

**ITALY**



## ITALY

### 1. GENERAL INFORMATION

#### 1.1. General Overview

A republic of Southern Europe, Italy is a peninsula set in the Mediterranean Sea. It extends from the Alps, its northern border, southward for 960 kilometres; it has a maximum width of 240 kilometres. To the east lays the Adriatic Sea, to the south the Ionian Sea and to the west the Tyrrhenian and Ligurian seas. Starting from northwest and moving to northeast, Italy is bounded by France, Switzerland, Austria and the Republic of Slovenia. The Apennines, a recent mountain chain, created by the collision of the African and European plates, subject to frequent earthquakes, extends the length of the peninsula. There are few large catchment basins and only the Po basin is suitable site for modern nuclear power plants.

The peninsula comprises much of Italy and includes the independent republic of San Marino as well as the Vatican City. In addition to the continental part there are two big islands, Sicily and Sardinia. The total area is 301,260 square kilometres.

Italy is located in the temperate zone, the mainland climate varies from the north to the south; summer temperatures are relatively uniform in most cities and range on average between 23°C and 28°C, while winter temperatures range between 12°C and 17°C. The annual average rainfall, generally, does not exceed 1,000 mm.

In 2000, the population of Italy was about 58 million with the density of 192 people per square kilometre. Table 1 gives the statistical data until 2000. The capital and largest city is Rome which had a population of 2,693,383 in 1991. The country is composed of 20 regions, which are subdivided into 104 provinces.

TABLE 1. POPULATION INFORMATION

	1960	1970	1980	1990	1996	1997	1998	1999	2000 <sup>(2)</sup>	An. growth rate (%)
										1980 To 2000
Population (millions) <sup>(1)</sup>	50.2	53.8	56.4	56.7	57.4	57.5	57.6	57.6	57.8	0.1
Population density (inhabitants/km <sup>2</sup> )	166.6	178.6	187.3	188.2	190.5	190.9	191.1	191.3	191.7	0.1
Urban population as percent of total	59	64	67	67	67	67	67	67	NA	-
Area (1000 km <sup>2</sup> )	301.3									

<sup>(1)</sup> Mid year

<sup>(2)</sup> Provisional

Source: ISTAT

#### 1.2. Economic Indicators

Table 2 shows the historical GDP data.

#### 1.3. Energy Situation

Italy is poor in natural resources and depends heavily on imported energy supply. In 2000, about 83% of Italy's energy was imported. Natural gas is Italy's largest domestic source of energy with proven reserves of 9.1 EJ in 1996 (Table 3).

Italy's total primary energy consumption was 184.8 Mtoe in 2000, of which solid fuels accounted for 12.8 Mtoe, oil 91.3 Mtoe, natural gas 58.1 Mtoe, renewable sources (hydro, geo, wind, solar, biomasses) 12.8 Mtoe, and electricity net imports 9.8 Mtoe. Historical data are given in Table 4.

TABLE 2. GROSS DOMESTIC PRODUCT (GDP)

	1970	1980	1990	1996	1997	1998	1999	2000 <sup>(4)</sup>	Growth rate (%/year) 1980/2000
GDP <sup>(1)</sup>	107.7	448.8	1,102.4	1,232.8	1,166.8	1,196.5	1,180.2	1,077.1	4.5
GDP <sup>(2)</sup>	577.5	823.5	1,030.0	1,109.2	1,131.7	1,152.2	1,170.7	1,204.9	1.9
GDP <sup>(3)</sup> per capita	2,001	7,953	19,437	21,480	20,288	20,777	20,473	18,646	4.4
GDP by sector (%):									
-Agriculture	5	4	3	3	3	3	3	3	-1.4
-Industry	33	31	29	28	28	28	27	27	-0.6
-Services	56	58	62	63	62	63	62	62	0.4
- (+)Ind. taxes (-)bank services	5	7	7	7	7	7	7	7	0.0

<sup>(1)</sup> Billions of current US\$<sup>(3)</sup> Current US\$ per capita<sup>(2)</sup> Billions of constant 1995 US\$<sup>(4)</sup> Provisional

Source: Country Information

TABLE 3. ESTIMATED ENERGY RESERVES

	Exajoule					
	Solid	Liquid	Gas	Uranium <sup>(1)</sup>	Hydro <sup>(2)</sup>	Total
Total amount in place	0.84	2.18	9.12	2.62	32.78	47.54

<sup>(1)</sup> This total represents essentially recoverable reserves.<sup>(2)</sup> For comparison purposes a rough attempt is made to convert hydro capacity to energy by multiplying the gross theoretical annual capability (World Energy Council - 1998) by a factor of 10.

Source: IAEA Energy and Economic Data Base; Country Information.

## 1.4. Energy Policy

The last Energy Plan approved by the Government dates back to August 1998. It focused on a set of actions capable of yielding substantial results in terms of energy conservation, environmental protection, development of domestic energy sources, diversification of imported energy sources and their origins, and safeguarding the competitiveness of the production system. Since 1988, the Italian Government has issued no further comprehensive energy documents. A five-years nuclear moratorium, following a popular referendum, which took place in 1987, officially expired in December 1993, nevertheless the Government remains steadfast in excluding nuclear energy. Recently, a new State owned Company (SOGIN) got the assets constituted by the closed existing power stations (about 1,400 MW) and will take care of their decommissioning. A return to nuclear power, in Italy, is for the moment not foreseeable.

## 2. ELECTRICITY SECTOR

### 2.1. Structure of the Electricity Sector

In 1962, the electric sector was nationalized by Law 1643 of 6 December 1962. ENEL (Ente Nazionale per l'Energia Elettrica, Italian Electricity Generating Board) was established to be wholly responsible for electricity production and transmission, and partially responsible for distribution of electric energy.

TABLE 4. ENERGY STATISTICS

											(Exajoule)	
											Growth rate (%/year)	
	1960	1970	1980	1990	1996	1997	1998	1999	2000 <sup>(2)</sup>	'60/'80	'80/'00	
Energy consumption												
- Total	2.11	5.02	6.13	6.81	7.19	7.30	7.50	7.65	7.74	5.5	1.2	
- Solids	0.45	0.46	0.53	0.66	0.53	0.55	0.58	0.59	0.62	0.8	0.8	
- Liquids	1.00	3.65	4.14	3.87	3.95	3.97	3.97	3.87	3.82	7.4	-0.4	
- Gases	0.22	0.45	0.95	1.64	1.94	2.00	2.16	2.34	2.43	7.6	4.8	
- Primary electricity <sup>(1)</sup>	0.44	0.46	0.52	0.64	0.77	0.78	0.80	0.85	0.87	0.8	2.6	
Energy production												
- Total	0.88	1.03	1.02	1.16	1.40	1.40	1.38	1.35	1.29	0.8	1.2	
- Solids	0.13	0.08	0.05	0.05	0.06	0.06	0.07	0.08	0.08	-4.7	2.6	
- Liquids	0.09	0.06	0.08	0.20	0.23	0.25	0.24	0.21	0.19	-0.6	4.6	
- Gases	0.22	0.46	0.43	0.59	0.69	0.67	0.66	0.60	0.56	3.4	1.3	
- Primary electricity <sup>(1)</sup>	0.44	0.43	0.46	0.32	0.42	0.42	0.42	0.46	0.46	0.2	-0.1	
Net import (import-export)												
- Total	1.29	4.14	5.13	5.73	5.85	5.86	6.11	6.26	6.66	7.1	1.3	
- Solids	0.32	0.39	0.48	0.58	0.49	0.46	0.50	0.51	0.56	2.0	0.8	
- Liquids	0.97	3.72	4.10	3.77	3.73	3.69	3.76	3.66	3.70	7.5	-0.5	
- Gases	0.00	0.00	0.50	1.06	1.28	1.35	1.47	1.71	1.98		7.2	
- Electricity	0.00	0.03	0.06	0.32	0.34	0.36	0.38	0.39	0.41		10.5	

(1) 2200 kcal/kW·h. Net of generation from hydro pumping plants

(2) Provisional

Source: Ministry of Industry, Italian National Energy Balances

Over the following three decades, the structure of the Italian electricity sector - in terms of production, transmission and distribution – was organized along the following model: a large, nation wide company: ENEL; a number of municipal utilities, namely in the large cities like Rome, Milan, Turin; and a large number of industrial autoproducers.

Starting from the early '90s, many changes have been developed in the Italian electricity sector and the consequences begin to appear.

By Decree No. 333 of 11 July 1992, the Government decided to privatize some state-owned industrial and commercial companies. The new companies issued shares for a total value equal to the net fixed assets given in the last balance sheet. The shares have been allocated to the Treasury and the revenue obtained by their sale will be used to reduce the national debt and to balance the Government's books. Thus, in August 1992, ENEL became a joint-stock company (ENEL S.p.A.) with its shares in the hands of the Treasury. In November 1995 the law setting up the Independent regulatory Authority has been approved, and the Authority has been operational since the beginning of 1997. In December 1995 The Ministry of Industry issued the new concession to Enel SpA.

In March 1999, a legislative Decree ("Bersani" Decree) was issued, for the restructuring and liberalization of the Italian electricity sector: the purpose of the Decree is both to reach a sufficiently large liberalization and to guarantee such general economic interest as, for instance, a universal service, tariff equalization, the development of renewable sources.

According to the mentioned decree, Enel SpA begun a process of complete reorganization. Enel is now an holding, whose shares are for 68% property of the Ministry of Economy and Finance (former Ministry of Treasury). The balance of 32% is already on the stock market. As for generation, Enel has subdivided its generation capacity in a few companies, with the perspective of reducing its generation share in the Italian market accordingly to the European directive. Companies Elettogen

(5720 MW) and Eurogen (7000 MW) have already been sold to private operators and for Interpower (2600 MW) the process is ongoing. Two other companies in the holding are dedicated to distribution (one company for the captive market and one for the free market), and one owns the transmission grid. Many other stock companies exist in Enel group for other business such as engineering, lighting, water management, and other for different industrial services.

## **2.2. Decision Making Process**

New generation capacity will be built according to the licensing procedure: producers wanting to operate on the free market will apply for the authorization. In order to encourage the use of renewable sources, operators producing more than 100 GW·h/year (coming from non renewable sources) will be obliged as of 2001 to insert a quota of energy into the grid produced with renewable sources equal to 2% of the amount exceeding 100 GW·h.

From January 2003, no producer or operator will be allowed to generate or import more than 50% of the total electric power generated and imported in Italy.

The management of the grid is assured by the Independent System Operator (ISO): a joint stock company, owned by the Ministry of Treasury and totally independent from the electricity industry. ISO has the task of dispatching energy and operating the national network, that mainly consists of the HV grid of Enel and HV lines of other operators.

## **2.3. Main Indicators**

Italy's total gross output capacity of electricity generating plants in 2000 amounted to 76.400 MW: thermal plants 56,700 MW, hydroelectric 20,600 MW, geothermal 631 MW and 400 MW renewable sources (Table 5). Total gross electricity production in 2001 was 279.630 GW·h., including wind and photovoltaic for about 0.8 TW·h. High voltage transmission lines, connecting power plants with the distribution system, are mainly based on 380 kV lines and 220 kV lines.

In 2000, the electricity demand on the national grid was 305.4 TW·h with a per capita demand of 5,154 kWh. In 2000, electricity's share in gross domestic energy demand was 35.4%. Energy related ratios are given in Table 6.

## **2.4. Impact of Open Electricity Market in the Nuclear Sector**

Nuclear is not an option at the moment in Italy: no impact of Open electricity market in the nuclear sector

# **3. NUCLEAR POWER SITUATION**

## **3.1. Historical Development**

Italy was among the first countries in the world to use nuclear technology for civil power generation purposes only. The Italian history of nuclear technology development can be split into three major periods:

- i) pioneering period from 1946 to 1965 during which the private industry played a fundamental role;
- ii) planning period from 1966 to 1987, during which the Government planned nuclear development;
- iii) post referenda period from 1988 onward, which is characterized by the efforts to abandon nuclear energy production.

TABLE 5. ELECTRICITY PRODUCTION AND CAPACITY

	1960	1970	1980	1990	1998	1999	2000 <sup>(3)</sup>	2001	Growth rate (%/year)	
									'60/'80	'80/'00
Gross electricity production (TW·h)										
- Total	56.240	117.423	185.741	216.891	259.786	265.657	275.881	279.630	6.2	2.0
- Thermal <sup>(1)</sup>	8.030	70.222	133.350	178.590	207.970	209.068	219.800	219.204	15.1	2.5
- Hydro	46.106	41.300	47.511	35.079	47.365	51.777	50.925	55.091	0.2	0.3
- Nuclear	0.000	3.176	2.208	0.000	0.000	0.000	0.000	0		
- Geothermal	2.104	2.725	2.672	3.222	4.214	4.403	4.705	4.509	1.2	2.9
- Wind <sup>(2)</sup>	0.000	0.000	0.000	0.000	0.237	0.409	0.451	0.826		
Gross maximum output capacity (GW)										
- Total	16.311	31.331	48.469	58.596	74.955	76.230	78.331		5.6	2.4
- Thermal <sup>(1)</sup>	4.56	16.96	30.65	39.12	53.95	54.81	56.70		10.0	3.1
- Hydro	11.47	13.41	15.90	18.97	20.26	20.56	20.60		1.6	1.3
- Nuclear	0.00	0.58	1.47	0.00	0.00	0.00	0.00			
- Geothermal	0.29	0.39	0.44	0.51	0.58	0.62	0.63		2.2	1.8
- Wind <sup>(2)</sup>	0.00	0.00	0.00	0.00	0.17	0.24	0.40			

<sup>(1)</sup> Including biomass<sup>(3)</sup> Provisional<sup>(2)</sup> Including solar

Sources: ENEL, GRTN

TABLE 6. ENERGY RELATED RATIOS

	1960	1970	1980	1990	1996	1997	1998	1999	2000 <sup>(3)</sup>
Energy consumption per capita (GJ/capita)	42	93	109	120	125	127	130	133	134
Electricity per capita (kWh/capita)	1091	2137	3181	4145	4580	4719	4850	4959	5154
Electricity penetration (%)	24.7	22.3	28.3	32.9	34.2	34.4	34.5	34.6	35.4
Nuclear/total electricity (%)	0	3	1	0	0	0	0	0	0
Dependence on imported energy sources (%) <sup>(1)</sup>	58.5	79.5	83.4	83.0	80.6	80.9	81.6	82.3	83.4
Load factor of electricity plants (%) <sup>(2)</sup>									
- Total	39	43	44	42	39	39	40	40	40
- Thermal	20	47	50	52	44	44	44	44	44
- Hydro	46	35	34	21	27	26	27	29	28
- Nuclear			63	17					

<sup>(1)</sup> 100 - (indigenous production/total demand)\*100<sup>(2)</sup> Rough evaluation referring to gross generation and gross maximum output capacity<sup>(3)</sup> Provisional

Source: Country Information

### 3.1.1. Pioneering Period

In November 1946, CISE (Centro Informazioni, Studi ed Esperienze) was founded, with the participation of the elite post-war Italian industries (Edison, Montecatini, FIAT) and some of the most prominent Italian nuclear scientists. Early on, the purpose of CISE was to lay down the foundations of civil nuclear engineering and, later on, to design a natural uranium fuelled, heavy water moderated test nuclear reactor.

In June 1952, the Government established CNRN (Comitato Nazionale per le Ricerche Nucleari), an agency in charge of developing and promoting nuclear technology. In August 1960, the agency was reorganized and renamed CNEN (Comitato Nazionale per l'Energia Nucleare).

In October 1958, the construction of the country's first nuclear power plant, Latina, began. This 200 MW(e) gas-graphite reactor (Magneox, from magnesium alloy used in the fuel cans) was connected

to the electric grid in May 1963. It was ordered by SIMEA, an ENI<sup>1</sup> (Ente Nazionale Idrocarburi) subsidiary, and contracted from the Nuclear Power Plant Company (NPPC) of the UK. The United Kingdom's Atomic Energy Authority was to offer support for the safety aspects.

In November 1959, construction work for the Garigliano nuclear power plant began. A Boiling Water Reactor prototype was ordered by SENN (Societa Elettro Nucleare Nazionale) from the International General Electric. In January 1964, Garigliano 150 MW(e) reactor started operation.

The Trino Vercellese nuclear power plant, a Westinghouse PWR with two separate turbine systems, was ordered by SELNI (Societa Elettro Nucleare Italiana), a subsidiary of the Edison group. Construction for the 260 MW(e) Trino Vercellese began in August 1961. It entered commercial operation in October 1964.

A general rule, Law 1860, to regulate peaceful use of atomic energy was issued for the first time in December 1962. This law assigned CNEN the role of the nuclear Regulatory Body and foresaw the issuance of a subsequent law for radioactive protection of population and workers.

In February 1964, the Italian Government issued a complete set of Regulations (D.P.R. 230) to cover into details the different aspects of nuclear safety and radiation protection. CNEN was confirmed as the official Regulatory Body. However, this responsibility created an inherent conflict of interests between its role as a public promoter of nuclear technology and as a Regulator. The safety criteria during the period were adopted from countries exporting nuclear technology (mainly the UK and the USA).

In 1962, after a long political struggle, the electric sector was nationalized and ENEL was established as the sole utility. In 1964, the ownership of Latina nuclear power plant was transferred to ENEL, and, in 1966, also the Garigliano and Trino units were transferred to ENEL, hence closing the first period of the Italian nuclear history.

### *3.1.2. Planning Period*

In December 1966, ENEL announced a huge nuclear programme forecasting 12,000 MW of nuclear power by 1980. A year later, in 1967, CIPE<sup>2</sup> (Comitato Interministeriale per la Programmazione Economica) - a Committee in charge of co-ordinating the activities of Ministries involved in the country's economic planning and of defining the nuclear programme of ENEL - reorganized the nuclear sector. Among the most important actors (all state-owned companies) were:

- i) ENEL, which maintained its position as the sole utility;
- ii) ENI, which was in charge of nuclear fuel;
- iii) ANSALDO, which was in charge of collaborating with foreign supplier(s) and later became the Italian nuclear components supplier.

In 1967, an agreement was signed by CNEN and ENEL for developing an Italian version of the Canadian CANDU. This reactor type, called CIRENE, was designed to use heavy water as moderator and boiling water as coolant. In 1972, ANSALDO got an order to build a 40 MW(e) prototype close to the Latina nuclear power plant. CISE actively participated in the design and construction of the CIRENE reactor, which, however, never became operational due to technical problems and the lack of economic resources. Its construction was finalized only in 1988.

In 1969, ENEL decided to build a BWR (G.E. BWR 4, Mark 2) on the site of Caorso; one year later ANSALDO, in a joint venture with G.E., officially received the order. The Caorso site construction began in 1970. After several delays in implementing improvements in the suppression

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<sup>1</sup> Italian Hydrocarbons Board

<sup>2</sup> Interministerial Committee for Economic Planning

pool and bolstering thermal fuel performance, this 860 MW(e) unit finally started commercial operation in 1981.

In 1974, following the Yom Kippur War and the consequent oil crisis, the Ministry of Industry, Commerce and Crafts (hereafter referred to as Ministry of Industry) approved a National Energy Plan that foresaw the construction of 20 nuclear power plants in order to reduce the contribution of oil on the Italian energy balance. The main effort during that period was to achieve a certain level of technological independence from the American licensor(s). Political indecision led the industry to spread technical and economic resources over five different reactor types; namely, the BWR of General Electric, the PWR of Westinghouse and Babcock types, the CANDU of AECL, and the indigenous CIRENE.

To attain the goals of the new energy plan, the Italian government in 1973, joined the EURODIF consortium. AGIP Nucleare, a subsidiary of ENI, and CNEN were in charge of providing the country with enriched uranium for fuel fabrication. Meanwhile, in 1972, ANSALDO -in a joint venture with G.E.- completed the Fabbricazioni Nucleari (Bosco Marengo) to manufacture the fuel elements for the future BWR's. The plant can produce 100 tons of fuel annually. It entered in operation in 1976 and has produced more than 500 tons of fuel for the Italian nuclear power stations and Leibstadt nuclear power station in Switzerland.

Later, in December 1973, three major European utilities signed an agreement to build a Superphenix, 1200 MW(e) fast breeder reactor in France. A second smaller station was planned in Federal Republic of Germany. The three original partners were Electricité de France (EdF), ENEL and Rheinisch Westfälisches Elektrizitätswerk (RWE). Subsequently RWE was substituted by Schnell-Bruter Kernkraftwerkgesellschaft (SBK), a joint enterprise of RWE, Belgian and Dutch utilities and, to a lesser extent, the British Central Electricity Generating Board (CEGB). Under the terms of this agreement the NERSA company was created in 1974 to undertake the construction of the Creys-Malville station. EdF's share of NERSA was 51%, ENEL had 33% and SBK 16%. Preliminary work on the Creys-Malville site started in December 1974. The first concrete was laid in December 1976. The reactor began operation in January 1986. Earlier, in 1983, construction had begun for PEC (Prova Elementi di Combustibile) for testing fast breeder fuel elements. This was intended to strengthen Italy's participation in the Superphenix venture.

In 1976, Montalto di Castro was selected as the site for two new BWR's (G.E. BWR 4, Mark 3). The site permit was issued in 1979, exactly one month before the Three Mile Island incident. This along with the active opposition of the environmental movements, delayed the implementation of the energy plan. Moreover, ENEL faced increasing difficulties with its nuclear power stations and conventional power plants with the construction of transmission system. During the 1980's, the nuclear option became one of the major political issues, almost completely halting all nuclear activities, despite the commitments of several energy plans.

The new National Energy Plan of 1982 reflected mixed attitudes. It called for two nuclear units at Montalto di Castro and six other units on three different sites (Piemonte, Lombardia and Puglia). The plan also identified the development of the so-called PUN<sup>3</sup> (Progetto Unificato Nazionale), a Westinghouse pressurized water reactor as the final reactor type for the country. The most important characteristic of PUN design was to standardize nuclear plant design and construction. ENEA<sup>4</sup> (Ente Nazionale per la ricerca e lo sviluppo dell'energia nucleare e delle Energie Alternative), formerly CNEN, was split into two major branches: ENEA responsible for research and promotion of nuclear technology; and, ENEA/DISP<sup>5</sup>, an independently acting nuclear Regulatory Body.

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<sup>3</sup> Standard Nuclear Plant Project.

<sup>4</sup> Italian Commission for research and Development of Nuclear and Alternative Energy Resources, set up under Act No. 84 of 5 March 1982 to reorganise CNEN.

<sup>5</sup> Directorate for Nuclear Safety and Health Protection.

In 1986, a few months before the Chernobyl nuclear disaster, CIPE reaffirmed its commitment for the two BWR units at Montalto di Castro and for the six PUN type pressurized water reactors. However, the impact of the Chernobyl disaster on public opinion was enormous and a general debate on the implications of the use of nuclear energy inflamed the contest in the political arena. In November 1987, three referenda were passed essentially stopping any activity in the nuclear sector.

### *3.1.3. Disengagement Period*

In December 1987, CIPE halted construction of the Montalto di Castro and Piemonte plants. These were the only two sites where construction work was effectively in progress. A nuclear moratorium period of five years became effective.

In June 1988, the Government, by Decree Nos. 230 and 324, ended all nuclear construction. The Caorso reactor, which was shut down in October 1986 for the annual refuelling remained in cold shut down for a complete safety review and assessment. In 1989, an OSART (Operational Safety Assessment Review Team, under the aegis of IAEA) inspection of the Caorso plant was conducted; but, despite of positive results of both reviews, CIPE decided, in July 1990, to close down the plant. At the same time Trino nuclear power plant was closed. The remaining units of Garigliano and Latina had already been closed down in August 1978 and November 1986, respectively.

At the same time ENEA decided to close down a number of facilities relevant to the fuel cycle: IFEC (Impianto di Fabbricazione Elementi di Combustibile), EUREX (Enriched Uranium Extraction), ITREC (Impianto di Trattamento e Rifabbricazione Elementi di Combustibile) and the plutonium plant at its Casaccia Centre. In effect, Italy is currently inactive in the nuclear energy sector.

In the context of the privatization and of the liberalization of the electric energy market, and accordingly to a legislative Decree (Decreto legislativo n° 79 , 16 March 1999) all Enel's liabilities and assets (and all capabilities and resources) connected to nuclear power have been assigned to a newly established company, named SO.G.I.N. (Società Gestione Impianti Nucleari, hereafter Sogin); Sogin is operational since November 1<sup>st</sup>, 1999; its shares have been transferred in 2000 to the Ministry of Treasury (now Ministry of Economy and Finance); nevertheless, Sogin will act accordingly to guidelines issued by the Ministry of Industry (now Ministry of Productive Activities).

The mission of Sogin covers:

- the decommissioning of the NPPs in Italy: as it is well known, all nuclear generation plants in Italy have been definitely shutdown; furthermore, Sogin has been allowed to act with joint ventures or similar co-operative initiatives in order to dismantle any other nuclear related structure in Italy: for this reason on 12 December 2000, Sogin entered into a Consortium with ENEA and Fabbricazioni nucleari (FN). The aim of the Consortium is to dismantle all plants related to the fuel cycle (fabrication and research plants: no installation for the back end of the cycle exist in Italy), which are property of ENEA and FN;
- the management of the back end of the related fuel cycle;
- the valorization of the assets such as sites, components, resources;
- providing engineering and consultancy services in the nuclear field within the domestic and the international market.

### 3.2. Status and Trends of Nuclear Power

TABLE 7. STATUS OF NUCLEAR POWER PLANTS

Station	Type	Capacity	Operator	Status	Reactor Supplier
CAORSO	BWR	860	Sogin <sup>1</sup>	Shut Down	AMN/GETS
ENRICO FERMI (TRINO)	PWR	260	Sogin <sup>1</sup>	Shut Down	WEST
GARIGLIANO	BWR	150	Sogin <sup>1</sup>	Shut Down	GE
LATINA	GCR	153	Sogin <sup>1</sup>	Shut Down	TNPG

Station	Construction Date	Criticality Date	Grid Date	Commercial Date	Shutdown Date
CAORSO	01-Jan-70	31-Dec-77	23-May-78	01-Dec-81	01-Jul-90
ENRICO FERMI (TRINO)	01-Jul-61	21-Jun-64	22-Oct-64	01-Jan-65	01-Jul-90
GARIGLIANO	01-Nov-59	05-Jun-63	01-Jan-64	01-Jun-64	01-Mar-82
LATINA	01-Nov-58	27-Dec-62	12-May-63	01-Jan-64	01-Dec-87

<sup>1</sup>Sogin since November 1<sup>st</sup>, 1999; before, the operator was ENEL.

Source: IAEA Power Reactor Information System as of 31 December 2001; Sogin.

### 3.3. Current Policy Issues

The future of the nuclear sector remains uncertain pending development and acceptance of the new generation of enhanced safety reactors.

Main nuclear policy issues relate to the decommissioning and waste disposal facilities. The ultimate strategic goal, for the former, is unrestricted site release.

On 14 December 1999, the Italian Government, with an announcement of the Ministry of Industry, has outlined strategic choices and plans to manage the problems connected with the closure of all nuclear activities in the country. These guidelines have been submitted to the Parliament, even if a wide consensus both on political and technical bodies has raised and a high level of confidence about their confirmation should be considered.

The ministry statement outlines three main goals:

- treatment and conditioning, within a 10 year period, of all liquid and solid radwaste currently in on-site storage, mostly issued from the operation of the plants, with a view to subsequent transport to a national waste repository;
- Site selection and construction of a national repository for low and intermediate level wastes, also within 10 years; the same site would be used for temporary storage of high level long lived wastes, particularly spent fuel and wastes resulting from reprocessing: the final selection of a site for waste disposal facilities has not been made yet;
- Decommissioning of the nuclear plants in about 20 years, proceeding directly to the dismantling stage in order to reach the site release with no radiological constraints.

It is worth mentioning that this announcement brings a new approach for the decommissioning: in fact, also as a consequence of the National Conference on Energy and Environment in the autumn of 1998, the deferred decommissioning strategy (Safe Store) was up to this moment the adopted and agreed strategy by Enel with the Government.

Nevertheless, during 1999 also representatives of ANPA (the Safety National Authority) have asked for the possibility of an acceleration, considering “prompt decommissioning” option to be preferred, as well taking into account dose constraints as the need of taking advantage of the reactor operational staff still available on the nuclear sites.

The policy for an immediate dismantling was confirmed with a decree of the Ministry of Industry on 2001, May 7<sup>th</sup>; this decree confirmed also the main objectives outlined in 1999 and stated the opportunity that Sogin would collaborate, under a specific convention, with the Ministry for specific items of Ministerial responsibility concerning siting and construction of the low level radioactive wastes repository.

Sogin has defined the decommissioning program according to the new guidelines of the government. As mentioned before, the target is to reach the complete radiological release of the site within 20 years from now.

The general programme for all plants has been in principle divided into three phases:

- The first phase will be devoted to all activities that are somewhat independent on the chosen strategy and on the availability of the national repository. Fuel storage and dismantling of BOP, of conventional buildings and lower contamination components are scheduled. In addition, all operating wastes will be conditioned. The general licensing procedure will be executed. This phase should be completed in mid 2005
- The second phase will consider all preparatory activities and mock up realisation for the final dismantling. It will start after the beginning of the realisation of the national repository; we consider that this phase should finish in 2008-2009.
- The third phase will be devoted to the dismantling of nuclear islands, to the transport off all wastes to the repository and to the site restoration. We consider that by the end of 2020 all sites should be released..

Of course, the objectives of this programme can be reached only if the construction of a national repository will be achieved in the due time.

For all plants, during 2001 a special effort was devoted to application for the dismantling and others licensing issue, such as EIA. In addition, many detailed projects were presented to the Safety National Authority, namely for the decontamination of primary circuits of Caorso and Trino. Main activities already performed on each plant are hereby summarised.

**Garigliano** (160MW BWR, operated from 1963 to 1978): the global decommissioning plan with the new strategy has been presented to initiate the decommissioning licensing procedure on august, 2001.

The plant was near to reach the safestore condition when the change of strategy occurred. The reactor is defuelled and no fuel is now on the site. The radiological characterisation has been completed. All operating wastes have been treated; no more necessary radwaste tanks have been dismantled and decontaminated.

**Latina** (160 MW GCR, operated since 1962 up to 1987): the global decommissioning plan for initiating the licensing procedure has been presented in Feb. 2002.

The plant has been totally defuelled; the primary circuit has been filled with dry air and blowers and portion of primary circuit outside the reactor building have been dismantled; first activities for the removal of asbestos from the turbine building were initiated.

**Trino**, (260 MW PWR, operated from 1965 to 1987): the global decommissioning plan with the new strategy has been presented to initiate the decommissioning licensing procedure in Dec. 2001; the reactor has been defuelled and part of the fuel is now stored in the pool of the plant. An On site Interim storage will be realised by 2003. No major decommissioning activities have been performed, while removal of asbestos and components from the turbine building are initiated.

**Caorso** (850 MW BWR, operated from 1981 to 1986): the reactor has been defuelled and the fuel is now stored in the pool of the plant. An On site Interim Storage will be realised by 2004. On August 4, 2000 the Ministry of Industry issued a Decree authorising specific decommissioning activities (dry

storage of irradiated fuel, dismantling of the turbine and Off-Gas, dismantling of the RHR towers, decontamination of the main circuit, treatment of previously produced waste). For other activities the global decommissioning plan has been presented on August 3<sup>rd</sup>, 2001. Removal of asbestos and non contaminated components from the turbine building (mainly the generator) are initiated.

*Planning activities together with on-site preparatory activities have continued, mainly operational wastes treatment and conditioning and the revision of the radiological inventory of the turbine.*

Recently Sogin carried out a deep re-examination of the NPPs decommissioning costs estimates, also with qualified assistance of international advisors. First assessments indicate a total amount of about 2600 MEURO for the total decommissioning of the 4 NPPs (constant money 2001, including fuel and wastes management and disposal costs)

As for funding the decommissioning, in the '80, even if there were no precise law disposition in this specific matter, Enel has created a fund for the plants decommissioning and a fund for the irradiated fuel management. A setting aside pluriannual plan has been defined and cumulated funds were transferred to Sogin at the date of its constitution. This amount was adequate to complete decommissioning activities within the Safe Store strategy.

Following the separation of Sogin from Enel, a funding mechanism has been defined to provide resources for additional costs deriving from the different economic conditions (new discount rate and taxes), from the management costs for the new company, and from the change in strategy (from Safe Store to DECON).

A Decree of the Ministry of the Industry issued on 2000, January 26<sup>th</sup>, states that above mentioned extra costs for Sogin shall be financed on a levy on the price of the sold kWh. Every year Sogin shall present the program of future activities, with associated costs: on this basis, the national Authority for Electric energy and Gas (the National body which defines tariff politics) shall re-evaluate the levy on kWh due to Sogin for next three years; this re-evaluation will take into account economic efficiency criteria

The same procedure is foreseen by the Decree in order to finance the dismantling of nuclear installation now property of ENEA and co-ordinated by the above mentioned Consortium.

### **3.4. Organizational Chart(s)**

In the framework of Decommissioning and Radioactive Waste management in Italy, the competent national bodies are the following:

#### *Ministry for Productive Activities*

The Ministry for Productive Activities (formerly of Industry) is the authority that issues the operating licence for all nuclear and radioactive installations, after the positive technical advice of ANPA. For installations related to radioactive waste storage and disposal, the concerted agreement of the Ministries of Environment, Internal Affairs, Welfare, and Health is also required.

#### *ANPA (National Agency for Environmental Protection)*

ANPA is responsible for the regulation and supervision (by inspection) of nuclear installations in matters of nuclear safety and radiation protection. Any licence granted by the Ministry for Productive Activities incorporate the corresponding preceptive and legally binding report of ANPA. It is a body governed by public law with administrative and financial autonomy, under the supervision of the Ministry of the Environment.

#### *Technical Commission for Nuclear Safety and Health Protection from Ionizing Radiations*

This Commission is composed of experts from ENEA, ANPA, and from various Ministries, and gives technical advice concerning the granting of licences for nuclear installations.

### **Regulatory function**

Authorization is formally granted by the Ministry for Productive Activities based on ANPA technical judgements and prescriptions.

The main tasks of ANPA to fulfil the obligations of the Legislative Decree no. 241/2000 are:

- controls and inspections on existing nuclear installations,
- licensing on new nuclear installations,
- controls and inspections on possession, commerce, transportation, utilisation, dismissal of radioactive material,
- controls and inspections on radioactive waste management,
- radioprotection of workers, public, environment,
- nuclear emergency preparedness,
- fulfilment of International Agreements on control and surveillance of nuclear materials (e.g.: Safeguards regime, Additional Protocol),
- promotion of international co-operation in the field of nuclear safety and radiation protection,
- promotion of actions aimed at maintaining and improving the national know-how and the national safety culture in the field of nuclear safety and radiation protection.

In addition to these duties, ANPA has also to:

- support the State Administrations to issue specific decrees for the implementation of the fundamental nuclear laws, specific technical guides,
- realize a National Database on all nuclear applications.

ANPA responsibilities for the licensing process of nuclear installations include:

- assessment of the safety analysis carried out by the operating organisation
- inspection of equipment and materials during the design, construction and operational phases for the systematic verification of facility operation safety
- enforcement action to remedy any failure to meet both the licensing conditions and any safety operation criteria

## **4. NUCLEAR POWER INDUSTRY**

### **4.1. Supply of Nuclear Power Plants**

Due to the historical development of nuclear technology in Italy, it was not possible to develop separate organizations for the roles of architect engineer and nuclear steam systems supplier. For PUN, it was foreseen that ENEL would have covered the role of architect engineering, and ANSALDO would have been the nuclear supplier. For the other reactors, both activities were performed mainly by foreign companies. For example, for Caorso nuclear power plant the supplier was a joint venture of ANSALDO and G.E. (AMN/GETS), while the architect engineering services were provided by Gibbs & Hill of the U.S.

At present, ANSALDO participates in a joint venture with AECL for construction of five CANDU reactors in Cernovoda, Romania.

Sogin is also present in the international market offering mainly engineering and consultancy services for refurbishing of power plants, for on site assistance programmes and for decommissioning activities. At present, Sogin is participating in PHARE and TACIS programmes: it is since 1997 leader in the On Site Assistance project of the Medzamor plant (Armenia); as a partner of EDF it is operating for safety improvements of Aktau (Kazakistan) and Beloyarsk (Russia) fast breeder reactors; other services have been granted in other eastern countries and in the field of training.

## 4.2. Operation of Nuclear Power Plants

Since 1962, ENEL has been the only utility owning and operating nuclear power reactors. ENEL has also acted as a maintenance company with several other private or state-owned companies (ANSALDO, Carlo Gavazzi, Fochi, Belleli, FIAT, etc.). For instance, half of the outage services at Caorso NPP are performed by the plant personnel and other half by external contractors. For training nuclear operators, ENEL established, in the 1980's, a training centre in Piacenza equipped with a full scale BWR simulator.

Now Sogin cares about post operation activities of NPPs to be decommissioned

## 4.3. Fuel Cycle and Waste Management Service Supply

### 4.3.1. Uranium enrichment and fuel fabrication

In Italy, there are no facilities for enriching Uranium. Several installations have the capability to manufacture fuel elements. However, at the present time all are closed.

### 4.3.2. Fuel transportation

Radioactive material can be transported only by authorized carriers. The authority responsible for issuing freight licences is the Ministry of Industry, after ANPA (Agenzia Nazionale per la Protezione dell'Ambiente, see section 5.1) has given its technical assessment. The rules regulating transport of radioactive material come from IAEA's Safety Series No. 6, and are in accordance with international regulations enacted by ICAO, ADR, RID and IMO.

### 4.3.3. Spent fuel disposal and storage

Some irradiated fuel removed from ENEL power plants has been reprocessed in the United Kingdom. The remainder is stored at ENEL and at Avogadro (Saluggia- Fiat Avio )storage.

In the middle of the 90ties, Enel has decided to terminate nuclear fuel reprocessing, on the basis of an economical and technical evaluation, and to proceed with interim dry storage of the remaining spent fuel of light water reactors. It was in fact recognized that, in the light of the Italian situation, reprocessing would not have brought important advantages in term of final disposal, since VHLW would have to be disposed anyway together with other reprocessing generated wastes; moreover, the waste form would not have implied specific advantages in term of final disposal, where only geological barriers could be credited.

For the temporary on site storage of irradiated fuel, among the various available technologies, the dry storage, inside dual-purpose metallic containers ("cask"), has been chosen.

Sogin is actively carrying on a project for an interim storage facility on the sites of Trino and Caorso NPPs where residual spent fuel of these plants can be kept safely for several decades pending the governmental decision on final disposal.

### 4.3.4. Waste management and disposal

The sources of radioactive waste in Italy include the power plants formerly operated by ENEL, the fuel cycle plants: operated by Fabbricazioni Nucleari S.p.A., ENEA research laboratories and experimental facilities, and non-energy applications (e.g., biomedical and other uses).

It is a governmental commitment the definition of guidelines and of a regulatory framework for the management of radioactive wastes: in this view a National Operator is to be created and appointed

for the management of all existing and future wastes; in the meantime, a procedure has been initiated by the government in order to select the site for the final repository for the second category wastes (see below): the repository is at present scheduled to be operating early in 2009. A specific task force of ENEA is now working on the siting of the repository. Waiting for the constitution of the national operator, Sogin and ENEA have provided strategies for the temporary storage on their sites of the produced wastes; NUCLECO (an ENI and ENEA joint company, established in 1981) has the responsibility for non-energy applications produced wastes. ANPA is responsible for licensing aspects.

Since 1996 ENEA is undertaking a Task Force for the investigation of the appropriate strategies and technologies to be adopted for the radioactive waste disposal. An Engineered Near Surface LLW Disposal Facility is considered by ENEA and they are currently involved in site selection criteria definition in order to start with a screening in the Italian territory.

The general safety objectives and criteria of a pre-conceptual design of the LLW repository, prepared by the ENEA Task Force, is currently under evaluation by ANPA.

On the institutional side, an Expert Group was set up on January 2000 by the relevant Ministries and Regional Authorities with the main objective to identify and propose a procedure for the site selection with the required level of consensus from the public and local authorities. The Group presented preliminary conclusions on September 2001. In July 2002 the Government issued a project of law that foresees the procedures for the establishment of the body that will care the siting, the construction and the operation of the repository. The law is not approved yet.

The criteria applicable to the classification, treatment and disposal of radioactive waste are set forth in ENEA/DISP's Technical Guide No. 26, issued in May 1988 and updated in 1997. These rules allow above ground disposal of treated low-level waste (Categories I and II) and prescribe suitable final disposal solutions (such as deep disposal) for high-level waste (Category III).

As for categories I and II, solid low-level waste is to be super-compacted and cemented. Liquid low-level waste is to be cemented in containers suitable for above ground storage.

At the present time, high-level and most low-level waste is stored at production sites (Sogin power plants and ENEA facilities). The quantities of energy related waste currently stored in Italy are the follows:

- about 5,300 cubic meters solid and 40 cubic meters liquid low level waste (Categories I and II);
- cubic meters solid high-level waste (Category III). This figure includes alpha-emitting waste, 120 cubic meters liquid waste. About 290 tHM of spent fuel have to be added.

Vitrification and cementation treatments are under consideration for liquid high-level waste, and cementation for solid high-level waste in category III containers for deep storage.

#### **4.4. Research and Development Activities**

Nuclear research is conducted by several agencies, institutions and universities. Every three years two governmental bodies (Consiglio Nazionale della Scienza e della Tecnologia and CIPE) issue the "Triennial Research Plan" in order to co-ordinate the whole research sector. The leading agency for applied nuclear research is ENEA with its Energy Research Centre (CRE) at Casaccia, near Rome. To a lesser extent, research activities are also performed by ENEL. Theoretical research in the nuclear field is performed mainly under the aegis of CNR<sup>6</sup> (Consiglio Nazionale delle Ricerche) and INFN<sup>7</sup> (Istituto Nazionale di Fisica Nucleare) in its four main laboratories - Laboratori Nazionali di Frascati, Laboratori Nazionali di Legnano, Laboratori Nazionali del Sud and the new Laboratori Nazionali del Gran Sasso.

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<sup>6</sup> Italian National Research Council

<sup>7</sup> Italian National Institute for Nuclear Physics

In nuclear engineering, the universities with degree programmes are the Università di Roma (power plant engineering), the Università di Pisa (safety assessments), and the Politecnico di Milano (plant engineering and probabilistic safety studies).

Some research activities, experiments and studies, mainly in connection with the above universities and agencies, are still performed at the facilities equipped with research reactors as shown in Table 8.

TABLE 8. RESEARCH REACTOR FACILITIES

SITE	POWER	OPERATOR	STATUS
Bologna	100 We	ENEA/RB3	not operating
Palermo	20 We	University of Palermo	in operation
Roma	1 MW	ENEA/TRIGA	in operation
Roma	5 kW	ENEA/TAPIRO	not operating
Pavia	250 kW	University of Pavia	in operation

Source: Country Information.

#### 4.5. International Co-operation in the Field of Nuclear Power Development and Implementation

Italy participates in several international co-operative projects developed under the aegis of the European Community, NEA/OECD and the International Atomic Energy Agency. In this setting two important research centres must be pointed out: the Joint Research Centre of Ispra<sup>8</sup> and the International Centre for Theoretical Physics in Trieste, a branch of IAEA. ANPA is participating in the PHARE and TACIS programmes of assistance to Central Europe and CIS countries. Sogin is also deeply involved in these programmes

In the area of nuclear safety and environmental protection, bilateral agreements have been signed with NRC (USA), NII (UK), CSN (Spain), N.N.S.A.(China), and D.S.I.N (France).

Some noteworthy activities in progress are: nuclear fuel research conducted with the Halden reactor; participation in the international EPRI-DOE programme on new generation reactors; and, in nuclear fusion field, participation in the Joint European Torus project.

### 5. REGULATORY FRAMEWORK

#### 5.1. Safety Authority and the Licensing Process

##### General legislation and regulation

The main corpus making up, inter alia, the Italian system are itemised below, as regards Statutes and Legislative acts:

- Law no. 1860 of 31 December 1962 published in the Italian Republic's Official Journal no. 27 of 30 January 1963, as amended by the President's Decree no. 1704 of 30 December 1965 (Italian Republic's Official Journal no. 112 of 9 May 1966) and by the President's Decree no. 519 of 10 May 1975 (Italian Republic's Official Journal no. 294 of 6 November 1975).
- Legislative Decree no. 230 of 17 March 1995 published in the Supplement to Italian Republic's Official Journal no. 136 of 13 June 1995, implementing six EURATOM Directives on radiation protection (EURATOM 80/836, 84/467, 84/466, 89/618, 90/641 and 92/3). The Decree replaced the previous DPR n°185 issued in 1964 and establishes radiation protection requirements for workers, public and environment.
- Legislative Decree no. 241 of 26th May 2000 has transposed EU (European Union) directive 96/29/Euratom laying down basic safety standards for the radiation protection of workers and

<sup>8</sup> Reactor Safety, Fusion Technology (with the European Tritium Handling Laboratory) and Advanced Materials are only some of the activities performed in the Centre. Another European research centre, in which Italy has a quota of 28%, is CERN (Consiglio Europeo per la Ricerca Nucleare) in Switzerland.

the public; the standards laid down in the directive incorporate the 1990 Recommendations of the International Commission on Radiation Protection (ICRP) into EU radiation protection legislation.

- Decree no. 241 has modified and integrated Legislative Decree no. 230 of 1995.

Besides, Legislative Decree no. 257 of 9th May 2001 was promulgated in order to modify certain details in Legislative Decree no. 241 of 2000 concerning requirements for notification and authorisation of non nuclear installations where ionising radiation is used for industrial, research and medical purposes.

Legislative Decree no. 230 of 1995, as modified by Legislative Decrees no. 241 of 2000 and no. 257 of 2001, now contains thirteen Technical Annexes which make almost all of the provisions applicable as of 1st January 2001, although some ministerial decrees enacting some of the provisions of the Legislative Decree have still to be published.

In addition to the provisions of Presidential Decree No. 230, ANPA publishes Technical Guides, which outline the safety criteria and license application formats. These guides are prepared for nuclear operators and are informational in nature. Their purpose is to provide a better understanding of the controls exercised by ANPA in matters of safety and health protection.

## **5.2. Main National Laws and Regulations**

According to Article six of the Law 1860, any organization that intends to operate a nuclear installation has to be licensed by the Ministry of Industry, as advised by the Regulatory Body.

The Act No. 393 of 23 August 1975, outlines a construction licensing procedure, which is broken into two main stages: a study of the site in relation to the basic design principles of the power plant in question; and, a study of the preliminary project of the planned power plant. Act No. 393 on the NPP site selection instituted the co-operation of national authorities with regional and local authorities to take due account of the administrative decentralization implemented in legislation.

In accordance with the established procedure, CIPE authorizes the areas where nuclear power plants can be constructed. In order to facilitate this phase, the Regulatory Body drew up a "National Sites Map", which indicates the areas where the nuclear power plants can be built. The CIPE's decision is taken after a consultation with ENEA and in agreement with the Inter-regional Advisory Commission made up of the presidents of the regional governments. In the first phase, each region concerned has to indicate, within 150 days following the CIPE deliberations, at least two areas in its territory where nuclear power plants could be constructed.

Once the areas have been selected, the utility is given permission by the Ministry of Industry to proceed with all investigations that are needed to determine whether the areas selected are technically suitable and to decide which area it would propose for the installation. Within 12 months, the utility has to submit a detailed report on the proposed site to the Minister of Industry, to the regions concerned and to the Regulatory Body. The report contains a detailed analysis of nuclear safety and health protection issues in accordance with the procedures laid down in D.P.R. No. 230, as relates to the siting of the location. Under the terms of Act No. 393, ANPA has to consult all concerned, e.g., Ministries of Interior, Employment, Public Works, Health. The Ministries are required to reply within sixty days of being consulted. The outcome of the investigation is referred to the Advisory Committee by the Regulatory Body and ultimately forwarded to the Ministry of Industry.

This technical phase is followed by a decision making phase culminating in a final choice of the site by the region in agreement with the municipality concerned. The region's decision must be communicated to the Ministry of Industry within two months.

Once the site has been approved, the Ministry of Industry authorizes the utility to begin preliminary site preparation under the control of the Regulatory Body. From this point on the licensing procedure continues along the lines set out in D.P.R. 230. This consists of the issuance of the construction permit and the operating license.

Before the final authorization is granted, nuclear power plants and facilities for the disposal of radioactive waste must undergo an environmental impact assessment, in accordance with Decree 377 of 1988.

*Filing of application:*

The utility submits the general design (site and plant) and the preliminary Safety Report to the Ministry of Industry and to the Regulatory Body. The documents supplied must also include a Preliminary Study on the treatment and disposal of radioactive waste.

The Regulatory Body draws up a technical report for nuclear safety and health protection evaluation of the installation. It also makes a critical appraisal of the preliminary safety report and the preliminary study on the treatment and disposal of radioactive waste determining whether these comply with the conditions laid down during site selection.

The Regulatory Body's technical report is forwarded to the Ministry of Industry, which then sends it to the Ministries of the Interior, Employment, Public Works, and Public Health for their comments. The comments should be forwarded to the Regulatory Body within sixty days. Having considered the assessment of the Advisory Committee, the Regulatory Body gives the Ministry of Industry its final evaluation. The construction license is granted by Decree from the Minister.

The Regulatory Body, on the advice of the Advisory Committee, establishes a list of the parts of the installation that involve nuclear safety and health protection. A detailed plan for each part of the installation included in the list has to be approved by the Regulatory Body, on the assessment of the Advisory Committee, prior to the construction. The study on treatment and disposal of radioactive waste must be handed to the Commission of the European Communities in accordance with section 37 of the EURATOM Treaty.

Two series of tests -non nuclear and nuclear- must be carried out and successfully performed before an operator can apply for a license to commission the installation. The results of non-nuclear tests are submitted to ANPA for approval. The test can be carried out only with its permission and under its supervision. Depending on the reports produced by the operator and the results of the checks made during these tests, the Regulatory Body issues a certificate stating that from the safety viewpoint the installation is ready to be loaded with the nuclear fuel.

Nuclear tests may not be carried out until the operator has submitted the Final Safety Report (with Operating Rules, Operating Manual, Structure of Operating Organization, Proposal of Technical Specifications) and obtained the Regulatory Body's approval on the general test programme, after the Advisory Committee has given its assessment. The approval is subject to the Ministry of the Interior's receipt of the emergency scheme for safety measures in case of an accident. Before beginning nuclear tests, the Regulatory Body also has to approve the maximum discharge levels for the radioactive effluents. The Operator must give the Regulatory Body a report on each nuclear test in order to get certified.

The operating license is granted in successive stages, depending on the results of the nuclear tests within the limits, conditions and technical specifications with which the operator must comply. A specific license is required for the reactor operators, reactor senior operators and plant supervisors. The operating license is granted by Decree of the Ministry of Industry and includes the technical requirements specified by the Regulatory Body. As a rule, the operating license is granted indefinitely. However, a general review of the installation's safety condition is usually undertaken after ten years. The period within which a safety review is carried out also depends on the operational life and on the

status of the specific plant. Any modification to the initial design must be approved by the Ministry of Industry, which takes its decision after consulting the Regulatory Body.

### 5.3. International, Multilateral and Bilateral Agreements

#### *AGREEMENTS WITH THE IAEA*

- Amendments to Articles VI & XIV of the Agency statute Not ratified
- Agreement on privileges and immunities Entry into force: 20 June 1985
- NPT related agreement INFCIRC/193 Entry into force: 21 February 1977
- Additional Protocol (GOV/1998/28) Signature: 22 September 1998
- Supplementary agreement on provision of technical assistance by the IAEA Not Applicable
- EURATOM Member

#### *MAIN INTERNATIONAL TREATIES etc.*

- NPT Entry into force: 2 May 1975
- Convention on physical protection of nuclear material Entry into force: 6 October 1991
- Convention on early notification of a nuclear accident Entry into force: 11 March 1990
- Convention on assistance in the case of a nuclear accident or radiological emergency Entry into force: 25 November 1990
- Vienna convention on civil liability for nuclear damage Not applicable
- Paris convention on third party liability in the field of nuclear energy Entry into force: 17 September 1975
- Joint protocol relating to the application of Vienna and Paris conventions Entry into force: 27 April 1992
- Protocol to amend the Vienna convention on civil liability for nuclear damage Signature: 26 January 1998
- Convention on supplementary compensation for nuclear damage Not signed
- Convention on nuclear safety Entry into force: 14 July 1998

- Joint convention on the safety of spent fuel management and on the safety of radioactive waste management      Signature      26 January 1998

*OTHER RELEVANT INTERNATIONAL TREATIES AND UNDERTAKINGS*

- Improved procedures for designation of safeguards inspectors      Rejected but agreed to special procedures
- ZANGGER Committee      Member
- Nuclear Export Guidelines      Adopted
- Acceptance of NUSS Codes      Summary: National regulations are in conformity with revised codes. Codes are sound international safety standards which should be made obligatory in all states operating NPPs. Letter:      27 December 1989
- Nuclear Suppliers Group      Member
- Establishment of CERN with 12 other European Countries      Paris      July 1953
- Halden Boiling Water Reactor project Italian representative: ENEA      June 1958
- Joint European Torus Undertaking Italian representatives: ENEA and      Brussels CNR      May 1978

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- [7] IAEA Energy and Economic Data Base (EEDB).
- [8] IAEA Power Reactor Information System (PRIS).
- [9] IEA, Beyond 20/20.

## Appendix

### DIRECTORY OF THE MAIN ORGANIZATIONS, INSTITUTIONS AND COMPANIES INVOLVED IN NUCLEAR POWER RELATED ACTIVITIES

#### *NATIONAL ATOMIC ENERGY AUTHORITY*

Ministry for Industry, Commerce and  
Handicrafts (MICA)  
Via Vittorio Veneto, 33  
I-00187 Rome, Italy

Tel: +39 6 470 51  
Fax: +39 6 470 528 44  
Telex: 616315 MICA

Italian Agency for New Technology,  
Energy and the Environment (ENEA)  
Lungotevere Thaon di Revel, 76  
I-00196 Rome  
Italy

Tel: +39 6 3627 1  
Fax: +39 6 3627 2591/2214  
Telex: 610183 ENEA  
<http://www.enea.it/>

#### *NATIONAL REGULATORY BODY*

Italian Agency for Environmental  
Protection (ANPA)  
Via Vitaliano Brancati, 48  
I-00144 Rome, Italy

Tel: +39 6 500 71  
Fax: +39 6 500 729 16/722 19  
<http://www.sinanet.anpa.it/>

#### *OTHER NUCLEAR ORGANIZATIONS*

Italian Forum for Nuclear Energy (FIEN)  
Via Flavia, 104  
00187 Rome, Italy

Tel: +39 6 486415  
Fax: +39 6 4744397

National Association for Nuclear  
Engineering (ANDIN)  
Via Flavia, 104  
00187 Rome, Italy

Tel: +39 6 486415  
Fax: +39 6 4744397

#### *NUCLEAR INDUSTRY*

##### **Supply of Nuclear Power Plants**

ANSALDO S.p.A. Nuclear Division  
Via Corso Perrone 25  
16161 Genova.

Tel: +39 10 6551

##### **Operation of Nuclear Power Plants**

SO.G.I.N p.a.  
Via Torino 6  
00184 Roma

Tel: +39 06 85091

##### **Fuel Fabrication**

FN S.p.A. Nuove Tecnologie e Servizi Avanzati  
S.S. 35 bis dei Giovi Km 15  
15062 Bosco Marengo - Alessandria

Tel: +39 131 2971  
Fax: +39 131 297250

## Transport

Air carrier:	Alitalia Via della Magliana 806 Roma	Tel: +39 6 65629133 <a href="http://www.alitalia.it">http://www.alitalia.it</a>
Land Carriers:	Borghi Nucleare V. le Liegi 33 Roma	Tel: +39 6 8546104 Fax +39 6 8543798
	MIT Nucleare Via dell'Artigianato 12 Carugate (Mi)	Tel: +39 2 921591 Fax +39 2 92150244
Rail Carrier:	Ferrovie dello Stato Piazza della Croce Rossa 1 Roma	Tel: +39 6 47305700
Marine Carrier:	Lloyd Triestino S.p.A. Piazza Unità d'Italia 1 Trieste	Tel: +39 40 3180111

Several other carriers are licensed for radioactive and fissile materials, their addresses are available from ANPA or from the Ministry of Industry.

<b>Spent fuel</b>	COMPES Via Cuneo 21 Torino	Tel: +39 11 26001 Fax: +39 11 850642
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<b>Waste Management</b>	NUCLECO Via Anguillarese 301 Roma
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### *NUCLEAR RESEARCH INSTITUTES*

ENEA/CRE Via Anguillarese 301 S.M. di Galeria (RM)	Tel: +39 6 30481 Fax +39 6 30494203 <a href="http://www.casaccia.enea.it/">http://www.casaccia.enea.it/</a>
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CNR le A. Moro 7 Roma	Tel: +39 6 49931 Fax +39 6 4461954 <a href="http://www.cnr.it/">http://www.cnr.it/</a>
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National Institute for Research in Nuclear and Subnuclear Physics (INFN) Piazza dei Caprettari 70 Roma	Fax: +39 6 68307924 <a href="http://www.infn.it/">http://www.infn.it/</a>
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Abdus Salam International Centre for Theoretical Physics (ICTP)	<a href="http://www.ictp.trieste.it/">http://www.ictp.trieste.it/</a>
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European Centre for Theoretical Studies in Nuclear Physics and Related Areas (ECT)	<a href="http://www.ect.it/">http://www.ect.it/</a>
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### *HIGH ENERGY INSTITUTES*

Elettra Synchrotron Light Source	<a href="http://www.elettra.trieste.it/">http://www.elettra.trieste.it/</a>
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Frascati National Laboratory (LNF)

<http://www.lnf.infn.it/>

ENEA (Frascati, Italy)

<http://www.frascati.enea.it/FTU/>

*OTHER ORGANIZATIONS*

Ministry for University based Science  
and Technology

<http://www.miur.it/>

International Centre for Genetic Engineering  
and Biotechnology (ICGEB)

<http://www.icgeb.trieste.it/>

International School for Advanced Studies (SISSA)

<http://www.sissa.it/>

Department of Electrical and Automation Research

<http://www.pea.enel.it/>

The Journal of High Energy Physics (JHEP)

<http://jhep.sissa.it/>

Architecture and Engineering Virtual Library

<http://www.uniroma1.it/cobai/bibvirt/start.htm>