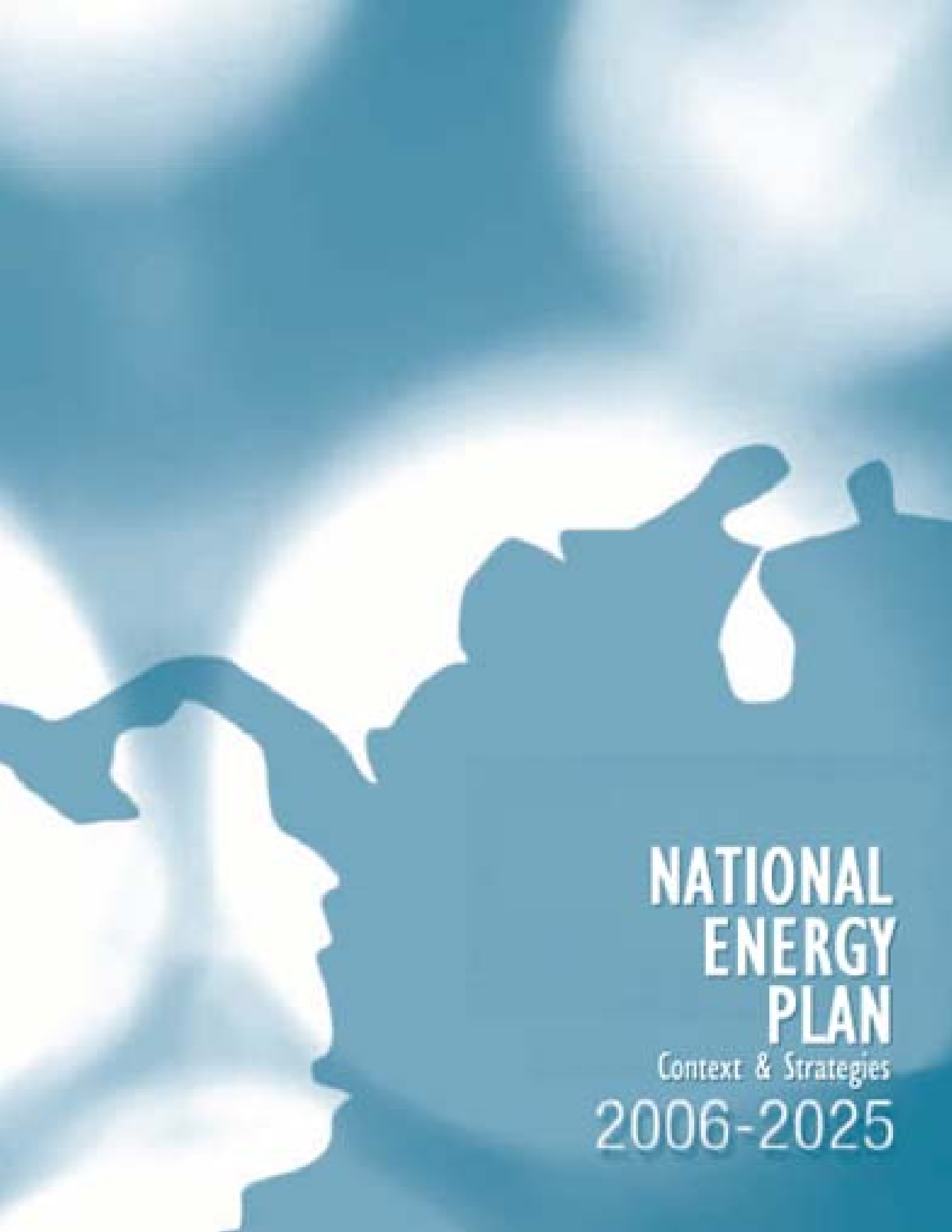

NATIONAL ENERGY PLAN

Context & Strategies

2006-2025

NATIONAL ENERGY PLAN 2006-2025
Context & Strategies

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With support from Subdirección de Planeación Energética
And consulting firm COSENIT S.A.
Editorial Coordination
Teresa Huertas Molina
Design & Printing Digitos & Diseños
ISBN 978-958-97855-7-7

The writing of this document ended in December 2006
Bogotá D. C. April, 2007

TABLE OF CONTENTS

Presentation
Introduction
Summary

PRESENTATION 5
INTRODUCCION 7
SUMMARY 10
CHAPTER 1: INTERNATIONAL ENVIRONMENT 23
1. GLOBAL TRENDS 23
2. GAS AND OIL INTERNATIONAL RESERVES 23
3. STRUCTURE OF GLOBAL CONSUMPTION OF PRIMARY ENERGY 26
4. ENERGY PRICES 31
5. THE IMPORTANCE OF THE ENVIRONMENTAL VARIABLE 33
6. ENERGY IN LATIN AMERICA 34
CHAPTER II: NATIONAL ENVIRONMENT 39
1. THE COLOMBIAN ECONOMY: EVOLUTION AND PROSPECTS 39
2. NATIONAL ENERGY DIAGNOSTICS 41
3. BEHAVIOR OF RELATIVE PRICES FOR ENERGY SOURCES 46
4. CURRENT SITUATION 48
CHAPTER III: PROSPECTIVE 61
1. PROSPECTS REGARDING THE BEHAVIOR OF THE ENERGY DEMAND IN COLOMBIA 2006-2025 61
2. BASIS CASE 63
3. REQUIREMENTS FOR PRIMARY ENERGY – BASE CASE 79
4. ADDITIONAL STUDIES 85
5. CO_2 EMISSIONS 95
6. LONG RANGE VISION OF THE NATIONAL TRANSMISSION SYSTEM 96
CHAPTER IV: COLOMBIAN VISION PLAN AND THE NATIONAL DEVELOPMENT PLAN 2006 – 2010 100
1. GENERAL CONSIDERATION TO THE COLOMBIAN VISION PLAN 2019 100
Energy Sector 102
2. THE NEP 2003-2020 OBJECTIVES WITHIN THE FRAMEWORK OF PLAN 2019 104
3. National Development Plan Project 2006-2010 106
CHAPTER V: NATIONAL ENERGETIC PLAN 2006 -2025 OBJECTIVES AND STRATEGIES 112
1. Main Objective: TO MAXIMIZE THE ENERGETIC SECTOR CONTRIBUTION FOR THE SUSTAINABLE COUNTRY'S DEVELOPMENT 114
2. Main Objective: TO ASSURE THE AVAILABILITY AND FULL SUPPLY OF ENERGETIC RESOURCES, TO SERVE THE DOMESTIC DEMAND AND TO GUARANTEE THE SUSTAINABILITY OF THE ENERGETIC SECTOR IN THE LONG TERM 115
2.2 The Oil Liquefied Gas – OLG 126
2.3 The Mineral Coal 128
2.4 Electric Energy 131
Main Objective: 3: TO CONSOLIDATE COMPETITION SCHEMES IN THE MARKETS 140
4.1 Oil and Natural Gas 141
4.2 Coal 146
4.3 Electrical Energy 147
5. Principal Objective 4: MARKET PRICE FORMATION OF THE ENERGETIC FUELS THAT ASSURE COMPETITIVENESS 152

5.1 Crude Oil and Natural Gas 153
5.2 Coal..... 158
5.3 Electrical Energy..... 159
6.1 Non-Interconnected Energy Zones..... 163
6.2 The performance of the FAZNI and FAER funds 163
6.4 Impact of the country's interior coal on local development..... 165
7.1 Non-Conventional Sources of Energy 169
7.2 Rational Use of URE Energy 174
8.1 The politics of quality of the fuels derived from crude oil..... 182
8.2 Bio-fuels..... 183
8.3 Technological upgrade of the vehicular park and emissions control..... 184
8.4 Environmental impact due to the use of energetic fuels such as natural gas, electrical energy, coal, GLP and others..... 185
8.5 Clean Development Mechanisms..... 187
8.6 Institutional Coordination 187
9.1 The utilization of coal as a clean resource 190
9.2 New uses for GLP..... 191
9.3 Technologies that use gas and coal in the production of liquid fuels such as CTL, GTL y CBM 191
9.4 Bio-fuels..... 192
9.5 Fuel Cells..... 193
10.1 ECOPETROL´s capitalization..... 194
10.2 Harmonization of the national regulatory frames with the sub-region 195
10.3 State participation within the fuel Sector companies..... 196
10.4 Sectarian Coordination 197
11.1 Business opportunities promotion 200
11.2 Public information and user training 200
11.3 The Education Agenda..... 201

ACRONYMS and ABBREVIATIONS 202

PRESENTATION

In a world that is ever more global, uncertain and dynamic, the circumstances for understanding and assessment of a strategy are constantly changing. For this reason, it is necessary to take a break periodically to review the environment, interpret the context and reformulate the strategies to follow the development of a long term policy. This is the foundation used to update the National Energy Plan every four (4) years, where it becomes a reference and orientation guide for sectional decisions.

The Colombian Vision Plan 2019, the National Development Plan 2006-2010 as well as the NATIONAL ENERGY PLAN 2006-2025 CONTEXT AND STATEGIES have determined the following as the focus for their sustainable development proposals and must be oriented towards economic growth, raise the quality of life and social benefits, without wasting the basic renewable resources on which they are based, nor deteriorate the environment nor the rights of future generations to use these goods to satisfy their own needs.

The recent behavior of the energy prices on a global level and an in-depth study of the structural factors that underlay this situation, indicate that it is very possible that the levels will stay higher than in the past.

This factor as well as the uncertainty of the availability of hydrocarbons in Colombia will be helpful as the energy sector will play a fundamental role in the future of Colombian energy. The higher prices for petroleum and gas will make coal more competitive – especially for the industry and for generating electricity as well as the development of non-conventional sources of energy.

With this in mind, it reinforces the importance of an integral energy policy that would consider the different subsections that would complement these measures to promote the energy offer with shares to encourage the rational and efficient use of energy.

The NEP presents a series of strategies to keep in mind duringthe development of this energy policy, with a long-term vision, to secure a supply of energy, without discarding the self-sufficiency benefits, as well as advancing in the regional integration, to consolidate the energy markets, encouraging the creation of efficient prices and generating local development to supply energy to the marginal sectors as well as the areas that are not inter-connected.

To reach the proposed objectives, private investment is fundamental to be able to develop the infrastructure required by the country and this is available when there is coherence and coordination in the institutions of the State, as well as with the active participation of society.

With an energy sector that is secure, trustworthy and efficient, we can all make Colombia a sustainable and competitive Country.

Hernán Martínez Torres
Minister of Mines and Energy

INTRODUCCION

Law 143 of 1994 in Article 16, establishes within the UPME functions, the creation and updating of the National Energy Plan – NEP, in accordance with the National Development Plan. Through the NEP, there are special policy features for the development of the energy sector of the country in the long-term.

In accordance with its functions, the UPME began the updating the NEP in 2006 utilizing the following sources of information and standards:

- The Colombian Vision Plan 2019, taking into account the appropriateness of following the guidelines designed for the Country in the long term.
- The studies: ¨Formulation of a National Strategy for Energy Supply¨ and ¨Design of an Integrated Policy of Energy Prices¨ contracted by the ANH and the UPME within the framework of an agreement between these entities.
- The NEP 2003-2020, to guarantee complete coherence with this Plan and, if possible, obtain continuity.
- Document - National Development Plan 2006-2010
- Internal Agenda for Competitiveness for the Energy Sector Document
- Other studies and plans that were developed by the UPME as part of their own functions as planner for the mining and energy sectors
- Written and verbal comments to the Proposal of Objectives and Strategies Document for the NEP 2006-2025, published in October 2006 as well as conversations held with associations and guilds linked to the energy sector, within the framework of a participative process.

Based on these sources of information, as well as the development of the activities fulfilled by the UNIDAD DE PLANEACION MINERO ENERGETICA – UPME (Energy mining Planning Unit) we have developed the NATIONAL ENERGY PLAN 2006-2025: CONTEXT AND STRATEGIES, which proposes elements to be used as an orientation tool towards decision making in the national energy sector with a long range vision.

The first chapter makes reference to the global and regional energy situation. At present there is an increasing fear regarding energy security facing a future with decreasing hydrocarbon reserves and at the same time, the considerable increase of energy consumption needed to push forward the rapid growth of economies in transition, with the increase of costs therein. We might add the concern, more apparent every day, by the environmental impact caused by the use of fossil fuels and the increasing awareness that the population must have regarding the preservation of the environment.

The second chapter presents a brief description of the Colombian economic situation and the evolution of the energy sector. One of the items it highlights is that our economy is recuperating with a positive and sustained growth rate of the Growth Domestic Product, which represents the greatest challenge to this sector, to be able to satisfy the needs for the supply of energy and contribute towards positive results in productivity and competitiveness in the country.

The third chapter presents a prospective agreement, with the assumption of a possible evolution in the Country, within economic variables, price estimates of the different types of energy, production or policy plans for implementation within the energy sector and results of specific studies completed by the UPME.

The projections allow us to observe a future demand situation by energy type as well as by economic sector. This, compared to the other scenarios, determine a supply of energy, especially for the critical areas such as petroleum, gas, sources for generating electricity and the DIESEL. At the same time, there are certain assumptions made for a greater growth of the economy and the application of some measures of energy policy geared towards ensuring energy supply.

The fourth chapter presents a brief summary of the Colombia Vision Plan 2019 regarding the energy sector, taking into consideration that this is a vision of the Country that we want and the type of society that the Colombians wish to have towards the year 2019, in this way, we are creating a guide to follow, that would indicate the lines of continuity and generates a collective purpose to build this vision together. At the same time, it makes reference to the objectives, strategies and actions that are presented in the National Development Plan 2006-2010.

The fifth chapter develops the structure of the Plan around the Central objectives to maximize the contribution of the energy sector towards the sustainable development of the country and the Main Objectives:

1. Ensure the availability and total supply of energy resources to fulfill the national demand and guarantee the sustainability of the energy sector long term.

2. Consolidate the regional energy integration

3. Consolidate competitiveness plans in the markets

4. Creation of market prices for energy sources that would ensure competitiveness and rational use of energy

5. Maximize coverage with local development

Due to the fact that the recommended strategies for the fulfillment of the Main Objectives present common themes, we identify the following Related Subjects that would assist in the fulfillment of said objectives:

1. Non-conventional sources and rational use of energy
2. Environment and public health
3. Science and technology
4. Institutional and normative framework
5. Information, promotion and training

SUMMARY

The following is a brief summary regarding the development of each one of the main objectives and related subjects through which the strategy proposals and actions of the NEP were developed. We have set up the report by strategies grouped by sectors of hydrocarbons, electric energy, and coal and common to those, although within the document, they were also developed in accordance to the objective or specific Related subject.

> **Core Objective**: Maximize the contribution of the energy sector towards the sustainable development of the Country.

The sustainable development leads towards economic growth, elevation of the quality of life and social wellbeing, without depleting the basic renewable natural resources that sustain them, nor deteriorate the environment or the right of future generations to utilize them to satisfy their own needs.

As the economy grows, we need a secure, trustworthy and efficient energy sector to make Colombia a competitive country with sustainable development.

> **Main Objective** 1: Ensure the availability and total supply of energy resources to fulfill the national demand and guarantee the supply of the energy sector long term

The country needs to be able to count on energy resources, whether they are of national or imported production, as well as adequate infrastructure to fulfill the needs of the different socio-economic sectors of consumption. However, Colombian society will have a higher level of wellbeing when the resources are found within the national territory as they would encourage increased fiscal and social security income and have a positive impact on the economic growth, on work and the possibility of improving incomes.

The concept of sustainability also makes reference towards multiple considerations regarding the environment and the institutional and normative aspects that allow for the strength and permanence of productive sectional structures.

Within the development of the objective several aspects are taken into consideration such as the balance of supply/demand, the transactions of the energy sources and the indicative planning, among others.

Main Objective 2: Consolidate integration of regional energy

It is a common wish for our Country and those of the region to: increase the energy security, diversify the sources of supply and optimize the investment costs and operation; however, considerations regarding the risks and the opportunities associated with the integration, differ structurally with regards to the availability of resources scenario in each country. Reaching this objective depends not only on the Country but on the will of the counterparts and the actions coordinated among the countries.

Main Objective 3: Consolidate competition plans in the markets

Strengthening the markets of those activities susceptible to develop competitively is one of the objectives that are maintained as this economic model is applied. There are special aspects for each energy sector which are touched upon depending on the appropriate situation of each market such as the availability of information, vertical integration, property concentration, free access and private investment, among others.

Main Objective 4: Create energy market prices to ensure competitiveness

A price policy whose signs would be at the same time a result of the energy markets in competitiveness, will contribute towards the creation of a more viable Colombian energetic system. Although this subject is closely related to the objective previously mentioned, it involves specific aspects that it will merit treatment as an independent objective, such as the contractual plans, tariff components and subsidies, among others.

Main Objective 5: Maximize coverage with local development

The access to commercial energy services is a very important way to increase the opportunities for generating of income and to improve the social climate, but it should be done in such a manner that it will be viable and contribute to the development of an energetic system that is environmentally sustainable.

Maximize the contribution of the energy sector with the equity and social development of the most vulnerable citizens, which means improving the level of the communities that are located in connected and non-connected areas, rural and lower levels of the population, through programs of access to commercial energy that would in turn encourage productive development programs in these regions. In this way, we are studying aspects such as the use of the applied funds for an increase in coverage and the use of electrical energy service in the non-connected areas, among others.

Related Subject 1: Non-conventional sources (FNCE) and Rational Use of Energy (URE)

As a result of the model implemented and while not unbalancing the status supply/demand for energy, little attention has been placed in Colombia on the development of successful policies, directed towards including the use of non-conventional sources of energy in the energy basket and encouraging energy efficiency programs that would improve the use of the available resources.

We have identified and analyzed some barriers that may be classified as technical, economical, financial, legal and institutional, that represent the greatest incidence in the results that have now been reached.

Although the FNCE and URE subjects are included under one title they are developed separately considering that the FNCE are related with the generation of energy and the substitution of conventional sources, while the URE refers to the demands of a better use of the relative scarce and non-renewable resources.

Related Subject 2: Environment and public health

Minimizing the impact on the environment and public health is one of the parameters incorporated into the NEP under the premise that the benefits of firm and prompt action for the protection of the environment, compensates for the economic costs of not acting in time. As the public welfare is a Related Subject on many activities, sections and organizations, the plans and development programs must be executed with synergetic focus placed on different areas of the territory with a shared objective vision between all the agents and authorities.

Related Subject 3: Science and technology

In such cases, as countries such as Colombia, it is important to have a strong force placed towards the subjects of development and innovation not only technological but scientific in the energy sector, considering the multiplicity of cases where there are requirements of greater technical and economical efficiency to encourage development of the sector. We try to acquire knowledge in specific areas of national interest defined by the Government that could be applied to medium or long term national problems.

Related Subject 4: Institutional and normative framework

For the implementation of the objectives and strategies of the Plan, it is important to be able to count on an institutional and normative framework that would guarantee the rules of the game clearly, which would make it easier for the companies to stay in business. Within this analysis, this Plan emphasizes the need to reach the highest levels possible for coordination of energy institutions as well as the other authorities involved, which are constantly increasing.

There are also specific subjects that have been taken into consideration, such as the capitalization of Ecopetrol and the coordination of the national regulatory framework with the other countries of the region.

Related Subject 5: Information, promotion and training

One of the subjects that comes up in the majority of subjects and sections under this study, is the requirement for the economic agents to have the information that they need to understand the development of the sector and to identify the business opportunities. Also, we mention the educational processes for the adequate use of the energy.

STRATEGY AND SUBSECCIONAL ACTIONS

We would like to present some of the main strategies and actions relating to each sector, considering those with a greater impact. They are classified as short and long term: 2010 as the short term and between 2011 and 2025 the long term. Those who remain at this time are classified in the first period.

HYDROCARBONS

SHORT TERM

- Maintain good conditions so as to ensure investments in exploration and production of hydrocarbons that will allow for the discovery of new reserves
- Improvement of geological possibilities in the frontier areas through an increase of investments made to the ANH in areas of low exploration, heating of areas and technical evaluation contracts.
- Accelerate the recovery of existing reserves
- Design and implementation of a Strategic Plan for promotion of extraction and treatment of heavy and extra heavy crude to allow us to consolidate a portfolio of reserves that will contribute to the supply, in the long term, with local resources
- Guarantee the viability and opportunity of the operations of the companies in the exploration and production of hydrocarbons, through the following:
- Maintain the Government-Industry Agreement regarding the basic subjects of security and cooperation with the military, energy and other related authorities.
- Develop mechanisms within the contractual framework for exploration and exploitation of hydrocarbons that tend to establish conditions that will ensure that the main focus on the internal demand is for natural gas.

+ Evaluate criteria and mechanism for the Country so that it may have access to international markets for natural gas such as GNC or the GNL.

+ Create a study to allow for the visualization of the effects that the final price for importing natural gas would be, as well as its implications in the generating, transportation, industrial and domestic sub-sections.

+ Follow up to the construction of a bi-national pipeline between Colombia and Venezuela.

- Define criteria to develop a plan that will ensure the local supply.

+ Establish as the priority the supply of crude to the local refineries, before allowing for the consumption as fuel or the exporting to international markets.

+ Establish, in an explicit way, the priority towards fulfilling the national demand for natural gas.

+ Determine criteria of trust ability for the supply of natural gas and liquid fuels.

- Strengthen the development of indicator planning in the hydrocarbon sub-sector, creating an Indicator Plan of Expansion of the Infrastructure, geared towards a stable and sustained energy development

+ Create an analysis and prospective studies with annual updates to be able to evaluate the effectiveness of our own capacity to guarantee complete and secure supply of hydrocarbons, detailing the needs for infrastructure to reach an adequate development of the sub-sector.

+ Identify critical situations for supply and develop the appropriate contingency plans.

- Establish the standards of access for third parties to the transportation and storage infrastructure, as well as the criteria for its expansion and remuneration.

- In the transportation activity, explore new regulatory models whose main purpose would be to guarantee the expansion of the infrastructure and be able to use it whenever the demands so require it.

- Develop new mechanisms that would work towards achieving the objectives planed in the special regimen for liquid fuels in the border areas which would also prevent distortions in the fuel market.

- Define outlines for the verification of fulfillment and execution of construction jobs compared to the 15 year investment plans to be utilized by the gas distribution companies.

- Identify the company that will administer the resources of the FONDO ESPECIAL CUOTA DE FOMENTO and the supervision of the execution of said projects

- Quantify the availability of the LPG for energy uses.

+ Characterize the offer of the LPG including the contributions to the new production projects.

+ Study and define projects on the use of Refinery LPG oriented towards the petro-chemical sector.

+ Develop a program to consolidate the use of LPG as energy in the periphery of the cities, in the municipalities that do not have natural gas services and in the rural areas.

+ Develop a study that would identify the market plan that would allow us to reach the greatest levels of coverage and quality of service.

- Define the regulatory and institutional framework that would make the development of the LPG sector viable for which several institutional groups must be taken into consideration as well as behavior of the agents and tariffs.

- Ensure the availability of appropriate and trustworthy operational and commercial information; which would make it easier to develop an appropriate indicative plan that would allow for decisions to be made by agents and institutions of the State.

LONG TERM

- Update the plans for operating the refineries to orient them towards processes of high conversion to allow for distilled products (half and smaller) offers of gasoline.

- Promote the development of new refinery plans considering the advantages that would be available with a new refinery located on the Colombian Pacific coast. A prospective study indicates that it would be a good opportunity to open one in 2017.

- Subject to the evaluation of technical, economical and environmental convenience – maximize the participation of the bio-fuels.

- Evaluate and define criteria and mechanism for easy access of the County to the natural gas international markets such as GNC or the GNL.

- + Analyze the option of installing a re-gasification plant, whose sole purpose would be a backup should we be unable to incorporate new gas reserves. In the overall reserve plan, this prospective indicates the need before the year 2018.

- + Evaluate the convenience of using a stamp tariff calculated for the total system, so as to balance the regional distribution of natural gas and have the availability of opening possibilities for the development of new markets.

COAL

SHORT TERM

- Quantify the reserves and capacity available of coal production for supply on a national basis as an energy source in fuel combustion and raw material for transformation, such as CTL.

- Search for a higher participation of coal in the national energy basket.

- Revise the standards and identify the barriers so that, under the same conditions as other energy sources, it would be possible to develop projects for generating electricity of low environmental impact derived from coal

- Quantify the reserve of methane gas linked to blankets of coal and promote its use for projects that generate electricity.

- Expand the development of scientific and technological knowledge regarding coal and the processes for its uses in the new petrochemical technologies and in generating energy.

- Develop programs to promote the use of coal industrially using low environmental impact technologies.

- Encourage the integration of the small producers through association plans - cooperational style, so that they can strengthen their productivity and improve the conditions for competitive efforts in the market.

- Encourage formalizing the illegal mining and strengthening the informal mining through programs that encourage the increase of the productivity and fulfillment of standards, by improving supervision of labor.

- Encourage the development of information systems, investigation of markets and publication mechanisms that will assist in the commercialization of the product by small miners.

LONG TERM

- Create incentives regarding demand for coal from the interior of the County towards production of liquid fuels and combustible gases.

- In accordance with the above, evaluate the viability of implementing transportation systems on a greater scale for coal in the interior of the Country.

ELECTRICITY

SHORT TERM

- Establish a follow-up mechanism to measure the results of the application of the new reliability charge, as a signal for expansion for generating electricity and becoming a part of the energy basket.

- For the cases in which the private sector does not react to the regulatory signals and to guarantee the required expansion in generating electricity, it has been proposed that mechanisms and activation points be development for said fulfillment by the Government who would be responsible as a ¨last resort¨ regarding public services usage.

- Strengthen the role of the UPME in the development of indicative plans and the promotion of projects regarding generating electricity.

- Strengthening the activities of the Superintendencia de Servicios Publicos (Public Services) to discourage anti-competitive behaviors and suggest standards for promoting competition in the MEM.

- Institutionalize a plan for operational coordination of gas-electricity.

- Establish practices of good corporative government in companies with a majority state participation, while the processes of linking new strategic investors is consolidated.

- Encourage activities to promote a plural participation in the bids for expansion of the Sistema de Tarnsmisión Nacional (National Transmission System).

- Develop the regulatory harmonization required for the electrical inter-connection between Colombia and Panama.

- Develop plans through the standard mechanisms that would allow for the strengthening of the distribution-commercialization companies considering the characteristics appropriate to the market, and to encourage adequate corporate management and execution of the investment plans that are required to expand coverage, lower or maintain lower levels of losses and offer a service with the required quality.

- Confirm the processes of having strategic investors join the distributing companies with majority participation in the Government, to strengthen their corporate management and improve their financial capabilities.

- Develop strategies and mechanisms that would promote competition in the commercialization of the product, to ensure the transfer of an efficient cost to the regulated and non-regulated market.

- + Consolidate the regulatory development of public bids on energy purchases through an auction type mechanism via computer, anonymous and with a standard product.

+ Establish a Commercialization Standard.

- Study the application of the subsidies of electric energy from the point of view of its focus, to be able to achieve the widest coverage possible for the objective population, optimizing the use of the resources of the Fondo de Solidaridad – FSSRI.

- For the Non-Interconnected Zones, implement management plans with specialized operators where incentives would incorporate: introduction of efficiency costs, better customer service regarding quality and coverage and replacement of fossil fuels.

LONG TERM

- Identify the different barriers or obstacles for better electrical services to encourage improvement in their development.

- Continue the separation process from the company of the Administrador del MEM (MEM Administrator) and the Centro Nacional de Despacho (XM) (National Dispatch Center) of any agent who participates in the electrical energy market.

- Develop activities and mechanisms that promote competition in the distributorship to ensure the transfer of an efficient cost to the regulated and non-regulated market.

  + Lower the limit to become a non-regulated user.

  + Make the measuring requirements more flexible for the regulated users who change their distributor.

  + Develop the standard and placement of the standardized contract system (SEC)

- For the ZNI, as a later stage in the management plan, we propose the establishment of exclusive areas for offering services (concessionaires), to ensure responsibility for coverage and where the community is involved as an integral part of the solution.

RELATED ITEMS

- Create a monitoring system of competitiveness for the Country in the energy sub-sectors.

- In view of the vertical integration in the gas chain and the electricity chain:

  + Review the coherence of the standards verifying the existence of rules of differentiation, according to the degree of integration of the companies in the market; also, review standards regarding the limits of participation in the activities that are susceptible to competition.

+ Evaluate the effects, positive as well as negative that are available at present, which may be a product of the vertical integration (for privileges given under the Law) to make the appropriate decisions, searching to consolidate competitiveness in the market and the greatest benefit for the final user, similar to the participation limits.

- Maximize coverage of energy service in the Country for which we must:

+ Create a portfolio of energy resources for supply of energy services in the rural areas of the country, including the environmental criteria, for health and welfare of the population.

+ Design programs for use of non-conventional sources of energy for generating electricity, including the modifications of regulatory standards that may be necessary.

+ Application and follow-up to the indicative coverage plan for electricity created by the UPME in accordance to the standards of law.

- Reinforce the institutionalism associated with the development of the non-conventional sources of energy, consolidating information systems, training in the communities and definition of financial plans to encourage implementation of the projects.

- Define, prioritize and implement the programs and sectors where the activities of the URE will take place, considering criteria such as consumption intensity, degree of impact, viability, investment, and financing as well as implementation time. Also, develop follow-up and monitoring of the projects.

- Minimize the impact of the use of energy on the environment and public health.

+ Evaluate the viability of lowering the sulfur content in the gasoline and diesel to levels lower than those established for 2010 and take them to international standards.

+ Complete a systematic evaluation of the environmental effects in the chain of ethanol and bio-diesel.

+ Design plans and economic instruments to promote the use of vehicles and fuel that are cleaner and more efficient

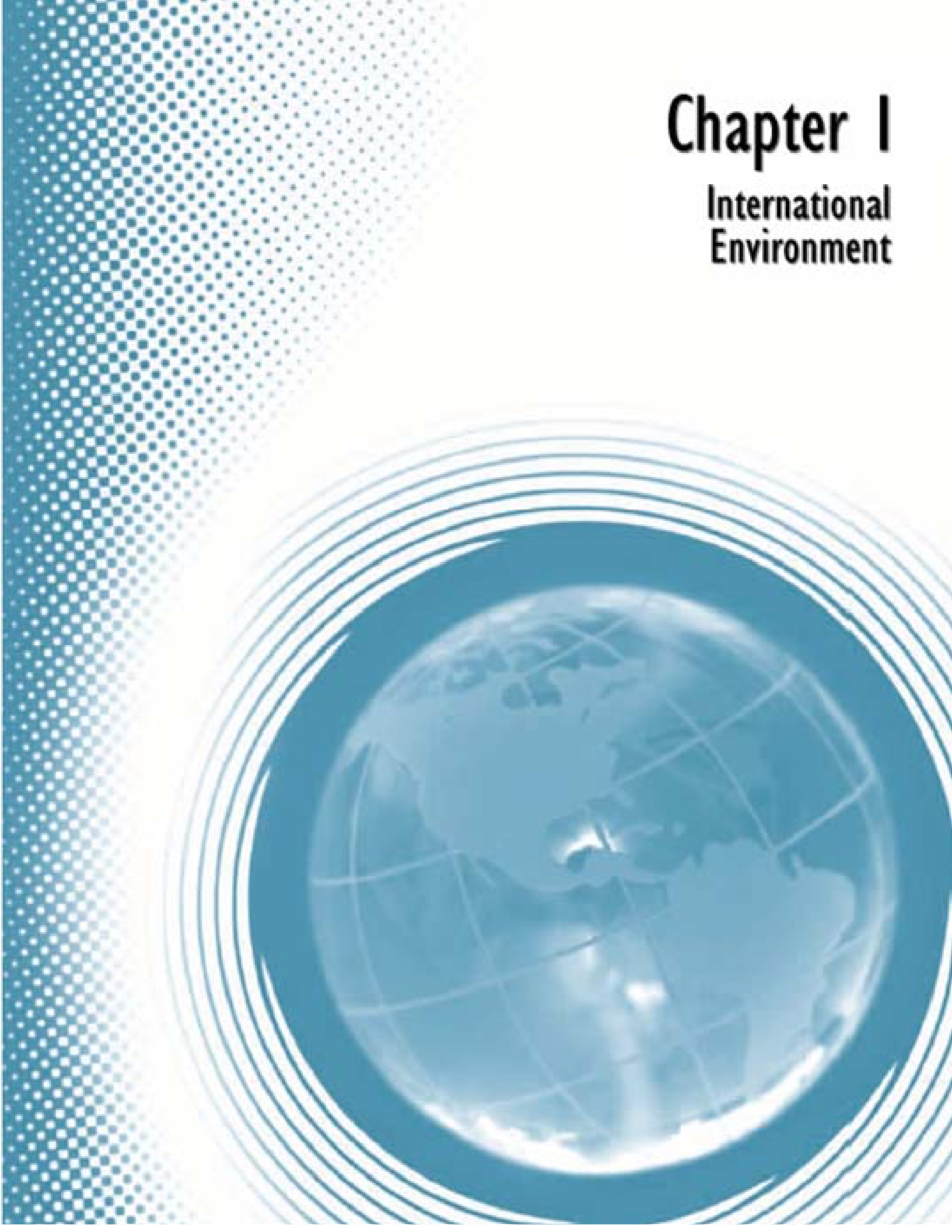
+ Strengthen the implementation of the strategic environmental evaluations.

- Direct the resources that are designated for the development of science and technology through the lines that are in the interest of the Country. A couple of examples: the use of coal as a clean resource with minimal effect on the environment, the development of non-conventional sources of energy and URE programs.

- The Ministry of Mines and Energy to design a policy for handling energy information, identifying sources, channels of access, verification and publication systems in the different sub-sections and activities of all the energy chains.

Chapter 1

International Environment



CHAPTER 1: INTERNATIONAL ENVIRONMENT

In this chapter we present an analysis regarding the regional and global energy environment, given the fact that there is a greater and more evident need to join the markets that allow for energy interchanges between different countries in the regional on a global scale. The subjects developed are as follows:

- Tendencies that will determine the development of the energy sector in the next few years.
- Analysis of the international environment of the Electrical Sector within the reach of the Latin American and the Caribbean region.
- Non-conventional sources and Rational Use of Energy and its treatment from an international perspective

1. GLOBAL TRENDS

The increasing degree of interdependences of the economies taking place after the globalization phenomenon makes it necessary to analyze the global development of the economy with a more complex focus, to determine the possible axis of growth and its effect on the different regions. Arguments such as technological competition especially between the USA and Europe, the tendency towards rapid modernization and urbanization of Asia (especially China and India) generate a certain degree of influence on the large emerging economies, who determine the evolution of the global energy consumption and at the same time become business and technological competitors in the industrialized countries.

The tendencies for supply and demand of energy are also affected by other difficult to predict factors such as the prices of energy, climate changes and public policies. At present, we can observe changes in the markets in response to: the high prices of energy from the year 2000, the great influence of the developing countries on the global demand, public opinion perception regarding the use of bio-fuels, climate changes and new technologies such as coal-to-liquids (CTS) gas to liquids (GTL) and the development of multiple projects to increase natural gas (GNL) business across the world.

2. GAS AND OIL INTERNATIONAL RESERVES

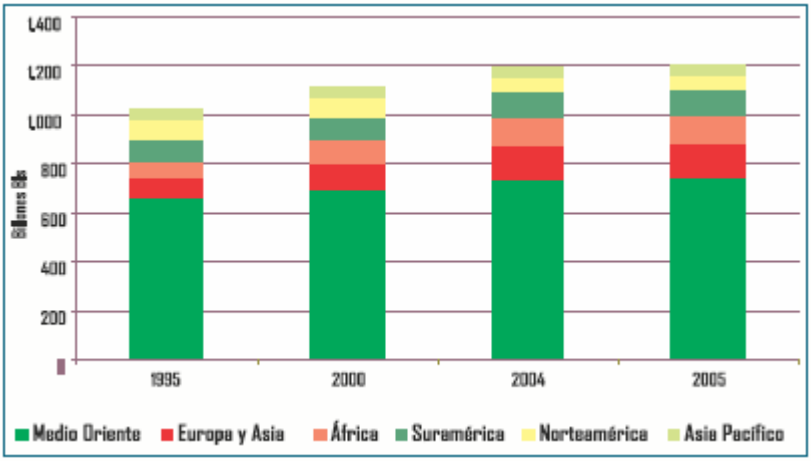
The origin of the close relationship between geo-politics and oil is found in the manner in which oil and gas reserves are distributed throughout the world. We see that a great deal of the reserves, 62%, is concentrated in the Middle East, in particular in Saudi Arabia

According to Graph 1, the world has been recovering, in a manner of speaking, from the reserves used to fill the demand and in regions such as Europe, Asia, Africa and Latin America have increased their reserves to higher amounts than those extracted,

while North America decreased their recoverable reserves by 32% between the period of 1995-2005, Europe and Asia increased 72.3%, Africa 52.7%, South America 23.5% and the Middle East 12.8%.

Regarding the depletion of the oil reserves that allowed for a sustained development of supply on a global level, DOE-EIA[1] assumes that, based on the fact that all or almost all the most promising oil reserves in the sedimentary basins have been discovered or are close to being discovered, the production will continue growing at a rate of 2% until it reaches a maximum production rate after which it will drop to a permanent rate of R/P equal to 10. Under those circumstances, and according to the EIA model, the peak of production is expected to occur towards the year 2037.

Graph No. 1
Global Distribution of Gas Reserves



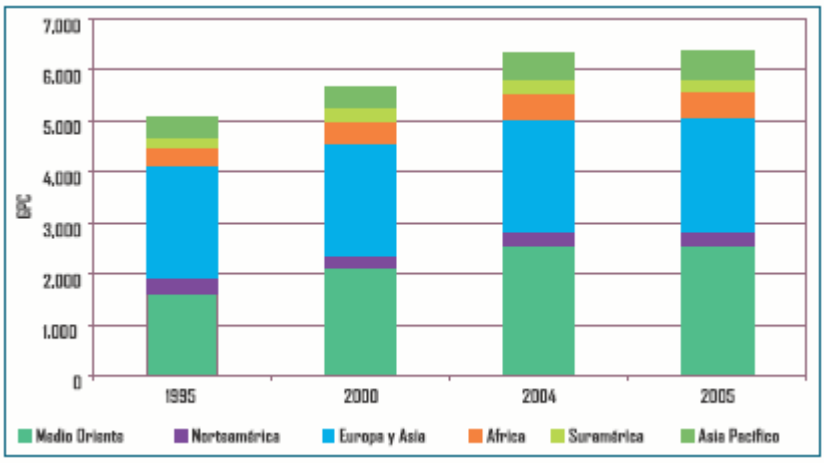
Source: BP Statistical Review of World Energy 2006

Regarding natural gas reserves, the situation is similar to that presented for the oil, regarding the decrease in recoverable volumes in North America with a decrease of 12% in the period 1995-2005. The greatest areas of reserves are located in Europe-Asia and the Asia Pacific region.

Graph No. 2 presents the global distribution of natural gas reserves, which indicates that the Middle East presents the rates of highest repositioning of reserves with 59% in the last 10 years followed by Africa and South America. Regarding natural gas, the subject of peak in production of the resources does not seem to be something that concerns the analysts. The relationship between proven reserves versus global consumption indicates that this consumption has been growing slowly (close to 66 years) to the end of 2005.

[1] Source: EIA ¨Long term world oil supply scenarios¨- August 2004.

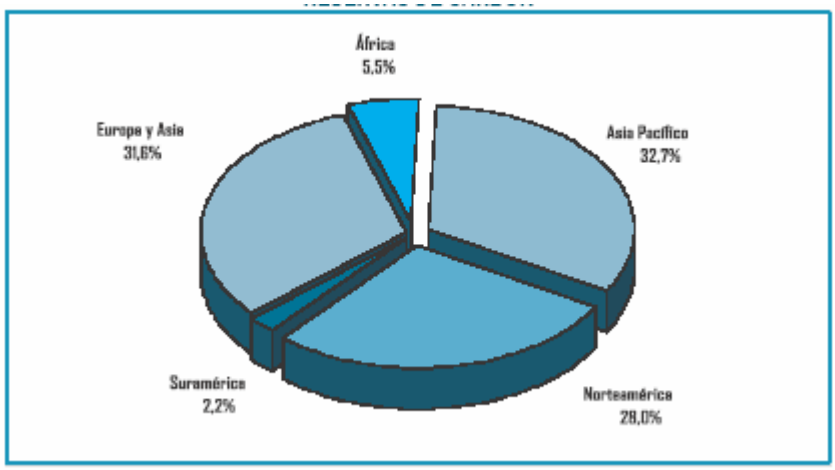
Graph No. 2
Global Distribution of Natural Gas Reserves



Source: BP Statistical Review of World Energy 2006

Contrary to what occurs with oil and natural gas, the global levels of available coal reserves are plainly sufficient to supply the actual and projected demand, considering that the relationship reserves/production is more or less 300 years. Graph No. 3 presents the availability of the resource per region:

Graph No. 3
Coal Reserves



Source: BP Standards Review of World Energy 2006

Regionally, the Asian-Pacific and Asian-European region, combined, have the greatest availability of coal, followed by North America with 28%, Africa represents 5.5% and South America 2.2%. Besides the abundance of supply, the economic signs and energy environment favor a consolidation of the supply for this resource. To begin with, the higher the prices of oil and gas will make coal much more competitive, especially in the electrical generating sector, at the same time, it is

possible to favor the investigation and technical development of a clean use and conversion of coal into liquids, substituting the oil derivatives.

3. STRUCTURE OF GLOBAL CONSUMPTION OF PRIMARY ENERGY

The global demand for primary energy points out that roughly 87% of energy that is consumed is exhaustible, something that generates insecurity regarding supply as does the volatility in prices, pushed by, among other factors, the greater requirements of the emerging economies such as China and India, both of whom are way above the global average.

The primary energy consumption in 2005 grew to 465.2 quadrillion BTU with an increase of 2.3% from 2004 and a growth annual average rate of 1.9% in the last 10 years (see Graph No. 4). Oil with a quota of 36.2% in 2005, continues to be the source of energy with a greater participation in the energy basket and its inter-annual growth in the last decade registers a rate of 1.72%.

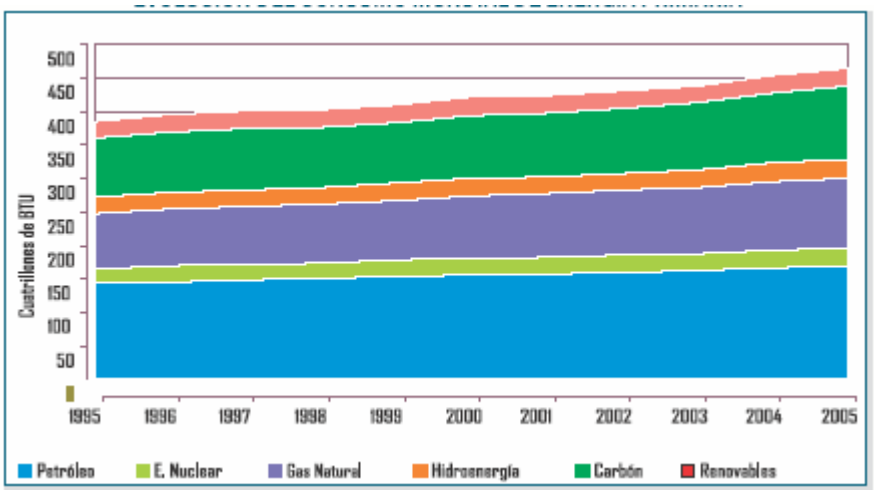
Coal occupies the second position with a contribution of 23.3% in 2005 and an inter-annual growth rate of 1.9% in the period from 1995-2005. In third place, and with the greatest increase of consumption of primary energy in the period 1995-2005, is natural gas with an annual growth rate of 2.48%. This energy source contributed to the structure of the primary consumption in 2005, with a quota of 22.6%. The increase in reserves and development of transportation internationally as well as national and local infrastructures, the low cost of investment, the high yield in generating electricity in a combined cycle and its low contamination under appropriate technological development, are factors that allow for this growth.

In fourth place is hydro-energy, whose participation in the primary energy basket reached 6.1% with an average growth of 1.6& per year during the period 1995-2005. At the same time, nuclear energy has been losing relative value, especially in industrialized countries, due to the strong social opposition and possible environmental impact due to radioactive accident. Its relative participation in 2005 was close to 5.7% of the energy basket, with an annual growth average of 1.7% in the last decade. Finally, the renewable energies have increased their participation and during 2005 represented 5.9% of the energy basket with an inter-annual growth of 1.12%.

The primary energy of greatest growth was the consumption of coal during 2005 with 3.9%, due to the increase of the emerging economies such as China that consumed 10.9% of the total coal.

The tendencies indicate that the countries are inclined to diversify their sources for electrical energy giving greater importance to the renewable sources as well as natural gas, decreasing their participation in nuclear energy and the solid fuels, due to socio-political and environmental considerations. In general, the countries that belong to the OECD (Organization for Economic Cooperation and Development) demanded greater primary energy with 52.6% of the total, followed by China with 14.7%, the rest of the Asian countries with 17.2%, the old Soviet Union with 9.6% and the rest with 5.3%.

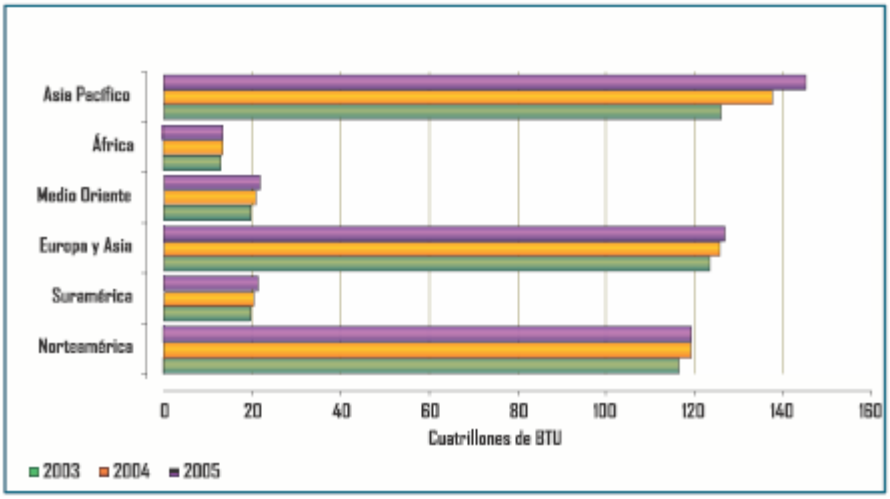
Graph No. 4
Evolution of the Global consumption of Primary Energy



Source: BP Statistical Review of World ergy 2006 and DOE-EIA 2007

Regionally and in line with the economic growth, consumption increased slightly in Europe and Japan while in Central and South America and the Asian Pacific region the demand increased by 4.5% and 5.8% respectively, with China as the largest user at 9.5%.

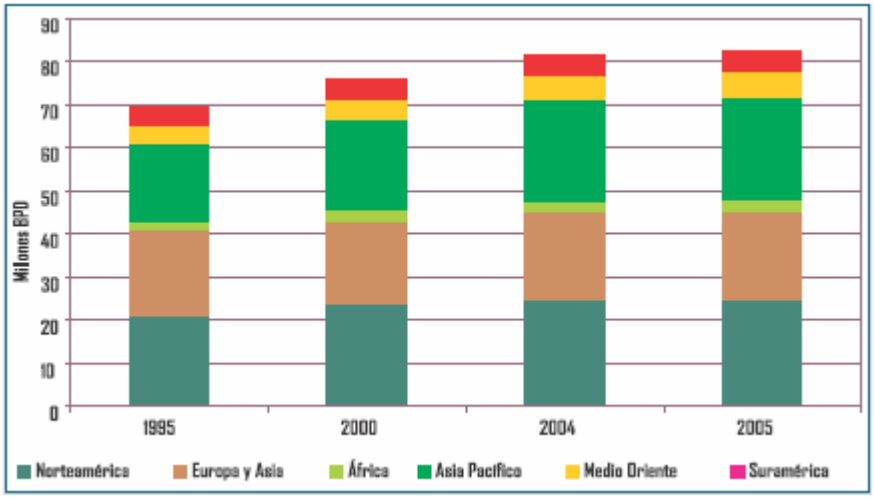
Graph No. 5
Regional Energy Consumption



Source: BP Statistical Review of World Energy 2006

The evolution of global oil consumption indicates that North America requires the greatest amount of crude oil to supply their needs, with a participation of 30%, followed by the Asian countries with 29% and Europe with a 25% need. The Middle East and South America, together, demand 12.7$ and Africa the other 3%. Graph No. 5 presents the regional oil evolution

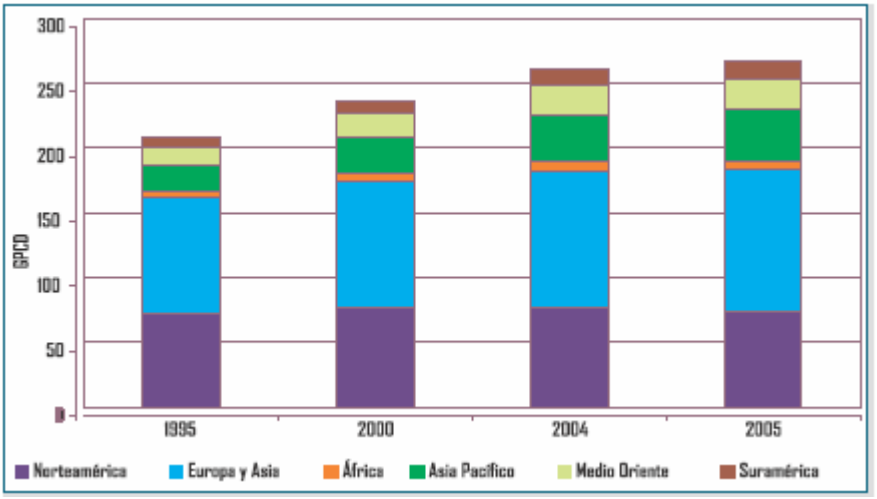
Graph No. 6
Regional Consumption of Oil



Source: BP Statistical Review of World Energy 2006

Regarding natural gas, Europe and other Asian countries carried the greatest quota of consumption with 40% of the total, while North America consumed 28% and the others represented 32%.

Graph No. 7
Regional Consumption of Natural Gas

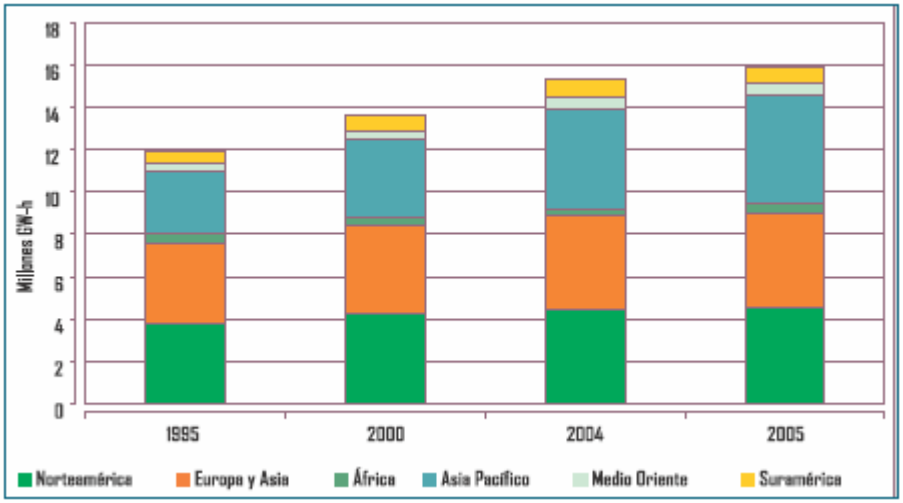


Source: BP Statistical Review of World Energy 2006

Natural gas has been growing significantly due to the intensification of international growth of the LNG (liquid natural gas) that has allowed for a greater penetration in the sector of generating electricity.

At the same time, electrical energy consumption continues to grow above the other energy sources with an annual average rate of 3% in the period 1995-2005 and increases the capacity for generating in all the sources, but predominately with coal. Electricity consumption increased by 4.1% between 2004 and 2005, highlighted by Asian countries, which grew a total of 6.6% in the last year. Generating electricity with gas has doubled since 1980, highlighting the new co-generation technologies and combined cycles in the developed countries as well as those who are in development. Graph No. 8 represents the distribution of consumption by regions.

Graph No. 8
Regional Evolution of Electricity Consumption



Source: **BP Statistical Review of World Energy 2006**

The primary sources structure for generating energy point to coal as the one with the greatest weight at 38%, followed by natural gas with 20%, then water with 18% and nuclear energy at 17%. The other sources (renewable and derived from oil) contributed with 3%.

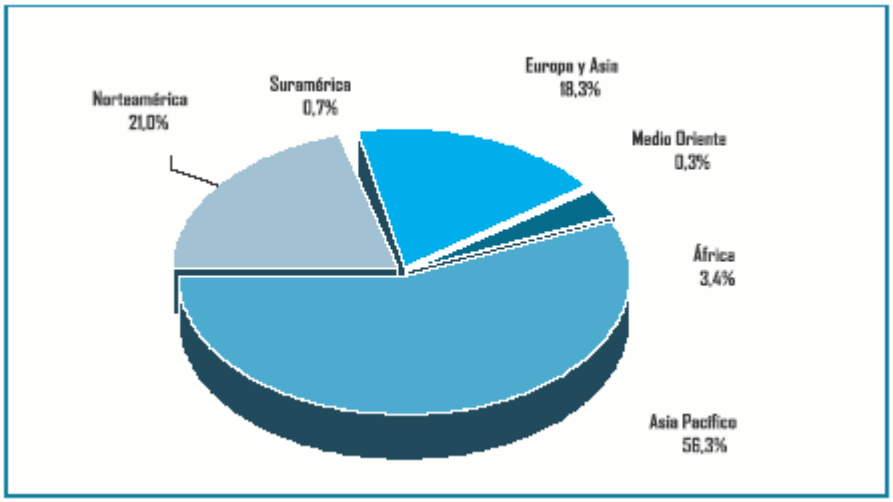
Coal consumption is contributing towards compensation of some of the economical pressures in the increase of the price of crude oil in some nations, representing an important change in energy consumption. This leading factor is growing rapidly, due to the fact that developing countries are looking for options that are cheaper to allow for energy as part of their own economies.

During 2005, coal was the energy source with the greatest growth and 80% of this growth took place in China. Of the total product in 2005, 67% was for generating electricity and 37% was based on industrial consumption. At the same time, in the field of electrical energy generation, coal is the most utilized resource surpassing oil derivatives, natural gas, nuclear energy and those renewable resources such as hydro-electricity.

Regionally, the Asian continent, especially China and India, territories with the greatest reserves of coal, demand more of this energy, in particular, in the demand for generating electricity. North America and Europe represent more than one third

of the global consumption and in a smaller margin South America. Graph No. 9 represents the regional distribution of consumption.

Graph No. 9
Regional Evolution for Coal Consumption



Source: International Energy Outlook 2006

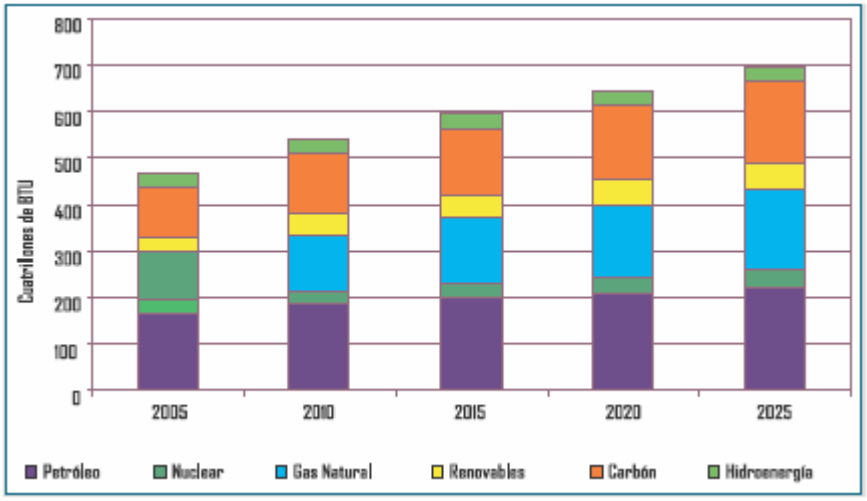
Regarding energy perspectives, it is important to point out that in accordance with the basic scenario of the DOE-EIA, global demand for energy will grow at an annual rate of 2% in the next twenty years, pushed by the economic growth of the emerging economies, where the demographic factors and mobility continue to have a significant impact on the future global energy demand.

Fossil fuels (oil, natural gas and coal) will continue with their dominant participation in the global energy demand, fulfilling 83% of the incremental energy requirements until the year 2025, and although the participation of crude oil in the primary energy basket will decrease slightly, it will continue to be the most important energy source with 32.3% participation for the year 2025, followed by coal with 25.3% and natural gas with 24.7%.

Coal will maintain its participation in the primary energy basket and will continue to be the fuel of greatest consumption with which to generate electricity: the largest growth will take place in those counties that are not part of the OECD, especially Asian countries and in particular China and India where the rates are the most significant.

It is projected that nuclear energy will grow at an inter-annual rate lower than 1.2% and its participation in the primary basket will decline to 5%. However, the changes originated by global warming have made the world look towards nuclear energy as an alternative to lower the gas emissions and greenhouse effect; hence, there are significant changes that will take place with regards to participation of renewable energy as well as nuclear energy in the global market.

Graph No. 10
GLOBAL ENERGY DEMAND PROJECTION



Source: Annual Energy Outlook 2007

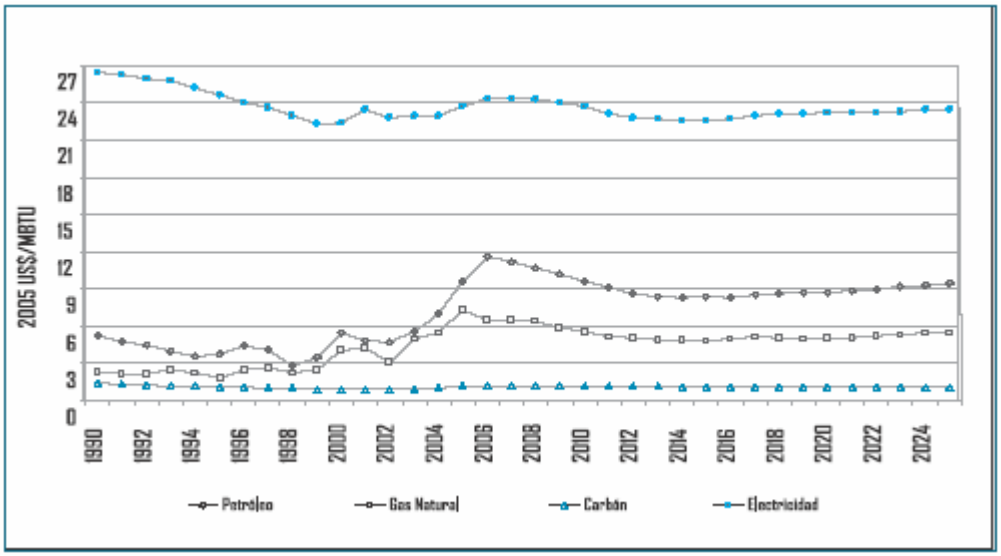
The greatest consumption growth is projected for the emerging economies whose growth will be above the global average. It will be particularly evident in Africa and Latin America, who will present inter-annual rates on the order of 2.9% and 3.3% respectively, while North America and Europe will not grow beyond 1.3% average per year in the between 2005-2025.

4. ENERGY PRICES

The individual factor that has changed the structure of the global oil industry during the last few years has been the tendency towards a sustained growth in the prices of oil in the international markets. Graph No. 11 presents the evolution of the prices with WTI, the crude oil marker for the markets in America, and an estimation of the prices of the different energy sources until 2025. With regards to the price projections for oil prices for the next few years, the DPE perceptions regarding its evolution until the years 2025 [2] indicate that in the reference scenario, these figures will remain in the higher ranges and vary between US$40 per barrel and US$ 80 per barrel.

Graph No. 11
EVOLUTION OF ENERGY PRICES

[2] Source: EIA Presentation ¨Long Term Outlook for Energy Markets¨ March 2006



Source: EIA Presentation ¨Long Term Outlook for Energy Markets¨ March 2006

The price forecast is evidence that the tendency for higher cost of oil will be maintained during the next few years. However, the great unknown is, if the medium and long range demand is sustainable with an average cost of US$60 per barrel, or, if once new supply capabilities are offered, the prices will remain at a high level, faced with a possible decline in demand, once the more dynamic phases of growth are completed in Asia.

Regarding natural gas, the price curve in the last 10 years indicates that until the year 2000 the prices stayed between 2.5 and 3.2 US$/MBTU and from that year on an increase of prices has taken place on the order of 8 US$/MBTU in 2005. This indicates the correlation that exists between the price of oil and the price of natural gas.

The price projections for gas at the wellhead have a tendency to decrease until 2015 when new competitors enter the market. However, these have not reached the levels of the nineties: after these years, the price is projected to be close to 6 US$/MBTU (dollars) in 2005.

The previous information indicates that the world, in general, is facing periods where the energy prices will remain at high levels, which would mean that the era of low energy prices are a thing of the past. For Colombia, this subject is of particular importance in the development of its economy in the medium and long range: as long as there are oil and gas exports at high prices, this will contribute to a good economic development: on the other hand, if a loss of self-sufficiency materializes, the Colombian economy may have to grow under adverse circumstances in the next few years.

Regarding the evolution of coal prices, the projections do not indicate any important changes and it is estimated that the prices will decrease until 2019 from 1.15

US$/MBTU to 1.08 US$/MBTU. From the year 2019 the projection figures indicate an increase in the generating plants that use coal as fuel and this could impact on the prices. In the long run, there is no evidence of significant variations in the price of this type of energy.

Regarding the behavior of the fuels to generate electricity, after the strong increases that have taken place in the last few years, it is projected that a final price of 23 US$/MBTU will be in effect in 2015 and then there will be an increase to 23.5 US$/MBTU for 2025.

PRICES OF OIL DERIVATIVES

The usage factor, at the refineries around the world, is presently at 87%, due in great measure to the high consumption in Asian countries, with which we are arriving to the limit of the global refinery capacity, originating growing refinery margins. However, sudden changes in the supply and demand structures may place the refinery systems in difficulties which will affect the prices of the derivatives significantly.

On the other hand, the changes that have originated by improving the quality of the derivatives have generated important modifications in the prices of these types of energy: however, the demand continues at an increasing pace as the acquisition power of the population continues to grow.

The United States has to resort to importing to balance the equation of fuel supply oil derivatives which represents 26.6% of global consumption. This situation opens important opportunities for refinery plants located outside of the US territory, such as the case of the Colombian Caribbean coast, that offer advantages such as the short transfer from exporting port to the Gulf Coast of the US and the location in an area that is free from hurricanes: Cartagena is an example of the above.

5. THE IMPORTANCE OF THE ENVIRONMENTAL VARIABLE

The environmental variable becomes important in the development of new projects and in the policies and strategies that will be adopted by the different governments, due to the commitments acquired by the nations that ratified the Kyoto protocol, whose objective is to decrease the climatic changes effects due to environmental contamination.

It is a fact that is recognized by the Convention Framework for Climate Changes of the United Nations, that the climate and the environment are resources that belong to everyone and that their balance could be affected by the gas emissions with a greenhouse effect, produced especially by industrial activities and by other types of activities, in particular, by the transportation sector in the large cities of the world.

A collateral affect related to the poorly organized use of energy is created by the growing concentration of populations in urban environments, creating great conglomerates which, in turn, are great consumers of energy, making it more complex and difficult to treat the problem of urban environmental contamination. The

increase in the indexes of mortality and morbidity and the costs associated to the effects of exposing people to different types of urban air contamination, become a reason for concern among the planners[3].

The environmental impacts caused by the use of fossil fuels (such as oil and coal) and the increase of awareness by the population regarding the need to recuperate and preserve a healthy environment, are the main strengths that are directing changes in the energy industry, in the consumption patterns and in final use technologies. Hence the pressures on the refinery industry translated into a demand for fuels with better environmental technical quality

On the other hand, significant changes have been noted in the consumption habits, among others, a reduction in the demand for heavy fuels such as fuel oil that normally is used for heating, an increased demand for bio-fuels and other alternative energies which, although they have a low participation in the market, have shown significant increases in the last few years. As a consequence of the above, the automotive industry is not immune to the demands made by the community.

There is a projection in the consumption of bio-fuels (such as ethanol and bio-diesel) and an increase in the ability to produce new technologies such as the CTL. Besides the cleaner fuels, there is also new technology in the transportation sector such as hybrid vehicles, flex-fuel. Also mentioned is the popularity of the use of vehicles that work on ¨combustion cells¨ that would increase the efficiency of internal combustion motors by two or three times. The production costs are still the main problem and there is no specific timeframe in which new technologies may be entering the market under competitive conditions.

With regards to generating electricity by means of nuclear energy, there have been advances made in development of ¨fourth generation¨ nuclear reactors that are less costly and are easier to use. The concerns of the population, based on real accidents at the nuclear centers and security fears of all sorts, are the main reason that they are opposed to any significant growth in the near future of this type of energy[4].

6. ENERGY IN LATIN AMERICA

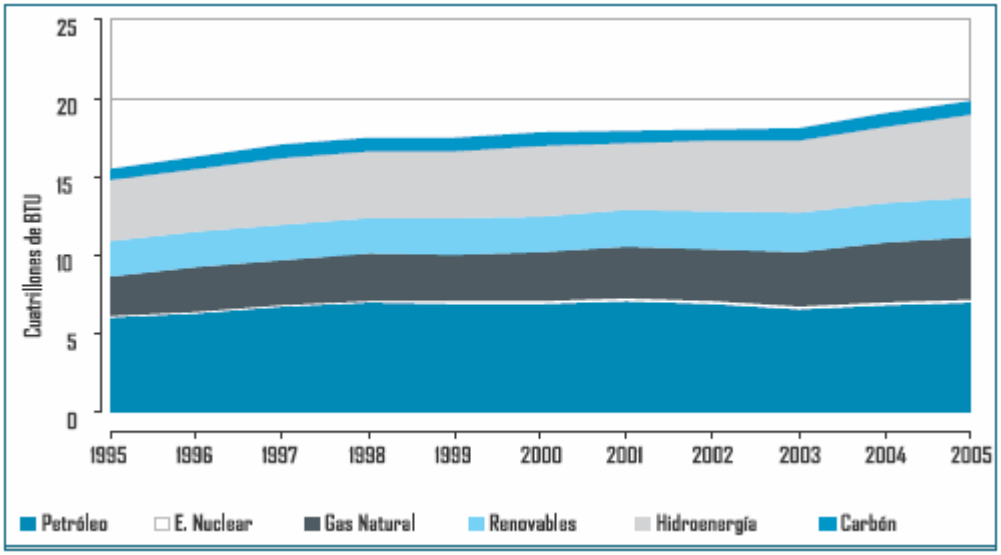
In Latin America the production of primary energy has been increasing steadily in the last few decades. The region has a wide range availability of resources distributed in a heterogeneous manner; the majority of the countries depend on importing material to cover their own consumption. Even with the restructuring of the energy sector, a total supply or balancing of energy markets has not been reached yet.

This region consumed 4.2% of the global total in 2005, whereas in the last 10 years it represented 4%. The main source of primary energy in Latin America is oil: however, although during the mid-90s the energy consumption was based on oil, this percentage dropped in 2005 to 35%. The other primary energy sources, on the

[3] Source: Larsen 2004
[4] Source : EIA – ADL Analysis

contrary, have increased their participation in the energy consumption structure. Hydro-energy, the second source in importance and main source of electrical power in Latin America, covered 25% of the energy consumption in 2005, compared to 27% in 1995.

Graph No. 12
EVOLUTION OF THE PRIMARY ENERGY CONSUMPTION IN LATIN AMERICA



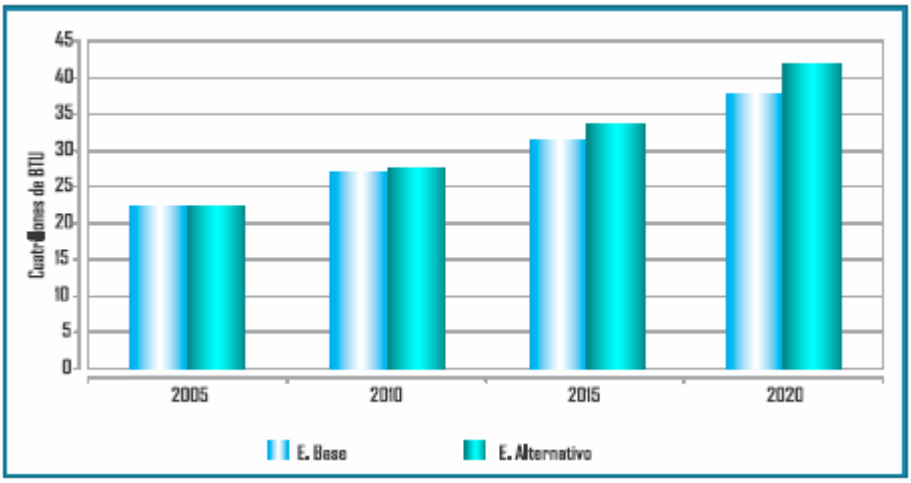
Source: EIA-DOE Annual Energy Review

The natural gas industry, the one that has shown the greatest increase in the last ten year, has gone from covering 16% of the energy needs in 1995 to 21% in 2006. The last places on the list are for mineral coal (covered about 5%) and nuclear energy (covered 1%) of the needs in 2005.

The biomass is a source of high usage not only with wood but with bagasse. During 1995, it participated in the consumption structure with a total of 14.3% up from 12.6% in 2005, especially due to the substitution of wood.

According to the study ¨Energy Perspectives in Latin America and the Caribbean 2005¨ developed by the OLADE (Latin American Energy Organization) and considering the interrelations of energy not only at a source level but also sector and country level, as well as considering the other intra-regional relationships, it is expected that the total energy demand in Latin America and the Caribbean will increase in the next 15 years from 22 to 37 quadrillion BTUs, on a scenario base with low integration between the countries while on an alternative or high energy integration level it will increase to 41 quadrillion BTUs, which would mean an increase of 68% and 85% respectively in the next 15 years.

Graph No. 13
EVOLUTION OF ENERGY CONSUMPTION IN LATIN AMERICA



Source: OLADE

It has been estimated that the consumption per capita of electricity in the region will grow about 58% on the scenario base and 107% on the alternative base. Natural gas will be the energy source with the greatest growth rate especially in the transportation and industrial sectors.

Regarding participation of oil, it is estimated that there will be a 5% reduction in the energy matrix for the countries in the region, due to the substitution of natural gas and other energy sources.

It is hoped that in the Andean Region, the demand for natural gas will increase as will the generating of electricity. Natural gas will be the source of dominant energy, in accordance with the study previously mentioned, and its participation in the primary energy basket will reach a total of 27% versus 21% in 2005.

The Andean energy market does not present elevated asymmetries, which would increase the creation of an integration process whose main axis will be the business of energy products. The exporting of electricity from Colombia and Peru to Ecuador is, at present marginal, but it is expected that they will be temporary until our Country finds solutions to its energy crisis. It is also hoped that the interchanges in natural gas will not be very large in the next few years.

It is important to highlight that given the global market structure, the phenomena's that are present in China, will also reverberate in other regions of the planet. For example, the sustained growth in Latin America over the last few years is due, in great part, to the demand for raw materials and products from China and India. Because of this, there is no doubt that technology will have to advance very rapidly towards other energy sources, to be able to respond to the dynamics and the new reality of global energy.

Chapter II

National Environment

CHAPTER II: NATIONAL ENVIRONMENT

1. THE COLOMBIAN ECONOMY: EVOLUTION AND PROSPECTS

The economic evolution in Colombia in the last few years has been improving substantially, surpassing the fragile conditions which developed between 1998 and 1999. The Gross Domestic Product (GDP) continues growing a situation that began in 2001. At the end of 2005, it grew to COP $ 88 billion pesos consistent since 1994, which represents an annual growth in real terms of 5.26% compared to 2004. Graph No. 1 presents the evolution of the annual variation of the GDP.

Graph No. 1
EVOLUTION OF THE COLOMBIAN GDP
Source: DANE

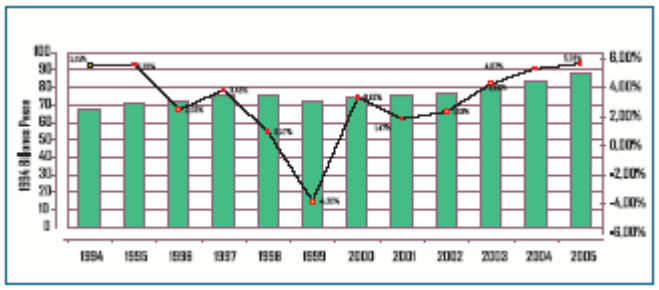


Table No. 1 details the behavior of the main economic indicators during the period 2000 – 2005 [5].

Table No. 1
BEHAVIOR OF ECONOMIC INDICATORS

INDICATORS	2000	2001	2002	2003	2004	2005
GNP Growth (%)	2,92	1,47	1,93	3,86	4,87	5,26
Domestic Inflation (%)	8,75	7,65	6,99	6.49	5,50	4.85
Unemployment Rate (%)	18,50	14,94	15,32	14.30	13,43	11.80
Exports Growth (%)	13,27	-6,19	-3.26	10.20	27,43	26.65
Imports Growth (%)	8.26	11.23	-1.05	9.38	20.58	26.61
Average TRM (COP$/US $)	2,088	2,300	2,506	2,876	2,628	2,321
Average Devaluation (%)	18.70	10.20	9.10	14.70	-8.70	-11.60
Net international reserve balance (billions $)	19.68	23.39	30.73	30.45	32.35	34.14

As an integral element of the Governmental strategy that has allowed us to reach higher economic growth rates, we find the channeling of investment resources towards sectors considered key to the development strategies such as hydrocarbons and infrastructure in transportation. In the first one of them, we channeled

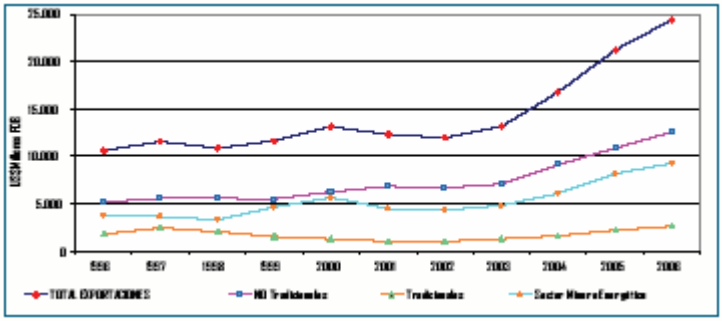
[5] Source: DNO – Banco de la Republica – DANE

approximately 63% of the total public expenses, mainly through ECOPETROL in exploration and production of hydrocarbons, while 28.6% of the public expenses were dedicated to investment, maintenance and rehabilitation of the transportation infrastructure.

The economic policies to control inflation have been successful, which is reflected in its decrease, reaching 4.9% in 2005, lower than that reached in 2004. At the same time, the unemployment rate presents a slight tendency towards decreasing and, sub-employment has remained relatively constant.

In 2005, Colombian FOB exports were in the order of US $21,190.5 million, of which 48.9% corresponded to traditional exports and 51.1% to non-traditional exports, indicating three of the four main traditional export products belong to the mining and energy sectors.

Graph No. 2
EVOLUTION OF COLOMBIAN EXPORTS



With regards to the long range GDP, the projected growth rate according to the alignments of the ¨ Colombian Vision Plan 2019 ¨ for the long term is of 6%. Due to the fact that the growth rates considered under said Plan are due to an optimistic outlook or, in other words, what is hoped for in the country, it is important to point out that the prospective activities of the NEP for 2006 – 2025 took into consideration scenarios of projections of supposed available macro-economies to October 2006, fulfilled by the Ministerio de Hacienda y Crédito Público (Ministry of the Treasury) and DNP and those considered by the National Development Plan whose description can be found in Chapter III.

We could determine that under this economic picture, the next few years are characterized by the following basic indicators:

- GDP Sustained growth of 6.0%
- Long range inflation rates of 3%
- Deficit in banks between 1.6% and 2.7% of the GDP
- Investment rates will increase from 21.8% to 25.3% of the GDP between 2006 and 2010

Detailed below are the basic considerations regarding the energy environment in Colombia. For the purpose of this study, we detail the most important aspects of the

institutional framework of the different energy sub-sectors and macro subjects that are considered relevant to the sector.

2. NATIONAL ENERGY DIAGNOSTICS

Regarding the energy policy, Colombia has been characterized by maintaining a constant revision of strategies to ensure and improve conditions for the supply and availability of energy products, wherein we could highlight:

- Opening of different energy markets, encouraging private participation plans and a reduction of direct governmental participation, reinforcing the role of the State in the regulation and planning aspects.

- Adoption of price systems that tend to reflect the reality in the international markets, including the progressive closing of subsidies and an indexation to the market prices.

- Care to be taken towards the needs of the users and consumers, encouraging alternatives for efficient use of energy products: development of alternatives for massive transportation and promoting vehicular natural gas among others.

- Encourage diversification of the energy supply through specific sectional plans, such as the increase of natural gas, use of non-conventional sources and creation of a bio-fuel market.

- Increase in investments and promotion of investments in various links of the hydro-coal chain such as the refining of crude oils.

- Institutional reforms to organize functioning of the energy sector, such as the creation of the Agencia Nacional de Hidrocarburos and XM (National Hydrocarbon Agency and XM)

- Great attention is being placed on the environmental aspects and definition of mechanisms to develop the energy sector, in harmony with the preservation and improvement of the environment.

- Revision and maintenance of the policies that would increase a greater social equity through the Ley de Servicios Pubilcos Domiciliarios (Home Utilities Law).

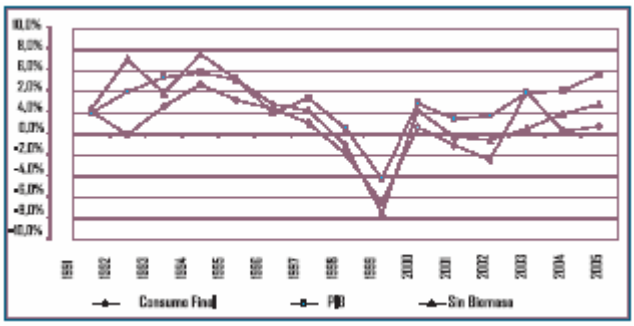
The final energy consumption in Colombia has increased by 11.5% between 1990 and 2005, versus an accumulated growth of the GDP of 54%. However, when you exclude biomass, the growth of he final energy consumption becomes 33%. The average inter-annual rates which results where the GDP is on the order of 2.9%: of which 1.9% is for final energy consumption without biomass and 0.6% for the final energy consumption, including all the energy sources.

In general terms, the behavior of the energy intensity has not been homogeneous and it is explained by such factors as urbanization and modernization, which lead towards a decrease in wood use, which when substituted for more efficient energy sources creaes a decrease in the consumption expressed in net energy. The evolution of each variable is presented in Graph No. 3

Also, a national management programs for energy supply introduced in the country, as well as an important increase in the usage of gas, explain the behavior of the relationship between energy consumption and a lower trend of the GDP.

The total production of primary energy grew at an average annual rate of 3.5% between 1990 and 2005, coming to a halt in 1999. The growth was mainly determined by coal (6.9% annual average), while oil had a rate of 1.22% and natural gas 3.9%. On the other extreme, wood managed a reduction in its production during the whole time period at an yearly average range of 1.23%. Due to this fact, the primary production structure is modified between 1990 and 2005 thus: coal goes from 28.7% to 46.9%; oil from 42.5% to 32.4%; natural gas from 8.4% to 9.1% and wood falls from 8.3% to 3.1%. The other sources (hydro-energy, bagasse and others) indicate a small incidence in the primary production.

Graph No. 3
EVOLUTION OF THE GDP GROWTH RATES AND THE FINAL ENERGY CONSUMPTION



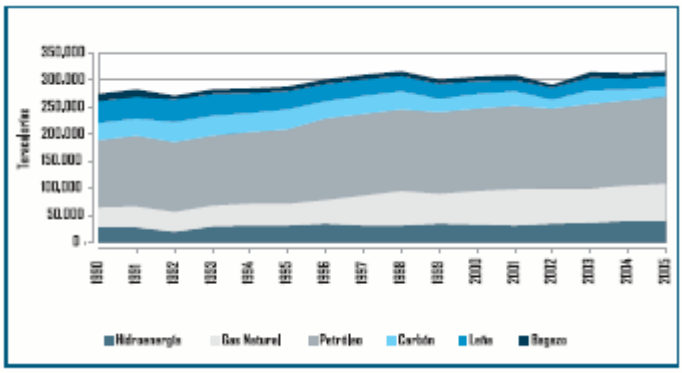
The imports of primary energy are marginal within the total supply and are due to the needs for oil because of the difficulties in internal transportation. On the other hand, the exports have had a growing importance beginning in 1985 and are comprised of coal and oil: in 2005 they represented 58% of the primary production.

However, one important aspect that must be highlighted is that the results in oil exploration have not allowed for a strictly exporting profile in a sustainable manner. This is due, in part, because of the institutional plan, recently modified with the creation of the ANH and on the other hand, to the strategy of the private associates to prioritize the value of the discovered reserves. It is hoped that the present oil policy will bring the hoped for results and prevent a possible loss in self-sufficiency in the medium range.

Due to the strong growth of oil and coal exports, the total internal consumption grew during the period 1990-2005 at a rate of 1.01% annual average. In 2005, oil

represented 48% of the total internal offer, natural gas and hydro-energy was 21% which in relative terms have increased their participation by 95% and 50% respectively, while coal and wood have registered important reductions, such as detailed in Graph No. 4. In general, the internal offer had as its main characteristic the continuation of the historic substitution of biomass processes for commercial forms of energy and, in particular, for natural gas and LPG.

Graph No. 4
EVOLUTION OF THE INTERNAL ENERGY CONSUMPTION

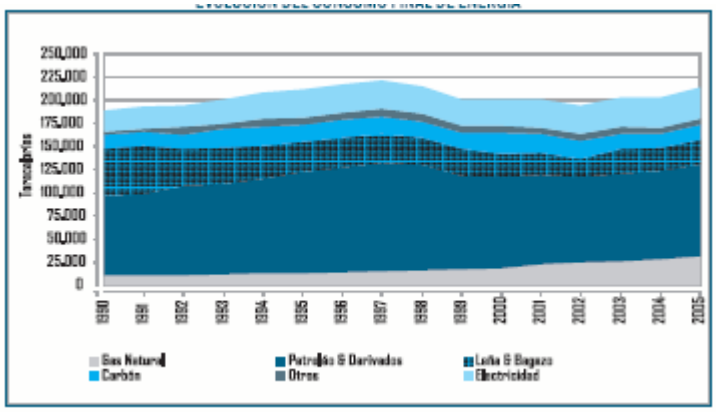


In the same analysis period, internal consumption of primary energy went from 230,660 Teracalories to 285,950 Teracalories with an average annual growth of 1.4%, generating important changes in the composition of the new matrix. Oil as fuel (crude), wood and the bagasse decreased their participation quota; the main reason being related to the strong increase in fuel gas consumption (natural and LPG) whose media annual rate of growth reached 7.6%.

Regarding the behavior of different sources, there has been a constant increase in natural gas and electricity, a smaller but sustained growth of oil products particularly in the last three years and a slow but continuous decrease in coal, even though it is the most abundant energy source in Colombia.

In summary, the biomass and in particular wood have been losing their participation in the energy consumption structure due to the movement of LPG towards rural and periphery areas of the cities, changing the consumption patterns in the residential rural sector. Graph No. 5 presents the evolution of the final consumption of primary energy in Colombia during the last 15 years.

Graph No. 5
EVOLUTION OF THE FINAL ENERGY CONSUMPTION

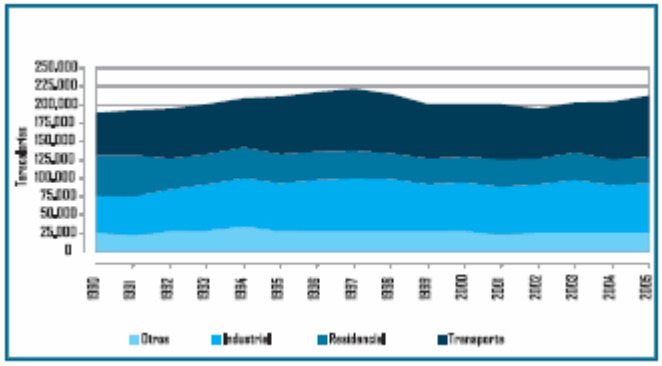


In certain sectors, transportation is the greatest user of final energy, representing at present close to 39% of the total. In the last fifteen years, its annual median growth was close to 2.14% and the general tendency of the sector is associated with the increase in economic activity, improvement in the level of every day life and the growth of population and expansion around large cities. The growth of traffic on the roads not only of merchandise but also of travelers, has translated into an increase of the energy consumption of land transportation that in the last three years has indicated important growth.

Oil derivatives are the main source of supply for the transportation sector, even though today they are part of the offer for new carburetion fuels such as VNG and bio-fuels, whose contributions, at present, are marginal. Other factors, such as the re-strengthening of vehicles in the public transportation sector and an inappropriate price signal of fuels destined for the transportation sector among others, have substantially modified the consumption composition in the interior of this sector: the DIESEL has indicated growth rates higher than in the past, increasing their participation in the market and generating a regression oin the gas consumption. This goal, although it was considered a good thing in the past, when Colombia was an importer of gasoline, has unbalanced the fuel market because there is too much gasoline and not enough DIESEL.

This phenomenon known as the dieselization of the automotive sector, has been generating difficulties to fulfill the demand, as the national supply is insufficient to fulfill the increasing volumes that are being requested, as well as increases in economic resources destined to the subsidies due to the higher price of imported DIESEL.

Graph No. 6
BEHAVIOR OF THE CONSUMPTION SECTION



Colombian industry is responsible for one third of the final energy consumption in the country and is in second place after transportation. The growth rate for the total energy consumption of the industrial sector from 1990 to 2005 was 1.91% annual average and there were interesting consumption modifications that took place per source, thanks to the substitution process, which indicate the following results: natural gas went from 8.7% to 26.5%, substituting mainly fuel oil as well as coal: oil (crude) had a significant participation until 1999 and after that year demand dropped rapidly: fuel oil was substituted almost completely going from 27.9% to 1.3%; there was certain penetration of diesel oil (DIESEL) to substitute fuel oil and electricity went from representing 19.5% to 16.3% of the industrial energy consumption.

Regarding final energy consumption by families, we could mention that it represents 17% of the total consumption which dropped in this period to an annual average rate of 2.68%. It is important to highlight that this is due primarily to the substitution of wood for higher quality sources of fuel, because in terms of useful energy, an important increase of 1.99% took place which indicated an annual average between 1990 and 2005.

The most important results of the substitution processes in the residential sector in this time period were: natural gas penetration from 0.5% to 22%, with significant increases in participation beginning in 1997: LPG penetration gong from 6.1% to 16.5%, electricity went from 8.3% to 38.2% due to its penetration in captive uses and the increase of coverage on a national level: the strong regression was for wood that went from 69.2% to 17.4% as it was substituted primarily by LPG and the almost complete substitution of LPG for natural gas in urban areas, that went from 8.2% to 1.4%

Regarding the other sectors, within which we find the commercial, agricultural, constructions and others, whose weight within the consumption matrix is on the order of 12%, there have been almost imperceptible increases in the growth rates during the period 1990 to 2005. During this era of economic retraction it lowered the energy consumption but now, due to the reactivation that is taking place, those levels are on the rise.

3. BEHAVIOR OF RELATIVE PRICES FOR ENERGY SOURCES

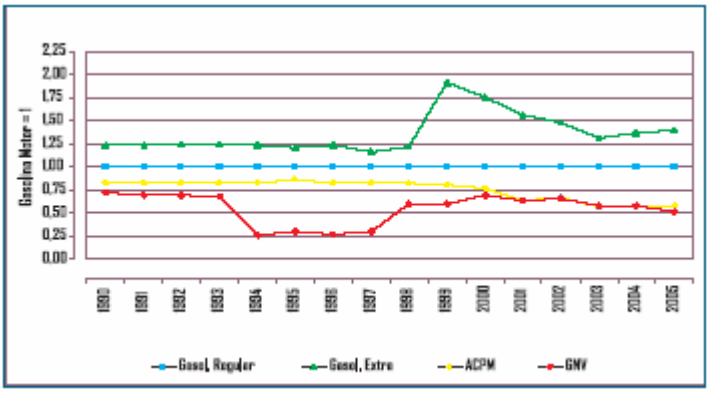
The behaviors demonstrated especially by liquid fuels, obey the directives established through prices, which are based directly on user logic when selecting ways to satisfy their energy needs.

In the case of the transportation sector, the policy implied maintaining the prices of diesel fuel (DIESEL) at a level close to 85% of the value of regular gasoline (taken as a reference) during the analysis period. In the case of VNG an option was made to use a different price that was attractive during the first years of usage and from the year 2000 it tended to converge with the price of DIESEL, which in turn is distancing itself from the price of regular gas in the last three years.

Since 2005 the price of VNG has shown a marked difference with DIESEL. On the other hand, the price of extra gasoline is always higher and its use is confined to a much reduced group of vehicles, as well as the fact that the tanking up with regular gas in Colombia is high and allows for its use in vehicles designed to use only extra type gasoline.

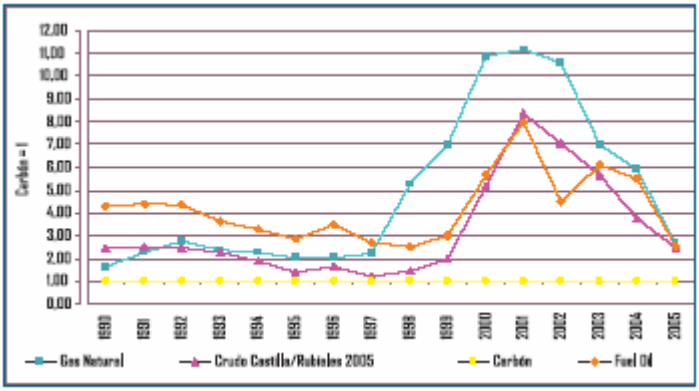
Given the historical importance of gasoline consumption and the change of its prices since 2000, it is important to highlight that the econometric analysis indicate the presence of certain elasticity in demand price close to 0.4% which indicates that the policy applied to the prices has stopped demand in a very important way. Graph No. 7 presents the evolution of the relative prices of energies that fulfill the needs for the transportation sector.

Graph No. 7
EVOLUTION OF RELATIVE PRICES IN THE TRANSPORTATION SECTOR



In the industrial sector, from the relative price point of view, coal appears to be the fuel with the greatest advantage. However, its higher usage depends on other factors such as the supply location and availability among others.

Graph No. 8
EVOLUTION OF RELATIVE PRICES IN THE INDUSTRIAL SECTOR



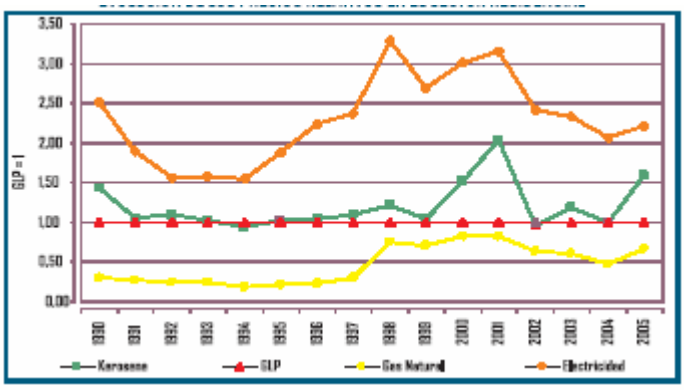
Elements such as the quality of substitute fuels, comfort of usage, environmental advantages and absence of residues, make it difficult or almost impossible to explain the behavior of the demand only with regards to relative prices.

With regards to natural gas, the difference with the price of crude in the energy basket was almost non-existent until gas was sold around the country. After 1997, the adaptation of gas prices to the costs in each stage of production has made it a very expensive substitute even though its penetration was important due to the improved quality of energy, although its potentiality has been curbed. Towards 2005, the price structure seemed to have changed towards relatively close values.

From the analysis we find that the competitiveness of natural gas and the definition of price policies regarding the industrial sector remains one of the most critical factors for the future, if there is a desire to make a balanced use of the most abundant resources, reflecting their costs.

Regarding the residential sector, the price of natural gas has been one of the highest for competitiveness although its coverage was spatially restricted until 1997 because of the absence of infrastructure that could connect the production centers with the largest markets. The competition between LPG and kerosene was always more favorable to LPG although its expansion was reduced by the cocinol, a fuel that had been considered to satisfy the demand in areas of lower incomes, but there were serious considerations regarding health due to the high degree of flammability of the product.

Graph No. 9
EVOLUTION OF RELATIVE PRICES IN RESIDENTIAL SECTORS



It is commonly known that one of the reasons to promote the Massive Gas Plan was, besides hoping to improve the solution of problems with electrical subsidies and use an abundant resource, was to substitute this gas for cocinol in the poorest sectors of the country. In this regard, it is important to mention, that the first installation for production began in the poorest areas of the capital city (Bogotá).

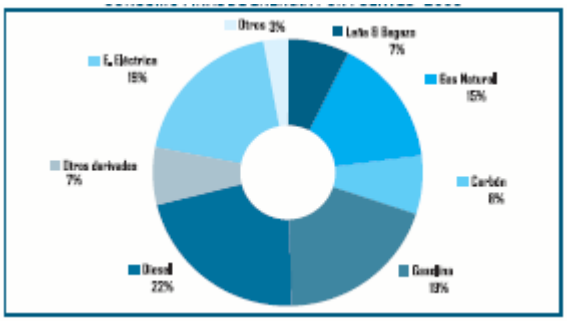
The behavior of the prices allows us to appreciate the high levels of kerosene prices, which has braked significantly with regards to consumption, as it is also prohibited to sell at gas stations. The present electricity rates have encouraged its usage and encouraged gas usage for caloric needs in residential sectors, increasing the need to expand supply and coverage.

In general, the substitution process was stimulated after the presentation of the Massive Gas Plan, thanks to competitive prices that oriented the tendencies towards more efficient sources, substituting electricity and wood.

4. CURRENT SITUATION

The result of applying different directives with regards to prices, as well as the co-existence of markets in different stages of development, have determined the final energy consumption structure in 2005 dominated by the oil derivatives, where DIESEL maintains the greatest participation. Although in 2005 the country entered the era of bio-fuels with the mixing of gasoline and alcohol (10% to date) it is still early to determine its presence in the consumption matrix.

Graph No. 10
FINAL ENERGY CONSUMPTION PER SOURCES – 2005



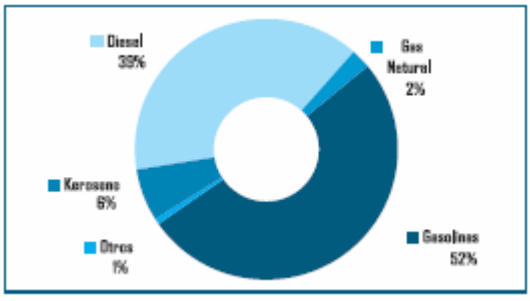
Energy consumption in the transportation sector has been modified structurally and at the end of 2005 was concentrated in two different energy sources which together supply almost 91% of the total energy needs.

In this sector, gasoline continues to occupy a relevant place in the consumption structure, with a slight advantage over DIESEL that shows an accelerated growth, while the participation of natural gas is still marginal, a situation that we hope to change in the near future.

Energy consumption in the Colombian transportation sectors is concentrated on the road, not only with passengers but also with merchandise, which represents almost 80% of total consumption in this sector.

In private transportation, the number of circulating automobiles and the roadways covered – these due to the increase in personal mobility – are offset by the continuous technical improvements in specific consumption of new vehicles available in the market place.

Graph No. 11
FINAL ENERGY CONSUMPTION TRANSPORTATION SECTOR -2005



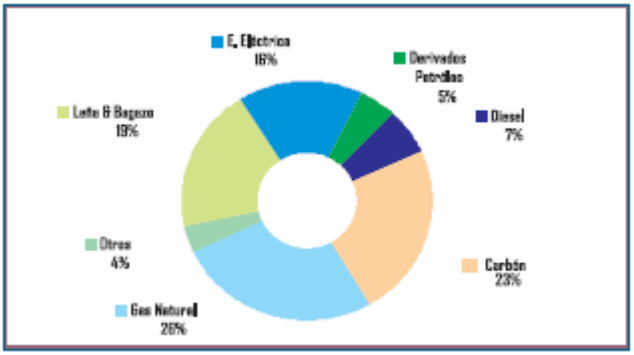
Many of the improvements in the performance of how vehicles perform have been reached by the improvement of motor fuels, especially the diesel cycle. However, due to the climate phenomenon, their have been other options presented to diversify the different energy sources in the transportation sector, such as the gas for vehicles and the use of bio-fuels.

In the industrial sector, this is characterized by the creation of different economic sectors, involving different industrial processes and many types of energy uses. In 2005, the energy consumption to be used for supplying energy needs of the sector were concentrated in natural gas, coal, followed closely by wood and bagasse. See Graph No. 12.

Energy sources such as crude from Castilla and Rubiales are still part of the energy basket in this sector, a condition that must be reverted, due to the added value of these recourses when they are used such as transformation of raw material. The supply of bagasse has been increasing at a very important rate due to the bio-fuel programs and it is estimated that there will be a relevant increase in its participation in consumption by the industrial sector.

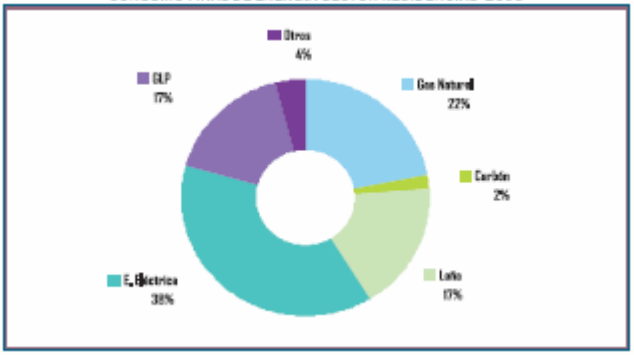
In this sector, the need for technological renovation mainly due to competition, has induced rapid penetration in the sectors of efficient energy technology and the reduction of specific energy: in general terms, this sector has a varied energy basket that will allows for the supply of various uses needed for the production of goods that are required for the economic development of a country.

Graph No. 12
FINAL ENERGY CONSUMPTION IN THE INDUSTRIAL SECTOR – 2005



Where it makes reference to energy consumption in the residential sector, electricity, whose total weight represents 38% of usage, it has given way to natural gas and LPG in the kitchen and heating of water.

Graph No. 13
FINAL ENERGY CONSUMPTION IN THE RESIDENTIAL SECTOR – 2005



Decree 1760 of June 2003, reformed hydrocarbons sector in Colombia. Through this Decree, the Empresa Colombiana de Petroleos (ECOPETROL) was structurally modified and the Agencia National de Hidrocarburos (National Hydrocarbon Agency) and the Sociedad Promotra de Energia de Colombia S.A (Energy Promoting Association of Colombia S.A), were created, restructuring the handling of hydrocarbons throughout the country.

From the moment this Decree went into effect, the ANH was in charge of the total administration of the hydrocarbon reserves owned by the Nation, and through the organization of new policies and the delivery to individuals or to ECOPETROL S.A. under equal conditions, the responsibility of exploration and exploitation of oil producing areas was shifted. ECOPETROL S.A. will assume full responsibility for the exploration, production, refining, transportation and commercialization of hydrocarbons.

The reform hopes to allow ECOPETROL greater autonomy to strengthen its commercial and corporate vision, consolidating it as a solid and sound fuel corporation in search of decisions that respond to the economic criteria and with the ability to generate its own resources.

Through the creation of the ANH the fuel contract system was reformed; today the country boasts of two (2) new contracts: one for the Technical Evaluation – TEAS – and the other with Exploration and Production – E & P.

With the new contract for Technical Evaluation, the purpose is to evaluate the potential of a large area, whose main purpose is to create a contract with E & P regarding a specific portion of the area. The contractor would commit to generating technical information for the ANH. The contracts would have a length of 18 months On-Shore and 24 months Off-Shore.

The Exploration and Production contract, would replace the type of association contract that has been used by ECOPETROL for the last 30 years, when they managed the resources of the country. With this new contract, there would be variable royalties disbursed, rights for higher prices and increased use of the sub-soil. There would be an exploration stage of 6 years, extended to 4 more years: there would be a period of evaluation that would extend from 1 to 2 years which could be extended for 5 more and the time for exploitation would be for 24 years which could be extended indefinitely. On the other hand, regulations regarding royalties have been modified by introducing a new scale system that allows for greater incentive for the exploitation of medium and smaller fields.

During the next few years, more of the fuel contract system seen will be completely different to those used in prior years, with new rules of the game characterized by:

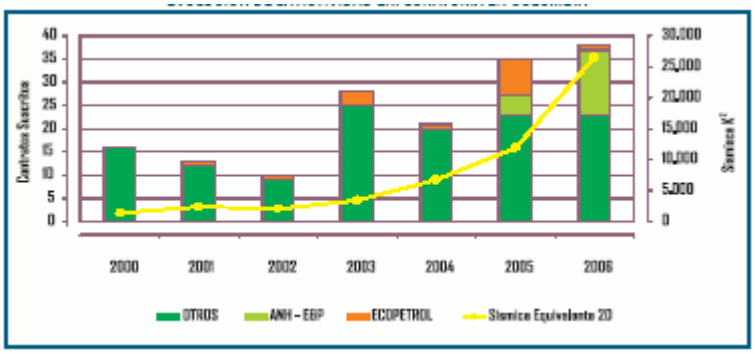
- Modernizing the concession contracts
- ECOPETROL may or may not be a partner
- Additional coverage in different areas

- Variable royalties

The results of the use of the new concession model indicate an increase in the number of contracts signed in the last three years. At the end of 2006, there were 44 contracts compared to 59 in 2005, increasing the goal initially established for the years 2002 – 2006 of 80 contracts, which later, in 2005 was modified in 110 contracts. At the same time, in seismic studies there was a 122% increase of acquired kilometers compared to 2005.

Exploration activity also has shown satisfactory results due to the increase in boring of new exploration wildcat wells, which went from 35 in 2005 to 56 in 2006. However, if the fuel prospective does not contribute to new discoveries, it is probable, even with the efforts of the Government, that the results of the new model will not be those that are expected. Graph No. 14 presents the evolution of the exploration drilling activity.

Graph No. 14
EVOLUTION OF EXPLORATION ACTIVITY IN COLOMBIA

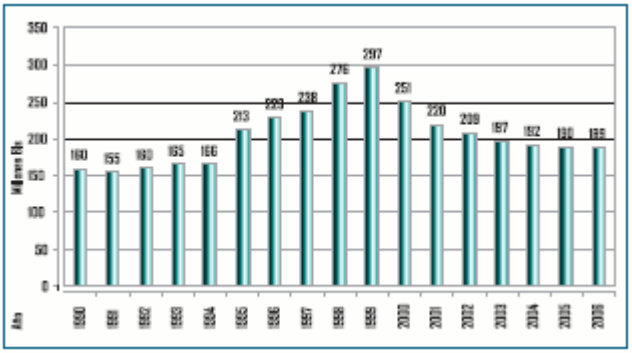


During the last few years, the oil reserves have presented a progressive decrease, due to the absence of new finds and the lack of repositioning of the used reserves. At the end of 2005, the oil reserves were at 1.453 billion barrels and in December 31, 2006, as a preliminary figure, the ANH reported 1.263 billion barrels, without considering re-evaluations, which indicates a 13% decrease. However, these results were also the counterpart to a very weak exploration effort. In this regard, allowing the ANH a greater operational maneuverability and recourses might be appropriate and necessary to increase the probability of new finds, which are not independent of the great exploration effort.

The levels of production in the last few years have been declining, although in 2006 and thanks to direct operating programs, we managed to contain the accelerated decrease that was being seen since the beginning of millennium. Graph 15 presents the evolution of the oil production. It can be observed that the tendency is one of a sustained decrease since 1999, when the maximum production level in the country was reached. The oil transportation system is in a surplus status due to the continued decrease of production.

The total capacity of national refinery is at 312,000 BPD, of which 73% is processed at the Barrancabermeja refinery, 23% corresponds to Cartagena and the other 4% is processed by smaller refineries located in the central part of the country. National capacity exceeds the demand for gasoline and some distilled products, with the exception of DIESEL where the supply is more than the demand. The transportation of derivatives has the sufficient capacity to cater to the actual demand: however, in the mid-term, there will be a need to expand, particularly towards the western section of the country.

GRAPH NO. 15
BEHAVIOR OF OIL PRODUCTION
Source: ECOPETROL



NATURAL GAS

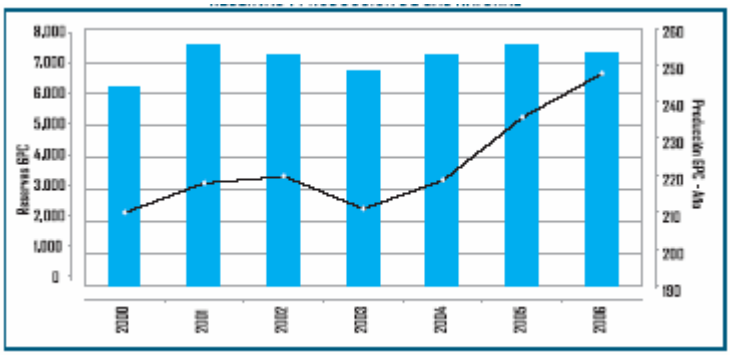
Exploration and exploitation activities for gas are simultaneous with those of oil, hence only drilling of oil wells confirms what type of hydro-carbons are found. However, in a certain way, the probability of finding one or another type of hydrocarbon also depends on the characteristics of the sedimentary river basins, hence, it is important to develop exploration trips to each one of them.

At present, there are intense programs taking place for exploration of hydrocarbons, trying to incorporate new natural gas reserves and expand the production capabilities to allow for a more trustworthy system and ensure internal supply and the exporting of natural gas. According to recent studies, there are great prospects to finding new natural gas reserves on the Atlantic Coast region that, at present, is the object of great exploration activity.

According to the information provided by the ANH, the natural gas reserves to December 31, 2005 were at 6,711 GPC, of which 1,710 correspond to the category of non-tested reserves.

Due to the high rates of decrease in the deposits, in 2006 the production dropped especially in the fields of the Guajira. To alleviate this situation, three new holes were dug, which increased the internal supply of natural gas. The actual supply depends of two great production centers located geographically in different regions, which vary not only in the markets they can supply but also in the physiochemical properties of the gas, as well as how the oil is produced and treated so that it can be delivered to the final user.

Graph No. 16
RESERVES AND PRODUCTION OF NATURAL GAS
Source: ECOPETROL S.A.



The product coming from the fields of the Guajira and the Piedemonte Llanero represents 90.1% of the national supply and needs are met with additional smaller fields. The fields in Guajira represent the main source of gas supplies for internal consumption, however since 2003 the supply produced by the Cusiana fields showed great important in the national plan to offer natural gas to the public. Should there be less success in the incorporation of reserves, the expansion of the internal supply will be concentrated geographically in the interior of the country.

Taking into account the growth in demand for natural gas, it will be necessary to increase its production for which we are expecting the commencement of production at a field in Gibraltar, the increase in the production at the field of Cusiana as well as the installation of a compression system in the wells of the fields in the Guajira. Also, importing of natural gas from Venezuela beginning in 2012 (according to agreements with Venezuela) will increase the supply which could balance the demand.

In reference to transportation of natural gas, Colombia has 8 companies that transport natural gas to 410 cities, connecting 4,131,177 users at a national level. The increasing demand has required expansion of the capacity of the transportation system and as a result it has increased the capacity from Cusiana with the installation of the compressor of Miraflores in November of 2006. There are also projections to increase capacity in the stretch between Ballena and Barrancabermeja during 2007.

To expand coverage and allow for development of the system in areas of lower resources, exclusive service areas have been established. The contract for concessions of exclusive gas service areas has a prime directive of ensuring that the concessionaire, on his own and at his own risk, offer residential public service to distribute natural gas under exclusive conditions in the area that has been assigned to him, including among the users a considerable and growing number of lower income families. For these concessions, eight-year duration contracts have been completed wherein fixed goals have been set in the number of users that must be connected and confirmed. The goals for these areas were surpassed in 2004.

Demand from the non-electrical sectors indicates stable behavior with sustained growth; however, sectors such as the industrial and transportation groups have indicated a higher rate of growth. The growth in the demand for natural gas in the industrial sector reflects the economic growth of the country in the last few years, while for the transportation section the price for liquid fuels has become an incentive for the public transportation systems that have converted to natural gas due to the fact that the price of VNG is approximately 60% of the equivalent amount of regular gasoline.

Demand from the thermo-electrical sector presents large variations due to the fact that thermal plants are used during periods of high demands and times of draught, which make the demand projections, vary according to the hydrological scenarios, producing a high level of uncertainty.

This demand scenario represents some difficulty for the expansion of the transportation and production systems, because to be able to back up the demand during those periods of time, it would take significant investments for which the demands must be justified in an area of high uncertainty. Also, expansion of the natural gas system is bid by contracts, which has demonstrated that through this system there not been clear expansion signals with enough anticipation for which to allow for growth at the time they are required.

In general terms, we can say that in the natural gas subsection there have been important advances fulfilled in the subjects regarding infrastructure development and service coverage. However, there are still important subjects to resolve so as to be able to continue on the path of consolidation of the gas markets.

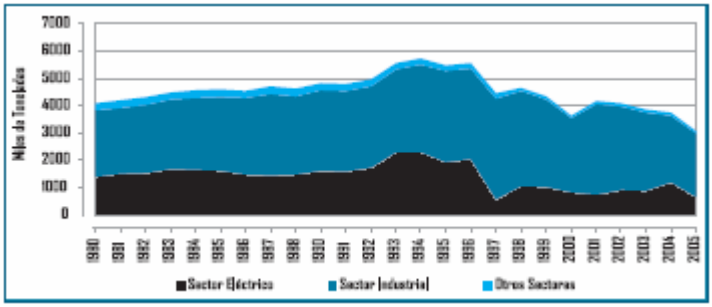
Coal

Colombia has registered proven coal reserves close to 6,600 million tons at the end of 2005, while production of same during that year produced 59 million tons, which allows for a relationship Reserves/Production of over 100 years. For this reason, this represents a highly strategic resource for the country.

From the mining sectors point of view, as well as from the energy sector and its exploitation and development, they should be made a part of the integral energy planning process of the country, in such a way that it would give this sector the appropriate consideration not only as a mining resource but also as an energy resource. As long as the characterization of the coal mining in Colombia is presented under different modalities and in different geographic sites, the planning for the sector should consider the specifics in each case.

Graph No. 17 presents the composition of the coal demand: the industry consumes 69% while the electric sector utilizes approximately 22%. As has been pointed out for some time, the coal industry has been framed within two large groups that made a difference in production chain of activities: the small and medium size mining, in the center of the country and great mining on the Atlantic Coast with the Cerrejon and la Jagua mines.

Graph No. 17
COMPOSITION OF THE FINAL COAL CONSUMPTION – WHOLE COUNTRY



The development of the coal sub-sector in the interior of the country is characterized by institutional as well as structural market factors that have limited the development of small mining concerns: the analysis and proposals of this situation are expanded in Chapter V regarding objectives and strategies.

Electric Energy

As we analyze the national electric sector, we can conclude that the overall plan coincides with what was presented in the Latin American and Caribbean countries towards the end of the 80´s, which considered that their structure which was based on vertically integrated state companies was inadequate, and for this reason the State has modified its role as the main actor in charge of the administration of the resources, investor as well as almost absolute owner of the electrical sector, to a clear separation of roles between the investors and the State, wherein the State has the responsibility to coordinate the energy policies, regulate as well as manage the control and protection and fulfillment of the sub-sector planning. Said planning is normative for the purpose of expansion of transmission and indicative for the expansion of generating energy.

The Constitution Política Nacional (Colombian National Constitution) and Laws 142 and 143 of 1994, are the basis for the reforms in the electrical sector and their institutional framework, wherein the following measures are to be followed:

- Promote private participation and reduce the State business participation
- Strengthen the role of the State in the general direction of the economy, through the creation of energy policies under the direction of Mines and Energy Ministry, whose planning would be under the responsibility of the UPME: by means of a regulation based on the responsibility of the CREG and controlled by the SSPD
- Promote free competition in activities of the sector
- Fulfill the principles of solidarity and redistribution of income and ensure availability of resources to cover subsidies established by the standards

- The need to regulate those situation in which due to a natural monopoly were defined, the plan does not guarantee an efficient service fulfillment
- The Wholesale Energy Market was defined
- Definition of the rates criteria that truly reflect the cost of the service was studied: we are inclined towards a gradual deregulation of prices
- A determination was made to extend coverage of electrical service for the country and plans were made to develop business plans for supply of services in the ZNI
- Confirmation of the needs to ensure the availability of the needed resources to cover the approved subsidies

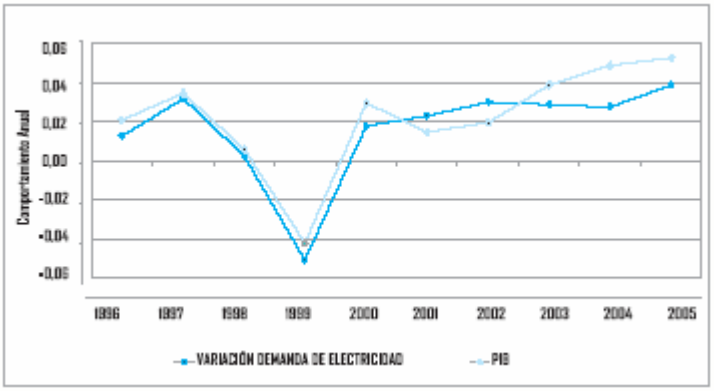
At present, the sector presents the following characteristics:

- We have been able to encourage an important participation from the private sector, especially in generating activities and in a lesser degree that of distribution. In transmission the private participation is reduced
- There is independence, integrity, credibility and good performance by the institutions in charge of planning, regulation, control and vigilance
- Separation of the competitive and monopoly activities has taken place as well as a vertical disintegration of the activities. This mandate is applied to all new agents. In the case of existing agents, this criterion is optional although the separation of accounts of each activity is required.
- Although the investments, particularly in generating energy have been very important, the number of actors in the market are small
- There is a differential in prices among the regulated as well as non-regulated users that is getting larger and larger.
- Free access to transmission and distribution networks
- Maintenance of the balance between recuperating service costs and the search for assistance to the poor and neediest population.
- Expansion of coverage

Traditionally, the growth of electrical energy demand has been related with the GNP and it is understood as a sign of the fulfillment of the productive capacity of the national economic development

In the evolution of the national demand for electric energy during the period 1996 – 2005, we find that in the last few years the interrelation is not as close s it was before the year 2000, among other reasons due to the penetration of natural gas.

Graph No. 18
GROWTH OF ELECTRIC ENERGY DEMAND AND GNP



Some of the indicators for the electrical sector are presented below for the period 2000 to 2005.

Table No. 2
EVOLUTION INDICATORS FOR THE ELECTRICAL SECTOR

	Evolución						
Indicator	In detail	2000	2001	2002	2003	2004	2005
Effective capacity (MW) (1)	Hydraulic	8.276	8.682	9.036	8.852	8.915	8.532
	Thermal G & C	4.238	4.420	4.369	4.375	4.416	4.353
	Others	67	67	64	70	68	436
	Total	12.581	13.169	13.469	13.297	13.399	13.348
Demand (1)	Energy (GWh)	42.240	43.206	44.499	45.768	47.019	48.826
	Energy Growth (%)	1.8%	2.3%	3.0%	2.9%	2.7%	3.8%
	Power (MW) (1)	7.712	7.787	8.078	8.257	8.332	8.638
Energy Interchanges (GWh-año)	Net Exports	13	196	614	1.166	1.683	1.758
	Net Imports	77	40	8	69	48	37
Coverage (5) (3)	(%)	87.4	88.5	88.4	89.4	89.9	91.9
Size of national transmission system NTS (length/capacity) (2)	500 kV (km)	1.449	1.449	1.449	1.449	1.449	1.449
	230 kV (km)	10.099	10.823	10.999	10.999	10.999	10.999
	Transformation (MVA)	3.510	3.960	3.96	3.960	4.560	4.560
Average market prices ($/kWh)	Market	45.0	53.0	48.8	6639	64.5	76.5
	Contracts	44.5	53.3	63.4	72.6	72.9	71.0
Average rate ($/kWh) (4)		117.8	135.5	157.0	157.8	175.9	179.0

Regarding the prior figures the general comments are as follows;

Installed Capacity for Generating Energy:
Installed capacity for generating energy at the hydraulic and thermal plants, have not presented any major changes since 2002. In the future, greater changes will be observed when the Porce III 660 MW project goes into effect - programmed for September 2010.

Energy Demand:
The average demand for energy has stayed around 2.9% annually and the demand for power around 2.3% a year. There is no doubt that these values have increased in recent years coinciding with the reactivation of the national economy. It is important to highlight that in 2006 the growth for the demand of electrical energy was of 4.07%.

Service coverage in the inter-connected system:
The coverage has increased close to 4.5 percentage points from the year 2001. It should be pointed out that these figures vary with the results of the last census: according to the DANE preliminary figures, for 2005, they indicate that coverage was of 93.6% (figures detailed in the National Development Plan).

National Transmission System:
This system is constituted by 10,999 km of transmission lines that operate through voltage levels of 220 and 230 kV and by 1,449 km of lines at 500 kV. ISA is the owner of 72% of the lines, Transelca of 12.4%, EEPPM for 6.5%, EEB for 5.6% and EPSA for 2.2%

The transformation capacity at a level of 500 kV is of 4.560 MVA and at 220 and 230 kV voltage levels it is 12.737 MVA.

The great change in the size of the STN will be seen with the operation of the new 500 kV circuit that will connect the Atlantic Coast and the interior of the country, Bolivar – Copey – Ocaña – Primavera – Bacatá and at a level of 230 kV with the second circuit project which will connect with Ecuador.

Market Agents:
We have been able to group the following by activities: 28 independent businesses: 17distribution businesses; 25 generator and generating businesses: and 15 integrated by generation and distribution businesses, 3 of which also have transmission: EEPPM, ESSA and EPSA.

The centrally located dispatch plants represent 96.53% (12-885 MW) and the centrally located non-dispatch plants represent 3.47% (463.44 MW). Of the total effective capacity at the end of 2005, hydraulic plants constituted 63.92%, thermal with gas 27.41% and coal 5.2%. The smaller hydraulic plants were at 3.08% and the smallest gas plants at 0.17%. The co-generators represent 0.15% and the eolic 0.07%

The net energy interchanges between Colombia and Ecuador and Venezuela represented exports of 1.757.8 GWh in 2005 with an annual increase of 4.5% while the imports decreased 23.7% going from 48.43 GWh in 2004 to 36.95 GWh in 2005.

Chapter III

Prospective

CHAPTER III: PROSPECTIVE

1. PROSPECTS REGARDING THE BEHAVIOR OF THE ENERGY DEMAND IN COLOMBIA 2006-2025

The estimates for energy demand in the mid and long term have been completed taking into considerations the prognosis for economic growth, the population as well as the price policy and the use of new technologies. The results of this analysis create the basic framework of the prospects, and an analysis has been completed regarding the sensitivity towards different variations of the economy and some of the energy policy measures.

We take this opportunity to present the most important results of this study that covers the period 2006 – 2025. The demand projections are estimated using two types of models: economic and analytical. The analytical model looks at the market conditions and ¨decides¨ how to satisfy the demand under restrictions or preferences (border conditions), taking into account technological variables of final use equipment that transforms the available energy sources into useful energy.

The main assumptions that determined the basic framework for energy projections in Colombia are as follow:

Gross Domestic Product: This variable took into account the projection scenarios of macroeconomic suppositions available up to October 2006, completed by the Ministerio de Hacienda (Finance Ministry) and Crédito Público (Public Credit) and the DNP.

The basic plan provides for a 4% growth on future prognosis, except for 2006 were a 4.8% is hoped for and in 2007 where a 4.5% is expected.

Population: We used the population growth expectations developed by the DANE [6] for the period from 2003 – 2015 and for the remaining period we assumed that they would behave in accordance with the average of the period. At the close of this report, we did not have the results of the population census completed in 2005, and for this reason we used the projection of the previous population census.

Prices: To project the prices for the different energies we used the standards defined by each one of them. Specifically, to estimate the prices for gasoline and the DIESEL we took a basic price of oil used by the medium range of prices from the DOE-EIA Energy Outlook 2006, then adjusted with prices from NYNEX dated February 2006.

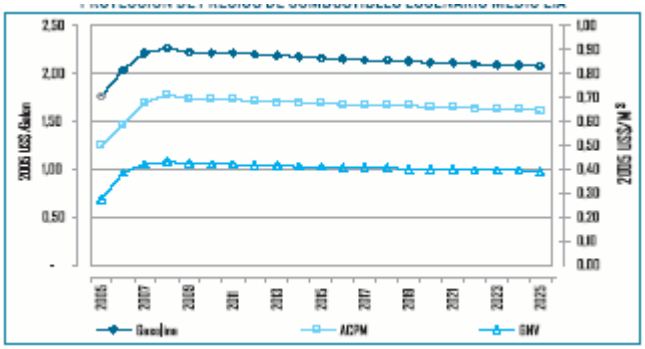
[6] Annual projections study of populations by sex and age 1985-2015.
DANE, Estudios Censales 4 (Census Studies 4)

The other variables that make up the price such as transportation of poly-products, global tax and brand tariff were projected with the TRM and with the IPC, gasohol with the devaluation and the IPP, indicators taken from the DNP projections.

Regarding natural gas for use in the transportation section or VNG, we estimated this figure based on the basic price of gasoline and we assumed it would correspond to 60% of the price of same, in energy terms. This information is presented in Graph 1.

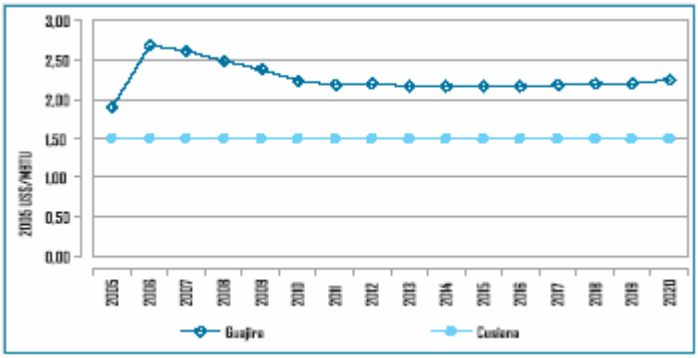
To estimate the price from the mouth of the natural gas well in the fields in Guajira, Opon and Payoa, we used the procedures established in CREG 119/2005 resolution, while the price for gas from Cusiana was estimated as the constant figure during 2005 of 1.50 U$/MBTU for the future projections.

Graph 1
PROJECTION OF FUEL PRICES - MEDIUM RANGE EIA



The cost of transportation for each section of the pipeline is projected by applying the present resolutions and total cost and consists of the sum of all (sections. Hence, the final cost of gas for generating electricity is equivalent to the sum of the price from the mouth of the well in a field plus the transportation from the production field to the generating plant. For this analysis, we considered the actual contracts for supply and transportation.

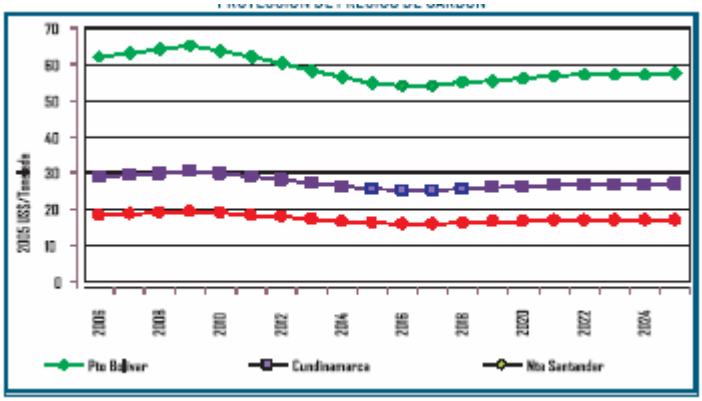
Graph 2
PRICE PROJECTIONS FROM NATURAL GAS WELL



The estimates for the prices of coal are based on an analysis of the behavior of the internal prices reported and the exporting of same, the transportation costs and handling at the port when it comes to foreign commerce[7], from the production areas to the loading areas and projection prices for exporting coal to the USA reported by the DOE-EIA.

To determine the behavior of said prices, we also considered the projections for internal transportation to the supply centers. Graph 3 presents the estimated prices for thermal centers of Norte de Santander and Cundinamarca and the estimates for coal at Puerto Bolivar.

Graph 3
PROJECTIONS FOR THE PRICES OF COAL



2. BASIS CASE

Results of the projection study by sector

Based on the previous suppositions, we obtained a projection for the demand of the different energy sources and the consumption sectors, although they do not include the expected results by the URE processes. The analysis shows that the energy demand will grow to a 2.3% annual average rate in the period 2006 – 2025 that is equivalent to an increase of approximately 143,000 Teracalories, highlighted by the growth of DIESEL and coal, due to the gas and electricity prices.

The main source that is substituted is gasoline, which is replaced by VNG, particularly in urban transportation, and by DIESEL in urban and inter-urban transportation. Gasoline will decrease its relative participation from 16.8% in 2006 to 9% in 2025.

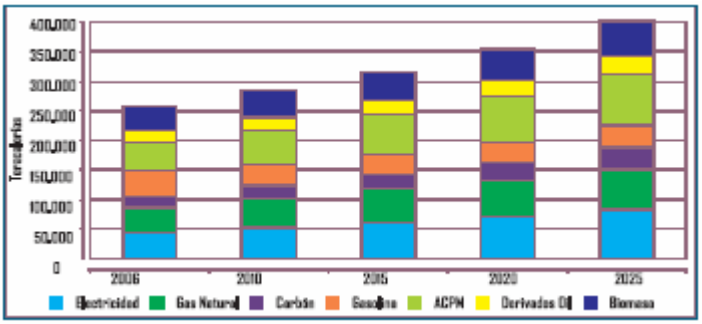
DIESEL with an inter-annual growth rate of 3.7% in the projection plan increases its participation in the energy basket going from 18.9% at the beginning of the period and ending in 2025 with a participation of 21.8% in the final figures.

Due to the increase in the industrial consumption, coal will grow to 3.7% annually, increasing its participation in 2.1 percentage points in the final consumption between

[7] Infrastructure Plan for the development of mining transportation in Colombia, UPME 2004

2006 and 2025. Chart4 details the composition of the final energy basket throughout the analysis plan.

Graph 4
DEMAND FOR FINAL ENERGY – BASIS CASE



The results of the basis case are presented by sectors in Graph 5. The distribution for demand indicates a rapid growth of commercial, transportation and industrial sectors, and slow growth in the residential sector. The evolution of the participation in total consumption is detailed in Table 1.

Graph 5
DISTRIBUTION OF CONSUMPTION BY SECTIONS

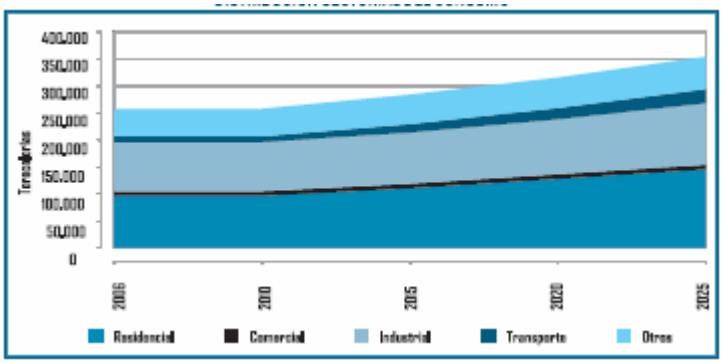


Table 1
PARTICIPATION OF CONSUMPTION BY SECTORS

SECTORS	2006	2010	2015	2020	2025
Residencial	19%	17%	16%	15%	14%
Commercial	4%	5%	6%	7%	8%
Industrial	39%	41%	42%	43%	43%
Transportation	35%	33%	32%	32%	32%
Others	3%	3%	3%	3%	3%

Residential Sector

The analysis of the residential sector included two different types of models: in the first model we differentiated the captive consumptions for electric energy[8] and in the second we considered the substitution between natural gas, LPG and coal. The results indicate an annual growth rate of 1.23% on the projection scale, with electricity increasing its relative participation by going from 36% in 2006 to 43% in 2025. This represents an increase of 1.78% per year.

Natural gas, whose relative participation shifts from 17% to 22% in the projection plan, indicates an annual average increase of 2.35%, while it maintains its participation with regards to the other energies. Coal decreases its relative participation dropping from 32% in 2006 to 18% in 2025, with an annual average decrease of 2.14%. The same situation occurs with coal, which registers an inter-annual decrease of 1% during the whole period of the analysis plan: the other energy sources have a marginal participation.

Graph 6
EVOLUTON OF THE DEMAND FOR SOURCES IN THE RESIDENTIAL SECTOR

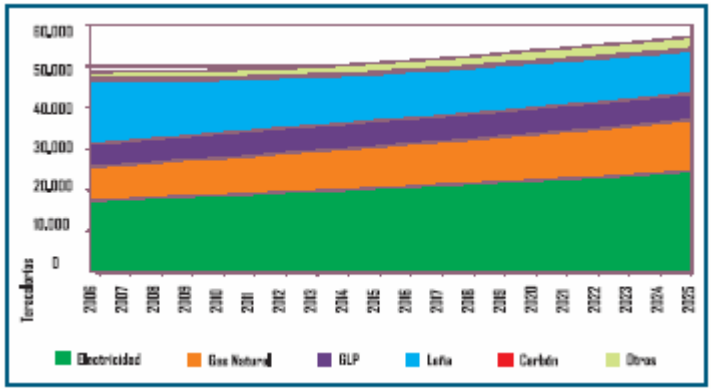


Table 2 details the growth rates of different energy sources that fulfill the needs in the residential sectors and Graph 7 presents a comparison of the participation of the sources at the beginning and the end of the analysis period.

Table 2
DEVELOPMENT OF MEDIAN GROWTH RATES OF THE SOURCES

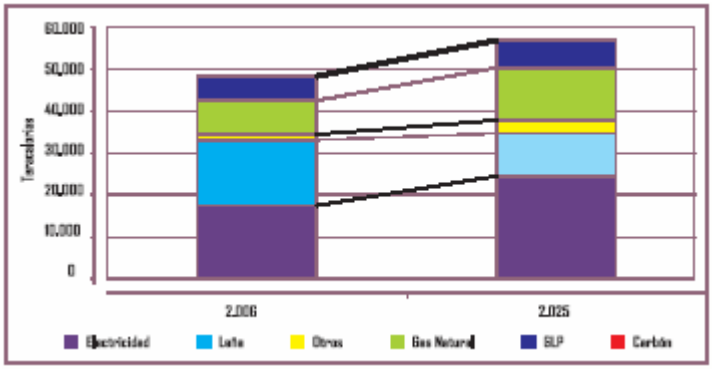
SOURCE	2006-2010	2011-2015	2016-2020	2021-2025
Electricity	1.7%	1.7%	1.9%	1.8%
Natural Gas	2.7%	2.3%	2.2%	2.3%
LPG	1.8%	0.9%	0.3%	0.1%
Firewood	-4.3%	-2.7%	-1.0%	-1.0%
Coal	-1.6%	-1.9%	-0.2%	-0.2%
Others	1.7%	1.7%	1.7%	1.7%

Recent studies completed by the UPME[9] reveal that in the homes the greatest use for electricity is for refrigeration, followed by lighting.

[8] The sector of electrical demand includes the losses of transmission and distribution
[9] Determination of the final energy consumption in the urban and commercial sectors, and the determination of consumption for domestic equipment for electric energy and gas, UPME 2006

On the other hand, uses for electric energy such as cooking and heating water tanks, has practically disappeared (UPME study 2006, Determination of Final Energy consumption in Residential, Urban and Commercial Sectors)

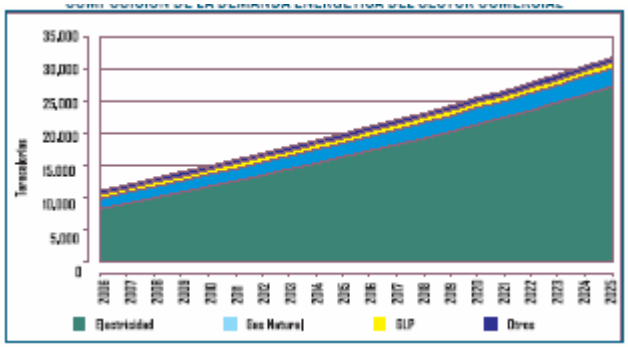
Graph 7
PARTICIPATION PER ENERGY SOURCE – INDUSTRIAL SECTOR



Business Sector

The business sector was analyzed in a similar way as what had been done with the residential sector. Graph 8 presents the evolution of the energy demand fo this sector.

Graph 8
COMPOSITION OF THE ENERGY DEMAND FOR THE COMMERCIAL SECTOR



It is estimated that the energy consumption of this sector will grow on average at a rate of 5.1% per year between 2005 and 2025. Electric energy is the main source of consumption, due to all its uses, and the forecast towards the end of the analysis is that 83% of the demand will be due to the electrical sector.

Table 3 details the inter-annual growth rates of the different energy sources that are used in the business sector, where high increments of electricity are seen, which increases their relative participation by 11.8 percentage points, while natural gas and LPG will decrease in relative terms by 5.8% and 3.2% respectively during the same period.

Table 3
ANNUAL AVERAGE GROWTH RATES – BUSINESS SECTOR

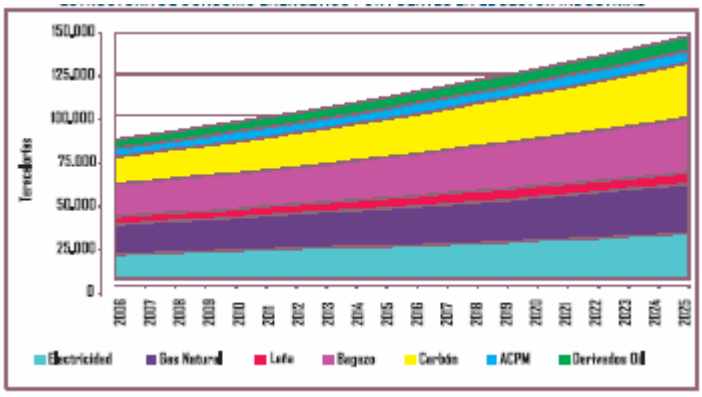
SOURCE	2006-2010	2011-2015	2016-2020	2021-2025
Electricity	9.3%	7.0%	5.7%	5.0%
Natural Gas	3.8%	3.0%	2.8%	2.6%
LPG	3.2%	1.8%	1.0%	0.7%
Gasoline	1.7%	1.7%	1.7%	1.7%
DIESEL	1.7%	1.7%	1.7%	1.7%

Industrial Sector

For the industrial sector[10] we modeled the captive demand for electric energy in accordance with the participation of the sector in the national demand. In the case of heat supply, we completed a regional scale model, to be able to consider the energy availability and the differences in growth all over the country, including usage of crude oil from Rubiales in the industry. This methodology ensures improved precision regarding the process of possible substitutions and for this reason it is appropriate to determine the penetration reach in each source.

The analysis results demonstrate that the industrial sector will grow by a median annual rate of 2.9% by the end of the analysis period: the main energy sources are bagasse, natural gas, electricity and coal.

Graph 9
STRUCTURE OF ENERGY CONSUMPTION BY SOURCES IN THE INDUSTIAL SECTOR



In relative terms, coal is the energy source with the highest growth followed by electricity. In absolute terms, all the energy sources offer positive growth although the contribution towards the energy basket of crude oil and oil derivatives such as fuel oil are very minor. Graph 10 allows for comparison of the structure of industrial energy consumption in the first and last year of the projection plan.

[10] In this analysis we do not include the energy consumption of the refinery and petrochemical plants

Graph 10
EVOLUTION OF THE ENERGY SOURCES IN THE INDUSTRIAL SECTOR

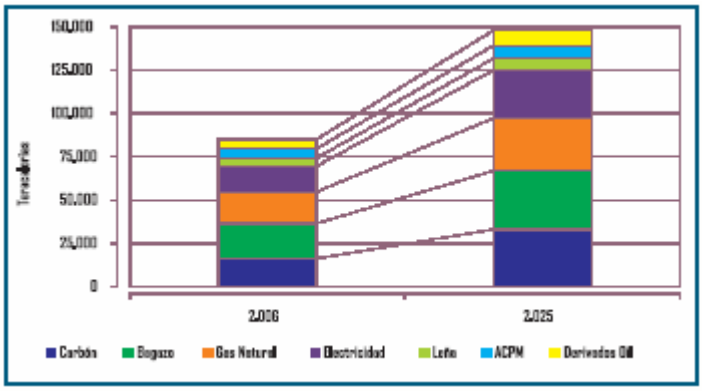


Table 4 details the growth rates for each of the energy sources that support the requirements of the industrial sector. It is important to note that electricity and coal maintain the highest growth factors at the beginning period of the study, a trajectory that is maintained at the end of the projection plan. With regard to natural gas and bagasse, they indicate a stable growth path, while coal presents a sustained decrease and it is estimated that towards the end of the study period it will disappear from the industry consumption structure completely.

Table 4
ANNUAL AVERAGE GROWTH RATES – INDUSTRIAL SECTOR

SOURCE	2006-2010	2011-2015	2016-2020	2021-2025
Electricity	3.5%	3.0%	3.1%	3.5%
Natural Gas	2.6%	2.7%	2.7%	2.8%
Firewood	3.2%	3.3%	2.0%	0.0%
Scrap	2.0%	2.6%	3.2%	2.8%
Coal	4.3%	3.9%	3.6%	3.6%
DIESEL	1.8%	1.8%	1.8%	1.8%
Oil byproducts	2.0%	2.0%	2.0%	2.0%

In reference to the consumption at the refineries, it is not included in the previous study.
According to the estimates submitted by ECOPETROL, the demand for natural gas for said refineries will increase, due to the expansions and updating that are being planned. It is expected that for 2006 – 2010 the demand for this energy source will growth close to 11% and in the period from 2011 – 2025 will grow 3% maintaining the demand for the rest of the period in 187 MPCD.

Natural gas consumption prices for the petrochemical industry are foreseen close to 14 MPCD by the end of the projection plan.

Transportation Sector

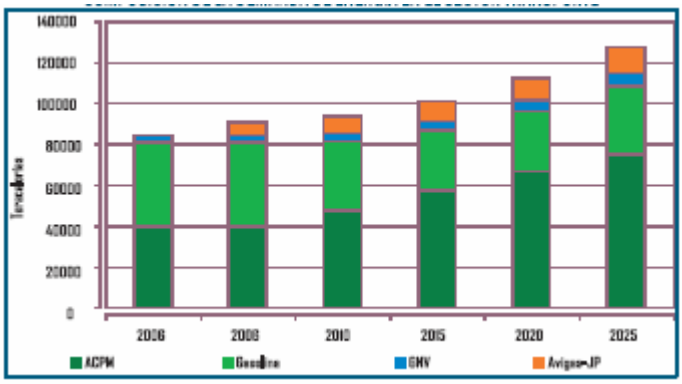
The transportation sector was analyzed taking into account the segments of passengers and cargo for urban and inter-urban sectors. In the specific case of

passengers, it was possible to consider alternatives the public has to move from one place to another, whether it is by private cars, taxis, motorcycles, etc or by collective transportation means such as conventional buses and massive transportation systems, which in turn have different technologies available to them and may use different types of fuels.

This model allowed us to consider new technologies that would allow for the same mobility of passengers and cargo with better efficiency, by comparing the old vehicles with carburetors and fuel injection vehicles and these vehicles in turn, with new technologies such as hybrid vehicles (gasoline-electricity).

The results presented in Graph 11, demonstrate the effect of the mobility policies with massive transportation alternatives that included, in accordance with the information available on their going into operation, the following phases of Bogotá and the new systems in Pereira, Medellin, Cali, Bucaramanga, Barranquilla and Cartagena. Two new systems were added to the figures for 2011 and 2017 in capital cities that reach an appropriate size that would benefit from the installation of this type of models[11]. It is important to note that in the basis case, all the systems are supported by diesel technology, due to the initial costs for investment in vehicles, lack of interest on the part of the business owners to use new technologies, low price for national DIESEL and the national offer for equipment based exclusively on DIESEL.

Graph 11
COMPOSITION FOR THE DEMAND OF ENERGY IN THE TRANSPORTATION SECTOR



This scenario estimates that the demand for energy will grow during the projected study plan at an average rate per year of 1.8% with great changes in the pattern of consumption. It is expected that there will be a significant decrease in the demand for gasoline for more technologically effective sources and alternative energy sources such as natural gas, as well as change in the way people are transported, originating a greater usage of collective transportation versus personal vehicles due to the expansion of the Transmilenio (articulated busses) system, whose efficiency in terms of specific consumption per passenger transported, is far superior to the previous public transportation systems. Also under consideration is the participation

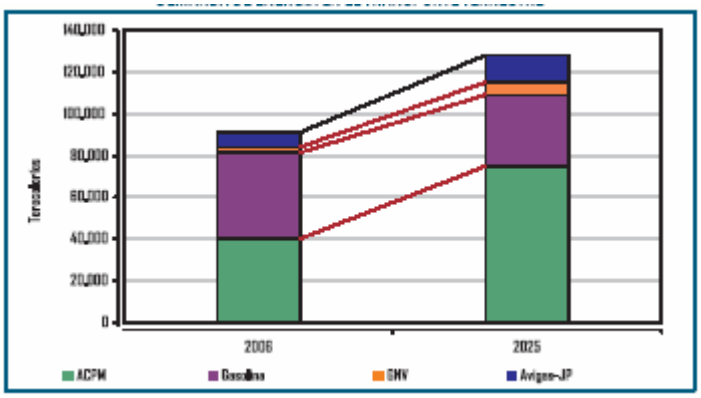
[11] The available information indicates that the probable candidates for the new equipment will be in the Eje Cafetero and Norte de Santander

of gasoline in the energy basket of the sector which registers a sustained decrease during the whole projection plan period.

The other change is due to the greater weight of the consumption structure for DIESEL, which increases from 43.7% consumption in 2006 to 58.7% in 2025 with an annual average increase of 3.3%. This is due especially to the price plan established where its use is encouraged.

VNG begins the analysis with a participation of 3.2% of energy consumed by the transportation sector, and is seen increasing to 4.9% at the end of 2025, with an average annual rate of growth of 4%. Graph 12 presents the comparison in different transportation means and participation in each of the sources at the beginning and ending of the projection interval. It is important to highlight that the treatment of the vehicular group per type, will ensure better estimates of real participation possibilities in each fuel type, under present technological fulfillment conditions.

Graph 12
ENERGY DEMAND IN LAND TRANSPORTATION



Also in Table 5 we can observe the median growth rates throughout the different periods of the projection plan.

Table 5
ANNUAL AVERAGE GROWTH RATE – TRANSPORTATION SECTOR

SOURCE	2006-2010	2011-2015	2016-2020	2021-2025
Gasoline	-5.1%	-2.6%	0.2%	2.6%
DIESEL	4.8%	3.7%	2.9%	2.4%
VNG	7.5%	3.3%	2.7%	3.3%
Jet fuel-JP	3.4%	3.3%	3.2%	3.1%

Other Sectors

The consumption sectors such as the official, construction, public lighting and others, together present a moderate increase in the projection period that corresponds to 1% annual average. Graph 13 presents the evolution of different sources of consumption during 2006 – 2025. It indicates a decrease in the

consumption of electrical energy that is the product of the relocation of provisional or temporary consumers in the different defined sectors, whose average rate decreases by 2.1% per year. The analysis also indicates an increase in the consumption of fossil fuels such as DIESEL and coal, with inter-annual rates close to 1.8% and 3.8% respectively. Regarding gasoline and natural gas, we observe sustained participation through the end of the projection plan.

Graph 13
COMPOSITION OF THE ENERGY DEMAND – OTHER SECTORS

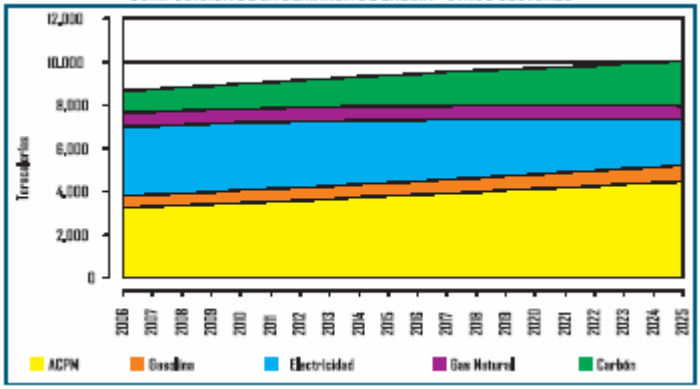


Table 6 presents the growth rates for each one of the ¨other ¨energy sources by category.

Table 6
ANNUAL AVERAGE GROWTH RATE – OTHER SECTORS

SOURCE	2006-2010	2011-2015	2016-2020	2021-2025
Electricity	-0.9%	-1.4%	-2.4%	-3.7%
Gasoline	1.7%	1.7%	1.7%	1.7%
DIESEL	1.7%	1.7%	1.7%	1.7%
Coal	4.3%	3.9%	3.6%	3.6%

The results of the final energy demands that are projected in the basis case are detailed by energy source:

Natural Gas

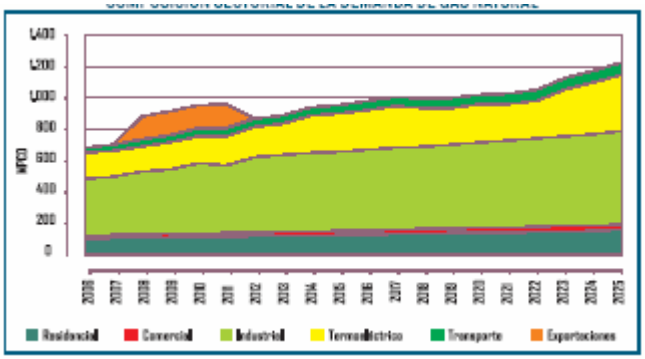
In the basis scenario, the requirements for natural gas in the next few years indicate an annual average growth rate of 3.1% which would increase the internal demand to 1,200 MPCD towards 2025, including the exports to Venezuela during four years beginning in 2008. The transportation sectors and the generation of electricity imply an annual average growth of 3.8% and 4.1% respectively, while the industrial and residential sectors represent inter-annual growth rates close to 2.3%.

In absolute terms the industrial sector would demand the greatest quantity of natural gas, followed by generating electricity and the residential sector. We should note that in the analysis completed, the industrial sector also comprises the consumption

by the refineries, petrochemical plants and the demand in compressors for the natural gas national transportation system.

Graph 14 presents the evolution of the demand for natural gas by sectors and Table 7 presents the sector participation in the different years of the projection plan.

Graph 14
COMPOSITION BY DEMAND SECTORS OF NATURAL GAS



In relative terms, the thermal sector gains close to 6 percentage points in the analysis period, and shifts from consuming 23.7% of the total natural gas in 2006 to 29.6% in the year 2025, which in absolute terms indicates an increase of 200 MPCS. In the industrial sector there is a reduction of the relative participation by going from consuming 53.4% in 2006 to 48.5% by 2025, although in absolute terms there would be a need for 230 MPCD more than at the beginning of the study period.

Table 7
NATURAL GAS PARTICIPATION BY SECTORS

SECTOR	2006	2010	2015	2020	2025
Residencial	14.6%	13.8%	13.0%	13.6%	12.7%
Commercial	2.9%	2.9%	2.8%	3.0%	2.9%
Industrial12	53.4%	55.7%	52.8%	53.4%	48.5%
Thermal	23.7%	21.6%	25.3%	23.6%	29.6%
Transportation	5.3%	6.0%	6.0%	6.4%	6.3%

Table 8 presents the average growth rates of final consumption for natural gas.

In the transportation sector it was estimated that a higher entry of the VNG in cars, with a high proportion of them being taxis, followed by cargo automobiles. The buses do not increase their participation because in this scenario we do not consider buses dedicated to VNG, nor do we consider the conventional transportation nor rapid transit modes due to the reasons already presented. In the projection plan, the transportation sector will increase their relative participation as will the thermo-electrical sector.

Table 8
NATURAL GAS GROWTH RATES

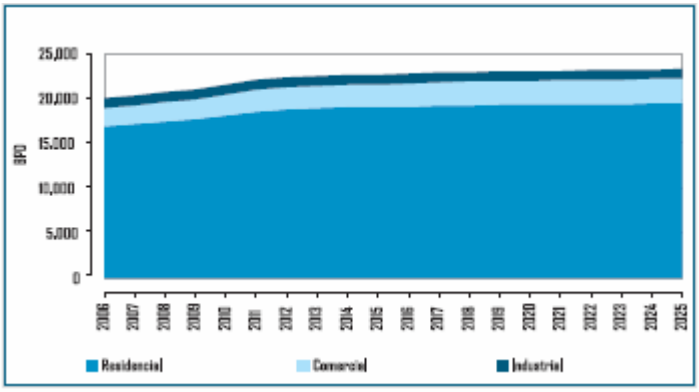
Share	2006-2010	2010-2015	2015-2020	2020-2025
Residencial	2.7%	2.3%	2.2%	2.3%
Commercial	3.8%	3.0%	2.8%	2.6%
Industrial[13]	5.3%	2.5%	1.6%	1.7%
Thermo-electric	1.9%	7.1%	0.1%	8.9%
Transportation	7.5%	3.3%	2.7%	3.3%

The residential sector indicates median growing rates towards the first period, that later will stabilize around 2% annual average, until the end of the analysis projections.

LPG

The estimates determined that the demand for LPG is closely linked with natural gas in the residential and commercial sectors with the displacement of wood as fuel, particularly in rural areas. We project a slight increase with an annual median rate close to 1% in the projection plan.

Graph 15
STRUCTURES BY SECTIONS FOR LPG DEMAND



The residential sector is more than 80% and in the basis scenario we expect an inter-annual growth of 0.8% while the industrial sector will reduce its participation to close to 4.8% of the total LPG consumption. In the business and commercial sector its participation is maintained with an inter-annual growth rate of 1.5% in the projection plan. Table 9 presents the participation structure. Table 10 presents the evolution of growth rates for LPG consumption.

Table 9
STRUCTURE FOR RELATIVE SECTION PARTICIPATION

Share	2006	2010	2015	2020	2025
Residencial	84.4%	84.3%	84.1%	83.8%	83.6%
Commercial	10.2%	10.7%	11.2%	11.5%	11.8%
Industrial	5.4%	5.0%	4.7%	4.7%	4.6%

Table 10

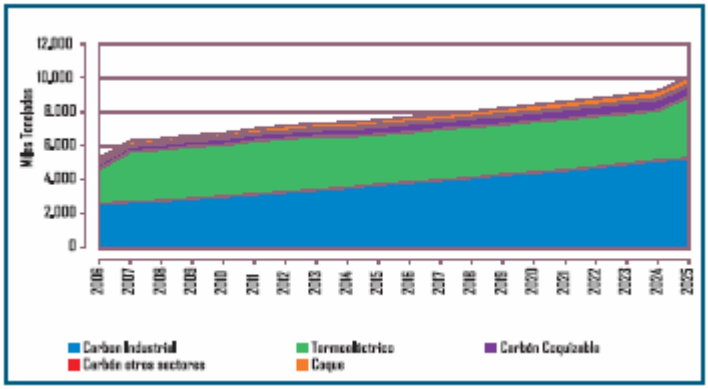
GROWTH RATE OF CONSUMPTION OF LPG

Share	2006-2010	2010-2015	2015-2020	2020-2025
Residencial	1.8%	0.9%	0.3%	0.1%
Commercial	3.2%	1.8%	1.0%	0.7%
Industrial	0.1%	0.1%	0.1%	0.1%

Coal

The estimates for coal consumption are associated with the prospects of natural gas in the different sectors of consumption given that it represents the closest substitute. In this way, we estimate that the demand for this energy source will come mainly from the industry and generating electrical energy, depending on the projects for generating energy that can be installed in the future, especially after 2015. The estimate for the internal demand indicates an annual average increase of 3.2% between 2006 and 2025, highlighting the industrial sector, whose median growth during the same period is equivalent to 3.6% and the electrical sector will grow at a rate of 2.8%.

Graph 16
COMPOSITION OF COAL DEMAND BY SECTORS



It is expected that there will be an increase in the coal participation in the energy structure due to the variation of the prices for energy sources with which it competes, especially for generating electricity.

Table 11
STRUCTURE BY SECTORS OF COAL CONSUMPTION

SECTORS	2006	2010	2015	2020	2025
Industrial	51.2%	47.0%	51.6%	55.4%	55.1%
Coke	6.1%	5.6%	6.2%	6.6%	6.6%
Other Sectors	1.9%	1.4%	1.1%	1.0%	0.8%
Thermo-electric	40.8%	46.0%	41.1%	37.0%	37.5%

Although coal participation in the energy matrix does not have a direct correlation with its availability, the results of the projection indicate an increase in the participation of final use of energy. The growth rates indicate that there is a greater dynamics towards the beginning of the period with a final deceleration towards the end of same.

Table 12
COAL CONSUMPTION GROWTH RATE

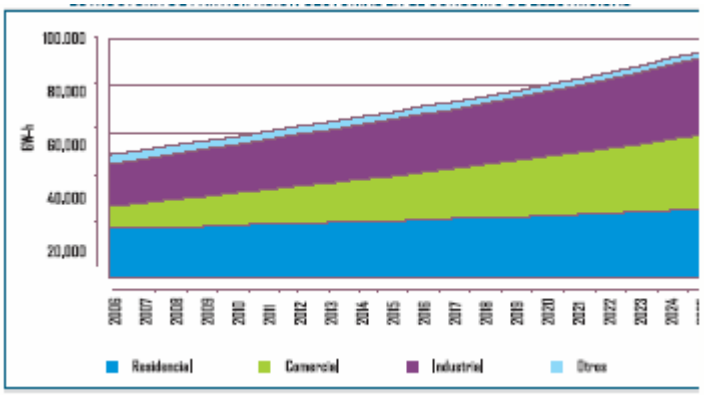
SECTORS	2006-2010	2010-2015	2015-2020	2020-2025
Industrial	4.3%	3.9%	3.6%	3.6%
Coke	4.3%	3.9%	3.6%	3.6%
Other Sectors	-1.6%	-1.9%	-0.2%	-0.2%
Thermo-electric	4.3%	3.9%	3.6%	3.6%

In this study we have not incorporated the coal demand for transformation to liquids, however, should the introduction of CTL become technically and economically feasible, the demand for coal might be larger creating a base for a restructuring of the small and medium size mining facilities and possibly for the use of non-exportable coal.

Electric Energy

The demand projections for electrical energy indicate that the growth rate on the projection plan will evolve at a lower rate than the GDP, which suggests substitution and more efficient processes, encouraged since 1997. It is estimated that the inter-annual growth rate will reach 3.3% in the analysis interval.

Graph 17
STRUCTURE OF PARTICIPATING SECTORS IN ELECTRICITY CONSUMPTION



Graph 17 presents the evolution of the requirements for demand of electricity in sectional form. It indicates an important growth in the commercial sector gaining 15 percentage points in the relative participation for the demand of electricity. The residential sector decreases its participation in the period, even when its annual average growth rate is close to 1.7%

The commercial sector will reach greater growth rates which annually represent 6.5% during the period of 2006 – 2025, followed by the industrial sector whose annual growth is about 3.2%, which the residential sector decreases its participation during the analysis period.

Table 13
GROWTH RATES FOR ELECTRICAL ENERGY CONSUMPTION

Share	2006-2010	2010-2015	2015-2020	2020-2025
Residencial	1.70%	1.79%	1.78%	1.89%
Commercial	8.98%	6.68%	5.42%	4.98%
Industrial	3.43%	3.00%	3.10%	3.59%
Others	-0.92%	-1.57%	-2.66%	-3.85%

Table14 presents the participation in sectors regarding consumption of electricity and its evolution in the different periods of the analysis. Towards the end of the projection plan, the residential, commercial and industrial sectors indicate participation that is similar to close to one third of the total consumption.

Table 14
STRUCTURE BY SECTORS OF ELECTRIC ENERGY CONSUMPTION

Share	2006	2010	2015	2020	2025
Residencial	40%	37%	34%	32%	30%
Commercial	18%	23%	27%	31%	33%
Industrial	35%	34%	34%	34%	34%
Others	7%	6%	5%	4%	3%

Gasoline

The prospective analysis for 2006-2025 indicates a constant decrease of gasoline (oxygenated to 10%) consumption up to approximately the year 2017, due to different factors such as: change in the mobility plans, renovation of vehicle group and introduction of technologies such as VNG and hybrid vehicles. Graph 18 describes the evolution of the participation for consumption of gasoline, considering the different segments for automotive transportation, which explains that the predominantly gasoline user is in private transportation, that includes private vehicles, taxis and motorcycles at 76.5% followed by cargo transportation with a 14.4% usage.

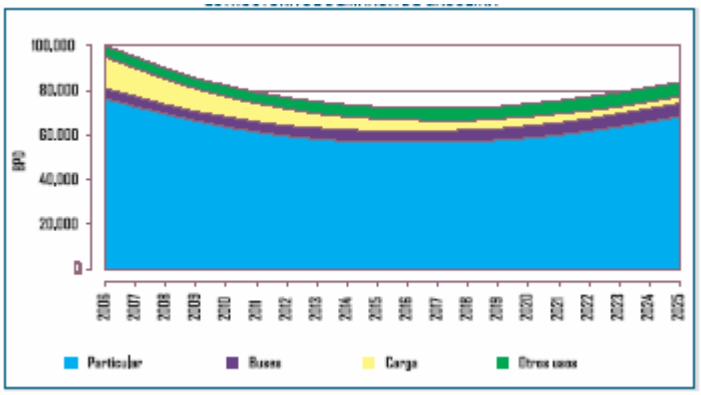
The demand for gasoline in the projected analysis, registers an annual average reduction of 0.9%, and cargo the segment that has decreased in the studied period, due to the process of substitution for DIESEL. Table 15 displays the growth rates per segment of transportation.

Table 15
GROWTH RATES FOR GASOLINE CONSUMPTION

Share	2006-2010	2010-2015	2015-2020	2020-2025
Private auto	-4.5%	-2.1%	0.6%	3.0%
Buses	0.6%	1.3%	1.8%	2.1%
Cargo	-11.0%	-9.1%	-6.6%	-4.0%
Other Uses	1.7%	1.7%	1.7%	1.7%

It is important to highlight that although we have the new technology for diesel buses we still do not have a supply location for gasoline that represents positive median rates of consumption throughout the period of estimates, although their participation is small compared to the total demand. On the other hand, personal transportation indicates a negative annual average growth that is recovered towards the end of the projection plan.

Graph 18
DEMAND STRUCTURE FOR GASOLINE



Regarding the relative participation per type of segment in transportation, Table18 details the evolution and contribution of each segment in the evaluation period. We can see that private automobiles are registering more than two thirds of the gasoline consumption with a tendency to grow.

Table 16
EVOLUTION OF THE PARTICIPATION STRUCTURE IN GASOLINE CONSUMPTION

SEGMENT	2006	2010	2015	2020	2025
Private auto	76.5%	77.4%	78.2%	79.5%	81.5%
Buses	4.4%	5.5%	6.7%	7.2%	7.0%
Cargo	14.4%	11.0%	7.7%	5.4%	3.9%
Other Uses	4.6%	6.0%	7.4%	7.9%	7.6%

DIESEL

With the actual price structure, ACMP will be one of the energy sources with the greatest growth in the Colombian energy basket, not only to supply for the needs of the transportation sector but also the needs of the industry, which is also used for generating electricity, machinery movement and cargo transportation. During the analysis period, the annual average growth rates for ACMP were estimated close to 3.1%

Transportation of passengers and cargo create the highest demands for DIESEL due to the improved efficiency of diesel technology.

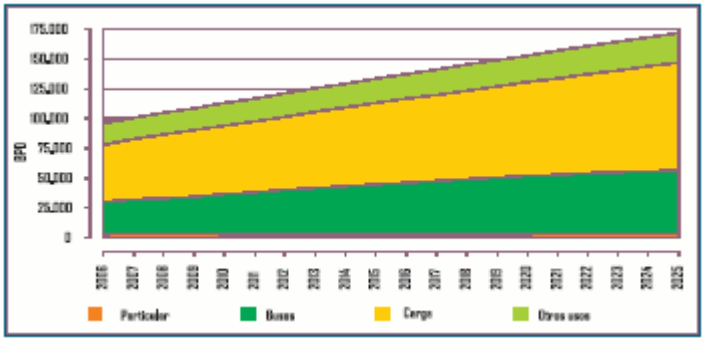
Table 17 registers the median growth rates for each one of the consumption segments, of which the passenger segment is responsible for the highest increase, with a median annual rate of 3.6% in the period 2006-2025. It is important to note that the motor technology has improved in the last few years and bus transportation with exclusive lanes and larger number of people transported will allow for continued reduction of specific consumption per passenger.

Table 17
GROWTH RATES FOR DIESEL CONSUMPTION

Share	2006-2010	2010-2015	2015-2020	2020-2025
Private auto	1.1%	-0.9%	0.8%	2.9%
Buses	5.8%	4.6%	3.0%	1.7%
Cargo	4.4%	3.5%	3.0%	2.8%
Other Uses	1.7%	1.7%	1.7%	1.7%

Graph 19 represents the evolution of the needs for DIESEL per transportation segment and other uses, where we can observe that cargo transportation represents approximately half of the total consumption of DIESEL in the country.

Graph 19
DEMAND STRUCTURE FOR DIESEL



The relative participation of the different transportation segments, indicate that personal transportation is minimal, with a decreasing tendency throughout the projected plan, similar to the category of other uses, which is referred to as the demand in the industry. The cargo segments and transportation of passengers gain a few percentage points in the participation with consumption of DIESEL.

Table 18
RELATIVE PARTICIPATION IN DIESEL CONSUMPTION

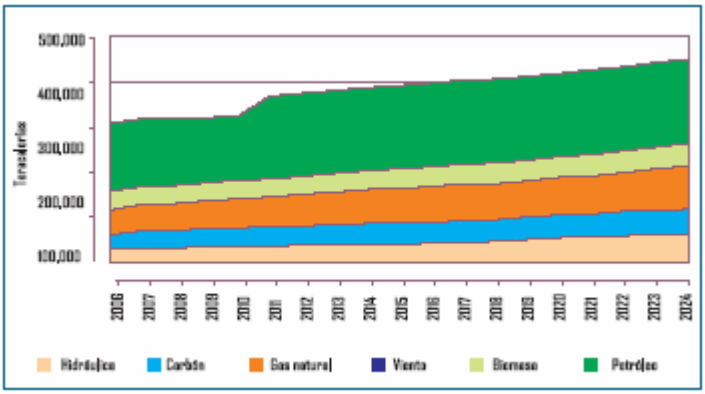
SEGMENTS	2006	2010	2015	2020	2025
Private auto	3.3%	2.9%	2.3%	2.1%	2.2%
Buses	27.8%	29.5%	31.2%	31.6%	30.8%
Cargo	50.3%	50.7%	50.9%	51.4%	52.7%
Other Uses	18.5%	16.7%	15.4%	14.6%	14.2%

3. REQUIREMENTS FOR PRIMARY ENERGY – BASE CASE

The country has a variety of energy sources, enough to handle the internal energy needs as well as to maintain exports of oil, coal and electricity; this last one has contracted several business interchanges with Ecuador. With the exception of DIESEL, the internal supply is, in essence, sufficient in potential terms to reach self-supply status. However, the view regarding oil production is very uncertain due to the actual decline of the present rate of production as well as the absence of new finds that would allow for replacement of extracted resources. It is important, to point out, that we are expecting successful results with the new exploration activities whose levels, in terms of exploratory wells is higher than those registered during the nineties.

The prospective analysis for the basis scenario implies availability of primary resourses that grow about 49% during the study period and shift from 309.000 Teracalories in 2006 to 462,000 in 2025, which implies a yearly average growth rate of over 2.1%.

Graph 20
DEMANDS FOR PRIMARY ENERGY 2006-2025



Hydro-energy and natural gas are two of the energy sources with the greatest dynamics, whose demand practically duplicates in the future of the analysis and in absolute terms increases by 35.000 and 43.000 Teracalories respectively. It is anticipated that in the 20 years of projection, coal will also increase its participation in the primary energy basket.

According to the results, the greatest consumption will be oil, followed by natural gas and hydro-energy. It is important to note that the increase in the oil

consumption projected for 2011 is due to the expansion of the capacity at the Cartagena refinery. The non-conventional energy sources such as biomass and wind indicate low growth rates and by the end of the study period, represent more than 10% of the total consumption, while oil participates will have close to 40%.

Table 19
COMPOSITION OF THE PRIMARY ENERGY STRUCTURE 1006-2025

SOURCE	2006	2010	2015	2020	2025
Petroleum	48.9%	44.0%	47.0%	43.8%	40.4%
Hydraulic	9.9%	11.1%	10.8%	13.3%	14.1%
Coal	10.3%	12.6%	11.6%	12.1%	13.1%
Natural Gas	17.9%	20.0%	19.7%	19.7%	21.4%
Wind	0.0%	0.0%	0.0%	0.0%	0.0%
Biomass	13.1%	12.3%	10.8%	11.2%	10.9%

It is interesting to note the decrease in oil participation throughout the projection plans, losing close to 8 percentage points during the analysis period, which are compensated with the increase in natural gas, coal and hydro-energy. In the meantime, there are projections for a decrease in the relative participation of the biomass.

Table 20

PRIMARY ENERGY GROWTH RATES 2006 to 2025

SOURCE	2006-2010	2011-2015	2016-2020	2021-2025
Petroleum	-1.30%	5.60%	-0.08%	0.37%
Hydraulic	4.32%	3.31%	5.60%	3.30%
Coal	6.82%	2.04%	2.16%	3.73%
Natural Gas	4.20%	3.50%	1.36%	3.70%
Wind	0.00%	0.00%	0.00%	0.00%
Biomass	-0.15%	1.11%	1.96%	1.60%
Total	1.33%	3.83%	1.36%	1.99%

To be able to fulfill the requirements for primary energy, we have considered four scenarios to supply crude and natural gas, based on studies completed regarding the reserve potential for hydro- carbons in the country, where geological, technical and economic aspects were taken into consideration.

The scenarios considered are called: of abundance, which is characterized by important finds of crude and gas reserves, incorporates 6.800 million barrels and 34.4 Terra cubic feet (TPC) during the period 2007-2025. The oil case scenario is different from the previous one by lowering the levels of discovery and would include 5,100 million barrels and 10.2 TPC in the same time period.

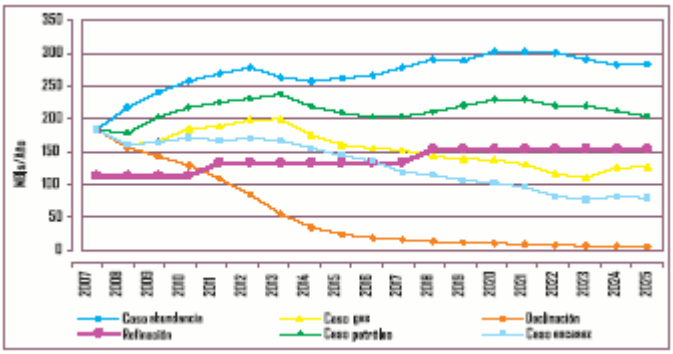
The third scenario would be gas, where there are plans to find 3,300 million barrels of oil and 22 TCP of gas. The last scenario is called scarcity, identified because it is critical to discover natural gas and oil reserves, adding only 2,300 million barrels of oil and 6 TCP of natural gas. The scenarios we considered are based on three strategies:

- Increase the recovery factor in the exploration areas.
- Develop new projects in exploration areas
- New discoveries

Each one of these scenarios has a production profile for oil and gas wherein balances will be completed. Facing the actual declining situation for production and in absence of new crude oil reserves, in the short term, towards 2010 it will become necessary to purchase crude from the associates of ECOPETROL to supply the needs for national refineries and from 2011 acquire crude from international markets to provide for internal needs.

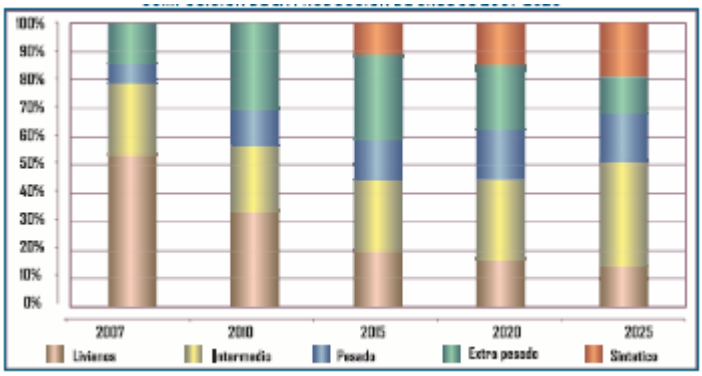
The projection scenarios in the case of abundance and in the case of oil, registered extra material for export. In the case of scarcity, there is a controlled reduction of production to 2013 and then from 2017 and 2018 the situation will become critical, because the balance of production supply is deficient in these scenarios, and it will become necessary, not only to import crude oil to charge the refineries, but it would also require increasing the national refinery capacity by close to 80,000 BPD to supply for internal demands.

Graph 21
PRODUCTION SCENARIOS FOR CRUDE OIL 2007-2025



Even with the above, the refineries will have to import crude oil from 2012 to compensate for the quality of the cargo, because the energy basket becomes heavier as the production of light crude oils declines. Graph 22 details the evolution of the basket of crude oils produced in the country, highlighting the decrease in light and medium crude oil supply, which would be substituted by heavy and extra heavy crude oils.

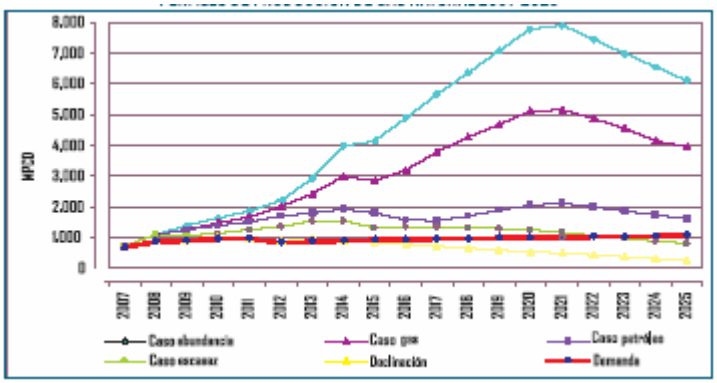
Graph 22
COMPOSITION OF THE CRUDE OIL PRODUCTION 2007-2025



Regarding the above, it is of vital importance to refit the refineries to operate with heavier crude oils, with a higher content of sulfur, that due to the pattern change in demand and the greater environmental restrictions regarding sulfur content in fuels, demand a very careful analysis of the investment strategies for the refineries.

Regarding natural gas, the new reserves are concentrated basically in the basins of La Guajira and Piedemonte Llanero and new ones are being incorporated in other areas, one of which, the Sinú basin, is of particular importance.

Graph 23
PRODUCTION PROFILES FOR NATURAL GAS 2007-2025



The increase in reserves would allow for a higher usage of gas in the scenarios considered to increase the supply during the evaluation projections. The scenarios in the case of abundance and in the case of gas, allow for self-sufficiency and the generation of extra material for export. The scarcity scenario, in the long run, is shown as critical for the basis demand scenario, because it is foreseen that from 2022 the consumption would be above the production capacity, without considering imports.

In the decreasing conditions and without new finds of natural gas, there will be difficulties in the short term, especially in 2009 when it will be necessary to go ahead with the compression programs in the fields of La Guajira and commence production in Gibraltar. Also, towards the year 2013, there would be a deficit situation that would be balanced by 2017 with the importing of gas from Venezuela. After that time, the imbalance would be of such magnitude that not even with the importing of 500 MPCD from Venezuela would we be able to supply our internal needs.

The above indicates the need for alternative strategies of positioning and the need to carefully follow the projection plan 2006-2025 and its different scenarios, several of which depend on exploration efforts, they also are derived from geological factors which today are insufficient. Hence the need to endow the ANH with an operative structure able to create and handle a greater number of programs, keeping in mind the temporary structure between the beginning of a contact and the actual putting into production of the liquid or gaseous hydrocarbons which could be found.

Regarding the other primary sources (coal, hydro-energy and biomass), although they are important to the energy basket and there are large sources of these materials in Colombia, there is a certain degree of uncertainty in the case of hydro-electricity due to its costs and the difficulties in financial closure of contracts, so that they might be developed by the private sector, and to coal due to the supply conditions for internal use and access to clean technologies. Both these aspects merit in depth studies with all possible alternatives and their costs because, although it is always possible to resort to imports, this would mean more unfavorable conditions from the macroeconomic and social point of view for the sustainable development of Colombia.

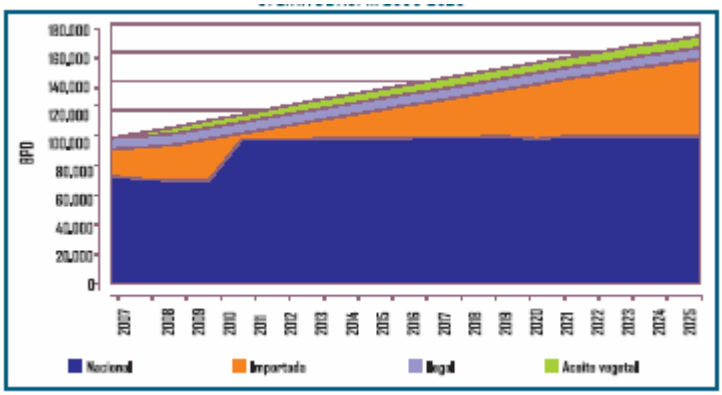
Regarding the supply of secondary energies or derived from processes of transformation such as electricity, gasoline, DIESEL and the LPG which are very important energy sources, due to their high participation in the final consumption and the availability of the resources is a priority for the internal supply.

With reference to gasoline, the production capacity is above the demand curve, producing high surplus that could be sold to international markets, generating important foreign cash flow as long as it is in accordance with the international quality requirements, especially regarding octane and the sulfur content (maximum 30 ppm)

Although LPG has registered moderate growth in demand during 2006-2025 as well as the reserves from the field of gas production, their availability could be compromised in the medium term as a result of the updating of refineries and their use as raw materials in the petrochemical processes. In this case, the total offer may not equal the demand after the year 2013.

The long range prospects for DIESEL supply is of great concern to us, given that the country confirms its dependence on external markets to satisfy internal demand. In the short term (2010) the import needs will be close to 22,000 BPD, which would decrease once the expansion at the refinery in Cartagena takes place.

Graph 24
DIESEL OFFER 2006-2025



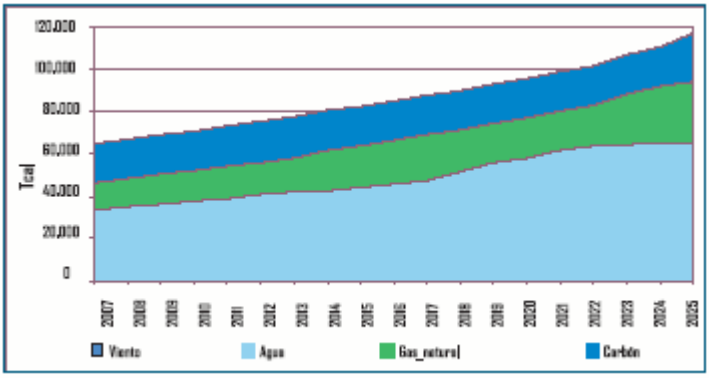
This view forces us to look for measures that curtail the accelerated growth of demand, such as modification of gasoline and DIESEL prices to find a balance of prices in energy terms. With these measures we may be able to expand and develop the natural gas for vehicles program.

For the electricity offer in the basis case, the generation of energy structure does not register any important changes during the evaluation period, with the continuing superiority of hydro-electricity over natural gas and coal.

This scenario assumes the finding of new natural gas reserves or making a decision to import gas on a massive scale via re-gasification or GNC on a high scale, with the increase of prices that follows. The low contribution of the non-conventional sources of energy to the generating basket could be modified taking regulatory measures that would ease development of the distribution of the energy, within which co-generation projects would be considered.

From the technological alternatives point of view, for modeling purposes, in this scenario we considered the possibility of incorporating: hydro-electric plants up to a maximum of 3,900 MW in the interior of the country, coal systems with a fluid bed, not only on the coast but also in the interior of the country after the year 2015 with a maximum of 2,150 MW, gas plants up to 3,000 MW distributed throughout the country, and possibly eolic systems up to 200 MW on the Atlantic coast. At the same time, within the modeling process we considered the prices of the generating technologies within the Expansion Plan 2006-2025 completed by the UPME.

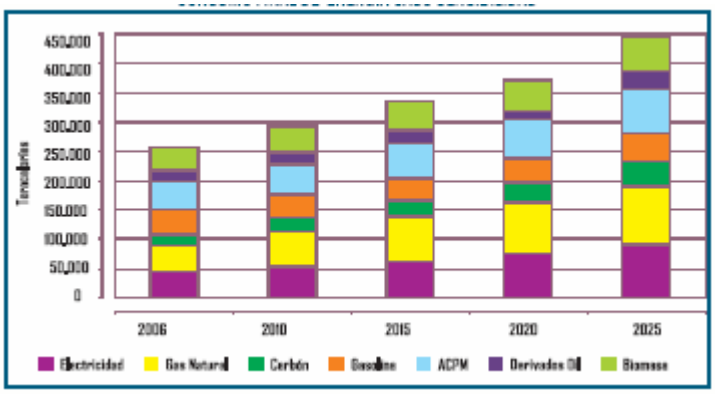
Graph 25
COMPOSITION OF THE ELECTRICITY SUPPLY 2006-2025



4. ADDITIONAL STUDIES

As a backup to the previous exercise we considered possible variations to the main estimates, to determine the eventual critical periods or behaviors that would require special measures. The parameter that modified the analysis and results was the GDP, which was used with higher growth rates as detailed in the growth goals detailed in the National Development Plan for the period 2006-2025 that are above 5% and for the rest of the period from 2011 to 2025 a growth rate of 4.5% was used.

Graph 26
FINAL ENERGY CONSUMPTION – SENSITIVITY CASE



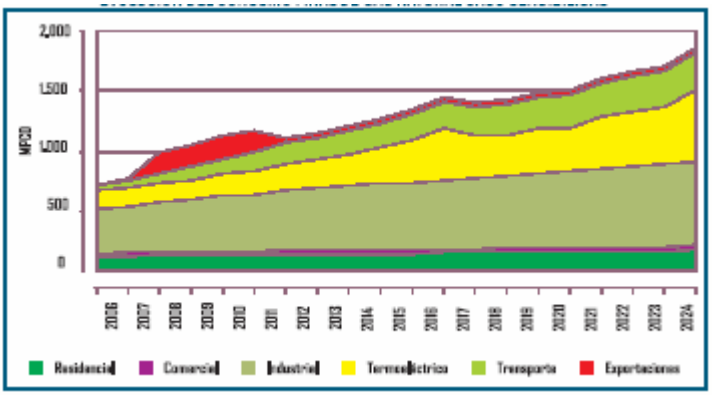
Graph 26 presents the composition of the energy basket in the sensitivity scenario. The results demonstrate an annual median growth of 2.9% in the study period, with coal showing the greatest inter-annual increase of 4.6% followed by natural gas a electricity. In absolute terms more than 44,500 teracalories are required above the basis scenario, of which natural gas will require 30,000 additional teracalories in 2025 with regards to the basis scenario.

Natural Gas

The sources analysis indicates that in the case of natural gas, the demand growth will be 42% at the end of the basis scenario. Said additional growth is attributed to the industrial sectors, thermo-electrical and transportation that indicate the largest growth rates. With reference to the relative participation, the residential and commercial sectors register an important decrease, while gas for the industrial sector will be positioned as the greatest consumer, followed by the generating of electricity (that includes a high demand of electrical energy) and the consumption as fuel for vehicular transportation. This last segment would register the highest inter-annual growth rate with a total of 11%.

Graph 27 describes the evolution of natural gas consumption that corresponds to the sensitivity scenario that in absolute terms requires 1,820 MPCD to supply the demand in 2025.

Graph 27
EVOLUTION OF FINAL SENSITIVITY SCENARIO FOR NATURAL GAS CONSUMPTION



In the case of gas for the transportation, the bio-fuels technology (natural gas-DIESEL) sector is introduced, the busses dedicated to VNG are included and it is specified that the new systems or phases of massive transportation systems beginning in 2008 are all utilizing natural gas including Bogotá. Also, we have considered that at the end of 2014, 630,000 vehicles will have been converted according to the goals set by ECOPETROL, which would modify the participation of vehicular consumption. However, the use of VNG in massive passenger transportation and long distance cargo will require overcoming the barriers that are in existence today.

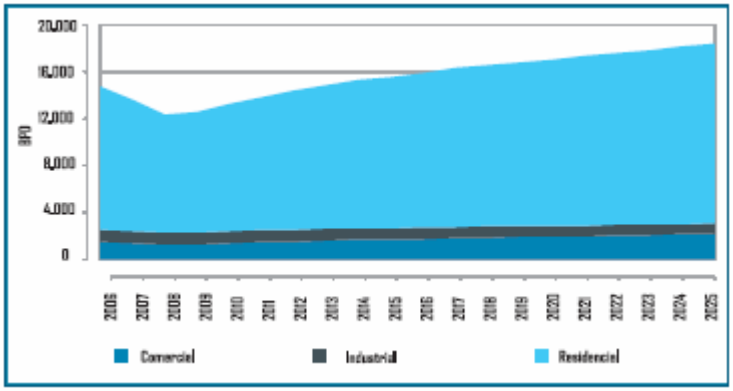
LPG

Due to the fact that the LPG projections are linked to the natural gas and wood projections, a greater participation of natural gas would mean a lower demand on LPG, hence the demand for LPG in the sensitivity scenario would decrease by 21%,

with regards to the basis case, which would be equivalent to a decrease of almost 5.000 BPD.

Graph 28 presents the evolution of the behavior of the LPG demand during the projection plan. We should highlight that the residential and commercial sectors indicate the highest retraction value, even as they increase their relative participation towards the end of the projection plan.

Graph 28
EVOLUTION OF THE FINAL LPG CONSUMPTION – SENSITIVITY SCENARIO

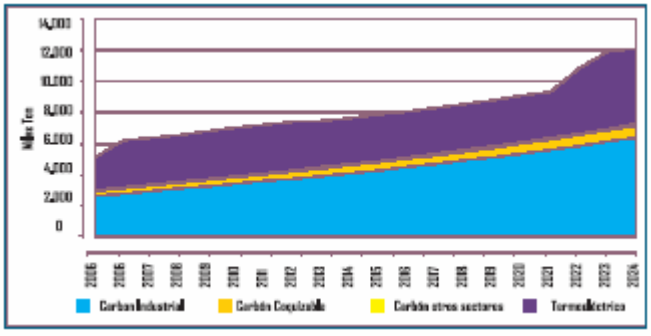


Goal

In the sensitivity scenario the consumption is increased by an additional 25% more that the basis scenario, specifically that the requirements for the generating of electricity will increase by 33.5% regarding the same basis scenario. Graph 29 presents the composition of the coal demand in the sensitivity scenario, whose annual median growth corresponds to 1.5%.

When it comes to relative participation, the industrial sector uses more than half the coal confirming their dominant weight within the consumption structure, followed by the generating of electricity sector, which would intensify their participation in the last years of the projection plan.

Graph 29
EVOLUTION OF THE FINAL COAL CONSUMPTION – SENSITIVITY SCENARIO

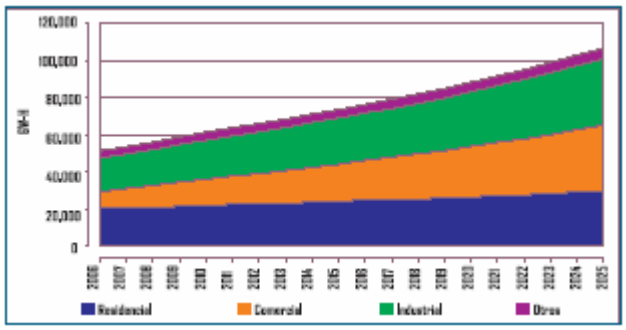


The other sectors only indicate a marginal percentage and its evolution indicates slight increase of demand toward the end of the projection plan. At he conclusion of this analysis, there will be a need for 12 million tons to supply the national demand, 6 million more than in 2007.

Electric Energy

The section of electrical demand in the sensitivity scenario is presented in Graph 30, which highlights the participation of the commercial and industrial sectors that register annual average growth on the projection plan of 7.1% and 3.7% respectively, whereas the total consumption growth is close to 3.9% inter-annually.

Graph 30
EVOLUTIONOF THE FINAL ELECRICITY CONSUMPTION – SENSITIVITY SCENARIO



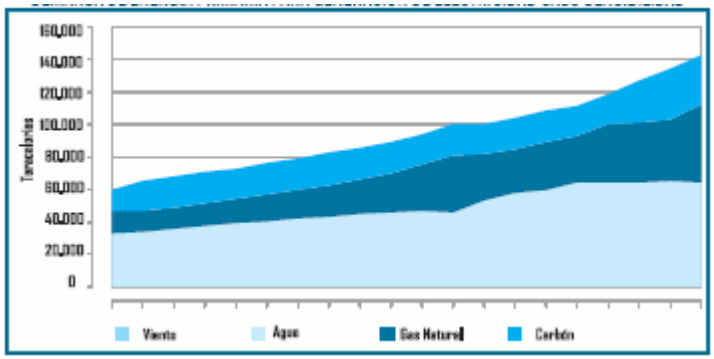
In this scenario, the commercial sector at the end of the study period, gains in participation regarding the basis scenario, the same as the industrial sector. In Graph 21, we can determine the average growth rates. In any case, with the exception of the first period, the growth of electrical consumption is less than the GDP, retaining the historical tendency between these two parameters.

Table 21
ELECTRICITY GROWTH RATE – SENSITIVITY SCENARIO

PERIOD	2006-2010	2011-2015	2016-2020	2021-2025
Total	4.68%	3.69%	3.73%	3.77%

The demand for primary resources for the generating of electricity is estimated to increase by 22% compared to the basis case, indicating the loss of participation of coal with relation to water and natural gas. In this scenario, an increase in the installed capacity of 3,980 MW was considered.

Graph 31
DEMAND FOR PRIMARY ENERGY FOR GENERATING ELECTICITY – SENSITIVITY SCENARIO



At the same time, water has decreased its participation by 2% by the end of the period, although it continues with its traditional dominant weight in the electricity generating structure and the thermal generation gains in its participation, especially with regards to natural gas as it presents an increase of 4 percentage points. Graph 22 summarizes the contribution of each one of the primary sources in the production of electric energy.

Table 22
PARTICIPATION IN PRIMARY SOURCES FOR GENERATING ELECTRICITY – SENSIBIITY SCENARIO

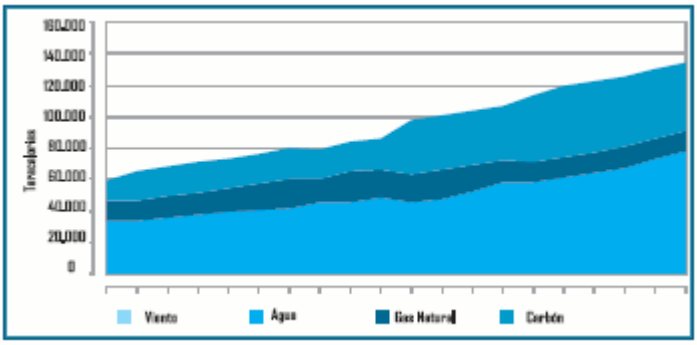
SOURCE	2006	2010	2015	2020
Wind	0.1%	0.1%	0.1%	0.1%
Water	76.1%	75.6%	72.9%	74.0%
Natural Gas	13.9%	12.4%	17.3%	17.8%
Coal	9.9%	11.9%	9.7%	8.1%

Due to the fact that the electrical sector is sensitive to the energy source prices to generate electricity, an additional sensitivity study was completed, incorporating a gradual increase to the price of natural gas from 2023 to 2016 by U$1 per MBTU for each year, maintaining the prices of the other energy sources constant, which would create a loss of participation for gas in favor of coal, while water maintains their participation, as is seen in Graph 23.

Table 23
PARTICIPATION OF PRIMARY SOURCES FOR GENERATING ELECTRICITY WITH INCREASES IN THE PRICE OF NATURAL GAS

Share	2006	2010	2015	2020	2025
Wind	0.1%	0.1%	0.1%	0.1%	0.0%
Water	76.1%	75.6%	75.9%	72.5%	76.4%
Natural Gas	13.9%	12.4%	13.9%	8.3%	6.9%
Coal	9.9%	11.9%	10.1%	19.2%	16.7%

Graph 32
DEMAND FOR PRIMARY ENERGY FOR GENERATING ELECTRICITY WITH INCREASES IN THE PRICE OF NATURAL GAS



As a result of the above, there will be an increase in coal demand in the sub-sector by 44%, which would imply arriving at a demand of close to 7 million tons a year at the end of the study period.

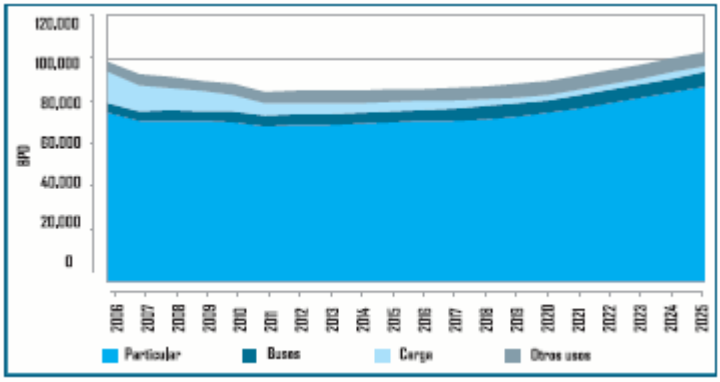
Gasoline

The demand for this energy source will increase regarding the basis scenario when the price of DIESEL and gasoline are the same. As a result, we estimate than in the different sectors, with the exception of cargo, the demand will increase compared to the basis scenario. Regarding the growth rates of the different transportation segments, Graph 24 summarizes the results.

Table 24
GROWTH RATE FOR GASOLINE – SENSITIVITY SCENARIO

SEGMENT	2006-2010	2011-2015	2016-2020	2021-2025
Private auto	-1.4%	0.0%	1.2%	2.9%
Buses	1.5%	2.0%	2.5%	2.7%
Cargo	-14.9%	-10.4%	-9.2%	12%
Other Uses	1.7%	1.7%	1.7%	1.7%

Graph 33
EVOLUTION OF THE DEMAND FOR GASOLINE – SENSITIVITY SCENARIO



Graph 33 represents the evolution of the demand behavior for gasoline during the period 2006-2025, sensitivity scenario. The projection indicates an increase of 4.5% during the whole period and the busses are the ones that show the highest inter-annual growth rate, gaining 2 percentage points in the final participation. The supply of gasoline is assured with the present refining capacity.

DIESEL

The results of this sensitivity allow us to observe how we could reduce the demand for DIESEL by making the price the same as gasoline, including bio-fuel technologies, conventional and massive passenger transportation to VNG. Within this model, we considered that for the inter-urban cargo sector we would implement mechanisms so that the variation of prices for this fuel would compensate with other measures, in such a way that its demand would not be affected.

Graph 33 presents the evolution of demand for DIESEL in the sensitivity scenario. At the end of the projection plan, we register a decrease of 11% in the demand, which is equivalent to 19,400 BPD compared to the basis scenario, reducing the need to import this energy source significantly.

In the scenario, the annual median growth rate is equivalent to 2.4% where the transportation of cargo is the segment with the highest participation in the final demand, as well as the greatest inter-annual growth (3.6%)

Table 25
REQUIERMENTS FOR DIESEL PER TRANSPORTATION SEGMENT – SENSITIVITY SCENARIO

BDC	2006	2010	2015	2020	2025
Private auto	3,203	2,752	2,099	17,42	1,6816
Buses	26,809	24,963	25,221	27,642	30,004
Cargo	48,362	58,395	69,494	81,859	96,212
Other Uses	17,753	18,991	20,661	22,478	24,455

Graph 34
EVOLUTION OF DEMAND FOR DIESEL – SENSITIVITY SCENARIO

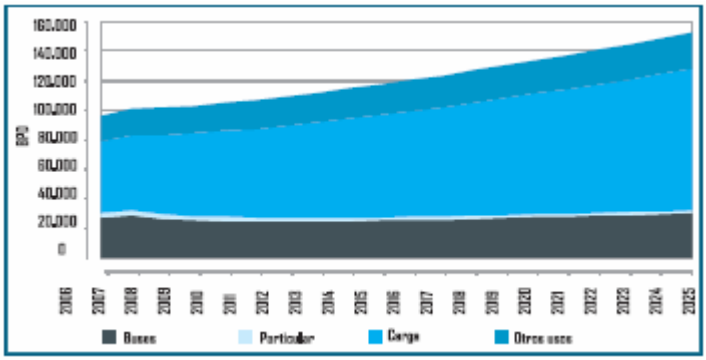


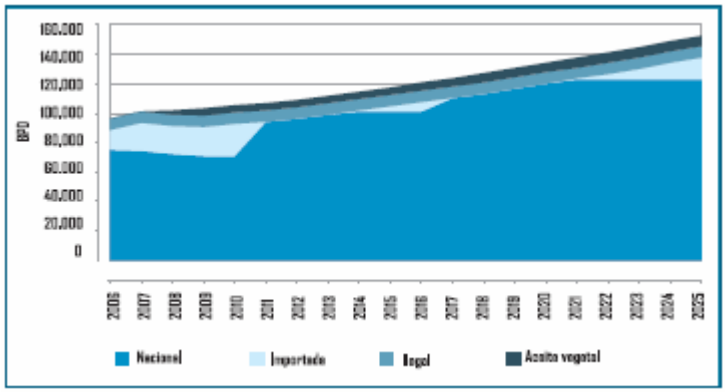
Table 26
EVOLUTION OF THE GROWTH RATE FOR DIESEL – SENSITIVITY SCENARIO

SEGMENT	2006-2010	2011-2015	2016-2020	2021-2025
Private auto	-3.5%	-5.3%	-3.7%	-0.7%
Buses	-1.6%	0.2%	1.9%	1.7%
Cargo	4.8%	3.5%	3.3%	3.3%
Other Uses	1.7%	1.7%	1.7%	1.7%
Total	2.3%	2.3%	2.6%	2.6%

Regarding supply, in the sensitivity scenario we find equilibrium between supply and demand during the period 2011 to 2013 due to the entry into operation of the new plants in the Cartagena Refinery.

To recuperate national self-sufficiency we are proposing the opening of a new refinery with a capacity of 80,000 BDP in 2017 and remain in operation until 2021, information which is presented in Graph 35.

Graph 35
COMPOSICION OF THE DIESEL OFFER – SENSITIVITY SCENARIO



When it comes to legal import volumes, although it is the goal of the Government to reduce them gradually, we have assumed a non-controllable supply, which is also included in the balance previously mentioned between supply and demand. Although it is not included in the offer, we are studying the possibility of producing DIESEL with Coal to Liquid CTL or GTL technologies based on gas, on a small scale of between 10.000 to 20.000 BPD.

PRIMARY ENERGY REQUIREMENTS – SENSITIVITY SCENARIO

When it comes to primary energy requirements, in the sensitivity scenario will require 13.6% more primary energy to supply for the needs to the country. We note a rapid growth of natural gas and coal in the projection plan, with the other primary sources remaining constant. With rates on the order of 5% average per year, natural gas grows quicker than the other sources, while the total growth rates for the primary energy sources is close to 2.7%

Oil and biomass lose relative participation at the end of the study period, while natural gas expands its contribution with close to 10 percentage points. At the same time, coal and hydro-electricity reach greater importance in the demand structure. Table 28 presents the evolution of the inter-annual growth rates.

Table 27

EVOLUTION OF PRIMARY SOURCES PARTICIPATION – SENSITIVITY SCENARIO

SOURCE	2006	2010	2015	2020	2025
Petroleum	48.5%	42.2%	44.0%	39.9%	35.5%
Hydraulic	9.8%	11.1%	10.8%	12.6%	12.4%
Coal	10.3%	12.5%	11.5%	12.0%	14.5%
Natural Gas	18.5%	22.3%	23.6%	25.3%	28.0%
Wind	0.0%	0.0%	0.0%	0.0%	0.0%
Biomass	12.9%	11.8%	10.1%	10.2%	9.6%

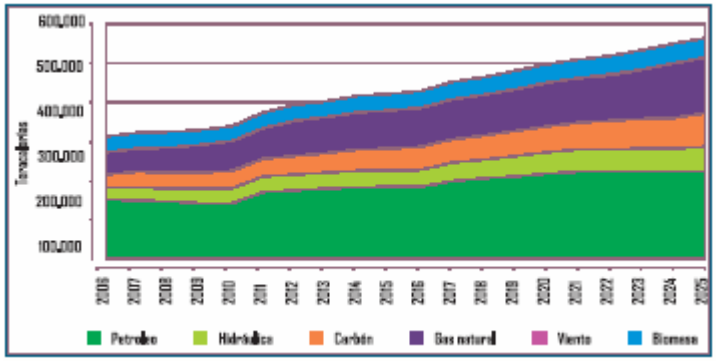
Table 28
GROWTH RATES FOR PRIMARY ENERGY – SENSITIVITY SCENARIO

SEGMENT	2006-2010	2011-2015	2016-2020	2021-2025
Petroleum	-1.30%	5.32%	3.51%	0.45%
Hydraulic	5.45%	3.65%	5.28%	2.43%
Coal	7.51%	2.51%	2.81%	6.67%
Natural Gas	7.15%	5.46%	3.40%	4.79%
Wind	0.00%	0.00%	0.00%	0.00%
Biomass	-0.18%	1.10%	2.05%	1.60%
Total	2.17%	4.30%	3.42%	2.57%

One of the implications contained not only in this scenario but also in the basis case, is the low participation of non-conventional sources of energy in the energetic matrix, and for this reason the regulation should try to include those renewable energies, within the primary sources of energy, to allow for action to be taken that would tend

to decrease the production and effects of greenhouse gases. Although the potential reach of said possible sources have their limits, all efforts should be made to increase their participation.

Graph 36
COMPOSITION OF THE PRIMARY ENERGY DEMAND – SENSITIVITY SCENARIO



5. CO_2 EMISSIONS

The problems of global climate changes originated by the consumption of fossil fuels, is becoming more and more evident in the global energy environment. However, it is recognized that it is impossible to enjoy the energy services without affecting the environment and the economic growth demands an increase of the consumption of different energy sources.

For this reason, it is necessary to combine sectional and inter-institutional policies to promote greater energy efficiency, which includes several action areas (transportation and urban development, implementation of the URE programs and maximum participation of FNCE including the clear use of coal)

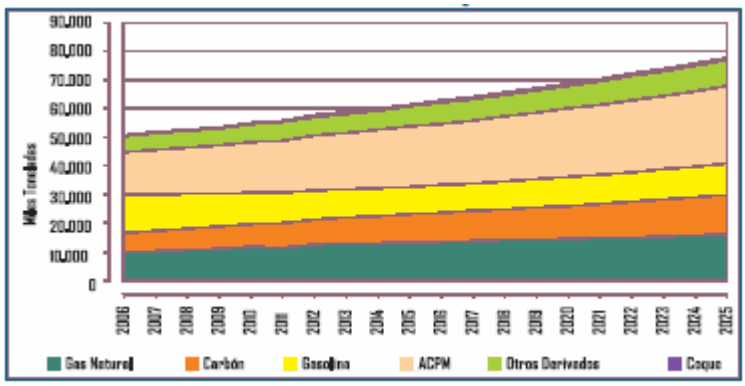
The NEP details the emissions of CO_2 using the emission factors of Colombian fuels that differ slightly from the global averages used by the Panel Internacional de Cambio Climático (International Panel for Climate Changes), as these factors depend directly on the coal contents in each available source.

Table 29 includes the emission factor for CO_2 for the different primary energy sources and Graph 37 presents the evolution of the emissions of CO_2 in the basis case.

Table 29
CO_2 EMISSION FACTORS

EMISSION FACTORS KG CEQUIV/GJ		KTon CO2
Coal	25	0.38354254
Petroleum Byproducts	20	0.30683403
Natural Gas	15	0.23012552
LPG	17	0.26080893

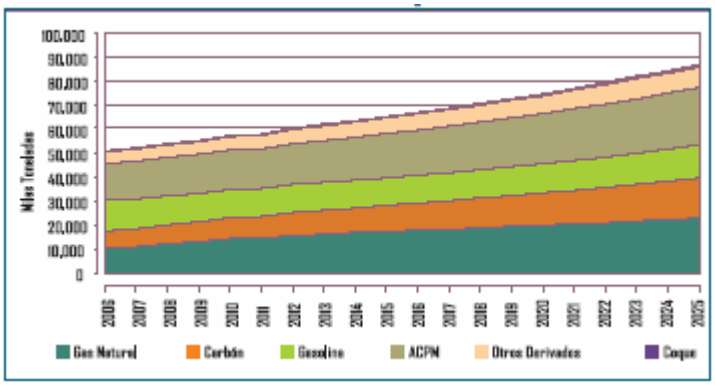
Graph 37
EVOLUTION OF THE CO_2 EMISIONS – BASIS CASE



In the basis scenario, the results present an increase of 27 million tons of CO_2 during the projection period, with an inter-annual rate of growth of 2.2%, with a significant increase in the growth rate of the emissions of DIESEL whose annual average increase reaches 3%, which in absolute terms corresponds to 11.8 million tons of CO_2.

In the sensitivity scenario, the emissions of CO_2 increase to an inter-annual rate of 2.8%, and the use of coal is the energy source with the highest amount of CO_2, which shifts from emitting 6.9 million tons at the beginning of the study period to 16.5 tons in 2025. At the same time, the emissions that come from natural gas increase by 120% which represents and increase of 12.5 million tons by the end of the projection plan and an increase of 9 million tons of CO_2 in 2025 compared to the basis scenario.

Graph 38
EVOLUTION OF THE CO2 EMISIONS – SENSITIVITY SCENARIO



6. LONG RANGE VISION OF THE NATIONAL TRANSMISSION SYSTEM

The normative planning functions that are fulfilled by the UPME regarding the expansion of the National Transmission System allow for the development of the following long range vision plan, describing the incorporation of possible projects during the analyzed period.

At the end of 2006 we incorporated 7.2 Km of 230 kV and 199.1 km of 500 kV to the system, which correspond to the Bogotá expansion project (UPME-01-2003) between the substations Primavera and Bacatá 500 kV, a total of 11,013.4 km of 220-230 kV lines and 1,648.1 km of 500 kV lines.

In 2007 these values will be increased to 11,490.6 km of 220-230 kv lines and 2,302.1 km of 500 kV lines, with the entry of the expansion project on the coast (UPME-02-2003) and the reinforcement of the interconnection with Ecuador (UPME-01-2005), both in progress at the end of 2006.

In 2010, with the connection with central Porce III coming into service, there will an additional 42 km of 500 kV network. For this same year we hope to incorporate approximately 340 km of line, which correspond to the Colombia inter-connection stretch of direct current with Panama, subject to the advancement of the agreements.

Towards 2015, we hope to begin the operation to reinforce the 500 kV line for the Bogotá area in the south of the city, incorporating a new substation at 500 kV, 240 km of network to 500 kV and 30 km to 230 kV. That same year, we would incorporate close to 100 km of network to 230 kV which corresponds to the connection between Urrá and Montería.

In the long term, that is, for the period between 2015 and 2025, including possible expansion for generating and requirements for different systems for regional transmission, the vision of the STN has considered the following macro projects for expansion:

- Closing the national ring to 500 kV, interconnecting the states of Cauca, Nariño and Tolima-Huila in the extreme southwest of the country, with the 500 kV network from the area of Bogotá and the Valle del Cauca.

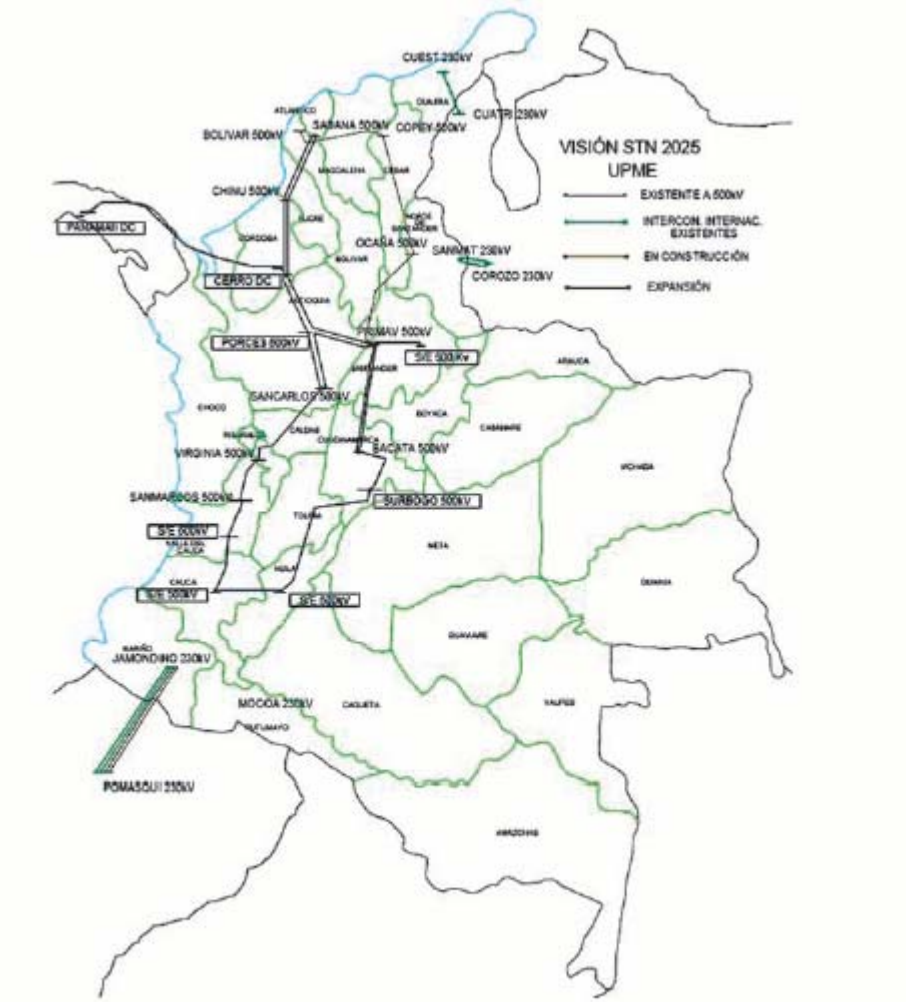
- Reinforce the 500 kV network of the Bogotá area, whether it is via expansion of its pre-existing corridors to 500 kV or by constructing a 500 kV ring around the capital city extending the 500 kV network towards the southwestern part of the city.

- Extend the 500 kV network in the northeast area

- Consolidation of the Colombian network to reinforce the technical conditions of the existing international inter-connections.

This is a long term vision presented in the graph on the following page:

Graph 39
VISION OF THE TRANSMISSION SYSTEM AS OF 2025



Chapter IV

Colombian Vision Plan 2019 and National Development Plan 2006 - 2010

CHAPTER IV: COLOMBIAN VISION PLAN AND THE NATIONAL DEVELOPMENT PLAN 2006 – 2010

1. GENERAL CONSIDERATION TO THE COLOMBIAN VISION PLAN 2019

The Colombian Vision Plan is an ambitious proposal covering several subjects such as peace, social justice, infrastructure, quality of life and consolidation of the democratic liberties in our nation, among others. The Plan is essentially a visualization of the country and the type of society that all Colombians hope to have towards the year 2019.

Our goal is to present a reference of continuity to the development plans for these four years, motivating future administrations to develop their plans within the general framework that would envision the country long term. However, due to the structure of the Plan, in some cases the goals that are proposed are of an indicative character and the figures will surely have to be revised when the real figures are detailed in the forecasts. For this reason, the Colombian Vision Plan should be used as a guide and a path to follow as we continue searching for a collective purpose to build this vision.

14. The information that is presented in this section is based on the documents ¨ Plan Vision Colombia – II Centenario¨ (Colombian Vision Plan 2019 - II Hundred Years ¨) and the Plan Nacional de Desarrollo 2006-2010 (National Development Plan 2006-2010), created by the National Planning Department.

The Vision Plan is based on two essential principles which are:

- consolidation of a deeply democratic political model, based on the principles of liberty, tolerance and brotherhood
- Consolidation of a socio-economic model for all Colombians, whose main denominator would be equality with a State that guarantees social equity.

To put these principles into effect, Plan 2019 establishes the need to develop four main objectives:

- An economy that guarantees a higher level of well-being
- A society that is more equal and united in solidarity
- A society of citizens that are free and responsible
- A State at the service of its citizens

The first and last of these main objectives are relevant for the structuring of the NEP 2006-2025. The first refers to the need to ensure an economic process with continuous and sustained growth long term, so that the highest levels of well-being are generated for all citizens. It is noted that towards 2010, the economy should be growing by 5% a year, and after 2014 it will grow by 6%. At that time, the GDP will double; the income per capita will increase to values on the order of US$ 3.800 in 2019 compared to US$ 2,288 average per year during the period 1990-2002.

We could say that the subject of economic growth is the main theme of the strategies for Plan 2019. To reach the above, it is essential to maintain a growing participation in private investment, sustainable long-range debt levels and macro-economic variables must under control, especially on subjects such as inflation and exchange rates.

This being the case, the private sector would be the protagonist in the execution of investment projects, by increasing their participation from 10.1% in 2005 to 18.3% in 2019. We also hope that public investments will double their investments in real terms reaching a level of 6.7% of the GDP during the whole period. Something similar is expected to happen with public savings with an increases from 4.3% to 6.1% which would favorably impact the fiscal balance.

The Plan also highlights the concept that the market economy and democracy are two important considerations but not the only ones to reach the social results, for which we foresee that the State will be the guarantor for the transformations that will have to take place to reach social equity. And this is precisely the subject of the fourth objective, which has to do with the role that the State wishes to fulfill in the Vision of the country long term, which in turn will have repercussions on the national institutional framework. What is this role that the State will have in the creation of a ¨new society?¨ In response to that questions, we would like to note that for the year 2019 the State will have consolidated an optimum intervention model for the economy, where the State functions as planner, regulator, controller and promoter and will have recreated its role as impresario.

However, we do not discount the possibility that the State will act in a direct manner in certain infrastructure projects, through asset contributions or with minor capital participations, leaving the larger portion in the hands of private agents. Regarding science and technology, there may be the possibility of more direct State initiatives.

The State also intends to give the citizens all the information they need to make their decisions in real time and that information will be trustworthy, appropriate and for everyone's use. This is what is called advancement towards consolidation of an informed society. As this document will show, the limitations of information that faces the sector agents, creates the need for institutionalized models for dissemination so that the agents may make the best decisions in their different fields of endeavor.

Within the framework of general considerations for Plan 2019, we highlight the commitment that is being completed regarding two subjects that are beginning to take on transverse characteristics:

Regarding Sciences and Technology, we hope that by the year 2019 the investment should be equivalent to 1.5% of the GDP, half of which would come from the private sector. The document recognizes that the lack of adequate development regarding the scientific and technology fronts is due to the inexistence of financing sources and scarcely any support from the private sector. However, determining that one of the foundations of sustained economic growth in the next few years should be based on scientific and technological development requires the need to create a new institutional framework endowed with the necessary resources to consolidate a national information and indicator system in science, technology and innovation.

The second topic refers to the sustainable development and its impact on the subject of public health. Plan 2019 highlights that for that year, all the economic and social growth should be compatible with the sustainable utilization of the environment. For this reason, the Plan indicates that it should ¨…emphasize the inclusion of the environmental criteria in the sector and territory planning processes¨. The above indicates that the Energy Plans such as the NEP 2006-2025, should study the environmental variable with great care, not only in reference to what it has to do regarding the care of natural resources but also with regards to the impact on the health of all Colombians. Regarding this last point, the Plan highlights, that in all Colombian cities and industrial zones, all standards for air quality must be fulfilled particularly in reference to maximum concentration of particles. It is also important to mention that today said standards are not being followed in any Colombian city, and Bogotá is a case in point.

Energy Sector

Regarding the energy sector, Plan 2019 indicates that the strategy will be closely linked to the need to generate an adequate infrastructure for development to position the country as a great ¨Regional Energy Cluster ¨that would guarantee the long range supply, with clear rules of the game the construction of the price signals.

According to Plan 2019, the positioning of Colombia as a ¨Energy Cluster¨ is based on the following principles and objectives long term, with the appropriate general statements:

- Regional integration
- Price Convergence
- Regulation
- Infrastructure Development

The four objectives or basic development principles of the Energy Sector have excellent backup plans that have also been made a part of the National Energy Plans previously developed by the UPME. First, the Regional Integration is presented based on reaching synergies that would result from the integral usage of regional energy sources, efficient prices and adequate trustworthiness and quality indexes. The purpose is to present an energy offer with good market prices and guaranteed quality to third parties and potential investors.

With reference to the convergence of prices, Plan 2019 again states the need to ensure that the creation of prices will be completed through market mechanisms, without distortions due to subsidies or imposing specific taxes and environmental systems. However, we should keep in mind that the component of environmental cost will have to be made a part of the process to create the prices in accordance with an important sustainable environmental development. Regarding bio-fuels, Plan 2019 indicates the need to define price policy ¨without transference of profit between productive sectors, preventing dominant positions and the substitutions of imports or refined products at prices that are not in conformance with efficiency criteria¨.

Regarding the subject of regulations, we will concentrate on the organization of the regulatory framework and on the definition of the price policies that would guarantee the supply of energy sources long term. Also, to complement the institutional part, we are establishing the following objectives:

- Identify the economic signals for expansion of the offer from the electrical sector and the distribution and commercialization activities.
- Establish incentives that would lead to investment in the interconnected urban and rural areas
- Have the support of private capital in the ECOPETROL investment projects
- Continue with the breakdown of subsidies for liquid fuels.
- Adjust the quality specifications, in such a way that they will always keep the environmental demands in mind and would reflect on the reality of the international markets. For this reason, import equality reference prices will be established, until we reach the creation of prices by market mechanisms.

Finally, regarding the development of the infrastructure, Plan 2019 indicates the need to structure projects that would insert Colombia into the global primary goods market such as coal and natural gas.

The main quantitative goals that are presented for the energy sector are as follows:

- Continue with the ventures with private capital for the exploration projects wherein we have determined the need to increase our knowledge of the national subsoil as a mechanisms to improve the quality of the oil prospects
- Continue with the ventures with private capital in the ECOPETROL investment project
- Consolidate the freedom of exports as a key policy in the natural gas sector
- Increase from 90% to 99.4% the electric energy coverage in the interconnected areas

- Increase the capacity from 13,398 to 16,017 MW to generate energy throughout the country

- Increase the number of oil reserve barrels to 3,500 million and natural gas reserves by 17 TPC.

- Increase coal exports from 50 to 100 (15) million tons towards the year 2019.

2. THE NEP 2003-2020 OBJECTIVES WITHIN THE FRAMEWORK OF PLAN 2019

The creation of the ¨Energy Policy Basis for the NEP 2006-2025 ¨should take into account the advances in the previous energy plans that were developed by the UPME and which have determined the basis for the formulation of these policies.

For this reason, we would like to make a brief summary of the specific NEP 2003-2025 objectives, to demonstrate that they are compatible with the energy situation in the country, the international environment of the energy sub-sectors and, especially, with the Colombian Vision Plan 2019, which has been taken as a reference point to structure the NEP 2006-2025. It is our wish that the new NEP, taking all that is relevant in the previous study into accunt, may present a solution for continuity in the National Sectional Plans.

(15) In accordance with the Plan Nacional de Desarrollo Minero (National Mining Development Plan) they project exports for 120 Mt in 2016

Guarantee the contribution towards commercial balance and national income

We can confirm that this was the main objective and possibly the most detailed in the NEP 2003-2020 due to the variety of subjects that it presented, including the following:

- Increase the production of crude oil

- Develop the value generation chain for the oil industry proper

- Decrease the dependence on gasoline and diesel in supply of fuel for the vehicle market

- Promote exports of natural gas, electricity and thermal coal

In the NEP 2003-2020 study, the number one objective was focused on generating income for the nation by increasing the exports of energy sources. This plan revives the old debate regarding economic growth strategies in an open market for which, you export raw materials or you maximize generating value through exports of value added products.

For this reason, with regards to the objectives of the previous NEP, such as maximizing exports of natural gas, oil, electricity and coal which are reachable, as a sustained growth element. However, it is preferable to maximize the value added because it generated industrial activity that stays the same even if non-renewable resources are depleted.

To reach the sustained economic growth goals such as those presented in Plan 2019, the export activity in the energy sector should not be limited to foreign sales of raw materials.

Consolidate the competitive plan in different markets

This objective was very important when the NEP 2003-2020 plan was created, due to the mixture of roles in key cases of the national energy policies, such as the one for ECOPETROL, where it was necessary to separate the business activities from those defined by the policies. This situation was clearly resolved with the creation of the ANH.

However, due to the strategies of Plan 2019, especially regarding the new policy on the economic intervention of the State, it is important to maintain the essential aspects of this objective because there are still certain aspects of State participation in businesses of the sector and in different markets that have yet to be resolved.

Complete an in-depth study of the Gas Expansion Plan

This objective is compatible with several basic concepts of Plan 2019. First, the structuring of the ¨Regional Energy Cluster¨ requires the need to complete an in-depth study of the Gas Expansion Plan in the different elements of its value chain. With regards to supply, which should increase to fulfill the challenges of the market mid and long term, Plan 2019 established that one of its goals was to ¨add new natural gas reserves and expand them¨.

Given the importance of natural gas in the national energy basket, the Gas Expansion Plan, its natural gas component as well as LPG, will have specific treatments within the NEP 2006-2025 objectives, considering that the expansion of gas reserves carries with it the establishment of unique development policies of demand in all its segments, including residential, electric energy, industry and exports.

Expand and guarantee the internal energy supply with appropriate prices and adequate quality

The definition of appropriate energy prices referred to under this heading in the NEP 2003-2020, has been a part of all National Energy Plans and sectional studies. Taking into account that the advances in this subject have not been completely satisfactory, especially the liquid fuels derived from oil, Plan 2019 incorporates this subject under the title of ¨price convergence¨ where the need to ensure the building price process will be completed through market mechanisms.

The structuring of the energy supply scenario, considers the definition of efficient prices and for this reason it is considered relevant to include as an objective for the NEP 2006-2025.

Improve regional and/or local development

The previous objectives, within the NEP 2003-2025 framework, are focused on subjects such as:

- Using specific sources such as co-generation
- Encouraging savings and energy efficiency programs
- Strengthening the use of resources for specific investment in the URE
- Expanding the energy networks towards areas that are not connected
- Using resources from FAZNI to support the development of programs, construction and installation projects for the new electrical infrastructure and for repositioning or rehabilitating the actual equipment

Preferential treatment for regional and local areas is one of the most important goals in the mining-energy sector for Plan 2019.

- Increase participation of the alternative energy sources in non-interconnected areas
- Increase the coverage of electrical energy service

The programs regarding non-conventional energy sources and rational use of energy under this heading in the NEP 2003-2025, will have specific treatment within the new NEP 2006-2025.

3. National Development Plan Project 2006-2010

The Development Plan 2006-2010, states that the energy consolidation policies in the long term are a very important requirement to ensure the ¨supply¨ of energy sources, and to keep the national production machinery going under efficient conditions and international competitiveness.

The National Development Plan 2006-2010 defines their basic principles as:

- Strengthening the energy security in the country
- Promote the efficient use of the energy basket
- Consolidate regional integration

Regarding energy security, the concept is developed in two ways: on the one hand the operative trust of the system short term, which can be reached once the available infrastructure allows for balancing the energy supply with the demand in real time; the other refers to the availability of having the appropriate energy supply in the median and long term, which is possible through the definition of economic signs that would stimulate investment in the expansion capacity in the sub-sectors of production, transportation and distribution.

The second criteria is the efficient use of the energy basket which refers to the structuring of signs that would encourage the substitution of less efficient energy sources for those that are efficient, based on prices generated by the specific markets.

The third aspect of the energy supply policy considers the consolidation of regional integration, to ensure the efficient usage of the energy sources available in the region, where it is necessary to harmonize the regulatory standards with the promotion of inter-connections with neighboring countries under competitive scenarios.

Energy Supply: Hydrocarbons and Coal

There are three great purposes, were we define some of their strategies:

- Continue to promote the exploration and exploitation of hydrocarbons and coal

The National Government will continue with the institutional consolidation of the sector, where they will work on the separation of responsibilities between the Ministerio de Minas y Energía (Mines and Energy Ministry) and the ANH as per Decree dated 1760 of 2003. The ANH will maintain their functions related to the integral administration of the hydrocarbon reserves which belong to the nation and the control and management of the oil operations of the country. The Mines and Energy Ministry will assume the functions relating to regulations and creating of policies for the sector, which initially was assigned to the ANH by Decree 1760 of 2003.

Plan 2006-2010 is explicit, among other things, in the paragraph that refers to the responsibilities for the supply of hydrocarbons to the country: it reads: ¨Develop the appropriate steps in the search to adequately supply for national demand of hydrocarbons and products, without prejudices to the responsibilities assigned to the Mines and Energy Ministry in this matter¨.

Also, the Development Plan document specifies that the central core of the oil policy is the capitalization of 20% of ECOPETROL.

Regarding the international business interchanges for natural gas, there will be a continuation of the implementation of the freedom policies of same, as part of the promotion policy for exploration and production of hydrocarbons.

Also, the Energy and Mines Ministry will define mechanisms that will allow the public access to information regarding the natural gas tested reserves that will assure the supply, respecting the economic balance of the existing contracts, and with contracting mechanisms that will be developed by the ANH.

- Promote the creation of energy prices through adoption of market prices.

We are hoping to encourage competition and investment in the refinery industry and importing of fuel, through actions such as:

  - Advance in the progressive downsizing program regarding subsidies for liquid fuels. For this process, we will use the market prices for oil derivatives on the Gulf Coast of the United States as a reference with the quality adjustments that are required and specific downsizing paths that will be defined.

  - Adjust the tax structure for liquid fuels, to eliminate the distortions that are seen at present, especially with regards to the use of diesel fuel. All the above without generating negative impacts in the income of the nation, department or municipalities.

  - Encourage the conversion of 160,000 vehicles to natural gas by the end of the study period (2010)

  - Promote competition between the different bio-fuels with financial, environmental and energy supply sustainability criteria and evaluate the convenience and viability of freeing up the prices of the bio-fuels within a shorter timeframe than the one established for downsizing of subsidies with the other fuels.

  - Adopt the necessary measures to reach the substitution goals of 10% ethanol in gasoline and 5% in bio-diesel. Also, we will complete evaluations to determine the possibility of increasing said percentages.

- Promote the consolidation of regulations in the hydrocarbons sector.

  - **Trust in Gas Supply and Transportation**: Design and implement a regulatory standard to pay for the investment in the supply and transportation infrastructure, to ensure the continuity of service during contingency periods.

  - **Distribution of Liquid Fuels**: Continue to advance in the issuance of regulations for access to the pipeline system in the country and the technical regulations of the distribution chain; continuity will be given to all those efforts geared towards the reduction of thievery and fuel smuggling and the special rules for liquid fuels in the border areas will be reviewed.

- **Propane gas or LPG**: We are hoping to establish a regulatory system that will allow for promotion of alternatives to this energy source, taking into account that the priority will be oriented to the complete satisfaction of the residential demand. As part of this standard regulatory framework, we will establish a plan of responsibilities for quality and security of fuel distribution.

Energy Supply: Electric Energy

In this case, Plan 2006-2019 proposes the development of international interchanges to strengthen the electrical energy market and to ensure their efficiency and competitive prices.

To reach these objectives the following procedures are mentioned:

- Develop a transportation infrastructure that will allow for the electrical inter-connection of Colombia, the Andean and Central American countries.
- Coordination of the regulatory frameworks in the region, especially with Panama
- Consolidate the regulatory framework of the Trust Charge and finally complete the energy auctions
- Optimize the operative coordination of gas – electricity
- Create incentives for the development of co-generation and auto-generation projects

Access to Electric Energy and Gas Services

To allow access of the population to public services, the National Development Plan mentions that the National Government will develop programs to:

- Consolidate the regulatory framework for activities of distribution and commercialization
- Consolidate policy standards for rendering of electrical services in sub-normal areas.
- Strengthen the electrical energy distribution companies with increased Government share participation
- Develop an Indicative Plan for Expansion of Coverage
- Establish plans for managing the non-interconnected zones – ZNI
- Promote generating projects that use ¨alternative energy sources¨
- Develop a program to expand the use of LPG

The tables presented below contain the most important goals for the energy sector for the next four years (2006-2010).

Table 1
Goals of the National Development Plan 2006 to 2010

Goals for the period 2007 - 2010	Baseline	Four-year goal
New oil exploration and exploitation contracts	150	120
New exploration wells drilled (Wilcats)	125	160
New-seismic kilometers equivalent to 2-D seismic	31.947	32.000
Daily average barrel loss because of fuel theft (1)	6.293	6.600
Number of departments where gasoline contains 10% alcohol (Acum)	13	26
Number of departments where Diesel contains 5% Biodiesel (Acum)	0	26
Percentage of gasoline subsidy removals (Acum)	74%	100%
Percentage of Diesel subsidy removals (Acum)	62.9%	100%
New vehicles converted to Vehicle Natural Gas	123.342	160.000
Electric energy coverage in the National Interconnected System (2)	93.60%	95.10%
Electric companies with private capital	3	8
New international electric interconnections	1	1
Area with management schemes per implemented results	0	3
New users with electric energy service in non-interconnected areas	15.000	40.000
Average time for electric energy services in non-interconnected areas	30%	10%
New-hydroelectric projects of a small operating scale	2	7
Installed generation capacity with fossil fuels substituted with alternative energy (except hydroelectric) (megawatts)	0.35	6.9
(1) the four year goal is equivalent to a reduction of 400 barrels average daily, compared to the progress in August 2006 and 6,600 average daily stolen in the year 2002 (7,200 barrels a day) (2) For the year 2005 figures from Dane.		

Chapter V

Objectives & Strategies for the National Energy Plan 2006 - 2025

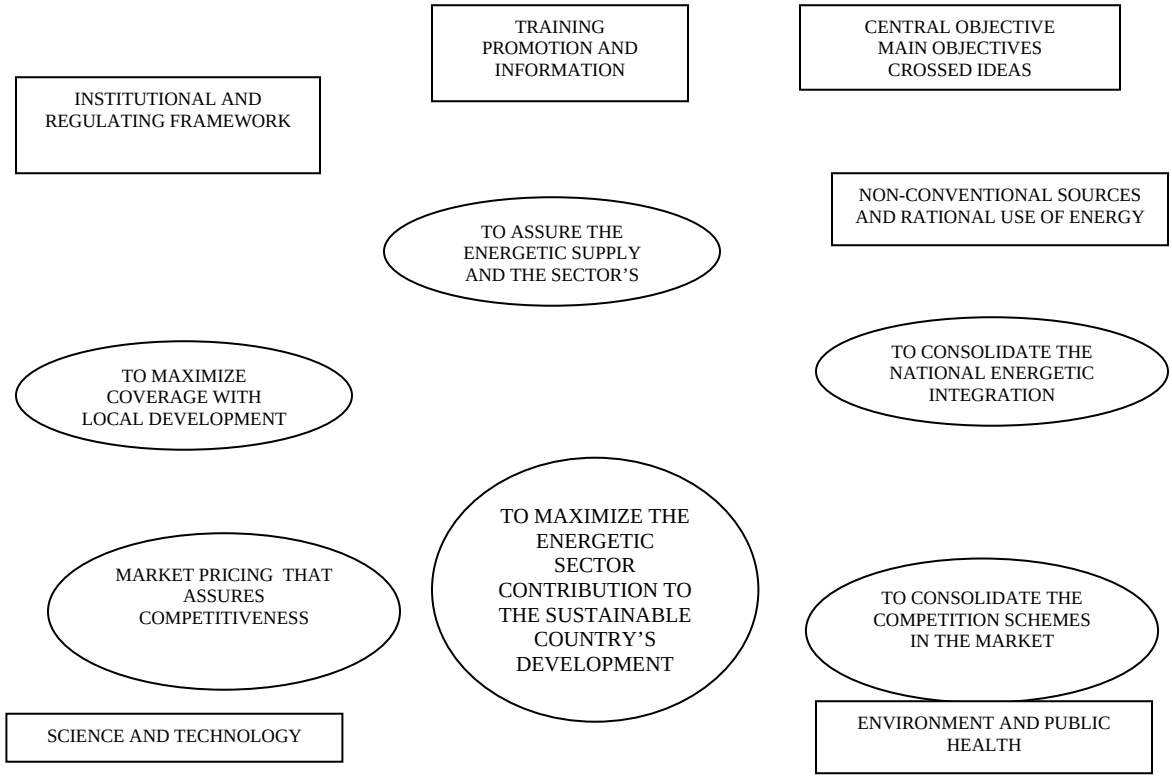
CHAPTER V: NATIONAL ENERGETIC PLAN 2006 - 2025 OBJECTIVES AND STRATEGIES

Considering the environment and the previous definitions, the NEP 2006-2025, objectives formulation presented in this chapter, has the structure defined from the following elements:

- Central Objective
- Main objectives or focal points
- Crossed ideas

Chapter V:
National Energetic Plan Objectives and Strategies

Graph 1
National Energetic Plan 2006-2025 Structure



Central Objective: addresses the mission statement and the PEN 2006-2025 conceptual framework.

Main objectives or focal points. In each of these objectives a conceptual analysis is carried out, and the importance of its consideration in the PEN general structure is highlighted. In addition, for each case, the most relevant strategies for their fulfillment are addressed.

Crossed Ideas: They are essential in the new PEN model, and contain conceptual developments common to one or several objectives. For each

one, an analysis of the role played in the model structure and the most important action lines in each case are carried out.

PEN 2006 – 2025 OBJECTIVES AND STRATEGIES FORMULATION

1. Main Objective: TO MAXIMIZE THE ENERGETIC SECTOR CONTRIBUTION FOR THE SUSTAINABLE COUNTRY'S DEVELOPMENT

The sustainable development leads to the economic growth, the enhancement of quality of life and the public welfare, without depleting the renewable natural resources foundation in which it is sustained, and without harming the environment or the future generations' right to use them, to satisfy their own needs.

An economy that guarantees a greater level of welfare for today's and tomorrow's Colombian population is a national priority and therefore, is the focal point in the Plan Vision Colombia 2019 framework, and of the National Plan of Development 2006-2010.

Only through an economy in expansion will be possible to solve the persistent Colombian society problems, which are translated into high levels of poverty and an increasing number of persons without satisfying their basic needs. As long as the economy grows, with the contribution of a solid energetic sector in expansion, the State will have the means to create a fair, equalitarian and solidary society.

The PEN 2006-2025 central objective statement, proposes:

- To strengthen the energetic sector contribution for environmentally sustainable economic growth and development, without limiting to the maximization of production and energetic resources exports.

- To change the paradigm of self-sufficiency for full supply, or the energy availability the country requires for its development. To achieve this goal, it is necessary to carry out integration processes with neighboring countries.

- The energetic resources full supply or availability is consistent with the convenience of finding such resources in the Colombian subsoil, because, with self-supply, the energetic sector contribution to the national economy is greater.

- To develop mechanisms to foster the export of oil and coal derivatives with aggregated value, complementary to the traditional raw materials or primary energetic resources exports.

Around the central objective, the main objectives are developed, accompanied by crossed ideas that make the energetic policy outline, presented in this document, coherent.

2. Main Objective: TO ASSURE THE AVAILABILITY AND FULL SUPPLY OF ENERGETIC RESOURCES, TO SERVE THE DOMESTIC DEMAND AND TO GUARANTEE THE SUSTAINABILITY OF THE ENERGETIC SECTOR IN THE LONG TERM

This objective is focused in two essential concepts: long term availability and sustainability.

From the Availability point of view, the Country requires to count with the energetic resources whether from domestic production or imports, and with the adequate infrastructure, to meet the needs of the different socio-economic consumption sectors.

Notwithstanding, the Colombian society will have a greater level of welfare, when the resources are found in the national territory, depending obviously, on the required investment.

Another advantage of having the energetic resources from local origin is the greater reliability in the supply. Even though, the limitation of energetic local resources is not a statement that obstructs the national economic growth and development, inasmuch as the resource in itself, might be imported to serve the needs of the national demand.

For the above considerations, it is necessary to adopt policies that allow developing a full and efficient availability strategy of energetic resources, considering the possibility of appealing to international markets.

The sustainability concept makes reference to two components: environmental and institutional and regulatory considerations. The first ones are aimed to the production and the use of energy, friendly with the environment and that make possible for the future generations, to satisfy their own needs.

The PEN recognizes the importance of the environmental dimension, considering it as a crossed theme that impacts the main objectives. The second component, considers the institutional and regulatory aspects that allows the solidity and permanence of the sub-sector structures that guarantee the rendering of services in the long term.

Following, these two concepts for each of the sub-sectors are developed:

2.1 Oil and Natural Gas

2.1.1 The activities of exploration and production

The oil and natural gas availability analyses, offer important conceptual differences, originated in their transability. On one side, the eventual deficit present in the oil and derivates supply can be overcame, through import spot operations, being a market with great liquidity, transparency and with complete information, for agents' decision making.

The situation is not the same for the natural gas, even though, its international transability is gradually improving with Liquefied Natural Gas (LNG), with the formation of a spot transactions market, though incipient, and through gas pipelines that imply supply options conditioned to distance limitations, transportation capacity and market size.

In regard to the oil and natural gas national availability, in the medium and long term, there is a great uncertainty, which is reflected in the scenarios and results of the Energetic Supply Study, carried out jointly by ANH and UPME, referred to in the Prospective chapter. The developed scenarios show the following results:

Table 1 Crude oil reserves by scenario (MMLB)

Reservas de Crudo por Escenario (MMBL)	ABUNDANCIA	SESGO PETRÓLEO	SESGO GAS	ESCASEZ
Nuevos Descubrimientos	5,000	3,300	2,000	1,000
Nuevos Desarrollos	210	210	133	133
Recuperación Mejorada	1,607	1,607	1,244	1,244
Total Nuevas Reservas	6,817	5,117	3,377	2,377

Table 2 Gas reserves by scenario (CFT)

Reservas de Gas por Escenario (TPC)	ABUNDANCIA	SESGO PETRÓLEO	SESGO GAS	ESCASEZ
Nuevos Descubrimientos	11.0	2.5	6.5	0.8
Proyectos exploratorios Específicos	14.0	4.0	9.0	2.0
Nuevos Desarrollos	9.4	3.7	6.8	3.2
Total Nuevas Reservas	34.4	10.2	22.3	6.0

Source ANH-UPME Supply Study

The results indicate that the exploratory efforts to carry out in the medium and long term should be significant, in order to obtain results in terms of new oil and natural reserves, which allow, in the first place, to maintain the self-sufficiency and secondly, to consolidate the country as exporter.

Notwithstanding, the experiences around the fast monetization policies, without assuring the long term supply, advise also, for moderation in that regard, since the topic should be viewed from the foreseen potential impacts upon the Nation in the short, medium and long term.

The depletion of light crude and the heavy crude production perspective indicate that towards 2025, the percentage of heavy and extra-heavy crude might have an important contribution in the national supply, in proportions close to 37% to 39%. This circumstance will have significant implications in the supply scheme and it will be necessary the design of a production, transportation, refining, and trade Strategic Plan, of these types of oils, in order to obtain the best results for the Country in economic and environmental terms.

For these oils to be recuperated and refined, the industry should performed enhancement and conditioning operations, before refining and upgrading processes, to obtain the maximum levels of conversion and production cost reduction of each barrel, as well as obtaining better quality fuels, according to the new requirements in the fuels quality specifications. Otherwise, in the medium term, it will be necessary to adjust the Colombian refining system, for the loading of heavy diets, with greater contains of sulphur and heavy metals, as well as the complexity of processes in the light of changes in the demand patrons and environmental restrictions.

The oil sector development has being sustained in recent decades, by the active participation of the private sector. Notwithstanding, the oil and gas supply is the State's responsibility, for which the Government should use the schemes and mechanisms of indicative planning, that allow developing integral market analyses, and addressing the actions to be taken, so the Colombian society counts on the necessary energy to fully satisfy its needs.

In the case of oil and its derivatives, the supply criteria imply other considerations, being a resource subject to free commercial interchange, but with low accessibility to international markets and subject to public utilities regime. The priority in the supply is for the household users, business and industrial, below 100,000 DCF or regulated users. In the event of domestic consumption restrictions, the National Government indicates the priorities and limitations according to the type of contract subscribed between the agents. In that sense, the 2006-2010 National development Plan, contemplates and responsibilities of Hydrocarbons National Agency (ANH), the development of contractual mechanisms to assure that with the natural gas proven reserves

the domestic demand is primarily served, following the guidelines defined by the Ministry of Mines and Energy.

In the face of unfavorable exploration results in gas matters, the full and reliable supply to all users will depend on the Venezuela's interconnection in the medium term and the entry into operation of other supply sources, as it is the case of Gibraltar field and the Cusiana production expansion.

Independently of new gas discoveries, new alternate supply sources are required, to assure to the Colombian society the full and accessible availability in the medium and long term. This will imply the exploration of import options, different from the interconnection via gas pipe, analyzing the feasibility of new technologies such as the compressed natural gas in great scale – CNG or LNG.

The stability of the game rules for the hydrocarbons exploration and production facilitates the permanence of business, and the probability of new discoveries will be greater. To ensure the operations success, is one of the purposes of this Plan, which will be only guaranteed in the integral coordination framework between the energetic authorities and other entities that participate with the investors in topics such as security and environment among others.

The hydrocarbons exploration and production sustainability is linked to the results of the new concession model, whose fundamental indicator is the discovery rate of new reserves. If, in the future, the model does not show the expected results, the contractual exploration and exploitation scheme might not be sustainable and will require changes to the model.

The proposed **strategies and actions** for the development of oil and natural gas exploration and production activities are:

- To maintain attractive conditions to assure hydrocarbons exploration and production investments, that allows the discovery of new reserves. For this strategy, the following actions will be developed:

    - Enhancement of geologic prospective in the frontier area, through ANH investment increasing in low exploration areas, warming of areas and technical assessment contracts.
    - More ANH promotion activity in the international markets to attract investors.

    - Follow up and continuous assessment of the oil concession model under execution, considering the results obtained in the incorporation of new oil and natural commercial reserves.

- To increase the exploratory perforation levels to values closed to 100 wells per year, in order to improve the Country's geological knowledge and the degree of success in the incorporation of new reserves.

- To accelerate the re-charge of the existing reserves

  - Promotion of investments in the current productions fields, from the extension of association contracts, subject to particular assessment to determine the convenience for the Country.

  - Incorporation of new economically feasible technologies that allow optimization the re-charge factor of production fields.

  - Design and implementation of a Strategic Plan, to promote the extraction and treatment of heavy and extra-heavy crude, in order to consolidate a reserves portfolio that contributes to the supply with local resources, in the long term.

- To guarantee the feasibility and opportunity of companies' operations in the hydrocarbons exploration and production, through the following actions:

  - To maintain the Government-Industry agreement in the basic subjects of security and cooperation with the military, energetic and other related authorities.
  - Agreements with the environmental authorities, to improve the management of subjects such as self-regulation and control.

- To develop mechanisms in the hydrocarbons exploration and exploitation contractual framework, tending to establish the conditions to assure that the natural gas domestic demand is primarily served.

- Provide the ANH with a better management operative capacity that allows the intensification of investments in exploration.

  - To asses and define criteria and mechanisms to Country's natural gas easy access to international markets such CNG and LNG.

  - To analyze the installation of a re-gasification plant, with the purpose of serve as a back up in case of no incorporation of natural gas new reserves. In the decline of reserves scenario, the prospective shows the necessity before 2018.

- To perform a detailed annual follow up of supply scenarios defined in PEN 2006-2025, in front of key variables such as seismic, exploratory wells perforation, new reserves and measured investments in terms of indicators.

2.1.2 The activities of transportation, refining, distribution and commercialization

OIL DERIVATIVES

For the development of crude and its derivatives transportation, refining, distribution and commercialization activities, it is a priority to analyze the current situation of the infrastructure and the future needs, according to the types of crude and derivatives to be transported and refined and with the future demand structure of those derivatives.

The refining activity plays an important role in the industrial development of the country, due to its raw materials contribution with high aggregated value, to the manufacturing industry and to the economic growth, in view of the requirements for safe full, and efficient supply of oil derivate fuels.

In the globalization framework, this constitutes a strategic activity for the Country, particularly, for the Cartagena refinery, due to the easy access to external crudes in case of scarcity, and the option of generation of excedents aimed to the foreign market. With the incorporation of a private investor, the plant expansion will take place in 2011 and will contribute with the domestic full supply of the increasing demand of Engines Fuel Oil, as seen in the prospective exercise.

The world trends, in fuels quality and the new mix quality of Colombian crude, make the refining process more complex due to the reduction of yields and efficiencies. The above, suggests the re-conditioning of national refining operations, leading them towards high conversion processes, to adjust them to the national and international markets needs, not only because of the economic efficiency, but also because of the impact in the Colombian public health, if we continue with the current scheme.

The transportation of derivative products and its storage in ports are activities performed by the state company, owner of the existing infrastructure, which is currently working at full capacity, except for the network transportation used in the past, for the import of gasoline (Pozos Colorados – Barranca).

Considering the need to expand the infrastructure in port, to manage the diesel increasing import volumes, and also take the increasing volumes of gasoline for export, will require a significant amount of investments in the medium term, whose definition is unavoidable. This implies the design of

schemes for access of third parties to the infrastructure, facilitating the private investment entry.

With regard to the derivatives commercialization, the activity is performed by the private sector and has a new regulatory framework, which should be continuously assessed in view of the new previsions, in case the results are not satisfactory.

It is worth mentioning, with regard to the special regime for the liquefied fuels in zones of frontiers, that this has not been an effective mechanism to avoid the illegal trade between frontiers, and to generate economic and social development in those areas; on the contrary, this has generated deviations of use and distortions in the fuels distributions in the neighboring towns, not covered by this benefit. Therefore, it is recommended the development of a new mechanism that promotes the achievement of the proposed objectives, without causing distortions in the fuels market.

The concept of sustainable operation in the refining, transportation, distribution and commercialization activities of liquefied products derived from oil, is focused on an adequate definition of the regulatory framework and the energetic pricing policy, that take into account the economic criteria of export and import parity, according to the relative position of Colombia in each moment, with regard to each energetic; similarly in regard to the quality of international products compared with the local products. The Country shall opt for clear and transparent pricing policy, gradually approximating the current levels to the international indexes that consider the reality of the market.

In that sense, the main **strategies and actions** are:

- To adequate the refineries operation schemes, that lead to high conversion processes, and a tendency to medium and small distilled gasoline supplies.

- To implement intense de-sulphurization processes to adjust the oil derivatives production operations, to the new world requirements in environmental matters.

- To adapt the transportation infrastructure, designed for gasoline import and expand it, to manage the increasing volumes of diesel imports.

- To enlarge the storage capacity and to expand the docks to allow the arrival of heavy draft vessels for export as well as for import.

- To developed the necessary regulation to allow access of third parties to the transportation and storage systems.

- To develop a new mechanism to promote the achievement of proposed objectives in the special regime for liquefied fuels in frontier areas, to avoid distortions in the fuels market.

NATURAL GAS

Transportation: The natural gas transportation is mainly an active task in this commercial chain for the technological competition of energetic substitutes in the different socioeconomic consumption sectors. The optimization of gas transportation requires a deep knowledge of the Colombia's energy market.

The natural gas transportation present a remuneration structure of charges, based in distance signals and requires subscribing agreements between the transporter and the sender, which directly influences the expansion of transportation systems in capacity as well as in opportunity. This circumstance leads to the existence of a certain degree of discretion whether to carry out the expansion and the investments, which is directly linked to the risk that should be assumed by such agent, thus, the expansion is carried out assuring a percentage of the new capacity under the contracts scheme.

Notwithstanding, the consequence of using this scheme is that the transportation system expansion might not be finished on time, when the demand requires it, putting at risk the serving of the natural gas demand in a reliable way. Besides, this can affect the agents' investment decisions, of expanding the production capacity, which requires a harmonization of the production plans with the transportation expansion plans, in order to preserve a well served gas market.

With regard to the sustainability concept in the natural gas transportation, the consistency of the regulatory scheme for the infrastructure expansion, related in turn, with the contractual structure of the service, should be reviewed. In this context, regulatory analysis should be performed, in order to determine the feasibility of introducing the concept of reliability, to guarantee fully serve the gas demand.

Distribution: The distribution activity is mainly oriented to rendering the service in efficiency and solidary conditions, with infrastructure remuneration from exit of the transportation system up to the connection point with the final user, using the methodology of medium escalating access, measured on medium term average costs, allowing the distributor to establish a set of tariffs by volume.

There is also the figure of "exclusive areas", which constitute an essential element in the natural gas penetration into the residential sector, which has allowed extending the service to low income consumers, in low density

population areas. In this way, a "globalization" scheme of the service has been defined, considering technical and economic criteria, but limited to the area of influence of the transportation trunk system.

Due to the above, in the medium term and in order to achieve the "globalization" of the service, it is required to review the contractual scheme and the remuneration methodology of the transportation activity, and make it compatible with the Oil Liquefied Gas service rendering.

The distribution activity has evolve to mainly a private participation, that operates without major difficulties, reaching rural areas, which has allowed to reduce the high impact energetic consumption for the stability of natural resources.

Trade: The trade activity is the last segment in the natural gas value chain, and allows taking the energetic to direct customers and to the different consumption sectors.

The current trade scheme, allows this agents direct participation in the non-regulated market, whose trade tariffs are the maximum, allowing competing in operations such as gas purchasing, service transportation negotiation, distributions and the efficiency in the rendering of the service, among others. The trade as an activity in competition will be a facto for analysis in objective No. 3.

The main proposed **strategies** are:

- To develop, through the regulation, the mechanisms that involve the efficiency, reliability and price criteria, necessary to assure that the natural gas transportation capacity expansions enter into operation when it is required.
- To develop the mechanisms and the programs tending to increase the natural gas service coverage, in the areas of influence of the transportation system trunk. In the medium term, and in order to reach the "globalization" of the service, it is required to review the contractual scheme and the remuneration methodology of the transportation activity.

2.1.3 The indicative planning in the hydrocarbons supply

According to the new private participation game rules, in the energy markets, it is recognized that the agents do not have among their responsibilities, to guarantee the Country's energetic supply, which corresponds only to the State. In this context, the Government as an executor of public policies and public welfare, should lead and orientate the energetic sector development to

seek the country's welfare, inside a judicial stability framework, for the participant agents of such markets.

It is no doubt, that the energetic sector, constitutes a dynamizing element of the economy, in its role as essential public utilities provider for the welfare of the population, as well as an aggregated value generator to the economy, being a key factor for the country's competitiveness.

In this way, besides establishing the rules and supervising their fulfillment, is the competency of the Government to foresee the future energetic needs, the necessary resources to satisfy them, and the evolution of market conditions to guarantee the supply, including the environmental protection criteria.

Consequently, the integral exercises of resources prospective, as well as the infrastructure and its corresponding investment needs, become an essential instrument at the service of the administrative instances and the economic operators that facilitate the investment decision making, from the private initiative as well as the energetic policy decisions. The anticipation and constant adaptation of the estimations to the evolution of the reality constitute an integral part and an essential tool of the energetic policy.

In the new institutional framework, it is necessary to highlight that the prospective analyses and exercises, correspond to an indicative planning scheme, without becoming binding elements for the agents, always respecting the entrepreneurial initiative. Even though, nothing prevents that some incentives are orchestrated in those areas in which the private investor is not willing to take risks, without re-investing its earnings in Colombia.

In such case, the oil high prices forecast in the medium term, constitutes the right time, to promote the local re-investment, taking into account, the contribution that such strategy might have upon the economic sustainability goals in the long term. A scheme of stimulus linked to the focused investment, might be an alternative to be assessed, as long as it does not alter the judicial security framework, being a Government active policy instrument in the market freedom context.

The planning task, obeys to some principles that carry with it the need to make the private initiative compatible with having a national energetic system, whose objectives are to guarantee the full reliable and accessible supply, preserving the environmental quality; objectives that not always are convergent.

The Governments' concern for assuring the energetic resources supply, specially those that are not renewable, and the need to have full autonomy in the development of policies associated to the energetic sector as a vector of economic development, have led to a change of paradigm and that the

Governments come back to the planning schemes, in such a way that, without abandoning the efficiency and competition objectives, can continue with the expansion of systems by the private sector, but guaranteeing to serve the domestic demand with local resources, targeting only the excedents for the interchange with other countries.

Nowadays, there exists in the world, a clear tendency towards the non renewable natural resources protection by the countries that dispose of those resources, and when they are viewed as strategic and scarce, the possibility to share them with other countries is low.

Consequently, it is necessary to strengthen the indicative planning schemes, through the regulation, understood as the exercise that is carried out by the State through its institutions in charge of the energetic topics, in order to detect the difficulties that the Colombian society might face in achieving its objective of having the necessary energy to satisfy the national needs. Such analyses will indicate the actions necessary to be taken, in order to guarantee the full supply of the Colombians energetic needs as gas, oil and its derivatives is concern.

The **strategies and actions** proposed are:

- To assure the availability of the timely and reliable operating and commercial information, so as to facilitate the development of an adequate indicative planning, for the agents and government institutions' decision making.

- To define criteria to develop a plan that ensures the local supply.

    - To establish the priority in the crude oil supply to the local refineries, in front of the fuel consumption or the exports to foreign markets.

    - To specifically establish the priority of serving the natural gas domestic demand.

    - To determine the reliability criteria for the gas natural supply.

- To strengthen the development of the indicative planning in the hydrocarbons sub-sector, executing an infrastructure indicative expansion plan, towards a stable and sustained energetic development.

    - To execute prospective analyses and exercises, with annual updates, in order to assess the own effective capacity to guarantee the hydrocarbons full and safe supply, specifying the

infrastructure needs, to achieve and adequate sub-sector development.

- To carry out prospective analyses that include the regional vision.

- To identify critical situations in the supply and to develop the corresponding contingency plans, evaluating its costs and terms of execution, in order to take timely measures in front of a context characterized by uncertainties.

2.2 The Oil Liquefied Gas – OLG

The OLG, a mix of propane and butane in a normal 80% and 20% proportion, is originated in the oil refining process or can be found as part of crude and natural gas in the hydrocarbons fields. In Colombia, is mainly produced by the oil refineries, where is simultaneously obtained from diverse transformation processes, generating continuous changes in the final mixture quality, limiting its role as a energetic, mainly for cooking and water warming in the households.

Even though, being a fuel of high energetic performance, with great use versatility, easy to transport and generating lower polluting emissions, its consumption has progressively being reduced, contrary to what was pretended in the gas massification plan, which proposed the creation of a gas culture and to gradually extend its services to those regions where it was not economically feasible the entry of natural gas, such as the rural areas and the big cities peripheries.

The found reasons are varied and from diverse origin, to give answer to the progressively reduction of consumption: the natural gas penetration in the cities at the Country's interior, a price increasing tendency, restraining the possibility of entering into new markets, a regulatory framework without clear definition, a low entrepreneurial management originated in financial insufficiency of some companies and the informality of others, seriously threatening the industry survival.

With regard to transportation, given the OLG market evolution with reducing demands, no restrictions had been found for its transfer from the refinery. Notwithstanding, a remuneration scheme of this activity, based on distance signals, reduces the competition possibilities, in front of other energetic and contrary to the objective of maximizing the OLG penetration in the cities' peripheries and in remote regions where the natural gas network construction is expensive.

The distribution – commercialization is perform through different capacities cylinders and through stationary tanks, similar to natural gas, facility that has not being used to enter into new markets, as the electricity small generation, which entered in remote areas or in the agro-industry, where they are a large number of applications. On the other hand, the economic resources needed to maintain the cylinders and tanks in good mechanical condition (maintenance and reposition), offering guarantee to the users, are assure.

Considering that this energetic meets the needs of households, whose possibilities and alternatives to improve the quality of life, are limited by its purchase power, is necessary to ensure the full and accessible supply, which will also allow an integral improvement of the population social welfare and of the economic activities in the territories outside the urban areas. This activities include and interesting market niche for the OLG.

There exists extended technologies and application portfolio, involved in the agro industrial activities that can develop new possibilities of consumption, and at the same time, foster the regional economic development. In that sense, it is required to modify and to extend the rural OLG program, accompanied by training schemes in the use and safe handling of this fuel, to generate confidence in the users and to assure the permanence of the companies.

On the other hand, the new OLG production, coming from Cusiana fields, and whose quality will exceed the refining standards, would allow a change in the supply operational scheme, because of its geographic location, guaranteeing the domestic supply in the medium term and making possible its export and the development of petrochemical projects with greater aggregated value.

In these circumstances and according to the proposals included in the National Development Plan, it is necessary to carry out a program to consolidate the use of OLG as an energetic in the periphery of the cities, in the most populated municipality areas, that do not have natural gas services and in the rural areas, for which, it is necessary to develop a market scheme that allows to reach better coverage levels and better quality of service, as well as an analysis of the potential of new uses that generate productivity and socio-economic welfare,

With regard to the sustainability subject, the CREG has put to the consideration of the society, several documents, in which some important changes are proposed in the sectorial regulatory framework, and therefore a definite adoption of such framework, is required, for orientation and consolidation of this industry.

The **strategies and actions** proposed are:

- To measure the OLG availability for energetic uses
    - To characterize the OLG supply including the contribution of the new production projects.
    - To study and define the use of OLG refinery projects targeted to the petrochemical sector.
- To develop a program to consolidate the use of OLG as an energetic in the cities peripheries, in the most populated municipality areas that do not count with the natural gas service and in the rural areas.
    - To carry out a study where the market scheme and the technologies of supply are identified, which allow to reach greater levels of coverage and better quality of service.
- To define the regulatory and institutional framework, that makes feasible the OLG sector development, for which the institutional subjects, such agents' behavior and tariffs, should be taken into account.

2.3 The Mineral Coal

The coal is one of the main country's energetic and economic resources, thanks to its excellent quality and abundance, sufficient to participate in the world market. The greater reserves are concentrated in the Atlantic Coast, where technified open fields mining predominates at great scale, while at the country's interior, prevails low technified underground exploitations.

Though, the Guajira and Cesar coal reserves, are aimed to supply the foreign markets because their characteristics, it should be considered, that the energy linked to the coal deposits, is not only referred to the one contained in liquid form, but also to the considerable identified and potential methane gas reserves linked to coal mantles, that should be use mainly for electricity production. On the other hand, there are reserves of less quality that might, in the future, consolidate the use as raw material for obtaining fuels, which should be analyzed in depth.

From the interior's coal reserves, the Norte de Santander, Cundinamarca and Boyacá, are highlighted, and other with less potential such as Antioquia and Valle. The interior's reserves are the ones that should be promoted to increase the coal participation in the national energetic portfolio. The participation of the coal produced at the country's interior, contributed with 3.8

Mt in 2005, which represented 7.02% of the national total, mainly destined to satisfy the domestic market.

The coal demand composition in the electric and industrial sub-sector represents 97% of the national, in which the industry participates with 75% and the electric sector with 22%.

It is necessary to carry out analyses that allow determining the real coal availability, as an energetic source for the Country, since its production and development are part of the integral energetic planning processes, and therefore, give it the relevance, not only as mining resource but also as an energetic one.

The new thermo electrical projects constitute an important coal potential demand, previous identification of the barriers that the coal as a source for electric generation, has in Colombia, so that, it competes in equal conditions with other energetic sources.

In the case of the manufacturing industry, it is considered that the coal and other energetic price signals are elements sufficient, for efficient investment decision making, including the requirements for the use of adequate technology that allows fulfilling the environmental standards. As it will be addressed in the crossed subjects of Science and Technology, the mechanism that could considerably activate the coal domestic demand, is the fuels production from this energetic; even though, this should be viewed as a long term measure. Preliminary data indicates that a 20,000 daily barrels of diesel production could double the domestic coal demand. Nevertheless, its abundance leads to the need of carrying out studies to take advantage of the current and foreseeable context of crude high prices.

It is considered important that the Country advances in the knowledge of available technologies for the use of coal in the gas and liquefied fuels production, which, besides generating a greater demand, will provide the market with new good quality derivative products, will allow the energetic supply diversification, and will reduce the pressure upon the oil resources the country has. On the other hand, the clean use of technologies in electric generation, are available and it is necessary to advance to an organizational and contractual scheme, that allows the development of an efficient industry, based in the demand perspectives in the long term, as it is the case in the natural gas market.

The mining at the country's interior can be classified under two categories: moderately technified and small-scale. Although, in the first group, there is technology and knowledge, the investment is low, while in the small scale or survival mining, the extraction is artisanal, without any kind of mining exploitation design. For the coal supplying the domestic market, some

measures aimed to strengthen the small miners, in an entrepreneurial way, are required to minimize the sterilization of reserves originated by the inappropriate exploitation and take advantage of the available reserves, using adequate production technologies.

With regard to the sustainability from the small and medium mining perspective, the formalization of the industry, considering legalization, fiscalization, market development, transportation and fulfillment of environmental regulations, is required. In such sense, a strategic sectorial plan might be an adequate instrument to establish general guidelines for the sector.

The **strategies and actions** proposed to that extend are:

- To measure the reserves and capacity of the coal available production to establish the domestic demand as an energetic source in the combustion and row material processes for transformation, such as Coal to Liquid tecnology.

- Look for greater participation of coal in the national energetic portfolio.

    - To review the regulation and identify the barriers, so that in equal conditions with other energetic sources, the electric generation projects development from coal, are promoted.

    - To measure the methane gas reserves, linked to coal mantles and to promote its use for electric generation projects.

    - To foster the development of scientific and technological knowledge about coal and the process for its use in new petrochemical technologies and in energy generation.

    - To carry out promotion programs for the use of coal in the industry, using low environmental impact technologies.

- ❖ To developed programs aimed to the formalization of the small and medium coal mining, aimed to promote the fulfillment of the regulation and to increase the productivity.

- ❖ To promote the use of coal for liquefied fuels and fuels gas production in the long term.
- ❖ In accordance with the above, assess the feasibility of implementing transportation systems at great scale for the coal at the country's interior.

2.4 Electric Energy

As part of the sector infrastructure, the industry was separated into four main activities: generation, transmission, distribution and commercialization, and for each one, an analysis from the supply and sustainability perspective is presented.

2.4.1 Generation

The spirit of the reform of the electric sector through Laws 142 and 143 of 1994 was the introduction of game rules to open this activity, giving participation to the private sector and creating an open and competitive Wholesaler Energy Market. Although, an important participation of the private sector has been obtained, in the electric energy generation investment (approximately 57%), this obeys mainly to a changes in the property, developed through the processes of privatization or capitalization.

A very important characteristic of the sectorial reform indicates that the Government through the UPME, executes the Electric Energy Generation Expansion Plans, which have an indicative feature. Even though, if the required expansion projects, are no developed by the investors, is the Government the responsibility to guarantee the supply and consequently, should take the necessary measures, to assure the start up operation of required projects to fully serve the demand.

The electric generation current situation shows that it still counts with a supply margin with regard to the demand requirements, viewed from the installed power, while in energy; depend on the behavior of hydrology associated to the reservoirs. Although, this margin will be reduced progressively, as long as there is an increase in the consumption. It should be noted, that except for Porce III with 660 MW and Rio Amoyá with 80 MW, the construction of new generation projects is still undefined for the next years, mentioning, that this projects are promoted by companies with state-owned capital such as EEPPM and ISAGEN.

To complete the national electric energy generation scene, it is necessary to take into account that the development risk level of a hydraulic generation project is very different from the thermal type. For hydraulic, the levels on investment, the geological and construction risks, are greater than those for the thermal projects, although, the latter, face the need to assure the fuel supply commitment to be used in its plant.

The electricity as an essential good, presents some singularities that make it different from other tradeable goods in the markets. The lack of a perfect substitute, to cover the electric energy requirements in the short term, makes it difficult the pricing and the balance between the supply and the demand in

real time. Therefore, the diversification of generation sources for the installation of new capacity in the short term is required. These characteristics are of vital importance to generate the necessary incentives to achieve the required reliability on the system.

One way to increase the country's generation capacity would be through the development of small and medium capacity projects, connected to the electric system distribution level, located near or at the point of consumption, called distributed *generation*[12]. The distributed generation, is more feasible each time, due to the fast development of small size and high efficiency generation equipment, with advantages for the electric system performance, such as the reduction of losses and the possibility to delay investments in transmission and distribution, among others. Besides, depending on the technology used, leads to the diversification of energy sources and environmental impact reduction.

In this way, the generator agents and the new investors can find investment opportunities in the development of this type of projects, for whose promotion it is necessary to carry out the analyses that allow identifying the different barriers or obstacles to the distributed generation, at the technical as well as at the economic and regulatory level.

With regard to the interconnections with neighboring countries, it should be mentioned, that the electric energy availability is limited, with the exception of Venezuela which has important resources east of the Country. Ecuador is currently an electric energy importer, and the marginal costs exceed the Colombian ones. The above, indicates that the generation expansion in Colombia, should handle the national demand and the export requirements.

Finally, considering that with the Regulation for Reliability Charge, it is sought to give the necessary signal, to make the electric generation sustainable in the long term, and therefore, for the reliability and efficient residential public service rendering of electricity, it is considered, that the future expansions, will depend mainly, on the perception that the agents and the new investors have with regard to the game rules determined in the new Charge structure.

In a free competition market, the role played by the UPME indicative planning, should be considered as an essential reference element for the government and the regulator, in order to verify whether the energetic policy decisions, as well as the regulation policies, produce the desired results for the Country in the long term.

The **strategies and actions** on that regard are:

[12] Inside the Distributed Generation, the co-generation, self-generation and isolated generation, are considered.

- To establish a follow up mechanism, of the application results of the new reliability charge:
  - As an expansion signal of the Colombian electric generation system.
  - Upon the characteristics that support the exporting condition: excedents capacity and less marginal costs with regard to neighboring countries.

- To strengthen the UPME role in the development of the indicative plans and the promotion of electric generation projects.

- To identify the different barriers or obstacles to the distributed generation in order to facilitate its development.

2.4.2 Transmission

The electric generation transmission in the medium and long term, does not present the risks that are perceived in the generation activity.

To support the planning processes in this activity, we count with the Planning Advisor Committee of the Transmission Expansion, to carry out the reference plan by UPME. For the entry of competition, there exists the mechanism of public bids in the execution of projects defined in the Plan. In this way, the UPME seeks to guarantee the availability of the transportation system and its expansions.

The remuneration of the new transmission projects, is given in function of the smaller income offered for the expansion of the new projects and the efficient costs for the remaining of the infrastructure. The tariffs are calculated, in such a way that a determined income in obtained, so that it covers the operating cost and the investor's earnings.

Due to the above considerations, one can say that so far, the system has developed Transmission Expansion Plans, which has motivated the execution of projects to serve the domestic demand. As it is known by the public, there had been a lot of attacks to the transmission infrastructure, even though; the reliability of the supply has maintained the quality standards, which shows the stability of the system and the capacity of the companies that render the service.

2.4.3 Distribution

The CREG Resolution 082 of 2002 approved the general principles for the methodology of the distribution activity remuneration, through which the infrastructure investment and the costs for Administration, Operation and

Maintenance (AOM), are recognize. In the case of infrastructure, the remuneration criteria are considered, using reposition costs, useful life, and energy and quality losses in the rendering of the service. It is worth mentioning, that in addition, a efficiency criterion is applied, using a reference maximum or efficient charge, for which some limits are originated, discouraging the coverage expansion in low density zones, served by the companies with medium high costs in relation to the reference costs.

The regulation establishes bimonthly distribution charges, which correspond to the four voltage levels, with annual review, for the IV level case or Regional transmission System (STR), whose tariff is subject to stamp tax. Different from the transmission and STR tariffs, the risk of the demand used to measure the distribution charge in levels I, II and III, is assumed by the distributors.

Given the distribution integration with commercialization in the most part of the market, the risk of collection upon the dealer, can affect the distribution activity, if the necessary investments that allow expanding the coverage, to reduce or maintain low levels of losses and to render the service with the required quality, are not executed

One can say that, distribution availability is assure and does not represent a treat for the service in the urban markets or with high population density. In the rest of the Country's areas, even though, there is been an beneficial evolution in its management indicators, there are companies that because of the dispersion characteristics and users socio-economic conditions of the market served, present a limited management, and maintain levels of losses higher to those recognized in the regulation and a low increase in coverage.

The **strategies** proposed in that sense are:

- To develop, through the regulation, the mechanisms that allow the strengthening of the distribution companies, considering the markets unique characteristics, in favor of an adequate management and the execution of the investment plans necessary to expand the coverage, reduce or maintain the low level of losses and to render the service with the required quality.

- To concrete the vinculation processes of strategic investors, with the distributor companies, with the Nation's majority interest, in order to strengthen their management performance and to improve the financial capacity.

- In relation with the non-connected zones, the coverage expansion indicative plans, should be considered, subject that is analyzed in Objective No. 5 – *To maximize coverage with local development.*

2.4.4 Commercialization

This activity comprises the energy purchase/sale, measurement, invoicing, collection and customer service. In virtue of the electric sector reform, the users are free to choose their own electric energy dealer, in particular for the non-regulated, to freely negotiate the tariff. For the regulated users, the charge established by CREG, should be collected, measured by the company and the Market, according to the average cost per invoice and the monthly average consumption per user.

The commercialization as an activity in competition is analyzed in Objective No. 3 – *To consolidate the competition scheme in the markets*. Linked to this objective and with regard to the supply or availability, from the commercialization point of view, it is important the role of the dealer at the end of the chain, which has the responsibility to provide the service.

In the Colombian case, it is understood that the dealers with approved regulated charges in the market, have the obligation of rendering the service to who may request it, conditioned to the technical and economic feasibility. Through Resolution 06 of 2003, the CREG defined the incumbent dealer as "that one that constitutes the last instance in a market and is associated with the Network Operator". In addition, the Decree 3734 of 2003, orders the CREG to remunerate the costs and risks, of that one who assumes the responsibility of last instance dealer. In this sense, it is proposed, that in order to assure the availability and at the same time to promote the competition in commercialization, this role must be consolidated.

Similarly to distribution, the commercialization costs are differentiated because of the characteristics of the market served by each company, which makes more difficult the coverage expansion in the markets with low population density. Besides, an increasing effect on tariffs, when the dealer losses non-regulated customers in its market.

The **strategy** proposed in this sense is:

To develop, through the regulation, the mechanism that allow the strengthening of the commercialization activity, considering the unique market characteristics, to promote an adequate management performance and the expansion of the coverage.

2.4.5 Gas-Electricity Coordination

Considering the magnitude of the gas demand, by the thermo-electric sector, the need to establish the two sectors operating coordination mechanisms, is been detected, for which it is essential to establish the timely flow of

information, needed for an adequate dispatch and operating planning, recognizing their particularities.

In this sense, an intra-sectorial strategy, is to institutionalize a gas-electricity operating coordination scheme.

1. Main Objective 2: TO CONSOLIDATE THE REGIONAL ENERGETIC INTEGRATION

The distribution of energetic resources in the South American countries, is not identical, which has affected the planning and startup of projects to carry out energy commercial interchanges between countries, as a means to attenuate the inequalities in the property of resources and to mitigate the impact generated by the oil and energetic high prices, which come from oil or that are found referenced in same.

For the countries with excedents, the integration allow them to take advantage of their export potential and eventually assure the supply in critical situations, notwithstanding, it constitutes a risk for the preservation of resources, particularly the non-renewable ones, required in the long term. Meanwhile, for the countries with deficit, is a fundamental tool to assure the supply of their demands at appropriate and stable prices; although, it is perceived as a risk in the supply assurance.

Although the purposes of increasing the energetic assurance, diversify the supply sources, reduce investment and operating costs, optimize the environmental management of infrastructure and to count with investment opportunities in the expanded markets, are common to all countries; the risks considerations and the opportunities associated to the integration, structurally differ, according to the resources scenario available in each country.

Due to the differences in the sector development model, between the countries, in aspects such as: inexpensive dispatch optimization criteria in the generation of electricity, types of electricity generation or transmission services remuneration, or natural gas transportation, tariff differences, taxes and subsidies applicable to the final energy goods and services; does not seem viable with only one system between countries, without discrimination, with free access, standardized financial contracts, single stock exchange, among others.

Taking into account that the oil and its derivatives are goods of high tradeability and that have of a world market, in which they can be purchased or sold without major restrictions, there is not need for integrations. Although, strategic associations in the region, might improve the oil availability at a lower costs, in case the local exploratory activity results, do not lead to interesting discoveries.

Instead, the electricity and natural gas can be only moved by a network that connects the production locations with the consumption centers, characteristic that constitutes the opportunity source for the energetic integration among the countries of the region.

In recent years, Colombia was perceived to have excedents in energetic resources, which, combined with a need to keep a positive trade balance, fostered the energetic integration processes, as a means to collect foreign currency, in an open market context, with the presence of private actors as investors and executor agents.

Under these considerations and in front of excedents in the installed capacity in the Colombian generation, an electric integration with Ecuador was initiated in the CAN Decision 536 framework, in which the free access to the international connection lines, coordinated inexpensive dispatch of electric markets, no price discrimination for the domestic and external market, prices and tariffs that reflect low costs and private participation promotion in the development of transportation infrastructure, among others, were established. Although, the regional institutionality is not already consolidated, being the most advanced initiative.

As it was previously mentioned, the Plan Vision 2019, proposes, to position our country as a regional energetic cluster, which should be consistent with the objective of assuring the availability and full supply of the energetic resources to serve the domestic demand in the long term. In that sense, the purpose is to generate an appropriate energetic infrastructure, an essential support for the development of the different economy sectors.

The group or energetic portfolio available is addressed in the context of this document, and it is at the disposal of the investors for the development of projects inside the country as well as the international trade. In a more ample sense, the cluster would include the different elements of the productive chain, such as human resources, vendors, universities, and research and development entities, among others, which rebound in a wider competition concept.

This objective, with which it is intended to consolidate the integration schemes, seeks to establish the mechanisms that allow to dispose of an energetic supply, sufficient to serve the country's requirements, to provide with the elements that make possible to sale the excedents and in general, to give the regional integration, the sense it should have, which is to optimize the energetic resources of the participating countries in the regional market, beyond the simple commodities export or import, so that it is structural and no circumstantial.

Colombia is a country with a privilege geographic location, with regard to the most import transportation flows around the world and in relation to the Unites States, one of the most important in the world, besides been the medium point between North and South America, which, combined with a considerable energetic potential, give the possibility of positioning as an energetic cluster, where converge all the region's interchanges, a specialized productive center is formed around the sector, and energetic interchanges between the different Latin American countries are achieved, even though, they are not necessarily unite by their frontiers.

In addition, there is a potential in the Colombian Pacific Coast, because its maritime connection with the Asian emergent markets, which represent an attractive opportunity, as long as the Country is regionally consolidated as an energetic cluster with considerable energy interchanges.

The regional energetic integration carries with it, the consideration of four elements: political, regulatory, environmental and physical. The electricity and the natural gas do not have the characteristic of commodities; thus, require commercial agreements and the infrastructure development necessary for the flow between neighboring countries, to generate the commercial interchanges that materialize the integration.

With regard to the politics element, it is necessary to generate enough confidence between the countries of the region, establishing commitments among the Governments through regional organizations such as the CAN, so that, the energetic integration mechanisms remain in front of a Country's critical situation or political voltage among them, such as the European experience that has made it feasible. Similarly, and with the purpose to intensify the use of regional infrastructure, the Governments should try to enter into framework agreements for the optimization of the existing resources usage.

The recent crisis in the economic integration processes, such the withdrawal of Venezuela from the CAN, does not allow foreseeing the strong integration between the countries of the region, in which there exists great interconnections, electricity integrated dispatch, trans-national instances to settle controversies and unified regulations[13].

With regard to the regulatory, it is necessary to identify the adjustments in the regulations that allow the development of commercial mechanisms that make possible the energy flow towards the foreign markets, with carries with it, the need to count with clear and stable game rules. Similarly, the elements that guarantee the domestic supply assurance, and a reasonable degree of

13

autonomy in the national decisions, without resigning to the efficiency objective, should be incorporated.

In this subject, the electric sector should be the focus of attention, assessing the international transactions between Colombia and Ecuador, to capitalize the experiences in the management of the schemes with other countries, such as the interconnection Colombia-Panama. The regulatory harmonization should include the environmental assessment, to determine the impact in the environment, in particular at the frontier zones.

To consolidate the regional energetic integration, requires activating the Country's competitiveness factors in the energetic sector, to evaluate the own situation in front of other countries of interest and to establish a sectorial coordination, in the management and administration of the own energetic resources. It will be necessary to know the updated information, about the availability of resources, geographic location, and to know the deficits or the excedents.

It also implies a great sectorial coordination in the management and administration of resources, as well as the consolidation and analysis of national energetic information and that of the neighboring countries, to give the public agents, the necessary signals for them to proceed.

The **strategies and actions** proposed are:

- To promote the strengthening of the institutionality, the regulatory harmonization and the energetic integration initiatives, inside the Organizations or regional countries' Agreements where Colombia participates.

- To create a monitoring system of the Country's competitiveness in the energetic sub-sectors:
  - Organize and make operative a management information system on the energetic resources of the Country and the region.

  - To develop methodologies to measure the competitiveness.

- To develop the regulatory harmonization, necessary for the Colombia-Panamá electric interconnection.

  - To channel the experiences of the TIE's schemes with Ecuador.

  - To establish the export conditions in scarcity situations.

- To promote and follow up the execution of interconnection projects.

- To promote the electric interconnection with Central America through the Colombia-Panamá project.

- To follow up the bi-national gas pipe construction between Colombian and Venezuela.

- To promote the gas integration projects with Central America and the Caribbean, when the Indicative Planning analyses prove the availability of excedents, once the requirements of the domestic consumption are fulfilled.

Main Objective: 3: TO CONSOLIDATE COMPETITION SCHEMES IN THE MARKETS

The subject of market competition was a specific objective of PEN 2003-2020, and is still valid as an objective of the energetic policy, since those activities of the energetic sub-sectors that are been developed under a competition model, still require the design of measurements to strengthen and to increase the level that guarantees efficient prices.

Before developing this objective, for each of the energetic sub-sectors and the activities of the corresponding chain, it is considered that the vertical integration degree, is a common element and of high impact for the achievement of this objective, for which, following a brief analysis is developed.

Vertical Integration

Although, the vertical integration presents positive effects for the companies, such as cost reduction, for the effects of scope companies and in some cases of transaction-, it is also true that the integration provides a structural advantage in the market, which can lead to a situation of abuse of dominant position and entry barriers, among others.

The lower costs originated by the integration, no necessarily are translated to the final price, in this situation, the user would not be benefited, and if it were the case, there would be distortions in the market, when the competition is present between integrated agents with those that are not integrated.

A previously mentioned benefit, resulting from the vertical integration is, in the Colombian case, the achievement in penetration and massification matters, specifically in the natural gas sector, distributed through pipes.

The vertical integration cannot be judged, as negative by itself, but it is clear that configuring comparative structural advantages for some agents, do not

favored the development of competition in the markets. To achieve it, its effects and the regulation coherence, should be assessed.

The **strategies** to apply by sub-sector are:

- To review the regulation coherence, verifying the existence of differentiation rules, according to the degree of integration of the companies in the market; similarly, with regard to the participation limits of the activities susceptible of competition.

- To assess the positive as well as the negative effects, that currently exist, resulting from the vertical integration (privileges given in the Law), to make the corresponding decisions, towards the consolidation of the competition in the market and the major benefit of the final user. Similarly, with regard to the participation limits of the agents in the markets.

4.1 Oil and Natural Gas

4.1.1 The activities of exploration and production

In the activities of hydrocarbons exploration and production, the competition in the markets, is not a relevant subject, since the methodology to assign the exploratory areas, combines the subscribing of direct contracts, with public bid procedures, looking for the greatest number of investors.

The market of opportunities of these activities is globalized and consequently are the contractual conditions offered and the promotion activities of ANH the elements that determine the entry of investors to this segment.

4.1.2 Refining, transportation, distribution and commercialization activities

Crude Oil Derivatives

Refining in Colombia counts with two big plants: the one in Barrancabermeja, property of ECOPETROL and the one in Cartagena, property of a new partnership made up of GLENCORE and ECOPETROL, the result of a bonding process of a strategic partner to duplicate the refining capacity.

Short term, to count on a full competence scheme involving refinement is limited by conditions that ECOPETROL displays. The size of the refinery en Barrancabermeja, the fact that ECOPETROL has a direct participation in the production of crude oil and indirectly through association contracts and the synergies obtained in the Barrancabermeja Industrial Complex thanks to the

integration with the petrol-chemical train, difficult the entry of agents which generate competition to ECOPETROL. It is necessary to gradually generate conditions to count on new agents which offer the national market fuel and crude oil derivatives that are needed.

In the current market conditions, the geographical location is an aspect to consider for the increase in refinement capacity, there can be important differences found between the refineries from the coast and the so called Mediterranean ones.

As to the refineries located within the interior of the country, the view on the procurement of crude oil faces logistic risks and problems due to the difficulties before mentioned, such as the costs of introducing the necessary crude for the refinement operation system. However, the fact that we count on mature markets within the interior of the country gives these projects the possibility of being viable and become supply sources of oil derivatives, generating added value and industrial development poles.

With the recent normative of recognizing opportunity prices in the sales of products originating from totally or partially owned plants, there have been advances in the generating of conditions necessary for the introduction of new agents. To eliminate the barriers which persist, it is precise to establish the access normative to third parties in the transportation and warehousing infrastructure, the same as the criteria for expansion and remuneration.

The refineries of the coast have the advantage of easily permitting the importation of crude when there is no availability of product of national origin and permit the exportation of products to the international markets, improving the commercial balance of the country. In addition to these benefits which are obtained from a coastal refinery, a project of this nature en the median time allotted could focus on the procurement of the growing Asian markets, at the same time generating competition in the refinement activity thus assuring its internal procurement. The prospective exercises show this need beginning in 2017. It is noteworthy that the placement of a refinery in the Colombian Pacific will have the particular characteristic of equalizing the internal supply points and balance the regional attention of the demand.

In the distribution and commercialization activities of fuel fuels derivatives of crude oil, the sector is open and complies with the competitive market rules: a homogeneous asset, a plural number of actors where none make the price, complete information, rational agents and freedom to enter and exit. In conclusion, the wholesaler and retailer distribution is sufficiently open with free access and possibilities of exits subject the commercial agreements.

You could also say that the GLP market is also open and permits the entrance and exit of new agents, however there exist difficulties. The

distribution activity – commercialization faces a difficult situation due to the competition facing natural gas and the new mode “GLP vs. GLP” understood as the practice whereby third parties are given a service in search of a costs reduction, which has generated anti-economic and improper operational schemes, with the consequent business weakening and decrease in the provision of service. The strategies proposed in the first Objective will cooperate in the consolidation of the competition in the distribution activity – GLP commercialization.

The **strategies** laid down to consolidate competition schemes in transportation, distribution and commercialization of oil and its derivatives are:

- Establish the access normative of third parties in the transportation and warehousing infrastructure, just as the criteria for expansion and remuneration.

- Promote the development of new refinery plants; consider the advantages that a new refinery could have placed in the Colombian Pacific. The prospective exercise shows that its entry would be opportune in 2017.

Natural Gas

In the natural gas sector there are competitive activities and others that could be called non- competitive. Within the first ones are found production and commercialization of natural gas; in the distribution you could present market competition, while the non-competitive corresponds to transport which is a natural monopoly by structure.

With respect to the production and commercialization of natural gas, the market presents high indexes of concentration, which can be explained by the structure itself of the association contract in which ECOPETROL participated as a partner in all the contracts, permitting this company to reach a privileged position and consequently a structure of low competition between producers.

Additionally, restrictions in the production of gas have affected the market development without allowing the generation of surplus, a situation which reduces even more the level of competition.

The prospective procurement of natural gas signal that if new reserves are not incorporated, its importation will be required as a means to make ready the resource, for which the normative should generate conditions which allow the provider of the gas assure its maintenance and let the users count on the energy source in a trustworthy manner.

The transport of natural gas, considered a natural monopoly due to its economic scale, does not seem sensitive in encouraging the competition within the market, but at the same time, in benefit to the competition, it is established that the transport of natural gas could not have economic interest in companies that have production, commercialization or distribution activities of gas as an objective.

The separation of activities allows a more developed market structure with a greater number of actors and potentates a greater private investment in segments or links of the chain, as well as permits a greater control of anti-competitive control and verification of the compliance of the principles of neutrality and efficiency on behalf of the Superintendence of Public Services.
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As mentioned before, it is necessary to evaluate the benefits that are represented for the users maintaining the actual system conditions, and in compliance with the objectives of Law 142 of 1994, promote through the normative conditions so that the competitive activities be sensitive to a development within competitive conditions.

On another hand, the adopted scheme of "*contract carriage" for* the expansion of the transport system and the utilization of bi-lateral contracts not normalized with different degrees of freedom provokes that this be developed when the transporter considers the contracts provide the necessary guarantees. This capability given to the transporter could become an obstacle for the corresponding attention of the demand, since it seems improbable that the scheme by itself guarantee the expansion of the system.

In virtue of the importance that the natural gas represents within the Colombian energetic fuels matrix and with the purpose of assuring a deserved attention to the demand in an opportune and trustworthy manner, it is proposed we study the regulatory modification mechanism to guarantee the transport infrastructure expansion; for example, using the auction- type scheme to adjudicate transport expansion projects defined in some normative planning exercises, which explicitly guarantees remuneration and execution of the projects stated and that these be found operational when the demand requires it.

The distribution activity is united with the commercialization activity and with the exception of the regulated users and the service areas exclusively, it is subjected to the competition as opposed to the commercialization in the attention of the non-regulated users. The tariff methodology permits the distributor to structure differential tariffs in consumer ranges, which in practice translates to volume tariffs, in such a way that in competition areas the entering marketers need to have available adequate and opportune information of the collection of tariffs established, which at last allows it to dispute the commercialization component.

The commercialization of natural gas is associated with the offer of the production and distribution of the demand. The country does not count with a wide and plural structure of marketers for reasons already mentioned, like in the old association contract for the exploration of hydrocarbons, originating low competition in the offer for a structure concentrated in the demand and by the tariff scheme in the distribution activity.

One of the possibilities to promote greater competition conditions in marketing could be the decrease of the threshold of 100.000 PCD which defines the non-regulated consumer, which would generate more potential users prone to negotiate directly the gas supplies with the producers and the transport through marketers.

However, so that this can translate into something beneficial for all the users, competitive conditions are required in production-marketing.

In general terms, the possibility to count with a wide competition in the service provision at the regulated and non-regulated end-user level in the Colombian market, presents difficulties due to the lack of adequate information which facilitates investment decision-making and so that the markets function efficiently.

Strategies established to consolidate competition schemes within transportation, distribution and marketing of natural gas are:

- Design the regulatory mechanisms which permit it to make ready of the natural gas in case there are new reserves incorporated, with the purpose of generating competitive conditions which allow the gas provider to assure his holding and the users can count on a trustworthy form of energy.

- In the transportation activity, to explore new regulatory models with the purpose of guaranteeing the expansion of the infrastructure and have them ready when the demands require.

- Inspect the tariff models of the distribution and marketing activities to make explicit the elements which form part of the price formation schemes and in this way contribute to generate competitive conditions.

- Apply the strategies as opposed to the vertical integration mentioned beforehand, especially for the gas transport activity, with the purpose of guaranteeing free access to the networks.

- Design an information system that permits the elimination of asymmetry, so that all the agents count on the judgment elements necessary in making decisions and in that way achieve a major market dynamic of natural gas.

4.2 Coal

As mentioned in the first Objective, there is a reference made to the market of the reserves from the interior of the country.

In the coal sector there is the case of an atomized offer in multiple and small producers and some buyers with a very strong commercial structure. These characteristics have generated little product homogeneity and quality, together with some prices that do not guarantee the maintenance of the industry in the long run. This leads to informality within the productive chain of coal.

Considering that among the characteristics that should be fulfilled in the competitive market you have the, i) homogeneous market asset, ii) that a plural number of actors exist so much in the offer as in the demand, iii) that the agents not have the market power to cut-in the price formation and, iv) that complete information be available in the decision-making, coal seems to distance from a true competitive market where efficient prices are formed.

The strategies outlined in the first Objective focused on the search for a greater participation of coal in the national energetic fuels collection and the formalization of the small and medium mining, would lead to favorable effects in the consolidation of the market competition in this energy source.

In the market, the availability of information is key in business. The coal in the interior of the country doesn't count on a source of centralized information regarding the specific needs of the clients and about the coal characteristics and the coke produced. When a national or international buyer searched for a type of coal with specific characteristics, they don't find an entity that provides them with information about the producers, marketers and volumes available for sale; they should assist referenced contacts and negotiate in some cases with many miners, without getting coal of optimum and homogeneous quality.

The consolidation of small and medium mining is considered a desirable goal if and when it becomes an organized activity and its business character is consolidated. The uncertainties regarding the production forecasts of crude oil and gas make the occasion favorable for the achievement of this objective which should be a priority in the procurement policies.

In the future, coal to liquid –CTL conversion projects present objective conditions to contribute to the formation of a long-term market where better market conditions are formed which promote a greater use of technology of this abundant resource.

The **strategies** laid down in this sense are:

- Promote the development of information systems, market investigation and disclosure mechanisms which facilitate the marketing of the product on behalf of the small miners.

- Encourage the integration of small producers through cooperative–type associative schemes to strengthen its productivity and improve market competition conditions.

- Impulse the coal demand of the interior of the country, for example through the development of the conversion of coal to liquids and development of long-term supply contract models.

4.3 Electrical Energy

The reform to the electrical sector developed in the decade of the 90´s had as a central principle the search for the efficiency of the provision of service for the end-user, motivating the participation of the private sector, introducing competition schemes where this type of activity was permitted and establishing a series of institutions that were in charge of defining the sector's rules and oversee its compliance.

Basically, the competition within the electrical energy market could be obtained in generation and market segments, while within the transmission and distribution segments there exists natural monopolies with a structure of regulated positions and open access.

The electrical energy sector has been taking important steps in the effort of consolidating competition schemes. Some of these achievements are as follows:

- We count with a wholesale energy market with more than 10 years of operation, time in which it has achieved its consolidation to the point that in a recent market behavioral analysis it is highlighted that "(…) the stock market prices have been converging around the median contract price that, at the same time, decreased it's variance notably, a

behavior which is consistent with an efficient market, in which the possibilities of arbitration[14] are minimized."

- Establishment of maximum participation on behalf of a business within the national generation total

- Specification of the obligation to maintain separate accounts for those businesses that do not disintegrate vertically

- It is permitted that the users can opt for a free market when their demands exceed the 100 kW or 55 MWh-per month

- For the regulated users it is established that the marketer should realize a public convocation and the adjudication be made with base to the least price offered, looking to take the competition's benefits to this type of user.

However, there are aspects that should be analyzed and on which we should act with the objective of consolidating the competition schemes.

The company which has the functions of MEM Administrator and the National Dispatch Center (currently XM) even though is an independent company, 99.73% of its capital belongs to ISA, the principle transporter of the country.

For the participating agents and possible investors of an electrical market, one of the aspects in which the transparency of the market is qualified is that the administrator and system operator not be controlled or have a direct link with a market agent.

Given that the key aspect to promote economic efficiency in the sector on behalf of the competition is to guarantee free and complete system access, the transmission activity, because of its central position in the system and market, configures a potential opportunistic risk. It is a decentralized market, as different academics refer to the subject[15]19, the transmission should function and operate as a separate activity.

In practice, the union or control of the administrator and system operator on behalf of a transmitting agent facilitates for example, as well as other situations of grave importance, information captures and technical captures in

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[14] MEM Follow-up Committee, Third Report SSPD, 2006

[15] Among others: NEWBERY, D (1999). Privatization, Restructuring and Regulation of Network Utilities. London: MIT Press-Cambridge, Massachusetts.

favor of the agent or weakness of the administrator and operator with the agent as far as
fines and penalties, which undermine and put into doubt the question of transparency and free access to the system.

With reason to this, in different countries the institutional organization of the sector had been designed to assure the independence of the administrator and system operator, as such is the case with the Independent System Operators (ISO's) of the United Stated of America, which even preserve in the states the vertical integration of its electrical industry, they were constituted as independent entities of the market agents.

It is irrefutable that the functions assigned it to the CND and ASIC, of which were in charge ISA through a "dependence with autonomous competitors" and now through XM, have been developed in the best manner. However, the actual bond implies that conflicts of interest could present themselves. Therefore, the independence of the company would represent advantages as to the transparency for the market participants, also being an aspect that potential investors will positively evaluate.

More than 60% of the capacity of the installed generation and 70% of the country's real generation is controlled by 4 companies, 3 of which count with the majority participation of the nation or of municipalities. As before mentioned in the first Objective, if the expansion projects required are not developed on behalf of the investors, the State maintains the responsibility to guarantee the procurement, with which the mood of assuring the provision of the service, the State could generate signals which don't favor the market development.

In this respect it is noteworthy to mention the reference made in the Colombian Vision Plan 2019 as far as the granting of the sovereign guarantee that the Nation delivered to EPPM: " As a short-term measure, and before the absence of other investors which execute projects, the Government considers as a valid alternative to support projects such as PORCE III, with the aim to guarantee the procurement of the demand during the planned period, while we await the new regulatory signals for the expansion".

Additionally, the same Plan emphasizes a new role of the State in which the character of the business is practically eliminated; however the State can't substrate its responsibility as a "last instance" provider of public services in the cases in which the private sector doesn't react to regulatory signals.

Even in this case, the state activity should contemplate specific mechanisms of activation points in such a way that the circumstances that could motivate the intervention be sufficiently known by the agents.

In the same way, confronted with the duality of being a businessman and a regulator, it is convenient to establish good corporate government practices in companies where the state participation is the majority.

Even though the event of the consolidation of the Energy Market Majority mentioned before, the analysis of the Follow-Up Committee to the MEM prove market power on behalf of some agents in determined situations, in which, being inappropriate the abuse of market power, the actions and faculties of the Superintendence of Public Services should be strengthened to disincentive anti-competitive behaviors and to suggest normative for the promotion of the MEM competence.

With respect to the competence in marketing, a recent analysis displayed by the CREG in the Document 065, 2006, titled " Definition of the generation component of the tariff formula of electrical energy", when reviewing the purchases destined for the regulatory market it was found that the agents integrated with generation (including business groups) attend to the major part of the demand with their own energy leaving a residual market for the non-integrated, an improper situation of a competitive market. In such a way that this aspect should be analyzed in relation with the vertical integration, mentioned at the beginning of this Objective.

As a mechanism in search of improving the contracting and avoiding the abuse and dominant position, the CREG has proposed the realization of public convocations by means of an auction mechanism via an electronic medium, anonymous and with a standardized product. A mechanism that in a second stage converts into the System Electronic Contracts (SEC), upon which the CREG has developed some regulatory proposals, including financial instruments which would provide the market with more liquidity.

The decrease of the limit to be a non-regulated user encourages competition conditions in the retail market, an increase in market volume of non-regulated users, taking price and service benefits to these users.
Additionally this would facilitate the increase of participating in the wholesale market, generating better competition conditions and price formation.

As far as the regulated users, if the existing legislation grants freedoms in the market selection or barriers exist such as high costs in the compliance of the measure requirement which prevents it from exercising this right that the law consecrates. In this sense, the flexibility of the requirements of measure is proposed for the regulated users that wish to change marketers with the purpose of making them benefit from the competition.

However, in order for the competition benefits of the retail marketer to materialize, it is important to count on a competitive wholesale market ,

awareness on behalf of the consumer so he has selection criteria, markets which support various marketers, and of course, adequate regulation.

Other aspects that favor the marketing competition development is the issuance of the Marketing Code, which proposes to eliminate entry barriers to new marketers and to define responsibility limits en the provision of services between distributors, marketers, among others.

With respect to the transmission of electrical energy, competences are present in the expansion given that the mechanisms utilized are public convocations conducted by the UPME, where they search for the plural participation and the investor with the minimum cost is chosen. Even though this mechanism has permitted to secure the expansions required by the National Transmission System, the participation of donators has been limited, in such a way that it results desirable conduct actions in search for a plural participation which guarantees the competition.

The **strategies** and **actions** laid down in this sense are:

- To continue the separation process of the company which has the functions of MEM Administrator and The National Dispatch Center (currently XM) of any agent that participates within the electrical energy market

- For the cases in which the private sector doesn't react to the regulatory signals and with the aim to guarantee the expansion required in the electrical generation activity, the development of mechanisms and activation points is proposed in fulfillment on behalf of the State of its responsibility of " last instance" in the provision of public services.

- To establish good corporate government practices within the companies with majority state participation meanwhile consolidating strategic investor bonding processes to these companies.

- Strengthening actions and faculties of the Superintendence of Public Services to disincentive anti-competitive behaviors and suggest normative for the promotion of the MEM competence.

- Develop actions and mechanisms which promote the market competition to assure the transfer of an efficient cost to the regulated and non-regulated market.

    - To consolidate the regulatory development for the energy-buying public convocations with an auction mechanism by electronic means, anonymous and with a standard product. Put into function the Standardized Contracts System .

- To make flexible the measurement requirements for the regulated users which change marketers

- Decrease the limit to be a non-regulated user

- To establish a Marketing Code

To apply the strategies that confront the vertical integration mentioned beforehand, especially for the electrical generation activity, with the aim to improve the market competition.

To conduct actions in the search of a plural participation in the convocations for the expansion of the National Transmission System.

5. Principal Objective 4: MARKET PRICE FORMATION OF THE ENERGETIC FUELS THAT ASSURE COMPETITIVENESS

In the energetic fuels sector the price policy is a fundamental mechanism to achieve the economic efficiency and it is constituted in an instrument whose signals are essential for the distribution and efficient use of these resources, just as for the adequate remuneration to whom provide such services. The prices, assets as well as energetic fuels services, impact the competitive productive structure of the Country and quality of life of the population, which require for its development and wellbeing a continuous and trustworthy supply at competitive and affordable prices, which are given in measure that there exists price equilibrium to facilitate the globalization of services, applying redistribution criteria.

In consequence, price policies whose signals are at the same time the result of the competition of the energy market, will contribute to create a Colombian energetic fuels system, more economically viable, more just, more equivalent and coherent form the environmental perspective. Even though this topic is closely related with the 3rd Principal Objective, it involves specific aspects that merit its treatment like an independent objective.

The analysis that is to continue shows the price formation concepts in those energetic fuels market segments which could be considered competitive. In the case of the energetic fuels subjected to the public service regime, the premise is that the regulation should have a tendency towards because the tariff structure reflects efficient costs, allows the maintenance of the businesses and benefits the Colombian users.

5.1 Crude Oil and Natural Gas

5.1.1 Exploration and production activities

In the first segment of the hydrocarbon chain, the prices reflect the world market behavior and depend on the evaluation that the investors make themselves, just like the profitability that they could receive for their investments in the country.

With the purpose of making conditions attractive for investment, different modifications were made to the contractual scheme and starting in 2003 we will count with a new model, which does not include the participation of the State, being the investor who assumes the risk in exchange to obtain the totality of the production rights, after royalties.

This model also includes a scheme to share benefits with the Colombian government when the crude oil prices surpass US$27 per barrel; one part of those resources will make up the future income of the ANH, whose objective is to promote exploration and production contracts.

In an international setting of high crude oil prices and under a new contracting firm, the exploratory activity has intensified within the last three years within the Country and the areas explored have increased by 38% with respect to 2001, and we await positive results in terms of new findings within the next few years.

In the particular case of natural gas, you could say that the price policy has been oriented towards the maximum price regulation in principal fields and the liberation of prices in new findings as well as in secondary and marginal fields of little impact in national aggregate production, which in practice they have as objectives the protection of the user and the continuous penetration of gas into the frame of the financial viability of the companies, at the same time granting signals which heighten exploration and search for new reserves of natural gas.

Currently we have price schemes for the two main natural gas production fields within the country, one of free prices for the fields Cusiana-Cupiagua and another with a maximum regulated price which corresponds to the Guajira field, which motivates the segmentation of the national system of gas in two markets with different degrees of development and coverage.

As you can see, the two fields have different production structures, which translate into a gas with different characteristics between one field and another. Breaking from resolutions CREG 018/2002 and CREG 050/2002 we opted for a regulation with a free price which permitted the gas from the

Cusiana field to fix prices in function with the market and taking into account the competition with the gas from Guajira which continues with a regulated price.

The new regulatory dispositions change in an important way the price perspective at the mouth of the well of the Guajira field, establishing two contractual options for the supply, as well as the Take or Pay scheme, which includes the bi-lateral option contract, written and to term, in which the buyer pays a freely accorded premium for the right to take a firm quantity and an accorded freely among the parties for the accepted and nominated gas, which could surpass the maximum regulated price.

In the first case or Take or Pay contract, when the real gas consumption is less than the minimum accorded, the resultant price is modified and the seller receives an inferior price to the regulated maximum price, with which we completely lose the sense of the contract to provide a minimum income for the producer which would allow him to recuperate the exploration risk investments and the corresponding ones in the field development phase. Things being this way, the scheme convert into a pay the demanded contract at the maximum regulated price without obligation or risk for the buyer.

With respect to the option to buy scheme, in the practice this measure takes with it the deregulation of the mouth of the well gas, which is also equivalent to saying that the entry prices of the National Gas transport System be defined by agreements of all the parties involved. This scheme seems to equilibrate the producers' forecasts as far as his income and permits greater flexibility for those users whose consumption levels are uncertain as times pass. However, the preoccupation on behalf of the users radiates the possibility of the price increase at the mouth of the well, a situation in which we could approach the substitutes, whose prices are in turn a ceiling for the gas prices.

However, like in the natural gas situation as in other types of fuels, since we are dealing with scarce resources and with high levels of world demand, tend towards international prices, with which they are giving the appropriate signals, waiting for greater activity in terms of exploration or the possibility of procurement with product from the international markets.

5.1.2 Transport of natural gas

With respect to natural gas, the fundamental principles that dictate the price formation of this activity are the economic efficiency and financial sufficiency, which translates into that the price to be recognized, should be that in competent conditions. The criteria defined by the CREG for the price determination in this segment corresponds to a regulation through incentives whereby the transporter assumes the risks of his income or profitability, which

constitutes it an active agent and its levels reached will depend principally on the commercial negotiation which will follow.

If the transport tariffs correspond at the beginning to maximum regulated loads, the transporter has the privilege of establishing discounts on the maximum tariffs if, in his concept, these decisions of a strategic character are needed to increase the market coverage, optimize income by way of increasing the use of its assets and not lose the clients. Subjacent to this methodology the distance signal, this comes close to what would happen in the competitive markets where the tariffs reflect the cost of the service provision.

The consequence of this situation is that the gas costs more proportional to the farther distance that the demand centers are located from the production fields as occurs with the markets of Bogotá, Medellín and in particular the West part of the Country, affecting the natural gas competitively as opposed to other energetic fuels fuel resources, which could affect the Transmission and Generation of Electricity Expansion Plan.

The methodology includes the concept of cargo couples, which allow the user establish the combination of fixed and variable cargo which most adjusts to the cargo curve. It should be noted that each cargo couple should be indifferent for the transporter, if the level of risks change from one couple to another; this is compensated by the tariff which increases in measure that you have a cargo couple with a greater variable component percentage. In case of not reaching a mutual agreement between the parties concerned, the regulation allows the possibility to hang on to the sequential approximation procedure, which converges to an intermediate point among the interests of the transporter and sender.

With respect to the tariff setting methodology it is convenient to study those based on stamped cargo, keeping in mind that in a natural gas market on its way to maturation such as in the case of Colombia, could achieved a greater penetration into natural gas by way of this model, more than in a scheme based on distance signals, what in a certain would encourage the deepening of the substitution of the situation in sectors such as transport and the industry, creating a greater competitiveness not only in the Coastal region and for exportation, but for the complete development of the internal market. On another hand, in legs where the utilization of the system is still low, a load of this nature could accelerate the gas penetration and improve the recuperation of the investments.

5.1.3 Distribution and marketing

The distribution activity in those areas of non-exclusivity is compensated by way of a scheme based on a collection of tariffs differentiated by consumer

ranges, in such a way that the total incomes do not surpass those that correspond to the cargo distribution average. The average costs at average-term are calculated compensating the base investment, the cost of the capital invested and the administration, operational and maintenance expenses.

The scheme also contemplates efficiency criteria like the adjustments between the total length of the distribution system and the number of users just like the cost adjustment of new investments by means of a definition of the efficient costs of the Constructive Units. Also, the regulatory determination structure of the distribution cargos according to tariffs per volume assure the economic efficiency by way of an assignation of revenues that are favorable short-term to the corresponding distributor, if and when they are allowed to order their tariff collection in the most convenient form.

In practice it is difficult to verify the compliance of the neutrality principle towards the consumer on behalf of the distributor. A consumer in particular does not have the elements to verify if he is being treated in equal conditions with respect to other users of similar characteristics, unless they have the information regarding the distributor's tariff scales and the specialized knowledge to make a deep analysis about the natural gas market.

The verification of the compliance of the premises that imply the tariff scheme is fundamental, as to the maximum loads they are determined based on an investment plan and if they are not contrasted with the compliance of the execution of works, could lead to the capture of additional revenue.

The formation of the marketing activity prices obeys the application of the frontier analysis method including Data Involvement Analysis, of a group of administrative or productive units for each of the market agents, of the annual expense variables of AOM and of the annual depreciation of the investments attributable to the activity, to evaluate the relative efficiency.

Advanced studies by UPME show a wide dispersion of charges, due in part to the different composition and size of the markets, but also to the values declared by the companies with respect to the analysis parameters. The greater difficulty is presented because of the lack of collective tariff information for merchant distributors according to consumption and producers – merchants over the price scales vs. volume. Possibly a business system with sufficient elements and information would give them greater capacity in the decision- making.

According to the legal codes, the residential users of low-income receive a subsidy originating from contributions from the high-income stratus (20%) and from commercial and industrial sectors (8.9%). In the same way, a special fund was structured to impulse infrastructure for development projects of natural gas in rural sectors with resources from the promotion quota paid for

by the users of the national transport of natural gas. Its field of application is directed exclusively at the confining of investment projects for the development of infrastructure which guarantee the provision of the natural gas service of the lower stratums in the municipalities and rural sector, primarily within the area of influence of distribution mains gas ducts and that have the highest index of Unsatisfactory Basic Needs.

One of the criteria defined to determine the viability of the projects is the cost comparison of transporting the natural gas, with the domiciliary public service provision cost of GLP in portable cylinders to the end-users, calculated according to current tariff methodologies established by CREG. This evaluation determines access to any municipality or population to the fund resources, even though the resources are not sufficient to attend the requests.

Currently there exists a greater demand of investment resources that those received by the fund, and thanks to the permanent and effective intervention that ECOGAS realized as a State company, the projects are being executed satisfying the expected. However, currently with the sale of ECOGAS there remain two functions that require to immediately defining the responsible party:
the administering of the resource funds and the supervision of the project execution. In consequence there is a need to identify the Entity to advance such obligations.

The strategies laid down in the natural gas and crude oil price formation that assure competitiveness are:

- Realize a study that allows to visualize the effects that the importing of natural gas would have on its final price, as well as the implications within the generation, transport, industrial and domestic sub-sectors

- With the aim to balance the regional consumption opening possibilities for the development of new markets, it is recommended to evaluate the convenience of using a stamped tariff calculated on the total system.

- Define schemes for the verification of the implementation of the execution of projects as to the investment pentad of the gas distribution companies, which reflect the real service costs.

- Identify the entity that administers the special quota sponsorship fund and the supervision of the execution of projects.
  Define the groundwork of a State Policy geared towards the GLP prices in rural zones and in the periphery of the cities.

5.2 Coal

Coal is a non-regulated energetic fuels resource and it would be hoped that it were the market that would favor the formation of efficient prices that benefit the development of the sector, one of which presents the greatest useful reserves. However, as described in Objective 1, the market characteristics for the interior of the country make it imperfect, being the internal demand the determining variable in the fixing of prices when this product is not internationally transable.
During 2004, there was a price bonanza in the international market due to an increase in the demand of coal coke, originating in the growth of the Asian market. This year, there was the opening of the external markets for the interior coal and its price reached historical records. However, the internal price bonanza ended due to that various coal shipments of coal and coke were not accepted by the exterior client because of non-compliance with the quality requisites, reason by which the demand dropped and the internal prices in 2005 descended.

The small and middle coal miner is faced with conditions that allow their existence but not an investment process for its modernization and expansion due to the demand. The efficient price formation is not viable due to market imperfections; this leads to the possibility of covering exploitation costs but not of an adequate compensation of the investments that entice a greater long-term demand and maintenance. The offer is found dispersed in multiple and small producers matched to some buyers with a strong commercial structure and negotiating power.

Also, the illegal miner, understood in the sense that the producers possess no mining title, create disloyal competition due to that they don't satisfy the laws and can offer the product at lesser value, generating imperfections in the price formation.

The **strategies** for the coal market price formation that assure competitiveness, added to those related in the consolidation objective, the market competence are:

- Propensity in the formalization of illegal mining and the strengthening of informal mining through programs that impulse the increase of productivity and satisfying the normative with actions such as improving laboral monitoring.

- Analyze the possibility of long-term contracts that allow the producers decide no the investment to be done to modernize the sector.

5.3 Electrical Energy

In the electrical energy sector there are different situations in the topic of prices according to the value chain that it is dealing with.
You could say that the optimum prices to the end-users are the result of the consolidation of competition schemes and the efficient design of mechanisms in price fixation to the end-user. At the same time, the optimum prices to the end-users should offer the adequate signals to guarantee the system expansion in each of the segments.

As to the generation and marketing of electrical energy, being competent activities, efficient prices will be obtained in the measure that there be results in the competitive and transparent market. The strategies laid down in the before mentioned objectives directed to controlling anti-competitive behavior within the Energy Stock Market as well as in the process of energy contracting destined to the regulated market, will conduct this objective.

The price formation of the generation includes the charge for trustworthiness, which according to the new normative would fix the price through a market mechanism and should generate the conditions for the permanence and entry of new generators required by the system. However, being the investor who decides the technology with which is participated, it remains to be seen the results of the charge application as to technology of the entry projects and consequently, the composition of the generator park, which is related to other projects which are related to others among the energy policy objectives such as the collective energy diversification and the maintenance of marginal costs that favor electricity exportations.

As to the regulated activities of transmission and distribution one should attempt that through the normative that recognized efficiency costs be translated, in the case of distribution and also for the regulated, characteristic of the markets.

UPME[16] studies indicate that in the distribution and marketing as regulated activities, there are certain inconveniences presented within the adopted efficiency schemes, because of the regional dispersion effects of the charges and due to the revision of the loses and the AOM costs, or for the average billing (for distribution and marketing, respectively). There also exists investment waysides recognized at the level of assets, such as radial lines and for the voltage levels which endanger the reposition, the continuity of the service and expansion. In this sense, the Ministry of Mines and Energy expedited decrees which deal with this problem.

As to the topic of subsidies and contributions, laws 142 and143 from 1994

[16] Design Study of an Integrated Policy of Energetic Fuel Prices, 2006, ANH – UPME

defined a scheme based on the principle of solidarity and redistribution of the income. The subsidy applies to defined subsistence consumption, while the contribution pays for the total consumption and the percentages are calculated over the cost of the service provisions
The initial objective of the Law of achieving a balance between subsidies and contributions in such a way that the IRS would not be affected by this concept, it was altered by the decrease in the contributions of the product the fall of industrial and commercial tariffs for the non-regulated market, while the subsidies maintained themselves over the maximums, an effect of the gradual dismount process to bring them up to code.

Additionally, Law 812 from 2003 established that the users from stratum 1 and 2 should have tariff increment equal to the inflation. This disposition produced in practice some subsidies for these variable stratum month to month and in the majority of the cases superior to the maximums of 50%and 40%, by which at the end would need a value increment of the contribution granted by the National Government.

From the subsidies focalization point of view, studies have calculated that an inclusion error in electrical energy (when it is delivered to persons which do not form part of this objective group, in this case of less income) of 50.8%[17].

Due to the stratification effect, high consumptions by rural users that receive subsidies occur, when in reality they should be classified into stratum 5 or 6;
as well as stratum 3, which isn't within the poverty limits, receive 12% of the subsidies granted.

Because of the before mentioned and considering that in the measure that the coverage indexes increase a greater deficit of the FSSRI will be generated, it seems convenient to study the application of the electrical energy subsidies from its focalization point of view with the aim to achieve the greatest coverage possible within the objective population and in the attempt to minimize the resources requirements of the national budget.

As well as the subsidies and contributions scheme, there are three more funds that gather resources from the electrical energy sector destined specifically in the following way: Fund for the Support of Energizing of the Non-Interconnected Zones - FAZNI, The Fund for Financial Support for the Energizing of the Non-Interconnected Rural Zones- FAER and The Social Energy Fund FOES. While this last one is maintained in 80% of the congestion revenues produced by the effect of the electrical energy exportations to Ecuador and it is destined to subsidy users located in difficult negotiation zones, rural areas of less development and sub-normal urban zones, the FAZNI and FAER funds are destined to the construction of

[17] Uniandes, CEDE. Exclusión e incidencia del gasto social, Nuñez y Espinoza, 2005

infrastructure to universalize this service. The negotiation of these funds will be seen in the following objective.

The strategies laid down for the formation of electrical energy market prices which assure competitiveness are:

- To permanently monitor the electrical energy wholesale market operations, including the energy auctions in related firms with the position of trustworthiness, with the goal to recommend actions which lead to the competitiveness of this segment of the electrical energy chain and consequently towards the formation of an efficient price

- Develop the normative necessary so that the distribution and marketing positions as a regulated activity tend to, when possible, have similar values for all the regulated connected to SIN

- Educate the electrical energy subsidy application from its focalization point of view with the aim to achieve the greatest coverage possible within the objective population optimizing the use of FSSRI resources.

6. Principal Objective 5: MAXIMIZE COVERAGE ALONGWITH LOCAL DEVELOPMENT

The universal access to commercial energy services is a way to increase the income generation opportunities, of improving the social climate and of contributing to the development of an environmental energetic fuels system sustainable for the totality of the citizens of today and for future generations.

A good part of the inhabitants of the countries on their way to being developed with low income live in rural areas and impoverished urban areas. They supply their needs with non-commercial sources of traditional energy such as the biomass, employing low efficiency technologies, in that way favoring environmental pollution and deforestation and generating negative impact for health and economic development. At the same time, it was detected that there exists a high grade of interdependency among the developed product of the isolated areas and the availability of energetic fuels resources.

Even though the general tendency towards urbanization is inevitable, offering the rural zone inhabitants energetic fuels options could potentially delay the migration to the cities because of the improvement of quality of life in the rural settings and because of opportunities that are offered in the development of productive projects.

In our country, just as the same in many Latin-American countries, the access to electricity and modern fuels is limited and scarce in impoverished areas

and rural zones as a consequence, among others of: absence of infrastructure to take the energetic fuels services, precarious economic conditions of the inhabitants to pay the costs of the services and because the solutions launched are not sustainable in the long-run.

Maximize the energetic fuels sector contribution to equity and social development of the most vulnerable citizens is nothing other than to better the quality of life of the communities located in the connected and non-interconnected zones,
rural population and low stratum of the population, via the programs of commercial energy access which impulse and integrate effectively impulse productive development programs of the regions.

For many years the Colombian State has been making investments in energetic fuels infrastructure, taking advantage of local energetic fuels sources to achieve to contribute to the development of these regions. In solar systems, small hydraulic plants and diesel plants, dozens of billions of pesos have been invested, of which a high percentage is not found functioning , have presented over- budget problems due to deficiencies in the design phase, or have a low useful life, providing a prejudice for the business of the State resources since non-integrated energy projects are financed to productive projects of the zone, which limit the permanence o the energetic fuels system due to the scarcity of the resources to maintain the operation.

An essential point to achieve the improvement of the conditions of life within the Colombian rural and in general the isolated areas, is the restructuring of projects with an energetic fuels portfolio which consults criteria of an economic, security and continuity type, in the procurement and minimization of the effects o f its use in the health of the users and the environment, including electrical energy and GLP with exclusive service area schemes.

Even though the problematic which registers in the negotiating of energetic fuels services within rural areas, the periphery of the cities and the non-interconnected zones is the same, the solution differs structurally and with greater reason when dealing with networked services. While the rural and isolated zones of the interconnected zones the actions for the improvement of the provision of services should be geared towards the bonding of the community so they can develop support activities, in marketing and distribution, in the case of the non-interconnected zones any energization program should consult the development perspectives and possibilities of the community to be attended assuring that the provision be sustainable according to the income and benefits they can cause, and not an additional cost for the user and the State.

6.1 Non-Interconnected Energy Zones

Many efforts have been made in the so called non-interconnected zones - ZNI with the purpose of improving the quality and the quantity of the electricity service, investing many important resources originating from the national budget, royalty funds and FAZNI.

Within these electrical energy coverage areas, 34% and 96% of the generation originate from the thermo plants which utilize as a fuel ACPM.
Even though there has been much achieved progress, the coverage is still low, the service is insufficient and limited and the energetic fuels potential of each region has not been taken advantage of, with which the development of the productive activities has been limited, which permit the generation of resources which tend to the social-economic wellbeing in the ZNI.

As a consequence, it is proposed to structure integrated projects for the generation and marketing of electricity in a regional form, which considers the availability of their own energetic fuels and its productive activity to guarantee the maintenance of the solutions.

In the design of these projects, the local authorities should get involved so they can be in charge of following-up the actions taken and form part of the implemented solutions. The community participation equally constitutes an essential element, it counts on the knowledge of the region's problematic and because they can contribute to decrease costs.

At the same time, it is necessary to establish a tariff scheme which adapts to the paying-capacity of the population, with direct support form the Government (resources originating from the funds) to achieve balance with efficient costs in the provision of service. The before mentioned implies a subsidy and contributions scheme revision and regulation en general, the same as a strengthening of the planning schemes and the promotion of concrete actions to broaden the availability of the service and improve the quality.

Conforming to the highlighted info in Related topic 1, it is necessary to evaluate in detail the inclusion of the non-conventional energy sources in the generation of electricity, employing technologies that take into account the zone conditions where the installation will take place and search for financial support from international cooperation resources or from the international coal market for the implementation of these projects.

6.2 The performance of the FAZNI and FAER funds

The FAZNI is nurtured from the resources obtained from the collecting of one peso ($1) for each kWh dispatched in the SIN, which is included in the prices that the generator charges the merchants and therefore, the end-user is carried-over in the tariff formula. In this case, it is the territorial entities, the companies that provide the electrical energy service and the IPSE the negotiators of the investment projects for improvement and new electrical infrastructure in the ZNI.

The FAER maintains itself through the payment of one peso ($1) for each kWh consumed by the Transmission System SIN, a contribution that the energy transport companies should make to the user via the transmission charge. It is destined to broaden the coverage and attempt to satisfy the energy demand within the feasible interconnected rural zones. 20% of the FAER goes towards normalization programs and network optimization of the SIM sub-normal neighborhoods. The FAER allows that the territorial entities are the plans, programs and priority investment projects negotiators for the construction and installation of the new electrical infrastructure.

The resources collected by these funds are plentiful, however its execution has not has a good rhythm, especially in the case of the FAZNI,
due to the scarcity of structured projects which guarantee its maintenance. To this respect we can mention that, if there indeed exists numerous energetic fuels solutions for the ZNI, there are found to be outdated and are in need of resources to develop a feasibility phase.

Given the limited technical, operative, and administrative capacity of the companies that operate the ZNI, the IPSE has come to assume the operations of the generation plants through agreements with operators, obtaining a better quality of service. In this line of action, the National Development Plan proposes[18] to structure negotiation schemes with specialized operators whereby incentives are incorporated to: introduce efficiency costs, better service provision as far as quality and coverage and the replacement of fossil fuels. This scheme is a commencement in resolving business negotiation problems, it should migrate towards concessions adjudication, in such a manner that they would assure responsibility for the coverage and where the community is involved as part of an integral solution.

It is hoped that the implementation of these schemes contribute to a better execution of the FAZNI resources.

Regarding FAER, The Indicative Plan to increase coverage, currently being developed on behalf of UPME, should contribute to establish the coverage levels, barriers and assignation criteria about the resources, which united to

[18] Conpes 3453, December 2006

the participation of OR in the structuring of projects, should facilitate the creation of objectives of achievement of the Fund.

6.3 Broadening the fuel gas service coverage in low-income stratum of the population

The natural gas massification policy has been particularly successful within the coverage extension of low-income stratum of the population of the influence zones of the natural gas transport system. It is estimated that 85% of the residential sector attended with natural gas corresponds to stratums 1, 2 y 3.

However, the penetration of fuel gas could broaden in low-income stratum and rural zones, for which competitive analysis between natural gas, electricity and GLP should continue, with the goal of establishing which is most convenient for a particular region, according to minimum costs criteria.

Whichever may be the energetic fuels, the joint and active participation of the community is necessary, so that with an adequate training in administrative and technical areas positive results could be achieved, inducing less costs and greater benefits for the community.
In dealing with GLP, it is precise to determine the most adequate tariff scheme with the payment capacity of whom receives the service in rural and marginal zones with the goal being that the service be complete and efficient, counting on the direct support from the State as a tool destined to guarantee a secure, equitable and competitive market keeping in mind the environmental advantages and the lesser user health impact.

6.4 Impact of the country's interior coal on local development

Subterranean coal mining within the interior of the country has been characterized by being intense in its use of man power, since the majority of the labor is manual and with low technology usage, as well as being one of the few sources of local employment. As it was mentioned in former chapters, within the coal sub-sector in the interior of the Country, illegal mining thrives, which implies with it serious consequences from a social point of view such as avoidance of the minimum rules of industrial security and the informal contracting of employees with our attending to their social security obligations. This situation as well as generating negative consequences for the development of the coal market, does not facilitate local development.

For these reasons and those exposed in analysis already presented, coal mining from the interior requires a commitment from all the sectors involves to advance the proposed actions with the objective to generate market and

competitive which lead to an improves local development and quality of life of the miners.

The **strategies** laid down are:

- Maximize the energy service coverage of the Country, for which it should:
  - Elaborate the energetic fuels resource portfolio for the provision of energy services in rural zones including environmental criteria, well-being and the health of the population.
  - Design non-conventional source of energy for th generation of electricity, including the modifications of a regulatory order that may be necessary
  - Optimize the utilization of natural gas or of the GLP according to the minimum costs criteria
  - Evaluate costs, subsidies and investments of the GLP program for rural and isolated zones, with the goal to determine the possibility of structuring exclusive areas , Apply and follow-up the indicative electrical coverage plan elaborated by UPME, according to the Law established
  - Establish particular electrical tariff schemes for the non-interconnected zones, with direct support form the Government, which allows the communities not only overcome the difficulties faced to access a better way of life, but also to increment its productivity and relative importance within the national development.
- Consolidate negotiation schemes with specialized operators where incentives are incorporated to: introduce efficiency costs, improve service provision as far as quality and coverage and the replacement of fossil fuels. For the long- and short-term of the ZNI it is proposed to migrate to exclusive area establishments of service negotiation (concessions) with the goal to assure responsibility for the coverage and where the community is involved as part of an integral solution.
- Advance energy programs within the connected and non-interconnected zones, associated with local productive development systems of the community in the negotiation scheme, with the goal to increment the income level of the population and give them the maintenance in the provision of service.

- Re-enforce the institutionalization and revise the associated normative with the development of the non-conventional sources of energy, consolidating information systems, training the communities and defining financial schemes to encourage the implementation of projects.

    - Keeping in mind that the development of non-conventional energy source projects in rural and isolated zones involve environmental, agricultural and energy authorities, it is precise that within the CIURE scenario to accord on the schemes and modalities to follow so that the implantation systems count on the deserved State coordination.

7. Related topic 1: NON-CONVENTIOAL SOURCES - FNCE AND RATIONAL ENERGY USE– URE

Before the need of supply alternatives which mitigate the current grave global impacts on the environment and economies, occasioned by the emission of fossil energy sources, the developed societies of the world are oriented toward a policy that looks for a reduction in the risks of external supply and realizes great efforts to take advantage of renewable local energetic fuels sources, stimulating and facilitating the technical, scientific and economic infrastructure mediums.

On another hand, there are warnings of growing demands, unreliable procurement, elevated and unstable petroleum prices and global-warming which now obligate us, while we still have some time left, to reconfigure the energy supplies, achieve less consumption, develop and investigate alternative sources other than crude oil and those which cause major environmental problems.

In Colombia, consequence to the implemented model and without imbalance between the offer and demand of energy, there was little attention given to the development of successful policies directed to include en the energetic fuels collective the use of non-conventional energy and efficiency programs, oriented towards taking better advantage of the available energetic fuels resources.

The Country counts with an important normative buffer active for the last 5 years, being the first of them the Law 697 of 2001 and however, the concrete results in which makes the URE development projects and the inclusion of non-conventional energy sources within the energetic fuels matrix, are not satisfactory. In a similar way to other developing countries and in the Latin-American theatre, the reason is attributable to barriers of a different nature such as an inadequate institutional background, little continuity in the implementation of public policies and the IRS and price policies, so much for

the electrical energy s for the fuels, that impact in different forms the energetic fuels efficiency and penetration of non-conventional sources of energy.

These barriers can be classified as technical, economical, financial, legal, and institutional, where the economical, financial and institutional barriers seem to prevail in the results reached up to now.

As to the economical, it is not probable that the non-conventional or alternative energies could substitute the traditional energetic fuels in the generation of electricity and reach competitiveness in an energy liberated market, where the generation and cost average of investment and cost are the only comparative among the technologies that utilize fuel fossil fuels and those that use renewable sources.

The financial barriers are found united with the operation of the markets and the need to establish via clear and stable regulatory frame mechanisms which permit the decrease of the financial risks that the companies should assume. Another reason could be the difficulty to apply to the international funds for the co-financing of URE programs and non-conventional energy sources due to the complexity and slowness in the proposals preparation.

The institutional barriers are found united with the lack of intervention of the Government in defining the clear and precise policies regarding the development of URE projects and the broad utilization of the non-conventional energy sources, just like its integration in the development of the Colombian energy sector. One of them is the perception that the markets are sufficient mechanisms for an efficient assignation of the resources and that consequently they will all give the appropriate signal to promote the sustainable development of the Country.

Obviously this focalization with respect to the FNCE and URE is not used by the developed countries that also operate under efficient assignation rules based on price signals, but they are found prone to re-enforce through specific promotion instruments, when they detect insufficient marker mechanisms.

In the same way the phenomenon is verified, due to the absence or too little promotion of negotiation programs on the side of the demand due to, in particular, the lack of interest of the companies that market their energetic fuels, which's rational, obeys the maximization of its benefits.

It is not foreign to this the weakness of the voluntary etiquette programs and the contradictions that present themselves among the interested providers and importers of teams that operate within a market scheme, adding to fact that the scarcity of revenue on behalf of many sectors of the population conduce to an inefficient fitting out .

In the same way the weakness of the controls of the Superintendence of Industry and Commerce lead to that there exists in the market products that don't correspond to the low typology under which the product is found conformant to the declared technical rules.

With the aim to count on the strategic addressing in the case of URE as in the non-conventional energy sources or renewable energies, is considered necessary to separate the policies of actions and instrument of each one. It is convenient to elaborate convergent instruments and actions, but at the same time that they be autonomous and independent, but when it deals with fields that present technological characteristics, very different economic and social impacts and above all because the intervention modes and public policy formulation are different. Also, the strategic and objective actors on which such policies should impact in a positive and opportune manner are completely different.

The FNCE include and affect the generation of energy and the substitution of conventional sources, involving very specific actors and interests, as is the case of the generating companies. On the contrary, the actions that propend for the optimum resource advantage imply conservation measures and an opportunity for economic savings, but also a need, even an investment obligation in more efficient equipping, with the double-goal of saving energy and decreasing costs, these being from production, if we refer to the industry of operating in the commercial sector or from services and from expenses within the residential sector.

The URE measures typically require specific promotion actions towards the industrial and service actors of the Country, and in the case of the families and the common citizen, a particular treatment so that, long-term actions and instruments that create awareness regarding URE could be incorporated.
In this sense, there exists a number of related topics and the need of fine financial architecture, of public and private inter-institutional coordination so that the URE reaches to materialize itself through specific programs.

7.1 Non-Conventional Sources of Energy

In the Colombian normative frame, the non-conventional sources of energy, according the definition established in Law 697 of 2001, refers to those sources of energy found to be available, but that within the country are not employed or they are utilized in a marginal way and not widely commercialized. In this sense, the renewable energies are found dispersed throughout nature, they are not susceptible of concentrating themselves as do the conventional energies, and they favor a use that is within the reach of

many and in more equitable and substantial conditions, with a greater social and environmental justice possibility.

The use of non-conventional sources of energy has been coming into use as a valid alternative to avoid the destruction of ecosystems and decrease the risks and damages at a planetary scale which represent matters such as climatic change or the deterioration of the ozone layer, due in great measure to the consumption of fossil energy.

If in Colombia hydraulic energy represents 75% of the generation of electricity, even though it is a renewable resource its socio-economic impacts of the ecosystems should be considered. On the contrary, the small hydro electrical projects PCH have only a small participation and a minimal impact on the environment and are classified MDL. Highlighted as innovative in Colombia is project Jepirachi with an installed capacity of 19.5 MW, wind-driven energy, whose generation does not produce major environmental impact, it contributes to reduce gases of the greenhouse effect and does not involve combustion. It equally presents some limitations such as the amount of energy generated depending on intermittent winds, which is why it can not attend to a continuous energy demand and should be associated with other sources.

The first wind-driven project was possible due to the union of various factors: the velocity level of winds in the Guajira, the special condition of the port, land transportation facilities, network connection, special customs zone, minimal impacts on the environment, and compatible, expandable and replicable scalability. Also, it contributes in the identification of aspects necessary to study the improvement of the wind-driven generation conditions such as: transfers, licenses, dispatch, trustworthy position, offer and dispatch forecast in the MEM. In this case EEPPM was willing to take tolerable financial risks for I+D thanks to " feasible" alternatives for benefits of the science and technology law COLCIENCIAS, the capture of coal for emissions reduction and soft credits.

Other advanced programs based on the utilization of non-conventional energies are the production of bio-fuels. Currently one million liter of alcohol is produced daily destined to the fabrication of oxygenized gasoline which is able to cover 57% of the current demand and we don't foresee an important increase of the alcohol production from sugar cane.

It does not seem possible to extend the agricultural border for new sugar cane crops in the Valle del Cauca which is the region with the best productivity indexes in the Country, of which is concluded the new projects in other regions of the country could experiment difficulties at the time of establishing the closing-economic equation.

There exist possibilities of alcohol production with other raw materials such as corn, casaba, milo maize and beet in general and any other sugar biomass, but it requires investigation and development. Within the country we still don't have the technology in the agricultural field to produce these inputs on a large scale, only some small advances in casaba and beet crops.

In the case of the biomass cultivated it is necessary to keep in mind strategies and maintenance studies that avoid the increase of the price of foods,
the depletion of the surface soil and guarantee the water availability,
laying down signals to utilize the less fertile lands and the reforestation. The utilization and exploitation of the biomass residual and the biogas in rural zones from animal and vegetable wastes could contribute to part of the solution of the energetic fuels needs of these zones.

There is also the option of the sanitary landfills, an energetic fuels valorization alternative which could be utilized for the formulation of Clean Development Mechanism projects of the Kyoto Protocol (MDL), and which allows to utilize the gas product of the urban solids residuals by way of flaming, to decrease the emission of the greenhouse effect gas(methane) and the utilization of thermo energy as an energetic fuels valorization alternative in the substitution of other energetic fuels, even the generation of water vapor and/or electrical energy in vapor or gas turbines.

As far as bio-diesel, it is planned to produce it from palm oil and substitute 5% of the ACPM demand. There currently exists a surplus production of oil, enough to produce the bio-diesel necessary to substitute 5% of the demand and there exists plant and a new seeding program. However, there still exists uncertainty as far as the endorsement that the vehicle producing companies to use mixtures superior to 5%, for which is required an exhaustive test on the motors of the vehicles, and with the different types of bio-diesel that can be produced within the Country, before making a decision to increase this level.

Another energetic fuels alternative is solar energy with its different technologies. If the one-family house would have considered its solar system design in photovoltaic panels as in solar collectors or simply an appropriate housing design to fully take advantage of the light and heat in comfort, it would contribute to the liberation of coal dioxide (CO2) to the atmosphere. In Colombia it is estimated that only massive programs in new housing and with payment time limits of 25 years would permit the viability of the implementation of these systems, even with crude oil and volatile gas prices and tendencies of long-term increases, the entry of alternative sources would be profitable in less time and with less effort.

Geothermal energy is a new energetic fuels option so much for its employment of electrical generation as in its supply of heat; there is research on uses on behalf of INGEOMINAS.

Even though Colombian advances in the use of non-conventional sources of energy and of the technological development in the world field in the generation of electricity and supply of energy from these sources, it is evident that the generalizations of the use of renewable sources of energy have not increased as was expected. A possible explication of this situation are the financial criteria of the electrical supply companies which favor low initial costs and permanent costs (each time higher) of fossil fuels, in places with initial high costs and low or no costs of fuels (non-conventional sources). The high initial costs prevent the generalized development of renewable energies technology.

There exist other additional factors that favor the use of conventional generation systems such as: the fuel subsidies, costs of the fuel storage and transport infrastructure defrayed by the public, availability of financing for low initial cost projects, absence of charges or penalties for environmental impacts and possibly resistance to change.

Within the non-interconnected zone, the possibilities of implementing energization projects are greater based in the non-conventional energy sources and constitutes one of the most important market niches for these energies, just like mitigating the poverty of its citizens. Today the production of electricity within the non-interconnected zones is 95% effective with ACPM.

However, the perspectives are changing and as well as providing well-being to the communities, electricity and rural energization in general as broader concepts, the extension of a network of assets supplies and energetic fuels services are laid down and can contribute to the productive development of the communities and eventually reduce the migration towards the cities. As is known, in a determined development phase of the cities, such migration no longer guarantees a better level of life and creates serious marginal problems with an elevated social cost and deterioration of the quality of life.

The **strategies** proposed to implement the use of the non-conventional energy sources in the generation of electricity destined to the rural areas and with the purpose of being sustainable in the long-term are:

- Strengthen the institutional scheme with a propensity to the promotion and development of non-conventional sources of energy adequate to the national needs.

- Promote the participation of renewable energy sources, incorporating the necessary incentives through promoter schemes or concessions for the ZNI. In this point a socio-economical analysis of each region is necessary with the aim to determine the most convenient technology,

according to the availability of the energetic fuels resources characteristic of the region.

- Define direct subsidies for rural energization. In zones where the market conditions are not so attractive for the companies, the state can directly subsidize the investments in projects with non-conventional sources of energy. It is advisable that such mentioned subsidies be direct, explicit in the national budget and be destined to cover the investment costs of the projects being supervised their execution.

- Restructuring of the subsidies. Traditionally many rural energetic fuels needs through subsidies for conventional fossil fuels, including diesel and kerosene. Since renewable energy requires an initial investment capital in place of fuel expenses, it is important to restructure the energetic fuels subsidies applied to the non-interconnected zones so that the renewable technologies can be applied.

The **strategies** for a greater use of non-conventional energy sources in relation to the energetic fuels production are:

- Advance studies which permit verification of positive results in the performance of the vehicles, with increases in the mixture of ethanol and bio-diesel defined in the regulation.

- Initiate investigations for the production of alcohol from cellulose.

- Initiate the financial and economic analysis of the importation of raw materials for the production of bio-fuels and evaluate its incidence on the final price.

The UPME has been developing the Atlas of the energetic fuels resources which should be the base to estimate the potential the Country has. The current updates should be continued to be developed of the availability of the resources and realize local evaluations in the most interesting sites for each type. To count on this updated information will be a means to proportion the interest of the potential investors and decrease its perception of risk.

In the case of the interconnected system, as well as advancing towards the identification and quantification of potential projects within the Country, the access to MDL type mechanisms should be promoted to obtain resources that allow to finance energization projects based in alternative energies for the generation of electricity as well as substitution uses such as heating water, electrical illumination etc. Additionally, in Colombia there exists a series of exemptions for projects that contribute to the energetic fuels

efficiency, in such a way that that to take advantage of these mechanisms major inter-institutional coordination be it public or private, is required.

7.2 Rational Use of URE Energy

As mentioned beforehand, the URE measures are routed to the development of projects where energy from fossil fuels is saved and/or is substituted by a currently imported energy (or less abundant in the country) for another originating from a better (or greater) local available source, to achieve the aim the reduction of greenhouse effect emissions, and the maintenance assurance of the activities of the project object, above the mere concept of economical benefit.

Consequently we are searching for more than just a reduction in the absolute consumption of energy, the decrease of specific consumption (or relative) of energy, associated to each one of the activities. For example, within the industrial sector we are attempting to decrease the relation energy consumption / production, in other words, consume less to produce the same or consume the same amount to produce more.

Similar consideration can be done with other activities: in transport, the consumption of fuels by the ton of product transported and/or by the amount of passengers transported; in the business, the energy consumed by unit of product sold; public lighting, energy consumed by number of inhabitants, among others.

Specific examples are found within sectors such as commercial and residential where problems are presented in the refrigeration systems due to lack of maintenance, inappropriate modifications and the age of the equipment with which the URE programs in this field could contribute to the reduction of energy consumption.
Another point detected is the bad use made in regard to the lighting, so much in the use of inefficient bulbs as in the inappropriate way that energy is being wasted and provoking health related problems due to its excess (illumination levels 10 times more than the necessary amount as required by international specifications which leads to vision problems, have been detected in businesses) or by defect.

The same as in the case of non-conventional sources of energy, Colombia has a guideline for the development of URE where subprograms which form part of the Efficient and Rational Use of Energy Program and other forms of non-conventional energy are defined PROURE. However, the concrete advances as far as an effective implementation of measures, projects and investments tending to achieve a decrease in the specific energy consumption, have been scarce in relation to the existing potential.

It is noteworthy that this is not a product of a specific Colombian inefficiency, but that it is a common situation presented in developing countries. This is due to the difficulty of facing a topic as is the URE, which has technical, economical-financial, fiscal, cultural, regulatory, environmental components, among others, which notably increases the difficulty for its promotion and development.

Even though the URE projects are socially highly rentable, the decentralized market mechanisms are not enough on their own to achieve that the same can be realized. The existence of very varied natural barriers (relative factors of a macroeconomic context, institutional plan, technological field, to the structure and workings of the energetic fuels markets) that the free chose of the private actors conduct to the decision of taking advantage of important investment opportunities of efficient energy.

On another hand, it is clear that taking advantage of URE potentials necessarily implies investment requirements and/or consumption habit changes. The fact of these actions do not surge spontaneously on behalf of the permanent actors, indicates that the decentralized mechanisms of decision do not conduct to optimize the country.

Institutional strengthening is required with the aim to achieve a true integration in public policies, which also permit synergies with private investment. It is then necessary the instance determinations and political authorities that establish the necessary mechanisms to intervene within the URE field in regulatory, organizational and coordination topics.

Breaking from the premise that the State should intervene in the URE topic due to its multi-dimensional character and the responsibility of the energetic fuels supply, it should establish promotion instruments to make the participation attractive to the private investors, when it regards options for the adequate use of energy.

With these considerations, the role of the Government should be as a greater protagonist and fundamentally dedicate its efforts to act as an action and project promoter, especially training, diffusion and public dissemination actions that allow the energy users, whatever sector the consumption may take place, have knowledge of what type of measures (investments or technologies, according to the case), are available on the market.

In the same way, it should assume an important role as an energetic fuels market regulator, having a tendency towards making current sectarian measures that promote URE actions and energetic fuels efficiency through its functions , such as : generate tariff signals to the market that induce to make an efficient energy use, introducing, in the case the political decisions

determine so, character explicit subsidies and putting them into evidence in the annual energetic fuels entities budgets that have the chore of assigning funds to their charge.

However, the determination of an adequate price signal is a necessary condition but not sufficient so that a URE project market can develop. There should be other additional regulatory signals to promote, for example, the co-generation or auto-generation of energy generated by way of these systems, because of its elevated global efficiency.

Keeping in mind the diverse elements that the URE actions imply, and in proportional form the government entities with inherency on the topic, a greater interaction between the State organisms related to the energy topic is fundamental, so that the conjunction of URE promotion actions can go forward. In this respect, the creation and pitting into practice of the CIURE was an important step but you must advance in the implementation of the programs.

One of the greatest weaknesses in the development of the projects is the investment financing associated with these. Even when there have been some attempts of involving the bank in this type of assistance, the achievements are none because of specific credit lines for the development of projects, which in their majority require change in their final energy equipment usage. Consequently, the mechanisms to achieve the access to the resources and the platform in which the impulse of the URE programs should be defined.

To specify the projects, the UPME proposes to develop the following scheme:

- The first component of the proposal implies that the Ministry of Mines and Energy define the execution scheme of its policy decisions and strategies regarding the matter. This includes the adequate coordination of the policies to fix the energetic fuels prices and the entities directly in charge of their fixation, watch out for the normative stability that regulate the aspects related with the URE projects and define clear goals in the reduction of energetic fuels intensity for the short, medium and long-term. The Ministry of Mines and Energy should implement the PROURE as a gradual plan which moves forward with defined goals, accompanying these actions with financing and divulging mechanisms.

- The second component of the proposal at short-term is to assign to the UPME the monitoring responsibility and information management. In this sense a structured scheme that allows the management of data related with the totality of the aspects involved in the analysis and execution of the URE project, the interchange of such data between all

the agents interested in this type of project and the retro-alimentation of the Ministry of Mines and Energy with respect to complying with the strategies with advancing the URE in an agile and precise way is required.

- In third place, it is necessary to define the structure that studies and defines an incentive plan that should be realized, depending on the size of the sectors. The incentives for the URE projects should reflect superior conditions than the ones normally gotten in the market. In this sense, the incentive should be given principally through creditor conditions, so much in the facility of its yielding as the interest rated offered. The level of incentives, the guarantees and other aspects of that nature are details that should be defined for that functional structure in charge with the execution of the strategy and for which is in charge of this function.

- Having realized the before-mentioned points, its precise that the CIURE define the programs and sectors where the URE actions take place, prioritizing the actions with the following criteria:

    - To consider and rule on the intensity of the energy consumption, be it electrical or thermal, for the different sectors, (especially when it has to do with the construction of commercial, industrial and housing buildings).

    - Determine the sectors where the impact of the URE projects is greatest, corroborate that the action within the chosen can really be taken to completion.

    - To establish which are the investment resources required in for the execution of the URE project and the identification of financial sources.

    - Finally, the implementation time and period of repaying the investment should be considered.

- Once the projects were determined we should proceed to the implementation with the help of third parties, corresponding to them whom develops the function of monitoring and of the information bridge, to coordinate with the different organisms and guilds the development of specific projects, under the guidance of the CIURE.

- Keeping in mind the training needs if the different Government fields and the private sector, this should be integrally developed by third

parties and it corresponds to the UPME which develops the monitoring function and of being an information bridge, coordinates the different needs among the different agents related to the topic.

- Following-up the projects is one of the fundamental activities in the implementation of the policies regarding URE. Under the coordination of the CIURE, the Government entities together with the UPME should follow-up and develop and inform on the results continuously.

- Simultaneously, investigation topics regarding URE topics can be defined, which should be accorded between UPME and COLCIENCIAS given the Country's characteristics and the investigation schemes defined within the normative. With the aim to reach a progressive development, this activity of URE theme investigation should be developed directly by third parties, m ay they be national or international.

The actions and programs realized in this theme are diverse and varied, for information purposes are listed as follows:

Industrial Sector

- Integral Negotiation of Energy program incorporating the development of URE practices, as has been realized with the environment topic, the negotiation of quality and others, in such a way that the pressure is reduced within the offer and this translates into an improvement of the industries competitiveness.

- Optimization program of the use of electrical energy for impelling force. A little more than 70% of the electrical energy that is utilized in the Colombian industry is associated with the use of electrical motors. Between the energetic fuels efficiency options for this last use, we highlight the utilization of "high performance" motors, the adequate dimensioning of the motor and implementation of maintenance programs.

- Co-generation program for the industrial sector, making the current normative background adequate to promote the use of co-generation and tri-generation plants within the national industry

- Upgrading illumination Technology Program, considering the lighting designs required for the adequate development of productive activities and better energetic fuels performance

- Optimization program of the combustion processes with preventive and corrective actions within the boilers in the vapor generation and thermal machines in general.

Residential Sector

- User information program for an adequate appliance purchase, fir which is recommended the efficient energy label. Propitiate the use of efficient energetic fuels technologies in the final energy uses, offering information to the users that acquire equipment, with respect to the energy consumption of these, through the energy efficient label supported in the NTC Colombian Technical Specifications.

- Refrigeration park upgrade program, to mitigate environmental impacts associated with the use of SAO Ozone Layer Depleting Substances used in the refrigerants and as foams within the refrigeration parks produced in Colombia, replacing it with technologies, which according to the NTC 5020 are classified within the ranges A and B of energetic fuels performance.

- Massification program of efficient luminaries integrated with programs that take adequate advantage of the illumination, be it natural or artificial

- Development of bio-climatic architectural programs applied to social interest housing, in principle, but extendable to the other social-economical sectors to achieve the least energy consumption per home and the greatest comfort.

Commercial sector

- Implement a co-generation program for the commercial sector

- Refrigeration park upgrade program and space conditioning

- Efficient luminary's massification program and regulation of the illumination systems.

- Energy consumption regulations in commercial centers to take them to efficient levels.

Official Sector

- URE educative program, inclusion of the topical URE in the academic contents that are developed in Colombia at the formal and informal education level, and for the different educative levels such as primary, secondary, technical, professional, post-graduate and doctorate

- Grant incentives that are considered necessary with the goal to orient the official self-propelled renovation park and efficient buildings

Transport Sector

- Integral management of the transport demand: to continue developing actions for the sector from the demand point of view, keeping in mind the objectives as the solution to parking problems, improving the roads, improving public transport, scraping vehicles, contaminants emissions reduction, road safety and congestion reduction and continue with the educative campaigns.

Obviously for these programs to be successful one should contemplate the conjunction of impacts that its implementation provokes, with the goal to coordinate between the actors a chronogram that makes the viable.

8. Related topic 2: THE ENVIRONMENT AND PUBLIC HEALTH

The evolution of the world's energetic fuels sector is closely related to the development of the countries, at the same time generating influence on the environment, product of the combustion of fossil fuels and of different ways of producing energy.

The increase of contaminating emissions and the concentration of gases that provoke the greenhouse effect and its incidence on the planet's temperature change is one of the principal environmental problems on a global, regional and local scale, for which we are seeking solutions based on international resolutions and agreements.

The most significant advance towards that objective was given in the Kyoto Protocol, whereby the industrialized countries committed themselves with specific reductions of greenhouse gases emissions.

With the accelerated increase of the energetic fuels consumption, the whole world is starting to make an effort at a global scale to achieve stability of the concentration of gases, due to the changes that are being noticed within the dynamic of the climates and its implications such as droughts, flooding, hurricanes and the melting of the poles.

In the case of Colombia, even though it doesn't form part o the countries that form part if the commitment to reduce greenhouse effect gases, there exists awareness regarding the need to modify how we use and consume energy, due to the health problems originated by the quality of air in the major cities of the Country, as is the case of Bogotá, where negative consequences for citizens because of the calls to Acute Respiratory Diseases, which seriously affect the infantile and third age population.

In the world of the self-propelled vehicles industry and the refineries have had to concentrate their efforts to comply with each time more demanding environmental regulation. The results have been levels of sulfur less in the fuels and emissions specifications each time more demanding for all types of vehicles. In the same way the long-term environmental challenges and stricter requirements awaited in the future are driving scientific investigation and technological investigation.

In countries such as ours, the number of vehicles is increasing exponentially and the fuels with high sulfur content continue being the standard, as well as the non-existence of incentives for the introduction of new vehicular technologies. The last generation vehicles designed to utilize fuels low in sulfur, could obtain a 50% or higher efficiency improvement with respect to vehicles form the previous generation.

The transportation sector consumes close to 39% of the national energetic fuels collective and as such deserves priority treatment within the maintenance development background. The emissions provoked during the combustion in the vehicles depends on the fuel and the quality, type of motor technology, age of the vehicle, pressure conditions (altitude above sea level) and atmospheric temperature, of the road conditions, (state of the roadways, vehicular congestion) and on the maintenance operations practices of the vehicles (driver's culture).

For these reasons, a strategy for clean mobility should be set in place along three main lines: improvement in motor technology, restructuring vehicular traffic and the quality of the fuels.

Minimize the impacts on the environment and public health is a line-up that is incorporated in the PEN 2006-2025 with one reflection: the benefits of a firm and early action for the protection of the environment compensates in the long-run the economical costs incurred without taking action. Under this context, being the public well-being a related topic in many activities, sectors and organisms, plans and development programs should be executed a synergetic approach within the different territorial fields and with a shared vision of objectives among all the agents and authorities.

The individual action of the energetic fuels authorities is not enough to offset problems that have been generating because of the consumption of energy; the creation of a shared multi-sectarian vision is essential, securing the spaces so that each entity or participant plays a role which permits the achievement of common objectives. With the purpose of reducing or at least stabilizing the contaminating emissions, it is proposed to work in the following fields:

8.1 The politics of quality of the fuels derived from crude oil

The increase of the number of vehicles in the main Colombian cities is a consequence of urbanization and growing economy, it has been generating great environmental impacts because of the emissions from the combustion process.
One of the greatest problems is associated with the presence of sulfur. This is on it's own a contaminant and no significant reduction strategy of air pollution could give any positive results without first reducing the sulfur from the fuels. The presence of sulfur has come to be considered as harmful as it was back in its glory day as lead in gasoline.

The developed world has precise goals to lower the sulfur content to less than 10 ppm starting in 2009. On the contrary, Colombia after various postponements, has planned to reduce the sulfur in gasoline to 300 ppm and diesel to500 ppm starting in 2010. For this, ECOPETROL will invest around $600 million dollars in its refinery in Barrancabermeja. This amount is very close to the estimated annual costs ($1.5 billon)[19] for health effects attributable to pollution.

Due to the gasoline and diesel desulphurization costs in the lowering of them to (10 ppm), represent important resources, the experts recommend that those countries that have not begun to reduce the sulfur in the fuels, do so in a single stage up to <10 ppm because it would be more economical than reducing in multiple stages,[20] therefore the balance becomes positive and the benefits are widespread because of the cost reduction.
Studies realized in the OECD[21] countries pointed out that the fuels low in sulfur (<10 ppm) significantly reduce total costs, directly incurring in a better

[19] Bjorn Larsen, 2004. Cost of environmental damage: A Socio-Economic and Environmental Health Risk Assessment

[20] Gasolina y Diesel de bajo azufre: La Clave para disminuir las emisiones vehiculares. Blumberg, Katherine O.; Walsh, Michael P.; Pera, Charlotte., for International Council on Clean Transportation (ICCT), 2003

performance of the fuel. The considerable potential to reduce greenhouse effect gases is an additional benefit to the positive impacts on health, environment and others, derived from the sulfur reduction.
As mentioned in Objetive1, the composition of the mixture of national crude oil will be more and more heavy, which difficult the production of fuels, less contaminants and there will be more fuel production and products with more contaminants..

On another hand, to produce fuels with international quality specifications, a medium converted refinery such as the one in Barrancabermeja needs deep technological transformations that go beyond the construction of some hydrodesulphurization units, sulfur recuperation and hydrogen production.
Consequently, a detailed evaluation is required to define if the current refining scheme in Barrancabermeja will be maintained, or if on the contrary it is precise to make much more significant investments (greater than $1.2 billion) to achieve a high conversion refinery, fundamentally for processes (such as hydro cracking, delayed coker) which permit the processing of heavy crude and in this way obtain fuels with a low sulfur content, which not only contribute to decrease the public health impacts, but would be able to widely market in the external markets with international quality specifications.

Keeping in mind the technological advances in relation to motors dedicated to the utilization of gaseous fuels, which have been translated into prototype vehicles that comply with low emissions demands and low fuel consumption, the program for the substitution of gasoline and ACMO for natural gas should be deepened.

8.2 Bio-fuels

The use of bio-fuels in transportation has two components. La technical basis and the technical and economical limits of its use combined use with gasoline and diesel, and the effects of their utilization looking at various aspects which go from the user and vehicular behavior, until the measure of its impact on public health.

The first topic is developed in Science and Technology, while the second mainly corresponds to the environment and public health. In this case, and considering that within the political development of the use of bio-fuels, it has been thought in the future of increasing the participation percentage of the

mixture, a complete evaluation is proposed and sistopical of the effects in the ethanol and bio-diesel chain committing the following actions:[22]

- Evaluate the effects in the quality of air due to the use of E10 mixtures, including aldehyde-acetate emissions changes, nitrous oxides and other non-regulated contaminants.

- Investigate possible effects on the bio-diversity that the intensification of cultures to produce bio-fuels could produce (African palm, sugar cane and any other type of bio-mass).

- Evaluate impacts and effects on the consumption destined to feeding, such as sugar, African palm and others.

Keeping in mind the internal supply in ACPM materials and the leadership of ECOPETROL for the direct production of bio-diesel, it is necessary to evaluate the performance of this new fuel in the big cities, en conjunction with the industrialists and assemblers, with the aim to establish the appropriate compositions to the Colombian case.

8.3 Technological upgrade of the vehicular park and emissions control

The population of vehicles at a global scale has been increasing at about 10 million vehicles/year. As the vehicular parks grows, stricter codes and regulations are needed and better technologies for self-propelled vehicles, including motorcycles which have had a vertiginous increase in particular due to the Asian industry boom.

In other research areas there have been parallel advances to improve automobile efficiency which could lead the world beyond the use of traditional fossil fuels, new materials so that the vehicles are lighter and renewable technologies that permit an important energy savings and contaminant emissions reduction.

Within the national scenario, in 1990 the vehicular park was 600,000 and for 2005
was superior to 3'600,000. The vehicular congestion since then is a critical problem that the authorities have not been able to resolve, and which the

[24]. Gasoline and Diesel low in sulfur: The key to decrease vehicular emissions. Blumberg, Katherine O.; Walsh, Michael P.; Pera, Charlotte., International Council on Clean Transportation (ICCT), 2003

[25] Bjorn Larsen, 2004. Cost of environmental damage: A Socio-Economic and Environmental Health Risk Assessment

environmental problem becomes more serious because of greater emissions. In the case of Bogotá, the positive effect produced by the transmilenio system in transportation, was annulled in a few years because the vehicular park grew to close to 50,000 vehicles/year, while the amount of roads remained the same, as well as the poor conditions they are in.

The emissions control program should be coherent, consistent and integral; based on regulator principles with the following characteristics:

- Emissions control during the life-cycle of the vehicle including motorcycles (in production, distribution and final disposition of vehicles and fuels)

- Define a price policy that internalizes environmental costs, which should re-enforce with clear specifications in areas of energy savings and emissions reduction

- It should be reinforced with clear specifications in areas of energy savings and emissions reduction

- Design of schemes and economical instruments to promote the use of cleaner and more efficient vehicles and fuels

- The emissions reduction measures should be designed in such a way that they should not incentive the growth in size, weight or the potential of the vehicles.

- The demand of the emissions standards should not be used to privilege differences between fuels; this generated distortions on the demand

- The programs should be designed to reduce conventional contaminants ,
  GEI, toxic compounds and the noise in unison, and not reduce some expenses due to the increment of others.

8.4 Environmental impact due to the use of energetic fuels such as natural gas, electrical energy, coal, GLP and others

The energetic resources have as a final objective to take care of the energy demand of the society in its different sub-sectors. Consequently, the need to evaluate the environmental impacts of its use to the end users of the same is imposed.

In the case of electrical energy, the utilization of fossil fuels could have an environmental impact, especially if the resource utilized is coal, diesel o fuel oil. With natural gas the impacts are minimal. Even in the case of hydro-electrical energy, the current energetic tendencies consider that the large reservoirs impact the social setting and environment due to the production of methane CH4 and car on dioxide CO2 which constitute greenhouse effect gases, the conflict between the use of water for irrigation and generation of electrical energy and the problematic of re-locating the affected communities due to the flooding.

In the case of coal, its major consumption corresponds to the generation of electricity, but it also supplies the residential sector in rural zones and the industry. Its contaminating effects due to combustion have brought new light upon new technologies that decrease their emissions.

In this sense, the help from URE programs should be demanded to the productive sector for the use of state of the art technology for emissions control. A different situation occurs in the rural sector, where it is necessary to develop an educative process with the aim to train the users in the proper use of this resource, with the aim to minimize its impact on health.

This special consideration on the rural sector is establishing one of the Principle Objectives of PEN 2006-2025 which signals the importance of maximizing the well-being of the Colombian countryside, supplying the adequate collection of energetic fuels.

As far as natural gas, it has a universal use and is favorable as far as its impact on the environment, so much in the generation of electrical energy as in the attention of the industrial, residential and commercial demand, as in its transport through the GNV.

In all these cases, the development of the energetic fuel politics should contemplate the minimization of the impacts on the environment, which comes from the planning processes until the development of the projects. In this sense the implementation of the strategic environmental evaluations should be strengthened.

With respect to the industry's emissions control, the use of heavy fuels such as heavy crude, used oils and coal, it is critical contamination factor within the cities and industrial corridors that deserve the authorities attention, especially the smaller industries that turn to any fuel to operate their installations without caring about their quality. The control to induce technological upgrade processes needs to be strengthened.

However, so the implementation of these measures isn't contradictory with the development of productive activities which contribute to their growth and

well-being Sin embargo, the specifications should contemplate realistic transformation chronograms through the creation of political and financial instruments which make them possible.

8.5 Clean Development Mechanisms

Colombia subscribed and ratified the United Nations Climatic Change Agreement and the Kyoto Protocol, however it has no commitments on the reduction of greenhouse effect gases because it is a developing Country.

The Clean Development Mechanism contemplated within the emissions reduction market among the industrialized countries and the developing countries, is an opportunity for the country and in particular for the fuel sector, so much that from a portfolio of 66 environmental[23] change mitigation projects that could currently turn to the international market of CO2reduction certificates correspond to the mines an energy sector have an emissions reductions sales contract two projects for the generation of electricity: the wind-driven park at Jepirachi and the electrical plant on the water at the Amoyá River.

The supply of electrical energy with renewable sources is a category from the portfolio of MDL projects. The use of renewable energies has long been becoming a valid alternative to reduce pressure on the offer of fossil fuels and in so reduce the contaminating emissions.

To mitigate the financially related barriers which prevent the incorporation and major use of non-conventional sources of energy, it is necessary to strengthen the cooperation schemes and national capacity to develop MDL projects which turn to the international market of emissions reductions certificates, and this adds to the benefits by deductions on the revenue tributaries for15 years for the sale of energy based on the wind-driven resources, bio-mass or agricultural residuals, as well as the IVA exemption in the importation of machinery and equipment destined to projects that generate certificates in the reduction of greenhouse effects gases.

8.6 Institutional Coordination

The environmental conduct related with the fuel consumption involves different sectors and does not exclusively depend on the environmental authorities or the Ministry of Mines and Energy. This is why its success in the

[23] Web Page MINAMBIENTE www.minambiente.gov.co, January 24, 2007

measures in which these topics are launched depends on an effective sectarian coordination.

The design of different Colombian policies should be realized in a closely coordinated institutional frame, which has a tendency towards the development of a productive apparatus in harmony with the environment.

One of the clearest examples of intra-sectarian coordination originates within the transport sector, keeping in mind that the environmental contamination solution derived form the use of fossil fuels is not only a problem for the Ministry of Mines and Energy in the improvement of the quality of the fuels, but of the Ministry of Transportation which regulates the entry of the vehicles policies and the transport policies of the Country which comprehends the definition of the transport modes and specifications of the roadways.

From another perspective, the institutional coordination is also necessary when attempting to define and apply the proceedings before the State, in this way if the institutions behave articulately, the procedures flow and the development of the infrastructure (without not knowing the compliance of the normative) needed by the Country is facilitated .

The hydro-electric generation is worth mentioning. Given that the Colombian generation park continues to be essentially hydro and the availability of such resource within the national territory is divided into basins whose flow rates have interdependency with and among their diverse tributaries, which are impacted on a large scale with the development of hydro-harnessing projects for electrical generation, this type of project should be subject to planning and hydro-resource administration specifications that assure its free access and availability, just as the equitive and rational of the same on behalf of the projects.

In this sense, the committees that proposed the Project Law 365 of 2005 regarding hydro resource planning should be impulsed.

9. RELATED TOPIC 3: Science and technology

The interactions manifested among the changes within the global, local and regional environments, with the economic and social spheres, are scouring the essential life support systems, some alterations such as climatic change, the loss of bio-diversity and the increment of social inequality, within a global economic context.

It is clear that not all the consequences of this interaction have a solution that involves science and technology, however from a technological point of view, there are many contributions to achieve energetic and fuel systems that

contribute to the economic prosperity and well-being of the population, without incrementing the environmental deterioration.

The globalization and market disengagement processes demand greater economic productivity and efficiency in aspects such as energy supply and utilization, at a time that it is precise to implement flexible energetic fuel systems to decrease the pressures on the depletion of the finite resources and has a proneness towards a competitive economy, which permits its insertion within the globalized world without deteriorating the access to the more needy sectors in commercial forms of energy.

The utilization of new technologies, so much in production as in the consumption of energy, will contribute in an important way to make the processes more efficient,
with which significant energy savings can be achieved, being an alternative to attend to the growing needs of the Colombian society, under the impostergable of implementing sustainable practices in reference to energy.

In this sense, the aperture also implies the introduction of imported technologies and artifacts, which should correspond to the specifications that contribute to resolve or mitigate the problematic laid-down. In this aspect an active participation on behalf of the Science and Technical sector is necessary to at least inform the consumers about the advantages and disadvantages of different alternatives. As is known, the short-term profitability criteria, insufficient incomes and the absence of habits are factors that contribute to a selection of artifacts and technologies not always efficient or clean.

Currently in the world a technological revolution is taking place to route the fossil energy towards the objective of reaching almost nil emissions, looking to not only liberate the environmental pressures and its consequences, but also to face the challenge of a sustainable development.

The investigation fields that are being explored to find energetic technologies that are profitable and at the same time protect the health and stability of the environment are diverse. However, there exist barriers that limit the development of the innovation and of the investigations, which are of greater persistence in the developing countries.

In the case of countries like Colombia, a strong impulse is required in terms of development and technological and scientific innovation in the fuel sector, in view of the multiplicity of cases where a major technical and economical efficiency is imperative to impulse the development of the energetic sector.

This is not about the State developing state of the art technology on these topics through one of its agencies, but it is about acquiring the knowledge

within specific areas of national interest defined by the government, and that can be applicable medium-term and long-term to national problems .

It is necessary to restructure the Colombian schemes and processes through which nowadays define the investigation line projects, for which, so that through the authoritative, academic and industrial consensus, the topics that are agreed upon converge to the national interest more than in a particular interest. This will permit a greater interaction and a clear definition of the Colombian needs, of which should be lead by COLCIENCIAS through workshops that allow defining and recommending to the National Government punctual topics, but of national interest.

The main **recommendations** regarding strategic lines within this related topic are as follows:

9.1 The utilization of coal as a clean resource

The national energetic policies should be supported in the utilization of available energetic resources whereby coal is included.

To achieve the complete exploitation of this resource, the PEN 2006-2025 proposes an integral evaluation of the technologies which permit the use of coal as a clean resource, utilizing caldron fluid mechanisms and technologies and other technologies that control the emissions of particle and gas contaminants.

Under these conditions, the volatile ashes generated by the combustion of the coal can be removed in 99.8% through electrostatic precipitators.

It is also considered convenient to evaluate the repotentiation of the thermo-electrical units already present with the fluid caldrons and install the Combined Cycle and Gasification Integration (IGCC) technology for future thermo-electrical projects to coal. A typical IGCC plant (Cycle combined with integrated gasification) can remove 99% of the sulfur present in the thermal coal.

As far as the coal demand in the residential sector and in particular the rural zones, it is proposed to evaluate the mechanisms available of combustion gases evacuation and residuals, with the aim to preserve the health of the population, including activities such as the design of stoves which allow the utilization of coal or wood at the same time that it protects the health of the user.

Finally, on the topic of coal, it becomes necessary to evaluate, in a complete way, as far as the technological development allows the utilization of coal as a clean resource with minimal effects on the environment.

In concordance with the before-mentioned, it is convenient to consider the possibility of introducing changes within the specifications in the use of coal, so that in the limiting of the source of emissions, these are regulated in the use of the resource.

Currently, the Colombian legislation introduces restrictions on the use of coal proportional to the amount of sulfur present within the mineral, which can lead to an excessive restrictive regulatory scheme in the utilization of a strategic resource for the Country.

9.2 New uses for GLP

In industrialized countries GLP has multiple applications, thoroughly proven and checked under the strictest security, climatic, environmental and efficiency conditions.

Applications of a diverse grade nature, of technological complexity such as the generation of electricity on a small scale, illumination, heating, refrigeration, and air-conditioning, drying grains, pure heat for industrial processes, agricultural applications in aviculture and growing of flowers, the control of weeds, all operating with GLP or natural gas, open an interesting portfolio of applications to explore.

Although there is a wide field of available applications, there exist much lack of knowledge on an industrial level and from the same distributors on technologies and their potentialities.

9.3 Technologies that use gas and coal in the production of liquid fuels such as CTL, GTL y CBM

The PEN 2006-2025 proposes a great technological effort with the aim of the country developing the knowledge that permits it to understand and apply the technologies that have been used throughout the world, with the objective of getting the most from the gas and coal deposits as possible. For this goal, the energetic fuel portfolio should be broadened, granting priority to the analysis of fossil fuel production technology from natural gas GTL, from coal CTL, and also the production of methane from the mineral coal - Coal Bed Methane.

In Colombia, the knowledge is being developed for coal gasification, so much as in the extraction of its energy from the mines, as in generating and distributing the gas fuel for domestic and industrial consumption.

In consequence, the proposed analysis for the GTL, CTL and CBM projects should have the following reach:

- Identification of available technologies
- Quantifications of the development, investment and operational costs
- Reserve requirements which justify the economical development
- Market, technical and economical feasibility for its development in Colombia

Keeping in mind the estimated high growths for the consumption of ACPM and the current need of turning to an external market to attend to these requirements of the Colombian society, it is precise to implement all the measures tending to decrease any dependence on energetic material.

9.4 Bio-fuels

The energetic future of Colombia is also going through the production of bio-fuels, bio-diesel being its greatest strength, which also offers a broad prospective in the conquest of external markets.

In reference to ethanol, the first goal will be reached when the complete coverage of ethanol mixtures to 10% volume of gasoline is achieved. To increment the participation of alcohol in the mixture, it is recommended to advance studies that permit determine in an integral form the effects of its utilization from the optical environment in its different corners, technical and economical limits, impacts and effects on the economy of other industries which utilize sugar as its input and its supply.

In reference to the mixtures of bio-diesel, the first limit will be presented when the demand of the mixtures of 5% volume are covered. The possibility of incrementing to superior levels has already been laid down. Keeping in mind the before-mentioned, a broad evaluation of the topic considering the behavior of the Colombian auto motor park in presence of higher percentages of mixtures, keeping in mind the type of vehicles and the age of the national park, user effects in terms of efficiency, expenditure in fuel and duration of the motors.

A careful evaluation of the topics laid down demand as well a study of international experiences in countries that have gone through similar processes and decisions and also with similar circumstances. If an increase in the percentages would be desirable for the Country from an energetic point of view, and we substituted fossil fuel for bio-fuels, than such a decision should be evaluated in detail in such a way that the Country's transport system user's interests would be protected.

9.5 Fuel Cells

Hydrogen as an energy carrier presents good prospective particularly within the transport sector through fuel cells, offering high efficiency and practically no greenhouse effect gas emissions. The advances in this area at a world level are important and could convert into a significant alternative in the long run for those cities like Bogotá, whose contamination levels are generating serious public health problems.

Another technology that has been implemented corresponds to the extra-light hybrid automobiles which use compressed hydrogen as fuel or they convert it into electricity in the form of a battery or a fuel cell. These technologies need two thirds parts less propulsory energy and a smaller fuel tank than the conventional automobiles.
In the future the Country should keep in mind within its knowledge and technical development lines of incorporation nuclear energy, hydrogen, fuel cells and solid state illumination, among others.

In consequence, the PEN 2006-2025 recommends the advancement of the actions to direct the resources destined to the development of science and technology through channels that really obey the country's interests.

10. Related topic 4: INSTITUTIONAL AND NORMATIVE FRAME

For the implementation of the objectives laid down in the Plan, you must count on an institutional and normative frame which guarantees clear and stable game rules which facilitate the permanence of the businesses. Within the frame of the institutional frame analysis, it is considered necessary to emphasize in the need to reach the highest coordination levels possible within the energetic institutions and other authorities involved, of which result being each time more numerous.

Within this order of ideas, the coordination between the Ministry of Mines and Energy as a rector of the national energy policies, the UPME as its support in the mining and energetic planning and the CREG in its role as regulator, is fundamental. However, the coordination with t he other ministries such as the

IRS, housing and development and education and culture seem ineludible in reference to the amount of transversal programs involved

The normative frame is no less important, not only at an internal level but also within the sub-region, to establish the sufficiently known and stable game rules and with a long-term projection that gives the signals that the agents require, public and private, within the investment project structure within the energetic sector.

It is also necessary that through the normative mechanisms are established that guarantee the opportune and information worthiness delivery on behalf of the participating agents in the markets that facilitate the planning and decision-making of the investors, an aspect that has reiterated the development of some of the principle objectives and related topics developed priorly.

With this institutional and normative topic it is proposed that we ideate coordination institutional mechanisms in particular among Government agencies, keeping in mind that various lines of action contemplated in the PEN require an information interchange, agreements and inter-institutional policies definition with the goal to achieve the objectives proposed. These mentioned linking committees should not only have a deliberate reach but also constitute themselves in agents of operative conduct.

10.1 ECOPETROL´s capitalization

ECOPETROL´s process of capitalization recently approved takes with it big changes within its operation and structure in the fuel sector, particularly the hydrocarbon sub-sector. This company has been operating as a political energy instrument of the Colombian State since it has had to subordinate its business objectives in wait of the compliance of the goals and needs of the Nation. The company has gyrated resources concept of utilities and transferences in function of solving short-term fiscal problems, in determent of medium and long-term objectives as would be the case of direct exploration and the modernization of the refineries. It also assumed the responsibility for the national procurement of crude and natural gas derivatives and the value of the liquid fuel subsidies.

The capitalization process takes with it deep changes in the handling of the national energetic policies such as the following:

- The profitability of ECOPETROL overrules the profitability of the country

- The monetization reserve through export operations could give way, which would impact the future panorama of hydrocarbon availability

- The transferences and the dividends will be the result of a medium and long-term investment plan defined by its stockholders and not a product of the budget of the central government.

- It will be necessary to justify the fuel prices in Colombia in such a way that they follow international indicators, also keeping in mind the quality of the national products with respect to the external ones and the position of the Country as exporter and importer of products. We could not turn to price scenarios that don't consult the strictest international market realities.

- The procurement responsibilities that ECOPETROL currently performs and the payment of the subsidies should be assumed by a different State entity, with the deserved budget appropriations which allow it to assume these types of obligations.

With respect to this last point, the National Development Plan 2006 – 2010 contemplates that the Ministry of Mines and Energy assume the function of monitoring for the adequate procurement of the national demand of hydrocarbons and derivatives, and that the Ministry of Internal Revenue and Public Credit appropriate in the general budget of the Nation the resources to cover the liquid fuel subsidies and coordinate with the ANH the policies that guarantee the largest local investment possible within the national territory.

10.2 Harmonization of the national regulatory frames with the sub-region

As mentioned in the regional integration objective, the positioning of Colombia as Cluster fuel requires the compliance of the prices in the convergence principles and the adequate regulatory frame which makes possible the international transactions. The sectors where the commercial interchanges could be realized in a context of energetic integration would be electrical energy, natural gas and derivatives of crude, for which it is necessary to advance in the harmonization of the sectarian fames especially within the electrical energy sector of Panama and the regional Central American market. The same occurs with natural gas and the construction of the Trans Caribbean pipeline which initiates in Venezuela.

10.3 State participation within the fuel Sector companies

This is an objective laid down in the PEN 2003-2020. Here we propose to structure a policy for the treatment of those company cases of the energetic sector in which the State still conserves an important participation with the objective of determining if the purposes and objectives of the PEN 2006-2025 could be reached with the State maintaining such mentioned participation, or if on the contrary it is convenient that a part or the totality of he properties of mentioned companies pass to private hands.

In this analysis it is necessary to determine the support of the stock-holder state participation, keeping in mind the political participation of the State, which was formulated in the Colombia Vision Plan 2019 and can be summed up as follows:

- Elimination of the presence of the State when the private sector assumes the direct service negotiations

- In the cases of monopolies with private negotiation, the State will concentrate on its role as regulator and controller

- In the cases in which you have public assets and properties that are required for the adequate provision of services, the State could contribute them to the constitution of mixed companies with private negotiation

- In specific cases where the execution of infrastructure is considered essential to assure the free access to the market agents, the State could consider minority character participations

- In technological innovation projects and depending on involved risk in the specific projects, the State could conform to new public companies or participate in mixed companies.

Some of the concrete cases that should be developed are:
ECOPETROL, which was mentioned before, generators and distributors of state energies. However, you should keep in mind that a certain control on the energetic active fuels is not possible without the participation of the company. The regulation and the control on the energetic policies without an active participation on behalf of the State in strategic assets have demonstrated in some countries procurement and discontrol of the sector that cannot be left unconsidered.

10.4 Sectarian Coordination

An essential topic to reach better levels of information for the agents, a greater participation of the society in the development plans and a more effective negotiation of the State agencies is the achievement of an adequate Sectarian Coordination in all aspects that have to do with the fuel sector. The key energy topics within the next few years will require the coordination among the following Ministries and Administrative Departments, mainly:

- Mines and Energy as rector of the policies of the mines and energy sector
- Transport as a rector of the policies of the sector, which is the main client and user of the crude derivatives
- Social Protection, due to the energetic policies impact on public health topics
- Territorial Environment, Housing and Development, for all the mines and energy licenses proceedings processes and for the regulations on air quality
- DNP, within the topics related to territorial development an identification of the energetic needs that surge from the orientation of the Development Plans.

The result of this activity should have been splatted in labor agencies between the Ministry of Mines and Energy and the mentioned entities, involving the related topics as is the case regarding the environmental and the rational use of energy, among others. Within this institutional coordination frame it is also considered opportune to study the convenience that the Country counts on with the Territorial Ordination Plan which allows it to separate the zones which definitively should not be intervened and in which there would not be incentives or would not generate conditions for the growth of human disposition, which generate pressure on the essential public services provisions, such as electrical energy in remote regions, and the availability of vital natural resources
(forest aquifers, water sources), producing its rapid degradation.

11. Related topic 5: INFORMATION, PROMOTION and TRAINING

One of the topics that is laid down with the most emphasis in Plan 2019 is the need that he economical agents count on the information they need to understand the state negotiation, just like the use and assignation of public resources and the available opportunities of its interests. Plan 2019 lays down the need to advance towards an informed society.

Information is a public asset; in a similar way to what occurs in more advanced societies which rely on the adequate information to make decisions, it is not just a need but also a right. Information ends up being a necessary requisite so that the society participates in the development of its negotiation. How to do it if the basic information is not available in an adequate manner? For this, the participation of the conceptual information is made necessary in any sectarian or national development plan which is formulated for the future.

The idea is how to achieve that the society advances towards processes where better information is available to participate in the negotiation of development and in the decision-making. For this, the PEN 2006-2025 proposes to lead the evaluation of a supply general frame and public information with the following references:

- Identify information deficiencies that the agents have within the different energetic: crude and natural gas, electrical energy, propane gas, coal
  and GLP. This activity should be realized through direct consults with the commercial agents who are the same ones t hat suffer from information deficiencies in the decision-making processes. It is worth noting that there exists a different grade of availability and quality of information between the mentioned sectors, in this sense, the advances in the electrical sector stands-out.

- Determine the compliance of the normative dispositions regarding information supply to the markets and purchase the former with the reality of the same.

- To design on behalf of the Ministry of Mines and Energy a policy for the management of the energetic information, identifying sources, access channels, and verification systems and spreading mediums of the different sub-sectors and activities of the chains.

- Coordinate with the DANE and other information producing organisms the mechanisms to generate bases of high complexity and information density with the aim to reveal information about equipments on the level of home income, introduction to additional questionnaires to the large industrial, importation registers, etc.

The PEN 2006-2025 considers that the solution to the information management problems is key for the development of the fuel sector, in such away that the necessary actions should be developed to have consolidated and credible statistical information available in the national fuel sector.

Through the development of PEN some specific cases as follows were mentioned:

- Indicative Planning in the hydrocarbons supply requires the assurance of operative and commercial information, in an opportune and trustworthy manner, which facilitates the decision-making of the agents and State institutions.

- The opportune flow of information necessary for an adequate dispatch and operative planning of the gas and electricity.

- Within the goal of regional integration, to have an information system available regarding the energetic resources of the Country and region, complemented with a permanent study on the competitiveness of the Country in each of the energetic sub-sectors.

- The structuring of a scheme that permits the agile and precise management and interchange related with the totality of the aspects involved in the analysis and execution of URE projects.

- Within the labeled energetic efficiency program, where there is a search for the use of efficient energetic technologies, it is fundamental to offer information to the users that acquire equipment, with respect to the energy consumption of these through the label of efficient energy supported in the NTC (Colombian Technical Code).

- For the coal located within the interior of the Country, we don't count with a source of centralized information regarding the specific needs of the clients or about the characteristics of coal and the coke produced. When a national or international buyer looks for coal with specific characteristics, he can't
  find an entity to supply information regarding the producers, merchants and volumes available for sale. In the same way, the atomization of the offer of coal make it that each one of the producers on their own not have access to possible businesses and opportunities.

- For the development of the Coverage Plan there have been some barriers, such as the lack and incoherence of coverage information (users reported to SUI vs. DANE housing) and geo-referenced information of the distribution infrastructure, of the real location of diesel plants, small hydroelectric plants and of the same populated center, for which the UPME has been jointly working with the aim to improve the quality of information.

11.1 Business opportunities promotion

The need of the Colombian energy systems to expand with the aim to attend to a growing national demand, demand that the agents know the possible businesses that could develop within the current legislative frame. One of them is to get to know potential investors in new electrical generation projects, the opportunities that could develop them within the sector.

There are other business opportunities that should be promoted through adequate information scheme, for example, the coal locates in the interior of the Country, URE and FNCE programs, bio-fuels and projects within the clean development mechanism frame, among others.

11.2 Public information and user training

In this case it deals with information and orientation schemes to the users of services in such topics as:

- Rights and obligations
- General regulatory frame
- Current security specifications
- Training the users in the use and handling of energetic resources
- Information regarding the costs and efficiency of domestic artifacts to evaluate the relation investment-consumption or variable expenditure.

The last of the points mentioned relates to various transversal axes that form part of the PEN structure. On another hand, in concordance to Objective 5 and the related topic of the environment and public health, it is necessary to advance in training schemes in coal users in the adequate and available use of the residues. Other energetic fuels where training is requires for their use are GLP and Natural Gas whereby, even though there have been efforts on behalf of the distributors and merchants, will always present a high risk if not handled properly by the user.

11.3 The Education Agenda

A “sustainable” society, in the fuel sense, should propose to its citizens the development of practices of adequate use of the available energy and this is achieved through educative processes in reach to all whereby the fundamentals of energy are explained, savings techniques, optimization of resources, and the use of renewable sources, among others.

For this, the PEN 2006-2025 proposes the development of an “Energetic Educative Agenda” together with the Ministry of National Education and the UPME, that they cover the topics mentioned beforehand and that in a gradual way and in the long-run generate consciousness regarding the importance that energy has so that the Colombian society can learn to “Live Better” and in this way achieve the long-term national development goals.

On another hand, technical careers are needed to be oriented on topics that train the population for access to credit mechanisms and clean development, innovation technology and energy development with the aim to create bases for a long-term development compatible with the goals laid down by the society through the Colombia Vision Plan of 2019.

Acronyms and Abbreviations

ACEM: Combustible Ecological Oil for Motor
ACP: Colombian Association of Petroleum
ACPM: Combustible Motor Oil
ANH: National Agency for Hydrocarbons
AOM: Administration, Operation and Maintenance
API: Scale that expresses the relative density of a liquid hydrocarbon
API: (American Petroleum Institute)
BOMT: (Build-Own- Operate Own Maintenance and Transfer)
BP: British Petroleum
CNO: National Operation Council
CAFAZNI: Administrative Committee Support Fund for the Energizing of the Non-Interconnected Zones
CANREL: Andean Committee of Normative Organisms and regulating Organisms of Electrical Services
CASEC: Electrical Sector Environmental Committee
CEPAL: United Nations Economic Committee for Latin America and the Caribbean
CIB: Barrancabermeja Industrial Complex
CIURE: Institutional Committee for the Rational Use of Energy
CND: National Dispatch Center
CNR: National Commission of Royalties
COLCIENCIAS: Colombian Institute for the Development of Science and Technology
CONPES: National Council for Social and Economic Policies
CPR: Risk Participation Contracts
CRD: Regional Dispatch Center
CTL: Coal to Liquid
CREG: Energy and Gas Regulation Commission
DANE: National Administrative Department of Statistics
DNP: National Department of Planning
DOE-EIA: United States Department of Energy
E&L: Losses, Energy and Operative Integrity
E&P: Exploration and Production Activity
ECOGAS: Colombian Gas Company
ECOPETROL: ECOPETROL S.A.
ESP: Public Services Company
FAEP: Savings Fund and Oil Industry Stabilization
FAER: Financial Support Find for the Energization of the Non-Interconnected Rural Zones
FAZNI: Financial Support Fund for the Energization of the Non-Interconnected Zones
FEN: National Electrical Financial
FES: Frequency of the Accounting Faults of the electrical energy service
FIP: Investment Fund for Peace
FNCE: Non-Conventional Sources of Energy
FNR: National Royalties Fund
FOES: Social Energy Fund
FSSRI: Solidarity Fund for Subsidies and Redistribution of Income
GLN: Liquid Natural Gas
GLP: Petroleum Liquid Gas
GNC: Compressed Natural Gas
GNCV: Compressed Vehicular Natural Gas
GNV: Vehicular Natural Gas
GTL: Gas To Liquid
ICONTEC: Colombian Institute of Technical Specifications and Certifications
ICP: Colombian Institute of Petroleum
IFO: Fuel for Boilers
IGBC: General Index of the Colombian Stock Market
IPC: Consumer Index price
IPP: Producer Index Price
IPSE: Institute for the Promotion of Energetic Solutions
ISA: Interconexión Eléctrica S.A.ESP
ISAGEN: Interconexión Eléctrica S.A
IVA: Added Value Tax
MDL: Clean Development Mechanism
MEM: Wholesale Energy Market
MHCP: Ministry of Internal Revenue and Public Credit
NBI: Unsatisfactory Basic Needs
OIEA: International Organism for Atomic Energy
OLADE: Latin American Energy Organization
OMC: World Commerce Organization
OR: Network Operation
PCH: Small Hydroelectric Plant
PEN: National Energetic Plan
PGN: General National Budget
PIB: Gross Internal Product
PPA: (Power purchase agreement)
PROURE: Rational Energy Use Program
RETIE: Technical Electrical Installation Regulations
RUT: Singular Transport Regulation
SIGOB: Presidential Negotiation Goals and Programming System2
SIMEC: Energetic Information on the Colombian Miner System
SIN: National Interconnection System
SSPD: Superintendence of Domiciliary Public Services
STN: National Transmission System
STR: Regional Transmission System
TIES: International Electricity Transactions
TRM: Representative Market Rate
UPME: Energetic Mining Plan Unit
URE: Rational and Efficient Use of Energy
US$: Dollars
WACC: Ponderated Average Cost of capital
WTI: International Reference Price of Crude Petroleum (West Texas Intermediate)
ZNI: Non-Interconnected Zone

CONVENCIONS AND UNITS of MEASURE

2D: 2 Bi-dimensional
3D: Tri-dimensional
BEP: Petroleum Equivalent Barrels
Bl: Barrel
BPD: Barrels per Day
BPDC: Barrels per Calendar Day
BTU: British Thermal Unit
CAR: Cartagena Refinery
g: Gram(s)
gal: Gallon(s)
GPC: Giga Cubic Feet
GWh: Gigawatts per hour
ha: Hectares(s)
HP: Horse-Power
KBDC: Thousands of Barrels per Calendar Day
KBLS: Thousands of Barrels
KBPD: Thousands of Crude Barrels per Day
kg: Kilogram
km: Kilometer(s)
km2: Square Kilometers
KPDC: Thousands of Cubic Feet per Day
kt: thousands of tons
kV: Thousands of Volts
kWh: Kilowatts per Hour
L: Liter(s)
lb: Pound(s)
M$: Millions of Pesos
MUS$: Millions of Dollars
m3: Cubic Meters
US$/MBTU: Dollars per Millions of British Thermal Units
mA: Milliamperes
MBLS: Millions of Barrels
MBPD: Millions of Barrels per Day
MBEP: Millions of Crude Equivalent Barrels
MBTU: Millions of British Thermal Units
Mm3: Millions of Cubic Meters
MPC: Millions of Cubic Feet
MPDC: Millions of Cubic Feet per Calendar Day
Mt: Millions of tons
MVA: Megavolt amperes
MVAr: Reactive Megavolt amperes
MW: Megawatts
Oz troy: Troy Ounces
PC: Cubic Feet
PCBs: Poli-chlorinated bi-phenols
PCD: Cubic Feet per Day
rms: Root Mean Square
RUT: Singular Transport Regulation
S/E: Sub- Station
t: Ton(s)
Tcal: Teracalories
TEC: Coal Equivalent Tons
TEP: Crude Equivalent Tons
TJ: Terajules
TPC: Cubic Therapies
US$: Dollars
US$/Bl: Dollars per Barrel
US$/KPC: Dollars per Miles of Cubic Feet

The Mining and Energy Planning Unit UMPE, publishes and makes available for sector agents, publications with high impact information for the mining and energy sectors in Colombia.

If you are interested in receiving any of the publications issued by UPME, please fill out the following form with your contact information and send it to fax (571) 221-9537 in Bogotá, Colombia.

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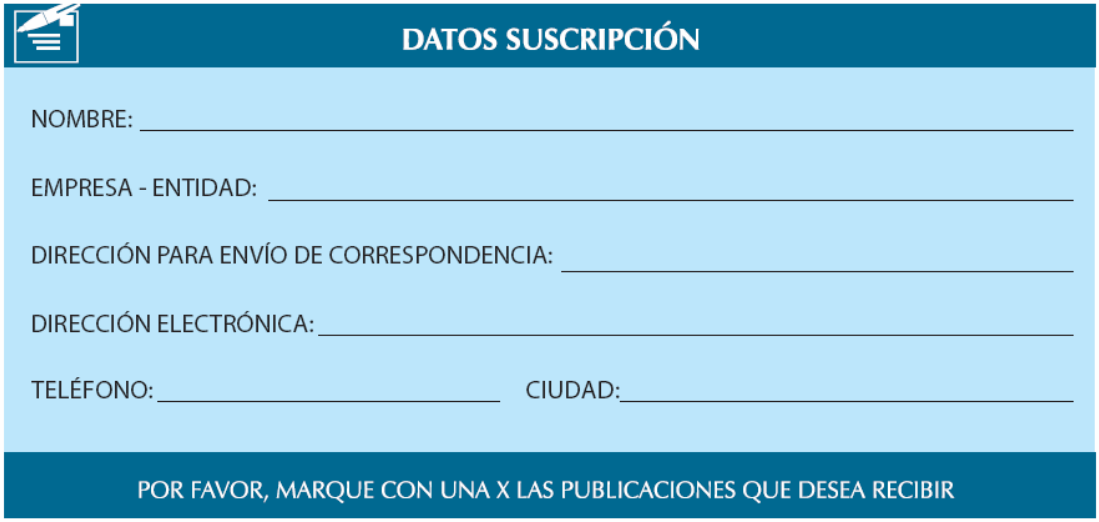

- National Fuel Plan
- Transmission and Generation Expansion Plan
- Strategies and Scenarios Magazine
- National Statistical Bulletin of Energy and Mines
- National Energetic Balances
- Natural Gas Chains in Colombia
- Liquid Gas Petroleum Chain in Colombia
- Petroleum Chain in Colombia
- Guide for the Presentation of Financial Support Funds Projects
- Colombian Coal Chain
- National Miner Development Plan
- Mining Code
- Miner Investment Guide in Colombia
- Compilation of Mining Material Specifications in Colombia
- District Miners: Transport Exportations and Infrastructure
- National and International Coal Market of Colombia

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