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## Letter from the Chairman

One of the European Union's main strategic objectives is to intensify and further the integration of the environment into those economic and social policies that might exert pressures on it.

To achieve this goal, public institutions, companies and citizens need to be committed to respecting their surroundings and guaranteeing sustainable development. As a result, economic growth and business profits must be conditional on environmental protection.

Since its creation 30 years ago, Enagas has brought the cleanest and most efficient fossil fuel to the largest number of users in all sectors, thereby contributing to sustainable development.

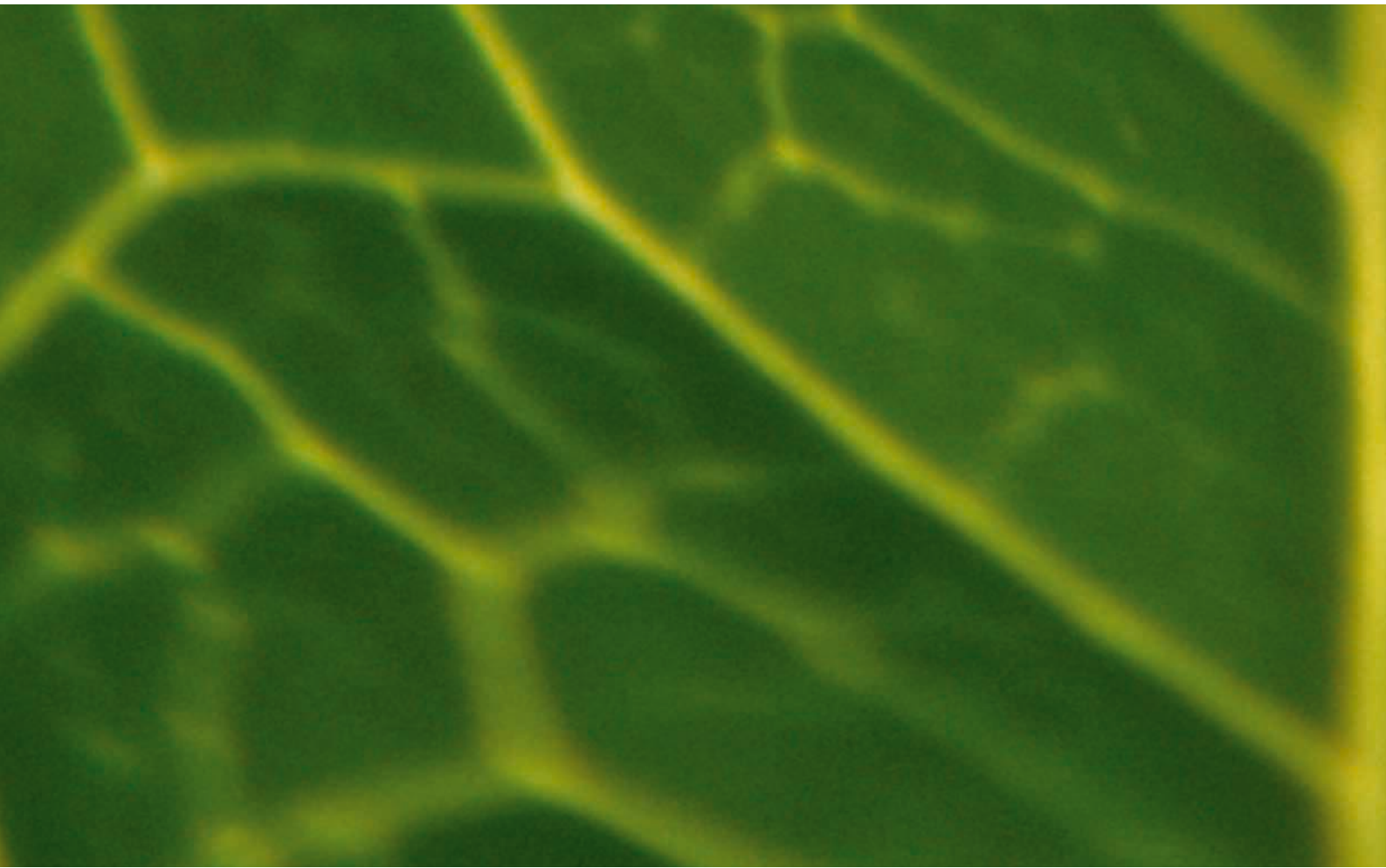
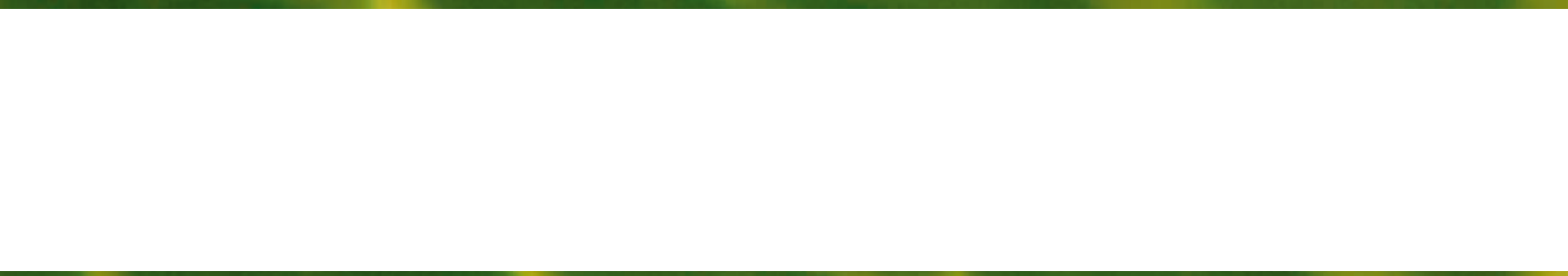
Environmental protection is taken into account in all of its operations, through the use of high-performance mechanisms, equipment and technology, as well as the implementation of environmental management techniques in all of its business activities. This means attending to environmental aspects in the business's general management, conducting strict controls of all operations in order to prevent and minimise their impact.

Our commitment and effort to improve our policy has earned us external recognition in the form of environmental management certification, according to the UNE EN ISO 14001 standard, for all of our production facilities.

This first Environmental Report, which I have the honour of presenting, summarises the work carried out by Enagas in 2002, reflecting the company's contribution and the commitment of all of its employees to the protection and defence of nature environment.

A handwritten signature in blue ink, which appears to read 'Antonio González-Adalid'. The signature is fluid and cursive.

Antonio González-Adalid  
Chairman



The image features a blurred green background with a white horizontal band across the middle. The text "Presentation of Enagas" is centered within this white band.

# Presentation of Enagas





## Presentation of Enagas

Enagas was created by the Ministry of Industry in March 1972 for the purpose of developing a network of gas pipelines for the supply and transport of natural gas.

Since then, it has progressively expanded its infrastructures, and it is currently present in most of the Spanish territory.

Today, Enagas is the leading gas transportation company in Spain, appointed Technical Manager of the Gas System by virtue of Royal Decree-Law 6/2000. As such, it is responsible, among other things, for guaranteeing the continuity and security of the natural gas supply and ensuring the proper coordination of access points, storage facilities, transport and distribution.

To carry out these functions, it has an extensive infrastructure, comprised of:

- *Regasification Plants*, located in Barcelona, Cartagena and Huelva, where it carries out the following activities:
  - Receipt and storage of the liquid natural gas transported from production centres in methane carriers.

- Regasification and preparation of the gas for its transport through the basic gas pipeline network.

- *Basic Gas Pipeline Network*, comprising over 6,400 kilometres of pipelines, operating at over 60 bar and supplied by the regasification plants, the international connections with France and the Maghreb-Europe pipeline, Spanish fields and the Serrablo and Gaviota underground storage facilities.

Spread out over the length of the basic gas pipeline network are regulation and measurement stations, which allow for control of the pressure in the distribution networks, as well as measurement of the gas flow, and compression stations, which raise the pressure of the gas, facilitating its transport through the basic gas pipeline network.

A series of centres are strategically distributed throughout the Spanish territory for the maintenance, operation and control of the basic gas pipeline network and its auxiliary facilities.

- *Underground Storage Facilities*: Used to store gas during low-consumption seasons, so that it can be withdrawn

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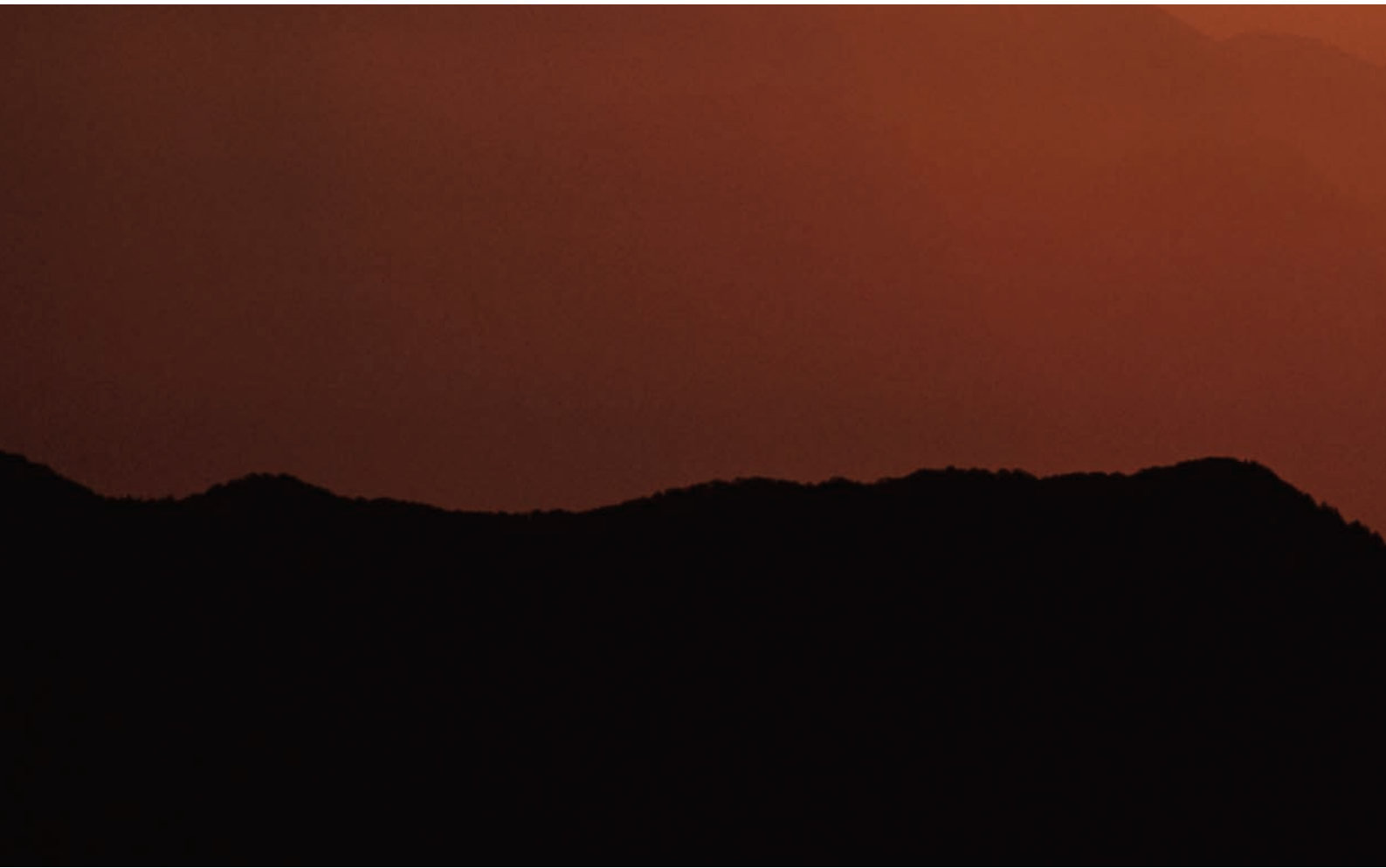
when the demand increases. This gas, after appropriate conditioning, is injected into the network, thereby guaranteeing the continuity of supply.

Its head quarters are located in Madrid and are home to company management and the bodies responsible for

coordinating the different work unit activities.

The General Office of Technology, Engineering and the Environment is responsible for coordinating and directing the activities of the entire Company in this area through the Environmental Unit.









# Natural Gas





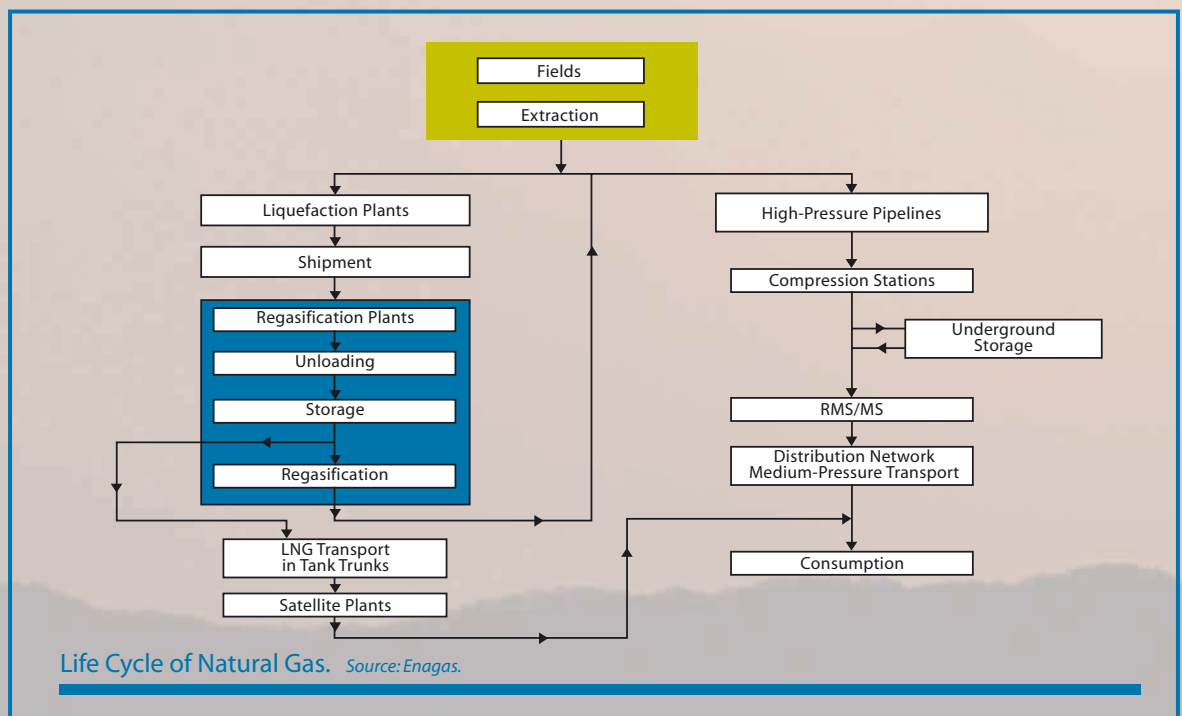
# Natural Gas

## Environmental Advantages

Use of primary energy sources, whether directly or through their transformation, is fundamental to the economic development of any society, but also one of the factors that most directly impacts the environment.

Rational use of these resources should allow for sustainable development, in other words, should make economic development compatible with non-permanent alterations in the environment, so as to ensure the conservation of the life on the planet.

Out of all of the sources of energy, natural gas has the lowest environmental impact in all stages of its life cycle, from its extraction to its final use.



## Extraction

The only impacts caused are those derived from the construction and installation of facilities, and they are temporary. The natural gas found in fields can be dry or associated with crude oil. In case of the former, after being processed at a treatment plant where the water content and certain impurities are removed, it is transported to consumption centres. When it is found together with crude oil, it is usually used for self-consumption at the production facilities.

## Transport

Depending on the distance and geography, transportation to consumption centres is carried out through gas pipelines or methane carriers. In the first case, the main impact is caused when the pipelines are built. As a result, all sorts of precautions are taken in the planning stages of the projects to minimise any negative effects. Upon conclu-

sion of the construction work, the only indications of their presence that remain are the signs used to denote their route and the auxiliary gas regulation and control facilities, which use minimal terrain.

Since the pipelines are airtight, no methane emissions are given off into the atmosphere save in case of accident. Such accidents could mainly be caused by external actions, since accidents stemming from the facilities' operation are largely avoided by means of a rigorous maintenance program.

Moreover, mention should be made of the shut-off valves, which enable isolation of the affected segment in case of incident, thereby ensuring minimal gas emissions into the atmosphere.

The transport of natural gas in methane carriers is carried out in its liquid phase. These ships are specially equipped to guarantee absolute water-tightness, both during transport and during the loading and unloading of the cargo.

The impact caused in this stage is that derived from the ship's own energy consumption and that caused by the liquefaction and gasification operations at the plants.

In this sense, it is worth noting that most of the energy consumed in this stage is natural gas.





## Distribution

Generally, natural gas reaches end consumers through the distribution network. This stage's impacts could occur during the construction of said networks, which are normally located in urban or industrial surroundings.

Methane emissions, due solely to leaks or malfunctions, are detected by means of an odouriser added to the gas, which ensures that any malfunction or even minimal emission of gas into the atmosphere is corrected immediately.

## Use

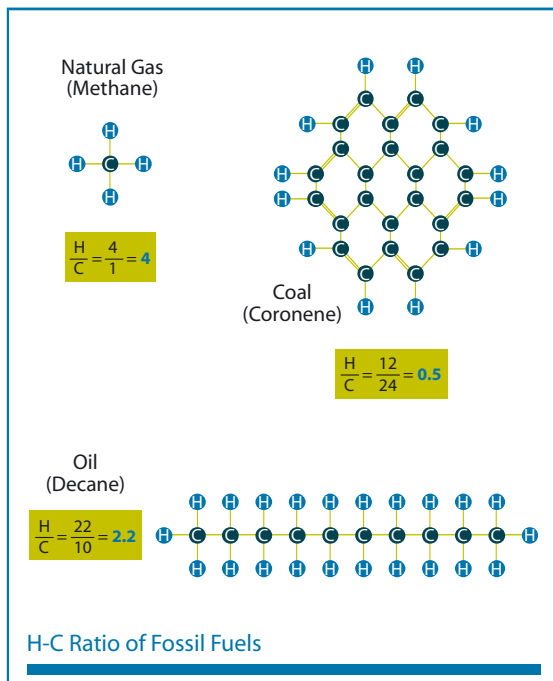
Natural gas is approximately 90% methane, which means that when it is

burned it emits less carbon dioxide per unit of energy than any other fossil fuel: 25-30% compared to oil derivatives and 40-50% compared to coal.

In addition, it contains no sulphur beyond that corresponding to the odouriser, it lacks volatile organic compounds, heavy hydrocarbons and other impurities, and its metal content is virtually negligible.

The intrinsic advantages arising from its composition are reinforced by its high performance rate and wide range of uses, all of which favours its consumption.

These are the main reasons why it is considered to be **"the cleanest fossil fuel"**.



EMISSION FACTORS OF FOSSIL FUELS			
Fuel	CO <sub>2</sub> (MT/toe)	SO <sub>2</sub> (Kg/toe)	COV (Kg/toe)
Coal	3.9	36.7	2.9
Lignite	4.2	58.2	2.9
Gas Oil	3.1	5.9	10.5
Fuel Oil	3.3	51.1	5.9
LPG	2.6	0.9	18.3
<b>Natural Gas</b>	<b>2.3</b>	<b>0.084</b>	<b>Negligible</b>

TOE: ton of oil equivalent.

Sources:

For CO<sub>2</sub>, "Energy Policy Options for Responding to the Climate Change" European Communities Commission, 1998.

For other contaminants, "Impacto medioambiental del gas natural respecto a otras energías" University of Barcelona, Bosch i Gimpera Foundation, 1997.

### **Domestic Consumption**

Heating systems have a notable impact on the quality of urban air, affecting contamination in large areas. Atmospheric emissions vary significantly depending on what kind of fuel is used. To confront this problem, both local and autonomous regional Governments favour the use of natural gas.

### **Industrial Consumption**

The industrial sector increasingly requires flexible, efficient and clean systems for the use of energy. In this sense, the high performance of natural gas, the extensive variety of its available applications and its environmental characteristics have led to its growing use in industrial sectors.



### **Automotive Transport**

Transportation generates 25% of all atmospheric pollution in the European Union and is responsible for 40% of urban emissions. It is estimated that in the last 15 years the emissions from this sector increased by about 36%, while industrial emissions fell by 17%.

Greater implementation of natural gas in this sector would lead to a substantial reduction in urban pollution. Therefore, Administrations are increasingly promoting its use for public transport.

### **Electric Generation**

Natural gas plays an increasingly important role in the generation of electricity, due to the high energy performance of combined-cycle power stations, namely about 50-60%.

Likewise, its use is more and more frequent at cogeneration plants, where global performance fluctuates between 70% and 90%.

### **A Source of Energy Today and for the Future**

Natural gas accounted for 23.3% of all primary energy consumption in the European Union in 2001, making it the second most important primary energy source in the EU-15.





With regard to the evolution of European consumption, natural gas is the primary energy source to undergo most growth in recent years, well beyond the rest. Specifically, between 1999 and 2001, consumption of natural gas as primary energy grew by approximately 5.1%.

In 2001, natural gas accounted for 13.4% of all primary energy consumption in

Spain, still less than the shares for coal and nuclear energy.

Between 1999 and 2001, consumption grew at an average annual rate of 10.6%, well above the average growth rates for the European Union.

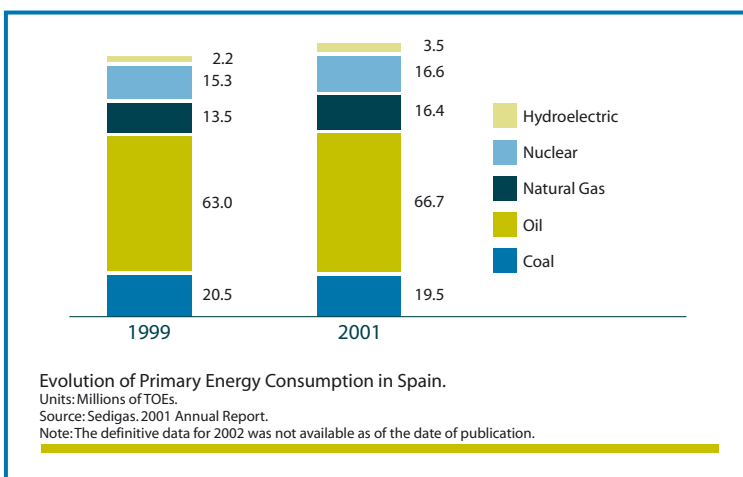
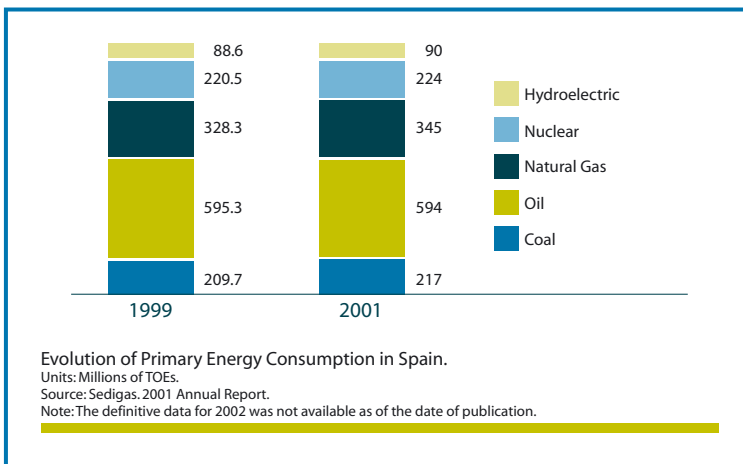
All of this underscores the high growth potential of the gas sector in our country.

Projections for the evolution of primary energy consumption in the world allocate a share of about 25.4% to natural gas by the year 2010, which will entail an annual growth of 3.3% in the demand for natural gas, compared to 1.9% for oil and 1.7% for coal.

With this increase in demand, natural gas will come to be second only to oil in the global energy consumption structure.

To this end, the European Union Commission reports indicate that natural gas consumption in the EU in 2005 will be 75% greater than in 1990, which will signify a substantial net reduction in carbon dioxide emissions as a result of the substitution of coal and oil with natural gas.

With regard to Spain, the projections drawn up by the Ministry of Economy forecast a substantial change in the energy supply structure, including significant growth of the share corresponding to



WORLD PRIMARY ENERGY CONSUMPTION 1990-2010				
Energy Source	1990	1997	2005	2010
Oil	3.4	3.8	4.3	4.8
Coal	2.3	2.3	2.7	2.9
Natural Gas	1.9	2.1	2.7	3.2
Nuclear	0.5	0.6	0.6	0.7
Other	0.6	0.8	0.9	1.0
<b>World Total</b>	<b>8.7</b>	<b>9.6</b>	<b>11.3</b>	<b>12.6</b>

Units: Billions of TOEs.

Source: BP Statistical Review of World Energy, 2001.

PRIMARY ENERGY CONSUMPTION IN SPAIN 2000 - 2011			
Source	2000	2006	2011
Oil	64,663	75,315	83,376
Coal	21,635	17,999	14,363
Natural Gas	15,223	26,905	39,305
Nuclear	16,211	16,570	16,602
Other	7,061	12,464	20,956
<b>Total</b>	<b>124,793</b>	<b>149,253</b>	<b>174,602</b>

Units: Thousands of TOEs.

Source: Sub-Directorate General for Energy Planning. Ministry of the Economy, 2002.

natural gas and renewable energies and a fall in the share of coal and nuclear energy.

Specifically, it is estimated that the total demand for natural gas in 2011 will be 39,305 kTOEs, making it the fastest-growing primary energy source, increasing at an average annual rate of 9.01% to com-

prise a 22.5% share of all energy consumption.

## Natural Gas and the Greenhouse Effect

The natural process by which the earth's atmospheric gases allow solar energy in, but retain the energy reflected into outer space, is what ensures an average global temperature on the planet's surface at which biological processes can occur. This process is known as the "greenhouse effect".

In recent years, the planet's average surface temperature has been rising due to the accumulation in the atmosphere of certain gases, emitted by both human activity and natural causes, that retain the energy reflected by the Earth.

This phenomenon is known as "global warming" and leads to certain disruptions in the climate.

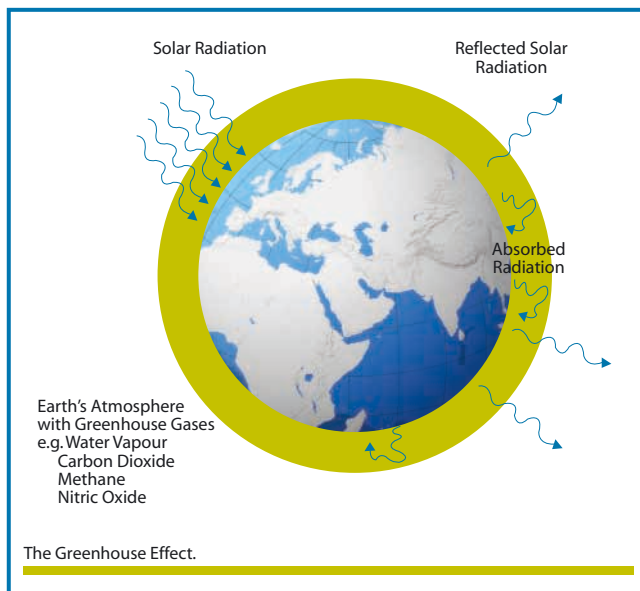
The main gases responsible for the greenhouse effect are carbon dioxide, methane, chlorofluorocarbons, nitric oxide and sulphur hexafluoride.

The value used to quantify the greenhouse effect is called the "global warming potential". It is defined as the quantity of carbon dioxide that would need to be emitted into the atmosphere to produce the same effect as the emission of



one unit of the gas in question over a given period of time.

Thus, using a time reference of 20 years, the emission of one ton of methane into the atmosphere today would have the same effect, in terms of global warming, as the emission of 56 tons of carbon dioxide.



GLOBAL WARMING POTENTIALS			
Gas	20 Years	100 Years	500 Years
CO <sub>2</sub>	1	1	1
CH <sub>4</sub>	56	21	6.5
N <sub>2</sub> O	280	310	170
HFC-23	9,100	11,700	9,800
HFC-32	2,100	650	200
SF <sub>6</sub>	16,300	23,900	34,900

Source: IPCC (1996). Climate Change (1995).

The use of this equivalence, instead of the gross emissions of each greenhouse gas, allows for an integrated evaluation of the contribution to global warming made by the emission of each one.

65% of the influence of human activity on the greenhouse effect is attributed to carbon dioxide, 19% to methane, 10% to chlorofluorocarbons and the remaining 6% to nitric oxide.

### Actions to Protect the Atmospheric Environment

The atmospheric environment largely influences quality of life and the conservation of biodiversity. As a result, and due to its universal nature, a series of international recommendations have been made to promote its protection.

The climatic change was recognised as a serious problem at the First World Climate Conference in 1979.

At the Kyoto Summit, held in December 1997, a Protocol was approved designed to limit the emissions of greenhouse gases in industrialised countries to the values emitted by these countries in 1990 and to give technical and economic assistance to developing countries to mitigate their emissions.

The European Union has made a commitment to reducing the emission of said gas-

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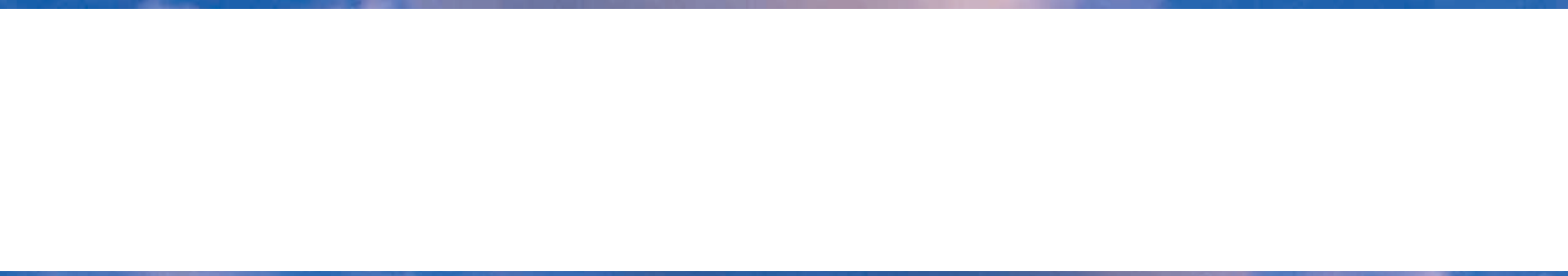
es by 8%. To fulfil this commitment, each production process must use the best and most cost-effective techniques available.

Since the Climate Summit, many meetings have been held to consolidate the bases and agreements set out in the Kyoto Protocol: Buenos Aires, The Hague,

Bonn and Marrakech. At these meetings, emphasis has been placed on the need to promote the research, development, production, distribution and transport of energy sources with lower impacts on the greenhouse effect, among which natural gas stands out.



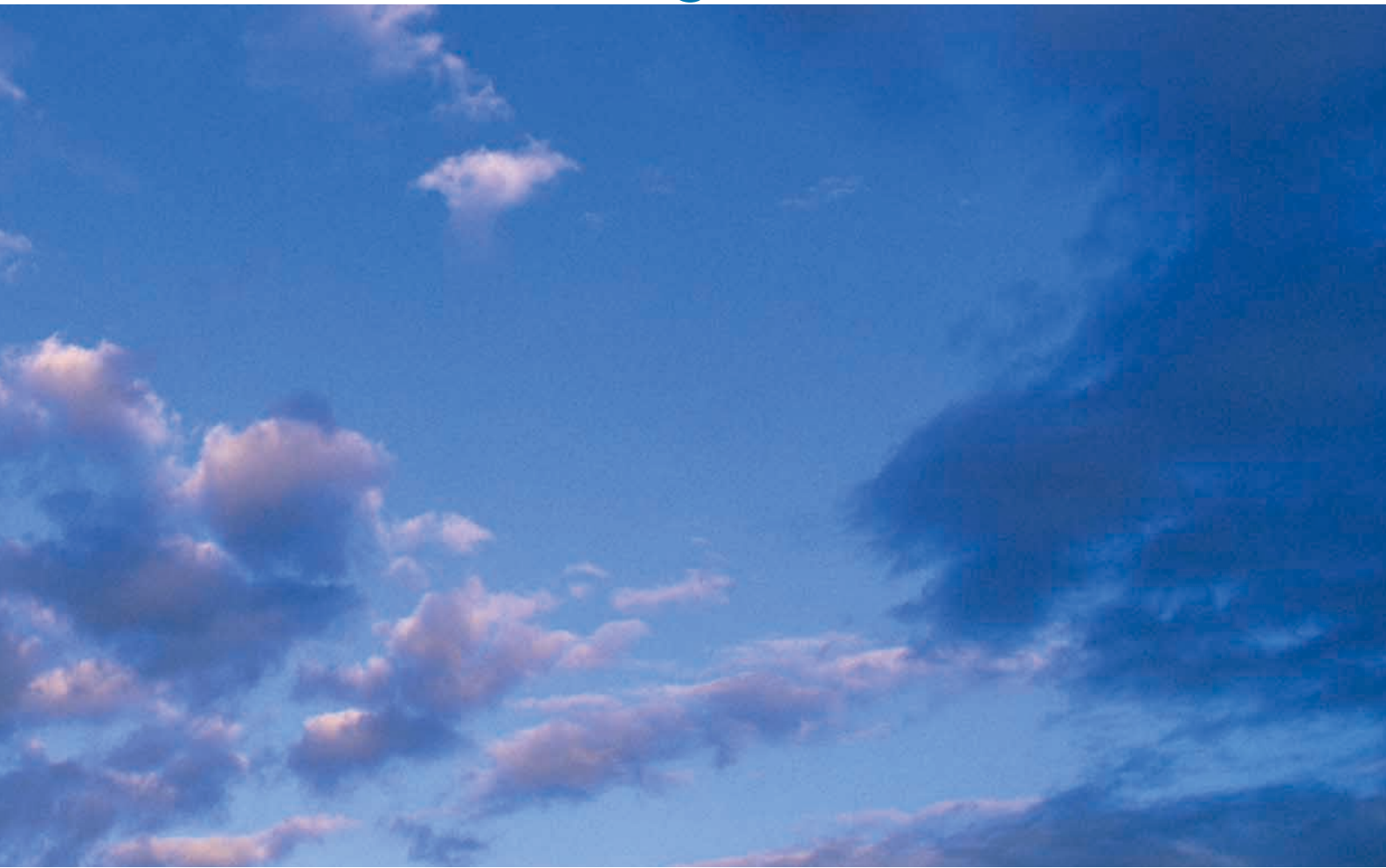






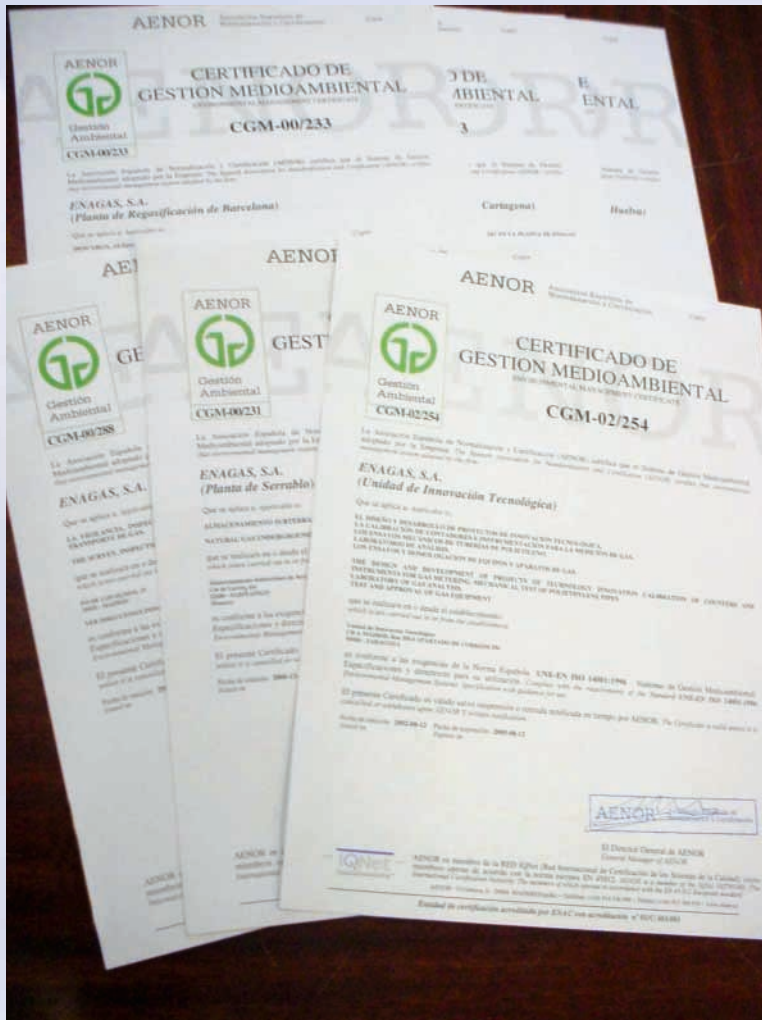


# Environmental Management





## Environmental Management at Enagas



In 2002, actions were carried out to consolidate the Environmental Management System that had been implemented in previous years.

Moreover, the System's implementation in the Technological Innovation Unit was concluded, such that, today, the following Enagas units have environmental management certificates, according to the UNE EN ISO 14001 Standard, issued by the Spanish Standardisation and Certification Association (AENOR):

- Serrablo Underground Storage Facility
- Barcelona Regasification Plant
- Cartagena Regasification Plant
- Huelva Regasification Plant
- Department of Gas Transport
- Technological Innovation Unit

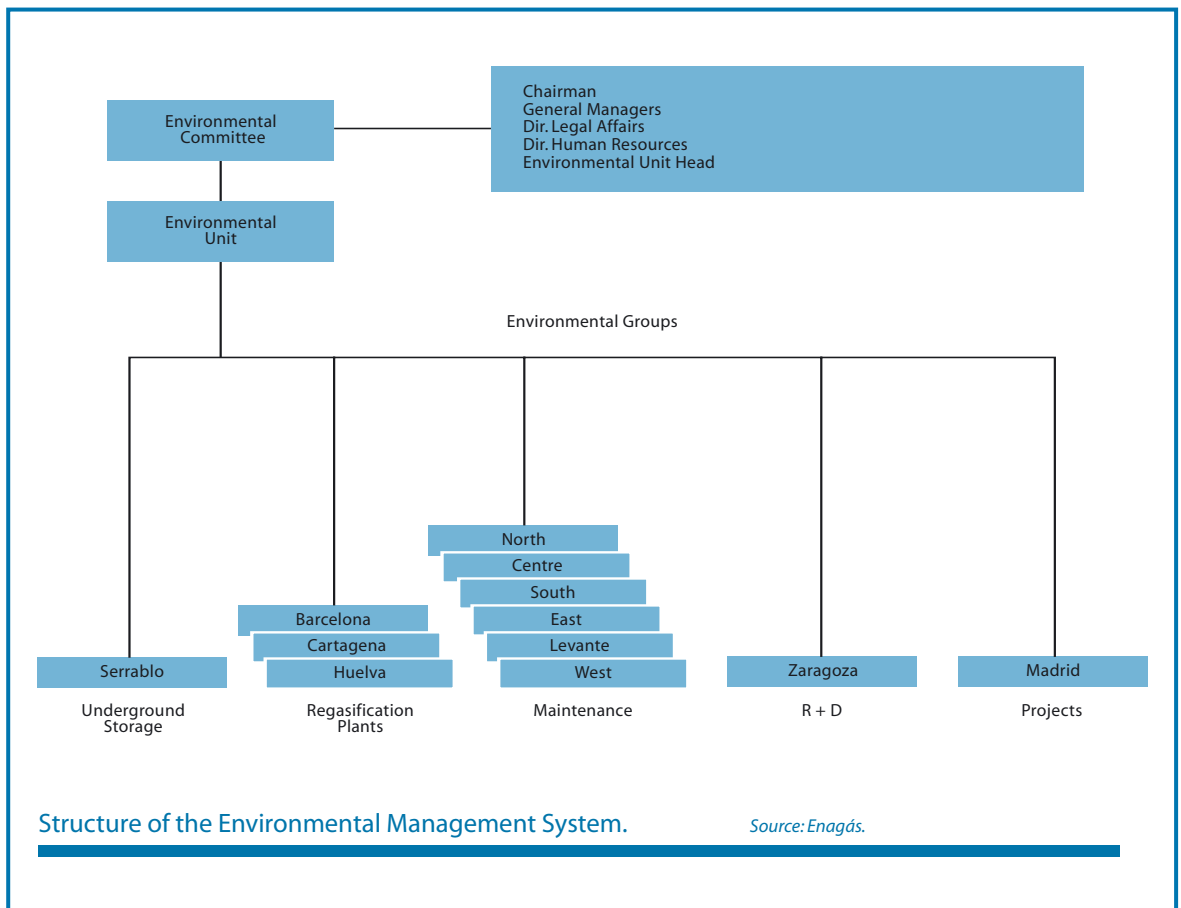
In addition, and as a result of its commitment to respecting its environment, work has begun on the preparation of projects to minimise and control the impacts derived from the execution of infrastructure building work.

## Structure

The organisational structure of the Environmental Management System comprises two main levels. The Environmental Committee, made up of the main Company executives, establishes and endorses basic operating guidelines. The

Environmental Groups are in charge of seeing said guidelines through.

The Environmental Unit is responsible for coordinating these levels. It also proposes basic actions designed to meet Enagás' environmental goals to the Environmental Committee for its approval.



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## Environmental Policy

Conservation of the surroundings and the environment is one of Enagas' guiding principles for action.

Consequently, Enagas states and undertakes the following environmental commitments and principles:

### Environmental Commitment

To carry out its activities in a way that respects the environment, paying special attention to protecting the surroundings, its clients and the public at large.

### Environmental Principles

#### Minimise the Impact.

To make an unflinching effort to identify, characterise and improve the environmental impact stemming from its activities and facilities, and to make the most efficient use thereof.

#### Constant Adaptation to Applicable Regulations.

To comply with the environmental legislation applicable to its facilities and activities. To take international regulations and legislative trends into account when planning actions that might have a significant environmental impact, particularly in those areas where no applicable legislation exists.

#### Pollution Prevention and Potential Risk Assessment.

To apply the basic principles of pollution prevention and potential risk assessment from the planning and decision-weighting stages all the way through to the execution and putting into operation of new projects.

#### Environmental Collaboration.

To collaborate whenever required with the different administrations, non-governmental organisations and public or private entities in search of solutions to the environmental problems that are posed.

#### Incorporation of Environmental Criteria with Regard to Contractors.

To incorporate environmental criteria into the decisions to award contracts for the provision of services or products, as well as to inform the contractors that work with Enagas of the applicable environmental procedures and requirements.

#### Environmental Communication and Information.

To promote internal and external environmental communication according to criteria of transparency, informing employees and the public at large of the goals that have been met and the work underway concerning the control of environmental aspects.

#### Constant Improvement.

To seek ongoing improvement through the systematic and periodic evaluation of the Environmental Management System, for which the carrying out of Audits will be considered a basic tool.

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## Documentary Structure

Having detailed documentation is key to the smooth working order of the Environmental Management System. Our documentation includes the following:

### Environmental Manual

This is a basic reference document that defines and develops the scope of the Environmental Management System. It describes the environmental policy and documents the primary functions and responsibilities, as well as the main interactions between the different elements.

## General Environmental Procedures

These procedures supplement the contents of the Manual and explain how to execute those operations or activities related to the environment so as to comply with applicable legislation, meet the standard requirements and fulfil the commitments undertaken by Enagas.

When the need arises to describe any of the operations or activities in greater detail, there is a third level of documentation comprised of the Specific Procedures and Technical Instructions that is fundamentally technical in nature and more restricted in scope.

## Environmental Strategic Plan

In July 2002, the Environmental Committee approved the new Environmental Strategic Plan for the 2002-2004 period with the aim of guaranteeing continuous improvement in environmental behaviour.

All of the commitments and principles set forth in the policy, as well as all significant environmental aspects, were taken into account in the preparation of this Plan.

The global objectives considered in the Environmental Strategic Plan comprise two lines of action: first, the improvement of the Company's environmental







behaviour, and second, the optimisation of the processes to manage and administer the Environmental Management System.

- **Improvement of Environmental Behaviour**

- Reduction of natural gas emissions into the atmosphere at the Barcelona regasification plant through the upgrading of the boil-off recovery system with the incorporation of a

relieveur and the related equipment.

- Noise reduction at the basic gas pipeline network's regulation and measurement stations.

This objective is broken down into two courses of action. On the one hand, the aim is to offset the noise at existing facilities by taking measures to minimise the transmission of sound to the exterior (insulation, closures, etc.).



On the other, the goal is to reduce the generation of noise at source through the study, selection and application of other types of regulator valves.

- Minimisation of the effects of electrical lines on bird life.

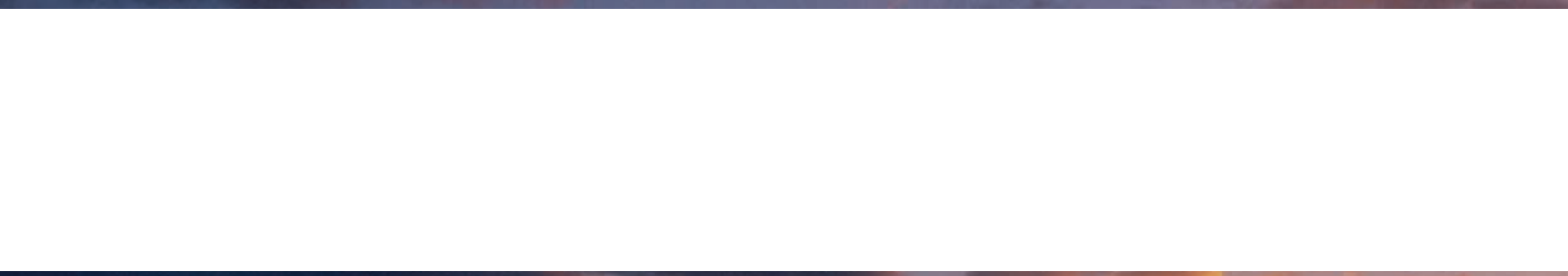
The definition of an action program is projected for this goal, to be based on the specific features of each facility and the areas where they operate.

- **Improvement of System Management and Administration Processes**

- Development and implementation of a computer system to update the applicable environmental legislation in order to simplify the management of this information.
- Design and implementation of a computer system to process and manage non-conformities and corrective and preventive actions in order to enable their monitoring.





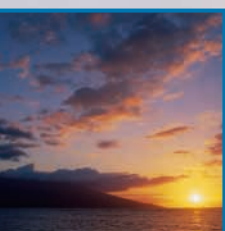




# Highlights and Actions







## Highlights and Actions

Enagas's Environmental Management System affords the Company control of environmental aspects, providing detailed knowledge of their behaviour, thereby allowing for the assessment of the corresponding costs and benefits.

The environmental improvements planned and carried out through the action programs for the Company's different activities in 2002 entailed a total investment of 4,970,000 euros, which can be broken down as follows:

SUMMARY OF INVESTMENTS	
Activity	Cost (Thousands of €)
Development, Implementation and Monitoring of Environmental Management	143.4
Campaigns to Monitor and Control Noise, Emissions and Spills	36.0
Waste Management	463.1
Restoration of Terrains	2,326.0
Cargo Drilling	19.1
Directed and Horizontal Drilling	1,768.2
Other Environmental Process Improvements	141.2
Archaeological Protection and Recoveries	73.0
<b>Total</b>	<b>4,970.0</b>

The most significant investment corresponds to environmental improvements applied with regard to the construction of gas pipelines; this amount varies depending on the number and scope of the projects carried out each year.

In terms of operating highlights, Enagas transported 20.286 million m<sup>3</sup> of gas through its 6,431 kilometres of pipeline in 2002, equivalent to 243,369 GWh of energy. The Serrablo





storage facility accounted for 145 million m<sup>3</sup> of this amount, while the regasification plants accounted for 11.031 million m<sup>3</sup>, of which 5.430 corresponded to Barcelona, 2.456 to Huelva and 3.144 to Cartagena.

ENERGY CONSUMED	
Area of Activity	GWh
Regasification Plants	476.3
Serrablo Storage Facility	80.7
Basic Gas Pipeline Network <sup>1</sup>	1,136.3
<b>Total</b>	<b>1,693.3</b>

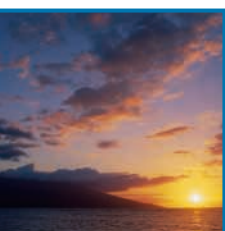
<sup>1</sup> Includes consumption corresponding to Head Quarters and the Technological Innovation Unit.

## Environmental Management

### Consumption Control

Enagas, aware of the importance of using natural resources rationally, carries out a variety of actions to control and minimise the consumption of the electrical and natural gas energy required for the proper operation and maintenance of its facilities.

Bearing in mind that the gas transported in 2002 amounted to 243,369 GWh, the energy consumed at the different Enagas facilities accounted for 0.70% of the total transported energy.



Broadly speaking, the share of this consumption corresponding to natural gas accounted for 90% of the total energy consumption, although this figure varied depending on the type of facility in question.

Thus, while natural gas accounted for 98% of the energy consumption corresponding to the basic gas pipeline network and the Serrablo storage facility, it accounted for 66% at the regasification plants.

### Emissions into the Atmosphere

Methane, the main component of natural gas, is one of the gases that most contributes to the greenhouse effect.

The Environmental Management System makes it possible to take measures to

control and reduce natural gas emissions into the atmosphere, which, in turn, enhances economic performance.

Total natural gas emissions account for 0.17% of the transported gas, within regular gas industry margins.

Out of this amount, 98% corresponds to the Barcelona regasification plant, which does not yet have the equipment needed to ensure the full recovery of the boil-off generated.

The plan to enlarge this Plant will remedy this situation, as it includes a new boil-off recovery system identical to those in use at the other plants.

The remaining natural gas emissions into the atmosphere primarily stem from the starting up and shutting down of the compression station turbocompressors.

With regard to the regasification plants, 152.2 m<sup>3</sup> of boil-off gas were recovered in 2002.

In keeping with its Environmental Policy, Enagas conducts controls at all of its facilities' combustion points: the boilers at the regulation stations, the turbo-compressors at the compression stations, the compressors in the Serrablo wells and the submerged combustion vaporisers at the regasification plants. In all cases, natural gas is the fuel that is used.

NATURAL GAS EMISSIONS INTO THE ATMOSPHERE	
Area of Activity	Thousands of m <sup>3</sup>
Regasification Plants	33,457
Serrablo Storage Facility	87
Basic Gas Pipeline Network <sup>(*)</sup>	631
<b>Total</b>	<b>34,175</b>

<sup>(\*)</sup> Includes emissions from the Technological Innovation Unit.

BOIL-OFF GAS RECOVERED	
Regasification Plant	Thousands of m <sup>3</sup>
Barcelona	65,143
Huelva	35,040
Cartagena	52,000
<b>Total</b>	<b>152,183</b>

EMISSIONS FROM COMBUSTION POINTS			
Area of Activity	CO (t)	CO <sub>2</sub> (t)	NO <sub>x</sub>
Regasification Plants	22	93,398	28
Serrablo Storage Facility	11	16,237	10
Basic Gas Pipeline Network <sup>(*)</sup>	35	227,068	83
<b>Total</b>	<b>68</b>	<b>336,703</b>	<b>121</b>

<sup>(\*)</sup> Includes emissions from the Technological Innovation Unit.

These measurements allow for the quantification of the contamination emitted into the atmosphere in terms of the parameters set out in current legislation.

The monitoring programs drawn up in 2002 generally resulted in concentration values for each and every one of the parameters much lower than those permitted under applicable legislation.

With regard to CO<sub>2</sub> emissions, an average ratio was registered of 16.6 grams per m<sup>3</sup>

of transported gas. Approximately 60% of these emissions corresponded to the turbocompressors at the compression stations.

With regard to CO and NO<sub>x</sub>, the average emission ratios were 3 and 6 mg per m<sup>3</sup> of transported gas, respectively.

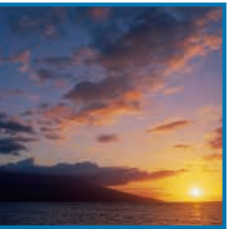
Additionally, continuing with the measuring campaigns of previous years, noise measurements were taken at 33 facilities over 2002, providing the Company with increased information on the noise pollution generated by its different facilities.

## Waste Management

Enagas has established and implemented a system for the segregation, storage and management of the waste products it generates, depending on their specific characteristics, pursuant to current legislation.

HAZARDOUS WASTE PROCESSED	
Type	Amount (t)
Spent Lights	0.6
Used Batteries	8.4
Alkaline, Saline and Button Batteries	0.5
Used Oils	20.8
Empty Chemical Containers	24.8
Greasy Rags and Absorbents	6.2
Methanol-Water	867.7
Oily Waters	44.3
Paint Residues	3.0
Materials with Asbestos	3.0
Other	22.3
<b>Total</b>	<b>1,001.6</b>





Out of all of these waste products, the only one directly associated with the production process is the methanol-water generated by gas treatment operations at the Serrablo storage facility.

The rest of the waste processed corresponds to maintenance tasks, most of which have generation cycles of over one year.

The sound environmental practices employed by Enagas personnel allowed for the recovery of over 112 tons of waste.

WASTE PRODUCTS RECOVERED	
Type	Amount (t)
Plastic	0.2
Scrap Metal	71.8
Paper and Cardboard	40.7
<b>Total</b>	<b>112.7</b>

### Main Actions

In keeping with its policy of respecting its environment, Enagas continued to make improvements in its activities and facilities in 2002, among which the following stand out:



- The substitution of methanol with dry air for the drying of water in the hydraulic tests at the facilities put into operation.
- The putting into operation of sewage treatment facilities at the Cartagena plant, after obtaining the corresponding permit.
- The execution of the project to modify the electrical feed lines at position 22 in Fuentes de Ebro (Zaragoza) to minimise the impact on bird life.
- Environmental authorisation for the existing facilities and for the enlargement of the Barcelona plant currently underway.
- The taking out of service of C-3003 boil-off compressors whose atmospheric emissions exceeded established limits.
- The installation, at the new compression station in Valencia, of turbocompressors equipped with low NO<sub>x</sub> emission systems.
- The encapsulation of the reduction valve and the insulation of the 16-bar line's outlet pipe, as well as the shielding of one of the submerged combustion vaporiser areas, at the Huelva plant.
- The installation of catalytic converters in the compressors in the J-17A, B and C wells at the Serrablo storage facility to reduce CO and NO<sub>x</sub> emissions.

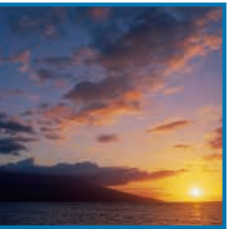
## Environmental Protection at Construction Sites

Environmental protection at gas pipeline construction sites is a constant concern for Enagas.

Therefore, from the works' initial planning stages, environmental and archaeological factors are taken into account in order to choose the best route and to minimise any possible impacts on areas with high ecological or archaeological value. Special construction techniques are employed, and work is scheduled to coincide with seasons







when impacts on local flora and fauna can be lessened.

In 2002, the directed drilling system was used in the following segments:

- Nansa River Crossing (100 m)
- Puron River Crossing (79 m)
- Escudo River Crossing (149 m)
- Sella River Crossing (85 m)
- Jarama River Crossing (189 m)
- Cobas Firth Crossing (777 m)
- Treto Firth Crossing (729 m)

Moreover, various tasks were performed to restore environments affected by gas pipeline construction, spanning a total surface area of over 4.3 million m<sup>2</sup>.

RESTORED SURFACE AREA	
REGIONS	m <sup>2</sup>
Madrid	157,404
Castilla - La Mancha	1,086,000
Cantabria - Asturias	1,008,056
Andalucia	2,145,624
<b>Total</b>	<b>4,397,084</b>

Likewise, to prevent the degradation of land due to a loss of vegetation cover, 88,417 m<sup>2</sup> of surface area affected by gas pipeline routes were reforested in 2002.

Additionally, to avoid the impact of building works on archaeological heritage, projects are planned and executed with the collaboration of archaeologists, who identify those areas that might contain historical remains.

Furthermore, throughout the different stages of the construction of the pipelines, a series of expert visits are conducted in order to monitor the building works from an archaeological point of view.

In 2002, work of this kind was performed as part of the construction of the following gas pipelines:

- Gajano-Treto-Laredo
- Collado Hermoso-Turegano
- Tarancon-Cuenca
- Puente Genil-Malaga
- Malaga-Estepona







# Glossary of Terms



## GLOSSARY OF TERMS

**Life Cycle Analysis:** Method for evaluating any environmental impact a given product might have over the course of its full life. It therefore includes the extraction and treatment of raw materials, production processes, distribution, utilisation, reutilisation and/or recycling and, finally, the final dumping process or other means of waste management.

**Boil-off:** Vapours arising from the spontaneous evaporation of natural gas in its liquid phase.

**Combined Cycle:** A modern system that supplements the electrical energy generated by gas turbines by recovering the residual heat from the combustion in a steam boiler. Its performance is notably better than that of traditional systems for the generation of electrical energy.

**Chlorofluorocarbons (CFCs):** Non-toxic halogenated hydrocarbons that contribute to the greenhouse effect and are approximately 10,000 to 20,000 times more effective than carbon dioxide. When released, they reach the ozone layer and destroy it, making it easier for the sun's ultraviolet light to penetrate to the earth's surface. They have been widely used in human activity (refrigerators, aerosols, etc.), although their use has begun to decline since the Vienna Convention of 1985.

**Cogeneration:** The combined production of electricity and heat, much more energy-efficient than traditional systems.

**Combustion:** Reaction of organic compounds with oxygen, producing carbon dioxide, steam and heat.

**Pollution:** Alteration of the environment's physical, chemical or biological characteristics as a result of human activities. Pollution can affect land, air or water. The most frequent pollutants are organic substances (hydrocarbons, chlorinated hydrocarbons, etc.), inorganic substances (asbestos, heavy metals, etc.), noise, heat, radiation, etc. Pollution can oc-

cur at the local, regional or even global level, as is the case with the greenhouse effect, acid rain, the disappearance of the ozone layer, etc.

**Sulphur Dioxide (SO<sub>2</sub>):** It is produced in the combustion of fossil fuels with high sulphur contents (coal, fuel-oils, coke, etc.). It is a very common pollutant in cities and industrial areas, where its concentrations, along with those of other pollutants, can increase under certain stable atmospheric conditions. It is one of the pollutants responsible for acid rain.

**Carbon Dioxide (CO<sub>2</sub>):** A colourless, odourless gas, heavier than air, generated by fossil fuel combustion processes, animal respiration, the decomposition of organic material, volcanic emissions, etc. It is essential for photosynthesis in plants, which incorporate it in the form of wood. It is found naturally in the atmosphere, although changes in its concentration resulting from human activities can provoke alterations in the earth's surface temperature, since it is the primary factor responsible for the greenhouse effect.







**Environmental Impact Analysis:** A technical and administrative process that allows for environmental impacts (on water, the atmosphere, soil, vegetation, fauna, artistic and historic heritage, etc.) to be estimated, thereby helping the relevant authorities form their opinion on the compatibility of a given project or activity with environmental protection, as well as the conditions under which it might be carried out.

**Natural Gas:** From the geological point of view, the gaseous phase of petroleum. It is basically composed of methane and a small quantity of other heavier gases,

depending on the field, such as ethane, propane, butane, etc. It is widely used as fuel for industry, businesses, dwellings, etc., and is an important raw material for the petrochemical industry.

**Liquid Natural Gas (LNG):** Natural gas in a liquid phase through the reduction of the temperature to  $-161^{\circ}\text{C}$  at atmospheric pressure, to facilitate its transport and/or storage. To be usable again, the LNG must be regasified through the supply of heat.

**Greenhouse Gases:** These are the gases that allow the solar radiation emitted by sun to enter the earth's atmosphere, but do not allow the infrared radiation emitted by the earth to get out. This property, similar to that of greenhouse plastics (from which it takes its name), affects the earth's thermal balance and can cause temperatures to rise. The main greenhouse gases are carbon dioxide, methane, chlorofluorocarbons (CFCs), nitrogen oxides and ozone.

**m<sup>3</sup>:** All m<sup>3</sup> are measured under normal conditions ( $0^{\circ}\text{C}$  and 1 atm).

**Nitrogen Oxides (NO<sub>x</sub>):** Oxidised nitrogen compounds in a gaseous phase. Nitric oxide (NO) is produced as a by-product due to the high combustion temperatures. It is subsequently transformed into nitrogen dioxide (NO<sub>2</sub>). When this compound absorbs the humidity from the air, it is transformed into



nitric acid (HNO<sub>3</sub>), a compound that contributes to acid rain.

**Hazardous Waste:** That waste which, due to the substances it contains and the quantities in which they are present, poses a risk to the environment. Its segregation, storage and final processing are regulated by environmental legislation.

**Environmental Management System (EMS):** It comprises the organisational

structure, responsibilities, practices, procedures and resources implemented by a company for the management of the environmental variables of its activities and operations in order to improve its environmental behaviour. The most common model used worldwide is based on the UNE-EN ISO 14001 standard.

**Ton of oil equivalent (TOE):** A unit of energy equivalent to 11.63 MWh.





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