GAS DISPERSION REDUCTION BY NETWORK OF ROME

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Agenda

- Italgas: Company profile

- HSE, Sustainable Development & Managing system

- Natural gas dispersions

- Company activities to minimise the gas emissions

- Gas dispersion by network of Rome

ITALGAS: Company profile

Italgas operates in the sector of distribution of natural gas, either directly or through Controlled Companies, in the main cities of Italy (approximately 1,500 municipalities: Turin, Rome, Naples, Florence, Venice).

Italgas started in Turin in 1837, where gas was used to illuminate streets, then *town gas* was introduced for cooking, moving on to the natural gas market in the 1960s.

Since 2003, the company has been fully controlled by **Eni**, an integrated energy provider engaged in promoting the growth of research, production, transport, transformation and the sale of oil and natural gas activities.

Italgas is committed to always providing top quality and highly efficient services. Considerable attention is dedicated to reconciling economic growth to the protection of health and safety and preservation of the environment.
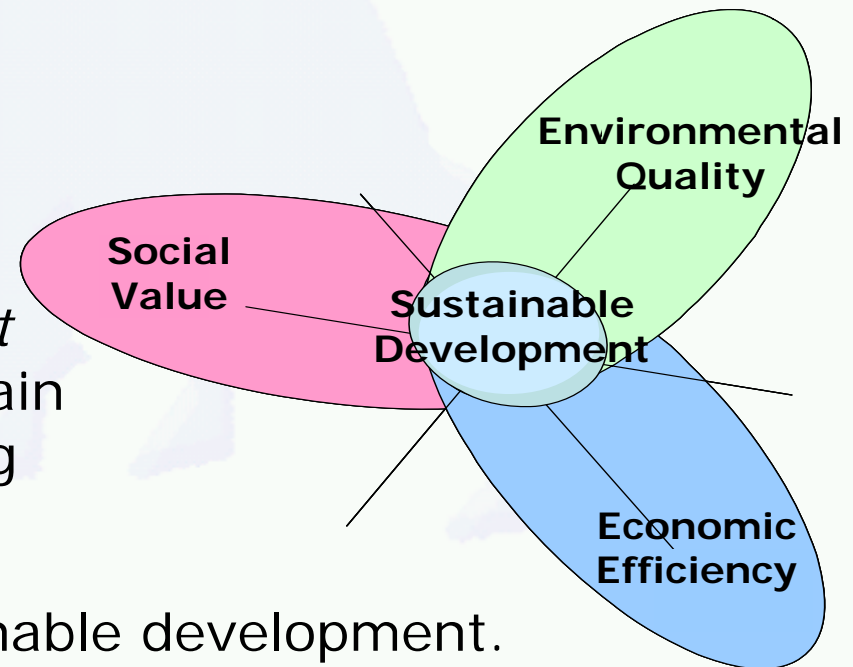
HSE & Sustainable Development

Italgas' key strength is the intense activity of research and innovation, to improve quality and safety standards of service and to reduce environmental impact.

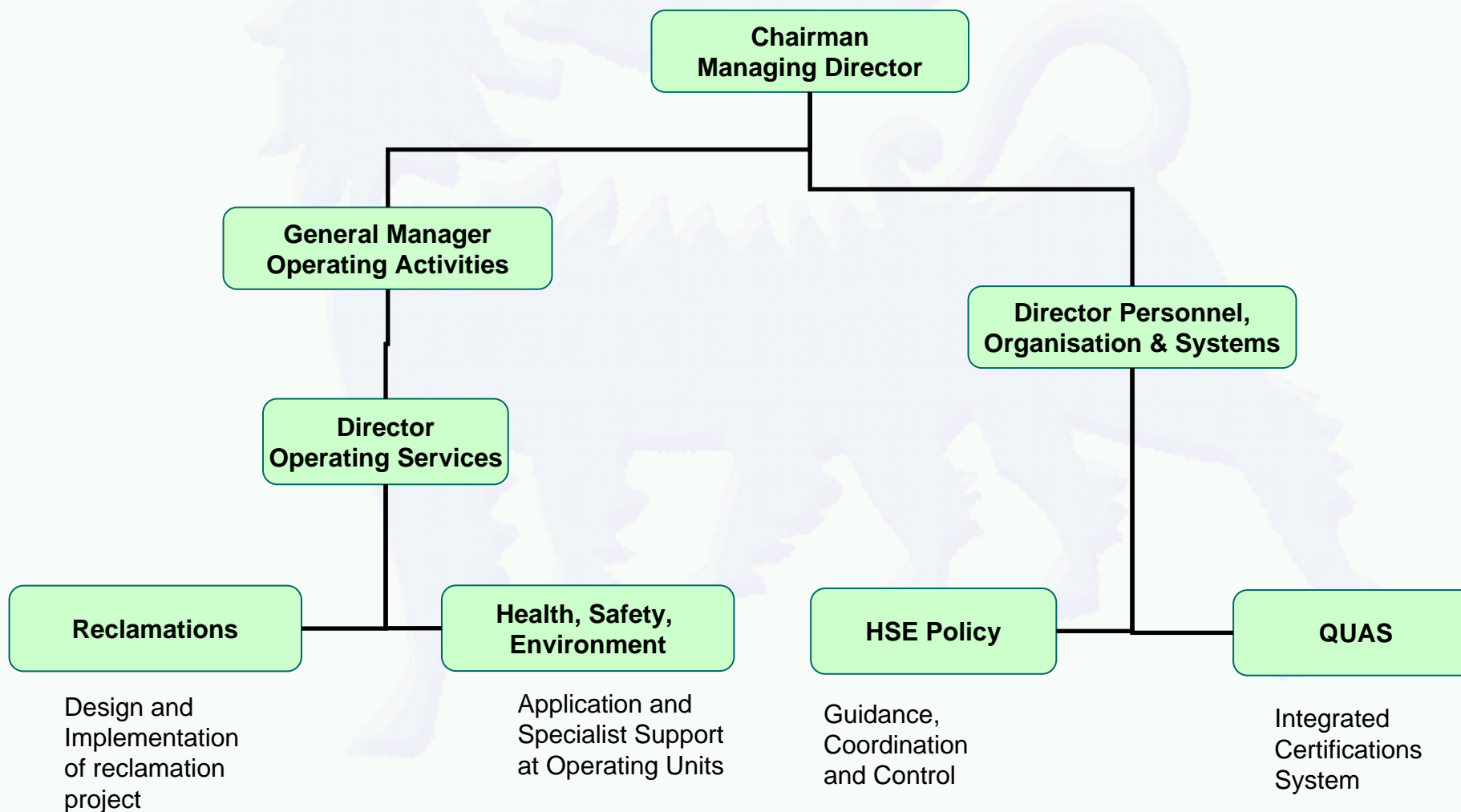In this context the *quality* of *Human Resources* is a crucial factor.

Consequently, any action directed towards improving *safety* is of fundamental importance.

Environmental preservation and *respect* are matters fully integrated with the main principles adopted by Italgas in carrying out its business.

Environmental Quality

Social Value

Sustainable Development

Economic Efficiency

These measures allow to pursue sustainable development.

Organization of HSE management

Chairman Managing Director

General Manager Operating Activities

Director Personnel, Organisation & Systems

Director Operating Services

Reclamations

Design and Implementation of reclamation project

Health, Safety, Environment

Application and Specialist Support at Operating Units

HSE Policy

Guidance, Coordination and Control

QUAS

Integrated Certifications System

Integrated QHSE Management System

The Company's unswerving commitment to environmental, health and safety issues is reflected in the adoption of the integrated "Quality, Environment, Health and Safety" Policy.

Italgas is certified by The **Det Norske Veritas** Accreditation Body. DNV has judged that all the adjustments made during the two annual audits, required to maintain this accreditation, complying with international regulatory standards (**UNI EN ISO 9001/2000; UNI EN ISO 14001/2004; OHSAS 18001/1999**).

Natural gas dispersion

Gas industry activities do not involve high levels of atmospheric emissions, so companies do not fall within the sphere of the main legislation that regulates emission (IPPC, Emission trading, ecc.).

The **main sources** of natural gas emission are:

- gas pressure reduction systems
- distribution pipelines.

However Italgas pays a lot of attention to gas emission because it's correlated to Environmental, Safety and Energy saving motivations.
In this context it's necessary to have shared and established methodologies in order to **estimate gas emissions**.
Gas dispersion can be diffused over the length of the supply chain with a high number of components and different operating procedures.

Measurement of natural gas dispersion

The measurement of natural gas emissions, in the atmosphere by gas distribution network, is a problem that is not easy and needs to be solved.

Generally, gas emissions derive from the discontinuity point (**joints**) of the pipeline.

Moreover additional **leaks** are due to:
- accidental failures caused by the heavy operating conditions under which pipes are buried in highly congested urban areas (traffic stress);
- accidental failures originated by other companies during underground works on pipes and cables.

The presence of **stray currents** in the sub-soil that may bring about corrosion phenomena.

Evaluation of
natural gas dispersion

In order to determine the total amount of natural gas emissions from the Italgas distribution network, some studies concerning the evaluation of the emissions have been conducted.

The methods to estimate the amount of the gas emission are based on the correlation between the gas leakage and the length of the pipeline.

In the past years, Italgas has conducted some studies aimed at evaluating the emission factors for each type of material and/or pressure class and the results were compared with those obtained to experimental campaign of measurement.

Emissions

The evaluation of total emissions is based on the following equation:

$$E = \sum_{i} A_i \times E_i$$

E = Emissions
A_i = Activity factor
E_i = Emission factor

Activity factors

The **activity factors** are the population of emitting equipments such as length of pipelines, number and type of valves, number of joints.

They are often estimated with a statistical approach based on a random sample of gas chain, introducing a factor of uncertainty.

Emission factors

The **emission factors** are defined as the quantity of methane emitted from each emitting source and for each emitting event.
Some emissions are known, some others can be evaluated on the basis of the characteristics of components and their emission factors.

The emissions from gas distribution are based on activity factors and emission factors for the different types of materials of pipelines.
In the emission factors all kind of emissions are included (incidents, maintenance, service lines, metering and reduction station).

Reduction of emissions from distribution system

Various means are used to minimise emissions from the gas supply system, for reasons of safety, environment, economic consideration and operational efficiency.

Some of the main options for reducing the amount of natural gas emissions are:

- Replacement of old distribution network
- Repair/relining
- Pressure management
- Conditioning of lead/yarn jointed mains
- Prevention of third party damage to pipeline networks
- Odorisation of distributed gas and hot numbers

Options for reducing natural gas emission (1)

Replacement of old distribution network

The first gas networks were laid originally for distribution of town gas, and later converted to natural gas. Some of the old networks are still in use but are being steadily replaced. Steel pipes and plastic pipes (polyethylene) used have much lower emissions compared with cast iron old pipes. Simultaneously the technology of joints has evolved. Companies' criteria for replacement can include: the history of the pipeline including previous need for repairs, its location, possible consequences of incidents, leak detection, etc.

Options for reducing natural gas emission (2)

Repair/relining

The system of repair / relining is used by inserting new plastic liners into old pipes.

Conditioning of lead/yarn jointed mains

Before the introduction of natural gas, *town gas* was manufactured from coal. Natural gas is a much drier form of gas than town gas. Due to the lack of moisture the yarn in the joints dries and shrinks when town gas is replaced by natural gas. This causes joints to become unsealed and allows gas to escape. To reduce the drying effect of natural gas and reduce leakage, natural gas is "conditioned" by adding, for example, water vapour or Monoethylene Glycol (MEG) into the pipe network.

Options for reducing natural gas emission (3)

Prevention of third party damage to pipeline networks

Third party damage to pipeline networks is undoubtedly <u>one of the most important causes of emissions</u>, at least in the distribution grid. The network operators invest in practices in order to limit as much as possible third party damage.

Digging contractors can create damages to pipelines, resulting in immediate or postponed emissions of methane and safety risks.

The company that intends to execute works to obtain the necessary information about the identity of network operators in the area of his projected works. This can be done by an information procedure on a local level (information to be gathered at the municipality).

Options for reducing natural gas emission (4)

Odorisation of distributed gas

- The odorisation of the distributed gas
- The use of free hot numbers in order to receive telephone calls of customers related to gas odour
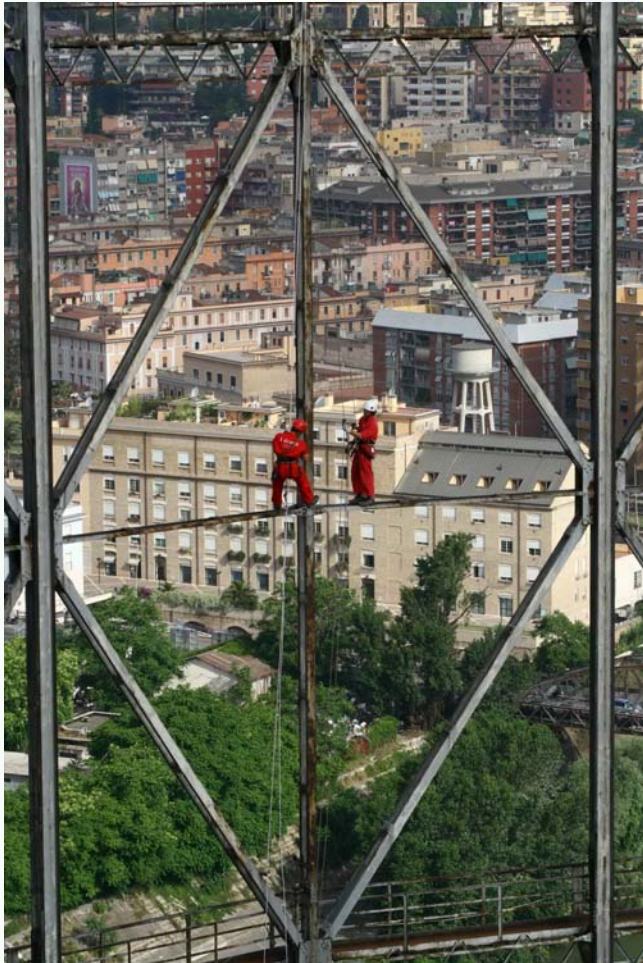- The fast and free of charge intervention after such calls

These elements form part of a safety policy which lead also to the limitation of those emissions of methane which can be observed by the sense of smell.

Emission Data of national network (*)

	2004	2005	2006	2007
Length of road networks in operation [km]	40.126	40.532	41.910	41.076
Natural gas emissions [$10^6 m^3$]	40,2	40,9	41,2	39,3
Natural gas emissions/ Length of networks [m^3/km]	1.001,8	1.009,1	983,1	956,8
Natural gas distributed [$10^6 m^3$]	7.335	7.276	6.807	6.510
Natural gas emissions / Gas distributed [%]	0.548	0.562	0.605	0,604

(*) Data are referred only to Italgas SpA

italgas   **PERORG-PHSE-GIR**   Oil & Gas Methane to Market
Side Event
Monterotondo – Roma - Maggio 2008   Pag. 18   **Eni**

Gas dispersion by network of Rome

The options for reducing methane emissions are evident when a local assessment is done.

An important observation can be seen in **Rome**.

The next figures show the reduction of gas dispersion as a consequence of the replacement of an old distribution network.

Different material of Rome mains

GROWTH OF GAS PIPELINE NETWORKS.
1990-2014. *City of Rome*

Legend:
- Polyethylene
- Steel
- Cast Iron

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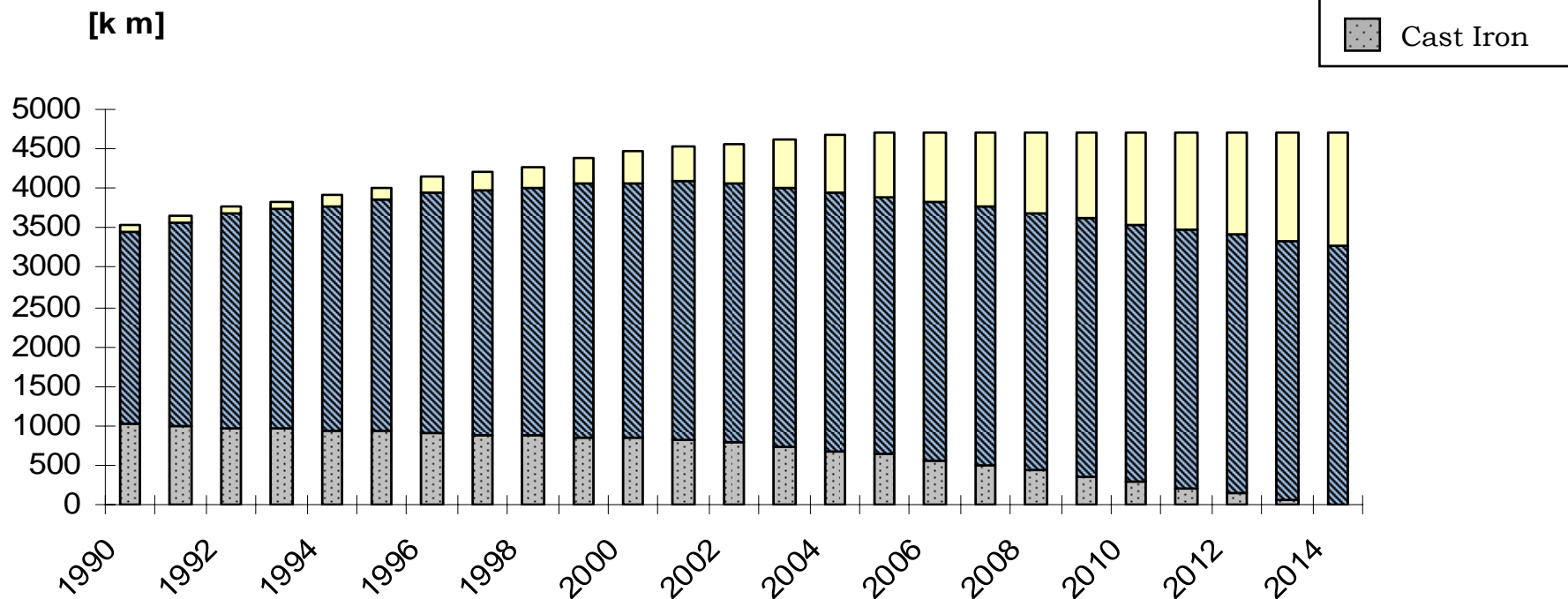
Replacement of cast iron with lead/yarn

	Year	Cast iron pipeline		Investiment Expenditure [M€]
		In operation on December, 31st [km]	Replaced [km]	
Amount	1990	1011	-	
	1991	998	13,1	
	1992	975	22,8	
	1993	963	12,8	
	1994	944	18,5	
	1995	924	19,8	
	1996	896	28,1	
	1997	885	11,1	
	1998	867	18,6	295
	1999	846	20,3	
	2000	834	12,2	
	2001	824	9,8	
	2002	799	25,1	
	2003	741	57,1	
	2004	683	59,4	
	2005	632	50,9	
	2006	566	66,0	
	2007	495	70	
Forecast	2008	425	70	
	2009	355	70	
	2010	285	70	
	2011	215	70	250
	2012	145	70	
	2013	75	70	
	2014	0	75	
	2015	0	0	

Reduction of Gas dispersion in the context of Rome

(forecast until 2014)