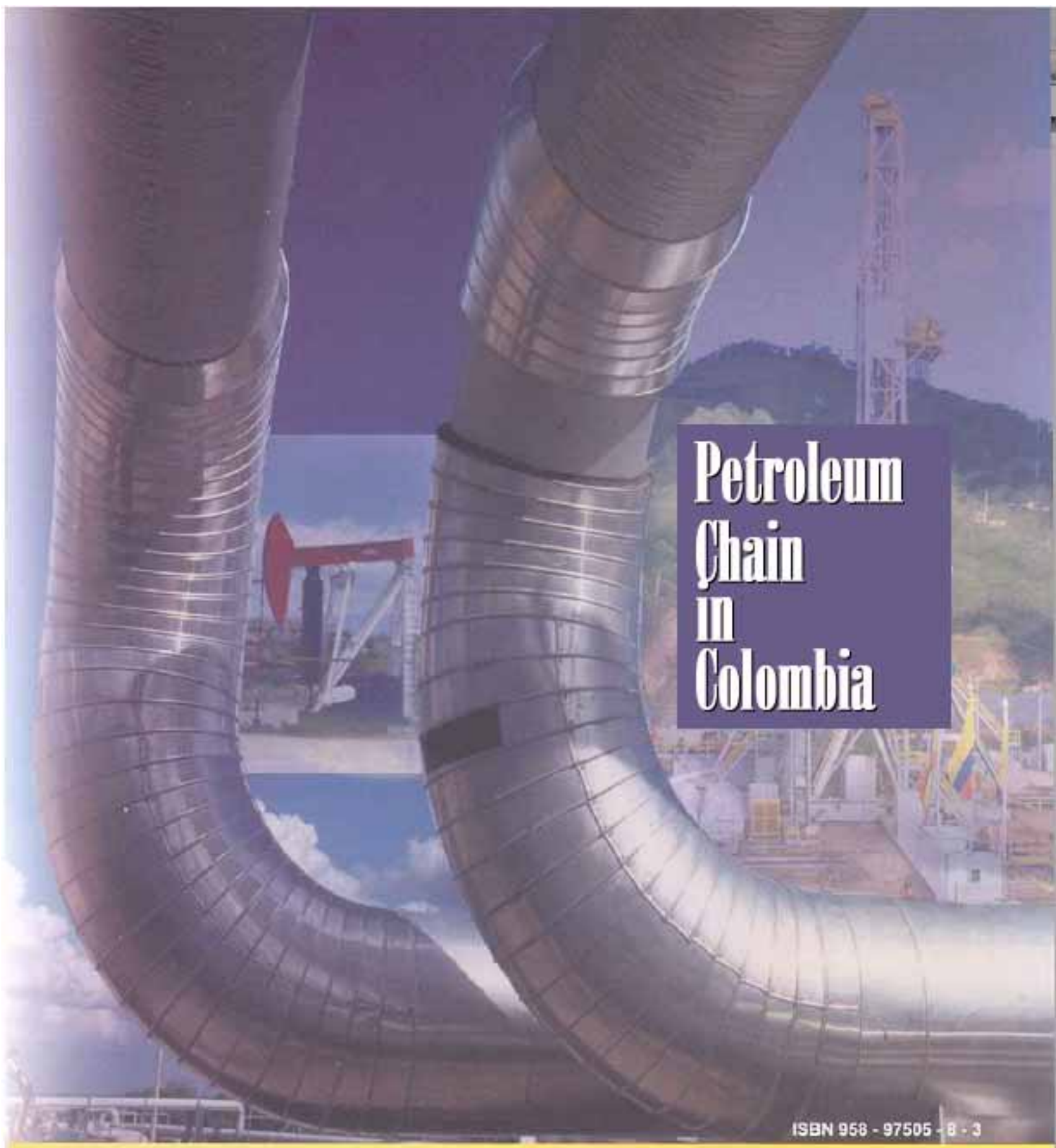

# Petroleum Chain in Colombia

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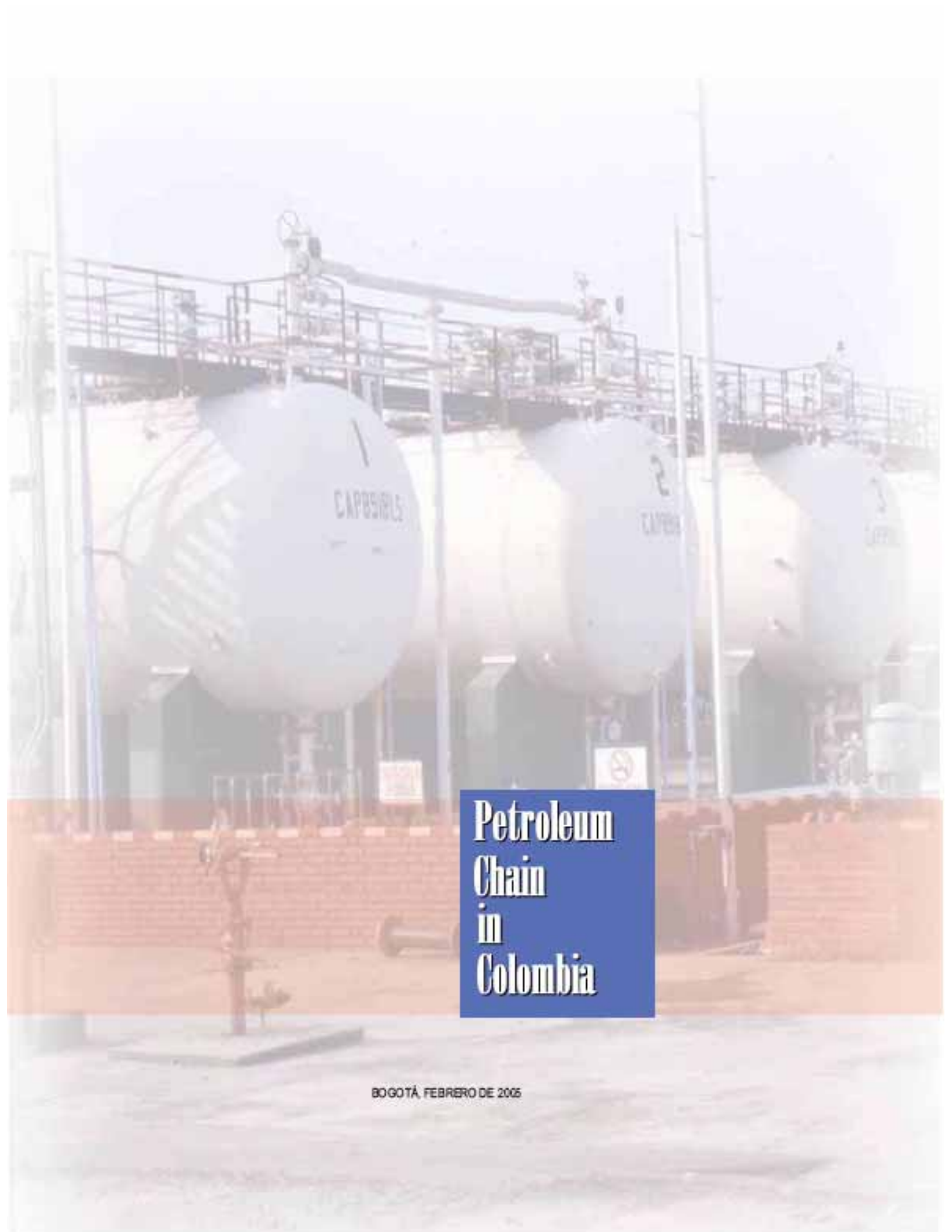

# Petroleum Chain in Colombia

BOGOTÁ, FEBRERO DE 2005

**THE PETROLEUM CHAIN**

Republic of Colombia Ministry of Mines and Energy

**Unidad de Planeación Minero Energética - UPME**

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# PRESENTATION

1

Social progress rests on economic development and the latter likewise depends on the energy demand that continues on the rise. Energy fuels productive processes, commerce, communications, but more than anything else it satisfies basic human needs avoiding recurrent cycles of poverty and increasing life expectancy.

Petroleum is the most important source of energy in our current society. It is a non-renewable natural resource, with indisputable impact on the economy, since it contributes with the largest percentage of total energy consumed in the world.

The high dependency that has been generated on petroleum, the instability that characterizes the international markets, and oil price fluctuations, have led to the investigation of alternative energy, although up to now there has been no really effective option to substitute it.

In Colombia, petroleum has become the motor of the economy and the fundamental basis for governmental finance. In this sense, hydrocarbons have participated in an average of 28 % of the Country's total exports in the last few years

With this document, the Unidad de Planeación Minero Energética - UPME offers its vision of the current petroleum sector situation and it describes in great detail each of the activities that make up the petroleum energy chain in Colombia.

**CARLOS ARTURO FLÓREZ PIEDRAHITA**
General Director

# 2

# INTERNATIONAL ENVIRONMENT

Worldwide production and has been gently on the increase, and it is currently slightly above demand, despite critical events such as the war in Iraq or the interruptions in supply by Venezuela and Nigeria. Humanity has been able to satisfy its energy requirements, even though the price per barrel of oil has topped the $50 per barrel figure.
Nevertheless, it is evident that the demand during the last two years has shown a major increase, and the production of the non-OPEC countries at increased by 1.43 MBPD1, to which OPEC reacted by increasing its offer by nearly 1.87 MBPD to avoid any drops in oil prices.

From the increase in oil production of the non-OPEC countries, it is worthwhile to point out the increase recorded by the old Soviet Union of nearly 700,000 barrels a day, to reach an average 9.4 MBPD so far in 2004, equivalent to 12.2 % of the world production. All other non-OPEC producers registered a production growth of only 1 %.

The boom in the world economy during 2004, presents the highest growth rate in the last 20 years. The United States, who consumes a quarter of the worldwide petroleum production, continues increasing its demand, while China consumed more than 6 million barrels of oil a day during the first quarter of 2004, 12.8 % more than the 2003, according to EIA (Energy Information Agency) figures.

The recent OPEC situation, the level of production and its current quota (including Iraq) represent the highest production levels in the last five years, with changes in composition between countries favoring Iraq whose production increase topped 2.22 %, Kuwait by 0.19 %, and Nigeria with figures hovering around 1 %, to the detriment of countries like Indonesia, due to the deplenishing of its reservoirs, and Saudi Arabia falling back from its 2.29 % original because of terrorism problems.

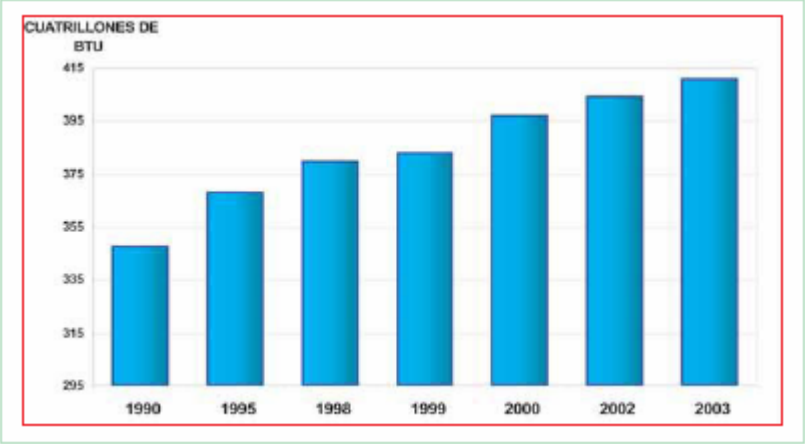
1 Millions of barrels per day

2 Organization of oil exporting countries, made up by Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, Arab Emirates and Venezuela.

## 2.1. WORLDWIDE ENERGY CONSUMPTION

Worldwide energy consumption during 2003 reached 411 quadrillion BTUs, showing an increase of 1.76 % with regard to the prior year.

**Figure No. 1**
**WORLDWIDE ENERGY CONSUMPTION 1990 - 2003**




Source: Energy Information Agency.

Of the 411 quadrillion BTUs, 37 % corresponded to petroleum, 24 % the natural gas, 25 % to coal, 6 % to nuclear energy and 6 % to hydroelectric energy. Of the total consumed, Europe and Eurasia were responsible for 30.1 %, North America for 29 %, Asia and the Pacific used 28.8 %, South and Central America 4.8 %, the Middle East 4.3 % and Africa 3.1 %.

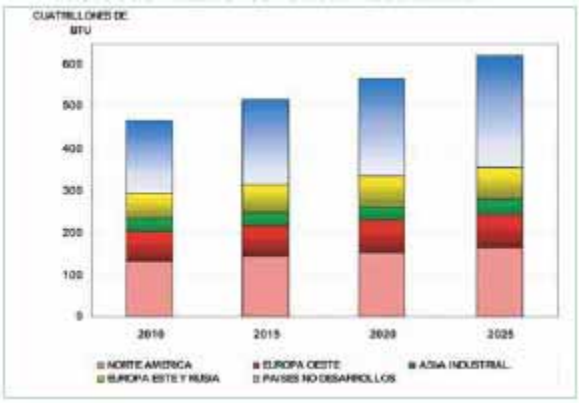
According to predictions made by the EIA, in their *International Energy Outlook 2004*, worldwide energy consumption will increase by 52 % during the period from 2002 to 2025, going from a consumption of 411 to 623 quadrillion BTUs and it will principally headed by developing countries, especially Asian countries, India and China, where the highest increase rates will show a growth in their economies, which are expected to grow by 5.1 % annually, compared to the annual growth rate for the world estimated at 3 %.

Conversely, the industrialized world has a slower energy consumption forecast of only 1.2 % annualy and 1.5 % for transitional economies (East Europe and the old Soviet Union). More efficiency in the end use of energy, combined with a slower growth in population cause these countries do have more moderate consumption.

3 Quadrillion: Figure followed by 15 zeros.

**Figure No. 2**

**WORLDWIDE ENERGY CONSUMPTION FORECAST**



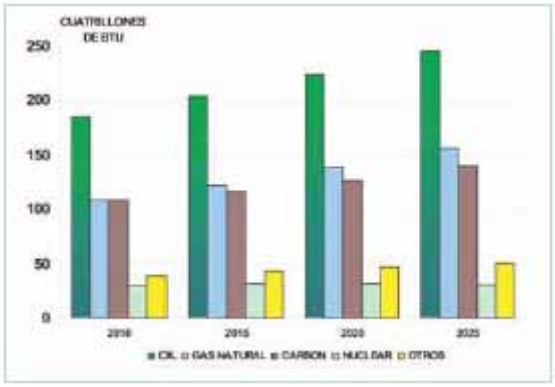

Source: Energy Information Agency.

Countries showing the greatest energy consumption growth, between 2001 and 2005 are the so-called "Under-developed" countries with 51.5 %, followed by the group of countries making up East Europe and the old Soviet Union with 28.1 %. Industrial Asia shows a 14.7 % increase and Western Europe 11.9 % increase. North America is expected to have an energy consumption increase of 23.8 %.

Of the worldwide energy consumption projected for the year 2025, crude oil continues to be the single strongest source of energy with 39.3 %, followed by natural gas with a 25.1 % share, coal went 22.5 %, nuclear energy with 4.81 % and all other sources 8 %. The energy source with the greatest growth for the period is natural gas with an increase of 44.2 %.

**Figure No. 3**

**PARTICIPATION BY TYPE OF SOURCE**




Source: Energy Information Agency.

The principal consumption sector for natural is electric power generation, because of the efficiency of gas turbines and the implications of the Kyoto protocol, which require cleaner processes reducing gases that produce a greenhouse effect.

Between 2001 and 2025 crude oil consumption will go from 77.1 to 120.9 MBPD. Its use will be

concentrated in the transportation sector in North America and in developing Asian countries, among them they will consume nearly 60 % of the total world production. For electric power generation, crude oil will diminish since it will be competing heavily with other sources like natural gas.

Coal by the year 2025 will be 7.6 billion tons slightly dropping its participation of total energy consumption from 22.9 % in 1999 to an estimated 22.5 % for the year 2025. The negative growth in consumption is mainly due to the fewer use in eastern and western European countries as well as in the Former Soviet Union (FSU)[4], basically because natural gas replaces a coal for electric power generation. Nevertheless, in countries like China and India consumption will increase.

As far as nuclear energy is concerned, consumption by the year 2025 will be in the range of 2.9 billion GWH. Growth in nuclear capacity will maily lie in developing countries, especially in Asia where a 4.4 % average annual growth is expected between 2000 and 2025 for electric power consumption generated by nuclear power plants.

Hydroelectric energy consumption and renewable sources will grow at an average annual rate of 1.9 %, going from 32.2 quadrillion BTUs in 2001 to 50.4 in 2025. This increase will be mainly caused by developing countries in Asia (China, India and Malaysia).

Despite the fact that the global energy resources are enough to satisfy the demand forecast, to mobilize the necessary investment to convert the resources into supply depends greatly on the capacity of the energy sector to compete with other sectors for this capital. The difficulty of energy investment becomes more complex when the need for capital grows larger, in real terms, in the following 30 years as compared to past 30. Thus, for example, the necessary investment for electricity will triple. This makes it even more important that investment conditions in the energy sector become more adequate to attract more capital.

In developing countries, with a faster production and demand growth, will need almost half of all the global investment in the energy sector, even taking into account that unitary costs for the increased capacity are less than those for the OECDS. China alone will have to invest USD $2.3 billion, which represents 14 % of the total global investment. The rest of Asia, India and Indonesia included, will need almost the same amount of capital.

A large part of this investment is destined to maintaining the current supply level. Oil and gas fields are running out, electric power plants are becoming obsolete and it is necessary to replace transmission and distribution lines. Extraction costs, including prospecting costs, will constitute the bulk of investment in the hydrocarbon sector, although the %age varies from one fuel to another.

## 2.2. WORLDWIDE OIL RESERVES AND SUPPLY

### 2.2.1. Worldwide oil reserves

In regard to offer forecasts, at the end of 2003 worldwide proven petroleum reserves topped 1,019.9 GBP[6] During the last decade reserves have practically stagnated. In fact, from 1980 to 1990 world reserves grew by almost 53 %, while from 1991 to 2003 there was only a 4.7 % growth, but there is feasibility that future volumes will grow at a greater rate thanks to technological developments in exploration and production, increasing the initially conservative estimates for reserves and economic changes.

4 FSU. Former Soviet Union.

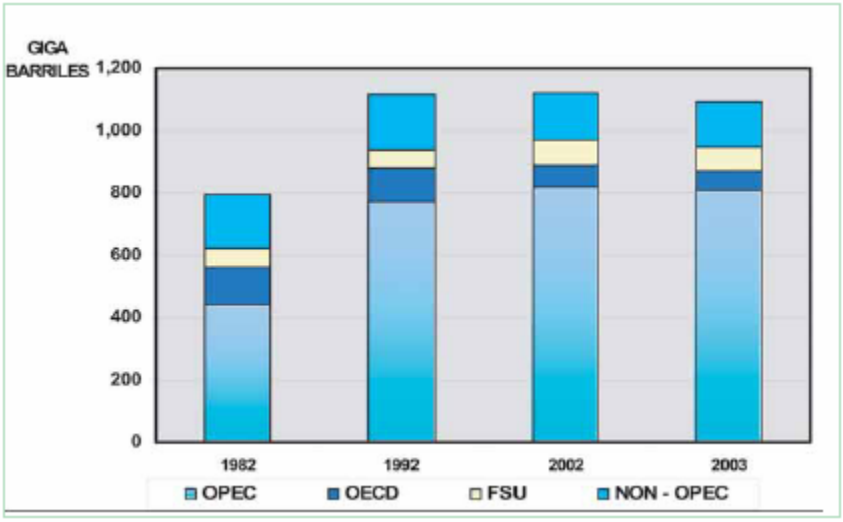
5 Organización para la Cooperación y Desarrollo Económicos, conformada por Estados Unidos, México, Canadá, Mar del Norte y otros.

6 Miles de millones de barriles

Of the total global reserves, 79.3 % are situated in OPEC countries. The former Soviet Union has 7.27 % of the total reserves, the non-OPEC countries have 14.27 % and OPEC countries have 6.23 %. Meanwhile, Colombia barely represents 0.2 % of total world reserves.

**Figure No. 4**

**OIL RESERVE EVOLUTION**




Source: BP-2003 Statistical Review

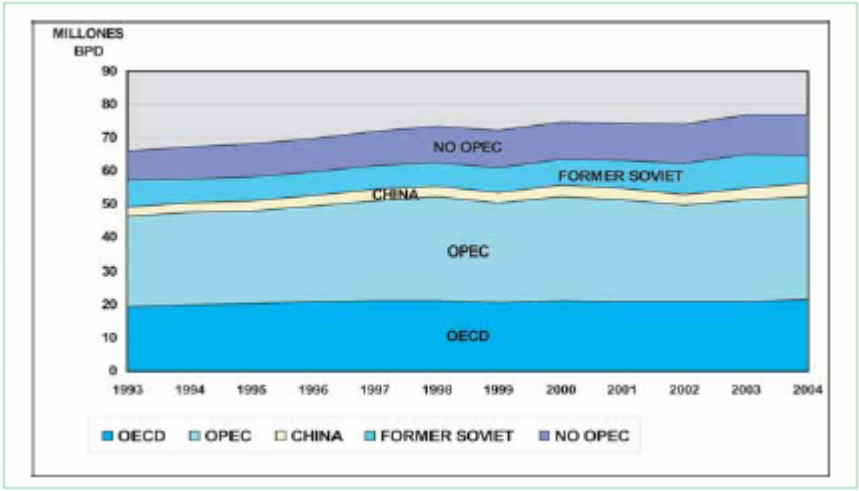
It may be worthwhile to highlight that proven reserves are volumes that from a geological point of view and from engineering studies have high future probability of being recovered under normal economic and operational conditions, as stated by the Oil & Gas Journal.

The relation R/P (Reserves–Production) for the OPEC countries hovers around 72 years, while for the rest of the world is only 35 years. The OPEC countries have a 7.4 year relation, the non-OPEC 9.6 and the former Soviet Union 19.6 years. This indicator is used to analyze reserves for each of the countries comparing it to the country's annual production.

Normally, the blazes were petroleum is produced are very far away from the areas where it is consumed. Although many countries have a very high production rate, it is not enough to satisfy their internal demand, so they are forced to import some. As we mentioned before, historically global petroleum production has always outdone its demand, thus allowing high consuming countries to avoid using their emergency reserves, avoiding also the fears of deplenishment and the uncertainty of high prices.

**Figure No. 5**

**GLOBAL PETROLEUM PRODUCTION**




Source: Oil Market Report -2003

During the first semester of 2004, production reached a total 77.6 MBPD, an increase of 3.05 percent with regard to 2003, caused by the increase in production in the former Soviet Union (9.78%), from the oil exporting countries with 5.41 percent and from developing countries with 3.91 percent.

The highest petroleum production is in the hands of the OPEC group, with nearly 29.52 MBPD, countries whose decisions influence the different markets, where they set minimum crude oil prices.

The Middle East originates the greatest part of all current global production, though never reaching the high percentages it did in the 70s. It is very likely that this concentration will move on into the future and the largest part of additional supply for the next few years will come from this region, Saudi Arabia being the principal producer, having the flexibility for additional or decrease supply on a short-term basis, without diminishing its crude recovery factor. Russia is situated as the second producer with 8.54 MBPD, 150,000 barrels less than Saudi Arabia, but with 2.97 MBPD more than in the United States.

According to the Monthly Petroleum Market Report and the offer and demand situation published by the IEA, in 2004 world production dynamics is improving, climbing 1.2 MBPD with regard to 2003, showing a clear economic recovery since the 2001 depression, topping off the crisis with the 9/ 11 terrorist attacks in New York that caused a reduction in OPEC demand.

## 2.2.2 Stocks

Because it is a natural resource, petroleum reserves are not distributed according to consumption needs, which cause the petroleum industry market to have global reach in its activities with intensly important international trade.

7 International Energy Agency

The petroleum stocks and its petroleum by-products play an important role in the crude oil market particularly upon its prices. Its importance lies in assuring an abundant and regular supply to end users and consumers when faced with the possibility of technical deficiencies in refineries or aboard vessels or pipelines, caused by natural disasters, uncertainty of political, economic and commercial problems, as well as by the crises that periodically affect relations between producing and consuming countries. For this reason, the oil stocks must be assured at every stage of the way, from the point of the extraction until it reaches the end user.

The need for stocks is evident as of the consequences of the second Arab Israeli war in 1973, which caused gas rationing in many countries, forcing them to establish the legal standards to regulate the existence of strategic reserves or petroleum and its petroleum by-products. Thus, petroleum companies are obliged to stock a certain quantity of product at all times to guarantee consumer market during a determined time.

Petroleum companies have tried to be more efficient during the last few years, operating with ever smaller crude oil deposits. This means that there is not enough room in the market to take up the effect of a supply interruption. Due to this reduced operating margin, unexpected situations such as violence in the Middle East, ethnic tensions in Nigeria and strikes in Venezuela have had a sizable affect on crude oil prices in 2003.

On another front, the attempt of petroleum companies to operate more efficiently has focused on decreasing crude oil stocks. This means that there is not enough margin in the market to take up the effect of a supply interruption. Given this reduced operating margin, unexpected situations such as violence in the Middle East, higher demand, and more so production capacity hitting the limits, have caused oil prices to reach record highs.

American petroleum stocks during the month of July reached their lowest level in over 27 years, stooping lower than 270 million barrels, making it very possible for refineries to eventually run into provisioning problems. The 270 million barrel mark sets an inflection point below the breakeven point where the supply chain loses flexibility, which could eventually increase the possibility of regional problems. The same happened to distilled products, which include domestic fuel oil and gas oil, whose inventories dropped below 103 million barrels, while gasoline stocks plumeted to 211 million. It is for this reason that there was such a major increase in crude oil imports, which represented the most drastic price rise so far this year.

It is difficult to access total global stocks statistics. The United States and in general the OPEC countries have this information readily available. Because of its huge and spread out countrywide market, the United States has the largest commercial stocks in the world with a little over a billion barrels. The Gulf Coast has the greatest share of available crude oil inventory, while the West Coast because of its high consumption and limited local supply, has the largest end product inventories.

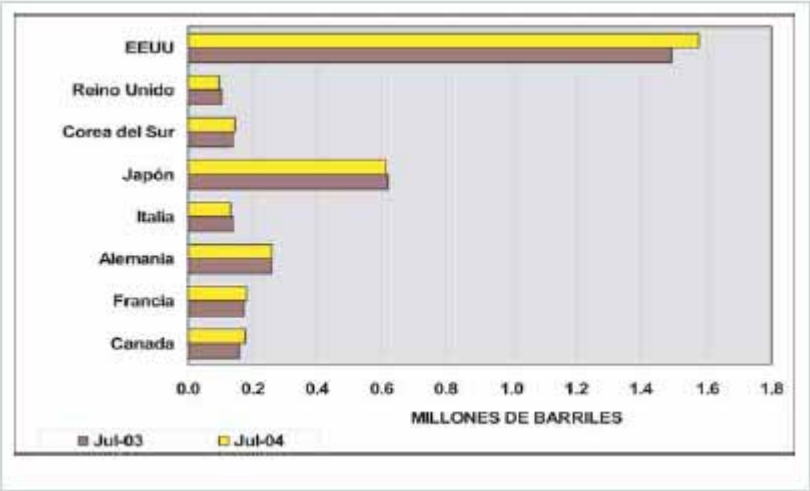
The United States has reserved levels called "Strategic Stocks", controlled by the government, set up as protection against severe supply interruptions. These reserves are stored in enormous underground caverns all along the Mexican Gulf Coast and our only rarely used, for example when the Gulf conflict in 1991 when they employed nearly 4 percent. Figure No. 6 shows the evolution of stocks in OPEC countries.

With the high price perspective, the increase in global crude oil demand is expected to decrease in 2005, given the impact they have on global economic growth.

It is expected that in the near future international tension will settle down and global economy growth will stabilize, at the same time normalizing inventories, particularly those of the United States.

**Figure No. 6**

**PETROLEUM INVENTORY EVOLUTION**




## 2.2.3 Oil Prices

Recent evolution in the international petroleum market evidenced the need for analysis and comprehension. It has been a market in constant change during the last 20 years, in which the offer and demand key players have also observed important transformations derived from the technological process of searching for new alternative energy sources and a growing relevance of the so-called marker crude oils in determining crude oil prices, among other factors.

Petroleum is not a homogenized item. There are different types of crude oil, mainly differentiated by the degree of viscosity (API Grade) and their sulfur content. Currently, despite the variety of crude oils offered in the market, only a few of them can be used to set prices, be it on a differential basis with regard to a specific crude oil or by means of formulas that integrate various types of crude oils.

In the practice, market quotations are used as a kind of counting unit for all other types of crude oil in international negotiations. Crude oils acting as markers under current market conditions are principally West Texas Intermediate (WTI) traded in Nueva York, Brent from the North Sea traded in London and Dubai traded in Singapur.

It may be worthwhile to point out that WTI is not traded in international markets, only in the United States market competing with imports, representing a reference price for the gigantic petroleum market within the United States economy, given its condition as a major consuming country.

An entire infrastructure has been set up around these markers, for transportation, storage and services, as well as facilities for information, regulations and contract options, allowing trading to be performed efficiently and accurately. Furthermore, these crude oils are negotiated under a spot delivery mode, advance contracts, futures and other petroleum by-products, which facilitate risk management.

The purchase and sale of crude oil has evolved from a vertical structure, dominated by transactions between subsidiaries of the same company, into effective marketing with different participants on both sides of the offer and demand equation. Furthermore, during the last few years, spot sales, advance contracts, futures, options and swaps have gained more transparency, which has permitted participation from players not necessarily linked to oil production or refinery.

The price of oil, affected by political events, by economic issues, infrastructure and even the weather has experienced sharp and unexpected variations in the economy and in international financial markets, with greater intensity than any other variable considered individually.

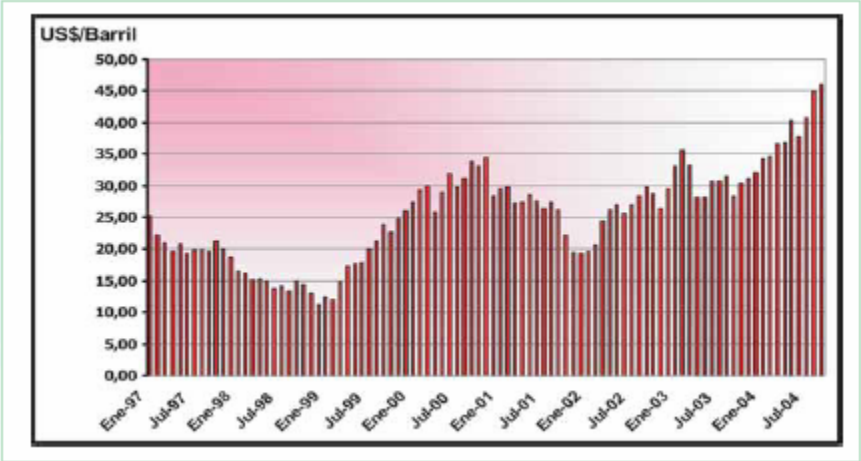
In the last 15 months, the international petroleum market has been excessively active because of drastic changes observed in crude oil prices, which have brought the price per barrel up to nearly USD $25 in May 2003 to USD $49 in September 2004, in other words, during this period that prices have practically doubled.

According to international analysts, the factor which has the most prevalence on the crude oil price increase is the intense speculative activity of future markets, after the increase of violence in the Middle East and during the month of September 2004, that generated doubts regarding Iraq's capacity of becoming a stable and safe producer. Political tension in producing countries also affects production and prices because of the uncertainty of a safe supply.

Increases in WTI crude oil have originated not only changes in oil prices at the well, but also the price of fuels such as gasoline and diesel, whose results have direct repercussions on the end-user.

Most analysts predict that prices will continue rising, affecting the growth of world economy and will only decrease once production is normalized and demand is slightly lower, and inventories are normalized.

**Figure No. 7**
**EVOLUTION OF AVERAGE WTI MONTHLY PRICES**




Nevertheless, it is necessary to bear in mind that the increase in crude oil prices reduces global growth, among other reasons, because it induces high interest rates to break the inflationary effect, whose figures depend on the way central banks react to the larger economies. Likewise, the growth in exports may turn out to be negative, since global manufacturing trade and the prices for raw materials are very sensitive to higher oil prices.

## 2.2.4. Worldwide oil consumption

Regularly, oil producing countries are not necessarily the largest consumers. The use of this energy source is associated with social economic development for each country. For example, from the 2004 consumption that reached 82MBPD, 60% was from industrialized nations (Mainly North America and OPEC nations) and 40% for developing countries, especially in Asia. Participation of South American petroleum demand shows a slight increase since 1990.

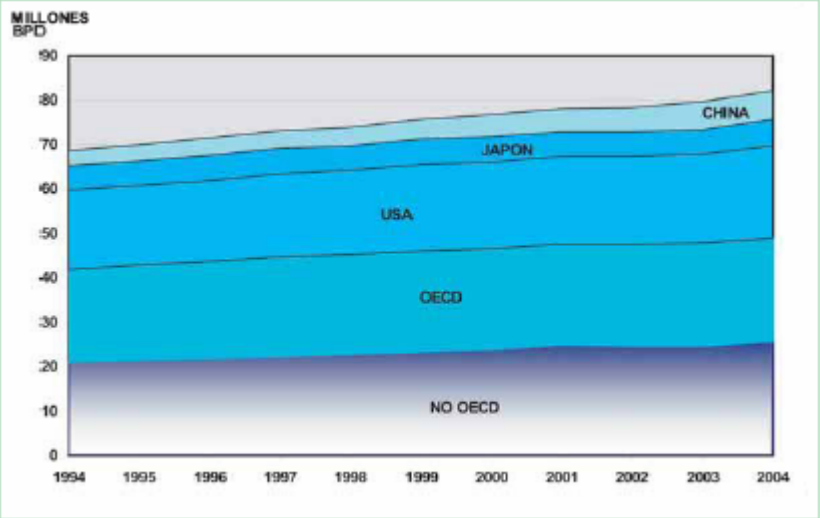
World petroleum demand is growing stronger than foreseen thanks to the rapid expansion of the global economic activity in China and the United States, especially during the first half of 2004. According to the IEA, petroleum demand has increased by nearly 2.43 MBPD during 2004, which represented an increase of 3.05% with respect to 2003.

The United States is still the first petroleum consumer in the world with nearly 20.3 million barrels per day, which represents 24.8 percent of the total world consumption. Likewise, China showed the greatest increase in petroleum consumption due to its strong annual economic growth added to the substantial increase in motor vehicle sales. During 2003, China increased its consumption by 12.55% and in the year 2004 in reached 12.8 %, in other words 710,000 BPD more than the prior year, taking Japan's second place for countries with the greatest energy consumption.

Oil consumption in the OPEC countries grew at a rate of 1.18 percent, Canada and France heading the list with an increase in demand in 76,600 and 76,100 BPD respectively. In Western Europe (countries also belonging to the OPEC), the increased rate of oil consumption has also decreased due to the natural gas market penetration, except for the transportation sector. Meanwhile, Australia and New Zealand have shown slight recovery achieving the levels reached at the beginning of this century.

The demand for countries not belonging to the OPEC, excluding China, shows a high increase of nearly 3.18 percent, which represents 900,000 BPD. In general terms, it may be well to point out that 2004 has been a recovery year for world consumption, which indicates an improvement in the economy of almost every country in the world.

**Figure No. 8**
**WORLDWIDE PETROLEUM CONSUMPTION EVOLUTION**




Source: Oil Market Report

Anyhow, high prices will open up a space for development of alternative energy sources, which will substitute the use of hydrocarbons.

## 2.3. PETROLEUM IN LATIN AMERICA

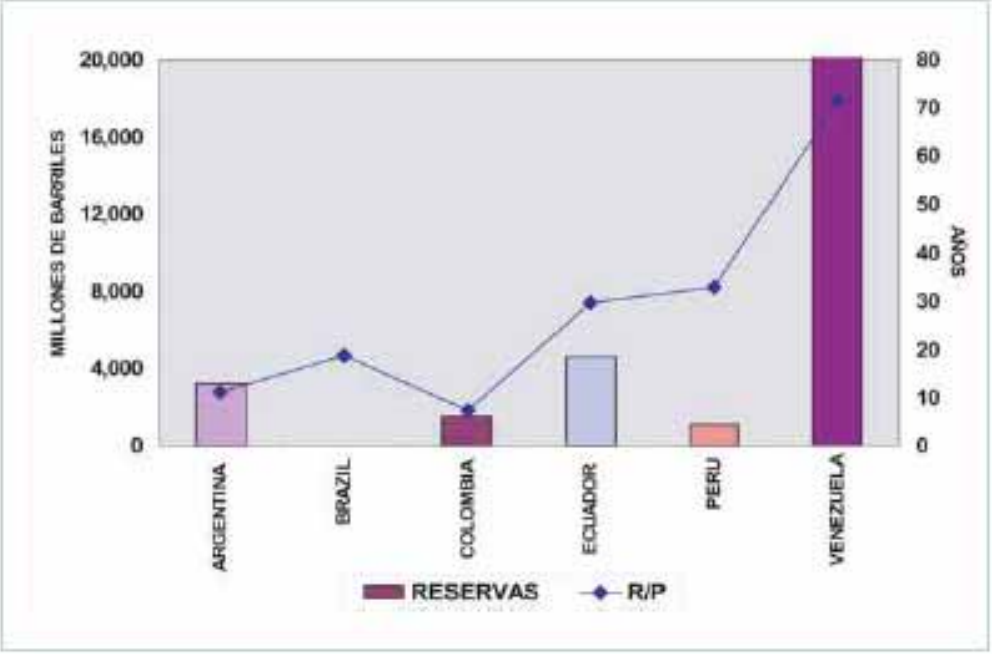
### 2.3.1. Reserves

Latin America currently has petroleum reserves of nearly 102.25 GBP, a figure that has been increasing during the last decade thanks to actions of local countries to develop their hydrocarbon potential in the region. By the end of 2003, petroleum in the region represented 8.90 percent of the total world reserves, which increased by 2 % with respect to 2002 and by 29.2 percent with respect to 2001.

Brazil, Venezuela and Argentina were responsible for the increased in available reserves in the Latin American continent, which show Brazil as the country with the greatest findings during 2003, when its reserves increased by 8.16 percent, equivalent to 800 million barrels, followed by Venezuela with 1.5 percent representing nearly 700 million barrels and in third-place Argentina with a 1 percent increase, corresponding to 400 million additional barrels.

Figure No. 9

**PROVEN RESERVES IN LATIN AMERICA**



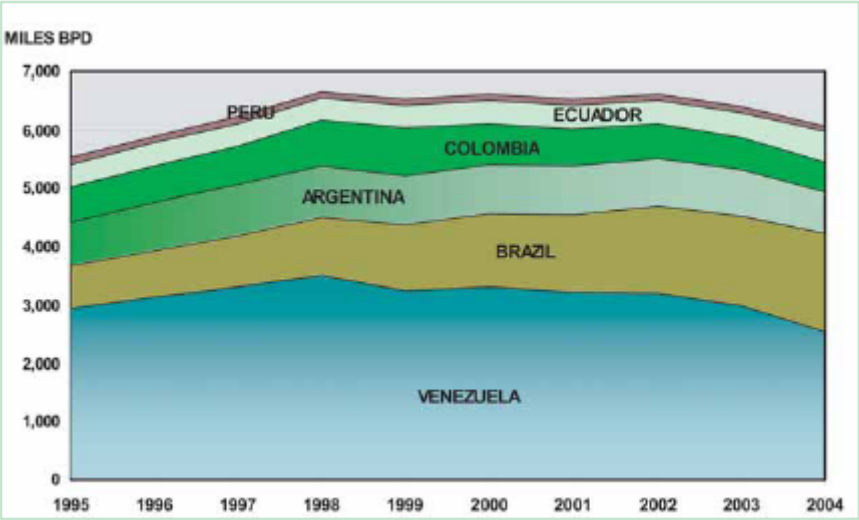

The region ranks third in production after the Middle East and North America, contributing 8.4 percent of the total. It has 46.9 years of production reserves, 10 more years than those reached during 2002. This information is broken down in figure 9.

## 2.3.2. Production

Petroleum production in the region has been on the decreased progressively since 1998, principally due to the decline in producer fields and that crises Venezuela is undergoing. The region went from 6.74 MBPD in 2003 to 6.07 in 2004, which represents a decrease of 9.88 percent and 12.47 percent with respect to 1998, the years with the greatest production contribution for the Latin America region.

In 2004, the country with the highest production is still Venezuela with 42 percent of the total and in second place is Brazil with 28 percent of the South American quota. Behind these two great producers, there is a group of countries made up of Argentina, Colombia and Peru, that although they are self-sufficient, they have been exhibiting a slight production decrease and at the same time they are the ones that have the least remaining reserves.

**Figure No. 10**
**PETROLEUM PRODUCTION IN SOUTH AMERICA**




For exporting countries in the region, such as Venezuela, Colombia and Ecuador, the petroleum sector is the one that generates the most income and fiscal contributions for the State. Therefore, petroleum is an important and crucial item for government, the economy and foreign policy for each of these countries. The policies adopted by the petroleum industry have influenced not only on other sectors of the economy, but also on the implementation of the principal public-policies.

Nations like Uruguay, Chile, Bolivia and Paraguay among others, must resort to the foreign market to cover their needs, since they don't have petroleum reserves. The following figure presents the evolution of petroleum production in South America.

In general terms, the world price situation favors Latin America, bearing in mind that it is a net exporting region and the immediate effect on income from abroad and on tax revenues, is positive. According to experts, for every USD $10 increase in the price of oil, the fiscal situation improves by 5% of the GNP in Venezuela, 4% in Ecuador and nearly 1% in México and Colombia. These favorable effects will help the region grow over 4.5 percent this year.

## 2.3.3. Consumption

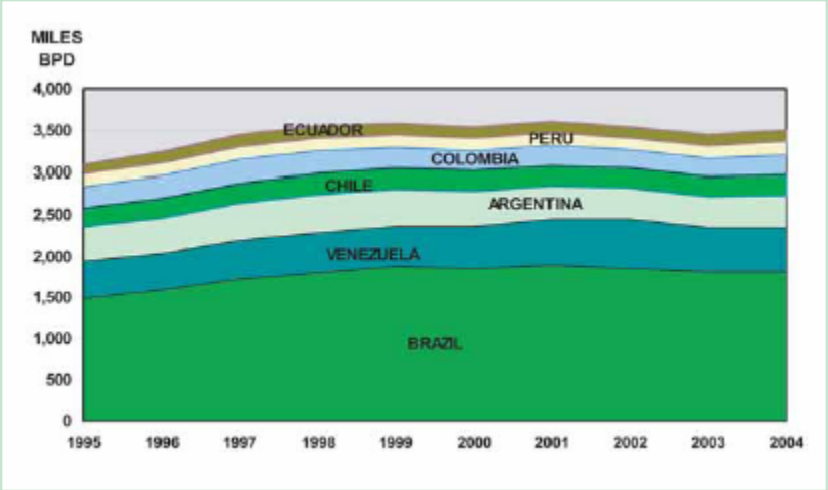
Petroleum consumption increases as economic growth increases in these countries, and as such the importance of petroleum expands as an economic agent. Latin America, who had consistent growth during the decade of the 80s, the first drop in energy demand in the new millennium, situation which was accentuated during 2003, principally caused by the problems in Venezuela and the decrease of consumption in the transportation sector in countries like Colombia and Brazil.

The Latin American continent consumes nearly 4.6 MBPD, equivalent to 5.62 percent of the world consumption. Brazil is the country with the most use, with a little more than half of the South American total, followed by Venezuela with 13.7 percent and Argentina with 10.5 percent. Every country has intensive energy consumption if compared with industrialized nations, who exhibit decreasing tendencies, from the decade of the 70s until the present.

So far during 2004, most countries show important economic recovery, which is reflected in the demand for intermediate products derived from petroleum for industrial processes, which has been having a determining effect on crude oil demand, unless the price of crude oil manages to drown out these economies.

**Figure No. 11**

**PETROLEUM CONSUMPTION EVOLUTION**




Sources: B.P Statical Revieu, and DOE

Latin America is slowly recovering: The economy is experiencing its best economic surge in the last five years, and leading the boom is Argentina, followed by Chile, Colombia, Peru and Ecuador. It is expected that the crude oil demand grow more rapidly than expected.

# 3 NATIONAL ENVIRONMENT

This chapter shows the historical behavior of Colombian economy through the principal indicators (GNP, inflation, unemployment rate, imports and exports, deevaluation and international reserves).

## 3.1. ENERGY AND THE ECONOMY

During the last few years the Colombian economy has been improving substantially, surpassing fragile conditions exhibited during the 1998-2001. Economy performance during 2003 showed an important increase, while inflation continued on a drop, just like the unemployment rate, although it is still high. During the first semester of the year 2004, economic behavior surpassed growth expectations and the representative market exchange rate dropped to the levels of 2002, to nearly COP $2500 per dollar.

2003 growth was higher than the initial goal of 2.0 percent and much higher than that obtained in 2002 (1.76 percent). This positive result shows a growth dynamic for the economy which is sustainable on a long term basis. Colombian economy grew by 37.4 percent more in 2003 than in 2002. From the offer point of view and calculations or the demand, the rate registered in 2003 is the highest since 1995 when it hit 5.20 percent worry. The construction sector was economic activity that showed the greatest variation during 2003 compared to 2002, with 19.19 percent.

The second quarter of 2004 exhibited a GNP of 4.25 percent, important figure for the growth of the economy. The construction sector led this growth, followed by the manufacturing industry that registered important increases in the second quarter of 2004, and it is expected that these sectors continue strong throughout the second semester of the year.

The behavior of the Colombian economy surpassed the average for the region, reflecting thereforemore, more confidence for investors, who find in Colombia a better investment option. The factor that most influenced the economic results in terms of growth was private investment, due to a reduction in risk achieved by lower requirements of idebtedness through credits. Checking account deficit was lower, even when the exchange rate was fluctuating but competitive.

This new phase of economic growth has developed under the following conditions: i) an external context that during the first semester was completely unfavorable, but that during the second half of 2003, especially because of the good performance of the American economy, displayed notorious recovery symptoms, ii) a significant improvement in prices of energy resources (oil and coal) in the international market, iii) a nonrestrictive monetary policy, that has allowed the keeping of liquidity of the economy and relatively low interest rates compared to historical standards and finally, iv) the dynamism displayed by sectors such as construction and financial, which are responding well to policies implemented by the current administration.

As far as performance of the foreign sector, Colombian exports recovered lost ground despite the Venezuelan crisis which had a negative effect. This behavior is partially explained by the extension of the ATPDEA agreement by the United States. On another front, imports also had a recovery principally due to larger economic activity. During the first semester of 2004, exports increased by 14.1 percent with regard to the first semester of 2003.

Better financial conditions in emerging markets during the second semester 2003 allowed reduction of foreign debt spreads. Likewise, capital exodus was reduced and on the contrary foreign private investment to emerging countries grew considerably. Overall, the implementation of the Democratic Security Strategy has allowed the substantial improvement of viable economic expectations for Colombia.

## 3.2. MAIN ECONOMIC INDICATORS

In 2003, added value for the mining sector increased by 11.04 percent thanks to the increase of coal production by 35.85 percent, metallic ores by 16.45 percent and other nonmetallic ores by 5.40 percent. Nevertheless, there was a decrease in crude oil and natural gas production of 7.64 percent, according to the data supplied by DANE (Colombian Official Statistics Bureau).

Traditional exports increased by 13.1 percent during 2003, principally due to good performance from coal, while the increase in nontraditional exports represented 5.7 percent. On another front, the growth in imports originated principally from larger purchases of nonqualified goods (57.9%), as well as imports of capital goods (15.7%)

**Table No. 1**
**ECONOMIC INDICATORS**

| ECONOMIC INDICATOR | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|
| GNP growth (%) Inflation (%) | 0.5 | -4.3 | 2.8 | 1.6 | 0.5 | 3.7 |
| Unemployment rate | 16.7 | 9.2 | 8.8 | 7.6 | 7.0 | 6.5 |
| Export growth (%) | 15.6 | 18.1 | 19.4 | 13.5 | 15.6 | 13.1 |
| Growth Exports (%) | -5.9 | 6.5 | 12.7 | -6.3 | -3.08 | 8.2 |
| Average exchange rate | -4.8 | -27.2 | 7.9 | 11.4 | -6.10 | 8.6 |
| (Pesos/Dollars) | 1.426 | 1.757 | 2.088 | 2.300 | 2.421 | 2.778 |
| International Reserves (Millions of US$) | 9.107 | 8.402 | 8.428 | 10.245 | 10.731 | 10.916 |

Source: DANE: Unemployment rate (fourth-quarter, 2003); Export growth (variation of December 2003/2002); Import growth (variation of December 2003/2002);.

**Table No. 2**

**EXPORT INDICATORS**

| MILLONES DE US$ | 2000 | 2001 | 2002 | 2003 | Variación 2003/2002 (%) |
|---|---|---|---|---|---|
| **ExportacionesTradicionales** | 6,947 | 5,463 | 5,310 | 6,004 | 13.1% |
| Petróleo y Derivados Café / | 4,775 | 3,285 | 3,275 | 3,383 | 3.3% |
| Carbón / Ferroníquel | 2,171 | 2,178 | 2,035 | 2,621 | 28.8% |
| **Exportaciones NoTradicionales** | 6,211 | 6,838 | 6,629 | 7,006 | 5.7% |
| **Total Exportaciones** | **13,158** | **12,301** | **11,939** | **13,010** | **9.0%** |

Fuente: DANE. Banco de la República. DNP. DIAN.

**Table No. 3**

**IMPORT INDICATORS**

| MILLONES DE US$ | 2000 | 2001 | 2002 | 2003 | Variación 2003/2002 (%) |
|---|---|---|---|---|---|
| Bienes de Consumo | 2,223 | 2,591 | 2,696 | 2,669 | -1.0% |
| Bienes Intermedios | 5,893 | 5,784 | 5,853 | 6,412 | 9.6% |
| Bienes de Capital | 3,625 | 4,442 | 4,123 | 4,770 | 15.7% |
| Bienes No Calificados | 16 | 4 | 19 | 30 | 57.9% |
| **Total Importaciones** | **11,757** | **12,821** | **12,690** | **13,881** | **9.4%** |

Source: DANE. Banco de la República. DNP. DIAN. The data as of July, 2002.

## 3.3. Energy Grid

Total energy consumption for the year 2003 began to show the effects of a recovering economy with a 2.86 percent increase obtained with respect to 2002, upon consumption of 233,724 Teracaloríes, nearly 5000 more than the prior year. The increase was due to good performance in the productive sector, particularly in the manufacturing industry, which consumed more than 6.53 percent more than in 2002.

Natural gas is built on an ascending consumption curve and since 1993 it has been exhibiting positive behavior, fueled by government policies for its use. Petroleum and its petroleum by-products remaine the main source of energy supply for Colombia, with 39.8 of the total, followed by firewood and bagasse was added consumption represented 20.2 percent Electric energy, natural gas and coal consumption represented 13.4 percent, 11.3 percent and 7.9 percent respectively.

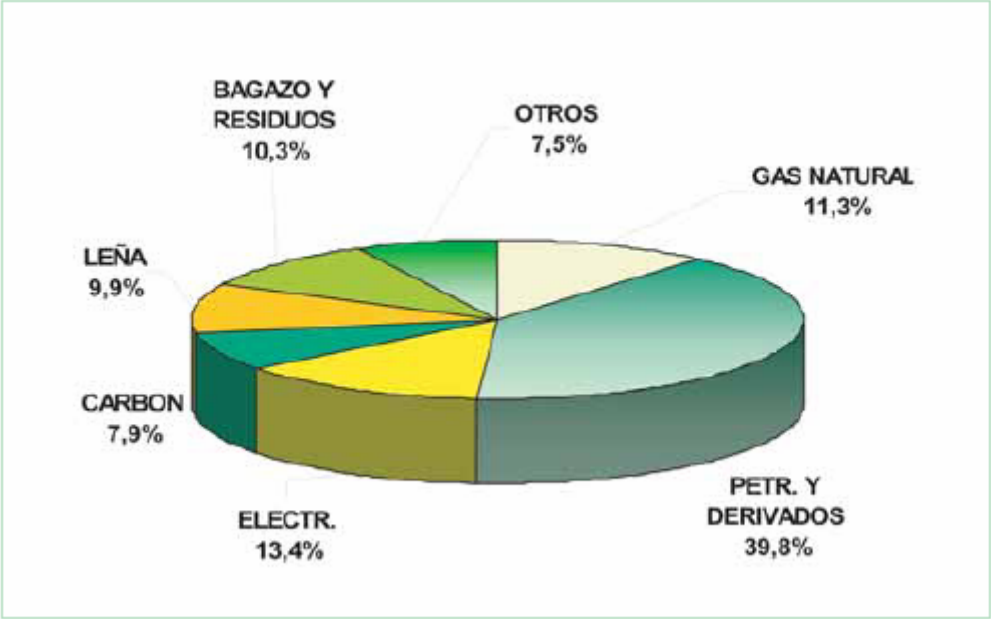
Electric power generation for the year 2003 was 46,112.6 giga watts, of which 75.78 percent corresponded to hydraulic sources, 20.02 percent to thermal, 2.77 to smaller power generators, co-generators and self-suppliers and 0.15 % to international imports.

Coal production during the year 2003 reached a record figure of 49.3 million tons, representing a 25 percent growth with respect to 2002. Just like prior years, the favorable evolution of export projects located on the Atlantic Coast helped achieve this figure of 43.4 million tons of coal exported.

A sector analysis shows that transportation holds the first place in consumption, especially of petroleum petroleum by-products. Out of petroleum by-products, diesel fuel has had a greater growth than expected, manifested by a phenomenon called desielization, as a consequence of unappropriate price signals in liquid fuels.

**Figure No. 12**

**STRUCTURE OF COLOMBIAN ENERGY CONSUMPTION 2003**




The industrial sector is the second energy consumer with levels close to that of transportation and coal as the most important energy source, followed by bagasse. The residential sector holds the third-place in energy consumption, representing a rapid expansion in the use of natural gas for home uses.

# 4

# THE PETROLEUM INDUSTRY IN COLOMBIA

As a consequence of the constitutional reform of 2003, the hydrocarbon sector underwent great transformations, such as the separation of roles that the State had as administrator of hydrocarbon and participant in industrial activities in the petroleum energy chain performed by ECOPETROL, thus eliminating a conflict of interests.

This change implied the creation of a new administrative unit called **AGENCIA NACIONAL DE HIDROCARBUROS – ANH**, whose administrative responsibility is to entirely manage hydrocarbon reserves, geological information, and hydrocarbon exploration and production contracts for Colombia.

The decision seeks to revert the possibility of losing Colombia's double condition of self-sufficiency and exporter, as well as ECOPETROL's guarantee of financial viability and its focus on being a more efficient and competitive enterprise both locally and internationally.

## 4.1. LEGISLATION

The "Contract" has been the legal instrument of government policy with regard to hydrocarbons, to regulate relations between the State and the private sector, given the complexity of technical operations and due to the great economic risks inherent of this industry.

The Concession Contract was the first mechanism used in Colombia to start off hydrocarbon exploration and exploitation. It was characterized by rigid regulations, without modifiable clauses, with very little participation from the State in the administration and operation areas, and in exchange it would receive royalty and taxes. It had a long period of duration until 1969, when the contracting scheme was modified and a new mode was created.

As of Law 20 of 1969, private property on petroleum subsoil is regulated, a new scheme is created where in the future the Association Contract would be implemented and petroleum contribution was set in place where ECOPETROL would receive certain areas for exploration and exploitation. This model had a short existence, since it was modified in 1974, catering to the existing need to incorporate new petroleum reserves to confront the current crisis.

The legal basis for a new type of contract called the Association Contract was defined by Decree 2310 of 1974, giving Ecopetrol the exclusive faculty of performing petroleum exploration and exploitation on national property, directly or in association with domestic or foreign individuals or companies, under different modes than those of the concession.

During the three decades of existence for this contractual mode, it underwent several changes in response to political and economic conditions at the moment they took place, as follows:

The original Association Contract was established with the idea of fomenting foreign investment in Colombia. Production distribution after royalties was 50 percent for each of the parties. This scheme worked until 1987.

In 1989 it underwent the first change to improve collecting resources by the government, where production distribution was discounted from 20 percent royalties, it was performed in an escalated manner, as reserves were found.

In 1994, in order to improve the terms offered to investors by escalated production, a new modification was introduced based on profitability “R” factor per oil field discovered. This "R" factor would be appplied when accumulated production of the area contracted reached 60 million barrels of petroleum.

Between 1997 and 1999 the incremental production contract was in place, in which total investment was put up by the company, in order to improve exploration and exploitation results and increase production and reserves. Establishes a baseline for field production and the higher production increase distributed between ECOPETROL and the associated company.

With the sanctioning of Law 756 of 2002, important changes appear in the royalty scheme with variables between 5 and 25 percent, depending on average daily production rates during the corresponding month.

As a consequence of Decree 1760 of 2003, which gave way to the ANH and with it the responsibility to manage the nation's resources, as well as establishing a new contract show mechanism for petroleum exploration and exploitation, the so-called favorability was introduced into the existing Association Contracts. This clause provided "mechanisms to level out economic conditions for those areas awarded by the ANH as the same type of area today contracted with ECOPETROL”.

In April 2004, in order to stimulate investment in the petroleum sector, Colombian government through the ANH presented a new contract model characterized by a modern concession scheme, based on a system of royalties and taxes, where the investor takes on all the risk in exchange for the entire production rights after royalties.
In this new model, the state does not interfere in the business decisions, but supervises compliance of all commitments. Investors will have six years for exploration and 24 for exploiting the oilfield with a possible 10-year extension. Lastly, the contract contemplates charging a representative amount for the use of the soil, by means of a surface rental fee.

It is expected that the changes performed will stimulate investment in the petroleum exploration and exploitation area, enabling findings and incorporating new reserves to guarantee self-sufficiency and contributing with Colombia's commercial portfolio.

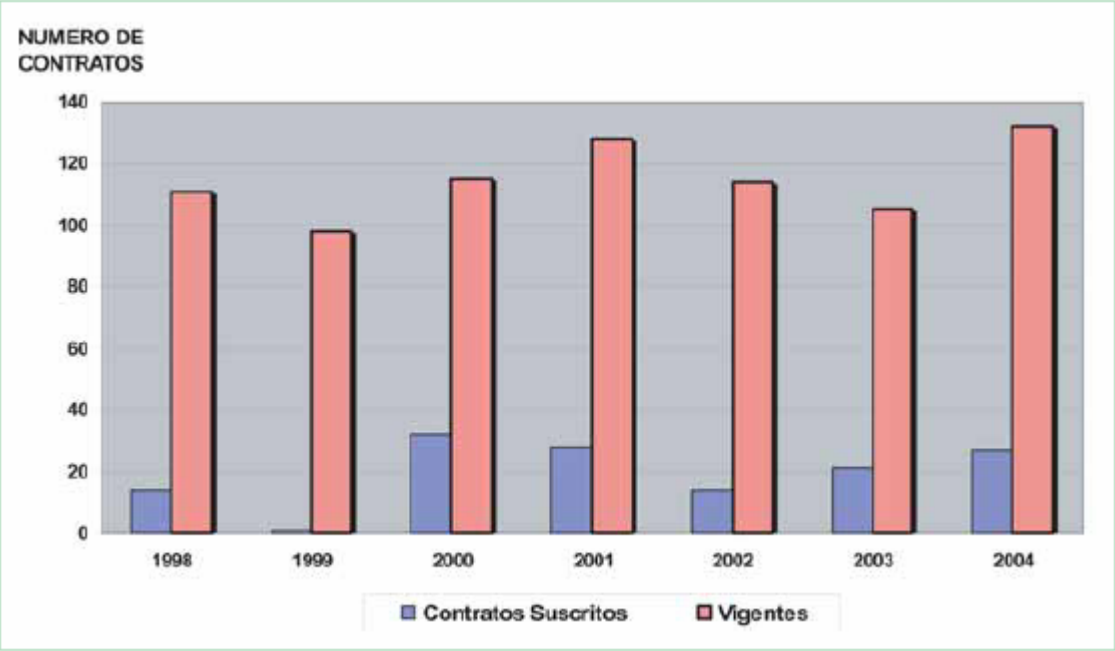
## 4.2 CONTRACTING

2003 was a year of great dynamism in signing new association contracts for petroleum exploration and exploitation. Covering a total of 1'278,695 hectares, 21 contracts were signed, seven more than in the year 2002, surpassing the goal set by the Government in this area.

At the end of 2003, there were 105 contracts en force grouped by 101 association contracts, three risk sharing contracts and one special contract (Las Monas). The area covered by the above-mentioned contracts totaled 10'006,722 hectares, representing 9.6% of their sedimentary areas.

**Figure No. 13**

**EVOLUTION OF CONTRACTS CURRENTLY SIGNED AND IN FORCE**




ECOPETROL currently has 2,752,114 hectares available for exploration represented in 22 blocks. Figure No 13 shows the evolution of petroleum contracts for the last six years.

During the first nine months of 2004, there were 27 new exploration, exploitation and technical evaluation contracts signed, with a total area of 84,099 $km^2$, in seven different sedimentary basins. According to the information provided by the ANH. By the end of the year there should be three additional contracts, for a total of 30 contracts.

## 4.3. EXPLORATION

Exploration was one of the most active areas for the petroleum industry during the years 2003 and 2004 and the most intence in the past 12 years: During 2003, twenty-eight wildcat wells and 14 delimiter wells were drilled. This result topped that of 2002 when 10 wildcats and 5 delimiters were drilled. Five of the

exploration wells were successful and two of the delimiter results were also positive.

By the end of September, 2004, there were records of 25 exploration wells drilled and 2 were about to be completed, with positive results in 10 of them. The 25 well goal set for 2004 is expected to be met easily, since everything indicates that 30 wildcat wells should be drilled during 2004.

Just like exploration drilling, seismic activity took off during 2003, easily topping the goals and objectives of 2,000 Kms of seismic studies. By the end of 2003, 3,470 Kms of studies were performed, of which associated companies did 1,819 Kms and ECOPETROL the remaining 1,651 Kms. By the end of 2004, we expect to have more than 3,000 Kms of new seismic studies. Table No 4 shows the evolution of exploration in Colombia.

**Table No. 4**

**EVOLUTION OF EXPLORATION ACTIVITY**

| **Total Exploration Activity** | **1999** | **2000** | **2001** | **2002** | **2003** |
|---|---|---|---|---|---|
| **2D Siesmic Adquisition** | 8680 | 731 | 1416 | 1150 | 1401 |
| 2D Terrestial (Kms) | 562 | 731 | 1416 | 1150 | |
| 2D Marine Siesmic (Kms) | 8118 | | | | |
| **3 D Siesmic(Km2)** | | 324 | 578 | 540 | 2033 |
| Wildcat wells drilled | 14 | 17 | 14 | 10 | 28 |
| Total number of wells drilled | 20 | 27 | 25 | 15 | 42 |

Source: ECOPETROL

## 4.3.1. Reserves

Generally speaking, petroleum production is associated with the availability of existing reserves, whose capacity runs out with production itself, for this reason the activity requires continuous and constant investment to be able to replace the reservoirs that are slowly depleted.

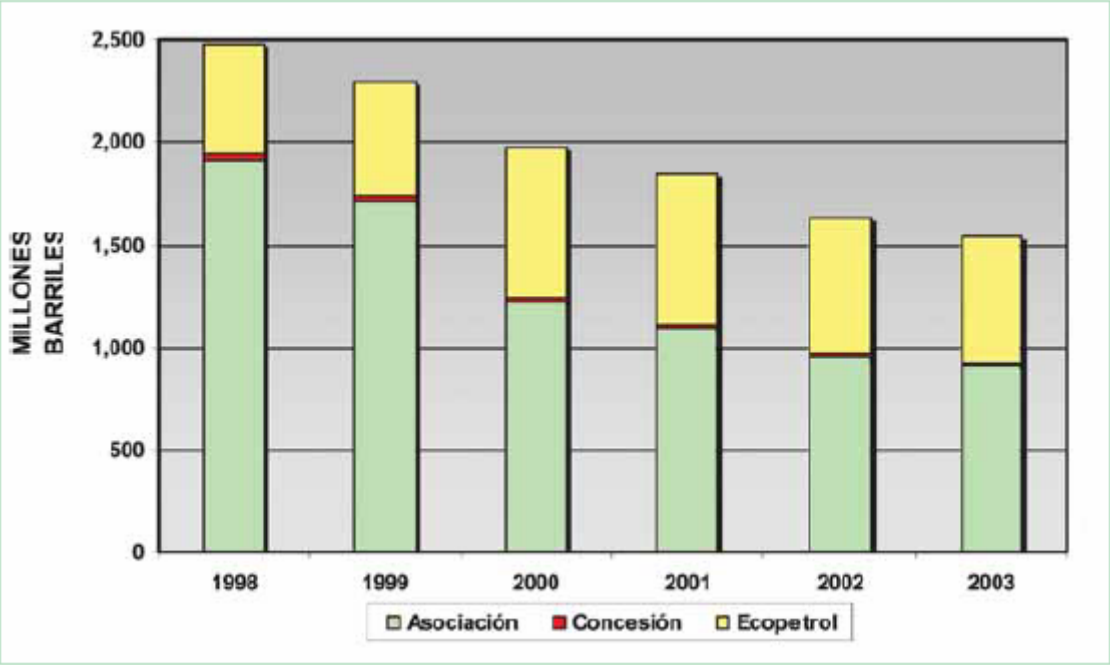
It has not been possible to revert the petroleum situation in regard to hydrocarbon reserves in the last five years. Petroleum reserves have shown an average reduction of 9.32% annually, while annual accumulated production is a round 200 million barrels of crude oil. Considering reevaluation of our reserves and given the availability of new reservoir information, by the end of 2003, Colombia would have 1.542 billion barrels of oil available.

Despite the technical and economic revaluation performed in some areas of exploration and exploitation, reserves continue on a decrease, effects which have been attenuated by the performance at Floreña and Cupiagua Sur.

Due to the changes in petroleum policies during 2003, the interest in petroleum companies to invest in exploration to find new fields is also expected to grow. The evolution of reserves shown in Figure No 14 shows that even when there were discoveries, these were below the annual extraction rate, and the situation worsens in 2000, a year when no new reserves were incorporated.

The association scheme has been the hardest hit, despite the fact that in 1998 there were more than 77% of all unavailable reserves, in 2003 the figure only reached 36.9%, decreasing its participation by 52% during the last five years. Likewise, direct operation has been increasing its share going from 21.7% to 24.9% during this same period, and displaying an increase of 14.9%, equivalent to 81 million barrels of oil.

Figure No. 14
**REMAINING PETROLEUM RESERVES FOR 2003**




Looking at the concession mode, reserves found are almost extinct since this system was abolished in 1974 and some of them have reverted back to the State, situation in which reserves were added to those operated by ECOPETROL.

## 4.3.2. Production and Supply

The policy developed during the mid-70s focused on self sufficiency and using adequate rationing of hydrocarbons, managed not only to contain the decrease in existing oilfields, but also helped improve production as of 1986, achieving important increases and as a result increasing petroleum exports.

Historically, petroleum production maintained a growing trend up to 1970, reaching levels of over 80 million barrels a year. During the following years it dropped continously, which in light of the internal demand, it led to the importation of expensive volumes of petroleum and gasoline, accentuating more so in 1979 when Colombia only reached a production of 49 million barrels, situation which coincided with the petroleum crisis era and prices that shot up uncontrollably.

In 1980 Colombia recovered its growing trend that took off in 1986, when it reestablished its self-sufficiency and returned to being an oil-exporting country as exploitation went into effect in the current oil fields of Caño Limón, Matanegra and La Yuca, among others, located in the Llanos Orientales basin.

It is important to highlight that within the growing petroleum production trend started in 1986, this trend will originated or started specifically in the area is exploited under the mode of association contract and of those operated directly by ECOPETROL, while the sharpest decreases were concerned with the old production fields in areas under the concession model.

During the period from 1989 to 1991, the largest production support is still the production from oilfields in the Cravo Norte Association (Caño Limón), despite some fluctuations, largely due to some inconveniences in the transportation infrastructure.

Again in 1993, with exploitation beginning in the producer fields of Cusiana and Cupiagua, petroleum exploitation increased progressively according to availability of the pipeline system. During the year 1999, the 800,000 barrel a day barrier was broken, due to production increases from the contracts at Santiago de Las Atalayas and Tauramena, as well as the adaptation of smaller oil fields which are allowed for production increases.

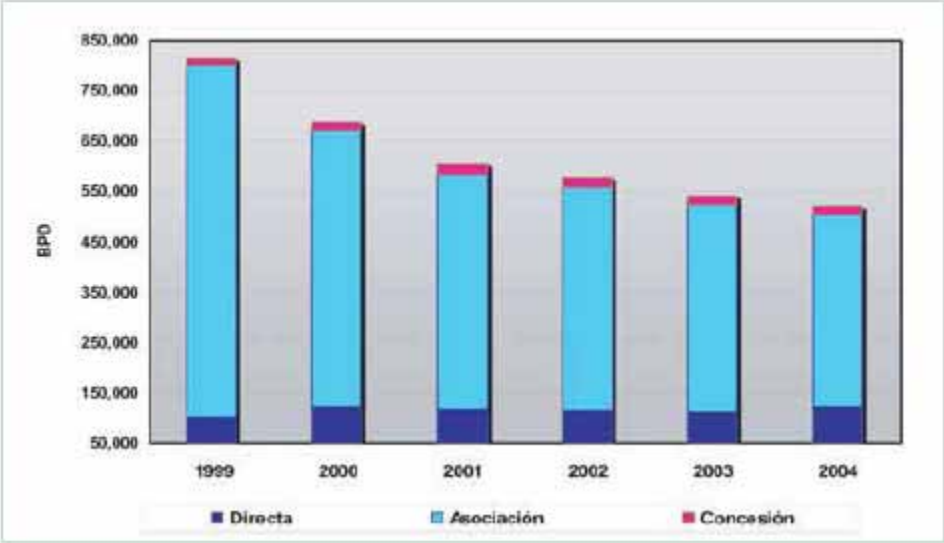
As of the year 2000, despite the continuous strategies to maximize oilfield exploitation, natural decrease has caused production to drop back by nearly 8% annualy.

Average production for 2002 was 578,000 barrels a day, decreasing by 4.3% with respect to 2001. In 2003 average production was 541,332 BPD of which 20.8% was due to direct production or ECOPETROL, 75.57% to associated production and 3.54% to production by concession.

So far in 2004, behavior is similar to prior years and and average production is remaining at 520,000 barrels a day, of which the association produces 73.5%, ECOPETROL 23.4% and the remaining 3% correspond to the concession scheme.

**Figure No. 15**

**PETROLEUM PRODUCTION**




## 4.3.3. Reserves/Production Relation

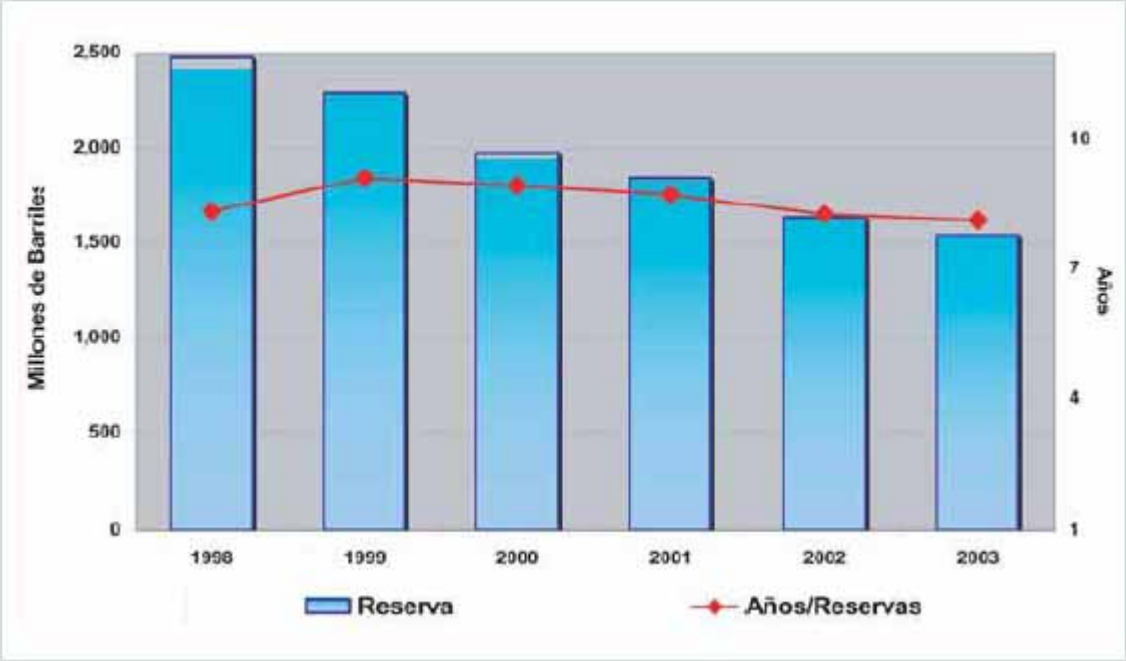
At this time, Colombia has petroleum reserves in the order of 1.542 billion barrels and a production rate of 541,332 barrels a day (average for the year 2003) which gives as a production reserve relation of 8.1 years.

The above-mentioned means that at the current production pace, and if no additional reserves to those counted as of 2003 are found, Colombia would have eight years of available supply and two years of exportations. Nevertheless, sings this figure is static and just for reference, it is easy to tell that the self-sufficiency situation for the country is shorter every year with the production decrease of its oil fields.

While the production rate drops by 8% yearly, reserves drop at a rate of 7.5%, for this reason the decrease in Factor R/P in relative time has only truly been one year in the past 5 years. It is very clear that the production evolution and its relation to new findings show a fast pace crude production, despite the normal decline in the oil fields (You can see this situation in Figure No 16). The above mentioned, due to Colombia's macroeconomic policies and the need for monetary resources in order to counteract fiscal difficulties affecting the country.

**Figure No. 16**

**RESERVES/PRODUCTION RELATION**




Under this scenario, as days go by, it is indisputable that there would be a sustained decrease of petroleum exports and their corresponding income drain, a difficulty to be overcome by an increase in exports of other products such as coal or manufactured goods. The greatest trouble will start with crude oil acquisition by associated companies by virtue of recoverable resources, corresponding to 59% of the total, and later having to seek the international market to have access to the crude oil required for domestic use.

# DOWN STREAM SITUATION

5

**Activities ranging from the transportation of crude oil, including a refining, fuel distribution to the end consumer, are all associated with a sector called "Down stream". Throughout this sector different public order and private agents participate, having very specific characteristics, associated with the activities developed.**

## 5.1 TRANSPORTATION

Transportation is the natural activity that follows the exploitation of a reservoir to move the product towards refining centers or to shipping ports for exportation, all of which add value to the crude oil. Pipeline capacity, unquestionably the best form of transportation for crude oil, is conditioned to the volume of reservoir production and the quantity of reserves associated with them.

Development of the petroleum transportation infrastructure is still the logical procedure after findings, requirements of current refineries and availability of surplus for exportation. Since 1985 construction and reinforcement of existing pipelines have gained momentum to update current infrastructure to match the Colombia's needs.

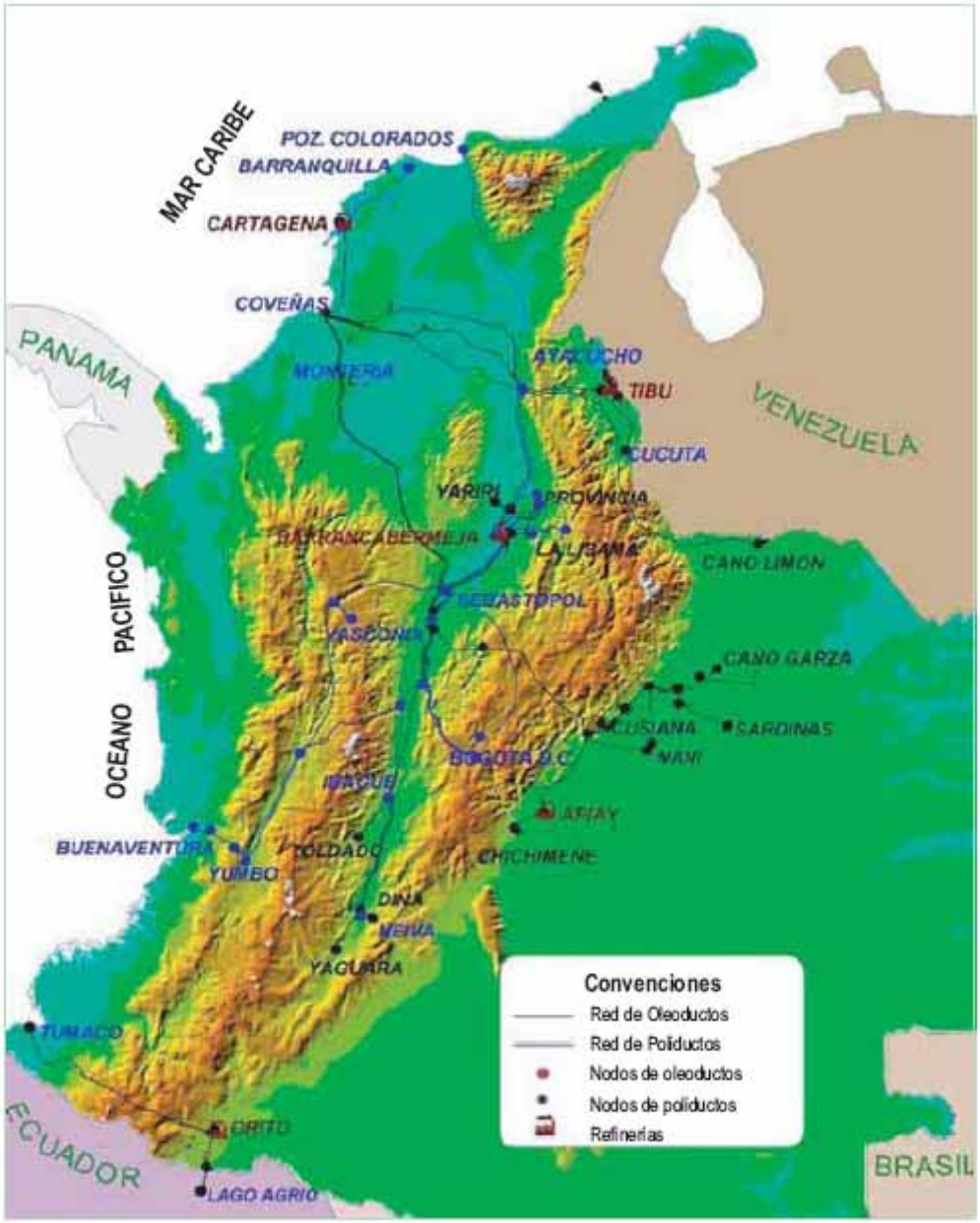
The greatest activity was concentrated in projects such as Caño Limón-Coveñas, Dina-Vasconia-Coveñas, Araguaney-El Porvenir-Vasconia-Coveñas and Cusiana-Vasconia-Coveñas, that permitted mobilization of greater volumes of production along the Alto Magdalena (Huila) basin and the Llanos Orientales (Arauca y Casanare) basins. This infrastructure was directly built by ECOPETROL or in conjunction with the corresponding Association.

Up until a few years ago ECOPETROL owned the majority of pipeline mileage, but with the state's deregulation policy, focused on stimulating private investment in this area of the petroleum subsector, financial mechanisms were designed for the construction and operation of pipelines to private enterprise specialized in this matter.

The pipeline grid is made up of 4,876 Kms distributed throughout 41 ducts that transport crude oil from the production sources, treatment or separation points and the refineries or exportation docks. ECOPETROL owns about 1,400 Kms, equivalent to 28.71% of the total, the private sector owns 785 Kms of lines that represent 16%, the remaining 55.1% are owned by the Associations between ECOPETROL and third parties. The main pipelines today work at 60% of their operational capacity, situation which originated from the normal production decline in the oil fields.

**Figure No. 17**

**NATIONAL PIPELINE GRID**



The pipelines with the greatest capacity are mainly i) Oleoducto Central between La Belleza-Vasconia - Coveñas with 615,000 barrel capacity and a length of 790 Kms, that specifically transports crude oil from the Piedemonte Llanero (Cusiana - Cupiagua) to the marine terminal at Coveñas and is owned by OCENSA, ii) Oleoducto CañoLimón-Rio Zulia-Coveñas with a length of 770 Kms, 215,000 barrel capacity, transporting crude oil produced at Caño Limón (Arauca) owned by ECOPETROL-OCCIDENTAL, iii) Oleoducto del Alto Magdalena with 212,000 barrel capacity and a length of 481 Kms, owned by Oleoducto Colombia S.A. transporting surplus petroleum from the south and eastern parts of the country, with international markets as their destination.

The national pipeline grid has a converging point at the Vasconia station, in the Central area of the country, where it is possible to route the product toward the refinery at Barrancabermeja or toward Coveñas, crude oil exportation port located on the Caribbean Sea. On the Pacific Ocean we find the port of Tumaco, final station of the pipeline Puerto Colón-Orito Tumaco owned by ECOPETROL, transporting petroleum production from Ecuador for exportation, pursuant to a National Government agreement with Ecuador. Table No 5 summarizes the distribution of the national crude oil transportation network.

According to current standards and to maximize reserves and crude oil production, users paying specific rates reflecting a profitability margin according to the risk capital invested, have access to the entire petroleum transportation system, irregardless of who owns each section.

During the last few years, development policies in this area have been aimed at private investment or associations between private producers and ECOPETROL, depending on the operational and/or financial needs for each project.

As a consequence of the presence of certain illegally armed groups, last decade they started a scheme of sabotage against the transportation infrastructure, especially focusing on crude oil. With strength and commitment from the Government, as well as by joint action from the Armed Forces, local authorities and the community, the year 2003 had the fewest number of attacks against the Caño Limón-Coveñas pipeline, and as such lesser and environmental impact and lesser effects on crude oil production from Cravo Norte, which has yielded benefits not only for the inhabitants in the area, but also for the country as a whole.

## Table No. 5
**NATIONAL PIPELINE GRID**

| Owner | Station Inicial | Final Station | Diameter (inches) | Length (Kms) | Capacity (KBDC) |
|---|---|---|---|---|---|
| Intercol | Buturama | Pto Morrosquillo | 4 | 17 | 5 |
| Houston | DINA | San Ignacio | 6 | 7 | 20 |
| Petronorte | Rio Zulia | Ayacucho | 10 | 186 | 30 |
| Petrocol | Andalucía | Aipe | 6 | 23 | 10 |
| Antex | El Difícil | Plato | 10 | 85 | 14 |
| Andian | Yarigui | Galán | 12 | 38 | 48 |
| Intercol | Provincia | Yariguí | 8 | 53 | 37 |
| Omimex | Velásquez | Galán | 12 | 181 | 35 |
| Omimex | Cocorná | Vasconia | 12 | 6 | 40 |
| Lasmo | Maní | Santiago | 10 | 10 | 20 |
| Hocol | San Francisco | DINA | 10 | 20 | 50 |
| Eurocan | Payoa | Galán | 8 | 57 | 33 |
| Chevron | Chichimene | Apiay | 10 | 40.5 | 18.9 |
| Kelt | Los Toros | Galán | 8 | 62 | 16 |
| Hocol – Esso - Total | Tenay | Vasconia | 20 | 398 | 100 |
| Oleoducto Colombia | Vasconia | Coveñas | 24 | 481 | 201.1 |
| ECP- Hocol - Kelt | Cravo Sur | El Cruce | 8 | 18 | 20 |
| ECP-Oxy | Caño Limón | Coveñas | 18-24 | 774 | 168 |
| ECP- CEPE | Lagoagrio | Colón | 10-12 | 37 | 50 |
| OCENSA | La Belleza | Vasconia | 30 | 92 | 555.9 |
| OCENSA | EL Porvenir | La Belleza | 30-36 | 189 | 555.9 |
| OCENSA | Vasconia | Coveñas | 30 | 475.8 | 201.1 |
| ECP-Hocol-Kelt | Caño Garza | Trinidad | 6 | 23 | 5 |
| ECP-Hocol- Kelt | Trinidad | Barquereña | 8 | 17 | 10 |
| ECP-Hocol- Kelt | Barquereña | Tocaría | 8 | 31 | 10 |
| ECP-Hocol-Kelt | Tocaría | Los Sabanales | 8 | 16 | 15 |
| ECP- Lasmo | Santiago | El Porvenir | 10 | 79 | 12 |
| ECP-Esso- Total | Yaguará | Tenay | 8 | 69 | 20 |
| ECOPETROL | Vasconia | CIB | 12-20 | 171 | 185.4 |
| ECOPETROL | Vasconia | Velásquez | | | 25.2 |
| ECOPETROL | Ayacucho | CIB | 14 | 187.4 | 42.8 |
| ECOPETROL | Apiay | Porvenir | 12-16 | 126 | 54.4 |
| ECOPETROL | Araguaney | Porvenir | 12-14 | 104 | 41.5 |
| ECOPETROL | Toldado | Gualanday | 10 | 61 | 11.4 |
| ECOPETROL | Yarirí | Comuneros | 18 | 21 | 30 |
| ECOPETROL | Colón | Orito | 12 | 58 | 30 |
| ECOPETROL | Orito | Tumaco | 10-14-18 | 305.4 | 58.3 |
| ECOPETROL | Ayacucho | Coveñas | 12-16 | 282 | 42.5 |
| ECOPETROL | Sincé | Coveñas | 10 | 65 | |
| GRAND TOTAL | 4876 | | | | |

Fuente: Ecopetrol

## 5.2 REFINING

This is strategic operation within the chain of petroleum performs the transformation of hydrocarbons to enable different uses. The petroleum refining commitment in Colombia is to supply fuel required by the country for its development, according to global environmental conservation policies and according to our new globalization scheme.

The strategy to meet this objective has been to increase the refining capacity in order to diminish imports of petroleum derived fuels, to optimize refining processes, to utilize the best operational practices and to implement new fuel reformulation programs.

Petroleum refining in Colombia follows the worldwide trend. This industry has undergone great changes because of the concern for the environment and for higher economic efficiency.

There have been important investments in Latin America in order to comply with requirements of less polluting emissions and the maximization of benefits, with motivations from the market and the economy. From the market because this area consumes more diesel and gasoline, and from the economy because refining costs in countries like the United States are way below those for the Latin American region, due to an estimated 10 year technological gap between these regions.

Economic refining concepts and margins are still related: The higher the margin the better the results, the heavy are the product is to refine, the less its profit. The challenge that prices have set today, is to make a better selection of crude oils at the moment of loading and to seek better profitability from the products, especially those valuable to program production, in order to obtain higher gross earnings.

With this frame of mind, the future of refining constitutes a interaction challenge between scientific research and technological development, because of the need to satisfy the ever higher fuel demand to cater to more stringent technical specifications resulting from the evolution of the automotive industry, environmental legislation and economic growth. At the same time, these demands will have to be satisfied with always heavier crude oils, characterized because of their high sulfur content and other compounds that lower profitability of the distilled products.

Traditionally in the operation and expansion of the crude oil refining capacity has been headed by ECOPETROL, who operates the industrial complexes at Barrancabermeja and Cartagena, considered of medium conversion, Orito and Apiay, of lesser capacity and lower technological processes.

Nevertheless, as per the new energy policies, the idea is for the private sector to build and operate new refineries. Nevertheless, achieving this objective has been a little difficult, mainly due to inconvenience this in marketing products, crude oil supplies and prices of petroleum by-products.

To perform this work, the National Government has defined more competitive policies such as the increase in the production of petroleum by-products, taking maximum advantage of better quality crude oils to guarantee environmentally friendly fuels, and considering the private sector as a key player in developing this activity. With the slow increase in investments for equipment recovery, existing refineries in Colombia are undergoing difficulties in obtaining environmental demands established by Colombian regulations.

Total Colombian refining capacity is 333,000 BPD[8], of which 71.4% is processed at the Barrancabermeja refinery, 22.8% in Cartagena, 0.8% at Orito, and 0.75% in Apiay, all of them operated by Ecopetrol, state owned refineries. The private sector, represented by Refinare, has 4.2% available, equivalent to a capacity of 14,000 BPD.

The national capacity exceeds the volume of the demand, but a quality level of products is required and high octane gasoline needs to be imported to satisfy local consumption and to improve quality of local standard gasoline mixtures.

during 2003, an average 302,634 BPD were refined in Colombia, with a maximum contribution coming from Barrancabermeja with 73.65% of the total processed, followed by Cartagena with 25.36%, and the remaining 1% was processed by Orito and Apiay. On the other hand, the Refinare refinery has been closed down, for technical reasons.

In order to achieve positive results in this area, the Barrancabermeja and Cartagena refineries reached a historical record in 2003, when they processed a load of 299,600 BPD, compared to the 285,800 BPD done in 2002.

The Barrancabermeja Refinery ended the year 2003 with a load of approximately 222,900 BPD, compared to the 211,900 BPD reached during 2002, while the Cartagena Refinery established a record 76,700 BPD, compared to the average 73,900 BPD for 2002. At the same time, the gross margin recorded for 2003 was the highest in the past three years, USD $7.24 per barrel, compared to USD $5.18 in 2002 and USD $6.76 in 2001, mainly due to favorable price behavior in international markets and better yields of valuable products.

During the first semester of 2004 an average 303,556 BPD have been refined, almost 100,000 more barrels than in 2003. The Cartagena Refinery has increased its operation to top its nominal capacity of nearly 800 BPD.

The load behavior for refineries has depended on availability and reliability of the different plants operating within each of the refineries. Table No 6 shows a breakdown of the evolution for the two main refineries in Colombia. On the average, the products in the refineries are as follows: Gasoline 39%, intermediate products (turbo, kerosene, diesel fuel) 31%, GLP[9] 8%, fuel oil 19% and asphalt 2%. Although Colombia is a net crude oil exporter, it imports high-octane gasoline to meet domestic specification demands.

**Table No. 6**

**REFINERY LOADS**

| YEAR | Refinery Barrancabermeja | Refinery Cartagena | Others ECOPETROL |
|---|---|---|---|
| 1998 | 200,067 | 74,954 | 5,430 |
| 1999 | 204,449 | 74,041 | 5,596 |
| 2000 | 217,177 | 69,705 | 3,966 |
| 2001 | 224,124 | 75,159 | 3,577 |
| 2002 | 211,886 | 73,972 | 3,400 |
| 2003 | 222,899 | 76,736 | 2,999 |
| 2004 | 223,249 | 77,806 | 2,748 |

## Barrancabermeja Refinery

The Barrancabermeja Refinery is the principal Colombian refinery and center of the petrochemical industry. It is located inside the mainland on the Magdalena River, a strategic waterway for distribution of some of the products obtained in the refinery. It has a nominal load capacity of 238 KBPD essentially composed of five topping units, four catalytic rupture plants, two polyethylene and alkilation plants, as well as plants for sulfuric acid, paraffin, aromatics and residue processing, and other less indispensable ones, such as cooling systems, sulfur and hydrogen recovery, among others.

8 barrels per day

9 liquefied gas from petroleum

These installations are currently responsible for 75% of the gasoline production, fuel oil, diesel and other fuels that Colombia requires to meet its energy needs. At the same time, it provides 70% of all petrochemical products commercialized in domestic markets.

Because of its technological characteristics, this refinery produces mainly gasolines, benzene, diesel, kerosene, JPA, avigas, LP GAS, fuel oil, paraffin waxes, lubricant basis, low density polyethylene, aromatics, asphalt, alkibenzene, cyclohexane and alyphatic solvents.Since the refining activity is strategic for Colombia, there has been major investment in the industrial complex at Barrancabermeja in order to assure reliability of supplies, quality in the products and to motivate national competition, as well as to search for productive efficiency. This also in order to optimize infrastructure which in turn would allow maximum benefit and minimum cost, including the change of equipment to guarantee mechanical reliability in the plants, as well as financial sustainability through quality products that can be commercialized in the international markets.

## Cartagena Refinery

The Cartagena refinery is the second-most important in the country. It is located on the Caribbean Sea and it has sufficient infrastructure and port facilities for the loading and unloading of products coming in and out of the country. The products processed by these plants meet the energy and petrochemical requirements for Colombia's northern and western areas.

It has a nominal load capacity of 76 KBPD, producing mainly LP GAS, gasolines (standard and extra), diesel fuel, Jet A, kerosene, gas oil, fuel oil, among others. It has vacuum distillation units, a viscosity reducer plant, a module for catalytic rupture, a polymerization plant and a sulfur treatment plant.

Because of its technological characteristics, conversion to valuable products is 72%, represented by 40.6% of LP GAS and gasolines, 31.4% of white products (diesel fuel, Jet A and kerosene) and 28% of fuel oil.

All around these installations an industrial zone developed at Mamonal because of the availability of raw materials in products and byproducts from petroleum refining used for different industrial processes in the chemical and manufacturing industry, aside from a strategic geographical location.

## Apiay Refinery

This is a small refinery located near Villavicencio in the central part of the country (Department of Meta), with a nominal load capacity of 2.5 KBDC. It has the following processing facilities: One atmospheric tower, a vacuum and steam recovery tower, which produces mainly asphalt, diesel fuel, benzene and gas oil.

## Orito Refinery

This is also a very small refinery located in Orito (Putumayo) with a nominal load capacity of 2.8 KBDC, produces mainly regular gasoline, kerosene, diesel fuel, benzene and fuel oil.

## Del Nare Refinery (Refinare)

It is the only private refinery operating in the country; it is located in the municipality of Puerto Triunfo (Antioquia), processes 14 KBPD of crude oil. It has three basic production units all interconnected, atmospheric and vacuum distillation, and a viscosity reduction unit, to produce asphalt, light and medium weight distilled products.

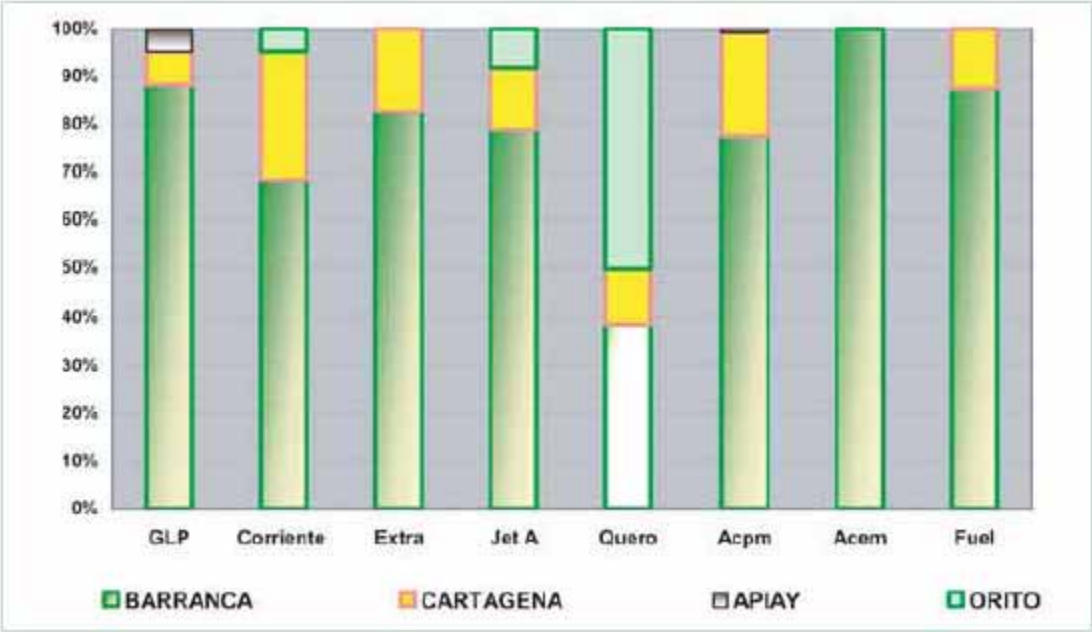
## Sebastopol Refinery

This is a private refining project, with 30 KBPD of processing capacity. The investment cost is estimated at USD $470 million and it is located in the municipality of Cimitarra, Department of Santander. The refinery will process Cusiana crude and will produce approximately: 21.9 KBPD of extra gasoline, 3.95 KBPD of diesel, 5.1 KBPD of LP GAS and 0.8 K BPD fuel oil.

Figure No 18 shows the current contribution for each of the existing refineries, within the national production of liquid fuels.

**Figure No. 18**

**PETROLEUM PRODUCT PRODUCTION BY REFINERY**




Source: Ecopetrol

A quick look at the production performance in Colombian refineries exemplifies their vocation for production of liquid fuels, meeting their responsibility to guarantee supply by ECOPETROL, but with a low level of raw material acquisition for the petrochemical industry.

Fuel production has been changing according to the country's needs and according to the quality of the crude oil processed. This is the case of fuel oil that while in 1999, it represented 20.87% of the total, in 2004 national production represented an average of 16.32%. The same thing happens with gasoline: So far during 2004, gasoline share has been 40.35%, while five years ago, this product participated with 42%. Diesel fuel is the product with the greatest growth rate, since its share in 1999 was 21.3% and now it represents 24.55% of the total production and 77.1% of distilled means.

Regular gasoline and diesel fuel are the fuels with the greatest demand and production in the refineries, to satisfy needs of the transportation sector, therefore they constitute strategic goods for the mobilization of passengers and merchandise: These products are supplied almost entirely by the industrial complex at Barrancabermeja.

Average gasoline production during 2003 was 111,962 BPD, while diesel fuel was 65,513. In both cases there was a production increase with respect to 2002, of around 3.1% and 9.29% respectively, the last product being the one with the greatest growth by volume handled. A positive variation was shown by avgas

used for air transportation: While 2002 registered production of 189 BPD, 863 BPD were produced in 2003, which represented an increase of 116.8%. Similar behavior was shown by LP GAS, when it registered a production increase of 17.4%.

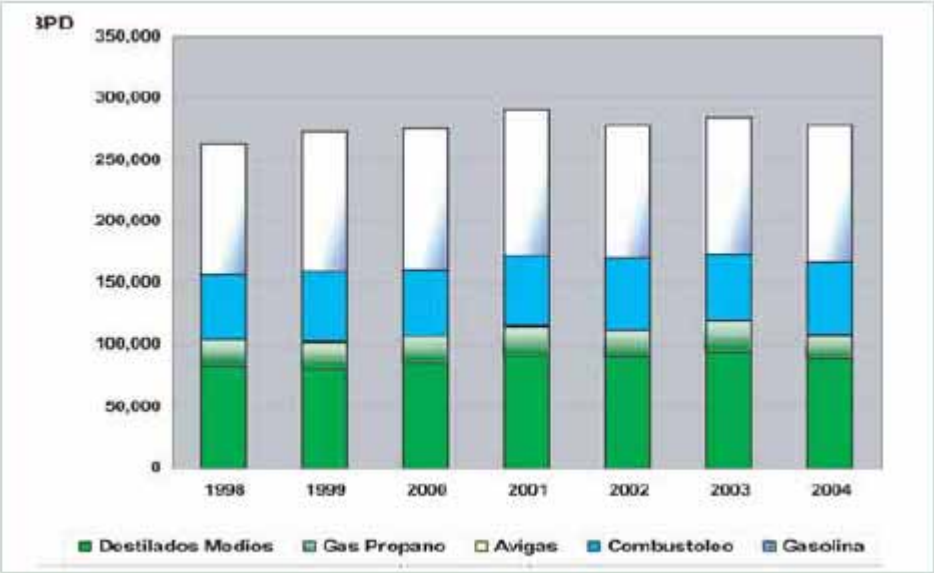
Although total production of petroleum products during the first semester of 2004 is less than that of 2003, because of the quality of the crude oil refined production of gasoline has gone up to 112,600 BPD, approximately 2,490 BPD more than in 2003. In the case of diesel fuel an average 68,500 BPD has been produced, representing 4.57% more than in 2003, equivalent to 3,000 BPD, entirely required.

Likewise, fuel oil has followed a rising path, just like Avgas, LP GAS and all other white products have a record contract for the quantity produced. By the end of the second quarter of 2004, fuel oil represented 20.8% reduction of petroleum products, while in 2003 it represented 18.7%, pertaining to 5,000 barrels/day more than the prior year.

The most important white products, Avgas and LP GAS, currently represent only 6.92% of petroleum byproduct production, nearly 5,600 BPD less than that produced during 2003, keeping in mind that this volume includes LP GAS produced in the natural gas treatment centers at the producer fields. The same is true of JP-A or aviation fuel, which has decreased sharply going from 26,760 BPD in 2003 to 19,400 BPD in the first semester of 2004, exhibiting a reduction of 27.33% equivalent to 7,300 BPD.

The reduction of these white products somehow explains the increase in gasoline and petroleum byproduct production, which in general terms points to a reduction in petroleum byproduct production during the first semester of 2004 of 1.64% with respect to 2003. Figure No 19 represents the evolution of petroleum byproduct production during the last seven years.

**Figure No. 19**
**TOTAL FUEL PRODUCTION**




Source: Ecopetrol

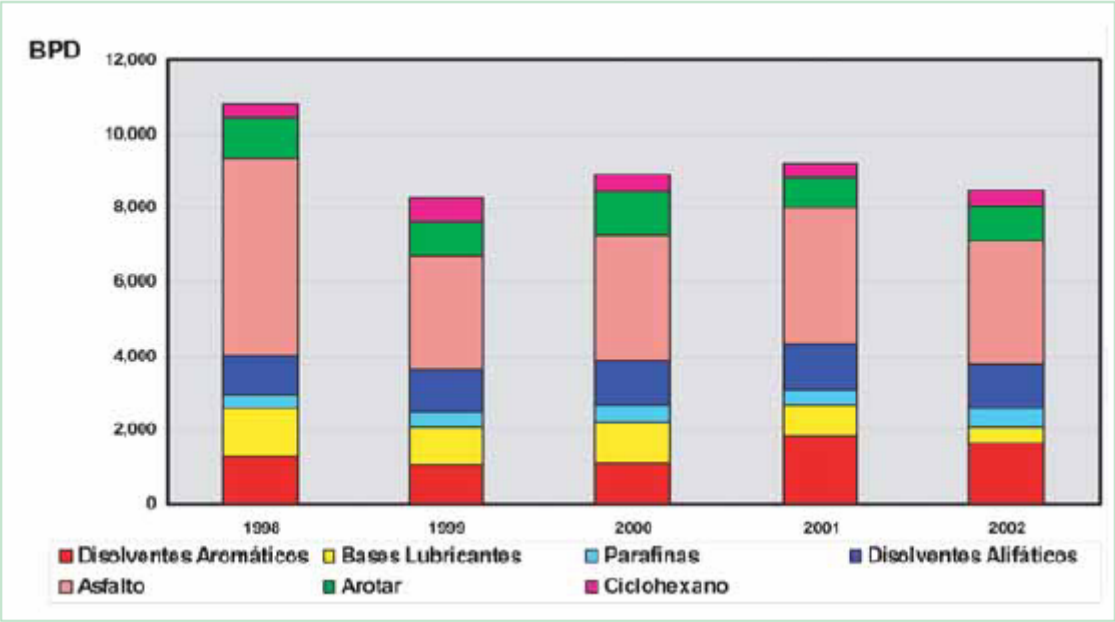
Within the refining process there is a second gender of products, which in special cases, are used as raw material for transformation processes, and occasionally are used as fuels. They are the so-called industrial product, or the results of those byproducts in the syntheses of the first chemical transformation of their

refining. It is a ample gamma generically known as “petrochemical products”, whose final destination are the productive chains in the manufacturing industries of fertilizers, plastics, food, pharmaceutical, chemicals and textiles, among others.

At several of its plants, ECOPETROL produces aromatics, lubricant bases, paraffin, solvents, asphalt, arotar and cyclohexane, among others.

Asphalt is the highest production byproduct and it corresponds to the heaviest part of fuel oil that can not be refined. Its production has also responded to the type of crude oil used as a load in refineries. Lubricant bases between 1998 and 2000 had an average production of 1,109 BPDC, but during the last few years this production has been reduced mainly due into operational of factors.

**Figure No. 20**
**PRODUCTION OF INDUSTRIAL PRODUCTS**




Source: ECOPETROL

Between 1998 and 2000 paraffin had an average production of 382 BPDC. During the year 2001 production of industrial products was nowhere by 9.6% with regard to the year 2000 with the highest impact on aromatics (17.4%), lubricant bases (26%), paraffin (16.7%) and cyclohexane (22.9%). The only reduction increase was was in solvents at (11.7%). These production drops were due to unscheduled stops for plants in each of these tasks.

The demand for industrial products has been subject to industry behavior in general that has been its principal client. The production-consumption balance for these products show less deficiency than the rest,

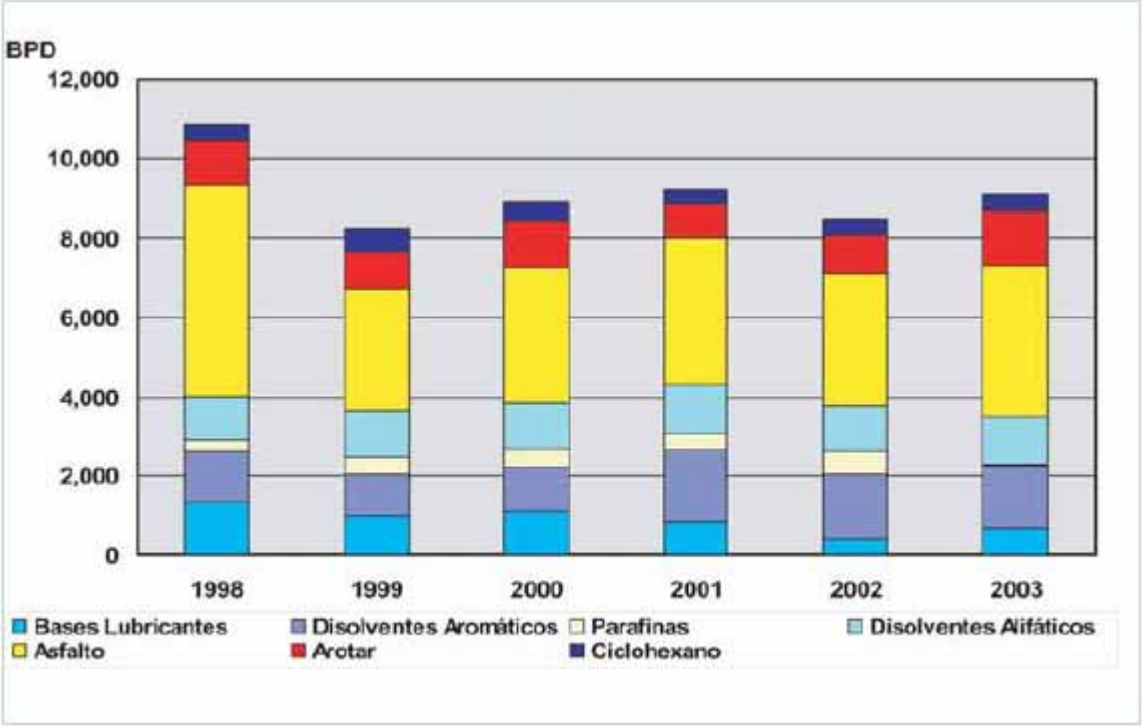


except for asphalt and arotar, which exhibit important surplus. As a whole, consumption of industrial products display variable behavior since 1999, one of the most critical years in Colombian economy due to

the drastic production drop and as such the national demand for raw materials.

On the other hand, paraffin and arotar have registered positive trends in sales. Comparing their behavior in the year 2000 and 2001 you can see that 2001 sales of basic compounds went up, in other words, the manufacturing industry and proved as a whole when the production of material goods grew by the transformation of raw materials.

**Figure No. 21**
**SALES OF INDUSTRIAL PRODUCTS**




Source: ECOPETROL

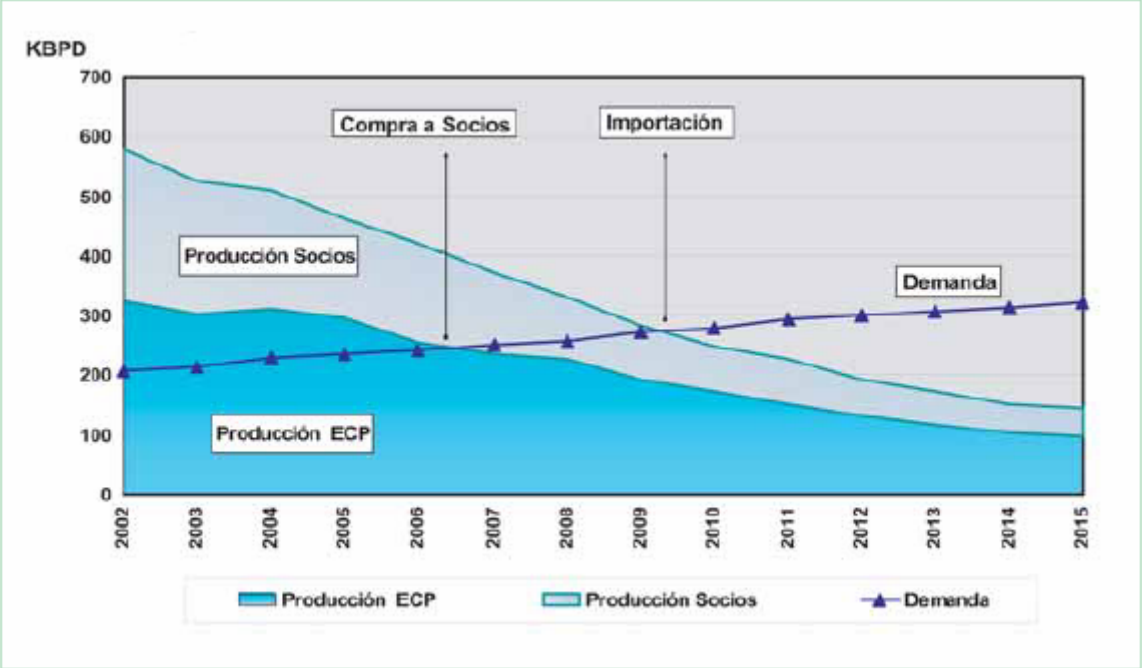
## 5.3 CRUDE OIL OFFER

The offer of crude oil employed for the different calculations done here correspond to the forecast performed by ECOPETROL, adding reserves to increase future petroleum production. This is a necessary condition in order to overcome the need to import crude oil. Figure No 22 shows how, with current proven reserves, it is possible to cover the national crude oil needs until 2008 and further, and how ECOPETROL would have the need to purchase crude oil from its partners as of 2006 to cover those same needs. With the expansion of the Cartagena refinery it would still be necessary to import crude oil as of 2008.

These forecasts correspond to the P 80 scenario for the ECOPETROL business plan version 2003. As far as crude oil production, short and midterm expectations for the scenario adopted, allow for self-sufficiency and generation of surplus for exportation. According to this scenario, by the year 2006, petroleum production should be approximately 460,000 barrels a day, in other words, 50,000 less than in 2005, of which 60% correspond to ECOPETROL production.

Bearing in mind the changes are occurring in this sector and the new strategy deployed by ECOPETROL, the P80 scenario was analyzed with newer and better exploration activities, seeking for the company to establish an objective of 400,000 BPD of its own production, coming up from the current level of 310,000 BPD.

**Figure No. 22**
**PETROLEUM OFFER AND DEMAND**




Source: ECOPETROL

Additionally, investments in exploration and production for the years 2004 thereon, contribute to the execution of the challenge established by the national government to incorporate one billion barrels, directly and in association with third parties, during the 2004 – 2007 period.

## 5.4 TRANSPORTATION OF PETROLEUM BYPRODUCTS

Transportation of petroleum products plays an important role in the petroleum industry and demands great investment. Self-sufficient countries have transportation networks available to mobilize petroleum products from the production centers to the end consumer, which are regularly a long distance away. In Colombia, this grid is made up of pipelines, propane pipelines, and fuel oil pipelines among others. This activity is a natural monopoly of the state that will continue so for a very long time, since it would make no sense to duplicate facilities to allow competition.

Colombian pipelines transport different products like gasoline, diesel and other fuels segregated up to the

wholesalers' warehouses; fuel oil pipelines mobilize surplus destined for exportation, and the propane pipelines move LP GAS from the refineries to the different storage points.

Transportation by pipeline is complemented by marine, river and land transportation, even when operations have been focused on maximum pipeline utilization with a corresponding decrease in other types of transportation especially land and maritime shipping.

In the particular case of the Barrancabermeja complex, the Magdalena River is used, to transport fuels by barges up to the refinery in Cartagena to cover internal needs and export available surplus. To satisfy the demand in San Andrés fuels are transported by cabotage and certain volumes required in the port of Buenaventura in the west side of the country.

For transportation of the different products, Colombia has a network of pipelines stretching 3,500 Kms, of which 99% are owned by ECOPETROL, except for the pipeline Medellín - Ríonegro, with a length of 28 Kms, which transports fuels from the intermediate station in Medellín up to the airport in Ríonegro, owned by Terpel Antioquia.

The pipeline grid layout is partially circular in the center of the country, starting off from the refinery at Barrancabermeja or at the Galán Station, where different products are dispatched to cover the needs of the Colombian population.

Bogotá area, Boyacá and part of Llanos Orientales, is established by the line setting out from Galán, passing through the Sebastopol Station, then on to Puerto Salgar, and ending up at the Mansilla Station in Facatativá. There is a second line that also provides fuel for this area, whose run is the same until the Salgar Station, veering off a little along the oriental mountain chain, ending up at the Tocancipá Station near Bogotá, forming a ring which supplies the largest market in the country. Its purpose is to assure two supply routes for the main consumer area in the country: Bogotá and its area of influence.

The Medellín region and its area of influence is supplied by the line from the Sebastopol Station and going to Cisneros Station and then on to Medellín. From La Maria Station in Medellín, there is a line that runs through the western area with five intermediate stations, ending its run in Yumbo, supplying fuel for the south of Antioquia and the North area of Valle del Cauca.

From Salgar in Cundinamarca, a line heads for Mariquita branching off into two lines, one that transports fuel for the south of the country and the other covering the West and arriving at Yumbo, thus closing the great national ring. The line transporting fuel to the to the south starts off in Mariquita, goes through Gualanday and ends up in Neiva, while the pipeline that turns west, goes through the region of Viejo Caldas supplying the needs for this area and finishing in Yumbo.

Table No 7 Displays a description of the pipeline grid for Colombia.

**Table No. 7**
**PIPELINE GRID**

| SYSTEM | CAPACITY (KBDC) | LENGTH (Km) | DIAMETER (inches) |
|---|---|---|---|
| B/vtura- Yumbo | 12.2 | 100.5 | 8,12,6 |
| Cartagena- Baranoa | 22.4 | 99.0 | 12 |
| Cartago – Yumbo 10” | 20.9 | 158.0 | 10 |
| Cartago – Yumbo 6” | 10.0 | 160.0 | 10,8,6 |
| Galán- Bucaramanga | 15.3 | 95.0 | 12,6,4 |
| Galán – Salgar (LP GAS) | 19.8 | 245.0 | 8 |
| Galán – Sebastopol 12” | 41.8 | 111.0 | 10,12 |
| Galán – Sebastopol 16” | 135.7 | 111.0 | 16 |
| Gualanday – Neiva | 11.7 | 161.0 | 8,6 |
| Mansilla – Bogotá | 58.3 | 42.5 | 10 |
| Salgar – Cartago | 20.2 | 124.0 | 6,8 |
| Mllin - Cartago- Yumbo | 24.7 | 395.0 | 12,10 |
| Pozos Colorados – Galán | 35.8 | 503.0 | 20,16,14,12 |
| Salgar – Gualanday | 23.4 | 166.0 | 12 |
| Salgar- Mansilla | 79.1 | 104.0 | 10 |
| Salgar- Mansilla (LP GAS) | 12.0 | 105.0 | 8 |
| Sebastopol – M/llin | 47.0 | 382.5 | 16,12,10 |
| Sebastopol – Salgar 12” | 37..3 | 116.0 | 12 |
| Sebastopol – Salgar 16” | 74..3 | 134.0 | 16 |
| Poliducto de Oriente | 40.0 | 257.0 | 20,16 |
| Yumbo – B/vtura | 25.9 | 100.5 | 8,12,6 |
| Galán – Coveñas | 16.2 | 463.0 | 8,12,14 |

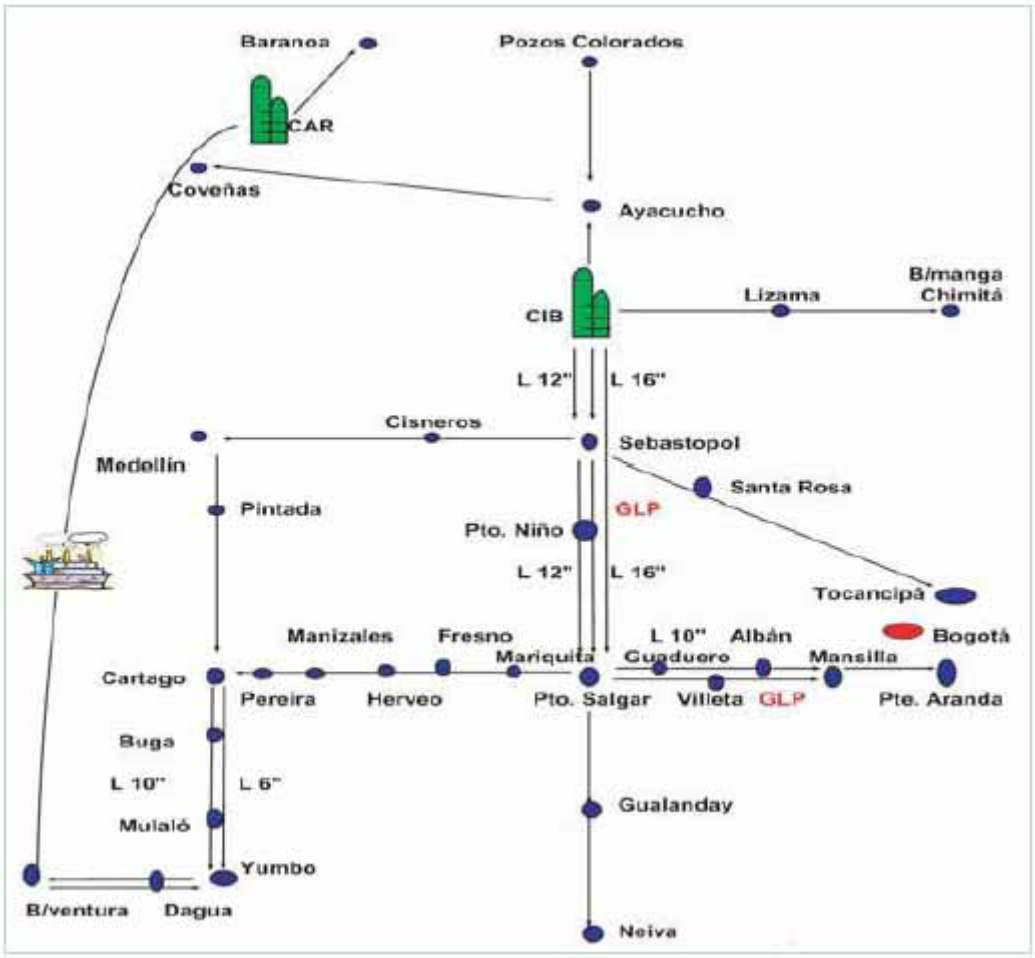
Source: ECOPETROL

There are other smaller pipelines such as the Buenaventura-Yumbo line that transports fuels to the port coming either by cabotage from Cartagena, or imported products, with enough volume to cover the growing demand in the west of the country.

The eastern area of the country, especially the Santanderes and Cesar, are supplied byproducts transported from Galán-Bucaramanga, with an intermediate station in Lizama. In the north of the country we can find the Cartagena-Barranquilla pipeline that supplies the departments of Atlántico, Magdalena and Guajira, while the west of the Costa Norte receives products directly from the Cartagena Refinery. The same is true for the Department of San Andrés y Providencia, which must receive products by cabotage.

for mass fuel imports, Colombia has a line that connects Pozos Colorados in the Caribbean with Galán Station in Barrancabermeja, which has an intermediate station located in Ayacucho.

**Figure No. 23**
**DISTRIBUTION FOR THE PIPELINE GRID**




There is a fuel oil pipeline that transports surplus fuel oil from the Barrancabermeja refinery for the foreign markets. This pipeline joins the Coveñas port with the mentioned refinery and has two intermediate stations: One at Ayacucho and the other at El Retiro. All along the pipeline grid there are intermediate stations where product is stored in warehouses in case of contingencies, owned by a fuel wholesale distributors of petroleum byproducts.

With regard to the fuel storage systems, there are two known types of storage depending on handling procedures: The operational owned by ECOPETROL, located at the refineries and at the different intermediate pipeline terminals, and the wholesale distributor storage also known as supply plants, located at intermediate stations themselves or at the end of pipelines or in far-off regions of Colombia not connected to the pipeline.

With regard to operational storage, ECOPETROL has been progressively incrementing its storage facilities at the different intermediate pipeline stations and at the Barrancabermeja and Cartagena refineries, providing more operational flexibility and increasing consumption days and inventory, while storage for wholesale distributors has been losing its strategic capacity, estimated at 15 consumption days.

## 5.5 DISTRIBUTION OF LIQUID FUELS

Distribution of fuel is another down stream segment where wholesaler distributors and retailers participate with very specific and unique characteristics.

**Wholesale distributors** are companies in charge of making a liaison between production products and retail distribution by using warehousing. A great number of the wholesale distributors handle service stations by means of commercial agreements.

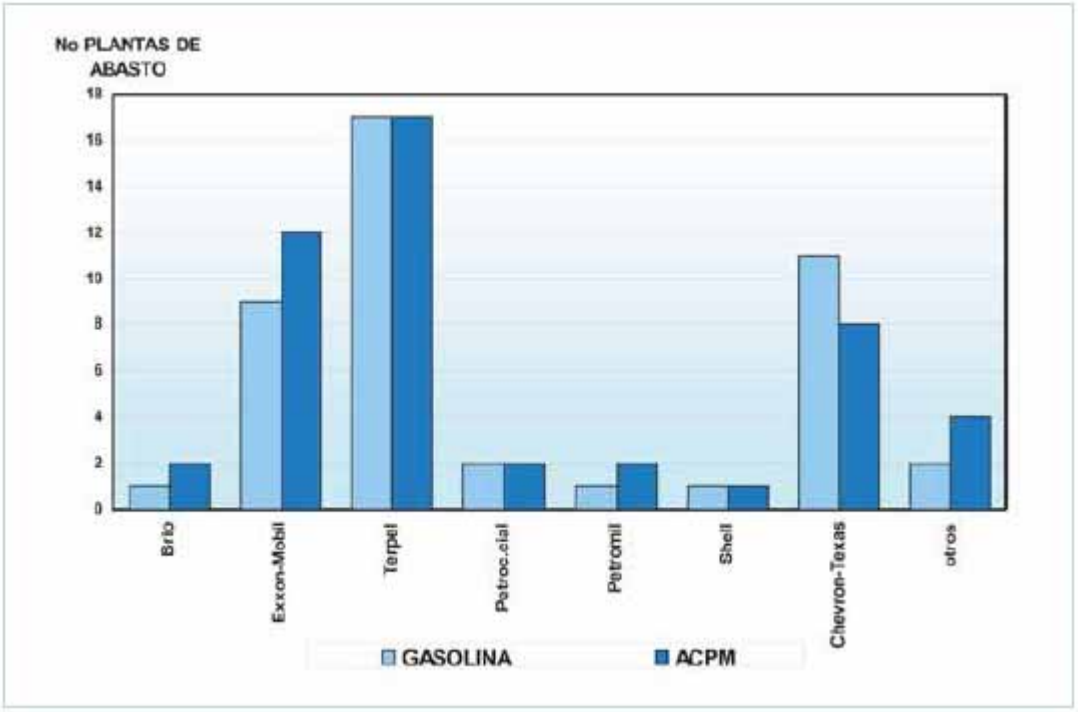
Nowadays, wholesale distributors have about 45 storage plants available, of different capacity according to the markets catered, 11 of them are located at airports, where they basically commercialize aviation fuel. The remaining 34 plants are located throughout the Colombian territory, supplying fuels and other required products for each of the regions in their area of influence.

Wholesale distributors buy fuel from ECOPETROL or from private refineries, they store their products and put in any additives at their plants to later move them to the service stations, either of their own or owned by third parties, for later sale to the public. In the fuel market, there are 15 major wholesalers reknown for their market share and coverage to more than 90% of the fuel market (gasoline, diesel fuel, kerosene and Turbo fuels).

Figure No 24 shows that the relation of the wholesale distributors and the number of plants they operate depending on the type of fuel. A quick glance will show that the Terpel organization, integrated by seven companies that share the trademark, operates the greatest number of storage plants, both for gasoline as well as diesel fuel.

**Figure No. 24**

**SUPPLY PLANTS ATTENDED BY WHOLESALE DISTRIBUTORS**




Source: ECOPETROL

The last agent in the distribution chain is the **retailer**, who for the most part is the owner of the more than 2000 service stations throughout the country, operating under the same flag of their wholesale distributor.

The retailer buys fuel at the supply plants and sells the product to the end-users at the service stations. With the measures taken by the national government for price liberation in 1998, there has been a great increase of wholesale distributors in the retail segment. Companies like Shell and Brío picked up pace in the retailer market especially in Bogotá, Colombia's chief market.

This has pushed Colombian Congress to study several projects of law to clearly define the rules of the game for the different down stream agents.

## 5.6 CONSUMPTION OF LIQUID FUELS

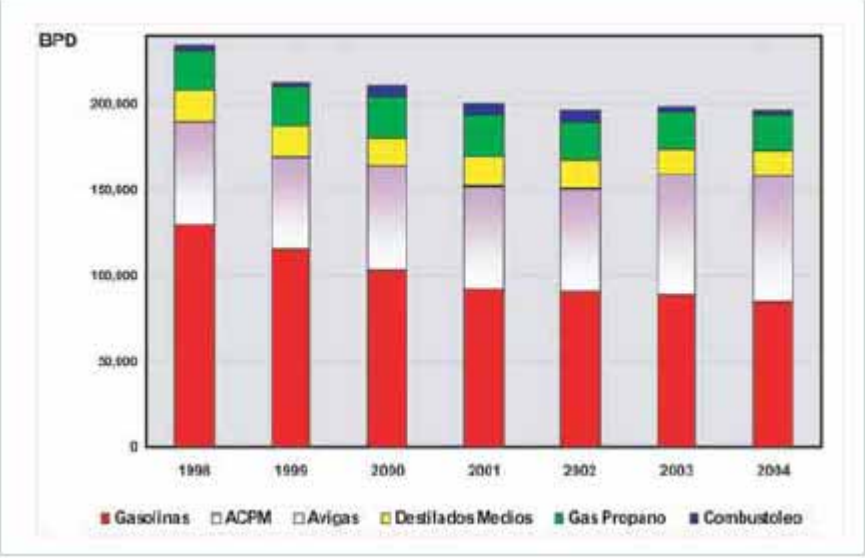
There has been a significant change in the fuel consumption patterns, especially in the transportation sector due to technical, technological and economic factors, among others. The greatest variation can be seen in the regression exhibited by gasoline and the penetration rate that diesel fuel has shown, phenomenon which has been called "the dieselization of the motor vehicle sector". Beside the worldwide technological advances, policies like the repowering of public transportation vehicles and the difference between gasoline and diesel fuel prices, have been the major causes for the changes.

During 2004, fuel consumption is still marking a negative variation in almost every product except for diesel fuel, which shows an increase of 4.56% with respect to 2003. Historical figures show a regression of more than a decade in the case of gasoline, were consumption has dropped by an average 4.93% during the last seven years. The reasons presented above, added to the current international WTI prices that affected the price of petroleum byproducts, indicate the trend being followed.

Figure No. 25 presents the evolution of fuel consumption, clarifying of course that the volumes presented in chart do not include theft or contraband of diesel fuel and gasoline.

**Figure No. 25**

**FUEL CONSUMPTION**




Source: ECOPETROL

In these cases, internal diesel fuel consumption is very close to the national production limit, accentuating the possibility of losing self-sufficiency and generating internal difficulties, since when consumption is larger

than the offer it must be covered by importing the product at international prices. This is why it is important to start aggressive substitution programs for the public transportation sector with more efficient energy sources, as well as local programs to increase mobility in large cities. Current diesel fuel consumption surpasses the 69,000 BPD mark, which forces in the country to use larger inventories and degrade the product to better quality and diesel fuel, sacrificing profits to satisfy internal demand.

Fuel oil is required by the industrial and power generating sectors. Internal consumption represents a small percentage of what is produced and the majority of the fuel is exported. Its internal consumption has registered a drastic drop as a consequence of the other energy sources such as Rubiales crude oil and coal. The average consumption now is around 2,206 BPD, while in 2003 there were 3,000 BPD consumed, which means a 26.69% reduction. Notwithstanding the above, Colombia has been favored by the capital flow from the export of fuel oil.

## 5.7 LIQUID FUEL DEMAND

The evolution of the energy basket, composed of the internal demand and energy imports, shows behavior associated with economic activity measured in terms of the GNP and the population growth rate. To determine the causes that will establish a future energy demand and the temporary correlation of the factors affecting it, has been for many years the study of prospective energy. Nevertheless, experience shows that temporary correlations are not enough to estimate what will happen in the future and how society will be able to make the demanded energy available.

To estimate into the future based on observed behavior in the past, to optimize the offer according to the demand, through analysis of regulatory measures and policies on a given energy system, ever changing with technological advances, by measures taken to improve capital mobility or in the great cities, as well as other norms to solve specific situations, make demand estimates difficult on a daily basis and make those models used less flexible and more sophisticated.

Bearing in mind the particular issues of our scheme, such as the dieselization of the motor vehicle sector, the implementation of a mass transportation system in Bogotá, the “pico y placa” curfew restrictions, the natural vehicle gas program and the reformulating of fuels with oxygen agents, among other measures, we perform the function of forecasting fuel demand for the 2004-2024 period.

The analysis was performed under the followings of suppositions:

1) By the official GNP scenario DNP, was future growth is projected at a rate of 4%.

2) With respect to crude oil prices, the WTI was selected as the basis for this projection scenario as presented by the United States Energy Information Agency, which considers an average price in terms of USD $35.10 per barrel for the period of 2004 – 2020. For each of the following years, the price of crude oil is established by calculating the average during the following five years in order to smooth out the variation each year, following the guidelines that the Ministry of Mines and Energy uses to establish a parallel importation objective.

a) In the specific case of regular gasoline, the projected prices were affected as established by Resolution 82438 of 1998 and is compared with that published by the Ministry of Mines and Energy, in determining the percentage of international parity, which is then taken to 100% for December 2005 with the reference of USD $ 31.24 a barrel.

b) In the specific case of regular gasoline, the projected prices were affected as established by Resolution 82439 of 1998 and is compared with that published by the Ministry of Mines and Energy, in determining the percentage of international parity, which is then taken to 100% for December 2005 with the reference of USD $ 31.24 a barrel.

c) Projections consider that the period from 2004 - 2006 the price of natural gas for vehicle use in energy units is equivalent to 92% of the price of diesel fuel, following the behavior observed during the period between January and September of 2004. As of 2007, is equal to 60% in energy units and regular gasoline.

In order to model the transportation sector, interdepartmental load, urban load and urban passenger mobility were separated.

The supply includes the scenario reviewed by ECOPETROL for control of theft and contraband of these of fuel and gasoline, presuming that the growth rate for these fuels would be the corresponding one if they were legally sold. An additional model of the mass transportation system, "Transmilenio", was performed fed with imported diesel fuel since 2005.

The results obtained for the base scenario point to a sustained growth in diesel fuel demand going from 87,700 BPD in 2004 to nearly 169,100 BPD in 2024. Likewise, gasoline would go from 90,800 to 87,600 BPD. Analysis show an energy basket put together at the beginning of the period with 46% for gasoline and 52% for diesel fuel, to be situated at 29% gasoline and 67% diesel fuel in 2024, accentuating the dieselization of the motor vehicle sector and highlighting the needs that the country has in this area.

**Figure No. 26**

**GASOLINE AND DIESEL FUEL DEMAND**

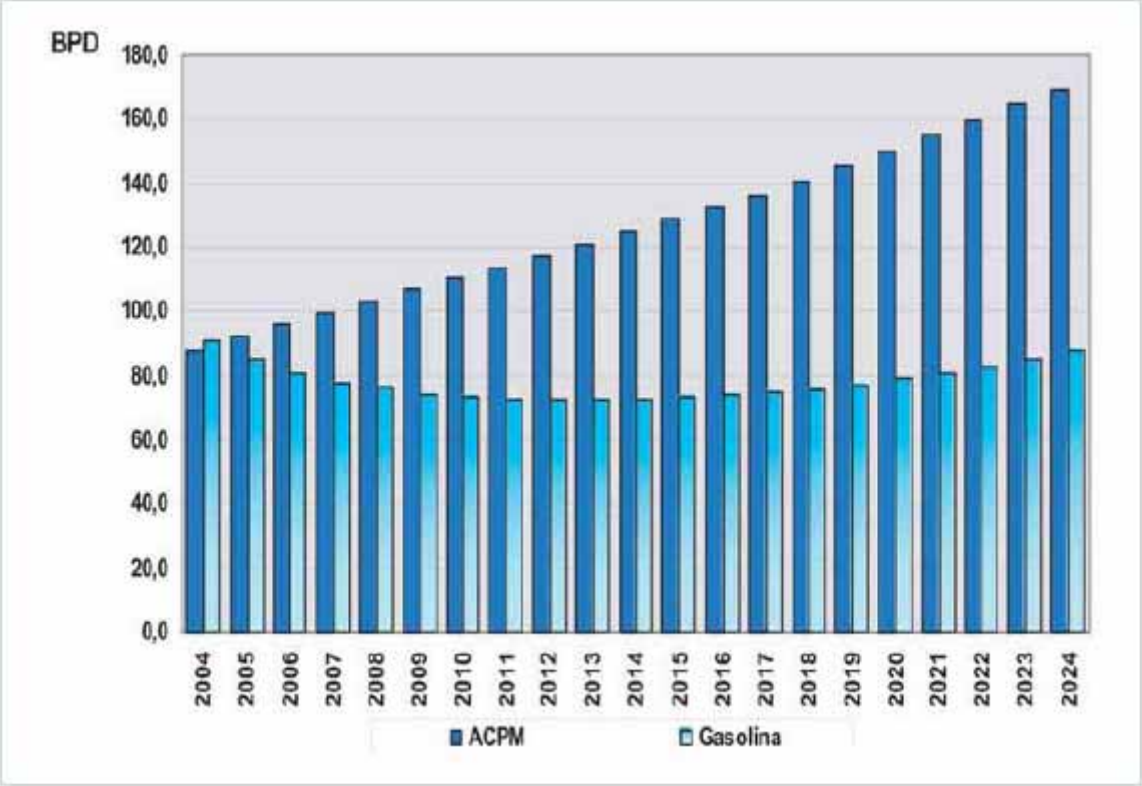
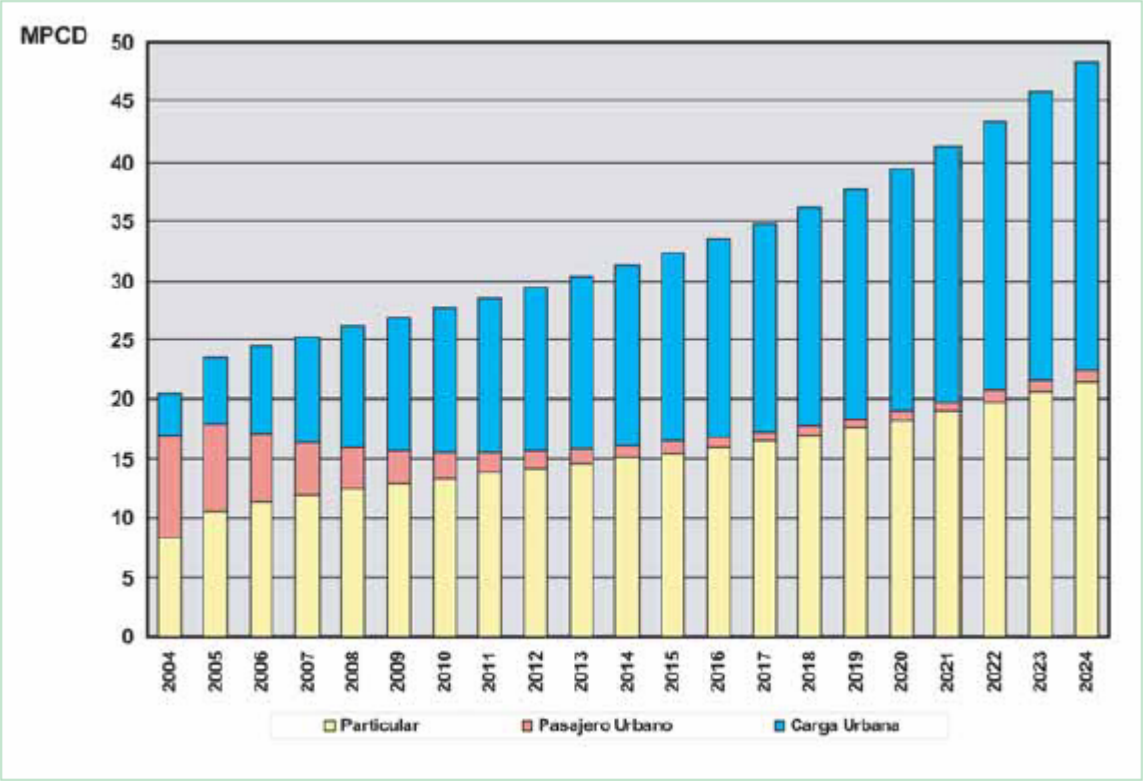


**Figure No. 27**
**WORLDWIDE NATURAL GAS CONSUMPTION FORECAST**

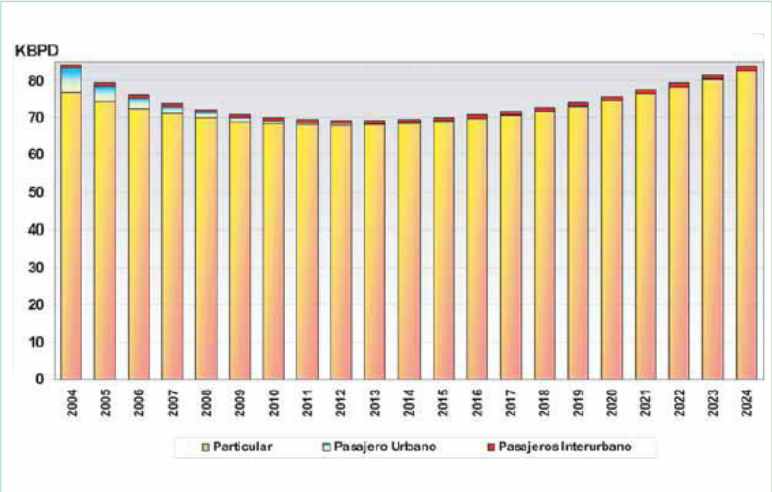



As figure 27 shows, natural gas could improve its market share in going from 20.5 MPCD in 2004 to 48.3 MPCD in 2024, in other words, its participation in the transportation sector will increase by one percent unit going from 2% to nearly 3% throughout the period of the study, with consumption increasing during the last quarter.

By transportation segment, a noticeable increase can be seen in urban cargo which may complete a 53% share by the end of the period, while in 2004 so far it represents 17%. Urban passenger transportation share shows a substantial reduction going from 42% in 2004 to 2.5%, in 2024. The reason for this drop is the market reduction for buses because of the so-called "bus-junking". The private transportation segment shows a positive growth going from 41% to 44.9% at the end of the period.

The results found for gasoline, exhibited an important decrease in the cargo segment, whose participation is estimated at 3.8% by the end of the period, highlighting that interstate cargo practically disappears.

**Figure No. 28**
**GASOLINE CONSUMPTION EVOLUTION**

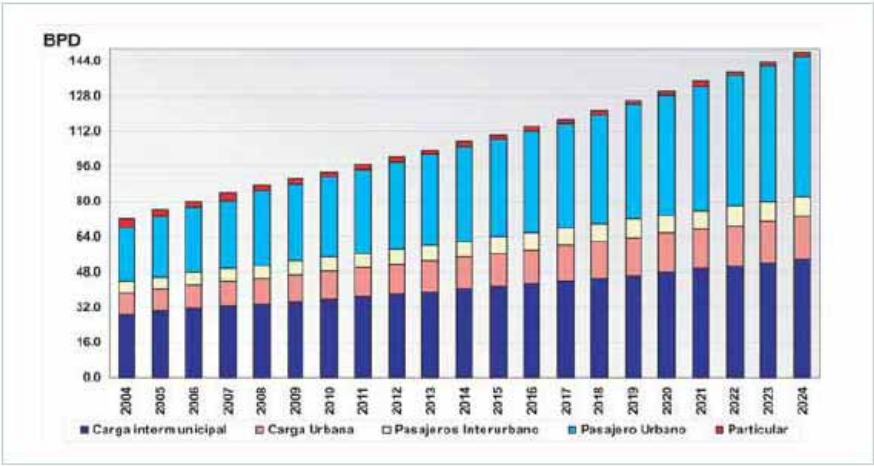



Gasoline consumption for public transportation both urban and interstate show a continuous reduction, since thier 10% share in 2004 ends up being 2% of the total gasoline consumed. The substitution of energy sources in urban areas and the renewal of the motor vehicle plant for more efficient interstate transportation media can be considered as possible causes of the market loss. Generally speaking, the use of gasoline is mainly for private vehicles, motorcycles and taxicabs, as shown in Figure No 28.

In the case of diesel fuel, in particular, we can see a continuous increase in consumption, surpassing other segments like gasoline for cargo and passenger transportation. Interstate cargo transportation and urban passenger transportation are the two sectors with the largest share of consumption for this fuel, when together they add up to nearly 80% throughout the period.

The private share continues we went down throughout the period of analysis, while the interstate passenger transportation segment continues with a vegetative growth. Evolution shown in Figure No 29.

**Figure No. 29**
**DIESEL FUEL DEMAND FORECAST**



It is worthwhile to point out the need to import diesel fuel in volumes of nearly 81,600 BPD which represent 48.25% at the end of the period. During 2004 importation started at the end of the year, with nearly 3,000 BPD.

## 5.8 FUEL PRICES

Regulations for fuel prices have as a legal support Decrees 2104 of 1974 and 1736 of 1975 issued by the Ministry of Mines and Energy, which were complimented after drafting Law 10 of 1984.

By means of this legislation the Ministry of Mines and Energy was assigned the task of establishing prices for petroleum byproducts and natural gas, setting its structure and the determining periodic increases. Later on legislation was extended by Decree Law 2119 of 1992, ratifying that it was the Ministry's responsibility to set prices for petroleum byproducts along the production and distribution chains, with the exception of LP GAS which is set by Decree 70 of 2001.

The development of the fuel market has been marked by three relevant points in time: The first period between 1975 and 1983, were periods of internal adjustment after the importation of oil at high international prices, a second export boom period between 1984 and 1998, during which prices were adjusted for inflation, and the third period as a 1999, looking to liberate the market.

### First Period: 1975 - 1983

Within the framework of an importing country and high international prices, national government policy concentrated on recovering earnings for the refineries in this manner strengthening ECOPETROL's finances. During this period and the prices in constant pesos for gasoline and diesel fuel more than tripled, nevertheless income for the refineries was kept much below import prices.

Prices for diesel fuel and gasoline were the same, with very few exceptions, since diesel fuel was exempt from national sales tax.

### Second Period: 1984 - 1998

This period coincides with the discovery of Caño Limón. The policy was based on price increases according to inflation, which was effective as of the first day in January of each year. Under this scenario gasoline and diesel fuel prices were the same until 1996. In the same fashion, price increases began to be done twice a year.

### Third Period: as of 1999

Ever since the January 1, 1999, price policy has been fundamented on international petroleum prices, whose actions are oriented at establishing an income for products reflecting international quotation behavior and the type of exchange, liberating the price of extra gasoline, liberating the margins for retailers and setting gasoline prices for regular and diesel fuel according to opportunity costs, that in this case corresponds to power at the using the Mexican Gulf Coast reference.

On December 23, 1998, the Ministry of Mines and Energy issued Resolutions 8- 2438 and 8-2439, structuring prices for production or importation, distribution and sale of regular motor vehicle gasoline and diesel fuel, respectively. The objective of the resolutions was to regulate the market in a clearer way and create a new incentive for competitors in the fuel market, by setting the price to the producer equivalent to the parity for importation of each of the fuels.

At present current price policy obeys three main objectives: i) efficient prices, ii) inflation objective iii) gradual reduction of subsidies. With regard to the first item, it is expected that this objective will contribute towards fostering competition, to the expansion of the distribution infrastructure, to the rational use of non-renewable resources, and to establish a real value or a strategic resource that is running out.

To meet the inflation goals and to eliminate the psychological factor of the past, are objectives that have been complied with gradually, since these fuels and do not directly participate in 1.08% of the total index. Nevertheless, indirectly the transportation subsector participation in the index is around 11.9%. Even so, the inflationary effect of the 2004 prices did not reach 1% of the index, highlighting the small relation existing between fuel price increases and inflation.

The last objective pursued is the gradual elimination of subsidies, generating a price scheme that recognizes the reality of international markets (until reaching the long awaited WTI prices, including the refining margin) , providing stability signs to investors and motivating attention to internal demand for local and imported products.

Due to fluctuations and crude oil price increases and the behavior of some variable macro economies, it has been necessary to modify on several occasions the methodology for calculating producer income, to diminish the impact generated by internal price changes on these variables.

The methodology established to calculate the price for sale to the public for gasoline and diesel fuel is made up of four major topics: Earnings for producer, transportation, distribution margins and taxes (national and territorial). In regard to the earnings for producers, transportation and distribution margins, it is the responsibility of the Ministry of Mines and Energy to set these prices by a resolution. Taxes are established by the Law. The most difficult item to calculate is producer income, which is defined by the following mathematical equation:

**IP= (Pr FOB + FL+ SE + IM)* TRM + A+TPC+TI**

**IP**: Income for Producer

**PrFOB**: Price of gasoline UNL 87[10] Mexican Gulf Coast, corrected by an octane correction factor.

**FL**: Fleet and other incurred costs of transporting a gallon of gasoline from the Gulf Coast of the United States up to the import dock in Colombia, in this case Santa Marta.

**SE**: Cost of marine or land insurance incurred for transporting one gallon from the Gulf Coast of the United States up to the local importation dock (Santa Marta). For 1999 it was established as 0.000387x PrFOB

**IM**: Cost of quality inspections at the port of loading and unloading. For 1999 that would be US$0.000286 per gallon.

**TRM**: Representative exchange rate on the date the calculation was done.

**A**: Amount corresponding to the payment of tariffs for gasoline imports. The current rate is 15% for regular gasoline and 10% for diesel fuel.

**TPC**: Payment of fuel transportation tariff at Pozos Colorados- Barranca pipeline. For 1999 the resolution was set at $31.4 per gallon. In October 2004 that amount was $46.42 per gallon.

**TI**: Amount corresponding to the payment of stamp tax. The rate is 1.50%

There is a similar formula for diesel fuel, but with a change in the producer that the transportation rate from Pozos Colorados to Galán. After multiple changes and adjustments in methodology for calculating the price of gasoline, as a September 1999, the price started to be set on a monthly basis according to criteria from the Ministry of Mines and Energy.

Continuous modifications to the elements of the formula yield the new price for regular gasoline and diesel fuel, which became an incentive for greater consumption of the latter. Figure No. 30 shows the evolution of fuel prices.

On the average, the share for income to the producer and tax on fuels represent 46.6% and 38.2% in the

case of gasoline, while these of field represents 54.9% and 25.8% respectively. In an international context, Colombia is one of the countries with the least amount of taxes, especially in the case on diesel fuel, a very important topic, since this corresponds to one of the principal sources of financing from governments.

Distribution margins have also suffered adjustments throughout the period 1999 to March 2004, whose increases during the same period reached amounts close to 135% in gasoline and 92% in diesel fuel, while IPC (Index to update margins) during the same period grew by 42%.

As of April, 2004, the pay scheme for wholesale and retail distribution activities were modified, setting the margin at eight (8) cents of a dollar per gallon from the wholesale distributor for operational and maintenance costs, as well as administration and sales expenses, losses because of evaporation and additive costs, while for the retailer the margin was established at US $ 0.12
per gallon, considering operational and maintenance costs, as well as administrative and sales expenses.

The transportation activity in the past used to be handled with a stamp amount, independently of the distance or of the product transported. As a necessary signal for the expansion of the Colombian pipeline grid, from the first quarter of 2003, the pay scheme was modified by establishing transportation rate by distance.

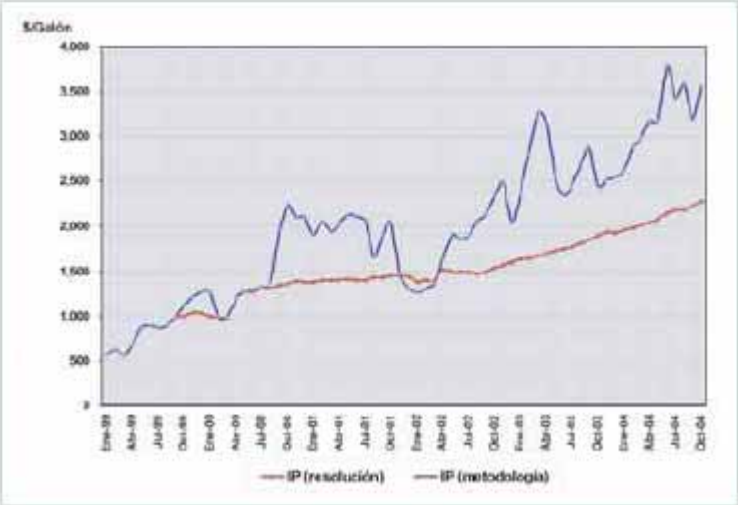
**Figure No. 30**
**FUEL PRICES**


Due to extreme crudeoil price behavior in the international markets, Colombian government intervened in the fuel market by offering a consumption subsidy, establishing a difference between the importation parity price and the producer price, defined by resolutions from the Ministry of Mines and Energy. Thus it began the process of eliminating the subsidy until 2004 for gasoline and until December 2006 for diesel fuel, avoiding excessive impact on the price to the end-user.

The subsidy for regular gasoline depends on the WTI quotes for Colombia, and on the market exchange rate. During the last few years, the WTI has had an important increase, reaching levels over US $54 per barrel, causing an increase in the subsidy. Figure No 31 shows the evolution of this subsidy. The upper line corresponds to the producer income amount (IP) calculated according to Resolution 82438 of 1998. The bottom line corresponds to the producer income figure (IP) that the Ministry of Mines and Energy establishes in their price resolutions, on a monthly basis. During just the first quarter of 2002, you can observe a higher internal price then the International one with regard to income to the producer.

**Figure No. 31**

**GASOLINE SUBSIDY EVOLUTION**

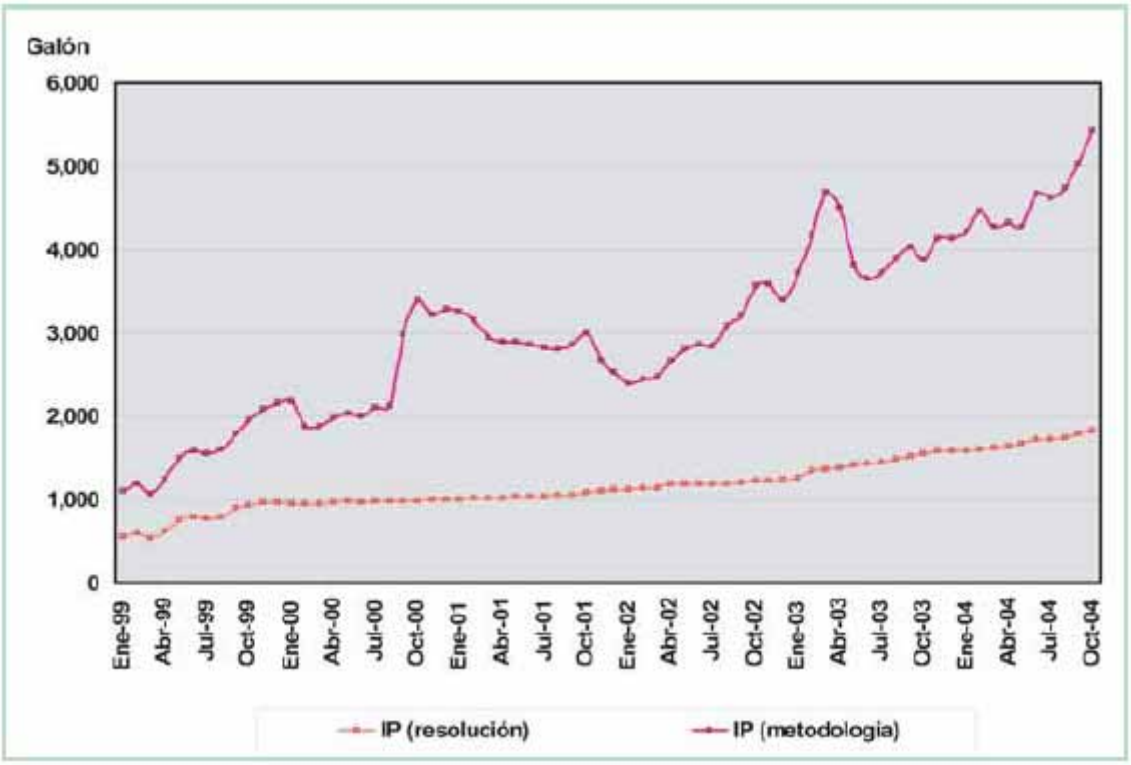



Diesel fuel subsidy is higher than that for gasoline, if you bear in mind that diesel consumption corresponds to 45 percent of consumption between the two. Figure No 32 shows the direct effect of the gradual removal of this subsidy and the gap between the defined price by the Ministry of Mines and Energy and the one that should be paid.

Unlike gasoline, the price defined by resolution for diesel fuel during the subsidy removal stage started in 1999, has never shown parity with importation and income for the producer has slowly been on the rise, to a point where the subsidy for consumption went from 48 percent to 96 percent. Furthermore, Ecopetrol revenue was lower in that same proportion, a situation that worsens when the company has to import the product.

**Figure No. 32**

**VARIATION OF DIESEL FUEL SUBSIDY**



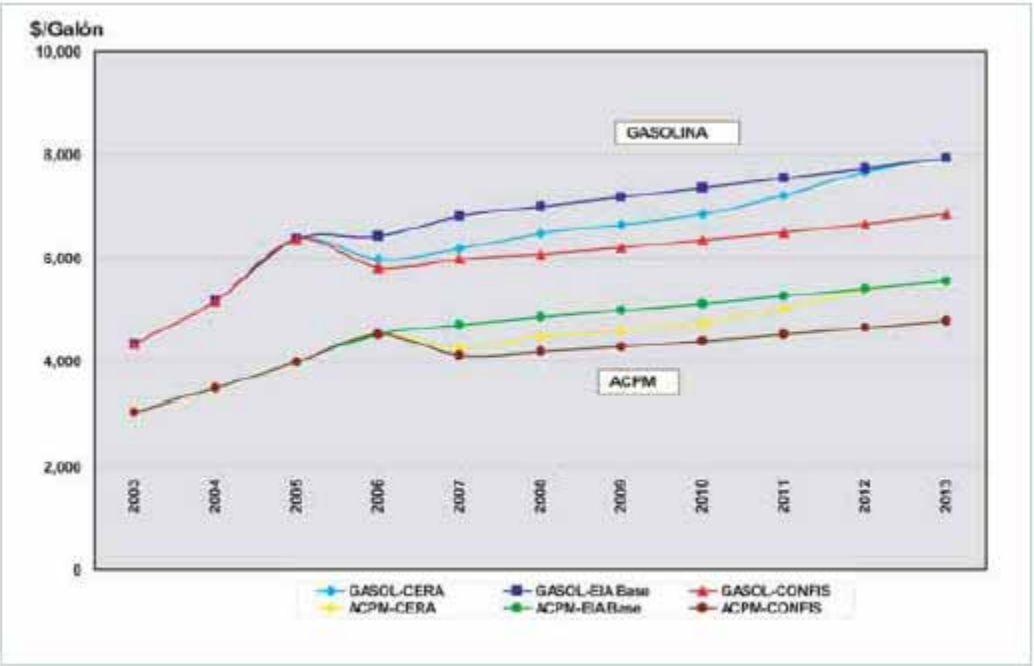

With the current price policies preferences have increased for the production and transportation sectors and just like for diesel fuel. Likewise, the signals may be reorienting the mobilization trends of Colombians towards public transportation (diesel consumption) instead of the private car. Nevertheless, future price increases will be banned on international prices, the behavior of the exchange rate and the level of competition between retailers on a short-term basis and the competition of wholesalers on a long-term bases.

Bearing in mind that the long-term reference WIT price for dismounting subsidies is US $31.24 per gallon, and using a scenario of median WTI prices from the US Department of Energy, the price projection was determined for gasoline during the next 15 years, was trend can be seen in figure No 33. This figure also presents sensitivity with the price scenario from CONFIS and with CERA reference.

It is easy to see that in December 2006, when all fuel subsidies are completely eliminated, regular gasoline will have a price closer to COP $6400 pesos per gallon and diesel fuel COP $4500 per gallon A difference that translates into $1900 per gallon in favor of diesel fuel, widening the gap between the two.

Figure No. 33

**PRICE FORECAST FOR GASOLINE AND DIESEL FUEL**



# FOREIGN TRADE

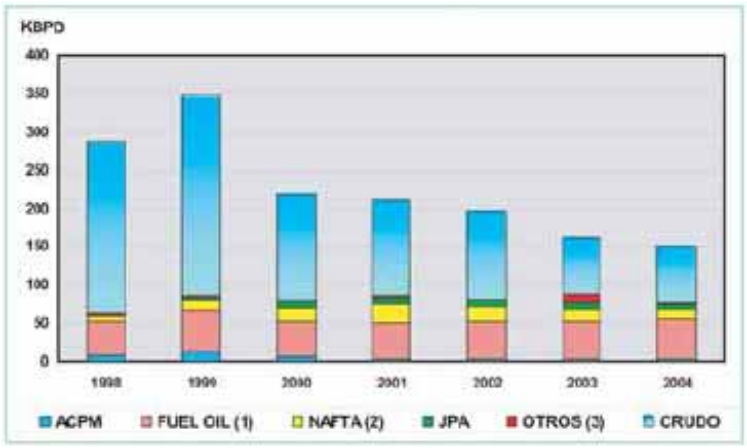
The exports of crude oil and their by products rose by 22% over the first eight months in 2004 in comparison to the same period of time in 2003, from USD $1.111 million to USD$ 1.358 million. The balance of trade rose by 25.07% with respect to the same period in 2003, equivalent to USD $257.32 million.

The above is due to the increase of international prices of oil and to a larger amount of exported refined products, which in terms of volume of exports represents an increase of 5.97% by changing from 163.103 BPD to 172.851 BPD, being crude oil and fuel oil the most salient commodities.

At the beginning of the third quarter, ECOPETROL sold abroad USD$ 253 million in fuel oil, USD$ 99 million is premium gasoline at an average price per barrel of USD$47; USD$ 162 million in raw naphtha at an average price of USD$ 43 per barrel and circa USD$ 55 million in jet fuel oil at an average price of USD $43 per barrel. The graph below displays the trend of hydrocarbons exports, although it is noteworthy to state that amounts do not include the volumes of crude oil exported by ECOPETROL associated companies.

**Figure No. 34**

**EVOLUTION OF HYDROCARBON EXPORTS**




Source: ECOPETROL

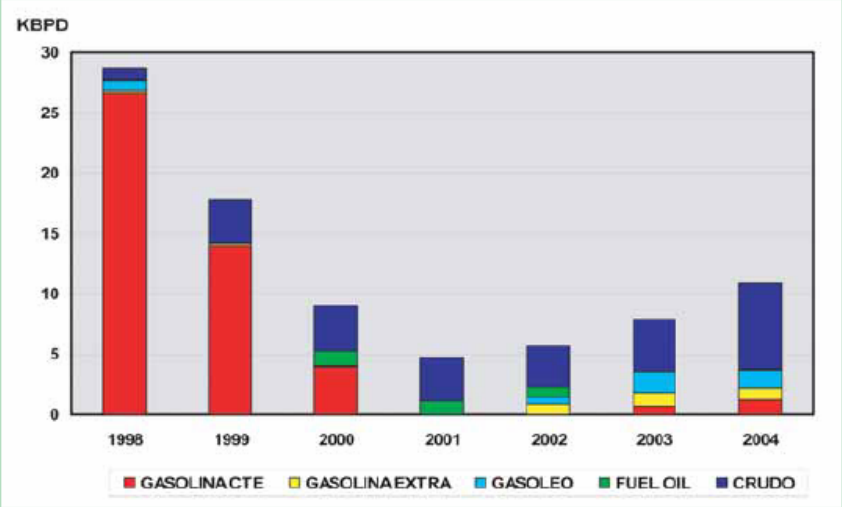
## HYDROCARBON EXPORT TREND

Oil continues to be the leading exports product, followed by fuel oil which volumes reach a total of about 127,500 BPD, backed up by naphtha and JPA which have been contributing to sustained exports amount although to a lesser extent. The amount for crude oil exports so far this year represent 47.9% of the total amount, compared to 52.1% represented by the refined products. The countries where most of the Colombian exports are made are the United States, Peru, Panama, Brazil and Chile among others.

In regards to imports, 62.9% of the volume corresponds to crude oil for reasons such as the best use of business opportunities, enhancement of the crude oils supplied to refineries following the production needs of some refined products and also to enhance stocks; 13.6% of the volume of imports correspond to gas-oil to provide the raw materials for the catalytic cracking units and also to produce high octane rate gasoline and also to take advantage of price deductions for the summer season in the international market. Graph no. 35 shows the evolution of imports.

**Figure No. 35**

**HYDROCARBONS IMPORTS TREND**




Source: ECOPETROL

Extra type gasoline is also imported into Colombia with the purpose of increasing the quality of refineries produced naphtha and to enhance the gasoline octane ratings. Additionally, fuel oils meeting the needs of Amazon and Guajira departments are also imported, as well as some volumes of ACPM to be used by large consumers.

There is no doubt that imports of extra type gasoline or premium type gasoline do not currently follow the same trends and purposes recorded five years ago. Volumes of imports have been abruptly reduced, reflecting thus the diminishing of consumption levels of this product and of current gasoline, in spite of the new vehicles quality requirements.

In general, the balance of trade has been notoriously improved during the 2004 period as a consequence of the increases of the volume of exports of crude oil and refined products too, which are attributed to a lower local consumption rate and to the increase of refineries production volumes.

7

# PETROCHEMICAL

Petrochemical development is associated to the existence of the oil refineries, as naphtha, LP-Gas, ethane and middle distilled production are the raw materials used by the oil processing industry. In Colombia no one of the currently existing refineries are in the position of producing such raw materials, which implies that the petrochemical process in Colombia is started at a later stage in the chain of production, being almost entirely dependant upon imported raw materials. Ethylene is currently produced in the refinery of Barranca (20% of consumption) whereas propylene is entirely imported.

Within the FTA (Free Trade Agreement) scenario, the petrochemical industry might eventually imply hardships due to the dependence upon the foreign market conditions for the provisioning of its raw materials, although this industry is somehow protected by the government, which has allowed it to operate in a competitive fashion.

One of the most known formulas used to make the petrochemical industry to procure the raw materials availability enabling the industry to efficiently perform, keeping on with the contribution of value-added to Colombia in the light of FTA challenges is that of being supplied with domestic raw materials in a prompt and proper manner. The future of this industry will depend upon saving these restrictions with projects such as the Master Plan in the Refinery of Cartagena, which in addition to its modernization, it will allow to supply the fuel oils required by the ever growing domestic demand.

The Colombian petrochemical industry was initiated by the end of the 50's with the production of urea, fertilizers and black smoke. By the decade of 70s, the petrochemical industry became stronger by the participation of ECOPETROL and the inception of large companies that allowed the development of this economical sector.

The plastics industry encouraged some projects for the production of polyvinyl chloride, some polystyrenes and plasticizer.

ECOPETROL has during the same decade and under the aegis of five year, plans started with the production of ethylene, propylene and some aromatic products, cyclohexane and alkylates for the production of detergents. PVC production encouraged the production of vinyl chloride and ethylene chloride.

During the decade of 80s, although there existed in Colombia some polymers and world-class resins plant sites with remarkable exports excess, the production of base petrochemicals and monomers was insufficient. It was therefore necessary to begin with the importing process.

The petrochemical production was diversified only by 1987, its development was concentrated on the production facilities expansion, in spite of the closing of some urea, and vinyl chloride Cartagena based plants. Polypropylene appears in 1990 in the domestic market. These productions were intended to meet the domestic demand and to export some surplus of products, which are definitely considered nowadays as the domestic exportable offering.

The petrochemical chain is based on several stages that are the raw materials, olefins and aromatics, monomers, polymers plastic and rubber manufactures.

### Raw materials

Raw materials that are required to start with the petrochemical chain are mainly oil, natural gas, and LP-Gas. In Colombia, these items are produced y Ecopetrol, and they are essentially used for the production of fuel oils.

### Olefines and Aromatics

The environmental conditions calling for the use of fuel oils with little contents of lead, and considering the market trend towards the manufacture of blank products, have forced the heavy crude to be divided into light weight fractions by means of the cracking process, which makes it possible to derive naphtha which are the raw materials for the aromatic and cyclohexanes production. In Colombia, the capacity of production of such naphtha is reduced and it is aimed at the optimization of fuels refining.

By the natural gas processing, it is possible to derive methane and ethane, which is useful for the production of ethylene. In addition, it is possible to obtain propane and butane that make part of the chemicals of gas.

In Colombia, there exists an insufficient offer of the products above, due to the absence of a cracking system aimed at meeting the domestic demand for olefins and aromatics. However, ECOPETROL produces several different gases in the plants operating in Barrancabermeja and Cartagena. Such gases are made especially by paraffin hydrocarbons (methane to butane), lephicin hydrocarbons (ethylene, or butylenes) and small proportions of acetylene and butadiene; ECOPETROL produces principally benzene, toluene, xylen, and ortoxylene as well as cyclohexanes in its Barrancabermeja plants.

### Monomeres

The following stage in the chain is the procurement of monomers, which are the basis for polymers production. Because there is no sufficient infrastructure to produce monomers in Colombia, monomers are to be imported. The main monomers that are imported are vinyl chloride (UVCM), DMT, ethylene glycol, styrene, terephthalic acid and propylene.

### Polymers

The principal polymers that are produced in Colombia are the following: low density polyethylene, polypropylene, polystyrene, and thermoplastics, such as the polyvinyl chloride and polyethylene

telephthalate. Likewise, capralacteme is produced from the cyclohexane, which is exported for nylon production.

**Plastic and ruber manufacture**

The production of plastic manufacturers aimed at the end users is the last stage in the production chain. The principal products include plastics and their manufactures, plastic shoes, discontinued synthetic fibers, man made threads and man-made natural rubber.

## 7.1 Cartagena refinery remodeling

The weakest point within the Colombian petrochemical chain are the oleo-olefins such as ethylene and propylene, which explains the great importance of the project development for Cartagena for the industry, including the plant that shall implement the production of olefin by the private sector.

The project includes the expansion of Cartagena refinery facilities by taking it from 75.000 to 140.000 bpd. The existing infrastructure and the available external facilities will enable the company to double the production of light products of the current refinery facilities, with the flexibility of operating nationwide crude, such as Basconia and imported crude oils such as the Venezuelan, similar to la Mesa and Leona which could be available in the long run within the geographical site of Cartagena refinery facilities.

The expansion shall also make it possible for the existing refinery to comply with the changes projected in the boxes of crude oils, increasing their profitability and competitive through a larger conversion of smaller value products into higher value transport fuel oils.

The project basic objectives are as follows:

Enhance the competitive positioning and profitability in the long run maximizing efficiency and reliability of the refinery site.

2.2 Comply with the fuel oils future quality requirements
3.3 Meeting the ever-growing local demand fro fuels for automotives
4.4 Produce raw materials for the construction of an olefins plant
5.5 Contribute to the Colombian balance of trade

The refinery site new configuration that could enable the site to be more efficient and comply with domestic and international standards, as well as modernizing the different stages of processes, including the following configuration, and the configuration appearing n Table No. 8.

A new unit of crude oil providing a better quality and yielding of products to supply the units further on.

More capacity of light products processing: new plants of reformed and alkylation.

New units of sulfur and treatments with amine and soda

More production of gasoline and ACPM of low sulfur contents. Incorporations of the processes of sulfur removal, cracking of gas-oil and naphtha treatment.

**Table No. 8**

**POSSIBLE CONFIGURATION OF CARTAGENA REFINERY SITE**

| | |
|---|---|
| Crude Oil Plant | 140,000 BPD |
| Vacuum Unit | 70,000 BPD |
| Viscocity Reducer Plant | 25,000 BPD |
| Catalytical Cracking Plant | 35,000 BPD |
| Sulfur Plant 1 | 35 TPD |
| Reformed Naphtha Plant | 30,000 BPD |
| Thermal Gas oil Distillates | 15,000 BPD |
| Diesel Desulfuring Plant | 45,000 BPD |
| Hydrogen Plant MSCFD | 45 BPD |
| Sulfur Plant 2 | 40 TPD |
| Sulfur Plant 3 | 40 TPD |
| Propylene Separation Refinery Grade | 11,000 BPD |
| Alquilation Plant | 5,000 BPD |

The amount payable for the works above is estimated to be US$ 628 million vs. US$ 2.500 million that would be cost to manufacture a new refinery site. Out of those US$628 million, US$130 million would be payable by the private sector.

The master plan development structure at cartage refinery includes the first block at ECOPETROL costs, where the processing plant will be included at a projected cost of US$ 500 million. The second block consisting of the provision of industrial supplies required by the refinery site (water, steam, electricity, hydrogen) estimated to be US$ 130 million, which shall be a private industry project. The project will be turned into an increase of about USD$ 2 per barrel over the current refining margin.

To assure the private participation n the project, CONPES document 3312 dated September 4 recommends the integration of an inter-institutional committee made by officers with the Ministry of Treasure and Public Credit, the National Planning Department, the Ministry of Mines and Energy and ECOPETROL, with the purpose of luring as much as the possible amount of the private capital and mitigating the fiscal impact of private capital.

The document proposes to the Ministry of Treasure and Public Credit, to the Ministry of Mines and Energy, and to ECOPETROL, to issue the standard or set up the parameters and procedures which are required to incorporate a process of product outsourcing, in the case that it is not possible to reach an international signal for the domestic selling prices for the products made by the refinery, so that investors can be provided with clear cut rules in relation to the price of products.

To assure that the petrochemical chain can be developed, leading to make the best use of the advantages of the expansion of Cartagena refinery, the construction of an olefins plant shall also be necessary, with the purpose of producing ethylene and propylene. The former will be used for the polyethylene, PVC and polystyrene manufacture, while the latter will be designated for the manufacture of polypropylene.

According to calculations of the olefins and aromatics company (Compañia Promotora de Olefinas y Aromaticos del Caribe, Ltda), the investment required by the petrochemical sector for the development thereof, that is the olefins plant site, that of monomers and polymers and services reach the sum of US$ 1.366 million. This project will not only impact the petrochemical sector but also the benefits thereof will be reaped by other economical sectors as well and principally by the end users.

## 7.2 HYDROTREATMENT PROJECT AT THE BARRANCABERMEJA REFINERY

The hydrotreatment project at the Barrancabermeja refinery, as well as the one in Cartagena, constitutes a project of strategic importance for the country. It will allow the fuels produced at the Industrial Complex of Barrancabermeja to comply with the environmental norms that new fuels require, in addition to achieving greater efficiency in refining by means of the compliance with international standards.

The objective of this project is to improve the quality of the fuels produced at this refinery by reducing the levels of sulfur in diesel fuel to approximately 500 ppm (parts per million) and in gasolines to approximately 300 ppm and to make them suitable to comply with air quality regulations. The project comprises the construction and set up of a hydrotreatment plant to remove the excess sulfur from the different currents of the refining units, and to produce a greater amount of petrochemical sulfur, which may meet the internal demand that is currently met with imported product.

The estimated cost of the project is USD $250 million and the execution in the neighborhood of 3 years. It will start operating in 2007. The following table describes the needs that for the new facilities:

**Table No. 9**

**NEW PROJECT FACILITIES**

| | |
|---|---|
| Hydrodesulfurtizer | 37,500 BPD and 18,000 BPD |
| Naphtha Treatment plant | 40,250 BPD and 2,1250 BPD |
| Amine Treatment | 22 Ton/day and 28 Ton/day |
| Hydrogen Plant | 40 Ton/day |
| Sulfur Plant | 44 Ton/day |
| Water Treatment Plant | 700 Ton/day |

Source: ECOPETROL

The first two years of the project will require the greatest investment and it is estimated that the profitability of the project will be more than 20%. This will give the company a greater perspective in the fuel market.

# 8 BIOFUELS

The growth of global population and the demographic density of cities have originated significant increases in the number of cars, which has caused phenomena that contribute notoriously to air pollution and heavy motor vehicle traffic. Among the main causes air pollution in the world, are the emissions generated during the combustion process of fossil fuels, mainly gasoline and diesel fuel in motor vehicles.

Since the origin of internal-combustion engines, the use of fuels derived from biomass as combustibles has been a subject of research which has never been abandoned and which has recently become important because of their capacity to reduce environmental problems of local and regional pollution and the greenhouse effect.

The temporary scarcity of petroleum products during times of war or economic and strategic perspectives of certain countries at certain moments of their industrial history have motivated certain periods of great development in production processes and the application of biofuels to engines, followed by other times of lower general interest.

The use of biomass for energy generating purposes implies preparing the raw materials for their use as combustibles in conventional systems. According to the nature of the biomass and the type of fuel that is desired, mechanical processes may be used (chipping, crushing, compacting), thermochemical processes (combustion, pyrolysis, gasification), biotechnological processes (micro bacterian or enzymatic) and extractive processes in order to obtain solid, liquid or gaseous fuels.

The main ways that biofuels are used are combustion to produce heat which may be applied to urban heating, industrial processes or generation of electricity and carburation in thermal engines, not only explosion but also internal combustion engines. Gaseous biofuels are also currently being developed for their use in gas turbines to produce electricity.

In the transportation sector, the most widely used fuels are bio-ethanol, a substitute for gasoline, which is obtained from biomass, which is produced in specific crops for this purpose (alcohol fuels) and biodiesel and the corresponding derived esters, which substitute diesel fuel are obtained from oleaginous seeds.

## 8.1 ETHANOL FUEL

Alcohols as fuels, especially ethanol, have the same origins as automobile fuels. Surplus amounts of ethanol at the end of the 19th century in Europe and the still scarce development of the petrochemical industry incited its use in the engines that were starting to be developed in those years.

During World War II, countries like Germany, which had scarce amounts of petroleum, developed the ethanol and methanol production technology as well as the petrochemical industry. This took the price of gasoline to a level 6 times lower than that of ethanol. The cyclic character of agricultural production, added to the relative stability of the petroleum market caused that towards 1950, the use of ethanol mixed with gasoline faded and finally disappeared in France and the rest of Europe.

Bearing in mind the environmental problems that were originated as a consequence of the intensive use of fossil fuels, the oil and automobile industries as well as the international scientific community started to make efforts to formulate proposals such as the reformulation of fossil fuels, and the manufacture of vehicles with technologies that allow an improvement of fuel economy and emissions control in order to solve these problems.

Because of these considerations, Law 693 was passed in Colombia in 2003 by which the use of alcohol fuels was regulated. Incentives were created for its production, marketing and consumption and other provisions were made. Such a norm made the use of a mixture of 10% ethanol in gasoline mandatory as of September of 2005 in urban centers with more than 500,000 inhabitants.

The production of alcohol will be obtained from the processing of yuca, corn, potato, beet and sugarcane crops, among others. According to estimates carried out to comply with the requirements of the Law, by the year 2010. The demand will be close to 700 million liters of alcohol, which will come from 150 thousand hectares of sugarcane crops in the vicinity of alcohol producing complexes, which have been identified on the Atlantic Coast, Antioquia, Cundinamarca, Río Suárez basin (Santander and Boyacá), Llanos Orientales (Eastern Plains), Valle del Cauca, the coffee growing region, Huila and Nariño, as shown on table No 10.

**Tabla No. 10**

**POSSIBLE ALCOHOL PRODUCING COMPLEXES**

| LOCATION | CAPACITY LITERS/DAY | RAW MATERIALS |
|---|---|---|
| Hoya del Rio Suárez | 300,000 | Sugar cane |
| Vegachí (Antioquia) | 350,000 | Sugar cane |
| Valle del Cauca | 300,000 | Sugar cane |
| Costa Norte | 300,000 | Sugar cane – yucca |
| Cundinamarca | 150,000 | Sugar cane |
| Llanos Orientales | 100,000 | Sugar cane – yucca |
| Eje Cafetero | 250,000 | Sugar cane |
| Huila | 200,000 | Sugar cane |
| Nariño | 150,000 | Sugar cane |

Source: UPME-CORPODIB.

Once the alcohol is produced, producers must add a denaturalizer to ethanol. This is generally gasoline, and it prevents the alcohol from being used for other purposes and guarantees its quality for producers according to the legal norms.

After the alcohol is produced, it is transported to the storage plants where the mixture is carried out. However, the transportation of alcohol must guarantee the absence of water in order to avoid technical problems and the separation of the phases of the product. Later, the product is taken to the service station to supply the end-user. The retailers are responsible for the final quality of the product.

## 8.2 BIODIESEL

Biodiesel is an environmentally friendly fuel that is obtained from plant oils by means of a transesterification process with alcohols. It is used in blends with diesel fuel, in different proportions for the mobilization of diesel engines without requiring changes or modifications in the engines.

The plant oils that may be used to produce biodiesel come mainly from African oil palm, soybeans, sunflower seeds, colza, coconut or cotton. The African oil palm is the first option for the production of plant oil for biodiesel due to the fact that:

a) It takes up more than 60% of the cultivated areas with oleaginous plants, with a constant growth in the last 30 years.

b) The price per ton of oil is USD $350, which is the lowest of the supply, except the colza which is not produced the country.

c) The production of palm oil is carried out in an organized sector, with a broad experience and capable of facing the challenge of an increase of 450,000 tons of oil in the next 10 years.

d) The production of African oil palm is is widely distributed throughout the country and at least 16 departments participate in it. The central western region produces 75% of the national total.

e) According to FEDEPALMA, the cultivated area currently represents only 4% of the land with a potential to cultivate African oil palm.

A biodiesel program apparently has fewer problems than alcohol fuel when it comes to logistics due to the fact that there is no problem with the presence of water. For this reason, it may be transported through pipelines, which make its use more attractive.

Some road tests carried out with biodiesel in the national roads, showed combustion characteristics similar to those of conventional diesel fuel. It is also pointed out that the consumption of biodiesel is proportional to the calorific power of the blend to be able to maintain the same power and contaminating emissions are less than with conventional fuel. Likewise, an electric the power plant was operated with biodiesel and no operational differences occurred compared to the use of diesel fuel. The performance of the fuel conversion in power in the axle was the same with diesel fuel and biodiesel.

The above means that the use of biodiesel is feasible for different uses without the need of conversions or modifications of engines, for the generation of electricity, for motor power, direct heat and others.

# 9 CHALLENGES FOR THE PETROLEUM ENERGY CHAIN

2002-2006 National Development Plan (NDP) "Towards a Community State" envisaged a profound and accelerated recovery of the hydrocarbons sector for it becomes an essential element of the country's development in all respects, and to ensure a short and medium term oil and gas self-sufficiency and the contribution to the State's trade balance by selling domestic surplus in the international market.

All actions necessary to comply not only with NDP's postulates but also with Colombian Political Constitution have been undertaken under the framework of the NDP. In this sense, important developments have been achieved during 2004 to date, such as the new exploration and production contracting framework based on a system of royalties, taxes and income on extraordinary gains; it is a flexible, straightforward and fully independent model to investors, which entails a better reward to the substantial high-risk investments this industry demands, thus significantly improving the country's competitiveness.

Likewise, a policy to extend existing exploration and production contracts to its economic limits was promoted, under the outstanding condition that it should represent improved benefits to the Nation. As of today extensions have been executed for Guajira, Las Monas, Cravo Norte and Casanare association contracts.

As regards liquid fuels, the reduction of subsidies granted on liquid fuels has continued, sending an opportunity cost price signal, which results in higher income to the Nation; also, the fuel theft reduction policy continues in force, showing a reduction from 7,675 barrels per day in July 2002 to 3,062 in September 2004.

For 2005 it is expected to continue promoting the exploration and exploitation of hydrocarbons, increasing oil reserves in 200 barrels; reaching an average crude production of 510,000 BPD; incorporating 2D 3,500 kilometers equivalent of seismic; drilling 25 new exploration wells (A3); executing 20 new hydrocarbon exploration and exploitation agreements; reducing the subsidies on gasoline by 100% and on ACPM by 86%. Hard efforts will continue being undertaken to reduce the theft of fuels to 2,804

Despite of the progress reached, some development strategies are presented hereunder as essential elements to ensure the availability of resources and to take rational and efficient advantage of country's resources.

## Oil strategies

1) Purchase reserves abroad, a common business practice in the oil industry carried out by private companies and by state companies to increase their reserves.

2) Relieve the restrictions which hinder exploration, in order to increase the reserves with medium and long term effects,. Among them:

a. Improving peace and increasing the security and protection provided to O&G infrastructure. This falls within the country's democratic security government goals.
b. Allowing the 50%-50% share association contracts under exploration stage to move to a 70%-30% share model in exchange for the partners undertaking aggressive A-3 well perforation programs
c. Improving follow up activities on the compliance of exploration obligations and minimizing the extensions granted to such obligations. ECOPETROL's activities should be aimed at removing the barriers that drive partners to request term extensions or freeze areas.
d. Under certain circumstances, strategic alliances may be entered with companies established in the country to speed up exploration projects as defined by ECOPETROL.
e. Speeding up the issuance of environmental permits and the negotiation with communities.

3) Increasing the production of remaining known reserves with short-term effects.

a. Promoting the incremental production in ECOPETROL's existing production fields taking advantage of actual infrastructure, and combining ECOPETROL's direct investment in some cases with the development of associations with private investors in others, so as to make maximum use of resources available.

b. Designing contractual models aimed at stimulating the development of small fields, taking the participation of domestic industry into consideration.

4) Encouraging the beginning and consolidation of a private O&G domestic industry, capable of exploiting small oilfields.

5) Continue improving the signals to catch the interest of international O&G companies.

## Derivative strategies

1) Properly develop the value generation chain of oil industry.

a. Exporting petrochemicals and refined products (in the case of surplus)
b. Necessary investments in petrochemical and refining projects should preferably be carried out by private investors.

c. Establishing policies to make private investment in these activities easier, either through raw materials supply trade agreements for the projects or by associations contributing the nation's assets to joint ventures.

2) Reducing the dependence on gasoline and diesel of the fuel offer for the automotive market, by developing alternative fuel sources, namely VNG, biodiesel and gasohol.

3) Improving the conversion capacity to produce more valuable derived products.

a. Operation changes and maintenance works are to be undertaken in Barrancabermeja.

b. It is necessary to carry out the master plan to overcome Cartagena's technological obsolescence

4) Establishing policies aimed at making private investment in refining and petrochemicals easier, and improving refining activity competitiveness.

a. Operation changes and maintenance works are to be undertaken in Barrancabermeja.
b. It is necessary to carry out the master plan to overcome Cartagena's technological obsolescence, incorporating private investment thereto.

5) More participation and clear rules for private investors regarding the distribution of liquid fuels.

a. A pricing policy that reflects market opportunity situations.

b. Ensuring that transportation and storage systems are neutral and open systems.

c. Making private and independent importation of fuels easier as well as the access of new traders to wholesaling markets.

d. Promoting storage and transportation of products as independent and profitable activities.

e. Issuing regulations regarding the storage of liquid fuels.

6) Establishing a mechanism to remunerate storage activities.

## Gasoline/ diesel strategies

1) A boost of National Government for VNG via a price policy in order to reduce the dependence on gasoline and diesel in the supply of fuels for the automotive market.

2) Developing the biodiesel program and other alternative fuels, in order to reduce the dependence on diesel in the supply of fuels for the automotive market.

3) Developing more efficient means of transportation in order to reduce the dependence on gasoline and diesel in the supply of fuels for the automotive market, namely:

a. Continue supporting urban mass transportation strategies.
b. Constructing high-mountain tunnels in heavy-traffic roads.
c. Improving and fully using fluvial and rail transportation.

4) Fighting theft and smuggling of fuels.

a. Implementing a control system at service stations, such as the electronic control in real time. Strangulation of illicit trade from the top of the chain.

b. Investing in state-of-the-art tools and equipment to identify the pipe perforation and theft of fuels, as well as to precisely determine the site affected.

5) Establishing permanent formulas to calculate the prices of gasoline and ACPM which allow obtaining adequate profits and which use international prices as a reference.

6) Gradually increasing the income of ACPM producers towards matching final ACPM and gasoline prices.

7) Establishing a charge on diesel pollution, which allows compensating environmental damage at urban centers.

8) Seeking mechanisms such as exemptions or reductions in taxes levied on transportation activities.