ALTERNATIVES ANALYSIS

Background

Section 404(b)(1) of the Clean Water Act prohibits the discharge of dredged or fill material into waters of the United States unless the proposed discharge is the least environmentally damaging practicable alternative capable of achieving the project purpose. Alternative routes for the pipeline and to the pipeline were evaluated pursuant to 40 CFR 230.10. The National Environmental Policy Act (NEPA) and implementing regulations at 40 CFR 1502.14, together with the Commonwealth Policy Act, require a range of reasonable alternatives including the no action alternative be evaluated. Under these laws and regulations, the no action alternative and action alternatives that meet the project purpose and need of the preferred alternative are considered to be reasonable alternatives. Under the aforementioned laws, these alternatives do not need to be available to the applicant. Though the Corps will evaluate these alternatives, the alternatives selected should be available to the applicant at the time of the permit decision.

The Government of Puerto Rico's 1993 Energy Policy acknowledged the island's high dependency on oil, which at the time was 99%, and the high environmental cost this caused. The policy directs the Puerto Rico Electric Power Authority (PREPA) diversification of fuel sources for power generation to reduce the volatility of oil prices and overall power generation costs and to introduce environmental criteria for the selection of new power plants. Following is a detailed discussion of alternatives to the proposed Via Verde project that meet the project purpose and need. Each alternative discussed addresses logistics, technology, cost and environmental consequences and is followed by a statement indicating whether or not we consider the alternative to be practicable. Among alternatives considered were: the construction of a natural gas import terminal on the north coast of the island, three tanker and buoys systems (Deepwater Port) for receipt of natural gas at Palo Seco, San Juan and Cambalache plants, and several terrestrial alignments for a natural gas pipeline system. The alternative of no action was also analyzed.

EVALUATION CRITERIA

To evaluate the data on each of the alternatives discussed, a set of criteria was defined and rated. Also, weight was given to each criterion according to its importance. Each alternative will be discussed separately and at the end, a table will be presented where the criteria is applied and the rating is multiplied by the weight to obtain a numerical value for each alternative. The alternative with the highest value is deemed the best alternative for construction.

Criteria used for site evaluation

Criterion number	Criterion	Consideration
1	Land Use	Avoid land targeted for high density developments. Favorable land uses considered to be public, commercial, agricultural, industrial
2	Bodies of water	Reduce number, complexity and width of crossings
3	Forests and nature reserves	Avoid or minimized to the maximum extent possible impact to known sites
4	Endangered species	Avoid or minimize to the maximum extent possible impact to the species and their habitat
5	Architectural and Archaeological findings	Avoid or minimized to the maximum extent possible impact to known sites
6	Road crossings	Reduce number of road crossings
7	Zoning	Favorable zoning designations: non residential, public, industrial, agricultural, commercial and non-zoned.
8	Topography	Seek route with smallest number of abrupt topographic changes
9	Community	Maximize safety to residents, avoid or minimize number of dwellings directly impacted by the project (expropriation)
10	Pipeline length	Reduce pipeline length to minimize impacts. Place pipeline parallel to or along existing linear disturbances (ROW's)
11	Impacts to jurisdictional areas	Avoid or minimized to the maximum extent possible, impact to jurisdictional areas
12	Pipeline security	Ideally the pipeline is located on private property where public access is limited. The pipeline is ideally suited to rural land uses unlikely to be targeted for high density

Criterion number	Criterion	Consideration
		uses.
13	Impact on transportation or traffic	Avoid or minimize to the maximum extent possible, impact to transportation and terrestrial or maritime traffic
14	Water Quality	Avoid or minimize to the maximum extent possible, impact to water quality, especially permanent effects
15	Aquatic resources	Avoid or minimize to the maximum extent possible, impact to aquatic resources
16	Cost	Develop project that is within the company's financial possibilities
17	Noise impact to communities and species	Minimize noise impact during construction and operation
18	Essential fish habitat	Avoid or minimize impact to this resource
19	Corals	Avoid or minimize impact to this resource
20	Ease of access	The location needs to provide safe access for routine maintenance and integrity monitoring.
21	Exclusion zone	Project location must comply with regulatory requirements on exclusion zones. A special exclusion zone could also be defined by the owner to avoid impact to certain resources.

Rating assigned to each criterion

Criterion number	Criterion	Comment	Condition	Rating
1	Land Use	Per cent of the project in land favorable to construction	0-10	5
			11-100	10
2	Bodies of water	Number of points were the project intercepts a body of water	0-25 crossings	10
			25-100	5
3	Forests and nature reserves	Per cent of the project in forest and nature reserves	0-10	10
			11-20	5

Criterion number	Criterion	Comment	Condition	Rating
4	Endangered species	Per cent of project in areas where these species are found	0-5	10
			5-10	5
5	Architectural and Archaeological findings	Number of sites impacted by the project	0-5	10
			5-10	5
6	Road crossings	Number of crossings	0-40	10
			41-100	5
7	Zoning	Per cent of the project in favorable zoning	0-20	5
			21-100	10
8	Topography	Number of abrupt topographic changes	0-60	10
			60-100	5
9	Community	Number of residences impacted by expropriation	0-15	10
			16-100	5
10	Pipeline length	Covers less miles from point A to point B	Less than 50 miles	10
			More than 50 miles	5
11	Impacts to jurisdictional areas	Percentage of project in jurisdictional areas	0-20	10
			21-50	5
12	Pipeline security	Percentage of auxiliary equipment exposed and accessible to public	0-5	10
			6-10	5
13	Impact on transportation or traffic	Has potential to affect land or marine traffic	Minimum or no impact	10
			Significant	5
14	Water Quality	Turbidity Sedimentation	Permanent	5
			Temporary	10
15	Aquatic resources	General impact to species	Permanent	5
			Temporary	10
16	Cost	Cost efficient	Less than 1 billion	10
			Greater than 1 billion	5
17	Noise impact to communities and species	Produces noise during construction or operation that impacts quality of life or harasses species	Yes	5
			No	10
18	Essential fish habitat	Per cent of the project in	Less or equal to 5	10

Criterion number	Criterion	Comment	Condition	Rating
		designated areas	Greater than 5	5
19	Corals	Per cent of the project in designated areas	Less or equal to 5	10
			Greater than 5	5
20	Ease of access	Safe access for maintenance and inspections	Yes	10
			No	5
21	Exclusion zone	Project location complies with regulatory requirements on exclusion zones	Yes	10
			No	5

Weight assigned to each criterion

1. Important 2. Mid importance 3. More important

Criterion number	Criterion	Weight
1	Land Use	3
2	Bodies of water	2
3	Forests and nature reserves	2
4	Endangered species	3
5	Architectural and Archaeological findings	2
6	Road crossings	2
7	Zoning	3
8	Topography	2
9	Community	3
10	Pipeline length	2
11	Impacts to jurisdictional areas	3
12	Pipeline security	3
13	Impacts on transportation or traffic	3
14	Water quality	3
15	Aquatic resources	3
16	Cost	3
17	Noise impact on communities an species	2
18	Essential fish habitat	2
19	Corals	2
20	Ease of access	2

Criterion number	Criterion	Weight
21	Exclusion zone	3

DESCRIPTION OF ALTERNATIVES CONSIDERED

No Action

The alternative of no action, although considered, was found not feasible given the transcendence, importance; and public welfare pursued by the project.

Preliminary environmental impacts and direct/indirect impacts associated with construction of a natural gas pipeline are considered. If the project is not built the following impacts would be avoided:

- Impacts from moving earth that could result in erosion and sedimentation in bodies of water
- Temporary increases in noise levels
- Impacts to forest reserves
- Temporary impacts to wetlands and other bodies of surface water
- Impacts to farmland
- Temporary impacts to infrastructure such as waterlines, buildings and (possible) phone lines
- Temporary impacts to traffic and roads, i.e. detours
- Potential impacts to archaeological sites
- Acquisition of land by expropriation

However, if the project is built most of these impacts, if not avoided completely, could be minimized and mitigated using engineering design options and support from agencies and municipalities the project would cross through.

No action is not indicative of no impact, since with this alternative PREPA will be forced to continue to produce electricity by burning petroleum products that generate greater amount of pollutants emitted to the air. While some of these emissions can be controlled by using technology that requires, in many cases, an investment of millions of dollars, modern emission reduction highlights that the emissions of these derivatives of petroleum would be greater if related to the burning of natural gas. In addition, maintenance of petroleum burning units has to take place more frequently and with higher costs to guarantee

optimal operation. Continuing to burn petroleum derivatives has other implications, such as an increased frequency of deliveries of these fuels to our ports which increases erosion of the seabed and the likelihood of spills. The continued use of fuels derived from petroleum increases the cost of electricity, which negatively impacts the Puerto Rican economy and results in a lower quality of life for its citizens. Finally, liquid fuels expose PREPA to fluctuations in the market value creating instability in the costs of energy production and invoices. Recognizing that the Puerto Rico economy is directly linked to PREPA's stability, it is important for the company to meet its strategic development plans and maintain a fixed cost structure to avoid sudden peaks of variations in the cost of purchased fuel. Compliance with this plan demonstrates vision, stability and commitment to customers, the ability to assess complex situations of world character and the ability to develop strategies to minimize adverse impacts making it easier to expand options to obtain fuels in the future.

After evaluating local and global dynamics, PREPA developed a strategic plan to guide future development of the company and Puerto Rico. This plan includes the following parameters:

- Diversification of energy sources
- Reduction in costs
- Geographic diversification of generating electricity
- Environmental considerations
- Expansion of electrical generation
- Diversification of revenue

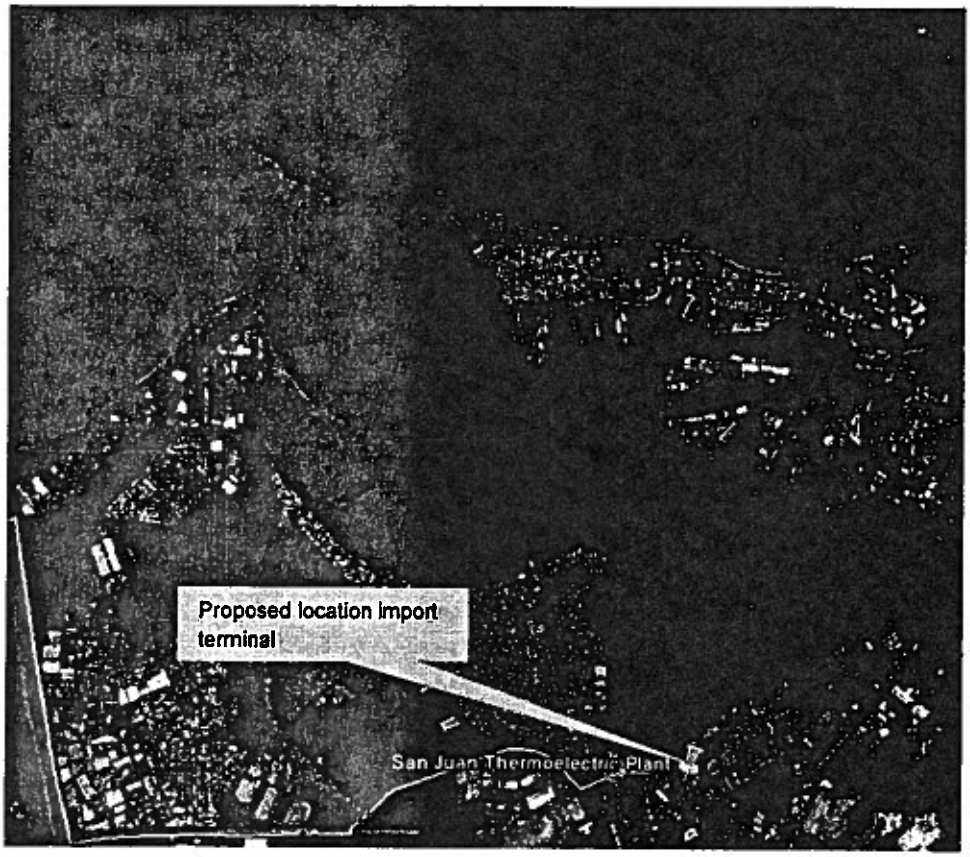
The Via Verde project is part of the plan to diversify fuels which can make PREPA better. In addition, there are important environmental considerations to help AEE to more effectively manage their energy costs. A significant percent of Puerto Rico's generated electrical power depends on oil. At the moment, AEE uses only No. 2 fuel (light distillate) and No. 6 (bunker C) its generator units and it buys electricity, in turn, from the AES co-generators in the municipality of Guayama (coal) and EcoElectrica in the municipality of Penuelas (natural gas). With the introduction of the co-generators AEE began to buy electricity generated from NG or coal but internally AEE still depends exclusively on oil.

PREPA aims to reduce its dependence on the use of oil, which currently is approximately 68%, to approximately 12% by 2014. To do this PREPA must identify alternative fuels that can meet their customers demand for power. Lack of action would only aggravate the current dependence on oil, and at a time of seizure or high global demand, Puerto Rico would have no viable alternatives to generate electricity. In addition, no action exposes PREPA to sudden changes in the cost of oil which reduces the economic capacity of PREPA and, consequently, the Puerto Rican economy. It is important to highlight that PREPA is limited by regulations to the type of fuel it can burn. The greatest limitation is the amount of sulfur contained in fuel. Low sulfur fuel is more expensive than fuel with higher sulfur content. If there are shortages in this type of fuel, or if PREPA cannot set contracts with the suppliers, there are only two options left: reduce the production of electricity, which is not feasible, or burn a cheaper fuel with higher sulfur content in violation of established environmental permits, with subsequent exposure to fines and sanctions from regulatory agencies. Natural gas significantly decreases emissions of pollutants to the environment. No action means PREPA must expend significant capital to reduce emissions that result from burning oil and to maintain their units, instead of using that capital to develop a more efficient system that uses cleaner fuel with lower maintenance costs.

The No Action Alternative would not meet the project purpose and will not be considered further.

Construction of a Liquefied Natural Gas Import Terminal

Currently Puerto Rico has the EcoElectrica Cogeneradora in the municipality of Peñuelas, to receive LNG (and meet PREPA's needs). Still, the alternative of building a new terminal closer to PREPA's power facilities was evaluated in consideration of environmental impacts potentially associated with the construction of a delivery pipeline from the EcoElectrica terminal. A location between the three power plants on the northern coast selected to convert to Natural Gas (NG) was identified next to the Central Thermoelectric San Juan (CTSJ) unit. Currently, an existing pier has infrastructure to transport diesel and Bunker C Fuel to two of the three plants, San Juan and Palo Seco.



A new LNG import terminal must be able to receive, download, and store up to 3.0 Bcf/d (3 trillion cubic feet) of liquid natural gas imported by sea. In addition, facilities to gasify and handle the natural gas would also need to be built. The construction of the terminal would result in an environmental impact associated with the different stages of the construction and operation, which include:

- Build, repair, or expand (depending on the case), a pier for receipt of liquid natural gas.
- Increase in the transit of ships.
- Construction of a tank for liquid natural gas storage and gasification - this plant would require an area of approximately 25 acres.
- Constructing navigation channels to support transit tankers, which would mean dredging and disposing dredged material.

Selecting a place to construct a terminal to receive liquid natural gas requires a deep port to minimize the environmental impacts associated with the development and operation of the terminal. In addition, a relatively low population density area with industrial development is necessary.

Three (3) criteria were used to determine whether building close to PREPA's installation import terminal was a viable alternative. These were: 1) specific factors at the workplace, 2) maritime operations and, 3) environmental issues.

1. Factors specific to the workplace

Availability of land

A suitable location must have enough space available to accommodate the proposed installation and all safety components required by the Federal Department of transportation regulations (49 CFR part 193), the U.S. Coast Guard (33 CFR part 127) and the National Fire Protection Association (NFPA). In addition, a site must comply with the regulatory distance required between structures used to gasify LNG and the LNG storage tank. Facilities would need to occupy an area of approximately 25 acres. Structures would include, among other components, a dual containment tank 167 feet in height and diameter with the ability to store 1,000,000 barrels of liquid natural gas at a temperature of minus 260 degrees Fahrenheit and a pressure of 2.0269 psig; vaporization or gasification systems to gasify liquid natural gas, and pipes to transport the natural gas to the power stations. Other factors to be considered would include activities outside and adjacent to the terminal and the distance or separation needed between the terminal to occupied areas of activity and/or populated areas (49 CFR parts 193.2055, 193.2057 and/or populated areas.

Availability of a coastal area

A site must have an available maritime quay with facilities for tankers 950 feet long, with PIP cubic meters capacity, and a minimum 40-foot boat anchor area. The criteria used to assess whether a port or dock has the capacity for this type of project are the depth of greater than 40 feet, navigation channels with extension airway passage (greater than 180 feet) and proximity to equipment to conduct storage and gasification of liquid natural gas. The quay must be approximately 30 feet wide by 1,700 long and have, among others: teams to tie up the tanker to the dock; a boat platform with two levels at the end (a 40-foot wide by 100 long lower level and 20 wide and 100 long upper level); and a emergency spill collection system.

Disposal of dredged material

Any area under consideration must include the requirement to dredge to create a proper shipping channel for the maritime tanker traffic to deliver the liquid natural gas; also a site must be identified for

dredged material generated during construction and future maintenance operations required for the channel.

2. Maritime Operations

Increase in ships

The transit of tanker ships is subject to more restrictions than general maritime traffic. Federal regulations and restrictions could affect other shipping and increase the risk of affecting other users of the navigation channel.

Access to the navigation channel

The quicker a tanker vessel can arrive at the terminal, unload and return to sea, the more economic the operation is. A shorter channel would reduce possible adverse effects on traffic for other ships from marine transit restrictions. Yaw (amplitude and proximity) area: a typical liquid natural gas tanker ship would require a dock with a minimum turning diameter of 1,200 feet and 40 feet of depth.

3. Environmental issues

Environmental consequences

Minimizing environmental impact by using places previously impacted, including the place for dock, and areas zoned for this type of use.

Compatibility with the region

The place must be compatible with future developments on adjacent properties.

According to the rating system described above, the import terminal is favorable based on the following criteria:

1. The land to be used for the project is compatible with the uses defined in the criteria (commercial, industrial, public, agricultural).
2. Bodies of water- the number of water bodies to be crossed are reduced, since the length of pipe between Peñuelas and Arecibo is eliminated with this option.
3. Forests and Reserves- the percentage of forests and reserves is considerably reduced because the length of pipe between Peñuelas and Arecibo is eliminated
4. Architectural and Archaeological findings- no findings anticipated in the marine portion of the project. There are no findings in the land portion from San Juan to Arecibo.
5. Road crossings- the number of road crossings is reduced since the length of pipe from Peñuelas to Arecibo is eliminated.
6. Zoning- the zoning in the project area is compatible with the zoning designated in the criteria: non residential, public, industrial, agricultural, commercial and non-zoned.

7. Topography- the number of abrupt topographic changes is significantly reduced since the length of pipe from Peñuelas to Arecibo is eliminated.
8. Community- the number of residences expropriated is reduced.
9. Pipe length- the length of pipe needed is reduced.
10. Pipeline security – the pipe is still underground.
11. Noise impact – the noise levels will be compatible with the noise levels in the area.

The import terminal proved disadvantageous based on the following criteria:

1. Endangered species- to bring the natural gas tanker to the selected location, the navigation channel must be dredged and a disposal site identified. The Estuary of the Bay of San Juan (EBSJ) is composed of several bodies of water. The EBSJ provides food and shelter to eight species of fauna and 17 species of flora in danger of extinction, such as the Antillean Manatee and several species of turtles, including the hawksbill and leatherback; 160 species of birds, such as the Brown Pelican and the Heron; 19 species of reptiles and amphibians, such as the coquí and Puerto Rican boa; 124 species of fish, Tarpon and bass; and 300 species of wetland plants are found on EBSJ.

2. Impact to jurisdictional areas- the San Juan Bay is considered waters of the United States. In addition to this, a disposal site for the dredged material must be identified. A deep water disposal site would also fall under the jurisdiction of the USACE.
3. Cost – the estimated cost to build an import terminal is approximately $1.2-$1.5 billion, above the government's financial capability at the moment.
4. Impact to transportation and traffic- the dredging operation to prepare the navigation channel and the gas natural tankers entering the area would have a significant impact on the maritime traffic of San Juan Bay. Also, there would an increase in maritime traffic due to the LNG ships entering the area. The transit of tanker ships is subject to more restrictions than general maritime traffic. Federal regulations and restrictions could affect other shipping and increase the risk of affecting other users of the navigation channel. One example of an effect would be the increase in maritime traffic restrictions which make it difficult, if not impossible, for others to use the navigation channels simultaneously with LNG tankers
5. Water quality and aquatic resources- Dredging operations would degrade the quality of the receiving waters due to suspended fine sediments. Effects from the turbidity plume

could occur daily during working hours and up to two (2) hours after the discharge of dredged material is completed. This would affect water quality and, consequently, water quality parameters required by environmental permits governing the CTSJ, especially turbidity, sedimentation and suspended solids.

6. Essential fish habitat – There are no identified essential fish habitats in the San Juan Bay.

7. Ease of access – the quicker a tanker vessel can arrive at the terminal, unload and return to sea, the more economic and safe is the operation. In order to reach the unloading pier, the LNG tanker must use three channels, Bar, Anegado and Army Terminal, until it reaches the pier at Puerto Nuevo Bay. A shorter channel would reduce possible adverse effects on traffic for other ships from marine transit restrictions.

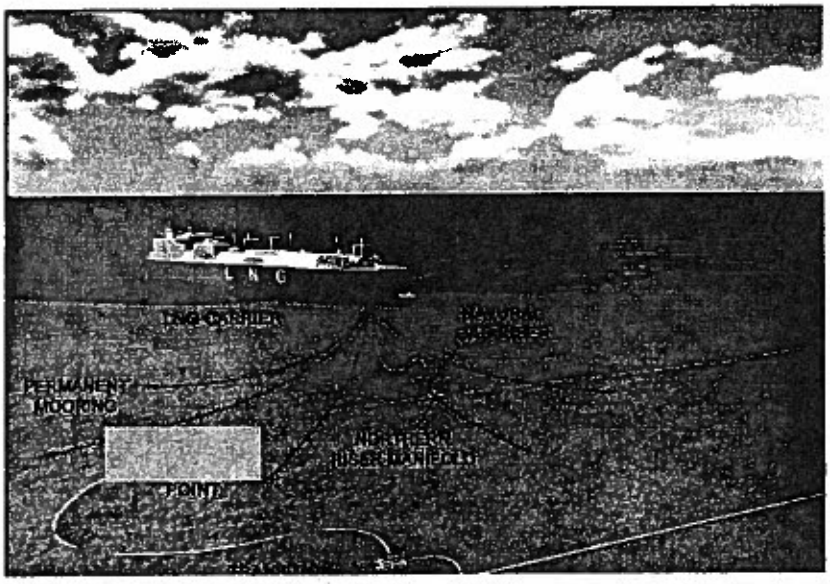
8. Corals- the entire north coast of Puerto Rico is designated critical habitat for elkhorn and staghorn coral. Species specific studies would have to be performed to determine the status of the species, if dredging is needed in designated areas.
9. Exclusion zone- the regulations establish an exclusion zone of 1-2 mile radius for the storage tank needed to store the LNG. This exclusion zone limitation could not be met.

Construction of a system of buoys and tankers (Deep water Port) in San Juan, Palo Seco and Arecibo

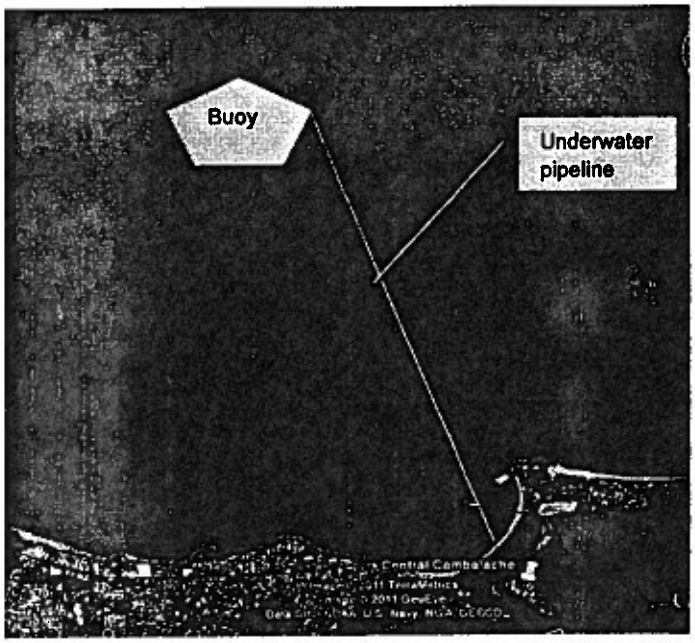
As one of the alternatives to the project, the installation and operation of tankers and a buoy for the receipt, storage and regasification to transport natural gas to each area in the north central system was considered. The buoy would be located 5km from the coast in Palo Seco and Arecibo. In San Juan, the buoy will be located 8 km offshore. The infrastructure needed is:

- one submerged turret loading buoy that connects to the vessel and serves as both a mooring for the vessel and a conduit for the discharge of natural gas
- chains, wire rope, and anchors used to secure the buoy to the seabed
- a flexible riser designed to connect the buoy to a seabed pipeline end manifold (PLEM) – allowing tie-in to a subsea pipeline

- a subsea PLEM that incorporates necessary control instrumentation and related valving; and,
- an interconnecting subsea pipeline to tie into downstream delivery infrastructure.

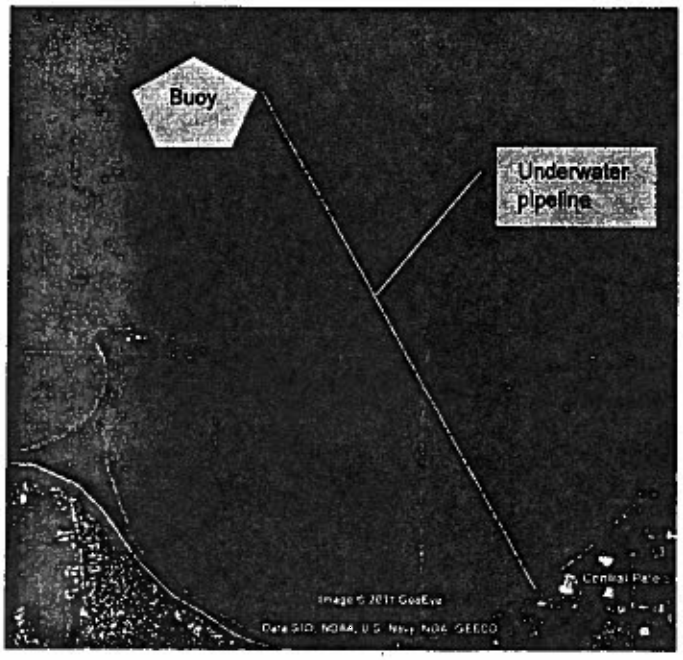


The delivery tanker will have a regasification system. This tanker will dock at the buoy which keeps afloat lines connecting the tanker to a pipeline on the seabed. This pipeline will transport compressed gas to a receiving terminal near the central power unit.



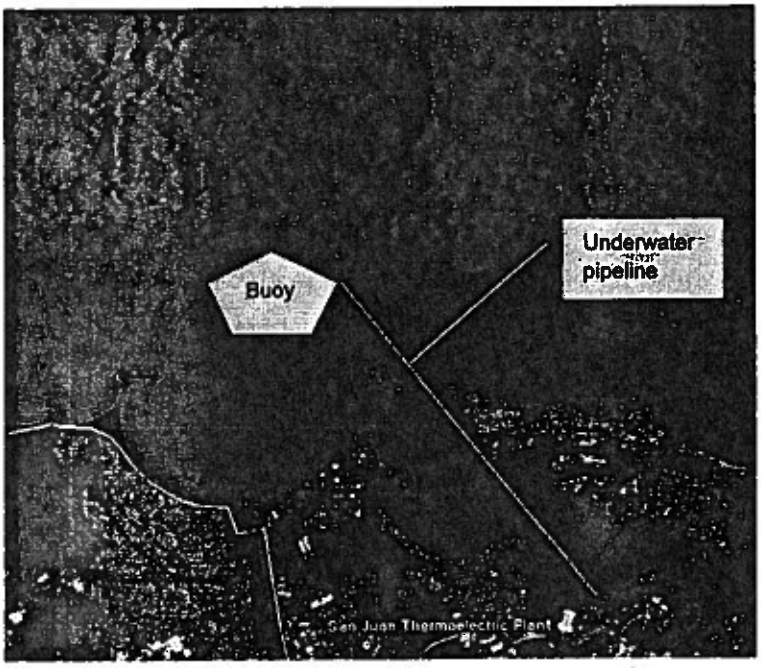
Proposed location LNG receiving buoy

Cambalache, Arecibo



Proposed location LNG receiving buoy

Palo Seco, Toa Baja



Proposed location LNG receiving buoy

San Juan

According to the ranking system described above, the buoy and barge system is favorable based on the following criteria:

1. Forests and Reserves- no forests and reserves are affected by this alternative
2. Architectural and Archaeological findings- no findings anticipated in the marine portion of the project, but required studies will be performed.
3. Road crossings- no road crossings
4. Topography- it is assumed that the seabed in the area is flat, but a bathymetric study will be performed
5. Community- no residences will be expropriated due to the projects construction.
6. Pipe length- the length of pipe needed is reduced
7. Pipeline security – the pipe is still underground

The import terminal proved disadvantageous based on the following criteria:

1. Bodies of water- although only one body of water is affected by the project, there are no alternatives to avoid its impact. Directional drilling is not an option in this case. The pipe to transport the gas must be buried in a trench of approximately 3 ft deep and 4 ft wide

for a length of ocean between 5-8 miles, per buoy. Also, there will be impact on the sea floor during the installation of the anchors and other equipment related to the buoys.

2. Endangered species- a number of endangered species of sea turtles, whales and others could be affected by the project's construction.

3. Impact to jurisdictional areas- waters affected by the project in San Juan, Palo Seco and Arecibo are jurisdictional.

4. Cost – The AEE would request a private company with expertise in the design, construction, and operating system of a Deepwater Port. This could cost AEE between $70 and $80 million per year, subject to signing a contract with that company for a period of not less than 20 years. At the end of the 20 year period the total cost would be approximately $1.6 billion dollars, per buoy system.

5. Impact to transportation and traffic- As in other cases, the Coast Guard may impose safety zones restrictions extending at least 500 meters in all directions from the buoy to protect vessels and mariners from potential safety hazards associated with the construction of the deepwater port facilities, and to protect the port's infrastructure. All vessels will be prohibited from entering into, remaining or moving within the safety zone.

6. Water quality and aquatic resources- The primary physical impact of construction on water quality would occur as a direct or indirect result of the sediment plume that will be created from setting the buoy anchors, installing the flowlines, and temporarily laying the mooring chain on the seafloor. Although temporary, plumes resulting from disturbance to the seafloor would be exposed to currents with the potential to carry them into the surrounding environment and strip nutrients and/or contaminants from the sediments and release them to the water column. The extent and duration of the turbidity plumes would be based on the strength of the currents at the location of the specific activity. Sediment re-suspension could release sediment bound contaminants, but this is an assumption that need to be validated by chemical analysis of the sediments.

Withdrawal of ballast and cooling water at the port as the regasification vessel unloads cargo (approximately 1 million gallons per day) could potentially entrain zooplankton and ichthyoplankton that serve as prey for other species.

7. Noise impact - During port operations, sound will be generated by the regasification of the LNG aboard the regasification vessel and the use of thrusters by vessels maneuvering and maintaining position at the port. Another potential sound source would be sound generated from large construction-type dynamic positioning (DP) vessels used for a major repair of the subsea pipeline or unloading facility. Of these potential operations and maintenance/repair sound sources, thruster use for DP is the most significant. The National Marine Fisheries Service recognizes three kinds of sound: continuous, intermittent (or transient), and pulsive. The project will not cause pulsive noise activities. Rather, the sound sources of potential concern will be continuous and intermittent sound sources, including underwater sound generated by regasification/offloading (continuous) and dynamic positioning of vessels (regasification and large repair vessels) using thrusters (intermittent). Both continuous and intermittent sound sources are subject to the National Marine Fisheries Service's 120 dB re 1μPa threshold for determining levels of underwater sound that may result in the disturbance of marine mammals. Potential effects of noise on marine mammals include masking, disturbance (behavioral), hearing impairment (temporary threshold shift [TTS] and permanent threshold shift [PTS]), and non-auditory physiological effects.

8. Essential fish habitat - Withdrawal of ballast and cooling water at the port as the regasification vessel unloads cargo (approximately 1 million gallons per day) could potentially entrain plankton and fish larvae .

9. Ease of access – although the delivery tankers will have easy access to the buoys, on shore personnel will have to travel 5-8 miles in case emergency situations arise.

10. Corals- the entire north coast of Puerto Rico is designated critical habitat for elkhorn and staghorn coral. Species specific studies would have to be performed to determine the status of the species. The species could be affected by trenching done to install the underwater pipeline.

11. The land to be used for the project is not compatible with the uses defined in the criteria (commercial, industrial, public, agricultural).

12. Exclusion zone- the Coast Guard will determine the exclusion zone during construction and operation of the project

13. Zoning- the zoning in the project area is not compatible with the zoning designated in the criteria: non residential, public, industrial, agricultural, commercial and non-zoned

Construction of a Natural Gas Pipeline (Terrestrial routes)

The purpose of this analysis is to select the best terrestrial route for a pipeline to deliver natural gas from the Ecoelectrica facility in Peñuelas to the Cambalache, Palo Seco and San Juan plants. Other works and studies contracted by PREPA were used during the Alternative Routes Selection effort. Part of the study conducted by *Power Technologies Corporation (PTC)* in 2006 was used for this analysis *(Corridor and Alternative Routes Selection Study)*. The PTC study was inclusive since it took into consideration the entire island. Corridors were evaluated every 1,000 meters and used the following criteria for such evaluation; topography, land use, existing corridors, and sensitive areas. Options were refined with other factors such as: individual residences, minor topographic variations, sensitive habitats identified during field visits, and methodology of construction in areas of greatest difficulty, such as: steep slopes, bridges and densely populated areas. Finally, the study selected multiple routes to bring natural gas to various points of the island. These included the PREPA facilities at Arecibo, San Juan and Palo Seco, which are the focal points of this Via Verde project.

The study carried out by PTC identified two viable alignments to transport natural gas from EcoElectrica to Central Cambalache and two segments from San Juan to Cambalache.

Ecoelectrica to Cambalache Segments

1. Alignment South to North "A"

Starting at EcoElectrica, take a Northeast route overland to Ponce and then follow the State Road 10 road easement. The route follows State Road 10 through Adjuntas and Utuado. At Utuado the pipeline moves away from but parallel to the State Road 10 corridor until it reaches Arecibo. At Arecibo the route follows Northern plains until it reaches Central Cambalache. This route runs a total of 45.1 miles and the study labeled this alignment *"Overland"*.

2. Alignment South to North "B"

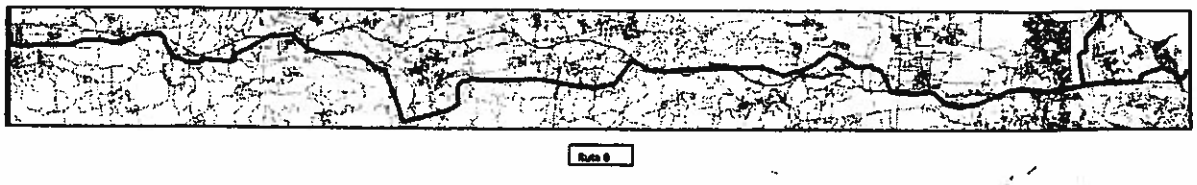
Starting at EcoElectrica, take one of two options to get to State Road 10. The first is to follow the right-of-way of the southern gas pipeline to Ponce and the second option is to take the State Road 10 right-of-way from Guayanilla. Both go to the west of Ponce where the pipeline route follows the State Road 10 right-of-way State Road 10 until it reaches Central Cambalache. This route runs a total of 36.8 miles and the study labeled this alignment *"DOT Route"*. The study also identified two viable alignments for the proposed natural gas pipelihe, from Central Cambalache to San Juan and Palo Seco.

San Juan to Cambalache Segments (East to West)

3. Alignment East to West "A" (Include drawing)

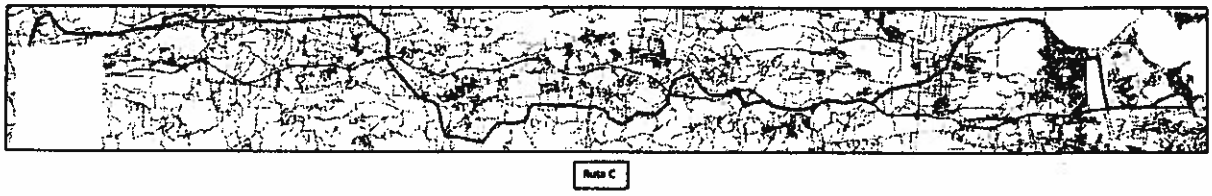
From San Juan, in Levittown, take a path west and cross the Municipalities,of Toa Baja, Dorado, Vega Alta, Vega Baja, Manati and Barceloneta to Arecibo. This route runs a total of 44.6 miles. The study labeled this alignment *"Overland Corridor"*.

4. Alignment East to West "B"



From Cataño, follow the PR-22 right-of-way to Arecibo. This route crosses the Municipalities of Toa Baja, Dorado, Vega Alta, Vega Baja, Manati and Barceloneta. This route would necessitate an investigation to determine if the pipeline would interfere with the right-of-way of the Superacueducto (Super Aqueduct). This alignment runs a total of 45.6 miles and the study called this alignment *"DOT Corridor"*.

5. Alignment "C" segments



A third alignment, which was not contemplated in any of the previous studies contracted by PREPA, was also considered for the Via Verde project that ran near both of the other two alternative routes but avoided more residential areas. In summary, three (3) routes were considered for the pipeline corridor from EcoElectrica to Arecibo and then from Arecibo to San Juan. These were: alignment South-North A (SNA), alignment South-North B (SNB), alignment South-North C (SNC); alignment West-East A (OEA), West-East B (OEB), West-East C (OEC).

Evaluation criteria for terrestrial route comparison

The following environmental criteria were used to evaluate the six alignment segments and determine which segments met the criteria as explained below:

- **Use of land** - The different uses of land were analyzed in each alignment. A route was defined as favorable for pipeline construction if existing land use was currently used for public, industrial, agricultural and commercial applications. A route was defined as not favorable for construction if land was currently in residential use and/or environmentally-sensitive. The percentage of the alignment with favorable uses and

then the percentage not favorable were compared to obtain a final value. The route which had the largest value received the positive (+) value.

- **Impacted water bodies** - The number of crossings of bodies of water increases the difficulty to construct the pipeline. Crossing a large body of water would need special construction methods to avoid adverse impacts. These construction methods increase the cost of the project. All bodies of water which were intercepted by an alignment were counted. The route with the fewest water body crossings received a positive (+) value.
- **Forests or nature reserves** - Forests and nature reserves were areas considered important public resources due to their high ecological value. For selection of a positive (+) value the criteria considered avoidance or minimization of impacts to these areas. The percentage of forested/nature reserves impacted was measured against the total length of each route alternative. The route with the smallest percentage of forests and nature reserves received the positive (+) value.
- **Endanqered Species** - This criterion measured the extent of the alignment alternative that was considered protected habitat and/or had listed species present. The route alternative with the smallest percentage of impact in protected habitat received the positive (+) value.
- **Archaeoloqical sites** - All identified architectural and archaeological sites that would be intercepted by an alignment alternative were marked. The route with the fewest sites received the positive (+) value.
- **Highway crossings** - Road crossings increase the difficulty of pipeline construction since special construction methods are needed to avoid affecting the integrity of the infrastructure and vehicle congestion. All roads intercepted by an alignment alternative were identified. The route with the fewest road crossings received the positive (+) value.
- **Zoning** - The different zonings were identified for each alignment alternative. Favorable zonings were considered to be non residential, public, industrial, agricultural, commercial and non-zoned. Not favorable was considered to be areas zoned residential, or areas identified as forests, historical sites and conservation lands. We measured the extent of alignment with terrain for favorable zoning against not-favorable zoning to obtain a final value. The route which had the largest value (favorable vs. not-favorable) received the positive (+) value.

- **Topography** - Puerto Rico has a variety of topographical areas within its limited geographical scope. The Cordillera Central area is characterized by its rugged topography. We analyzed different levels and steepness of topography and types of soils within each alignment. Abrupt changes in the topographic levels were marked. The route which had the smallest number of abrupt topographic changes received the positive (+) value.
- **Residential areas** - Due to its limited geography and high population density, Puerto Rico has abundant residential areas, especially in the coastal plains. Distance from Residential Areas, as part of the general public safety factors was considered to be a very important factor in identifying the best, practicable alternative. For this reason, greater weight was given in the project planning criterion to minimize the number of homes in the vicinity of an alignment. Any residence which would be within 150 feet from the center of an alignment was identified and counted. The route with the fewest number of residences received the positive (++) value.

To determine the best terrestrial alternative, the three (3) segment alternatives for the South-North section were compared to each other based on the results obtained once the criteria was applied. The three (3) segment alternatives for the East- West section were also compared. The route option with the least impact to each criterion received a positive value (+). Then the total number of positive values for each route alternative was added and tabulated. The route option with the largest number of criteria in its favor was selected. The analysis is summarized in the Table 1.

Table 1: Route Selection Matrix for Terrestrial Route

Criteria	South North A		South North B		South North C		West East A		West East B		West East C	
Use of land	3.09		8.68		14.35	+	1.32		14.38		18.89	+
Bodies of water	23		25		20	+	15		12	+	13	
Forests or nature reserves	1.39	+	2.50		3.04		0.59		0.03	+	2.79	
Endangered Species	6.49		11.69		6.01	+	7.03		1.53	+	10.43	
Architectural and archaeological findings	1		0	+	0	+	0	+	0	+	0	+
Highway crossings	40		28		21	+	64		47		30	+
Zoning	24.21		30.61		33.41	+	4.28		0.44		32.42	+
Topography	86		78		59	+	15		12	+	13	
Residences	17		2	+	2	++	29		22		1	++
Total Positive criteria		1		3		9		1		5		6

Of the three south-north segments, the South-North C (SNC) segment was the most favorable with nine positive points, while South-North B had three positive points and South-North A only one positive point. Minimal direct impact to residential areas also favored segment SNC.

Of the three west-east (east-west) segments, the West East C (OEC) segment was the most favorable with six positive points while, West-East B had five positive points and West-East A only

one positive point. Again, direct impact to residences strongly supported segment OEC since only one residence would be directly impacted while the other two segments potentially directly impact over twenty residences each.

Based on this analysis, together, segment South North C and segment West East C were selected as the best option for a pipeline route.

EVALUATION OF ALTERNATIVES USING RATING AND WEIGHT – Table 2

	Terrestrial Route			Buoys			Import Terminal		
Criteria	Rating	Weight	Total	Rating	Weight	Total	Rating	Weight	Total
Land use	10	3	30	5	3	15	10	3	30
Bodies of water	5	2	10	5	2	10	10	2	20
Forests and nature reserves	5	2	10	10	2	20	10	2	20
Endangered species	5	3	15	5	3	15	5	3	15
Architectural and archaeological findings	10	2	20	10	2	20	10	2	20
Road crossings	5	2	10	10	2	20	10	2	20
Zoning	10	3	30	10	3	30	10	3	30
Topography	5	2	10	10	2	20	10	2	20
Community	10	3	30	10	3	30	10	3	30
Pipe length	5	2	10	5	2	10	10	2	20
Impact to jurisdictional areas	5	3	15	5	3	15	5	3	15
Pipe security	10	3	30	10	3	30	10	3	30
Impact on transportation and traffic	10	2	20	5	2	10	5	2	10
Water quality	10	3	30	5	3	15	5	3	15
Aquatic Resources	10	3	30	5	5	25	5	5	25
Cost	10	3	30	10	3	30	5	3	15
Noise impact	10	2	20	5	2	10	10	2	20
Essential fish habitat	10	2	20	10	2	20	5	2	10
Ease of access	10	2	20	5	2	10	5	2	10
Corals	10	2	20	5	2	10	5	2	10
TOTAL			**410**			**365**			**385**

CONCLUSIONS

1. The alternative of building a terminal at or near the CTSJ is not feasible, nor practicable, when comparing potential environmental impacts associated with the construction of a natural gas pipeline to service AEE's power stations. It must be considered that the process of constructing and operating an LNG import terminal is complex. Permits and endorsements are regulated by the Federal Energy Regulatory Commission (FERC). In comparison, the EcoElectrica studies and permit process to construct an import terminal and start of the operation took between 7 to 10 years. This timeline would not satisfy AEE's need to begin a project to facilitate the transition from oil to a renewable source of energy. The cost of the existing EcoElectrica terminal fluctuated around $570 million in 1995. Considering inflation, the construction of a similar terminal today would be too onerous as it would be beyond $1 billion. As a project of the Government of Puerto Rico, it would require funding through bond issues, limiting savings on electrical bills.

   Although an area of maritime use, the CTSJ (as well as the other two stations in the northern area) does not comply with depth criteria or the anchor capacity for the necessary tankers. This alternative lacks a dredged material disposal area and necessary dredging activity would adversely impact the benthic community in the area. Maritime traffic would be highly compromised by the existence of only one entrance channel to San Juan Bay. It is believed that locating a receiving terminal here would adversely impact the local economy, as well as the tourism industry.

2. The system of mono buoy and tanker would cost approximately $70 to $80 million per year. The plants (Cambalache, Palo Seco and San Juan) have a small footprint and do not have space to locate the terminal facility to receive the CNG. The period of time required to put the system into operation, in compliance with all applicable federal and State legislation is estimated between 5 to 8 years. Although this project is not viable at this time, PREPA will continue to study this possibility since multiple projects using two buoys a natural gas without compression have been constructed in the US Mainland and are operating successfully.

3. Although the terrestrial route is not without impacts, it is the best alternative to deliver natural gas to PREPA's plants in northern Puerto Rico. Impacts to human and other resources can be avoided, minimized or mitigated. There is extensive knowledge about the resources affected by the project and PREPA will work following the regulatory agencies recommendations and strict construction codes.

Chapter 4. STUDY OF ALTERNATIVES AND SELECTION OF THE ALIGNMENT

The different alternatives evaluated for the execution of this project are discussed in this chapter. Among said alternatives the construction of a liquefied natural gas receiving terminal in the north of the island, the installation of tankers and buoys systems for the receipt, storage and regasification of liquefied natural gas and several terrestrial alignments for a natural gas pipeline were considered. Also analyzed were the alternative of using renewable energy sources technically available in the commercial sphere and the No Action alternative.

4.1 No Action

The No Action alternative, although considered, was found to be unfeasible due to the transcendence, importance and public well-being pursued by the project.

In Chapter 6, Impacts and Mitigation, of this Preliminary Environmental Impact Statement (DIA-P), the direct and indirect impacts associated to the construction of the natural gas pipeline are considered. If the project is not constructed, the following impacts are averted:

- The impact of the movement of earth which can produce soil erosion and sedimentation of bodies of water
- Temporary increase in noise levels
- Limited impact to forest reserves
- Temporary impact to wetlands, mangroves and other surface water bodies
- Temporary impact to agricultural land
- Temporary impact to water, highways and (possibly) telephone infrastructure
- Temporary traffic increase and readjustment
- Potential impact to archaeological sites
- Acquisition of land by expropriation

Most of these impacts, in case the selected alternative is constructed, although they cannot be avoided due to the project's construction specifications, can be minimized and mitigated with engineering measures and sedimentation and erosion control measures, supervision and the support of agencies and municipalities, among other measures.

No Action is not indicative of no impact, because faced with the No Action alternative PREPA will have to continue the production of electric energy by burning petroleum products that generate a greater amount of air polluting emissions. The use of natural gas represents a significant reduction in the criteria pollutant emissions and others such as carbon dioxide. This reduction of emissions, acquires greater importance if we consider that the new regulation of the Environmental Protection Agency (EPA), which

will become effective in 2020, requires an additional and compulsory reduction in the quantity of emissions of certain air pollutants. To achieve said reduction, PREPA would be forced to install emission control equipment, such as Electrostatic Precipitators (ESP) or Multiple Bag Collectors (Baghouses for the removal of particulate matter), catalytic converters (for the removal of nitrogen oxide, NOx), and Scrubbers (for the removal of sulphur dioxide, SO_2). This kind of equipment is very costly, which would require a great capital investment, and would result in an increase in the cost of the kilowatt/hour. In addition, this kind of equipment requires a lot of space, which would represent a difficulty to PREPA, because some of our power plants do not have the space necessary for its installation. The conversion of our units to use natural gas will have the impact of reducing emissions to the levels required by this new regulation, without the need to install this equipment, which requires an estimated capital investment cost of $200 million dollars, and at the same time providing a more economical fuel for the generation of electricity.

In addition, it is emphasized that the maintenance related to units that burn petroleum derivatives must be made frequently and with higher costs to insure the optimal functioning of the same. Continuing to burn petroleum derivatives has other implications, such as a greater frequency of deliveries of said fuels in our ports, which increases the erosion of the seabed and the probability of spills. The continued use of petroleum-derived fuels increases the cost of the electric energy service, which in its stead impacts negatively the Puerto Rican economy and results in a lower quality of life for its citizens. Of no less importance is the fact that the use of these fuels exposes PREPA to market value fluctuations, which creates instability in energy production costs and in the electric bills. All of the above, together with the impact of the new federal environmental regulations projected for 2020, force PREPA to establish a definite strategy to avoid a dislocation of the electrical system as a result of the installation of additional control equipment required by the EPA.

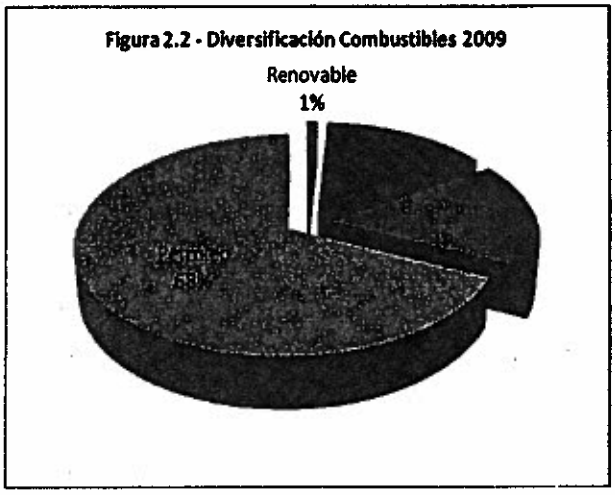
Recognizing that the Puerto Rican economy is directly related to the stability of PREPA, it is important for the company to comply with its strategic development plans and maintain a fixed cost structure that avoids sudden peak variations in the cost of the fuel purchased. Complying with these plans attests PREPA's vision, stability and commitment to its clients. In addition, it demonstrates the company's ability to evaluate complex global situations and develop strategies to diminish their impact, which facilitates broadening the fuel use options in the future.

After evaluating the local and global dynamic, PREPA developed a Strategic Corporate Plan 2009-2012. This Plan includes the following parameters, among others:

- Adding alternative energy sources to reduce the cost of fuel
- Protecting the environment
- Collaborating with all efforts to improve the quality of life in the Puerto Rican society

The construction of Via Verde is the largest fuel diversification project PREPA will be able to make in these times. This diversification guides PREPA to establish the actions required to comply with the new federal environmental regulations in a structured manner. Together with the above, there are important environmental considerations that will help PREPA to manage its energy costs effectively.

As shown in Figure 4.1, Puerto Rico depends on petroleum in a significant percent. At this moment, PREPA uses only No. 2 fuel oil (light distillate) and No. 6 (Bunker C) in its generating units and, at the same time, purchases the electricity produced in the AES co-generator in the Municipality of Guayama (coal) and EcoEléctica in the Municipality of Peñuelas (natural gas). With the introduction of the co-generators, we began to purchase electricity generated without the use of petroleum, but internally, PREPA still depends exclusively on it.



PREPA's goal is to reduce its dependence on the use of petroleum, which at present is 68%, approximately, for which reason the plan is to reduce it to close to 12% by 2014. For this, PREPA has to take action and identify alternative fuels that can supply the capacity its clients demand. Lack of action would only worsen the dependence on petroleum, and in times of embargo or high world demand, our island would not have viable alternatives to generate electricity. In addition, the No Action alternative leaves a latent impression that PREPA is affected by sudden changes in the cost of petroleum, which diminishes the agency's economic capacity and, in consequence, Puerto Rico's economy.

It is important to underscore that PREPA is limited by federal and state permits on the type of fuel it can burn in its units. The greater limitation is in the percentage of sulfur the fuel contains. This fuel is more expensive than fuel with higher sulfur percentages. If there is a scarcity of this type of fuel or if it is not possible to enter into purchase contracts with the suppliers, PREPA has two options: to cease generating electricity, which is not viable, or burn a cheaper fuel with a higher sulfur percentage than that established in the environmental permits and be exposed to fines and sanctions from the regulatory agencies.

The use of natural gas significantly reduces the atmospheric emissions of pollutants to the environment. No Action means that PREPA will maintain an investment of capital to reduce its emissions from petroleum, and will provide maintenance to its units instead of using that capital to develop a more efficient system that uses a cleaner fuel.

4.2. Liquefied Natural Gas Receiving Terminal in the San Juan Power Station

There are millions of miles of pipelines to transport natural gas throughout the world and over 1,500,00 of these are in the United States. This Nation has eight liquefied natural gas receiving terminals servicing it. Puerto Rico has one of these importation terminals, the EcoEléctrica Co-generator in the Municipality of Peñuelas, which has the capacity to supply our needs. Even so, the alternative of constructing an importation terminal near one of our installations with the purpose of eliminating part of the environmental impact associated with the construction of trenches for the natural gas pipelines was considered. Among the three power plants in the North area where the use of natural gas to generate electricity is contemplated, the San Juan Steam Plant (SJSP) was selected because it is the only one next to an existing fossil fuel receiving dock (see: Figure 4.2, San Juan Thermoelectric Power Plant). The dock has the infrastructure to transport diesel and Bunker C to two power plants, San Juan and Palo Seco. The other power plants don't have appropriate infrastructure next to the power plant.

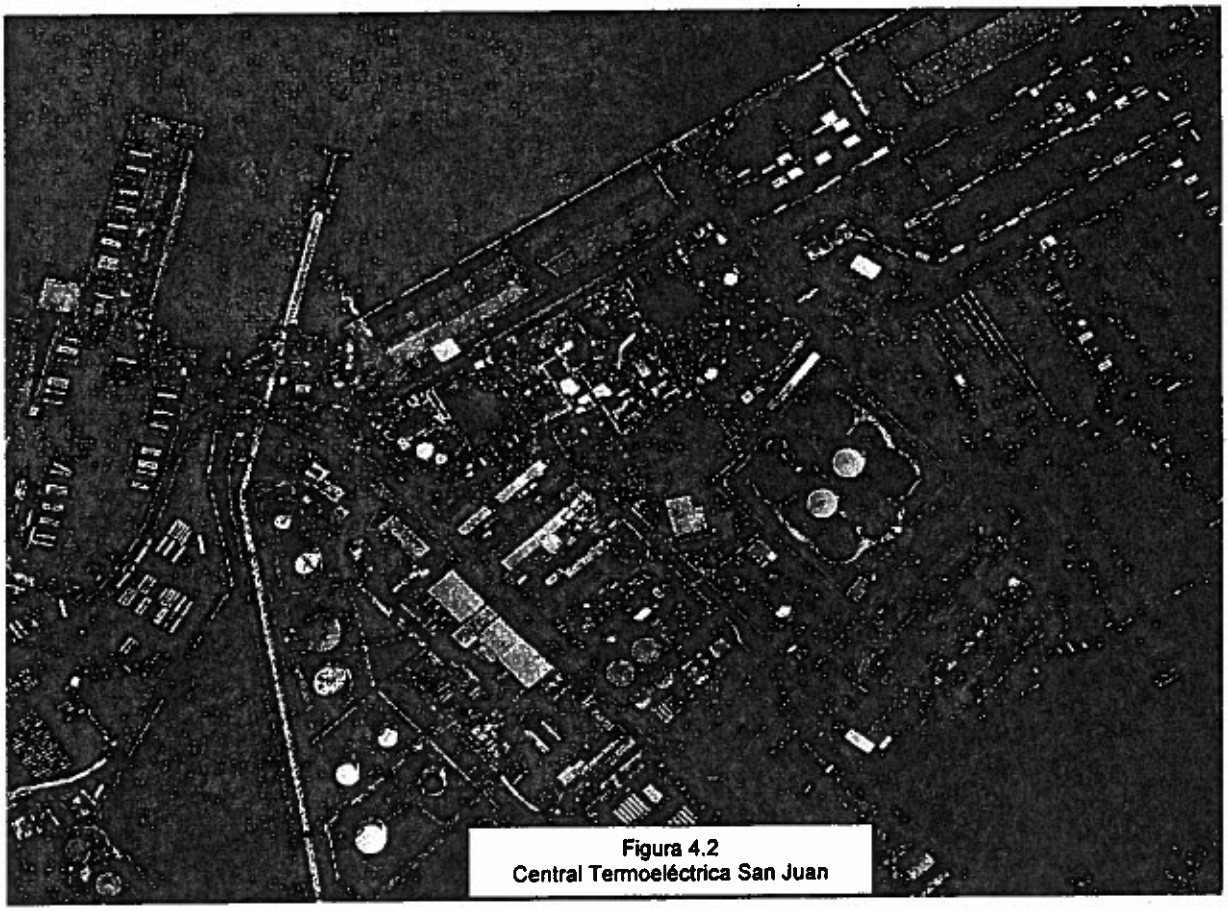


Figura 4.2
Central Termoeléctrica San Juan

When we use by way of example the importation terminal existing in Puerto Rico, the

terminal to be constructed must possess the capacity to receive, unload and store an approximate maximum amount of 160,000 cubic meters of liquid natural gas imported over the high seas; in addition to installations to gasify and handle the same. The construction of such terminal would imply an environmental impact associated with the different stages of the construction and operation of the same, among which would be included:

- Constructing, repairing or expanding, as the case may be, a dock for the receipt of liquid natural gas.
- Increase in the traffic of ships, which has an impact on the ships that supply us with the products we import, as well as on the tourism cruisers that use San Juan Bay regularly.
- Construction of a storage tank for liquid natural gas and a gasification plant. This would occupy an area of approximately 25 acres, in addition to an exclusion zone in accordance with the regulations in effect.
- Conditioning the navigation channels to support the transit of tankers, which would imply dredging and disposing of the dredged material.

The selection of a place for the construction of a natural gas receiving and regasification terminal requires the existence of deep ports to minimize the environmental impact associated with the development and operation of such terminal and the existence of areas of low population density suitable for an industrial development.

Three criteria were used to determine whether constructing an importation terminal near our installation was a viable alternative: location-specific factors, maritime operations and environmental issues.

- Location-specific factors
  - Availability of the land area: the location must have sufficient space available to accommodate the proposed installation and all the safety components required by the regulations of the Federal Department of Transportation (49 CFR Part 193), the United States Coast Guard (33 CFR Part 127) and the National Fire Protection Association (NFPA, NFPA 59A); in addition it must comply with the regulatory distance between the gasification plant and the liquid natural gas storage tank. The land facilities would occupy an area of approximately 25 acres (101,173 m^3). They would include, among other components: a double containment tank 167 feet tall and 269 feet in diameter, with a storage capacity of 1,000,000 barrels (160,000 cubic meters) of liquid natural gas at a temperature of -260°F and pressure of 2.0 psig; vaporization or gasification systems to

gasify the liquid natural gas so it can be transported to the turbines in the power plants. Other factors to consider associated with the location are the activities, external and adjacent to the terminal, and the distance or separation the terminal must observe to these areas of activity and to densely populated areas (49 CFR Parts 193.2055, 193.2057 and 193.2059).

- Availability of coastal area: the location must have available an area of maritime dock with anchoring facilities for tankers 950 feet long, 140,000 cubic meters capacity and minimum draft of 40 feet. The criteria used to evaluate whether a port or dock has the capacity for this type of project are the depth of the navigation channels (over 40 feet), the extension of the obstacle clearance height (greater than 180 feet) and its proximity to the liquid natural gas storage and gasification terminal. The dock must be approximately 30 feet wide by 1,700 feet long and possess, among others, equipment to secure the tanker to the dock, a two-level platform at the end, 40 feet wide by 100 feet long in the lower level and 20 feet wide by 76 feet long on the upper level, and a spill collection basin in case of emergencies.

- Dredged material disposal site: an area must be located for the disposal of the material to be dredged to create an appropriate navigational channel that will permit an increase in maritime traffic and the receipt of tankers with liquid natural gas and to dispose of the material generated by the routine maintenance dredging required for the appropriate flow of ships.

- Infrastructure: the importation terminal will require an adequate infrastructure that includes a reliable source of energy and appropriate highways or roads, especially for emergency response, as well as an access for tankers for the receipt of construction materials.

• Maritime operations

- Increase in the traffic of ships: the transit of tanker ships is subject to more restrictive federal regulations than general maritime traffic, which could influence the traffic of other ships and increase the risk of affecting other users of the navigation channel.

- Access to the navigation channel: the sooner a tanker can arrive at the terminal, unload, and return to sea, the better the economy of the area will be. In addition, a shorter channel would diminish the effect in traffic for other ships due to the maritime traffic restrictions on tanker ships. This is achieved with the availability of a navigation channel next to the storage and gasification terminal and with sufficient depth, width and obstacle

clearance height for the operation of a typical tanker ship, which would be in the rank of 950 feet long by 150 feet wide and which would require a minimum depth of 40 feet in the navigation channel and an obstacle clearance height of 180 feet.

- Turning area (amplitude and proximity): a typical liquefied natural gas tanker ship would require a turning basin with a minimum diameter of 1,200 feet and a depth greater than 40 feet.

• Environmental issues

- Environmental consequences: minimize the environmental impact by using sites within a previously impacted area, including the site for the dock and areas zoned for that use.

- Compatibility with regional plans: the location must be compatible with the future development of the adjacent properties.

- Zoning and land use: one of the goals of the project is to avoid or minimize adverse impacts on the environment due to development. The site must be located within an area zoned for industrial development to help confine any environmental impact in previously industrialized areas.

- Distance to populated areas: the location would be catalogued depending on its distance from populated areas or residences. Avoiding populated areas will help towards ensuring compliance with the location criteria of the DOT (49 CFR 193.2055, 193.2057 and 193.2059), which regulates in regard to the establishment of an exclusion zone, or an area where a terminal cannot be constructed due to population density. Respect for the distance established in this exclusion zone minimizes the negative public perception of safety issues normally associated with liquid natural gas terminals.

The tanker ships commonly used to transport liquid natural gas have a capacity ranging from 125,000 m^3 to 140,000 m^3. The longer ships range from 950 to 1,000 feet in length, with a typical draft of 38 to 40 feet. To insure that liquid natural gas tanker ships don't run aground easily or frequently, an additional depth of 2 feet under keel clearance is required. This implies that tanker ships require a maritime access and a docking and turning basin area in bodies of water with depths of more than 40 feet.

The SJ consists of 32.85 acres (132,941 m^3). It receives fossil fuel from the dock located to the west of it, in the San Juan port zone. Said dock is located on the Puerto Nuevo navigation channel, east of the Army Terminal dock (see Figures 4.2 and 4.3). This maritime area was prepared for the navigation of fuel vessels, among others. Currently, the tankers that service PREPA unload the fuel at the dock on the Puerto

Nuevo navigation channel.

According to the bathymetric charts, the anchorage area for the tankers that serve PREPA has a depth of little more than 30 feet. The maximum depth of the Army Terminal turning basin is, in just one point, of 40 feet, fluctuating mostly between 35 and 37 feet. This basin connects with the Army Terminal channel which is the one that reaches the Anegado Channel. This last one joins the channel that serves as the entrance for every ocean-going vessel to the San Juan bay, the Bay Channel (see Figures 4.3 and 4.4).

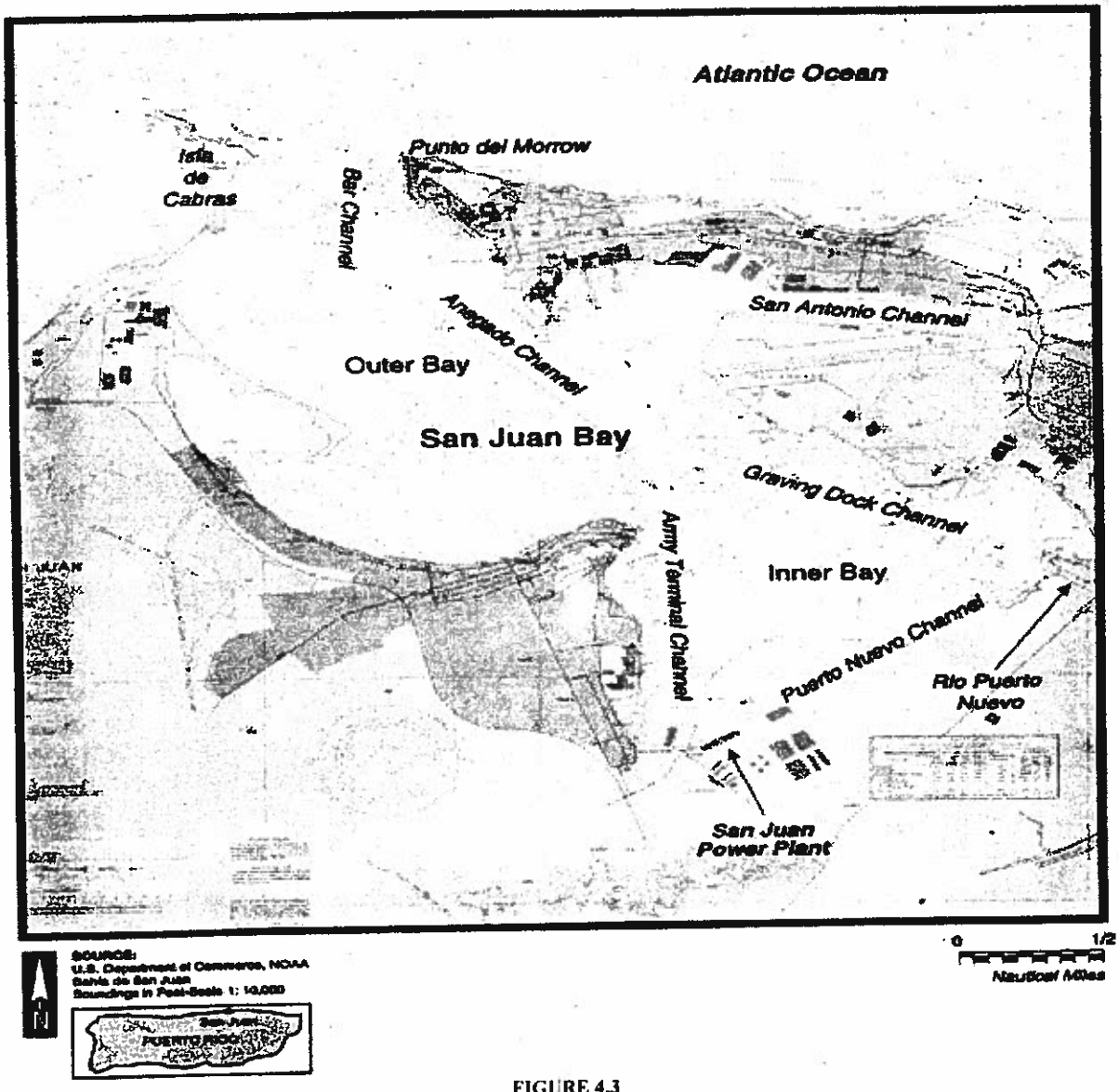
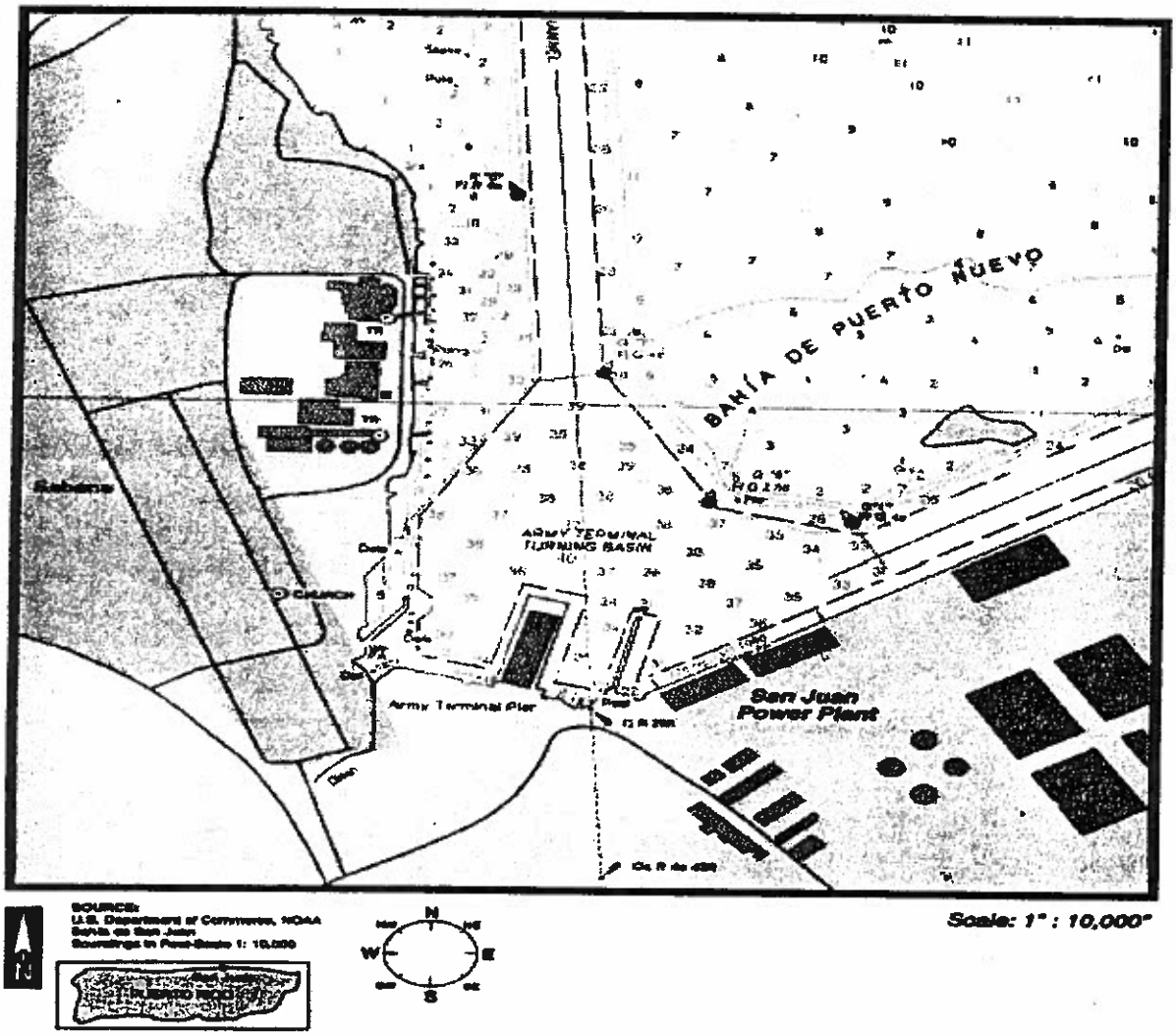


FIGURE 4.3
Approximate Location of San Juan Power Plant
and San Juan Bay Shipping Channels



Bathymetry of Bahia de P[illegible] FIGURE 4.4 [illegible]r San Juan Power Plant

To prepare the maritime area to receive tanker ships, the navigation channels and the existing turning basin would have to be dredged to reach a depth of 40 feet and for the navigation channels to reach a minimum width of 300 feet. The disposal of this dredged material would present the problem of finding an adequate site for its disposal in a way that would not represent a harmful impact on the environment. At present, Puerto Rico does not have land sites with the capacity to receive or process the amount of material that would be generated during dredging of such magnitude. Historically, it has been demonstrated that the majority of land sites for disposal of dredged material are not appropriate for industrial or commercial development, which would disable the area for future uses and development.

The disposal of the dredged material would have to be offshore, in an ocean disposal site. This presents several inconveniences. The area would have to be sufficiently large so the amount of material to be disposed of does not have an adverse impact on the area's benthic community or the impact is minimal. In addition, it should have the capacity to receive material from the routine maintenance dredging necessary to avoid interrupting the continuous flow of receipt of liquid natural gas. The initial effect of the disposal operations would be a high concentration of sediments near the surface (due to the suspended sediments). Carried by the ocean currents, this material would not necessarily reach the bottom of the ocean disposal site, for which reason the benthic area impacted would be larger than the estimated. It is underscored that the use of this disposal option is highly limited, because at present there isn't an approved ocean dumping area near the San Juan bay.

The dredging operations would produce a degradation of water quality due to the fine suspended sediments, since the dredging activities would take months. The turbidity plume would affect daily during working hours and up to two hours after the same, before the sedimentation of suspended material. This would affect the water quality and, consequently, the parameters of water quality required in the environmental permits which govern the SJSP, especially the turbidity, sedimentation and suspended solids.

The docks and ports of San Juan Bay receive annually 80% of the products imported into Puerto Rico and they play a crucial part in the export process of all kinds of products. The Port of San Juan Bay is number 17 by size in the world. Over 1.3 million tourists visit in cruise ships. It receives an average of 700 cruise ships annually. Over one thousand fishermen use the system every year, with an average catch of 350,000 pounds of fresh fish.[1] All the maritime traffic in the bay uses the Bay and Anegado common channels. In addition, the majority of the imported goods cargos that arrive in this bay, arrive at the Army Terminal dock, so they use the channel to reach that dock. It is estimated that a liquid natural gas importation terminal would increase maritime traffic in the San Juan Bay area at the rate of 25 to 60 crossings yearly, depending on the size of the liquid natural gas tankers used. The tankers would have to use these three channels until they reach the discharge point of the liquid natural gas in the dock of the Puerto Nuevo Channel. This represents an increase in maritime traffic that would affect our economy and tourism disproportionally, for diverse reasons. Among these reasons are: the high security restrictions on maritime traffic, which preclude other users from using the navigation channels or the dock simultaneously with the tanker ships.

The San Juan Bay Estuary (EBSJ) is composed of several bodies of water. Of these, one of the most important is the San Juan Bay. The EBSJ offers food and shelter to: 8 animal and 17 plant species in danger of extinction such as the West Indian Manatee

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[1] http://www.estuario.org/

(Trichechus manatus) and several species of marine turtles, among them the hawksbill turtle *(Eretmochelys imbricata)* and the leatherback turtle *(Dermochelys coriacea)*; 160 species of bird, such as the brown pelican *(Pelecanus occidentalis)* and the great egret *(Egretta alba egretta)*; 19 species of reptiles and amphibians, such as the coqui frog (*Eleutherodactylus coqui*) and the Puerto Rican boa *(Epicrates inornatus)*; 124 species of fish, such as the tarpon *(Megalops atlanticus)* and the snook *(Centropomus undecimalis)*; 300 species of wetland plants. The estuarine system sustains resident and migratory species and also external species that exit through one of the system's three outlets to the ocean.[2]

The body of water nearest to the SJSP is the Puerto Nuevo Bay, which is part of the San Juan Bay. An area of microalgae exists near the turning basin for vessels in the Army Terminal dock. The existence at that location of mats of *Gracilaria Sp.*, and, in lesser quantities, of *Enteromorpha sp.*, were reported. Associated with these microalgae, the presence of an abundant population of invertebrates was reported, among which are: tube worm *(Onuphia sp.)*, blue crab *(Callinectes sp.)* and some classes of bivalves (*Corbula contracta* and *Diplodonta semiaspera*). There is no evidence of coral reefs in the SJSP area.

The area of the Constitution Bridge and the entrance to the Martin Peña Canal, which are part of the EBSJ, were designated as costal Critical Wildlife Areas. The same are near the shores of the SJSP. However, there is no mangrove growth in the vicinity of the power plant.

Among the mega invertebrates are: *Callinectes sp.*, *Micropanope sp.*, and the pink shrimp (*Pemaeus duorarum*). Although no fish studies have been conducted in the vicinity of the SJSP, it is reasonable to expect that the same are those found in the San Juan Bay. Among the fish found in this bay are: tarpon (*Megalops atlantica*), guppy (*Lebistes reticulatus*), *Lepomis macrochirus*, *Elops saurus*, *Eleotris pisonis* and *Ictalurus punctatus*. No species of vertebrate wildlife, protected or endangered, are perceived near the SJSP.

However, in studies that cover the coastline from Punta Las Marías to Punta Boca Juana (the mouth of the La Plata River), which includes the San Juan Bay (see Figure 4.5), threatened and endangered species were seen, such as: green turtle *(Chelonia mydas)*, hawksbill turtle (*Eretmochelys imbricata*), leatherback turtle (*Dermochelys coriacea*), West Indian Manatee *(Trichechus manatus)*, the brown pelican (Pelecanus occidentalis) -recently removed from the endangered species list- and an as yet unidentified school of dolphins. These turtles and manatees were not seen in the lagoons, canals or the bays that were in the study area or near the SJSP, although the brown pelican was seen near this power plant.[3]

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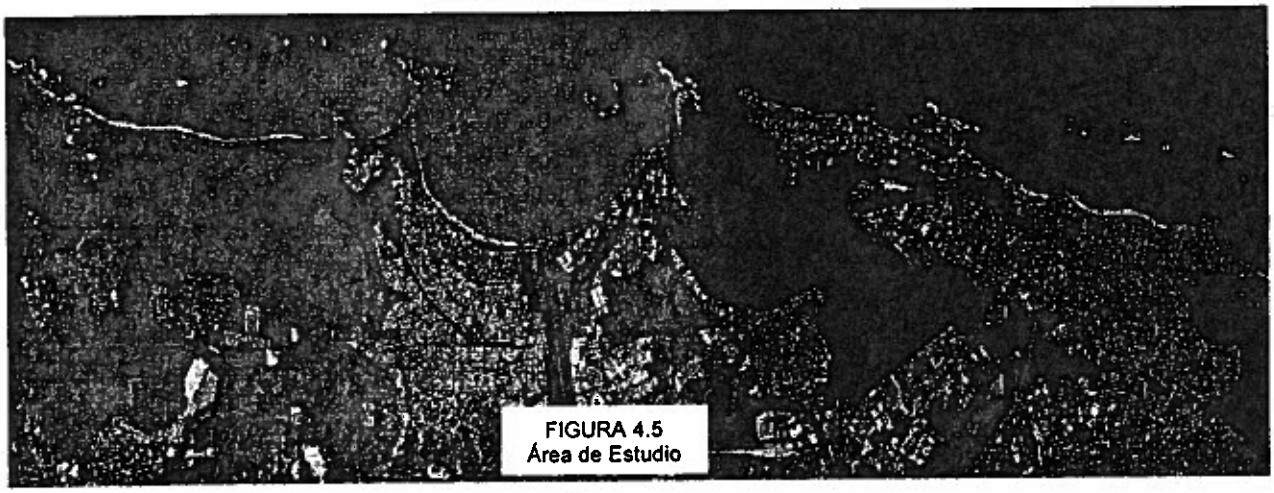
[2] http://www.estuario.org/

[3] Section 316(a) and (b), Demonstration, San Juan Power Plant; ENSR; July,



It is anticipated that an importation terminal, in combination with the existing SJSP system, will cause an impact on the water temperature in the Puerto Nuevo Bay, the body receiving the cooling and discharge waters of the power plant. The temperature of the discharged waters of the importation terminal would exceed the water's ambient temperatures, especially during the winter and spring months. This would produce a warming of the waters adjacent to the discharge structure during these months.

In addition, the extraction of marine water for the importation terminal's cooling system, added to the present extraction of the SJSP, would have a cumulative effect on the benthic community of the Puerto Nuevo Bay and, in consequence, the San Juan Bay, especially on the community of microalgae. It is to be expected that a loss of these would have an impact on the local populations of invertebrates and fish, added to the impact that the already mentioned turbidity and sedimentation associated with dredging would have on these species. Also, the rise in the discharge temperature would affect water quality and, consequently, the water quality parameters required in the environmental permits which govern the SJSP, specifically temperature.

The installation of the components of an importation terminal in the SJSP area would occupy a surface area of 25 acres, approximately. The SJSP covers 32.85 acres and does not have any free space (see Figure 4.1). The space is totally occupied by its diverse systems, among which are included: generating units, service and fuel reserve tanks, plants to demineralize and treat water, water storage tanks, cooling towers, buildings for warehouses, offices and laboratories. An importation terminal must comply with the regulations that regulate, among other things, the spaces that must be kept between the different elements inside the terminal (such as the distance between the liquid natural gas storage tank and the vaporizers) and the space that must be kept between the terminal itself and populated areas (exclusion zone). This, in compliance

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with regulations 49 CFR 193, 33 CFR 127 and NFPA 59A. Locating the different elements of the importation terminal in the areas around the SJSP, outside of it, would not comply with these standards, not only because of how distant they would be from each other, but also because there isn't enough free and available space in the surroundings. Also the exclusion zone required by regulations would be unavailable, because the SJSP is located in one of the most densely populated areas of Puerto Rico.

The alternative of constructing an importation terminal in or near the SJSP is not a viable one to comply with the purpose of eliminating the environmental impact associated with the construction of trenches for the natural gas pipeline. Even if the construction of the importation terminal were to materialize, it would be necessary to carry natural gas to the other power plants in the north area, Palo Seco and Cambalache. This would have to be by the construction and installation of a pipeline to transport natural gas. The construction, installation and operation of said terminal does not exclude the environmental impact the construction and installation of a pipeline to transport natural gas would bring.

In addition to the environmental factors, costs and space limitations for the construction of an importation terminal in or near the SJSP, we have to consider that the process of construction and operation of a natural gas importation terminal is complex. Obtaining the permits and endorsements for the same are regulated by the Federal Energy Regulatory Commission (FERC). Taking by comparison the importation terminal existing in Puerto Rico, EcoEléctrica, the process of studies and permits together with the construction and beginning of operations can take between 6 and 7 years. The previously featured data of the time to obtain the permits and the construction of these facilities are supported by information obtained from projects recently developed in the United States, which are described in the table illustrated below:

Evaluated Area	Information Collection Time	Permits Approval Time	Construction Time	Average Total Time
Gulf	1 year	1.5 years	3 years	5.5 years
East	1 year	2-3 years	3 years	6 to 7 years
West	1 year	2-3 years	3 years	6 to 7 years

Through this observation, PREPA doesn't pretend to circumvent the permit processes before the federal agencies. The purpose of evaluating the times it takes to establish this type of project is to identify an option that could respond to the energy infrastructure crisis in an opportune and diligent manner.

This reality would turn the alternative of constructing an importation terminal into a

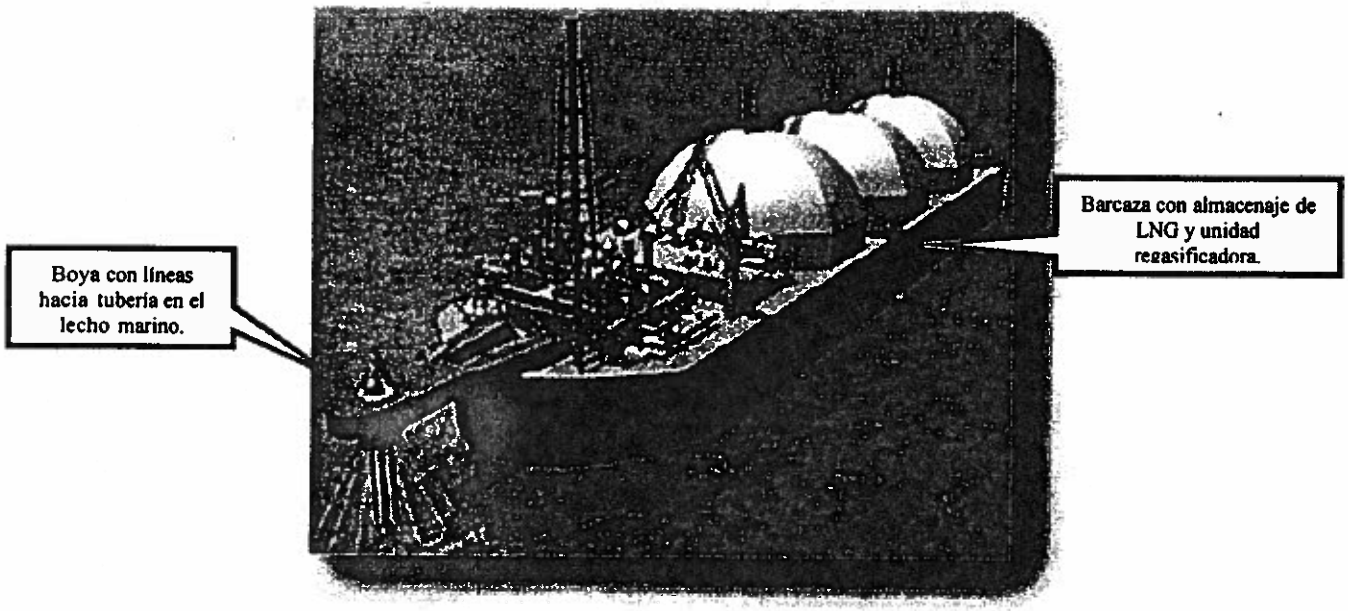
medium-term project, which would not satisfy our need for an immediate project to bring about the transition from petroleum to renewable sources of energy. The construction cost of the existing terminal was over $570 million in 1995 dollars. When we consider the cost of the present dollar and add the cost, as we indicated before, of the construction of a pipeline to transport natural gas which would connect the power plants of the north of the island, the project would be too onerous because it would surpass a billion dollars. Being a project of the Government of Puerto Rico, it would have to be financed through bond issues, which limits the savings in the electric energy bills.

The construction of an importation terminal inside or near the grounds of the SJSP as an alternative is not viable when the physical situation of the area is compared with the physical conditions required by this type of terminal. In addition, the environmental consequences in the area would be adverse and above all the time required to complete the approval of permits, as well as the construction time, would not permit a response to the energy infrastructure crisis in the least possible time. When the evaluation criteria were applied to this project, together with the previously described data, deficiencies were found that make it little or not viable at all. Although there is a maritime dock area, as opposed to the other power plants in the north area, it does not comply with the depth requirements or with the capacity for the anchorage of tanker ships of this kind. Were this alternative to materialize, there is no area for the disposal of dredged material and the dredging activity would be adverse to the area's benthic system and it would affect the water quality parameters the SJSP must comply with. Maritime traffic would be highly compromised because there is only one entrance channel to the San Juan Bay (Bay Channel) and the Anegado Channel is the only passageway to the tankers' discharge area. This would greatly affect the local economy, as well as the tourism industry.

4.3 Tankers and Buoys System

PREPA considered the installation and operation of a system of tankers and monobuoy for the receipt, storage, regasification and transport of natural gas to each one of the north area power plants as one of the alternatives to the project.

These systems of tankers and buoy, known as Deepwater Ports, suppose the construction of a receiving terminal for compressed natural gas (CNG) in the vicinity of each one of the power plants. This terminal would receive the gas from a station located some 5 km offshore, in which a tanker bringing the natural gas from its exportation point would anchor and couple. Said tanker would have a regasification unit that would couple to a buoy that holds and keeps afloat the connection lines from the tanker to the pipeline lying on the ocean floor and will transport the compressed gas to the receiving terminal near the power plant. The CNG receiving terminals require a minimum area of 2,500 m^2.



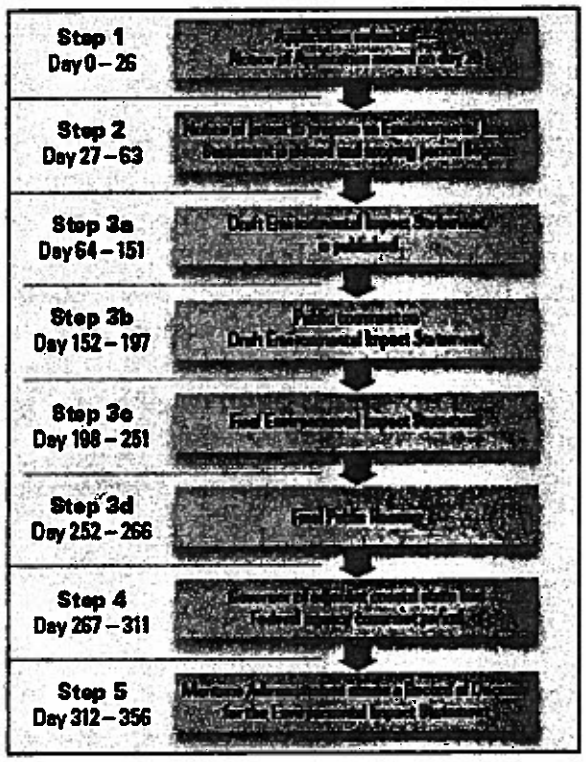
The construction, installation and operation of these tankers and buoys systems are regulated by two leading agencies: the Maritime Administration (MARAD), ascribed to the Federal Department of Transportation, and the US Coast Guard, under their Deepwater Ports Standards division. Other federal agencies with jurisdiction over the construction, installation and operation of these systems are: Advisory Council on Historic Preservation (ACHP), Council on Environmental Quality (CEQ), Department of Energy (DOE), Department of State, Environmental Protection Agency (EPA), Federal Energy Regulatory Commission (FERC), Minerals Management Service (MMS), National Marine Fisheries Service (NMFS), Department of Commerce under its National Oceanographic and Atmospheric Administration (NOAA), Pipeline and Hazardous Material Safety Administration (PHMSA), US Army Corps of Engineers (USACE), US Fish and Wildlife Service (FWS), and the White House Energy Streamlining Task Force. At the state level the agencies with jurisdiction are: Office of the Governor, Department of Natural and Environmental Resources (DRNA), Puerto Rican Culture Institute (ICP), State Historic Preservation Office (SHPO), Ports Authority, Public Service Commission (CSP), Environmental Quality Board (JCA), Urban Planning Board (JPU) and the Electric Power Authority (AEE).

PREPA would request a private company experienced in the matter, to design, construct and operate the tankers and buoy system. This would have an approximate annual cost to PREPA of 70 to 80 million dollars, subject to signing a contract with said company for a term of not less than 20 years. At the end of the 20 years, the total cost would be some 1.6 billion dollars.

The process to obtain the permits for the construction and operation of these systems begins by filing an application with the MARAD. The authority to grant licenses for the construction and operation of the tanker systems which was conferred on the Federal

Secretary of Transportation under the Deepwater Port Act, as amended, was delegated on this office in 2002. The temporary regulation 33 CFR, Parts 148, 149 and 150, which govern the license application process for the construction and operation of these systems, arises under this law.

The license application process starts with a pre-application phase during which the applicant discusses the project with the concerned agencies, both at the state and federal levels. Then the application is filed and a 356-day term is activated within which the MARAD has to issue a Record of Decision (ROD), in accordance with what is set forth in the diagram on the right, taken from MARAD's internet web page.[4]



After the publication of the ROD, the applicant must have its installation completely operational before the MARAD grants the license. This process usually takes from two to four years.

In parallel form to the process before the MARAD, the applicant must comply with the requirements of the National Environmental Policy Act (NEPA), which usually takes some 240 days from the moment in which the application notification is issued. During this 240-day period, other agencies intervene and the Environmental Impact Statement is produced. Also in parallel form the permits and endorsements from the state sphere are procured. The Environmental Impact Statement generated under the NEPA process, as well as the data and studies which supplement the same, can be used also to satisfy the requirements of the state's Environmental Public Policy Act.

Given that the ownership of the system will be in private hands, one of the most important aspects MARAD considers before issuing the required license is the applicant's financial capacity to construct and operate the tankers and buoys system under consideration. Moreover, the private applicant must have the financial capacity to post a bond sufficient to cover the expenses of the complete removal of the system, once the license expires or is revoked.

In addition, the private applicant must prove that the tankers and mono-buoy system is in the national interest and that it is consistent with the federal public policies on national security, energy independence and environmental quality, among others.

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[4] http://www.marad.dot.gov/ (March, 2010)

Neither can the system interfere with international navigation and other reasonable uses of the high seas, as defined in treaties, agreements or in the customary international law. At the state level the authorization of the governor of the state adjacent to the project is required.

The public must be kept informed of the whole process by means of the Federal Register and through the publication of all the related documents in the Federal Docket Management System: www.regulations.gov. In addition, processes under NEPA, as well as the state processes, provide for holding public hearings through which citizen participation is assured, similar to the processes established by the Environmental Quality Board in the applicable regulations (which are designed as what is denominated as a "NEPA- like process").

The environmental impacts of this alternative are similar to those analyzed for the previous alternative. Despite not having to dredge to permit accommodating the great draft of the tankers, a submarine line would have to be built from the buoy to the CNG tank and that would have an impact on an ecologically sensitive area such as the San Juan Bay and its estuary, or in the north coast areas which are considered as critical habitat for five species of coral in danger of extinction, such as the acropora.

PREPA evaluated the viability of the construction of these systems in three areas: San Juan, Toa Baja and Arecibo. The criteria considered in said evaluation were environmental impact, costs, space, time to start operations, permits, security, environmental justice, and past experiences in Puerto Rico and in the United States.

4.3.1 System Analysis for the San Juan Power Plant

The annual rental cost would be some $70 to $80 million dollars. The power plant does not have available space to locate the CNG receiving terminal. It is estimated that the time required to make the system operational, in compliance with all the applicable state and federal legislation, will be between 5 and 8 years. The permit process is complicated and costly, which together with the area's physical limitations, limits keeping this alternative as a viable one to respond to the energy infrastructure crisis. The pipeline on the ocean floor to the area of the San Juan Power Plant would run through an area of intense maritime traffic, which would raise safety and Homeland Security issues, this being a national and international port. There are low-income communities near the project which could be affected, for which reason in an environmental justice analysis the project would probably not be favored. The San Juan Power Plant is in the vicinity of CAPECO where there was an explosion on October 23 of 2009 that affected the nearby communities, which is still very recent in their memories and could support the opposition's position, even if it is an allegation lacking in merit. The project would entail impacts on San Juan Bay and its estuary. For all the reasons set forth above, the construction of the system for the San Juan Power Plant within the time frame required for the action under consideration was discarded. As a consequence, the supply of natural gas to this power plant will have to be

unavoidably through a natural gas pipeline.

4.3.2. System Analysis for the Palo Seco Power Plant in Toa Baja

The annual rental cost would be some $70 to $80 million dollars. The power plant does not have available space to locate the CNG receiving terminal. It is estimated that the time required to make the system operational, in compliance with all the applicable state and federal legislation, will be between 5 and 8 years. The permits process is complicated and costly. In the area of the Palo Seco Power Plant there are low-income communities near the project which could be affected, for which reason in an environmental justice analysis the project would probably not be favored. The Palo Seco Power Plant is in the vicinity of CAPECO where there was an explosion on October 23, 2009 that affected the nearby communities, a situation that is still very recent in their memories and could support the opposition's position, even if it is an allegation lacking in merit. Another aspect which must be taken in consideration during the analysis of this option is the fact that the energy of the Atlantic Ocean is significant, which possibly would require specialized construction techniques for the mono-buoy system in said area. The construction of this alternative would have an environmental impact on the Boca Vieja Bay. For all the reasons set forth above, the construction of the system for the Palo Viejo Power Plant within the time frame required for the action under consideration was discarded. As a consequence, the supply of natural gas to this power plant will have to be unavoidably through a natural gas pipeline.

4.3.3. System Analysis for the Cambalache Power Plant in Arecibo

The annual rental cost would be some $70 to $80 million dollars. The power plant does not have available space to locate the CNG receiving terminal. It is estimated that the time required to make the system operational, in compliance with all the applicable state and federal legislation, would be 5 to 8 years. The permits process is complicated and costly. There are low-income communities near the project that could be affected, for which reason in an environmental justice analysis the project would probably not be favored. Another factor that must be taken in consideration during the analysis of this option is the fact that the energy of the Atlantic Ocean is significant, which would probably require specialized construction techniques for the mono-buoy system in said area. As a point of reference, at present the delivery of fuel to the Cambalache facility owned by PREPA is affected by marine conditions an average of 3 to 4 months a year, this supports the facts and concerns previously expressed. For all the reasons set forth above, the construction of the system for the Cambalache Power Plant within the time frame required for the action under consideration was discarded. As a consequence, the supply of natural gas to this power plant will have to be inevitably through a natural gas pipeline.

4.4 Use of Renewable Energy

The structured integration of renewable energy sources, intermittent in nature, to electrically isolated, low-inertia systems, such as the one in Puerto Rico, requires specialized and scientific studies to evaluate its impact on the levels of stability and reliability of the electric grid. This is so because this type of system permits a maximum limit of interconnected sources of intermittent energy before its stability and reliability are affected. The Electric Power Research Institute (EPRI), recognized world-wide for its experience in the development of advanced studies in the analysis of power systems, completed a highly specialized study of this kind for PREPA in August, 2009.

One of the main objectives of the EPRI study is to provide PREPA with guidelines and technical recommendations that would allow us to integrate, in an orderly, structured, responsible and scientific manner, intermittent renewable energy sources into the electric grid, considering the critical aspects of safety and stability inherent to the operation and the dynamic nature of electrically isolated and low-inertia power systems. The following conclusions were reached based on the scientific studies of power system analysis conducted by PREPA and EPRI teams in charge of planning in the company:

a) At present, the proposed renewable energy projects of an intermittent nature submitted for our consideration could present challenges in what has to do with the maximum penetration limits considered in the EPRI study. This, in view that the reserve requirements in rotation and control considered by EPRI are significantly higher than the actual operational requirements, for which reason the equivalent penetration limits studied by EPRI are considerably lower than the penetration levels under consideration at PREPA.

b) Because of this, and in order to safeguard the electric system's stability and reliability, we must evaluate the integration into the electric grid of additional projects of renewable energy sources of an intermittent nature, regardless of their location in the electric system, until the additional studies recommended by EPRI are conducted.

c) The required studies must consider the present projections of demand for electric power, the corresponding dispatch schemes, the integration of solar parks, the location of the renewable energy projects under contract and the fuel conversion plans, among other aspects. An update of the pending studies must be complemented with the acquisition of specialized analysis tools for high level power systems and with the pertinent technical training. In this manner we guarantee that the study areas of PREPA's power systems can provide continuity to the evaluations required to transform our electric grid in harmony with Our Strategic Corporate Plan 2009 - 2012 and with Law 82 of 2010.

d) Establish, on the basis of scientific criteria for the analysis of power systems, a strategic plan for the structured integration of renewable energy sources of an intermittent nature, that do not place the stability and reliability of Puerto Rico's electric system at risk. We must establish inviolable limits and percentages of geographical penetration, which must be safeguarded in a consistent manner for the well-being and socioeconomic development of Puerto Rico.

In addition, PREPA prepared the following table in which the generating capacity from some renewable sources that could be acquired is compared with what would be invested in the installation of generating infrastructure for Via Verde, $450 MM.

Comparative Generation Table

Technology Considered	Computation Base	Equivalent Generation	Capacity Factor	Adjusted Generation	Generation with Via Verde	Estimated Time for Permits and Construction
Photovoltaic Panels	$6/Watt	75 MW	32%	24 MW	1,542 MW	1-2 years
Wind Turbines	$2/Watt	225 MW	38%	86 MW	1,542 MW	1-2 years
Solar Heaters	$2/Watt	225 MW	32%	72 MW	1,542 MW	1-2 years

When considering the data in the previous table, we conclude that the use of renewable energy technologies exhibits higher costs than those obtained by generating electricity with Vía Verde. In view of this technological reality, PREPA proposes the use of the Vía Verde infrastructure as an orderly and effective transition to the integration of these renewable technologies. This will achieve furthering the island's economic development which will in its stead permit investment in new renewable technologies. In this way, Vía Verde will spare Puerto Rico from committing the tactical error Spain committed by fomenting the construction of wind turbine projects and technologies by means of the approval of credit and economic incentives. This action led Spain to not having the capacity to repay those credits, which affected the viability of the Spanish economy.

In accordance with the previous cost analysis and the recommendations made on the basis of the EPRI study, we conclude that the use of these technologies in Puerto Rico's base generation of electricity is not cost effective and does not permit an immediate response to the energy infrastructure crisis. At the same time, this