GENERAL INDEX

DIAGRAM INDEX

PRIMARY PRODUCTION

Exploration
Field Exploitation and Development

INDUSTRIAL TRANSFORMATION

Refining
Process of Gas and Condensates
Petrochemistry

DISTRIBUTION AND COMMERCIALIZATION

COMPLEMENTARY GLOSSARY

Other technical terms
Financial terms
Abbreviations used
The Oil Industry in Mexico

Seismic Exploration

Crude Oil and Natural Gas Production

Basic Products of Crude Oil

Crude Oil Distillation and Product Distribution

Processing of Liquids and Natural Gas

Pemex Petroquimica Productive Chain

Commercialization of Oil Products

Distribution of Gasolines
The Oil Industry in Mexico

Pneumatic Pumping

Non-Associated Gas

Gas and Condensate Processing

Petrochemical Products

Petroleum Products

Condensates

Crude Oil

Separation

Refining

Other Self-consumption

Sour Gas

Sour and Sweet Gas

ATM

Associated Gas

Crude Oil

Exportation

Importation

Natural Gas

Petrochemical Products

Petroleum Products

Natural Gas

Other Self-consumption

Condensates

Crude Oil

Petrochemical Products

Petroleum Products

Condensates and Natural Gas Liquids

Raw Material

Crude Oil

Non-Associated Gas

Petroleum Products

Natural Gas
Seismic Exploration
PRIMARY PRODUCTION

- Exploration

The activities of the oil industry start with exploration, whose aim is to discover geological structures in the subsoil with the possibility of finding hydrocarbons and to determine, in a subsequent stage, the profitability of exploring such deposits discovered. The intention of doing so is to assess the oil potentiality that a region has. All the oil companies in the world use an important part of their technical and economic resources to perform this activity expecting to increase their reserves.

The oil exploration can be divided in three phases; previous studies, surface studies and subsoil studies.

Petroleos Mexicanos, from the administrative point of view, divides its explorations in 16 active areas: Burgos, Poza Rica-Altamira, Veracruz, North Region Exploration, Cinco Presidentes, Bellota-Jujo, Samaria-Luna, Muspac, Macuspana, South Region Exploration, Cantarell, Ku-Maloob-Zaap, Exploration in the Northeast Marine Region, Abkatun-Pol Chuc, Tabasco Litoral and Exploration in the Southwest Marine Region.

Cenozoic: Geologic era that starts 63 million years Before Christ up to now. It includes the Tertiary Period and Quaternary Period.

Salt Dome: Domelike structure of stratified rocks whose central part or core is formed by rock salt. It is found in the oil fields of the Gulf of Mexico Coast and it often forms oil deposits.

Surface studies: These refer to those studies that form the basis to consider the oil possibilities in an area. Its main objective is to determine the different types of rocks and their characteristics, as well as the recognition of the stratigraphic associations and the deformations to which they have been subject, with the aim of determining the possible presence of structural traps. These works are based on three fundamental disciplines: Geology, Geochemistry and Geophysics.

Subsoil studies: These studies refer to the knowledge of the characteristics and composition of the subsoil layers through drilling wells known as exploratory wells.

Oil Exploration: Set of field and office activities whose main aim is to discover new hydrocarbon
deposits or extensions of the existing ones.

**Geophysics:** Science in charge of carrying out the indirect research of the subsoil structure using physical and even chemical properties of the rocks, through special equipments and methods based on the principle that in every observation place all the subsoil parts, in proportion to the distance, show their presence by means of their physical properties. The geophysical methods are directed to locate geologic structures which are favorable for the existence of commercial value deposits. In the oil exploration, the most used geophysical method is seismology.

**Geochemistry:** It is the study of relative or absolute abundance of the Earth elements and of the physical and chemical processes that have produced it, as well as their distribution. The geochemistry studies consist of the analysis of collected samples both during the exploratory phase and then during the drilling phase in order to determine the type and degree of alteration that the organic matter in the rocks has and to track the presence of hydrocarbons.

**Migration:** Term used in exploration to determine the movement that the oil suffers, from the place where it was formed to the reservoir rock or trap.

**Permeability:** Characteristic of the reservoir rock that allows the movement of fluids through interconnected pores. The measuring unit is milidarcy.

**Porosity:** It is the ratio between the volume of the pore space in the reservoir rock and the total bulk volume of the rock. It is a measure of the rock storage capacity.

**Well:** A hole drilled for carrying out search processes, for producing crude oil, natural gas or for providing services related to them. The wells are classified according to their objective and result as: oil and associated-gas wells, dry-gas wells and injecting wells.

**Exploration well:** A hole drilled in an area where at that moment there is not oil and/or gas production, but the oil exploration studies state the probability of finding hydrocarbons there. The exploratory drilling is a direct technique which consists of making a well through the different subsoil structures, taking data and samples from it in a systematic manner, accurate information about the characteristics of each rocky layer, as well as the possibility of finding exploitable hydrocarbon accumulations arise from these activities.

**Oil deposit prospecting:** Technique through which the discovery and assessment of the reserves are carried out, the preparation for the oil and gas field commissioning is made as well. It consists of two stages: search and prospecting. During the search stage the geologic, aeromagnetic and gravimetric surveys of the location, the geochemical research of the rocks and waters, and the outline of different maps take place.
Then, the prospecting test drilling with exploration wells is carried out. The result of the search stage is the preliminary assessment of the reserves that may exist in this new oil field. The main objectives of the prospecting stage are to state the oil field limits, to determine its potential and the saturation of its strata, as well as the oil and gas horizons. Once the prospecting stage is concluded, the oil reserves are estimated and recommendations to exploit the oil fields are made.

**Pilot Project:** It is the project carried out in a small sector representative of an oil field, where similar tests to the ones that would be performed in the entire area are carried out. The objective is to collect information and/or obtain results that can be used as the basis of conventional studies or mathematical simulation of the entire oil field.

**Previous Analysis:** Oil exploration starts with this phase, which is based on general studies that include very wide areas and whose aim is to identify interest areas for developing the oil activity, in accordance with the information obtained in previous studies, the cartographic support and the aerial photographs (mainly referred to the study of the topographical characteristics that the area has) in order to determine the possibilities of carrying out an intensive exploration.

**Reservoir Rock:** Highly permeable sedimentary rock (limestone, sand or shale) through which petroleum may migrate, and given their structural and stratigraphic characteristics it forms a trap that is surrounded by a seal layer that will avoid that the hydrocarbons escape.

**Source Rock:** Sedimentary rock formed by very fine grain and with an abundant content of organic carbon which is deposited under reducing and low-energy conditions, generating hydrocarbons over time.

**Trap:** In oil exploitation, it defines a reservoir bed with a geometry that allows the concentration of hydrocarbons and keeps them under adequate hydrodynamic conditions preventing their escape.

**Reservoir bed (deposit):** Subsoil unit formed by permeable rocks which contain oil, gas and water, and which form a single system.
Crude Oil and Natural Gas Production Process

- Burner
- Oil pipeline
- Gas pipeline
- Compressor
- Rectifier
- Divider Stage
- Gas
- Oil
- Transfer Pump
- Atasta Recompression Station
- Dos Bocas Maritime Terminal
Field Exploitation and Development

Based on the discoveries achieved by the exploration works, the drilling activities developed by the oil fields are started. Once the location of a reservoir bed has been verified and the location of the wells has been defined, an access road is built, the materials and equipment are transported and the drilling works are started. The system used for this work is rotary digging. The drilling is finished when the last section of the casing pipeline is cemented.

Once the last pipeline has been cemented and the pressure has been measured, the well is placed in production stage, usually through the permanent finishing technique, which consists of filling the well with water, introducing the production piping, installing the valve stem, taking down the rock that has the hydrocarbons and making it explode. After doing that the well is opened so it can flow by itself, or it is drilled if is necessary. Finally, the well already producing is connected to the discharge piping to lead the hydrocarbons to the separation installations and equipments where the gas oil is segregated and which continue their course through different ducts.

Nowadays the Pemex Exploracion y Produccion Entity is organized in 11 explotation areas: Cantarell, Ku-Maloob-Zaap, Abkatun-Pol Chuc, Litoral Tabasco, Cinco Presidentes, Bellota-Jujo, Macuspana, Muspac, Samaria-Luna, Poza Rica-Altamira, Veracruz
Drill: Tool used to drill oil and/or gas wells. A drill consists of a cutting element and a rotating element. The cutting element can be made of dented steel, diamond or tungsten carbide button. The rotating element can be formed by ducts that allow the passing of fluid through the drill and the use of mud hydraulic stream to improve the penetration speed.

Barrel: Unit of volume for oil and derivative hydrocarbons; one barrel equals 42 gal. (US) or 158.987304 liters. A cubic meter is equivalent to 6.28981041 barrels.

Barrel of oil equivalent (boe): It is the gas volume (or other energy resource) expressed in barrels of crude oil at 60°F, and which are equivalent to the same amount of energy (energetic equivalence) obtained from the crude oil. This term is frequently used to compare natural gas in units of crude oil volume in order to provide a common measure for different gas energy qualities.

Barrel per day (bd): Under production, the number of hydrocarbon barrels produced in a 24-hour period. In general, it is an average figure of a longer period of time. It is estimated dividing the number of barrels during the year by 365 or 366 days, as the case may be.

Separation battery: A series of production plants and equipments working as a unit. It is used to separate the liquid components from the gas ones in a collection system. The separators can be vertical, horizontal and spherical. The separation is mainly carried out by gravity action, in other words, the heaviest liquids go to the bottom and the gas rises.

Beam pumping: Artificial production system where the activation of the subsuperficial pumping equipment takes place in the surface and it is transmitted to the pump through the upward and downward movement of the sucker rods. Due to the fact that a rod pump is used, the rod movement produces a vacuum inside the work barrel making that the liquid penetrates to the barrel through the footvalve occupying the space. The liquid displacement from the bottom of the well to the surface through the interior of the production piping is carried out through the upward and downward movement of the rod string. This system is the most used in shallow and medium depth wells; for off-shore operations it is heavy and bulky.

Gas lift: Artificial production system in which special valves are introduced in the production piping and through which high-pressure gas is injected and when it mixes with oil it makes that the oil surfaces. Occasionally due to the depletion and/or low pressure of the reservoir bed, the oil contribution can be so low that the gas lift becomes a bit inefficient, since it is necessary to inject great amounts of gas but the oil volume keeps on being insignificant. In similar cases it can be resorted to another artificial system with mechanical pumping.

Wellhead: The control equipment adjusted to the wellhead which is used to control the flow and
prevent explosions and it consists of piping, valves, power outlets and blow up preventers, etc.

**Field:** A geographical area in which a number of oil and gas wells produce from the same proved reserves. A field can refer only to a superficial area or to underground formations. A single field can have reserves separated at different depths.

**Complex:** Term used in the oil industry to refer to a series of fields or plants that share common surface facilities.

**Aromatic base crude oil:** Crude oil that contains great amounts of low molecular weight aromatic compounds and naphtene, together with smaller amounts of asphalts and lubricating oils.

**Asphalt base crude oil:** Crude oils that produce high yields of pitch, asphalts and heavy fuel oil.

**Naphtene base crude oil:** Crude oil that contains mainly naphthenes, that is to say, saturated cyclic compounds with naphthenic and paraffinic lateral chains; they may contain great quantities of asphalt material. When these crude oils are refined they produce lubricating oils that are different from the ones obtained from paraffinic crude oils because they have lower gravity and viscosity, and they have less carbon as well.

**Paraffin base crude oil:** Crude oil with a high content of waxes and lubricating oil fractions, having small amounts of naphthenes or asphalts and low in sulphur, nitrogen and oxygen.

**Topped crude (reduced crude):** Crude oil from which naphthas and other light hydrocarbons have been extracted in order to produce aromatic oils.

**Isthmus crude oil:** Crude oil with 33.6° API density and 1.3 weight % sulfur.

**Light crude oil:** Crude oil with API density range from 27° to 38°. The Southeast Marine Region, Poza Rica Area and Cinco Presidentes Area are within the most important areas that produce this type of oil.

**Maya crude oil:** Crude oil with 22° API density and 3.3 weight % sulfur.

**Mexican crude oil mix:** Combination of crude oils exported by Mexico, formed by the Maya, Isthmus and Olmeca crude oils.

**Olmeca crude oil:** Very light crude oil, 39.3 API density and 0.8 weight % sulfur.

**Heavy crude oil:** Crude oil with API density less than or equal to 22°C. Altamira area and the Northwest Marine Region are within the most important regions that produce this type of crude oil.

**Enriched oil:** Crude oil topped with light naphthas and pentanes injections.

**Extra light oil:** Crude oil with API density greater than 38°C. Jujo–Tecominoacan Area, Bellota–Chinchorro Area, Muspac Area and Samaria Sitio Grande Area are within the most important regions that produce this type of crude oil.

**Derrickman:** Name given to the operator that is in charge of carrying out the works in the highest
part of the drilling tower. This member of the drilling group holds the upper part of the drill string as it is moved into or out of the well. He is also responsible for the rotating equipment and the drilling fluid conditions.

**Sour gas:** Natural gas that contains hydrocarbons, sulphidric acid and carbon dioxide (these last two elements in concentrations greater than 50 ppm).

**Associated gas:** It is the natural gas that can be found in contact and/or dissolved in the crude oil of the reservoir bed. This can be classified as free gas or dissolved gas.

**Lift Gas:** Gas injected to the well production piping through special valves in order to decrease the hydraulic column density in the piping.

**Formation gas:** Associated or non-associated formation gas. Gas that comes from reservoir beds.

**Gas of injection:** Gas (nitrogen, carbon dioxide, dry gas, etc.) which is injected to the reservoir bed in order to keep the pressure, it is used as the secondary recovery system.

**Sweet gas:** It is the natural gas that contains hydrocarbons and low amounts of sulphhydric acid and carbon dioxide.

**Wet gas:** It is the natural gas that contains more than 3 gal/Mpc of liquid hydrocarbons.

**Natural gas:** It is a mixture of light paraffinic hydrocarbons with methane as its main component with small amounts of ethane and propane; with variable proportions of non-organic, nitrogen, carbon dioxide and sulphhydric acid. The natural gas can be associated with crude oil or it can be found independently in non-associated gas or dry gas wells. In order to use it, it has to meet certain quality specifications such as: liquefiable content 0.1 l/m3 maximum, maximum humidity of 6.9 lb/MMpc; minimum heat power of 1184 Btu/pc; maximum total sulfur 200 ppm; maximum content of CO2 + N2 of 3% in volume. It is used for domestic purposes in industries and electricity generation.

**Non-associated gas:** Natural gas found in reserves that do not contain crude oil.

**Dry gas equivalent to liquid:** It is the volume of dry gas that, due to its heat power, is equivalent to crude oil.

**Specific gravity (Sg):** It is the quotient of the weight of a given material volume between the weight of the water volume measured at the same temperature; it is denominated as Sg Tm/Ta.

**API gravity:** It is the specific gravity of a crude oil expressed in terms of API degrees, and it is estimated with the following ratio:  

\[
\text{API}^\circ = \frac{sg}{141.5} \times 131.5 
\]
**Hydrocarbons**: Group of organic compounds that contain mainly carbon and hydrogen. They are the simplest organic compounds and they can be considered as the main substances from which all the other organic compounds come from. The simplest hydrocarbons are gaseous at environment temperature, as their molecular weight increases they turn into liquids and finally they are solids, their three physical states are represented by the natural gas, the crude oil and the asphalt. There are open-chain hydrocarbons (aliphatic) and single-bond hydrocarbons which form the group of alkanes and paraffins such as propane, butane and hexane. In case of having an open chain and double bonds they form the alkene or olefin group such as ethylene or propylene. The alkyne contains triple bonds and they are very reactive, for example the acetylene. The alkene and the alkyne, both unsaturated compounds, are mainly produced in refineries, especially in the cracking process. The closed-chain or cyclic compounds can be saturated (cycloalkane) such as the cyclohexane or unsaturated. The most important group of unsaturated cyclic hydrocarbons is the aromatic, which has a six-carbon ring base and three double bonds. The benzene, toluene, anthracene and naphthalene are among the most representative aromatic compounds.

**Total liquid hydrocarbons**: It is the addition of the oil and condensate volumes, plus the natural gas liquids obtained in plant.

**Total hydrocarbons**: It is the addition of crude oil, condensates, gas liquids and the dry gas liquid equivalent estimated based on the equivalent factor of its heat power.

**Air drive**: Mechanical process that provides continuous or intermittent gas or compressed air to the well in order to move the fluids produced, generating a pressure reduction in the well bottom and substantially increasing the oil extraction rate.

**Drilling mud**: Fluid that is used when drilling a well. Besides of its function of taking the drill borings to the surface, the drilling mud cools and lubricates the drill and the drilling string, it prevents lack of control by avoiding the subsoil formation pressure signs and it forms a rendering in the wall of the hole in order to prevent the loss of fluid towards the formation. Although originally it was a mixture of soil, especially clays in water, the mud used nowadays is more complex, since it is a mixture of liquids, solid reagents and inert solids, the most common one is a mixture of barite, clays, water and chemical additives.

**Hoisting engine**: It is one of the most important parts of the drilling equipment. It has the following functions: it is the control center from which the driller operates the equipment; it contains the clutches, chains, accelerating gear of the machines and other mechanisms that allow
to direct the engine power to the particular operation being developed, having also a drum that collects or feeds the drilling wire.

**Development drilling:** Drilling that is carried out after the discovery of a hydrocarbon reserve. In general, several wells are required to develop a reserve.

**Petroleum:** The petroleum is a mixture that is present in nature and which is composed mainly of hydrocarbons in solid, liquid and gaseous phases; the solid state is denominated natural bitumen, the liquid, crude oil and the gaseous, natural gas, this is at atmospheric conditions. There are two theories about the origin of petroleum: the inorganic one which explains the formation of petroleum as a result of geochemical reactions among water, carbon dioxide and several inorganic substances, such as carbides and metal carbonate, and the inorganic one which assumes that petroleum is a product of the decomposition of vegetable and animal organisms that existed during certain periods of the geologic era.

**High sulfur crude oil:** It is petroleum that contains from 0.51 to 2.0% sulfur; in this case the gasoline fraction contains it in no more than 0.15%, in the one used for jet motors in no more than 0.25% and the fuel one for diesel motors in no more than 1%.

**Light sulfur oil:** Petroleum that contains no more than 0.5% sulfur with the characteristic that the gasoline fraction contains it in no more than 0.15%, in the one used for jet motors in no more than 0.1% and the fuel one for diesel motors in no more than 0.2%.

**Equivalent crude oil:** It is the addition of crude oil, condensate and dry gas equivalent to the liquid (see equivalent oil barrel).

**Platform:** Fixed marine structure built over piles from which the wells are drilled and operated. The entire platform has a substructure and superstructure. The substructure is the lower part that is supported on the sea bed and embedded through piles; the superstructure is the upper part that holds the drilling packages, the production equipments, etc. depending on the type of platform in question.

**Compression platform:** The function of this type of platform is to hold the compressor equipments that supply gas at the pressure that is necessary for its transportation, as well as its conditioning, for example, sweetening the sour gas.

**Linkage platform:** The function of this type of platform is to collect the crude oil with the gas coming from the production platforms and to distribute it for its processing, also the ducts that collect the crude oil with the oil pipelines that transport it to land join in this platform. The reception and delivery wellheads of crude oil and gas are installed in this platform.
**Drilling platform:** The function of this type of platform is to hold the equipment, tower, piping and accessories that will enable to drill and exploit the well and to install the wellhead where the production platform will be placed later on; its cover has two levels, a production one at 16m over the sea level and a drilling one.

**Production platform:** The equipments and devices to separate the gas from the crude oil and to pump this one to ground is formed by a substructure which has eight columns and a supersubstructure which has two levels as the drilling platform.

**Repumping platform:** As its name indicates it, the pumping equipment that is in charge of increasing the pressure to transport the crude oil from the middle point between the link platforms and the facilities in land is located in this platform. It holds the gas turbines to activate the pumps, as well as enough electric generators to meet its own needs of electric energy.

**Work platform:** Platform located in the drilling tower, in the rotary system, approximately at the same height where the drill piping sets are and which is used to hold the worker (derrick man) in charge of handling them.

**Housing platform:** As its name indicates it, the function of this type of platform is to create adequate conditions so that the workers can live in their work place. It has the capacity to accommodate from 45 to 127 workers; besides, it has a heliport, radio booth, firefighting system, waste water treatment plant, kitchen, dinning rooms, recreational rooms, library, electric energy generation plants, clinic and gym.

**Development well:** Well drilled and finished in a proved area of a field for the production of crude oil and/or gas.

**Non-productive well:** Well finished up to the objective set forth without achieving production because it is dry or non-commercial, or there is an unforeseen geological column or water invasion.

**Input well:** Well used for injecting water, air or gas to a stratum with the aim of increasing the pressure in other wells in the reservoir bed.

**Flowing well:** Well in which petroleum surfaces due to the stratum's energy pressure. The spontaneous flow of petroleum causes losses of gas and petroleum and it can be the cause of a fire or of a sudden well destruction.

**Flush production:** Production of a well during the initial period before it decreases to the pressure level of the wells that have been producing in the same field for some time now.

**Flaring:** It is a device used for burning in a controlled and safe manner the gas that cannot be used due to technical or commercial reasons.
**Enhanced oil recovery (tertiary recovery):** It is the additional extraction of petroleum after the primary recovery, adding energy or changing the natural forces of the reservoir bed. This includes water injection or any other means that completes the recovery processes of the reservoir bed.

**Primary oil recovery:** Extraction of oil using only the natural energy available in the reservoir beds to move the fluids through the rock of the reservoir bed towards the wells.

**Secondary oil recovery:** It refers to additional oil extraction techniques after the primary recovery. This includes water or gas injection with the aim of keeping the pressure in the reservoir bed.

**Differed resources:** Volume of hydrocarbons discovered with exploratory wells and confirmed with pressure-production tests that at the current conditions are not technically and/or commercially exploitable. This resource, in case the conditions change favorably must pass to the category of proved reserves and vice versa.

**Gas-oil ratio:** Indicator that determines the gas volume per oil volume unit measured at superficial conditions. It is used in the analysis of the reservoir bed exploitation behavior.

**Oil reserves:** It is the feasible portion to be recovered of the total volume of hydrocarbons existing in the subsoil rocks.

**Original reserve:** It is the volume of hydrocarbons at atmospheric conditions which is expected to be economically recovered with the means and exploitation systems applicable to a specific date. It can also be said that it is the resource fraction that can be obtained at the end of the reservoir bed exploitation.

**Probable reserves:** It is the amount of hydrocarbons estimated at a specific date, in drilled and non-drilled traps, defined by geologic and geophysical methods, located at areas adjacent to productive reservoir beds where it is considered that there are probabilities of obtaining technically and economically a production of hydrocarbons, at the same stratigraphic level where there are proved reserves.

**Proved reserves:** It is the volume of hydrocarbons measured at atmospheric conditions, which can be economically produced with the exploitation methods and systems applicable when the assessment is made, both primary and secondary.

**Possible reserves:** It is the amount of hydrocarbons estimated at a specific date, in non-drilled traps, defined by geological and geophysical methods, located at areas adjacent to productive ones buy inside the same producing geological province with possibilities of obtaining technically and economically a production of hydrocarbons, at the same stratigraphic level where there are
proved reserves.

**Remaining reserve:** It is the volume of hydrocarbons measured at atmospheric conditions, which can still be produced from a reservoir bed at a determined date with the exploitation techniques applicable. From another viewpoint, it is the difference between the original reserve and the accrued production of hydrocarbons on a specific date.

**Casing:** Name given to the different piping sections that are cemented inside the well. These pipe lines vary with regard to their diameter and number in accordance with the different areas drilled; the depths and the producing characteristics of the well. In general, three pipe lines are cased in a well; the one with the greatest diameter is called superficial and control piping, the next one is called intermediate one and the one with less diameter and greater depth is the exploitation piping.

**Drilling piping:** It is the set of pipes linked by means of joints or special conic couples that have in their lower end the drill or drilling tool in the rotary system. The piping sections that are regularly used are of approximately 9 m (30 feet).

**Production piping:** Set of pipes joined by couples and threads which is introduced in the well when it is going to be started, so that the oil and/or gas hydrocarbons flow from the bottom to the surface in a controlled manner.
INDUSTRIAL TRANSFORMATION

- Refining

Once the crude oil is extracted, it is treated with chemical products and heat to eliminate water and solid elements and the natural gas is separated. Then, the petroleum is stored in tanks from where it is transported to the National Refining System through oil pipelines or by ship. All the important oil fields are connected to large oil pipelines.

The refining process starts in the atmospheric distillation tower, where the crude oil is subject to pressure obtaining primary gasoline, light kerosene, jet fuel, primary light gasoil, primary heavy gasoil and residues. These residues are processed in the high vacuum section where vacuum light gasoil, vacuum heavy gasoil and vacuum residue are obtained.

Atmospheric distillation of crude oil and product distribution

[Diagram showing atmospheric distillation process]

- Crude oil
- Gasolines
- Naphthas
- Kerosenes
- Light gasoil
- Heavy gasoil
- Residue

Temperature Ranges:
- Butane and lighter: <32.2 °C
- Gasolines: 32.2 °C
- Naphthas: 104.4 °C
- Kerosenes: 157.2 °C
- Light gasoil: 232.2 °C
- Heavy gasoil: 343.3 °C
- Residue: >426.7 °C
The primary gasoline obtained is fed to the naphtha hydrodesulfurization unit, where sulfur is removed and then it goes into the naphtha reforming plant to obtain reformed gasoline. This plant also removes nitrogenous compounds and metallic pollutants producing a mixture of isopentanes and pentanes that constitute the load of the isomer plant from which isopentane, pentanes, butanes, propane are obtained and then they are sent to tanks.

The intermediate streams (light primary gasoil, jet fuel and kerosene) of the atmospheric tower are sent to the hydrodesulfurization unit where sulfur compounds are removed. When they exit, they are loaded into the fractionator where through distillation they are separated into jet fuel, kerosene and diesel, which are also sent to tanks.

The gasoil obtained is sent to the catalytic cracking plant where the breaking of their molecular structures takes place producing high octane gasoline, light oil, propane-propylene and butane-butylene, basic products for the production of low-pressure liquefied gas and propylene to be used in petrochemistry.

The residue of the vacuum tower is divided in two streams. One of them is sent to the viscosity reducing plant or to the hydrodesulfurization unit of H-Oil residues for the production of fuel oil and the other part is sent to the asphalt preparing plant.

**Bright Stock**: High Viscosity Residual Lubricating Oil from which paraffin has been removed. In general, it is obtained from residues either with acid treatment or through extraction with solvents and it is used in the elaboration of lubricating oils.

**Residual oil**: In the petroleum refinery, it is the viscose fuel, or semi-liquid bottom residues obtained from the crude oil distillation, it is used as adhesive, asphalt or low-grade fuels.

**Lubricating oil**: In general, they are mixtures of paraffinic basic oils (with or without additives). In Petroleos Mexicanos they are obtained from the residue distillation in the Salamanca refinery. The paraffinic basic oils come from a mixture of Pozoleo and Isthmus crude oils. They are classified according to their consistency in semi-liquid, plastic and solid. They are used to decrease the friction between mobile surfaces and they are incorporated in materials used in the manufacturing process of other products.

**Additive**: Chemical product that is added to another one in order to improve or increase its physical properties (smell, color, octane, conductivity, etc.). For example, the additives are used to improve the lubricating properties of car engine oils.

**Alkylation**: Process through which an isoparaffin (of short chain) is chemically combined with an olefin in presence of a catalyst in order to form another isoparaffin (of long chain), called alkylate which has a high octane rating.

**Alkylate**: Product of the alkylation reaction between the isobutane in presence of an acid catalyst at a temperature that ranges from 0 to 10 °C in order to form branch hydrocarbons, mainly isooctane, with an octane index of approximately 94, thus it is very valued to prepare high octane gasoline. They are in alkylation plants in the refineries of Cadereyta, Madero, Salamanca, Salina Cruz and Tula.

**Antiknocking compounds**: Compounds used in fuel oils to avoid knock and detonations in an internal combustion engine (increasing the octane) as the one in cars when they are working overheated and to avoid the loss of power that arises from this phenomenon.

**Aromatization**: It is a process through which light olefins are turned into aromatics. Through this process the light naphthas are treated to reduce the olefins present with controlled production of aromatics increasing the number of octane from 6 to 9 RON and from 7 to 13 MON.

**Asphalt**: It is a black or dark-brown heavy fraction of crude oil. Its consistency can vary from liquid to solid. Asphalt is the heavy fraction of crude oil after having been subjected to distillation at high vacuum and mixed with other residues, thinners and polymers to adjust it to the specifications depending on the type of asphalt. Currently the most common asphalt in the national market and for export purposes is the asphalt AC-20. In Pemex, it is produced in the refineries of Cd. Madero, Salamanca, Salina Cruz, Tula and Cadereyeta. It is used for coatings.
and pavements of highways, streets, parking lots, airports, and also as waterproofing and sealer, it is handled in tank trucks and tank cars with heating system.

**Bitumen:** It is any of the different natural mixtures of hydrocarbons with its non-metallic derivatives. Petroleum without having been processed, asphalt and tar are bitumen, they are dark-brown or black and contain little nitrogen, oxygen or sulfur. Oil bitumens are obtained from heavy oil residues using deep concentration methods (the residual) and oxidation methods (the oxidated). Bitumens are solid materials or non-water soluble liquids. They are widely used in the construction of highways and in different civil and industrial engineering works, as well as in the production of materials for roofs, asphalt varnishes and typography ink.

**Carbon:** It is a solid element that exists in several forms in nature, including diamonds, graphite, coke, and vegetable carbon. The combination of carbon with hydrogen is known as hydrocarbon and they can be large or small molecules.

**Catalyst:** It is a substance that accelerates or retards a chemical reaction without suffering any alteration or chemical change during the process.

**Industrial fuel:** Fuel liquid of a brownish-yellow color with petroleum smell. It is obtained from the combination of fractions of the crude oil atmospheric distillation, it is non-water soluble. It is basically used in industrial boilers and ovens.

**Fuel oil:** It is the crude oil heavy fraction after having been subjected to high vacuum distillation; it is prepared with the mixture of other residual elements, such as catalytic residue, reduction residue and H-oil residues (residual hydrocracking); thinners are used to adjust the required specifications; the heavy fuel oil must contain 4% weight % sulfur maximum and viscosity from 475 to 550 SSF (Standard Saybolt Furol) at 50°C. It is produced in Cadereyta, Cd. Madero, Minatitlan, Salamanca, Salina Cruz and Tula. It is used as industrial fuel for electricity generation, in trains and ships; in refineries it is used in the direct fire heaters. It must be carefully handled in case of any leakage since it is manipulated at temperatures over the ambient one. It must be kept in tanks with heating system at a temperature between 70° and 80°C.

**Coke:** It is a porous solid mass of a color that ranges from grey to black. The coke has macromolecular hydrocarbons and it is highly aromatic. It is obtained through coking tars and cracking residues (cracking) and pyrolisis in Cd. Madero. It is used as a solid fuel for boilers and it is handled as a bulk product in gondolas or rack trucks.

**Fluid cocking:** It is process through which solid fluids disintegrate thermally in order to obtain liquid and gaseous products, in addition to coke. The process uses heat produced by burning 25% of the coke generated to provide heat to the process (496-538°C).
Deasphalting: It is a process through which the vacuum distiller residue is introduced in a tower where it is in contact with liquid propane which dissolves all the components, except for the asphalt and which is deposited in the bottom of the column. The column is operated at pressures of approximately 35 kg/cm² in order to maintain the propane in liquid state at the operating temperatures.

Cracking: It is the process of breaking down large molecules of heavy hydrocarbons (non-distillable residues) into smaller molecules of light hydrocarbons, with the aim of turning these residues into more valuable products, mainly gasoline, light hydrocarbons and distilled products.

Thermal cracking: It is a process originally used for the production of gasoline and light distilled products; it is currently used for reducing the viscosity of the residual fractions or for coke production. It is called thermal because the load is subjected to high temperatures of 455 °C and pressures over the atmospheric one. As it happens with the catalytic cracking, the products contain olefinic hydrocarbons.

Catalytic cracking: It is a process carried out at temperatures that range from 455 to 540°C and at pressures slightly over the atmospheric one but with the presence of a catalyst. The process turns a load (in general gasoil) into a better quality gasoline than the one obtained through the thermal cracking process, in addition to other light and distilled olefinic hydrocarbons.

Dewaxing: It is a process through which the waxes present in the lubricating oil are separated through crystallizing them at low temperatures. The conventional processes consist of putting the oil in contact with a dissolvent, for example, methyl-ethyl-ketone, that dissolves oil and waxes. When the solution is cooled, the waxes crystallize and then they can be separated when they are filtered.

Distillation: It is a process that consists of heating a liquid until the most volatile components pass into the vapor phase and then the vapor is cooled to recover such components in their liquid state through condensation. The main objective of the distillation is to separate a mixture of several components using their different volatilities, or to separate the volatile materials from the non-volatile ones.

Vacuum flashing: It is a refining process whose load is the residues that come from the atmospheric distillation and which is carried out under low pressure and therefore at regular temperatures to avoid the decomposition or disintegration of the material that is being distilled, increasing by doing so the number of more valuable light distilled products that can be obtained.

Atmospheric distillation: It is a primary process used in refining crude oil to separate its components, which is carried out at atmospheric pressure, at temperatures that range from 315 to
374°C (depending on the crude oil nature and the desired products) in presence of water vapor; with product extractions in different points of the distillation tower, corresponding to the different ebullition temperatures of the mixture (cuts or fractions) to be cooled and condensed later on.

**Fractional distillation**: Separation of the components of a liquid mixture through vaporization and collection of fractions or cuts, which condensate at different temperature ranges.

**Middle distillates**: Group of products that due to their composition characteristics identify themselves with their ebullition interval that ranges from 193°C to 399°C. This fraction is formed by diesel, industrial fuel and kerosene.

**Light distillates**: Group of products that due to their composition characteristics identify themselves with their ebullition interval that ranges from 0°C to 280°C. This fraction is formed by: liquefied gas, gasoline, naphthas and aviation gasoline.

**Heavy distillates**: Group of products that due to their composition characteristics identify themselves with their ebullition interval that ranges from 330°C to 500°C. This fraction is formed by: lubricants, paraffins, greases, asphalts, coke, vacuum gasoil, fuel oil and others.

**Detergent**: Additives used to inhibit the formation of deposits in the fuel and in the car internal systems.

**Diesel**: Liquid fuel obtained from the crude oil atmospheric distillation between 200 and 380 °C and later on it receives a treatment in the hydrodesulfurization plants. It is heavier than kerosene and it is produced in all the refineries administered by Pemex Refinacion. This product is used as fuel in the industrial and car areas. Due to its different uses and with the aim of meeting the pollutant emission environmental restrictions, which are stricter everyday in the international arena, Petroleos Mexicanos offers to the market its Pemex Diesel products for motor uses; Industrial Diesel Industrial to be used by the industry and Special Marine Diesel for vessels.

**Low sulfur industrial diesel**: Industrial fuel with a maximum content of 0.05 weight % sulfur for the exclusive use of open-flame burners as boilers, steam generators, etc.

**Special marine diesel**: Fuel with a maximum content of 0.5 weight % sulfur and a cetane index of 40 minimum, a maximum temperature of 350°C at 90% of distillation, to be used exclusively by the marine sector.

**Fractioner**: Plant in which through distillation small fractions of a hydrocarbon mixture are separated.

**Light fraction**: Low molecular weight fractions (light), which are the result of the first petroleum distillation.

**Heavy fractions**: Also known as heavy residues, they are oils with large molecules that emerge from the bottom of the fractioning column during the crude oil refining.
**Residual gas:** Gas obtained as byproduct during the cracking process and it is mainly composed of methane.

**Aviation gasoline:** It is a high-octane alkilate, highly volatile and stable and with a low freezing point. It is obtained as a result of the catalytic cracking of heavy gasoil that in turn is a crude oil primary distillate. It is used in helix airplanes with piston motors. It is flammable and a long exposition to its vapors causes a depression of the central nervous system. It is produced in the refinery located in Cd. Madero. It is handled with tank trucks and tank cars, and 200L drums.

**Domestic gasoil:** Liquid fuel which has to be used only in open burners for domestic-type services, this product is provided with a light-purple color. It is the product that arises from the mixture of petroleum refined products that is carried out in sale centers, and whose density is 0.814 kg/l. In Pemex, it is produced in the Cadereyta refinery.

**Light gasoil:** Byproduct obtained from the atmospheric distillation and which starts its ebullition between 175 and 200°C and ends between 320 and 350°C. It is used as fuel component for diesel engines.

**Heavy gasoil:** It is a distillation residual product whose ebullition interval ranges from 423 to 600°C. It is used as raw material for the catalytic cracking and in mixtures with other products to obtain fuel oil.

**Vacuum gasoil:** It is a mixture of light gasoil and heavy gasoil that comes from the vacuum tower and which is used as the load for the catalytic plants where in presence of a catalyst and temperature, the breaking down of its molecule structures is favored and high octane gasoline is produced.

**Motor Gasoline:** Name used in a wide manner to refer to lighter products obtained by means of the crude oil distillation, which are subjected to different processes to give them the physical and chemical characteristics required for the appropriate operation of the car’s internal combustion engines. The specifications for motor gasoline under which a great part of this product is sold, vary considerably; it has an initial ebullition point that ranges from 35 to 49°C, its final ebullition point or final temperature is between 221 and 225°C. This fuel is produced in all the refineries and there are three types of motor gasolines: Pemex Magna, Pemex Magna Reformulada (oxygened) and Pemex Premium, which are handled with tank trucks and ducts.

**Cracked gasoline:** Mixture of cracked gasoline to which the octane rating has been increased through a catalytic cracking process during which it has been subjected to a dehydrogenation.

**Stripped gasoline:** Primary gasoline from which the low ebullition point components have been removed.

**Pemex Magna gasoline:** Primary gasoline subject to cracking processes and mixture of cracked and catalytic gasoline to which high octane components are added (light alkilate) to meet the
quality specification required, with an octane index of \((\text{RON}+\text{MON})/2\) minimum of 87; 4.9% of maximum volume of benzene; maximum FET 225°C and a RVP from 7.8 to 9.0 lb/inch\(^2\). This type of gasoline is produced in all the refineries.

**Pemex Magna Oxigenada gasoline:** Pemex Magna gasoline added with oxygenated compounds (MTBE and TAME) which improve the gas combustion and reduces the non-burned hydrocarbons emission to the atmosphere, with specifications of one octane index \((\text{RON}+\text{MON})/2\) minimum of 87; FET of 225°C maximum; a RVP from 6.5 to 7.8 lb/inch\(^2\) for the Metropolitan Area of the Valley of Mexico and from 9 to 10 lb/inch\(^2\) for the Metropolitan Areas of Monterrey and Guadalajara; 1 to 2% maximum volume of benzene; 10 to 12.5% maximum volume of olefins; 25 to 30% maximum volume of aromatics; 1 to 2% maximum volume of benzene and from 1 to 2 weight % oxygen. It is produced in the Tula, Salamanca and Cadereyta refineries.

**Pemex Premium gasoline:** Primary gasoline subject to cracking processes and mixture of cracking and catalytic gasolines to which high octane components (light alkilate) and oxygenate compounds (MTBE) are added to meet the quality specifications required, with one octane index octane index \((\text{RON}+\text{MON})/2\) minimum of 93; FET of 225°C maximum; 2% maximum volume of benzene; 15% maximum volume of olefins; 32% maximum volume of aromatics; a RVP from 7.8 to 9 lb/inch\(^2\) and from 1 to 2 weight % oxygen. It is produced in the Cadereyta, Cd. Madero, Salina Cruz, Tula and Minatitlan refineries.

**Reformulated gasoline:** Gasoline whose volatility and content of aromatics has been reduced through chemical methods, adding oxygenated compounds with the aim of decreasing the emissions produced during its combustion.

**Hydrodenitrogenation:** It is process that takes place simultaneously with the hydrogenation processes where nitrogen and oxygen are removed; this improves the quality of the catalytic cracking fractions.

**Hydrodesulfurization:** It is a process through which sulfur is removed by turning it into sulphydric acid in the gaseous stream, which can be easily separated and transformed in elemental sulfur.

**Intermedio 15:** *(Intermediate 15)* Maritime-use fuel formed by the mixture of fuel oil and diesel. The proportions of these products vary but in general they are close to 70% and 30%, respectively.

**Isomerization:** It is a process through which the fundamental arrangement of the atoms of a molecule is modified without adding or subtracting anything of the original molecule. Butane is isomerized to isobutene to be used in the alkylation of isobutylene and other olefins for the production of high-octane hydrocarbon production such as the isooctane \((2, 2, 4,\text{-trimetilpentane})\). Natural gasoline fractions \((\text{C}_5/\text{C}_6)\) and other refining streams are isomerized in order to obtain
high-octane products, to produce enriched high-octane gasoline.

**MTBE (Methyl-Tert-Butyl-Ether).** Colorless liquid with a density equal to 0.746gr/cc. It is obtained from the isobutilene contained in the butane-butylene cut of the FCC catalytic unit and methanol, using as catalyst a strong acid cationic resin, being able to feed streams with greater concentrations of isobutylene, doing so favors the production of MTBE. It is used to increase the octane rating of the gasolines and the percentage of oxygen in the mixtures to reduce the emissions to the atmosphere of non-burned hydrocarbons in the combustion engines and to meet the environmental specifications in force.

**Naphthenes:** Also known as cycloparaffins. They are saturated chains of cyclic hydrocarbons (for example: cyclohexane, cyclopentane, etc.), many of which contain in their structure methyl groups. The presence of a great percentage of cyclohexanes and clohexanes and cyclopentanes in the gasoline is important because they are the precursors of aromatic hydrocarbons.

**Octane number:** Index through which the gasoline antiknocking capacity is measured. It is common to specify for the motor gasoline two types of octane numbers, one known as RON which is measured in relatively moderated test conditions, and the other one known as MON which is measured at higher motor temperatures and speeds. A high index of octane provides greater combustion efficiency, greater power, less carbon deposits and better motor functioning, as well as less pollution.

**Paraffin wax:** White, odorless, fragile and solid material that is currently produced by Pemex in the Salamanca refinery. It is obtained from crude oil distillates or from residues through cooling, dewaxing, and/or precipitation. It is mainly used in the manufacturing of chloride paraffins, candles, and waxed paper. It is handled through tank trucks and tank cars.

**Pemex Diesel:** Light-yellow fuel with a content of 0.05 weight % sulfur and a minimum centane index of 48; a maximum temperature of 275°C at 10% of distillation and 345°C at 90% of distillation; a 30% of maximum volume of aromatics and its use is mandatory in the Metropolitan Areas of Mexico, Guadalajara and Monterrey Cities for the public transportation activity.

**Catalytic polymerization:** It is a process through which the refinery gases rich in olefins are polymerized with the aim of producing motor gasoline with high octane rating and petrochemical derivatives.

**Thermal polymerization:** Thermal process that turns light gas hydrocarbons into liquid fuels. The paraffinic hydrocarbons are cracked in order to produce olefinic material which is generally polymerized through pressure and heat to polymeric gasoline.

**Process:** It is the set of physical and chemical activities related to producing, obtaining, conditioning, packing and handling of intermediate or final products.
**Gross production**: In Pemex Refinacion it is the refinery production exclusively based on the crude oil process, consequently excluding what is obtained in the process of other external inputs.

**Own production**: In Pemex Refinacion it is the refinery production exclusively based on the crude oil process and on other primary inputs, excluding all the external inputs in the mixture. Own production = Total production – external products transfers.
**Total production:** In Pemex Refinacion it is the amount of finished product obtained in a refinery with quality specifications, excluding external transfers of the same product. It is estimated as follows:

Total production = shipments + consumptions – receptions of the same product + inventory variation.

**Final product:** Those products finished which are sent to sales and which meet the quality standards.

**Intermediate products:** Intermediate products are those inputs for plants, processes and mixtures to finish final products.

**Kerosene:** Liquid fuel formed by the crude oil fraction that is distilled between 150 and 300°C. It is produced in all Pemex refineries. It is used as fuel for food cooking, lighting, engines, refrigeration equipments and as solvent for bitumens and domestic-use insecticides. It is handled by means of tank trucks and 200L drums.

**MTBE Raffinate:** It is the mixture of hydrocarbons, mainly butanes, byproducts of the MTBE elaboration processes. It is used as the component of liquefied gas and it is produced in the Cadereyta, Salamanca, Salina Cruz and Tula refineries.

**TAME Raffinate:** It is a mixture of hydrocarbons, mainly pentanes, byproduct of the TAME elaboration processes. It is used as a component of Pemex Magna gasoline and it is produced in the Salina Cruz and Tula refineries.

**Chemical reaction:** It is a process through which a substance or group of substances interact, affecting their molecular structure.

**Reagent:** It is any substance that due to its capacity to go through certain reactions is used to determine, examine or measure other substances, or to prepare a substance different to the original one.

**Viscosity reduction:** It is a process of thermal disintegration which is fed from the bottom of the vacuum distillation tower with the aim of turning heavy loads into distilled products with greater economic value. Such disintegration is carried out at a temperature of 435°C and at a pressure of 15 kg/cm²; this process is used where heavy crude oil mixtures are processed.
Refinery: Work center where crude oil is transformed into its derivatives. This transformation is achieved through the following processes: atmospheric distillation, vacuum distillation, hydrodesulfurization, thermal cracking, catalytic disintegration, alkilation and catalytic reforming, among others.

Catalytic reforming: It is a refining process at high temperatures where the reactions are carried out with a catalyst. It is used to improve the octane rating of desulphurized gasoline; therefore it is the most important process to improve gasolines. During the reforming isomerization reactions from paraffins to isoparaffins, reactions to form cyclic structures from paraffins to naphthenes; deshydrogenation from naphthenes to aromatics; disintegration from naphthenes to butane and light products, as well as the lateral aromatic chain detachment to form light products take place.

Thermal reforming: It is a process that uses heat (but not catalysts) to carry out a molecular rearrangement of low-octane naphtenes to high-quality antiknocking gasoline.

Auxiliary services: These are the services carried out in facilities that are used to provide electric energy, vapor, water, compressed air and other supplementary services in refineries and petrochemical complexes. The term does not reflect the importance of these services, if it is considered that they are the ones that make it possible the process plant operations.

Solvent: It is a substance, usually liquid, which is capable of absorbing another one either in liquid, gas or solid state to form a homogeneous mixture. One of the most used solvents in the oil industry is the diethanolamine (DEA), whose characteristic is to absorb the sulfhydric acid during the catalytic cracking process.

TAME (Tertiary-amyl- ether): Oxygenate compound which is mixed with gasoline to increase the octane and reduce the hydrocarbon emissions to the atmosphere. TAME is obtained from the methanol etherification reaction with the isoamilenes contained in the catalytic gasoline stream of the FCC, using as catalyst a strongly acid cationic resin.

Absorber: Vertical and cylindrical reservoir where heavy hydrocarbons are recovered from a mixture whose main content is light hydrocarbons. It is used to dehydrate gas through its bubbling in glycol.

Jet fuel: Crude oil fraction used as fuel for jet propulsion airplanes; it is produced in all the refineries. It is obtained through distillation in accordance with its molecular weight and ebullition temperature; the jet fuel fraction has an ebullition temperature limit that ranges from 200 to 300°C maximum, this primary product is subject to a hydrodesulfurization process in order to obtain jet
fuel that meets the following specifications: 10% in volume distillates at 205°C maximum, with a maximum final ebullition temperature of 300°C, maximum freezing temperature of -47°C; a maximum pressure drop of 25 mmHg; a content of aromatics no greater than 22% volume and a specific weight at 20/4 °C between 0.772 and 0.837, among others. The main client of this product is ASA. Its sale to third parties requires the approval of this entity and of the Civil Aeronautical General Direction of the Ministry of Communications and Transportations. It is handled with tank trucks, tank cars, tank vessels and ducts.

**Virgin Stock:** Product obtained directly through crude oil distillation and it does not contain chemically modified material.
Processing of Liquids and Natural Gas

- Dry gas directly from the fields
- Sour humid gas from fields
- Sweet gas from fields
- Acid gas
- Condensates
- Stabilizer of condensates and sweetening plants
- Condensate sweet gas
- Stabilized condensates
- Extraction of liquefiable products
- Ethylene
- Sulfur
- Gas Liquids
- Sweet gases upon extraction of liquefiable products
- Sweetening Plant
- Cryogenic and/or Absorption Divider
- Liquefied Gas
- Natural Gasoline
- Others
- Ethanol
- Ethylene Plant
- For clients
- Reprocesses
• Process of Gas and Condensates

In gas processing centers, the basic raw materials are: sour humid gas, sweet humid gas and sour and sweet condensates obtained in different fields in exploitation.

The sour humid gas is processed at gas sweetening plants, in order to obtain sweet humid gas and acid gases. The sweet humid gas is processed at absorption and cryogenic plants in order to recover liquefiable hydrocarbons from ethane. Acid gases are processed at sulfur plants, having as an objective to recover the sulfur for the national use, export and to protect the environment.

Sour condensates are processed at sweetening plants of liquids in order to obtain sweet condensates that joins with the liquid product obtained at absorption and cryogenic plants.

Liquids and gas obtained from the gas process constitute in turn the raw material of the secondary petrochemistry.

Petroleos Mexicanos currently has 8 gas-processing complexes (CPGs, as in Spanish) located in different places in the national territory, which are: Cactus in Chiapas; Matapionche, Poza Rica, and the Coatzacoalcos area in Veracruz; Nuevo Pemex, La Venta and Cd. Pemex, in Tabasco; and, Reynosa in Tamaulipas, which are operated by Pemex Gas and Basic Petrochemistry. It is worth mentioning that the Coatzacoalcos area CPG is integrated, in turn, by Pajaritos, Morelos and La Cangrejera.
**Absorption:** Process through which a substance is retained instead of another one, for example, the sulfhydric acid and the carbon dioxide in the sour humid gas, are retained in an absorbent compound that may be an amine and subsequently are released due to the temperature.

**Alkali:** From Arabic alkali meaning soda, is the name given to metallic hydroxides that, due to their soluble characteristics in water, may act as energy bases. At present the term alkali is being substituted by base. Its function is to neutralize acid substances. It is utilized in the sweetening process of the acid gas.

**Butanes:** Hydrocarbons from the family of alkanes formed by four atoms of carbon and ten atoms of hydrogen and that are produced mainly in association with the natural gas process and certain refinery operations such as the catalytic dissociation and reformation. The term butane covers two structural isomers: N-butane and isobutane. Mixed with propane, it gives rise to the liquefied gas of petroleum.

**Sour condensates:** Condensed liquid hydrocarbons from the natural gas called that way due to their content of sulphydric acid, mercaptans and carbon dioxide.

**Sweet condensates:** Condensed liquid hydrocarbons from the natural gas called that way due to their content of sulphydric acid, mercaptans and carbon dioxide.

**Stripped condensates:** Condensed liquid hydrocarbons from the natural gas to which hydrocarbons lighter than propane have been extracted.

**Cryogenic Process:** Cooling process to which the natural gas is submitted in order to recover liquid components heavier than the methane; mainly ethane. In its operation, Turbo-Expanders that reduce the temperature of the natural gas are used (from -100 to -145°C) and separate the liquids contained in it by means of liquefaction; under these conditions it is possible to separate 60-86% of the ethane and all the propane, plus heavier ones.

**Debutanization:** Distillation carried out to separate the butane and components lighter than the natural gasoline.

**Dehydrogenation:** Process through which hydrogen is removed from chemical compounds, for example, the removal of two atoms of hydrogen from butane in order to create butylene.
**Depentanizer:** Divider column utilized to separate the pentane from the natural gasoline.

**Unpacking:** The extraction process of stored and compressed product in pipelines or equipment.

**Packing:** The compression and storage process of product in pipelines or equipment.

**Netpacking:** It is the difference between the packing and the unpacking. It is also the difference between the volume of product injected into a distribution system minus the volume extracted thereof in a given period of time.

**Shrinkage:** Reduction in the volume of gas that occurs during its process, due to the extraction of liquid hydrocarbons, condensates and sour gases.

**Shrinkage due to acid gases:** Is the reduction of the volume of gas due to the extraction of acid gas from the sour humid gas coming from fields at sweetening plants. This acid gas is sent to the sulfur plants.

**Sweetening plant:** Plant in which acid gases are separated from sour natural gas or condensates.

**Compressor station:** Station located every 60 km or 80 km along a pipeline gas and its operation consists of recompressing the gas in order to maintain its specified pressure and flows.

**Acid gas:** Gas that contains significant amounts of sulfhydric acid, carbon dioxide and water. It is obtained from the treatment of humid sour gas with easily regenerable bases such as the mono and diethanolamine (MEA and DEA) that are frequently utilized for this purpose.

**Liquefied petroleum gas (LPG):** Gas resulting from the mixture of propane and butane. It is obtained during the separation of liquids from the gas or during the separation of refinery liquids. Lighter fraction of crude oil for domestic use and carbureting. In Pemex it is produced in each and every refinery administered by PR and at the gas processing centers of Cactus, Nuevo Pemex, Morelos, Cangrejera, Poza Rica, Reynosa, and Matapionche. In the refinery process of crude oil, liquefied refinery gas (LRG) is obtained, which is composed by butane and/or propane and may differ from the LPG gas in which propylene and butylene may be present.
**Gasification:** Process through which gaseous fuel is produced from solid or liquid fuels.

**Dry gas:** Condensable-hydrocarbon-free natural gas (basically methane).

**Natural gasoline:** It is a highly volatile mixture of C₄ and C₅⁺ hydrocarbons and forms part of liquids in the natural gas. It is commonly added to car gasoline in order to increase its steam pressure, as well as the starting mechanism at low temperatures. The natural gasoline is also utilized in petrochemistry to provide isobutane and isopentane that are utilized in alkylation processes. It is separated by compression or absorption, or by a combination of both processes.

**Mercaptans:** Highly odorous hydrocarbons containing sulfur in its chain. They are frequently found both in gas as in crude oil. In some occasions, they are added to the natural and liquefied gas in order to add a scent for security reasons.

**Liquefaction:** Process in which a gas is submitted to low temperatures and high pressures to produce a liquid.

**Natural gas liquids:** (NGL). Liquids obtained in gas/liquid dividers of field facilities; in the handling, transportation and compression of natural gas; and at gas processing plants by means of dividers. They are mainly constituted by ethane and heavier hydrocarbons, they are classified in sour condensates due to their content of sulphhydric acid and mercaptans, sweet condensates because they do not contain sulfur compounds, and stripped condensates when all light gases and CO₂ have been extracted.

**Methane (CH₄):** It is a gaseous and inflammable paraffin hydrocarbon. It is the main constituent of natural gas and is used as fuel and raw material for the production of ammonia and methanol.

**Absorption plant:** Plant utilized to recover condensates from the natural gas or refinery gas, absorbing hydrocarbons from the ethane and heavier elements by means of the absorption oil, followed by the separation of the absorbent liquid from liquids (more ethane).
**Girbotol process (Sweetening):** Process carried out at sweetening plants of sour humid gas and sour condensates, whose function consists of absorbing mercaptans and carbon dioxide. The process consists of washing the sour gas with an aqueous solution of Diethanolamine (DEA) or Monoethanolamine (MEA). DEA is more used given its low corrosion rank; said substances absorb the referred impurities and in the following phase of the process, the DEA or MEA is regenerated with a steam treatment and is recycled, releasing the CO₂ and the sulfur absorbed in the form of sulfhydric acid.

**Merox Process:** Process in which liquid sour components are treated with caustic soda containing an organic and metallic catalyst to convert mercaptans into insoluble caustic disulfides. The Merox solution is regenerated mixing it with air and oxidizing agents. By means of the use of the Merox solution, a high removal rate of mercaptans in a stream of liquids is obtained. For a complete removal, Merox also provides a fixed-bed catalytic conversion to transform mercaptans to disulfides. These disulfides will not be removed from the liquid stream, but they do not generate an odor as it happens with mercaptans.
Petrochemicals are grouped in chains formed by chemically related compounds among them. In this manner, they have chains from methane, ethane, aromatics and propylene. Ammonia and methanol are derived from methane. Acetaldehyde, vinyl chloride, dichloromethane, ethylene, ethylene glycols, ethylene oxides, perchloroethylene and polyethylene are obtained from ethane. Aromatics are constituted by heavy aromatics, aromine 100, benzene, cyclohexane, cumene, styrene, fluxoil, orthoxylene, paraxylene, toluene and xylene. The propylene and its derivative products are constituted by hydrocyanic acid, the acrylonitrile, heavy alkylaryl, dodecylbenzene, isopropanol, light polymer, polypropylene, propylene and propylene tetramer. There are other products formed with derivative products and byproducts from processes such as: nitrogen, raffinate II, heptane, petrochemical polymer, etc.

Each chain is formed by related compounds, which are often prepared in a same petrochemical center.

At present, Petroleos Mexicanos has eight centers: Cosoleacaque, La Cangrejera, Escolin, Morelos and Pajaritos in Veracruz, Independencia (San Martin Texmelucan), in Puebla; Camargo in Chihuahua, and Tula in Hidalgo, operated by Pemex Petroquimica.

Acetaldehyde (Ethanal): Volatile colorless liquid, with a spicy and suffocating odor, with a density of 0.778 (20/4°C), boiling temperature at 20.2° C, soluble in water, alcohol, acetone, benzene, gasoline, naphtha and other solvents, whose formula is CH₃CHO. It is obtained by direct oxidation of ethylene with pure oxygen under pressure, utilizing palladium chloride and copper in solution as catalyst. In Pemex it is produced at the following petrochemical plants: La Cangrejera, Morelos and Pajaritos. It is utilized to obtain acetic acid, vinyl acetate, alcohol, pentaerythritol, insecticides and scents.
The steam irritates the eyes, paralyzes the lung muscles and is very inflammable. It is managed through tank cars and tank trucks.

**Acetonitrile (Methyl cyanide):** Aromatic colorless liquid, with density of 0.783, boiling temperature of 82°C, soluble in water and alcohol, great polarity and highly reactive, with formula CH₃CN. It is obtained as a byproduct from the propylene-ammonia process in the production of acrylonitrile in a proportion of 3.6%. It is currently produced at the following petrochemical plants: Morelos, Independencia and Tula. It is utilized as an organic compound selective solvent, for example, the butadiene and in the production of pharmaceutical products and synthetic perfumes. It is toxic and inflammable.

**Hydrocyanic acid (Hydrogen cyanide, prussic acid):** Colorless liquid under 26.5°C, with spicy odor and formula HCN. It is obtained as a byproduct in the production of acrylonitrile in the petrochemical plants of Morelos, Independencia and Tula. It is utilized in the production of methyl methacrylate for obtaining sodium cyanide, laminates and transparent objects, as well as methionine for the preparation of food for cattle. It is extremely toxic; it paralyzes the respiratory system in a very brief time. It is handled through pipelines.

**Acrylonitrile (Vinyl cyanide):** Colorless liquid, with slightly spicy odor and boiling temperature of 77.3°C, soluble in water and common organic solvents, whose formula is H₂C=CHCN. It is obtained in the reaction of a mixture of propylene, ammonia and air in the presence of a phosphorous, bismuth and molybdenum catalyst. Its byproducts are hydrocyanic acid and acetonitrile. In Pemex it is obtained at the petrochemical plants of Morelos, Independencia and Tula. It is mainly used in the production of acrylic fiber and ABS resins. It is toxic when inhaled and ingested. It is handled in tank trucks and drums of 200 l.

**Ammonia:** Colorless gas with a very irritating odor, lighter than the air, easily liquefiable under pressure, soluble in water and methanol whose formula is NH₃. The direct combination of hydrogen and nitrogen in the presence of a catalyst and pressure produce it at the petrochemical plants of Camargo, Cosoleacaque and Salamanca. The anhydrous ammonia is mainly utilized in the production of nitrogen fertilizers. It is handled through pipelines and tank cars.

**Carbonic anhydride (Carbon dioxide):** Liquefiable, colorless gas; with a density of 1.97 g/l. It forms a volatile, heavy, and colorless liquid with a density of 1.101 (-37°C).
When comprising the liquid, the result is a solid similar to ice (dry ice) with a density of 1.56 (-79°C). Soluble in water, acid, alkalis and in most part of organic solvents. Chemical formula CO₂. It is obtained as a byproduct in the production of ammonia. In Pemex it is obtained at the petrochemical plants of Camargo, Cosoleacaque and Salamanca. It is a suffocating gas at concentrations over 10%; in low concentrations from 1 to 3% it increases the ventilation of lungs. It is used to obtain urea, carbonates, bicarbonates, cooling and carbonated beverages. It is handled through pipelines and tank trucks.

**Aromatics:** Hydrocarbons with unsaturated cyclic structure, generally with smell and good solvent properties, for example, the benzene.

**Aromatization:** The conversion of aliphatic or alicyclic compounds to aromatic hydrocarbons.

**Benzene:** Is the simplest aromatic compound and one of the most important raw materials in the chemical industry. It is a non-polar, colorless liquid, with aromatic odor, boiling temperature of 80.1°C, fusion temperature of 5.5°C, density of 0.8790 (20/4°C), soluble in alcohol, ether, acetone, carbon tetrachloride, slightly in water, and formula C₆H₆. It is obtains by means of two processes: the catalytic reformation of naphtha (BTX) and the hydrodealkylation of toluene. At present, Pemex prepares this product at the petrochemical plant La Cangrejera and at the refinery of Minatitlan, Veracruz. It is utilized for the preparation of ethylbenzene, phenol, cyclohexane, dodecylbenzene, maleic anhydride, dichlorodiphenyltrichloroethane, nitrobenzene, cumene and hexachlorobenzene. It is handled through tank cars and tank trucks.

**BTX:** Acronym representing the benzene, toluene and xylene aromatic hydrocarbons.

**Production Capacity:** The amount of product that can be elaborated by a plant according to the process facilities.

**Nameplate capacity:** The specified or planned production capacity by the manufacturer of a process unit or the maximum amount of a product that can be prepared when operating the plant at its maximum capacity.

**Idle capacity:** The component of operable capacity that is not in operation and that is not under active repair, but capable for commissioning in less than 30 days; and capacity not in operation but under active repair that may be completed within 90 days.
Operable Capacity: The percentage of the operation capacity being operated at the beginning of the period; or that is not in operation or under active repair, but capable for commissioning in 30 days; or that is not in operation but under active repair that can be completed within 90 days. The operable capacity is the sum of the capacity in operation and the idle capacity and is measured in barrels and/or tons per each calendar day.

Operation capacity: It is the real operation capacity of a plant.

Vinyl chloride (chloroethylene): Easily liquefiable gas with ether odor, which is generally presented in a colorless and inflammable liquid, with a density of 0.912, boiling temperature of -13.9°C. It polymerizes in the presence of light or catalysts. Soluble in carbon tetrachloride, ether, ethanol, little soluble in water. Molecular formula CH₂=CHCl. It is produced thanks to the disintegration of dichloroethane, obtaining hydrochloric acid as a byproduct. At present, Pemex prepares it at the Petrochemical Plant Pajaritos. It is mainly utilized to prepare polyvinyl chloride (PVC), tiles, shapes, and film for upholstery, among others. It is handled through tank cars and tank trucks.

Cumene (Isopropyl benzene): Colorless liquid soluble in ethanol, carbon tetrachloride, ether and benzene, insoluble in water, with boiling point of 152.7°C and formula C₆H₅-CH(CH₃)₂. It is obtained from the catalytic alkylation of benzene and propylene (chemical degree) or propylene from the C₃ cut of refinery gases. The reaction is made between 200 and 250°C at a pressure of 400-600 lb/plg². At present, it is produced at the Petrochemical Plant La Cangrejera. It is used basically in the production of phenol and acetone. Toxic when ingested, inhaled, absorption in the skin, narcotic in highly concentrations.

Styrene (Benzene vinyl, phenylethylene): Yellowish, odorous, oily liquid, with a density of 0.945 (25/25°C), which polymerizes slowly when stored and quickly when heated or exposed to the light or peroxides. The ethylbenzene is transformed into styrene by means of a catalytic dehydrogenation in the presence of steam (90% performance). It is marketed in two presentations: technical degree 99.2% and polymer degree 99.6%. It is obtained at the Petrochemical Plant La Cangrejera and is utilized mainly in the production of polystyrene, rubber, latex and others. Toxic when ingested or inhaled. It is handled through pipelines, tank cars and tank trucks.
**Ethylbenzene (phenylethane):** Colorless liquid heavier than the air, with a density of 0.867 (20°C). It has three presentations; technical, pure and for research. It is produced by means of the alkylation of benzene with ethylene in the steam phase at La Cangrejera, and is used mainly for the production of styrene. It is toxic and irritating.

**Ethylene, ethene:** Colorless gas with sweet flavor and odor, with a density of 0.5139 (20°C). It is obtained by means of the disintegration of ethane recovered from liquids of natural gas. The ethane with water steam is pyrolized in an oven at a temperature from 850 to 900° C. It is obtained at the petrochemical plants La Cangrejera, Morelos, Pajaritos, Escolin and Reynosa, being mainly utilized in the production of polyethylene, acetaldehyde, ethylene oxide, dichloroethane and ethylbenzene.

**Absorption gasoline:** Gasoline extracted from the natural gas or refinery gas. The gaseous steam is put in contact with absorption oil, which is finally distilled to obtain gasoline.

**Glycols:** Group of organic compounds that are characterized for containing two hidroxi radicals in their structure. The monoethylene glycol is prepared by means of the thermal hydration of the ethylene oxide in the presence of an excess of water. The diethylene glycol and triethylene glycol are obtained as byproducts from the reaction. The conversion of oxide into glycols is almost complete. Pemex obtains them at La Cangrejera and Morelos. They are utilized to dehydrate gases or liquid hydrocarbons or for inhibiting the formation of hydrates. In car radiators they are utilized as antifreeze; glycols commonly utilized are ethylene glycol, diethylene glycol and triethylene glycol. Ethylene glycols have in general little toxicity and a minimum explosivity limit of 3.2% (air).

**Raw material for carbon black.** Hydrocarbon obtained from petroleum or coal from which carbon black is obtained. It is obtained from a cut of high aromaticity hydrocarbons. It is utilized in the industry of natural and synthetic rubber for the production of tires, conveyor belts, etc.
Methanol (methyl alcohol, wood alcohol): Colorless, volatile, and very polar liquid, with a density of 0.792 (20/4°C) and formula CH₃-OH. It is synthesized when hydrogen reacts with carbon monoxide; these two components constitute the synthesis gas that is obtained for reformation of the natural gas. At present, in Pemex it is produced at the Independencia Petrochemical Center. It is utilized especially to obtain dimethyl terephthalate, formaldehyde and methacrylate. It is inflammable and toxic when ingested; it provokes blindness.

Naphtha: Generic name applied to the fractions of crude oil and liquid products of the natural gas with a boiling temperature that oscillates between 175 and 240°C.

Light naphtha: Cyclic and paraffin hydrocarbons found in the C₄–C₇ interval.

Heavy naphtha: Cyclic and paraffin hydrocarbons found in the C₈+ interval.

Orthoxylene (1, 2-dimethylbenzene): Colorless, toxic liquid with a density of 0.881 at 20/4°C. Formula C₆H₄(CH₃)₂. It is obtained from the divider of aromatics, in which xylenes are separated. The o-xylene is separated from the mixture of meta and p-xylenes by distillation. Its obtaining in Pemex is carried out at the Petrochemical Plant La Cangrejera. It is used to produce phthalic anhydride, although it may be utilized in the production of vitamins and pharmaceutical synthesis. Toxic when ingested or inhaled. It is handled through tank cars and tank trucks.

Ethylene oxide (Epoxyethane): Organic compound in gaseous state at ordinary temperature, colorless, soluble in organic compounds, miscible in water, with a density of 0.8711 (20/20°C). Formula (CH₂-CH₂)O. In Petroleos Mexicanos, the catalytic oxidation of ethylene is obtained at La Cangrejera, Morelos and Pajaritos. It is utilized in the production of ethylene glycols, surface-actives, ethanolamines, etc. It is reported as a cancerigenic potential. It is handled through tank cars.

P-xylene (1,4-dimethylbenzene): Colorless or solid liquid (colorless monocyclic crystals) whose fusion and boiling temperatures are 13 and 138°C respectively, with a density of 0.861 (20/4°C); soluble in alcohol, ether and other organic solvents in all proportions; practically insoluble in water, it is volatile under atmospheric and inflammable conditions at temperatures over 27°C. Formula 1, 3-C₆H₄(CH₃)₂.
It is produced by means of the catalytic reformation of naphtha, which is distilled to separate the components of the mixture. Its obtaining in Pemex is carried out at La Cangrejera. It is utilized in the production of dimethyl terephthalate (DMT) and for terephtalic acid; both are raw materials in the textile industry, for the manufacturing of polyester fibers. Toxic when ingested and inhaled. It is handled through pipelines and tank trucks.

**High density polyethylene (HDP) and low density polyethylene (LDPE):** White solid. Its density is over 0.950 g/cm³ (HDP), or 0.915 g/cm³ (LDPE), fusion temperature of 135°C and 115°C respectively, insoluble in water, high electric resistance. Chemical formula (-CH₂- CH₂-)ₓ. The polymerization of ethylene is obtained in the presence of a catalyst based on aluminum and titanium at atmospheric pressure and at 60°C. It is not necessary to utilize high purity ethylene, but it is necessary to get rid of main impurities. In Pemex, they are produced at La Cangrejera (LDPE), Escolin (HDP and LDPE), Morelos (HDP) and Reynosa (LDPE). They are mainly utilized in the production of boxes for sodas, bottles, containers, toys, cable coatings, etc. Non toxic but inflammable. It is handled through 25 kilogram sacks.

**Polymerization:** Process through which two or more simple molecules unite to form a larger molecule called polymer. In the refinery process of petroleum, the temperature and pressure are utilized to polymerize light hydrocarbons into larger molecules, such as those utilized to produce high octane gasoline. In the production of petrochemicals, unions are generated to form plastics, for example, polyethylene.

**Polymer:** Substance consisting of large molecules formed by many small units that are repeated, calls monomers. The number of units repeated in a large molecule is called polymerization degree. Some examples of polymers are polyethylene and polypropylene.

**Polypropylene:** Crystalline solid with a density of 0.90 g/cm³, fusion temperature between 168 and 171°C, insoluble in organic solvents, is softened with hot solvents, formula (C₃H₅)ₓ. In Pemex it is produced in Morelos. It is utilized in plastics, tubes, bottles, artificial grass, etc. Not toxic, it burns slowly.
Propylene (propene): Colorless, stifling, inflammable, and explosive gas with a lightly sweet scent, soluble in alcohol and ether, slightly soluble in water; boiling point-47.7°C, and formula CH$_3$CH=CH$_2$. It is obtained as a byproduct at FCC catalytic plants that are utilized to increase the amount and quality of the gasoline. A small part is obtained as a byproduct from ethylene plants (upon the thermal disintegration of the ethane). At present, in Pemex it is produced at La Cangrejera and Morelos. Three purity degrees are marketed: 95% (refinery degree), 99% (polymer degree) and for research purposes or chemical degree. It is mainly utilized in the production of acrylonitrile, propylene tetramer, dodecylbenzene, cumene and isopropyl alcohol.

Propylene tetramer, tetrapropylene: Colorless flammable liquid with similar characteristics to kerosene whose boiling rank goes from 183 to 218°C. Formula (CH$_2$=CH-CH$_3$)$_4$. It is produced through the condensation of four molecules of propylene in the presence of a catalyst. In Pemex, it is produced at the Independencia Petrochemical Center and is utilized mainly to produce dodecylbenzene.

Toluene (Methylbenzene): Colorless liquid with aromatic odor, density of 0.866 (20°C/4), boiling temperature of 110°C, soluble in ether, ethanol, acetone, benzene and insoluble in water and chemical formula C$_6$H$_5$CH$_3$. In Pemex the catalytic reformation is produced by means of aromatic naphtha (hydroforming process) at La Cangrejera. In the process, a mixture of aromatic hydrocarbons is obtained. The obtaining of benzene, benzoic acid and others is obtained and it is used as a solvent of paintings, lacquers and varnishes. Inflammable, toxic when inhaled, when absorbed and in contact with the skin. It is handled through tank cars and tank trucks.

Urea: White powder, somewhat hygroscopic, similar to sugar with a melting point of 132.7°C, also known as carbamide; it breaks down before arriving at its boiling temperature; soluble in water, alcohol and benzene, content of nitrogen 46.55% in weight, with formula CO(NH$_2$)$_2$. The urea is produces by indirect dehydration of ammonium carbamate, intermediary formed when an excess of ammonia with carbon dioxide reacts at high pressure. The commercially prepared urea is utilized in the manufacturing of agricultural fertilizers. Also it is utilized as a stabilizer in explosives of nitrocellulose and is a basic component of synthetically prepared resins. A little toxic; non flammable; with diuretic and antiseptics effects in the human being.
Commercialization of Oil Products
Distribution of gasolines
DISTRIBUTION AND COMMERCIALIZATION

Pemex transports its products between producing centers and sales centers through pipelines, tank barges, tank cars and tank trucks with the purpose to cover the demand throughout the country.

Products are sold by means of two fundamental modalities: wholesale and retail trade. Wholesale trade is carried out at three types of centers: the producing center; the shipping center and the maritime terminals, destined fundamentally to the distribution of large volumes. The second modality of distribution, the retail trade, is integrated by 77 sales centers of Pemex Refinacion throughout the country, which focus their activity on the sales for service stations and the private users.

To distribute its products, Pemex prepares a monthly distribution program taking into account, among others, the following variables: the regional demand, the process of crude oil and the corresponding performances of each product at each Refinery, the prices in the domestic market and the unit costs of distribution.

Petroleos Mexicanos markets its products abroad by means of PMI Comercio Internacional, who buys, sells and transports hydrocarbons elaborated by the four subsidiary agencies.

**Tank truck:** Transportation utilized and conditioned to transport oil or petrochemical products. It is the most flexible mean of transportation available, since its reply velocity to the presentation of requirements is larger, and it practically does not require prior infrastructure for its use. On the other hand, it is the highest unit cost.
**Barge:** Deposit towed by a vessel. It is not a vessel since is not driven by itself. They are utilized to transport oil products through rivers, lakes, etc. A drilling system may be assembled on a barge and it may be utilized to drill wells in lakes.

**Anchor buoy:** Floating mark utilized in signaling systems, restricting exploration, exploitation or spill areas.

**Tank barge:** Barge divided into compartments that are utilized to transport crude oil and/or its derivative products. It is the mean of transportation with relatively low operation unit cost that allows the execution of large economies of scale. Nevertheless, its infrastructure requirements are large and expensive, both for the acquisition of the tank barge and the execution of harbor works required to operate. It is a very adequate mean of transportation when it has to do with moving large volumes to large distances.

**Coastal traffic:** Maritime traffic on the coasts of the same country.

**C&F:** (Cost and Freight). International trade commerce meaning cost and freight. The salesperson shall pay the necessary costs and freights to carry the merchandise to the destination. The risk of loss or damage, as well as any increase in the costs is transferred from the salesperson to the buyer, when the merchandise passes the shipboard on the shipment port.

**Tank car:** Railway car used to transport liquids.

**CIF:** Cost, Insurance and Freight. This term indicates that the salesperson covers the cost and freight and besides he/she has to acquire an insurance against the risk of loss or damage of the merchandise during the transportation. The salesperson establishes the contract with the insurer and pays the insurance premium.

**Bill of lading:** It is the receipt signed by the common carrier or an individual acting on his/her behalf, issued by the shipper, which acknowledges that the merchandise has been shipped in a certain mean of transportation and to a certain destination described therein. Is the evidence that the merchandise has been shipped.

**Floatboat:** Type of vessel sometimes used to transport a great variety of products through channels.
**Pig:** Petroleum term utilized to describe the equipment used to clean and inspect pipelines. For its cleaning, the pig is introduced in the pipeline and is guided by the operating pressure through it. An "assembled pig" is the one equipped with sensors, which verify the levels of corrosion or defects in the pipeline.

**Availability:** Volume of intermediate or final products that is ready to be utilized for self-use, sale, or load to plants.

**Distribution:** Assembly of activities mainly focused on the transportation of hydrocarbons and its derivative products, toward different places, whether of process, storage or sale, by means of pipelines, vessels, tank cars or tank trucks.

**Dike:** Wall built to contain liquids. In the case of vessels, it is the place where they are cleaned, built or repaired. In terms of storage, this obstacle contains fuel spills.

**Pipeline:** Tubing connected, generally buried or placed on the marine bed, that are used to transport crude oil, natural gas, oil or petrochemical products utilizing mechanical elements, compressed air, vacuum or gravity as the driving force; exteriorly they are protected against the corrosion with coal tar, fiberglass and asbestos plush, with a thickness between 2 and 48 inches of diameter according to their use and type of soil where they are located. It is the mean of transportation that offers maximum economy of operation and maximum useful life, but it is also the one that requires the maximum investment and presents the minimum of flexibility.

**Service station:** (gas station). Place in which automobile fuels and products manufactured by the refinery industry are sold. These may be property of Petroleos Mexicanos or as franchisees. According to the assembly of services offered, they are classified in two and three stars.

**Production to be sold:** Net production ± variation of inventories ± transfers to other products outside the producing center.

**FOB:** (Free on Board). The salesperson delivers the merchandise to the port or terrestrial space agreed on the purchase and sale contract. The risk of loss or damage is transferred from the salesperson to the buyer when the merchandise has been passed over the transportation shipboard or starboard, i.e., that the salesperson assumes all the responsibility and costs until the specific point of delivery.
**Natural line:** Line used for the transportation of gas.

**Stock:** List in which goods and their amounts or availability are detailed, whether of finished or in-process products, raw materials, machines, tools, etc., that belong to the company, on a specific date.

**Spot market:** International market in which crude oil or its derivative products are sold for immediate delivery at current price ("spot" price).

**Crude line:** Line used for the transportation of crude oil.

**Losses (reductions).** Volume reductions that occur during activities being carried out since the product is manufactured until it gets to the final user. Among others, we find the losses due to storage, transportation and distribution.

**Products pipeline:** Line used for the transportation of petrochemical and oil products.

**End user sale price:** Sale price of finished products to users, including taxes (VAT, special tax on production and services, etc.):

**Interagency price:** Price set forth by Pemex based on its price politics to value products object of exchange between its subsidiary agencies. Said price includes adjustment per quality and logistics cost in function of the balance between offer and demand of each product in the domestic market:

Interagency price = reference price + adjustment per quality + net logistics cost.

**Reference price:** Price taken at relevant markets for the commerce of hydrocarbons produced or acquired by Pemex. Said reference price is the most representative price to simulate the competition conditions in an open market.

**Resale price:** Price fixed to another subsidiary or agency so that it resells the product.

**Transfer price:** Price assigned to trends inside a complex, process center (among plants).

**Informative price:** It refers to the price utilized as a base input of a reference price formula to set the export price of crude oil and/or products.
**Netback price:** It is the price that given its characteristics of competitiveness in the international market for those products that Pemex manufactures or acquires, is considered as the most representative price to simulate the competition conditions in an open market.

**Producer price:** Price of the finished product assessed at the door of the center in which it is produced.

**Storage and Distribution Terminal:** (TAR, as in Spanish). Assembly of facilities for receiving, storing, delivering and distributing petroleum products that generally supplies one area; nevertheless, it may also supply other areas, depending on the size of facilities. There are several terminals located throughout the country and they may be maritime or terrestrial. TARs are located at strategically selected areas, based on the demand, geographical configuration and roadways.

**Stocks change:** The stocks change reflects the difference between the closing stocks level with regard to the start stocks level of the period being analyzed. A positive difference reflects an accumulation of stocks and a negative one, a reduction.

**External sales:** Sales that PEMEX bills to its clients outside the national territory.

**Domestic Sales:** Sales that PEMEX bills to its distributors in the national territory or that are directly performed with national clients for final and intermediate use. The value of sales excludes taxes (special tax on production and services and VAT) and charges to distributors.
COMPLEMENTARY GLOSSARY

Other Technical Terms

**Adsorption:** Superficial retention of atoms, ions or molecules of a gas or liquid (adsorbate) by a solid or liquid (adsorbent).

**International Energy Agency, IEA.** Founded in November 1974 as an autonomous entity inside the OECD to implement an international energy program. Its basic purposes are: to monitor the world energy condition and to develop strategies to provide energy during emergency periods.

**Residual water:** Water with different composition coming from the discharges of commercial, industrial, municipal, services, agricultural, livestock, domestic and in general of any another use, as well as their mixture.

**Environmental audit:** Systematic and documented verification process to obtain and evaluate objectively tests that determine if specified environmental activities, events, conditions, administrative systems or the information regarding this issues are adjusted to the audit criteria and to communicate the results of this process to the client.

**Mass balance:** To take into account the mass flow that goes into and goes outside the system, the generalized way of the conservation of the matter law is stated as a mass balance that is nothing but an accounting of mass flows and changes in the mass stock of the system, which indicates that the accumulation is equal to the inflows minus the outflows.

**Energy balance:** Count representing the assembly of balance ratio that measures the physical flows through which the energy is produced, is exchanged with the outside, is transformed, and is consumed, etc., all this calculated in a common unit, for a specific period (generally a year).

**BTU:** British Thermal Unit. The amount of heat required to increase the temperature of a pound of pure water under normal conditions of pressure and temperature in one Fahrenheit degree.
**Specific heat:** Amount of heat necessary to increase the temperature of a substance’s mass unit in one degree. In the International System of Units, the specific heat is expressed in joules per kilogram and Kelvin degrees; from time to time it is also expressed in calories per gram and Celsius degree. The specific heat of the water is a calorie per gram and Celsius degree, that is, one calorie must be supplied to one gram of water in order to raise its temperature in one Celsius degree.

**Emission Certificate:** It is a document issued by the Ministry of Environment, Natural Resources and Fishing (SEMARNAP, as in Spanish), that credits the amount of contaminants in the atmosphere that a fixed source is allowed to issue in one year according to its nominal capacity and the regional level of emissions.

**CNGM:** North American Coast of the Gulf of Mexico, acronym in Spanish.

**Oxidizer:** The substance that oxidizes fuels, that is, it activates or initiates the combustion, and the most common is oxygen, although in special cases there are others, such as chlorates and bromates.

**Fuel:** Any substance used to produce calorific energy through a chemical or nuclear reaction. The energy is produced by the conversion of the flammable mass into heat.

**Liquid or gaseous fossil fuels:** Crude oil and natural gas by-products, such as diaphanous petroleum, gasoline, diesel, fuel oil, diesel oil, liquefied petroleum gas, butane, propane, methane, isobutane, propylene, butylene or any of their combinations.

**Solid fuels:** They are the varieties of mineral coal and petroleum coke whose fixed content of carbon varies from 10% until 90% in weight.

**Combustion:** Fast chemical reaction between flammable substances and an oxidizer, generally oxygen that is usually accompanied by heat and light in the shape of a flame. The combustion process is commonly initiated for factors such as heat, light or sparks, which allow that flammable materials reach the corresponding specific ignition temperature.

**Condensation:** It is the result of the reduction of temperature caused by the elimination of latent heat of evaporation; sometimes the resultant liquid of the process is called condensate. The elimination of heat reduces the volume of steam and reduces the speed of its molecules and the distance among them.
According to the kinetic theory of the behavior of the matter, the loss of energy leads to the transformation of gas into liquid.

**Energetic consumption:** Consumption of product such as gasoline, natural gas, diesel, liquefied gas, electricity, fuel oil, kerosene, etc., whose purpose is to generate heat or energy, for transportation, industrial or domestic use.

**No energetic consumption:** Use of products such as gasoline, natural gas, diesel, liquefied gas, electricity, fuel oil, kerosene, etc., to be used as raw material in processes.

**Own use (self-use):** Use of energy to produce primary and/or secondary energy used by the sector for their operation, for example, the use of gasoline and diesel required by engines.

**Density:** Magnitude that represents the mass of a substance divided by the volume it occupies. In the International System, the unit utilized is kg/l.

**Dehydration:** Action to extract liquids from gas pipelines; as well as the extraction of water from crude oil emulsified and streams of liquid and/or gaseous hydrocarbons.

**Desorption:** Inverse process to the adsorption in which the material absorbed is removed from the adsorbent.

**Statistical differences:** It is the difference between points of measurement, in a balance, and they may be as a consequence of losses by evaporation, compression and transportation.

**Boiling:** It is the physical process that occurs when the steam pressure of a liquid equals the existing atmospheric pressure on said liquid. During the boiling, steam is created inside the liquid, which escapes as bubbles.

**Final energy:** The primary or secondary energy utilized directly by the final user. It is the energy as it goes into the user sector and is differentiated from the net energy (without losses of transformation, transmission, transportation, distribution and storage) by the own use of the sector energy. It includes the energy and non-energy use.

**Unused energy:** It is the energy that due to the technical and/or economic availability of its exploitation, at present is not being utilized, for example: crude oil spilled, gas released into the atmosphere, etc.
**Primary energy:** Primary energy refers to the different forms of energy as they are obtained in the nature, whether in direct form as in the case of the hydraulic or solar energy, firewood, and other vegetable fuels; or after an extraction process such as petroleum, mineral coal, geoenergy, etc. **Secondary energy:** It refers to the different energy products coming from different transformation centers and whose purpose is the sectors of use and/or transformation centers.

**Useful energy:** It is the energy really utilized in final energy processes, since not all the energy that goes into to a user system is taken advantage of and depends in each case of the efficiency of consuming equipment. The net energy to which losses due to the utilization of the equipment or devices where they are consumed at the user have been discounted. Applicable to both the own use and the final energy use.

**Evaporation:** Gradual conversion of a liquid into a gas without boiling. The molecules of any liquid are in constant movement, the mean (or average) velocity of molecules only depends on the temperature, but there may be individual molecules that move at a much greater or smaller velocity that the mean. At temperatures under the boiling point, it is possible that individual molecules approaching the surface with a velocity over the mean have the sufficient energy to escape from the surface and to go into to the space located over the gas molecules. Due to the fact that only the fastest molecules escape, the mean velocity of the other molecules is reduced; given the fact that the temperature, in turn, only depends on the mean velocity of molecules, the temperature of the remaining liquid is also reduced.

**Fluid:** Substance that immediately gives in to any strength altering its form, with which it moves and adapts to the form of the container. Fluids may be liquids or gases.

**ISO 9000:** Term applied to a series of standards sponsored by the International Standardization Organization (ISO). The ISO created ISO 9000 with the purpose of standardizing the quality systems that should be set forth by the manufacturing and services companies around the world. It is a consequence of and almost alike to the BS-5750 British Standard. It is also virtually identical, in the majority of aspects, to the IN-29000 European standard and to the Q90 American Standard sponsored by the American Society for Quality Control. ISO 9000 is a system to establish, document and maintain a procedure that ensures the quality of the final product.
Predictive maintenance: Group of techniques for the diagnosis, which generally consist of measurements and registrations for periodic interpretations that show the performance of the equipment in a determined period of time, in such a way that it provides the possibility to foresee the failure and to do the corresponding corrections, which allow preserving the equipment in an adequate operation.

Preventive maintenance: These techniques are based on the statistics and the regular and systematic review that allows making the exact decisions to avoid a failure. The preventive maintenance allows us planning and programming the corrective maintenance. With this technique, spare periods and timely changes of the equipment for replacement equipment are set forth.

Corrective maintenance: It refers to repairs or improvements of the equipment that has been damaged or deteriorated due to inadequate conditions of operation variables, or either for the normal wear of an operation sustained for a long period of time.

OPEC: Organization of Petroleum Exporting Countries. International organization in charge of coordinating petroleum-related policies prepared by its members. The OPEC, which was founded in 1960, is constituted by 12 countries: Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, and Venezuela (Ecuador joined in 1973, but abandoned the organization in 1992). The headquarters of the OPEC are located in Vienna (Austria). Its supreme authority is the Conference, composed by highly representatives of the government members, who met at least twice a year to define the political guidelines to continue with respect to petroleum exports. The Committee of Governors applies the resolutions of the Conference and administers the organization.

PEP: Acronym in Spanish referring to the Pemex Exploration and Production agency, which forms part of Grupo Pemex. Its main objective is to maintain the global levels of production of crude oil and to incorporate proven reserves of hydrocarbons that ensure the long-term availability.
PGPB: Acronym in Spanish referring to the Pemex Gas and Basic Petrochemical agency, which forms part of Grupo Pemex. Its main objective is to process natural gas and liquids from natural gas, to transport, to distribute and to market natural gas and liquefied gas in the national territory, and to produce and market basic petrochemicals for the petrochemical industry.

PMI: Acronyms referred to PMI Comercio Internacional S.A. de C.V., a company in which Petroleos Mexicanos has capital stock. PMI Comercio Internacional has under its charge the execution of foreign trade operations of PEMEX, such as the export of crude oil and the export and import of chemical, petrochemical and oil products and catalysts.

Calorific value: Amount of heat produced by the complete combustion of a flammable substance. It may be measured dry or saturated with water steam; "net" or "rough". The term rough means that the water steam produced during the combustion has been condensed into a liquid, thus releasing its latent heat. On the other hand, "net" means that the water is maintained as steam. The use is "dry" and "rough".

PPQ: Acronym in Spanish referring to the Petrochemical Pemex agency, which forms part of Grupo Pemex. Its main objective is to prepare and market different petrochemical products that serve as the basis for the chemical and manufacturing industry.

Potential hydrogen (pH). Measurement of the acidity or alkalinity in a system. The temperature of reference for the pH is 25°C and its scale goes from 0 (highly acid) to 14 (highly basic), for pH = 7 the solution is neutral.

PR: Acronym in Spanish referring to the Pemex Refinacion agency, which forms part of Grupo Pemex. Its main objective is to transform the crude oil into oil products that comply with the strictest ecological standards and to satisfy the growing domestic demand throughout its complex distribution network.

Byproduct: Product obtained in a secondary way during the manufacturing process of another product (main product of the reaction).

Floating roof: Cover on the surface of liquid hydrocarbons contained in a tank floats along with the level of the liquid. A floating roof eliminates the steam contained above the liquid in the tank and preserves light fractions of the liquid.
**Critical temperature:** Temperature from which two fluid phases stop occurring (liquid and gas) thus existing only one fluid phase.

**Autoignition temperature (spontaneous combustion):** The minimum temperature to which petroleum steams mixed with the air are inflamed without any external ignition source. The work of internal combustion diesel engines is based exactly in this property of petroleum by-products. The autoignition temperature is of several hundreds of degrees higher than the inflammation.

**Ignition temperature:** The minimum temperature to which the steam, from the product being analyzed, when introducing an external inflammation source, form a stable flame that does not extinguishes. The ignition temperature is always higher than that of the inflammation and frequently the difference is of several degrees.

**Free Trade Agreement (NAFTA):** Economic pact, whose original name is North American Free Trade Agreement (NAFTA), that establishes the gradual suppression of tariffs and other barriers to the free trade in the majority of products manufactured or sold in North America, the elimination of barriers to the international investment, and the protection of copyrights. The NAFTA was signed by Canada, Mexico and United States on December 17, 1992 and became effective on January 1, 1994.

**Viscosity:** Property of a fluid that tends to be opposed to its flow when a force is applied on it. The viscosity in poises is defined as the magnitude of the force (measured in dynes per square centimeter of surface) necessary to maintain, in equilibrium, a difference of velocity of 1 cm per second among layers separated by 1 cm. The viscosity of the water at room temperature (20°C) is of 0.0100 poises; in the boiling point (100°C) it is reduced until 0.0028 poises.
Financial Terms

**Assets:** Goods that are still immersed in the production and final good pending to be distributed; the main assets of a company are: its facilities and machinery, its stocked goods of raw materials and semi-finished products. They also include debts pending of collection, for example, the collection of goods sold but not charged, or the collection of interests per financial assets.

**ADEFAS:** Tax Indebtness from Prior Fiscal Years, as in Spanish. Is the assembly of obligations contracted, registered and authorized of prior fiscal years with charge to the current budgetary fiscal year.

**Amortization of debt:** *(Repayment, amortization).* It is the partial or total payment of capital in the form and in the terms agreed; it does not include the payment of interests.

**Government Charges:** Tax collections resulting from surcharges, fines and other public law revenues, not classifiable as taxes, rights or products.

**Allocation:** Term utilized to state the amount of the budget authorized by the legislative power to agencies integrating the system.

**Final allocation:** It states the modified amount of the original allocation plus the budgetary appropriations that may be extensions or reductions.

**Backwardation:** When the current price of an underlying asset is greater than the future estimated price.

**Financial balance sheets:** It is an accounting document that shows us the assets, liabilities and equity capital on a specific date. It is presented in a global and consolidated way and per each subsidiary agency.

**Bonus:** Legal credit instrument through which the commitment to pay a prefixed amount on a specific date is acquired, provided that determined requirements are met.

**Equity:** It represents the part of assets in a company financed by common and preferential shareholders.

**Actual assets:** They refer to long-term productive assets (plant and equipment).
**Capitalization:** Process through which interests are integrated into the capital.

**Private allocation:** The direct sale of securities to a financial institution made by a company. The intermediary is eliminated and the allocation cost for the company is reduced.

**Public allocation:** The sale of securities among the public by means of the traditional process of the stock exchange as the intermediary. The public allocations shall be registered before the Securities and Exchange Commission.

**Assets purchase:** A financial accounting method to register merges in which the difference between the purchase price and the adjusted value in books is acknowledged as the commercial credit and is paid throughout a maximum period of 40 years.

**Concession:** Governmental transfer by means of which an individual is offered rights for the exploitation or use of a property in the country.

**Constant Pesos Accounting (Updated):** It is one of the methods to restate the financial statements that have been approved by the Financial Accounting Standards Board. The financial statements shall be adjusted to present prices, by utilizing the user price index. Generally this information is presented as explanatory or complementary notes, or as complimentary statements to the financial statements.

**Accounting of updated costs:** One of the methods known for restating financial statements approved by the Financial Accounting Standards Board in 1979. The financial statements are adjusted to present information of updated costs and not only an index. This information is presented as complementary information.

**Fixed costs:** Costs remaining relatively constant without taking into consideration the volume of operations. Some examples include rents, depreciations, property taxes and certain administrative expenses.

**Inventories costs:** It includes items such as interests, storage costs, insurances and expenses due to the handling of materials.
**Variable costs:** Costs that fluctuate in a direct form with a change in the production volume. As an example it includes raw materials, direct factory labor and charges for salespersons.

**Depreciation:** In accounting terms, process to assign in a rational and systematic way the cost of a capital good during its validity. The depreciation enters in the books the reduction of the utility potential of assets invested in a business, due to the physical wear of the asset caused by the frequent use, to the deterioration due to the action of elements, to the obsolescence due to technological changes or to the introduction of new and better machines and production methods. The term depreciations may also be applied to the monetary units to express its devaluation due to the inflation or to a smaller demand of said currency compared with others.

**Rights:** They are the fiscal liabilities set forth by the authority, according to the law, in the payment of a service.

**To be owed:** It is the registration of a revenue or expenditure in the accounting period to which it refers, in spite of the fact that the receipt or the disbursement may be made, in the same period or later on.

**Net debt:** Difference resulting when comparing the expenditures per amortization of debt with the revenues due to the allocation of loan capitals (dispositions).

**Income statement:** A financial statement that measures the profitability of the company through a period. All the expenses are subtracted from the sales in order to obtain the net profit.

**Income statement forecast:** A projection of anticipated sales, expenses and profits foreseen.

**Consolidated financial statements:** Documents quantitatively showing the origin and application of resources utilized by companies with the objectives established, showing the result obtained, its development and the condition related thereof.

**Financial statement forecast:** A series of projected financial statements. Also important, the results statement forecast, the balance forecast and the cash budget are included.

**Consolidated budget statements:** Documents reflecting the assembly of expenditures carried out by the central and semi-private section, with charge to the Expenditures Budget of the Federation.
Cash flow: Financial statement presenting the balance of the revenues and expenditures performed by each agency in a consolidated manner. Revenues are represented due to domestic sales, interagency sales, exports and several revenues; and expenditures, and due to operation and investment expenditures, interagency purchases, direct and indirect taxes, payment of interests and yields.

Investment expense: Total of allocations for the creation of capital and conservation goods of those that already exists, to the acquisition of real estate goods and securities by the company, as well as the resources transferred to subsidiaries for the same purposes.

Operation expense: Amount of expenditures for the development of administrative and production functions, such as: labor expenses, acquisition of materials, conservation, maintenance and general services. These operations do not increase the assets of the company.

SPPS: Special Tax on Production and Services, as in Spanish. Tax through which the Federal Government levies the self-use and the sale of gasoline, diesel, and natural gas of carburetion that Pemex Refinacion and Pemex Gas y Petroquimica Basica perform with authorized dealers, who in turn sell directly to the final user.

Direct Tax: Tax imposed by the government to individuals and corporate entities directly on their revenue or profits respectively. The income tax of individuals and the tax on the benefit of partnerships are examples of this tax and the main sources of resources for governments in countries.

Indirect tax: Taxes that levy the sale and use of specific goods. Indirect taxes may be, a good of fixed amount, enlarging in one same quantity the price of all the goods being levied, or well a percentage of the initial price, for which the price of most expensive goods will increase, for example: VAT, Special Tax on Production and Services (IEPS, as in Spanish), and government charges on gas, gasoline and others.

VAT: Value-Added Tax.

Ministration: Term utilized in the petroleum system to indicate the shipment of money on the part of Pemex Corporation to agencies.
**Alien Operations**: Term utilized to describe those operations carried out by Pemex and subsidiary agencies that are not business-related. For example, those that may be recovered, such as: loans, savings fund, and those on the account of third parties: income tax withholding to companies outside the petroleum system. There are revenues and expenditures per alien operations.

**PIDIREGAS**: Term referred to the group of to the long-term productive infrastructure projects.

**Strategic Investment Projects**: Projects whose execution follows decisions that compromise the course of the institution; which in the short and medium-term require large amounts of resources from the company and that require of long development periods.

**Operational Investment Projects**: Projects that follow short-term operating problems; their investment amounts are proportionally smaller to those required by strategic investment projects; their development terms are short in order to reply to immediate needs and generally, it has to do with complementary or maintenance projects related to the current productive plant.

**Operation result**: Results statements that shows at an accrued level the profit or loss reached by the subsidiary agencies in its commercial and productive operation that results from the difference between revenues and total expenditures. Revenues are represented by: internal sales, interagency sales, exports and several revenues and variables expenditures (interagency purchases and imports), as well as fixed (operation expenses, labor reserve, corporate expenses and depreciaions). This statement does not include interests and taxes.
### Abbreviations used

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA</td>
<td>Airports and Auxiliary Services</td>
</tr>
<tr>
<td>°C</td>
<td>Degree Celsius</td>
</tr>
<tr>
<td>°F</td>
<td>Degree Fahrenheit</td>
</tr>
<tr>
<td>ABS</td>
<td>Acrylonitrile, Butadiene, Styrene</td>
</tr>
<tr>
<td>API</td>
<td>American Petroleum Institute</td>
</tr>
<tr>
<td>b</td>
<td>Barrels</td>
</tr>
<tr>
<td>bd</td>
<td>Barrels per day</td>
</tr>
<tr>
<td>bpce</td>
<td>Equivbarrels of oil equivalent</td>
</tr>
<tr>
<td>Btu</td>
<td>British Thermal Unit</td>
</tr>
<tr>
<td>C₃</td>
<td>Propane y propylene C₃+ includes heavier</td>
</tr>
<tr>
<td>C₄</td>
<td>Butanes and butenes</td>
</tr>
<tr>
<td>C₅</td>
<td>Pentanes, pentenes and pentadienes</td>
</tr>
<tr>
<td>C₆</td>
<td>Hexanes, hexenes, hexadienes and benzene</td>
</tr>
<tr>
<td>C₇</td>
<td>Heptanes, heptenes, heptadienes and toluene</td>
</tr>
<tr>
<td>C₈</td>
<td>Octanes, octenes, octadienes and xilenes</td>
</tr>
<tr>
<td>cm</td>
<td>Centimeters</td>
</tr>
<tr>
<td>cm²</td>
<td>Square centimeters</td>
</tr>
<tr>
<td>CST</td>
<td>Centistocks</td>
</tr>
<tr>
<td>FCC</td>
<td>Catalytic Cracking of Fluidized Bed</td>
</tr>
<tr>
<td>FOB</td>
<td>Free on Board (FOB)</td>
</tr>
<tr>
<td>g</td>
<td>Grams</td>
</tr>
<tr>
<td>gal</td>
<td>Gallons</td>
</tr>
<tr>
<td>GLP</td>
<td>Petroleum Liquified Gas</td>
</tr>
<tr>
<td>GLR</td>
<td>Refinery Liquified Gas</td>
</tr>
<tr>
<td>HDPE</td>
<td>High Density Polyethylene</td>
</tr>
<tr>
<td>HDS</td>
<td>Hydrodesulfurizing unit</td>
</tr>
<tr>
<td>STPS</td>
<td>Special Tax on production and services</td>
</tr>
<tr>
<td>ISO</td>
<td>International Standardization Organization</td>
</tr>
<tr>
<td>IT</td>
<td>Income Tax</td>
</tr>
<tr>
<td>VAT</td>
<td>Value Added Tax</td>
</tr>
<tr>
<td>Symbol</td>
<td>Abbreviation</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------</td>
</tr>
<tr>
<td>kg</td>
<td>Kilograms</td>
</tr>
<tr>
<td>km</td>
<td>Kilometers</td>
</tr>
<tr>
<td>l</td>
<td>Liters</td>
</tr>
<tr>
<td>lb</td>
<td>Pounds</td>
</tr>
<tr>
<td>LDPE</td>
<td>Low Density Polyethylene</td>
</tr>
<tr>
<td>m</td>
<td>Meters</td>
</tr>
<tr>
<td>m3</td>
<td>Cubic Meters</td>
</tr>
<tr>
<td>max</td>
<td>Maximum</td>
</tr>
<tr>
<td>mg</td>
<td>Miligrams</td>
</tr>
<tr>
<td>min</td>
<td>Minimum</td>
</tr>
<tr>
<td>ml</td>
<td>Mililiters</td>
</tr>
<tr>
<td>mmHg</td>
<td>Millimeters of mercury</td>
</tr>
<tr>
<td>MMpc</td>
<td>Millions of Cubic Feet</td>
</tr>
<tr>
<td>MON</td>
<td>Number of octane</td>
</tr>
<tr>
<td>Mpc</td>
<td>Thousands of cubic feet</td>
</tr>
<tr>
<td>MTBE</td>
<td>Methyl-tert-butyl-ether</td>
</tr>
<tr>
<td>OECD</td>
<td>Organization for</td>
</tr>
<tr>
<td></td>
<td>Economic Cooperation</td>
</tr>
<tr>
<td></td>
<td>and Development</td>
</tr>
<tr>
<td>pc</td>
<td>Cubic Feet</td>
</tr>
<tr>
<td>PEMEX</td>
<td>Petroleos Mexicanos</td>
</tr>
<tr>
<td>inch2</td>
<td>Square Inches</td>
</tr>
<tr>
<td>ppm</td>
<td>Parts per million</td>
</tr>
<tr>
<td>RVP</td>
<td>Reduced Vapor Pressure</td>
</tr>
<tr>
<td>RON</td>
<td>Number of octane</td>
</tr>
<tr>
<td>SCT</td>
<td>Ministry of</td>
</tr>
<tr>
<td></td>
<td>Communications and</td>
</tr>
<tr>
<td></td>
<td>Transportations</td>
</tr>
<tr>
<td>SEMARNAP</td>
<td>Ministry of Environment, Natural Resources and Fishing</td>
</tr>
<tr>
<td>SSF</td>
<td>Standard Saybolt Furol</td>
</tr>
<tr>
<td>TAME</td>
<td>Tertiary-amyl- ether</td>
</tr>
<tr>
<td>TCC</td>
<td>Catalytic Thermal</td>
</tr>
<tr>
<td></td>
<td>Cracking</td>
</tr>
<tr>
<td>FET</td>
<td>Final Ebullition</td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
</tr>
<tr>
<td>NAFTA</td>
<td>Free Trade Agreement</td>
</tr>
<tr>
<td>vol</td>
<td>Volume</td>
</tr>
</tbody>
</table>