DEVELOPMENT OF A COMPUTING PLATFORM FOR TECHNICAL SUPPORT TO THE AREA OF NATURAL GAS.

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ABSTRACT

The lack of a comprehensive and accessible material for the processing and management of natural gas has been an incentive and impetus for conducting this paper, which consists of 12 theoretical and practical issues displayed, which integrate the manual, Audio-book, images, and videos.

KEYWORDS

Natural Gas, Hydrates, dehydration, sweetening, extraction of NGL, LPG, Amines, Glycol, TEG, MEG, MEA, TEA

INTRODUCTION

Natural Gas is currently in the center of the global debate about energy and climate issues, due to its increasing availability as a clean, efficient and low-cost nonrenewable resource. This situation demands of professionals and technicians with expertise in the area of natural gas, processing and handling. In this paper, is presented a platform specifically designed for students and professionals in the hydrocarbon sector, which helps to obtain fundamental knowledge about the industry, in addition to providing a tool for good management of knowledge in this area.

METHODOLOGICAL FRAMEWORK

Type of Research

This work represents two types of studies. The documentary, as it deals with the study of problems in theory and the information required to deal with it is basically printed, broadcasted and / or electronic materials. It also includes a special study, because consists of creating educational material, that can be used to solve the weaknesses evidenced in issues related to the natural gas industry, and it is also characterized by its innovative value, and significant contribution to the Spanish speakers community.

Investigation design

This work consists of a bibliography compilation, based primarily on documentary information gathered, allowing the design of an accurate, reliable and updated source, containing the relevant information in the area of natural gas. However, some criteria are established for the pursuit of information presented in this research, which are rigorously followed as part of the methodology applied in the project.

TOPIC 1: INTRODUCTION TO NATURAL GAS INDUSTRY

The natural gas is defined as an odorless and colorless mixture of hydrocarbon components, and small amounts of other gases in the gas phase or in solution with the crude oil located in natural deposits [1].

Natural gas is classified by origin as associated, non-associated, and condensate. Depending on its composition, is classified, according to the water content as wet gas, dry gas, and gas hydrate. According to its acid content, is classified as sour gas, sweet gas, and acid gas. According to its heavy components, is classified as rich gas, and lean gas.

The macro-processes of natural gas are composed by cleaning impurities, dehydration, sweetening, NGL recovery and fractionation, compression, transportation, storage, reservoir injection, and measurement.

Among the products derived from processing of natural gas, are including: methane, ethane, propane, normal butane, isobutane and natural gasoline. Figure 1 summarizes the scheme of the natural gas industry.

Natural gas can be marketed through various options: LNG (liquefied natural gas), NGL (Natural Gas Liquid), LPG (liquefied petroleum gas), CNG (compressed natural gas), GTL (gas to liquid), HNG (hydrates of Natural Gas).

Among the options for handling the natural gas produced, are include: Selling via pipeline, reinjection within reservoirs, burn or vent, used as fuel in the field, liquefy and export as LNG, compressing and exporting as CNG, power generation, manufacturing petrochemicals, hydrogen production.

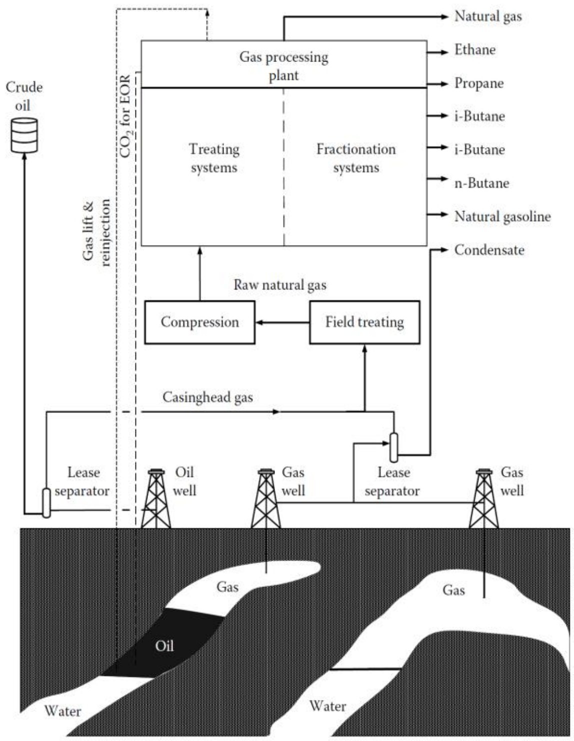

Figura 1. Esquema de la industria del gas natural [2].

TOPIC 2: NATURAL GAS PROPERTIES

Natural gas is a mixture of hydrocarbon compounds and impurities. Within the hydrocarbon gases, are found normally methane, ethane, propane, butanes, pentanes and a small amount of hexanes, heptane, octanes and heavier gas fractions. The impurities found in the mixture include carbon dioxide, hydrogen sulfide, nitrogen, water vapor, and fractions of heavy liquid hydrocarbons are removed in additional processes, that have greater commercial benefit by selling them separately rather than mixed gas. Is usually obtained mainly a mixture of methane, and ethane with various small amounts of propane, in the transmission line for the final sale of the gas [5].

The properties of the natural gas can be determined directly through laboratory tests or from predictions based on known gas composition. In the latter case, the calculations are based on the physical properties of each individual component of the gas.

Among the properties discussed in this topic are: volumetric or molar fraction, density, molecular weight, specific gravity, weight fraction, parts per million, calorific gas compressibility factor, bubble pressure, dew point, vapor pressure, level moisture, liquid content (richness), level of acidity, viscosity, pressure gradient.

Equation of state in the natural gas

The primary use of an equation of state involves predicting the state of the gases. One of the simplest relations for this purpose is the equation of state of ideal gas, which is approachable to the behavior of gases at low pressures, and temperatures above the critical point. However, this equation loses much accuracy, if the environment has high pressures and low temperatures, which results in the inability to predict the condensation of gas into liquid.

The compressibility factor is one of the more accurate parameters that difference the behavior of fluids, in the gaseous and fluid state. It defines the behavior of gases in certain conditions of pressure and temperature, and becomes essential element for all designs, and installations that work with compressible fluids [6].

TOPIC 3: PHASE EQUILIBRIUM.

The energy possessed by any substance depends mainly on its phase. There are three different and known phases: solid, liquid and gas (vapor).

The gas phase has no definite shape or volume, and doesn’t fill entirely the container. Gas molecules have more energy than liquids, in fact, are more active.

The main interest is based on the mechanisms to be applied to maintain a phase, or otherwise, if you want to produce a phase change, and how to properly use the energy to do so. If is required to melt a solid to a liquid state, it must be added energy to the process. If additional energy is added, the liquid will be vaporized.

It is understood, that each of the phases of the material is under a determined condition of pressure, volume and temperature. According to the energy level associated with them, the substances are classified as follows: Pure substances (mono-component systems), and mixtures of substances (multi-component systems) [4].

A mono-component system is entirely composed by one kind of atoms or molecules. It is often used the word "pure" to describe this system. For a multi-component System, another variable must be added to the system phase diagram, and this is the composition. The location of the lines in the phase diagram, depends on this property.

Many production and processing operations involve control of the present phases. Selected components must be vaporized or condensed to achieve specific objectives. Equilibrium is the word commonly used to describe a condition, where over time will not affect the system behavior.

The vaporization rate (Ki) is defined as the ratio between the mole fraction of any component in the vapor phase, and the mole fraction of any component in the liquid phase [4].

Three different and important calculations are performed to understand the behavior and characteristics of a liquid-vapor mixture: (1) Calculation of the bubble point to know and define this portion of the envelope phase, (2) calculation of dew point to the remaining portion, (3) flash calculations for all pressures and temperatures within the phase envelope.

The following two calculations are made primarily for a water-hydrocarbon system: calculation of water content in the gas, and predicting the conditions under which gas hydrates are formed. The prevention of hydrates, by dehydration or inhibition, is important in petroleum operations.

TOPIC 4: NATURAL GAS DEHYDRATION

In addition to separating the oil and part of the condensate from the wet gas stream, is necessary to remove a large amount of associated water. Much of the liquid and free water associated with natural gas is removed by simple separation methods, at or near the wellhead. Either way, the removal of the steam which exists in solution in the natural gas, requires treatment with more complex, this treatment involves the "dewatering" of the natural gas [7].

Dehydration is the process used to remove water and natural gas liquids, and is required to prevent hydrate formation and condensation of free water in processing and transportation facilities, also to meet the specification of water content, and to prevent corrosion in pipes and equipment.

Some techniques for the dehydration of natural gas, gas condensate, and NGLs, include using liquid desiccant absorption, adsorption using solid desiccants, CaCl2 dehydration, drying cooling, and drying permeable membranes.

The glycol dehydration process has the following advantages over the solid desiccant:
-Lower installation costs: Kohl and Riesenfeld (1979) reported that plants of solid desiccants cost 50% more for a gas stream 10 MMSCF, and 33% to 50 MMSCF gas stream.

- Smaller pressure drops: 5 to 10 psi versus 10 to 50 psi for solid desiccant units.

-Glycol-Dehydration is continuous rather than batch as with the dry desiccant bed.

-Glycol-regeneration is easily completed. Reload solid desiccant tower takes time, and sometimes requires discontinuation of gas marketing.

-Glycol units require less regeneration heat per pound of water removed, and thus reduce costs.

-The glycol system will operate in the presence of materials that would leave the solid desiccant badly.

-Glycol units can dehydrate natural gas at 0.5 pounds of water / MMSCF [7].

The advantages of the solid desiccant are:

-May be obtained dew points as low as -150 °F. They are less affected by slight changes in pressure, temperature or gas flow rate.

-They are less susceptible to corrosion or foaming [7].

TOPIC 5: HYDRATE FORMATION.

Gas hydrates are a type of clathrate first discovered in 1810. In 1888 were presented the first data showing the behavior of hydrocarbon hydrates. Since then, the scientific study of these physical properties has been extensive [4].

A hydrate is a physical combination of water and other small molecules, which has an ice appearance, but it has a different structure. Its formation in gas systems or NGL can clog the flow lines, equipment and instruments, restricting or shutting off the flow.

Among the primary considerations that affect the formation of hydrates, are found: The gas or the liquid must be at or below the dew point of water or at saturated conditions (is not required the presence of water in liquid for the formation of hydrates), temperature, system pressure, and gas composition. Among secondary considerations, are include the kinetics of the particles, the salinity, the physical space for the formation and agglomeration of crystals such as pipe bends, holes, thermos containers, or weight indicators [4].

When dewatering systems are designed, especially glycol systems, to meet the specifications of extremely low dew point, is necessary to determine the water content in equilibrium with the gas hydrate, using a correlation such as that presented in publications RR-GPA 45, 50 and 80. If a metastable correlation is used, it can overestimate the saturated water content of the gas to the dew point specifications. This correlation depends closely for a defined composition, which cannot be extrapolated. Hydrate inhibition, using injection of the glycols or methanol in a process stream, which can be combined with the aqueous phase condensed to lower the temperature of hydrate formation at a given pressure. Ethylene glycol (EG), diethylene glycol (DEG), and triethylene glycol (TEG) were used for hydrate inhibition. The most popular has been the ethylene glycol, because of its low cost, low viscosity and low solubility in liquid hydrocarbon. To be effective, the inhibitor should be present at the place where the wet gas is cooled to the temperature of hydrates. The injection should be such that it can allow good distribution in each pipe, in refrigerators, and heat exchangers that operate under hydrate formation temperature [4].

TOPIC 6: SWEETENNING NATURAL GAS

Through the years, has been necessary the imposition of specifications for natural gas, especially for those that contain significant amounts of toxic components. There are over 30 processes natural gas sweetening. These can be classified as:

1. Aqueous Solutions of Amines: Such as monoethanolamine, diethanolamine, diglycolamine, and methyldiethanolamine. These solutions are regenerated and are used to remove large amounts of sulfur, and carbon dioxide when is required.
2. Physical Solvents: Such as Selexol, Rectisol, Purisol, and fluorine solvent. These may be regenerated without heat and are often used for gross removal of CO2, most usually in offshore operations.
3. Mixed solutions: Mixtures of an amine, physical solvent and water. These solutions also absorb organic sulfur and are able to support high loads of acid gas.
4. Solutions hot potassium carbonate: As Hot Pot, and Catacarb, These are chemically similar to the physical solvent.
5. Direct Oxidation of sulfur: As Stretford, these processes virtually eliminate emissions of H2S.
6. Adsorption: As Linde, and Davison's chemical molecular sieves. The use is limited to low concentrations of acid gases, and the gas is simultaneously dehydrated.
7. Batch processes: As Iron Sponge, and Caustic Soda, The use of this technology is limited to the removal of small amounts of sulfur, small flow rates and / or low concentrations of hydrogen sulfide.
8. Membranes: are the most suitable for the gross separation of CO2, especially when the concentration of the feed gas is very high [7].

TOPIC 7: EXTRACTION OF NATURAL GAS LIQUIDS.

The recovery of light fractions of liquid hydrocarbons from natural gas stream may range from a simple control of the dew point, to a deep localized extraction of ethane in the mixture. The desired degree liquids recovery has an important effect on the selection process, as well as its complexity and cost of the facilities where it takes place [3].

The term NGL (Natural Gas Liquids) is applied to the recovered natural gas components such as ethane and heavier fractions. The term LPG (Liquefied Petroleum Gas) describes the hydrocarbon mixture in which the main components are propane, iso and normal butane, propene and butenes.

The gas processing facilities today generally produce a product called "ethane plus" which is transported externally for future fractionation and processing. The mixed product will be fractionated on these or other facilities to make products such as pure ethane, ethane-propane, commercial propane, iso butane, normal butane, mixed butanes, butane gas, and gasoline (condensate stabilized). The degree of fractionation that occurs is dependent on geographical market.

Early efforts in the 20th century for the recovery of natural gas liquids, involved compression and cooling of the gas stream and the stabilization of a gasoline product. The process of absorption of lean oil was developed in the 1920s to increase the recovery of gasoline and products with increasing amounts of butane gas. These gasoline products were, and still are marketed by specification of Reid vapor pressure, the vapor pressures of 10, 12, 14, 20 or 26 psia are the most common for gasoline products. To further increase the production of liquids, the absorption of lean cooled oil was developed in the 1950s. Upon cooling oil and gas through the cooling process, propane can be recovered. With the production of propane in lean oil plants, a market for LPG as a portable liquid fuel was developed [3].

Instead of using lean oil, gas cooling can be used to recover propane and heavier components. The use of direct cooling is typically much more economical in a processing plant. Gas cooling can be achieved through mechanical cooling, absorption by refrigeration, expansion across a JT valve, or by combination thereof. To achieve even lower temperatures of processing have been developed and applied technologies such as cascade refrigeration, the turboexpander, and the implementation of mixed refrigerants. With these technologies, the liquid recovery can be significantly increased to achieve deep ethane recovery. In the earliest centers of ethane recovery, the recovery was about 50%. As the processes were developed, the ethane recovery efficiency increased to over 90% [3].

In some cases the heavy hydrocarbons are removed to control the dew point of the natural gas and thus prevent the liquid condensed in the pipeline, and fuel systems. In this case, the heavy fractions are a byproduct of processing, and can be used as fuel if no market exists for them. Moreover, these fractions can be stabilized, and marketed as condensate.

TOPIC 8. FRACTIONATION OF NATURAL GAS LIQUIDS.

The liquids recovered from natural gas (NGL), form a multi-component mixture which is separated into fractions of individual compounds or in combination, through a fractionation step. It is called distillation, the process by which the operation of fractionation is achieved.

Distillation is probably the cheapest method for separating a mixture into its individual components. Fractionation involves the separation of the components by relative volatility, from which depends on the difficulty of separation, as well as the purity of the products in the stream. The separation is easy if the relative volatility of the light key, and heavy key compounds are substantially greater than one. The lighter components (overhead product) are separated from the heavier (bottom product). Thus, the bottom product in a column is the feed to the next column, which can operate at a lower pressure but higher temperature [3].

The height of the column, number of trays or height of packing depends on the relative volatility. The lower the relative volatility, the column height is higher. Virtually all gas processing plants produce natural gas liquids that require at least a fractionator to produce a liquid product which meets the sales specifications.

The heat is introduced to the reboiler to produce stripping vapors. The vapor rises through the column contacting the descending liquid. The vapor exiting the top of the column, enters to the condenser where heat is removed by a cooling medium.

The liquid is returned to the column as reflux to limiting losses of heavy component over the top.

Internal components such as trays or packing promote contact between the liquid and vapor in the column. For efficient separation, intimate contact between the vapor phase and the liquid is required. The steam that enters in a separation step is cooled whereby the condensation of some heavy components occurs.

The liquid phase is heated, resulting in some vaporization of the lighter components. Thus, heavy components are concentrated in the liquid phase to become bottom product. The vapor phase continuously enriched with lighter components to become overhead product.

The vapor exiting the top of the column can be fully or partially condensed. In a total condenser, all the steam that goes in, comes out as a liquid, and reflux returned to the column with the same composition as the top distillate product. In a partial condenser only the portion of the steam entering is condensed to liquid. In most of the partial capacitors, only enough fluid is condensed to serve as reflux in the tower. In some cases, it will condense more fluid than is required for reflux, and certainly will be two top products, one having the same composition as reflux and a product vapor which is in equilibrium with the liquid reflux [3].

The number and type of required fractionator, depends on the number of products to be produced and on the composition of the feed stream. Typical products are natural gas liquids, for which the following fractionation processes are used:

- Demethanizer.
- Deethanizer.
- Depropanizer.
- Debutanizer.

Among NGL products that are produced from the fractionation process are found:

- Demethanized Products (C2 +).
- Deethanized Products (C3 +).
- Mix ethane propane (EP).
- Commercial propane.
- Mix butane-propane (LPG).
- Butanes.
- Mix of butane gas.
- Natural Gas.
- Mixtures with a vapor pressure specification [3].

TOPIC 9: NATURAL GAS COMPRESSION.

Natural gas compression requires equipment, comparable to those used for the pumping of liquids. The centrifugal and reciprocating compressors are the most commonly used for compressing the gas.

Rotary screw compressors, lobes, and paddle are mainly used in specialized services. The last two can be useful, especially when discharge pressures does not exceed 30 psi and, if the rate is not too large. Screw compressors may be used for much higher pressure shock. All three have favorable weight and vibration characteristics. Major uses include collecting low-pressure gas, cooling units and dehydration in a closed cycle [4].

It should be taken into account that is used four different lists for reciprocating compressors. There are two separable units for working with high and low engine speed; the last two are integral compressors, those long type, and those short type.

A separable compressor is a separate unit that is directly coupled by a belt-driven through an independent controller (usually on a common platform). The integral compressor, unlike the previous one, has an internal combustion engine on the same assembly, integrated with gas compressor cylinders. The difference between the long rate and the short rate is somewhat arbitrary, however could be mentioned that the short rate, is that which can achieve power outputs of 1000 kW and its maximum size is such that it may be possible its assembly in a factory . Larger compressors have to be fixed in concrete foundations and coupled into a pipe field [4].

TOPIC 10: TRANSPORTATION OF NATURAL GAS

The flow of any fluid through a line which contains a heating device is considered isothermal and adiabatic. You can then combine the first and second laws of thermodynamics, using those assumptions to write the equation 1 [4].

$$\int Vdp + \frac{g}{g_c}\Delta X + \frac{{v_2}^2 - {v_1}^2}{2g_c} = -\frac{2 \times f \times v^2 \times L}{g_c \times D} - W \qquad (1)$$

The fundamental equation of thermodynamics used for liquid flow can also be used for gases. Aiming to conveniently manipulate Equation 1, many assumptions are made:

- No external work is done by or on the system, therefore W= 0.
- Natural gas behaves as an ideal gas, P1V1 = P1V2 therefore.
- The flow is isothermal.
- The change in elevation of a long flow line is negligible, therefore X = 0 [4].

All these assumptions have been used successfully in most long pipelines except the assumption that involves an ideal gas behavior. However, if the design uses pressures over hundreds of psi, these equations are derived on a basis that usually contains a compressibility factor. The assumptions of isothermal flow have little effect on the final accuracy, which can be tested assuming adiabatic conditions, which are the opposite end.

When the pressures are increased in a system of natural gas, the ideal gas assumptions are no longer valid. Therefore, it is advisable and desirable to incorporate the compressibility factor Z in the flow equations to eliminate this error [4].

There are many ways in which one can incorporate a compressibility factor of equations derived from the assumption of ideal gases:

- Using a Z average at the same pressure for the line section studied.
- Expressing Z as function of pressure and temperature.

TOPIC 11: SIMULATING THE BEHAVIOR OF NATURAL GAS

Process simulation can be defined as a technique for fast and robust way to evaluate a process based on the representation of it, by using mathematical models. The solution of these is carried out by means of computer programs that enable a better understanding of the behavior of the process. The number of variables in the mathematical description can be as large as 100,000, and the number that must be resolved by thousands of nonlinear equations, and so the only feasible way to solve the problem is by using a computer [8].

Process simulation is a modern tool that has become indispensable for successful problem solving process. Allows for the analysis of chemical plants in operation and perform the following tasks, which are common in the various branches of the chemical industry and natural gas:

- Predicting the behavior, properties, and parameters of a system under certain prescribed conditions. For example the phase diagram, hydrate formation, specific gravity, calorific power, gpm, among others.
- Detection of bottlenecks in production.
- Prediction of the effects of changes in operating conditions, and plant capacity.
- Optimization operating variables.
- Analyze cases of study / scenarios, use of equipment / processes used.
- Optimize the handling and processing of hydrocarbons.
- Analysis of critical operating conditions.
- Designing equipment, processes, pipes, etc.. For example: determining power flow and product composition, diameter.
- Assist in the engineering stage. For example: create balance of matter and energy.
- Planning facilities for the development of a field. For example: Growth and compression treatment.
- Analysis of feasibility and viability of new processes.
- Training of operators and process engineers.
- Research the feasibility to automate a process [8].

The variety of applications of process simulators is very large, previously they were only used by engineers designing process, simulators are now handled by environmental engineers, hydrocarbons, and to plant engineers in the workplace; engineers with little or no programming instruction can model complex processes.

TOPIC 12: NATURAL GAS INDUSTRY IN VENEZUELA.

In September 12, 1999, included in Enabling Law of April 26, 1999, President Hugo Chavez Power issued Decree with Rank and Force of Organic Law of Gaseous Hydrocarbons, whose Preamble were established the main lines of government on natural gas and its components.

The evolution of the gas industry in Venezuela for the coming years is framed in developing the potential of free gas, expansion and construction of processing infrastructure, transport and distribution of methane gas and natural gas liquids. Evidence of this we observe in table number 1; the most importants for the development of the gas industry in Venezuela projects are CIGMA project (Industrial Complex Gran Mariscal de Ayacucho), the project delta Caribbean, and the Rafael Urdaneta project.

Table 1: Major natural gas projects [9].

Project	Target	Kind of	Inver. (MM$)
Deltana platform	Produce 1,470 MMSCF	Gas Development	3,810
Mariscal Sucre	Produce 1,200 MMSCF, and building LNG plant	Gas Development	2,700
Rafael Urdaneta	Produce 1,000 MMSCF	Gas Development	2,900
Gas Anaco	Produce 2,400 MMSCF	Gas Development	2,433
Criogénico de Occidente	Extraction 62 MMSCF of ethane	Gas Development	926
Jose 250	Increase NGL fractionation	Gas Development	664
ICO	Gas supply to the West	Gas Development	530
Nor-East System	Management of offshore gas.	Gas Development	1,066
National gasification	Gas supply to 2.6 million families	Gas Development	2,334
GNV	Gas supply to 450 thousand vehicles	Gas Development	921

The project CIGMA comprises four well areas evaluated: Rio Caribe, Mejillones, Patao and Dragon. It aims to develop in harmony with the environment, 70% of the reserves of non-associated gas and condensate liquids of Dragon, Patao, Mejillones and Rio Caribe fields, located in the north of Paria, to produce up to 1,200 MMSCFD of gas and 18 MBPD of condensate. The project is located north of the Paria Peninsula and has an area of 4,750 km ^{2}, with water depths ranging between 90 and 150 Mts, from west to east. Are estimated the Drilling of 36 wells, 24 of which are subsea, and 12 surface's, and further the construction of two production platforms [9].

The delta caribbean project consists on the construction of the infrastructure required to incorporate in the domestic market, gas from the offshore gas developments in the east. It covers the following facilities: 563 Km of marine pipelines; urbanism, roads and services in the Gran Mariscal de Ayacucho Industrial Complex; dock construction and services; adequacy plants and gas processing; power generation (900 MW and 450 MW in Güiria in Cumana, Sucre state); electric transmission and distribution as well as liquefaction plants [9].

This project includes quantifying volume book between 6 and 10 TSCF. Are expected gas production of 1,000 MMSCFD addressed to meet the demand of the domestic market and elsewhere for exploitation; additionally includes transport infrastructure (pipeline) to the Gran Mariscal Ayacucho Industrial Complex. The Deltana Platform has expectations for the 38 TSCF by gas [9].

The Rafael Urdaneta project included the development of offshore area of the Gulf of Venezuela, and Falcón northeast, was divided into Phases "A" and "B" for the granting of licenses for exploration and exploitation and was offered in 2005. This project is oriented towards the execution of exploration activities in the Gulf of Venezuela, mainly in Robalo, Merluza, Liza and Sierra fields, in order to produce 1,000 MMSCFD of gas, which will be for the domestic market and the exceeding, for opportunities of international business. Additionally, this project includes the development of infrastructure for offshore gas production, pipelines necessary to transport gas and condensate, and a gas liquefaction plant with shipping facilities needed to handle modern ships of NGL [9].

COMPUTING PLATFORM

The twelve subjects that make up this work were collected in a computer and interactive platform as shown in Figure 2 different softwares such as autoplay design menu for the graphical interface and content distribution were used, loquendo for creating audiobooks each topic, and the sony program for creating educational videos based on the various topics covered.

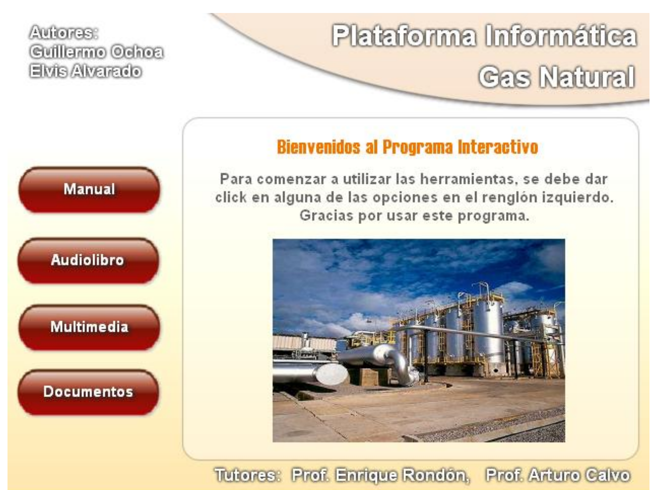

Figure 2 Natural Gas computing platform.

clicking on "manual" issues are accessed in digital format in order to facilitate reading, as well as access to abc booklet which includes the most important aspects of the gas industry. clicking "audiobook access the theoretical content in MP3 format. clicking on "multimedia", leads to a series of images and videos related to the area of natural gas. clicking on "Documents" access to a database of documentary material related to the gas area.

CONCLUSIONS

- Knowledge of common terms and definitions allow basic familiarity with the language often used in the Natural Gas Industry.
- Understanding the requirements and specifications for natural gas help to shape the operations area and select the most appropriate technologies and processes for the removal of the unwanted components in the gas.
- The study of the physical and chemical properties of natural gas, facilitate the resolution of various basic and complex problems arising in the gas industry, including properties that are of great importance may be mentioned: heat value, compressibility factor, dew points of water and Hydrocarbons, specific gravity, wealth (GPM), etc.
- It is important to differentiate the existing phases in a gas stream, the application of the equilibrium concept allows the engineer to determine the conditions of pressure and temperature which may be a single-phase and two-phase hydrocarbon system.
- The water in the gas stream contributes to the corrosion in the system, condensation and formation of hydrates in the pipeline. For this reason, it is important to quantify the amount of water vapor present in the stream, as well as determining of its dew point, it will help in the selection of a suitable dehydration process.
- The acid gases in the gas stream are harmful to health, and help to reduce the calorific value of the product. It is therefore important to quantify the amount of CO2 and H2S in the stream, this will help in choosing a suitable sweetening process.
- Products such as NGL, ethane and GLN have a high economic value in international markets, which is why it is important to plan processes to extract these products from a natural gas stream.
- Fractionation of Natural Gas Liquids (NGL) involves its separation into its most commercially valuable components, according to the relative volatility. Separation occurs because a component is heated to passing the vapor phase, and the other part remains in the liquid phase.
- The compressors will provide the energy needed to transport gas from one place to another through a system of pipes, these systems can be simple or complex depending on the design.
- Process simulation is a modern tool that has become indispensable for the proper solution of the problems related to the natural gas industry. These programs can save time and money, both in the design of new plants and the optimization of existing ones.
- Venezuela has enough reserves to supply for many years the domestic market and for export via pipeline or LNG, and get a great benefit in return. There are projects to enhance gas production and utilization of our resources, which should be expanded and accelerated to achieve an early benefit for Venezuelan society.

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