

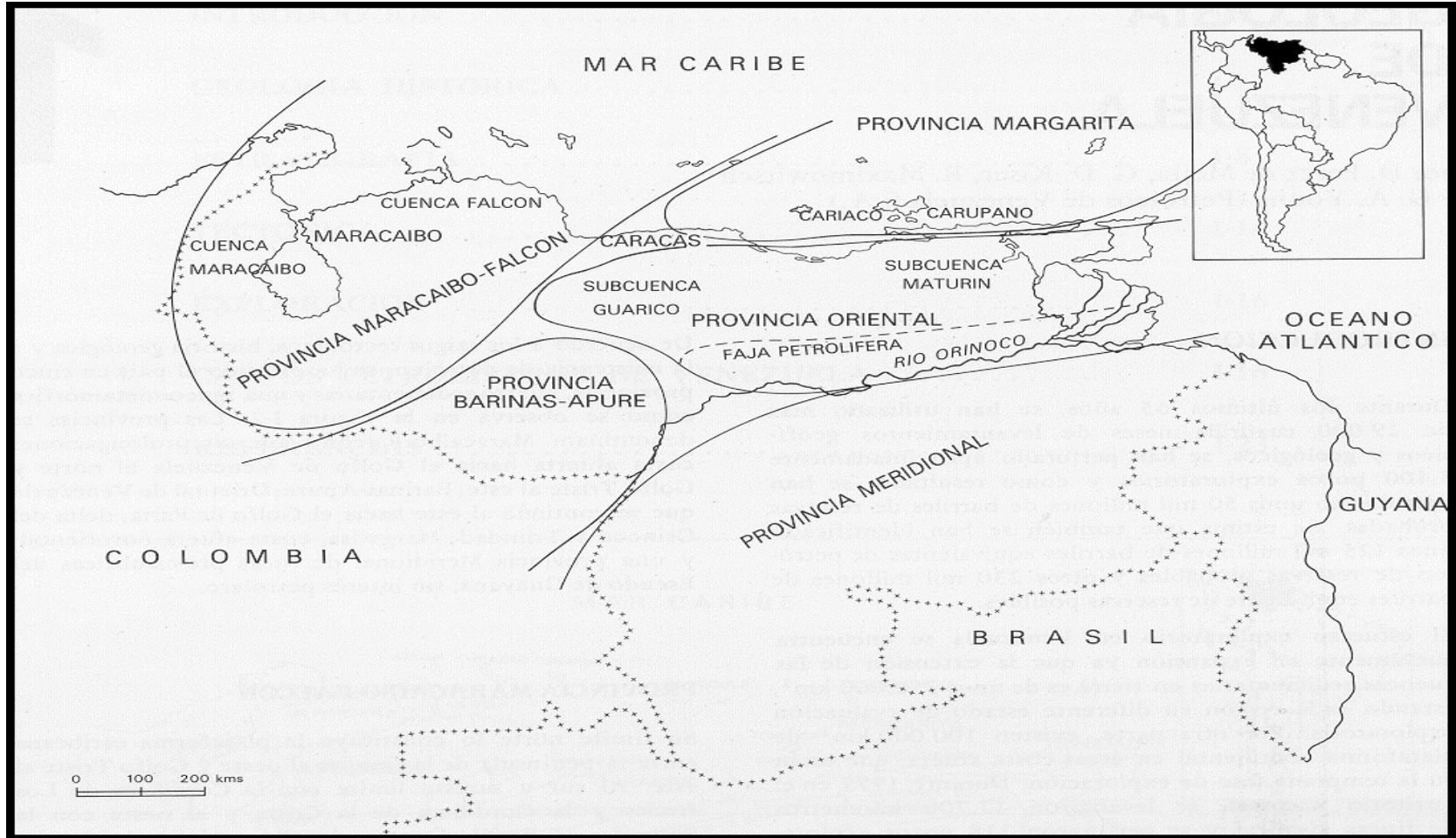


**Feasibility of Creating Gas Underground Storage in Frame Gas
Development of The Bolivarian Republic of Venezuela.
WO8-3_LOPEZ**

**By: Yilsa Lilibeth López Pérez - Petróleos de Venezuela, SA.
Bolivarian Republic of Venezuela , Septiembre 2014.**

- **Objetive**
- **Geographical Location of the Bolivarian Republic of Venezuela**
- **Antecedents of the project**
- **Expectations of the project**
- **Technical Premises**
- **Methodology**
- **Forecast Volumes of Gas Needed for ASG in Bolivarian Republic of Venezuela.**
- **Technical Criteria for the Selection Object Creation.**
- **Relative Location of ASG in the Bolivarian Republic of Venezuela.**
- **Economic Fundamentals Evaluated**
- **Conclusions**
- **Recommendations**

Give an overview of the only study of its kind undertaken by the Venezuelan state company “Petróleos de Venezuela, S.A.” in the Bolivarian Republic of Venezuela on the feasibility of creating Underground Storage of Gas as part of gas development the nation to long term.



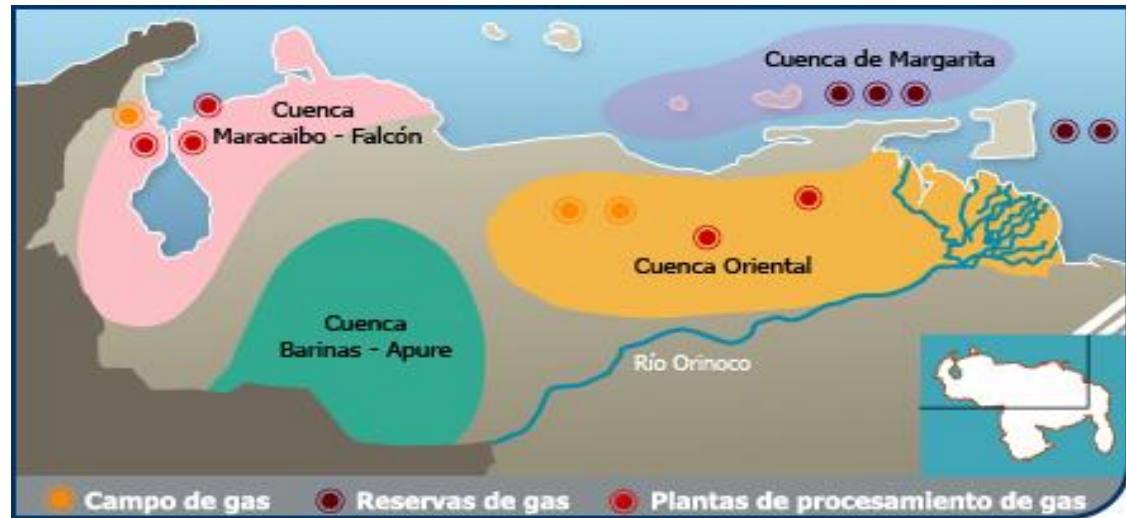
PROVINCIAS SEDIMENTARIAS DE VENEZUELA

© WEC, Schlumberger – Técnicas en Venezuela (1980)

Venezuela has large proven reserves of natural gas ranking as the country with the eighth largest proven reserves of natural gas and the first in Latin America.

Proven gas reserves in Venezuela totaled 151 Billion Cubic Feet of gas (PCBs) and have a volume of 40 billion possible reserves and resources base about 196 billion PCBs, for a total volume of 427 trillion cubic feet of gas.

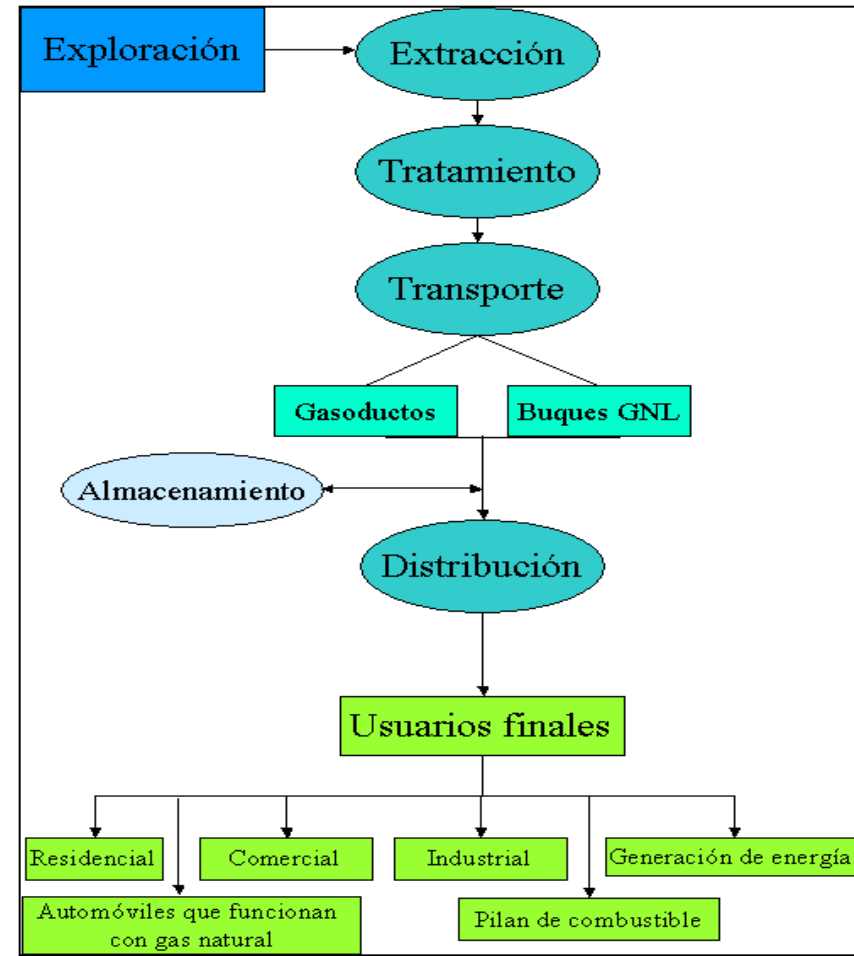
TECHNICAL SUPPORT BY
 RUSSIAN COMPANY
 GAZPROM UNDER THE
 COOPERATION BETWEEN
 THE BOLIVARIANA
 REPUBLIC OF VENEZUELA
 AND THE RUSSIAN
 FEDERATION.



Location of Major Gas Reserves in the Bolivarian Republic of Venezuela.

As part of the study on the gas development of the nation was analyzed the technical feasibility of the creation of Underground Storage of Gas (ASG), on the basis of:

- Generate sustainable and harmonious gas development based on growth plans of the nation.
- Environmental conservation.
- To position Venezuela as a reliable and secure supplier nationally and internationally to long term.



- **Develop draft technical feasibility of creating ASG in the Bolivarian Republic of Venezuela merited the analysis of the structure of gas consumption in Venezuela.**
- **To determine the required volume of gas reserves in the ASG by variant P -50 Development of Gas Industry and justify the geographical location of the storages, for it was necessary to analyze:**
 - 1.- **The spatial structure of the demand for gas according to the forecast schemes gas demand as the peak and moderate variant.**
 - 2.- **Technical features, existing and planned transport of gas.**
 - 3.- **To determine the volumes of gas reserves required by province in the country.**

The Study Merited to Analyze:

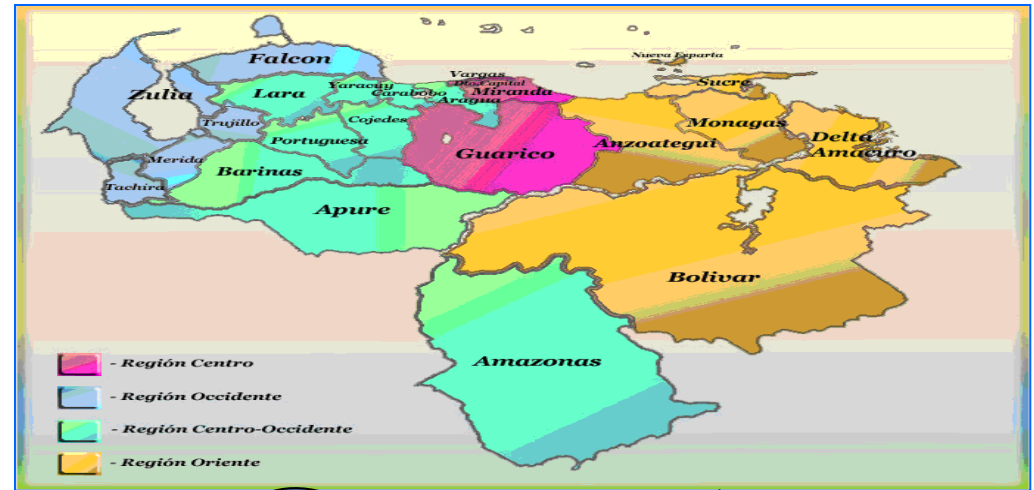
The main sources of energy.

Gas production in the country and comparing production rates of oil and gas.

Use of the capacity of the Gas Transportation System of Venezuela.

The gas market in Venezuela.

The balance of production and distribution of gas.



Prognostic schemes gas demand fluctuations and rates of consumption to long term according to variants and moderate peak.

Justification to create active gas volume in the Bolivarian Republic of Venezuela.

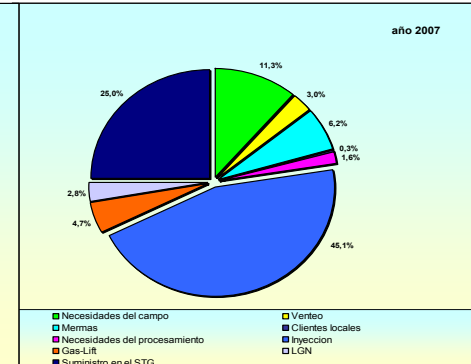
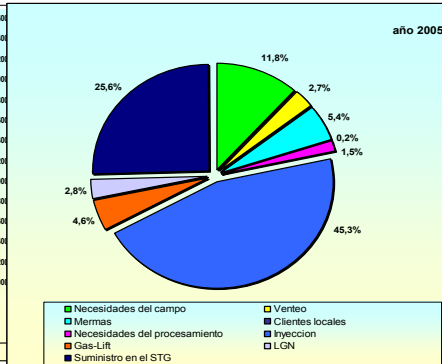
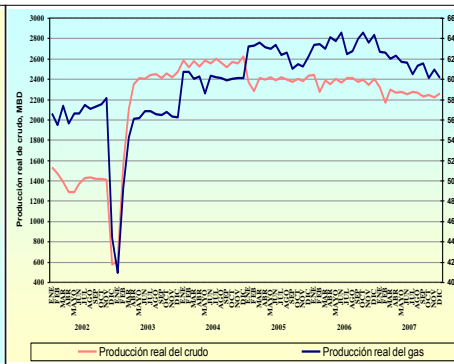
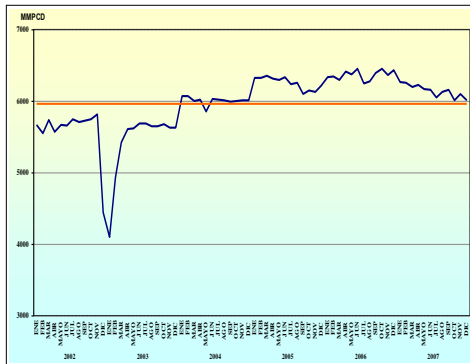
To select the storage reservoir and perform the economic evaluation of the creation of ASG in Venezuela

DETAILED ANALYSIS INFORMATION HISTORICAL

Definitions and causes of production irregularity gas in Venezuela by fields, regions, and at the country level

Definitions and causes of Consumer irregularity gas in Venezuela by customers, regions and at the country level

Irregularity of Use of capacity Gas Transportation System of Venezuela by fields, Companies, regions and at the country level



A basis of retrospective analysis were analyzed the main causes of the irregularities in the Gas Industry in Venezuela.

The balance of the gas rates in Venezuela are affected by two Independent Gas Transportation Systems (East and West).

The parameters of irregular consumption of gas in Venezuela were analyzed separately for each region so: East, West, Central and Central-Western and country levels.

Aspect Considered in the Analysis of the Balance of Gas and Gas Distribution in the Bolivarian Republic of Venezuela

Manufacture of gas;

Own production needs;

Gas losses:

- Venting,
- Reductions,
- Injection.

Local customers;

Gas Lift;

Gas processing;

Supply Gas System Transport and Distribution.

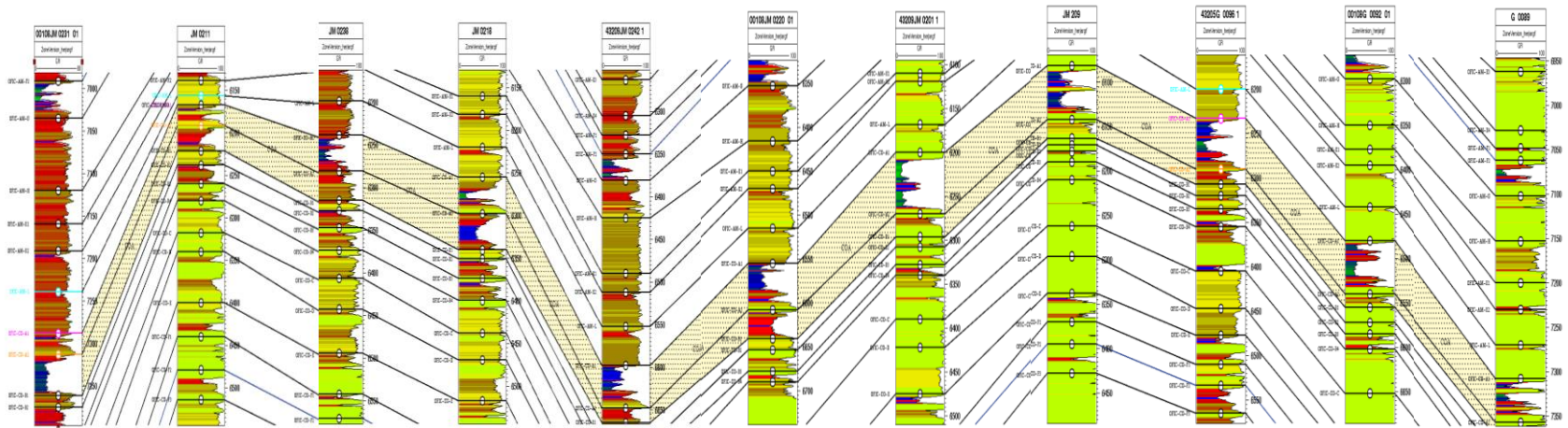
Forecast volumes of gas reserves needed for underground storage of gas in Venezuela until 2030 (MMMMPC).

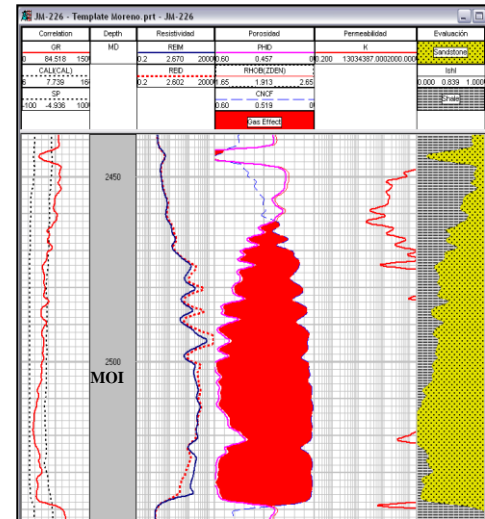
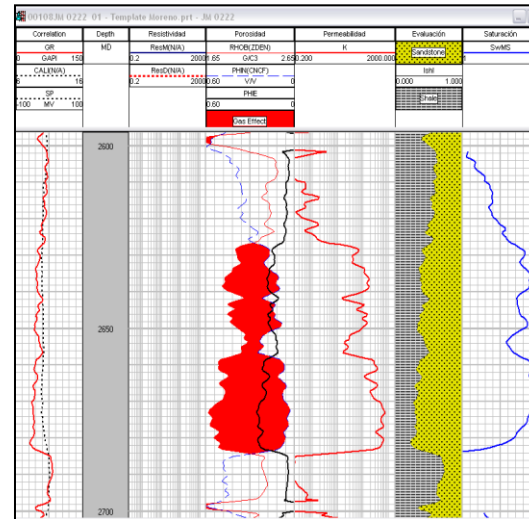
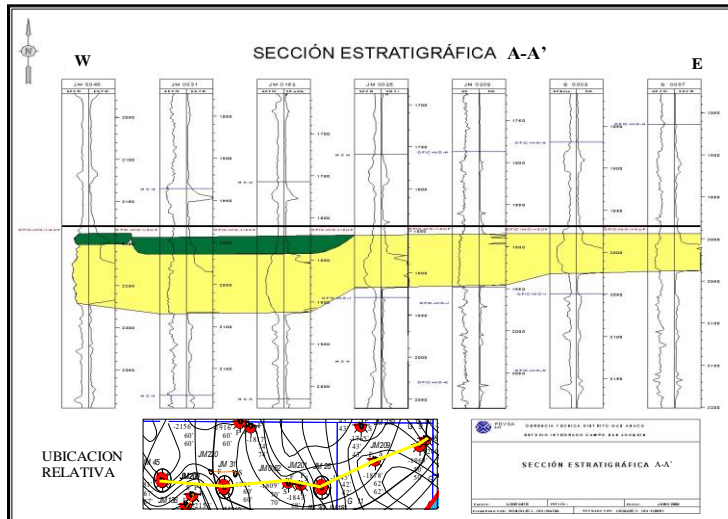
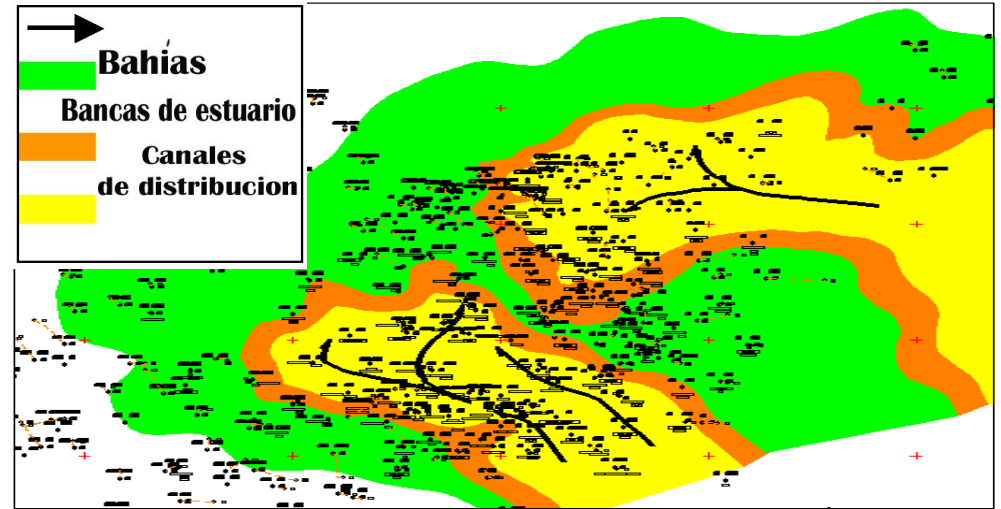
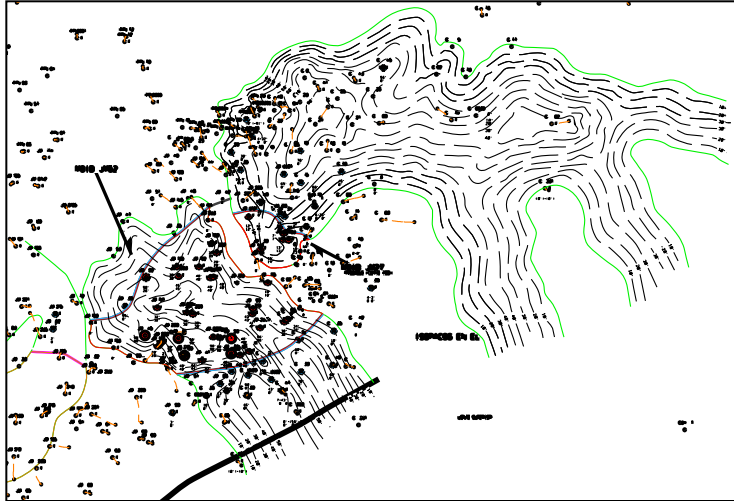
Región de ubicación de ASG	2015		2020		2025		2030	
	de pico	básico	de pico	básico	de pico	básico	de pico	básico
Occidental	20,5	11,6	25,4	13,6	29,5	14,1	33,0	16,9
Central	22,0	15,7	32,3	22,0	32,4	22,1	32,5	22,2
Oriental	48,7	28,9	56,8	33,4	62,9	36,8	74,3	43,0
TOTAL:	91	56	114	69	125	73	140	82

Forecast necessary productivity of underground gas storage in Venezuela until 2030.

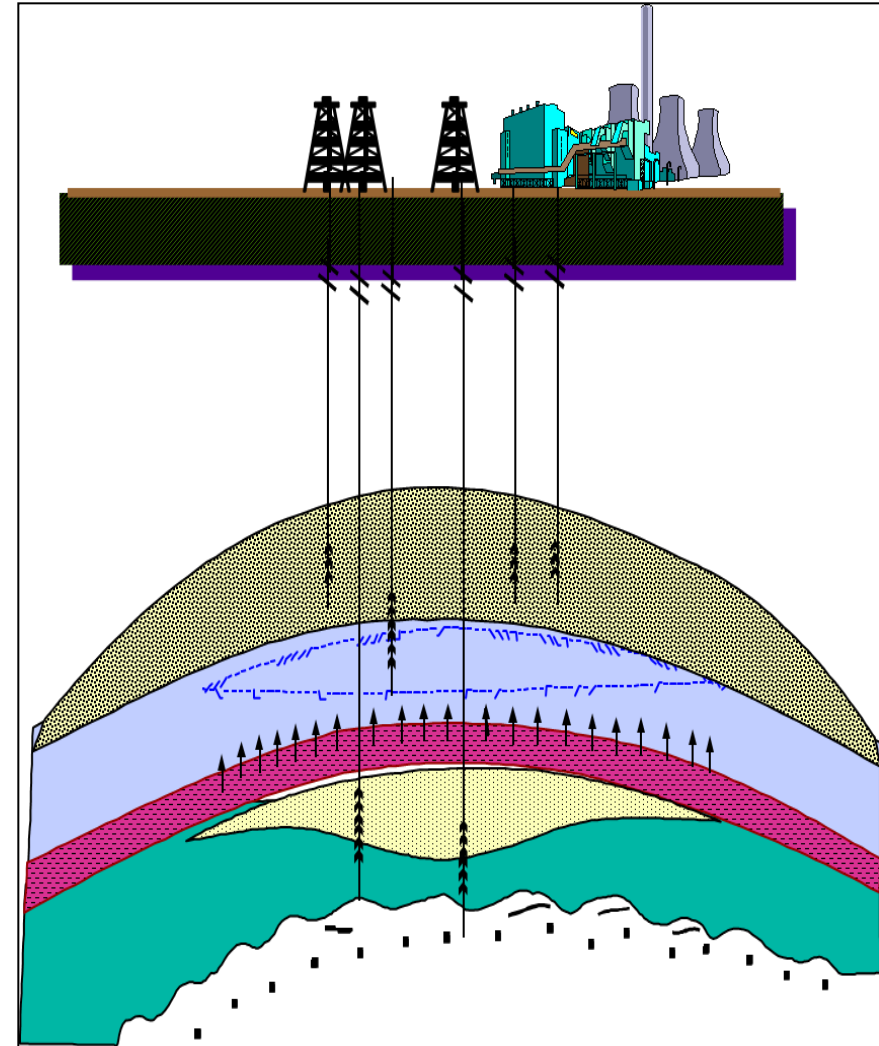
Región de ubicación de ASG	2015		2020		2025		2030	
	de pico	básico	de pico	básico	de pico	básico	de pico	básico
Occidental	659	665	817	778	948	806	1059	967
Central	757	723	1114	1012	1118	1017	1120	1021
Oriental	822	766	957	887	1060	975	1253	1141
TOTAL:	822	766	957	887	1060	975	1253	1141

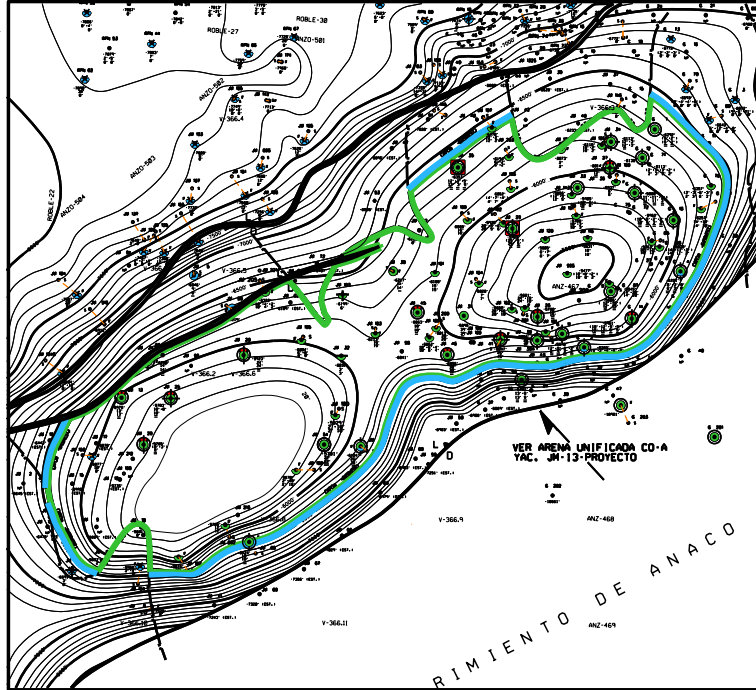
- Major geological criteria considered for selection of the reservoirs to be intended as ASG is the impermeability of the object.
 - Seals fluid must guarantee insulation of the object in operation under conditions of increased interstitial pressure.
 - The impermeability of the object must be studied to avoid unpleasant consequences during the gas injection and the possible migration of gas to underlying and overlying horizons.





- The second important technical and economic criteria in the feasibility study of creating ASG is the depth of the geological object, which impacts on the following aspects:
 - The less deep that the object the better the relationship between the working gas and the buffer gas.
 - It will be easier to control the tightness of the object.
 - Increased productivity of wells.
 - Low cost drilling and well maintenance.



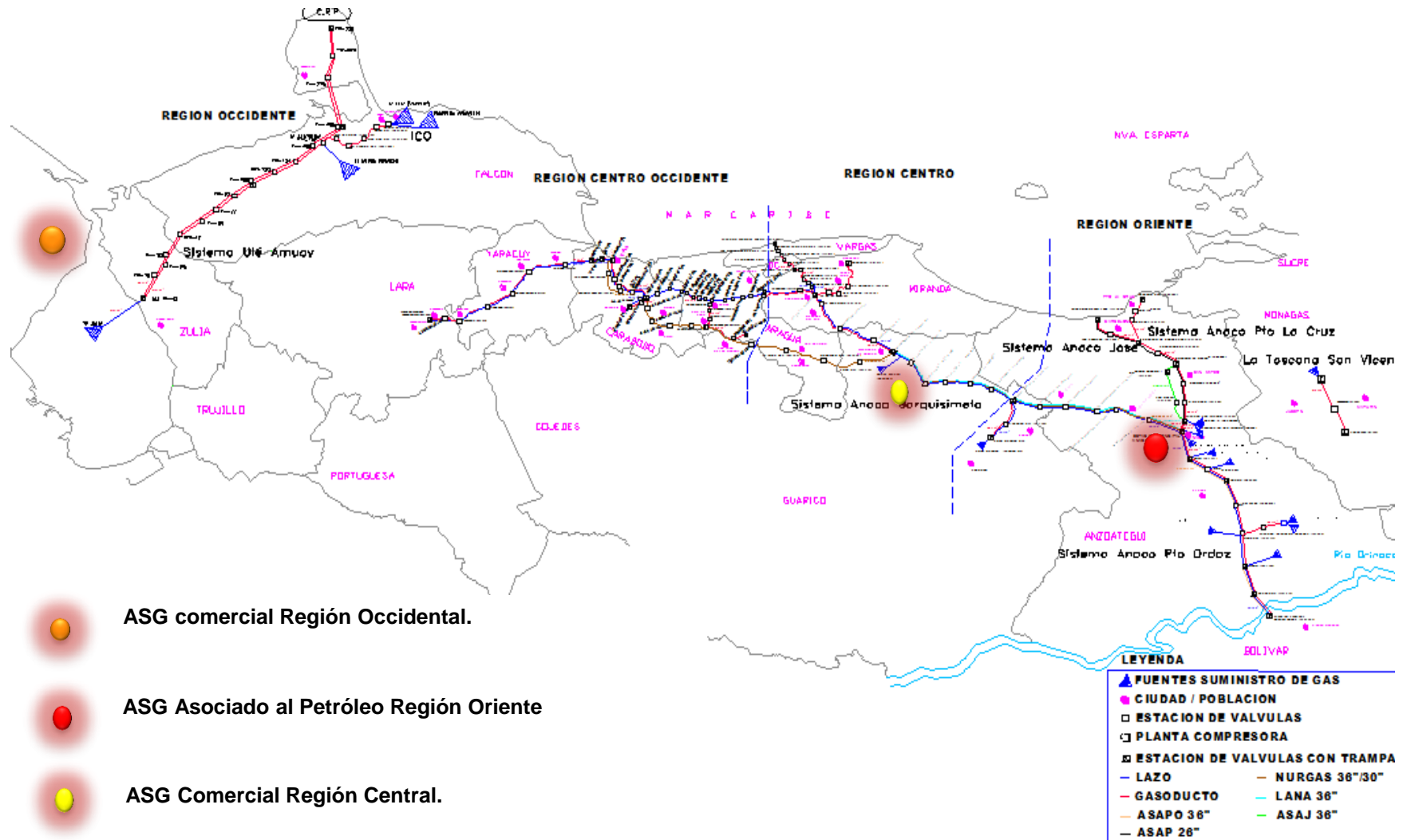


The advantages of creating ASG based gas fields and condensate and gas are:

- -Well-study of the object.
- -Tightness proven geological object.
- -Infrastructure.
- - Ability to use old wells.

Additional requirements in choosing objects based ASG gas fields and condensate and gas:

- - Absence of aggressive components (CO_2 , H_2S) in the gas.
- -Original booking (recovered) optimal gas in the reservoir.
- - Isolation reservoir of underlying and overlying layers and aquifers productive horizons.
- -Tightness of old wells (exploration, operation, injection, etc.) and the possibility to use them for the purposes of ASG.



ASG comercial Región Occidental.

ASG Asociado al Petróleo Región Oriente

ASG Comercial Región Central.

Study of technical and economic feasibility of the establishment of priority facilities ASG

The technological and geological properties of each object influence the basic original indices require separate storage and distribution costs, depending on:

- 1.- The creation of the active storage volume of gas.
- 2.- Injection necessary volume of gas-buffer.
- 3.- Number of operating wells and wells to be drilled.
- 4.- The amount of conditioning technological objects.

The structure of investment includes the following chapters:

1.-Gas-buffer;

2.-Drilling:

Operating;

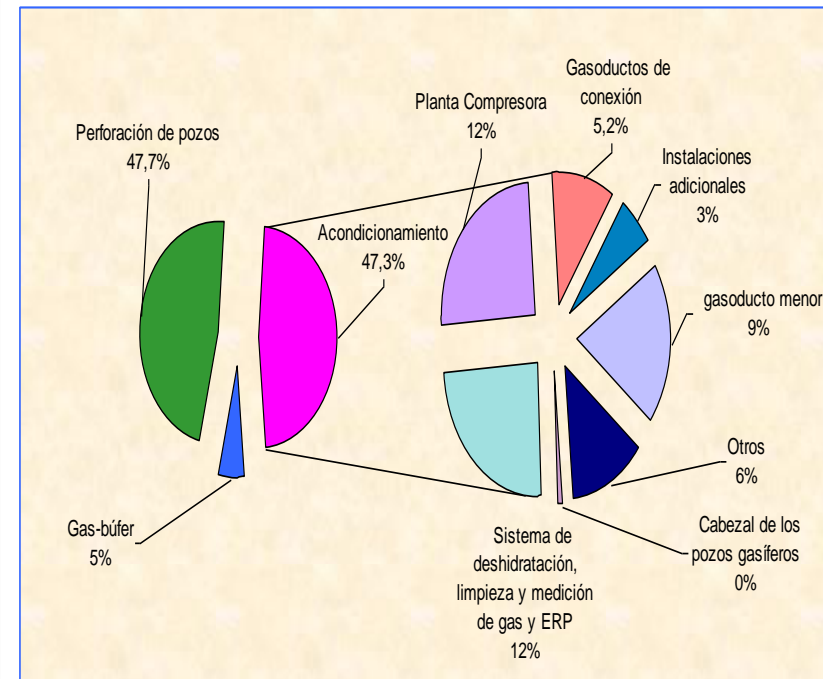
Additional;

Restoration of wells.

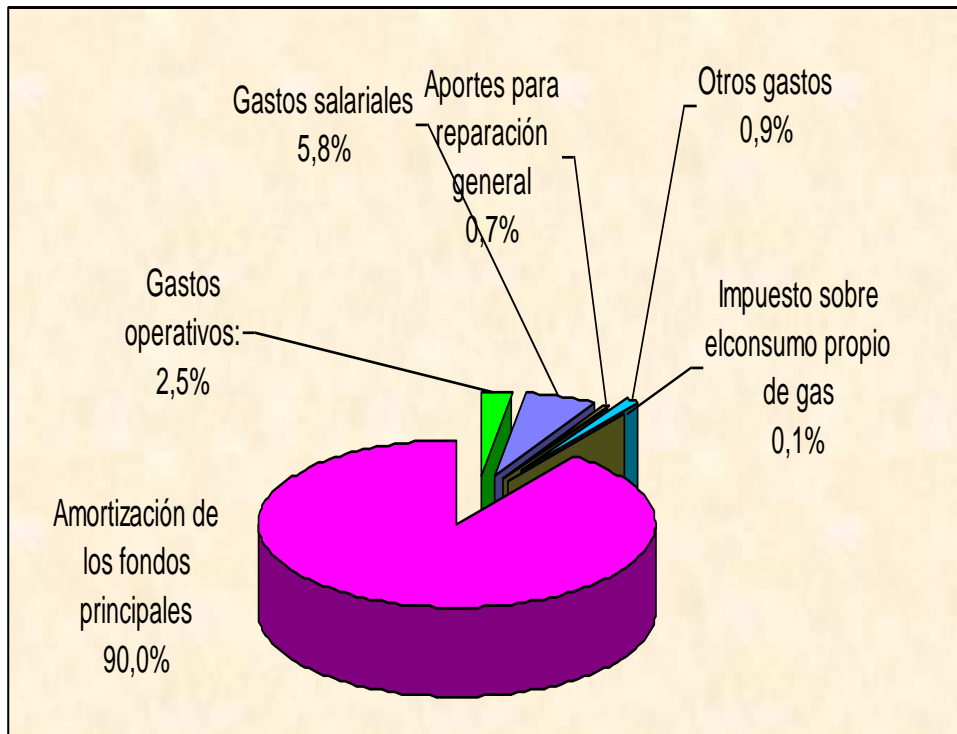
3.-Facilities conditioning Gas:

- Equipment installed in the mouths of gas wells;
- Dehydration system, cleaning, gas measurement and ERP;
- Compressor Plant;
- Gas connection;
- Additional facilities;
- Lower pipeline;
- Other.

As a basic technological parameter for calculating capital investment was accepted active volume of gas in storage.



Operating expenses for extraction, storage and injection of gas in the UGS



The structure of operating expenses include the following costs:

- material costs;
- salary costs;
- overhaul;
- other expenses;
- taxes;
- amortization of the principal funds.

Once analyzed the gas demand forecast as the P-50 variant of the development of the Gas Industry in Venezuela and creating different scenarios of gas consumption: the peak; values based on fluctuations in gas consumption during the historical period, and moderate; determined by the average value of gas consumption per month during the historical time period considered for determining the necessary volumes of gas reserves because of its scope and objectives, and conclude the following:

- Venezuela is a big producer of hydrocarbons with excellent positioning worldwide.**

- **Predicted changes are currently facing with increased consumption of natural gas as fuel in various industrial processes aligned with the development and balance of resources. This condition requires performing projects in the medium and long term to ensure the supply of gas to customers in the domestic market of the country and to strengthen Venezuela's position in the global energy market.**
- **The feasibility of existence and availability of Underground Gas Storage strengthen the supply of gas to customers in the domestic market of the country and secure gas exports abroad.**

- The Underground Gas Storage are the main and most effective technical means to ensure the supply of gas to customers.
- The required volume of gas reserves in Venezuela forms of commercial reserves, compensation for partial delivery of gas if stoppages and breakdowns and planned maintenance (unplanned), the country's strategic reserve and reserve securely export.
- Values of harvesting gas supply to the Customer fully insure the supply of gas in case of breakdowns, and gas supply due to market conditions.
- Existing Gas Transportation System, considering the future expansion and new projects are sufficient to supply gas to the ASG while no limit to Customers located in different regions of the country and ensure the supply of gas ASG Customers of the Central, East and West regions of the country in the event of unforeseen circumstances beyond its control.

- **All countries should put their grain of sand in saving the planet and the human species on the planet, make efficient use of energy is the challenge we all have ahead. The gas is an energy source that should be used well sheltered and underground gas storage facilities are a safe haven option.**
- **All companies must conduct studies aligned commitment to minimize the impact to the environment that could be causing any of the activities developed.**

The planet needs all of us, do not disappoint !!!!!!

Thank you for your attention

If you want more information about the
specific topic of the project you can write to
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