Associazione Italiana
Economisti dell'Energia

EUSUSTEL

European Sustainable Electricity
Comprehensive Analysis of Future European Demand and
Generation of European Electricity and its Security of Supply

WP1: Country-wise analysis for EU-25

HORIZONTAL DESCRIPTION OF ITALY

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Country Paper

ITALY

1. Factual information

1.1 Geographical description

Italy is a peninsula located in the South of Europe which begins in the Alps and stretches out for over 1100 km to the southeast into the Mediterranean sea. Italy is bordered by France, Austria, Switzerland, and Slovenia and englobes two small independent States - Vatican City and the Republic of San Marino. Its total land area[1] is 301,230 km^2, with over 3000 km of coast, also including two of the largest islands in the Mediterranean: Sardinia and Sicily, as well as several other minor offshore island groups.
Italy exhibits different geographical, climatic and cultural environments. Northern inland regions have a continental climate with hot summers and cold winters. The South enjoys a Mediterranean climate. Winters tend to be cold and dry in alpine regions and milder towards the coastal areas. Italy is mostly mountainous or hilly. Running North to South over the entire length of the peninsula, the Apennine mountains form the peninsula's backbone. Just south of the Alps in the northeast part of the country is a large and fertile plain known as the Po River Valley. This area is the most densely populated and includes the most important industrial and agricultural resources of Italy. Much of the area of Southern Italy is either rugged, hilly terrain or heavily forested with some plains and numerous mountain plateaus created by volcanic activity. A fault line runs just south of Naples to Sicily and, as a result, Southern Italy has several active volcanoes. This area is also susceptible to earthquakes.

1.2 Demography

Italy has the fifth-highest population density in Europe — about 191.2[2] persons per km^2. The most populated areas are in the North where 45% of the population live. Central Italy has 19% of the population, the South 24.5% and the islands 11.5%. As of July 2004, the population[3] of Italy just exceeded 58 M, slightly less than Britain and France. The population growth rate is 0.09% per year, due to immigration, whose rate is 0.094%. It has a rapidly aging population, placing it among the oldest of the OECD countries (18% aged 65 and older), and the smallest group of people under 24 years old (15.5 % of its population, slightly less than Japan) (see Fig. 1).
The population is expected to decrease slightly to about 54.65 Million in 2030.
The population is divided in 25.6 Million households; the number of people per household has decreased from 2.98 in 1970 to about 2.27 in 2005; the trend is towards further decrease.

1.3 Economic situation

In 2004, Italy's nominal **Gross Domestic Product**[4] (GDP) was 1.349.370 M€, or 20,232 € per person, the fourth-largest in Europe and the tenth-largest in the world. In the last years, however, the performance of Italy's economy has lagged behind the rest of the EU. In 2003 and 2004, Italy experienced real GDP growth of 0.4 and 1.2%, respectively, compared to 1.0 and 2.2% for the EU as a whole.
Industry contributes to GDP by 32% employing 31.8% of the working population; services by 63% employing 63.3%; and agriculture by 5% employing 4.9% of the working population.
Unemployment rate in 2004 was 8.7%, which is in average of the developed countries rate; with a juvenile unemployment rate of 2.1%.
Consumer Price Index[5] (CPI) fell a 2.2% in 2004.

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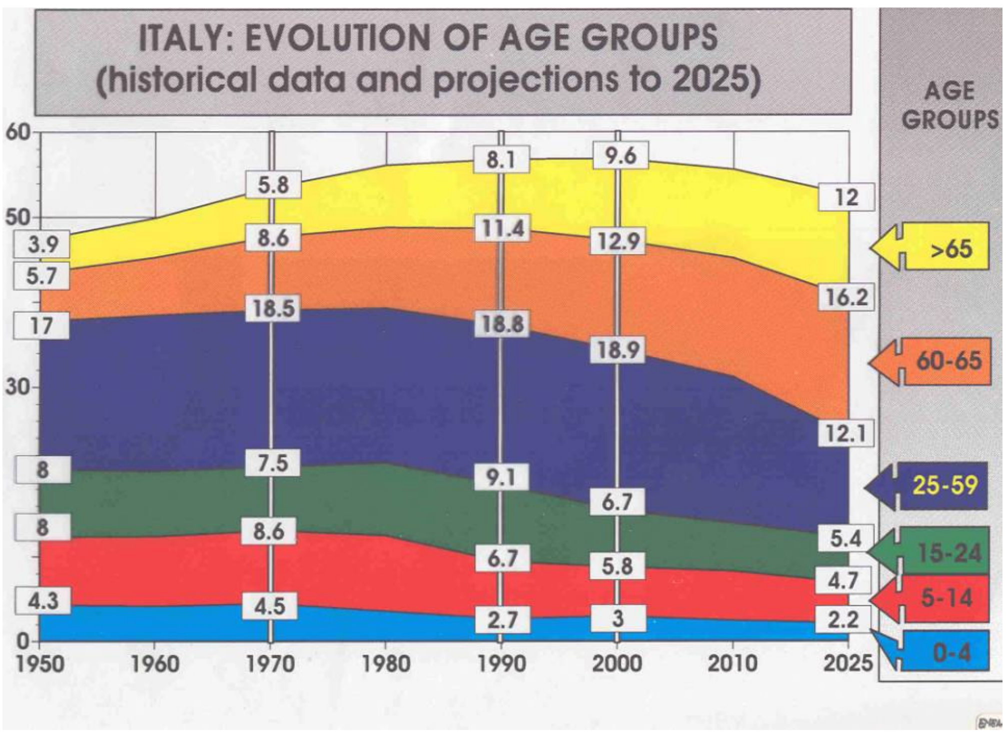
[1] Description from Ministero Attività Produttive.
[2] Data from Ministero dell'Economia e delle Finanze Annual Report.
[3] Data from Istat.
[4] Data from Ministero dell'Economia e delle Finanze.
[5] Data from Istat.

Italy - Demography and Economics [6]

Year	*1990*		*2000*		*2010*		*2020*		*2030*	
Population *(million)*	*56.72*		*57.76*		*57.92*		*56.61*		*54.65*	
Variation *(% per year)*		*+ 0.18*		*+ 0.03*		*- 0.23*		*- 0.35*		*(00-30: - 0.18)*
Inhabitants per household	*2.64*		*2.37*		*2.16*		*1.97*		*1.83*	
Variation *(% per year)*		*- 1.07*		*- 0.92*		*- 0.92*		*-0.72*		*(00-30: - 0.85)*
Per capita GDP (€)	*17,570*		*20,165*		*25,395*		*32,439*		*41,408*	
Variation *(% per year)*		*+ 1.39*		*+ 2.33*		*+ 2.48*		*+ 2.47*		*(00-30: + 2.45)*



1.4 Energy

With limited domestic energy sources, Italy is highly dependent on energy imports to meet its consumption needs. In absolute terms, oil consumption has remained relatively stable since 1970, but oil's share of Italy's primary energy mix has decreased significantly, steadily replaced by natural gas. Over the past decade, Italy's installed electricity generation has barely been able to keep up with demand, resulting in an increased share of electricity imports, from 8.8% in 1997 to 11% in 2002. (*Electricity data are from Ref.* [7])

In 2004, **total primary energy consumption**[8] was 194.76 Mtoe, which represented 0.8% growth over the previous year. Coal consumption, with a 8.7% of total consumption, increased by 11.6%; oil, with a 45%, fallen by 3.1%; gas,

[6] European Commission, Directorate-General for Energy and Transport, "European Energy and Transport Trends to 2030", Brussels, January 2003
[7] GRTN (Gestore Rete Trasmissione Nazionale), Dati provvisori di esercizio del sistema elettrico 2004, www.grtn.it
[8] "Bilancio di sintesi dell'energia in Italia 2004", Ministero delle Attività Produttive.

with 33.9%, increased by 3.7%; renewables reached 7.2% of total, which represents 10.4% over the previous year. Finally, electricity import shows a 5% of total consumption and is fallen by 10.5%.

Total primary energy consumption in Italy in 2004 by source (Mtoe)

	Coal	Natural gas	Oil	Renewables	Electric import	Total
Production	0.400	10.700	5.400	13.250		30.020
Import	17.000	55.400	82.900	0.600	10.040	165.940
Total energy supply	17.400	66.100	88.300	12.920	10.049	194.760

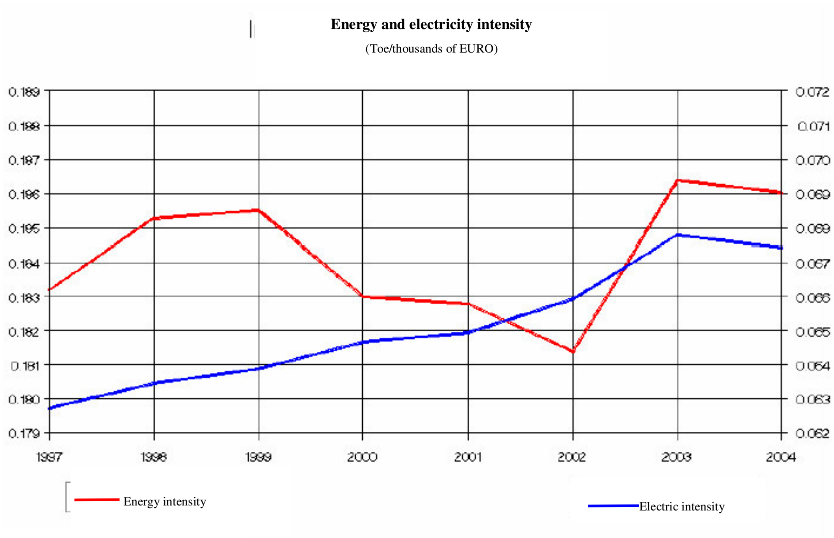
Total final energy consumption in 2004 was 143.354 Mtep, with a growth rate of 1.1% over the previous year.
At the sector level, industry demands 28.9%, transportation 31%, housing and services 30.2% and agriculture 3.3%.
It is worth noting the large increase of housing and services sector consumption, from 40.5 Mtep in 2002 to 43.254 in 2004 (+8.2%). This is a sector in continuous expansion. This growth, however, depended mostly on climatic factors (colder winter and hotter summer).

Total final energy consumption in 2004 by sector (Mtoe)

	Coal	Natural gas	Oil	Renewables	Electric energy	Total
Usage by sector	***4.17***	***42.30***	***70.00***	***1.70***	***25.183***	***143.354***
Industry	4.044	17.564	7.60	0.20	11.982	41.390
Tranport	-	0.40	43.00	0.20	0.817	44.417
Housing and services	0.017	23.30	6.80	1.20	11.937	43.254
Agriculture		0.136	2.60	0.10	0.447	3.283
Non energy uses	0.110	0.90	6.60			7.610

Italy imports more than 80% of its energy consumption, while the average in the EU is 50%.
Self supply has reduced in the last few years mainly due to the reduction of national natural gas production. The maturation of Italy's natural gas fields and the rapid advance in domestic consumption have increased the country's reliance upon natural gas imports, which supplied 84% of the country's domestic consumption in 2004, versus 59% in 1985. The country consumed 79,521 million Nm^3 of natural gas in 2004, with consumption increasing at an average of 7.4% per year since 1985. An increase in the construction of combined-cycle plants has been the principal driving force behind the increase in natural gas consumption.
Italy was one of the first European countries to completely stop domestic coal production, with the last facility closing in 2001. The importance of coal in Italy's energy needs declined to only 6.8% in 2002, one of the lowest levels in the EU.
Italy has proven crude oil reserves of 622 million barrels, the fourth-largest in the EU, and proven natural gas reserves of 220 billion cubic metres, the sixth-largest in the EU. Italy is a net exporter of refined petroleum products.

In Italy, **primary energy intensity** followed a growing trend during the last few years, with a peak in 2003 and it already shows a decrease trend. Especially, the largest increase, in comparision with a weak GDP growth, depends on increased consumption in the transport, housing and service sectors.



Source: Elaboration on Grtn data

1.5 Electricity

The electricity demand in 2004 was 322.0 TWh; this was met by a national production of 276.4 TWh (85.8%) and a net import of 45.6 TWh (14.2%). In 2003, the corresponding figures were demand 320.7, domestic production 269.7, import 51.0 TWh (15.9%).
The demand increased on the average 2.3% per year since 2000:

Electricity demand in Italy

year	*TWh*	*% variation*
2000	*298.5*	*+4.4%*
2001	*304.8*	*+2.1%*
2002	*310.7*	*+1.9%*
2003	*320.7*	*+2.9%*
2004	*322.0*	*+0.4%*

Generation mix in 2004

source	*TWh*	*% of generated*	*% of used*
Hydro	*48.0*	*17.4%*	*14.9%*
Fossil	*221.5*	*80.1%*	*68.8%*
Geothermal	*5.1*	*1.8%*	*1.6%*
Wind	*1.8*	*0.7%*	*0.6%*
Total generated	276.4	100 %	85.9%
IMPORT	*45.6*		*14.2%*
Total used	**322.0**		**100%**

It should be noted that 2004 was a rainy year, and hydroelectric production was 10.1% greater than in 2003 (43.6 TWh or 13.6% of demand)

Breakdown of the fossil fuel component by fuel in 2004

Fuel	TWh	% of fossil fuel generated electricity	% of total generated electricity
Coal	*45.1*	*20.3%*	*16.2%*
Natural gas	*121.4*	*54.8%*	*44.0%*
Oil products	*45.1*	*20.3%*	*16.2%*
Others	*9.9*	*4.6%*	*3.7%*
Total	**221.5**	**100 %**	**80.1%**

There have been important changes between 2003 and 2004, indicating a definite trend: the contribution of oil has decreased from 65.8 to 47.2 TWh, compensated by an increase of coal from 38.9 to 47.1 and of natural gas from 117.3 to 126.9 TWh.

Breakdown of the electricity demand by sector in 2004

Sector	TWh	%
industry	*154.2*	*51.2%*
domestic	*64.8*	*21.5%*
tertiary	*77.2*	*25.6%*
agriculture	*5.2*	*1.7%*
Net consumption	**301.4**	**100%**
Grid losses	*20.6*	

Peak power demand

Year	Power (GW)	Time
2002	52.6	December 12, 2002 at 17:00
2003	53.4	December 10, 2003 at 17:00
2003	53.6	December 16, 2004 at 17:00

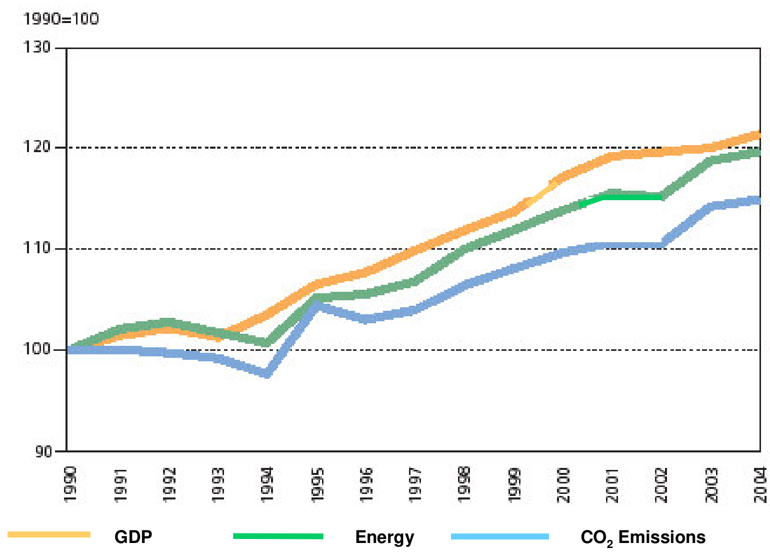
Traditionally, as it appears here, the peak demand has been during the winter. However, the peak of the demand during the summer months has been increasing steadily and rapidly due to the diffusion of air conditioning. In 2004, the summer peak has practically equaled the winter peak: on July 23, 2004, at 11 a.m. the power demand has reached 53.507 GW, as compared with 53.606 GW of the winter peak. This crossing had actually been predicted ten years ago for the year 2005!

1.6 Environmental issues

Environmental awareness has grown in Italy in recent years; air pollution remains a serious problem.
Italy first adopted a *Clean Air Act* in 1966, with additional regulations added in 1983 and 1988, which set guidelines for controlling pollution. Over the past two decades, Italy has made great improvements in reducing emissions of sulphur dioxide (SO_2), primarily by substituting natural gas for fuel oil.
The Italian government is gradually strengthening environmental laws in response to the country's obligations as a member of the European Union.
As an Annex I country under the Kyoto Protocol, Italy has agreed to reduce its carbon dioxide emissions by the 2008-2012 commitment period. Under the EU plan, Italy must reduce its carbon dioxide emissions by 6.5% below the 1990 level during 2008-2012. In 2002, **CO_2 emission** per inhabitant was 7.8 tCO_2eq. The total amount of CO_2 for Italy is 469 Mt of which 443 Mt arise from the energy sector, higher than in 1990., and 9% above the Kyoto target.
Particularly, 35% of CO_2 emissions arises from electric generation, 28.2% from transport sector, 18% from industry and 18% from other sectors.
In 2002, the Greenhouse Gas (GHG) emissions, all sector included, accounted for 553,5 Mt CO_2eq. Power generation, transport and industry are the main sectors responsible for these emissions. The energy sector represents 29.4% and has increased (15%) since the 1990 level due to electric consumption growth. Despite the country's rising carbon emissions over the past two decades, Italy's carbon intensity has decreased over that time period reflecting the country's shift to more clean-burning natural gas in its energy mix as well as to gains in energy efficiency. The transport sector, instead, shows the highest growth rate (22.7%), while industry and building sectors shows a decrease (3.3%).

Air Emissions						
	1990	**1995**	**2000**	**2001**	**2002**	**2003***
Greenhouse gas emission ($MtCO_2$)	509	525	544	554	554	
CO_2 (Mt)	431	447	462	470	469	
from energy sector	*403*	*420*	*462*	*443*	*443*	*459*
CO (kt)	7.117	7.111	5.179	5.090	4.486	
from energy sector	*6.671*	*6.700*	*4.781*	*4.679*	*4.097*	*4.021*
SO_2 (kt)	1.774	1.287	772	737	665	
from energy sector	*1.734*	*1.264*	*752*	*717*	*649*	*480*
No_x (kt)	1.929	1.789	1.374	1.359	1.267	
from energy sector	*1.911*	*1.770*	*1.356*	*1.340*	*1.250*	*1240*
NMVOC	2.038	2.021	1.541	1.442	1.340	
from energy sector	*1.318*	*1.399*	*959*	*883*	*793*	*744*

* Preliminary data.



Source: Elaboration UP on Istat, Ministry of Environment and Ministry of Poduct Activity data.

2 Historical development and trends

Much of the peculiarity of the present electric system in Italy derives from its history. It may therefore be interesting to review its highlights as keys to understanding its present structure.

2.1 The early times (1893 to 1962)

The first commercial power plant (selling electricity to the users) was inaugurated by the Edison Company in Milan in 1893, just one year after the world first (New York 1892). It consisted of six generators of 90 kW each, and in its first year of operation it generated 760,000 kWh. Applications were mostly to lighting; industrial applications lagged behind (each industry preferring to generate its own electricity as needed). The second large application of electricity in Italy was the electrification of railways: in 1913 Italy was the first country in Europe in terms of electric railways (810 km). This first position was maintained until the second World War (3929 km in 1937)[9].

Another peculiarity of the electric system in Italy (only partly matched by France) was the prevalence of hydroelectricity in the generation mix, due to the favourable geographic conditions (especially in the Alps) and to the scarcity of domestic coal deposits. In 1897, hydroelectricity accounted for more than 50% of the total (44 GWh, or 59%

[9] G.B. Zorzoli, "Il mercato elettrico Dal monopolio alla concorrenza," Quaderni AIEE, Franco Muzzio editore, Roma (2005)

of the electricity generated); this proportion increased to over 95% in the 1930's, and only in 1966 will thermoelectricity again take the lead. The obliged location of the power plants at the appropriate mountain sites in Northern Italy also pushed the development of transmission lines at increasingly high voltage.

A further distinctive feature of the Italian electricity supply system (although on a lower scale) is the use of geothermal energy. Italy was the first country in the world, in 1905, to generate electricity from geothermal heat (the steam deposits in the Larderello area in Tuscany). With an installed capacity which grew to about 500 MW in the 1980's, Italy remained for a long time the largest producer of geothermal electricity in the world.

The second world war had a disruptive effect on the Italian electricity system; 40% of the electricity production assets were destroyed in Southern Italy, 96% in Central Italy, but only 5% in Northern Italy. Since most of the production was concentrated in the North, on the whole of Italy the destruction involved only about 25% of the generating capacity. The electricity produced in 1945 (when the war ended) was 12.6 TWh. or nearly two thirds of that generated in the first year of war, 1940 (19.4 TWh).

2.2 The nationalisation of the electricity sector (1962 to 1999)

Following with a long delay Great Britain and France, the electricity sector was nationalised in Italy only in December 1962, with the creation of ENEL (the National Electricity Board), which inherited the production plants, the transmission lines, and the distribution networks of a large number of private (and a few public) companies. This concentration had a number of positive impacts: it allowed an increase in technical efficiency and reduction of waste; it created the necessary conditions to access the financial resources required for the massive investments needed to meet the rapid growth of demand; and it supplied the instrument needed for implementing a national energy policy, in terms of strategic choices, of extending the distribution grid in rural regions (an unattractive market for private companies) and of providing electricity at equal rates all over the country, in an attempt to rebalance economic disparities between the North, the South and the islands.

In the meantime, the interest in nuclear power had started playing a major role in the electric business[10]. Shortly before the nationalisation of the electric industry, three different groups (one private, two public) had obtained permissions and had started building three nuclear plants based on three different technologies (a GCR from the UK, a BWR and a PWR from the US). These plants were completed and started to operate between 1963 and 1965 in the frame of ENEL. At the end of the 1960's and beginning of the 1970's Italy was the third country in the world (after the US and the UK) for electro-nuclear capacity and production. The subsequent energy plans approved by the government aimed at a further massive introduction of nuclear power. Lacking any measure of realism, the plans made in the middle 1960's had a goal of between 33,000 and 46,000 MW for 1990 and between 74,000 and 108,000 MW for the year 2000 of installed nuclear power in Italy. Actually, the construction started only for three new power plants, only one of which was completed and started operating in 1981. In the meantime, ENEL (with the technical support of ENEA and the collaboration of industry) developed the "Unified Nuclear Design" of a 1000 MW Light Water Reactor. Toward the end of the 1970's public opinion, which had been previously either indifferent or in favour of nuclear energy, turned against it particularly at the local level. The Three Mile Island accident (1979) and especially the Chernobyl accident in 1986 transferred the opposition at the national level. In November 1987 a popular referendum expressed a vote contrary to further development of nuclear power. The nuclear production was halted and in the following months the construction of the new plants was discontinued.

The choice that was done at that point was to rely heavily on fuel oil. This corresponded to an economic opportunity: the price of fuel oil was low because at that time European refineries were driven by the demand of petrol for cars, the mix of products was rather rigid before catalytic cracking, hydrogenation and reforming became common technology and there was little demand for fuel oil (especially from the power industry). In addition, fuel oil could be used in gas turbines, which were then employed especially for load-following generation.

This choice, which was profitable on the short term, proved to be counterproductive on the longer term and still has a negative effect on the present Italian power system (which has the highest dependence on petroleum products in Europe). Cheap fuel oil had a very high content of sulphur giving rise to huge emissions of SO_2 (the ENEL plants released 1.35 million tonnes (Mt) of SO_2 in 1980, and still more than 1 Mt in 1987[11]. Initially, health effects were reduced by diffusing the pollution over a wide area by means of high stacks, but when at the beginning of the 1980's the preoccupations about acid rains started diffusing, the "Sulphur Protocol" was signed, and the European Directive on Large Combustion Plants was approved (in 1988) it was imperative to reduce emissions. End-of-pipe measures were difficult and costly, and the main route was the use of fuel oil with less sulphur (Medium- and Low-Sulphur Content fuel oils) which however were more expensive; this, together with the restructuring of the refineries that produced a greater share of light products, reduced if not cancelled the initial economic advantage.

The attention then turned to coal: although coal deposits are practically non-existent in Italy, coal could be imported at low cost (relative to other energy sources). However, the possibility of increasing the use of coal for power production met with a very strong public opposition: practically the same that had cancelled the nuclear programme. It is somewhat surprising that this opposition had not turned up against the plants burning fuel oil, which had a an environmental record much worse than a state-of-the art coal plant.

[10] P. Fornaciari, "Il petrolio, l'atomo e il metano - Italia nucleare 1946-1997," 21.mo Secolo Editori, Milano (1997)
[11] Data from ENEL annual reports

The solution devised by ENEL out of this impasse was to build "multi-fuel" plants, that could employ indifferently coal, oil derivatives and natural gas, and switch from one to the other according to needs and opportunities. This strategy, which would enhance flexibility, had its merits, but proved in the end a complete failure. The reason for this was the high capital cost of the plants (that having to accommodate coal, could not cost less than a coal-based plant, the most expensive of the three) and at the same time the low efficiency when burning gas (less than 40% against a 50+, and now even more, of a combined cycle plant costing less than one half). Because local opposition continued to prevent ENEL from burning coal, the solution was in many cases to use the multi-fuel plant to burn natural gas: thus obtaining the maximum capital cost plus the maximum fuel cost for the electricity generated.

Although the situation was later partially corrected by the progressive installation of new combined-cycle gas plants and the phasing-out of some of the more inefficient plants, the following process of privatisation and liberalisation of the market started with the heavy legacy of very high "stranded costs" due to the aborted nuclear programme, and of an inefficient and expensive generation park.

2.3 Privatisation and liberalisation of the electricity market (1999 to present)

The liberalisation of the electricity market, required by the European Directive 96/92/CE published in January 1997, was officially initiated by the Ministerial decree of March 31, 1999[12]. Previous steps in this direction, however, had been, in 1992, the transformation of ENEL from a public body into a private-type company (as a prelude to its slow privatisation) and the creation, in 1995, of the Authority for Electricity and Gas, which by subtracting the fixation of tariffs from the government during the liberalisation process would actually make this process possible.

ENEL was at that time the third largest electric utility in the Western world, supplying good quality service, with a high asset of competences and a very active programme of research and development. ENEL supplied about 90% of the electricity generated in Italy: the rest was split among a few municipal companies (also public, and mainly engaged in distribution) and some self-producers (large industries producing electricity for their own needs, often coupled with process heat production in CHP). ENEL was the owner and manager of the high and medium voltage electricity lines, and the predominant distributor of electricity (about 87% in 2003), the balance being again a few municipal companies. ENEL had served the main policy objectives of the government by extending the access to electricity to virtually everywhere in Italy, including the countryside; it had supplied electricity under cost to a broad section of low-income citizens as well as to high-energy intensive industries so as to allow them to compete on the international market; the artificially low price of electricity was also a means to limit inflation. This had brought in the 1980's to heavy losses, of the order of one billion euro per year, which were partially repaid by public money (through the so-called "endowment funds"). All this was to be ended if privatisation and liberalisation were to take place.

The guidelines of the reform process were:

- The liberalisation of electricity production
- The creation of an independent company for electricity transmission and dispatching
- The opening of a direct competition for an increasing fraction of the final market
- The creation of an independent Single Buyer (to take care of the interests of clients not yet qualified for a competitive market)
- The constitution of an Electric Market.

In order to allow an initial competition in electricity generation to start, the objective was that ENEL should not exceed 50% of total production, and ENEL was obliged to sell at least 15,000 MW of its generating capacity to three Generating Companies (GENCO).

The European directive called for the "unbundling" of ENEL so as to separate generation, transmission and distribution activities. This was done by transforming ENEL into a holding; however, four of the five companies into which ENEL was split remain of its ownership, so that the subdivision of the activities risks to remain theoretical.

ENEL remained the owner of the electricity transmission system, but its management was given to a public company, GRTN (Gestore Rete Trasmissione Nazionale) so as to ensure equal rights of access to the grid (and equal transmission costs) to all producers and clients. This situation is being presently changed, with ownership and management of the grid being transferred to a company, TERNA, formerly part of ENEL, whose shares will be sold on the market.

As could be easily be predicted, the processes of privatisation and of liberalisation of the electricity market in Italy have proceeded slowly, due to the entirely monopolistic starting point, as well as to the strong position (and political influence) of the monopolist. The fraction of electricity generated by ENEL is decreasing with time, as the new actors enter the market, but for the first time in 2003 it barely managed to go below the goal of 50% maximum (49.4%[13]). The access to the market of the "eligible clients" (initially, only industrial clients having an yearly consumption larger than 20 GWh per year, progressively lowered) has started in a lively manner, especially when industrial clients were given the possibility of forming consortia that would represent them, and so be able to aggregate demand surpassing the threshold. At present, all industrial and business clients are eligible, and domestic clients will be

[12] E. Curcio, S. Delli Colli, "La faticosa apertura del mercato elettrico," Quaderni AIEE, Elicònie Editrice, Roma 2004

[13] Autorità per l'Energia Elettrica e il Gas, e Autorità Garante della Concorrenza e il Mercato, "Indagine Conoscitiva sullo stato della liberalizzazione del settore dell'energia elettrica," 9 Febbraio 2005

able to choose in the next couple of years. However, their choice in terms of providers is very limited for the time being, and the most interesting option appears to be direct import of electricity from abroad.

The privatisation of ENEL is also proceeding, but it is far from being concluded.

Corrections to the regulation of the electricity market have been introduced since the liberalisation decree entered into force, to take into account some of the problems that have shown up. On June 26, 2003, there was a "brown-out" met by a programmed cut of non priority users to avoid a general blackout. On the night of September 28, 2003, at a time of minimum demand (4 a.m.) there was a general blackout in all Italy, lasting several hours, the worst of the recent history in Italy. The first one was linked with the insufficient reserve margin existing at the time, and signalled the necessity of promoting some stand-by capacity; the second actually originated in Switzerland, which at the time provided practically the totality of the power required, and pointed to the vulnerability of an excess dependence on electricity import.

2.4 Energy efficiency in Italy

The high price of energy (and electricity in particular) prevailing for a long time in Italy induced a fairly high degree of efficiency in the final uses. Industry in particular had a high record of performance in terms of kWh per unit of added value (the particular mix of products prevailing in the "made in Italy" helping in this respect). The performance of the domestic and tertiary sector is perhaps less brilliant than that of industry; the difference in climate makes comparison with other countries less easy; however, Italian appliances have been known in the past for good energy performance; and electric (resistance) space heating has a very low diffusion.

3 Legislation

As previously mentioned, the present legislation in Italy applies the European Directive on the single market for energy. Its implementation, however, is limited by the scarce competition existing on the electricity market and by the dominant position of the traditional monopolist and main provider, ENEL, that, by possessing the cheapest generating plants (large scale hydro and coal plants) is in a position to fix the final price in most cases; many people think that competition will have a limited effect in lowering electricity prices for final users. The situation is unlikely to change in the short and medium term, even if the Authority for Energy is striving to introduce more market elements.

A political problem not yet fully solved is the respective roles of central government and regional governments.

Italy has a system of “Green Certificates” to promote the diffusion of renewable energy sources (RES). The legislation in this respect is innovative and interesting, but its effects are endangered by the fact that district heating is “assimilated” to RES and may unfairly compete with real renewables in generating green certificates. Moreover, the green certificate system runs parallel with the heritage of the previous system, which included direct subsidies and assured uptake price for RES generated electricity; the plants built within the previous system presently generate green certificates that are publicly owned and put on the certificate market at a fixed price, which acts as a ceiling for the price of green certificates.

Italy also has introduced (since January 2005) an innovative system of White Certificates to promote efficiency in the final uses of energy. This system sets an obligation on distributors of electricity and of gas (for the moment limited to those serving more than 100,000 clients) to prove each year that they have introduced energy-saving measures in final uses, in amounts proportional to the quantity of gas or electricity they distribute. The saving do not have to concern their own clients, but can be obtained anywhere in sectors of final use (excluding those subject to the Emission Trading directive). At least 50% of the savings must be of electricity for electricity distributors, and similarly for gas distributors. The distributors can make these saving interventions directly, or through Energy Service Companies, or they can buy on the market (from independent energy service companies or from other distributors) certificates generated by others. The system is similar to the Energy Efficiency Commitments of the UK, but it is not limited to a pre-defined set of interventions, nor to the residential sector. The system now being considered in France is similar to the Italian one.

4 Peculiarities

Summing up what has been said just now, it may be stated that the peculiarities of the Italian electric system are:

- A high dependence on imported fuel and on imported electricity
- The exclusion of nuclear power
- A decreasing but still important role of oil in electricity generation
- An increasing penetration of dual-cycle natural gas generating plants
- A minor role of coal
- A relatively important contribution of large-scale hydro (also for pumped electricity storage) and the most important contribution in Europe of geothermal energy
- A high share of industrial CHP and a small presence of district heating CHP
- A slow penetration of renewable sources, with limited effects of the Green Certificate system
- A relatively high energy efficiency in final uses, especially in the industrial sector
- An innovative legislation to promote increases in energy efficiency
- A theoretical more than actual free market for electricity

- A somewhat confused situation as regards the respective roles of local, regional and central governments in energy matters

5 Prospects for the future

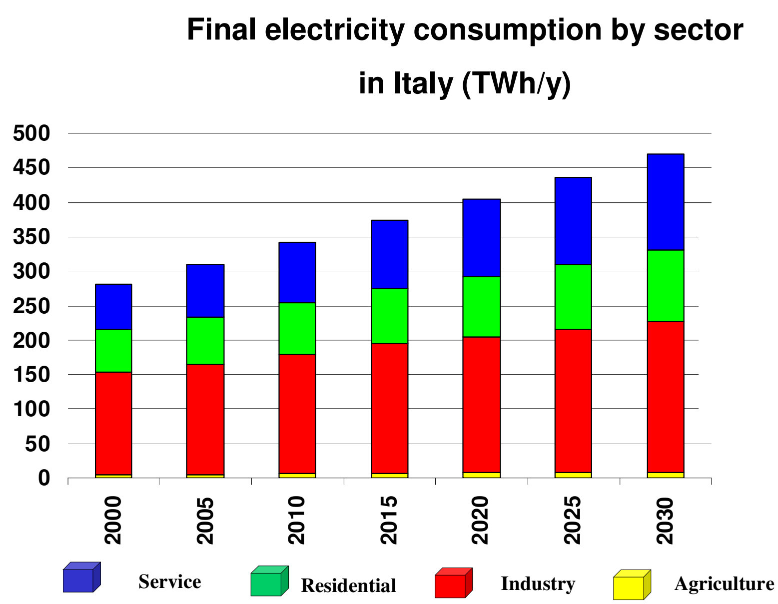
At the present time, there is little debate in Italy on the long-term energy future, and no strategic energy document has been issued so far by the government. Some discussions, partly initiated by a statement of the Prime Minister, concern the possibility that Italy reconsiders its stand vis-à-vis nuclear energy, but the question remains highly speculative and does not seem to lead to practical action, legislative or other.

The shortage of electricity generating capacity which was looming in the last three years now appears to have been overcome by the construction of new power stations or the re-powering of existing ones. The tendency is towards high-efficiency natural gas dual cycle power plants, to replace inefficient oil burning plants. Some industrial pressures are in the direction of a larger use of coal, which is perceived as the least-cost solution. Electricity imports are expected to remain at the present level, or even higher, but more for economic reasons than for structural weakness of the power system. The main worry at present is the high cost of electricity in Italy, which endangers the competitive position of industry, especially in the energy-intensive sectors. Hopes that the increasing role of the market will improve the situation are dwindling.

On the short term, no clear solution for respecting the Kyoto engagements can be seen other than making a large use of the flexibility mechanisms. Little discussion, at least officially, concerns the post-Kyoto horizon, with a tendency to steer clear of further engagements.

As mentioned above, no official long-term energy scenario is available. GRTN (the Italian Transmission System Operator) has published a 10-years extrapolation scenario.

A long-term trend scenario of final electricity uses in Italy, by economic sector, final utilisation and geographical region was built by employing a MARKAL-TIMES model, by the Italian Association of Energy Economists and by CESI (Italian Experimental Electricity Centre)[14] in the frame of the SCENARI research project.



The scenario displays an increase of final electricity consumption from 280 TWh in 2000 to 470 TWh in 2030, with an average yearly in crease of 1.7% over the thirty years, slightly higher than the GDP growth, implying a small increase of the electricity intensity of final uses. Electricity consumption should increase on the average 2.0% per year until 2010, 1.7% per year from 2010 to 2020 and 1.5% from 2020 to 2030. Industry will maintain the lager share of electricity consumption, passing however from the present 23% to 46% in 2030. The service sector will be the most dynamic, with annual growth rates of about 3% until 2010 and 2.5% between 2010 and 2020. Its share will grow from the present 21% to 28% in 2030. The residential, transport and agricultural sectors will keep their present share more or less constant. Thus, unlike the present, the service sector will consume more electricity than the residential sector.

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[14] CESI is the institution in charge of the electric system R&D (*www.ricercadisistema.it*), which is financed by means of a levee of 0,3 €/MWh on the electricity bill.