

# CICAAE

COMITÉ INTERSECTORIAL  
DE CUMPLIMIENTO AMBIENTAL Y ALTERNATIVAS ENERGÉTICAS



(INTERSECTORAL COMMITTEE ON ENVIRONMENTAL  
COMPLIANCE AND ENERGY ALTERNATIVES - ICECEA)

## REPORT ON THE NECESSARY MEASURES TO COMPLY WITH NEW EPA REGULATIONS, AND THE CONVERSION TO, AND USE OF NATURAL GAS IN, THE NORTHERN POWER PLANTS

June 15, 2012

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## **I. EXECUTIVE SUMMARY**

On December 16, 2011, the U.S. Environmental Protection Agency (EPA) enacted regulations revising its Mercury and Air Toxic Standards (MATS). In addition, EPA modified its National Ambient Air Quality Standards (NAAQS) for sulfur dioxide (SO<sub>2</sub>). In light of the challenge presented to Puerto Rico by these new federal regulations, on February 15, 2012, the Governor of Puerto Rico, Hon. Luis G. Fortuño issued Executive Order OE-2012-06 creating the Intersectoral Committee on Environmental Compliance and Energy Alternatives (ICECEA or Committee) whose principal mission was to prepare this Report, which contains the results of a comprehensive study on the measures identified as necessary to comply with the above regulations.

In order to realize this mission, the ICECEA was organized into three work groups: 1) the legal group, in charge of studying the applicable regulations and suggesting strategies; 2) the technical group, in charge of gathering information on emission sources and technology, and other information regarding reducing emissions and refining the models; and 3) the economic group, in charge of studying the economic impact of the new regulations and suggesting models to address the possible competitive disadvantages for Puerto Rico. One of the tasks performed by ICECEA was an activity directed at groups that may be affected by the regulations so that they could contribute their ideas to address the impact of the regulations and contribute to the creation of measures. As part of the analysis, the following topics were identified: NAAQS, MATS, identifying potential areas of non-attainment, evaluation of modeling approaches, comparison with other states of the Nation, judicial review of EPA regulations, analysis of emissions, and, as stated in the Executive Order, assessment of alternatives, including, among others, the alternative of converting our electric infrastructure to natural gas. After hours of deliberation, the exchange of ideas, strategic analysis and research, the ICECEA selected a series of alternatives to address the situation created by the federal regulations.

The information gathered by the ICECEA reveals that, as of 2009, the fuel usage in the installed electric generating capacity in Puerto Rico was 82% liquid fossil-fuels, 9% natural gas, 8% coal and 1% renewable fuels. As of 2012, this distribution was 67.5% liquid fossil-fuels, 22.8% natural gas, 8% coal and 1.7% renewable fuels. EPA's new and more strict NAAQS represent a serious threat to the way we operate in Puerto Rico, especially with respect to the costs of operating under those conditions. In light of the fact that MATS sets strict environmental compliance goals within 36 months, with a sense of urgency we have identified and included as part of this Report the

measures that, based on the best available information, should be taken to put Puerto Rico on the right path to achieve the required results. Puerto Rico faces its greatest energy and, potentially, economic challenge in recent history.

As to PREPA, the Committee concluded that the most efficient way to achieve compliance with federal regulations is to convert its power plants to natural gas.

Of all the alternatives presented to supply natural gas to the northern plants, the Committee determined that the viable options are the following:

**ALTERNATIVES TO SUPPLY NATURAL GAS TO NORTHERN PLANTS**

Alternatives
<b>Supply gas in small vessels from Aguirre or Guayanilla to a northern satellite terminal</b>
<b>Buoys for barges in the North and a northern offshore or onshore pipeline</b>
<b>North-South gas pipeline with added gas capacity</b>
<b>Compressed Natural Gas (CNG)</b>

In addition, the Committee concluded that the conversion to natural gas would generate net savings by reducing fuel costs (by around 5-6 cents/kWh), and that its distribution to the industrial and commercial sector would promote the creation of 20,000 jobs in the next five (5) years.

To address the Governor’s assignment, the Committee also produced six (6) recommendations.

**COMMITTEE RECOMMENDATIONS**

Recommendations
Initiate as soon as possible a consultation process with the relevant federal agencies (i.e., COE, FERC, EPA) on the subject of feasibility, necessary permits and time required to implement each of the alternatives.
Extend the life of the Committee until December 2012 in order to give continuity to its works and evaluate the response of the federal agencies to the recommended alternatives. This will allow for the active participation and support of the private sector in materializing the solution(s).
Establish an expedited evaluation process for reviewing or modifying

Recommendations
emission sources permits filed in order to comply with the new regulations.
The Government Development Bank and PREPA should move swiftly and responsibly to acquire natural gas export terminal capacity in the US while preferential prices exist.
Continue efforts aimed at promoting liberalization of federal laws and regulations limiting the variety of vessels and crews available to transport fuel for power generation between US ports.
Continue judicial and administrative efforts by PREPA to ensure that island jurisdictions which are immersed in good-faith efforts to comply with the new federal regulations have reasonable time to achieve compliance levels.
Direct a competitive process between the different alternatives, after receiving the input from the federal agencies, so that they remain viable in terms of costs and time.
The viable alternatives must endeavor to use local talent in all development and operating aspects, ensuring the development of the necessary expertise in these technologies. We recommend including this requirement as part of the competitive selection process.

Finally, the Committee wishes to thank all the entities and persons that collaborated in the study and preparation of this Report.

## **II. INTERSECTORAL COMMITTEE ON ENVIRONMENTAL COMPLIANCE AND ENERGY ALTERNATIVES**

On February 15, 2012, the Governor of Puerto Rico issued Executive Order OE-2012-06,<sup>1</sup> which created ICECEA, comprised of nine (9) heads of agencies, as well as professional organizations, and presided over by the Chairman of the Environmental Quality Board.

The Committee’s principal mission was to conduct a comprehensive study and submit this Report to the Governor on the necessary measures to comply with new EPA regulations relating to NAAQS and MATS, including the conversion to, and use of natural gas in, the Cambalache, Palo Seco, and San Juan power plants located in the north region of the island. In addition, the Committee was charged with evaluating the impact on the business and economic sector of not complying with the EPA

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<sup>1</sup> See Attachment I.

regulations.

The Committee is composed of the following members:

Pedro J. Nieves Miranda	Chairman, Environmental Quality Board
Kenneth D. McClintock	Secretary of State
Otoniel Cruz Carrillo	Executive Director, Puerto Rico Electric Power Authority
José Ortiz Vázquez	Chairman of the Board, Puerto Rico Electric Power Authority
Juan M. Román Rivera	Executive Vice President and Fiscal Agent, Government Development Bank
Ángel González	President, Association of Engineers and Surveyors
Pedro Watlington	President, Puerto Rico Manufacturers Association
Fernando Peña	Deputy Director, Puerto Rico Federal Affairs Administration
Luis G. Rivera Marín	Secretary, Department of Consumer Affairs

On February 17, 2012, the ICECEA held its first meeting. The ICECEA agreed to create three (3) work groups:

1. Technical Group – Gathered and analyzed the information on emission sources, technology, alternatives and other data in order to reduce air emissions, refine modeling, and recommend feasible alternatives to comply with MATS and NAAQS. The group is presided over by the Environmental Quality Board and is composed by representatives from the following agencies and organizations:

- Puerto Rico Association of Engineers and Surveyors
- Puerto Rico Electric Power Authority
- Government Development Bank
- Environmental Quality Board

2. Economic Group – Analyzed the economic impact of complying with the regulations and of not complying with the regulations, and evaluated the economics of the alternatives presented. The group is presided over by the Government Development Bank and is composed by representatives from the following agencies and organizations:

- Puerto Rico Manufacturers Association
- Board of Directors of the Puerto Rico Electric Power Authority
- Department of Consumer Affairs

- Government Development Bank

3. Legal Group – Studied the applicable regulations and the judicial actions submitted by Puerto Rico and the different states of the Nation. This Group also suggested strategies to address the situation. The group is presided over by the Environmental Quality Board and is composed by representatives from the following agencies:

- Secretary of State
- Puerto Rico Federal Affairs Administration
- Environmental Quality Board

From February to June 2012, the Committee and its work groups met on more than twenty occasions, and thousands of man hours were invested in structuring a work plan, coordinating procedures, analyzing and evaluating the information, and considering and selecting the viable alternatives. The work of ICECEA members and their agencies' and organizations' support staff was an integral and essential part in carrying out the mission.

### **III. BACKGROUND**

#### **A) Energy Crisis and Compliance with Federal Regulations**

Puerto Rico's excessive dependency on petroleum-based fuels has made us all prey to the volatility of crude oil prices. This vulnerability threatens the life, health, economy, environment, and safety of all Puerto Ricans. For this reason, it is imperative to find other sources of energy that will reduce energy costs in the Island, which will promote business development and ensure the continuity of existing businesses, while reducing electricity costs for all families in Puerto Rico.

In addition to the need to reduce energy costs, it is imperative to seek alternative energy options to comply with new regulations recently enacted by EPA. MATS and NAAQS require power plants and businesses using fossil fuels in their operation to reduce their potential air pollutant emissions. The largest emitters of these pollutants in Puerto Rico are the Puerto Rico Electric Power Authority's (PREPA's) power plants and some private manufacturing and power generation businesses that produce electricity with alternate systems that emit pollutants (mainly SO<sub>2</sub>).

The conversion to natural gas as a fuel source would be a viable alternative that would dramatically reduce air pollutants. This is one of the reasons why it is essential for PREPA to convert most of its operations to natural gas generation. Should PREPA not convert most of its plants to natural gas generation, it would have to invest in additional emission control equipment in order to keep using oil-based fuel and meet EPA regulations. In the event that PREPA does not meet EPA regulations in time, it could end up paying fines for environmental violations and passing the cost of these fines and its investment in additional equipment on to its residential, commercial and industrial customers, all of whom are the engine of our economy. The Committee agrees that this potential effect lends a sense of increased urgency to the conversion to natural gas, as soon as possible.

If PREPA does not manage to convert its power generation to use natural gas, which would help lower its operational costs, then: (1) PREPA would incur increased capital costs in order to comply with EPA regulations, and (2) there would be an increase in the production costs of businesses as a result of electric power being produced with more expensive oil-based fuel. The manufacturing sector also might have to incur capital expenditures in order to comply with some of the EPA regulations. In addition, should PREPA not comply with the EPA regulations, there would be a potential increase in energy costs for all its customers, including residential customers.

As part of the efforts of the Government of Puerto Rico, the Environmental Quality Board and other permit agencies were authorized to use an expedited process that would govern the evaluation of environmental documents and permits submitted for actions in connection with power generation infrastructure development, through Executive Orders that set in motion the provisions of Act No. 76 of May 5, 2000, as amended.<sup>2</sup> This process covers projects using alternative sources to petroleum-based fuels, renewable and alternative energy sources, and natural gas. As part of the Government of Puerto Rico's specific plan, over twenty (20) energy projects have been evaluated and approved through this expedited process to date. These projects represent and demonstrate the commitment to positioning the Island towards a more efficient energy future, which is less vulnerable, more economic and environmentally sustainable.

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<sup>2</sup> Law exempting the Governor in projects arising as a result of states of emergency as declared by Executive Orders. 3 L.P.R.A. §1931 *et seq.*

As part of the options considered to address fuel diversification and reduce energy production costs in Puerto Rico, the Vía Verde project was evaluated and approved. This project entails the construction of a natural gas transportation system for electric power generation through the installation of a pipeline running from the Eco Eléctrica natural gas terminal in the Municipality of Peñuelas to PREPA's thermoelectric plants in the North of the island. This energy project also includes making changes to PREPA's plant units so that they operate using a combination of natural gas and petroleum-based fuels.

## **B) New Federal Regulations**

The Clean Air Act (CAA) requires EPA to establish National Ambient Air Quality Standards (NAAQS) for air pollutants, better known as criteria pollutants. These pollutants are sulfur oxides, ozone, lead, carbon monoxide, nitrogen oxides, and particulate matter. The law also requires EPA to periodically revise and check whether the standards are appropriate to ensure environmental and health protection, and to update them, as needed.

Similarly, the Clean Air Act establishes how Energy Generating Units (EGU) must be regulated. Section 112(n) requires a study assessing the harmful effects on the health of the population resulting from power generation emissions. Once the list of units that must be regulated is created, the law requires the development of standards for larger sources, which must use maximum achievable control technology (MACT).

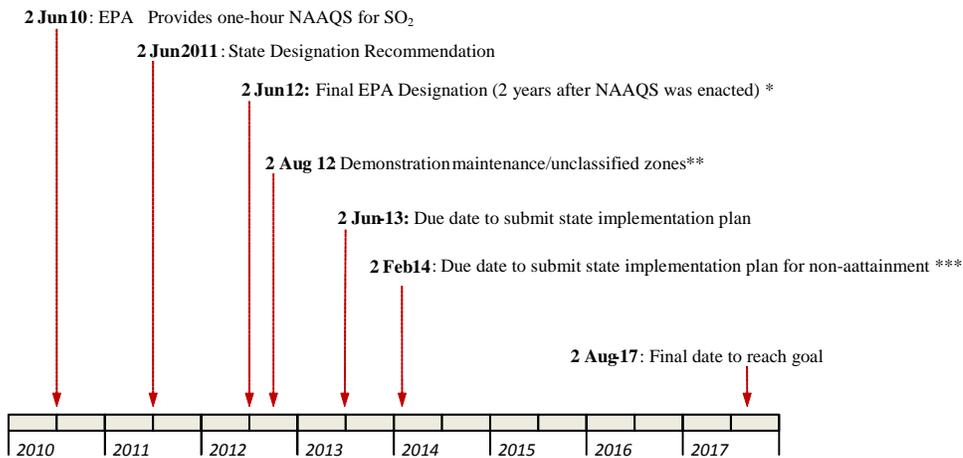
### **1) NAAQS - New National Ambient Air Quality Standards for Sulfur Oxides**

On June 2, 2010, the EPA enacted the one-hour NAAQS for sulfur dioxide (SO<sub>2</sub>). The new standard of 75 parts per billion (196 µg/m<sup>3</sup>) is computed using the 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years. Together with the new standard, the EPA also announced the repeal of the existing primary annual and 24-hour standards for SO<sub>2</sub>. The new standard is approximately five times more restrictive than the previous one.

With the publication of the new standard, the EQB conducted a preliminary study identifying five potential areas of non-compliance with NAAQS for SO<sub>2</sub>. In light of this situation, the EQB initially determined that it should make

recommendations as to non-attainment zones for said areas. As part of the Committee’s works, additional data was gathered through the technical work group on emissions, which cast doubt on EQB’s original conclusions relative to potential non-attainment areas. In light of this situation, and due to the time it takes to conduct studies in order to determine the applicability or non-applicability of these zones, on March 26, 2012, the EQB withdrew its non-attainment zone recommendation, and identified Puerto Rico as non-classifiable (unclassifiable).

**Key dates in the designation process for the new NAAQS for SO<sub>2</sub>**



\* EPA is behind schedule in the implementation. The federal Clean Air Act provides that the EPA may delay the final designation process for up to 12 months, if there is not sufficient information (42 U.S.C. 7407(d)(1)(B)(i)).

\*\* Required, 12 months after final designation. Delayed until the EPA completes the designation process.

\*\*\* Required, 18 months after the non-attainment designation.

**2) MATS – Mercury and Air Toxic Standards**

On December 16, 2011, the EPA enacted a rule to reduce emissions of toxic pollutants from electric generation plants with a capacity of more than 25 megawatts. The rule, known as MATS for EGU, is expected to reduce emissions from new and existing generating units burning coal and liquid fossil fuels.

The new standard limits emissions of the following pollutants:

<b>MATS Regulated Pollutants</b>
Particulate Matter
Metallic Hazardous Air Pollutants

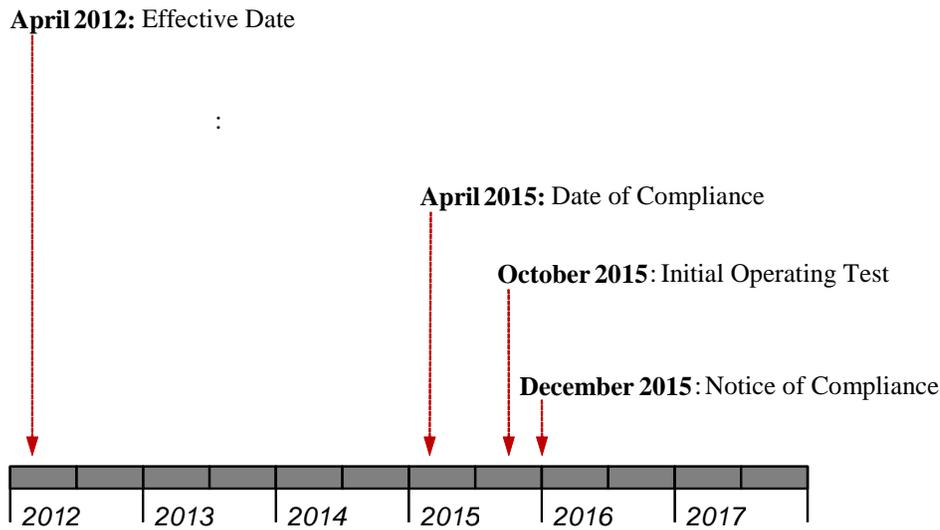
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Hydrogen Chloride  
 Hydrogen Fluoride

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The source affected by these regulations is the collective group of all the generating units with a capacity of more than 25 MW that use coal- or liquid-fossil-fuel burning boilers to produce electricity.

Below is a table with the dates of compliance:



### 3) Timetable to comply with MATS

MATS grants generating plants until April 2015 to be in compliance with the new standard. Some units will be eligible for a one-year extension (April 2016) to be granted by the state entity in charge of regulating emissions. In Puerto Rico, this entity is the Environmental Quality Board.

In separate guidelines, the EPA has established a limited mechanism to grant, by exception, additional extensions to those coal- or oil-fired generating plants whose withdrawal could cause potential electric system reliability problems.<sup>3</sup> The EPA has already stated that it does not foresee having to use this mechanism in general and that it will only grant authorizations to continue operating in very limited cases in which there is a certification from the Federal Energy Regulatory Commission (FERC) or the North American Electric Reliability

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<sup>3</sup> See *Enforcement Response Policy for CAA 113*.

Corporation (NERC) establishing that the operation of the generating unit is essential to maintain system reliability. The guidelines accord FERC only an advisory role in EPA's decision process. FERC's intervention is limited to issue an opinion as to whether the unit's compliance with the regulations may result in a breach of the reliability criteria issued by FERC.

In order to take advantage of the extensions, PREPA would have to thoroughly document that it has been planning and implementing concrete steps towards complying with MATS, and that it has made progress taking those steps, such as:

- Exploring alternatives
- Taking steps to procure permits
- Contracting the acquisition of emission control equipment
- Building new plants

#### **IV. ANALYSIS OF VIABLE ALTERNATIVES FOR COMPLIANCE**

##### **A) Emission Control Equipment**

As part of the evaluation of technologies and processes to comply with new regulatory requirements, the installation of additional emission control equipment in PREPA's generating units was examined. This option includes installing electrostatic precipitators or baghouses (to remove particulate matter), catalytic converters (to remove nitrogen oxides NO<sub>x</sub>), and scrubbers (to remove sulfur dioxides, SO<sub>2</sub>). However, installing this equipment requires space inside PREPA's plants, which represents a difficulty for PREPA because only the Aguirre Thermolectric Plant has the necessary space to install this kind of control equipment.

Another significant aspect is the time it takes on average to modify state and federal permits relating to the construction and operation of this control equipment. A further aspect is the time it takes to manufacture, transport, install and test the equipment, which shows how unlikely it would be for them to comply with PREPA's due date to comply with MATS. PREPA estimates that the capital investment in the acquisition of emission control equipment would total \$1.5 billion, plus an increase in operating and maintenance costs that is yet

to be determined.<sup>4</sup>

This investment would have the effect of increasing the cost of electricity. Therefore, based on the above considerations, we believe that installing additional emission control equipment is not a viable compliance alternative.

## **B) Increased Use of Existing Fuels**

PREPA currently utilizes No. 6 residual (bunker) and No. 2 diesel as fuel in their generating units.<sup>5</sup> Using a bunker with 0.3% sulfur is not an option, as it would increase energy costs significantly and would not comply with emission limits for contaminants imposed by new federal regulations.

As part of our evaluation, both the EQB and PREPA used dispersion models in order to determine the generating units' maximum emission levels. Both agencies agreed that in order to meet NAAQS compliance, the EQB must burn liquid fuel with a sulfur content of 0.1 percent per weight or less. This would imply that PREPA would be burning diesel in all of its combustion units. Currently, this fuel is only utilized in the most efficient combined cycle units, since its high cost is not economically feasible for use in other units. Increasing the use of No. 2 diesel fuel in turn increases the cost of fuel purchases. Below are the estimated costs of different fuels available for use in PREPA units.

## **C) Renewable Energy**

Law 82-2012 and Law 83-2010 establish the criteria in Puerto Rico for the inclusion of renewable energy for the Island's electrical system. PREPA and private entities are developing alternative renewable energy projects that in the short term do not contribute significantly to complying with the new federal regulations.

## **D) Replacement and/or renovation of generating units**

The two main ways of generating electricity with natural gas in Puerto Rico are:

- Convert existing units to utilize natural gas; and/or

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<sup>4</sup> SAIC Energy, Environment & Infrastructure, LLC estimates a cost of \$200-\$400 per kWh produced. According to information provided by PREPA, maximum generation capacity using boilers totals 2,452 MW.

<sup>5</sup> We clarify that certain units in Costa Sur Plant have already begun partially operating with natural gas. In addition, at present, PREPA makes limited use of propane gas to start its combined cycle units.

- Install new generating units that utilize natural gas

Proposals are in place to substitute generators with combined cycle technology. The criteria considered include the time for the permit and construction process. The proposed locations for this new generation are the Bay of San Juan and Roosevelt Roads. However, these options are also long term and do not ensure compliance with the new regulations.

Neither renewable energy and substitution or renovation of generating units, in the short term, significantly contribute to compliance with new federal regulations.

## **E) Natural Gas**

After evaluating the above considerations, the Committee concludes that the best alternative is the conversion of generating units to use natural gas as fuel. Based on available information, we understand that this alternative fuel is the best means to allow PREPA to comply with the dates specified in federal regulations, and maintain the generation and transmission system stable and cost effective.

The conversion of natural gas units will have the impact of reducing emissions to levels required by these new regulations, without the need to install additional emission control equipment. Currently, PREPA pays between \$19 and \$25 per million British Thermal Units (MMBtu) and it is projected that by 2016 natural gas will be available between \$6 and \$9 MMBtu. For example, the contracted cost of fuel is currently \$19.1 per MMBtu, compared with the current cost of natural gas at \$14.34 per MMBtu<sup>6</sup>, which provides a more economical fuel for generating electricity.

To comply with emission requirements set by the new federal regulations, it is estimated that PREPA must burn a minimum of 80% natural gas. It is estimated that the projects should be able to supply 279 million cubic feet per day (MMSCFD) on average, excluding the Aguirre Power Plant.

## **F) Gasification of Southern Plants**

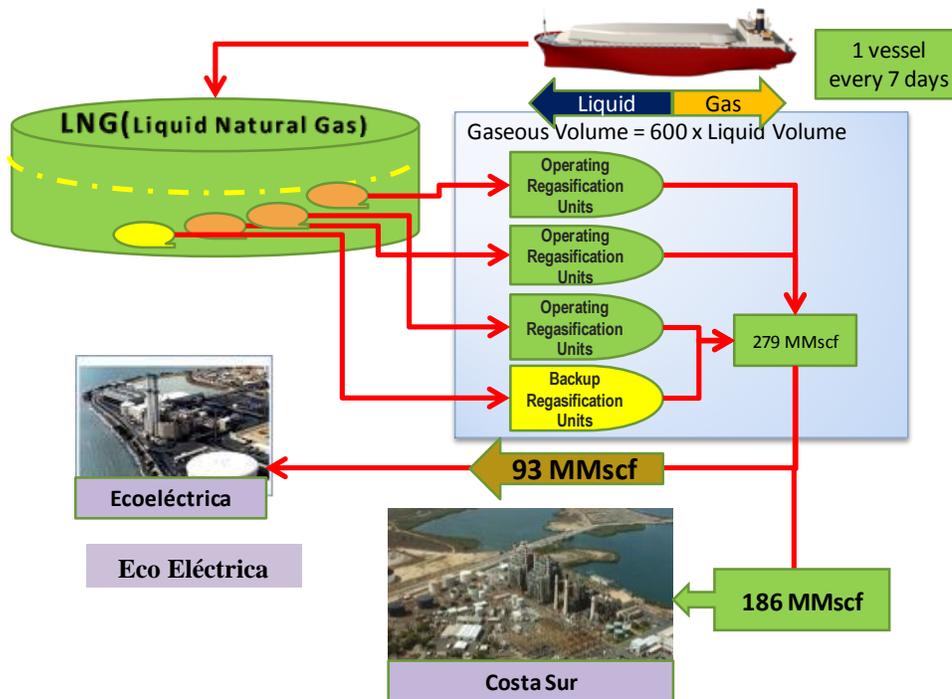
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<sup>6</sup> Cost based on the present contract with Gas Natural Fenosa. There is a projected cost reduction when using fuel based on the Henry Hub index.

## 1) Costa Sur

In April, units 5 and 6 of the Costa Sur plant began to use natural gas as fuel in limited quantities. The amount of gas required by units 5 and 6 of the South Coast Power Plant can reach up to 186 million cubic feet per day (MMSCFD). The amount of gas required by units 5 and 6 of the South Coast Power Plant can reach up to 186 million cubic feet per day (MMSCFD). The current amount of gas available for PREPA is about 93 MMSCFD. To increase the amount of natural gas transmitted to 186 MMSCFD through the marine terminal for importing natural gas from Eco Eléctrica, PREPA would have to reach an agreement with Gas Natural Fenosa to increase the capacity of gasification of the Eco Eléctrica facility with existing equipment. That negotiation, along with the permit process associated with bringing additional container ships for liquefied natural gas (LNG), requires between 9 to 18 months for completion.

The following graph shows the gas supply process for the existing Eco Eléctrica tank.



## 2) Aguirre

The floating storage and regasification units (FSRU) are designed to receive LNG from a conventional LNG carrier, store it and subsequently re-gasify the LNG as required. Below is a photo of an existing terminal. The Aguirre plant would need to have an average natural gas capacity of 250 MMSCFD.



These units can be used in an offshore docking facility or along the coast, or can be discharged using specialized buoys. In order for the Aguirre plant to receive LNG, an offshore platform would be used, which is expected to be completed by 2014. An initial capital investment of approximately \$173 million is required to build the terminal, in addition to an annual cost of \$75 million for operation and maintenance of the natural gas supply process

## **G) Gasification of Northern Plants**

### **3) Supply of gas from Aguirre or Guayanilla to a satellite terminal in the North**

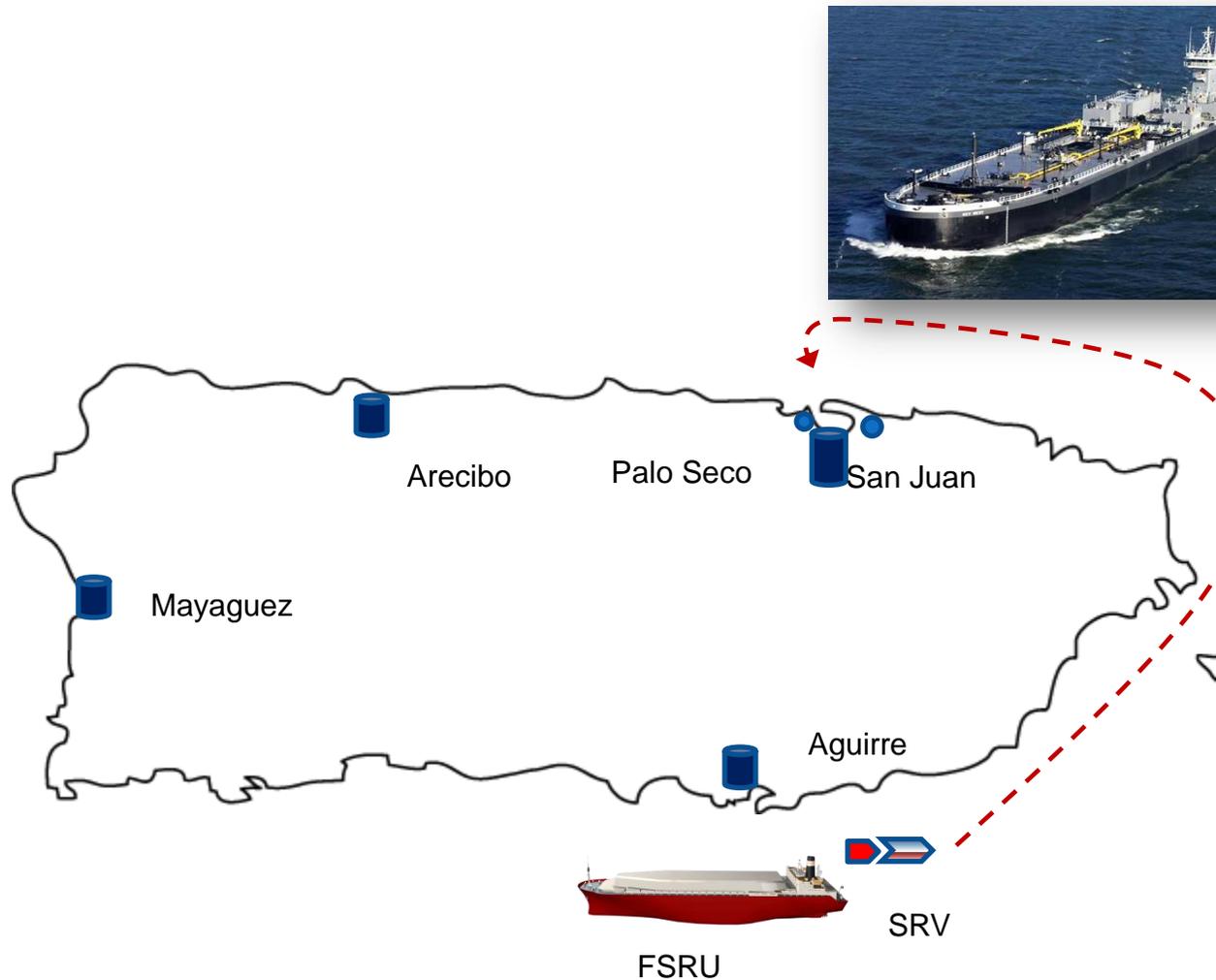
This option consists of supplying gas from the Aguirre Gas Port using small barges to transport to a satellite terminal gas generating plant near San Juan and Palo Seco. The satellite terminal would have a tank of about 0.75 trillion cubic feet. Thermoelectric Power Plants in Palo Seco and San Juan would be supplied using this terminal.

A major challenge that must be analyzed in greater detail is the space available to place this satellite terminal near San Juan, which would be the main geographic point for the use of natural gas. Based on information submitted by PREPA, it is estimated that it takes between 12 to 13 acres of land to create an LNG satellite tank when considering the exclusion areas that FERC requires to be established around the LNG tanks. The GDB estimates that the satellite terminal may require an initial capital investment of approximately \$175 million, in addition to another \$195 million related to the construction<sup>7</sup> of 2 LNG barges.

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<sup>7</sup> It is foreseen that PREPA will retain services; therefore, PREPA will not be directly responsible for the capital costs related to the construction of the barges.

The following diagram shows the conceptualization of the option presented.



The northern terminal would also supply LNG through a connector to industrial and commercial operations located in the northern part of Puerto Rico for co-generation of energy, and/or operation of boilers. This way, clean and cheap fuel would be available to both the industrial and commercial sectors. In turn, it would also allow adequate space for industrial development, either for the expansion of existing operations and/or new operations.

#### 4) Use of buoys in the Northern Pipeline

Another technology presented to the Committee by PREPA involves the construction of a buoy where a LNG ship could be anchored off the northern

coast of the island. This buoy, in turn, would supply natural gas to an offshore and/or onshore pipeline that connects to power plants located in the north as well as to industries.

Due to sea conditions in the north, in order for the ship to recharge LNG with suppliers, it would have to undock from the buoy and travel to the southern part of the island where fuel is transferred from the supplier ship to the gasifier ship. In order to eliminate the waiting time without supply, a second ship would have to be put in use or a storage tank built, which would ensure the continued availability of LNG while recharging takes place. The approximate amount of time for construction of the buoys and ships is estimated between 5 and 6 years, with a capital investment of \$150 million, along with \$50 million in annual expenses related to contracting two ships, as estimated by the GDB.

## **5) Compressed Natural Gas (CNG)**

There is a preliminary feasibility study for an onshore terminal of CNG. The scope of the proposal also includes natural gas, along with infrastructure for transport, treatment and delivery to the generating units, with an estimated completion date of 2016. However, this technology is still under development and a detailed analysis of the required permits has not been completed.

### **Options for dispatching natural gas through the alternatives mentioned above are as follows:**

- a. Pipeline or onshore connector from satellite terminal to users. GDB estimates a capital investment of approximately \$225 million.
- b. Offshore pipeline linking Palo Seco, San Juan and Cambalache, as well as industries in the northern region, which could be affected by the NAAQS. The offshore pipeline requires a capital investment of approximately \$150 million, according to estimates by the GDB, excluding the cost of additional connectors to supply gas to industry in the region.

It is important to note that with respect to this option, it is necessary to obtain additional information about design, location, supply, as well as complete cost and construction schedule estimates.

## **6) North-South Gas Pipeline with Added Gas Capacity**

The analysis conducted by the Committee indicates that as conceptualized, the Vía Verde project is not a viable option in order to comply with the MATS and NAAQS, because of the amount of natural gas currently available for the project. According to information gathered, the project cannot meet the demand of about 279 MMSCFD units required by PREPA in order to comply with regulations.

In order to achieve compliance, gas supply capacity needs to be added to the pipeline from South to North. Based on information available as of today, it is not viable for 2015. Total cost estimates for the installation of the pipeline range from \$450 to \$500 million. Estimated time of completion, from permits to completion of construction, is approximately two years. This 2-year period does not include the time it would take to implement the options discussed below. This cost does not include the tank, buoy or additional pipeline required to supply the additional gas that is needed. Below, an outline of the options that would be necessary in order to proceed with this alternative:

- a) One option to add gas supply capacity is to establish a buoy located near Costa Sur, with one or two FSRUs, depending on design and needs, to be connected to the pipeline. The GDB estimate of capital investment for construction of the terminal is approximately \$173 million, with an annual cost of approximately \$75 million. The approximate completion time for the project is 5 to 6 years.
- b) Another option is to add dispatch capacity to Eco Eléctrica, through the installment of an additional tank to connect to the pipeline. The GDB estimates that this would require an approximately \$300 million investment, with an implementation period of approximately 6 to 7 years.
- c) The final option is to transport additional gas from the Aguirre terminal to the South Coast facility. The time and cost of this option should be evaluated in further detail.

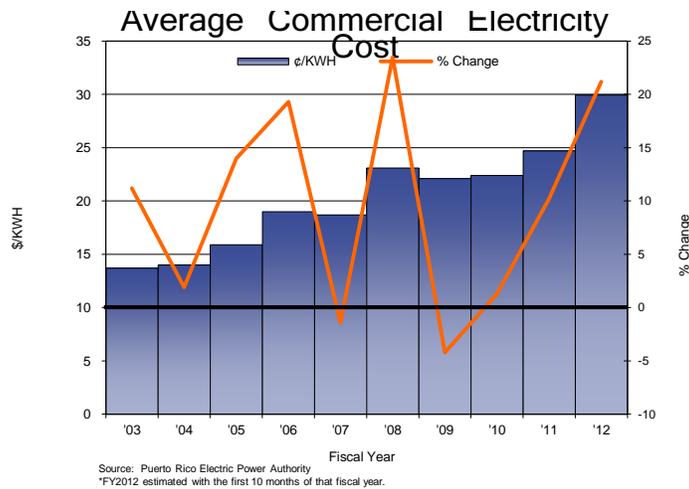
## **H) Propane Gas (as a transitional measure)**

As a short-term alternative, PREPA is working on the option of using propane gas as fuel in Units 5 and 6 of the San Juan plant. This is a viable short-term alternative for reducing fuel costs, because propane is cheaper than the diesel fuel used in these combustion turbines. This option was recently presented to

the Committee and has its support to be used immediately, but not for more than 5 years, or until natural gas can be brought to San Juan area plants. An expansion of existing propane gas terminals is anticipated to meet fuel demands for San Juan units 5 and 6 (combined cycle). The expansion includes a storage barge connected to the dock to meet the demand for fuel. According to the information provided, this fuel would be available within 3-6 months. Currently, PREPA is in negotiations to use the fuel in Units 5 and 6 in San Juan.

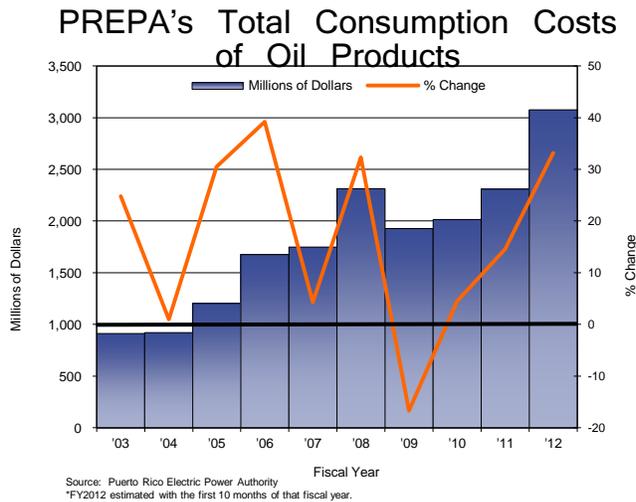
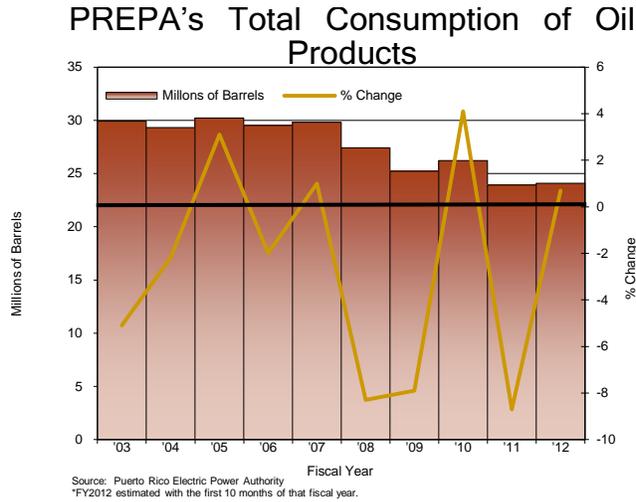
## V. ECONOMIC IMPACT OF ENERGY COSTS

Energy costs affect both producers and consumers of this product. This impact is then transmitted throughout the rest of the economy. For example, for the first three quarters of fiscal year 2012, the average cost of commercial electricity was 28.8 cents/kwh. This is due to the high costs of liquid fossil fuels upon which PREPA depends. Below is a chart with the history of energy costs in the sector.



As a measure to reduce energy costs, during the last five years from (fiscal years 2007 through 2012), PREPA has reduced the total consumption of petroleum and derivatives at an average annual rate of 4.18%. However, it is expected that for FY 2012, PREPA will end up paying between \$2.8 billion and \$3.0 billion in petroleum products. These increases in fuel costs by PREPA are largely due to price increases in the cost of petroleum products, which have continued to increase for the past 3 years, and which for FY 2012 are expected to be 31.4% above those recorded during the previous fiscal year. This is primarily due to higher global oil prices, particularly for low-sulfur oil purchased by PREPA in order to comply with environmental regulations.

Below is a graph showing the cost of PREPA’s consumption of oil and its derivatives.<sup>8</sup>



On the other hand, if PREPA is unable to convert its existing units to the use of natural gas (including completing necessary infrastructure for natural gas supply) it would have to incur major capital investments in order to further control emissions and thus comply with new regulations within the stipulated 3-year time frame. Currently, PREPA estimates that such required capital investments could range between \$631.6 million to \$1.26 billion, in addition to other expenses related to the operation and maintenance of these emission control systems.

According to studies by consultants from SAIC Energy, Environment &

<sup>8</sup> Note the cost increase in recent years.

Infrastructure, LLC, fuel purchase savings can reach up to \$647 million a year by burning natural gas in combination with 0.5% fuel sulfur in PREPA’s units. These savings depend on the cost of oil and depend on the pricing formula contracted with Gas Natural Fenosa for Costa Sur, which represents between 21%-25% of the cost of oil, based on a 2010-2011 capacity factor for each plant.

The figures provided by SAIC Energy, Environment & Infrastructure, LLC, estimating savings from burning natural gas in combination with 0.5% sulfur in PREPA plants, include conversions and the Aguirre Plant.

% Natural Gas	Fuel Costs	Fuel Savings to 0.5%
	\$MM/yr	Sulfur oil, \$MM/yr
	<b>0.5%</b>	<b>0.5%</b>
<b>0</b>	2,745	-
<b>25</b>	2,669	76
<b>50</b>	2,479	266
<b>75</b>	2,288	457
<b>100</b>	<b>2,097</b>	<b>647</b>

**Source :** SAIC Energy, Environment & Infrastructure, LLC, Report, 2012.

## VI. CONCLUSION AND RECOMMENDATIONS

### A. CONCLUSION

The fastest and most economically viable way to comply with EPA regulations is the conversion of power plants to natural gas on or before 2016. Although the possibility exists that PREPA can get an extension granted until 2017, there is still uncertainty as to what the specific criteria would be in order to obtain such an extension and if PREPA, as structured today, could meet them. We therefore believe that 2016 is a conservative date that PREPA should establish as the limit to start operating with natural gas, with a minimum proportion of 80% of consumption.

Furthermore, economic analysis shows that the conversion would result in net savings by reducing the cost of fuel, and distribution to industrial and commercial sectors could encourage the creation of 20,000 jobs over the next 5 years. In addition to not complying with federal environmental regulations, the potential consequence of not converting to natural gas would jeopardize an average 40,000 to 60,000 jobs (from a base of 924,000 jobs), depending on the impact of increased energy costs in Puerto Rico’s manufacturing sector.

The change to natural gas would result in additional savings of at least 5 to 6 cents/kWh, when all measures are implemented.

## **B. RECOMMENDATIONS**

1. In order to ensure that one or more of the alternatives materializes, we recommend beginning as soon as possible a consultation process with the pertinent federal agencies (i.e. COE, FERC, EPA) in terms of feasibility, necessary permits and time required to obtain permits for the implementation of the options presented herein.
2. It is recommended that the Governor of Puerto Rico amend Executive Order EO-2012-06 to extend the term of this Committee until December 2012. This continuity will allow for a structured evaluation of the response of federal agencies to the recommended alternatives. In addition, it will provide active private sector participation and sector support relating to the solutions implemented by PREPA, the results of which will affect all sectors impacted by federal regulation.
3. The manufacturing sector is implementing or will implement changes to their operations that will result in the submission of applications for permits with the EQB. Given the likely increase in these requests, and the short amount of time to comply with the regulations, we recommend establishing an expedited review process in the review or modification of permits for emission sources in order to comply with the new regulations.
4. Market projections for the price of natural gas, and the limited availability of export terminals in the United States, oblige us to recommend that the GDB and PREPA move swiftly and responsibly in the acquisition of capacity in these terminals, while there are preferential rates.
5. It is recommended that efforts be continued to promote the liberalization of laws and federal regulations that restrict the variety of vessels and crews available to transport fuel between U.S. ports, specifically those related to electricity generation.
6. It is recommended that PREPA continue judicial and administrative efforts aimed at allowing island jurisdictions that are immersed in good-faith efforts

- to comply with new federal regulations to have a reasonable amount of time in order to achieve compliance levels.<sup>9</sup>
7. It is suggested that after receiving input from federal agencies, a competitive process between the different options is structured in order to determine the extent to which they continue to remain viable in terms of cost and time.
  8. Viable alternatives shall endeavor to use local talent in all facets of development and operation. In this way, we will be able to develop the necessary expertise in these technologies for the benefit of future generations. We recommend including this requirement as part of the competitive selection process.

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<sup>9</sup> Committee Chairman, Pedro J. Nieves Miranda, and associate member, Fernando Peña, refrained from taking part in the discussion of this recommendation and disqualified themselves when it was voted on.

**VII. APPROVAL**



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**Angel González**  
President  
Association of Engineers and  
Surveyors



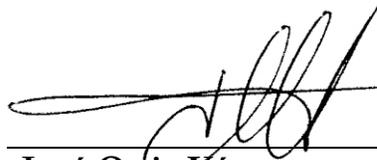
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**Pedro Watlington**  
Outgoing President  
Puerto Rico Manufacturers Association



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**Kenneth McClintock**  
Secretary of State



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**José Ortiz Vázquez**  
Chairman of the Board  
Puerto Rico Electric Power Authority



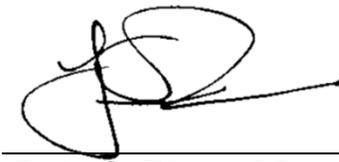
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**Otoniel Cruz Carrillo**  
Executive Director  
Puerto Rico Electric Power  
Authority



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**Juan M. Román Rivera**  
Executive Vice President  
Government Development Bank



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**Luis G. Rivera Marín**  
Secretary  
Department of Consumer Affairs



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**Fernando Peña**  
Deputy Executive Director  
Puerto Rico Federal Affairs  
Administration



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**Pedro J. Nieves Miranda**  
President  
Environmental Quality Board