

## PROJECT ABSTRACT

Project number	PE-0094
Project name	Aguaytia Gas and Power Project
Country	Peru
Sponsors	Aguaytía Energy del Peru S. R. Ltda.
Total project cost	US\$252.8 million
IDB participation	IDB A-Loan: US\$60 million
Department	Private Sector Department
Status	Approved by the Board of Executive Directors
Date	December 11, 1996

- I. General Data About the Project Borrower: Aguaytía Energy del Peru S. R. Ltda. (Aguaytia or the Project Company) Responsible Division: Private Sector Department  
Total Cost: US\$252.8 million IDB Amount: US\$60 million.
- II. Introduction
  - 2.1 Providing electricity to more of the Peruvian population is one of the Government's main objectives. With the enactment of new laws and the privatization of the hydrocarbon and the electric power sectors in Peru, free markets for hydrocarbons and electricity are being established.
  - 2.2 In March 1993, Maple Gas Corporation ("Maple") was awarded the Aguaytia Gas and Power Project by the Government of Peru pursuant to the terms of an international tender. One year later, after negotiating the contractual terms and receiving the necessary governmental approvals, Maple's Peruvian affiliate signed a 30-year license contract with the Government for the development of the Aguaytia gas field. Though the field was discovered by Mobil Oil Corporation in 1961, it had not been commercialized due to the lack of a market for the natural gas and reverted back to Petroperu in 1972.
  - 2.3 The legal framework for the Peruvian electric sector is established in the Electricity Concessions Law, Decree Law No. 25844, which was enacted in November, 1992. Regulations to the Law of Electrical Concessions, Supreme Decree No. 009-93-EM, were enacted in February, 1993. Environmental responsibility for the Executive Branch in Peru is carried out through the environmental offices of the various ministries. The Ministry of Energy and Mines (MME), which regulates the energy sector, and the General Office of Environmental Matters (DGAA) within the MME, provides a framework for environmental regulation and oversight in this sector. In addition, the recently created National Council of the Environment (CONAM) is responsible for coordinating environmental policy at a national level.
  - 2.4 The consortium includes the following six experienced U.S. energy companies: Maple Gas Corporation, PanEnergy International Development Corporation, El Paso Energy International Company, Illinova Generating Company, Scudder Latin American Power Fund and Power Markets Development Company.

### III. Project Justification

- 3.1 The Aguaytia Gas and Power Project (the “Project”) responds to the need for reliable power sources in the central region of Peru. The Project will utilize the natural gas resources of the Ucayali region to supply cleaner fuel and gas byproducts to the regional and national market. The power component of the Project will provide power transmission to the central coast of Peru, a region that has suffered from chronic power shortages and has low electric power generation capacity. The transmission lines will traverse areas, such as Aguaytia-Tingo Maria-Hu nuco-Pativilca, that lack electricity service which in turn limits the rate of economic growth.
- 3.2 A new transmission line across the mountains, between the cities of Hu nuco and Paramonga, will provide energy to a very important mining region of Peru. This region has experienced limited potential development, partly due to the lack of a cost efficient source of energy.
- 3.3 As an additional route for power into the Lima region, the transmission line will ensure more reliable delivery of electricity to Lima and to the large industrial centers along the coast near Lima. Currently, the other two routes consist of the transmission lines from the Mantaro hydroelectric complex to Lima and from Pisco to Lima. The new transmission line will also provide a better voltage regulation profile to the existing 220 KV transmission system, as it will close the 220/138 KV ring in the center/north part of the Central North Interconnected (Electricity) System (“SICN”). Furthermore, the new transmission line makes possible future rural electrification along the route from Hu nuco to Paramonga. Most of this area is currently without electricity.
- 3.4 By delivering electricity to Paramonga, losses of power and energy on the primary transmission system will be reduced. Currently, approximately 100 MW are supplied during peak hours from generators in the Lima area to locations north of Paramonga along the coast. Based on May 1994 dispatch data, capacity and energy losses between the Zapallal substation near Lima and the Paramonga substation 157 km to the north grew by approximately 10%.

### IV. Characteristics and Components of the Project

- 4.1 The Project consists of: the construction and operation of a gas-fired, 155 MW simple-cycle thermal power plant; the construction of approximately 400 km of 220 KV transmission lines and related facilities to connect the power plant with the SICN; the development of the Aguaytia gas field to supply gas to the new power plant and sell natural gas liquids (“NGLs”) to the existing domestic market; and the construction and operation of gas processing facilities, gas and NGL pipelines, and NGL fractionation, storage and loading facilities.

#### A. Power Plant

- 4.2 The power plant will include two gas turbines (ABB type GT11N1) with a net output of approximately 77 MW each and a heat rate of approximately 10,750 BTUs per KWH (LHV) at base load conditions. The fuel source for the plant will be natural gas transported to the plant by pipeline (totaling approximately 139 km) from the Aguaytia

gas field located to the northeast. The civil construction and plant layout will be completed to facilitate a future expansion from simple-cycle to combined-cycle.

- 4.3 The plant will incorporate a zero-discharge design of process fluids. Air cooling will be used to dissipate excess turbine heat. Water for use at the plant, both for process and domestic uses, will be from an on-site water well which will preclude the installation of a pipeline (thereby minimizing environmental impacts) to tap the Aguaytia river. Oily waters resulting from runoff and operation will be collected in a plant wide drain and sump system. If necessary, an API type separator will be installed. Oily wastes will then be sent, via truck, to the Pucallpa refinery for recycling.

#### B. Power Distribution and Transmission

- 4.4 Since the power plant will produce electricity at 13.8 KV, a substation facility will be constructed at the power station in Aguaytia to convert the electricity to a higher voltage of 220 KV for long distance transmission. In addition to the transformer equipment, this facility will include three 220 KV line bays and one 220 KV busbar coupling bay.
- 4.5 A new electric transmission line of approximately 400 kilometers in length will be constructed to connect the new Aguaytia substation to two existing substations along the Peruvian National Power grid (SICN), one at Tingo Maria in the jungle highlands and one at Paramonga on the coast of Peru, north of Lima.
- 4.6 When the proposed Aguaytia power station is operating at base load conditions, approximately 100 MW will be delivered to the Paramonga substation, which is part of the primary transmission system of the SICN. The total losses of power (at peak load operating conditions) along the new 220 KV transmission lines as well as along the existing 138 KV transmission line from Tingo Maria to Cerro de Pasco are estimated at 10.0 MW, or approximately 6.5% of the 155 MW generated.
- 4.7 The transmission towers will be located on an average distance of 0.5 km center to center. The transmission tower base footprint will be approximately 15 meters by 15 meters. The towers will be made of steel and will (except in limited cases) be constructed using existing roads between Tingo Maria and Hu nuco.

#### C. Development of Gas Field

- 4.8 The Aguaytia natural gas field is located near the Aguaytia River, in an area known as Curimana, about 56 miles west of Pucallpa and it is part of Block 31-C which is 41,093 acres in size. Mobil and Petroperu drilled 4 wells during the period between 1961 and 1986 to confirm the size of the field and the amount of reserves.
- 4.9 Up to five additional gas wells will be drilled in the Aguaytia gas field by the Project Company, resulting in a total of seven wells capable of operation. Four wells are required to serve the fuel needs of the Aguaytia power plant at peak load capacity and the existing government power plant in Pucallpa. The optimal number of wells is seven because even if the Aguaytia plant is not dispatched, four wells can be producing 55 MMCFD. This gas will be processed for the extraction of NGLs, and gas remaining after the extraction process other than that destined for Pucallpa (and other long-term off-takers) can be reinjected into the other three wells until the Aguaytia power plant is dispatched again and requires gas to fuel the plant. Each of these new wells will have an average depth of

9000 feet and will be located in a north/northeast- south/southwest trend along the top of the subsurface anticline structure.

- 4.10 The development, drilling and production practices for each of these wells will follow the appropriate guidelines proposed by the Oil Industry International Exploration and Production Forums (E&P Forum) Oil Industry Operating Guidelines for Tropical Rain Forests (Report No. 249/170) and will satisfy World Bank and Peruvian environmental guidelines.

D. Gas and NGL Pipelines and Processing and Compression Facilities

- 4.11 Gas processing facilities will consist of a cryogenic plant designed to extract a minimum of 82% of propane, 90% of the butane, and 97% of the pentane and other heavier components from the inlet natural gas stream. The gas plant's footprint is estimated at 4 hectares. Two main pipeline systems originating from the gas processing facilities will be constructed, one for natural gas and the other for NGLs. After satisfying any necessary fuel requirements for the operation of facilities in the gas field, the gas from the processing facilities will be recompressed and transported to the power plants in Aguaytia and Pucallpa and other markets in Peru. Any residue gas in excess of market demand will be reinjected into the gas reservoir.
- 4.12 The gas pipeline system will have four segments with a total length of 215.5 km and sizes ranging from 4.5 inches to 12.75 inches in outside diameter (OD). The segments transporting the gas from the gas field to the Aguaytia power plant will total approximately 139 km. The pipeline system for the NGLs will include 113 km of 6.625 inch OD pipeline running from the gas processing plant to a fractionation unit that will be constructed in Pucallpa. Both lines will extend parallel to Neshuya and will be installed in the same right of way. It will be assumed that all access roads and construction impacts associated with the construction of the pipelines will be limited to 15 meters from the pipeline route centerline (i.e. a 30 meter right of way). All pipelines will be of coated steel with a cathodic protection and will be buried at a depth of one meter. Compression boosting stations are not contemplated at this time.
- 4.13 The pipeline component contemplates the crossing of two significant rivers, the Aguaytia and the San Alejandro. The installation method will be either dredged and weighted pipeline or boring. Block valves will be installed periodically over the course of the pipeline sectors. All of the pipelines will be built to the United States Department of Transportation (US DOT) specifications.
- 4.14 The NGL fractionation and storage facility will be constructed on the west side of Pucallpa. The fractionation facility will fractionate NGLs sent by pipeline from the Aguaytia field into LPG (propane and butane), and natural gasolines (pentane and heavier components).
- 4.15 The LPG will then be sent to on-site storage facilities which the Project Company will construct. Additionally, the Project Company will build truck loading facilities, pipeline delivery systems and river barge loading facilities along the Ucayalli River to deliver the LPG from the storage tanks to customers purchasing these products. The natural gasolines will be trucked or pipelined from the fractionation facility to the existing Pucallpa oil refinery. E. Gas Reserves

- 4.16 The Aguaytia gas field is a thrust related anticline that is approximately 7.8 miles long and 1.1 miles wide, located on the western flank of the Ucayali Basin. Mobil and Petroperu conducted numerous tests and studies to verify the amount of natural gas and condensate in the field. Drilling and testing of several wells resulted in production tests ranging from 9.6 million cubic feet per day ("MMCFD") to 15.7 MMCFD of gas and 386 barrels per day ("BPD") to 601 BPD of condensate per well.
- 4.17 Maple as well as Netherland, Sewell & Associates, Inc., an experienced reserve engineering firm, have reviewed the existing reserve data. Maple calculates that proved reserves are 302 billion cubic feet ("BCF") of gas and 21.9 million barrels of natural gas liquids. Netherland, Sewell calculated the amount of total gas reserves at 306.9 BCF, but only classified 222.6 BCF as proved reserves. The balance of the 306.9 BCF of gas reserves were classified as probable (37.1 BCF) and possible (47.2 BCF).