PREPA Ex. 1.0

**COMMONWEALTH OF PUERTO RICO**
**PUERTO RICO ENERGY COMMISSION**

| | |
|---|---|
| IN RE: AGUIRRE SITE ECONOMIC ANALYSIS | **No.** CEPR-AP-2017-0001<br><br>**SUBJECT:** Direct Testimony of Gregory Rivera-Chico |

Direct Testimony of

**GREGORY RIVERA-CHICO**

Superintendent – Planning, Planning and Research Division
Puerto Rico Electric Power Authority

April 28, 2017

## TABLE OF CONTENTS

# I. INTRODUCTION

## A. Witness Identification

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

A. My name is Gregory Rivera-Chico. I am a Superintendent – Planning, Planning and Research Division, of the Puerto Rico Electric Power Authority ("PREPA" or the "Authority"). My business address is 1110 Ponce de Leon Avenue, San Juan, Puerto Rico 00907.

**Q. On whose behalf are you testifying before the Puerto Rico Energy Commission (the "Commission") in this proceeding?**

A. I am testifying on behalf of PREPA.

**Q. Have you previously testified before the Commission?**

A. Yes. I testified in the recent Rate Review, case no. CEPR-AP-2015-0001.

## B. Summary of Direct Testimony and Attachments

**Q. What are the purposes and subjects of your direct testimony?**

A. My testimony addresses the following purposes and subjects:

1. I discuss the background of this proceeding;
2. I discuss the Commission's requirements issued to PREPA for the Aguirre site economic analysis, testimony, and work papers, as modified and clarified;
3. I present and attach the Analysis and the required associated work papers, and I also present the separate required fuel plans document;

4. I describe how the Analysis was prepared, including how it meets the Commission's requirements, and present certain related information that the Commission directed by included in the testimony;

5. I describe the results of the Analysis;

6. I present certain additional facts that PREPA believes to be pertinent to the subject matter of this case; and,

7. I present PREPA's conclusions and recommendations.

**Q. Please summarize PREPA's conclusions and recommendations.**

A. The results of this evaluation show that having the Aguirre Offshore Gasport ("AOGP") in operation is more beneficial for the people of Puerto Rico than terminating the project and constructing new combined cycle ("CC") plants (a large new CC plant at Aguirre and a large new CC plant at Palo Seco) that would burn light distillate as fuel. PREPA recommends that the Commission fully approve and proceed with AOGP and the associated natural gas conversions at Aguirre (Aguirre thermal [steam] units 1 and 2 and Aguirre CC units 1 and 2) in the least time practically possible, in order to comply with the United States Environmental Protection Agency's ("US EPA") Mercury and Air Toxics Standards ("MATS"), 40 C.F.R. Parts 60 and 63, which were adopted under the federal Clean Air Act, 42 U.S.C. § 7401, *et seq.*, avoid the significant incremental liability risk to fines due to delays under other options, and proceed with the most advantageous option, due to the demonstrated savings over the most probable outcomes.

**Q. Are there any exhibits attached to your testimony?**

A. Yes. My testimony includes the following attached exhibits:

- PREPA Exhibit ("Ex.") 1.01: My *curriculum vitae;*
- PREPA Ex. 1.02: The Analysis, which consists of the Report (incuding its four Appendices) filed by PREPA on April 24, 2017 (PREPA Ex. 1.02 is split into two .pdf documents, Part I and Part 2, because of the size of the Report and its Appendices);
- PREPA Ex. 1.03: The applicable work papers for the Analysis, which consists of the 12 Excel spreadsheets, which include the financial model and PROMOD IV® outputs for each scenario, filed by PREPA on April 21, 2017. Creating a .pdf version of the 12 spreadsheets would be difficult because of the number of spreadsheets, the number of tabs, and the size of some of the tabs. Accordingly, PREPA is supplying working electronic versions of the work papers on a "USB drive". PREPA is submitting a one page cover page .pdf as PREPA Ex. 1.03, which incorporates by reference the spreadsheets on the USB drive.
- PREPA Ex. 1.04: A report on the fuel plans regarding deliveries of liquefied natural gas ("LNG") or compressed natural gas ("CNG"):

## C. Qualifications and Professional Background

**Q. What are your duties and responsibilities as a Superintendent in the Planning and Research Division of PREPA?**

A. I became Superintendent – Planning of the Planning and Research Division of PREPA in 2014. My duties in this position, in brief, are to supervise and coordinate the activities of the Strategic Planning, Forecasting and Statistics, and Engineering Systems Departments,

of the Planning and Research Division. More detail is found in PREPA Ex. 1.01, which is my curriculum vitae.

**Q. Please briefly describe the positions you previously have held at PREPA, when, and what were your duties in those positions.**

A. My prior positions at PREPA are described in PREPA Ex. 1.01.

**Q. Do you hold any professional licenses?**

A. Yes. I hold Puerto Rico Professional Engineer License #10857. I am a member of the Puerto Rico College of Engineers and Surveyors.

**Q. What is your educational background?**

A. From 1994-1996, I was enrolled at the Georgia Institute of Technology, from which I obtained a Masters of Science in Electric Engineering. I had a concentration in power engineering. From 1985-1989, I studied at the University of Hartford, where I obtained a Bachelors of Science in Electrical Engineering, *summa cum laude*. I had a minor in Mathematics.

## II. THE BACKGROUND OF THIS PROCEEDING

**Q. Please describe the background of this proceeding.**

A. The background of this proceeding, in the most basic sense, is that PREPA, as everyone knows, is in the process of reform and recovery. In brief, those efforts include plans and measures to modernize PREPA's system to comply with environmental law and improve the environment, to be a more adequate and reliable provider of electric service, to reduce the long term costs of service, and to move to compliance with the statutory renewable

energy portfolio standard (Act 82-2010) and effectively integrate more renewable energy. There also are two prior Commission proceedings that are particularly relevant to this Aguirre case.

**Q. What are the two prior Commission proceedings that are particularly relevant to this Aguirre case?**

A. The prior Commission case that is the most relevant to this Aguirre case is the integrated resource plan ("IRP") case, but the Rate Review also is relevant.

**Q. Please briefly describe the relevant aspects of the IRP case.**

A. To begin with, the framework for the IRP case was legislation adopted by the Commonwealth. More specifically, on May 27, 2014, Act 57-2014, the Puerto Rico Energy Transformation and RELIEF Act, was approved. Act 57-2014 required PREPA to prepare an integrated resource plan (IRP) and to submit the IRP to the Commission for review and approval or modification. *See, e.g.*, Section 6B(h) of Act 83-1941, the Puerto Rico Electric Power Authority Act, as added by Act 57-2014 and renumbered by Act 4-2016, the Electric Power Authority Revitalization Act; and Section 6.23 of Act 57-1941.

In July 2014, PREPA began work on its proposed IRP.

In May 2015, the Commission's proposed Regulation on Integrated Resource Plan for the Puerto Rico Electric Power Authority was approved.

In June 2015, the Commission initiated its case no. CEPR-AP-2015-0002: "In re Integrated Resource Plan for the Puerto Rico Electric Power Authority".

In July 2015, PREPA finalized and submitted its proposed IRP to the Commission.

The IRP case thereafter was conducted with the participation of PREPA and various intervenors, and included discovery, although there was not testimony or briefs.

In August and September 2015, pursuant to Commission directives, PREPA prepared a submitted a revised proposed IRP to the Commission. The revised IRP often is referred to as the "Base IRP".

In December 2015, the Commission issued an order that required PREPA to submit a supplemental IRP that used certain assumptions that involved energy efficiency, among others, as directed by the Commission as well as an updated fuel forecast.

PREPA prepared and submitted an interim version of the supplemental IRP in March 2016, and, pursuant to Commission directives, PREPA submitted the final version in April 2016. The supplemental IRP sometimes is referred to as "the Supplemental IRP", "the "April IRP", the "Fuel IRP", or the "Updated Fuel IRP".

Both the Base IRP and the Supplemental IRP proposed, in part, that the Commission approve PREPA's proposed Aguirre Offshore Gasport ("AOGP"), which would allow PREPA to import natural gas without relying solely on the current natural gas import monopoly of EcoEléctrica, and the associated conversions to natural gas of Aguirre thermal (steam) units 1 and 2 and Aguirre combined cycle ("CC") units 1 and 2.

In brief, PREPA contended that AOGP and the associated conversions were critical elements of its plan to move into compliance with the US EPA's Mercury and Air Toxics Standards (MATS). PREPA has numerous generating facilities that are out of compliance with MATS, and has been engaged in a long negotiation with US EPA and

the United States Department of Justice regarding this subject.[1] PREPA also contended that pursuing any alternatives would delay MATS compliance, expose PREPA to significant civil and criminal penalties, citizen suits, and cease and desist orders, and would delay environmental justice to communities neighboring PREPA's non-compliant generating facilities.

The Commission, in its September 23, 2016, Final Resolution and Order ("Final Order"), however, neither approved nor disapproved PREPA's proposed AOGP and the associated conversions. The Commission instead approved PREPA's proceeding with permitting, engineering, and planning of AOGP and the conversions, but subject to a going forward $15 million spending cap, pending the Commission's consideration of further analysis to be submitted by PREPA. The Final Order provided that the Commission would give PREPA further directives regarding the required additional analysis. The Final Order appeared to require that PREPA submit the required additional analysis by June 30, 2017.

The Final Order also directed PREPA to seek permitting of what the Commission considered to be a possible combined alternative of building a large new combined cycle plant at Aguirre and repowering Aguirre CC units 1 and 2, although no party had made such a proposal.[2] The Final Order, in this respect, essentially moved forward, by many years, steps that PREPA had proposed would take place after AOGP and the conversions were in place. The Final Order established a "Modified IRP", subject to the process of

[1] The fact of the negotiations' existence is well known, but the content of the negotiations is confidential under a contractual agreement among the negotiating parties.

[2] The Final Order also addressed the other components of PREPA's and intervenors' proposals.

parties seeking reconsideration. The Final Order directed PREPA to submit a write-up of the Modified IRP that the Commission then would review for compliance with the Final Order.

PREPA filed a timely Verified Motion for Reconsideration on October 13, 2016. In brief, as to the above subjects, PREPA sought approval of its proposals, and elimination of the directives regarding the combined alternative, on legal and factual grounds. The contentions included, among others, the legal position that PREPA could not continue to pursue AOGP and the conversions and simultaneously pursue permitting of the combined alternative, and the position that the years of delay attendant to the combined alternative would expose PREPA, and thus its customers, to the risk of additional civil penalties of $279,843,750 for non-compliance with MATS. The factual contentions also included discussion of the respective merits of PREPA's proposal and the combined alternative (as well as discussion of the impracticality / lack of merit of other hypothetical alternatives).

The Commission essentially adhered to the Final Order's above rulings in its February 10, 2017, Resolution on PREPA's motion for reconsideration, although the Commission clarified that it expected further steps before PREPA might be expected to seek permitting of the combined alternative.

On April 5, 2017, in the IRP case, in response to a March 10, 2017, motion by PREPA, the Commission clarified that the deadline for PREPA's submitting a write-up of the Modified IRP would be stayed until sometime after the conclusion of this Aguirre case.

**Q. Please describe the relevant aspects of the Rate Review.**

A. While the Commission was in the late stages of the IRP case, the Commission also was considering PREPA's first Rate Review, in its case no. CEPR-AP-2015-0001. The Rate Review involved setting new base rates for PREPA for the first time since 1989. The Rate Review included, among other things, a close examination of PREPA's actual and expected costs for its Fiscal Year 2017 (July 2016 through June 2017). A relatively small portion of those costs were costs of AOGP and the associated conversions.

Accordingly, in the Rate Review, among other things, PREPA also sought approval of AOGP and the associated conversions. PREPA submitted both previous and new points in support of that position. PREPA notes that one of the Commission's own Staff members testified, among other things, that the potential alternatives would add about four years to the timeline for MATS compliance.[3]

The Commission, in its January 10, 2017, Final Resolution and Order in the Rate Review, however, basically adhered to the relevant rulings in its IRP case Final Order, subject to the outcome of PREPA's then-pending IRP case motion for reconsideration.

On January 20, 2017, PREPA filed a motion for clarification of certain points, and on January 30, 2017, PREPA filed a timely Verified Motion for Reconsideration. The reconsideration motion included, among other things, a request for reconsideration as to AOGP and the associated conversions.

On March 8, 2017, the Commission issued its Final Resolution on PREPA's reconsideration motion. The Commission did not grant reconsideration as to AOGP and

[3] Testimony of Dr. Jeremy Fisher, December 7, 2016. He also questioned, however, whether the $280 million in civil penalties risk was supported by sufficient evidence.

the associate conversions, but the Final Resolution essentially did not discuss the subject beyond pointing to the initiation of this Aguirre case, which had occurred by that point.

**Q. Are your discussions of the IRP case and the rate Review intended to be exhaustive?**

A. No. Those two cases were extensive and complicated, and they involved thousands of pages of documents. My brief discussion of this background information is an extremely high level overview that is not intended to be a complete discussion of all of this subject matter.

**Q. How was this Aguirre case initiated?**

A. On February 10, 2017, the same day as the Resolution on reconsideration in the IRP case, the Commission (unexpectedly from PREPA's view) issued a separate Order Initiating Proceeding on Aguirre Site Economic Analysis, commencing the separate proceeding in which I am submitting this Direct Testimony. The Commission basically moved the further analysis called for by the IRP case Final Order into this case, and moved up the schedule.

## III. THE COMMISSION'S REQUIREMENTS

### A. The Commission's Requirements for the Analysis

**Q. Has the Commission, in this Aguirre case, issued detailed instructions regarding the Aguirre site economic analysis (the Analysis) required of PREPA?**

A. Yes, the Commission's February 10, 2017, initiating Order was very helpful, in that it was quite specific on what the Commission expected from PREPA in the Analysis. On March 3, 2017, PREPA did file a Verified Motion for Limited Amendments to the

Commission's February 10, 2017, Order. That Motion sought limited changes to the required Analysis. On March 15, 2017, the Commission basically granted the Motion and amended portions of the requirements for the Analysis. Meanwhile, the Commission's Staff also had clarified certain requirements for the Analysis in technical conferences held on March 9, and March 14, 2017.[4] The Commission's requirements, as amended and clarified, speak for themselves.

**Q. Understanding that the Commission's requirements for the Analysis, as amended and clarified, speak for themselves, nonetheless, could you briefly describe the nature of the requirements?**

A. Yes. The February 10, 2017, initiating Order is very specific, and the Commission later has made specific modifications and clarifications. In brief, the Commission has required the following in relation to the Analysis:

1. PREPA must "test" four resource plans, using the Modified IRP scenarios as approved in the IRP case Final Order, with the Commission's energy efficiency modeling assumptions as used in the Updated Fuel IRP. In brief, the four scenarios are
    a. PREPA's proposal as presented in Portfolio 3 Modified Future 1 Modified of the Updated Fuel IRP, which includes natural gas conversions at Aguirre and AOGP construction, referred to as "AG".

[4] On March 23, 2017, PREPA filed a separate motion for clarification, but that motion basically involved clarification regarding certain requirements involving information to be provided to intervenors, not the requirements of the Analysis as such. On March 27, 2017, the Commission ruled on that motion.

b. PREPA's Portfolio 3 Modified Future 1 Modified Sensitivity 4 as presented in the Updated Fuel IRP, with full compliance with the targets in the statutory renewable portfolio standard (Act 82-2010), and with demand response, referred to as "AG+RE".

c. PREPA's Portfolio 3 Modified Future 2 Modified as presented in the Updated Fuel IRP, which excludes gas conversions at Aguirre and AOGP construction, referred to as "NO".

d. PREPA's Portfolio 3 Modified Future 2 Modified as presented in the Updated Fuel Case in the Supplemental IRP with full compliance with the targets in the renewable portfolio standard and with demand response, referred to as "NO+RE".

(Note that the scenarios were clarified.)

2. PREPA, as to the second and fourth scenarios, must make certain assumptions about demand response.

3. PREPA must engage in certain data updating, although it is not required to do new transmission system modeling.

4. PREPA must comply with the Commission's directives regarding fuel price data. (These directives were modified.)

5. PREPA must comply with certain directives regarding the sales forecast.

6. PREPA must comply with certain directives regarding the modeling of the scenarios.

7. PREPA must describe certain options for fuel delivery, at a minimum, and must discuss their respective costs, their paths to full-fleet MATS compliance, and must assess their feasibility and risks, including delays and cost increases.

8. PREPA also must perform certain liquefied natural gas (LNG) and compressed natural gas (CNG) market research in addition to the Analysis. (These directives were modified.)

## B. The Commission's Requirements for Testimony and Work Papers

**Q. Has the Commission also issued requirements for the testimony accompanying the Analysis?**

A. Yes. The Commission also has issued requirements relating to the testimony required to accompany the Analysis. The testimony must (1) present the results of each of the four scenarios, including a specific list of items; (2) include the fuel delivery options descriptions referenced above; and (3) present the results of the LNG and CNG market research referenced above. I note, as to item (3), that PREPA's legal team and the respective suppliers' legal teams are working on a mutually acceptable non-disclosure agreement ("NDA") for the suppliers to release the needed information to PREPA. As soon as this is done, PREPA can provide the LNG/CNG market research to the Commission, Commission Eyes Only, as established in the Commission order dated March 15, 2017.

**Q. Has the Commission also issued any work papers requirements?**

A. Yes. PREPA, simultaneously with its submission of the Analysis and the testimony, also must supply working copies of all relevant work papers, including at least its financial

model and PROMOD IV® outputs for each scenario. PROMOD IV® is a licensed production cost model used by PREPA.

## IV. THE AGUIRRE SITE ECONOMIC ANALYSIS AND OTHER REQUIRED INFORMATION

### A. The Analysis

**Q. Is the Analysis that PREPA performed at the direction of the Commission attached to your testimony as PREPA Ex. 1.02?**

A. Yes (in two Parts, as I noted earlier).

**Q. Are the required work papers for the Analysis attached to your testimony as PREPA Ex. 1.03?**

A. Yes.

**Q. Please describe the Analysis.**

A. PREPA conducted an economic analysis of the value of its plans for the Aguirre site, which include AOGP and planned generating units natural gas fuel conversions at Aguirre, and other scenarios, as specified by the Commission. The analysis consisted of the evaluation of several scenarios, which examine four different resource plans, two of them which include AOGP and planned conversions at Aguirre, and two resource plans that do not. Each plan was evaluated under three different fuel forecast scenarios ("Reference" [most likely], "High Oil", and "Low Oil") to compare the costs and to demonstrate the benefits of the Aguirre proposed plan as such and in comparison to the specified alternatives. PREPA used PROMOD IV® to run the scenarios. With the PROMOD IV® results and the pre-existing financial model framework, PREPA

297 calculated the total present value of system costs for each resource plan under each
298 scenario, using a twenty year study period from fiscal years 2018 through 2037
299 (beginning in July 1, 2017, and ending in June 30, 2037).

300 **Q. What costs are considered in total system costs?**

301 A. The system costs include amortized capital costs, fuel costs, variable and fixed generation
302 operating costs, purchased power costs from independent power producers AES-PR and
303 EcoEléctrica, renewable purchased power costs, and energy efficiency and demand
304 response costs. The system costs also include EPA Statutory Maximum Civil Penalties
305 associated with MATS non-compliance.

306 **Q. What capital costs are considered in the Analysis?**

307 A. The capital costs considered in the evaluation are those associated with construction of
308 new generation, conversion of existing units to use natural gas, cost of demolition of
309 existing generation, fuel infrastructure, and transmission upgrades and improvements.

310 **Q. How were EPA Statutory Maximum Civil Penalties associated with MATS non-**
311 **compliance calculated?**

312 A. PREPA considered statutory penalties to accrue from July 1, 2017, until the dates
313 compliance is achieved at a rate of $93,750 per violation per day occurring thereof, as per
314 Table 2 – Civil Monetary Penalty Inflation Adjustments of 40 C.F.R. § 19.4. PREPA
315 considered dates when generating units are scheduled to be out of service due to
316 programmed maintenance or environmental outages.

317 **Q. How was the Analysis prepared?**

A. PREPA used PROMOD IV® to evaluate the scenarios indicated by the Commission. PREPA updated the models prepared for the Updated Fuel Cases in the Supplemental IRP as specified by the Commission: (1) PREPA's Portfolio 3 Modified Future 1 Modified, which includes gas conversions at Aguirre and AOGP construction; (2) PREPA's Portfolio 3 Modified Future 1 Modified Sensitivity 4, with full compliance with the targets in the statutory renewable portfolio standard (Act 82-2010), and with demand response; (3) PREPA's Portfolio 3 Modified Future 2 Modified, which excludes gas conversions at Aguirre and AOGP construction; and (4) PREPA's Portfolio 3 Modified Future 2 Modified with full compliance with the targets in the renewable portfolio standard and with demand response. PREPA prepared Excel spreadsheets, which include the financial model and PROMOD IV® outputs for each scenario to tabulate and analyze the results. PREPA filed those 12 spreadsheets on April 21, 2017, and they are part of PREPA Ex. 1.03, as noted earlier.

**Q. What were the updates to the models?**

A. PREPA updated the PROMOD IV® models with a new load forecast, three fuel price forecasts, maintenance itinerary, AOGP schedule, renewable energy projects and new generating alternatives commissioning dates, among others.

**Q. What load and energy forecast was used for the analysis?**

A. PREPA updated the load and energy forecast according to the latest econometric model from Advanced Business Consulting, Inc. (October 2016), which showed an annual growth rate of 0.15% from fiscal year 2017 through 2022. The energy sales are lower than in the forecast used in the Supplemental IRP due to a more pessimistic view of the

economic and fiscal situation in Puerto Rico. A description of the forecast and the models selected by service class are presented in Section 3 of the Report in PREPA Ex. 1.02.

**Q. Was energy efficiency considered in the load and energy forecast?**

A. Yes. PREPA's load forecast considers the estimated energy reduction resulting from the government energy efficiency program implementation. Besides that, beginning in 2017, Demand Side Management ("DSM") Energy Efficiency ("EE") achieves a reduction on the modeled load starting from 0.2 percent rate of reduction and incrementing by 0.2 percent each year through 2024, and from 2025, and thereafter the rate of reduction stabilizes at 1.5 percent per year. Energy efficiency was assumed at a cost of 4.5 cents per kWh, using the dollar value for 2014. It was assumed that the load shape of EE is identical to the overall aggregate load requirement for PREPA. Table 3-2 and Table 3-3 of the Report in PREPA Ex. 1.02 show the modified demand and sales with the above mentioned EE included.

**Q. Please explain the fuel prices forecasts used in the Analysis.**

A. The Commission directed PREPA, in the February 10, 2017, order, to prepare fuel price forecasts based on the Henry Hub ("HH") and West Texas Intermediate ("WTI") price forecasts in the Reference, High Oil Price, and Low Oil Price cases from the Energy Information Administration's 2017 edition of the Annual Energy Outlook. The methodology to develop the forecasts consisted in obtaining mathematical models with econometric tools to estimate the performance of a dependent variable, the fuel prices in this instance. Historical daily values of fuel prices and adders, as well as the price

362 formulas defined in the contracts, were considered for Fuel Oil No.6, No. 2, and for
363 natural gas at Costa Sur. In addition, the contractual information and methodologies for
364 fuel price calculations for AES-PR and for EcoEléctrica were used. An econometric
365 model was developed for each fuel using these historical values and the EIA indicators.
366 On March 29, 2017, PREPA requested the Commission the allow changes to the fuel
367 price projections calculations for No. 6 and No. 2 from WTI to Residual Fuel Oil and
368 Distillate Fuel Oil prices from the 2017 Energy Outlook. This request was made because
369 the prices obtained for No.2 in the Low Oil Scenario were unrealistic. The Commission
370 agreed. The adders were applied to the forecasted prices of No. 6 and No. 2 according to
371 the different locations for power generation. A detailed description of the fuel price
372 forecast is presented in Section 6 of the Report in PREPA Ex. 1.02.

373 **Q. What were the commissioning dates updates considered?**

374 A. Aguirre Offshore Gasport was assumed to come online by April 2019. PREPA estimates
375 this is the earliest expected date for AOGP to be constructed and fully operational, in
376 view of the current permitting process status. Accordingly, the operation with natural gas
377 of the converted Aguirre steam and combined cycle units was rescheduled to April 2019.
378 The repowering of the Aguirre CC units was delayed two years and is assumed to be
379 operational by July 1, 2022. In the "AG" scenarios, the new SCC-800 (or similar model)
380 combined cycle unit at Palo Seco begins commercial operation in January 1, 2023. In the
381 "NO" scenarios, the commissioning dates of the new H-Class (or similar model)
382 combined cycles at Aguirre and Costa Sur are delayed. The new H-Class (or similar
383 model) combined cycles at Palo Seco and Aguirre begin commercial operation in

January 1, 2024, while the H-Class (or similar model) combined cycle at Costa Sur starts commercial operation in January 1, 2025. The retirement of Aguirre steam units was delayed until December 31, 2023. The renewable energy projects commission dates considered in the Supplemental IRP were updated for the Analysis based on their current status. Some projects entered in commercial operation during this period of time and the dates were revised in PROMOD IV®. Those projects whose commissioning dates have not been achieved to date were delayed by three (3) years in consideration of a more representative simulation.

**Q. Please describe the assumptions used for Demand Response.**

A. A demand response ("DR") program to shift demand from the night peak to the mid-day to increase the capability to incorporate renewable energy projects was assessed in the "AG+RE" and "NO+RE" scenarios. As in the Supplemental IRP evaluation, the demand response was designed so that the curtailment was limited to two percent and it was optimized each year to reflect the increasing capability of PREPA's fleet to accommodate renewable generation. A cost of 2 cents per kWh, using the dollar value for 2016, was assumed for the control systems to shift from the night peak to the mid-day. A more detailed description of the Demand Response program assumptions is provided in Section 5 of the Report in PREPA Ex. 1.02.

**Q. Was any additional transmission system modeling performed?**

A. The Commission's directives did not require any additional transmission system modeling for this analysis. However, the schedule and the capital costs associated with transmission system upgrades were updated.

406 **Q. How does the Analysis meet the requirements set out by the Commission?**

407 A. The Analysis speaks for itself, but the short answer is that PREPA very carefully
408 considered the Commissions' directives, and sought limited amendments and
409 clarifications of those directives, so that PREPA could design, perform, and present the
410 Analysis in manners that comply fully with the directives. PREPA then followed the
411 steps needed to comply fully.

412 **B. <u>Description of the Options for Fuel Delivery</u>**

413 **Q. Please list the fuel delivery options that the Commission's February 10, 2017,**
414 **initiating Order refers to as "Options with gas to Aguirre only".**

415 A. The initiating Order (at p. 6) describes three such options: (1) "AOGP, with the earliest
416 expected online date"; (2) "AOGP, with a one-year delay from the earliest expected
417 online date (i.e., due a delay in permitting or financing)"; and (3) "Deliveries of
418 containerized liquefied natural gas ('LNG') or compressed natural gas ('CNG'), absent
419 AOGP".

420 **Q. Please describe the first of the three "Options with gas to Aguirre only", including**
421 **the required cost, path to full-fleet MATS compliance, and feasibility and risk**
422 **information called for by the Commission.**

423 A. The first of the "Options with gas to Aguirre only" concerning "AOGP, with the earliest
424 expected online date" was evaluated for the resource plans in AG and AG+RE scenarios.
425 For those scenarios, PREPA assumed that AOGP was completed by April 1, 2019, which
426 reflects the earliest expected online date, in view of the current permitting process status.
427 The information about the AG and AG+RE scenarios costs and evaluation results is

contained in Section 8 of the Report in PREPA Ex. 1.02 and in the Excel spreadsheets filed and served on April 21, 2017, and also included in PREPA Ex. 1.03. MATS compliance for the AG and AG+RE scenarios, is discussed in Section 7 of the Report in PREPA Ex. 1.02.

**Q. Please describe the second of the three "Options with gas to Aguirre only", including the required cost, path to full-fleet MATS compliance, and feasibility and risk information called for by the Commission.**

A. The second of the "Options with gas to Aguirre only" refers to "AOGP, with a one-year delay from the earliest expected online date (*i.e.*, due a delay in permitting or financing)". PREPA evaluated the possibility of a one-year delay in the construction and operation of AOGP considering a commissioning date for AOGP of April 2020. This modified schedule was incorporated in the AG_Base scenario, with the corresponding delay in Aguirre steam and combined cycle units operation with natural gas. The AG_Base Delay case has a present value of system cost of approximately $186 million dollars higher than the AG_Base case. There are two major contributors to these differences: fuel costs and exposure to civil penalties. The effect of the maximum statutory civil penalties under the Clean Air Act for the Aguirre Complex due to one-year delay in the operation of the AOGP entails an additional cost of $66 million. The fuel consumption portion entails an increase of approximately $80 million due to the delay in the AOGP operation by April 2020 (FY 2020 values). However, the AG_Base Delay case is still much lower than the NO_Base (no AOGP) case by a difference of more than $ 3.2 billion dollars. This result shows that having AOGP in operation and converting Aguirre steam units 1 & 2 is more

beneficial than disapproving the Project and beginning the construction of new combined cycle units using light distillate as fuel.

**Q. Please describe the third of the three "Options with gas to Aguirre only", including the required cost, path to full-fleet MATS compliance, and feasibility and risk information called for by the Commission.**

A. The third of the "Options with gas to Aguirre only" regarding "Deliveries of containerized liquefied natural gas ('LNG') or compressed natural gas ('CNG'), absent AOGP." is discussed in the report PREPA Fuel Delivery Option Assessment prepared by Siemens Industry included in PREPA Ex. 1.04. The assessment concludes that LNG delivery in ISO containers to Aguirre absent AOGP is not practical due to the expected gas demand and the amount of container handling required on a daily basis and vessel deliveries required on an annual basis. In addition, dredging will be required at the Aguirre port, which could be a fatal flaw. The sheer volume of CNG containers in comparison to LNG ISO containers rules it out as a viable option. In addition, there are no existing CNG production facilities of the scale required to satisfy PREPA's volume requirements.

**Q. Please list the fuel delivery options that the Commission's February 10, 2017, initiating Order refers to as "No gas or gas to North only" options.**

A. The initiating Order (at p. 6) describes two such options: (1) "Gas to the North only, using deliveries of containerized LNG or CNG, as described on page 5-2 of the Base IRP"; and, (2) "A no-gas scenario.".

**Q. Please describe the first of the two "No gas or gas to North only" options, including the required cost, path to full-fleet MATS compliance, and feasibility and risk information called for by the Commission.**

A. The first of the "No gas or gas to North only" options concerns "Gas to the North only, using deliveries of containerized LNG or CNG. This option is discussed in the report PREPA Fuel Delivery Option Assessment prepared by Siemens Industry included in PREPA Ex. 1.04. The assessment concludes that costs and operational risks for LNG delivery in ISO containers to San Juan are prohibitively high. CNG delivery either as a bridge fuel or long-term solution is not practical due to the expected demand.

**Q. Please describe the second of the two "No gas or gas to North only" options, including the required cost, path to full-fleet MATS compliance, and feasibility and risk information called for by the Commission.**

A. The second of the "No gas or gas to North only" refers to "A no-gas scenario." PREPA evaluated such option for the resource plans in NO and NO+RE scenarios. The information about the NO and NO+RE scenarios costs and evaluation results is contained in Section 8 of the Report in PREPA Ex. 1.02 and in the Excel spreadsheets filed and served on April 21, 2017, and also included in PREPA Ex. 1.03. MATS compliance for the NO and NO+RE scenarios, is discussed in Section 7 of the Report in PREPA Ex. 1.02.

## C. The Results of the Analysis

**Q. What are the results of the Analysis for the first scenario?**

A. The system costs summary for the AG scenarios are tabulated in Appendix C of the Report in PREPA Ex 1.02: Appendix C-1 shows the results for AG_Base, Appendix C-2 shows the results for AG_High_Oil, and Appendix C-3 shows the results AG_Low_Oil. The present value of system costs in the AG_Base scenario aggregates to $27.97 billion over the 2018-2037 study period. AG_High_Oil fuel case resulted in a present value of system costs of $32.23 billion, and AG_Low_Oil case resulted in a present value of system costs of $26.04 billion over the 2018-2037 period. The difference in total present value of system costs for the forecast period of 2018-2037 between the AG_Base scenario and the AG_High_Oil and AG_Low_Oil scenarios ranged from $4.26 billion higher to $1.93 billion lower, respectively, due to the substantial differences in the fuel prices forecasts. More information about the AG scenarios and their results are contained in Section 8 of the Report in PREPA Ex. 1.02 and in the Excel spreadsheets filed and served on April 21, 2017, and also included in PREPA Ex. 1.03.

**Q. What are the results of the Analysis for the second scenario?**

A. The system costs summary for the AG+RE scenarios are tabulated in Appendix C of the Report in PREPA Ex 1.02: Appendix C-4 shows the results for AG+RE_Base, Appendix C-5 shows the results for AG+RE_High_Oil, and Appendix C-6 shows the results AG+RE_Low_Oil. The present value of system costs for the AG+RE_Base scenario aggregates to $29.65 billion over the 2018-2037 forecast period, which is about $1.68 billion higher than the corresponding value for the case with a reduced renewable portfolio standard ("RPS") target and without demand response (AG_Base). AG+RE_High_Oil fuel case resulted in a present value of system costs of $32.45 billion,

which is approximately $2.8 billion higher than the AG+RE_Base with base fuel forecast, driven by the substantially higher fuel forecast assumed in the fuel sensitivity analysis. The present value of the system costs is about $221 million higher than the corresponding value for the case with a reduced RPS target and without demand response (AG_High_Oil case). AG_Low_Oil case resulted in a present value of system costs of $26.93 billion over the 2018-2037 period, which is approximately $2.72 billion lower than the AG+RE_Base with base fuel forecast, driven by the substantially lower fuel forecast assumed in the fuel sensitivity analysis. The present value of the system costs is about $890 million higher than the corresponding value for the case with a reduced RPS target and without demand response (AG_Low_Oil). AG+RE scenarios resulted in higher system costs than AG scenarios. This is primarily due to two reasons: (1) the cheaper conventional generation is replaced by PV generation which has a higher price; and (2) an estimated cost of 2 cents per kWh for the control systems to shift from the night peak to the mid-day. More information about the AG+RE scenarios and their results are contained in Section 8 of the Report in PREPA Ex. 1.02 and in the Excel spreadsheets filed and served on April 21, 2017, and also included in PREPA Ex. 1.03.

**Q. What are the results of the Analysis for the third scenario?**

A. The system costs summary for the NO scenarios are tabulated in Appendix C of the Report in PREPA Ex 1.02: Appendix C-7 shows the results for NO_Base, Appendix C-8 shows the results for NO_High_Oil, and Appendix C-9 shows the results NO_Low_Oil. The present value of system costs in the NO_Base scenario aggregates to $31.38 billion over the 2018-2037 forecast period, which is about $3.42 billion higher than the

corresponding value for the case that AOGP is built (AG_Base), thus demonstrating the value of the AOGP project in the base case, which is the scenario that represents the most likely conditions to occur.. NO_High_Oil fuel case resulted in a present value of system costs of $43.28 billion, which is approximately $11.9 billion higher than the NO_Base with the reference fuel forecast, driven by the substantially higher fuel forecast assumed in the analysis. The present value of the system costs for NO_High_Oil is about $11.05 billion higher than the corresponding value for the case that the AOGP is built (AG_High_Oil), thus resulting in a tremendous economic advantage of the AOGP project in case world oil prices raise to considerably high values. NO_Low_Oil case resulted in a present value of system costs of $24.32 billion over the 2018-2037 period, which is approximately $7.07 billion lower than the NO_Base with the reference fuel forecast, driven by the substantially lower fuel forecast assumed in the fuel sensitivity analysis. When comparing the present value of the system costs of NO_Low_Oil Scenario with the corresponding value of $26.04 of AG_Low_Oil, the NO_Low_Oil scenario costs are about $1.72 billion lower. In this scenario world oil prices fall significantly and remain low during all the study period. The average price for Fuel Oil No. 6 is $30/BBL and at the end of the study period is still lower than $38/BBL. The average price for Fuel Oil No. 2 is $67/BBL and the price is below $93/BBL at the end of the twenty year forecasted period. More information about the NO scenarios and their results are contained in Section 8 of the Report in PREPA Ex. 1.02 and in the Excel spreadsheets filed and served on April 21, 2017, and also included in PREPA EX. 1.03.

**Q. What are the results of the Analysis for the fourth scenario?**

A. The system costs summary for the NO+RE scenarios are tabulated in Appendix C of the Report in PREPA Ex 1.02: Appendix C-10 shows the results for NO+RE_Base, Appendix C-11 shows the results for NO+RE_High_Oil, and Appendix C-12 shows the results NO+RE_Low_Oil. The difference in total present value of system costs for the study period of 2018-2037 between the NO+RE_Base scenario and the NO+RE_High_Oil and NO+RE_Low_Oil scenarios ranged from approximately $11 billion higher to $6.7 billion lower, respectively, due to the substantial differences in the fuel prices forecasts. NO+RE_Base and NO+RE_Low_Oil scenarios resulted in total value of system costs higher than the corresponding NO scenarios, but NO+RE_High Oil scenario resulted in lower total present value of system costs than NO_High_Oil scenario. The reasons for higher costs in NO+RE_Base and NO+RE_Low_Oil are: (1) the cheaper conventional generation is replaced by PV generation which has a higher price; and, (2) an estimated cost of 2 cents per kWh for the control systems to shift from the night peak to the mid-day. In the NO+RE_High Oil scenario, due to the high fuel prices, the cost of the renewable generation becomes lower than the cost of conventional generation. The comparison of the base scenario, AG+RE_Base (AOGP is built) with the base case NO+RE_Base (no AOGP and no gas), results in an economic benefit of $2.3 billion for the AOGP project. The conditions assumed in the base scenarios represent the most likely to occur. The present value of the system costs is about $10.5 billion higher than the corresponding value for the case that the AOGP is built (AG+RE_High_Oil), thus resulting in a tremendous economic advantage of the AOGP project in case world oil prices raise to considerably high values. When comparing the present value of the system costs of NO+RE_Low_Oil Scenario with the corresponding

value of AG+RE_Low_Oil, the costs for the NO+RE_Low_Oil scenario are $1.65 billion lower. In this scenario world oil prices fall significantly and remain low during the twenty year study period. The average price for Fuel Oil No. 6 is $30/BBL and at the end of the study period is still lower than $38/BBL. The average price for Fuel Oil No. 2 is $67/BBL and the price is below $93/BBL at the end of the twenty year forecasted period.

## V. ADDITIONAL FACTS PERTINENT TO THIS PROCEEDING

**Q. Are there other facts PREPA believes to be pertinent to this proceeding and that should be considered by the Commission?**

A. In the Analysis, PREPA has addressed the four modelling scenarios (resource plans), each in three different fuel scenarios, consistent with the Commission's directives in this case. There have been times in the IRP case and the Rate Review when other hypothetical alternatives to AOGP have been raised as ideas, such as a Costa Sur to Aguirre pipeline or more use of renewables and storage. In the IRP case and the Rate Review, PREPA explained why the hypothetical alternatives are not live options at all and/or are impractical and untimely, would add years before reaching MATS compliance, and would expose PREPA and thus its customers to very large incremental increases in penalties risks (see discussion above), and delay environmental justice. *See*, for example, the testimony of Dr. Javier Quintana at the technical hearing in the Rate Review on December 6 and 7, 2016, and the testimony of Rafael Marrero on December 6, 2016. I do not understand the scope of PREPA's direct testimony in this Aguirre case to include my listing such other hypothetical ideas and then explaining again the many reasons that they do not work.

## VI. PREPA'S CONCLUSIONS AND RECOMMENDATIONS

**Q. What are PREPA's conclusions and recommendations?**

A. PREPA's conclusions and recommendations are listed in Section 2 of the Report in PREPA Ex. 1.02. In brief, some of relevant conclusions are:

- The AG_Base scenario, when compared with the NO_Base scenario, demonstrated the benefits of AOGP. Similarly, the comparison of the base scenario, AG+RE_Base, for the case that the AOGP is built, with the base case where there is no AOGP and no gas, NO+RE_Base, results in an economic benefit for the AOGP project. Even though NO scenarios has lower capital costs, AG Scenarios has lower overall system costs due to higher fuel costs incurred without AOGP. The forecasted Fuel Oil No. 6 average prices, are similar to current prices for the short term, and remain lower than $60/BBL until 2019, when they begin to grow gradually. The average short term price forecasted for Fuel Oil No. 2 is $93/BBL. In the twenty year forecasted period, average prices are in the order of $110/BBL for Fuel Oil No. 6 and $147/BBL for Fuel Oil No. 2. The fuel prices reach values of $182/BBL at the end of the study period for Fuel Oil No. 6 and of about $214/BBL for Fuel Oil No. 2. The conditions assumed in the base scenarios use the reference case assumptions which represent the most likely to occur.
- The present value of systems costs, for the twenty year study period, was substantially higher for the NO_High_Oil and NO+RE High Oil Scenarios than for the AG_High_Oil and AG+RE_High_Oil Scenarios. AOGP provides a tremendous economic advantage in case world oil prices rise to considerably

626 higher values. In the High Oil fuel forecast, average prices are in the order of
627 $240/BBL for Fuel Oil No. 6 and $295/BBL for Fuel Oil No. 2 in the twenty year
628 forecasted period. The fuel prices reach values of $350/BBL of the study period
629 for Fuel Oil No. 6 and of over $400/BBL for Fuel Oil No. 2.

630 • The present value of systems costs, for the twenty year study period, was lower
631 for the NO_Low_Oil and NO+RE_Low_Oil Scenarios than for the AG_Low_Oil
632 and AG+RE_Low_Oil Scenarios. In the Low Oil fuel forecast world oil prices
633 fall significantly and remain low during the twenty year study period. The
634 average price for Fuel Oil No. 6 is $30/BBL and at the end of the study period is
635 still lower than $38/BBL. The average price for Fuel Oil No. 2 is $67/BBL and
636 the price is below $93/BBL at the end of the twenty year forecasted period.

637 • The results of this evaluation show that, even with a one year delay, having
638 AOGP in operation is more beneficial for the people of Puerto Rico than
639 terminating the project and constructing new combined cycles that would burn
640 light distillate as fuel.

641 • The results obtained show that if the Commission disapproves the AOGP Project
642 (conversions of Aguirre steam boilers 1&2 and combined cycle units 1&2, as well
643 as the AOGP construction), PREPA and thus its customers will be exposed to
644 unnecessary and additional civil penalties due to the delays forecasted in MATS
645 compliance for the Aguirre, San Juan, and Palo Seco generating units. Based on
646 the economic analysis results, such additional penalties will accrue to
647 $317,059,000.

- LNG delivery in ISO containers to Aguirre absent AOGP is not practical due to the expected gas demand and the amount of container handling required on a daily basis and vessel deliveries required on an annual basis.
- The costs and operational risks for LNG delivery in ISO containers to San Juan are prohibitively high
- CNG delivery either as a bridge fuel or long-term solution is not practical due to PREPA's expected demand at Aguirre, San Juan, and Palo Seco.
- The results of the economic analysis demonstrated that it is economically feasible to achieve environmental compliance, provide environmental justice, and electricity price stabilization that will help to improve Puerto Rico's economic situation.
- PREPA recommends that the Commission fully approve and proceed with AOGP and the associated conversions in the least time practically possible, in order to comply with MATS, avoid the liability risk to fines, and proceed with the most advantageous option possible for the people of Puerto Rico, due to the demonstrated savings over the most probable outcomes.

## VII. CONCLUSION

**Q. Does this complete your Direct Testimony?**

A. Yes.

**ATTESTATION**

The undersigned, Gregory Rivera-Chico, being of legal age, married, engineer, and resident of Guaynabo, Puerto Rico, in his capacity as Superintendent – Planning, Planning and Research Division, for the Puerto Rico Electric Power Authority, states that the foregoing testimony, presented in written Question and Answer format, is true and correct to the best of his knowledge and belief.

Gregory Rivera-Chico

Affidavit No. 2046

Acknowledged and subscribed before me by Gregory Rivera-Chico, of the personal circumstances above mentioned, in his capacity as Superintendent – Planning, Planning and Research Division, for the Puerto Rico Electric Power Authority, who is personally known to me or whom I have identified by means of his driver's license number 158440 8, in San Juan, Puerto Rico, this 28th day of April 2017.

Public Notary

EXENTO PAGO ARANCEL
LEY 47
4 DE JUNIO DE 1982

LIONEL E SANTA CRISPIN
ABOGADO - NOTARIO