

PDWAX349



THE UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT



THE INSTITUTE OF INTERNATIONAL EDUCATION

ENERGY TRAINING PROGRAM

IIE / S&T MEMORANDUM

TO: Shirley Toth
Office of Energy
U.S.A.I.D.

FROM: Ahmad Ghamarian
Energy Training Program

DATE: July 12, 1991 9:45 AM

RE: Country reports from participants at the Refinery Energy
Conservation course

As you know, this years' Refinery Energy Conservation course began in Houston, Texas, on June 25, and is running with 28 participants.

During the orientation I asked the participants to prepare reports on their countries' refinery industry. This assignment was meant to give the participants some common ground for discussion and problem solving.

I believe this was a great success and I'm very pleased with the results. I am forwarding a copy of their reports to you because I think they may be of interest to the Office of Energy.

Names: Easmon Asamoah - Refinery Shift Supervisor
Isaac Takyi - Processing Units Supervisor
Dennis Baidoo - Mechanical Engineer (Production Department)

Company: Ghaip Oil Refinery

Country: Ghana

BRIEF DESCRIPTION OF THE "GHAIP OIL REFINERY" IN GHANA

The name of the refinery where we work is the "Ghaip Oil Refinery". It has a maximum processing capacity of 34,000 BPSD. Our main source of crude oil is from Nigeria.

The refinery consists of the processing units, the utilities section, the product movement section, the production planning and quality control departments, the maintenance department, and the safety and security section.

The processing units consist basically of three (3) main units namely the Topping Unit, the Premiumforming Unit and the Merox Unit. At the Topping Unit, the crude oil undergoes a physical process which is initiated by preheating the crude oil from a temperature of about 30°C to 200°C in a heat exchanger train. This is attained by the exchange of heat from hot streams namely light gasoil, heavy gasoil, upper pumparound, lower pumparound and residue. After preheating, the crude oil then enters the main furnace where the temperature is further increased to 340°C.

It is then flashed into the main atmospheric distillation column where the various basic fractions namely residue, heavy gasoil, light gasoil, kerosene, and virgin naphtha are removed at various sections along the column. Heavy gasoil, light gasoil and kerosene then pass through a stripper before going to storage. The virgin naphtha, which is obtained as a result of the condensation of the overhead products from the atmospheric stabilization, is then sent to a splitter, where it is split into light and heavy gasoline.

The heavy gasoline thus produced from the Topping Unit has a low octane number of about 60-65. It then serves as the source of raw material for the Premium-forming Unit where it undergoes a chemical process to upgrade the octane number.

At this Unit, which has a processing capacity of 6,500 BPSD, the heavy gasoline undergoes an initial pretreating process before it undergoes a series of chemical reactions at a high temperature and pressure, to upgrade the octane number to between 88-96. The reformed gasoline is then stabilized and sent to storage.

At the Merox Unit, the light gasoline obtained from the Topping Unit undergoes a mecaptan oxidation process before it goes to storage.

The Product Movement Section directs and stores the various hydrocarbon fractions in their respective tanks to prevent any contamination. This Section is also responsible for the blending and marketing of the products, and receiving of crude oil.

Description of
"Ghaip Oil Refinery" in Ghana
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The Utilities Section provides the entire refinery with basic utilities namely electrical power, steam, fuel oil, compressed air, and cooling water.

The Production Planning and Quality Control Department liaise with the Production Department to ensure that set production targets are obtained based on available production resources and to ensure that the products thus obtained are within ASTM Specifications.

Maintaining of the refinery equipment is the responsibility of the Maintenance Department which consists of a mechanical, electrical, instruments, and civil works sections.

The Safety and Security Section ensures that all the refinery safety regulations are strictly adhered to, as well as ensuring that the refinery equipment are kept intact.

Name: Marcelo Jorge Rossetti
Company: Petroquimica Bahia Blanca
Country: Argentina (32,000,000 people)

BRIEF DESCRIPTION OF "PETROQUIMICA BAHIA BLANCA" IN ARGENTINA

Petroquimica Bahia Blanca (PBB) is the leader plant of the Bahia Blanca's petrochemical complex. The main product is ethylene. The raw material is ethane (330,000 MTons/year), that results in the highest yield of ethylene (about 75%) within actual production of PBB of 245,000 MTons/year. The design capacity of the plant was 200,000 MTons/year, and in 1990, we finished the revamp to reach the above mentioned capacity.

PBB is 51% state held (distributed in 3 state companies) and 49% privately held (distributed in 6 companies).

The raw material supplier is the gas state company that obtains the ethane from the natural gas. The other plants are:

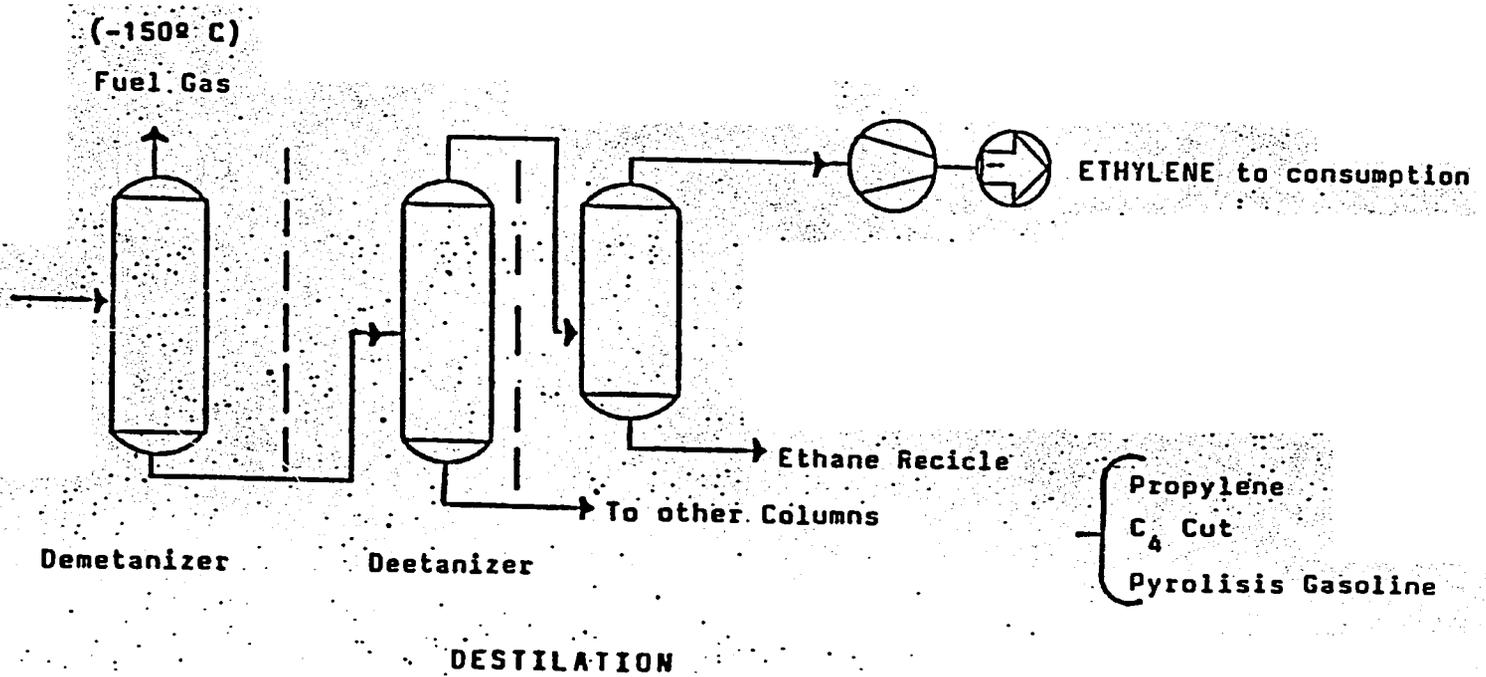
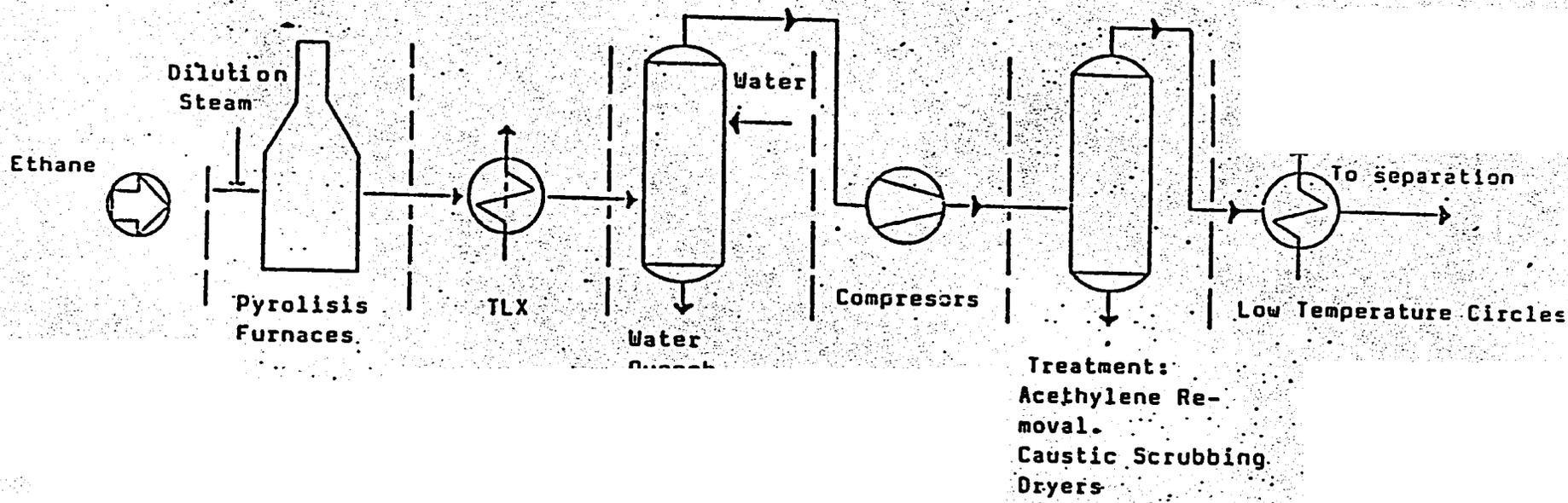
- 1 low density polyethylene (210,000 MTons/year)
- 1 high density polyethylene (62,000 Mtons/year)
- 1 VCM (130,000 Mtons/year)
- 1 Chlorine (90,000 Mtons/year) and caustic soda (102,000 Mtons/year)
- 2 PVC: 1 installed (58,500 Mtons/year)
1 in construction (41,500 Mtons/year)

At present, we must import about 85,000 Mtons/year of ethylene. To avoid this, we are involved in a new plant project (200,000 Mtons/year), the raw material selected was gasoline, that is available in the area. The start-up of the plant will be in September 1991 and the design technology belongs to Liude A.G. (Germany)

Total employees: 316
A simplified process flow diagram is attached.



SIMPLIFIED PROCESS DIAGRAM



Name: Humerto Adolfo Paz - Chief Process Engineer
Rodrigo Urrejola - Process Engineer

Company: Texas Petroleum Company

Country: Guatemala

BRIEF DESCRIPTION OF "TEXAS PETROLEUM COMPANY", REFINERY OF GUATEMALA

The Guatemala Refinery is the only one in the country.

Guatemala is a country of Central America between Mexico and Honduras and El Salvador. It has 8 million people. The Refinery provides approximately one half of the hydrocarbon consumed of the country, the other half is imported from other countries.

Designed to process 17,000 BPD, it is only processing about 12,000 BPD. It was built in 1964 and was revamped in 1970 and 1982 to reach actual capacity.

The crude it refines is imported mainly from Mexico and Venezuela with a specific gravity range of 30-40 API.

The refinery has one atmospheric crude distillation unit, one diesel and kerosene hydrotreating unit with a capacity of 2,640 BPD, one naphtha hydrotreating unit with a capacity of 4,200 BPD, and a catalytic reforming unit with a capacity of 3,480 BPD.

At the present time, the refinery is producing all of the fuel oil diesel, jet fuel, unleaded gasoline and LPG consumed in Guatemala. Recently, it had to change, in a two month period of time, from producing leaded gasoline to unleaded, due to new government environmental regulations that forced the refinery to reduce production of gasoline, therefore it is considering a revamp of the catalytic reforming unit. We are also in the process of revamping the diesel and kerosene hydrotreating unit to reach a higher degree of desulfurization in diesel.

Name: Cesar German Lizarazo S. - Operational Group Head
Superintendency of Operations III

Company: Ecopetrol

Country: Colombia

BRIEF DESCRIPTION OF "ECOPETROL" IN COLOMBIA

The state oil company, Ecopetrol, manages all the petroleum industry in our country since 1951. All related activities are performed directly except in the areas of exploration and exploitation where it has some association contracts with foreign companies. In this field, Colombia offers special facilities for foreign investment. Crude production is about 500 KB/d. Half of this is from our main production site, Cano Limon. This light, low sulfur crude is mainly for exportation.

Ecopetrol owns two medium size refineries located at Barrancabermejo (200 KB/d) and Cartagena (70 KB/d). There are also two small refineries at Tibu (10 KB/d) and Orito (5 KB/d).

Barrancabermejo Ref: 5 distillation units, 2 visbreakers, 3 FCC units, 1 DEMEX and 1 Unibon unit with some petrochemical plants producing Paraffins, Aromatics, Polyethylene, and sulfur

Gasoline Prod: 60 KB/d

Cartageno Ref: 2 dist. units, 1 visbreaker, 1 FCC

Gasoline Prod: 20 KB/d

All our refineries generate their own utility services and are interconnected for emergency uses with the National Electric. Some Special projects in progress: (1) construction of a new refinery of 100 KB/d capacity (Design Phase), and (2) new FCC unit in the Borrancabermejo Refing (Conceptual Design Phase). Both projects are intended to increase the gasoline production to cover the country needs. We have to import about 30 KB/d gasoline, currently.

We are also involved in the construction phase of a revamp of our DEMEX and visbreaker plants.

Ecopetrol, like most of the oil companies in developing countries, has much to do in order to increase its productivity. This course is an excellent opportunity to learn a technology to help achieve our goals. We are especially interested in reducing the utility usage. That constitutes about 70% of our operational costs.

Name: Carlos Augusto Arentz Pereira - Process Engineer of Duque de Caxias Refinery (coordinates energy conservation program)

Rafael Mauro Comino - Equipment Engineer of Petrobras main office (coordinates the energy conservation program of the 11 refineries)

Company: Petrobras

Country: Brazil

BRIEF DESCRIPTION OF "PETROBRAS" BRAZILIAN OIL COMPANY

Petrobras, the Brazilian Oil Company, owns a monopoly on production, refining and transportation of crude oil and distillates in Brazil.

Brazil consumes 1.2 millions bpd of crude oil. This oil is processed by 12 refineries and one asphalt unit. Only two of these refineries, processing together 50,000 bpd, are not operated by Petrobras. Eight million NM³/day of natural gas are also consumed. Total refining capacity of these refineries, based on the crude distillation units, is 1.5 millin bpd.

Basic production profile of oil products in Brazil is:

Refinery gas	4.5%
LPG	8.0%
Naphtha, gasoline & light distillates	27.5%
Kerosene	5.0%
Diesel & medium distillates	33.8%
Lube-oils & parafins	4.1%
fuel-oils, asphalt & heavy distillates	17.1%

A basic refinery in Brazil is composed of:

- Atmospheric and vacuum crude distillation unit
- Catalytic cracking unit
- Downstream treatments
- Basic utility facilities including a powerhouse with cogeneration cycle, water, and liquids effluents systems.

Petrobras has in its refineries the following downstream units:

- 11 catalytic cracking units with a total capacity of 360,000 bpd.
- 2 catalytic reforming units with 25,000 bpd of total capacity.
- 3 Lube-oil & parafins trains producing 14,700 bpd.
- 2 propane deasphalting units with 68,000 bpd of total capacity.

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Description of "Petrobras" of Brazil

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- 2 delayed coking units with a production of 3 million #/day of green coke
- 7 hydrofinishing units with 160,000 bpd of total capacity.
- 5 natural gas processing units with 10 million Nm³/d.

Sixty percent of the petroleum processed is Brazilian oil. Imported oil comes mostly from Middle-East (81.5%) and Africa (14.4%).

In processing this crude oil, 6.6 bbl of full-oil equivalent are consumed for each 100 bbl of crude oil. This energy equivalence in fuel oil includes not only petroleum consumption but also hydroelectrical and natural gas energy.

Since 1972, energy conservation is a main concern in Petrobras. There are 35 air preheater systems in operation attached to 67 process furnaces. Ten co-boilers are installed in catalytic cracking units recovering waste-heat.

Names: Mario Del Castillo Vega
Emilio Herbas
Marco Antonio Parada
Carlos M. Vilar

Company: Bolivia State Oil Company

Country: Bolivia

BRIEF DESCRIPTION OF "BOLIVIA STATE OIL COMPANY" IN BOLIVIA

Bolivia has three refineries located in different cities across the country:

Cochabamba Refinery	27,000 BPD
Santa Cruce Refinery	15,000 BPD
Sucre Refinery	3,000 BPD

The Cochabamba Refinery consists of the following units:

- Crude Unit
- Hydrobon/Platforming Unit
- Gas Recovery Unit
- Redistillation Unit for AV-Gas
- Vacuum Units
- Propane Deasphalting Unit (PDA)
- Furfural Extraction Unit (FEU)
- MEK-TOL Dewaxing Unit
- Hydrofinishing Unit

The Santa Cruz Refinery consists of the following units:

- Crude Unit
- Hydrobon/Platforming Unit
- Recovery Gas Unit
- Redistillation Unit for AV-Gas

The small refinery located in Sucre consists only of a crude unit.

Each of these refineries contains with its own utility system and power generation system.

The production of the different fuels and lube oils by these three refineries is sufficient for the internal consumption of our country.

Name: Mohammed Yusof Ab. Rahman

Company: Petronas

Country: Malaysia

BRIEF DESCRIPTION OF "PETRONAS" IN MALAYSIA

Lately, the petroleum industry has grown very rapidly in Malaysia. Previously all exploration and refining works were undertaken by large multi-national companies such as Shell and Exxon. At present, Malaysians, through their own semi-private oil corporation Petronas, play a very important role in both upstream and downstream activities of this industry.

Having successfully completed and operated its first refinery, Petronas is embarking on an ambitious project of constructing its second one. This is due to growing internal demand of petroleum products. In addition, Petronas also wants to tap the overseas market, especially in places where the product specifications will be very stringent due to environmental regulations.

The project consists of two trains built side-by-side on the west coast of Malaysia, which each having a capacity of 100K BPSD. The first train, or the sweet train, will be processing local crudes and the second train, or the sour train, will be processing middle east crudes. The former will be a simple topping unit with several hydrotreaters and a reformer. In the sour train, there will be a vacuum unit and conversion units, i.e., RCC, alkylation, dimerization, isomerization, hydrocracker in addition to the topping unit and the reformer. Both trains will be build on the concept of synergism which means each train will take advantage of the other's existence in simultaneously meeting product specifications and maximizing profits.

Name: Ahmed Rufai Shehu
Company: Nigerian National Petroleum Corporation (NNPC)
Country: Nigeria

BRIEF DESCRIPTION OF "NNPC" OF NIGERIA

We have three refineries and three petrochemical plants. Two of the petrochemical plants are integrated with 2 of the 3 refineries while the remaining petrochemical plant, in the final stage of construction, is going to be on its own.

One interesting aspect of the refineries and petrochemical plants is that they generate their own electricity, and have water treatment plants.

All three refineries have fuels plants while one of them has a lube plant in addition to the fuel plant.

The 3 refineries, with their corresponding units and operating capacity, are as follows:

KADUNA REFINING & PETROCHEMICAL COMPANY

Fuel Units

Crude Dist. Unit
Kero Hydrotreating Unit
Naphtha Hydrotreating Unit
Catalytic Reforming Unit
Fluid Catalytic Cracking Unit
Vacuum Dist. Unit - I

Lubes Units

Vacuum Dist. Unit
Propane Deasphalting Unit
Furfural Extraction Unit
Methylethyl Ketone Deoiling Unit
Methylethyl Ketone Dewaxing Unit
Wax hydrotreating Unit
Asphalt Blowing unit
Hot oil System

The operating capacity is 100K BPD

WARRI REFINING & PETROCHEMICAL COMPANY

Has all the fuel units as above. Its capacity is 120K BPD.

PORTHARCOURT REFINERY

Has all the fuel units as above. It's operating capacity is 200K BPD.

Name: Carlos Escarcega Puego
Marco A. Osorio Bonilla
Jesus Zuniga Herrera

Company: Mexican Petroleum Institute (IMP)

Country: Mexico

BRIEF DESCRIPTION OF "MEXICAN PETROLEUM INSTITUTE" IN MEXICO

Our country is among the main oil producers of the world with a production capacity of about 2.5 million BPD, of which 1.4 million BPD are processed within the national refineries. The remaining production is exported mainly to the U.S.A., Japan, Spain and some Latin-American countries.

There are seven major refineries in Mexico, each one of them being made up of several processing plants. The atmospheric distillation units have capacities ranging from 50,000 to 150,000 BPD of crude, and the vacuum distillation units have capacities up to 65,000 BPD. Moreover, there exist other plants such as visbreaking units, hydrodesulfurization units for gasolines and intermediate distillates, among other processes.

We work at the Mexican Petroleum Institute (IMP), which is a state company, created to be the technological back-up to the state petroleum industry (PEMEX).

The main activities of IMP are related to the technological investigation projects for new refining and petrochemical plants, and also the revamping of existing plants.

Recently, atmospheric and vacuum pipe stills have been designed and are now in operation.

At present, we are working on the reducing of the energy consumption of some refineries.

In order to accomplish its activities, IMP uses several computational tools for the design and simulation of the processes and equipment involved.

Name: Jorge Rodriguez
Emel Ramirez
Company: RECOPE (The National Oil Company of Costa Rica)
Country: Costa Rica

BRIEF DESCRIPTION OF "RECOPE" IN COSTA RICA

Refinery name: Moin Refinery

Capacity: Light Crude Oil: 15,000 BPSD
Heavy Crude Oil: 600 BPSD

Units:

Crude (15,000 BPSD)
Vacuum (600 BPSD)
Naphtha HDT/Reformer (1,200 BPSD)
Dist. Hydrotreater (1,200 BPSD)
Thermal Cracker (Visbreaker) (5,000 BPSD)
Gas Recovery/Merox (800 BPSD)

Diesel Generator Production: 1,600 kVA
250# Steam : 127,200 lb/h

Crudes Oil:

Isthmus (Mexico)	-	Light
Bachaquero (Venezuela)	-	Heavy
Oriente (Ecuador)	-	Light

Name: Jesus yepez
Elizabeth Escalona

Company: Lagoven, S.A.

Country: Venezuela

BRIEF DESCRIPTION OF "LAGOVEN, S.A." OF VENEZUELA

Venezuela's capital is Caracas and has 912,050 square Km of surface. It is in the northern part of South America. Its population is about 18 million people.

Venezuela is one of the bigger oil producing countries in the world. The main petroleum and petrochemical company in Venezuela is PDVSA (Petroleor de Venezuela, S.A.) and it has three oil affiliates (Maraven, Corpoven and Lagoven) and a petrochemical affiliate (Pequiven).

The following table shows the refineries which operate in Venezuela and the capacity of each one:

Name	Capacity (KBPD)	Property of:
Amuay	650	Lagoven
Cardon	320	Maraven
El Palito	120	Corpoven
Puerto La Cruz	100	Corpoven
El Toreno	15	Corpoven

Amuay refinery is one of the three bigger refineries around the world. The crude processing in Amuay has 25 API average, and its principal fuel is natural gas.

Amuay refinery has the following plants:

- 5 atmospheric pipestills
- 5 vacuum pipestills
- 4 hydrotreaters
- 3 hydrogen plants
- 2 sulphur recovery units
- 2 NMP Extraction plants
- 1 propane Dewaxing plant
- 1 thermal cracker (FLEXICOKER)
- 1 cat-cracker (FLEXICRACKER)

- 1 Isomerization unit
- 1 Alkylation unit
- 1 crude light end recovery unit
- 1 caustic treatment unit
- 1 power plant that supplies all the utilities needed in the process (water treatment, steam, electricity, cooling water, instrument and service air and nitrogen).