

**BEFORE THE FLORIDA
PUBLIC SERVICE COMMISSION**

**DOCKET NO. 110309-EI
FLORIDA POWER & LIGHT COMPANY**

**IN RE: FLORIDA POWER & LIGHT COMPANY'S
PETITION TO DETERMINE NEED FOR
MODERNIZATION OF PORT EVERGLADES PLANT**

DIRECT TESTIMONY & EXHIBITS OF:

JUAN E. ENJAMIO

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1 **BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION**

2 **FLORIDA POWER & LIGHT COMPANY**

3 **DIRECT TESTIMONY OF JUAN E. ENJAMIO**

4 **DOCKET NO. 11____-EI**

5 **NOVEMBER 21, 2011**

6

7 **Q. Please state your name and business address.**

8 A. My name is Juan Enjamio. My business address is Florida Power & Light
9 Company, 9250 West Flagler Street, Miami, Florida 33174.

10 **Q. By whom are you employed and what position do you hold?**

11 A. I am employed by Florida Power & Light Company (FPL) as Supervisor of
12 Integrated Analysis in the Resource Assessment & Planning group.

13 **Q. Please describe your duties and responsibilities in that position.**

14 A. In my current position as Supervisor of Integrated Analysis, I am responsible for
15 supervision and coordination of analyses involving FPL's resource needs.

16 **Q. Please describe your educational background and professional experience.**

17 A. I graduated from the University of Florida in 1979 with a Bachelor of Science
18 degree in Electrical Engineering. I joined FPL in 1980 as a Distribution Engineer.
19 Since my initial assignment in FPL I have held positions as a Transmission
20 System Planner, Power System Control Center Engineer, Bulk Power Markets
21 Engineer, Supervisor of Transmission Planning, and Supervisor of Supply and
22 Demand Analysis. In 2004, I became Supervisor of Integrated Analysis –
23 Resource Planning.

1 **Q. Are you sponsoring any Exhibits in this case?**

2 A. Yes. I am sponsoring the following Exhibits:

- 3 • JEE-1, Projection of FPL's Resource Needs through 2021;
- 4 • JEE-2, Resource Plans Utilized in the Analyses;
- 5 • JEE-3, Results of the Economic Analysis Relative to PEEC;
- 6 • JEE-4, Projection of Approximate Bill Impacts;
- 7 • JEE-5, Non-Economic Analysis Results: Emission Reductions Compared to
- 8 PEEC Resource Plan;
- 9 • JEE-6, Non-Economic Analysis Results: Reduction in Fuel Use Compared to
- 10 PEEC Resource Plan; and
- 11 • JEE-7, Forecasted Costs of Air Emissions.

12 **Q. What is the purpose and scope of your testimony?**

13 A. My testimony addresses eight major areas. First, I discuss FPL's integrated
14 resource planning process. Second, I describe the major assumptions used in the
15 analyses described in my testimony. Third, I identify FPL's projected resource
16 needs beginning in the year 2016 and explain how this need was determined.
17 Fourth, I discuss the evaluation of various potential options to meet the 2016
18 need. Fifth, I discuss the economic analysis used to reach the conclusion that the
19 modernization of the Port Everglades Plant is the most cost-effective option for
20 FPL's customers with which to meet the 2016 need. Sixth, I present the results of
21 the economic analysis performed. Seventh, I present the results of the non-
22 economic analyses performed. Finally, I present my conclusion from these
23 analyses.

1 **Q. Please summarize your testimony.**

2 A. FPL's most recent resource planning work determined that FPL has future
3 resource needs starting at about 284 megawatts (MW) in 2016 and growing to a
4 total of 1,468 MW of incremental generation capacity through 2021. Demand
5 Side Management (DSM) programs that are known to be cost-effective and which
6 have been approved by the Florida Public Service Commission (Commission)
7 through 2014, plus an assumption that currently projected annual implementation
8 levels of DSM will continue for 2015-2025, has already been reflected in FPL's
9 most recent resource planning work. In order to meet FPL's summer reserve
10 margin criterion of 20% in 2016, FPL needs to add new generation capacity.

11
12 To meet its 2016 resource need, FPL developed and analyzed four resource plans.
13 The first resource plan assumes returning to service the four existing steam units
14 at Port Everglades which have been placed in inactive reserve; this plan is
15 referred to as the "Return to Service Resource Plan." The second resource plan
16 adds a new combined cycle (CC) unit at a greenfield site in 2016; this plan is
17 referred to as the "GFCC Resource Plan." The third resource plan adds two
18 combustion turbines (CT) in simple cycle mode at a greenfield site in 2016, and
19 thus defers the Port Everglades modernization (Port Everglades Next Generation
20 Clean Energy Center, or "PEEC") to 2019; this plan is referred to as the "GFCT
21 Resource Plan." The fourth plan, which is the most cost-effective, adds PEEC in
22 2016; this plan is referred to as the "PEEC Resource Plan." These four plans
23 were compared using economic and non-economic criteria to determine the most

1 cost-effective and desirable option for FPL's customers to meet the 2016 resource
2 need.

3

4 The economic analysis results show that the PEEC Resource Plan will provide
5 savings to FPL's customers of about \$469 million in cumulative present value of
6 revenue requirements in 2011 dollars (CPVRR) when compared to the Return to
7 Service Resource Plan, about \$838 million in CPVRR when compared to the
8 GFCC Resource Plan, and about \$425 million in CPVRR when compared to the
9 GFCT Resource Plan. Projected approximate bill impacts also show that
10 customers will save on average the following: \$0.38 per 1000 kWh when
11 compared to the Return to Service Resource Plan, \$0.64 per 1000 kWh when
12 compared to GFCC Resource Plan, and \$0.42 per 1000 kWh when compared to
13 the GFCT Resource Plan (based on the average approximate bill impact from
14 2016 to 2047).

15

16 The non-economic analysis results show significantly lower overall system air
17 emissions for the PEEC Resource Plan when compared to those plans that do not
18 include a new 3x1 combined cycle unit starting in 2016 (Return to Service and
19 GFCT Resource Plans). The results also show significant reductions in fuel use
20 for the PEEC Resource Plan when compared to the Return to Service and the
21 GFCT Resource Plans.

22

1 Based on these results, FPL is seeking an affirmative determination of need for
2 the modernization of the Port Everglades Plant with a proposed commercial
3 operation date in June 2016.
4

5 **I. FPL's INTEGRATED RESOURCE PLANNING PROCESS**
6

7 **Q. Can you briefly describe FPL's existing generation supply system?**

8 A. FPL has one of the cleanest generating fleets in the country, and is an industry
9 leader in energy efficiency, conservation, and load management through its DSM
10 program. FPL meets its customers' needs through a mix of fossil and nuclear
11 generating units, renewable generation, purchased power, which also includes
12 renewable generation, and DSM. The existing FPL generation resources are
13 located at sixteen sites distributed geographically throughout its service territory,
14 and also include partial ownership of one unit in Georgia and two units in
15 Jacksonville, Florida. At the time of filing this testimony, FPL's active generation
16 fleet totaled approximately 22,474 MW (summer) of capacity, and its generating
17 units consist of four nuclear units, three coal steam units in which FPL holds
18 partial ownership interests, fifteen combined cycle units, five oil/gas steam units,
19 fifty combustion turbine units, two solar photovoltaic units, and one solar-thermal
20 facility. This fleet total does not include 1,922 MW of FPL's generation in
21 Inactive Reserve status.
22

1 FPL presently has a long-term Unit Power Sales (UPS) contract to purchase up to
2 931 MW of coal-fired generation from Southern Company. FPL also has
3 contracts with Jacksonville Electric Authority for the purchase of 375 MW
4 (summer) and 383 MW (winter) of coal-fired generation from St. John's River
5 Power Park (SJRPP) Units One and Two. However, the UPS contract expires at
6 the end of 2015, and due to Internal Revenue Service regulations, the total amount
7 of energy that FPL may receive from the SJRPP purchase is limited. FPL
8 currently assumes that this limit will be reached prior to the summer of 2016.

9
10 FPL also has contracts to purchase firm capacity and energy from cogeneration
11 and small power production facilities (qualifying facilities or "QFs") totaling 595
12 MW. FPL currently projects that a total of about 740 MW of firm generation
13 capacity will be available to FPL in 2016 from a combination of renewable
14 resources and QFs.

15
16 FPL has fostered the expansion of renewable energy sources through development
17 of its own renewable generation projects. As stated previously, FPL operates
18 three commercial-scale solar generation facilities in Florida. FPL has two solar
19 photovoltaic facilities that generate a combined 35 MW of capacity. The third
20 solar facility, located at the Martin site, is a hybrid solar plant that provides 75
21 MW of solar thermal capacity in an innovative way that directly displaces fossil
22 fuel usage on the FPL system.

23

1 Since the inception of its DSM programs through 2010, FPL has achieved 5,245
2 MW (at the generator) of summer peak demand reduction and an estimated
3 cumulative energy savings of approximately 55,462 GWh (at the generator). It is
4 estimated that FPL will avoid an additional 109 MW of capacity as a result of
5 DSM additions in January through July of 2011. Another 817 MW of capacity
6 will be avoided by DSM additions from August 2011 to August 2016. This
7 results in a total of 6,171 MW of capacity avoided by DSM programs by August
8 of 2016. This amount of peak demand reduction (at the generator, after taking
9 into account the 20% reserve margin requirements) has eliminated the need for
10 the equivalent of 15 new 400 MW generating units. FPL has achieved this level
11 of demand reduction through DSM programs designed to reduce electric rates for
12 all customers, DSM participants and non-participants alike.

13 **Q. What are the objectives of FPL's integrated resource planning process?**

14 A. The fundamental approach used in FPL's integrated resource planning (IRP)
15 process was developed in the early 1990s and has been used and refined since that
16 time to accomplish three primary objectives: 1) determine the timing of when new
17 resources are needed to maintain the reliability of the FPL generation system, 2)
18 determine the magnitude (MW) of the needed resources, and 3) determine the
19 type of resources that should be added. The analyses required to accomplish the
20 first two objectives – determining the timing and magnitude of the needed
21 resources – are often referred to as the reliability assessment portion of FPL's IRP
22 process.

23

1 The analyses required to accomplish the third objective – determining the type of
2 resources that should be added – are more complex and involve the consideration
3 of both economic and non-economic perspectives. From an economic
4 perspective, the type of resources that should be added is primarily based on a
5 determination of the resources that result in the lowest system average electric
6 rates for FPL customers. When only power plants or power purchases are the
7 resources in question, the determination can be made on the basis of the lowest
8 total cost (CPVRR). The lowest total cost (CPVRR) in these cases is the same as
9 the lowest average electric rate perspective because the number of kilowatt-hours
10 over which the costs are distributed does not change, as would be the case when
11 DSM resources are being examined.

12
13 However, the decision of what type of resources to add is also influenced by
14 considerations such as whether a resource can be brought into service on FPL’s
15 system in time to meet a projected capacity need and whether a given resource or
16 resource plan is best suited to address system considerations that may have been
17 identified in the planning process. While these system considerations usually
18 have an economic component or impact, they are often discussed in quantitative,
19 non- economic terms, such as percentages rather than actual dollar amounts.

20 **Q. What are some other system considerations and how are they addressed in**
21 **FPL’s IRP Process?**

22 A. One system consideration is maintaining a regional balance between load and
23 generating capacity, particularly in Southeast Florida. As discussed in witness

1 Modia's direct testimony, FPL would have to make significant investments in the
2 transmission infrastructure before the year 2020 if the existing Port Everglades
3 units are not returned to service or no new generation is added in Southeast
4 Florida before the year 2020. The PEEC Project addresses this system concern
5 better than returning the existing units to service because PEEC will operate as
6 base-load capacity while the existing Port Everglades units would operate at low
7 capacity factors if returned to service.

8
9 Another important consideration is lowering utility system carbon dioxide (CO₂)
10 emissions over the long term to reduce greenhouse gas emissions as well as
11 reducing other utility system air emissions, specifically sulfur dioxide (SO₂) and
12 nitrogen oxides (NO_x). FPL witness Kosky addresses the environmental benefits
13 of PEEC in his direct testimony.

14 15 **II. ASSUMPTIONS USED IN THE VARIOUS ANALYSES**

16
17 **Q. What are the major assumptions used by FPL in the analyses described in**
18 **this testimony?**

19 A. The following are the major assumptions used by FPL in the analyses described in
20 this testimony:

21 Load Forecast:

22 The load forecast used was updated in September 2011 and is therefore different
23 than the load forecast used in FPL's "Ten Year Power Plant Site Plan 2011-2020"

1 document filed on April 1, 2011. The new load forecast is described in the direct
2 testimony of FPL witness Morley.

3

4 Projected DSM:

5 Current projections consist of all the DSM programs currently approved for FPL.
6 Many of the approved DSM programs were based on projections through 2014
7 only. For purposes of these analyses, FPL has assumed that it will continue to
8 achieve its projected incremental level of DSM-based peak and energy savings for
9 the years 2015-2025. This assumes that through August of 2016, FPL and its
10 customers will have avoided a total of 6,171 MW of generating capacity by
11 August of 2016 as a result of DSM programs. Thereafter, FPL projects an
12 additional average annual summer peak reduction of approximately 130 MW.

13

14 Upgrade of 7FA Combustion Turbine Fleet:

15 FPL is planning to upgrade most of its existing 7FA technology combustion
16 turbine fleet. This upgrade of 26 turbines at five plant sites will add
17 approximately 190 MW of summer capacity to FPL's existing units. These
18 upgrades will be completed before 2016, and that assumption is included in the
19 determination of the capacity need analysis.

20

21

22

23

1 Nuclear Upgrades:

2 The upgrade of FPL's four existing nuclear units is currently projected to add
3 approximately 450 MW of additional capacity at time of summer peak. These
4 upgrades are projected to be completed by early 2013.

5

6 Units in Inactive Reserve:

7 The Port Everglades 1-4 and Turkey Point 2 steam units are in Inactive Reserve
8 status (except in the Return to Service Resource Plan where the four Port
9 Everglades units are brought back into service). Turkey Point 2 is currently
10 operating as a synchronous condenser, which provides transmission system
11 voltage support but does not generate additional MW to serve system load. All
12 the resource plans assume that the Turkey Point 1 steam unit will be removed
13 from active generation service and placed in Inactive Reserve in 2016 when it too
14 will start to operate as a synchronous condenser.

15

16 Retired Units:

17 The Cutler 5 and 6 and the Sanford 3 steam units will be retired by the end of
18 2012.

19

20 New generation capacity in-service prior to 2016:

21 The Cape Canaveral and Riviera Next Generation Clean Energy Centers are
22 assumed to be in-service by summer of 2013 and 2014 respectively.

23

1 Fuel Forecast:

2 The fuel forecast was developed in August 2011 using FPL's Long Term Fuel
3 Price Forecasting methodology. This methodology is described in the direct
4 testimony of FPL witness Stubblefield.

5

6 Emission Price Forecast:

7 FPL's Environmental II Emission Price Forecast was used in the analyses. This
8 forecast was updated in January 2011 based on price forecasts developed by ICF
9 Consulting in late 2010. This emission price forecast is addressed in the direct
10 testimony of FPL witness Kosky and is shown in Exhibit JEE-7 of my testimony.

11 **Q. You previously stated that the resource plans studied assume that Turkey
12 Point 1 will be placed in Inactive Reserve and converted to a synchronous
13 condenser in 2016. Please discuss this assumption.**

14 A. Starting in 2016, FPL plans to place the Turkey Point 1 steam unit in Inactive
15 Reserve Status. This unit will then start to serve in a transmission voltage support
16 role as a synchronous condenser. This is the current mode of operation of its
17 sister unit Turkey Point 2.

18

19 FPL's economic analysis demonstrates that it is cost effective to place the Turkey
20 Point 1 steam unit in Inactive Reserve in 2016. The economic analysis shows that
21 this will result in savings of approximately \$300 million CPVRR when compared
22 to a resource plan which keeps the unit in its traditional generation role. In the

1 development of its resource plans, FPL therefore assumed the Turkey Point 1
2 steam unit was placed in Inactive Reserve in 2016.

3
4 **III. FUTURE FPL RESOURCE NEEDS**

5
6 **Q. How did FPL decide it needed additional resources?**

7 A. FPL uses two analytical approaches in its reliability assessment to determine the
8 timing and magnitude of its future resource needs in order to continue to provide
9 reliable electric service to its customers. The first approach is to make a
10 projection of reserve margins for summer and winter peak hours for future years.
11 A minimum reserve margin criterion of 20% is used to judge the projected reserve
12 margins. The 20% minimum reserve margin criterion is based on the reliability
13 planning standard FPL currently believes is necessary to ensure reliable service,
14 which FPL committed to maintain and the Commission approved in Order No.
15 PSC-99-2507-S-EU.

16
17 The second approach is a Loss-of-Load-Probability (LOLP) evaluation. Simply
18 stated, LOLP is an index of how well a generating system may be able to meet its
19 demand by measuring how often load may exceed available resources. In contrast
20 to the reserve margin approach, the LOLP approach looks at the daily peak
21 demands for each year, while taking into consideration the probability of
22 individual generators being out of service due to scheduled maintenance or forced
23 outages. LOLP is typically expressed in units of “number of times per year” that

1 the system demand could not be served. The FPL LOLP criterion is a maximum
2 of 0.1 days per year. This LOLP criterion is generally accepted throughout the
3 electric utility industry.

4
5 In evaluating the results of the reserve margin criterion analysis, FPL has become
6 concerned that its reserves over time will become increasingly dependent upon
7 DSM resources as opposed to generation resources. FPL is conducting reliability
8 studies to determine if the 20% reserve margin criterion should be supplemented
9 with a minimum reserve margin contribution from generation-only resources.
10 These studies are ongoing as of the date of this filing.

11 **Q. Did FPL use the analytical approaches and assumptions just described to**
12 **determine its need for additional generation capacity?**

13 A. Yes. For a number of years, FPL's projected need for additional resources has
14 been driven by the 20% summer reserve margin criterion. The reserve margin
15 analysis calculates that FPL has a need of 284 MW by summer of 2016; this
16 grows to a need of 1,468 MW by summer of 2021. A projection of FPL's
17 Resource Need is presented in Exhibit JEE-1 of my testimony.

18

1 **IV. POTENTIAL OPTIONS TO MEET FPL'S 2016 NEED**

2

3 **Q. Please describe the potential options, or resource plans, considered by FPL to**
4 **meet its 2016 resource need.**

5 A. FPL considered four options or resource plans, described below, as candidates to
6 meet its 2016 resource need:

7 Return to Service Resource Plan: This plan consists of the return to service of the
8 four existing Port Everglades steam units from Inactive Reserve status starting in
9 2016. These units were placed into service in the 1960s. Their combined
10 capacity is 1,187 MW. This plan also assumes the conversion of the Turkey Point
11 1 unit to synchronous condenser operation in 2016, a GFCC unit in 2021, and the
12 commencement of operations of Turkey Point 6 and 7 nuclear units in 2022 and
13 2023, respectively.

14

15 GFCC Resource Plan: This plan assumes the construction of a new greenfield CC
16 in 2016 as an alternative to PEEC, and using the same technology. That CC
17 would have a summer capacity of 1,262 MW. This plan assumes the conversion
18 of the Turkey Point 1 unit to synchronous condenser operation in 2016, an
19 additional greenfield CC unit in 2021, and the commencement of operations of
20 Turkey Point 6 and 7 nuclear units in 2022 and 2023, respectively.

21

22 GFCT Resource Plan: This plan consists of the construction of two new
23 combustion turbines at a greenfield site which defers the need for PEEC to 2019.

1 These turbines would operate in simple cycle mode, with a summer capacity of
2 162 MW each. This plan also assumes the conversion of the Turkey Point 1 unit
3 to synchronous condenser operation in 2016, the conversion of the Port
4 Everglades units into PEEC in 2019, and the commencement of operations of
5 Turkey Point 6 and 7 nuclear units in 2022 and 2023, respectively.

6
7 As discussed in the direct testimony of FPL witness Modia, operation of the FPL
8 system without generation at Port Everglades (other than the existing gas
9 turbines) in the 2016-2019 time frame would create serious transmission
10 reliability concerns. Nevertheless, this case was included in the economic
11 analysis to demonstrate that it would not be economic to defer PEEC even if there
12 were no system reliability concern.

13
14 PEEC Resource Plan: This plan assumes the conversion by 2016 of the Port
15 Everglades site by replacing the four existing steam units with a new combined
16 cycle unit (the PEEC Project). The resulting new CC unit would have a summer
17 capacity of 1,277 MW. This plan also assumes the conversion of the Turkey
18 Point 1 unit to synchronous condenser operation in 2016, a greenfield CC in 2021,
19 and the commencement of operations of Turkey Point 6 and 7 nuclear units in
20 2022 and 2023, respectively.

21
22 These resource plans are presented in Exhibit JEE-2 of my testimony.

23

1 **Q. Please briefly describe the PEEC Project.**

2 A. The PEEC Project consists of the removal of the existing four steam units at Port
3 Everglades Plant (Units 1-4), which are currently in Inactive Reserve, and adding
4 a new advanced CC unit at the same site to be placed in service by summer of
5 2016. This new advanced CC unit will have a summer capacity of 1,277 MW and
6 a heat rate of 6,330 Btu/kWh. It will use natural gas as its primary fuel, and will
7 be able to use ultra-low sulfur distillate oil as backup fuel. These performance
8 characteristics are consistent with the advanced CT technology that FPL assumed
9 for the purposes of its analysis.. This Project is described in greater detail in the
10 direct testimony of FPL witness Gnecco.

11

12 **V. ANALYTICAL APPROACH USED TO ANALYZE THE FOUR**
13 **OPTIONS/RESOURCE PLANS**

14

15 **Q. Please provide an overview of the analytical approach FPL utilized to evaluate**
16 **which option/resource plan would be the most cost-effective in meeting its**
17 **2016 need.**

18 A. The analytical approach FPL utilized can be summarized as follows. First, FPL
19 developed the four plans previously described. Second, after the resource plans
20 were identified, FPL conducted economic analyses to determine the CPVRR
21 amounts for each of the four resource plans. In addition, projections of
22 approximate customer bill impact were made for the four resource plans.

23

1 **Q. What is the appropriate period to be used to perform economic analyses?**

2 A. The useful life of a new CC unit such as PEEC is assumed to be thirty years.
3 Therefore, the appropriate period to use for economic analyses is thirty years in
4 order to fully capture and fairly compare all the economic and non-economic
5 impacts of different capacity options that could be added to a utility system.

6 **Q. How were the economic analyses performed?**

7 A. The economic analyses were carried out in the following three steps:

8

9 Step 1 - FPL quantified fuel/efficiency and other variable costs savings. The
10 PMAREA production costing model was used to determine the resulting
11 difference in FPL's system fuel costs between the four resource plans. This
12 model has been used by FPL in fuel cost recovery proceedings as well as in
13 numerous need proceedings brought before the Commission. The PMAREA
14 model simulates the operation of FPL's system on an hourly basis. The model
15 captures variable costs (such as fuel, variable O&M, and environmental
16 compliance costs) in its production costing calculations, projects the annual
17 emission levels associated with the resource plans, incorporates the effects of
18 major transmission transfer limits on the dispatch of the generating units, and
19 recognizes gas constraints in FPL's system.

20

21 Step 2 - FPL used the Fixed Cost Spreadsheet Model to capture all of the fixed
22 costs (such as capital, fixed O&M, capital replacement, capacity payments for
23 purchases, and firm gas transportation) associated with the four resource plans.

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Step 3 - All of the components of system costs identified in Steps 1 and 2 were then aggregated to determine the CPVRR of each of the four resource plans.

Q. Did FPL quantify any differences in transmission losses among the four resource plans for use in the economic analysis?

A. No. As FPL witness Modia describes in his direct testimony, however, generation resources added outside of the Southeast Florida area are located farther away from FPL’s load center and would likely have higher transmission losses when compared to plans that add generation close to areas of concentrated load, and more specifically at Port Everglades. Two of FPL’s resource plans add units at unspecified greenfield sites that are unlikely to be close to the areas of concentrated load, but quantifying losses for generation resources at unspecified sites is somewhat speculative. Therefore, the difference in the cost of transmission losses has not been quantified.

While these differential losses have not been quantified, it is clear that the PEEC Resource Plan would have the lowest transmission system losses. Not quantifying the cost of losses in this instance benefits the relative economics of the GFCC, GFCT, and Return to Service Resource Plans when compared to PEEC. FPL believes that not including the cost of losses is a conservative assumption.

1 **Q. Did FPL quantify any differences in major transmission system expenditures**
2 **between the four resource plans?**

3 A. Yes. As explained in the direct testimony of FPL witness Modia, FPL's
4 transmission planning process has identified that adding or returning generation at
5 the Port Everglades site has significant transmission system benefits. These
6 benefits translate into large transmission infrastructure cost savings for resource
7 plans which include significant generation at Port Everglades (the Return to
8 Service, GFCT, and PEEC Resource Plans), when compared to a resource plan
9 which provides little or no generation at this site (the GFCC Resource Plan). This
10 savings in transmission investment has been quantified to be approximately \$638
11 million in overnight capital costs (in 2016 dollars) and has been included in the
12 economic analysis for the GFCC resource plan.

13

14 **VI. RESULTS OF ECONOMIC ANALYSIS**

15

16 **Q. What are the results of the economic analysis in CPVRR?**

17 A. The economic analysis indicates that the PEEC Resource Plan provides the
18 greatest benefit to FPL customers resulting in about \$469 million lower CPVRR
19 than the Return to Service Resource Plan, about \$838 million lower CPVRR than
20 the GFCC Resource Plan, about \$425 million lower CPVRR than the GFCT
21 Resource Plan. The results of the economic analysis are shown in Exhibit JEE-3
22 of my testimony.

1 **Q. What are the results of the projection of approximate bill impacts for the**
2 **four resource plans?**

3 A. Projected approximate monthly bill impacts show that PEEC will result in lower
4 average bill impacts when compared to the other three resource plans: \$0.38
5 lower per 1000 kWh when compared to the Return to Service Resource Plan,
6 \$0.64 lower per 1000 kWh when compared to GFCC Resource Plan, and \$0.42
7 lower per 1000 kWh when compared to the GFCT Resource Plan (based on the
8 average approximate bill impact from 2016 to 2047).

9
10 The projection of Approximate Bill Impacts can be seen in Exhibit JEE-4 of my
11 testimony.

12

13 **VII. RESULTS OF NON-ECONOMIC ANALYSIS**

14

15 **Q. Does the PEEC Resource Plan result in lower air emissions than the Return**
16 **to Service Resource Plan?**

17 A. Yes. The PEEC Resource Plan results in significantly lower system air emissions
18 and lower green house gases. Over a thirty-year life, when compared to the
19 Return to Service Plan, PEEC will reduce SO₂ air emissions by approximately 41
20 thousand tons and NO_x emissions by approximately 33 thousand tons. The
21 Project will also result in the reduction of about 22 million tons of CO₂ over the
22 thirty-year life. Reducing emissions is a very important benefit to FPL's
23 customers because of the risk that environmental costs in the future could be

1 higher than projected, thus resulting in CPVRR savings in excess of the projected
2 \$469 million.

3

4 The reductions in emissions are detailed in Exhibit JEE-5 of my testimony.
5 Further description of PEEC's environmental benefits is provided in the direct
6 testimony of FPL witness Kosky.

7 **Q. Does the PEEC Resource Plan result in a lower FPL system heat rate?**

8 A. Yes. PEEC is projected to have a heat rate of 6,330 Btu/kWh, at full capacity,
9 which is significantly lower than the existing system average heat rate. A lower
10 heat rate indicates higher efficiency in the conversion of fuel to electrical energy
11 and, therefore will result in less fuel being burned to produce a given amount of
12 electricity. The projected PEEC heat rate is also much lower than the heat rate of
13 the generating units in two of the other options under consideration: the GFCT
14 with a heat rate of 10,410 Btu/kWh, and the existing Port Everglades steam units,
15 with a projected average heat rate of approximately 9,800 Btu/kWh. Because of
16 this lower heat rate, the PEEC Resource Plan reduces FPL average system heat
17 rate to 8,042 Btu/kWh. This compares to an average system heat rate of 8,145
18 Btu/kWh for the Return to Service Resource plan, a reduction of 103 Btu/kWh.

19

20 Both the GFCC and the PEEC Resource Plans add CC units of the same
21 technology and efficiency, both in-service 2016. Therefore, the difference in
22 system heat rate under these two plans would be minimal.

23

1 **Q. Does the PEEC Resource Plan result in reduced fuel consumption?**

2 A. Yes. The PEEC Resource Plan, by virtue of PEEC's very high efficiency, reduces
3 the use of both natural gas and oil when compared to the GFCT and the Return to
4 Service Resource Plans. For example, between 2017 and 2026, natural gas use is
5 reduced by approximately 48 million MMBtu, and oil use is reduced by
6 approximately 5.3 million barrels when compared to the Return to Service
7 Resource Plan. When the fuel reductions are quantified over the thirty-year life of
8 the Project, natural gas use is reduced by approximately 90 million MMBtu when
9 compared to the Return to Service Resource Plan, and 40 million MMBtu when
10 compared to the GFCT Resource Plan. Oil use is reduced by approximately 10.4
11 million barrels when compared to the Return to Service Resource Plan, and 5.0
12 million barrels when compared to the GFCT Resource Plan. Reductions in fuel
13 use are very important to FPL's customers because of the projected rising cost of
14 natural gas and oil in the future. Furthermore, there is a risk that actual fuel costs
15 in the future could be even higher than projected, thus resulting in CPVRR
16 savings beyond the projected \$469 million.

17

18 Both the GFCC and the PEEC Resource Plans add CC units of the same
19 technology, both in-service 2016. The difference in fuel use between these two
20 plans is relatively small.

21

22 The reductions in fuel use are shown in Exhibit JEE-6 of my testimony.

1 **Q. Are there other non-economic benefits of the PEEC Resource Plan when**
2 **compared to the Return to Service Resource Plan?**

3 A. Yes. In addition to reducing costs to customers, fuel use, system heat rate, and
4 FPL system-wide air emissions, PEEC will extensively utilize existing
5 infrastructure with minimal new infrastructure needed for electrical transmission,
6 gas transportation, and the provision of water. Also, by reducing the height of the
7 smokestacks and building a lower profile than the existing units, the Project will
8 significantly improve the aesthetics of the site. The direct testimony of FPL
9 witness Gnecco provides a more detailed description of these benefits.

10

11

VIII. CONCLUSION

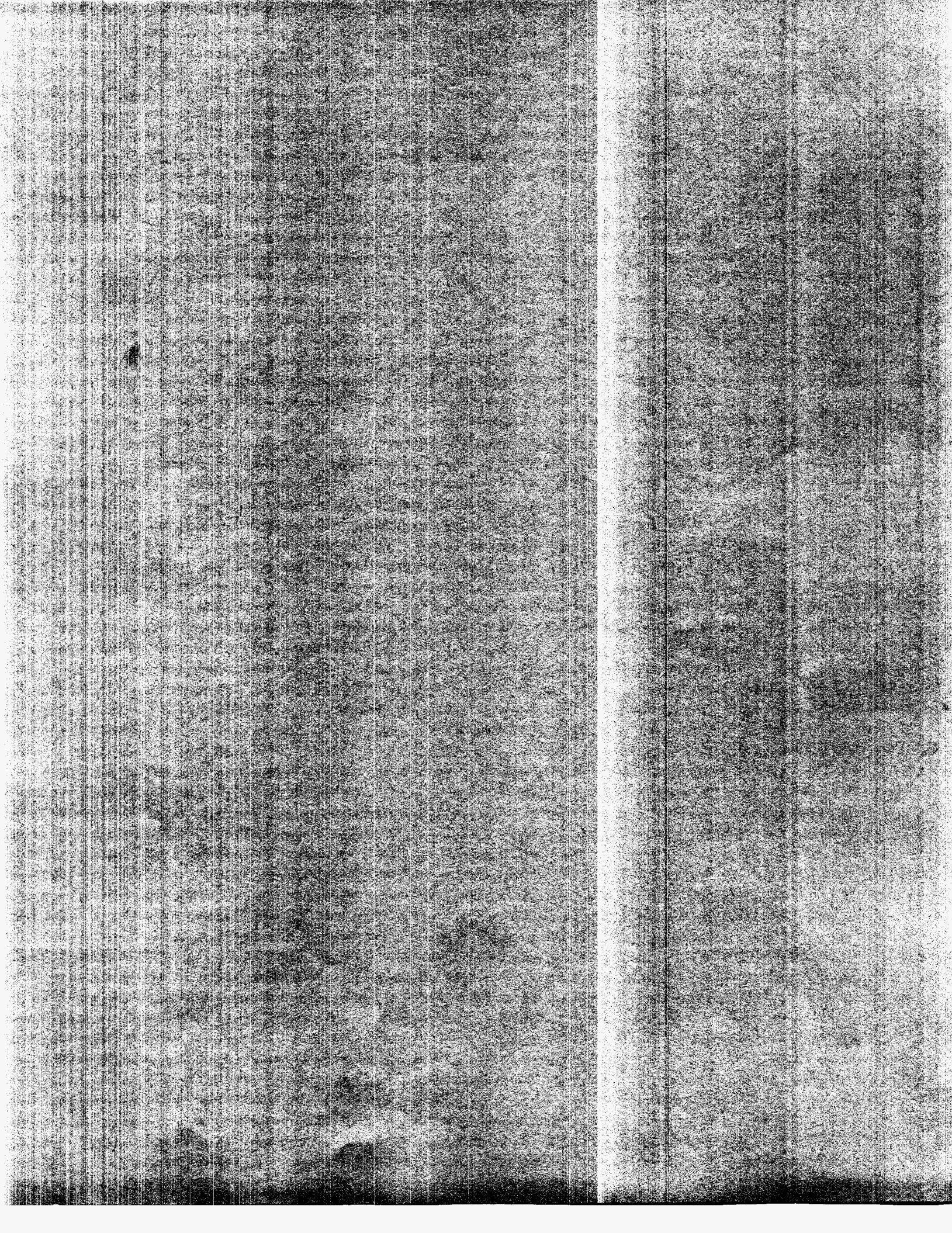
12

13 **Q. Is the PEEC Project the best option available to FPL to meet its 2016 need**
14 **for generation?**

15 A. Yes. The economic analysis shows that PEEC will result in lower costs to
16 customers of at least \$469 million CPVRR over the life of the Project when
17 compared to resource plans without PEEC, as well as providing significant non-
18 economic benefits to our customers. I, therefore, conclude that PEEC is the best
19 option available to meet FPL's resource needs beginning in 2016, which will
20 serve FPL's customers in the most cost-effective manner.

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

22 A. Yes.



Projection of FPL's Resource Needs through 2021
 (Assuming Unit Additions through 2015 Only)

	(1)	(2)	(3)	(4) = (1) + (2) - (3)	(5)	(6)	(7) = (5) - (6)	(8) = (4) - (7)	(9) = (8) / (7)	(10) = ((7)*1.20)-(4)
August of the Year	Projected FPL Unit Summer Capability (MW)	Projected Firm Capacity Summer Purchases (MW)	Projected Scheduled Maintenance * (MW)	Projected Total Summer Capacity (MW)	Projected Summer Peak Load (MW)	Projected Summer DSM Capability (MW)	Projected Summer Firm Peak Load (MW)	Projected Summer Reserves (MW)	Projected Summer Reserve Margin w/o Additions (%)	Projected MW Needed to Meet 20% Reserve Margin ** (MW)
2011	22,474	2,056	0	24,530	21,618	1,856	19,762	4,767	24.1%	(815)
2012	23,437	1,956	714	24,679	21,623	1,986	19,637	5,042	25.7%	(1,115)
2013	24,164	1,956	826	25,294	21,931	2,109	19,822	5,472	27.6%	(1,507)
2014	25,467	1,956	826	26,597	23,243	2,272	20,971	5,626	26.8%	(1,432)
2015	25,507	2,046	0	27,553	23,786	2,404	21,382	6,170	28.9%	(1,894)
2016	25,111	740	0	25,851	24,315	2,536	21,779	4,071	18.7%	284
2017	25,111	740	0	25,851	24,529	2,667	21,862	3,989	18.2%	384
2018	25,111	740	0	25,851	24,674	2,799	21,875	3,975	18.2%	400
2019	25,111	740	0	25,851	25,041	2,930	22,111	3,740	16.9%	683
2020	25,111	740	0	25,851	25,499	3,062	22,437	3,413	15.2%	1,074
2021	25,111	740	0	25,851	25,960	3,194	22,766	3,085	13.6%	1,468

* MW values shown in Column (3) represent 714 MW out-of-service during the Summer of 2012 (St. Lucie 2), and 826 MW out-of-service during the Summer of 2013 and 2014 due to the installation of electrostatic precipitators at FPL's 800 MW generating units.

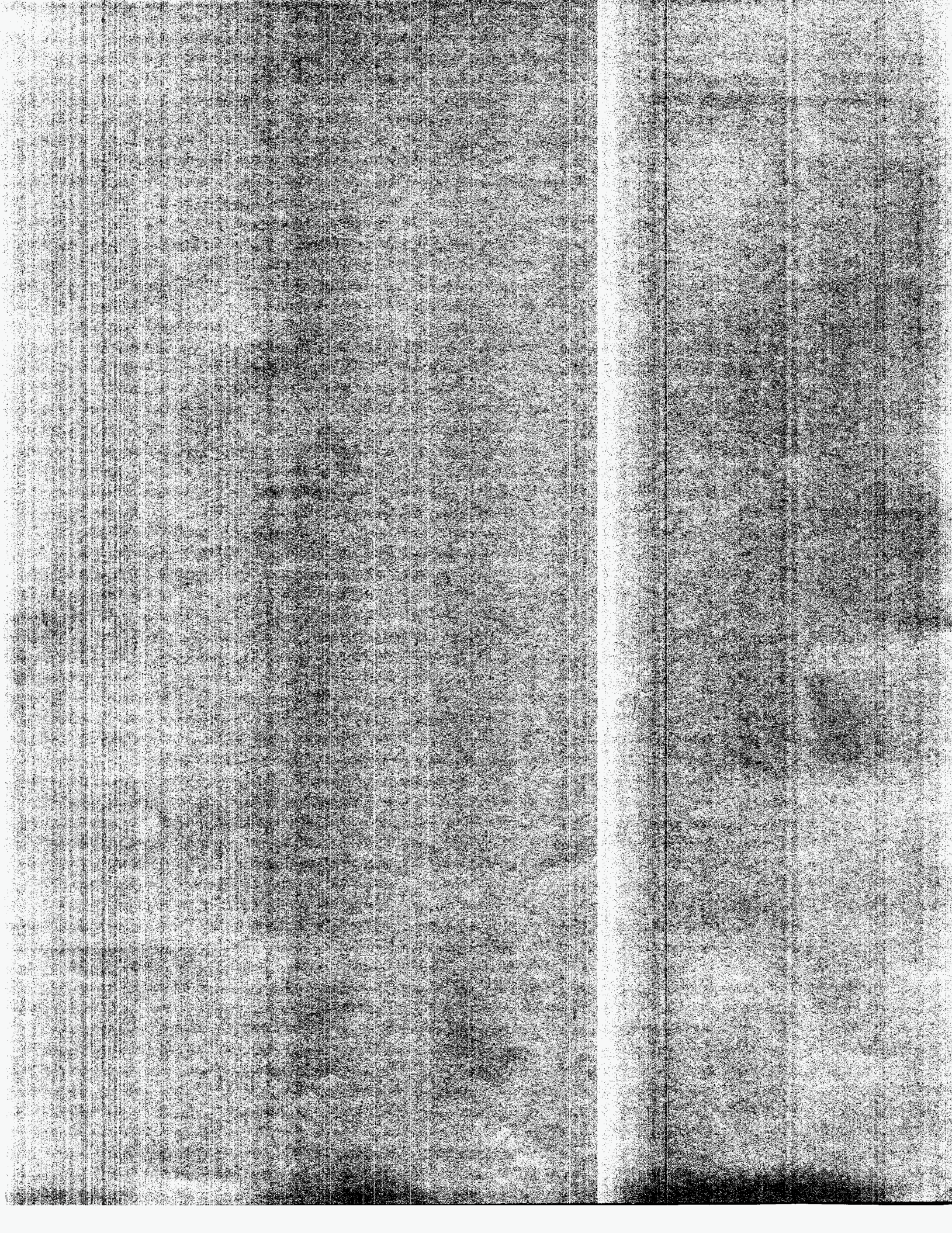
** MW values shown in Column (10) represent new generating capacity needed to meet the 20% reserve margin criterion.

Projection of FPL's Resource Needs through 2021
 (Assuming PEEC Addition in 2016)

	(1)	(2)	(3)	(4) = (1) + (2) - (3)	(5)	(6)	(7) = (5) - (6)	(8) = (4) - (7)	(9) = (8) / (7)	(10) = ((7)*1.20)-(4)
August of the Year	Projected FPL Unit Summer Capability (MW)	Projected Firm Capacity Summer Purchases (MW)	Projected Scheduled Maintenance * (MW)	Projected Total Summer Capacity (MW)	Projected Summer Peak Load (MW)	Projected Summer DSM Capability (MW)	Projected Summer Firm Peak Load (MW)	Projected Summer Reserves (MW)	Projected Summer Reserve Margin w/o Additions (%)	Projected MW Needed to Meet 20% Reserve Margin ** (MW)
2011	22,474	2,056	0	24,530	21,618	1,856	19,762	4,767	24.1%	(815)
2012	23,437	1,956	714	24,679	21,623	1,986	19,637	5,042	25.7%	(1,115)
2013	24,164	1,956	826	25,294	21,931	2,109	19,822	5,472	27.6%	(1,507)
2014	25,467	1,956	826	26,597	23,243	2,272	20,971	5,626	26.8%	(1,432)
2015	25,507	2,046	0	27,553	23,786	2,404	21,382	6,170	28.9%	(1,894)
2016	26,388	740	0	27,128	24,315	2,536	21,779	5,348	24.6%	(993)
2017	26,388	740	0	27,128	24,529	2,667	21,862	5,266	24.1%	(893)
2018	26,388	740	0	27,128	24,674	2,799	21,875	5,252	24.0%	(877)
2019	26,388	740	0	27,128	25,041	2,930	22,111	5,017	22.7%	(594)
2020	26,388	740	0	27,128	25,499	3,062	22,437	4,690	20.9%	(203)
2021	26,388	740	0	27,128	25,960	3,194	22,766	4,362	19.2%	191

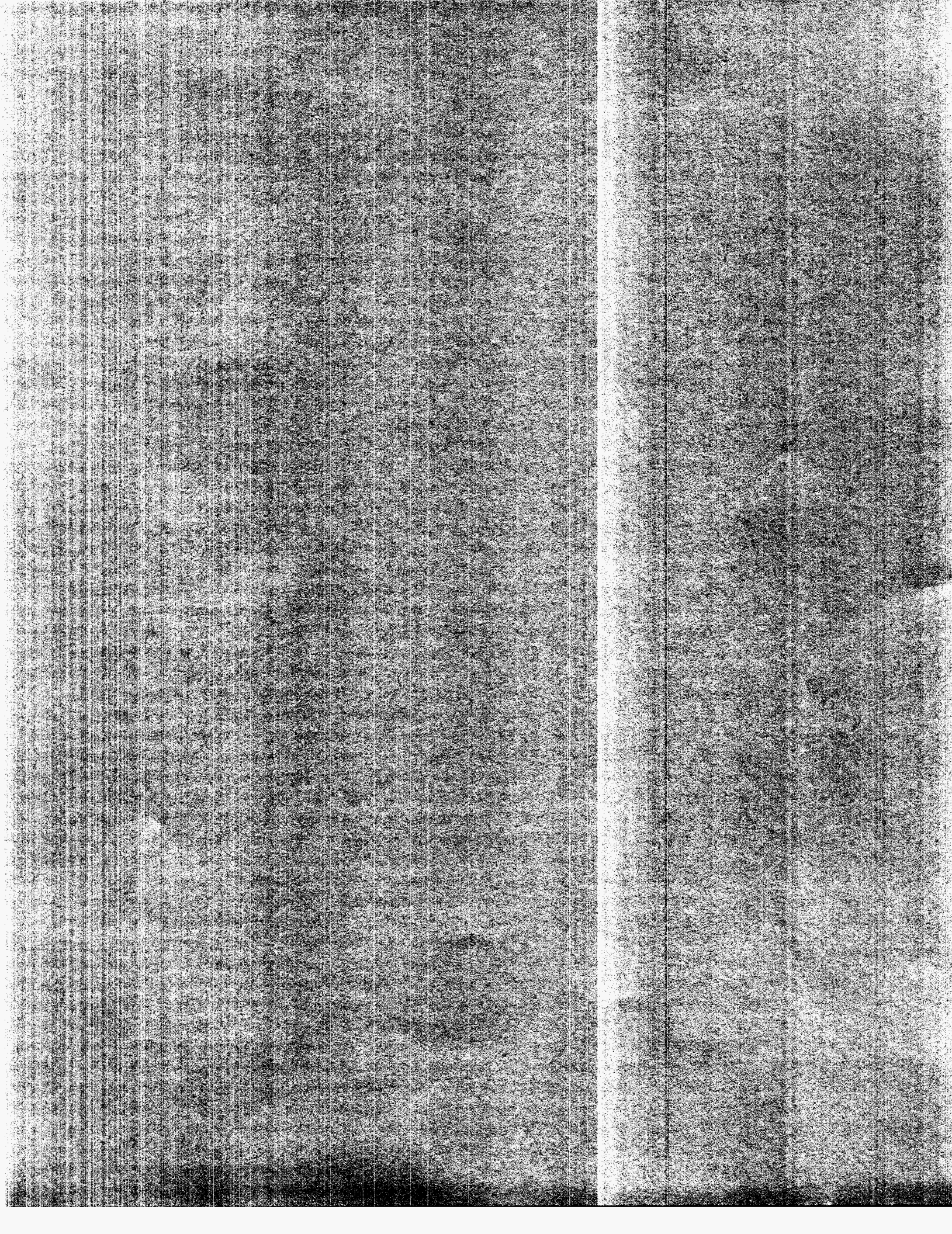
* MW values shown in Column (3) represent 714 MW out-of-service during the Summer of 2012 (St. Lucie 2), and 826 MW out-of-service during the Summer of 2013 and 2014 due to the installation of electrostatic precipitators at FPL's 800 MW generating units.

** MW values shown in Column (10) represent new generating capacity needed to meet the 20% reserve margin criterion.



Resource Plans Utilized in the Analyses

Resource Plan	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
PEEC	PEEC					3X1 CC	TP6	TP7			
Return to Service Greenfield Combined Cycle (GFCC)	PE3			PE4	PE1	PE2 3X1 CC	TP6	TP7			
Greenfield Combustion Turbine (GFCT)	2 - SC CT			PEEC			TP6	TP7			3X1 CC



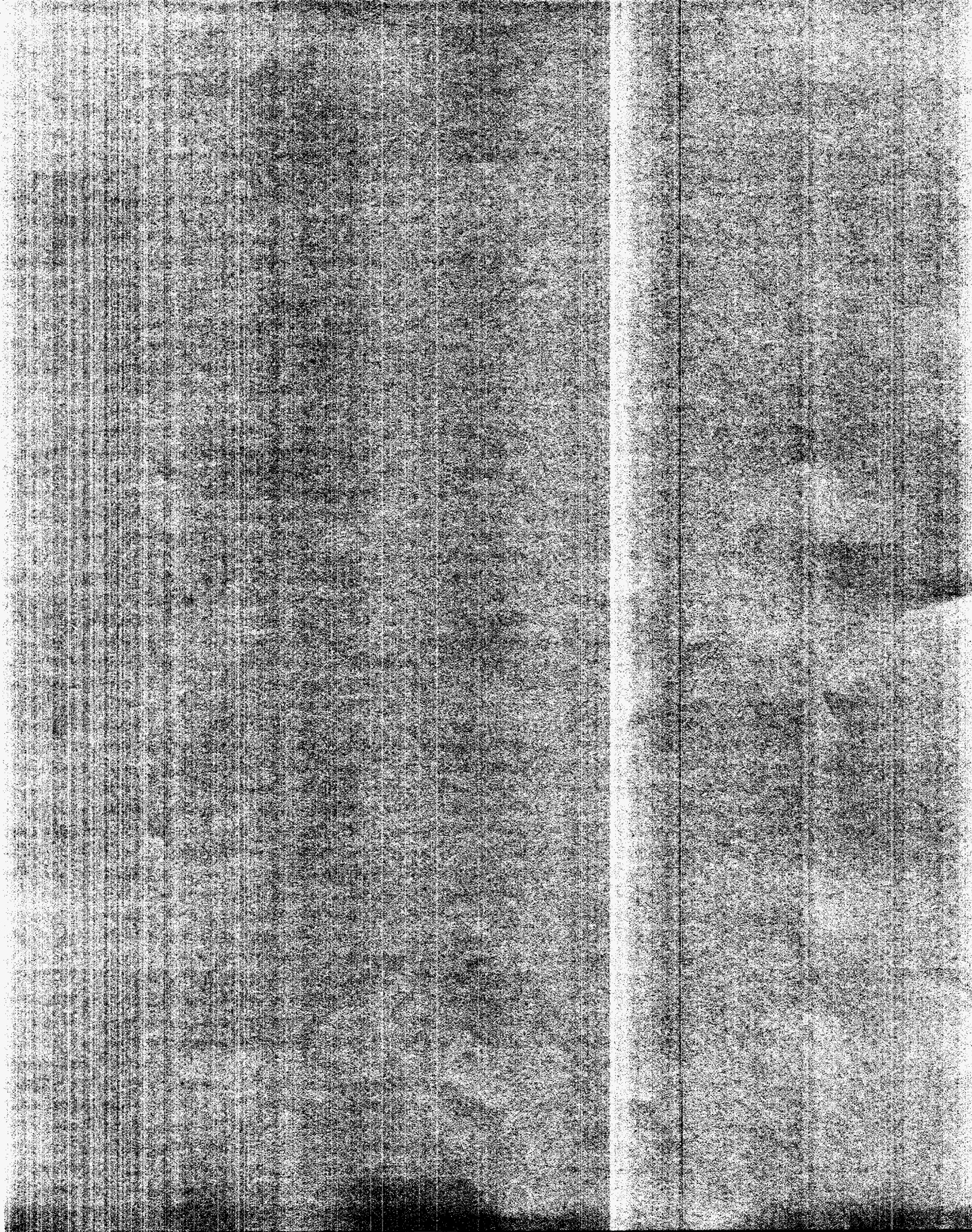
**Results of the Economic Analysis
 Relative to PEEC**

(millions, CPVRR, 2011\$, 2011-2047)

Resource Plan	System Costs			Difference from Lowest Cost Plan
	Fixed Costs*	Variable Costs**	Total Costs	
PEEC	14,578	128,333	142,911	--
Return to Service	13,501	129,879	143,380	469
Greenfield Combined Cycle (GFCC)	15,270	128,479	143,749	838
Greenfield Combustion Turbine (GFCT)	14,199	129,137	143,336	425

* Generation system fixed costs include: capital, capacity payments, fixed O&M, capital replacement, and firm gas transportation. (Note that Turkey Point 6 & 7 generation and transmission capital costs are assumed to be zero in this analysis for all resource plans.)

** Generation system variable costs include: variable O&M, plant fuel, FPL system fuel, and environmental compliance costs.



**Projection of Approximate Bill Impacts:
 PEEC vs. Return To Service Resource Plans**

Year	(1)	(2)	(3)	(4)	(5)	(6)
	Plan with Port Everglades Modernization	Plan Returning Inactive Reserve Units PPE 1-4 to Service	=(1)-(2)	Projected Total Sales After DSM (GWh at the meter)	=((3)x100)/(4)	=(5)x10
	Annual Total Revenue Requirements (\$millions, Nominal \$)	Annual Total Revenue Requirements (\$millions, Nominal \$)	Differential in Annual Total Revenue Requirements (\$millions, Nominal \$)	Differential in Customer Bill of 1,000 kWh (\$)	Differential in System Average Electric Rates (cents/kWh)	
2016	4,794	4,748	46	109,787	\$0.04	\$0.42
2017	5,291	5,251	39	111,105	\$0.04	\$0.35
2018	6,927	6,941	-14	112,313	-\$0.01	-\$0.12
2019	7,470	7,522	-52	113,670	-\$0.05	-\$0.46
2020	8,240	8,294	-54	116,014	-\$0.05	-\$0.47
2021	9,111	9,197	-86	118,800	-\$0.07	-\$0.72
2022	9,561	9,552	9	121,725	\$0.01	\$0.07
2023	9,490	9,509	-20	124,286	-\$0.02	-\$0.16
2024	10,224	10,277	-53	126,776	-\$0.04	-\$0.42
2025	11,182	11,246	-63	129,260	-\$0.05	-\$0.49
2026	11,830	11,926	-96	131,782	-\$0.07	-\$0.73
2027	12,609	12,706	-97	134,088	-\$0.07	-\$0.72
2028	13,230	13,315	-85	136,356	-\$0.06	-\$0.62
2029	13,996	14,089	-93	138,542	-\$0.07	-\$0.67
2030	14,956	15,007	-51	140,654	-\$0.04	-\$0.36
2031	15,824	15,902	-78	143,001	-\$0.05	-\$0.55
2032	17,143	17,223	-80	145,378	-\$0.05	-\$0.55
2033	19,320	19,403	-82	147,808	-\$0.06	-\$0.56
2034	20,763	20,832	-69	150,273	-\$0.05	-\$0.46
2035	21,759	21,832	-74	152,778	-\$0.05	-\$0.48
2036	24,103	24,170	-66	155,325	-\$0.04	-\$0.43
2037	25,618	25,700	-83	157,912	-\$0.05	-\$0.52
2038	26,878	26,957	-79	160,542	-\$0.05	-\$0.49
2039	28,542	28,599	-56	163,216	-\$0.03	-\$0.35
2040	30,044	30,094	-50	165,929	-\$0.03	-\$0.30
2041	31,584	31,637	-53	168,692	-\$0.03	-\$0.31
2042	33,561	33,640	-79	171,497	-\$0.05	-\$0.46
2043	36,309	36,378	-69	174,349	-\$0.04	-\$0.39
2044	38,787	38,831	-44	177,247	-\$0.02	-\$0.25
2045	40,918	40,965	-46	180,192	-\$0.03	-\$0.26
2046	43,259	43,323	-64	183,186	-\$0.04	-\$0.35
2047	45,749	45,826	-77	186,229	-\$0.04	-\$0.41
				Average 2016-2047		-\$0.38

Notes: (1) This projection assumes instantaneous adjustment to electric rates and is for illustrative purposes only.
 (2) The values presented in Columns (1), (2), and (3) are total system revenue requirements and include all costs: capital, system fuel, etc.

**Projection of Approximate Bill Impacts:
 PEEC vs. GFCC Resource Plans**

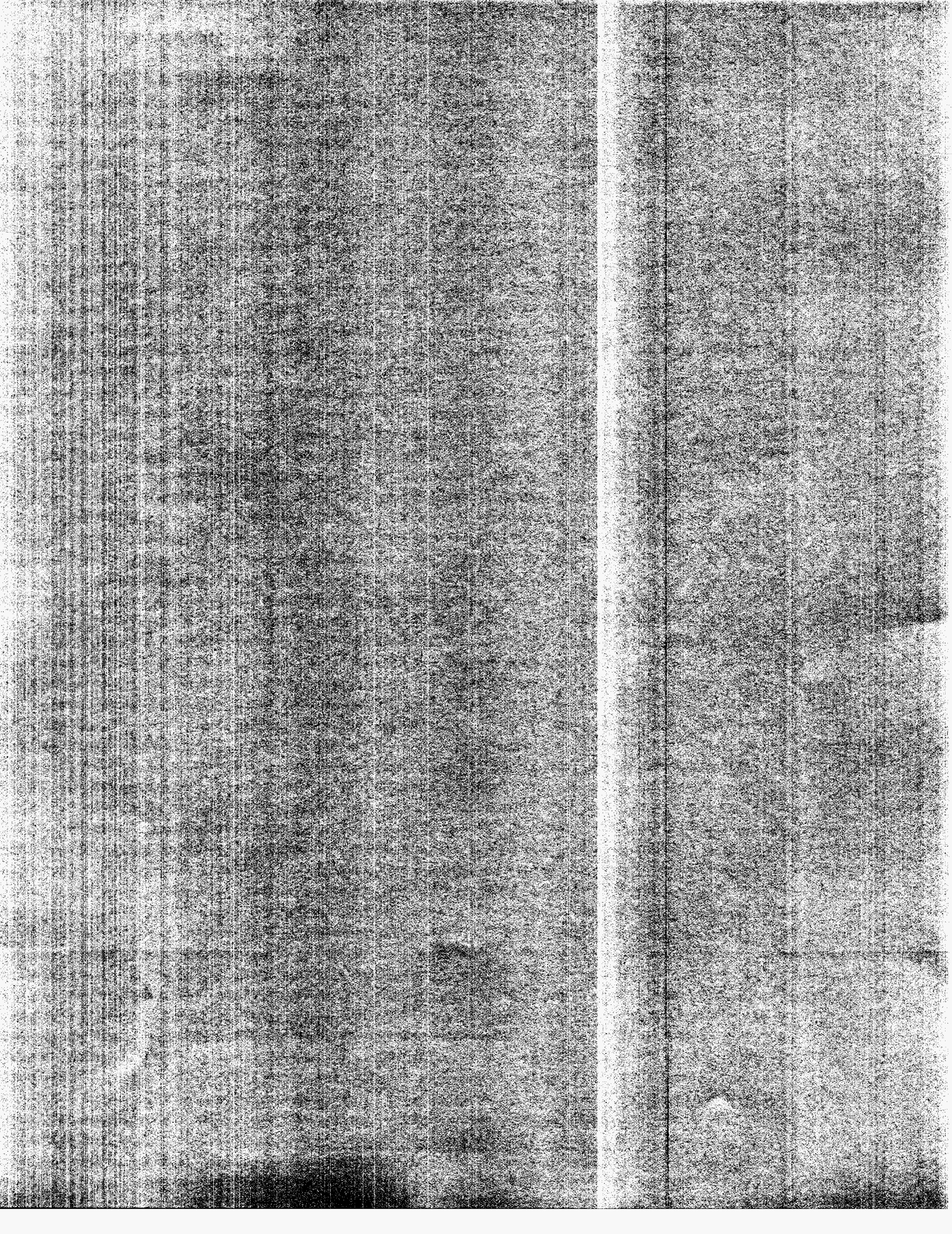
Year	(1)	(2)	(3)	(4)	(5)	(6)
	Plan with Port Everglades Modernization Annual Total Revenue Requirements (\$millions, Nominal \$)	Plan with Greenfield Site Combined Cycle Annual Total Revenue Requirements (\$millions, Nominal \$)	=(1)-(2) Differential in Annual Total Revenue Requirements (\$millions, Nominal \$)	Projected Total Sales After DSM (GWh at the meter)	=((3)x100)/(4) Differential in System Average Electric Rates (cents/kWh)	=(5)x10 Differential in Customer Bill of 1,000 kWh (\$)
2016	4,794	4,818	-24	109,787	-\$0.02	-\$0.22
2017	5,291	5,332	-42	111,105	-\$0.04	-\$0.37
2018	6,927	6,972	-44	112,313	-\$0.04	-\$0.39
2019	7,470	7,521	-51	113,670	-\$0.04	-\$0.45
2020	8,240	8,351	-111	116,014	-\$0.10	-\$0.96
2021	9,111	9,264	-153	118,800	-\$0.13	-\$1.29
2022	9,561	9,699	-138	121,725	-\$0.11	-\$1.13
2023	9,490	9,622	-132	124,286	-\$0.11	-\$1.06
2024	10,224	10,353	-129	126,776	-\$0.10	-\$1.02
2025	11,182	11,305	-123	129,260	-\$0.10	-\$0.95
2026	11,830	11,949	-120	131,782	-\$0.09	-\$0.91
2027	12,609	12,725	-116	134,088	-\$0.09	-\$0.86
2028	13,230	13,340	-110	136,356	-\$0.08	-\$0.80
2029	13,996	14,105	-109	138,542	-\$0.08	-\$0.78
2030	14,956	15,061	-105	140,654	-\$0.07	-\$0.75
2031	15,824	15,925	-101	143,001	-\$0.07	-\$0.70
2032	17,143	17,240	-97	145,378	-\$0.07	-\$0.67
2033	19,320	19,415	-94	147,808	-\$0.06	-\$0.64
2034	20,763	20,854	-92	150,273	-\$0.06	-\$0.61
2035	21,759	21,847	-88	152,778	-\$0.06	-\$0.58
2036	24,103	24,188	-85	155,325	-\$0.05	-\$0.55
2037	25,618	25,702	-84	157,912	-\$0.05	-\$0.53
2038	26,878	26,960	-82	160,542	-\$0.05	-\$0.51
2039	28,542	28,623	-81	163,216	-\$0.05	-\$0.50
2040	30,044	30,123	-79	165,929	-\$0.05	-\$0.48
2041	31,584	31,664	-79	168,692	-\$0.05	-\$0.47
2042	33,561	33,639	-78	171,497	-\$0.05	-\$0.45
2043	36,309	36,384	-75	174,349	-\$0.04	-\$0.43
2044	38,787	38,862	-75	177,247	-\$0.04	-\$0.42
2045	40,918	40,991	-73	180,192	-\$0.04	-\$0.41
2046	43,259	43,330	-71	183,186	-\$0.04	-\$0.39
2047	45,749	45,813	-64	186,229	-\$0.03	-\$0.34
				Average 2016-2047		-\$0.64

Notes: (1) This projection assumes instantaneous adjustment to electric rates and is for illustrative purposes only.
 (2) The values presented in Columns (1), (2), and (3) are total system revenue requirements and include all costs: capital, system fuel, etc.

**Projection of Approximate Bill Impacts:
 PEEC vs. GFCT Resource Plans**

	(1)	(2)	(3)	(4)	(5)	(6)
			=(1)-(2)		=((3)x100)/(4)	=(5)x10
	Plan with Port Everglades Modernization	Plan with Simple Cycle Combustion Turbine (CT)	Differential in	Projected	Differential in	Differential in
	Annual Total Revenue Requirements (\$millions, Nominal \$)	Annual Total Revenue Requirements (\$millions, Nominal \$)	Annual Total Revenue Requirements (\$millions, Nominal \$)	Total Sales After DSM (GWh at the meter)	System Average Electric Rates (cents/kWh)	Customer Bill of 1,000 kWh (\$)
Year	-----	-----	-----	-----	-----	-----
2016	4,794	4,784	10	109,787	\$0.01	\$0.09
2017	5,291	5,273	18	111,105	\$0.02	\$0.16
2018	6,927	6,931	-3	112,313	\$0.00	-\$0.03
2019	7,470	7,519	-49	113,670	-\$0.04	-\$0.43
2020	8,240	8,338	-98	116,014	-\$0.08	-\$0.84
2021	9,111	9,155	-44	118,800	-\$0.04	-\$0.37
2022	9,561	9,533	27	121,725	\$0.02	\$0.23
2023	9,490	9,442	47	124,286	\$0.04	\$0.38
2024	10,224	10,195	29	126,776	\$0.02	\$0.23
2025	11,182	11,195	-12	129,260	-\$0.01	-\$0.10
2026	11,830	11,893	-64	131,782	-\$0.05	-\$0.48
2027	12,609	12,735	-126	134,088	-\$0.09	-\$0.94
2028	13,230	13,352	-121	136,356	-\$0.09	-\$0.89
2029	13,996	14,110	-114	138,542	-\$0.08	-\$0.82
2030	14,956	15,064	-108	140,654	-\$0.08	-\$0.76
2031	15,824	15,929	-105	143,001	-\$0.07	-\$0.73
2032	17,143	17,244	-101	145,378	-\$0.07	-\$0.69
2033	19,320	19,423	-103	147,808	-\$0.07	-\$0.70
2034	20,763	20,861	-99	150,273	-\$0.07	-\$0.66
2035	21,759	21,854	-95	152,778	-\$0.06	-\$0.62
2036	24,103	24,197	-93	155,325	-\$0.06	-\$0.60
2037	25,618	25,705	-87	157,912	-\$0.06	-\$0.55
2038	26,878	26,964	-86	160,542	-\$0.05	-\$0.54
2039	28,542	28,624	-81	163,216	-\$0.05	-\$0.50
2040	30,044	30,121	-77	165,929	-\$0.05	-\$0.46
2041	31,584	31,659	-75	168,692	-\$0.04	-\$0.44
2042	33,561	33,634	-73	171,497	-\$0.04	-\$0.43
2043	36,309	36,378	-68	174,349	-\$0.04	-\$0.39
2044	38,787	38,850	-63	177,247	-\$0.04	-\$0.36
2045	40,918	40,977	-59	180,192	-\$0.03	-\$0.33
2046	43,259	43,330	-70	183,186	-\$0.04	-\$0.38
2047	45,749	45,831	-82	186,229	-\$0.04	-\$0.44
				Average 2016-2047		-\$0.42

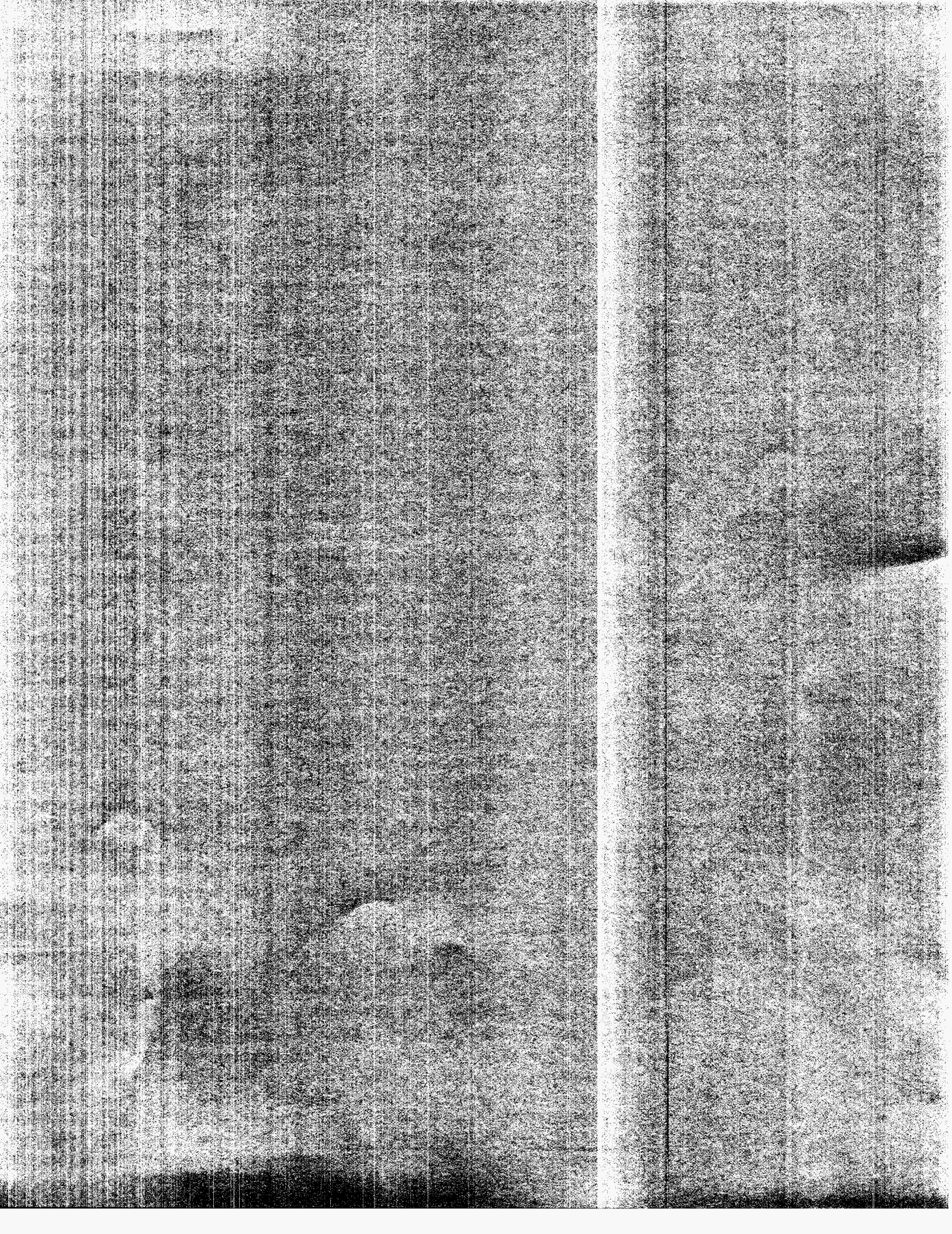
Notes: (1) This projection assumes instantaneous adjustment to electric rates and is for illustrative purposes only.
 (2) The values presented in Columns (1), (2), and (3) are total system revenue requirements and include all costs: capital, system fuel, etc.



**Non-Economic Analysis Results: Emission Reductions
 Compared to PEEC Resource Plan**

	Return to Service			GFCC			GFCT		
	S ₀ ₂ (Tons)	NO _x (Tons)	CO ₂ (Tons)	S ₀ ₂ (Tons)	NO _x (Tons)	CO ₂ (Tons)	S ₀ ₂ (Tons)	NO _x (Tons)	CO ₂ (Tons)
2016	1,375	1,151	548,000	4	7	11,000	1,346	1,015	551,000
2017	2,259	1,782	956,000	25	5	21,000	2,227	1,565	952,000
2018	2,230	1,677	983,000	105	32	125,000	2,161	1,517	978,000
2019	2,403	1,970	1,138,000	163	106	283,000	608	429	372,000
2020	2,744	2,340	1,177,000	90	96	246,000	-26	-50	-6,000
2021	2,532	2,004	1,140,000	55	73	182,000	1,551	953	552,000
2022	1,799	1,273	925,000	22	14	25,000	1,802	1,200	906,000
2023	1,401	1,006	845,000	10	9	24,000	1,393	951	829,000
2024	1,516	1,093	846,000	6	16	39,000	1,470	1,017	816,000
2025	1,981	1,304	952,000	-3	9	19,000	1,919	1,191	918,000
2026	1,656	1,339	778,000	-22	2	9,000	658	540	413,000
2027	1,632	1,450	750,000	-29	2	19,000	424	292	179,000
2028	1,630	1,371	774,000	-35	-2	9,000	384	284	202,000
2029	1,520	1,125	787,000	-15	-1	11,000	372	248	178,000
2030	1,262	1,017	745,000	-15	-2	12,000	247	211	137,000
2031	1,263	1,066	856,000	-8	1	20,000	336	268	260,000
2032	1,281	1,016	939,000	-26	-3	9,000	286	218	186,000
2033	1,229	975	812,000	-9	0	16,000	291	229	201,000
2034	1,076	844	683,000	-6	0	17,000	269	194	155,000
2035	1,001	780	612,000	-9	0	16,000	238	177	132,000
2036	921	788	599,000	-4	0	17,000	201	172	137,000
2037	882	659	566,000	-6	0	16,000	181	145	120,000
2038	844	653	531,000	-6	0	17,000	152	146	109,000
2039	691	566	492,000	0	0	17,000	190	137	118,000
2040	611	511	433,000	-1	0	17,000	150	119	83,000
2041	571	527	417,000	-2	0	17,000	109	107	79,000
2042	506	454	401,000	1	0	17,000	122	112	95,000
2043	524	452	380,000	0	1	18,000	128	107	74,000
2044	392	397	305,000	1	0	17,000	80	94	69,000
2045	380	375	320,000	1	0	18,000	82	87	73,000
2046	253	336	264,000	1	0	18,000	65	81	59,000
2047	296	334	278,000	1	0	17,000	81	88	74,000
Total	40,661	32,635	22,232,000	289	365	1,319,000	19,497	13,844	10,001,000

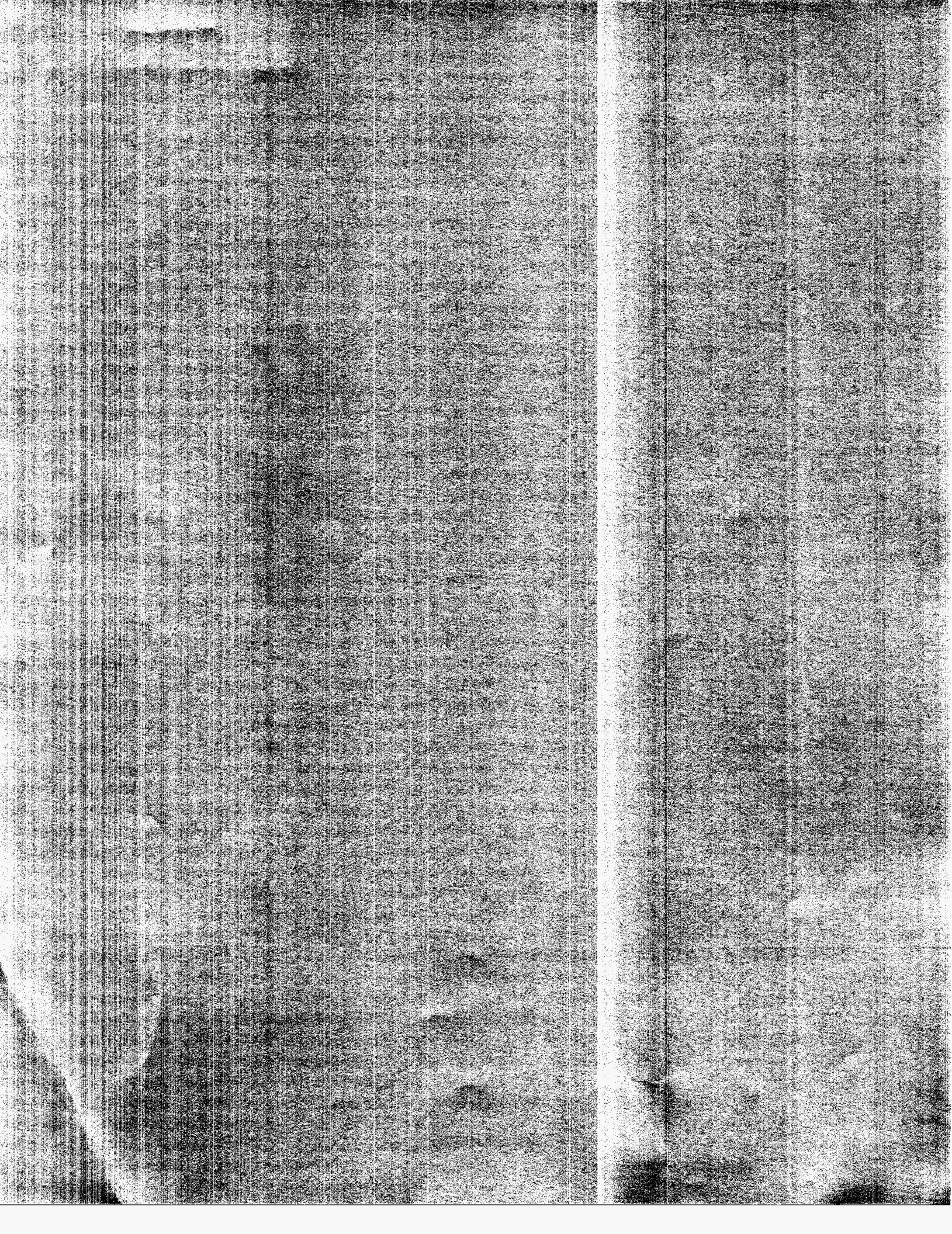
(+) Refers to a reduction in emissions to the PEEC plan when compared to all resource plans.



**Non-Economic Analysis Results: Reduction in Fuel Use
 Compared to PEEC Resource Plan**

	Return to Service		GFCC		GFCT	
	Oil Bbl (000)	Gas MMBtu million	Oil Bbl (000)	Gas MMBtu million	Oil Bbl (000)	Gas MMBtu million
2016	386	4	-3	0	377	4
2017	588	6	5	0	579	6
2018	560	5	-17	-1	538	5
2019	600	4	-13	-2	124	2
2020	711	6	-29	-2	-20	0
2021	671	5	-8	-1	458	3
2022	450	5	6	0	464	4
2023	352	4	2	0	350	3
2024	375	4	-2	0	379	4
2025	496	4	-8	0	520	3
2026	475	5	-20	1	184	2
2027	467	5	-27	0	123	1
2028	466	5	-32	1	108	1
2029	422	3	-17	0	95	0
2030	348	3	-15	0	71	1
2031	332	1	-14	0	81	-1
2032	316	0	-21	0	71	0
2033	301	1	-9	0	70	0
2034	261	1	-8	0	66	0
2035	252	2	-10	0	58	0
2036	233	2	-6	0	46	0
2037	217	1	-6	0	43	0
2038	209	2	-7	0	42	0
2039	163	1	-1	0	44	0
2040	149	1	-1	0	39	0
2041	139	1	-3	0	27	0
2042	119	1	0	0	29	0
2043	125	1	-1	0	33	0
2044	97	2	0	0	18	0
2045	87	1	0	0	17	0
2046	53	1	0	0	12	0
2047	64	1	0	0	16	0
Total	10,484	90	-265	5	5,062	40

(+) Refers to a reduction in fuel to the PEEC plan when compared to all resource plans.



Forecasted Cost of Air Emissions

Year	ENV II \$/ton nominal		
	CO ₂	SO ₂	NO _x
2011	0	53	473
2012	0	104	485
2013	0	113	497
2014	0	57	509
2015	0	58	522
2016	0	59	535
2017	0	61	548
2018	27	62	562
2019	29	64	576
2020	32	66	590
2021	34	67	605
2022	37	69	620
2023	40	71	636
2024	44	72	652
2025	47	74	668
2026	51	76	685
2027	55	78	702
2028	59	80	719
2029	64	82	737
2030	68	84	756
2031	70	86	775
2032	72	88	794
2033	74	90	814
2034	75	93	834
2035	77	95	855
2036	79	97	877
2037	81	100	898
2038	83	102	921
2039	85	105	944
2040	88	108	968
2041	90	110	992
2042	92	113	1,016
2043	94	116	1,042
2044	97	119	1,068
2045	99	122	1,095
2046	102	125	1,122
2047	104	128	1,150