

## **5.0 INDUSTRY STATUS**

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## 5.1 OVERVIEW

This section addresses the status of the Gas Processing industry, and its related infrastructure under the following headings:

- Current Gas Processing facilities.
- Future developments.
- Gas Industry legal framework.

Traditionally, natural gas has been produced in association with oil and during the initial phases, part of it was flared. However, through the years, the oil industry has developed a considerable infrastructure to gather, conserve and transport the gas so that it can be:

- Reinjecting for "reservoir pressure maintenance",
- Used as fuel for internal operations or in refineries,
- A source of valuable liquids (NGL) and
- Used to cover the expanding industrial and residential demand for methane gas in the most populated parts of the country.

Until recently, the gas business was handled as a monopoly by the oil industry, under the supervision of the Ministry of Energy and Mines (MEM), with private participation limited to the commercialization of bottled LPG and methane distribution (by some municipal entities). Internal market prices were regulated and were mostly subsidized at low levels.



Until the end of 1997, the former affiliates of PDVSA (Lagoven, Maraven and Corpoven), were each independently handling their gas. However, as part of the transformation process of PDVSA, beginning January 1, 1998, a new company called PDVSA Gas was created, to consolidate the gas business in one entity. The objectives of PDVSA Gas are to unify, promote and develop the natural gas sector, based on the new legal framework and national policy which opens the industry to outside participation and market competition.

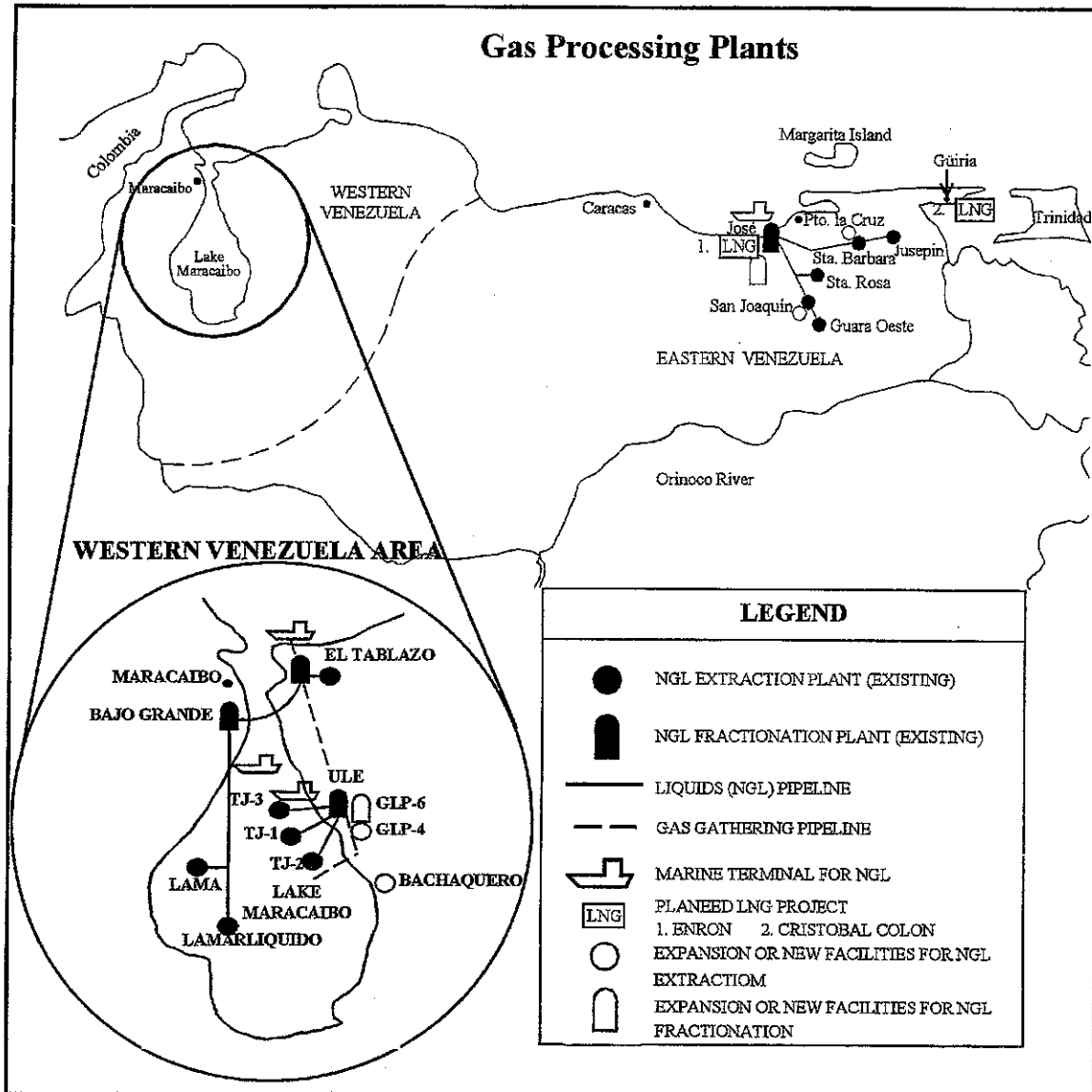
The target is to develop the gas sector and promote new businesses in the following areas:

- Exploitation of the non-associated gas reserves (both offshore and onshore) for domestic usage, and for sale, as LNG or pipeline gas, to export markets.
- Expansion of gas processing capacity, including facilities for injection, conditioning, and NGL extraction/fractionation.
- Conversion of gas to liquids (GTL).
- Expansion of the national gas transmission system.
- New gas distribution networks in cities.

The Gas Processing facilities for extraction and fractionation of NGL, that could support and provide synergy to the GTL projects, are well developed and present both in Eastern and Western Venezuela.

Figure 5-1 shows an overview of the gas processing facilities in the country.

Figure 5-1 Gas Processing Plants



## 5.2 CURRENT GAS PROCESSING FACILITIES

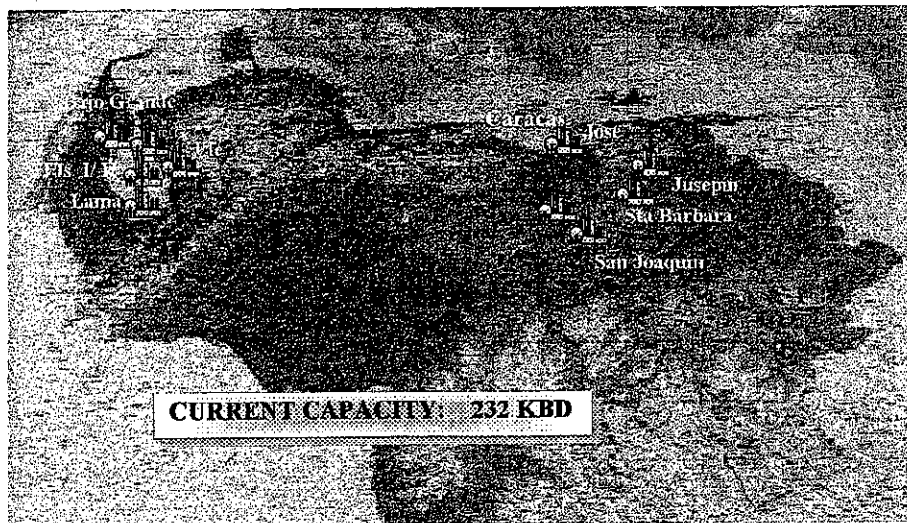
This discussion covers the current gas processing facilities in the country, particularly those located in Eastern Venezuela, that are involved in the

extraction and fractionation of NGL, and therefore could support or provide synergy opportunities to the GTL plants. The existing gas processing infrastructure is extensive and well developed, ranked second in Latin America (only surpassed by Mexico), evolving as one of the main world producers of NGL. Current production (1998) is in the order of 170 MBPD, used as feed to the petrochemical sector and refineries, consumed in the internal market, and exported in significant quantities (See Figure 5-2). The facilities are described under the following headings:

- NGL extraction plants.
- NGL fractionation plants.

Currently, there is no LNG production capability, but there will be shortly (See 5.2.2: LNG Plants in this section). Emphasis will be on the facilities located in Eastern Venezuela, since all the GTL sites under consideration are in that area.

**Fig. 5-2 NGL Plants - Current Infrastructure**



### 5.2.1 NGL Extraction Plants

As mentioned earlier, the bulk of the rich associated gas from the different oilfields, is gathered and processed in extraction plants to remove liquids, with the lean gas destined for the gas transmission system. Those plants are located near the main gas production areas, both in Western and Eastern Venezuela, currently (1999) having an installed extraction capacity of around 212 MBPD.

#### 5.2.1.1 Western Venezuela

- This region has the following extraction plants (See Table 5-1), located mainly in and around Lake Maracaibo:

Table 5-1 Western Venezuela Extraction Plants

Plant	NGL Capacity BPD	Type
Tia Juana 1	12,000	Absorption
Tia Juana 2	25,000	Refrigeration
Tia Juana 3	21,000	Refrigeration
Lamarliquido	7,000	Refrigeration
Lama	6,000	Refrigeration
El Tablazo I/II	26,000	Cryogenic
Total Capacity	97,000	

The Tia Juana 1,2 and 3 extraction plants are located offshore in Lake Maracaibo and deliver their produced liquids to the Ulé fractionation plant (located onshore on the East side of the Lake).

The Lamarliquido and Lama extraction plants are also located offshore in Lake Maracaibo, delivering their output to the Bajo Grande fractionation plant, located onshore south of Maracaibo.



The extraction section of the onshore El Tablazo plant, located east of Maracaibo, sends its output to its own fractionation section and as supplementary feed to the Bajo Grande fractionation plant.

- Raytheon have recently completed a TDA sponsored study to investigate the recovery of gas currently being vented in Western Venezuela to alleviate the gas shortage in the area.

#### 5.2.1.2 Eastern Venezuela

- This region has the following extraction plants (See Table 5-2), located in the States of Anzoategui and Monagas:

**Table 5-2 Eastern Venezuela Extraction Plants**

Plant	NGL Capacity BPD	Type
San Joaquín	45,000	Cryogenic (Expander)
Santa Rosa	4,000	Refrigerated Absorption (Refrigerated lean oil)
Guara Oeste	1,000	Absorption (Ambient lean oil)
Santa Barbara	30,000	Cryogenic (Expander)
Jusepin	35,000	Refrigeration
<b>Total Capacity</b>	<b>115,000</b>	

The San Joaquín extraction plant is located onshore in Anzoategui State, near the city of Anaco. It delivers its liquid production to the Jose Cryogenic Complex, through a main NGL pipeline (16" dia. x 112 Km). The Santa Rosa and Guara Oeste plants, located around Anaco, are old facilities that are no longer in operation.

The Santa Barbara and Jusepin extraction plants are located onshore in Northern state of Monagas, adjacent to their respective fields. The output from the Jusepin plant is sent first to Santa Barbara (via a 10" dia. x 12 Km



pipeline). From there, the combined output of both plants is also sent to the Jose Cryogenic Complex, through a 164 Km long, 16" dia. pipeline.

- The current oil cutback has not had much effect on this region, and present production of NGL in Eastern Venezuela is running near plant capacity, at around 110,000 BPD.

## 5.2.2 NGL Fractionation Plants

The fractionation plants receive the bulk of their charge from the NGL extraction plants located adjacent to or near them, with supplementary LPG feed from the different refineries. Thus, their capacities are greater than those of the extraction facilities. The current (end of 1999) total installed capacity is around 247 MBPD, having increased from 232 MBPD (in 1998) due to the revamping of the C train at Jose.

### 5.2.2.1 Western Venezuela

- Western Venezuela has the following fractionation plants (See Table 5-3), located near the city of Maracaibo (El Tablazo and Bajo Grande) or on the eastern side of the Lake (Ulé):

**Table 5-3 Western Venezuela Fractionation Plants**

<b>Plant</b>	<b>NGL Capacity BPD</b>
El Tablazo	14,000 <sup>1</sup>
Bajo Grande	25,000
Ulé	58,000 <sup>2</sup>
<b>Total Capacity</b>	<b>97,000</b>

<sup>1</sup> Excluding counting the ethane production.

<sup>2</sup> Including the current revamp and new GLP-5 unit.

The fractionation section of the El Tablazo plant produces 30 MMSCFD of ethane, propane, and a mixture of butanes and heavier. Its output of ethane and propane is used as charge to the adjacent El Tablazo



petrochemical complex, while the butanes and heavier are delivered to the Bajo Grande plant. It has its own storage tanks and marine export pier.

The Bajo Grande plant produces propane, normal-butane, iso-butane and natural gasoline. It supplies propane to the El Tablazo petrochemical complex and has its own storage tanks and marine export pier.

The Ulé plant (also called the Ulé LPG Complex), is currently undergoing a revamp to increase its basic capacity from 50,000 BPD to 58,000 BPD (to be finalized by the end of 1999), involving the expansions of the GLP-1, GLP-2 and GLP-3 units, together with the new GLP-5 unit. Besides propane and natural gasoline, it is also capable of producing normal-butane and iso-butane (through its GLP-3 unit). It has storage tanks, but exports its products through the La Salina terminal. The iso-butane is sent to the Paraguaná and El Palito refineries.

#### 5.2.2.2 Eastern Venezuela

The only fractionation plant in the region is the so-called "Cryogenic Complex" at Jose, having a capacity of 150,000 BPD, in three trains. It is the largest plant in Venezuela and one of the biggest in the world. It produces propane, normal-butane, iso-butane, pentanes and natural gasoline. It supplies the local LPG demand together with export markets and is interconnected to the Puerto La Cruz refinery and the Jose Petrochemical Complex.

Currently the complex is producing at near capacity levels. Although it does not yet produce ethane, there are plans to provide this capability and to increase its overall production and storage capacity, as part of the ACCRO III/IV expansion plan (See 5.3 in this section). Due to its seashore location, the plant also has its own marine export pier, with two loading berths.

The "Cryogenic" in the name is really a misnomer, since the complex does not have any "Cryogenic" (expander plant) extraction facilities, and is primarily a Fractionation Plant. It derives its name from the fact that it receives liquids from some "Cryogenic" extraction plants.

### 5.3 FUTURE DEVELOPMENTS

PDVSA's current business plan for the years 2000 to 2009, under a normal case scenario, calls for an oil production capability of 5.8 MMBPD by the year 2010. Currently (3Q 1999), oil production is around 2.9 MMBPD. In order to process the increased volume of associated gas (from the current 6 MMMSCFD to around 12 MMMSCFD), which will come both from traditional and new exploratory areas, operating agreements, new gas processing facilities are underway or planned (See Figure 5-2). This is without counting the projected non-associated gas developments, foreseen to produce more than 1 MMMSCFD by the year 2010, will be in addition to those mentioned earlier.

Also, as part of the foreseen expansion of the petrochemical sector, there are plans to install new gas based olefins plants, particularly at the Jose Industrial Complex, requiring an increased supply of ethane.

The new facilities being installed, and planned projects, are discussed under the following headings:

- NGL extraction and fractionation plants.
- LNG projects.
- Other projects.

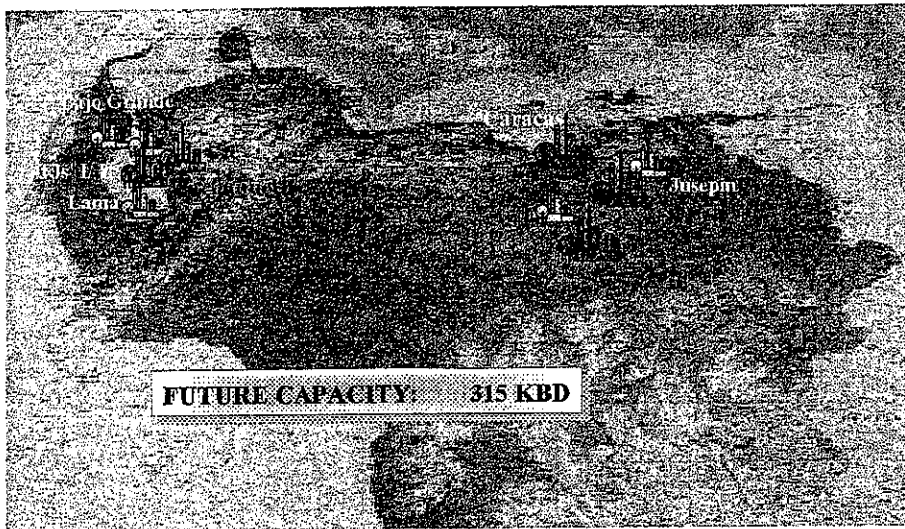
### 5.3.1 NGL Extraction and Fractionation Plants

The following projects are currently underway or planned in the country:

#### 5.3.1.1 Western Venezuela

Plans to increase NGL production in Western Venezuela, involving additional extraction (new Bachaquero plant and GLP-4 unit at Ulé) and fractionation (new GLP-6 unit at Ulé) capacity, are currently deferred.

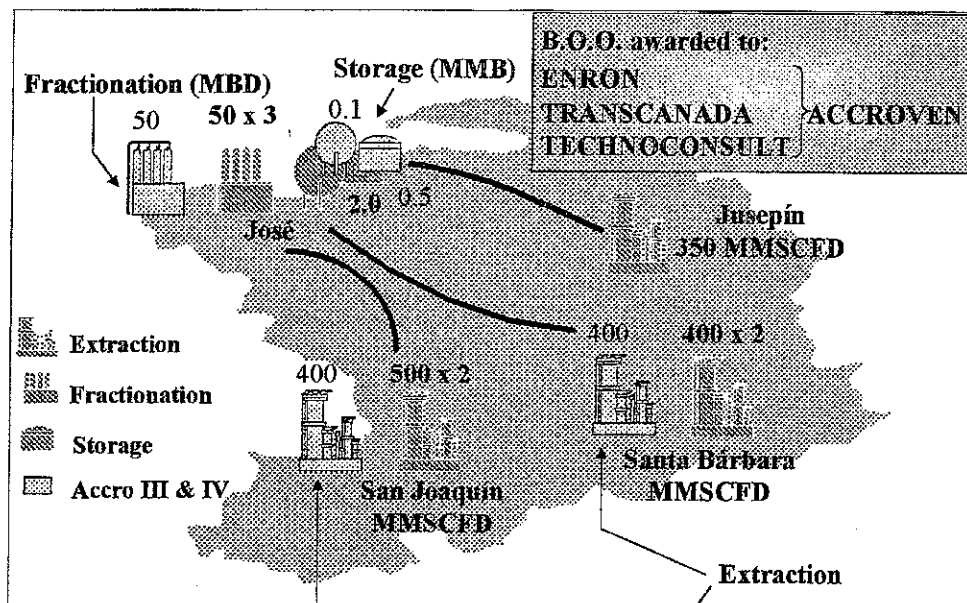
**Fig. 5-3 NGL Plants - Additional Infrastructure**



#### 5.3.1.2 Eastern Venezuela

- In July 1998, PDVSA Gas signed a BOO contract with the ACCROVEN SRL Consortium, to increase the extraction and fractionation capacity of the Complejo Criogenico de Oriente, as part of the ACCRO Phase III/IV project. It is currently under construction, most of it to be completed in the year 2001, with the rest by the year 2005. The scope of this project is the following (See Figure 5-4):

Fig. 5-4 ACCRO III & IV



- A new train in the Santa Barbara Extraction Plant, to process an additional 400 MMSCFD of rich gas and produce 26 MBPD of NGL. This will bring the capacity of the plant to 1,200 MMSCFD rich gas and 56 MBPD of NGL.
- A new train in the San Joaquín Extraction Plant, to process an additional 400 MMSCFD of rich gas and produce 22 MBPD of NGL. This will bring the capacity of the plant to 1,400 MMSCFD rich gas and 67 MBPD of NGL.
- A new train in the Jose Fractionation Plant, to process an additional 50 MBPD of NGL, increasing its production to 200 MBPD.
- A 610 MBbls expansion of the storage capacity in the Jose Fractionation Plant, increasing it to 2,445 MBbls.



- New facilities to recover ethane in the expanded San Joaquín and Santa Barbara extraction plants, with related pipelines for delivery to the Jose Industrial Complex, to feed the new Olefins Complex there. The first phase of this potential project is expected to be completed by the year 2004 and provide 63 MBPD of ethane, increasing to 126 MBPD by the year 2008. This will be developed partly by PDVSA Gas as an extension to the ACCRO Phase III/IV project.

The Olefins Complex at Jose, to be undertaken as a joint venture between PEQUIVEN and MOBIL, involves the production of 1,000,000 MTA of ethylene, 300,000 MTA of low density polyethylene, 400,000 MTA of linear low or high density polyethylene and 400,000 MTA of ethylene oxide/ethylene glycol. All this is expected to be completed by the end of the year 2004, requiring an investment of around 2,250 MM US\$. A future expansion would include new trains to double the capacity, by the year 2008.

- The planned expansions of the Jose Cryogenic Complex (to 200 MBPD) and the Ulé Complex (to 88 MBPD), together with the existing plants at El Tablazo (14 MBPD) and Bajo Grande (25 MBPD), will increase the normal fractionation capacity from the current 247 MBPD to 327 MBPD by the year 2006. The new extraction and fractionation facilities will require investments between 680 and 740 MM US\$.

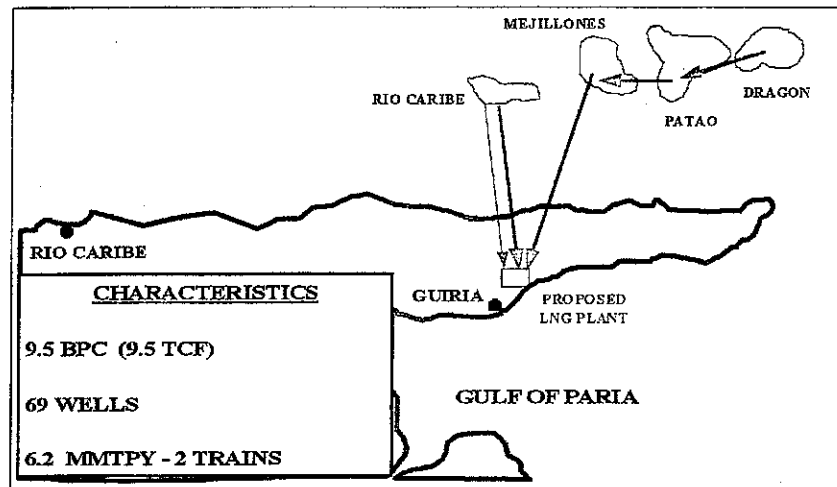
### 5.3.2 LNG Projects

The following LNG projects are currently under study:

- There are plans to build a new LNG plant, with a capacity of around 350 MMSCFD, dedicated to the export market. The single train plant is to be located inside the Jose Cryogenic Complex, in an area belonging to PDVSA Gas. The gas supply is expected to come from PDVSA Gas' existing transmission system originating in Anaco, which is slated to be expanded.

- An offshore LNG project has also been considered. Its purpose is to develop the offshore non-associated gas fields located north of the Paria area. Exploration and production activities, construction and operation of the liquefaction plant, and LNG shipping and commercialization are all included in the project. This is all based on recoverable reserves estimated at being over 10 TCF, with the potential for additional gas discoveries in the Rio Caribe, Mejillones, Dragon and Patao fields, as mentioned before (See Figure 5-5).

**Fig. 5-5 Potential LNG Project Supplied with Gas from Offshore Fields North of Paria**

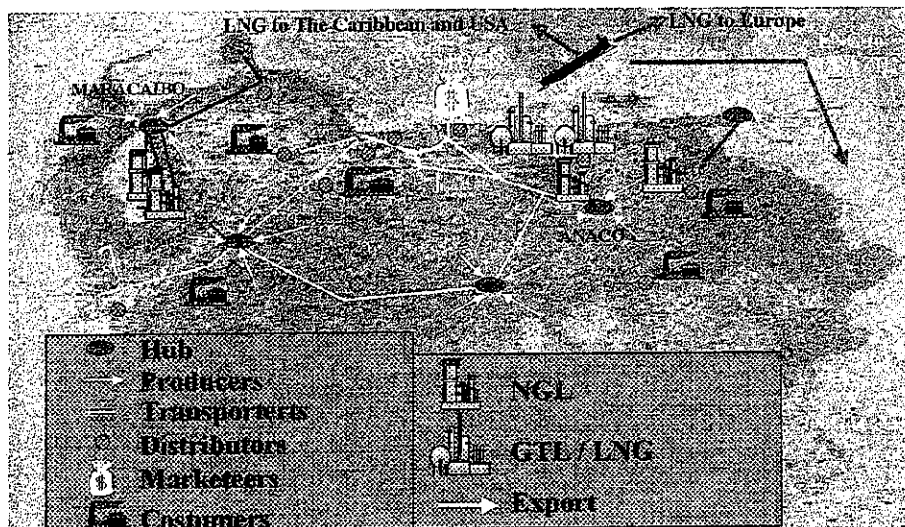


- The LNG plant, to be located onshore near the city of Guiria, will be dedicated to the export market around the Atlantic Basin (especially North America, Brazil and Western Europe).

### 5.3.3 Other Projects

"Long term", based on the offshore gas reserves north of Paria and in the Orinoco Delta, it is foreseen that surplus non-associated gas will be available to not only cover the LNG requirements north of Paria, but also to feed a GTL plant based in Güiria and to export gas by pipelines to Brazil. (See Figure 5-6).

**Fig. 5-6 Natural Gas Potential: Beyond Business Plan**



To cover the increased energy growth and to support the planned expansion of the petrochemical industry, the development of the gas industry, together with expansion of the gas transmission and distribution systems mentioned earlier, is considered a national priority. It is evolving from a regulated monopoly to a free market, open to private investors, based on the new legal framework recently established.



#### **5.4 GAS INDUSTRY LEGAL FRAMEWORK**

The first step taken by the National Executive, to open the gas industry and reduce discretionary authority, was through Decree 2532, dated May 20, 1998. This decree focused the legislation that existed, and established opportunities for the private sector to participate in the gas business. Together with its complementary regulations (Resolution No. 323), the decree focused on promoting greater private sector participation and competition in the transmission and distribution areas, especially in the area of providing gas to cities, while a new Gas Law was promulgated.

In the meantime, internal market prices for methane and LPG were being adjusted by the MEM, to competitive values with respect to other fuels, taking into account production, transportation and opportunity costs and providing margins for distribution.

Recently, a new Organic Gaseous Hydrocarbons Law was promulgated (under Decree No. 310, dated September 12, 1999), providing the needed legal framework for the sector, offering security and stability to investors. The highlights of this law are the following:

- It opens the way for private investment, both national and foreign, with or without State participation, in all areas of the industry. Those areas include exploration and exploitation of non-associated gas, together with its processing, transportation, distribution and commercialization (both internal and for export) of associated and non-associated gas.
- The new modes of participation include direct State participation (through PDVSA), mixed enterprises, or direct operation by private companies.
- It creates a Regulatory Gas Board, with functional autonomy but attached to the MEM, with the authority to establish prices, taking into account the respective costs and equitable margins.
- Promotes competition and national participation on an equal footing with outside sources.



- Although the royalty tax was increased to 20%, it applies only to extracted gas and not to reinjected gas.
- The income tax rate applicable to the gas industry will now be 34%.