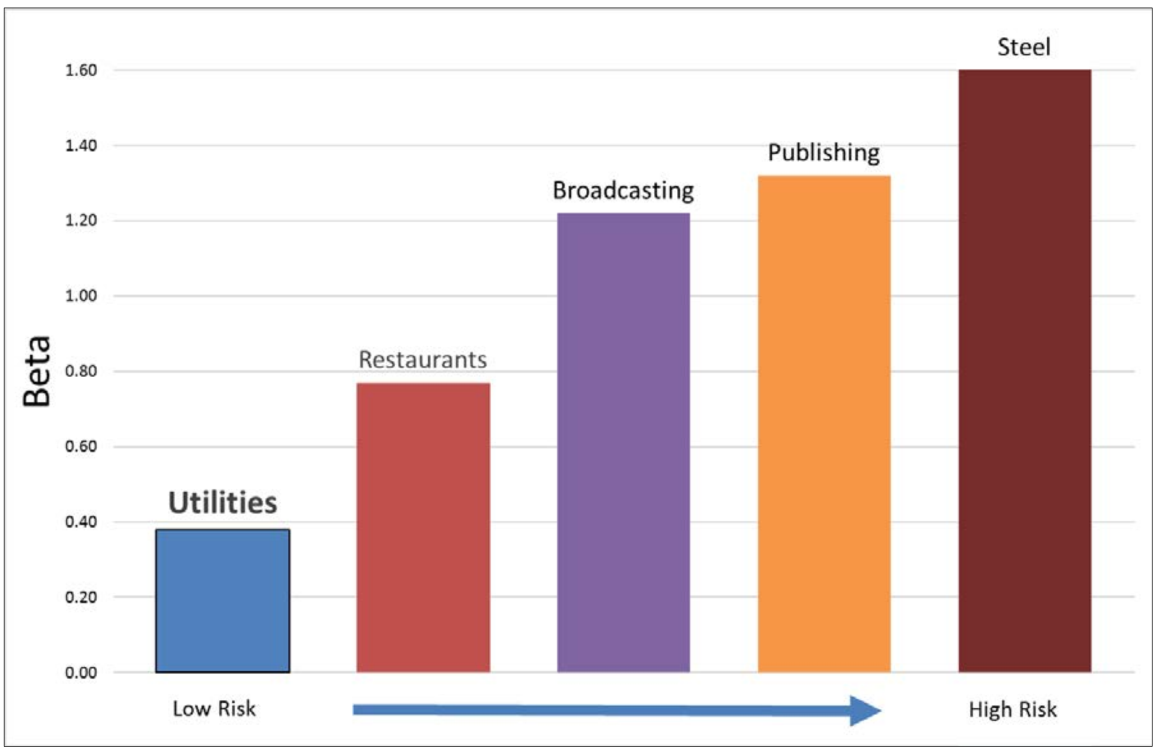
[23] *Id*. at 180-81.

[24] Though it will be discussed in more detail later, Exhibit DJG-9 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.

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

exposed to a greater level of market risk. Securities with betas less than one, other the other hand, are known as "defensive stocks." Companies in defensive industries, such as public utility companies, "will have low betas and performance that is comparatively unaffected by overall market conditions."[26] In fact, financial textbooks often use utility companies as prime examples of low-risk, defensive firms. The figure below compares the betas of several industries and illustrates that the utility industry is one of the least risky industries in the U.S. market.[27]

Figure 4:
Beta by Industry



[26] *Id*. at 383.

[27] *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 very 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.

The fact that utilities are defensive firms that are exposed to little market risk is beneficial to society. When the business cycle enters a recession, consumers can be assured that their utility companies will be able to maintain normal business operations and provide safe and reliable service under prudent management. Likewise, utility investors can be confident that utility stock prices will not widely fluctuate. So while it is preferable that utilities are defensive firms that experience little market risk and are relatively insulated from market conditions, this fact should also be appropriately reflected in FCG's awarded return.

VII. <u>DISCOUNTED CASH FLOW ANALYSIS</u>

Q. DESCRIBE THE DISCOUNTED CASH FLOW ("DCF") MODEL.

A. 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:[28]

---

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

Equation 2:
General Discounted Cash Flow Model

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

where: P_0 = *current stock price*
$D_1 \ldots D_n$ = *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.

Q. PLEASE DESCRIBE THE ASSUMPTIONS UNDERLYING ALL DCF MODELS.

A. The DCF Models rely on the following four assumptions:[29]

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;
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.

[29] *See* Roger A. Morin, *New Regulatory Finance* 252 (Public Utilities Reports, Inc. 2006) (1994).

Q. DESCRIBE THE CONSTANT GROWTH DCF MODEL.

A. 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 3:
Constant Growth Discounted Cash Flow Model

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

where:	K	=	*discount rate / required return on equity*
	D_1	=	*expected dividend per share one year from now*
	P_0	=	*current stock price*
	g	=	*expected growth rate of future dividends*

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.

Q. DOES UTILIZATION OF THE CONSTANT GROWTH DCF MODEL REQUIRE ADDITIONAL ASSUMPTIONS?

A. Yes. In addition to the four assumptions listed above, the Constant Growth DCF Model relies on four additional assumptions as follows:[30]

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.

Since 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.

Q. DESCRIBE THE QUARTERLY APPROXIMATION DCF MODEL.

A. The basic form of the Constant Growth DCF Model described above is sometimes referred to as the "Annual" DCF Model. This is because the model assumes an annual dividend payment to be paid at the end of every year, as well as an increase in dividends once each year. In reality, however, most utilities pay dividends on a quarterly basis. The Constant Growth DCF equation may be modified to reflect the assumption that investors receive

[30] *Id.* at 254-56.

successive quarterly dividends and reinvest them throughout the year at the discount rate. This variation is called the Quarterly Approximation DCF Model.[31]

Equation 4:
Quarterly Approximation Discounted Cash Flow Model

$$K = \left[\frac{d_0(1+g)^{1/4}}{P_0} + (1+g)^{1/4}\right]^4 - 1$$

where: K = *discount rate / required return*
d_0 = *current quarterly dividend per share*
P_0 = *stock price*
g = *expected growth rate of future dividends*

The Quarterly Approximation DCF Model assumes that dividends are paid quarterly and that each dividend is constant for four consecutive quarters. All else held constant, this model actually results in the highest cost of equity estimate for the utility in comparison to other DCF Models because it accounts for the quarterly compounding of dividends. There are several other variations of the Constant Growth (or Annual) DCF Model, including a Semi-Annual DCF Model which is used by the Federal Energy Regulatory Commission ("FERC"). These models, along with the Quarterly Approximation DCF Model, have been accepted in regulatory proceedings as useful tools for estimating the cost of equity. For this case, I chose to use the Quarterly Approximation DCF Model described above.

Q. DESCRIBE THE INPUTS TO THE DCF MODEL.

A. There are three primary inputs in the DCF Model: (1) stock price (P_0); (2) dividend (d_0); and (3) growth rate (g). The stock prices and dividends are known inputs based on recorded

[31] *Id*. at 348.

data, while the growth rate projection must be estimated. I will discuss each of these inputs in turn.

A. Stock Price

$$\left[K = \frac{D_1}{\boldsymbol{P_0}} + g\right]$$

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

A. For the stock price (P_0), I used a 30-day average of stock prices for each company in the proxy group.[32] Analysts sometimes rely on average stock prices for longer periods (e.g., 60, 90, or 180 days). According to the efficient market hypothesis, however, markets reflect all relevant information available at a particular time, and prices adjust instantaneously to the arrival of new information.[33] Past stock prices, in essence, reflect outdated information. The DCF Model used in utility rate cases is a derivation of the dividend discount model, which is used to determine the current value of an asset. Thus, according to the dividend discount model and the efficient market hypothesis, the value for the "P_0" term in the DCF Model should technically be the current stock price, rather than an average.

---

[32] *See* Exhibit DJG-4.

[33] *See* Eugene F. Fama, *Efficient Capital Markets: A Review of Theory and Empirical Work*, Vol. 25, No. 2 The Journal of Finance 383 (1970); *see also* Graham, Smart & Megginson *supra* n. 20, at 357. The efficient market hypothesis was formally presented by Eugene Fama in 1970, and is a cornerstone of modern financial theory and practice.

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

A. Using a short-term average of stock prices for the current stock price input adheres to market efficiency principles while avoiding any irregularities that may arise from using a single current stock price. In the context of a utility rate proceeding there is a significant length of time from when an application is filed and testimony is due. Choosing a current stock price for one particular day during that time could raise a separate issue concerning which day was chosen to be used in the analysis. In addition, a single stock price on a particular day may be unusually high or low. It is arguably ill-advised to use a single stock price in a model that is ultimately used to set rates for several years, especially if a stock is experiencing some volatility. Thus, it is preferable to use a short-term average of stock prices, which represents a good balance between adhering to well-established principles of market efficiency while avoiding any unnecessary contentions that may arise from using a single stock price on a given day. The stock prices I used in my DCF analysis are based on 30-day averages of adjusted closing stock prices for each company in the proxy group.[34]

[34] Exhibit DJG-4. 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.

B. Dividend

$$\left[K = \frac{\mathbf{D_1}}{P_0} + g\right]$$

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

A. The dividend term in the Quarterly Approximation DCF Model is the current quarterly dividend per share. I obtained the quarterly dividend paid in the fourth quarter of 2016 for each proxy company.[35] The Quarterly Approximation DCF Model assumes that the company increases its dividend payments each quarter. Thus, the model assumes that each quarterly dividend is greater than the previous one by $(1 + g)^{0.25}$. This expression could be described as the dividend quarterly growth rate, where the term "g" is the growth rate and the exponential term "0.25" signifies one quarter of the year.

Q. DOES THE QUARTERLY APPROXIMATION DCF MODEL RESULT IN THE HIGHEST COST OF EQUITY IN THIS CASE RELATIVE TO OTHER DCF MODELS, ALL ELSE HELD CONSTANT?

A. Yes. The DCF Model I employed in this case results in a higher DCF cost of equity estimate than the annual or semi-annual DCF Models due to the quarterly compounding of dividends inherent in the model.

[35] Nasdaq Dividend History, http://www.nasdaq.com/quotes/dividend-history.aspx.

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

A. No. Although my stock price and dividend inputs are more recent than those used by Dr. Vander Weide, there is not a statistically significant difference between them because utility stock prices and dividends are generally quite stable. This is another reason that cost of capital models such as the CAPM and the DCF Model are well-suited to be conducted on utilities. The differences between my DCF Model and Dr. Vander Weide's DCF Model are primarily driven by differences in our growth rate estimates, which are further discussed below.

C. Growth Rate

$$\left[K = \frac{D_1}{P_0} + \boldsymbol{g}\right]$$

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

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

(1) The Various Determinants of Growth

(2) Reasonable Estimates for Long-Term Growth

(3) Quantitative vs. Qualitative Determinants of Utility Growth: Circular References, "Flatworm" Growth, and the Problem with Analysts' Growth Rates

(4) Growth Rate Recommendation

1. <u>The Various Determinants of Growth</u>

Q. DESCRIBE THE VARIOUS DETERMINANTS OF GROWTH.

A. Although the DCF Model directly considers the growth of dividends, there are a variety of growth determinants that should be considered when estimating growth rates. It should be noted that these various growth determinants are used primarily to determine the short-term growth rates in multi-stage DCF models. For utility companies, it is necessary to focus primarily on long-term growth rates, which are discussed in the following section. That is not to say that these growth determinants cannot be considered when estimating long-term growth; however, as discussed below, long-term growth must be constrained much more than short-term growth, especially for young firms with high growth opportunities. Additionally, I briefly discuss these growth determinants here because it may reveal some of the source of confusion in this area.

1. Historical Growth

Looking at a firm's actual historical experience may theoretically provide a good starting point for estimating short-term growth. However, past growth is not always a good indicator of future growth. Some metrics that might be considered here are a historical growth in revenues, operating income, and net income. Since dividends are paid from earnings, estimating historical earnings growth may provide an indication of future earnings and dividend growth. In general, however, revenue growth tends to be more consistent and predictable than earnings growth because it is less likely to be influenced by accounting adjustments.[36]

2. Analyst Growth Rates

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

3. Fundamental Determinants of Growth

Fundamental growth determinants refer to firm-specific financial metrics that arguably provide better indications of near-term sustainable growth. One such metric for fundamental growth considers the return on equity and the retention ratio. The idea behind

[36] *See generally* Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 271-303 (3rd ed., John Wiley & Sons, Inc. 2012).

this metric is that firms with high ROEs and retention ratios should have higher opportunities for growth.[37]

Q. DID YOU CONSIDER ANY OF THESE DETERMINANTS OF GROWTH IN YOUR DCF MODEL?

A. No. Primarily, the growth determinants discussed in this section will provide better indications of short to mid-term growth for firms with average to high growth opportunities. Utilities, however, are mature, low-growth firms. While it may not be unreasonable on its face to use any of these growth determinants for the growth input in the DCF Model, we must keep in mind that the stable growth DCF Model considers only long-term growth rates, which are constrained by certain economic factors, as discussed further below.

2. <u>Reasonable Estimates for Long-Term Growth</u>

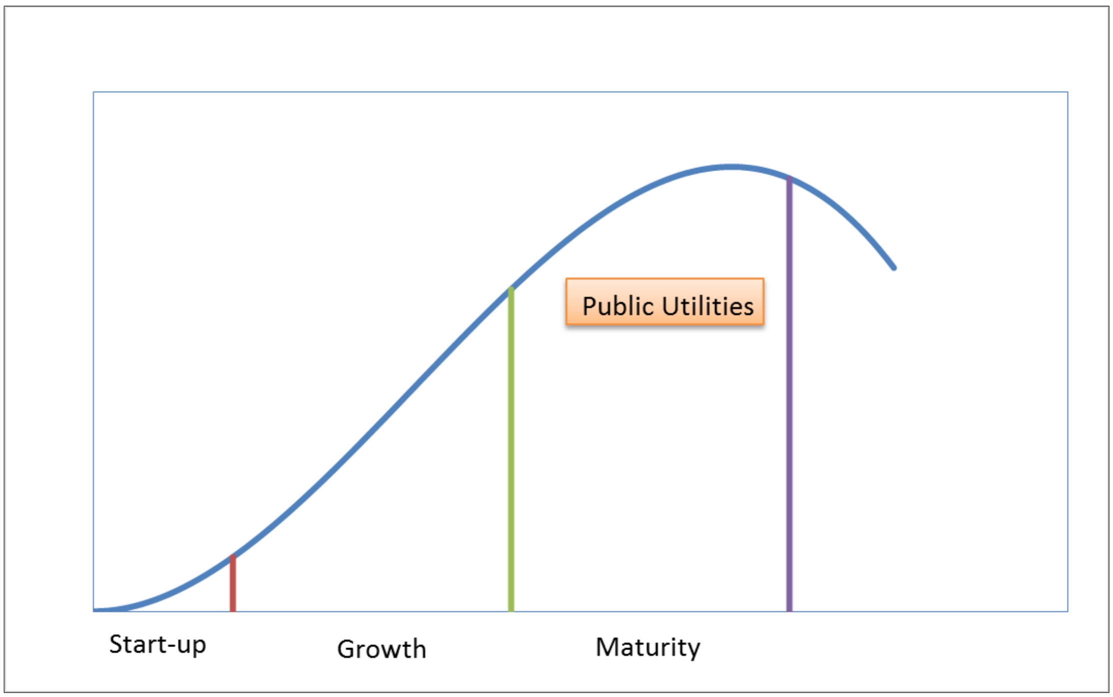
Q. DESCRIBE WHAT IS MEANT BY LONG-TERM GROWTH.

A. Recall that in order to make the DCF a viable, practical model, an infinite stream of future cash flows must be estimated and then discounted back to the present. Otherwise, each annual cash flow would have to be estimated separately. Some analysts use "multi-stage" DCF Models to estimate the value of high-growth firms through two or more stages of growth, with the final stage of growth being constant. However, it is not necessary to use multi-stage DCF Models to analyze the cost of equity of regulated utility companies. This

[37] *Id.*

is because regulated utilities are already in their "terminal," low growth stage. Unlike most competitive firms, the growth of regulated utilities is constrained by physical service territories, and limited primarily by the customer and load growth within those territories. The figure below illustrates the well-known business / industry life-cycle pattern.

Figure 5:
Industry Life Cycle



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

Q. IS IT WIDELY ACCEPTED THAT THE TERMINAL GROWTH RATE CANNOT EXCEED THE GROWTH RATE OF THE ECONOMY, ESPECIALLY FOR A REGULATED UTILITY COMPANY?

A. Yes. A fundamental concept in finance is that no firm can grow forever at a rate higher than the growth rate of the economy in which it operates.[38] Thus, the terminal growth rate used in the DCF Model should not exceed the aggregate economic growth rate. This is especially true when the DCF Model is conducted on public utilities because these firms have defined service territories. As stated by Dr. Damodaran:

> "If a firm is a purely domestic company, either because of internal constraints . . . or external constraints (such as those imposed by a government), the growth rate in the domestic economy will be the limiting value."[39]

In fact, it is reasonable to assume that a regulated utility would grow at a rate that is <u>less</u> than the U.S. economic growth rate. Unlike competitive firms, which might increase their growth by launching a new product line, franchising, or expanding into new and developing markets, utility operating companies with defined service territories cannot do any of these things to grow. Gross domestic product ("GDP") is one of the most widely-used measures of economic production, and is used to measure aggregate economic growth. According to the Congressional Budget Office's Budget Outlook, the long-term forecast for nominal U.S. GDP growth is 4%, which includes an inflation rate of 2%.[40] For mature companies in mature industries, such as utility companies, the terminal growth rate will likely fall

---

[38] *Id*. at 306.

[39] *Id*.

[40] Congressional Budget Office Long-Term Budget Outlook, https://www.cbo.gov/publication/51580.

between the expected rate of inflation and the expected rate of nominal GDP growth. Thus, FCG's terminal growth rate is between 2% and 4%.

Q. IS IT REASONABLE TO ASSUME THAT THE TERMINAL GROWTH RATE WILL NOT EXCEED THE RISK-FREE RATE?

A. Yes. In the long term, the risk-free rate will converge on the growth rate of the economy. For this reason, financial analysts sometimes use the risk-free rate for the terminal growth rate value in the DCF model.[41] I discuss the risk-free rate in further detail later in this testimony.

Q. PLEASE SUMMARIZE THE VARIOUS LONG-TERM GROWTH RATE ESTIMATES THAT CAN BE USED AS THE TERMINAL GROWTH RATE IN THE DCF MODEL.

A. The reasonable long-term growth rate determinants are summarized as follows:

1. Inflation
2. Real GDP Growth
3. Current Risk-Free Rate
4. Nominal GDP Growth

Any of the foregoing growth determinants would provide a reasonable input for the terminal growth rate in the DCF Model for any company. In general, we should expect

---

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

that utilities will, at the very least, grow at the rate of projected inflation. However, the long-term growth rate of any U.S. company, especially utilities, will be constrained by nominal U.S. GDP growth.

3. <u>Qualitative Growth: The Problem with Analysts' Growth Rates</u>

Q. DESCRIBE THE DIFFERENCES BETWEEN "QUANTITATIVE" AND "QUALITATIVE" GROWTH DETERMINANTS.

A. Assessing "quantitative" growth simply involves mathematically calculating a historic metric for growth (such as revenues or earnings), or calculating various fundamental growth determinants using various figures from a firm's financial statements (such as ROE and the retention ratio). However, any thorough assessment of company growth should be based upon a "qualitative" analysis. Such an analysis would consider specific strategies that company management will implement in order to achieve a sustainable growth in earnings. Therefore, it is important to begin the analysis of FCG's growth rate with this simple, qualitative question: How is this regulated utility going to achieve a sustained growth in earnings? If this question were asked of a competitive firm, there could be a number of answers depending on the type of business model, such as launching a new product line, franchising, rebranding to target a new demographic, or expanding into a developing market. Regulated utilities, however, cannot engage in these potential growth opportunities. This is why it is not surprising to see very low load growth, customer growth, and related projections in utilities' integrated resource plans. In fact, FCG's own projections of customer growth are less than 1% per year over the next ten years.[42]

Q. WHY IS IT ESPECIALLY IMPORTANT TO EMPHASIZE REAL, QUALITATIVE GROWTH DETERMINANTS WHEN ANALYZING THE GROWTH RATES OF REGULATED UTILITIES?

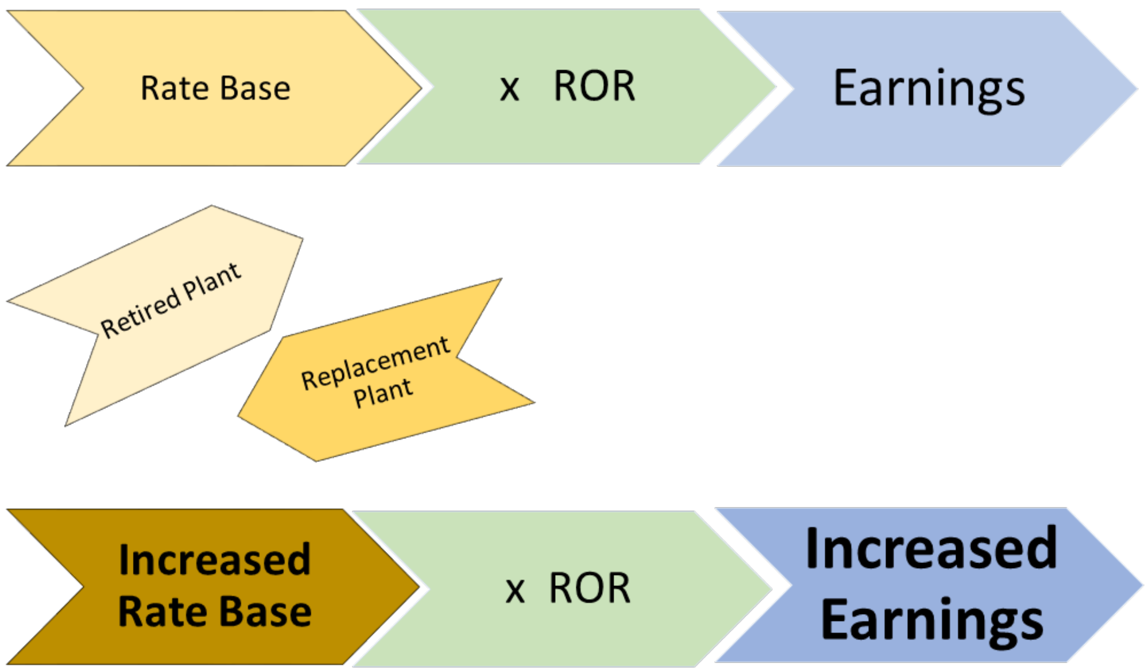
A. While qualitative growth analysis is important regardless of the entity being analyzed, it is especially important in the context of utility ratemaking. This is because the rate base rate of return model inherently possesses two factors that can contribute to distorted views of utility growth when considered exclusively from a quantitative perspective. These two factors are (1) rate base and (2) the awarded ROE. I will discuss each factor further below. It is important to keep in mind that the ultimate objective of this analysis is to provide a foundation upon which to base the fair rate of return for the utility. Thus, we should strive to ensure that each individual component of the financial models used to estimate the cost of equity are also "fair." If we consider only quantitative growth determinants, it may lead to projected growth rates that are overstated and ultimately unfair, because they result in inflated cost of equity estimates.

[42] *See* FCG's response to OPC POD 46.1, worksheet "CUST CT-TOTAL" (applying compound annual growth rate from December 2017 to December 2027).

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

A. Under the rate base rate of return model, a utility's rate base is multiplied by its awarded rate of return to produce the required level of operating income. Therefore, increases to rate base generally result in increased earnings. Thus, utilities have a natural financial incentive to increase rate base. This concept is also discussed in Part II of my direct testimony as it relates to accelerated depreciation and the misleading narrative of "intergenerational inequity." In short, utilities have a financial incentive to increase rate base regardless of whether such increases are driven by a corresponding increase in demand. A good, relevant example of this is seen in the early retirement of old, but otherwise functional coal plants in response to environmental regulations. Under these circumstances, utilities have been able to increase their rate bases by a far greater extent than what any concurrent increase in demand would have required. In other words, utilities "grew" their earnings by simply retiring old assets and replacing them with new assets. If the tail of a flatworm is removed and regenerated, it does not mean the flatworm actually grew. Likewise, if a competitive, unregulated firm announced plans to close production plants and replace them with new plants, it would not be considered a real determinant of growth unless analysts believed this decision would directly result in increased market share for the company and a real opportunity for sustained increases in revenues and earnings. In the case of utilities, the mere replacement of old plant with new plant does not increase market share, attract new customers, create franchising opportunities, or allow utilities to penetrate developing markets, but may result in short-term, quantitative earnings growth. However, this “flatworm growth” in earnings was merely the quantitative byproduct of the rate base rate of return model, and not an indication of real, fair, or qualitative growth. The following diagram illustrates this concept.

Figure 6:
Analysts’ Earnings Growth Projections: The “Flatworm Growth” Problem

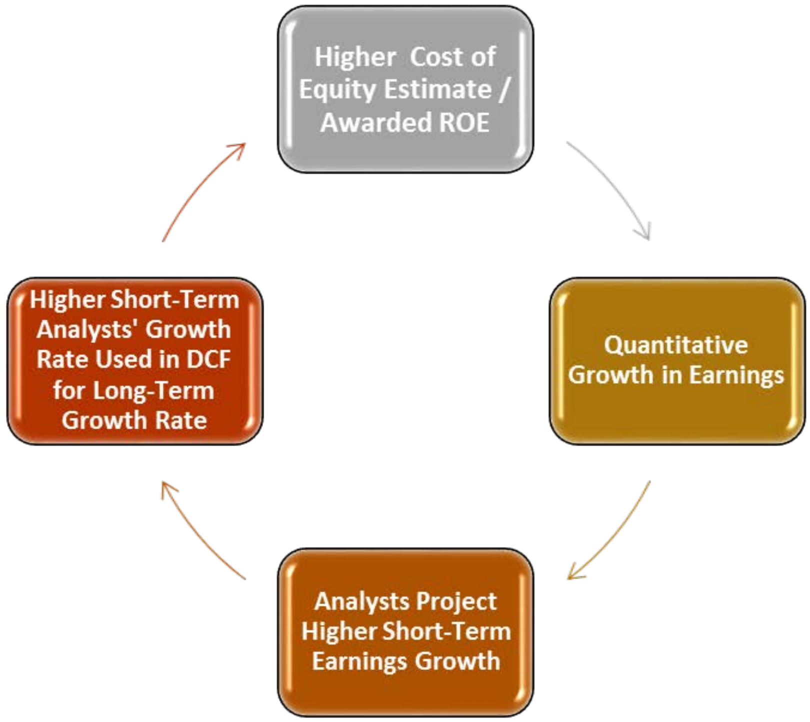


Of course, utilities might sometimes add new plant to meet a modest growth in customer demand. However, as the foregoing discussion demonstrates, it would be more appropriate to consider load growth projections and other qualitative indicators, rather than mere increases to rate base or earnings, in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

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

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

Figure 7:
Analysts' Earnings Growth Projections: The "Circular Reference" Problem



Therefore, it is not advisable to simply consider a quantitative historical or projected growth rate in utility earnings, as this practice will not provide a reliable or accurate indication of real utility growth.

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

A. Yes. While the foregoing discussion shows two reasons why we cannot rely on analysts' growth rate projections to provide fair, qualitative indicators of utility growth in a stable growth DCF Model, the third reason is perhaps the most obvious and undisputable. Various institutional analysts, such as Zacks, Value Line, and Bloomberg, publish estimated projections of earnings growth for utilities. These estimates, however, are <u>short-</u>

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

4. Long-Term Growth Rate Recommendation

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

A. I considered various qualitative determinants of growth for FCG, along with the maximum allowed growth rate under basic principles of finance and economics. The following chart shows three of the long-term growth determinants discussed in this section.

Figure 8:
Terminal Growth Rate Determinants

Growth Determinant	Rate
Nominal GDP	4.10%
Inflation	2.00%
Risk Free Rate	2.77%
Highest	**4.10%**

For the long-term growth rate in my DCF model, I selected the maximum long-term growth rate of 4.1%, which means my model assumes that FCG's qualitative growth in earnings will match the nominal growth rate of the entire U.S. economy over the long run, which is a charitable assumption.

Q. PLEASE DESCRIBE THE FINAL RESULTS OF YOUR DCF MODEL.

A. I used the Quarterly Approximation DCF Model discussed above to estimate FCG's cost of equity capital. I obtained an average of reported dividends and stock prices from the proxy group, and I used a reasonable terminal growth rate estimate for FCG. My DCF cost of equity estimate for FCG is 6.6%, as expressed in the following equation:[43]

Equation 5:
DCF Results

$$\mathbf{6.6}\% = \left[\frac{\$0.37(1+4.1\%)^{1/4}}{\$61.92} + (1+4.1\%)^{1/4}\right]^4 - 1$$

As noted above, this estimate is likely at the higher end of the appropriate range due to the high estimate for the long-term growth rate.

Q. DR. VANDER WEIDE'S DCF MODEL YIELDED MUCH HIGHER RESULTS. DID YOU FIND ANY ERRORS IN HIS ANALYSIS?

A. Yes, I found several errors. Dr. Vander Weide's DCF Model produced cost of equity results as high as 11.1%.[44] The results of Dr. Vander Weide's DCF Model are overstated because of a fundamental error regarding his growth rate inputs. Specifically, Dr. Vander

---

[43] *See* Exhibit DJG-7.

[44] *See* Exhibit No. JVW-1 Schedule 1.

Weide used long-term growth rates in his proxy group as high as 7.95%, which nearly twice as high as projected, long-term nominal U.S. GDP growth. This means Dr. Vander Weide's growth rate assumption violates the basic principle that no company can grow at a greater rate than the economy in which it operates over the long-term, especially a regulated utility company with a defined service territory. Furthermore, Dr. Vander Weide used short-term, quantitative growth estimates published by analysts. As discussed above, these analysts' estimates are inappropriate to use in the DCF Model as long-term growth rates because they are estimates for short-term growth. In other words, while a commercial analyst may think that UGI Corp.'s earnings might quantitatively increase by 7.95% each year over the next few years, it is *Dr. Vander Weide*, not the analyst, who is telling this Commission that UGI Corp.'s earnings will grow by nearly twice the rate of U.S. GDP each year, every year, for decades into the future.[45] This assumption is simply not realistic, and it contradicts fundamental concepts of long-term growth. Furthermore, the long-term growth rate input for each company in Dr. Vander Weide's proxy group exceeds long-term projections for nominal U.S. GDP growth. As a result, Dr. Vander Weide's DCF cost of equity estimates are artificially inflated above market levels.

[45] *Id*. Technically, the constant growth rate in the DCF Model grows dividends each year to "infinity." Yet even if we assumed that the growth rate applied to only a few decades, the annual growth rate would still be too high to be considered realistic.

Q. WHAT ADDITIONAL ERRORS DID YOU FIND IN DR. VANDER WEIDE'S DCF ANALYSIS?

A. A proper DCF analysis considers the market-based stock price of a firm for the stock price input of the model. In this case, Dr. Vander Weide arbitrarily reduced the stock prices of each one of his proxy companies by 5%. Mathematically, this decision results in higher DCF results (i.e., the denominator of the DCF formula is decreased so the result is increased). According to Dr. Vander Weide, he made this decision to account for flotation costs. When companies issue equity securities, they typically hire at least one investment bank as an underwriter for the securities. "Flotation costs" generally refer to the underwriter's compensation for the services it provides in connection with the securities offering.

Q. DO YOU AGREE WITH DR. VANDER WEIDE'S FLOTATION COST ALLOWANCE?

A. No, I do not. Dr. Vander Weide's flotation cost allowance is inappropriate for several reasons. First, Dr. Vander Weide did not account for flotation costs properly. A proper flotation cost estimate is much more complicated than simply reducing market-based stock prices by a substantial 5%. Investors do not view market stock prices in this way. In other words, when an investor considers whether to buy a share of ABC Inc. for $100, the investor does not assume that the "real" price is actually $95 to account for flotation costs. This problem is further exacerbated when applied to a ratemaking context. If a regulator awards a utility with flotation costs in a particular case, and the utility (or its parent) does not issue any shares between that time and the next rate case, the utility recovers additional funds through rates for a cost it never incurred. Dr. Vander Weide has presented no evidence regarding plans for any company in the proxy group to issue new equity shares over the next few years. Moreover, he presented no evidence supporting the arbitrary proposition that every utility in his proxy group should have a flotation cost allowance of exactly 5%. Even if he had, it would still be inappropriate to increase the DCF cost of equity estimate for flotation costs. In addition, the Commission should not allow recovery of flotation costs in this case for the following three reasons:

1. <u>Flotation costs are not actual "out-of-pocket" costs</u>.

FCG has not experienced any out-of-pocket costs for flotation. Underwriters are not compensated in this fashion. Instead, underwriters are compensated through an "underwriting spread." An underwriting spread is the difference between the price at which the underwriter purchases the shares from the firm, and the price at which the underwriter sells the shares to investors.[46] Furthermore, FCG is a wholly owned subsidiary of Southern Company, which means it does not issue securities to the public and thus would have no need to retain an underwriter. Accordingly, FCG has not experienced any out-of-pocket flotation costs, and if it has, those costs should be included in the Company's expense schedules.

2. <u>The market already accounts for flotation costs</u>.

When an underwriter markets a firm's securities to investors, the investors are well aware of the underwriter's fees. In other words, the investors know that a portion of the

[46] *See* Graham, Smart & Megginson *supra* n. 19, at 509.

price they are paying for the shares does not go directly to the company, but instead goes to compensate the underwriter for its services. In fact, federal law requires that the underwriter's compensation be disclosed on the front page of the prospectus.[47] Thus, investors have already considered and accounted for flotation costs when making their decision to purchase shares at the quoted price. As a result, there is no need for the Company's shareholders to receive additional compensation to account for costs they have already considered and agreed to. We see similar compensation structures in other kinds of business transactions. For example, a homeowner may hire a realtor and sell a home for $100,000. After the realtor takes a six percent commission, the seller nets $94,000. The buyer and seller agreed to the transaction notwithstanding the realtor's commission. Obviously, it would be unreasonable for the buyer or seller to demand additional funds from anyone after the deal is completed to reimburse them for the realtor's fees. Likewise, investors of competitive firms do not expect additional compensation for flotation costs. Thus, it would not be appropriate for a commission standing in the place of competition to award a utility's investors with this additional compensation.

3. It is inappropriate to add any additional basis points to a cost of equity proposal that is already far above the true required return.

For the reasons discussed above, flotation costs should be disallowed from a technical standpoint, and they should also be disallowed from a practical standpoint. FCG is asking this Commission to award it a cost of equity that is well over 300 basis points

[47] *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.

above its true cost of equity. Under these circumstances, it is especially inappropriate to suggest that the effect of flotation costs should be considered in any way.

Q. DISCUSS THE FINAL RESULTS OF DR. VANDER WEIDE'S DCF MODEL, DESPITE ITS FLAWS.

A. Despite the fundamental errors and upwardly biased inputs in Dr. Vander Weide's DCF Model, the final results of his DCF Model applied to the proxy group produce a cost of equity estimate of 9.1%,[48] which is relatively close to my awarded ROE recommendation of 9.25%. While I do not think that 9.1% is a reasonable estimate for FCG's cost of equity, it would represent a reasonable awarded ROE in this case. That is, an "end result" of 9.1% for the awarded return would be reasonable in this particular case under the concept of gradualism – or moving towards a market-based cost of equity gradually rather than abruptly.

Q. WERE THE RESULTS OF YOUR DCF MODEL CONSISTENT WITH THE RESULTS OF YOUR CAPM?

A. Yes, although the financial models are based on different inputs, the results were consistent. The DCF Model yielded a cost of equity of 7.6%. The CAPM yielded a cost of equity of 7.4%, as discussed in the following section. This further highlights the validity

---

[48] *See* Dr. Vander Weide's workpapers in FCG's response to OPC POD No. 2, worksheet "Schedule 1" – average DCF Model Result of 9.1%.

and accuracy of the models, especially when they are conducted on utility companies. The details of my CAPM results are discussed in the next section.

VIII. CAPITAL ASSET PRICING MODEL ANALYSIS

Q. DESCRIBE THE CAPITAL ASSET PRICING MODEL.

A. The Capital Asset Pricing Model ("CAPM") is a market-based model founded on the principle that investors demand higher returns for incurring additional risk.[49] The CAPM estimates this required return.

Q. WHAT ASSUMPTIONS ARE INHERENT IN THE CAPM?

A. 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 on the basis of 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,

[49] William F. Sharpe, *A Simplified Model for Portfolio Analysis* 277-93 (Management Science IX 1963); *see also* Graham, Smart & Megginson *supra* n. 20, at 208.

8. Total asset quality is fixed, and all assets are marketable and divisible.[50]

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.

Q. IS THE CAPM APPROACH CONSISTENT WITH THE LEGAL STANDARDS SET FORTH BY THE U.S. SUPREME COURT?

A. Yes, it is. The U.S. Supreme Court has recognized that "the amount of risk in the business is a most important factor" in determining the allowed rate of return,[51] and that "the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks."[52] The CAPM is a useful model because it directly considers the amount of risk inherent in a business. It is arguably the strongest of the models usually presented in rate cases because unlike the DCF Model, the CAPM directly measures the most important component of a fair rate of return analysis: Risk.

Q. DESCRIBE THE CAPM EQUATION.

A. The basic CAPM equation is expressed as follows:

---

[50] *Id*.

[51] *Wilcox*, 212 U.S. at 48 (emphasis added).

[52] *Hope Natural Gas Co.*, 320 U.S. at 603 (emphasis added).

Equation 6:
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. Each term is discussed in more detail below, along with the inputs I used for each term.

A. The Risk-Free Rate

$$\left[K = \boldsymbol{R_F} + \beta_i(R_M - R_F)\right]$$

Q. EXPLAIN THE RISK-FREE RATE.

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

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

A. Yes. In valuing an asset, investors estimate cash flows over long periods of time. Common stock is viewed as a long-term investment, and the cash flows from dividends are assumed to last indefinitely. Thus, short-term Treasury bill yields are rarely used in the CAPM to represent the risk-free rate. Short-term rates are subject to greater volatility and thus can lead to unreliable estimates. Instead, long-term Treasury bonds are usually used to represent the risk-free rate in the CAPM. I considered a 30-day average of daily Treasury yield curve rates on 30-year Treasury bonds in my risk-free rate estimate, which resulted in a risk-free rate of 2.77%.[53]

B. <u>The Beta Coefficient</u>

$$\left[K = R_F + \boldsymbol{\beta_i}(R_M - R_F)\right]$$

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

A. As discussed above, beta represents the sensitivity of a given security to movements in the overall market. The CAPM states that in efficient capital markets, the expected risk premium on each investment is proportional to its beta. Recall that a security with a beta greater (less) than one is more (less) risky than the market portfolio. A stock's beta equals

[53] Exhibit DJG-8.

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:[54]

Equation 7:
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^2_m	=	*variance of market portfolio*

Typically, an index such as the S&P 500 Index is used as a proxy for the market portfolio. The historical betas for publicly traded firms are published by various institutional analysts. Beta may also be calculated through a linear regression analysis, which provides additional statistical information about the relationship between a single stock and the market portfolio. As discussed above, beta also represents the sensitivity of a given security to the market as a whole. The market portfolio of all stocks has a beta equal to one. Stocks with betas greater than one are relatively more sensitive to market risk than the average stock. For example, if the market increases (decreases) by 1.0%, a stock with a beta of 1.5 will, on average, increase (decrease) by 1.5%. In contrast, stocks with betas of less than one are less sensitive to market risk. For example, if the market increases (decreases) by 1.0%, a stock with a beta of 0.5 will, on average, only increase (decrease) by 0.5%.

[54] Graham, Smart & Megginson *supra* n. 19, at 180-81.

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

A. I used betas recently published by Value Line Investment Survey. The beta for each proxy company is less than 1.0. Thus, we have an objective measure to prove the well-known concept that utility stocks are less risky than the average stock in the market.

C. The Equity Risk Premium

$$\left[K = R_F + \beta_i\left(\boldsymbol{R_M} - \boldsymbol{R_F}\right)\right]$$

Q. DESCRIBE THE EQUITY RISK PREMIUM.

A. The final term of the CAPM is the equity risk premium ("ERP"), which is the required return on the market portfolio less the risk-free rate ($R_M – R_F$). In other words, the ERP is the level of return investors expect above the risk-free rate in exchange for investing in risky securities. Many experts would agree that "the single most important variable for making investment decisions is the equity risk premium."[55] Likewise, the ERP is arguably the single most important factor in estimating the cost of capital in this matter. There are three basic methods that can be used to estimate the ERP: (1) calculating a historical average; (2) taking a survey of experts; and (3) calculating the implied ERP. I will discuss each method in turn, noting advantages and disadvantages of these methods.

---

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

1. <u>Historical Average</u>

Q. DESCRIBE THE HISTORICAL EQUITY RISK PREMIUM.

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

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

A. Many investors use the historic ERP because it is convenient and easy to calculate. What matters in the CAPM model, however, is not the actual risk premium from the past, but rather the current and forward-looking risk premium.[56] Some investors may think that a historic ERP provides some indication of what the prospective risk premium is; however, there is empirical evidence to suggest the prospective, forward-looking ERP is actually <u>lower</u> than the historical ERP. In a landmark publication on risk premiums around the world, *Triumph of the Optimists,* the authors suggest through extensive empirical research that the prospective ERP is lower than the historical ERP.[57] This is due in large part to what is known as "survivorship bias" or "success bias" – a tendency for failed companies to be excluded from historical indices.[58] From their extensive analysis, the authors make the following conclusion regarding the prospective ERP:

---

[56] Graham, Smart & Megginson *supra* n. 19, at 330.

[57] Dimson, Marsh & Staunton *supra* n. 55, at 194.

[58] *Id*. at 34.

> The result is a forward-looking, geometric mean risk premium for the United States . . . of around 2½ to 4 percent and an arithmetic mean risk premium . . . that falls within a range from a little below 4 to a little above 5 percent.[59]

Indeed, these results are lower than many reported historical risk premiums. Other noted experts agree:

> The historical risk premium obtained by looking at U.S. data is biased upwards because of survivor bias. . . . The true premium, it is argued, is much lower. This view is backed up by a study of large equity markets over the twentieth century (*Triumph of the Optimists*), which concluded that the historical risk premium is closer to 4%.[60]

Regardless of the variations in historic ERP estimates, many scholars and practitioners agree that simply relying on a historic ERP to estimate the risk premium going forward is not ideal. Fortunately, "a naïve reliance on long-run historical averages is not the only approach for estimating the expected risk premium."[61]

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

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

---

[59] *Id*. at 194.

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

[61] Graham, Smart & Megginson *supra* n. 19, at 330.

2. EXPERT SURVEYS

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

A. As its name implies, the expert survey approach to estimating the ERP involves conducting a survey of experts including professors, analysts, chief financial officers and other executives around the country and asking them what they think the ERP is. Graham and Harvey have performed such a survey every year since 1996. In their 2016 survey, they found that experts around the country believe the current risk premium is only 4.0%.[62] The IESE Business School conducts a similar expert survey. Their 2017 expert survey reported an average ERP of 5.7%.[63]

3. IMPLIED EQUITY RISK PREMIUM

Q. DESCRIBE THE IMPLIED EQUITY RISK PREMIUM APPROACH.

A. The third method of estimating the ERP is arguably the best. The implied ERP relies on the stable growth model proposed by Gordon, often called the "Gordon Growth Model," which is a basic stock valuation model widely used in finance for many years:[64]

---

[62] John R. Graham and Campbell R. Harvey, *The Equity Risk Premium in 2016*, at 3 (Fuqua School of Business, Duke University 2014), copy available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2611793.

[63] 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://papers.ssrn.com/sol3/papers.cfm?abstract_id=2598104. 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.

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

Equation 8:
Gordon Growth Model

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

where:	P_0	=	*current value of stock*
	D_1	=	*value of next year's dividend*
	K	=	*cost of equity capital / discount rate*
	g	=	*constant growth rate in perpetuity for dividends*

This model is similar to the Constant Growth DCF Model presented in Equation 3 above ($K=D_1/P_0+g$). In fact, the underlying concept in both models is the same: The current value of an asset is equal to the present value of its future cash flows. Instead of using this model to determine the discount rate of one company, we can use it to determine the discount rate for the entire market by substituting the inputs of the model. Specifically, instead of using the current stock price (P_0), we will use the current value of the S&P 500 (V_{500}). Instead of using the dividends of a single firm, we will consider the dividends paid by the entire market. Additionally, we should consider potential dividends. In other words, stock buybacks should be considered in addition to paid dividends, as stock buybacks represent another way for the firm to transfer free cash flow to shareholders. Focusing on dividends alone without considering stock buybacks could understate the cash flow component of the model, and ultimately understate the implied ERP. The market dividend yield plus the market buyback yield gives us the gross cash yield to use as our cash flow in the numerator of the discount model. This gross cash yield is increased each year over the next five years by the growth rate. These cash flows must be discounted to determine their present value. The discount rate in each denominator is the risk-free rate (R_F) plus the discount rate (K).

The following formula shows how the implied return is calculated. Since the current value of the S&P is known, we can solve for K: The implied market return.[65]

Equation 9:
Implied Market Return

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

where:		
V_{500}	=	*current value of index (S&P 500)*
$CY_{1\text{-}5}$	=	*average cash yield over last five 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* $= CY_5\,(1+R_F)\,/\,K$

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

Equation 10:
Implied Equity Risk Premium

$$Implied\ Expected\ Market\ Return - R_F = Implied\ ERP$$

Q. DISCUSS THE RESULTS OF YOUR IMPLIED ERP CALCULATION.

A. After collecting data for the index value, operating earnings, dividends, and buybacks for the S&P 500 over the past six years, I calculated the dividend yield, buyback yield, and

[65] *See* Exhibit DJG-10 for detailed calculation.

gross cash yield for each year. I also calculated the compound annual growth rate (g) from operating earnings. I used these inputs, along with the risk-free rate and current value of the index to calculate a current expected return on the entire market of 7.66%. I subtracted the risk-free rate to arrive at the implied equity risk premium of 4.88%. Dr. Damodaran, one of the world's leading experts on the ERP, promotes the implied ERP method discussed above. He calculates monthly and annual implied ERPs with this method and publishes his results. Dr. Damodaran's average ERP estimate for January 2018 using several implied ERP variations was 5.37%.[66]

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

A. For the final ERP estimate I used in my CAPM analysis, I considered the results of the ERP surveys along with the implied ERP calculations and the ERP reported by Duff & Phelps.[67] The results are presented in the following figure:

[66] http://pages.stern.nyu.edu/~adamodar/

[67] *See also* Exhibit DJG-11.

Figure 9:
Equity Risk Premium Results

IESE Business School Survey	5.7%
Graham & Harvey Survey	4.0%
Duff & Phelps Report	5.0%
Damodaran	5.4%
Garrett	4.9%
Highest	**5.7%**

While it would be reasonable to select any one of these ERP estimates to use in the CAPM, in the interest of reasonableness, I selected the highest ERP estimate of 5.7% to use in my CAPM analysis. All else held constant, a higher ERP used in the CAPM will result in a higher cost of equity estimate.

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

A. Using the inputs for the risk-free rate, beta coefficient, and equity risk premium discussed above, I calculated the CAPM cost of equity for each proxy company. Using the same CAPM equation presented above, the results of my CAPM analysis are expressed as follows:[68]

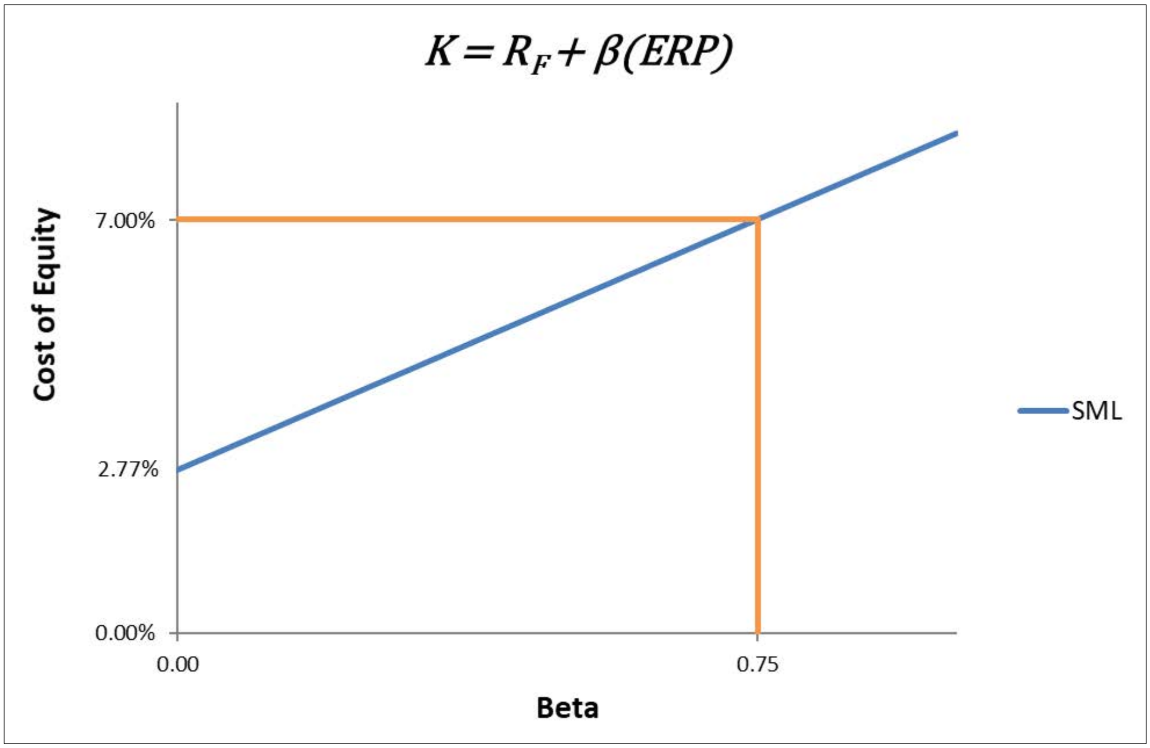
Equation 11:
CAPM Results

$$\mathbf{7.0}\% = 2.77\% + 0.75(5.70\%)$$

[68] Exhibit DJG-12.

The CAPM suggests that FCG's cost of equity is approximately 7.0%. The CAPM may be displayed graphically through what is known as the Security Market Line ("SML"). The following figure shows the expected return (cost of equity) on the y-axis, and the average beta for the proxy group on the x-axis. The SML intercepts the y-axis at the level of the risk-free rate. The slope of the SML is the equity risk premium.

Figure 10:
CAPM Graph



The SML provides the required rate of return that will compensate investors for the beta risk of that investment. Thus, at an average beta of 0.75 for the proxy group, the estimated cost of equity for FCG is 7.0%.

Q. DR. VANDER WEIDE'S CAPM ANALYSIS YIELDS CONSIDERABLY HIGHER RESULTS. DID YOU FIND SPECIFIC PROBLEMS WITH DR. VANDER WEIDE'S CAPM ASSUMPTIONS AND INPUTS?

A. Yes, I did. Dr. Vander Weide's CAPM cost of equity results are as high as 11.3%.[69] There are three problems with Dr. Vander Weide's CAPM analysis. His inputs for the equity risk premium, beta coefficient, and risk-free rate are all unreasonably high and unsupportable. I will discuss each of these problems further below.

Q. DID DR. VANDER WEIDE RELY ON A REASONABLE MEASURE FOR THE ERP?

A. No, he did not. Dr. Vander Weide used an input as high as 7.7% for the ERP, which is unreasonable.[70] The ERP is one of three inputs in the CAPM equation, and it is one of the most single important factors for estimating the cost of equity in this case. As discussed above, I used two widely-accepted methods for estimating the ERP, including consulting expert surveys and calculating the implied ERP based on aggregate market data. The <u>highest</u> ERP produced from this analysis is 5.7%. This means that Dr. Vander Weide's overestimated ERP is more than 200 basis points higher than the range of ERPs utilized by firms and analysts across the country. There are several reasons why Dr. Vander Weide's ERP input is overestimated. First, in one of his EPR estimates, Dr. Vander Weide considered market data as far back as 1926. As discussed above, leading scholars agree

---

[69] *See* Exhibit No. JVW-1 Schedule 9.

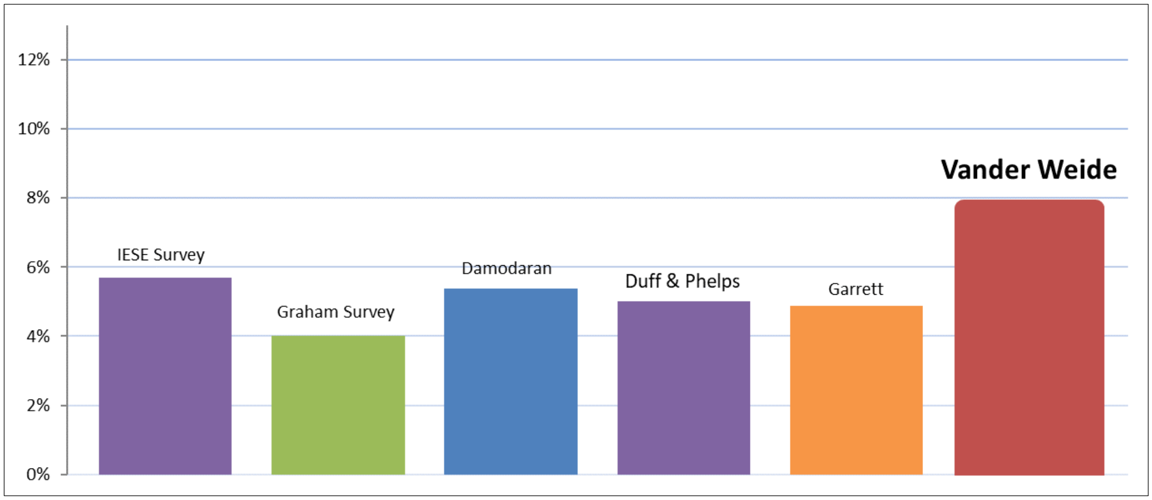
[70] *Id*.

that relying on historical premiums is problematic because there is strong empirical evidence to suggest the prospective, forward-looking ERP is actually lower than the historical ERP. This is due in large part to what is known as "survivorship bias" or "success bias" – a tendency for failed companies to be excluded from historical indices. Furthermore, the U.S. economy experienced unprecedented periods of extensive economic growth following the great depression. In other words, in considering a historical average dating back to 1926, Dr. Vander Weide has included many years of historically high premiums in his analysis. This approach is so problematic that some scholars have referred to it as "naïve."[71] Because the ERP is not firm-specific, there are fairly standardized ERP levels that are widely recognized by several prominent national expert surveys. For example, as discussed above, Graham and Harvey's 2016 expert survey reports an average ERP of 4.0%. The IESE Business School expert survey reports an average ERP of 5.7%. Similarly, Duff & Phelps estimates an ERP of 5.0% for 2016. The following chart illustrates that Dr. Vander Weide's ERP estimate is far out of line with industry norms[72].

[71] Graham, Smart & Megginson *supra* n. 19, at 330.

[72] The ERP estimated by Dr. Damodaran is the average of several ERP estimates under slightly differing assumptions.

Figure 11:
Equity Risk Premium Comparison



When compared with these well-established ERP benchmarks, it is clear that Dr. Vander Weide's ERP estimate is not within the range of reasonableness. As a result, his CAPM cost of equity estimates are overstated.

Q. DID DR. VANDER WEIDE USE A REASONABLE MEASURE FOR HIS BETA INPUT?

A. No, he did not. According to Dr. Vander Weide, the utility betas published by analysts such as Value Line are understated because betas that are less than 1.0 are less reliable.[73] In fact, however, there is evidence to the contrary.

[73] Direct Testimony of Dr. Vander Weide, p. 46.

Q. DISCUSS THE EVIDENCE THAT SUGGESTS PUBLISHED UTILITY BETAS ARE LIKELY TOO HIGH, RATHER THAN TOO LOW.

A. Published betas are 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.[74] Some analysts use an adjustment method proposed by Blume, which adjusts raw betas toward the market mean of one.[75] 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."[76] 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

---

[74] *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).

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

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

the raw beta calculation.[77] 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 statistical quality of the regression."[78] The Vasicek beta adjustment equation is expressed as follows:

Equation 12:
Vasicek Beta Adjustment

$$\beta_{i1} = \frac{\sigma^2_{\beta_{i0}}}{\sigma^2_{\beta 0} + \sigma^2_{\beta_{i0}}}\beta_0 + \frac{\sigma^2_{\beta 0}}{\sigma^2_{\beta 0} + \sigma^2_{\beta_{i0}}}\beta_{i0}$$

where:	β_{i1}	=	*Vasicek adjusted beta for security i*
	β_{i0}	=	*historical beta for security i*
	β_0	=	*beta of industry or proxy group*
	$\sigma^2_{\beta 0}$	=	*variance of betas in the industry or proxy group*
	$\sigma^2_{\beta i0}$	=	*square of standard error of the historical beta for security 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:

[77] 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).

[78] 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. <u>This is most useful in looking at companies in industries that on average have high or low betas</u>.[79]

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 auto-regressive tendencies in <u>utility</u> betas lends support to the application of adjustment procedures such as the . . . adjustment procedure presented by Vasicek."[80] Gombola also concluded that adjusting raw betas toward the market mean of 1.0 is <u>too high</u>, and that "[i]nstead, they should be adjusted toward a value that is less than one."[81] In conducting the Vasicek adjustment on betas in previous cases, it reveals that utility betas are even lower than those published by Value Line.[82] Gombola's findings are particular important here, because his study was conducted specifically on utility

---

[79] *Id*. at 78 (emphasis added).

[80] 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).

[81] *Id*. at 91-92.

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

companies. Despite the strong evidence presented by Vasicek and Gombola that utility betas published by Value line are too high, I used the Value Line published betas in the interest of reasonableness. Regardless, it is clear that adjusting betas to a level that is higher than Value Line's betas is not reasonable, and would produce CAPM cost of equity results that are too high.

Q. DESPITE THE TECHNICAL DIFFERENCES BETWEEN THE BETAS ESTIMATED BY DR. VANDER WEIDE AND THE VALUE LINE BETAS YOU RELIED ON, IS THERE EVIDENCE THAT DR. VANDER WEIDE'S CAPM COST OF EQUITY ESTIMATE IS UNREALISTICALLY HIGH?

A. Yes, there is. Although there are various schools of thought regarding beta calculations and adjustments, there is a more straight-forward approach to assessing whether the ultimate results of the CAPM and DCF Model are reasonable. This reasonableness check involves estimating the "ceiling" on utility cost of equity. I discuss this in more detail below, but in short, since it is undisputed that utility stocks are less risky than the average stock (with a beta of 1.0), then in fact, utility cost of equity must be less than the market cost of equity. Currently, the market cost of equity is only about 7.8%.[83] Therefore, since 7.8% is the estimated "ceiling" for FCG's true cost of equity, we know that cost of equity estimates as high as 11.3% are not realistic, and thus, must be based on unrealistic inputs, such as Dr. Vander Weide's unreasonable beta assumptions.

[83] *See* Exhibit DJG-14.

Q. DID YOU FIND ANY PROBLEMS WITH DR. VANDER WEIDE'S RISK-FREE RATE INPUT?

A. Yes, I did. The concept of a risk-free rate is important in financial analysis. For example, the risk-free rate represents the bare minimum return required by any investor who invests in a risky asset (such as a company equity share or bond). Therefore, when analysts attempt to estimate the required return on the market portfolio (i.e., all stocks), for example, the analysis must start with an estimate of the risk-free rate. Consistently, analysts have relied on the returns of U.S. Treasury securities of varying terms for estimates of the risk-free rate. Since the U.S. government has never defaulted on its debt, the rate on treasury securities is universally viewed as the closest proxy for a "riskless" return. In Dr. Vander Weide's estimate of the risk-free rate, however, he considered in part the return on utility bonds.[84] Unlike U.S. Treasury securities, utility bonds (or any bonds issued by publicly-traded firms) are not viewed as "riskless" assets. Therefore, it is inappropriate to add any sort of premium or upwardly biased factor based on risky assets to well established benchmarks for the risk-free rate.

Q. DID YOU ALSO REVIEW DR. VANDER WEIDE'S OTHER RISK PREMIUM ANALYSES?

A. Yes. Before I discuss Dr. Vander Weide's risk premium model, I will reiterate that the CAPM itself is a "risk premium" model. In short, it takes the bare minimum return any

---

[84] *See* Dr. Vander Weide's workpapers in FCG's response to OPC POD No. 2, worksheet "Forecast Yields."

investor would require for buying a stock (the risk-free rate), then adds a *premium* to compensate the investor for the extra risk he or she assumes by buying a stock rather than a riskless U.S. Treasury security. The CAPM has been utilized by companies around the world for decades for the same purpose we are using it in this case – to estimate cost of equity. When reasonable inputs are used in the CAPM, this model tends to produce cost of equity results for utility companies that are much lower than the excessive awarded returns requested by utility executives. Thus, utility witnesses often downplay or completely distort the Nobel-Prize-winning CAPM and instead promote their own various risk premium models.

In this case, Dr. Vander Weide's risk premium model suffers from the same errors as his DCF Model: utilizing growth rate estimates for individual companies that exceed the growth rate of the entire U.S. economy. Specifically, Dr. Vander Weide used long-term growth rates as high as 12.97% in conducting his risk premium model, which means we cannot view his results as realistic.[85] To reiterate, Dr. Vander Weide is suggesting that a company's earnings can grow at a rate more than four times greater than projected U.S. GDP growth over the long-term, which is simply not realistic. Moreover, the results of his risk premium model were as high as 11.0%,[86] which is over 300 basis points above the utility cost of equity "ceiling" discussed above (approximately 7.8%).[87]

---

[85] *See* Exhibit No. JVW-1 Schedule 9.

[86] Direct Testimony of Dr. James H. Vander Weide, p. 37, line 18.

[87] *See* Exhibit DJG-14.

Q. PLEASE PROVIDE A SUMMARY CONTRASTING THE INPUTS AND RESULTS OF YOUR AND DR. VANDER WEIDE'S CAPM ANALYSIS.

A. There are only three inputs to the CAPM: risk-free rate, beta, and the equity risk premium. It is important to use reasonable quantities for each of these inputs in order for the CAPM to produce reasonable results. The figure below summarizes the amount and source of the inputs used by Dr. Vander Weide and me in our CAPM analyses.

Figure 12:
CAPM Contrast

Mr. Garrett's CAPM Inputs and Result

Risk-Free Rate	+	**Beta**	x	**ERP**	=	**7.0%**
2.77%		0.75		5.7%		
Used current yields on 30-year T bonds - an undisputed reasonable proxy for the risk-free rate in the CAPM, even though they are <u>higher</u> than shorter-term treasury securities.		Used betas published by Value Line - a respected third party analyst firm, even though evidence indicates these betas may be too <u>high</u> for utilities and other low-beta firms.		Used the <u>highest</u> ERP from following sources: ERP published by third-party analyst, ERP reported in expert surveys, and ERP estimated by respected unbiased expert.		

Dr. Vander Weide's CAPM Inputs and Result

Risk-Free Rate	+	**Beta**	x	**ERP**	=	**11.3%**
4.20%		0.90		7.7%		
Used forecasted yield considering treasury and non-treasury securities. Not an accepted proxy for risk-free rate in finance community.		Calculated his own betas which are considerably higher than those published by Value Line - an unbiased third party.		Conducted a DCF analysis on 100 non-comparable firms using long-term growth rates more than three times U.S. GDP for some companies.		

Looking at the figure above, there is a consistent theme inherent in the inputs chosen by Dr. Vander Weide: instead of selecting widely-accepted, unbiased inputs for the risk-free rate, beta, and ERP, Dr. Vander Weide chose to calculate his own inputs using questionable methods outside of accepted industry standards. It is also noteworthy that for each of these inputs, Dr. Vander Weide's selections are markedly <u>higher</u> than the inputs provided by widely-accepted, unbiased sources. As a result, Dr. Vander Weide's final CAPM result is far above one that can be considered reasonable in the current market environment. In stark contrast to Dr. Vander Weide's approach, the inputs I selected for each input are from widely-accepted and unbiased sources. For the risk-free rate, I selected the current yields on 30-year T-bonds which are published by the U.S. Department of Treasury. No forecasting or guessing is required to obtain this reasonable and reliable input. For the beta input, I used the betas published by Value Line – an unbiased, independent investment research firm. While there is some evidence suggesting that Value Line's betas might be too high for consistently low-beta firms such as utilities, I selected these betas in the interest of reasonableness. Finally, for the ERP input, I selected the highest ERP from several independent and unbiased sources, including independent analysts and experts. Consequently, the final result of my CAPM stems from reasonable and unbiased inputs.

IX. OTHER COST OF EQUITY ISSUES

Q. ARE THERE ANY OTHER ISSUES RAISED IN DR. VANDER WEIDE'S TESTIMONY TO WHICH YOU WOULD LIKE TO RESPOND?

A. Yes. In his testimony, Dr. Vander Weide suggests that certain firm-specific risks and other factors should have an increasing effect on the cost of equity, apparently beyond that which is indicated by the CAPM and DCF Models. These issues include demand uncertainty, operating leverage, and regulatory uncertainty, among others.[88] As discussed and illustrated above, however, it is a well-known concept in finance that firm-specific risks

[88] *See* Direct Testimony of Dr. James H. Vander Weide pp. 14-13.

are unrewarded by the market. Therefore, the Company's firm-specific business risks, while perhaps relevant to other issues in the rate case, have no meaningful effect on the cost of equity estimate. Rather, it is market risk that is rewarded by the market, and this concept is thoroughly addressed in my CAPM analysis discussed above. I would also add a comment about the term "regulatory uncertainty" used by Dr. Vander Weide. Terms like this, along with terms like "regulatory risk," are often used by utility witnesses as part of a narrative suggesting that the regulatory process somehow adds risk to regulated utility companies; this could not be more misleading. In reality, the utility industry is one of the lowest risk industries in the country <u>because</u> of regulation, not in spite of it. The fact that utility companies possess very little risk is beneficial to society, and this low level of risk should be appropriately reflected in low awarded returns on equity.

X. COST OF EQUITY SUMMARY

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

A. The following table shows the cost of equity results from each model I employed in this case.[89]

[89] *See* Exhibit DJG-13.

Figure 13:
Cost of Equity Summary

Model	Cost of Equity
Discounted Cash Flow Model	6.6%
Capital Asset Pricing Model	7.0%
Average	**6.8%**

The average cost of equity resulting from the DCF Model and the CAPM is 6.8%. Furthermore, it is noteworthy that these two models produced relatively similar results, especially considering the fact that the inputs for the two models are completely different. Again, the DCF Model considers stock price, dividends, and a long-term growth rate. The CAPM considers the risk-free rate, beta, and the equity risk premium. These inputs are relatively unrelated to each other, and yet the models produced similar results. This fact further highlights the validity of these two models, which have been relied upon by executives, analysts, academics, and regulators for decades to value companies and estimate cost of equity.

Q. IS THERE A MARKET INDICATOR THAT YOU CAN USE TO TEST THE REASONABLENESS OF YOUR COST OF EQUITY ESTIMATE?

A. Yes, there is. The CAPM is a risk premium model based on the fact that all investors will require, at a minimum, a return equal to the risk-free rate when investing in equity securities. Of course, the investors will also require a premium on top of the risk-free rate to compensate them for the risk they have assumed. If an investor bought every stock in the market portfolio, he would require the risk-free rate, plus the ERP discussed above. Recall that the risk-free rate plus the ERP is called the required return on the market portfolio. This could also be called the market cost of equity. It is undisputed that the cost of equity of utility stocks must be less than the total market cost of equity. This is because utility stocks are less risky than the average stock in the market. (We proved this above by showing that utility betas were less than one). Therefore, once we determine the market cost of equity, it gives us a "ceiling" below which FCG's actual cost of equity must lie.

Q. DESCRIBE HOW YOU ESTIMATED THE MARKET COST OF EQUITY.

A. The methods used to estimate the market cost of equity are necessarily related to the methods used to estimate the ERP discussed above. In fact, the ERP is calculated by taking the market cost of equity less the risk-free rate. Therefore, in estimating the market cost of equity, I relied on the same methods discussed above to estimate the ERP: (1) consulting expert surveys; and (2) calculating the implied ERP. The results of my market cost of equity analysis are presented in the following table:[90]

[90] *See* Exhibit DJG-14.

Figure 14:
Market Cost of Equity Summary

Source	Estimate
IESE Survey	8.5%
Graham Harvey Survey	6.8%
Damodaran	8.1%
Garrett	7.7%
Average	7.8%

As shown in this table, the average market cost of equity from these sources is only 7.8%. Therefore, it is not surprising that the CAPM and DCF Model indicate a cost of equity for FCG of only 6.8%. In other words, any cost of equity estimates for FCG (or any regulated utility) that is above the market cost of equity should be viewed as unreasonable. In this case, Dr. Vander Weide suggests a cost of equity more than 300 basis points above the market cost of equity, which is simply unrealistic.

XI. CAPITAL STRUCTURE

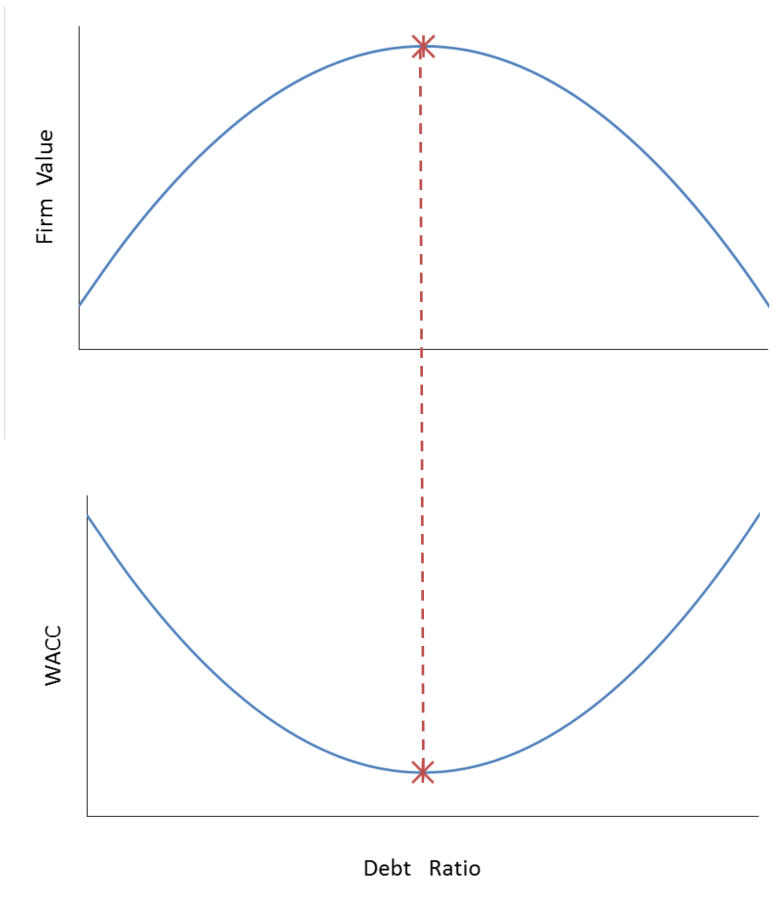
Q. DESCRIBE IN GENERAL THE CONCEPT OF A COMPANY'S "CAPITAL STRUCTURE."

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

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

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

Figure 15:
Optimal Debt Ratio



As shown in this figure, a competitive firm's value is maximized when the WACC is minimized. In both of these graphs, the debt ratio [D/(D+E)] is shown on the x-axis. By increasing its debt ratio, a competitive firm can minimize its WACC and maximize its value. At a certain point, however, the benefits of increasing debt do not outweigh the costs of the additional risks to both bondholders and shareholders, as each type of investor will demand higher returns for the additional risk they have assumed.[91]

[91] *See* Graham, Smart & Megginson *supra* n. 19, at 440-41.

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

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

Equation 13:
Revenue Requirement for Regulated Utilities

$$RR = O + d + T + \boldsymbol{r}(A - D)$$

where:	RR	=	*revenue requirement*
	O	=	*operating expenses*
	d	=	*depreciation expense*
	T	=	*corporate tax*
	$\boldsymbol{r}$	=	***weighted average cost of capital (WACC)***
	A	=	*plant investments*
	D	=	*accumulated depreciation*

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

Q. DO YOU BELIEVE THAT, GENERALLY SPEAKING, UTILITIES CAN AFFORD TO HAVE HIGHER DEBT LEVELS THAN OTHER INDUSTRIES?

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

> Since financial leverage multiplies the underlying business risk, it stands to reason that firms that have high business risk should be reluctant to take on financial leverage. It also stands to reason that firms that operate in stable businesses should be much more willing to take on financial leverage. Utilities, for instance, have historically had high debt ratios but have not had high betas, mostly because their underlying businesses have been stable and fairly predictable.[92]

Note that the author explicitly contrasts utilities with firms that have high underlying business risk. Because utilities have low levels of risk and operate a stable business, they should generally operate with relatively high levels of debt to achieve their optimal capital structure. There are objective methods available to estimate the optimal capital structure, as discussed further below.

Q. IS IT APPROPRIATE TO CONSIDER ONLY THE CAPITAL STRUCTURES OF THE PROXY GROUP IN ASSESSING A PRUDENT CAPITAL STRUCTURE?

A. No, it is not. In this case, Dr. Vander Weide considered the capital structures of the proxy group in an attempt to justify yet another upwardly-biased adjustment to his cost of equity

---

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

estimate.[93] Utility witnesses often argue that regulators should primarily consider the capital structures of other regulated utilities in assessing the proper capital structure. This type of analysis is oversimplified and insufficient for three important reasons:

1. Utilities do not have a financial incentive to operate at the optimal capital structure. Under the rate base rate of return model, utilities do not have a natural financial incentive to minimize their cost of capital; in fact, they have a financial incentive to do the opposite. Competitive firms, in contrast, can maximize their value by minimizing their cost of capital. Competitive firms minimize their cost of capital by including a sufficient amount of debt in their capital structures. Simply comparing the debt ratios of other regulated utilities will not indicate an appropriate capital structure for the Company in this proceeding. Rather, it is likely to justify debt ratios that are far too low. It is the Commission's role to act as a surrogate for competition and thereby ensure that the capital structure of a regulated monopoly is similar to what would be appropriate in a competitive environment, not a regulated environment. This cannot be accomplished by simply looking at the capital structures of other regulated utilities or the target utility's test-year capital structure.

2. The optimal capital structure is unique to each firm. As discussed further below, the optimal capital structure for a firm is dependent on several unique financial metrics for *that* firm. The other companies in the proxy group have different financial metrics than the target utility, and thus, they have different optimal

[93] Direct Testimony of Dr. James H. Vander Weide, pp. 5-6.

capital structures. An objective analysis should be performed using the financial metrics of the target utility in order to estimate its unique optimal capital structure.

3. The capital structures of the proxy group may not have been approved by their regulatory commissions.

The actual capital structure of any utility falls within the realm of managerial discretion. That is, a utility's management has the discretion to choose the relative proportions of debt and equity used to finance the utility's operations. Regulatory commissions, however, have a duty to examine those decisions, and to impute a proper capital structure if the company's actual capital structure is inappropriate. Thus, the actual capital structures of other utilities may have been deemed inappropriate by their own commission. For all of the foregoing reasons, simply comparing the capital structures of other regulated utilities is insufficient to determine a prudent capital structure.

Q. WHAT IS YOUR RECOMMENDATION REGARDING FCG'S CAPITAL STRUCTURE?

A. I analyzed the Company's optimal capital structure based on the approach discussed above. In my opinion, FCG's proposed capital structure is reasonable in this case. However, I strongly disagree with Dr. Vander Weide's attempt to use the capital structures of the proxy group as a way to justify a cost of equity estimate as high as 12% for FCG.[94] I am not aware of any commission awarding such an inflated ROE based on a comparison of the capital structures of the proxy group. This unrealistically high estimate is more than 400

[94] Direct Testimony of Dr. James H. Vander Weide, p. 5, lines 1-12.

basis points above the cost of equity of the entire market, more than 500 basis points above FCG's market-based cost of equity, and more than 200 basis points above the current national average of awarded ROEs for gas utilities. In addition, Dr. Vander Weide's capital structure analysis is outdated, as it considers capital structures up to 10 years old. More recent and relevant analysis of the proxy group capital structures shows that the average debt ratio is 45%, which is substantially similar to FCG's debt ratio.[95] The details of my capital structure analysis are presented in Exhibit DJG-16.

Q. IN RESPONSE TO DISCOVERY, DID FCG PROPOSE CHANGES TO ITS CAPITAL STRUCTURE RELATED TO THE 2018 TAX REFORM LAW?

A. Yes. In response to OPC ROG 8-175, the Company provided revised schedules showing its proposed changes related to the 2018 tax reform law, including a proposal to increase the Company's equity ratio. According to FCG, the proposed change in capital structure is necessary to maintain Southern Company's credit metrics because the tax law will adversely affect its cash flow.

Q. DO YOU AGREE WITH FCG'S PROPOSED CHANGE TO ITS CAPITAL STRUCTURE?

A. No. In general, regulated utilities are well suited to operate with higher debt ratios than other industries due to steady revenues, ample fixed assets, and predictable business operations. While I am not proposing a hypothetical capital structure with higher debt ratio

---

[95] *See* Exhibit DJG-18.

for FCG in this case, it would not be an unreasonable proposal given the high debt ratios of similar industries around the country. If FCG is to deviate from its current capital structure, it should be recapitalizing with higher levels of debt, not equity. Furthermore, even if Southern Company's bond rating were downgraded as a result of the new tax law, it makes no logical sense that ratepayers should be adversely affected due to FCG's imprudent decision to recapitalize with a higher equity ratio. As discussed above, the primary figure that we should be concerned with is the weighted average cost of capital. Currently, the Company's equity is costing ratepayers 11.25%, while the Company's debt is costing ratepayers only 4.66%. Apparently, FCG is implying that if the Company receives a ratings downgrade, it's cost of debt will increase, and therefore, it should raise its equity ratio to prevent a ratings downgrade. This argument is disingenuous because it conveniently ignores the impact on the most important figure – the weighted average cost of capital. In other words, customers would happily pay a slightly higher cost of debt in exchange for having more debt in the capital structure, because their overall cost would be lower. FCG has a duty to operate at the lowest reasonable cost of capital, and raising the equity ratio would increase the Company's cost of capital. FCG's primary purpose is to provide safe and reliable service to its customers, not to maximize Southern Company's credit rating by operating with imprudently high levels of expensive equity in order to boost its awarded rate of return.

PART TWO: DEPRECIATION

XII. LEGAL STANDARDS

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

A. In *Lindheimer v. Illinois Bell Telephone Co.*, the U.S. Supreme Court stated that "depreciation is the loss, not restored by current maintenance, which is due to all the factors causing the ultimate retirement of the property. These factors embrace wear and tear, decay, inadequacy, and obsolescence."[96] The *Lindheimer* Court also recognized that the original cost of plant assets, rather than present value or some other measure, is the proper basis for calculating depreciation expense.[97] Moreover, the *Lindheimer* Court found:

> [T]he company has the burden of making a convincing showing that the amounts it has charged to operating expenses for depreciation have not been excessive. That burden is not sustained by proof that its general accounting system has been correct. The calculations are mathematical, but the predictions underlying them are essentially matters of opinion.[98]

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

---

[96] *Lindheimer v. Illinois Bell Tel. Co.*, 292 U.S. 151, 167 (1934).

[97] *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."

[98] *Id*. at 169.

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

A. Yes. While the *Lindheimer* case and other early literature recognized depreciation as a necessary expense, the language indicated that depreciation was primarily a mechanism to determine loss of value.[99] Adoption of this "value concept" would require annual appraisals of extensive utility plant, and thus, is not practical in this context. Rather, the "cost allocation concept" recognizes that depreciation is a cost of providing service, and that in addition to receiving a "return on" invested capital through the allowed rate of return, a utility should also receive a "return of" its invested capital in the form of recovered depreciation expense. The cost allocation concept also satisfies several fundamental accounting principles, including verifiability, neutrality, and the matching principle.[100] The definition of "depreciation accounting" published by the American Institute of Certified Public Accountants ("AICPA") properly reflects the cost allocation concept:

---

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

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

> Depreciation accounting is a system of accounting that aims to distribute cost or other basic value of tangible capital assets, less salvage (if any), over the estimated useful life of the unit (which may be a group of assets) in a systematic and rational manner. It is a process of allocation, not of valuation.[101]

Thus, the concept of depreciation as "the allocation of cost has proven to be the most useful and most widely used concept."[102]

XIII. ANALYTIC METHODS

Q. DISCUSS YOUR APPROACH TO ANALYZING THE COMPANY'S DEPRECIABLE PROPERTY IN THIS CASE.

A. I obtained and reviewed all of the data that was used to conduct the Company's depreciation study. The depreciation rates proposed by Mr. Watson were developed based on depreciable property recorded as of December 31, 2016. I used the same plant data in my analysis to develop my proposed depreciation rates, and applied those rates to the Company's updated plant balances to arrive at OPC's final adjustment to depreciation expense.[103]

---

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

[102] Wolf *supra* n. 99, at 73.

[103] *See* Exhibit DJG-20.

Q. DISCUSS THE DEFINITION AND PURPOSE OF A DEPRECIATION SYSTEM, AS WELL AS THE DEPRECIATION SYSTEM YOU EMPLOYED FOR THIS PROJECT.

A. The legal standards set forth above do not mandate a specific procedure for conducting a depreciation analysis. These standards, however, direct that analysts use a system for estimating depreciation rates that will result in the "systematic and rational" allocation of capital recovery for the utility. Over the years, analysts have developed "depreciation systems" designed to analyze grouped property in accordance with this standard. A depreciation system may be defined by several primary parameters: 1) a <u>method</u> of allocation; 2) a <u>procedure</u> for applying the method of allocation; 3) a <u>technique</u> of applying the depreciation rate; and 4) a <u>model</u> for analyzing the characteristics of vintage property groups.[104] In this case, I used the straight line method, the average life procedure, the remaining life technique, and the broad group model to analyze the Company's actuarial data; this system would be denoted as an "SL-AL-RL-BG" system. This depreciation system conforms to the legal standards set forth above, and is commonly used by depreciation analysts in regulatory proceedings. I provide a more detailed discussion of depreciation system parameters, theories, and equations in Appendix A

[104] *See* Wolf *supra* n. 99, at 70, 140.

Q. ARE THERE OTHER REASONABLE DEPRECIATION SYSTEMS THAT ANALYSTS MAY USE?

A. Yes. There are multiple combinations of depreciation systems that analysts may use to develop deprecation rates. For example, many analysts use the broad group model instead of the equal life group model. In this case, however, I used the same depreciation system that Mr. Watson used. Although some of our assumptions and inputs are different, the analytical system we used is essentially the same.

Q. DESCRIBE THE COMPANY'S PLANT DATA AND HOW IT AFFECTED YOUR APPROACH AND ANALYSIS IN THIS CASE.

A. In this case, the Company had "aged" historical data for its distribution accounts and provided that data to me in response to discovery. Aged data refers to a collection of property data for which the dates of placements, retirements, transfers, and other actions are known. In keeping aged data, when a utility retires an asset, it would not only record the year it was retired, but it would also track the year the asset was placed into service, or the "vintage" year. In general, aged data is preferable to unaged data because depreciation analysts can perform actuarial analysis on aged data, as opposed to "simulated" actuarial analysis on unaged data. However, in order for an actuarial analysis to yield reliable results, there must be a sufficient amount of aged data. For example, actuarial scientists perform a similar analysis on the mortality patterns of human beings for life insurance and other purposes. If, however, there were only 10 years of data available to the analyst, it would not be enough to provide a statistically reliable indication of average human life, since humans live much longer than 10 years on average. In this case, the aged data for many of FCG's accounts was simply not long enough to yield reliable results through traditional actuarial analysis and Iowa curve fitting techniques. Mr. Watson has also agreed that for many of the Company's accounts, "there is insufficient data for actuarial analysis."[105]

XIV. <u>ACTUARIAL ANALYSIS</u>

Q. DESCRIBE THE ACTUARIAL PROCESS YOU USED TO ANALYZE THE COMPANY'S DEPRECIABLE PROPERTY.

A. The study of retirement patterns of industrial property is derived from the actuarial process used to study human mortality. Just as actuarial analysts study historical human mortality data in order to predict how long a group of people will live, depreciation analysts study historical plant data in order to estimate the average lives of property groups. The most common actuarial method used by depreciation analysts is called the "retirement rate method." In the retirement rate method, original property data, including additions, retirements, transfers, and other transactions, are organized by vintage and transaction year.[106] The retirement rate method is ultimately used to develop an "observed life table," ("OLT") which shows the percentage of property surviving at each age interval. This pattern of property retirement is described as a "survivor curve." The survivor curve

---

[105] *See e.g.* Exhibit No. DAW-2 (Depreciation Study) p. 32.

[106] 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).

derived from the observed life table, however, must be fitted and smoothed with a complete curve in order to determine the ultimate average life of the group.[107] The most widely used survivor curves for this curve fitting process were developed at Iowa State University in the early 1900s and are commonly known as the "Iowa curves."[108] A more detailed explanation of how the Iowa curves are used in the actuarial analysis of depreciable property is set forth in Appendix C. For a few of FCG's accounts, there were sufficient aged data to conduct actuarial analysis and traditional Iowa curve fitting techniques. Regardless of whether a particular account had sufficient aged data, I began my analysis of each account by organizing the data to develop observed life tables, which is discussed further below.

A. Service Life Estimates

Q. GENERALLY DESCRIBE YOUR APPROACH IN ESTIMATING THE SERVICE LIVES OF MASS PROPERTY.

A. I used all of the Company's aged property data to create an OLT for each account. The data points on the OLT can be plotted to form a curve (the "OLT curve"). The OLT curve is not a theoretical curve, rather, it is actual observed data from the Company's records that indicate the rate of retirement for each property group. An OLT curve by itself, however, is rarely a smooth curve, and is often not a "complete" curve (i.e., it does not end at zero percent surviving). In order to calculate average life (the area under a curve), a complete

---

[107] *See* Appendix C for a more detailed discussion of the actuarial analysis used to determine the average lives of grouped industrial property.

[108] *See* Appendix B for a more detailed discussion of the Iowa curves.

survivor curve is needed. The Iowa curves are empirically-derived curves based on the extensive studies of the actual mortality patterns of many different types of industrial property. The curve-fitting process involves selecting the best Iowa curve to fit the OLT curve. This can be accomplished through a combination of visual and mathematical curve-fitting techniques, as well as professional judgment. The first step of my approach to curve-fitting involves visually inspecting the OLT curve for any irregularities. For example, if the "tail" end of the curve is erratic and shows a sharp decline over a short period of time, it may indicate that this portion of the data is less reliable, as further discussed below. After inspecting the OLT curve, I use a mathematical curve-fitting technique which essentially involves measuring the distance between the OLT curve and the selected Iowa curve in order to get an objective, mathematical assessment of how well the curve fits. After selecting an Iowa curve, I observe the OLT curve along with the Iowa curve on the same graph to determine how well the curve fits. I may repeat this process several times for any given account to ensure that the most reasonable Iowa curve is selected.

Q. DO YOU ALWAYS SELECT THE MATHEMATICALLY BEST-FITTING CURVE?

A. Not necessarily. Mathematical fitting is an important part of the curve-fitting process because it promotes objective, unbiased results. While mathematical curve fitting is important, however, it may not always yield the optimum result; therefore, it should not necessarily be adopted without further analysis.

Q. SHOULD EVERY PORTION OF THE OLT CURVE BE GIVEN EQUAL WEIGHT?

A. Not necessarily. Many analysts have observed that the points comprising the "tail end" of the OLT curve may often have less analytical value than other portions of the curve. In fact, "[p]oints at the end of the curve are often based on fewer exposures and may be given less weight than points based on larger samples. The weight placed on those points will depend on the size of the exposures."[109] In accordance with this standard, an analyst may decide to truncate the tail end of the OLT curve at a certain percent of initial exposures, such as one percent. Using this approach puts a greater emphasis on the most valuable portions of the curve. For my analysis in this case, I not only considered the entirety of the OLT curve, but I also conducted further analyses that involved fitting Iowa curves to the most significant part of the OLT curve for certain accounts. In other words, to verify the accuracy of my curve selection, I narrowed the focus of my additional calculation to consider the top 99% of the "exposures" (i.e., dollars exposed to retirement) and to eliminate the tail end of the curve representing the bottom 1% of exposures. I will illustrate an example of this approach in the discussion below.

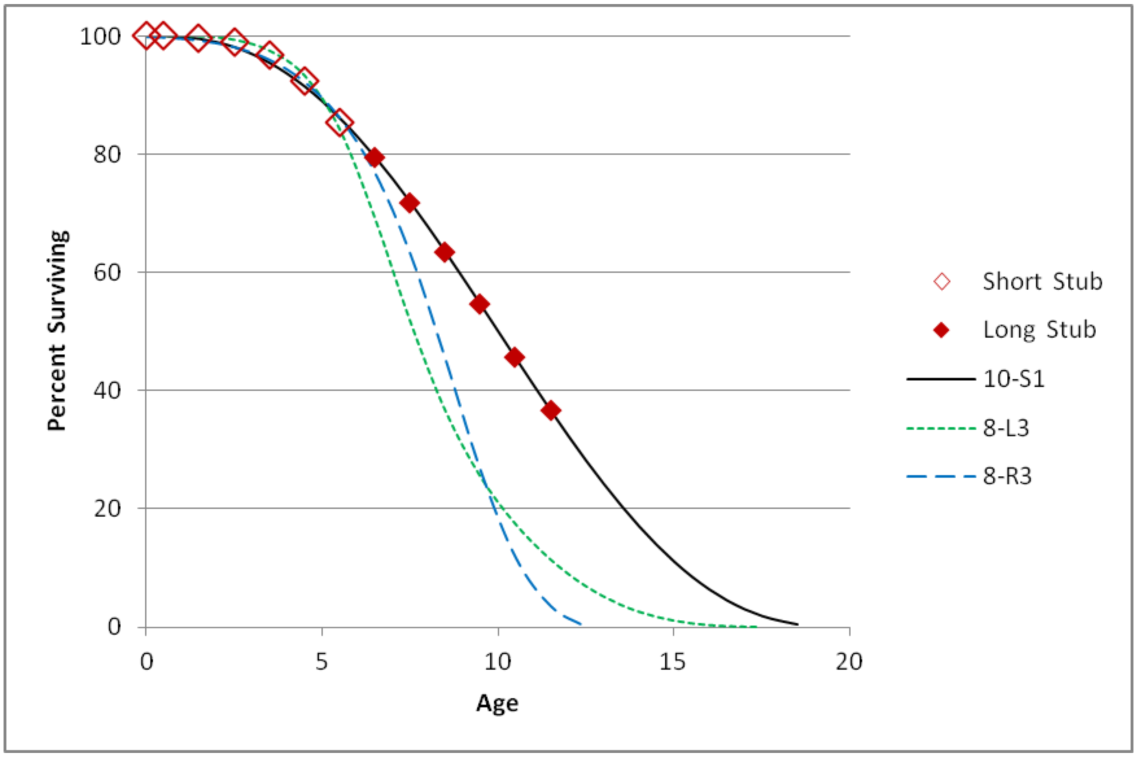
---

[109] Wolf *supra* n. 99, at 46.

Q. PLEASE ILLUSTRATE WHY THE COMPANY'S ACTUARIAL DATA IS INSUFFICIENT TO GIVE A CLEAR INDICATION OF FUTURE RETIREMENT PATTERNS AND AVERAGE LIFE FOR MANY OF ITS ACCOUNTS.

A. As discussed above, depreciation analysts use utility actuarial data to construct an OLT for each account. An OLT curve, however, is often not a "complete" curve (i.e., it does not end at zero percent surviving). For this reason, it is sometimes called a "stub" survivor curve. In order to calculate average life (the area under a curve), however, a complete survivor curve, such as an Iowa curve, is required. The graph below shows an example of a typical OLT "stub" curve that is generated from actuarial data using the retirement rate method. If a utility does not have sufficient actuarial retirement history, the data will produce a shorter OLT stub curve.

Figure 1:
OLT "Stub" Curve Example



The first seven data points (the clear diamonds) show an OLT curve that is arguably too short to provide a good foundation for Iowa curve fitting. This graph also shows three Iowa curves. If an analyst were working with only the first seven data points of the OLT curve, it would be difficult to determine the best fitting Iowa curve, since many Iowa curves have similar shapes toward the top portion of the curves. However, as shown in the graph, when more data points are added to the OLT curve to form a longer stub curve, the best-fitting Iowa curve becomes clearer. In this case, the OLT curves derived from FCG's aged data for many of its account are too short to provide a good indication of the average life. Therefore, it is helpful to look to other recommended service lives across the industry that were based on more complete actuarial data. Over time, as FCG accumulates more actuarial retirement history, the Iowa curve fitting process will become more valuable as an indicator of average service life.

Q. PLEASE SUMMARIZE YOUR SERVICE LIFE ADJUSTMENTS.

A. I am proposing service life adjustments to five of the Company's distribution accounts. For these accounts, I do not believe the Company has met its burden of proof to make a convincing showing that its proposed depreciation rates and expense for these accounts are not excessive, as mandated by the U.S. Supreme Court. For most of these accounts, the Company did not provide sufficient aged data to support its positions from an objective, statistical standpoint. Rather, the Company's primary support for its positions on many of these accounts is simply derived from the best guesses of Company personnel regarding how long they think their assets will be in service. For example, in forming his recommendation for the service life on Account 379 (M&R Equipment – City Gate), Mr. Watson acknowledges that there are "too few retirements to make actuarial analysis effective. . ." (which is true), and he then states that "Company personnel feel that 35 years is a reasonable estimate for this account."[110] This arrangement is highly problematic because it calls into question the reliability and objectivity of the Company's proposal. In short, FCG has hired an independent expert to recommend service lives for each of its accounts. These service life estimates significantly affect the depreciation expense charged to ratepayers. Furthermore, FCG did not provide sufficient actuarial data upon which an objective statistical analysis could be conducted to arrive at reliable, unbiased service life

---

[110] *See* Exhibit No. DAW-2, p. 38 of 171.

estimates. Instead, FCG personnel simply told its independent expert about how long it "feels" its assets will survive, and the expert has partially based his recommendations on the feelings of Company personnel. This arrangement results in a position that falls far too short of the legal burden requiring FCG to make a "convincing showing" that its proposed depreciation is not excessive.[111] Thus, I do not believe the Company has met its burden of proof, and in my opinion, there are reasonable adjustments that should be made to the following accounts for the reasons discussed below.

B. <u>Account 376.2 – Distribution Mains – Plastic</u>

Q. DISCUSS THE COMPANY'S POSITION ON ACCOUNT 376.2 – STRUCTURES AND IMPROVEMENTS.

A. Mr. Watson proposed an S3-55 curve for this account, which corresponds to a depreciation rate of 2.5% and an annual accrual of $3.8 million.[112] In his depreciation study, Mr. Watson also acknowledged that there was "insufficient data for actuarial analysis" for this account."[113]

---

[111] *Lindheimer v. Illinois Bell Tel. Co.*, 292 U.S. 151, 167 (1934).

[112] Exhibit DAW-2, p. 102 of 171.

[113] *Id.* at p. 34 of 171.

Q. HAS FCG MADE A CONVINCING SHOWING THAT ITS PROPOSED DEPRECIATION EXPENSE FOR THIS ACCOUNT IS NOT EXCESSIVE?

A. No, it has not. I believe that FCG has underestimated the proposed service life for this account.

Q. DID FCG PROVIDE SUFFICIENT ACTUARIAL DATA TO CONDUCT OBJECTIVE ACTUARIAL ANALYSIS FOR THIS ACCOUNT?

A. No. Mr. Watson also agrees that "there is insufficient data for actuarial analysis" for this account.[114] When there is insufficient actuarial and simulated plant data in conducting depreciation analysis for a particular utility, it is instructive to consider and compare the retirement patterns of the same account for other utilities. At the very least, this technique may provide an <u>objective</u> basis upon which to gauge the reasonableness of a recommendation. The subjective beliefs and feelings of Company personnel do not satisfy the Company's burden to make a convincing showing that its proposed depreciation expense is not excessive.

---

[114] *Id*.

Q. HAVE YOU ANALYZED ACTUARIAL DATA FOR ACCOUNT 376.2 FROM ANOTHER FLORIDA GAS UTILITY INDICATING A LONGER SERVICE LIFE THAN 55 YEARS?

A. Yes. In Docket 160159-GU, Peoples Gas System ("PGS") filed a petition for approval of its 2016 depreciation study. PGS provided historical aged data for Account 376.2, and although the quantity of data was less than ideal for actuarial analysis, it indicated that the average service life for the account was much greater than 55 years.[115]

Q. HAVE YOU ALSO ANALYZED SIMULATED PLANT RECORD DATA FROM OTHER GAS UTILITIES INDICATING LONGER SERVICE LIVES FOR PLASTIC MAINS?

A. Yes. Recently, in CenterPoint Energy's rate case, the company filed a depreciation study sponsored by Mr. Watson with simulated plant data for Account 376.2. Simulated plant record analysis involves statistically analyzing a company's unaged data by choosing an Iowa curve that best simulates the actual year-end balances in the account. In that case, the simulated data indicated that the service life in Account 376.2 could be as high as 65 years. Moreover, Mr. Watson recommended a 63-year average service life for the plastic mains account in that case.[116]

---

[115] *See* Preliminary Report of David J. Garrett filed November 4, 2016 on behalf of the Office of Public Counsel regarding the revised depreciation study filed by Peoples Gas System, Docket 160159-GU, pp. 11-13.

[116] *See* Exhibit DAW-2, p. 26 to Direct Testimony of Dane A. Watson, filed Before the Railroad Commission of Texas, GUD No. 10567 – Statement of Intent of CenterPoint Energy Resources Corp.

Q. ARE YOU AWARE OF OTHER EVIDENCE INDICATING THAT PLASTIC MAINS CAN LAST MUCH LONGER THAN 55 YEARS?

A. Yes. Several studies of PVC and other plastic pipe indicate that these kinds of pipes can last 100 years or more. According to the Plastics Industry Pipe Association of Australia:

> Based on the use of 50 year stress regression data, it has been incorrectly assumed that plastics pipe systems have a life expectancy of 50 years. In reality, such systems can reasonably be expected to last 100 years or more.[117]

While I am not suggesting that the Company's plastic mains should have an estimated service life of 100 years, this study provides further evidence suggesting that the Company's proposed service life of only 55 years is too conservative.

Q. WHAT IS YOUR RECOMMENDATION FOR ACCOUNT 376.2?

A. I recommend that the remaining life for this account be calculated using an Iowa S3-59 curve. This curve is the same shape as the Iowa curve proposed by Mr. Watson, with an average life of 59 years – four years longer than the Company's proposal. Given recent data from other gas utilities indicating average lives for this account in excess of 65 years, including Mr. Watson's own recommendation of 63 years, as well as evidence suggesting that plastic pipes can last 100 years in certain applications, a proposed average life of only 59 years is conservative and reasonable. All else held constant, lower service lives result in higher depreciation expense. Applying an Iowa S3-59 curve to this account results in a

[117] Plastics Industry Pipe Association of Australia Limited, "Life Expectancy for Plastic Pipes," Polyolefins Technical Information (accessed 2018).

remaining life of 47.5 years, a depreciation rate of 2.38%, and an annual accrual of $3.6 million.[118]

C. Account 379 – M&R Station Equipment – City Gate

Q. DISCUSS THE COMPANY'S POSITION ON ACCOUNT 379 – M&R STATION EQUIPMENT – CITY GATE.

A. Mr. Watson proposed an S4-35 curve for this account, which corresponds to a depreciation expense of $270,052.[119]

Q. HAS FCG MADE A CONVINCING SHOWING THAT ITS PROPOSED DEPRECIATION EXPENSE FOR THIS ACCOUNT IS NOT EXCESSIVE?

A. No, it has not. I believe that FCG has underestimated the proposed service life for this account.

Q. DID FCG PROVIDE SUFFICIENT ACTUARIAL DATA TO CONDUCT OBJECTIVE ACTUARIAL ANALYSIS FOR THIS ACCOUNT?

A. No. Mr. Watson also agrees that there "are too few retirements to make actuarial analysis effective" for this account.[120] When there is insufficient actuarial and simulated plant data in conducting depreciation analysis for a particular utility, it is instructive to consider and compare the retirement patterns of the same account for other utilities. At the very least,

---

[118] *See* Exhibit DJG-21.

[119] Exhibit DAW-2, p. 102 of 171.

[120] *Id*. at 38.

this technique may provide an objective basis upon which to gauge the reasonableness of a recommendation, instead of relying too heavily on the feelings of FCG personnel. According to Mr. Watson, "Company personnel feel like 35 years is a reasonable estimate for this account."[121]

Q. HAVE YOU ANALYZED SIMULATED PLANT RECORD DATA FROM OTHER GAS UTILITIES INDICATING LONGER SERVICE LIVES FOR PLASTIC MAINS?

A. Yes. In CenterPoint Energy's recent rate case, the company filed a depreciation study sponsored by Mr. Watson with simulated plant data for Account 390. In that case, the data indicated that the service life in this account could be 43 years or more. Mr. Watson recommended a higher service life of 38 years in that case for the same account.[122]

Q. WHAT IS YOUR RECOMMENDATION FOR ACCOUNT 390?

A. I recommend that the remaining life for this account be calculated using an Iowa R0.5-39 curve. This curve shape is identical to the curve shape indicated by the simulated plant data discussed above. An average life of 39 years represents a good balance between the feelings of FCG personnel of a 35-year life, and the 43-year average life indicated by the more reliable data provided by other gas utilities. Applying an Iowa R0.5-39 curve to this

---

[121] *Id*.

[122] *See* Exhibit DAW-2, p. 26 to Direct Testimony of Dane A. Watson, filed Before the Railroad Commission of Texas, GUD No. 10567 – Statement of Intent of CenterPoint Energy Resources Corp.

account results in a remaining life of 28.2 years, a depreciation rate of 2.06%, and an annual accrual of $206,492.[123]

D. Account 380.2 – Services – Plastic

Q. DISCUSS THE COMPANY'S POSITION ON ACCOUNT 380.2 – SERVICE – PLASTIC.

A. Mr. Watson proposed an Iowa S4-45 curve for this account, which corresponds to a depreciation expense of $2.1 million.[124] According to Mr. Watson, "Company personnel feel that 45-year life for this account is reasonable."[125]

Q. HAS FCG MADE A CONVINCING SHOWING THAT ITS PROPOSED DEPRECIATION EXPENSE FOR THIS ACCOUNT IS NOT EXCESSIVE?

A. No, it has not. I believe that FCG has underestimated the proposed service life for this account.

Q. HAS FCG MET ITS BURDEN OF MAKING A CONVINCING SHOWING THAT ITS PROPOSED DEPRECIATION EXPENSE FOR THIS ACCOUNT IS NOT EXCESSIVE?

A. No. FCG is the applicant in this case who is requesting to charge ratepayers $14 million per year in depreciation expense. Utilities have an incentive to recover its capital

---

[123] *See* Exhibit DJG-21.

[124] Exhibit DAW-2, p. 102 of 171.

[125] *Id*. at 42.

investments through depreciation at a higher rate in order to increase cash flow, reduce risk, and provide sooner opportunities to replace depreciated assets to boost rate base and earnings. Therefore, if the Commission is to base proposed service life proposals on the subjective beliefs of FCG personnel, it should expect those proposals to be underestimated, leading to a higher proposed depreciation expense. Regardless of the Company's intentions, FCG has not met its burden of proof for this account.

Q. HAVE OTHER GAS COMPANIES SPECIFICALLY ADOPTED AVERAGE SERVICE LIVES OF UP TO 58 YEARS FOR ACCOUNT 380?

A. Yes. In Oklahoma Natural Gas Company's ("ONG") 2015 rate case, the Oklahoma Commission approved a joint settlement among the parties. With regard to depreciation expense, there was only one account specifically mentioned in the settlement agreement: Account 380. According to the settlement agreement, the parties agreed to:

> Depreciation Expense adjustment in the amount of ($5,818,495). As part of this adjustment [ONG's] <u>Asset Account 380.0 Service (Plastic) shall reflect a 58-year average life</u>.[126]

In fact, ONG's actuarial data in that case indicated a longer average life than 58 years for this account; however, the parties ultimately settled on 58 years.

Q. WHAT IS YOUR RECOMMENDATION FOR THIS ACCOUNT?

A. Given the information discussed above, I am proposing an average life of 54 years for this account. While other gas utilities have proposed service lives up to 58 years for this

[126] *See* Joint Stipulation and Settlement Agreement paragraph 3, filed November 13, 2015 in Cause No. PUD 201500213 before the Oklahoma Corporation Commission (emphasis added). This agreement was approved in Order No. 648236 filed in the same cause and entered January 6, 2016.

account, I am proposing a shorter average life (i.e., higher relative depreciation expense) for this account. Selecting an R2.5-54 curve for this account results in a remaining life of 43.5 years, a depreciation rate of 2.54%, and an annual accrual of $1.6 million.[127]

E. <u>Account 382 – Meter Installations</u>

Q. DISCUSS THE COMPANY'S POSITION ON ACCOUNT 382 – METER INSTALLATIONS.

A. Mr. Watson proposed an S3-30 curve for this account, which corresponds to a depreciation expense of $322,344.[128] According to Mr. Watson, "Company personnel believe a more reasonable life expectation would be in the range of 20-30 years.[129]

Q. HAS FCG MADE A CONVINCING SHOWING THAT ITS PROPOSED DEPRECIATION EXPENSE FOR THIS ACCOUNT IS NOT EXCESSIVE?

A. No, it has not. I believe that FCG has underestimated the proposed service life for this account.

Q. DID FCG PROVIDE ACTUARIAL DATA FOR THIS ACCOUNT?

A. Yes. Although the data were not extensive, FCG provided more aged data for this account compared to the other accounts discussed previously.

---

[127] *See* Exhibit DJG-21.

[128] Exhibit DAW-2, p. 102 of 171.

[129] *Id*. at 49.

Q. DOES THE DATA PROVIDED BY FCG SUPPORT ITS PROPOSAL OF A 30-YEAR AVERAGE LIFE FOR THIS ACCOUNT?

A. No. According to Mr. Watson, "the actuarial analysis supports the company position of a decreasing life in more recent years."[130] I disagree, as further discussed below.

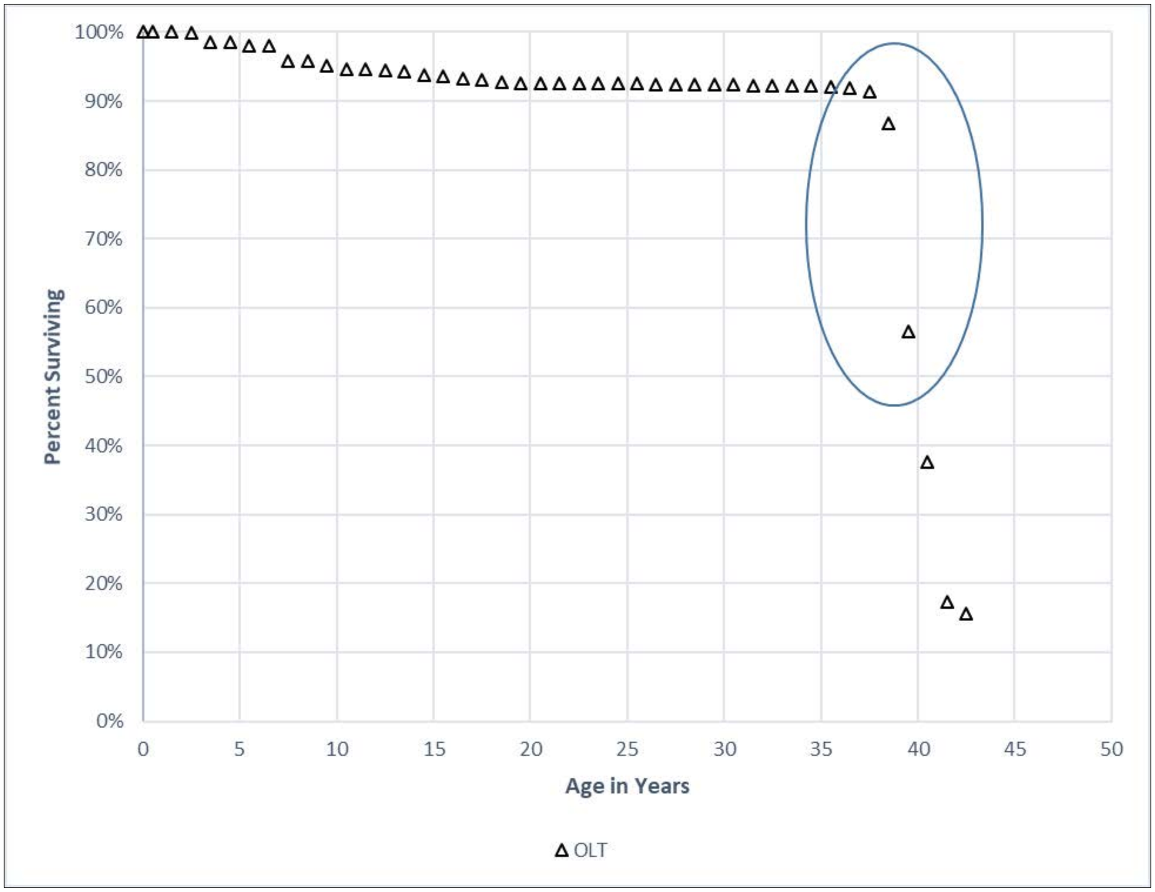
Q. DESCRIBE YOUR SERVICE LIFE ESTIMATE FOR THIS ACCOUNT, AND COMPARE IT WITH THE COMPANY'S ESTIMATE.

A. The observed survivor curve for this account provides a good example of how the tail end of the observed survivor curve can be unreliable and statistically irrelevant. The observed survivor curve is derived from the OLT calculated from the Company's aged plant data. Thus, as set forth above, the OLT curve is not an estimate or a theoretical curve, rather, it represents actual data. The graph below shows the OLT curve (black triangles) for this account.

---

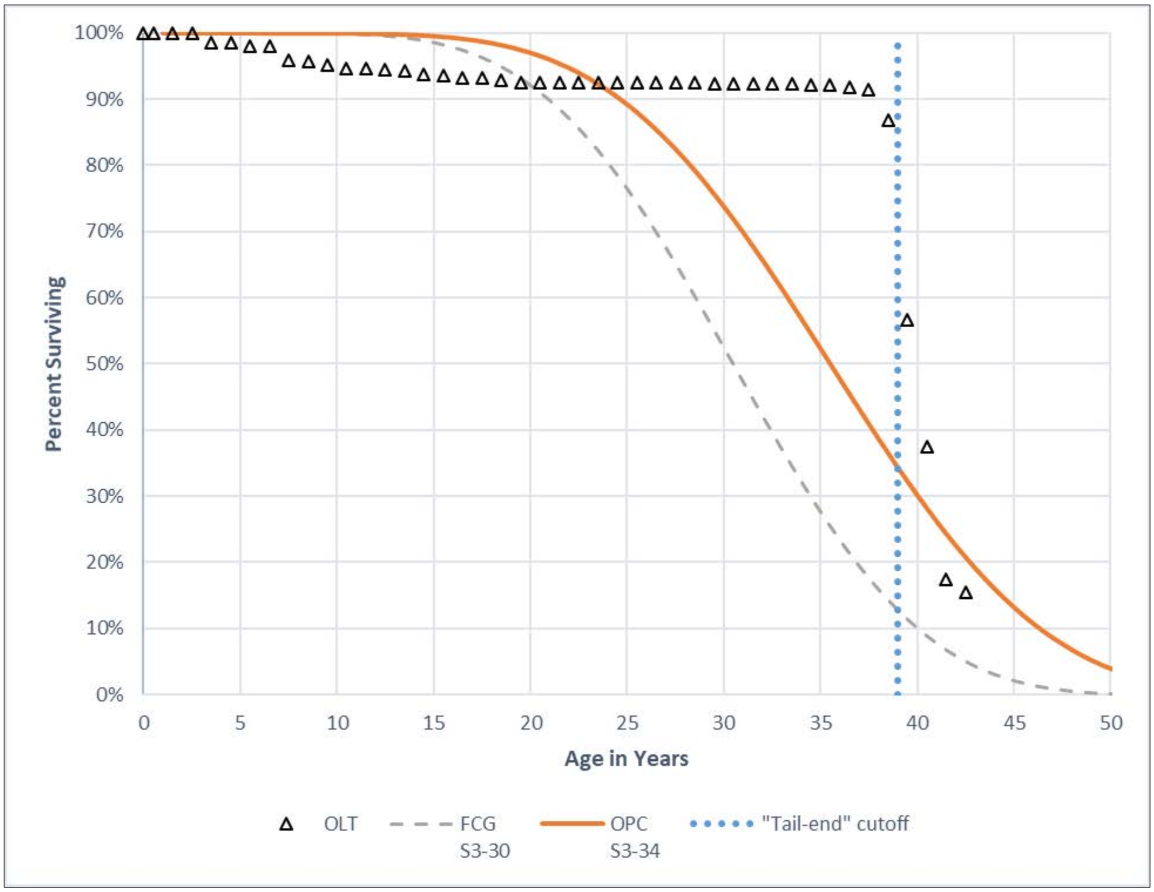
[130] *Id*. at 49.

Figure 16:
Account 382 – Meter Installations – OLT Curve



This graph shows the entire OLT curve obtained from the Company's plant data. Notice how there is a sudden drop in the OLT curve at age 38. This sudden drop is caused by a relatively small amount of dollars exposed to retirement. Thus, it would be inappropriate to give this portion of the OLT curve the same statistical weighting as the upper and middle portions of the curve for this particular data set. The graph below shows the same OLT curve, along with the Iowa curves selected by Mr. Watson and me. For this account, the Company selected the Iowa S3-30 curve to represent its retirement rate, and I selected the Iowa S3-34 curve.[131]

Figure 17:
Account 382 – Meter Installations – Iowa Curves



The vertical dotted line at the 38-year age interval shows the erratic drop in the OLT curve discussed above. The data points of the OLT curve to the right of this line should be ignored from a statistical standpoint. According to Mr. Watson, the data support his position of a 30-year average service life. The graph above, however, suggests otherwise. Part of the Iowa curve fitting process involves visually and mathematically comparing

[131] *See also* Exhibit DJG-22.

various Iowa curves in an attempt to select a curve that closely matches the observed OLT curve. Mr. Watson's S3-30 curve is far too short and steep to provide a close fit to the observed data. In fact, even the S3-34 curve I selected is arguably too short given the data provided. This further suggests that the average life of 34 years that I am proposing is relatively conservative and reasonable (i.e., a longer Iowa curve would provide a better fit to the OLT curve and result in lower depreciation expense).

Q. IS YOUR SELECTED IOWA CURVE A BETTER MATHEMATICAL FIT TO THE RELEVANT PORTION OF THE OLT CURVE?

A. Yes. Although it is visually clear that the Iowa S3-34 curve is a better fit to the OLT curve, this fact can also be confirmed mathematically. Mathematical curve fitting essentially involves measuring the distance between the OLT curve and the selected Iowa curve. The best mathematically-fitted curve is the one that minimizes the distance between the OLT curve and the Iowa curve, thus providing the closest fit. The "distance" between the curves is calculated using the "sum-of-squared differences" ("SSD") technique. In this account, the total SSD, or "distance" between the Company's curve and the OLT curve is 5.2550, while the total SSD between S3-34 and the OLT curve is only 2.1119. Thus, the S3-34 curve is a better mathematical fit and results in a more reasonable service life estimate for this particular account. Applying the S3-34 curve to this account results in a remaining life of 21.8 years, a depreciation rate of 3.57%, and an annual accrual of $255,844.[132]

[132] *Id.*

F. <u>Account 385 – Industrial M&R Station Equipment</u>

Q. DISCUSS THE COMPANY'S POSITION ON ACCOUNT 385 – INDUSTRIAL M&R STATION EQUIPMENT.

A. Mr. Watson proposed an R3-30 curve for this account, which corresponds to a depreciation expense of $84,273.[133]

Q. HAS FCG MADE A CONVINCING SHOWING THAT ITS PROPOSED DEPRECIATION EXPENSE FOR THIS ACCOUNT IS NOT EXCESSIVE?

A. No, it has not. I believe that FCG has underestimated the proposed service life for this account.

Q. DID FCG PROVIDE SUFFICIENT ACTUARIAL DATA TO CONDUCT OBJECTIVE ACTUARIAL ANALYSIS FOR THIS ACCOUNT?

A. No. Mr. Watson also agrees that there "is limited retirement activity in this account, so no actuarial analysis could be performed."[134] As with the accounts discussed above, Mr. Watson bases his recommended service life for this account on the recommendations of the company that hired him to conduct the depreciation study. According to Mr. Watson, "Company personnel believe that assets in this account will have a life between 20-30 years."[135] As with the accounts discussed above, FCG has not met its burden of proof to

---

[133] Exhibit DAW-2, p. 102 of 171.

[134] *Id*. at 58.

[135] *Id*.

support its position. The Company has based their proposals on subjective beliefs and has admitted that their objective historical data is insufficient and limited. Therefore, it is imperative for the Commission to consider and compare the retirement patterns of the same account for other utilities.

Q. HAVE YOU ANALYZED SIMULATED PLANT RECORD DATA FROM OTHER GAS UTILITIES INDICATING LONGER SERVICE LIVES FOR PLASTIC MAINS?

A. Yes. In CenterPoint Energy's recent rate case, the company filed a depreciation study sponsored by Mr. Watson. In that case, Mr. Watson's recommended service life for this account was considerably higher than it is in this case. Specifically, Mr. Watson recommended a 45-year service life for this account, which is 15 years longer, or 50% higher, than his recommended service life in this case.[136] Similarly, in ONG's last rate case in Oklahoma, the company's own witness recommended a 43-year service life for this account, which was based on more reliable and objective actuarial data than is available in this case.[137]

Q. WHAT IS YOUR RECOMMENDATION FOR ACCOUNT 385?

A. While the evidence presented above, including Mr. Watson's own recommendation from another case, indicates that an appropriate service life estimate for this account could be as

---

[136] *See* Exhibit DAW-2, p. 26 to Direct Testimony of Dane A. Watson, filed Before the Railroad Commission of Texas, GUD No. 10567 – Statement of Intent of CenterPoint Energy Resources Corp.

[137] *See* Direct Testimony of Dr. Ronald E. White filed in Cause No. PUD 201500213 before the Oklahoma Corporation Commission.

high as 45 years, I am recommending a shorter service life of 37 years in the interest of reasonableness. The curve I selected for this account is an Iowa R2-37 curve. Applying this curve to Account 385 results in a remaining life of 19.8 years, a depreciation rate of 1.48%, and an annual accrual of $45,185.[138]

XV. NET SALVAGE ANALYSIS

Q. DESCRIBE NET SALVAGE.

A. If an asset has any value left when it is retired from service, a utility might decide to sell the asset. The proceeds from this transaction are called "gross salvage." The corresponding expense associated with the removal of the asset from service is called the "cost of removal." The term "net salvage" equates to gross salvage less the cost of removal.

Q. DESCRIBE HOW YOU ANALYZED THE COMPANY'S NET SALVAGE RATES.

A. In this case, I examined the Company's historical net salvage data over different periods of time.

Q. ARE YOU RECOMMENDING ANY ADJUSTMENTS TO THE COMPANY'S PROPOSED NET SALVAGE RATES?

A. Yes. I am recommending an adjustment to the proposed net salvage on Account 380.1 – Services – Non Plastic.

[138] *See* Exhibit DJG-21.

Q. DESCRIBE THE COMPANY'S NET SALVAGE RECOMMENDATION ON ACCOUNT 380.1.

A. Mr. Watson recommends a negative 100% net salvage for Account 380.1. According to Mr. Watson, the most recent study bands for net salvage indicate negative net salvage rates in excess of 300%.[139]

Q. WHAT IS YOUR RECOMMENDATION REGARDING THE NET SALVAGE FOR ACCOUNT 380.1?

A. The extreme negative net salvage values calculated in Account 380.1 highlight a trend in higher negative net salvage values in the utility industry. This is problematic because it leads to more volatility in attempting to estimate future net salvage values and the current depreciation rates for a particular account. I recommend the current authorized net salvage rate of negative 80%. The Commission should also advise FCG to reevaluate its retirement and replacement process before its next depreciation study for the purpose of examining how the Company might shift a greater percentage of the total costs of removal / replacement toward installation and away from removal. For example, when a utility retires a section of plastic mains and replaces it with new mains, it would be arguably preferable to maximize the percentage of total removal/replacement costs to the installation of the new mains. This practice would reduce, and perhaps reverse, the trend of increasing negative net salvage and promote more accurate and less volatile cost estimates.

[139] Exhibit DAW-2, p. 41 of 171.

Q. WHAT IS THE IMPACT OF YOUR RECOMMENDATION ON THIS ACCOUNT?

A. Leaving FCG's currently-authorized net salvage rate for Account 380.1 results in an adjustment decreasing the Company's proposed annual accrual by $171,215 for this account.[140]

XVI. CONCLUSION AND RECOMMENDATIONS

Q. SUMMARIZE THE KEY POINTS OF YOUR COST OF CAPITAL TESTIMONY AND RECOMMENDATION.

A. The Company's proposed ROE of 11.25% is equal to its current awarded ROE, which was set back in 2004. The objective market data, as well as the data on average awarded ROEs, indicate a significant decline in utility cost of equity and awarded ROEs since 2004. There is no question that FCG's current ROE of 11.25% is outdated and unreasonably high in today's economic and regulatory environment. Pursuant to the legal and technical standards guiding this issue, the awarded ROE should be based on, or reflective of, the utility's cost of equity. FCG's estimated cost of equity is about 7.0%. However, these legal standards do not mandate the awarded ROE be set exactly equal to the cost of equity. Rather, the Commission's final decision on the awarded ROE can consider the totality of the circumstances to ensure that the end result is reasonable. In my opinion, if the Commission were to award a return on equity equal to FCG's current, market-based cost of equity, it would represent an abrupt change in FCG's awarded return, which could

[140] *See* Exhibit DJG-20.

increase market risk for the Company. Thus, I recommend a gradual, rather than abrupt move towards market-based cost of equity. Specifically, I recommend that the Commission award a return on equity of 9.25%. This recommendation represents a good balance between the Court's indications that awarded ROEs should be based on cost, while also recognizing that the end result must be reasonable under the circumstances.

Q. SUMMARIZE THE KEY POINTS OF YOUR DEPRECIATION TESTIMONY AND RECOMMENDATION.

A. I employed a well-established depreciation system and used actuarial and simulated analysis to statistically analyze the Company's depreciable assets in order to develop reasonable depreciation rates in this case. I made adjustments to the Company's proposed service life and net salvage for several accounts. In this case, FCG's positions on service life were primarily based on the Company's feelings and beliefs, and were admittedly unsupported by sufficient, objective actuarial data. As a result, FCG failed to meet its burden of proof regarding its service life proposals. Instead of basing my recommendations on my own subjective beliefs, I relied on comparisons between other comparable gas companies, including the recommendations of FCG's own witness, Mr. Watson, in other cases, as well as the recommendations of other utility witnesses, in the interest of reasonableness. In those cases, the witness's recommendations were arguably based on more reliable, objective data, rather than subjective, unsupported opinions of the utility-applicant. Therefore, I recommend the Commission adopt my proposed depreciation rates for the following accounts:

Acct.	Description	Rate
376.20	Distribution Mains - Plastic	2.38%
379.00	M&R Station Equipment - City Gate	2.06%
380.10	Services - Steel	1.53%
380.20	Services - Plastic	2.54%
382.00	Meter Installations	3.57%
385.00	Industrial M&R Station Equipment	1.48%

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

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

APPENDIX A:

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.[141] 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.[142] The figure below illustrates the basic concept of a depreciation system and includes some of the available parameters.[143]

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.

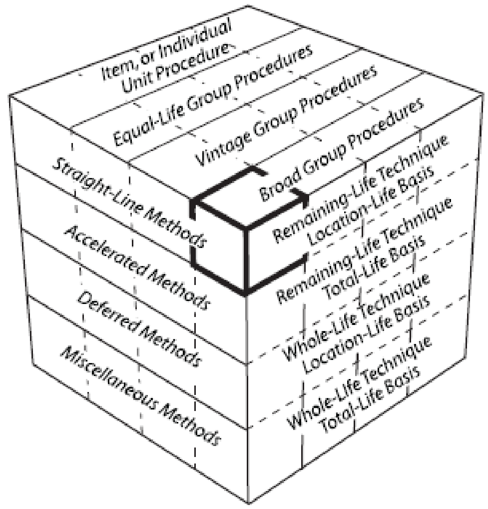
---

[141] Wolf *supra* n. 99, at 69-70.

[142] *Id.* at 70, 139-40.

[143] 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 18:
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.[144] 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.[145] The basic formula for the straight-line method is as follows:[146]

[144] NARUC *supra* n. 100, at 56.

[145] *Id*.

[146] *Id*.

Equation 14:
Straight-Line Accrual

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

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.[147] 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:[148]

Equation 15:
Straight-Line Rate

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

2. <u>Grouping Procedures</u>

The "procedure" refers to the way the allocation method is applied through subdividing the total property into groups.[149] 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

[147] *Id*. at 57.

[148] *Id*. at 56.

[149] Wolf *supra* n. 99, at 74-75.

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.[150] When analyzing mass property categories, it is important that 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.[151]

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.[152] 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.[153] Under the equal life procedure the property is divided into subgroups that each has a common life.[154]

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

[150] *Id*. at 74.

[151] NARUC *supra* n. 100, at 61-62.

[152] *See* Wolf *supr*a n. 99, at 74-75.

[153] *Id*. at 75.

[154] *Id*.

remaining life technique seeks to recover undepreciated costs over the remaining life of the plant.[155]

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 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.[156] 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.[157] 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

---

[155] NARUC *supra* n. 100, at 63-64.

[156] Wolf *supra* n. 99, at 83.

[157] NARUC *supra* n. 100, at 325.

in the annual accrual.[158] 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:[159]

Equation 16:
Remaining Life Accrual

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

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.[160]

4. <u>Analysis Model</u>

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.[161] 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

---

[158] NARUC *supra* n. 100, 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.").

[159] *Id*. at 64.

[160] Wolf *supra* n. 99, at 178.

[161] *See* Wolf *supra* n. 99, at 139 (I added the term "model" to distinguish this fourth depreciation system parameter from the other three parameters).

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 from 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 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 B:

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.[162] 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.[163] 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. <u>Development</u>

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

[162] Wolf *supra* n. 99, at 276.

[163] *Id*. at 23.

representing the life characteristics of each group of property.[164] They generalized the 65 curves 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.[165] 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."[166] 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 Appendix C.)

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.[167] 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

---

[164] *Id*. at 34.

[165] *Id*.

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

[167] 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. 7, at 305-38 (publishing the percent surviving for each Iowa curve, including "O" type curve, at one percent intervals).

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 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:[168]

> 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.[169]

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

---

[168] *See* Wolf *supra* n. 99, at 37.

[169] *Id*.

used to depict retirements which are all planned to occur at a given age. Finally, analysts 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. <u>Classification</u>

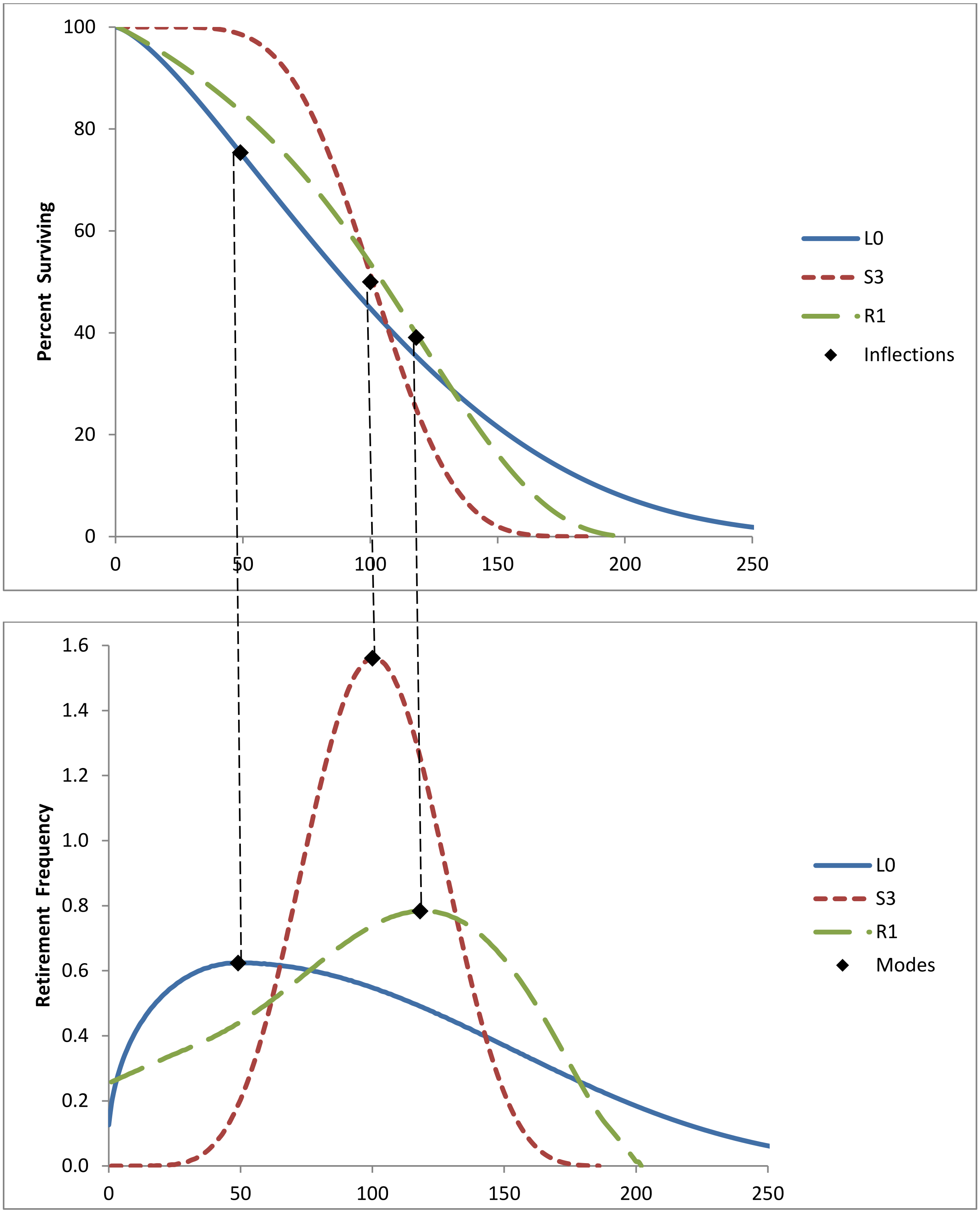
The Iowa curves are classified by three variables: modal location, average life, and variation of life. First, the mode is the percent life that results in the highest point of the frequency curve and the "inflection point" on the survivor curve. The modal age is the age at which the greatest rate of 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).[170] 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.

---

[170] 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. 8, at 68).

Figure 19:
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:

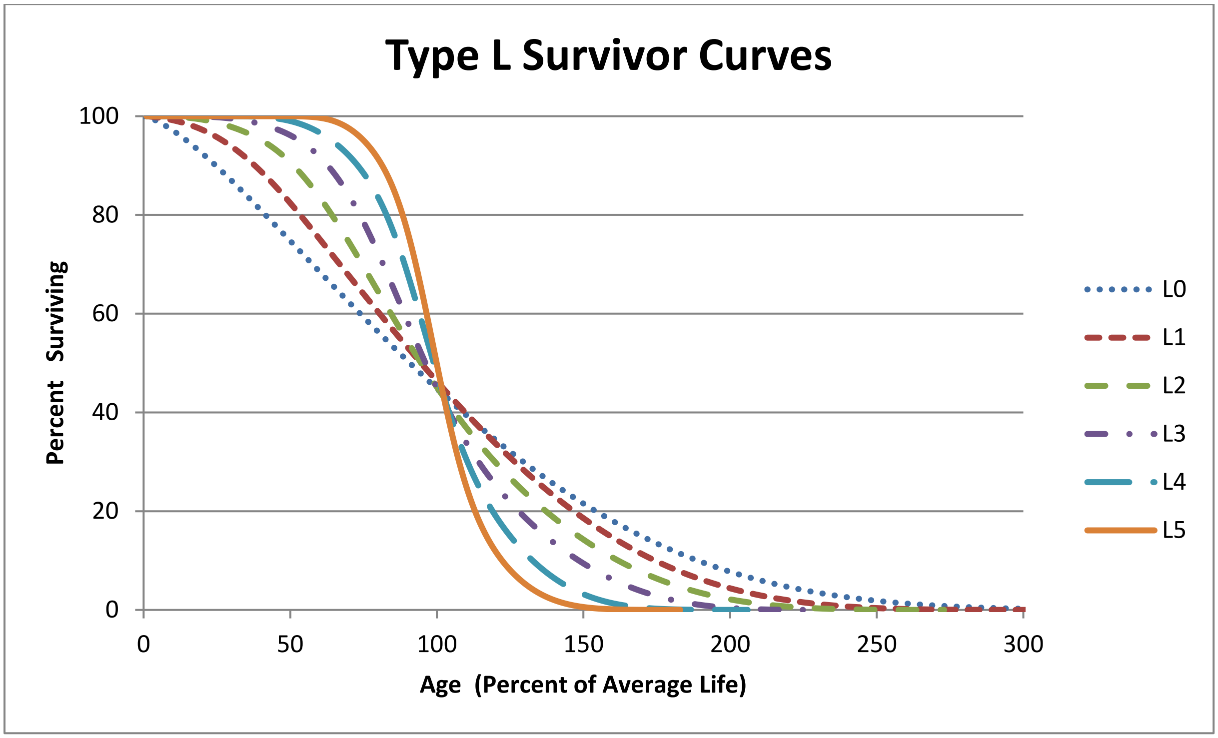
> Since the location of a particular survivor on a graph is affected by both its span in years and the shape of the curve, it is difficult to classify a group of curves unless one of these variables can be controlled. This is easily done by expressing the age in percent of average life."[171]

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.

[171] Winfrey *supra* n. 166, at 60.

Figure 20:
Type L Survivor and Frequency Curves



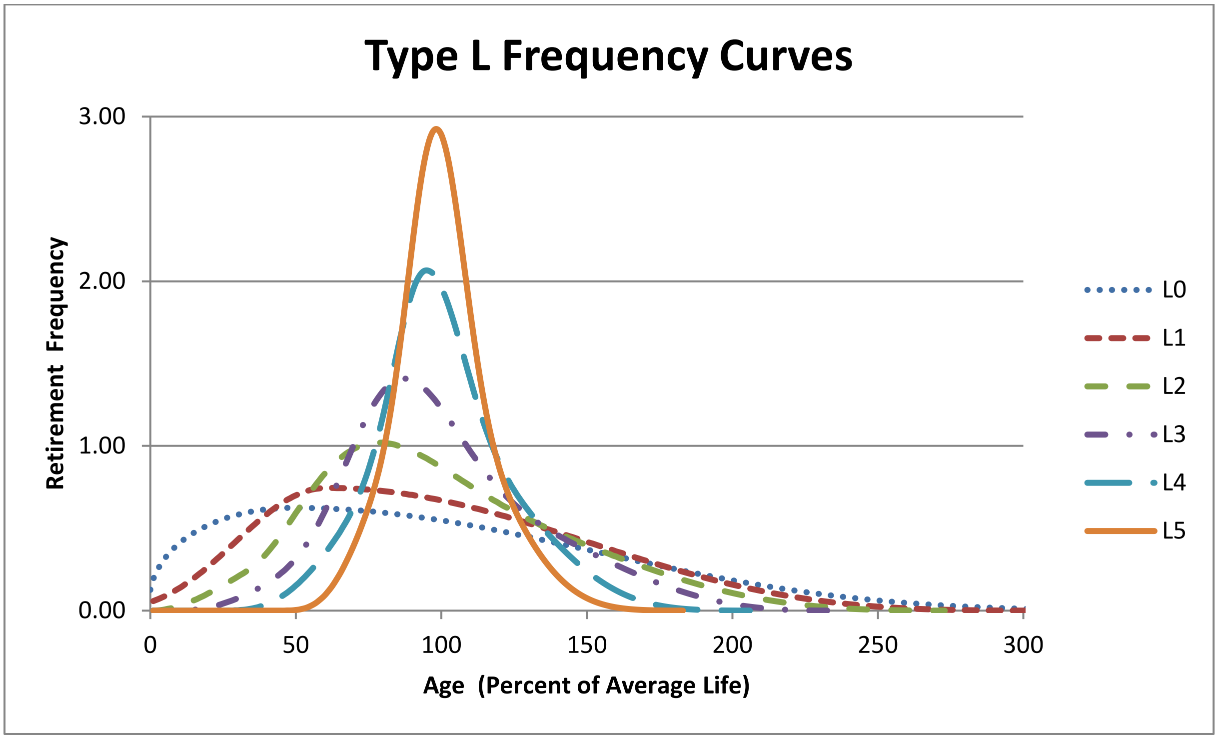
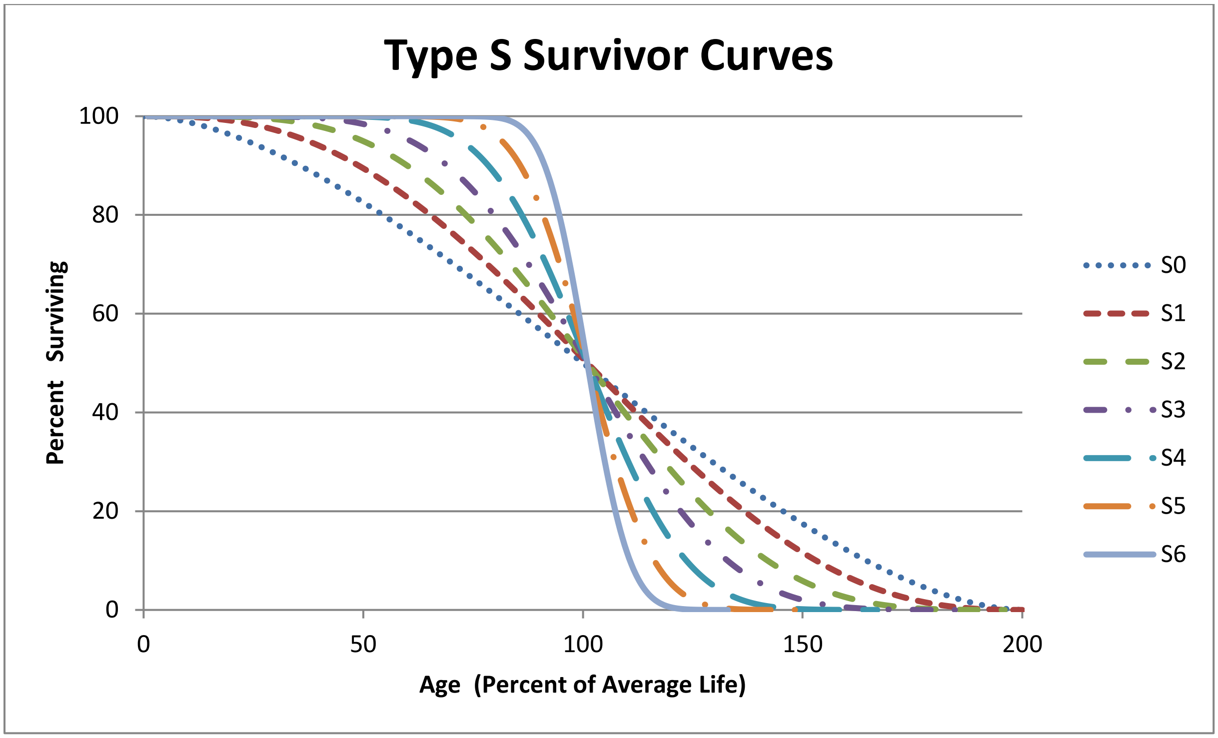


Figure 21:
Type S Survivor and Frequency Curves



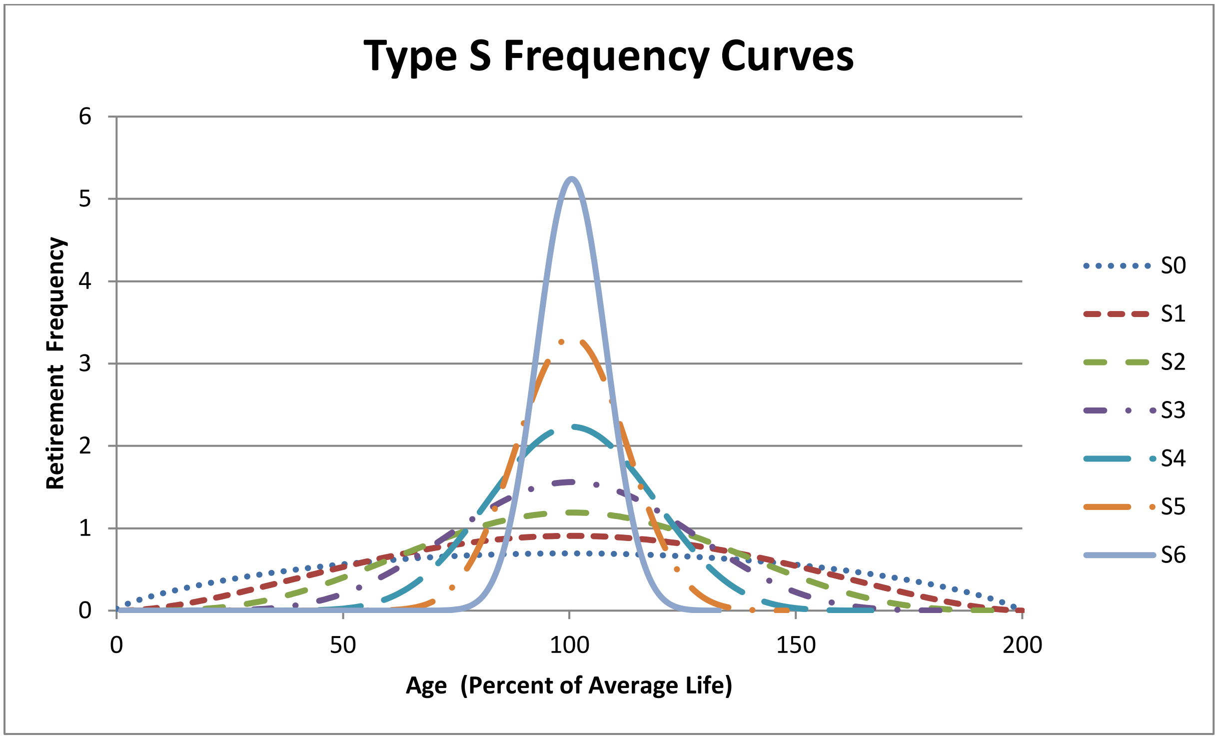
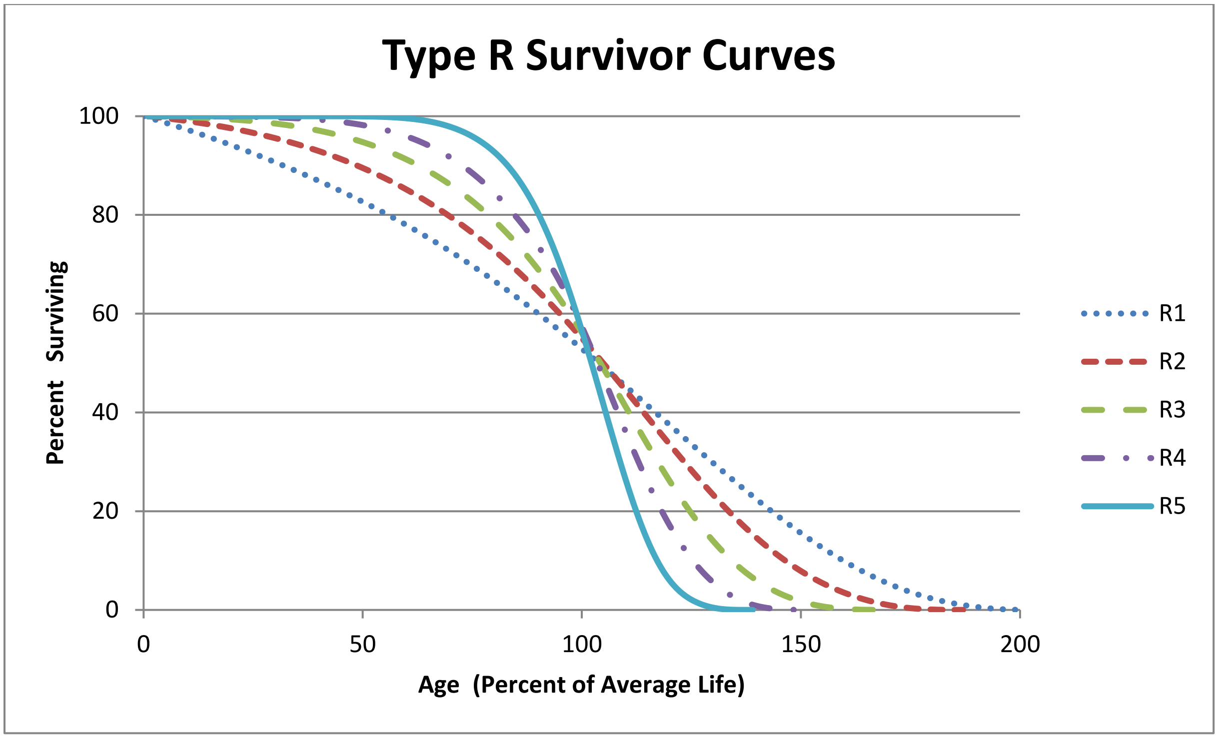
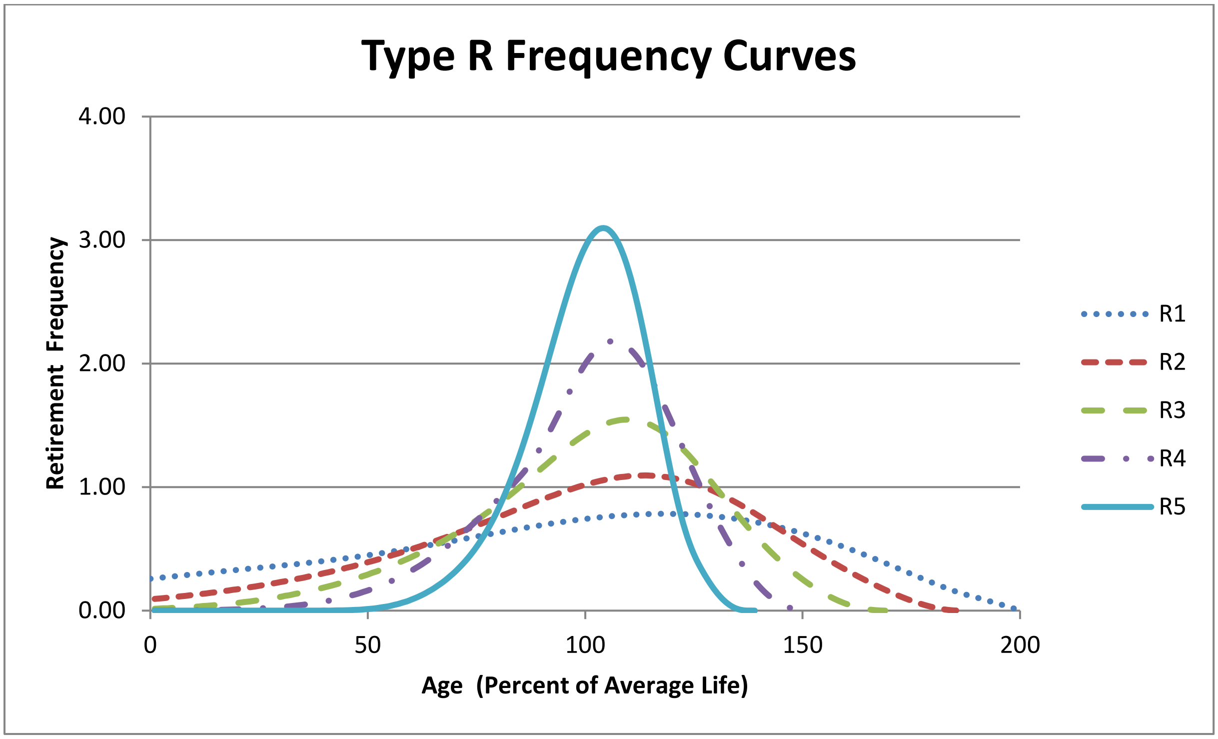


Figure 22:
Type R Survivor and Frequency Curves





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.[172]

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:[173]

Equation 17:
Average Life

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

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

[172] 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.

[173] *See* NARUC *supra* n. 100, 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 Appendix C).

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.[174] 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.[175] 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 potion of the survivor curve is divided by the percent surviving at age x (denoted S_X). Thus, the average remaining life formula is:

Equation 18:
Average Remaining Life

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

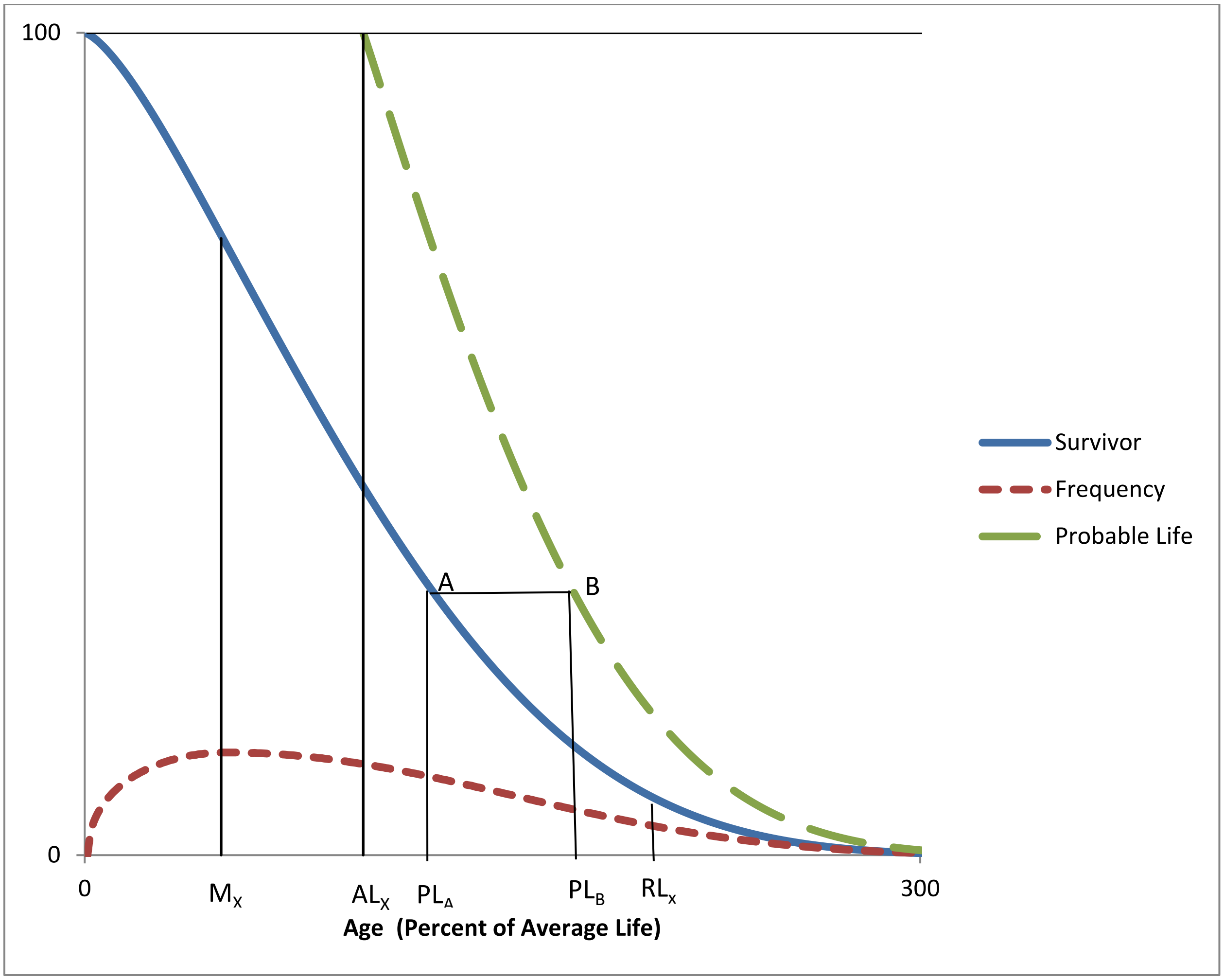
It is necessary to determine average remaining life in order to calculate the annual accrual under the remaining life technique.

---

[174] *Id*. at 73.

[175] *Id*. at 74.

Figure 23:
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.[176] 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

176 Wolf *supra* n. 99, 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 C:

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.[177]

Figure 24:
Forces of Retirement

Physical Factors	Functional Factors	Contingent Factors
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

[177] NARUC *supra* n. 100, 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.[178] 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 calculating observed survivor curves for property groups. Of these methods, the retirement rate method is superior, and is widely employed by depreciation analysts.[179] The retirement rate method is ultimately used to develop an observed survivor curve, which can be fitted with an Iowa curve discussed in Appendix B 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 exposures

[178] *Id*. at 112-13.

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

at the beginning of each year.[180] 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 25:
Exposure Matrix

	Experience Years Exposures at January 1 of Each Year (Dollars in 000's)									
Placement Years	2008	2009	2010	2011	2012	2013	2014	2015	Total at Start of Age Interval	Age Interval
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	

180 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 26:
Retirement Matrix

Placement Years	2008	2009	2010	2011	2012	2013	2014	2015	Total During Age Interval	Age Interval
	Experience Years Retirments During the Year (Dollars in 000's)									
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.[181] 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).

[181] Wolf *supra* n. 99, 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 – 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 27:
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**
					38.91
Total	23,268	1,052			

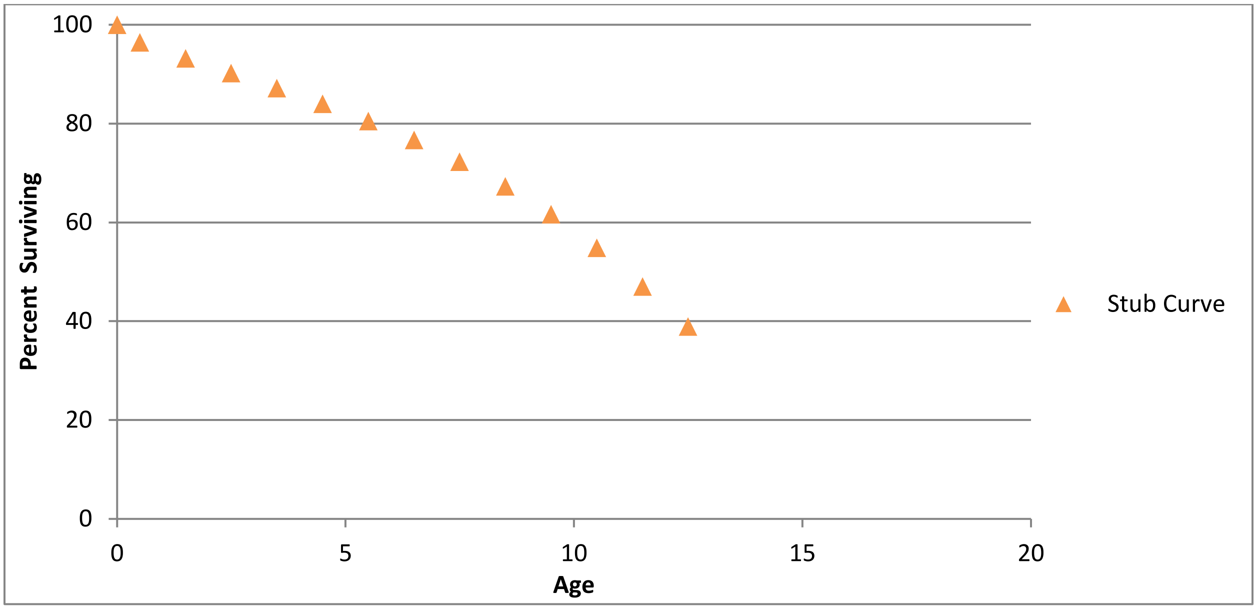
Column F on the right shows the percentages surviving at the beginning of each age interval. This column starts at 100% surviving. Each consecutive number below is calculated by multiplying the percent surviving from the previous age interval by the corresponding survivor ratio for that age interval. 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)[182].

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

[182] 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 28:
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.

<u>Banding</u>

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.[183] 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.[184]

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.

[183] NARUC *supra* n. 100, at 113.

[184] *Id*.

Figure 29:
Placement Bands

Placement Years	Experience Years Exposures at January 1 of Each Year (Dollars in 000's) 2008	2009	2010	2011	2012	2013	2014	2015	Total at Start of Age Interval	Age Interval
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.[185] 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

[185] Wolf *supra* n. 99, 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.[186]

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.

[186] NARUC *supra* n. 100, at 114.

Figure 30:
Experience Bands

	Experience Years									
	Exposures at January 1 of Each Year (Dollars in 000's)									
Placement Years	2008	2009	2010	2011	2012	2013	2014	2015	Total at Start of Age Interval	Age Interval
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.[187] 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

[187] *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.

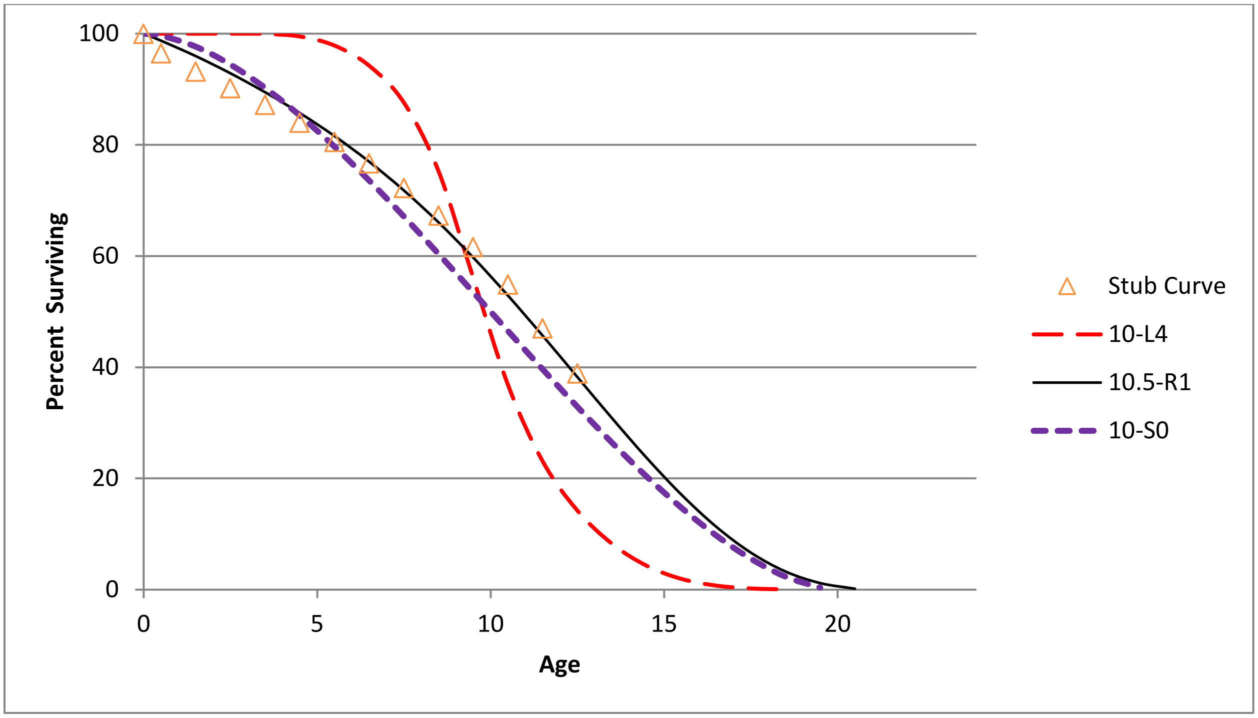
Curve Fitting

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."[188]

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.

[188] Wolf *supra* n. 99, at 46 (22 curves includes Winfrey's 18 original curves plus Cowles's four "O" type curves).

Figure 31:
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 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.[189]

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."[190]

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 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.

---

[189] Wolf *supra* n. 99, at 47.

[190] *Id*. at 48.

Figure 32:
Mathematical Fitting

Age Interval	Stub Curve	Iowa Curves 10-L4	Iowa Curves 10-S0	Iowa Curves 10.5-R1	Squared Differences 10-L4	Squared Differences 10-S0	Squared Differences 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**

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that a true and correct copy of the foregoing Direct Testimony and Exhibits of David J. Garrett has been furnished to the following parties by hand delivery 1st day of February, 2018.

Beth Keating, Esq.
Lila A. Jaber, Esq.
Gregory Munson, Esq.
Gunster Law Firm
215 South Monroe Street; Suite 601
Tallahassee, FL 32301
bkeating@gunster.com
ljabor@gunster.com
gmunson@gunster.com

Walter Trierweiler, Esq.
Stephanie Cuello, Esq.
Danijela Janjic, Esq.
Florida Public Service Commission
2540 Shumard Oak Blvd.
Tallahassee, FL 32399-0850
wtrierwe@psc.state.fl.us
scuello@psc.state.fl.us
DJanjic@psc.state.fl.us

Ms. Carolyn Bermudez
Florida City Gas
4045 N.W. 97th Avenue
Doral FL 33178
cbermude@southernco.com

Federal Executive Agencies
A.J. Unsicker/L.L. Zieman/N.A. Cepak/R.K. Moore
c/o AFLOA/JACE-ULFSC
139 Barnes Drive, Suite 1
Tyndall AFB FL 32403
andrew.unsicker@us.af.mil
ULFSC.Tyndall@US.AF.MIL
lanny.zieman.1@us.af.mil
natalie.cepak.2@us.af.mil
ryan.moore.5@us.af.mil
Thomas.jernigan.3@us.af.mil
Ebony.payton.ctr@us.af.mil

/s/Virginia Ponder
Virginia Ponder
Associate Public Counsel

100 Park Avenue, Suite 700
Oklahoma City, OK 73102

DAVID J. GARRETT

405.249.1050
dgarrett@resolveuc.com

EDUCATION

University of Oklahoma — Norman, OK
Master of Business Administration — 2014
Areas of Concentration: Finance, Energy

University of Oklahoma College of Law — Norman, OK
Juris Doctor — 2007
Member, American Indian Law Review

University of Oklahoma — Norman, OK
Bachelor of Business Administration — 2003
Major: Finance

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
Certified Civil / Commercial & Employment Mediator

WORK EXPERIENCE

Resolve Utility Consulting PLLC — Oklahoma City, OK
Managing Member — 2016 – Present
Provide expert analysis and testimony specializing in depreciation and cost of capital issues for clients in utility regulatory proceedings.

Oklahoma Corporation Commission — Oklahoma City, OK
Public Utility Regulatory Analyst — 2012 – 2016
Assistant General Counsel — 2011 – 2012
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.

Perebus Counsel, PLLC — Oklahoma City, OK
Managing Member — 2009 – 2011
Represented clients in the areas of family law, estate planning, debt negotiations, business organization, and utility regulation.

Moricoli & Schovanec, P.C. — Oklahoma City, OK
Associate Attorney — 2007 – 2009
Represented clients in the areas of contracts, oil and gas, business structures and estate administration.

TEACHING EXPERIENCE

University of Oklahoma — Norman, OK
Adjunct Instructor – "Conflict Resolution" — 2014 – Present
Adjunct Instructor – "Ethics in Leadership"

Rose State College — Midwest City, OK
Adjunct Instructor – "Legal Research" — 2013 – 2015
Adjunct Instructor – "Oil & Gas Law"

PUBLICATIONS

American Indian Law Review — Norman, OK
"Vine of the Dead: Reviving Equal Protection Rites for Religious Drug Use" — 2006
(31 Am. Indian L. Rev. 143)

VOLUNTEER EXPERIENCE

Calm Waters — Oklahoma City, OK
Board Member — 2015 – Present
Participate in management of operations, attend meetings, review performance, compensation, and financial records. Assist in fundraising events.

Group Facilitator & Fundraiser — 2014 – Present
Facilitate group meetings designed to help children and families cope with divorce and tragic events. Assist in fundraising events.

St. Jude Children's Research Hospital — Oklahoma City, OK
Oklahoma Fundraising Committee — 2008 – 2010
Raised money for charity by organizing local fundraising events.

PROFESSIONAL ASSOCIATIONS

Oklahoma Bar Association 2007 – Present

Society of Depreciation Professionals 2014 – Present
Board Member – President 2017
Participate in management of operations, attend meetings, review performance, organize presentation agenda.

Society of Utility Regulatory Financial Analysts 2014 – Present

SELECTED CONTINUING PROFESSIONAL EDUCATION

Society of Depreciation Professionals — Austin, TX
"Life and Net Salvage Analysis" — 2015
Extensive instruction on utility depreciation, including actuarial and simulation life analysis modes, gross salvage, cost of removal, life cycle analysis, and technology forecasting.

Society of Depreciation Professionals — New Orleans, LA
"Introduction to Depreciation" and "Extended Training" — 2014
Extensive instruction on utility depreciation, including average lives and net salvage.

Society of Utility and Regulatory Financial Analysts — Indianapolis, IN
46th Financial Forum. "The Regulatory Compact: Is it Still Relevant?" — 2014
Forum discussions on current issues.

New Mexico State University, Center for Public Utilities — Santa Fe, NM
Current Issues 2012, "The Santa Fe Conference" — 2012
Forum discussions on various current issues in utility regulation.

Michigan State University, Institute of Public Utilities — Clearwater, FL
"39th Eastern NARUC Utility Rate School" — 2011
One-week, hands-on training emphasizing the fundamentals of the utility ratemaking process.

New Mexico State University, Center for Public Utilities — Albuquerque, NM
"The Basics: Practical Regulatory Training for the Changing Electric Industries" — 2010
One-week, hands-on training designed to provide a solid foundation in core areas of utility ratemaking.

The Mediation Institute — Oklahoma City, OK
"Civil / Commercial & Employment Mediation Training" — 2009
Extensive instruction and mock mediations designed to build foundations in conducting mediations in civil matters.

Utility Regulatory Proceedings

State	Regulatory Agency / Company-Applicant	Docket Number	Testimony / Analysis: Issues	Type	Date
WA	Washington Utilities & Transportation Commission Avista Corporation	UE-170485 UG-170486	Cost of capital and authorized rate of return	Prefiled	10/27/2017
WY	Wyoming Public Services Commission Powder River Energy Corporation	PUD 201700151	Risk and credit analysis	Prefiled Live	8/28/2017 9/29/2017
OK	Oklahoma Corporation Commission Public Service Co. of Oklahoma	PUD 201700151	Depreciation rates, terminal salvage, risk analysis	Prefiled Live	9/21/2017 11/6/2017
TX	Public Utility Commission of Texas Oncor Electric Delivery Company	PUC 46957	Depreciation rates, simulated plant record analysis	Pending	
NV	Nevada Public Utilities Commission Nevada Power Company	17-06004	Depreciation rates, net salvage	Prefiled	10/6/2017
TX	Public Utility Commission of Texas El Paso Electric Company	PUC 46831	Depreciation rates, interim retirements	Prefiled	6/23/2017
ID	Idaho Public Utilities Commission Idaho Power Company	IPC-E-16-24	Accelerated depreciation of North Valmy plant	Settled	5/31/2017
ID	Idaho Public Utilities Commission Idaho Power Company	IPC-E-16-23	Depreciation rates	Settled	5/31/2017
TX	Public Utility Commission of Texas Southwestern Electric Power Company	PUC 46449	Depreciation rates, decommissioning costs, terminal net salvage	Prefiled Live	4/25/2017 6/8/2017
MA	Massachusetts Department of Public Utilities Eversource Energy	D.P.U. 17-05	Cost of capital, capital structure, and rate of return	Prefiled	4/28/2017
TX	Railroad Commission of Texas Atmos Pipeline - Texas	GUD 10580	Depreciation rates, depreciation grouping procedure	Prefiled	3/22/2017
TX	Public Utility Commission of Texas Sharyland Utility Co.	PUC 45414	Depreciation rates, simulated and actuarial analysis	Prefiled	2/28/2017
OK	Oklahoma Corporation Commission Empire District Electric Co.	PUD 201600468	Cost of capital, depreciation rates, terminal salvage, lifespans	Prefiled Live	3/13/2017 5/11/2017

Utility Regulatory Proceedings

State	Regulatory Agency / Company-Applicant	Docket Number	Testimony / Analysis: Issues	Type	Date
TX	Railroad Commission of Texas CenterPoint Energy Texas Gas	GUD 10567	Depreciation rates, simulated and actuarial analysis	Prefiled	2/21/2017
AR	Arkansas Public Service Commission Oklahoma Gas & Electric Co.	160-159-GU	Cost of capital, depreciation rates, terminal salvage, lifespans	Prefiled	1/31/2017
FL	Florida Public Service Commission Peoples Gas	16-159-GU	Depreciation rates	Report	11/4/2016
AZ	Arizona Corporation Commission Arizona Public Service Co.	E-01345A-16-0036	Cost of capital, depreciation rates, terminal salvage, lifespans	Pre-filed	12/28/2016
NV	Nevada Public Utilities Commission Sierra Pacific Power Co.	16-06008	Depreciation rates, terminal salvage, lifespans, theoretical reserve	Pre-filed	9/23/2016
OK	Oklahoma Corporation Commission Oklahoma Gas & Electric Co.	PUD 201500273	Cost of capital, depreciation rates, terminal salvage, lifespans	Pre-filed Live	3/21/2016 5/3/2016
OK	Oklahoma Corporation Commission Public Service Co. of Oklahoma	PUD 201500208	Cost of capital, depreciation rates, terminal salvage, lifespans	Pre-filed Live	10/14/2015 12/8/2015
OK	Oklahoma Corporation Commission Oklahoma Natural Gas Co.	PUD 201500213	Cost of capital and depreciation rates	Pre-filed	10/19/2015
OK	Oklahoma Corporation Commission Oak Hills Water System	PUD 201500123	Cost of capital and depreciation rates	Pre-filed Live	7/8/2015 8/14/2015
OK	Oklahoma Corporation Commission CenterPoint Energy Oklahoma Gas	PUD 201400227	Fuel prudence review and fuel adjustment clause	Pre-filed Live	11/3/2014 2/10/2015
OK	Oklahoma Corporation Commission Public Service Co. of Oklahoma	PUD 201400233	Certificate of authority to issue new debt securities	Pre-filed Live	9/12/2014 9/25/2014
OK	Oklahoma Corporation Commission Empire District Electric Co.	PUD 201400226	Fuel prudence review and fuel adjustment clause	Pre-filed Live	12/9/2014 1/22/2015
OK	Oklahoma Corporation Commission Fort Cobb Fuel Authority	PUD 201400219	Fuel prudence review and fuel adjustment clause	Pre-filed Live	 1/29/2015
OK	Oklahoma Corporation Commission Fort Cobb Fuel Authority	PUD 201400140	Outside services, legislative advocacy, payroll expense, and insurance expense	Pre-filed	12/16/2014

Utility Regulatory Proceedings

State	Regulatory Agency / Company-Applicant	Docket Number	Testimony / Analysis Issues	Type	Date
OK	Oklahoma Corporation Commission Public Service Co. of Oklahoma	PUD 201300201	Authorization of standby and supplemental tariff	Pre-filed Live	12/9/2013 12/19/2013
OK	Oklahoma Corporation Commission Fort Cobb Fuel Authority	PUD 201300134	Fuel prudence review and fuel adjustment clause	Pre-filed Live	10/23/2013 1/30/2014
OK	Oklahoma Corporation Commission Empire District Electric Co.	PUD 201300131	Fuel prudence review and fuel adjustment clause	Pre-filed Live	11/21/2013 12/19/2013
OK	Oklahoma Corporation Commission CenterPoint Energy Oklahoma Gas	PUD 201300127	Fuel prudence review and fuel adjustment clause	Pre-filed Live	10/21/2013 1/23/2014
OK	Oklahoma Corporation Commission Oklahoma Gas & Electric Co.	PUD 201200185	Gas transportation contract extension	Pre-filed Live	9/20/2012 10/9/2012
OK	Oklahoma Corporation Commission Empire District Electric Co.	PUD 201200170	Fuel prudence review and fuel adjustment clause	Pre-filed Live	10/31/2012 12/13/2012
OK	Oklahoma Corporation Commission Oklahoma Gas & Electric Co.	PUD 201200169	Fuel prudence review and fuel adjustment clause	Pre-filed Live	12/19/2012 4/4/2013

CAPM Comparison

Mr. Garrett's CAPM Inputs and Result

Risk-Free Rate	+	**Beta**	x	**ERP**	=	**7.0%**
2.77%		0.75		5.7%		
Used current yields on 30-year T bonds - an undisputed reasonable proxy for the risk-free rate in the CAPM, even though they are <u>higher</u> than shorter-term treasury securities.		Used betas published by Value Line - a respected third party analyst firm, even though evidence indicates these betas may be too <u>high</u> for utilities and other low-beta firms.		Used the <u>highest</u> ERP from following sources: ERP published by third-party analyst, ERP reported in expert surveys, and ERP estimated by respected unbiased expert.		

Dr. Vander Weide's CAPM Inputs and Result

Risk-Free Rate	+	**Beta**	x	**ERP**	=	**11.3%**
4.20%		0.90		7.7%		
Used forecasted yield considering treasury and non-treasury securities. Not an accepted proxy for risk-free rate in finance community.		Calculated his own betas which are considerably higher than those published by Value Line - an unbiased third party.		Conducted a DCF analysis on 100 non-comparable firms using long-term growth rates more than three times U.S. GDP for some companies.		

Proxy Group Summary

		[1]	[2]	[3]	[5]
Company	Ticker	Market Cap. ($ millions)	Market Category	Value Line Safety Rank	Financial Strength
Atmos Energy	ATO	9,500	Mid Cap	1	A+
Chesapeake Utilities	CPK	1,300	Small Cap	2	B++
New Jersey Resources	NJR	3,800	Mid Cap	1	A+
NiSource Inc.	NI	9,100	Mid Cap	3	B+
Northwest Nat. Gas	NWN	1,900	Small Cap	1	A
ONE Gas Inc.	OGS	4,000	Mid Cap	2	B++
South Jersey Inds.	SJI	2,600	Mid Cap	2	A
Southwest Gas	SWX	3,900	Mid Cap	3	B++
Spire Inc.	SR	3,800	Mid Cap	2	B++
UGI Corp.	UGI	8,300	Mid Cap	2	B++

[1], [3], [5] Value Line Investment Survey

[2] Large Cap > $10 billion; Mid Cap > $2 billion; Small Cap > $200 million

Stock and Index Prices

Ticker	^GSPC	ATO	CPK	NJR	NI	NWN	OGS	SJI	SWX	SR	UGI
30-day Average	2644	88.98	81.01	41.99	26.49	64.71	76.12	32.25	82.18	77.67	47.74
Standard Deviation	35.3	2.41	2.67	2.02	0.86	3.59	2.01	0.88	1.87	2.36	0.84
11/16/17	2586	89.46	81.52	44.71	27.32	67.25	77.53	32.49	82.85	78.20	47.82
11/17/17	2579	88.84	81.22	44.46	27.08	66.70	77.12	32.38	82.69	78.00	47.72
11/20/17	2582	88.62	81.47	44.01	27.09	66.15	76.95	32.12	82.13	77.65	47.45
11/21/17	2599	88.93	83.32	43.51	27.22	67.05	77.24	32.36	82.29	78.35	47.31
11/22/17	2597	88.61	82.37	43.31	27.04	66.75	76.74	32.51	82.26	77.60	47.48
11/24/17	2602	88.72	82.02	42.27	27.04	66.65	76.79	32.54	81.70	77.75	47.20
11/27/17	2601	89.50	82.82	42.92	27.10	66.95	77.30	32.53	82.96	78.20	47.64
11/28/17	2627	90.27	84.51	43.56	27.20	67.80	78.11	33.16	84.12	79.49	47.68
11/29/17	2626	90.51	85.01	44.01	27.17	68.55	78.17	33.32	84.96	80.43	47.74
11/30/17	2648	92.29	85.21	44.31	27.53	69.15	79.25	33.58	85.94	81.68	48.76
12/01/17	2642	92.24	84.41	44.06	27.33	68.40	78.78	33.54	86.23	81.18	48.37
12/04/17	2639	91.70	83.51	44.01	27.03	68.75	78.08	33.40	85.66	81.18	48.73
12/05/17	2630	91.45	83.07	43.02	26.80	68.05	77.40	33.01	83.40	79.79	48.56
12/06/17	2629	91.43	82.27	43.12	27.00	67.75	77.35	32.97	82.74	79.79	49.01
12/07/17	2637	91.56	82.02	43.27	27.03	67.55	77.45	33.11	82.67	79.99	49.38
12/08/17	2652	91.80	82.12	43.31	27.14	67.20	77.50	32.99	82.81	80.20	49.34
12/11/17	2660	91.91	82.37	42.92	27.18	65.35	76.79	32.99	82.95	79.50	49.14
12/12/17	2664	89.28	79.88	41.82	26.39	64.00	75.44	32.14	80.48	77.15	48.07
12/13/17	2663	89.96	80.88	41.48	26.43	64.50	76.48	32.17	80.53	77.55	47.85
12/14/17	2652	89.42	79.95	40.45	26.48	64.05	75.77	31.35	79.40	76.55	47.31
12/15/17	2676	89.37	81.65	40.95	26.51	65.05	76.38	32.34	80.11	77.05	47.93
12/18/17	2690	88.71	80.05	40.30	25.98	62.50	75.75	32.07	79.67	76.55	47.22
12/19/17	2681	87.19	77.80	39.25	25.30	60.55	74.23	31.03	82.46	75.05	46.79
12/20/17	2679	86.55	76.60	39.45	24.96	59.80	73.79	31.13	81.74	74.90	46.90
12/21/17	2685	84.86	75.35	38.80	24.66	58.80	72.57	30.81	80.82	73.70	46.78
12/22/17	2683	85.09	76.80	38.75	25.28	58.95	72.59	31.00	80.23	73.95	47.02
12/26/17	2681	84.60	76.90	38.65	25.06	58.60	72.38	30.78	80.00	73.75	46.48
12/27/17	2683	84.99	77.95	39.25	25.24	58.90	73.11	31.14	80.36	74.50	46.58
12/28/17	2688	85.59	78.80	39.70	25.56	59.95	73.40	31.25	80.90	75.35	47.04
12/29/17	2674	85.89	78.55	40.20	25.67	59.65	73.26	31.23	80.48	75.15	46.95

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

Dividend Yields

		[1]	[2]	[3]
Company	Ticker	Dividend	Stock Price	Dividend Yield
Atmos Energy	ATO	0.485	88.98	0.55%
Chesapeake Utilities	CPK	0.325	81.01	0.40%
New Jersey Resources	NJR	0.273	41.99	0.65%
NiSource Inc.	NI	0.175	26.49	0.66%
Northwest Nat. Gas	NWN	0.472	64.71	0.73%
ONE Gas Inc.	OGS	0.420	76.12	0.55%
South Jersey Inds.	SJI	0.280	32.25	0.87%
Southwest Gas	SWX	0.495	82.18	0.60%
Spire Inc.	SR	0.563	77.67	0.72%
UGI Corp.	UGI	0.250	47.74	0.52%
Average		**$0.37**	**$61.92**	**0.63%**

[1] Fourth quarter 2017 dividends per share. Nasdaq.com
[2] Average stock price from Exhibit DJG-4
[3] = [1] / [2]

Terminal Growth Rate

Growth Determinant	Rate	
Nominal GDP	4.10%	[1]
Inflation	2.00%	[2]
Risk Free Rate	2.77%	[3]
Highest	**4.10%**	

[1], [2] CBO Long-Term Budget Outlook 2016 - 2046
[3] From Exhibit DJG-8
*Highest growth rate used in DCF calculation

Final DCF Result

[1]	[2]	[3]	[4]
Dividend (d_0)	Stock Price (P_0)	Growth Rate (g)	**DCF Result**
\$0.37	\$61.92	4.10%	**6.6%**

[1] Average proxy dividend from dividend exhibit
[2] Average proxy stock price from dividend exhibit
[3] Highest growth rate from growth determinant exhibit
[4] Quarterly DCF Approximation = $[d_0(1 + g)^{0.25}/P_0 + (1 + g)^{0.25}]^4 - 1$

Risk-Free Rate

Date	Rate
11/16/17	2.81%
11/17/17	2.78%
11/20/17	2.78%
11/21/17	2.76%
11/22/17	2.75%
11/24/17	2.76%
11/27/17	2.76%
11/28/17	2.77%
11/29/17	2.81%
11/30/17	2.83%
12/01/17	2.76%
12/04/17	2.77%
12/05/17	2.73%
12/06/17	2.71%
12/07/17	2.76%
12/08/17	2.77%
12/11/17	2.77%
12/12/17	2.79%
12/13/17	2.74%
12/14/17	2.71%
12/15/17	2.68%
12/18/17	2.74%
12/19/17	2.82%
12/20/17	2.88%
12/21/17	2.84%
12/22/17	2.83%
12/26/17	2.82%
12/27/17	2.75%
12/28/17	2.75%
12/29/17	2.74%
Average	**2.77%**

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

Beta Results

Company	Ticker	Beta
Atmos Energy	ATO	0.70
Chesapeake Utilities	CPK	0.70
New Jersey Resources	NJR	0.80
NiSource Inc.	NI	0.60
Northwest Nat. Gas	NWN	0.70
ONE Gas Inc.	OGS	0.70
South Jersey Inds.	SJI	0.85
Southwest Gas	SWX	0.80
Spire Inc.	SR	0.70
UGI Corp.	UGI	0.90
Average		0.75

*Betas from Value Line Investment Survey

Implied Equity Risk Premium

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Year	Index 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%

Cash Yield	5.15%	[9]
Growth Rate	0.96%	[10]
Risk-free Rate	2.77%	[11]
Current Index Value	2,644	[12]

	[13]	[14]	[15]	[16]	[17]
Year	1	2	3	4	5
Expected Dividends	138	139	140	142	143
Expected Terminal Value					3008
Present Value	128	120	112	105	2179
Intrinsic Index Value	2644	[18]			
Required Return on Market	7.66%	[19]			
Implied Equity Risk Premium	**4.88%**	[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] = Compund annual growth rate of [2] = (end value / beginning value)^1/4-1
[11] Risk-free rate from DJG risk-free rate exhibit
[12] 30-day average of closing index prices from Exhibit DJG-4
[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

Equity Risk Premium Results

IESE Business School Survey	5.7%	[1]
Graham & Harvey Survey	4.0%	[2]
Duff & Phelps Report	5.0%	[3]
Damodaran	5.4%	[4]
Garrett	4.9%	[5]
Highest	**5.7%**	

[1] IESE Business School Survey
[2] Graham and Harvey Survey
[3] Duff & Phelps Client Alert 2016
[4] Average ERP est., http://pages.stern.nyu.edu/~adamodar/
(avg. 4.75%, 5.08%, 6.27%)
[5] From Exhibit DJG-10
*Highest ERP used in CAPM calculation

CAPM Final Results

Company	Ticker	[1] Risk-Free Rate	[2] Value Line Beta	[3] Risk Premium	[4] CAPM Results
Atmos Energy	ATO	2.77%	0.700	5.70%	6.8%
Chesapeake Utilities	CPK	2.77%	0.700	5.70%	6.8%
New Jersey Resources	NJR	2.77%	0.800	5.70%	7.3%
NiSource Inc.	NI	2.77%	0.600	5.70%	6.2%
Northwest Nat. Gas	NWN	2.77%	0.700	5.70%	6.8%
ONE Gas Inc.	OGS	2.77%	0.700	5.70%	6.8%
South Jersey Inds.	SJI	2.77%	0.850	5.70%	7.6%
Southwest Gas	SWX	2.77%	0.800	5.70%	7.3%
Spire Inc.	SR	2.77%	0.700	5.70%	6.8%
UGI Corp.	UGI	2.77%	0.900	5.70%	7.9%
Average			0.745		**7.0%**

[1] From Exhibit DJG-8
[2] From Exhibit DJG-9
[3] From Exhibit DJG-11
[6] = [1] + [2] * [3]

Cost of Equity Summary

Model	Cost of Equity
Discounted Cash Flow Model	6.6%
Capital Asset Pricing Model	7.0%
Average	**6.8%**

Market Cost of Equity

Source	Estimate	
IESE Survey	8.5%	[1]
Graham Harvey Survey	6.8%	[2]
Damodaran	8.1%	[3]
Garrett	7.7%	[4]
Average	7.8%	

[1] Average reported ERP + risk-free rate
[2] Average reported ERP + risk-free rate
[3] Average reported ERP + risk-free rate
[4] From Exhibit DJG-10

Market Cost of Equity vs. Awarded Returns

	[1]		[2]		[3]		[4]	[5]	[6]	[7]
	Electric Utilities		Gas Utilities		Total Utilities		S&P 500	T-Bond	Risk	Market
Year	ROE	#	ROE	#	ROE	#	Returns	Rate	Premium	COE
1990	12.70%	44	12.67%	31	12.69%	75	-3.06%	8.08%	5.00%	13.08%
1991	12.55%	45	12.46%	35	12.51%	80	30.23%	7.09%	5.14%	12.23%
1992	12.09%	48	12.01%	29	12.06%	77	7.49%	6.77%	5.03%	11.80%
1993	11.41%	32	11.35%	45	11.37%	77	9.97%	5.77%	4.90%	10.67%
1994	11.34%	31	11.35%	28	11.34%	59	1.33%	7.81%	4.97%	12.78%
1995	11.55%	33	11.43%	16	11.51%	49	37.20%	5.71%	5.08%	10.79%
1996	11.39%	22	11.19%	20	11.29%	42	22.68%	6.30%	5.30%	11.60%
1997	11.40%	11	11.29%	13	11.34%	24	33.10%	5.81%	5.53%	11.34%
1998	11.66%	10	11.51%	10	11.59%	20	28.34%	4.65%	5.63%	10.28%
1999	10.77%	20	10.66%	9	10.74%	29	20.89%	6.44%	5.96%	12.40%
2000	11.43%	12	11.39%	12	11.41%	24	-9.03%	5.11%	5.51%	10.62%
2001	11.09%	18	10.95%	7	11.05%	25	-11.85%	5.05%	5.17%	10.22%
2002	11.16%	22	11.03%	21	11.10%	43	-21.97%	3.82%	4.53%	8.35%
2003	10.97%	22	10.99%	25	10.98%	47	28.36%	4.25%	4.82%	9.07%
2004	10.75%	19	10.59%	20	10.67%	39	10.74%	4.22%	4.84%	9.06%
2005	10.54%	29	10.46%	26	10.50%	55	4.83%	4.39%	4.80%	9.19%
2006	10.32%	26	10.40%	15	10.35%	41	15.61%	4.70%	4.91%	9.61%
2007	10.30%	38	10.22%	35	10.26%	73	5.48%	4.02%	4.79%	8.81%
2008	10.41%	37	10.39%	32	10.40%	69	-36.55%	2.21%	3.88%	6.09%
2009	10.52%	40	10.22%	30	10.39%	70	25.94%	3.84%	4.29%	8.13%
2010	10.37%	61	10.15%	39	10.28%	100	14.82%	3.29%	4.31%	7.60%
2011	10.29%	42	9.92%	16	10.19%	58	2.10%	1.88%	4.10%	5.98%
2012	10.17%	58	9.94%	35	10.08%	93	15.89%	1.76%	4.20%	5.96%
2013	10.03%	49	9.68%	21	9.93%	70	32.15%	3.04%	4.62%	7.65%
2014	9.91%	38	9.78%	26	9.86%	64	13.52%	2.17%	4.60%	6.77%
2015	9.85%	30	9.60%	16	9.76%	46	1.38%	2.27%	4.54%	6.81%
2016	9.91%	48	9.45%	16	9.80%	64	11.77%	2.45%	4.62%	7.07%
2017 *	9.74%	34	9.75%	16	9.74%	50	21.64%	2.41%	4.77%	7.18%

[1], [2], [3] Average annual authorized ROE for electric, gas, and total utilities and number of cases - RRA Regulatory Focus Report

[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

*Data through thrid quarter of 2017

Optimal Capital Structure

Inputs

EBIT	4,629	[1]
Interest Expense	1,317	[2]
Book Debt	42,629	[3]
Book Equity	26,612	[4]
Debt / Capital	61.57%	[5]
Debt / Equity	160%	[6]
Debt Cost	4.89%	[7]
Tax Rate	35%	[8]
Unlevered Beta	0.36	[9]
Risk-free Rate	2.77%	[10]
Equity Risk Premium	5.70%	[11]
Coverage Ratio	3.51	[12]
Bond Rating	Baa2	[13]

Ratings Table

[14] Coverage Ratio	[15] Bond Rating	[16] Spread	[17] Interest Rate
8.5 - 10.00	Aaa/AAA	0.60%	3.37%
6.5 - 8.49	Aa2/AA	0.80%	3.57%
5.5 - 6.49	A1/A+	1.00%	3.77%
4.25 - 5.49	A2/A	1.10%	3.87%
3.0 - 4.24	A3/A-	1.25%	4.02%
2.5 - 2.99	Baa2/BBB	1.60%	4.37%
2.25 - 2.49	Ba1/BB+	2.50%	5.27%
2.0 - 2.24	Ba2/BB	3.00%	5.77%
1.75 - 1.99	B1/B+	3.75%	6.52%
1.5 - 1.74	B2/B	4.50%	7.27%
1.25 - 1.49	B3/B-	5.50%	8.27%
0.8 - 1.24	Caa/CCC	6.50%	9.27%

Optimal Capital Structure Calculation

[18] Debt Ratio	[19] D/E Ratio	[20] Levered Beta	[21] True Cost of Equity	[22] Awarded ROE	[23] Debt Level	[24] Interest Expense	[25] Coverage Ratio	[26] Pre-tax Debt Cost	[27] After-tax Debt Cost	[28] Optimal WACC	[29] WACC at 11.25% ROE
0%	0%	0.365	4.85%	11.25%	0	0	∞	3.37%	2.19%	4.85%	11.25%
20%	25%	0.424	5.19%	11.25%	13,848	677	6.84	3.57%	2.32%	4.62%	9.46%
30%	43%	0.467	5.43%	11.25%	20,772	1,016	4.56	3.87%	2.52%	4.56%	8.63%
50%	100%	0.602	6.20%	11.25%	34,621	1,693	2.73	4.37%	2.84%	4.52%	7.05%
60%	150%	0.721	6.88%	11.25%	41,545	2,032	2.28	5.27%	3.43%	4.81%	6.56%
70%	233%	0.919	8.01%	11.25%	48,469	2,370	1.95	6.52%	4.24%	5.37%	6.34%

[1], [2] 2016 Annual Statement (mil's)
[3], [4] 2016 Annual Statement (mil's)
[5] = [3] / ([3] + [4])
[6] = [3] / [4]
[7] Company Schedule
[8] Estimated corporate tax rate
[9] Average beta / (1+(1 - [8])*[6])
[10] From Exhibit DJG-8
[11] From Exhibit DJG-11

[12] = [1] / [2]
[13] Company bond rating
[14] Ranges of coverage ratios
[15] Moody's / S&P bond ratings
[16] NYU spread over risk-free rate
[17] = [16] + [10] = est. debt cost
[18] = debt / total capital
[19] = [18] / (1 - [18])
[20] = [9] * (1 + (1 - [8]) * [6]

[21] = [10] + [20] * [11]
[22] Recommended awarded ROE
[23] = [18] * ([3] + [4]); (000's)
[24] = [22] * [7]; (000's)
[25] = [1] / [23]
[26] Debt cost given coverage ratio per Ratings Table
[27] = [25] * (1 - [8])
[28] = ([18] * [26]) + ((1 - [18]) * [21])
[29] = ([18] * [26]) + ((1 - [18]) * [22])

Competitive Industry Debt Ratios

Industry	Number of Fimrs	Debt Ratio
Advertising	41	87%
Hospitals/Healthcare Facilities	38	84%
Broadcasting	30	83%
Restaurant/Dining	86	82%
Tobacco	22	80%
Coal & Related Energy	38	79%
Brokerage & Investment Banking	45	76%
Retail (Building Supply)	6	75%
Retail (Automotive)	25	73%
Auto & Truck	15	73%
Trucking	30	73%
Packaging & Container	26	66%
Bank (Money Center)	10	66%
Beverage (Soft)	36	66%
Office Equipment & Services	24	65%
Telecom. Services	67	64%
Retail (Distributors)	88	62%
Power	68	62%
Hotel/Gaming	69	61%
Telecom (Wireless)	17	61%
R.E.I.T.	238	60%
Food Wholesalers	16	60%
Retail (Grocery and Food)	14	59%
Real Estate (Operations & Services)	54	59%
Transportation	17	59%
Chemical (Basic)	45	58%
Construction Supplies	51	58%
Environmental & Waste Services	89	57%
Farming/Agriculture	37	56%
Business & Consumer Services	165	56%
Air Transport	18	56%
Green & Renewable Energy	25	55%
Computer Services	117	54%
Oil/Gas Distribution	78	54%
Utility (Water)	22	54%
Cable TV	14	53%
Steel	38	53%
Rubber& Tires	4	52%
Drugs (Biotechnology)	426	52%
Chemical (Specialty)	100	52%
Recreation	66	51%
Software (System & Application)	236	51%
Metals & Mining	97	51%
Beverage (Alcoholic)	25	51%
Information Services	64	51%
Household Products	129	51%
Chemical (Diversified)	8	50%
Aerospace/Defense	96	50%
Building Materials	41	50%
Oil/Gas (Production and Exploration)	330	50%
Investments & Asset Management	156	49%
Auto Parts	63	48%
Total / Average	**3660**	**61%**

http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/dbtfund.htm

Proxy Group Debt Ratios

Company	Ticker	Debt Ratio
Atmos Energy	ATO	36%
Chesapeake Utilities	CPK	24%
New Jersey Resources	NJR	48%
NiSource Inc.	NI	60%
Northwest Nat. Gas	NWN	44%
ONE Gas Inc.	OGS	39%
South Jersey Inds.	SJI	39%
Southwest Gas	SWX	48%
Spire Inc.	SR	51%
UGI Corp.	UGI	57%
Average		45%

Debt ratios from Value Line Investment Survey

Summary Depreciation Adjustment

Plant Function	Original Cost	Company Position		OPC Position		OPC Adjustment	
		Rate	Expense	Rate	Expense	Rate	Expense
Distributrion	$ 392,007,843	2.90%	$ 11,368,741	2.63%	$ 10,322,898	-0.27%	$ (1,045,843)
General	17,240,768	5.26%	907,242	5.26%	907,242	0.00%	-
Total Plant Studied	$ 409,248,610	3.00%	$ 12,275,984	2.74%	$ 11,230,141	-0.26%	**$ (1,045,843)**

Detailed Rate Comparison

		[1]	[2]				[3]				[4]	
			Company Proposal				OPC Proposal				Difference	
Account No.	Description	Original Cost	Iowa Curve Type	AL	Rate	Annual Accrual	Iowa Curve Type	AL	Rate	Annual Accrual	Rate	Annual Accrual
	Distribution Plant											
375.00	Structures & Improvements	-	R5	32	3.10%	-	R5	32	3.10%	-	0.00%	-
376.10	Distribution Mains - Steel	109,201,912	S3	55	2.50%	2,730,048	S3	55	2.50%	2,730,048	0.00%	-
376.20	Distribution Mains - Plastic	150,016,423	S3	55	2.50%	3,750,411	S3	59	2.38%	3,573,575	-0.12%	(176,835)
378.00	M&R Station Equipment - General	3,009,723	S3	30	3.50%	105,340	S3	30	3.50%	105,340	0.00%	-
379.00	M&R Station Equipment - City Gate	10,001,911	S4	35	2.70%	270,052	R0.5	39	2.06%	206,492	-0.64%	(63,559)
380.10	Services - Steel	14,597,872	S6	45	2.70%	394,143	S6	45	1.53%	222,927	-1.17%	(171,215)
380.20	Services - Plastic	61,702,824	S4	45	3.40%	2,097,896	R2.5	54	2.54%	1,570,251	-0.86%	(527,645)
381.00	Meters	19,544,112	R1.5	20	6.10%	1,192,191	R1.5	20	6.10%	1,192,191	0.00%	-
382.00	Meter Installations	7,163,196	S3	30	4.50%	322,344	S3	34	3.57%	255,844	-0.93%	(66,500)
382.10	Meter Installations - ERTs	4,694,672	R1.5	20	3.10%	145,535	R1.5	20	3.10%	145,535	0.00%	-
383.00	House Regulators	5,883,813	S3	30	3.00%	176,514	S3	30	3.00%	176,514	0.00%	-
384.00	House Regulator Installations	2,308,976	S3	30	3.20%	73,887	S3	30	3.20%	73,887	0.00%	-
385.00	Industrial M&R Station Equipment	3,045,478	R3	30	2.80%	85,273	R2	37	1.48%	45,185	-1.32%	(40,088)
387.00	Other Equipment	836,930	S5	30	3.00%	25,108	S5	30	3.00%	25,108	0.00%	-
	Total Distribution Plant	392,007,843			2.90%	11,368,741			2.63%	10,322,898	-0.27%	(1,045,843)
	General Plant											
390.00	Structures & Improvements	8,410,478	R1	40	2.50%	208,814	R1	40	2.50%	208,814	0.00%	-
392.00	Transportation Equipment	1,224,133	L2.5	12	8.40%	102,383	L2.5	12	8.40%	102,383	0.00%	-
392.10	Transportation Equipment - Autos & Lt Trucks	128,095	L3	8	11.00%	-	L2.5	8	11.00%	-	0.00%	-
392.20	Transportation Equipment - Service Trucks	3,231,812	L3	8	12.10%	390,504	L3	8	12.10%	390,504	0.00%	-
392.30	Transportation Equipment - Heavy Trucks	374,204	L3	13	4.90%	18,406	L3	13	4.90%	18,406	0.00%	-
394.10	Natural Gas Vehicle Equipment	3,661,963	S4	20	4.70%	173,511	S4	20	4.70%	173,511	0.00%	-
396.00	Power Operated Equipment	210,084	SQ	15	6.50%	13,625	SQ	15	6.50%	13,625	0.00%	-
	Total General Plant	17,240,768			5.26%	907,242			5.26%	907,242	0.00%	-
	TOTAL PLANT STUDIED	**409,248,610**			**3.00%**	**12,275,984**			**2.74%**	**11,230,141**	**-0.26%**	**(1,045,843)**

[1] From Company depreciation study; plant balances as of the study date
[2] Company Depreciation Study
[3] Rates and Accruals from Rate Development exhibit. (Some unadjusted accounts hard coded to zero to account for rounding differences)
[4] = [3] - [2]

Depreciation Rate Development

		[1]	[2]		[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
			Iowa Curve							Service Life		Net Salvage		Total	
Account No.	Description	Original Cost	Type	AL	Net Salvage	Depreciable Base	Book Reserve	Future Accruals	Remaining Life	Accrual	Rate	Accrual	Rate	Accrual	Rate
	Distribution Plant														
375.00	Structures & Improvements	-	R5	32	0.0%	-	(80,099)	80,099							**3.10%**
376.10	Distribution Mains - Steel	109,201,912	S3	55	-50.0%	163,802,868	70,680,741	93,122,127	34.0	1,131,577	1.04%	1,598,471	1.46%	2,730,048	**2.50%**
376.20	Distribution Mains - Plastic	150,016,423	S3	59	-40.0%	210,022,992	40,242,440	169,780,552	47.5	2,310,545	1.54%	1,263,030	0.84%	3,573,575	**2.38%**
378.00	M&R Station Equipment - General	3,009,723	S3	30	-5.0%	3,160,209	146,541	3,013,668	28.3	101,173	3.36%	4,167	0.14%	105,340	**3.50%**
379.00	M&R Station Equipment - City Gate	10,001,911	R0.5	39	-5.0%	10,502,006	4,685,120	5,816,886	28.2	188,739	1.89%	17,753	0.18%	206,492	**2.06%**
380.10	Services - Steel	14,597,872	S6	45	-80.0%	26,276,169	22,559,287	3,716,882	16.7	-477,502	-3.27%	700,429	4.80%	222,927	**1.53%**
380.20	Services - Plastic	61,702,824	R2.5	54	-45.0%	89,469,095	21,210,271	68,258,824	43.5	931,506	1.51%	638,746	1.04%	1,570,251	**2.54%**
381.00	Meters	19,544,112	R1.5	20	-5.0%	20,521,318	3,486,513	17,034,805	14.4	1,118,789	5.72%	73,402	0.38%	1,192,191	**6.10%**
382.00	Meter Installations	7,163,196	S3	34	-20.0%	8,595,836	3,023,561	5,572,275	21.8	190,066	2.65%	65,778	0.92%	255,844	**3.57%**
382.10	Meter Installations - ERTs	4,694,672	R1.5	20	0.0%	4,694,672	2,821,080	1,873,592	13.0	144,267	3.07%	1,267	0.03%	145,535	**3.10%**
383.00	House Regulators	5,883,813	S3	30	-5.0%	6,178,003	2,643,921	3,534,082	19.8	163,865	2.79%	12,649	0.21%	176,514	**3.00%**
384.00	House Regulator Installations	2,308,976	S3	30	0.0%	2,308,976	1,151,145	1,157,832	15.8	73,379	3.18%	508	0.02%	73,887	**3.20%**
385.00	Industrial M&R Station Equipment	3,045,478	R2	37	0.0%	3,045,478	2,149,455	896,023	19.8	45,185	1.48%	-	0.00%	45,185	**1.48%**
387.00	Other Equipment	836,930	S5	30	0.0%	836,930	332,635	504,296	20.0	25,209	3.01%	(101)	-0.01%	25,108	**3.00%**
	Total Distribution Plant	392,007,843				549,414,553	175,052,610	374,361,943	36.3	5,946,799	1.52%	4,376,100	1.12%	10,322,898	**2.63%**
	General Plant														
390.00	Structures & Improvements	8,410,478	R1	40	0.0%	8,410,478	578,148	7,832,329	37.5	208,814	2.48%	-	0.02%	208,814	**2.50%**
392.00	Transportation Equipment	1,224,133	L2.5	12	12.0%	1,077,237	18,870	1,058,366	10.3	116,593	9.52%	(14,210)	-1.12%	102,383	**8.40%**
392.10	Transportation Equipment - Autos & Lt Trucks	128,095	L3	8	12.0%	112,724	149,007	(36,283)	7.2	-2,917	-2.28%	2,917	13.28%	-	**11.00%**
392.20	Transportation Equipment - Service Trucks	3,231,812	L3	8	12.0%	2,843,994	629,930	2,214,065	5.7	458,905	14.20%	(68,401)	-2.10%	390,504	**12.10%**
392.30	Transportation Equipment - Heavy Trucks	374,204	L3	13	12.0%	329,299	204,897	124,403	6.8	25,050	6.69%	(6,644)	-1.79%	18,406	**4.90%**
394.10	Natural Gas Vehicle Equipment	3,661,963	S4	20	0.0%	3,661,963	401,398	3,260,565	18.8	173,511	4.74%	-	-0.04%	173,511	**4.70%**
396.00	Power Operated Equipment	210,084	SQ	15	10.0%	189,076	48,344	140,732	10.3	15,659	7.45%	(2,034)	-0.95%	13,625	**6.50%**
	Total General Plant	17,240,768				16,624,770	2,030,593	14,594,177	16.1	995,614	5.77%	(88,372)	-0.51%	907,242	**5.26%**
	TOTAL PLANT STUDIED	**409,248,610**				**566,039,323**	**177,083,203**	**388,956,120**	**34.6**	**6,942,413**	**1.70%**	**4,287,728**	**1.05%**	**11,230,141**	**2.74%**

[1] From Company depreciation study; plant balances as of the study date
[2] Selected Iowa curve type and average life through mathematical and visual curve fitting-techniques and professional judgement.
[3] For life span accounts, weighted net salvage considering interim and terminal retirements. For mass accounts, estimated net salvage through historical analysis.
[4] = [1]*(1-[3])
[5] From the Company's property records; any negative book reserve balances were replaced with the Company's redistibuted reserve calculations
[6] = [4] - [5]
[7] Average remaining life based on Iowas Curve in Column [2]
[8] = ([1] - [5]) / [7]
[9] = [8] / [1]
[10] = [12] - [8]
[11] = [13] - [9]
[12] = [6] / [7]. Some unadjusted accruals may be hard coded to match the Company's proposed accrual.
[13] = [12] / [1]. Some unadjusted rates may be hard coded to match the Company's proposed rate.

Account 382 Detailed Curve Comparison

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] FCG S3-30	[5] OPC S3-34	[6] FCG SSD	[7] OPC SSD
0.0	4,460,166	100.00%	100.00%	100.00%	0.0000	0.0000
0.5	4,205,280	100.00%	100.00%	100.00%	0.0000	0.0000
1.5	3,971,827	100.00%	100.00%	100.00%	0.0000	0.0000
2.5	3,730,545	99.98%	100.00%	100.00%	0.0000	0.0000
3.5	3,505,608	98.51%	100.00%	100.00%	0.0002	0.0002
4.5	3,657,037	98.49%	100.00%	100.00%	0.0002	0.0002
5.5	3,630,905	98.00%	99.99%	100.00%	0.0004	0.0004
6.5	3,487,693	97.99%	99.98%	100.00%	0.0004	0.0004
7.5	946,505	95.86%	99.96%	99.99%	0.0017	0.0017
8.5	1,063,029	95.73%	99.90%	99.98%	0.0017	0.0018
9.5	1,221,286	95.20%	99.81%	99.96%	0.0021	0.0023
10.5	1,388,849	94.64%	99.66%	99.92%	0.0025	0.0028
11.5	1,321,761	94.62%	99.42%	99.85%	0.0023	0.0027
12.5	1,391,307	94.50%	99.06%	99.74%	0.0021	0.0027
13.5	1,517,270	94.22%	98.54%	99.57%	0.0019	0.0029
14.5	1,504,027	93.76%	97.82%	99.33%	0.0017	0.0031
15.5	1,456,669	93.54%	96.87%	98.98%	0.0011	0.0030
16.5	1,350,898	93.19%	95.63%	98.50%	0.0006	0.0028
17.5	1,385,963	93.16%	94.06%	97.87%	0.0001	0.0022
18.5	1,401,358	92.81%	92.14%	97.05%	0.0000	0.0018
19.5	1,444,340	92.54%	89.83%	96.02%	0.0007	0.0012
20.5	1,371,532	92.51%	87.12%	94.75%	0.0029	0.0005
21.5	1,200,924	92.51%	83.99%	93.20%	0.0073	0.0000
22.5	1,197,513	92.49%	80.45%	91.37%	0.0145	0.0001
23.5	1,180,799	92.49%	76.53%	89.23%	0.0255	0.0011
24.5	1,318,933	92.49%	72.25%	86.77%	0.0410	0.0033
25.5	1,045,924	92.49%	67.65%	83.99%	0.0617	0.0072
26.5	965,938	92.45%	62.80%	80.89%	0.0879	0.0134
27.5	946,396	92.44%	57.76%	77.49%	0.1203	0.0224
28.5	905,333	92.44%	52.60%	73.80%	0.1587	0.0348
29.5	874,924	92.35%	47.40%	69.85%	0.2020	0.0506
30.5	854,744	92.31%	42.24%	65.68%	0.2507	0.0709
31.5	702,145	92.29%	37.20%	61.34%	0.3035	0.0958
32.5	639,440	92.29%	32.35%	56.86%	0.3593	0.1256
33.5	584,491	92.26%	27.75%	52.29%	0.4162	0.1597
34.5	398,652	92.14%	23.47%	47.71%	0.4715	0.1974
35.5	312,590	92.12%	19.55%	43.14%	0.5267	0.2399
36.5	69,973	91.83%	16.01%	38.66%	0.5749	0.2827
37.5	59,135	91.37%	12.88%	34.32%	0.6160	0.3255
38.5	51,119	86.76%	10.17%	30.15%	0.5866	0.3205
39.5	17,150	56.64%	7.86%	26.20%	0.2380	0.0927
40.5	11,356	37.55%	5.94%	22.51%	0.0999	0.0226
41.5	5,246	17.34%	4.37%	19.11%	0.0168	0.0003
42.5	4,703	15.55%	3.13%	16.01%	0.0154	0.0000
43.5	4,100	13.56%	2.18%	13.23%	0.0130	0.0000
44.5	1,705	5.64%	1.46%	10.77%	0.0017	0.0026
45.5	52,067	5.64%	0.94%	8.63%	0.0022	0.0009

Account 382 Detailed Curve Comparison

[1]	[2]	[3]	[4]	[5]	[6]	[7]
Age (Years)	**Exposures (Dollars)**	**Observed Life Table (OLT)**	**FCG S3-30**	**OPC S3-34**	**FCG SSD**	**OPC SSD**
46.5	51,524	5.58%	0.58%	6.80%	0.0025	0.0001
47.5	40,819	4.42%	0.34%	5.25%	0.0017	0.0001
48.5	40,473	4.38%	0.19%	3.98%	0.0018	0.0000
49.5	40,295	4.36%	0.10%	2.95%	0.0018	0.0002
50.5	40,287	4.36%	0.04%	2.13%	0.0019	0.0005
51.5	40,252	4.36%	0.02%	1.50%	0.0019	0.0008
52.5	40,252	4.36%	0.01%	1.02%	0.0019	0.0011
53.5	40,252	4.36%	0.00%	0.67%	0.0019	0.0014
54.5	40,252	4.36%	0.00%	0.43%	0.0019	0.0015
55.5	40,252	4.36%	0.00%	0.26%	0.0019	0.0017
56.5	40,252	4.36%	0.00%	0.15%	0.0019	0.0018
57.5	0	0.00%	0.00%	0.08%	0.0000	0.0000
Sum of Squared Differences for Relevant OLT				[8]	5.2550	2.1119

[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 the Company's property records. These numbers form the original survivor curve.

[4] The Company's selected Iowa curve to be fitted to the OLT.

[5] My selected Iowa curve to be fitted to the OLT.

[6] = ([4] - [3])^2. This is the squared difference between each point on the Company's curve and the observed survivor curve.

[7] = ([5] - [3])^2. This is the squared difference between each point on my curve and the observed survivor curve.

[9] = Sum of squared differences excluding less than 1% of beginning exposures.

*Below the bold horizontal line represents less than 1% of beginning exposures.

FCG
Gas Division
376.20 Distribution Mains - Plastic
Observed Life Table
Retirement Expr. 1977 TO 2016
Placement Years 1977 TO 2016

Age Interval	$ Surviving At Beginning of Age Interval	$ Retired During The Age Interval	Retirement Ratio	% Surviving At Beginning of Age Interval
0.0 - 0.5	$108,994,709.59	$13,427.30	0.00012	100.00
0.5 - 1.5	$96,416,396.59	$6,069.55	0.00006	99.99
1.5 - 2.5	$86,915,453.65	$110.20	0.00000	99.98
2.5 - 3.5	$77,668,297.29	$7,264.59	0.00009	99.98
3.5 - 4.5	$75,895,807.77	$102,743.14	0.00135	99.97
4.5 - 5.5	$72,880,248.95	$90,509.82	0.00124	99.84
5.5 - 6.5	$69,240,226.87	$73,324.61	0.00106	99.71
6.5 - 7.5	$66,101,699.67	($6,991.39)	-0.00011	99.61
7.5 - 8.5	$62,256,627.36	$0.00	0.00000	99.62
8.5 - 9.5	$56,400,667.27	$596.34	0.00001	99.62
9.5 - 10.5	$52,237,232.44	$10,168.45	0.00019	99.62
10.5 - 11.5	$47,904,095.86	$17,272.42	0.00036	99.60
11.5 - 12.5	$47,252,133.31	$107,692.68	0.00228	99.56
12.5 - 13.5	$46,206,999.91	$5,624.22	0.00012	99.33
13.5 - 14.5	$43,539,133.53	$190,241.69	0.00437	99.32
14.5 - 15.5	$39,400,097.13	$12,523.32	0.00032	98.89
15.5 - 16.5	$36,939,322.12	$8,820.65	0.00024	98.86
16.5 - 17.5	$34,430,056.00	$1,269.23	0.00004	98.83
17.5 - 18.5	$32,247,629.38	$10,363.54	0.00032	98.83
18.5 - 19.5	$28,768,088.46	$0.00	0.00000	98.80
19.5 - 20.5	$27,335,625.57	$12,837.24	0.00047	98.80
20.5 - 21.5	$23,961,038.37	$67,770.82	0.00283	98.75
21.5 - 22.5	$20,860,835.26	$12,820.85	0.00061	98.47
22.5 - 23.5	$16,487,223.33	$0.00	0.00000	98.41
23.5 - 24.5	$13,699,682.32	$231.69	0.00002	98.41
24.5 - 25.5	$11,442,821.17	$60,683.20	0.00530	98.41
25.5 - 26.5	$8,984,957.72	$13,623.31	0.00152	97.89
26.5 - 27.5	$6,282,315.91	$24,513.67	0.00390	97.74
27.5 - 28.5	$4,163,660.01	$1,644.26	0.00039	97.36
28.5 - 29.5	$2,372,041.09	$44,645.97	0.01882	97.32
29.5 - 30.5	$554,983.48	$12,497.16	0.02252	95.49
30.5 - 31.5	$521,050.44	$6,066.27	0.01164	93.34
31.5 - 32.5	$471,269.61	$3,310.05	0.00702	92.25
32.5 - 33.5	$467,959.56	$0.00	0.00000	91.60
33.5 - 34.5	$467,959.56	$92,780.97	0.19827	91.60
34.5 - 35.5	$372,438.00	$3,209.73	0.00862	73.44
35.5 - 36.5	$369,228.27	$31,525.07	0.08538	72.81

FCG
Gas Division
376.20 Distribution Mains - Plastic

Observed Life Table
Retirement Expr. 1977 TO 2016
Placement Years 1977 TO 2016

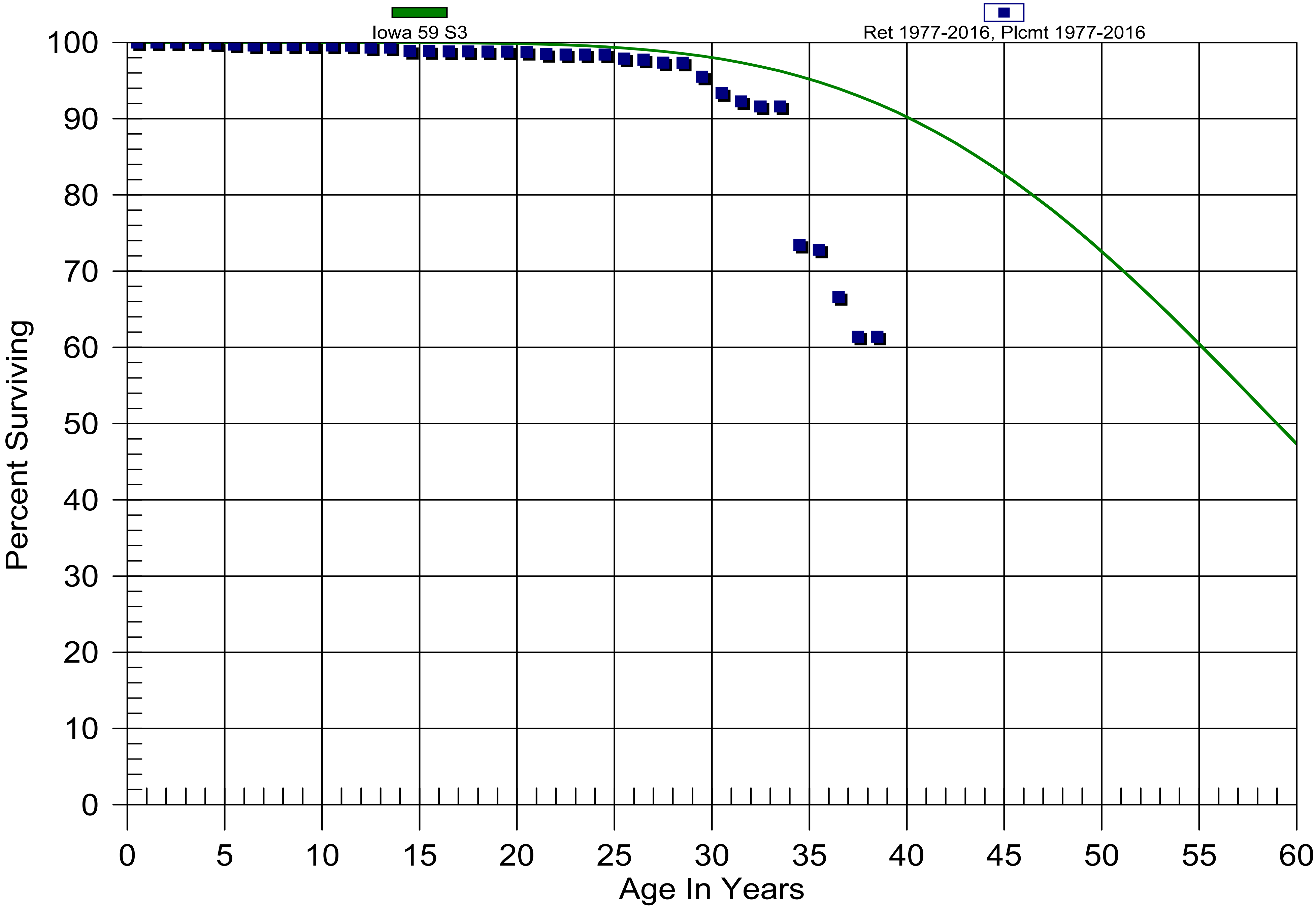
Age Interval	$ Surviving At Beginning of Age Interval	$ Retired During The Age Interval	Retirement Ratio	% Surviving At Beginning of Age Interval
36.5 - 37.5	$336,716.75	$26,248.42	0.07795	66.59
37.5 - 38.5	$181,510.37	$0.00	0.00000	61.40

FCG

Gas Division

376.20 Distribution Mains - Plastic

Original And Smooth Survivor Curves



FCG
Gas Division
379.00 Meas. & Reg. - City Gate

Observed Life Table
Retirement Expr. 1966 TO 2016
Placement Years 1959 TO 2016

Age Interval	$ Surviving At Beginning of Age Interval	$ Retired During The Age Interval	Retirement Ratio	% Surviving At Beginning of Age Interval
0.0 - 0.5	$6,939,371.03	$0.00	0.00000	100.00
0.5 - 1.5	$6,934,552.44	$0.00	0.00000	100.00
1.5 - 2.5	$6,727,779.80	$0.00	0.00000	100.00
2.5 - 3.5	$6,306,028.16	$0.00	0.00000	100.00
3.5 - 4.5	$6,309,747.71	$0.00	0.00000	100.00
4.5 - 5.5	$6,311,598.47	$0.00	0.00000	100.00
5.5 - 6.5	$6,299,681.02	$0.00	0.00000	100.00
6.5 - 7.5	$6,319,203.36	$0.00	0.00000	100.00
7.5 - 8.5	$6,080,940.33	$0.00	0.00000	100.00
8.5 - 9.5	$6,047,369.05	$0.00	0.00000	100.00
9.5 - 10.5	$6,047,369.05	$0.00	0.00000	100.00
10.5 - 11.5	$6,047,369.05	$0.00	0.00000	100.00
11.5 - 12.5	$6,047,369.05	$0.00	0.00000	100.00
12.5 - 13.5	$5,420,208.49	$0.00	0.00000	100.00
13.5 - 14.5	$5,100,411.73	$0.00	0.00000	100.00
14.5 - 15.5	$4,846,996.15	$0.00	0.00000	100.00
15.5 - 16.5	$4,760,457.73	$0.00	0.00000	100.00
16.5 - 17.5	$4,448,990.70	$0.00	0.00000	100.00
17.5 - 18.5	$4,109,001.75	$0.00	0.00000	100.00
18.5 - 19.5	$3,511,756.91	$0.00	0.00000	100.00
19.5 - 20.5	$2,218,155.52	$0.00	0.00000	100.00
20.5 - 21.5	$2,155,002.17	$0.00	0.00000	100.00
21.5 - 22.5	$1,957,864.96	$0.00	0.00000	100.00
22.5 - 23.5	$1,219,756.73	$0.00	0.00000	100.00
23.5 - 24.5	$790,721.41	$0.00	0.00000	100.00
24.5 - 25.5	$710,742.04	$0.00	0.00000	100.00
25.5 - 26.5	$491,377.22	$0.00	0.00000	100.00
26.5 - 27.5	$334,727.21	$0.00	0.00000	100.00
27.5 - 28.5	$334,707.39	$0.00	0.00000	100.00
28.5 - 29.5	$334,707.39	$0.00	0.00000	100.00
29.5 - 30.5	$333,344.51	$0.00	0.00000	100.00
30.5 - 31.5	$333,344.51	$0.00	0.00000	100.00
31.5 - 32.5	$333,344.51	$0.00	0.00000	100.00
32.5 - 33.5	$333,344.51	$0.00	0.00000	100.00
33.5 - 34.5	$333,344.51	$0.00	0.00000	100.00
34.5 - 35.5	$332,894.06	$0.00	0.00000	100.00
35.5 - 36.5	$315,957.01	$0.00	0.00000	100.00

FCG
Gas Division
379.00 Meas. & Reg. - City Gate
Observed Life Table
Retirement Expr. 1966 TO 2016
Placement Years 1959 TO 2016

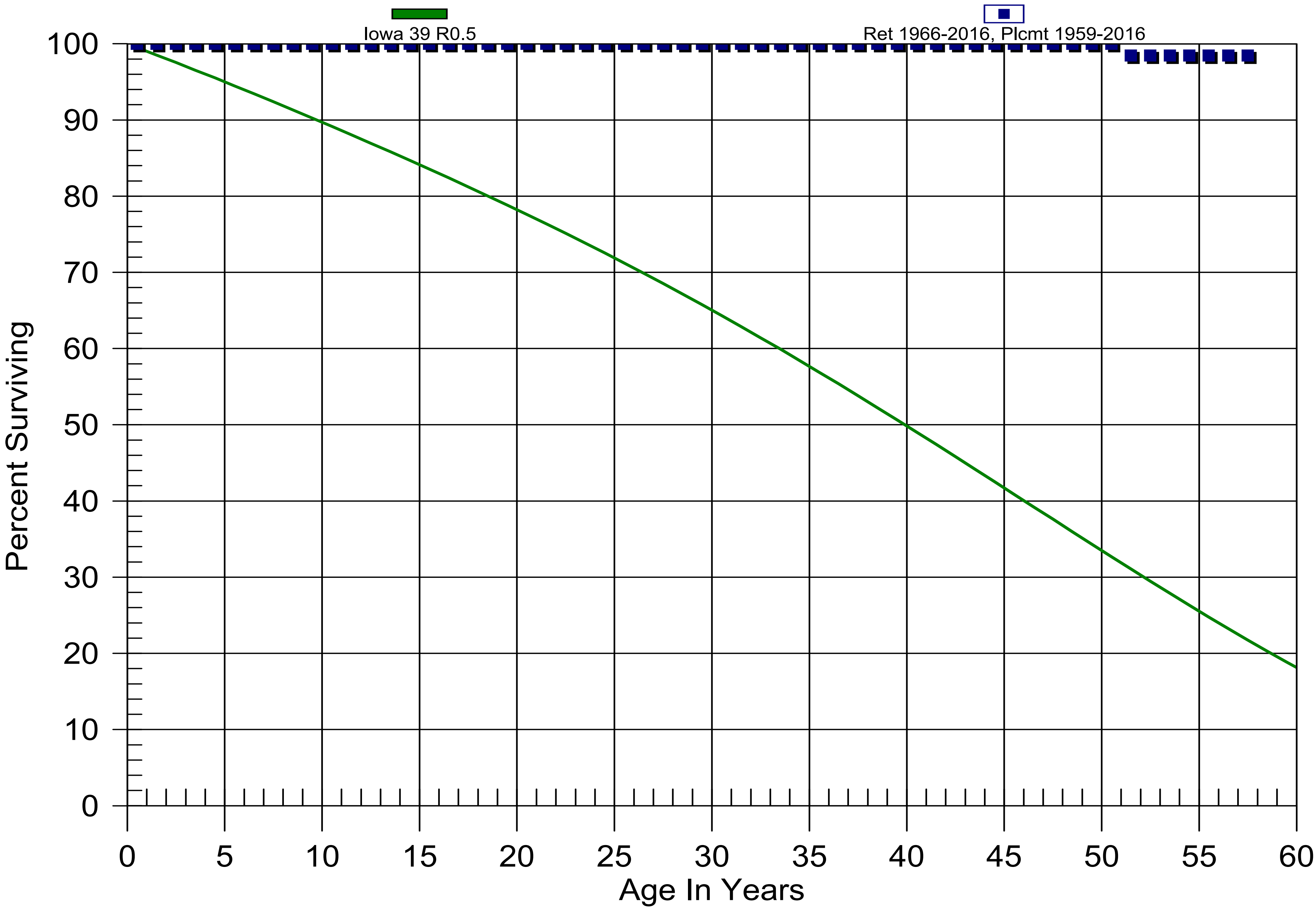
Age Interval	$ Surviving At Beginning of Age Interval	$ Retired During The Age Interval	Retirement Ratio	% Surviving At Beginning of Age Interval
36.5 - 37.5	$314,118.63	$0.00	0.00000	100.00
37.5 - 38.5	$314,118.63	$0.00	0.00000	100.00
38.5 - 39.5	$314,118.63	$0.00	0.00000	100.00
39.5 - 40.5	$313,624.77	$0.00	0.00000	100.00
40.5 - 41.5	$188,920.69	$0.00	0.00000	100.00
41.5 - 42.5	$185,333.41	$0.00	0.00000	100.00
42.5 - 43.5	$154,263.43	$0.00	0.00000	100.00
43.5 - 44.5	$143,545.68	$0.00	0.00000	100.00
44.5 - 45.5	$123,032.38	$0.00	0.00000	100.00
45.5 - 46.5	$102,125.15	$0.00	0.00000	100.00
46.5 - 47.5	$83,786.60	$0.00	0.00000	100.00
47.5 - 48.5	$43,456.62	$0.00	0.00000	100.00
48.5 - 49.5	$43,168.15	$0.00	0.00000	100.00
49.5 - 50.5	$41,614.01	$0.00	0.00000	100.00
50.5 - 51.5	$34,688.07	$532.52	0.01535	100.00
51.5 - 52.5	$27,757.78	$0.00	0.00000	98.46
52.5 - 53.5	$27,757.78	$0.00	0.00000	98.46
53.5 - 54.5	$27,296.78	$0.00	0.00000	98.46
54.5 - 55.5	$23,577.23	$0.00	0.00000	98.46
55.5 - 56.5	$21,726.47	$0.00	0.00000	98.46
56.5 - 57.5	$21,643.06	$0.00	0.00000	98.46

FCG

Gas Division

379.00 Meas. & Reg. - City Gate

Original And Smooth Survivor Curves



FCG
Gas Division
380.20 Services - Plastic

Observed Life Table
Retirement Expr. 1966 TO 2016
Placement Years 1961 TO 2016

Age Interval	$ Surviving At Beginning of Age Interval	$ Retired During The Age Interval	Retirement Ratio	% Surviving At Beginning of Age Interval
0.0 - 0.5	$58,730,017.42	$0.00	0.00000	100.00
0.5 - 1.5	$50,609,004.48	$88,382.25	0.00175	100.00
1.5 - 2.5	$47,986,521.32	$66,445.22	0.00138	99.83
2.5 - 3.5	$43,970,119.16	$29,405.20	0.00067	99.69
3.5 - 4.5	$42,763,008.60	$82,889.91	0.00194	99.62
4.5 - 5.5	$39,106,345.56	$23,992.29	0.00061	99.43
5.5 - 6.5	$38,276,446.61	$10,757.81	0.00028	99.37
6.5 - 7.5	$36,375,303.83	$20,925.10	0.00058	99.34
7.5 - 8.5	$33,835,097.03	$42,576.17	0.00126	99.28
8.5 - 9.5	$31,196,824.82	$62,277.81	0.00200	99.16
9.5 - 10.5	$29,190,308.76	$10,182.34	0.00035	98.96
10.5 - 11.5	$27,767,582.38	$24,866.21	0.00090	98.92
11.5 - 12.5	$27,377,704.46	$20,609.61	0.00075	98.84
12.5 - 13.5	$26,732,478.15	$67,221.89	0.00251	98.76
13.5 - 14.5	$24,619,730.25	$38,961.45	0.00158	98.51
14.5 - 15.5	$22,866,985.83	$33,221.22	0.00145	98.36
15.5 - 16.5	$21,474,595.42	$30,214.08	0.00141	98.21
16.5 - 17.5	$18,489,174.18	$26,733.31	0.00145	98.08
17.5 - 18.5	$17,289,206.56	$34,411.98	0.00199	97.93
18.5 - 19.5	$15,153,411.01	$56,969.24	0.00376	97.74
19.5 - 20.5	$14,234,933.21	$55,713.19	0.00391	97.37
20.5 - 21.5	$13,186,557.37	$77,475.80	0.00588	96.99
21.5 - 22.5	$11,333,107.68	$85,861.64	0.00758	96.42
22.5 - 23.5	$9,180,893.63	$117,556.55	0.01280	95.69
23.5 - 24.5	$7,411,857.87	$68,656.35	0.00926	94.46
24.5 - 25.5	$6,083,286.40	$109,077.60	0.01793	93.59
25.5 - 26.5	$4,862,133.76	$128,733.96	0.02648	91.91
26.5 - 27.5	$3,665,116.49	$154,643.63	0.04219	89.48
27.5 - 28.5	$2,575,935.48	$93,372.42	0.03625	85.70
28.5 - 29.5	$1,365,271.63	$65,815.24	0.04821	82.60
29.5 - 30.5	$521,716.42	$29,602.26	0.05674	78.61
30.5 - 31.5	$469,075.96	$11,654.50	0.02485	74.15
31.5 - 32.5	$304,142.74	$7,543.73	0.02480	72.31
32.5 - 33.5	$185,815.51	$55,454.30	0.29844	70.52
33.5 - 34.5	$103,677.81	$17,115.03	0.16508	49.47
34.5 - 35.5	$86,562.78	$24,844.08	0.28701	41.31
35.5 - 36.5	$61,629.74	$1,753.81	0.02846	29.45

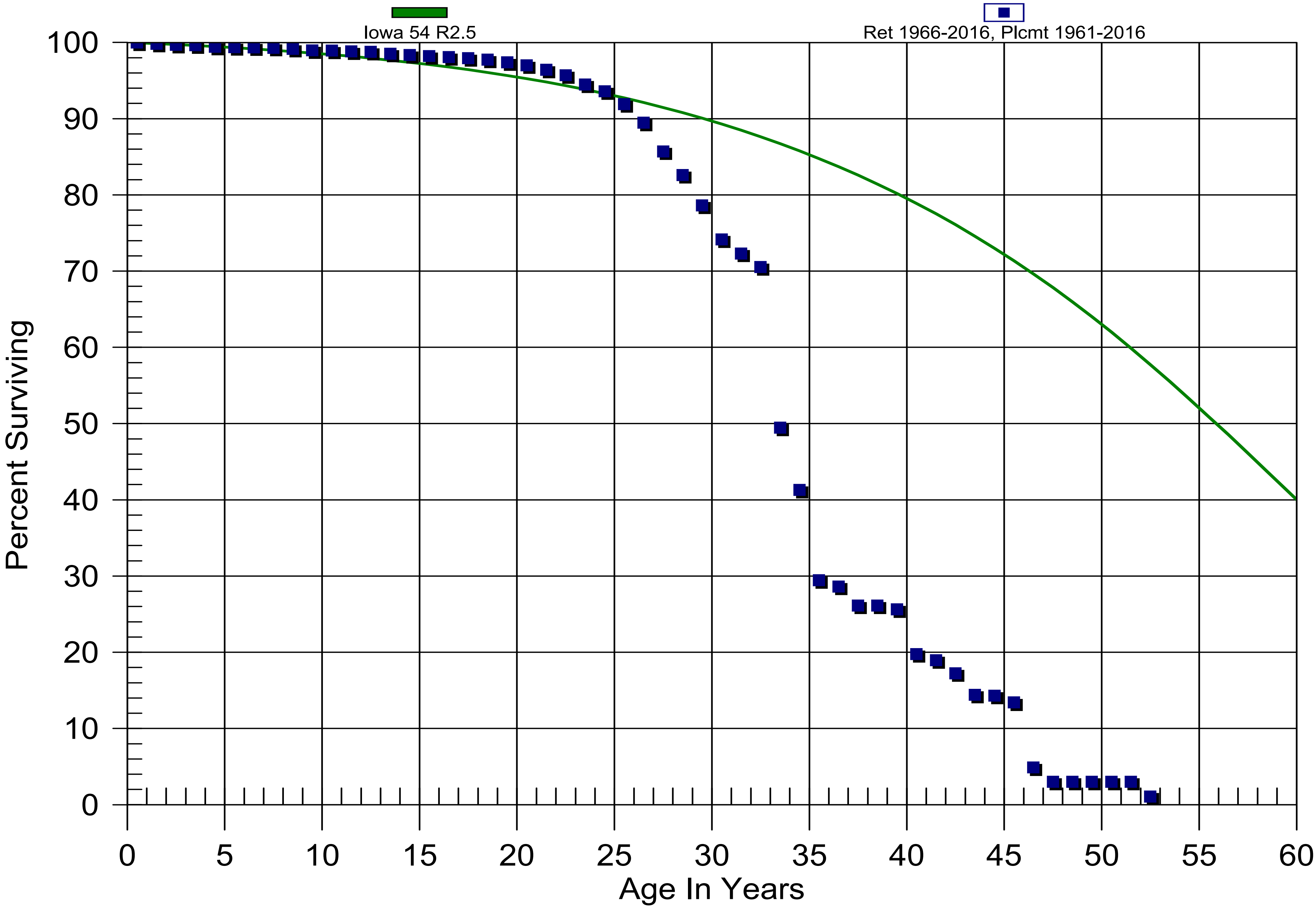
FCG
Gas Division
380.20 Services - Plastic

Observed Life Table
Retirement Expr. 1966 TO 2016
Placement Years 1961 TO 2016

Age Interval	$ Surviving At Beginning of Age Interval	$ Retired During The Age Interval	Retirement Ratio	% Surviving At Beginning of Age Interval
36.5 - 37.5	$59,875.93	$5,202.90	0.08689	28.61
37.5 - 38.5	$313.87	$0.00	0.00000	26.13
38.5 - 39.5	$313.87	$6.09	0.01940	26.13
39.5 - 40.5	$307.78	$70.44	0.22886	25.62
40.5 - 41.5	$237.34	$9.57	0.04032	19.76
41.5 - 42.5	$227.77	$20.79	0.09128	18.96
42.5 - 43.5	$206.98	$33.76	0.16311	17.23
43.5 - 44.5	$173.22	$1.50	0.00866	14.42
44.5 - 45.5	$171.72	$10.47	0.06097	14.29
45.5 - 46.5	$161.25	$102.67	0.63671	13.42
46.5 - 47.5	$58.58	$22.65	0.38665	4.88
47.5 - 48.5	$35.93	$0.00	0.00000	2.99
48.5 - 49.5	$35.93	$0.00	0.00000	2.99
49.5 - 50.5	$35.93	$0.00	0.00000	2.99
50.5 - 51.5	$35.93	$0.00	0.00000	2.99
51.5 - 52.5	$35.93	$23.02	0.64069	2.99

FCG

Gas Division
380.20 Services - Plastic
Original And Smooth Survivor Curves



FCG
Gas Division
382.00 Meter Installations

Observed Life Table

Retirement Expr. 1966 TO 2016
Placement Years 1959 TO 2016

Age Interval	$ Surviving At Beginning of Age Interval	$ Retired During The Age Interval	Retirement Ratio	% Surviving At Beginning of Age Interval
0.0 - 0.5	$7,344,034.71	$0.00	0.00000	100.00
0.5 - 1.5	$7,053,289.31	$0.00	0.00000	100.00
1.5 - 2.5	$6,656,637.13	$519.45	0.00008	100.00
2.5 - 3.5	$6,303,236.64	$54,895.03	0.00871	99.99
3.5 - 4.5	$5,979,954.82	$707.03	0.00012	99.12
4.5 - 5.5	$5,962,659.14	$251.00	0.00004	99.11
5.5 - 6.5	$5,954,446.89	$497.02	0.00008	99.11
6.5 - 7.5	$5,842,714.47	$57,119.24	0.00978	99.10
7.5 - 8.5	$3,213,888.08	$1,275.70	0.00040	98.13
8.5 - 9.5	$3,183,140.05	$5,862.52	0.00184	98.09
9.5 - 10.5	$3,111,372.58	$6,908.49	0.00222	97.91
10.5 - 11.5	$3,087,318.82	$17,919.77	0.00580	97.69
11.5 - 12.5	$2,896,086.26	$20,474.67	0.00707	97.12
12.5 - 13.5	$2,841,752.32	$4,019.62	0.00141	96.44
13.5 - 14.5	$2,674,638.88	$7,332.19	0.00274	96.30
14.5 - 15.5	$2,573,028.64	$2,568.76	0.00100	96.04
15.5 - 16.5	$2,473,207.88	$6,448.20	0.00261	95.94
16.5 - 17.5	$2,319,332.08	$915.71	0.00039	95.69
17.5 - 18.5	$2,318,416.37	$5,069.59	0.00219	95.65
18.5 - 19.5	$2,313,346.78	$4,296.64	0.00186	95.44
19.5 - 20.5	$2,202,952.68	$697.34	0.00032	95.27
20.5 - 21.5	$2,064,417.97	$21.89	0.00001	95.24
21.5 - 22.5	$1,838,808.60	$196.97	0.00011	95.24
22.5 - 23.5	$1,649,014.18	$22.34	0.00001	95.23
23.5 - 24.5	$1,544,326.55	$53.63	0.00003	95.22
24.5 - 25.5	$1,439,460.75	$26.34	0.00002	95.22
25.5 - 26.5	$1,155,461.11	$402.89	0.00035	95.22
26.5 - 27.5	$1,067,451.12	$63.63	0.00006	95.19
27.5 - 28.5	$1,013,908.03	$0.00	0.00000	95.18
28.5 - 29.5	$967,101.01	$916.54	0.00095	95.18
29.5 - 30.5	$930,580.53	$382.35	0.00041	95.09
30.5 - 31.5	$909,809.62	$217.46	0.00024	95.05
31.5 - 32.5	$756,608.16	$3.88	0.00001	95.03
32.5 - 33.5	$691,508.52	$159.02	0.00023	95.03
33.5 - 34.5	$636,559.12	$768.55	0.00121	95.01
34.5 - 35.5	$450,175.93	$93.27	0.00021	94.89
35.5 - 36.5	$363,129.12	$999.68	0.00275	94.87

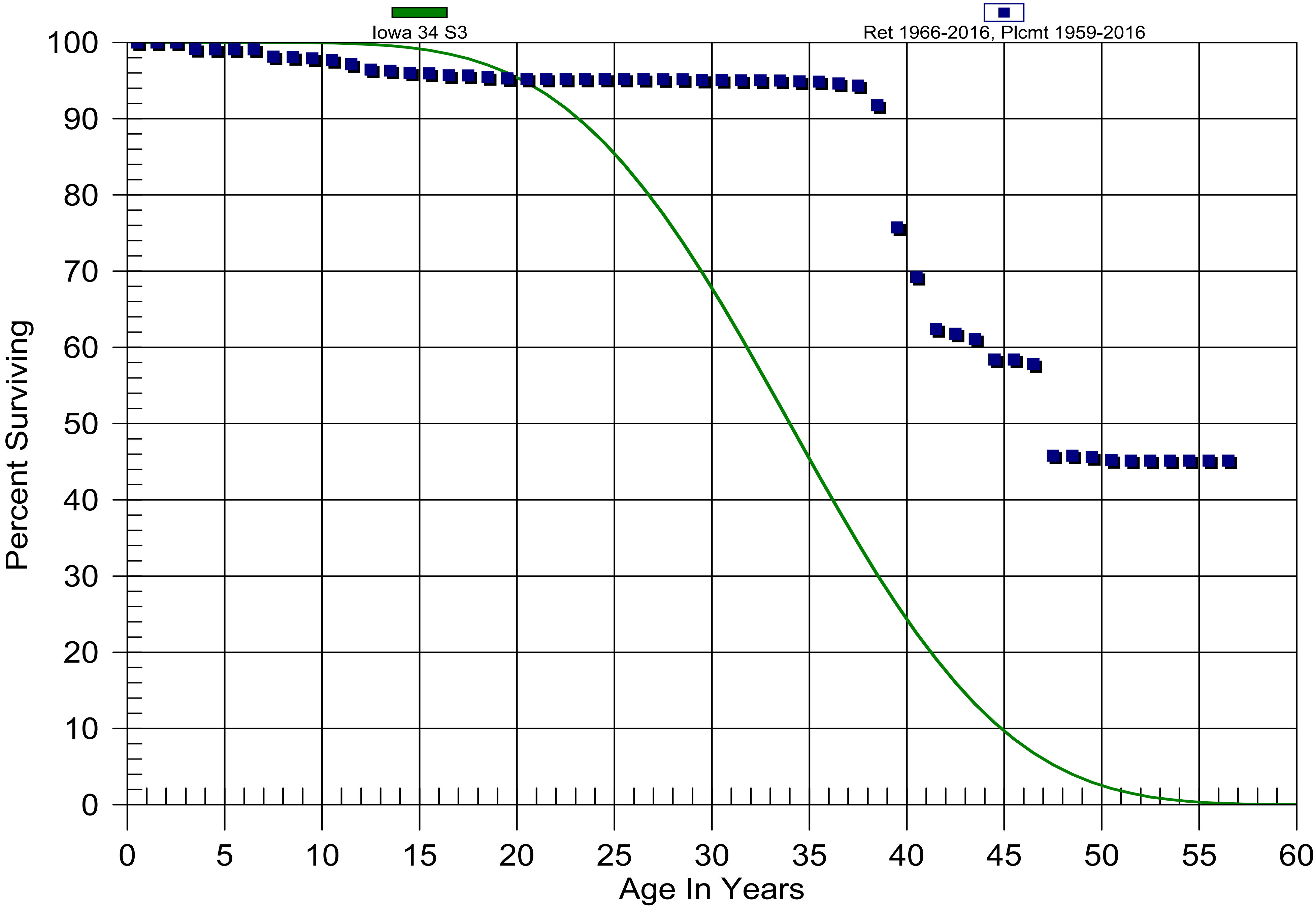
FCG
Gas Division
382.00 Meter Installations

Observed Life Table
Retirement Expr. 1966 TO 2016
Placement Years 1959 TO 2016

Age Interval	*$ Surviving At Beginning of Age Interval*	*$ Retired During The Age Interval*	*Retirement Ratio*	*% Surviving At Beginning of Age Interval*
36.5 - 37.5	$120,511.82	$347.18	0.00288	94.61
37.5 - 38.5	$109,497.08	$2,982.99	0.02724	94.34
38.5 - 39.5	$101,480.84	$17,746.19	0.17487	91.77
39.5 - 40.5	$67,511.45	$5,781.64	0.08564	75.72
40.5 - 41.5	$61,718.14	$6,110.45	0.09901	69.24
41.5 - 42.5	$55,607.69	$543.39	0.00977	62.38
42.5 - 43.5	$55,064.30	$602.31	0.01094	61.77
43.5 - 44.5	$54,461.99	$2,395.33	0.04398	61.10
44.5 - 45.5	$52,066.66	$0.00	0.00000	58.41
45.5 - 46.5	$52,066.66	$542.79	0.01042	58.41
46.5 - 47.5	$51,523.87	$10,705.18	0.20777	57.80
47.5 - 48.5	$40,818.69	$0.00	0.00000	45.79
48.5 - 49.5	$40,818.69	$177.52	0.00435	45.79
49.5 - 50.5	$40,641.17	$354.50	0.00872	45.59
50.5 - 51.5	$40,286.67	$35.05	0.00087	45.19
51.5 - 52.5	$40,251.62	$0.00	0.00000	45.15
52.5 - 53.5	$40,251.62	$0.00	0.00000	45.15
53.5 - 54.5	$40,251.62	$0.00	0.00000	45.15
54.5 - 55.5	$40,251.62	$0.00	0.00000	45.15
55.5 - 56.5	$40,251.62	$0.00	0.00000	45.15

FCG

Gas Division
382.00 Meter Installations
Original And Smooth Survivor Curves



FCG
Gas Division
385.00 Ind. Meas. & Reg. Sta. Equip

Observed Life Table

Retirement Expr. 1970 TO 2016
Placement Years 1970 TO 2012

Age Interval	$ Surviving At Beginning of Age Interval	$ Retired During The Age Interval	Retirement Ratio	% Surviving At Beginning of Age Interval
0.0 - 0.5	$3,047,920.49	$0.00	0.00000	100.00
0.5 - 1.5	$3,047,920.49	$0.00	0.00000	100.00
1.5 - 2.5	$3,047,920.49	$0.00	0.00000	100.00
2.5 - 3.5	$3,047,920.49	$0.00	0.00000	100.00
3.5 - 4.5	$3,047,920.49	$0.00	0.00000	100.00
4.5 - 5.5	$3,047,644.32	$0.00	0.00000	100.00
5.5 - 6.5	$3,042,013.19	$0.00	0.00000	100.00
6.5 - 7.5	$3,033,941.41	$0.00	0.00000	100.00
7.5 - 8.5	$2,920,906.28	$0.00	0.00000	100.00
8.5 - 9.5	$2,785,230.72	$0.00	0.00000	100.00
9.5 - 10.5	$2,785,230.72	$0.00	0.00000	100.00
10.5 - 11.5	$2,785,230.72	$0.00	0.00000	100.00
11.5 - 12.5	$2,785,230.72	$0.00	0.00000	100.00
12.5 - 13.5	$2,768,315.14	$0.00	0.00000	100.00
13.5 - 14.5	$2,734,921.26	$0.00	0.00000	100.00
14.5 - 15.5	$2,725,295.76	$0.00	0.00000	100.00
15.5 - 16.5	$2,707,351.04	$0.00	0.00000	100.00
16.5 - 17.5	$2,429,349.74	$0.00	0.00000	100.00
17.5 - 18.5	$2,201,871.78	$0.00	0.00000	100.00
18.5 - 19.5	$2,174,653.67	$0.00	0.00000	100.00
19.5 - 20.5	$1,538,184.79	$0.00	0.00000	100.00
20.5 - 21.5	$1,521,589.74	$0.00	0.00000	100.00
21.5 - 22.5	$1,419,555.89	$0.00	0.00000	100.00
22.5 - 23.5	$1,244,658.05	$0.00	0.00000	100.00
23.5 - 24.5	$1,099,381.54	$0.00	0.00000	100.00
24.5 - 25.5	$856,294.58	$0.00	0.00000	100.00
25.5 - 26.5	$715,144.77	$0.00	0.00000	100.00
26.5 - 27.5	$493,674.21	$0.00	0.00000	100.00
27.5 - 28.5	$430,364.04	$0.00	0.00000	100.00
28.5 - 29.5	$311,531.87	$0.00	0.00000	100.00
29.5 - 30.5	$210,012.28	$0.00	0.00000	100.00
30.5 - 31.5	$153,595.03	$0.00	0.00000	100.00
31.5 - 32.5	$108,838.17	$0.00	0.00000	100.00
32.5 - 33.5	$79,111.89	$0.00	0.00000	100.00
33.5 - 34.5	$38,388.77	$0.00	0.00000	100.00
34.5 - 35.5	$35,637.81	$0.00	0.00000	100.00
35.5 - 36.5	$17,893.92	$0.00	0.00000	100.00

FCG
Gas Division
385.00 Ind. Meas. & Reg. Sta. Equip

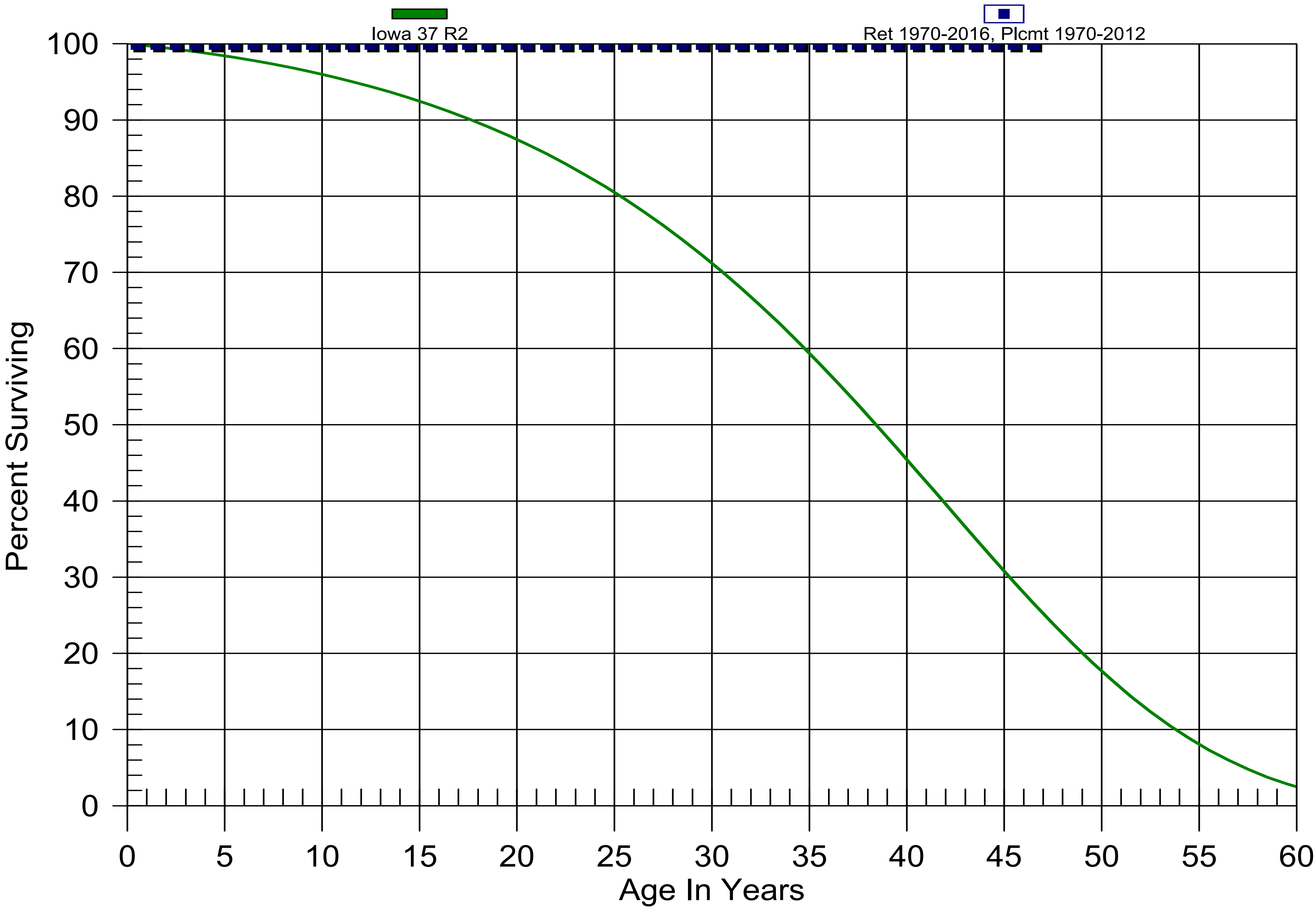
Observed Life Table

Retirement Expr. 1970 TO 2016
Placement Years 1970 TO 2012

Age Interval	$ Surviving At Beginning of Age Interval	$ Retired During The Age Interval	Retirement Ratio	% Surviving At Beginning of Age Interval
36.5 - 37.5	$15,431.07	$0.00	0.00000	100.00
37.5 - 38.5	$9,035.03	$0.00	0.00000	100.00
38.5 - 39.5	$7,298.09	$0.00	0.00000	100.00
39.5 - 40.5	$7,298.09	$0.00	0.00000	100.00
40.5 - 41.5	$7,298.09	$0.00	0.00000	100.00
41.5 - 42.5	$7,298.09	$0.00	0.00000	100.00
42.5 - 43.5	$7,298.09	$0.00	0.00000	100.00
43.5 - 44.5	$7,298.09	$0.00	0.00000	100.00
44.5 - 45.5	$7,298.09	$0.00	0.00000	100.00
45.5 - 46.5	$7,298.09	$0.00	0.00000	100.00

FCG

Gas Division
385.00 Ind. Meas. & Reg. Sta. Equip
Original And Smooth Survivor Curves



FCG
Gas Division
376.20 Distribution Mains - Plastic

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2016
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 59 *Survivor Curve:* S3

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1978	181,510.37	59.00	3,076.44	22.79	70,125.20
1979	128,957.96	59.00	2,185.72	23.53	51,431.30
1980	986.45	59.00	16.72	24.29	406.15
1982	2,740.59	59.00	46.45	25.87	1,201.60
1985	43,714.56	59.00	740.92	28.37	21,016.56
1986	21,435.88	59.00	363.32	29.23	10,619.45
1987	1,772,411.64	59.00	30,040.83	30.11	904,573.85
1988	1,789,974.66	59.00	30,338.51	31.01	940,727.93
1989	2,094,142.23	59.00	35,493.88	31.91	1,132,783.13
1990	2,689,018.50	59.00	45,576.52	32.84	1,496,635.61
1991	2,397,180.25	59.00	40,630.11	33.77	1,372,147.44
1992	2,256,629.46	59.00	38,247.90	34.71	1,327,723.00
1993	2,787,541.01	59.00	47,246.39	35.67	1,685,171.12
1994	4,360,791.08	59.00	73,911.60	36.63	2,707,351.27
1995	3,032,432.29	59.00	51,397.08	37.60	1,932,445.19
1996	3,361,749.96	59.00	56,978.73	38.57	2,197,819.91
1997	1,432,462.89	59.00	24,279.00	39.55	960,315.04
1998	3,469,177.38	59.00	58,799.53	40.54	2,383,629.81
1999	2,181,157.39	59.00	36,968.71	41.53	1,535,174.56
2000	2,500,445.47	59.00	42,380.37	42.52	1,801,931.48
2001	2,448,251.69	59.00	41,495.73	43.51	1,805,563.21
2002	3,948,794.71	59.00	66,928.62	44.51	2,978,824.53
2003	2,662,242.16	59.00	45,122.68	45.50	2,053,294.06
2004	937,440.72	59.00	15,888.80	46.50	738,874.38
2005	634,690.13	59.00	10,757.44	47.50	510,996.13
2006	4,322,968.13	59.00	73,270.54	48.50	3,553,684.74
2007	4,162,838.49	59.00	70,556.48	49.50	3,492,579.84

FCG

Gas Division

376.20 Distribution Mains - Plastic

Original Cost Of Utility Plant In Service

And Development Of Composite Remaining Life as of December 31, 2016

Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 59 *Survivor Curve:* S3

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
2008	5,855,960.09	59.00	99,253.41	50.50	5,012,323.80
2009	3,852,063.70	59.00	65,289.12	51.50	3,362,400.30
2010	3,065,202.59	59.00	51,952.51	52.50	2,727,512.63
2011	3,549,512.26	59.00	60,161.14	53.50	3,218,626.47
2012	2,913,097.01	59.00	49,374.45	54.50	2,690,912.30
2013	1,765,224.93	59.00	29,919.02	55.50	1,660,508.34
2014	9,247,046.16	59.00	156,729.36	56.50	8,855,222.75
2015	9,494,873.39	59.00	160,929.82	57.50	9,253,478.66
2016	12,564,885.70	59.00	212,963.85	58.50	12,458,403.78
Total	107,929,551.88	59.00	1,829,311.72	47.51	86,906,435.52

Composite Average Remaining Life ... 47.51 Years

FCG
Gas Division
379.00 Meas. & Reg. - City Gate

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2016
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 39 **Survivor Curve:** R0.5

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1959	21,643.06	39.00	554.93	8.84	4,907.32
1960	83.41	39.00	2.14	9.24	19.77
1961	1,850.76	39.00	47.45	9.64	457.58
1962	3,719.55	39.00	95.37	10.05	958.13
1963	461.00	39.00	11.82	10.45	123.55
1965	6,397.77	39.00	164.04	11.28	1,849.59
1966	6,925.94	39.00	177.58	11.69	2,076.35
1967	1,554.14	39.00	39.85	12.11	482.71
1968	288.47	39.00	7.40	12.54	92.75
1969	40,329.98	39.00	1,034.07	12.97	13,411.75
1970	18,338.55	39.00	470.20	13.41	6,303.15
1971	20,907.23	39.00	536.06	13.85	7,422.09
1972	20,513.30	39.00	525.96	14.29	7,516.62
1973	10,717.75	39.00	274.80	14.74	4,051.16
1974	31,069.98	39.00	796.64	15.20	12,107.75
1975	3,587.28	39.00	91.98	15.66	1,440.45
1976	124,704.08	39.00	3,197.43	16.13	51,569.48
1977	493.86	39.00	12.66	16.60	210.23
1980	1,838.38	39.00	47.14	18.06	851.20
1981	16,937.05	39.00	434.27	18.56	8,058.19
1982	450.45	39.00	11.55	19.06	220.13
1987	1,362.88	39.00	34.94	21.66	757.01
1989	19.82	39.00	0.51	22.74	11.56
1990	156,650.01	39.00	4,016.53	23.29	93,558.03
1991	219,364.82	39.00	5,624.55	23.85	134,128.29
1992	79,979.37	39.00	2,050.68	24.41	50,047.13
1993	429,035.32	39.00	11,000.53	24.97	274,664.69

FCG
Gas Division
379.00 Meas. & Reg. - City Gate

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2016
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 39 **Survivor Curve:** R0.5

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1994	738,108.23	39.00	18,925.20	25.54	483,262.87
1995	197,137.21	39.00	5,054.63	26.11	131,962.09
1996	63,153.35	39.00	1,619.26	26.68	43,205.50
1997	1,293,601.39	39.00	33,168.13	27.26	904,213.07
1998	597,244.84	39.00	15,313.45	27.84	426,386.00
1999	339,988.95	39.00	8,717.37	28.43	247,826.43
2000	311,467.03	39.00	7,986.06	29.02	231,733.49
2001	86,538.42	39.00	2,218.86	29.61	65,695.01
2002	253,415.58	39.00	6,497.61	30.20	196,231.23
2003	319,796.76	39.00	8,199.64	30.80	252,508.01
2004	627,160.56	39.00	16,080.49	31.39	504,794.83
2008	33,571.28	39.00	860.77	33.79	29,089.11
2009	238,263.03	39.00	6,109.10	34.40	210,148.63
2010	2,653.24	39.00	68.03	35.01	2,381.43
2011	12,000.86	39.00	307.70	35.61	10,958.85
2014	422,212.64	39.00	10,825.59	37.45	405,460.78
2015	206,772.64	39.00	5,301.68	38.07	201,840.68
2016	11,216.36	39.00	287.59	38.69	11,127.04
Total	6,973,526.58	39.00	178,802.25	28.17	5,036,121.69

Composite Average Remaining Life ... 28.17 Years

FCG
Gas Division
380.20 Services - Plastic

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2016
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 54 **Survivor Curve:** R2.5

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1979	54,359.16	54.00	1,006.65	22.50	22,650.95
1981	88.96	54.00	1.65	23.90	39.37
1983	26,683.40	54.00	494.14	25.34	12,519.50
1984	110,783.50	54.00	2,051.54	26.07	53,483.98
1985	153,278.72	54.00	2,838.49	26.81	76,109.85
1986	23,038.20	54.00	426.63	27.57	11,760.58
1987	777,739.97	54.00	14,402.56	28.33	407,969.89
1988	1,117,291.43	54.00	20,690.54	29.10	602,036.83
1989	934,537.38	54.00	17,306.21	29.88	517,054.12
1990	1,068,283.31	54.00	19,782.98	30.66	606,641.21
1991	1,112,075.04	54.00	20,593.94	31.46	647,907.08
1992	1,259,915.12	54.00	23,331.72	32.27	752,807.06
1993	1,651,479.21	54.00	30,582.89	33.08	1,011,561.96
1994	2,066,352.41	54.00	38,265.71	33.90	1,297,080.13
1995	1,775,973.89	54.00	32,888.34	34.72	1,142,041.64
1996	992,662.65	54.00	18,382.61	35.56	653,691.38
1997	861,508.56	54.00	15,953.83	36.40	580,767.65
1998	2,101,383.57	54.00	38,914.43	37.25	1,449,669.01
1999	1,173,234.31	54.00	21,726.52	38.11	827,981.94
2000	2,955,207.16	54.00	54,725.95	38.97	2,132,740.70
2001	1,359,169.19	54.00	25,169.75	39.84	1,002,797.34
2002	1,713,782.97	54.00	31,736.66	40.72	1,292,242.62
2003	2,045,526.01	54.00	37,880.04	41.60	1,575,808.54
2004	624,616.70	54.00	11,566.95	42.49	491,457.75
2005	365,011.71	54.00	6,759.46	43.38	293,237.83
2006	1,412,544.04	54.00	26,158.17	44.28	1,158,309.19
2007	1,944,238.25	54.00	36,004.34	45.18	1,626,839.41

FCG

Gas Division

380.20 Services - Plastic

Original Cost Of Utility Plant In Service

And Development Of Composite Remaining Life as of December 31, 2016

Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 54 *Survivor Curve:* R2.5

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
2008	2,595,696.04	54.00	48,068.35	46.09	2,215,673.69
2009	2,519,281.70	54.00	46,653.27	47.01	2,193,109.94
2010	1,890,384.97	54.00	35,007.06	47.93	1,677,809.85
2011	805,906.66	54.00	14,924.17	48.85	729,063.35
2012	3,573,848.49	54.00	66,182.25	49.78	3,294,473.70
2013	1,177,705.36	54.00	21,809.32	50.71	1,105,960.07
2014	3,949,995.54	54.00	73,147.92	51.65	3,777,752.16
2015	2,534,100.91	54.00	46,927.70	52.58	2,467,679.65
2016	8,121,012.94	54.00	150,388.83	53.53	8,049,936.13
Total	56,848,697.43	54.00	1,052,751.57	43.47	45,758,666.06

Composite Average Remaining Life ... *43.47 Years*

FCG
Gas Division
382.00 Meter Installations

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2016
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 34 *Survivor Curve:* S3

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1976	11.67	34.00	0.34	4.63	1.59
1977	16,223.20	34.00	477.15	4.91	2,341.21
1978	5,033.25	34.00	148.04	5.20	769.62
1979	10,667.56	34.00	313.75	5.51	1,727.71
1980	241,617.62	34.00	7,106.40	5.83	41,438.59
1981	86,953.54	34.00	2,557.46	6.17	15,789.12
1982	185,614.64	34.00	5,459.26	6.54	35,680.08
1983	54,790.38	34.00	1,611.48	6.92	11,148.68
1984	65,095.76	34.00	1,914.58	7.32	14,020.26
1985	152,984.00	34.00	4,499.53	7.75	34,877.31
1986	20,388.56	34.00	599.66	8.21	4,920.29
1987	35,603.94	34.00	1,047.18	8.69	9,095.40
1988	46,807.02	34.00	1,376.68	9.19	12,657.87
1989	53,479.46	34.00	1,572.93	9.73	15,309.36
1990	87,607.10	34.00	2,576.68	10.30	26,546.41
1991	283,973.30	34.00	8,352.16	10.90	91,073.55
1992	104,812.17	34.00	3,082.71	11.54	35,570.97
1993	104,665.29	34.00	3,078.39	12.21	37,578.54
1994	189,597.45	34.00	5,576.40	12.91	71,988.66
1995	225,587.48	34.00	6,634.93	13.65	90,538.65
1996	137,837.37	34.00	4,054.04	14.42	58,440.51
1997	106,097.46	34.00	3,120.52	15.22	47,485.97
2000	147,427.60	34.00	4,336.11	17.80	77,177.11
2001	97,252.00	34.00	2,860.35	18.71	53,520.54
2002	94,278.05	34.00	2,772.89	19.64	54,471.17
2003	163,093.82	34.00	4,796.88	20.59	98,790.31
2004	33,859.27	34.00	995.86	21.56	21,470.21

FCG
Gas Division
382.00 Meter Installations

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2016
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 34 **Survivor Curve: S3**

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
2005	173,312.79	34.00	5,097.44	22.54	114,872.74
2006	17,145.27	34.00	504.27	23.52	11,860.40
2007	65,904.95	34.00	1,938.38	24.51	47,510.31
2008	29,472.33	34.00	866.83	25.50	22,108.50
2009	2,571,707.15	34.00	75,638.49	26.50	2,004,576.47
2010	161,597.13	34.00	4,752.86	27.50	130,707.22
2011	7,961.25	34.00	234.15	28.50	6,673.46
2012	16,588.65	34.00	487.90	29.50	14,393.12
2013	268,386.79	34.00	7,893.73	30.50	240,758.79
2014	352,881.04	34.00	10,378.86	31.50	326,933.93
2015	396,652.18	34.00	11,666.25	32.50	379,152.81
2016	290,745.40	34.00	8,551.34	33.50	286,469.73
Total	7,103,713.89	34.00	208,932.88	21.78	4,550,447.18

Composite Average Remaining Life ... 21.78 Years

FCG
Gas Division
385.00 Ind. Meas. & Reg. Sta. Equip

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2016
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 37 *Survivor Curve:* R2

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1970	7,298.09	37.00	197.24	6.41	1,264.50
1978	1,736.94	37.00	46.94	9.54	448.04
1979	6,396.04	37.00	172.86	10.00	1,729.26
1980	2,462.85	37.00	66.56	10.48	697.47
1981	17,743.89	37.00	479.56	10.97	5,260.88
1982	2,750.96	37.00	74.35	11.48	853.40
1983	40,723.12	37.00	1,100.62	12.00	13,208.32
1984	29,726.28	37.00	803.41	12.54	10,075.66
1985	44,756.86	37.00	1,209.64	13.10	15,842.67
1986	56,417.25	37.00	1,524.78	13.67	20,841.11
1987	101,519.59	37.00	2,743.75	14.25	39,109.06
1988	118,832.17	37.00	3,211.66	14.86	47,711.86
1989	63,310.17	37.00	1,711.07	15.47	26,474.25
1990	221,470.56	37.00	5,985.65	16.10	96,380.49
1991	141,149.81	37.00	3,814.83	16.75	63,888.26
1992	243,086.96	37.00	6,569.87	17.41	114,356.67
1993	145,276.51	37.00	3,926.37	18.08	70,977.05
1994	174,897.84	37.00	4,726.94	18.76	88,690.80
1995	102,033.85	37.00	2,757.65	19.46	53,667.09
1996	16,595.05	37.00	448.51	20.17	9,047.22
1997	636,468.88	37.00	17,201.75	20.89	359,401.72
1998	27,218.11	37.00	735.62	21.63	15,910.05
1999	227,477.96	37.00	6,148.01	22.37	137,556.25
2000	278,001.30	37.00	7,513.50	23.13	173,788.91
2001	17,944.72	37.00	484.99	23.90	11,590.60
2002	9,625.50	37.00	260.15	24.68	6,419.79
2003	33,393.88	37.00	902.53	25.47	22,984.38

FCG
Gas Division
385.00 Ind. Meas. & Reg. Sta. Equip

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2016
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: **37** *Survivor Curve:* **R2**

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
2004	16,915.58	37.00	457.17	26.27	12,007.75
2008	135,675.56	37.00	3,666.88	29.56	108,383.47
2009	113,035.13	37.00	3,054.98	30.40	92,881.41
2010	8,071.78	37.00	218.15	31.26	6,818.83
2011	5,631.13	37.00	152.19	32.12	4,888.36
2012	276.17	37.00	7.46	32.99	246.24
Total	3,047,920.49	37.00	82,375.68	19.83	1,633,401.80

Composite Average Remaining Life ... **19.83 Years**