

**STRATEGY, INVESTMENTS AND ENVIRONMENTAL POLICY
IN THE api REFINERY AT FALCONARA MARITTIMA**

Guidelines for sustainable development
in a petroleum refinery

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Part 1 - General aspects

THE api GROUP PROFILE

The “api” Group, which was founded in Ancona in 1933 as a company for the distribution of petroleum products is today among the most important of Italy’s industrial groups and performs its activities by managing, through its own operating companies, the entire petroleum cycle from crude oil supply through refining on to the distribution and sale of the products.

The group today enjoys a solid organizational structure that, through its own operating companies and its network of more than 1600 stations, covers the whole Italian territory. With an average market share of four percent and a total of more than nine hundred employees, the “api” Group can count on a consolidated invoiced sales of some 6000 billion liras in 1997.

During the nineties, after the various phases of industrial development had been concluded during the previous decades (the seventies) and after its marketing strategy had been defined (the eighties), “api” started up a company restructuring process; among its objectives, the diversification of its business so as to become, during the new millennium, an integrated energy “pole” and center of action.

The carrying out of this strategy influenced both the company structure and its production system, with new systems being created within the Falconara Marittima refinery and the startup of new business activities in various areas of renewable energy.

The “api” Group companies:

More than twenty firms form today the “api” Group. Heading it up is the company controlling it: api holding, which today has under it the following companies:

- **api anonima petroli italiana**, which coordinates the acquisition of raw materials, and the distribution and sale of the products;
- **api raffineria di ancona**, owner of the Falconara Marittima refinery and responsible for the production sector;
- **apioil Ltd. and apioil GmbH**, headquartered in the Bermudas and in Frankfurt, for international trading in crude and products;
- **api services Ltd** of London, which monitors the market and offers operating services to the group;
(all operating in the petroleum field, which constitutes the company’s core business);
- **api energia**, a joint venture between api, ABB and Texaco for the managing of the new gasification-cogeneration plant for the production of electrical power from production cycle residues, already under construction in the Falconara refinery;
- *as well as a series of companies in which “api” has holdings and are headed up by Finco, the group’s holding company.*

api's ENVIRONMENTAL POLICY

Within the sphere of these demanding restructuring projects, which, as we have seen, involve both the company structure and the production structure, great importance has been taken, and for many years so far, by the environment protection.

This principle, in fact, has for a long time been included among the company's strategy objectives and is considered, at all company levels, to be an objective of extensive reach, one to be achieved in many different ways.

Product quality, the reduction of outside impact associable with the production cycle, the increase of in-site and off-site levels of safety, the search for the best insertion in and the best relationship with the territory in which the refinery operates: these, in summary, are the objectives that are concretely carried out by the "api" environmental policy.

Owing to the startup of demanding investment plans and to the adoption of an effective and sophisticated operating management, today "api" can count on a plant that is among the most modern and reliable not only in Italy but in Europe, in which the constant search to improve environmental performance, in the widest sense as just mentioned, has become a reality characterizing the group and that, more and more in future, will represent one of the guidelines of development, with the achievement, during the first few years of 2000, of a series of significant goals.

THE api REFINERY AT FALCONARA MARITTIMA

The refinery has a production capacity of more than four million tons per year and directly employs about 360 persons; it has an investment plan that, from 1992 to date, has pursued the objective of restructuring and modernizing the production cycle, with multiple investments worth more than 1500 billion liras.

These in summary are the characteristics of the “api” refinery at Falconara Marittima, which is the only refinery in east-central Italy and serves, with its energy products, a hinterland comprising the entire region of The Marches, a part of the Abruzzo and of Umbria, and the provinces of Forlì and of Ravenna in the Emilia- Romagna.

Located on a coastal area of sixty-five hectares, the refinery breaks down into two distinct areas: one turned toward the sea, where the production plants stand, together with the storage tanks for crude oil, semi-finished products and LPG, and the other on the interior, made up exclusively of storage tanks for finished products, and loading areas for land transportation.

To improve the yield of the process cycles, to increase the safety and the quality environmentwise of the finished products and to reduce the plant’s environmental impact are the objectives that have been pursued for years.

The results of this effort are confirmed by these facts:

- the emissions of gaseous pollutants and of liquid effluents are well below the limits specified by law;
- the process cycle systems, built ex novo and subjected to a thoroughgoing modernizing, have an average life of around ten years: among the lowest of those recorded in the seventeen refineries operating in Italy.

As a consequence of this commitment to a continuous and constant process of technological innovation, the Falconara Marittima refinery is one of the safest and most modern refineries in all of Europe.

THE PROCESS CYCLE

The “api” refinery at Falconara Marittima is of the medium-conversion type, obtained by thermal conversion processes. The process cycle is broken down into a series of operating sections that form homogeneous functional units.

The first distillation of the crude takes place in a section made up of three distillation units, of which one under atmospheric pressure and the others under vacuum. This makes possible a total processing capacity of more than four million tons of crude each year.

Coming out of the distillation unit are the light distillates (gasolines) and the medium distillates (kerosene and gasoil). The former are conducted off to the stabilization and octanization cycle, made up of a desulphurisation unit and of a system that stabilizes the primary and cracking naphthas, of a naphtha-splitter plant, of a catalytic reforming plant, and of a light-gasolines isomerization system. The medium distillates are instead sent to the catalytic desulphurisation units, which reduce the sulphur content in the finished product to within legal limits.

The conversion cycle for the residues adopted by the Falconara Marittima refinery is of the thermal type and comprises the Vacuum3, Thermal Cracking and Visbreaking systems.

At the end of the process cycle the finished products are: petroleum products of mass consumption, such as LPG, gasolines, gasoils, fuel oils, and products going to specialist applications, such as the bitumens and the sulphur.

For the crude oil supply the refinery is outfitted with a single-mooring platform, of the rotary-head type, connected by an undersea pipeline sixteen kilometers long, which enables the discharge of the crude from tankers of up to 400,000 DWT.

A steel island standing 3.9 kilometers from the coast, equipped with a dual mooring and a concrete wharf outfitted with three moorings are instead used to unload special crudes and semi-finished and finished products.

The storage system relies on a total capacity of 1,570,000 cubic meters distributed over an area of some 300,000 square meters. The industrial structures are completed by a free deposit for loading all the fuels distribution network, from which more than 1,500,000 kilo-liters of gasoline and diesel fuel for motor vehicles are sent each year.

The finished products are transported both by land (79%) and by sea (21%).

The refinery is outfitted with sophisticated systems for the treatment of the liquid and gaseous effluents: two systems for recovering the sulphur from the acid refinery gases and a system for the treatment of waste waters, complete with biological treatment, and for the treatment of the ballast waters of the tankers. All the wastes produced by the refinery are treated directly in plants using inertization systems; they are then disposed of through authorized operators.

SAFETY AT THE api REFINERY AT FALCONARA MARITTIMA

The “api” refinery at Falconara Marittima was the first in Italy to have concluded the administrative procedure required by the Decree of the President of the Republic 175/88 (the so called “Seveso law” absorbing the Community Directive on the risks of major accidents from specified human activities), and with the issuance of the document of administrative procedure conclusion by the Ministry for the Environment in concert with the Ministry of Health.

The “Seveso law” classifies refineries as activities at risk of major accidents and therefore calls for a specific nationwide administrative procedure to analyze in detail the levels of risk, impact areas, to define the operations on the structures needed to reduce the probability of accident and to provide all the elements necessary to the preparation of special emergency plans, both inside and outside the facility to be agreed with the prefecture.

The prescriptions envisioned in the aforesaid document, in order to make the facility completely compatible with the surrounding territory, were all promptly applied and in particular during 1996 the construction of the new LPG storage plant, a mounded-vessels type was completed, in substitution of the old tanks, all above ground.

To improve the safety of the facility and to reduce its environmental impact within the surrounding territory, the “api” refinery at Falconara Marittima is undergoing a constant process of innovation. Today the refinery is in compliance with the most advanced international design standards.

All the refinery systems are designed on the basis of severe standards covering the prevention of failures and accidents.

A scheduled maintenance plan constantly checks the state of operation of the components of all production systems and replaces the components before the end of their scheduled life cycle.

More than fifty field gas analyzers, located all around the process plants and the storage tanks promptly detect gas leaks and give a specific alarm to the control room, which enables per operators to identify the origin of the leak and shut down, if necessary, the process in absolute safety conditions. The production cycle is in fact completely computerized but is always monitored by the centralized control room.

At present all employees are given more than 6000 hours of annual training to make them aware of the safety rules and how to follow them.

Six fire-fighting squads have been formed, made up of six men each, to ensure complete coverage of the work shifts. They can intervene in fifty seconds, and a sophisticated series of fixed systems makes it possible, in case of fire, to get it under control rapidly.

The recovery of the sulphur that comes from the desulphurisation unit in the form of hydrogen sulphide recovered using an amine solution, takes place in a circumscribed area of the refinery.

Furthermore, all loading and unloading operations have been completely automated and computerized, so as to reduce to the minimum the probability of a human error.

Part II – Enforcement of the environmental protection policy in the facility: new environmental systems and product quality for a “white refinery”

TOWARDS A “WHITE REFINERY”: api’s “SAFETY, ENERGY AND THE ENVIRONMENT” PROJECT

To innovate in the refinery cycle in order to improve safety and reduce its environmental impact and to improve the quality and the yield of the products, to create an integrated plant for the gasification of the heavy residues and to produce clean electrical power. These are the main items of the “api” commitment to upgrade its production structure and to fulfil its environmental policy.

It is along two lines of action, the “**Safety and Environment project**” and the “**Energy project**” that the “**Safety, Energy and the Environment project**” has been developed, with which “api” aims to convert the Falconara Marittima facility into a “white refinery”, from which, only high quality products and electrical power will come out, with process cycles having very low emissions.

This project, started up in 1991, was authorized in July 1994 after an administrative procedure that involved more than thirty administrations.

The content of the “**Safety and Environment project**” was approved by the BEI (European Bank for Investments) which granted, after a long investigation, facilitated loans of 100 billion liras on a total financing of 300 billion liras.

The “**Safety and Environment project**” featured in particular:

The improvement of the distillates yield and of energy recovery:

in this regard, the new Vacuum3 plant was built in 1993, and in 1995 the capacity of the Thermal Cracker unit was increased.

The enhancement of the gasolines quality:

in this case a unleaded gasoline having a benzene content of less than 1% has been marketed since June 1996, in advance of the deadline imposed by law (July 1st 1998), and at the same time an increase in the isomerization capacity was made.

The reduction of sulphur in gasoils:

achieved by the insertion of a third high-performance desulphurisation unit for cracking gasoils (HDS3) a content of 0.05% sulphur in the diesel fuels was achieved;

The reduction in the refinery’s risk level:

accomplished by having dismantled in 1996 the old LPG pressurized storage plant and replaced it with eight new mounded tanks, as well as by having realized a new automated LPG loading unit far from both the railway and storage tanks, and also by reducing from 100 to 10 cubic meters the storage capacities of the tetraethyl lead used in gasoline formulation;

The reduction in atmospheric emissions:

effective owing to the increase in the capacities of the three existing sulphur recovery systems (the third of very recent construction) and to the installation of a tail gas recovery system for the two earlier systems.

The “Energy project” instead featured the strategic completion of the heavy residues process cycle by the installation, before the end of 1999, of an integrated gasification-cogeneration plant (known as IGCC).

Thanks to this new system, which replaces the old refinery’s thermoelectric power plant and which will generate electrical power and steam starting from the gasification of the high sulphur-content process residues, the “api” refinery at Falconara Marittima will have a zero in heavy fuel oils output and will be able to produce only ecologically compatible products and electrical power, whose surplus over in-site needs will be sold to the public power system (ENEL).

THE IGCC SYSTEM IN THE api REFINERY AT FALCONARA MARITTIMA

The national energy scenario for the coming years envisions two lines of action of which "api", as an active participant in this sector, could not but take into account of them.

One concerns the request, especially within the Kyoto agreements, made for ever more efficient and less polluting energy processes, this meaning the need to replace the existing low-efficiency thermoelectric power plant (efficiency less than 35%), which makes, furthermore, a large contribution to the whole refinery's current SO₂ emissions.

The other, according to the provisions laid down by Decree of the President of the Republic 203/88, imposes a drastic reduction in environmental pollution from the ENEL power stations, which, in the coming years, will lead to the disappearance from the market of high and medium sulphur content fuel oils, used in those stations.

Account being taken of this scenario and foreseeing what could be the after-Kyoto energy and environmental strategies, the refinery decided to get outfitted to take on this challenge, converting a series of constraints into business and environmental opportunities to eliminate its own surpluses of residues no longer convertible in of high-sulphur-content fuel oils.

This challenge was in fact accepted by the adoption, at the Falconara Marittima refinery, of the IGCC technology, which, after having been applied in the USA for more than ten years, is now spreading into the other industrialized countries.

The new technology used has the dual purpose of eliminating the process heavy residues (so far mixed with medium distillates to produce some 600 thousand tons per year of high-sulphur-content fuel oils) and of replacing the old thermoelectric power plant with a high-efficiency one (more than 55%) that also has considerably lower emissions.

The IGCC facility displays outstanding advantages energy - and environment-wise, among which the production of more than two billion kWh per year, which means a reduction in The Marches region energy deficit from 87% to 50_%, and to drastically cut the air pollutant emissions released by the entire refinery.

Among the environmental advantages to be noted is the reduction by 30% of the whole facility's SO₂ emissions, so that its levels of concentration will be reduced by 70-80 %.

The construction of the plant demanded up to 1300 billion liras loans, entirely located on the international financial market through the Project Financing system, an innovatory formula by means of which it is possible to bring into our country foreign financial resources, which are traditionally shy of making long-term investments in Italy.

THE NUMBERS OF THE IGCC PLANT

Technical data

- **440,000 tons per year of heavy refinery residues** converted into syngas through an integrated gasification-cogeneration cycle producing electrical power and steam.
- **286 MWh of gross production of electrical power** for 8000 hours per year and a combined production of 65 tons per hour of steam for refinery technological use.
- **220 MW** is the **net electrical power** transferred to the ENEL electrical system.
- **8 kilometers is the length of the 132 KV power line** to be built by ENEL to connect the new station with the public electrical network.

Economic data:

- **1300 billion liras** of investments by international banks.
- **300 new jobs just in the Falconara Marittima area for the three years of construction.**
- **150 billion liras in building construction contracts** just for the Marches contractors.
- **150 new in-site and off-site jobs** for the entire period of operation of the plant.

Direct benefits to the environment:

- **reduction by 30% of the refinery SO₂ emissions** with consequent improvement in the environment of the surrounding area.
- **reduction by more than 70-80% in the current SO₂ concentrations** in gas released to the atmosphere by the refinery, giving the refinery values of fallout actually lower than the threshold limits imposed for the future by Decree of the President of the Republic 203/88.
- **elimination from the atmosphere of 18,000 tons per year of SO₂** no longer fired by power stations and industrial plants as the result of the refinery's withdrawal from the market of the dense fuel oils.
- **elimination of new emissions by the alternative electrical power stations** for equal production, avoiding energy losses due to long-distance transport of electrical power imported from other regions.

Indirect environmental and social-economic benefits:

The IGCC technology, in eliminating from the market 600,000 tons per year of fuel oils and producing non-dangerous products like steam and electrical power makes the following possible:

- **large investments for the construction of local electrical power stations are no longer necessary**, owing to the reduction in the substantial electrical power deficit of the Marches region (87%) and of the whole of east-central Italy.
- **the environment is safeguarded**, the installation of new power stations being avoided, production being concentrated in an existing industrial site without modifying its visual impact.
- **safety is safeguarded**, the installation of high-risk conversion plants within the refinery being obviated.
- **a further increase in cracking capacity is not necessary**, it already being in surplus both in Italy and in Europe, compared to the actual market needs of the petroleum products.
- **heavy traffic in trucks and ships is drastically decreased**, the risk of environmental pollution being averted.
- **the refinery's technological gap is eliminated**, relative to the more advanced European refineries.
- **alternative investments of the same order of magnitude within the refinery for conventional conversion systems are avoided.**

OTHER ENVIRONMENT-RELATED ACTIONS

The new LPG storage plant and loading system

The new LPG storage, and the loading system built by "api" was conceived and built adopting the best technology available today in LPG systems safety field, and that is, the "mounded-vessels" type.

In fact, the new system has wholly replaced the existing pressurized LPG tank fleet, the refrigerated LPG storage system and, finally, the system for loading on tank trucks and rail cars, today located along the right side of the Esino river.

This system, because of the safety measures adopted in its construction, is today the most technologically advanced in Italy, and is looked upon in Europe as a "reference point" in terms of safety, accident prevention and environmental protection.

The facility breaks down into two areas:

- the actual storage, made up of eight 1500 cubic meter tanks, each outfitted for the storage of three different types of LPG (propane, butane and LPG mixtures), together with the product shipping control room.
- the LPG loading installations, with their product shipping control room.

The fully automated operations (earlier human-operated), such as loading maneuvers and shipping of products, provides complete control in real time of the whole cycle: from the supplying of the LPG directly from the process vessels into the storage tanks through the handling and dispatching of the GPL itself on up to the entrance and exit of the road tankers.

Two computerized control rooms, an extensive network of gas detectors, alarms and automatic blocks, and a local supervisory computer network check in real time all the operating systems, ensuring total safety to the operations and the immediate detection of faults, so as to permit a timely actuation of all necessary preventive operations before potentially dangerous situations can arise.

In particular, the new system displays the following advantages from the safety and environmental protection standpoint:

- the replacement of all existing outside storage systems located along the railway and the right bank of the Esino river, with mounded tanks and the reduction of the total LPG storage capacity (from 17,500 cubic meters to 12,000 rated);
- the elimination of the LPG loading installations for loading LPG on road-tankers and rail-tankers located nearby the railway;
- the elimination of possible releases of gas into atmosphere with possible effects outside the refinery in case of accident;
- the improvement of internal traffic of trucks by the elimination of a railway connection line over a kilometer long destined to rail cars traffic, and the computerized controlling of vehicles admission and exit from the refinery;
- the siting of new facilities in an area more distant from the railway and from inhabited areas;
- the planting of rows of tall evergreen trees alongside of the railway;
- the creation of a "green hill" inside the refinery by planting a lawn on the earth fill covering the new LPG tanks.

The HDS3 gasoils desulphurisation unit

This is the third gasoils treatment unit and it has a much higher efficiency than the first two, it yielding a gasoil having 0.05% sulphur or less, whatever be the original crude sulphur contents.

The HCR recovery system of the sulphur recovery units tail gas

The HCR system has been inserted on the tail of the sulphur recovery systems (Claus units) built before the entry into operation of HDS3 and featuring an efficiency of 96%, with the aim of increasing it. In particular, the tail gas recovery system is located between the Claus unit and the sulphur recovery system post-combustor.

The system's function is to convert the sulphur compounds not yet converted in the Claus units, which sulphur compounds, in the form of hydrogen sulphide, are re-injected upstream to the sulphur recovery system itself.

By means of this process, comparable to a forced circulation of the exhaust gases, it is possible to increase the efficiency of the Claus units from 96% to 99.5 % minimum guaranteed, and thus reduce SO₂ emissions.

Part 3 - The relationship with the territory: negotiation, self-regulation, information to the public

A NEW PHASE IN api's ENVIRONMENTAL POLICY: NEGOTIATION WITH THE TERRITORY

The construction of the new IGCC plant in the "api" refinery at Falconara Marittima, owing to the size of the structure and to the positive effects that it will provide to the local community, involved the startup of a series of meetings between "api" and the various economic and social entities in the territory.

These encounters, highly in-depth and under a spirit of cooperation aiming at ensuring the greatest benefits arising from the various contributions, had as their optimal conclusion three formal documents signed by "api" with the following bodies:

- the trade unions (Program agreement of July 24th 1996)
- the city of Falconara Marittima (convention approved by the municipal government on October 15th 1996)
- *Legambiente* (an environmentalists' association: Protocol of agreement signed on December 16th 1996).

The three agreements define as a whole a picture of concrete engagements taken by "api" to ensure the greatest safeguarding of the population and the environment, the reduction of risks tied to production activities and the maximization of people's knowledge of the refinery processes.

One achievement of this policy of full range negotiation was that concrete results were obtained that go well beyond the simple improvements in specific aspects or parameters.

In fact, besides the achievement of the individual objectives set by the three different documents, owing to the startup of this policy, it was possible to enter into a new phase of environmental policy, a more radical one able to have positive fallout on the whole refinery system.

Today, in fact, "api" and the Falconara Marittima refinery are concretely engaged in moving toward the demanding goals of environmental certification of the production site on the basis of the ISO 14000 standards, with the adoption of the best available technologies where operations are carried out to modify or modernize the facilities, and with the eco-compatible management of all refinery activities.

The environmental commitments arising from the agreements

- *to recover by the end of 1996 up to 99.5% of the sulphur content of the refinery exhaust gases, relative to the current recovery level of 95%.*
- *to reduce, by the entry into service of the IGCC system, sulphur dioxide emissions from the current 7800 tons down to 5400 tons per year.*
- *to further reduce, at the same time, nitrogen oxides (NOx) emissions from 1200 tons to 1100 tons per year.*
- *to carry out, by the end of 1998, the installation of a secondary seal on all fuel storage tanks.*
- *to complete, by the end of 1998, the plan for limiting emissions of volatile organic compounds (VOC) begun in 1994.*
- *to reduce, by the end of 1996, from 17,500 tons to 12,000 tons the LPG stored in the refinery, by the recent construction of the new "mounded-vessels" storage plant.*
- *to produce, by the end of 1996, gasoils of very low sulphur content, with the entry into operation of the new catalytic desulphurisation.*
- *to publish yearly starting from 1999 an environmental report on all production activities of the refinery for the purpose of providing a complete and transparent view of environmental protection activities.*
- *to promote and organize, starting from 1997, an annual environmental forum in which all parties involved can discuss the principal environmental issues in a cooperative atmosphere.*