PREPA Ex. 5.0

COMMONWEALTH OF PUERTO RICO
PUERTO RICO ENERGY COMMISSION

IN RE: THE PUERTO RICO ELECTRIC POWER AUTHORITY	**No.** CEPR-AP-2015-0001
INITIAL RATE REVIEW	**SUBJECT:** TESTIMONY IN SUPPORT OF PETITION

Testimony of

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On behalf of the
Puerto Rico Electric Power Authority

May 27, 2016

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I. INTRODUCTION

A. Witness Identification

Q. **Please state your name, title, employer, and business address.**

A. We are Dr. Francis X. Pampush, Lucas D. Porter, and Dan T. Stathos.

Francis X. Pampush, PhD, CFA is a Director at Navigant Consulting, Inc. ("Navigant"), a global business and advisory firm. His business address is 30 S. Wacker Drive, Suite 3100, Chicago, Illinois 60606.

Lucas D. Porter is a Managing Consultant at Navigant. His business address is 685 Third Avenue, 14th Floor, New York, NY 10017.

Dan T. Stathos is an Associate Director at Navigant. His business address is 98 San Jacinto Blvd., Suite 900, Austin, Texas 78701.

Q. **On whose behalf are you testifying?**

A. We are testifying as a panel on behalf of the Puerto Rico Electric Power Authority ("PREPA"), a publicly-owned (public power) electric utility and instrumentality of the Government of the Commonwealth of Puerto Rico (the "Commonwealth").

B. Summary of Testimony

Q. **What is the purpose of your testimony?**

A. We are testifying in support of PREPA's Petition requesting that the Puerto Rico Energy Commission (the "Commission") approve and establish new rates for PREPA. More specifically, our testimony provides the results of our analysis of PREPA's historical and current investments in electric plant in service and its costs of operation to serve its

customers. This analysis focuses on PREPA's financial requirements in order to develop the "Revenue Requirements" for the Effective Rate Year 2017 (defined below) sufficient to allow PREPA to meet its obligations to provide safe, reliable, and reasonably priced electric power and services to its residential, industrial, commercial, and governmental customers. By "Revenue Requirements" we mean, in brief, the applicable costs of providing those services (including costs incurred in order to maintain and acquire the assets necessary provide the services). We provide a more complete definition of that term later in our testimony.

In Section II of our testimony, we describe our approach to the development of Revenue Requirements that provides a reasonable basis for rates to be proposed to the Commission. This includes evaluations using three different methodologies: an evaluation of PREPA's cash needs to meet its obligations, which we found to be the most suitable approach; an evaluation of revenues sufficient to provide a minimum Debt Service Coverage Ratio ("DSCR"); and an evaluation of the revenues required to produce a reasonable return on Rate Base (i.e., the net investments in its system on which it should earn a return of and on that investment) under traditional Accrual Basis (Rate Base/Rate of Return) regulation. The analysis starts with a "test year" of PREPA's Fiscal Year ("FY") 2014 (July 1, 2013, through June 30, 2014) and then reflects known and measureable adjustments through FY 2017 (July 1, 2016, to June 30, 2017), referred to as the Effective Rate Year. FY 2014 is a suitable test year starting point because it is the most recent year for which PREPA has audited financial statements at this time. We conclude based on the Modified Cash Basis approach that PREPA has a revenue

requirement of $3,462,194,772 for FY 2017 (FY 2014 adjusted for known and measureable adjustments through FY 2017).

It should be pointed out that this revenue requirement, and our associated analyses, assume that a proposed restructuring, which is being addressed in a separate proceeding, is approved by the Commission and is implemented. Our revenue requirement includes the revenues proposed to be recovered by PREPA as servicer under the Transition Charges discussed later in our testimony. The overall revenue requirement including revenues to be collected through the Transition Charge shows under-recovery ("revenue deficiency") under existing rates for FY 2017 of $725,521,027. Provided below is a comparison of the revenue requirements and revenue deficiencies under three different approaches that we considered.

Overall Revenue Requirement (including Transition Charge Revenue)

Method	Revenue Requirement	Revenue Deficiency
Modified Cash Basis	$3,462,194,772	$725,521,027
Cash Basis	$3,520,836,180	$784,162,435
Accrual Basis	$3,518,296,631	$781,622,886

If the revenues proposed to be collected by the Transition Charges are removed from the calculation, then the revenue deficiency in each of the approaches is reduced by $503,264,237. Under the Modified Cash Basis Method, which is our recommended method, exclusion of the Transition Charge revenue results in a revenue deficiency of $222,256,790. Below is a table comparing the revenue requirements and deficiencies using the three alternative approaches after subtracting expected transition charge revenues.

Revenue Requirement (excluding Transition Charge Revenue)

Method	Revenue Requirement	Revenue Deficiency
Modified Cash Basis	$2,958,930,536	$222,256,790
Cash Basis	$3,017,571,944	$280,898,199
Accrual Basis	$3,015,032,394	$278,358,649

In Section III of this testimony, we describe the impact on rates and costs of capital from a longer term financial perspective. We describe the results of our financial analysis that forecasts both rates and PREPA's financial condition from PREPA's FY 2017 to FY 2030.

In Section IV, we discuss the financial profile that PREPA should seek to attain as a condition of regaining access to credit markets. This section provides some identifiable metrics that can be tracked for progress. We also use these metrics in our long-term financial model to estimate an approximate date of capital market re-entry.

Q. **Does your testimony comply with Section 2.17(B) of the Commission's rules as you understand it?**

A. Yes. The Commission's Regulation No. 8720, Section 2.17(B), contains language regarding the prudence and reasonableness of costs addressed by a witness. We are testifying in support of PREPA's costs, along with other witnesses. Accordingly, we do state that it is our professional opinion that the costs sought to be incurred through PREPA's proposed rates are reasonable and prudently incurred, for the reasons

established by our testimony and that of the other witnesses directly presenting and supporting the specifics of the revenue requirement. Please see, in particular:

- Direct Testimony of Lisa Donahue, Managing Director and Global Leader of North American Turnaround & Restructuring Services at AlixPartners, LLP ("AlixPartners"), and Chief Restructuring Officer of PREPA, PREPA Exhibit ("Ex.") 2.0;
- Direct Testimony of Sonia Miranda, Director, Directorate of Planning and Environmental, PREPA, and Antonio Perez Sales and Virgilio Sosa, Directors, AlixPartners, LLP, PREPA Ex. 3.0; and
- Direct Testimony of Lawrence Kaufmann, Senior Advisor, Navigant, PREPA Ex. 6.0.

C. Professional Background & Education

Q. **Would each of you please describe your educational background and professional experience?**

A. Yes. My name is Dr. Francis Pampush. I have been involved in the analysis and evaluation of network industries (e.g., electric utilities; telecommunications; cable; wireless; Internet; and oil pipelines) for nearly 30 years. I was awarded a PhD in Economics from the University of North Carolina at Chapel Hill and am also a Chartered Financial Analyst®. My specialties include financial analysis, damages estimations, and cost of capital analysis. I have testified on the topics of revenue requirements, nuclear decommissioning fund returns, and cost of capital at the Federal Energy Regulatory Commission ("FERC"). My resume summarizes my education, professional

qualifications, and experience in detail and is attached as PREPA Ex. 5.01. In general, as to those portions of the testimony that address matters pertaining to the rate of return on investments, Dr. Pampush is the member of the panel responsible for the analysis.

My name is Lucas Porter. I have been an analyst and consultant in the Energy, Power, and Utilities industries for 6 years, with roles including publicly traded equity research, capital raising, transaction advisory services, and financial analysis. I am a Chartered Financial Analyst® and have a Bachelor of Arts in Economics degree from Boston College with minors in Mathematics and Environmental Studies. My resume, which reviews my education, professional qualifications, and experience in detail, is attached as PREPA Ex. 5.02.

My name is Dan Stathos. I have been involved in the electric utility industry for the past 45 years, either as a member of utility staff, as a regulator, or in a consulting role. For the past 19 years, I have provided consulting services to investor-owned utilities and public power and joint action agencies, primarily in the areas of finance and accounting, rates and regulatory matters, operational excellence, and process improvement. Before becoming an Associate Director at Navigant, I served as an executive at a large municipal electric utility, with responsibilities for change management, support services, information technology, materials management, and emergency operations. Prior to that, I spent over 12 years in consulting roles with Ernst & Young, Oracle Systems and Deloitte Haskins + Sells (now Deloitte & Touche), providing financial feasibility, utility accounting and rate and regulatory advice. I have testified before the Texas Public Utilities Commission, the Texas Water Commission, the Georgia Public Service Commission and a number of governmental venues involving public power utilities. I am

a Certified Public Accountant in Texas, though neither I, nor Navigant Consulting provides any attestation of other services considered public accounting in Texas or any other jurisdiction. My educational background includes a Bachelor of Business Administration degree in accounting from University of Texas at Austin. My resume, which reviews my education, professional qualifications, and experience in detail, is attached as PREPA Ex. 5.03.

D. Additional Attachments to Direct Testimony

Q. **In addition to your resumes, are there any additional exhibits to your testimony?**

A. Yes. We are sponsoring a number of exhibits that support this testimony. The following exhibits are provided to support the proposed revenue requirements and analysis.

- PREPA Ex. 5.04: PREPA Revenue Requirements – Known and Measurable Changes
- PREPA Ex. 5.05: Revenue Requirements Approach Results – Restructuring Scenario
- PREPA Ex. 5.06: Modified Cash Basis Debt Service Coverage Ratio Adder
- PREPA Ex. 5.07: PREPA Rate Base Components
- PREPA Ex. 5.08: U.S. Regulated Utility Authorized Rate of Return 2010-2015
- PREPA Ex. 5.09: Puerto Rico General Obligation Bonds Market Yield to Maturity
- PREPA Ex. 5.10: U.S. Regulated Utility Authorized Cost of Debt 2010-2015
- PREPA Ex. 5.11: PREPA Bonds Market Value Yield to Maturity
- PREPA Ex. 5.12: Revenue Requirement by Scenarios
- PREPA Ex. 5.13: Overall Rate by Scenario
- PREPA Ex. 5.14: Debt Service Coverage Ratio by Scenario
- PREPA Ex. 5.15: Equity Balance by Scenario
- PREPA Ex. 5.16: Access to Capital Markets Metrics

- PREPA Ex. 5.17: U.S. Corporate Bond Yield Spreads over U.S. Treasury Bonds by Ratings Class
- PREPA Ex. 5.18: Default Rates by Rating Class (Investment Grade v. Speculative Grade)
- PREPA Ex. 5.19: Summary of Key Credit Metric Results for PREPA's Potential Improved Credit Rating and Re-admittance to the Credit Markets (Based on an Analysis of Fitch Ratings 2015 Study of 85 Public Power Utilities 2010-2014)
- PREPA Ex. 5.20: Number of Public Power Authorities by Ratings Category (Based on Fitch 2015 Public Power Peer Study 2010-2014)
- PREPA Ex. 5.21: Credit Metrics in the 2015 Fitch Ratings Public Power Study
- PREPA Ex. 5.22: Credit Metrics Not Used in This Analysis
- PREPA Ex. 5.23: Credit Metric Averages and Medians by Ratings Class (Fitch 2015 Public Power Peer Study)
- PREPA Ex. 5.24: Correlation Matrix of 2015 Fitch Ratings Public Power Credit Metrics (2010-2015)
- PREPA Ex. 5.25: Basic Structure of a Classification Tree
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- PREPA Ex. 5.31: Full Dataset of 425 Observations Plotted in Terms of the Top 3 Classification Metrics (Based on 1,000 Iterations Using 85 Random Observations per Iteration)
- PREPA Ex. 5.32: Predictions on the 425 Observation Dataset based on the Scenario 2 Classification Tree

- PREPA Ex. 5.33: Test of Statistical Significance (95% Confidence)
- PREPA Ex. 5.34: Measures of Diagnostic Accuracy for the Classification Tree (Scenario 1)
- PREPA Ex. 5.35: R statistical code used in analysis.

Q. **Did you prepare, or have prepared under your supervision, any of the Schedules and other papers submitted to the Commission under its Regulation No. 8720 as support for and attached to PREPA's Petition for new rates?**

A. Yes, we prepared or have prepared under our supervision certain of the Schedules and other papers. (In some instances, other personnel from Navigant or PREPA's restructuring and recovery consultant, AlixPartners , also participated in the supervision or preparation, as noted below.)

Mr. Stathos and Mr. Porter prepared or had prepared under his supervision the following items:

- Schedules A-1 through A-6.
- Schedules B-1 through B-3.
- Schedules C-1 through C-3.
- Schedules E-1 through E-8.
- Schedules F-1 through F-4.
- Schedules L-1 and L-2.

Dr. Pampush and Mr. Porter, in coordination with Millstein & Co., prepared or had prepared under their supervision the following items:

- Schedules D-1 through D-6.

II. REVENUE REQUIREMENTS

A. Overview of the Revenue Requirement Approaches and Results

Q. **Please provide an overview of the results of your analysis of PREPA's Revenue Requirements and the required increase in current rates necessary to return PREPA to financial stability in order to allow it to meet its service obligations.**

A. Based upon our analysis, PREPA's overall rates (1) require an immediate aggregate increase of $725,521,027 or approximately 26.5% overall, including securitized debt, to meet its revenue requirement of $3,462,194,772. This assumes the restructuring of PREPA's bonds and the adoption of transition charges that were proposed in a separate proceeding. Alternatively, without restructuring of PREPA's financial obligations, an increase of $1,025,587,382 to $1,495,673,287 or approximately 36.8% to 42.3% increase in rates. The revenue requirements in the restructuring scenario include the revenues to be collected by PREPA as servicer under the Transition Charges being addressed in a separate proceeding. If Transition Charge revenues are removed from the calculation, then the revenue deficiency is reduced by $503,264,237. Thus, the "after Transition Charges" revenue deficiency in the Restructuring scenario is $222,256,790.

The recommended increase in base rates (assuming debt restructuring), coupled with decreasing costs of fuel and purchased power, allows PREPA rates to become relatively stable going forward, while allowing PREPA to transition out of a negative equity position. The requested increase in base rate revenues provides PREPA with financial stability that may allow it to regain access to capital markets at reasonable rates. Stability and long-term capital cost reductions are long-term benefits to PREPA's customers.

Q. **How did you arrive at this conclusion?**

A. As we will explain below, we started with the book values of FY 2014 shown in column A of PREPA Ex. 5.04. We made adjustments for known and measureable changes through FY 2017 in column B to arrive at the final FY 2017 results are shown in column C.

Q. **Explain the term "Revenue Requirements" in more detail as it is being used in this context.**

A. Revenue Requirements in a utility regulatory context refers to the revenues that a utility requires in order to cover its costs of providing service, including its capital costs. Typically, a Revenue Requirement computation includes all of the utility's operating costs for a selected annual period, referred to as a "Test Year." Operating costs include the operations and maintenance expenses of the utility, the return on its investments incurred to provide service, any income taxes, and taxes other than income taxes paid. PREPA is exempt from income taxes, but mandated by law to provide certain customers such as municipalities and low income customers with electricity at no cost or a subsidized level. The overall goal of a Revenue Requirements analysis is to account for all of the costs required to provide service without double-counting. How these costs are measured and accounted for in the analysis depends upon the Revenue Requirements methodology that is used. We will have more to say about what specific costs are included when we describe the various Revenue Requirements approaches that we considered.

If the Test Year is an historical test year, operating costs typically are adjusted for known and measurable changes, and we do that in our analysis. Such known-and-measureable adjustments can include the elimination of significant one-time costs that occurred in the past but that will not occur in the future; new costs that had not occurred in the past but will occur in the future (e.g., as a result of adopted programs), and adjustments to costs to reflect a more accurate depiction of the level of costs that rates are intended to recover from customers, such as those related to known inflation and/or productivity improvements.

Q. **Why do you compute a Revenue Requirement?**

A. Under cost-of-service regulation, prices (or rates) are based on the costs incurred to create the service that is sold to customers. After the Revenue Requirement is computed, it is compared to the revenues that reasonably would be generated by existing rates during a year. A shortfall of revenues at existing rates relative to the Revenue Requirement indicates the need for an increase in rates, with the difference between the Revenue Requirement and the revenues computed at existing rates being the amount that the rate increase should generate. This cost recovery shortfall commonly is called the "revenue deficiency". For firms subject to income tax, the cost recovery shortfall would then be grossed up for income taxes so that the rate increase actually covers the cost recovery shortfall. However, since PREPA is not subject to income taxes, we do not make this adjustment.

Q. **Please describe your approach to the development of Revenue Requirements for PREPA in this proceeding.**

A. We initially applied two methodologies to develop a reasonable Revenue Requirement for PREPA. After analyzing the results of these two approaches, we performed a third analysis, which we conclude is better aligned with PREPA's current financial condition, has less immediate impact on rates, and therefore is more appropriate for determining overall Revenue Requirements at this time.

Q. **Please provide an overview of your methodologies.**

A. The first methodology is a traditional Accrual Basis approach (Rate Base / Rate of Return) that is used by many regulatory agencies in both the United States and internationally. (As noted earlier, rate base is the net investments in its system on which it should earn a return of and on that investment.) This methodology is primarily applied to investor-owned or publicly-traded utilities, and for reasons we describe later is not suited for PREPA at this time.

The second methodology, Cash Basis, establishes a revenue requirement at a level that is expected to allow PREPA to meet its debt service requirements and maintain a sufficient DSCR to meet PREPA's bond covenants.

This second methodology is more often used by public power agencies such as state and municipally-owned utilities, as well as not-for-profit joint action agencies. PREPA is a public power electric utility, as we noted earlier. However, the Cash Basis approach assumes that a utility has sufficient cash flow to cover its ongoing costs and debt service requirements **and** has access to capital markets to continue to fund its capital expenditure requirements. The latter is a critical point. Discussion of PREPA's access to the capital markets will be discussed in Section III and IV of this testimony.

The third methodology, and the one that we ultimately recommend in this case, focuses on the actual annual cash requirements of the company to meet its operating costs and fund its capital expenditures program. We refer to this as the Modified Cash Basis approach. We implemented the approach by comparing PREPA's annual cash requirements to the results of the traditional Accrual Basis and Cash Basis methodologies to determine whether the revenue generated would be sufficient to meet all of PREPA's spending requirements, including its expected capital expenditure requirements. Because PREPA lacks reasonable access to capital markets, we conclude that the Modified Cash Basis approach provides the only reasonable Revenue Requirements option to PREPA.

Q. **How do the different methodologies for Revenue Requirement compare?**

A. Not precisely, but the overall differences in the Revenue Requirements among the approaches are relatively limited for FY 2017 (FY 2014 as adjusted for known and measureable through FY 2017). As can be seen in PREPA Ex. 5.05, the Total Revenue Requirements in the Restructuring scenario range from $3.462 billion to $3.521 billion in FY 2017.

Q. **What sources of information did you use to conduct your analyses?**

A. Sources of information used in this analysis included FY 2014 PREPA audited statements of financial position and results, supplemented by analyses prepared by PREPA related to staffing changes as part of the current debt restructuring and recovery effort. FY 2014 is the test year starting point, as we noted earlier. As we stated, FY 2014 is a suitable test year starting point because it is the most recent year for which PREPA has audited financial statements at this time. Because a year with complete audited financial

statements requires significant third party scrutiny, we think this represents the most stable and reliable information to start with. Additional information was gathered through an interview and information request process with PREPA, and through discussion with AlixPartners. This process included, among other things, consideration of PREPA's Business Plan dated June 1, 2015, as well as performance improvements and other variances to the Business Plan, and PREPA's fuel and load forecasts. The basis for Rate of Return Assessment (in Section II.D.3) and PREPA's Re-Entry into the Capital Markets (in Section IV) included financial information obtained through SNL's Energy Velocity, Bloomberg, and Fitch Ratings, Inc. ("Fitch" or "Fitch Ratings"), services, all financial information services used widely in the utility sector.

B. Three Approaches to Revenue Requirements as Applied to PREPA

Q. **Please describe your Accrual Basis Approach in more detail.**

A. The Accrual Basis approach has three components: Operating Expenses, Rate Base, and Return on Rate Base. The basic formula is:

$$Revenue\ Requirement = Operating\ Expenses + Depreciation + Rate\ Base \times Rate\ of\ Return$$

Operating Expenses include fuel and purchased power, subsidies, and non-fuel expenses. Non-fuel expenses include labor costs, pension underfunding (catchup), safety upgrade expenditures, and other operations and maintenance expenses. We also include operating cost performance improvements as estimated and expected in the business plan, bad debt expenses, and an assessment for the Energy Commission. We add depreciation expense to the operating expenses. We do not add interest expense, because this is accounted for in the return computation.

The Rate Base involves identifying all utility investments (net of accumulated depreciation) that are "used and useful" for the provision of electric power and service as of a specific date, as well as adding any working capital for operations (e.g., inventories) and other required investments.

The Rate of Return typically is based on the utility's cost of capital and is expressed as a percentage. The Rate of Return is applied to (i.e., multiplied by) the Rate Base to generate the "Return on" portion of the Revenue Requirement in dollar terms.

Q. **Please describe the Cash Basis approach for computing a Revenue Requirement.**

A. The formula for the Cash Basis approach is:

$$\begin{aligned} &Revenue\ Requirement = Operating\ Expenses + Depreciation + \\ &Legacy\ Debt\ Service + \\ &Additional\ Coverage\ to\ Meet\ Minimum\ DSCR + \\ &Gross\ Revenue\ Requirement\ for\ Securitization \end{aligned}$$

We use the same definition of Operating Expenses (including depreciation expense) as was used in the Rate of Return approach. Under the Cash Basis approach, we do not explicitly provide a return, but instead determine the revenues required to meet all financing costs (interest expense and principal repayment) and include additional margin if coverage is not sufficient to meet minimum DSCR. The minimum coverage is a legal requirement of the loans, and is stipulated in the Trust Agreement.[1] DSCR is computed as a ratio of the available cash flow from the utility's operations relative to the total current year principal and interest payments on its debt. Because depreciation is a

[1] "Trust Agreement: Puerto Rico Water Resources Authority to First National City Bank Trustee," January 1, 1974. (On May 30, 1979, by virtue of Law #57, the Puerto Rico Water Resources Authority changed its name to the Puerto Rico Electric Power Authority. See, "A Sketch of Our History," at http://www.prepa.com/historia_eng.asp.

non-cash expense, it is included as cash available for debt service. If a deficiency in cash is calculated such that the DSCR does not meet the required level, additional cash is added to the revenue requirement to relieve the deficiency. The minimum coverage amount computed by multiplying the DSCR by the sum of the non-securitized portion of principal repayment and interest expenses, roughly $314 million. We exclude the securitized debt service because there is a separate mechanism for ensuring debt service coverage in the special purpose vehicle ("SPV"). The securitized debt is covered by a debt service reserve fund and has adjustments built in to the Transition Charge calculation for collections lag and uncollectible revenue.

We understand that PREPA's bond covenants require that coverage be a minimum of 1.20 times the amount of principal and debt payments.[2] Public power authorities whose bonds are rated at A or AA typically have DSCRs greater than 1.20.[3] In our experience with regard to U.S. power entities, the Cash Basis approach is more commonly used by public power authorities.

We include the Gross Revenue Requirement for Securitization in the total estimate for Cash Basis revenue requirement because the level of debt service assumed in the securitization, roughly $394 million, is only possible in a transaction scenario. In a scenario without securitization the debt service requirement would be greater than the sum of the securitized and legacy debt service, $708 million, because there would be no principal reduction or deferred interest.

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2 See the Trust Agreement.
3 See Section IV of our testimony.

Q. **How are Revenue Requirements computed under the Modified Cash Basis approach?**

A. Under the Modified Cash Basis Approach, we compute Revenue Requirements as:

$$Revenue\ Requirements = Operating\ Expenses\ (ex.Depr\ Expense) + Capital\ Expenditures + Legacy\ Debt\ Service + Additional\ Coverage\ Requiredto\ Meet\ Minimum\ DSCR + Gross\ Revenue\ Requirement\ for\ Securitization$$

In this approach, all costs are funded from current-period revenues, including funding for necessary capital spending and the servicing of existing debt. That is why we exclude depreciation expense but include capital expenditures ("capex"). This approach funds the capital and operating cash needs of the business. Because PREPA does not have sufficient access to capital markets to fund capital expenditures, we add capex directly to revenue requirement rather than relying on a proxy such as depreciation or return on rate base. PREPA has significant cash funding requirements for infrastructure improvements that cannot be financed at this time, but may be in the future. Adding capex costs directly will allow for the rate setting process to consider only projects that PREPA needs to cash fund. When PREPA regains access to capital markets this portion of the revenue requirement will decline because we only add revenue funded capex to the revenue requirement, externally financed projects would not be included. Regulatory oversight will be maintained through a capex tracker to ensure capital expenditures that are paid for through base rate revenues are recovered appropriately (see Schedule F-3).

In the initial period, revenue funded capex will be sufficient to maintain an adequate DSCR. When revenue funded capex declines to a level at which the DSCR is no longer adequate to meet bondholder requirements, additional revenue will be need to

be added to the revenue requirement recovered through rates to cover the shortfall. This will happen when PREPA is able to finance a majority of its projects externally. An example of this approach is illustrated in PREPA Ex. 5.06.

C. Computing Operating Expenses Under the Various Revenue Requirements Approaches

Q. **Please summarize this section of your testimony.**

A. As the formulas above indicate, each of the three approaches to Revenue Requirements contains operating expenses. The components in operating expenses are the same for the most part across the three approaches, so this section of our testimony describes how we developed operating expenses for the test year FY 2014 adjusted to FY 2017. As the formulas show, there are some differences related to capital needs and financing, namely the methodology for capital return and recovery:

- Modified Cash Basis recovers prior year capital expenditures through debt service and anticipated capital expenditures through "revenue funded capex"
- Cash Basis recovers prior and anticipated capital expenditures indirectly through consideration of debt service expense and depreciation.
- Accrual Basis recovers prior and anticipated capital expenditures indirectly through depreciation expense and return on rate base.

Accordingly, we discuss how we developed depreciation expense, capex, interest expense, and principal repayments for the different approaches as well.

Q. **Did you prepare an exhibit that shows your results?**

A. Yes. The results of the analysis are summarized in PREPA Ex. 5.04. The first column of the exhibit shows the actual values of various costs as they appeared in PREPA's books of account for FY 2014. The middle column shows the "known and measureable" adjustments that would be made to the beginning FY 2014 amounts to arrive at FY 2017 (FY 2014 adjusted for known and measureable items through FY 2017) amount. The final column shows the results of applying those adjustments to arrive at the FY 2017, the first year in which new rates would be effective.

Q. **How did you arrive at your *pro forma* (known and measureable) adjustments?**

A. We adjusted individual line items for what we conclude are known and measurable changes. To arrive at these figures, we worked with PREPA's restructuring consultant, AlixPartners, to determine the estimated change in PREPA's costs of providing electric service. We relied on the Business Plan and performance improvement estimates developed by AlixPartners and PREPA to adjust non-fuel operations and maintenance ("O&M") expense. We also used performance improvement estimates to adjust the fuel and purchased power estimates developed by PREPA. Because the rates being considered for implementation will not apply until the debt restructuring takes effect, we made a number of *pro forma* adjustments to reflect the effect of the restructuring. In order to develop an FY 2014 test year as adjusted for known and measureable changes through FY 2017, we analyzed the 2014 and 2015 results and identified specific changes in PREPA's operations that are expected to affect operating results for FY 2017. These adjustments include adjustments to Fuel and Purchased Power, Labor Adjustments, depreciation expense, and Contributions in Lieu of Taxes ("CILT").

Q. **Let's turn to your adjustments that appear in column B of PREPA Ex. 5.04. Could you please explain these individual components?**

A. Yes. In advance of the approval of Act 66-2014 in June 2014, there was a large reduction in PREPA staff, resulting in a meaningful adjustment to each of the categories of operating expense shown in PREPA Ex. 5.04. We reviewed actual changes in labor costs through 2015 and further estimated cost reductions prepared by AlixPartners, and have reflected these reductions in staff and elimination of other costs items in our final operating cost numbers. The development of Revenue Requirements began with PREPA's FY 2014 operating results. We focused broadly on the following components, as recorded on the books and records of PREPA from its last audited financial statements:

- Fuel
- Purchased Power
- Generation Expenses
- Transmission Expense
- Distribution Expenses
- Customer Billing Expenses
- Administrative and General Expenses

Additionally, under a traditional Accrual Basis approach, Revenue Requirements would include depreciation expense, and any expenses for taxes other than income taxes. Accordingly, we examined recorded depreciation expense for FY 2014, CILT, and Energy Commission Assessment.

The components of Revenue Requirement can be broadly summarized as follows:

- Fuel & Purchased Power
- Labor O&M Expenses
- Non-labor O&M Expenses
- Other Expenses

For presentation purposes, we have summarized at this level for comparison of the annual Revenue Requirements from FY 2014 through FY 2017.

Q. **What is the purpose of the Fuel and Purchased Power adjustments that appear in the middle column of PREPA Ex. 5.04?**

A. Because PREPA's fuel and purchased power expenditures are dependent upon both the market price of fuel and the mix of generation and purchased power used to meet its customers' power demands, we have reduced Fuel Expense by $1.575 billion to reflect lower fuel costs that PREPA is expected to realize through the overall reduction in oil prices in the market and an increased dependence on natural gas for generation. We have also increased Purchased Power by approximately $19.2 million. These amounts have been developed by PREPA and are based on the most recent fuel and load forecasts at the time of the preparation of our analysis.

Q. **Please describe the Non-Fuel O&M Expense adjustments that appear in the exhibit.**

A. All of these adjustments are a reflection of the reductions in cost that have resulted from the restructuring and the PREPA restructuring Business Plan developed by AlixPartners working with PREPA and will be discussed in more detail in other testimony. See especially PREPA Ex. 3.0; see also PREPA Ex. 2.0.

Q. **Please discuss the Allowance for uncollectible revenue adjustment.**

A. As you can see, there is nothing in column A of the exhibit for uncollectible accounts. The reason is that PREPA's revenues are shown net of uncollectible accounts, so the amount of revenues shown in the first column has already been reduced by the uncollectible revenue. This is done because we are comparing those net revenues at current rates to the Revenue Requirement of a past period. However, because rates will need to be set at a level sufficient to provide for these uncollectible accounts going forward, we have added them into the costs of providing service to assure that those costs are collected. To record this expense, we used a Year-to-Date FY 2016 average percentage gross up factor of 3% applied to total revenue requirement. The calculation was based on a 12-month rolling average of total collections to total billed revenue.

Q. **Is the Uncollectible Accounts percentage used for FY 2017 (FY 2014 as adjusted) different from the uncollectible percentage used by Navigant to develop the Transition Charges in the SPV filing of the Puerto Rico Electric Power Revitalization Corporation with the Commission?**

A. Yes. This value of 3% is significantly lower than that in the pending "SPV" filing because the Transition Charge calculation uses an uncollectible revenue estimate based on a 120-day cutoff date. For the base rate revenue requirement, we analyzed actual all-customer billing and collections data, and compared this to past year bad debt write off amounts. The SPV filing is part of the necessary steps to accomplish the debt restructuring. The SPV filing involves establishing the Transition Charges to be collected by PREPA as a servicer. The revenues collected under those charges are for

amounts owed to the Revitalization Corporation. The SPV filing also seeks to establish the Adjustment Mechanism (reconciliation) associated with the Transition Charges. In the SPV filing, the bad debt expense percentages also took into account the reduced collection of revenues for the securitization charge that results from applying credits for the payments in lieu of taxes for municipalities. Failure to reflect those non-cash transactions would have left a deficiency in collections for the Transition Charges being collected for the securitized debt. Because the Revenue Requirement here is intended to reflect the overall revenue requirements of PREPA, and we have reflected CILT as a separate line item, the lower 3% bad debt expense is appropriate for this purpose.

Q. **Do the PREPA Revenue Requirements include recovery of amounts to be collected under the Transition Charges, such that there is a double recovery of costs?**

A. No. The PREPA Revitalization Corporation will be a separate entity from PREPA wherein securitized debt will be held. This debt will be a legal liability of the corporation and will be accounted for separately. Any debt service required for the securitized debt in the SPV will only be funded through Transition Charge revenues and will never be considered in base rate revenue requirement nor funded through the base rate. PREPA will recover and remit the Transition Charges revenues only as a servicer.

Q. **Please describe the adjustment in PREPA Ex. 5.04 regarding the Energy Commission Assessment.**

A. Under Act 57-2014 ("Act 57"), PREPA is required to provide funding for the activities of the Commission and its related entities.[4] The Act specifies that PREPA will submit $5.8 million per year for the funding of the Commission activities, paid semi-annually, and so it is included in the cost of service computation.

Q. **You have referred a number of times to CILT. What is CILT?**

A. CILT is currently comprised of municipal and public lighting consumption that is not paid. It is a legal requirement for PREPA to provide municipal and other special customers with free electric service. "CILT and Subsidies" comprises three major categories of subsidy expenses: public lighting, special customer subsidies – primarily low income customers, and municipalities. The current definition of CILT, which includes municipalities and public lighting, will be changed to include only municipalities. Going forward, public lighting will be categorized with special customer subsidies. Act 4-2016 stipulates that CILT will be capped so municipalities that exceed a certain level of consumption will have to pay for excess consumption.

Q. **Why do you include CILT as a component of PREPA's Revenue Requirements?**

A. CILT is a recoverable cost of PREPA's operations. Recoupment of CILT subsidies is currently covered through an imperfect mechanism based on the fuel and purchased power cost adjustments. This approach does not truly reflect the cost of the subsidies to PREPA. The new rate proposal will treat CILT as an independent pass-through, much like a traditional fuel and purchased power pass-through, so that the cost of the subsidies

[4] Act 57, Section 6.16.

548 is collected directly. Treatment of CILT as a component of Revenue Requirements
549 assures that PREPA has sufficient cash flow to meet those obligations. To establish rates
550 for all customers that will be sufficient to meet these costs, the full amounts of these costs
551 should be reflected in Revenue Requirements and, through the Embedded Cost of Service
552 Study, allocated to the appropriate customer classes.

553 Q. **Would including CILT as a cost in the Revenue Requirements calculation, as you**
554 **recommend, reflect a change in the way it has been accounted for previously?**
555 A. Yes. PREPA has treated CILT as a "below the line" or non-operating expenditure item,
556 treating it as one of the uses of its operating income. During certain previous years and
557 under the previous approach, revenue from operations has been insufficient to fund the
558 cost of providing service to the recipients of the CILT subsidy. This has resulted in a
559 significant increase in PREPA's accounts receivable balances that will never be collected.
560 Failure to adequately cover CILT as an expense (and setting rates to generate sufficient
561 revenues to cover this expense) leaves PREPA in a cash-flow shortage position. This
562 impairs PREPA's ability to meet requirements for its sinking fund, construction fund, and
563 debt service requirements. We therefore recommend that CILT be recovered directly as a
564 pass through rate.

565 Q. **Is PREPA proposing temporary (also referred to as provisional) rates as well as new**
566 **"permanent" base rates (permanent in the sense that they will remain in place until**
567 **re-set by a formula ratemaking mechanism ("FRM") or rate review)?**
568 A. Yes, PREPA is proposing provisional rates, as is discussed in Exhibit 12.0. The revenue
569 requirements for the provisional rates and for the permanent rates are the same. In both

cases, the Transition Charge, or securitization revenues are excluded for determining both provisional and permanent rates.

In addition, in Exhibit 7.0, PREPA is proposing a formula ratemaking mechanism, as is discussed in other testimony. This approach will allow the Commission to periodically review the rates and their adequacy to meet revenue requirements.

Q. **How did you account for CILT in your analysis for the provisional rate and the new ("permanent") rate structure?**

A. The provision for CILT credits has historically been based upon requirements of legislation that set aside 11% of the fuel and purchased power charge.[5] For our estimation of the required provisional rate, we calculated the amount of revenues that would be recovered for CILT through the fuel adjustment clause in FY 2017 and compared it to the estimated forward cost of providing service to special customers and municipalities. This resulted in a deficiency in the level of the CILT collected through the fuel and purchased power adjustment clause. That deficiency in CILT collections was added to the Revenue Requirements to be recovered through base rates. Because fuel and purchased power costs are reduced for FY 2017 (i.e., FY 2014 as adjusted), CILT costs also have been reduced.

[5] Act 57, Section 22.B.

1. *Pro Forma* Expense Adjustments that Pertain to the Modified Cash Basis and/or Cash Basis Approaches

Q. **Does your analysis of expenses using the Modified Cash Basis approach to Revenue Requirements include depreciation expense?**

A. No, it does not. Unlike the Accrual Basis and Cash Basis approaches, the Modified Cash Basis approach does not include depreciation expense as a cost. Instead, it includes a specific estimate capital expenditures required, as developed by PREPA Planning for its Capital Improvement Program.

Q. **Please explain why depreciation expenses are excluded in the Modified Cash Basis approach.**

A. As shown in the formula earlier, the Modified Cash Basis approach to Revenue Requirements determines the Revenue Requirements only on the basis of cash spending. Depreciation expense is not a cash expense. Rather than reflect depreciation expense as a line item, we include the capex that PREPA has made to maintain its electric plant in service, as shown in PREPA Ex. 5.04. Under the other two approaches (Cash and Accrual Basis), depreciation expense is included in the operating expenses, however, capex is not.

Q. **Why is it appropriate to include the capital expenditures as a cash requirement, rather than capitalizing that spending and then depreciating it over the useful lives of the assets as is done in the Accrual Basis approach?**

A. There are several reasons but the primary one is that PREPA does not have the cash to fund these capital expenditures, nor access to capital markets to finance them. A second

reason is that a portion of these capital expenditures are for replacement and maintenance of the existing system or for repowering existing generation units. Because Fuel and Purchased Power cost reductions will almost immediately flow through to customers as part of the Fuel and Purchased Power Adjustment factor, it seems appropriate. Last, this approach provides to PREPA's customers a path toward longer term financial stability, and as a result a path toward longer term stability in energy costs.

Q. **Please describe your inclusion of Revenue Funded Capital Expenditure adjustment in PREPA Ex. 5.04.**

A. Our estimate of Revenue Funded Capital Expenditure is based on the capex amounts developed by PREPA. These amounts included both capital intended for replacement and upgrades of existing plant (maintenance capex) and investment in new transmission, distribution, and other projects (investment capex) intended to meet load or system configuration enhancements. The sum of the maintenance capex and investment capex is $337 million for FY 2017. We observed that the adjustment is positive. This is because the amount of maintenance capex presented in the Business Plan is higher than PREPA's historical run rate. However, we also note that PREPA's constrained financial situation has resulted in insufficient maintenance capex in recent years. As a result, we concluded that the maintenance capex presented in PREPA's Business Plan is reasonable.

As noted, the investment portion of capex includes capex for new transmission and distribution and other projects. According to PREPA management, these projects are needed to improve PREPA's reliability and grid resilience, and for projects such as the Aguirre Offshore Gas Port ("AOGP"), which is needed to help bring PREPA into

compliance with legal standards, as well as reduce overall costs of fuel and purchased power. Our understanding is that investment in AOGP capex is a key component of PREPA's capital improvement program. The gas port will provide PREPA and the island of Puerto Rico with increased access to abundant and affordable natural gas from continental North America and it will help decouple PREPA's rates from historically volatile oil prices. Because PREPA lacks sufficient access to capital markets to fund capital expenditures, it must fund these useful and mandatory projects through its rates. (We note that AOGP costs in the Revenue Requirements are only the applicable costs through FY 2017.)

Q. **Please the rationale for your pro forma adjustment for Legacy Debt Service in PREPA Ex. 5.04.**

A. The Revenue Requirements reflect that PREPA is expected to meet its obligations for principal and interest on outstanding bonds. The amounts shown in the FY 2014 column of PREPA Ex. 5.04 are the amounts that were due to be paid for that period. It is also important to note that the amount shown is the minimum payment for debt service in the sense that there is no additional revenue funding to improve debt service coverage. The reduction to legacy debt reflects the assumption that a significant portion of PREPA's debt will be securitized and serviced by Transition Charge revenues through the SPV. The debt service included in Legacy Debt Service is composed in roughly equal parts of non-participating PREPA bonds and 5 year amortization of Fuel and Governmental Development Bank ("GDB") lines of credit. The debt service amount included in Securitization is only for PREPA bonds participating in the transaction. The Legacy

Debt Service amount in FY 2014 does not include any repayment of Fuel or GDB lines of credit, it is only debt service for PREPA Bonds.

Q. **Please explain the approach you took to develop Revenue Funded Debt Service.**

A. This is another way that the Modified Cash Basis and the Cash Basis approaches differ from the Accrual Basis approach. Under Modified Cash Basis and Cash Basis, we include as recoverable costs interest expenses and principal repayments. These costs are subsumed in the return calculation (Rate Base multiplied by Rate of Return) in the Accrual Basis approach. Selecting one or the other method ensures against double recovery. For PREPA there are reasons for addressing the financing portion of its costs directly as we have done here.

PREPA's debt service must be revenue funded because the Authority's bond agreements do not permit it to raise additional capital specifically to pay debt service. Members of the Navigant team worked with the restructuring advisors to PREPA and the GDB, AlixPartners and Millstein & Co., respectively, to obtain (1) estimates of the level of debt service and (2) capital expenditures that will be required by PREPA in the coming rate cycle.

The level of debt service included in the base rate portion of the revenue requirement is the estimated amount of non-securitized debt that PREPA is obligated to recover through its base rates. This debt service includes 5 year amortization of Fuel and GDB lines of credit and PREPA bonds assumed to not participate in the securitization transaction.

D. PREPA's Revenue Requirements Under an Accrual Basis Approach

1. Overview of the Approach

Q. **You mentioned that you also performed an analysis of the return component using an Accrual Basis approach. Please describe this briefly.**

A. As noted above, many of the components of operating expenses are common to the three methodologies. The only key difference between the Accrual Basis methodology and Cash Basis methodology is whether depreciation expense is included as a line item and how financing opportunity costs are treated (i.e., how the return on invested capital is calculated).

In the Accrual Basis methodology, the return is computed as the utility's investment (rate base) multiplied by the rate of return. The rate of return is based on the utility's cost of capital. The rate base is computed by identifying all investments (net of accumulated depreciation and other offsets) that are used and useful in the provision of electric power and service as of a specific date. Added to this net plant figure are working capital for operations and other investments. The total rate base reflects investments made in the provisioning of electrical service.

Like any asset, the rate base incurs a cost as a result of tying up investor money. In the Accrual Basis approach, this cost (called the return on the rate base) is expressed as a percentage rate, and it is multiplied by the rate base to derive the return component of the Revenue Requirement in dollar terms.

Under the Accrual Basis approach, it is necessary to identify the investments that PREPA has made to meet its service obligations to its customers, and to determine an appropriate rate of return. To do this, we developed the Rate Base, Rate of Return, and

Revenue Requirements for a FY 2014 test year adjusted for known and measurable changes through FY 2017.

This resulting Revenue Requirement is then compared to the revenues that a service provider would be expected to receive from existing rates during the test period to determine the adequacy of those rates to provide the service provider with its full costs of providing services, including a return on its invested capital.

2. Rate Base Development

Q. **What steps did you take to develop a Rate Base?**

A. We began with the financial statements for PREPA's Fiscal Year Ending June 30, 2014. We identified investments made by PREPA on behalf of its customers, net of accumulated depreciation. PREPA Ex. 5.07 shows the rate base as developed, totaling $7.3 billion as of the end of FY 2014.

Q. **What are the main components or adjustments made to arrive at the Rate Base?**

A. As noted, we began with FY 2014 ending balances of Electric Plant in Service less Accumulated Reserve for Depreciation. In addition, we added inventories of fuel and materials and supplies on hand because these investments likewise are used to provide service. We also included a working capital allowance and any prepayments of costs that will be charged to expense in future periods.

Q. **What is working capital?**

A. PREPA requires some level of cash on hand to allow the utility to pay its bills (e.g., wages, salaries, taxes, fuel) before the customer pays his or her bills. Utilities typically

718 experience lags in collections that are greater that the leads of when service is provided
719 and payment is made. Cash on hand helps the utility cover this lead/lag timing gap. The
720 cash working requirement can be allowed for in a number of ways including a detailed
721 lead-lag study. However, a number of regulatory agencies allow for the inclusion of a
722 working capital allowance equivalent to 12.5%, 1/8 of a year, or 45 days of non-fuel
723 operating expenses. We have added to the rate base the equivalent of 45 days working
724 capital for non-fuel (and purchased power) operating expense. We did not make any
725 provision for working capital in the modified cash approach due to the economically
726 sensitive nature of the rate case, and thus are relying on scant existing cash reserves to
727 cover immediate cash requirements. Going forward and as necessary, requests will be
728 made to adjust working capital so the company can fund its immediate cash needs.
729 Please note that PREPA Ex. 4.0 addresses the subject of working capital in relation to
730 fuel and purchased power costs.

731 Q. **Did you make any contra adjustments that reduced Rate Base?**

732 A. No. Traditional treatment also calls for Rate Base to be reduced by any cost-free capital
733 (also known as contributed capital) that has been provided either through the collection of
734 special reserve funds collected through previous rates or through certain tax treatments.
735 Insofar as there are no unrestricted reserve funds available, and PREPA is not subject to
736 income taxes, no such cost-free capital has been identified.

737 **3. <u>Rate of Return Assessment</u>**

738 Q. **How did you determine the appropriate rate of return used under the traditional**
739 **Accrual Basis approach in this rate case?**

A. We analyzed several methodologies and present two that we used to calculate an appropriate cost of capital for the Accrual Basis approach. The first is based on the average authorized return on rate base for U.S. utilities adjusted for geographic risk, which produces 26.6%. The second, based on the market yield of PREPA's debt, unadjusted for the effect of insured debt issuances, produces a result of 16.9%. Both results indicate a real marginal cost of capital well above the statutory maximum of 12% for Puerto Rico general obligation ("GO") bonds.

Q. **Please provide an overview of the analysis that you used with the traditional Accrual Basis approach to determine this recommendation.**

A. In the first approach, we took the average overall return (Authorized Return on Rate Base) allowed by U.S. regulators for vertically integrated utilities and added it to our estimate of geographic risk premium. The average rate of return authorized by U.S. regulators for vertically integrated utilities in both settled and fully litigated proceedings from 2010 to 2015 was 7.8% as shown in PREPA Ex. 5.08. The risk premium we calculated is based on the spread between yields on a broad index of investment grade U.S. municipal bonds and Puerto Rico GO bonds. We used the 2015 average yield on the Standard & Poor's Ratings Services ("Standard & Poor's" or "S&P") Municipal Bond Index, 3.0%, relative to the May 2015 market price weighted yield to maturity on Commonwealth of Puerto Rico General Obligation bonds, 21.7%. This implies a geographic risk premium of approximately 18.8%, which we added to our regulated utility authorized return on rate base to arrive at 26.6% (PREPA Ex. 5.09). Looking at authorized cost of debt from the same sample set of vertically integrated utilities reduces

the cost of capital by 220 basis points (PREPA Ex. 5.10). In our second approach, we calculated PREPA's market–price weighted average yield to maturity on outstanding debt (PREPA Ex. 5.11). Our initial analysis of PREPA's market priced average cost of debt in May 2015 produced a result of 10.1%. A more recent refresh of this study in May 2016 produced a result of 16.9%. These results are biased heavily downward because a large portion of debt is insured by investment grade credit bond insurance companies. If these particular debt issuances were not insured against default by credit worthy entities, prices would be much lower and yields much higher. Thus, we believe the real marginal cost of capital is in fact much higher than 16%.

A. **What is the return requirement if you were to apply the traditional Accrual Basis approach?**

A. We elected to show revenue requirement only an overall return of 12%, which conforms to recent relending costs of debt completed in 2015 and 2016 at the statutory maximum for Puerto Rico General Obligation Bonds[6]. Applying a 12.0% overall return to the Rate Base developed in this Section produces a return requirement of approximately $815 million.

Q. **With regard to your first approach, what is the basis for comparing PREPA's debt cost to the overall allowed returns on regulated utilities?**

A. PREPA's capital structure is 100% debt, it has no market equity (i.e., stock) and its book

[6] "Commonwealth of Puerto Rico: Financial Information and Operating Data Report, November 6, 2015," at http://www.bgfpr.com/documents/CommonwealthReport11-06-15.pdf p.121: "General Obligation Bonds debt service is calculated assuming...interest at the maximum allowable rate per annum under Puerto Rico law (12%)."

equity is negative.[7] Accordingly, PREPA's debt acts as its "first loss" capital (a role typically played by equity) and so the debt cost is indicative of PREPA's overall cost of capital. In contrast to PREPA's 100% debt structure, the average authorized leverage ratio of regulated U.S. utilities during the 2010 to 2015 timeframe is approximately 50%.

As for the logic of examining regulated rates of return, we use this approach simply as a benchmark related to regulatory outcomes, and not as a precise estimate of PREPA's cost of capital for the reasons described earlier.

Q. **Do you have any other observations about your cost of capital opinion?**

A. Yes. The figures presented in our analyses are intended to serve as guidelines rather than as precise estimates, because practically speaking, PREPA would be unable to access capital markets today without significant financial restructuring and new revenue inflows.

4. Effect of Different Rates of Return on Key Financial Variables

Q. **Let's turn to the issue of Debt Service Coverage. What would PREPA's DSCR be at the different rates of return that you have discussed?**

A. Assuming PREPA is able to achieve a reasonable level of restructuring, we calculated what the company's return on rate base. Using an overall capital cost of 12.0%, the return produced a DSCR of roughly 1.7 for total debt service. Using a cash basis approach, where we consider only non-securitized legacy debt service in the coverage calculation, the DSCR would be 2.1. The Modified Cash Basis approach that we recommend, considering only non-securitized legacy debt service in the coverage

[7] See Schedule D-1.

802 calculation, produces a DSCR of 3.9, whereas including securitized debt service produces
803 a 1.9 DSCR. In Section IV of this testimony, we discuss how a DSCR on the order of
804 1.57 to 2.00 would put PREPA on a path to financial health.

805 Q. **What are PREPA's revenue requirements and revenue deficiencies under the**
806 **scenario of the debt restructuring being accomplished?**
807 A. PREPA's revenue requirements and revenue deficiencies in FY 2017 (FY 2014 as
808 adjusted) assuming debt restructuring and including revenues collected by the Transition
809 Charges, are as follows:

Method	Revenue Requirement	Revenue Deficiency
Modified Cash Basis	$3,462,194,772	$725,521,027
DSCR	$3,520,836,180	$784,162,435
Rate Base/Rate of Return	$3,518,296,631	$781,622,886

810 Q. **What are PREPA's revenue requirements and revenue deficiencies under the**
811 **scenario of the debt restructuring not being accomplished?**
812 A. PREPA's revenue requirements and revenue deficiencies in FY 2017 (FY 2014 as
813 adjusted) under the scenario of the debt restructuring not being accomplished are as
814 follows:

815

Method	Revenue Requirement	Revenue Deficiency
Modified Cash Basis	$4,282,908,830	$1,495,673,287
DSCR	$4,330,645,309	$1,543,409,766
Rate Base/Rate of Return	$3,757,333,587	$970,098,044

III. LONG TERM FORECAST OF REVENUE REQUIREMENTS AND POTENTIAL CHANGES IN RATES

A. Overview

Q. **Please summarize the purpose of this part of your testimony.**

A. The development of Revenue Requirements in the previous sections of this testimony is for the FY 2014 Test Year as adjusted through FY 2017 and reflects PREPA's current financial and operational status. In our opinion, given (1) PREPA's current financial position; (2) the existence of a new regulatory framework, and the (3) transformation that PREPA is undergoing, it is also important to perform a forecast of future Revenue Requirements and analyze the impact of changes made now on out-year revenues and income.

In order to gain an understanding of the types of changes that are anticipated over the next few years, we discussed the economic and business outlook with both PREPA management and advisors. Based on information from PREPA's financial department, the Business Plan prepared by AlixPartners and PREPA, and various financial obligation restructuring scenarios provided by Millstein & Co, we developed a fifteen-year financial statement forecast that includes the Income Statement, the Balance Sheet, Cash Flows and the Debt Schedules. We believe that having such a forecast will help with an understanding of the effects that decisions made in this rate case may have on subsequent options and opportunities.

We designed our forecast model with the ability to assess the various financial restructuring options proposed by the creditors and their advisors. The goal is to determine whether the desired effects of principal deferral and lowered interest rates can

put PREPA on the road to financial health. The forecast is intended to estimate the level of future financial metrics that can be compared to investment grade credit metrics, and in turn determine whether a given plan will help PREPA regain access to capital markets and lower PREPA's cost of capital. Regaining the ability to issue debt at investment grade credit ratings will produce lower costs for PREPA's customers.

B. Four Factors Addressed in a Long-Term Forecast

Q. **What are the factors that you wish to address?**

A. There are four:

- Capital expenditures to support a fuel change from oil to natural gas;
- Employee staffing reductions and operational improvements;
- Implementation of energy efficiency programs; and
- Potential changes in debt service requirements.

Q. **Please summarize the capex issue.**

A. As part of the restructuring plan and in response to Act 57, significant investment is underway for projects that convert existing generation assets from using No. 2 and No. 6 fuel oil to natural gas. Investment is also underway for a facility to accept delivery of liquefied natural gas ("LNG") at an offshore site on the south coast of Puerto Rico, along with pipeline retrofits to accommodate new gas flow capacity. The proposed capital expenditure program for the electrical system, which includes normal replacement of aging and deteriorating plant, amounts to approximately $1.4 billion over the next three years.

860 Q. **Please summarize the employee staffing and operational improvements issue**

861 A. As part of the restructuring currently underway, AlixPartners has identified and
862 quantified potential performance improvements and cost reductions, such as improved
863 collection through theft reduction and better fuel inventory management. We
864 incorporated these reduced operating costs and performance improvement estimates into
865 our financial model to determine the effect of these costs on overall rates.

866 Q. **Please summarize the Energy Efficiency programs issue.**

867 A. This is a price-structure issue. Implementation of energy efficiency programs and
868 renewable energy programs such as third-party-owned solar in past years have eroded
869 both the demand for electricity and the kilowatt hour sales of PREPA. A significant
870 portion of PREPA's costs are fixed and not related directly to kWh sales. However,
871 PREPA traditionally has sought to recover its costs through a bundled price on kWh
872 sales. This cannot be sustained in an environment where some PREPA customers reduce
873 (or even reverse) load but nevertheless utilize transmission and distribution services.
874 Because renewable programs utilize the transmission and distribution infrastructure (and,
875 in fact, impose incremental costs of their own), PREPA's bundled prices must be
876 unbundled so that costs are efficiently allocated. The subject of rate design is addressed
877 by other testimony. See, in particular, PREPA Ex. 4.0.

878 Q. **What is the change in Debt Service requirements issue?**

879 A. Due to PREPA's current financial position, it is unable to meet its current obligations of
880 principal and interest and is operating under a forbearance agreement with the

bondholders. There is a proposed debt restructuring, but to accomplish it requires the satisfaction of a number of conditions.

C. Scenario Analysis

Q. **What is the purpose of your Scenario Analysis?**

A. The primary objective is to demonstrate the potential impact of Restructuring versus an alternative scenario on PREPA rates, Balance Sheet equity position, and Debt Service Coverage Ratio. An improved equity position would allow PREPA to obtain future financing of operations at reasonable borrowing costs.

Q. **What debt restructuring scenarios did you evaluate?**

A. We evaluated two scenarios. We developed 15 year financial forecasts using the data provided by PREPA Finance Department, AlixPartners, and Millstein & Co. The scenarios are:

- **Restructuring Scenario**: Debt Securitization and FRM Regulation
  - Full Performance Improvements
  - Debt restructuring, participating principal deferral / interest reduction for 5 years
  - 80% of AOGP debt financed under DOE loan guarantee program
  - Revenue Funding of Maintenance and non-AOGP investment capex
- **No Restructuring Scenario**: No Securitization and Non-FRM Regulation
  - Limited Performance Improvements
  - No debt restructuring
  - Refinance fuel / GDB lines of credit
  - New capital for debt service reserve fund and self-insurance fund
  - All capex revenue funded

Q. **How would you characterize the Restructuring Scenario relative to PREPA's current situation?**

A. The Restructuring Scenario represents PREPA's and its advisors best estimate of how costs will develop if the restructuring proceeds as planned. This includes a series of operating cost performance improvements detailed in the PREPA Business Plan, approval and successful closing of the securitization transaction, the potential for financing of AOGP supported by the DOE loan guarantee program, the potential for future access to capital markets at reasonable rates, and approval of the FRM to expedite efficiently and fairly the rate process and provide PREPA with the level of revenues it needs to cover costs.

Q. **Would you characterize the No Restructuring Scenario as a best estimate relative to PREPA's not going forward with the Restructuring?**

A. No, we would not. The No Restructuring Scenario is intended to show some potential financial outcomes; we would not characterize it as a best estimate. Indeed, we understand that PREPA and its advisors would not consider No Restructuring Scenario to be realistic. The reason is that absent restructuring there simply are innumerable variables that come into play and multiple possible outcomes to consider that make the formulation of a single high-probability alternative scenario impossible.

For example, among the potential outcomes of a No Restructuring Scenario is receivership and forced privatization of assets. We do not have a basis to assign a probability to such an outcome, but it certainly could occur. The No Restructuring Scenario contemplated for this filing envisions (1) no securitization; and (2) no Formula Rate Making. These two assumptions imply that PREPA would have limited opportunity for funding operating cost improvements due to further decreases in credit quality and

financial credibility. We further assume in the No Restructuring Scenario that there is no debt restructuring, a new capital injection of $1.8 billion, and a fully litigated ratemaking process. (The $1.8 billion in new capital is intended to refinance fuel and GDB lines of credit, and cover the debt service reserve requirement and self-insurance fund. However, we are doubtful that PREPA would be able to raise this much capital absent the Restructuring Support Agreement with creditors holding most of the debt, or at least be able to raise such capital at any reasonable cost.)

Q. **How did you compare each of these scenarios?**

A. We computed and compared the revenue requirements of each scenario using the Modified Cash Basis approach. The debt restructuring has a clear dampening effect on required revenue for the immediate forecast period, as shown in PREPA Ex. 5.12.

Q. **What did you find with regard to rate levels?**

A. Provided in PREPA Ex. 5.13 is the overall cost per kWh under each scenario. If rates were increased or decreased to meet Revenue Requirement each year, the overall rate would follow the route shown in the exhibit for each scenario. The Restructuring Scenario shows better overall cost per kWh than the No Restructuring Scenario due to greater performance improvements and lower debt service requirements.

Q. **How did you measure the long-run financial impact of these scenarios?**

A. We estimated DSCR and Equity position, along with other key metrics for each scenario. The results with regard to DSCR are shown in PREPA Ex. 5.14. The results with regard to Equity are shown in PREPA Ex. 5.15.

949 Q. **What did you determine with regard to Debt Service Coverage?**

950 A. PREPA Ex. 5.14 shows the annual DSCRs that would be achieved assuming a 25% Base
951 Rate increase in FY2017 only. As can be seen, the most optimistic No Restructuring
952 Scenario results in PREPA never meeting its 1.2 DSCR requirement. DSCR remains
953 below the limit stipulated in the Trust Agreement for the majority of the forecast period,
954 implying PREPA would not be able to meet its debt obligations from cash flows alone.
955 This scenario would keep PREPA shut out of capital markets and PREPA would not be
956 able to continue its power generation fuel source conversion program, nor gather
957 sufficient capital for replacement of aging electric system assets.

958 Q. **What did you find with regard to Equity position?**

959 A. From a credit rating agency and creditor's perspective, balance sheet equity levels are a
960 key indicator of financial health. As shown in PREPA Ex. 5.15, the No Restructuring
961 Scenario, has a highly negative effect on PREPA's financial position going forward. No
962 increase in base rates and no debt restructuring would result in an over 30% negative
963 equity position, which would further limit PREPA's access to capital markets and
964 increase risk to counterparties. The same one-time 25% rate change under the
965 Restructuring Scenario would result in nearly 50% positive equity, which would provide
966 better access to capital markets and substantially lower borrowing costs. It would also
967 allow PREPA to improve terms with suppliers and other counterparties, reducing costs
968 and thus overall Revenue Requirement.

969 Q. **Based on your analysis, do you have a time period in which PREPA will be re-**
970 **admitted to the capital markets?**

A. We do not have a precise time prediction, since re-admittance depends on whether investors and rating agencies are convinced about the operational efficiencies and financial produce of PREPA with the proposed changes. Our findings from analysis of credit metrics, however, show that if securitization is completed and the revenue requirements are met, PREPA would immediately attain the DSCR and Coverage of Full Obligations metrics needed for access to capital markets, as shown in PREPA Ex. 5.16. The Days Liquidity metric would be deficient based on the current assumption that no provision is made for working capital. However, consideration for such a provision is made pending the completion of a more detailed working capital study. Greater liquidity would be a positive signal to investors and ratings agencies.

We found that whether or not PREPA passed the Debt to Funds Available for Debt Service metric depended upon whether we view PREPA on a consolidated basis with the SPV or PREPA in isolation. Investors may consider the SPV as a fully isolated entity that PREPA is effectively insulated from, or, it may be seen ultimately as a liability of PREPA's. In either case, the classification tree results presented in Section IV provide benchmarks that can be monitored and used by PREPA to develop its business case for investors.

IV. PREPA RE-ENTRY INTO THE CAPITAL MARKETS

A. The Role of Credit Ratings for Capital Market Access

Q. **What does this section of your testimony address?**

A. The question that this section helps address is: "When will PREPA be able to regain access to the capital markets?" Our initial estimates show that with debt restructuring as

envisioned by the proposed securitization transaction and with rate changes to revenue requirement, PREPA will be able to regain access to "reasonable" access capital markets by 2020 or later. By "reasonable" access, we mean access to capital markets at a practical cost, well below what would currently be required. The primary purpose of this analysis is to (1) provide the Commission and PREPA credit market benchmarks that will indicate PREPA's progress toward re-integration into the capital markets; (2) identify the metrics that have been most influential in determining the credit rating of public power bonds in the last few years; and (3) provide specific benchmarks that, in combination with the Navigant financial model, will help determine an approximate time period when PREPA may be re-integrated into the capital markets.

This analyses provide quantitative targets that we run through a financial planning model to estimate the time period in which PREPA reasonably might be re-introduced into the credit markets. While the ultimate test of creditworthiness is the market's expectation of timely repayment of interest and principal regardless of the borrower's circumstances, this analysis focuses on the measureable aspects regarding the borrower's ability to repay debt.

Q. **What do you mean by the term credit rating?**

A. A credit rating is an opinion about credit quality. Credit ratings that investors are familiar with are constructed and published by certain companies or agencies that specialize in evaluating credit quality. The ratings opinion itself is summarized as letter classification such as "AAA" to indicate highest credit quality. The credit rating opinions regard the vulnerability of a debt obligation to default. The ratings opinions are based on

information both public and non-public, including information that the ratings agency obtains from its discussions with management.[8]

Q. **Why did you analyze credit ratings?**

A. Credit ratings are a tangible indicator of the market's view of a borrower's credit worthiness. Entities whose bonds receive low credit ratings can have a difficult time obtaining additional capital, except at a high price (high interest rate). PREPA Ex. 5.17 shows that lower-quality credit ratings are associated with higher interest rates, and this is especially the case during periods of capital market uncertainty as existed in and around 2008.[9] PREPA Ex. 5.18 shows that speculative-grade (or what we refer to as High Yield or "HY") bonds historically have had substantially higher default rates than investment grade bonds.[10] Higher default risk translated into higher debt cost.[11]

PREPA's credit has been evaluated by three major credit rating agencies: Fitch Ratings, Moody's Corporation ("Moody's"), and Standard & Poor's. Since June 26

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8 For a discussion of credit rating opinions generally, see, "Understanding Credit Ratings," Fitch Ratings, at https://www.fitchratings.com/jsp/general/RatingsDefinitions.faces?context_ln=5&detail_ln=500&context=5&detail=509.

9 The chart shows yield spreads, which are defined as the yield on the corporate bond (by ratings class) less the yield on U.S. Treasury bonds. Data are monthly averages. Data are from The St. Louis Federal Reserve FRED database available at https://alfred.stlouisfed.org/series?seid=BAMLH0A0HYM2 (for high-yield bonds, and similarly for the other ratings classes).

10 Diane Vazza, Nick W Kraemer, "2014 Annual Global Corporate Default Study and Rating Transitions," Standard & Poor's, April 30, 2015, Table 1, at https://www.nact.org/resources/2014_SP_Global_Corporate_Default_Study.pdf. The default rates are computed within one year of the bond attaining its investment grade or speculative grade default.

11 These exhibits are intended to be illustrative and not definitive because credit risk may be considered to have both idiosyncratic risk (risks that are associated with the particular business) and systematic risk (likelihood of default in bad times) components, and bond ratings have been shown to be correlated with the latter. See, Jens Hilscher and Mungo Wilson, "Credit ratings and credit risk: Is one measure enough?," at http://sbsplatinum-test.sbs.ox.ac.uk/sites/default/files/SBS_working_papers/creditratings_0.pdf

2014, Fitch Ratings has rated PREPA as CC;[12] Moody's downgraded PREPA's bonds in 2014 from Caa3 to Caa2;[13] and S&P rates the bonds as CC.[14]

According to Fitch Ratings, a CC rating is viewed as "Very high levels of credit risk. Default of some kind appears probable."[15] This perceived high risk of default is what causes PREPA's borrowing costs to be in ranges that effectively preclude it from accessing capital through the issuance of debt.

Q. **Please summarize the results of your credit metric analysis as applied to PREPA.**

A. The analyses demonstrate that moving from low credit ratings (that is, credit ratings below investment grade or BBB-)[16] to higher investment-grade ratings (including A or AA-ratings) is associated with the characteristics shown in PREPA Ex. 5.19, namely:

- DSCR in excess of 1.57 (and possibly 2.00);
- Days Liquidity of about ½ a year;
- Full Obligation Coverage of approximately 0.9; and
- Debt to Funds Available for Debt Service ("Debt to FADS") of no more than 6.

The credit metrics themselves (DSCR, Days Liquidity, Full Obligation Coverage, and Debt-to-FADS) are those provided by Fitch in its credit study whose values closely correlate with the rating class that Fitch Ratings assigns to a public power authority. As

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12 See, "Fitch Downgrades Puerto Rico's GO and Related Ratings to 'CC'; Maintains Rating Watch Negative," Fitch Ratings, June 29, 2015.

13 "UPDATE 1-Moody's downgrades Puerto Rico's PREPA revenue bonds," Reuters, at http://www.reuters.com/article/usapuertorico-prepa-idUSL3N0RI4TU20140917.

14 "PREPA Investor Resources," at http://www.gdb-pur.com/investors_resources/prepa.html.

15 "Ratings Definitions," Fitch Ratings, (hereafter Fitch Ratings Definitions) at https://www.fitchratings.com/jsp/general/RatingsDefinitions.faces?context=5&context_ln=5&detail=507&detail_ln=500.

16 The distinction between BBB- and above as investment grade and bonds with a less than BBB- rating as speculative or high yield is generally accepted in the financial analysis industry. See, e.g. Fitch Ratings Definitions, p. 6.

discussed later, low-rated bonds invariably fail these measures. However, some better-rated bonds fail these rules as well, which appears to imply that other metrics or non-measured features (e.g., opinions of Fitch Ratings that are formed as a result of its discussions with management that might not be reflected in accounting-based credit metrics) affect bond ratings. Meeting or exceeding the critical values of these credit metrics is a gating factor on the road back to financial stability and credibility but the rating agencies evidently must have other (possibly non-tangible) evidence regarding credit quality as well.

B. Description of the Fitch Ratings Public Power Study and the Data Used in Our Credit Metric Analyses

Q. **What data did you use in your analysis?**

A. We used a 2015 study of public power performed by Fitch Ratings.[17] Fitch Ratings' Public Power study provides ratings and credit ratios for 85 public power entities that sold power to retail customers for the years 2010 through 2014.

Q. **Please provide an overview of the data in the Fitch Ratings study.**

A. Fitch Ratings provides its then-current credit ratings for the 85 public power entities. All of the credit ratings fall into one of five letter classes: AA, A, BBB, B, and CC. These letter classes are further differentiated by notches (i.e. a "+" or a "-") such that there are 11 separate ratings within the dataset, ranging from AA+ to CC. PREPA Ex. 5.20 shows

[17] "U.S. Public Power Peer Study—February, 2015," FitchRatings Public Finance. (This study is an Excel file with multiple tabs. The tab from which I obtain data is denoted as [Retail], and this lists public authorities with retail-level customers (as opposed to Wholesale or G&T public power authorities, for which Fitch also provides data). The study is dated February 2015, but it was updated and finalized for 2014 in June 2015. As of this report date, 2015 data are not available to me (Dr. Pampush).

that most of the public power authorities have bond ratings of A or AA. As of the study date, 24 of the 85 public power agencies were rated A+ and 24 were rated AA-. In other words, 48 of the 85 power authorities had ratings that are clustered in neighboring classes: either A+ or AA-. In the dataset, there are only two public power agencies rated below BBB-, which is often considered the dividing line between investment grade and speculative of high-yield bonds. These are PREPA (rated CC) and Virgin Islands Electric System (rated BB). Five public power authorities are rated as BBB (i.e., from BBB- to BBB+).

Q. **Does the Fitch Ratings study provide data in addition to the credit ratings themselves?**

A. Yes, it does. The Fitch Ratings study provides a variable called Outlook/Watch that indicates whether an upgrade or downgrade might be on the horizon; the entity's fiscal year end date; the entity's Region of operation; the entity's Primary Fuel Exposure; and 12 other credit metrics for the period 2010-2014. These 12 additional metrics are listed in PREPA Ex. 5.21.

Q. **Please discuss the 12 other credit metrics provided by the Fitch Ratings study.**

A. For each credit metric, there are approximately 425 entries or observations since there are five years of data (2010-2014) for each of the 85 entities.[18] We assume that the credit metrics provided by Fitch Ratings in its report on public power are important to that agency in rating public power bonds and that is why they report them. Accordingly, we

[18] I (Dr. Pampush) say "approximately," because there are a few observations with missing values.

evaluated how these metrics differ by ratings class and draw inferences as to how these metrics have influenced the ratings decisions made by Fitch Ratings.

Q. **Do you use all of the metrics provided by Fitch Ratings?**

A. We use all of the years (2010-2014) but not all of the credit metrics. We did not use the items listed in PREPA Ex. 5.22. The items listed in that exhibit are not under management's control, at least in a reasonably short time period, or (in the case of Total Debt) they are better modeled using ratios (such as Debt-to-Total Capital) in order to separate the effect of indebtedness from the effect of sheer size.

This leaves as potential candidates eight financial metrics that are directly reported by Fitch Ratings, plus an additional variable that we constructed from the data by dividing debt by total revenue. We used all of the years insofar as historical data may have a role in how an agency evaluates trends and therefore recent ratings.

C. Averages and Medians of the Fitch Ratings Credit Metrics by Ratings Class

Q. **Please describe your first analysis.**

A. We compute means (i.e., averages) and medians (i.e., midpoints) of the credit metrics by letter ratings class. The purpose of this analysis was to determine whether and to what extent the credit metric values of higher-rated public power bond observations are different from (or the same as) the values of lower-rated observations and so may be useful to PREPA and to the Commission as policy targets.

Q. **Please explain why you analyzed the median values of the credit metrics.**

A. A median is a midpoint: the values of half of the observations in a dataset are greater than the median value and half are less than that value. We report the medians because most of these data series are skewed. Skewed data are asymmetrical around the mean—there are outliers in one direction. Skewness can affect the mean in a way that makes it less useful as a representative or typical value for the ratings class.

For example, the existence of a Bill Gates or Mark Zuckerberg in a dataset of household incomes can make the average of those data a misleading indicator of a representative or typical household income. Medians reduce the impact of extreme outliers such as a Gates or a Zuckerberg. The median income of the U.S. is unlikely to change much if one were to add a Warren Buffet to the dataset, although the mean will go up (perhaps considerably), and so the median can provides a useful measure of central tendency. We investigated whether the results that are presented PREPA Ex. 5.19 have means and medians that are similar or dissimilar. We found that while the data are highly skewed, the median values are often similar to the mean values.[19]

Q. **Please describe your findings.**

A. We report the averages and medians of the nine credit metrics in PREPA Ex. 5.23. With regard to my review of the means, the data show the following:

- Capex to Depreciation Expense averages are scattered across the observations, and across ratings classes as well, indicating the possibility of extreme values and making inferences difficult. The medians provide an indication that better-rated credits have more robust capital spending plans. Higher credit ratings provide

[19] In all cases, the medians are less than 0.30 standard deviations from the means.

access to capital and the wherewithal to support network improvements. In terms of cause-and-effect, it would seem that capex-to-Depreciation is an indicator of the benefits of a higher credit rating, not a driver of a higher credit rating.

- Higher Full Obligation Coverage is associated with higher-rated entities. AA-rated entities having Full Obligation Coverage that is about 36% to 67% higher than the low-rated (BBB and High Yield respectively) entities. Moreover, the averages and medians of the Full Obligation Coverage Ratio at each rating are statistically different than one another at a 95% confidence level, as we discuss below.
- Higher rated bonds also have substantially a greater liquidity cushion as measured either by Days Cash or Days Liquidity. On average AA bonds have 204 Days Cash and 236 Days Liquidity, which is 11 to 14 times as much liquidity or cash (respectively) as that which is shown by the High-Yield observations. We discuss this further in my discussion on classification analysis. We use Days Liquidity instead of Days Cash because Days Liquidity has no missing variables. As might be expected, the two data series are highly positively correlated, as discussed below.
- Debt-to-FADS (Funds Available for Debt Service) is substantially higher for High Yield entities, with A and AA-rated observations having Debt-to-FADS ratios that are substantially less than the High Yield Debt-to-FADS ratio, whether measured as a mean or as a median.
- Debt per Customer produces ambiguous results, especially with regard to averages. This indicates the presence of extreme values. Even examining

medians indicates ambiguity because BBB-rated credits have higher median (and average) Debt per Customer than High Yield observations.

- Debt Service Coverage ratio of approximately 2.00 is associated with ratings of A or AA. DSCR of around 1.2 to 1.3 is associated with BBB. We will later discuss how a DSCR of at least 1.57 is important in moving toward an investment grade rating.
- Higher-rated observations have substantially lower leverage (a greater proportion of equity in the capital structure) as measured by the Equity-to-Capital ratio, but there is no material difference between the leverage of A and AA-rated entities (at about 50:50).
- Debt-to-Total Revenues (which we computed from the data provided by Fitch, and was not itself among the Fitch ratios) is ambiguous and not particularly revealing.

In sum, and based on the data reported here (and their statistical significance discussed later), we conclude that capital markets would be more receptive to a public power agency with the characteristics that described in PREPA Ex. 5.19.

Q. **Does PREPA need to attain all of the benchmarks listed for the A and AA-Rated bonds in PREPA Ex. 5.23 before it can access the credit market?**

A. That is unclear because the true test of credit worthiness is the belief by lenders that they will receive timely and complete repayments of all of the cash flows that are due to them. This analysis cannot capture these subjective beliefs, but can provide values relative to quantitative indicators, and these are reported in PREPA Ex. 5.19. With that caveat, we

note that improvements in one credit metric typically are associated with improvements in another. This implies that a policy that targets a subset of metrics will be sufficient to improve PREPA's overall financial health insofar as other metrics follow along.

Q. **Please explain what you mean when you say that improvements in one credit metric are associated with improvements in another.**

A. Better values in one credit metric typically are associated with better values in another credit metric. To see this, we computed the correlation coefficients between all of the credit metrics in the Fitch Ratings dataset listed in PREPA Ex. 5.24. A correlation coefficient ranges from -1.0 (perfectly negatively correlated) to +1.0 (perfectly positively correlated).[20] A correlation coefficient indicates the degree of linear association between two variables. If two variables are highly positively correlated (close to 1.0), increases in one variable historically and across the public authority database are associated with increases in the other variable. Similarly, if two variables are highly negatively correlated (close to -1.0), increases in one variable historically and across the public authority database are associated with decreases in the other variable. While a correlation analysis does not identify which of the two metrics is the driver of the improvement, it still can provide confidence that improvements in credit metrics do not occur in isolation.

Q. **How does your exhibit illustrate which credit metrics are correlated?**

A. PREPA Ex. 5.24 shows all of the correlations that are statistically different than zero at a 95% confidence level. In other words, there is less than a 5% chance that the correlation

[20] Richard A. DeFusco, Dennis W. McLeavey, Jerald E. Pinto, and David E. Runkle. QUANTITATIVE METHODS FOR INVESTMENT ANALYSIS (2ND ED.) (2004)(Baltimore: United Book Press), (hereafter Quantitative Methods), p. 337.

coefficient that is shown in the exhibit is an outcome of mere chance when in reality the correlation is zero. We purposefully left as blank those cells in which the correlation failed this significance test. Darker blue indicates that the correlation is approaching 1.00 and darker red indicates that the correlation is approaching -1.00.

The main point of this exercise is that a number of the credit metrics are associated with one another so that an improvement in one area is likely to be coincident with an improvement in another. This implies that there is a reduced need to track and follow a lengthy list of credit metrics.

Q. **Are there any particular correlation results that you would like to point out?**

A. Yes. There are a few correlations that are noteworthy because one or the other of the credit metrics appears (based on the analysis described below) to be relatively important to Fitch in in determining a credit rating.

- Days Cash and Days Liquidity are very highly correlated, indicating that only one of the two likely would provide independent information regarding classification. We selected Days Liquidity because it has no missing values.
- DSCR is negatively correlated with the Debt-to-FADS ratio. This indicates that an increase in one has been associated with a decrease in another. Moreover, we found (unreported in the table) that (1) if DSCR outliers are eliminated and (2) the natural log is taken to the Debt-to-FADS ratio, the correlation increases in absolute terms to -0.74. We point this out to note that while we use unadjusted DSCR data, there can be subtle correlations between variables.

- Full Obligation Coverage is moderately positively correlated with Days Cash and Days Liquidity as well as with DSCR. This indicates that improvements seen in this ratio will likely be accompanied by improvements in these others.

We show later that DSCR, Days Liquidity, and Full Obligation Coverage are important to Fitch Ratings in making its credit classifications. Improvements in these key credit metrics are likely to be followed by improvements in others that are correlated. This provides support for listing only some (and not all) of the metrics as goals for PREPA in PREPA Ex. 5.19.

D. Credit Metrics (and their Values) that have been Important in Fitch's Public Power Ratings Opinions on Creditworthiness

Q. **Let's turn to the topic of establishing which credit metrics are most important in determining the credit rating of a public power authority. Please describe your analysis.**

A. We used a classification tree analysis to determine which of the credit metrics provided by Fitch Ratings were most important in determining an entity's credit rating.

Q. **What is a classification tree analysis?**

A. A classification tree analysis is a type of decision tree. Decision trees are common. You will have used a decision tree if you have worked through a series of questions in a computer manual intended to help you determine what is wrong with your computer or your printer. A doctor may have used the results of a decision tree analysis to ask you questions that would help him classify your symptoms as either serious or nothing to be worried about.

The term classification tree is used when the dependent variable (printer performance, your health, or, in this case, credit rating) is categorical, as it is here. The classification tree approach is used in many so-called machine learning and exploratory data analytic applications where there is a desire to classify observations into one of any number of buckets. Classification trees are used to classify flora or fauna into different species based on various physical measurements;[21] classify distressed firms based on financial ratios;[22] determine credit scoring criteria for businesses and individuals;[23] and even classify e-mail as being spam or genuine e-mail based on keyword analysis.[24] As noted in a monograph on statistical learning:

> Examples [of decision tree applications] include clinical decision making, manufacturing, document analysis, bioinformatics, spatial data modeling (geographic information systems), and practically any domain where decision boundaries between classes can be captured in terms of tree-like decompositions or regions identified by rules.[25]

This quote captures the essence of the problem here, which is to decompose a set of data regarding public power agencies into different classes (or regions) by establishing

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21 See, e.g., Anantha M. Prasad, Louis R. Iverson, and Andy Liaw, Newer Classification and Regression Tree Techniques: Bagging and Random Forests for Ecological Prediction Ecosystems (2006) 9: 181–199, 2at http://avesbiodiv.mncn.csic.es/estadistica/bt3.pdf.

22 Halina Frydman, Edward I. Altman, and Duen-Li Kao, "Introducing Recursive Partitioning for Financial Classification: The Case of Financial Distress," The Journal of Finance, vol. XL, no. 1, March 1985, pp. 269-291, at https://www.researchgate.net/profile/Halina_Frydman/publication/4742063_Introducing_Recursive_Partitioning_for_Financial_Classification_The_Case_of_Financial_Distress/links/0fcfd50eae514c24b3000000.pdf.

23 Bee Wah Yap, Seng Huat Ong, Nor Huselina Mohamed Husain, Using data mining to improve assessment of credit worthiness via credit scoring models," Expert Systems with Applications 38 (2011) 13274–13283. See also, Alireza Hooman, Mohana Omidi, G. Marthandan, Wan Fadzilah Wan Yusoff, Sasan Karamizadeh, Statistical and Data Mining Methods in Credit Scoring," Proceedings of the Asia Pacific Conference on Business and Social Sciences 2015, Kuala Lumpur (in partnership with The Journal of Developing Areas) ISBN 978-0-9925622-2-9 at https://www.aabss.org.au/system/files/published/001172-published-apcbss-2015-kuala-lumpur.pdf. The latter notes that in the literature, trees are used for their efficiency, accuracy, and robustness.

24 Shweta Rajput and Amit Arora, "Designing Spam Model- Classification Analysis using Decision Trees," International Journal of Computer Applications (0975 – 8887) Volume 75– No.10, August 2013, at http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.402.4957&rep=rep1&type=pdf.

25 Naren Ramakrishnan , "C4.5," in Xindong Wu and Vipin Kumar, THE TOP 10 ALGORITHMS IN DATA MINING, (2009) (Boca Raton: CRC Press / Taylor Francis), chapter 1, at https://www.crcpress.com/The-Top-Ten-Algorithms-in-Data-Mining/Wu-Kumar/9781420089646.

a set of targets, namely the values of the credit metrics identified here. The boundaries (or cut points) of the credit metrics are values of the variable that cause the user to branch one way or the other (branches are binary—a left branch indicating failure of the cut point value of the node and the right branch indicating passing the cut point value of the node). Other common terminology in discussing classification trees includes "nodes" from which emanate "branches" (or splits), and "leaves" (endpoint or terminal nodes).

Q. **Why did you use the classification tree approach?**

A. For several reasons. As noted, the classification tree approach is well-suited for this type of problem. The tree approach:

- Selects from a set of metrics those that are most important in determining classification;
- Provides quantitative cut points or borders between ratings levels; and
- Is relatively robust to outliers.

The tree approach specifically is designed to provide clearly interpretable results that can be used both in modeling (as our Navigant team did here) and by decision makers in monitoring progress. Because the approach provides quantitative cut points between ratings levels, it gives decision makers targets to shoot for. The approach is relatively robust to outliers because the results are unaffected if the classification is consistent with the outlier's value (e.g., if a public power entity with very high liquidity also happens to be classified as AA rather than High Yield). Finally, the classification tree approach is well-suited to categorizing multiple potential outcomes, as is the case here.

Q. **Could you please provide a brief description of how a classification tree works?**

A. Yes. PREPA Ex. 5.25 provides a schematic of the classification tree approach. The classification tree starts at node 1 (also called the root node) with all of the observations in a single class. The classification tree algorithm picks a credit metric to split the original dataset into two parts (there is no particular order to the selection, the algorithm ultimately will try each credit metric and each value of each credit metric). The algorithm selects one of the metric's values and splits the data into two parts using that value as the cut point. Next, the algorithm adds up the number of misclassified observations in each of the two new nodes.[26] It compares that sum to the number that were misclassified in the root node.[27] The difference between the two sums is called the gain. The algorithm then tries another credit metric (and each value of that credit metric) and computes the gain on that credit metric. Ultimately the algorithm selects as the winner of the node the credit metric (and credit metric value) that produces the greatest gain for that node.

The bonds that fail Credit Metric 1 in the root node test fall into the losers' bracket (red and orange cells of the exhibit). The classification process replicates the process at node 2 (the "losers' bracket") in PREPA Ex. 5.25. The splitting algorithm splits node 2 using the same process that we described and selects the credit metric that produces the largest gain for node 2.

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[26] One of the ratings categories is picked as the "correct" assignment in the root node.

[27] The method employed here uses the Gini index. The Gini index is a measure of variance across the ratings categories. Technically, the Gini index is defined as $G = \sum_{k=1}^{K} \widehat{p_{mk}}(1 - \widehat{p_{mk}})$, where $\widehat{p_{mk}}$ is defined as the proportion of observations in the m^{th} region that are from the k^{th} class. See, Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani. AN INTRODUCTION TO STATISTICAL LEARNING WITH APPLICATIONS IN R. (2014) (New York: Springer), p. 312.

The procedure then turns to node 3, the "winners' bracket" (green and yellow cells), and performs the splitting test, trying each of the credit metrics, and selecting the one that produces the largest gain. The winner of the winners' bracket may or may not be the same credit metric as the winner of nodes 1 or 2.

The splitting process continues until all observations are segregated into their own classes or until the process is halted according to some rule that deems the gain from an additional split to be insufficiently large to warrant another split.[28]

The numbering convention that we show in PREPA Ex. 5.25 (nodes 1, 2, and 3) is the same convention as that used in the analytical program (whose output is shown later in PREPA Ex. 5.27 and PREPA Ex. 5.32. The losers' bracket is node 2, and the winners' bracket is node 3. A node 4 would branch off the branch labeled "Bonds that Fail Metric 2."

Q. **How do you evaluate whether the classification tree is useful in predicting ratings?**

A. There are standard statistics that are used to compare the number of observations correctly classified by the model versus those incorrectly classified. We also evaluated statistical significance, which refers to the confidence with which we can conclude that the results arose as a result of the hypothesized model instead of merely by chance. We computed several of these statistics and describe the results later.

Q. **Did the Fitch Ratings data present any issues that you had to consider before analyzing using the classification tree?**

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[28] See, Alan Agresti. CATEGORICAL DATA ANALYSIS (3RD ED.). (2013) (Hoboken: John Wiley), Section 15.2.

A. Yes. As noted above, there are a large number of A and AA observations (195 in each class); only a few (10) that are rated as High Yield (below BBB-); and only 25 rated as BBB. An analysis based on an unbalanced data structure can result in the procedure improving overall fit by focusing on the numerous A and AA-rated bonds to the potential detriment and reduced fit of the relatively sparse High-Yield and BBB bonds.[29] However, the results based on such an outcome would not be informative to us in this instance because our goal is to investigate the distinguishing characteristics between poorly-rated High Yield credits and better-rated BBB-and-above credits.

Q. **What did you do about this?**

A. To address this issue, we adopted the strategy of computing classification trees using more balanced data. We used stratified random sampling to produce datasets that have similar numbers of observations for the High Yield, BBB, A, and AA bonds. We rebalanced the dataset in two ways:

- Maintain the number of High-Yield bonds at 10, and limit the number in each of the other categories to 25, which corresponds to the number of BBB bonds (85 total observations).
- Reduce all of the bonds in the sample set to 10 at each level so that the samples are completely balanced (40 total observations).[30]

Q. **Can you please describe the intuition of the two rebalancing approaches?**

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[29] For an overview of this issue and the sampling response (as used here), see, Nitesh V. Chawla, Nathalie Japkowicz, and Aleksander Kolcz, "Editorial: Special Issue on Learning from Imbalanced Data Sets," Sigkdd Explorations, Volume 6, Issue 1, pp. 1-6, at https://www3.nd.edu/~dial/publications/chawla2004editorial.pdf.

[30] The code used in this and all of the other tree calculations can be viewed in PREPA Ex. 5.35 (pdf). Native files have been provided as well.

A. In the first approach, we reduced the number of A and AA-rated observations to the next-highest number, which is the 25 observations of the BBB-rated bonds. We used the first rebalancing approach because 10 observations per ratings category (as in the second approach) is not many on which to base a statistical analysis. Relative to the second approach, the first approach provides more observations for use in the computations. Using more data can improve the performance of the classification tree, but this is achieved by increasing somewhat the emphasis on these better-rated bonds. In the second case, we completely balanced the dataset by using 10 observations of each class, sacrificing potential statistical significance in the process.

In both cases, we formed the dataset by reducing the numbers of A and AA-rated observations (and BBB-rated bonds in the second dataset), rather than by oversampling High Yield or BBB observations. This reduces the likelihood that the reported statistical significance of the results is overstated.

We rebalanced the datasets using random sampling with replacement. Because we did not want the results to rest entirely on the luck of the sample of 25 (or 10) observations per class drawn from the 195 A and 195 AA observations, we computed 1,000 classification trees on 1,000 random samples. Each iteration produced a winner at node 1, a winner at node 2, and so on. The overall winner at each of the node was the metric that had been the most frequent winner in the 1,000 iterations. We then computed the average value that the winning variable took.

Next, we looked at node 2 (the losers' bracket). We computed the average value of the most frequent winner (called the unconstrained winner) and the average value of the most frequent winner given the winner of node 1 (called the constrained winner of

node 2 given the winner of node 1). As is shown in PREPA Ex. 5.26, the constrained and unconstrained values are substantially the same.

Q. **What were your results?**

A. PREPA Ex. 5.26 shows the results of the analysis. Scenario 1 represents the use of 85 observations, distributed among the four credit ratings classes. Scenario 2 represents the use of a balanced dataset with 40 observations.

Q. **Please describe the results of Scenario 1.**

A. PREPA Ex. 5.26 indicates that the most important credit metric under Scenario 1 is the Debt Service Coverage Ratio. DSCR won the root directory in 78.9% of the iterations (789 wins in 1,000 iterations of the model), and with an average cut point (or branching) value of 1.57. PREPA Ex. 5.27 shows how the Scenario 1 model would classify the full dataset of 425 observations by applying the three screens by using the method of screening.

- 9 of 10 observations rated High Yield had DSCRs less than 1.57;
- 20 of 25 observations rated BBB had DSCRs less than 1.57;
- Only 50 of 195 observations rated A had DSCRs less than 1.57; and
- Only 11 of 195 observations rated AA had DSCRs less than 1.57.

In the winners' bracket, where DSCR is greater than or equal to 1.57, the differentiator between good ratings (such as single-A) and better ratings (AA) was the substantial amount of liquidity of 186 days enjoyed by AA-rated observations. In contrast, based on the data, 9 of 10 of the High Yield observations had Days Liquidity

less than 40 days. It is clear that higher ratings are associated with the cash and cash flow that can be called upon to pay debts as they become due.

Q. **What do these classification tree results imply for PREPA?**

A. We understand that the Trust Agreement refers to a DSCR of 1.20, and so will show how that benchmark relates to credit ratings. The classification tree analysis implies that using the rate of return that is consistent with a DSCR of 1.57 (and even higher) would move PREPA toward re-integration into the capital markets.

PREPA Ex. 5.28 shows how this is the case. The exhibit shows density plots for the DSCR of each letter grade. A density plot can be thought of as a smoothed histogram. Correspondingly, a histogram is a bar chart where the x-axis of the bar chart has all of the values of the variable of interest, such as DSCR. The height of each bar represents the number of observations at each value.[31] The density plot presents a smoothed curve that makes it easier to see where most of the DSCR values are in the dataset by Ratings category.[32] Like a histogram, a density plot is useful because it shows (1) the most popular value of the variable of interest for the ratings class (also called the mode of that class); (2) the distribution of observations across values of the variable of interest in a way that makes it possible to get a sense of overlap and differences. In this case, the results are more clearly and powerfully displayed by the use of the density graphic rather than the traditional histogram, and so we use it here.

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31 When a variable is continuous, as is DSCR, it is customary to group the data into "bins" (e.g., 0.00 to 0.50 in the first bin; 0.51 to 1.00 in the second bin; 1.01 to 1.51 in the third bin, and so on) so that more than a single observation will be associated with each bin of the variable of interest. The histogram, like the density plot, shows which values (or bins of values) of the variable contain the most observations and whether or not the data are skewed.

32 The density curve is analogous to a smoothed histogram, but the values on the Y-axis represent densities, not counts.

The vertical lines in PREPA Ex. 5.28 are at 1.20, 1.57, and 2.00. As is shown in the exhibit, the green vertical line at 1.20 is somewhat higher than the mode for BBB-rated observations. In other words, a DSCR of 1.20 is consistent with the bottom rung of the investment-grade bonds. (Recall that the median DSCR for BBB-rated bonds was 1.15.[33]) The turquoise vertical line at a DSCR of 1.57. The 1.57 DSCR is approximately at the mode of A-rated observations, indicating better credit risk characteristics and a move toward financial stability. The orchid vertical line at a 2.00 DSCR is approximately at the mode of the AA-rated observations. The DSCR of 2.00 is also close to the median value of the A-rated observations.[34] The density plot (and classification tree results) demonstrate that these various DSCR figures are economically meaningful.

Q. **What credit metrics are found most important at the second and third nodes?**

A. PREPA Ex. 5.26 shows that the winner at the second node (the so-called losers' bracket) was Full Obligation Coverage Ratio, with an average cut point value of 0.94 (average of its values regardless of which credit metric wins node 1 in any particular iteration) or 0.90 (average of its values given that DSCR is also the winner of node 1). This second node largely acts as a boundary between High Yield and BBB-rated observations. BBB is the next rating above High Yield and, as noted above, can be characterized as being at the cusp of capital market acceptance.

Node 3 is the sub node in the winners' bracket after the root node. In other words, node 3 largely acts as a boundary between A and AA-rated observations. The

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33 See PREPA Ex. 5.23.
34 See PREPA Ex. 5.23.

most important credit metric for node 3 is Days Liquidity, with a value of 186 days. Of the 195 AA-rated observations, 110 pass both the DSCR and Days Liquidity tests. On the other hand, none of the High Yield observations has Days Liquidity greater than 43 days.

Q. **Can you better show how the key credit metrics partition the ratings data?**

A. Yes. PREPA Exhibits 5.29, 5.30, and 5.31 provide a view of how the classification tree analysis divides ratings data into regions using the key credit metric boundaries.

PREPA Ex. 5.29 shows how the credit metrics of DSCR and Days Liquidity are associated with the Fitch's ratings decisions. The solid vertical line is a DSCR of 1.57. The dotted vertical line is DSCR of 2.00. The solid horizontal line is Days Liquidity of 186 days. The dotted horizontal line is Days Liquidity of 40.3.

The boundaries estimated by the classification tree divide the public power ratings observations into rectangular regions. The highest-risk and lowest rated observations have a DSCR less than 1.57 times and Days Liquidity below 40.3 days. In contrast, the better-rated AA-rated securities have DSCR in excess of 1.57 and Days Liquidity in excess of 186 days.

It is obvious that numerous BBB and A-rated observations in PREPA Ex. 5.29 also are found in the "Lowest Rating" quadrant, this is due in part to other factors—a third dimension if you will—that would help differentiate between the lower and higher-rated observations. One such factor is Full Obligation Coverage Ratio.

The Full Obligation Coverage Ratio is shown plotted against DSCR in PREPA Ex. 5.30. As before, the vertical lines in this graphic show DSCR of 1.57 (solid line) and

2.00 (dotted line). This time, the horizontal line shows the Full Obligation Coverage Ratio, and at a value of 0.94. As in PREPA Ex. 5.29, PREPA Ex. 5.30 shows that the upper right-hand quadrant contains the better-rated public power agencies.

While the two graphics show that some of the better-rated observations appear in the lower quadrant, it unambiguously identifies the credit observations that have better ratings.[35] What this means is that other factors, including non-measured features appear to affect bond ratings. These non-measured features appear to allow some observations to maintain an investment-grade credit rating even though, on paper, they would appear not to deserve it.

Finally, PREPA Ex. 5.31 illustrates how the three key metrics identified by the classification tree—DSCR, Full Obligation Coverage, and Days Liquidity—work together to separate the full set of 425 observations into lower- and higher-rated regions. The gold points in the exhibit are the High Yield entities; green points are BBB; blue points are A and purple points are AA. High Yield entities (gold points) are clustered around the origin at 0,0,0 (near-zero DSCR, near-zero Full Obligation Coverage, and near-zero Days Liquidity). The floating red grid in the figure represents Days Liquidity of 186 days. Better-rated credits appear above this floating grid. The preponderance of observations above the floating grid and with a DSCR greater than 1.57 are AA-rated entities. For those in the losers' bracket (with a DSCR less than 1.57), it is important to

[35] As discussed later, the metrics that are evaluated in this analysis provide reasonably good ability to identify problematic credits but the metrics also can produce false positives (classifying good credits as problematic). This is observed in the scatter plots.

exceed Full Obligation coverage of 0.9 in order to be consistent with even the BBB-rated credits.

Q. **Please discuss your Scenario 2.**

A. Scenario 2 limits all credit classes to 10 observations, which is the number of observations in the High Yield ratings class. This is a completely balanced dataset so that the classification algorithm will not weight results toward one class or another. The downside of this scenario is that with only 10 observations per class the results may not be robust predictors.

Q. **What do you conclude?**

A. The results of the Scenario 2 analysis are reported in tabular fashion PREPA Ex. 5.26, and are also shown graphically in PREPA Ex. 5.32. The table and figure show that Days Liquidity is the most important credit metric. PREPA Ex. 5.26 shows that Days Liquidity resolved as the most important credit feature in 572 of 1,000 iterations.

Unlike Scenario 1, there is no node 2 in Scenario 2. When applying the tree analysis to the full dataset of 425 observations, simply knowing that there are fewer than 40.3 Days Liquidity is sufficient to group together 9 of 10 High Yield observations as being rated as High Yield. Hence, Days Liquidity is a reasonable classifier and the classification tree algorithm does not proceed further.

In the winners' bracket, DSCR is used to make the distinction between good (A-rated) and better (AA-rated) observations. DSCR was also the second place finisher in the root node with 210 wins (relative to the 572 wins of Days Liquidity.) In other words, both DSCR and Days Liquidity were important credit metrics in Scenario 2, as they were

in Scenario 1, although flipped from node 1 to node 2. Days Liquidity in excess of 40.3 days and DSCR in excess of 1.71 is associated with investment grade ratings of either A (127 out of 195 observations) or AA-rated (174 out of 195 observations).

We conclude that this exercise confirms the Scenario 1 results in that DSCR and Days Liquidity remain key credit metrics associated with the credit classifications in the Fitch Study.

Q. **Did the lower number of observations in Scenario 2 have any effects on the results?**

A. Yes. In addition to the differences already described, the Scenario 2 model had a difficult time discerning A-rated observations and assigning them to one or another "leaf." About two-thirds of the A-rated observations were assigned to the AA class and the rest were assigned to the BBB class. Evidently (and not surprisingly), using 10 observations per rating class did not provide enough information for the algorithm to robustly make the distinction. This may have been anticipated insofar as about 60% of the A-rated observations (120 out of 195) were rated as A+ and about 60% of the AA-rated observations were rated as AA- (also 120 out of 195). A+ and AA- are neighboring ratings classes. As a result, there was minimal differentiation between these two ratings classes for these observations.

Q. **What are the key learnings from the classification tree analysis?**

A. The analysis suggests that in order to move from a High Yield status to a higher credit rating, it will be important for PREPA to increase both DSCR as well as Days Liquidity to at least the target cut point levels. Liquidity is very important to Fitch in evaluating low-quality credits. This means that PREPA would want to increase its liquidity through

business operations related to price, output sold, and costs—not by getting an infusion of cash from the central authority. Because Days Liquidity and DSCR are not (statistically significantly) correlated (see PREPA Ex. 5.24), both metrics may have to be independently managed—one may not automatically follow from the other.

Q. **Earlier you mentioned that you tested the scenarios for goodness of fit and statistical significance. What do you conclude with regard to goodness of fit and statistical significance of your analyses?**

A. PREPA Ex. 5.33 shows some summary statistics for the evaluation of the averages and medians that are shown in PREPA Ex. 5.23. When data are highly skewed or contain outliers, a test of whether the medians of two ratings classes are similar or different can be a more appropriate approach to determining differences in central tendencies of the data than a test of differences of means. Accordingly, we present a test for differences in medians.[36]

A "Yes" in upper panel of PREPA Ex. 5.33 means that the difference between the mean of a credit metric of one rating and the mean of that same credit metric in the adjoining rating is statistically significant at a 95% level of confidence. A "Yes" means that the difference would be expected to arise fewer than 5 times out of 100 if the true difference were actually zero. A "Yes" in the lower panel of PREPA Ex. 5.33 indicates the same thing for differences of medians of adjoining ratings classes.

[36] We used the Mann-Whitney-Wilcoxon rank sum test. See, Michael P. Fay and Michael A. Proschan, "Wilcoxon-Mann-Whitney or t-test? On Assumptions for Hypothesis Tests and Multiple Interpretations of Decision Rules," Statistics Surveys, vol 4, 2010, pp. 1-39.

What is notable is that the medians for DSCR, Days Liquidity, and Full Obligation Coverage are statistically significantly different across all of the ratings classes. This indicates that these metrics are reasonably likely to be a gating factor for bonds, and this is what the classification tree analysis confirms.

Q. **Please describe the goodness-of-fit and statistical significance tests that you applied to the classification tree analysis.**

A. PREPA Ex. 5.34 shows the summary statistics with regard to the classification tree analyses. With regard to overall statistical significance, we computed the Diagnostic Odds Ratio ("DOR") as a test.[37] The Diagnostic Odds Ratio provides a general overview of whether the model (or at least the portion of the model under consideration, such as High Yield separately from BBB) is better than chance assignment. That is found here to be true. For each of the comparisons (HY to BBB; BBB to A; and A to AA), the Diagnostic Odds Ratio is greater than 1.00 and the confidence interval for the Diagnostic Odds Ratio does not include 1.00. This means that in every case, the model provides some statistically significant predictive value.

Also among the summary statistics shown in PREPA Ex. 5.34 is one called Sensitivity. Sensitivity is an indicator of how well the classification tree is able to identify what it is supposed to identify. It is defined as the ratio of those correctly identified as (e.g.) High Yield (so-called True Positives) to the total number of High

[37] The Diagnostic Odds Ratio is defined as the ratio of [Number of True Positives * Number of False Positives] / [Number of True Negatives * Number of False Negatives] and it is interpreted the ratio of the odds of the test being positive if the observation is truly of the indicated class (e.g., High Yield or BBB) to the odds of the test being positive if the observation truly is not of that class. Afina S. Glas, Jeroen G. Lijmen Martin H. Prins, Gouke J. Bonsel, Patrick M.M. Bossuyt, "The Diagnostic Odds Ratio: A Single Indicator of Test Performance," Journal of Clinical Epidemiology 56 (2003), (hereafter "Glas *et al.*"), pp. 1129-1135.

Yield observations.[38] The test was able to correctly identify High Yield observations 72% of the time.

The Specificity statistic describes how well the classification tree does at not misclassifying credits. Specificity is defined as the ratio of those correctly identified as not being part of the class of interest (so-called True Negatives) to the total number of those not in the class of interest.[39] In a test of High Yield bonds, Specificity describes how well the test is able to avoid misidentifying non-High Yield bonds as High Yield. In this case, Specificity is 0.97 in the High Yield column, which means that the classification tree does a good job keeping non-HY credits out of the claimed High Yield class.

As was noted based on the graphs shown in PREPA Ex. 5.28, 5.29, and 5.30, there are a number of BBB and A-rated observations that arguably should be classified as High Yield if the cut points were the only factors considered by Fitch in making its assessments. In other words, what on paper would look like a poor credit rating was classified by Fitch as a higher rating for reasons having to do with information not contained in these metrics.

Q. **Given the foregoing analyses, please summarize your opinion regarding the key credit metrics that would influence whether and when PREPA will be re-admitted to the credit markets.**

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38 See, Glas *et al.*, p. 1130.
39 See, Glas *et al.*, p. 1130.

A. These analyses demonstrate that there are several credit metrics whose values are associated with better credit ratings for public power entities. Of key importance are DSCR and Days Liquidity as described in PREPA Ex. 5.19.

To some extent, improvements in one credit metric typically are associated with improvements in another. The key drivers of an improved credit rating, and therefore re-admission to the credit markets, according to the classification tree analyses, are DSCR and Days Liquidity, and improvements of these key metrics historically have been associated with higher ratings by Fitch Ratings.

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

A. Yes, it does.

No. CEPR-AP-2015-0001
PREPA Ex. 5.0

ATTESTATION

Affiant, Lucas D. Porter, being first duly sworn, states the following:

The prepared pre-filed Direct Testimony and the Schedules and Exhibits attached thereto and the Schedules I am sponsoring constitute the direct testimony of Affiant in the above-styled case. Affiant states that he would give the answers set forth in the pre-filed Direct Testimony if asked the questions propounded therein at the time of the filing. Affiant further states that, to the best of his knowledge, his statements made are true and correct.

Lucas D. Porter

Affidavit No. 3,575

Acknowledged and subscribed before me by Lucas D. Porter, of the personal circumstances above mentioned, in his capacity as Managing Consultant of Navigant Consulting, Inc., who is personally known to me or whom I have identified by means of his driver's license number From New York 410 957 692, in San Juan, Puerto Rico, this 26th day of May 2016.

Public Notary
c

JAIME J. ORTIZ RODRIGUEZ
PUERTO RICO
NOTARIO PUBLICO

EXENTO PAGO ARANCEL
LEY 47
4 DE JUNIO DE 1982

No. CEPR-AP-2015-0001
PREPA Ex. 5.0

ATTESTATION

Affiant, Dan T. Stathos, being first duly sworn, states the following:

The prepared pre-filed Direct Testimony and the Schedules and Exhibits attached thereto and the Schedules I am sponsoring constitute the direct testimony of Affiant in the above-styled case. Affiant states that he would give the answers set forth in the pre-filed Direct Testimony if asked the questions propounded therein at the time of the filing. Affiant further states that, to the best of his knowledge, his statements made are true and correct.

Dan T. Stathos

Affidavit No. 3,573

Acknowledged and subscribed before me by Dan T. Stathos, of the personal circumstances above mentioned, in his capacity as Managing Consultant of Navigant Consulting, Inc., who is personally known to me or whom I have identified by means of his driver's license number Password card C 10696 f34, in San Juan, Puerto Rico, this 26th day of May 2016.

Public Notary

JAIME J. ORTIZ RODRIGUEZ
PUERTO RICO
NOTARIO PUBLICO

EXENTO PAGO ARANCEL
LEY 47
4 DE JUNIO DE 1982

ATTESTATION

STATE OF GEORGIA)
) ss.
COUNTY OF FULTON)

Affiant, Francis X. Pampush, being first duly sworn, states the following:

The prepared pre-filed Direct Testimony and the Schedules and Exhibits attached thereto and the Schedules I am sponsoring constitute the direct testimony of Affiant in the above-styled case. Affiant states that he would give the answers set forth in the pre-filed Direct Testimony if asked the questions propounded therein at the time of the filing. Affiant further states that, to the best of his knowledge, his statements made are true and correct.

Francis X. Pampush

Affidavit No.____

Acknowledged and subscribed before me by Francis X. Pampush, of the personal circumstances above mentioned, in his capacity as Director of Navigant Consulting, Inc., who is personally known to me or whom I have identified by means of his driver's license number 057381789, in Atlanta, Georgia, this 25th day of May 2016.

Notary Public

Ingrid Trammell
NOTARY PUBLIC
STATE OF GEORGIA
My Commission Expires October 28, 2017

(Box 796-1 - Approved Dec. 18, 1953)

ORIGINAL

Certificate of Appointment
OF NOTARY PUBLIC

Notary's Signature

GEORGIA, COBB COUNTY.

I CAROLYN S. WHITMAN DEPUTY, Clerk of the Superior Court in and for said County, hereby certify that INGRID TRAMMELL whose address is 1189 L. ASHBOROUGH DR MARIETTA GA 30067 Age, 60 , Sex, F, was duly appointed and sworn in as a Notary Public under the provisions of O.C.G.A. Title 45, Chapter 17, Article 1, as amended, that their term of office begins on the 29TH day of OCTOBER , 20 13 , and expires on the 28TH day of OCTOBER , 20 17 .

WITNESS my hand and seal of said Court, this 29TH day of OCTOBER , 20 13 .

Carolyn S. Whitman DEPUTY

Clerk of the Superior Court COBB County, Georgia