PROVISIONAL DATA ON OPERATION OF THE ITALIAN POWER SYSTEM

2007

Terna
Rete Elettrica Nazionale

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Introduction

Terna - Rete Elettrica Nazionale SpA - is the company in charge of electricity transmission and dispatching over the high and extra-high voltage grid throughout Italy. To provide security, reliability and quality of electricity supply, Terna must, instant by instant, collect data on the status of the power system. By processing these data, Terna develops yearly indicators of power system performance.

This publication summarises the provisional data on operation of the Italian power system in 2007.

Among the 2007 highlights, it is worth mentioning the overall growth of electricity consumption, which was up by 0.7% on 2006.
In 2007, electricity demand reached 339.8 billion kWh. Of this figure, 86.5% was covered by domestic production allocated for consumption (+0.5% on 2006) and 13.5% by imports (+2.1% on 2006).
The installed generating capacity grew by about 5%. Wind farms gave a significant contribution (over 500 MW) to this growth.

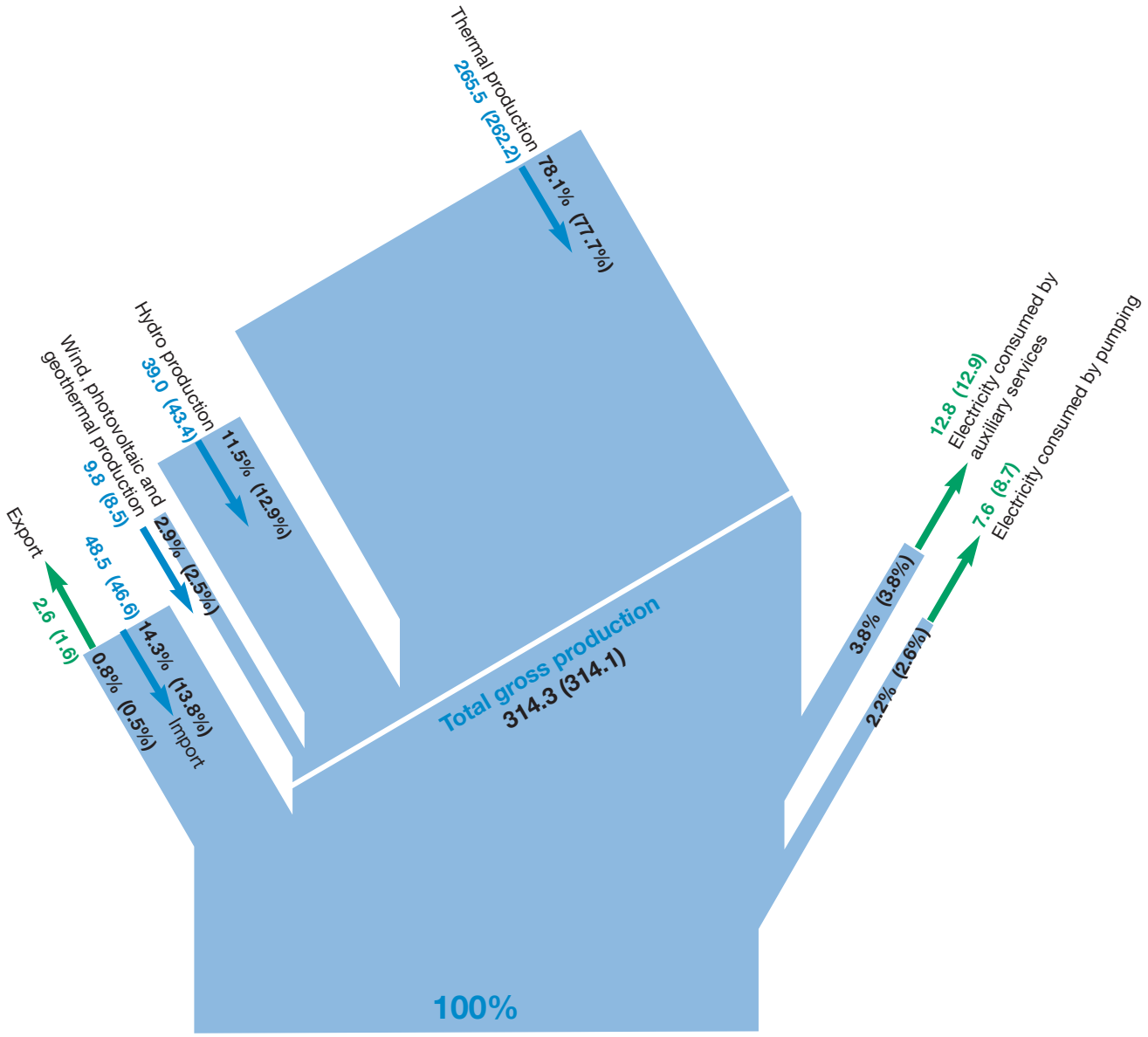
Two other phenomena characterised demand in 2007:

- a new all-time peak load on the national power grid (56,822 MW on 18 December 2007, at 17:00), which was up by 2.2% on the previous year;
- a new all-time peak demand in the Summer period (20 July 2007), which was comparable to the one of the Winter period (56,589 MW) and up by 1.7% on the corresponding value of 2006.

The following pages give more insight into these and other aspects of Terna's management & operation of the Italian power system.

Italian Electricity Balance

TWh (2006 data between parentheses)



Electricity supplied (consumption + losses) **339.8 (337.5)** **2007/2006 variation** **+ 0.7%**

Electricity Balance by Regional Area and Total (GWh)

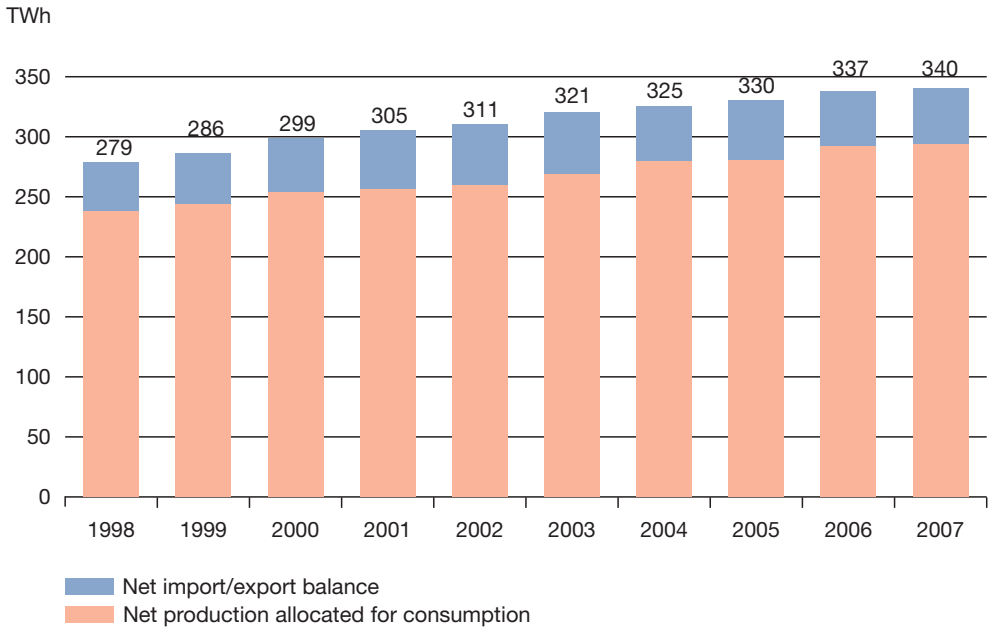
	TURIN	MILAN	VENICE	FLORENCE	ROME	NAPLES	PALERMO	CAGLIARI	Total		
									2007	**2006**	**% var.**
Hydro Production	8,982	9,453	11,240	1,716	3,143	3,194	689	626	39,043	43,423	- 10.1
Thermal Production	27,724	56,797	26,542	29,714	32,463	54,827	23,869	13,620	265,556	262,167	1.3
Wind, photovoltaic and geothermal production	12	0	0	5,599	376	2,337	793	637	9,754	8,501	14.7
Total gross production*	**36,718**	**66,250**	**37,782**	**37,029**	**35,982**	**60,358**	**25,351**	**14,883**	**314,353**	**314,091**	**0.1**
Electricity consumed by auxiliary services	1,243	2,423	1,428	1,384	1,352	2,925	1,144	909	12,808	12,864	- 0.4
Total net production	**35,475**	**63,827**	**36,354**	**35,645**	**34,630**	**57,433**	**24,207**	**13,974**	**301,545**	**301,227**	**0.1**
Electricity consumed by pumping	1,348	2,171	158	556	222	1,942	814	425	7,636	8,753	- 12.8
Net production allocated for consumption	**34,127**	**61,656**	**36,196**	**35,089**	**34,408**	**55,491**	**23,393**	**13,549**	**293,909**	**292,474**	**0.5**
Import	*18,719*	*25,072*	*4,616*	*0*	*0*	*163*	*0*	*0*	*48,570*	*46,596*	*4.2*
Export	*592*	*3*	*289*	*0*	*0*	*1,135*	*0*	*621*	*2,640*	*1,611*	*63.9*
Net import/export balance	**18,127**	**25,069**	**4,327**	**0**	**0**	**- 972**	**0**	**- 621**	**45,930**	**44,985**	**2.1**
Balance of physical exchanges between regional areas	- 15,721	- 15,924	8,811	15,619	13,962	- 5,273	- 1,419	- 55			
Electricity supplied	**36,533**	**70,801**	**49,334**	**50,708**	**48,370**	**49,246**	**21,974**	**12,873**	**339,839**	**337,459**	**0.7**
Year 2006	36,831	70,037	49,397	50,673	48,201	48,108	21,470	12,742			
% variation	**- 0.8**	**1.1**	**- 0.1**	**0.1**	**0.4**	**2.4**	**2.3**	**1.0**			
*of which CIP-6 production	931	2,647	7,864	19,651	6,498	8,160	5,040	2,965	**53,756**	**51,699**	**4.0**

N.B. Net import/export balance excluding the Republic of San Marino and the Vatican City.

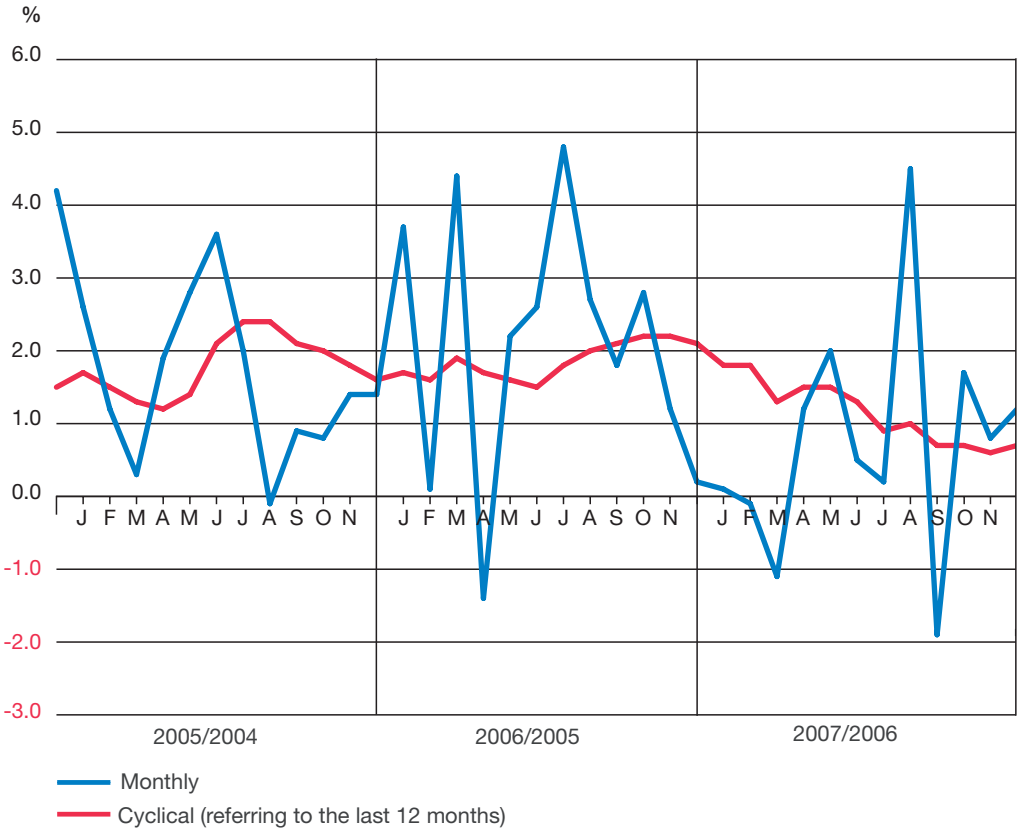
During the year, **electricity demand** reached 339.8 billion kWh (+0.7% on 2006), with a fairly variable monthly performance.
Net domestic production allocated for consumption rose by 0.5%, whereas the balance of physical exchanges of electricity with neighbouring countries grew by 2.1% on the previous year.
In particular, production from thermal sources and renewables (geothermal, wind and photovoltaic) was up by 1.3% and 14.7%, respectively; conversely, production from hydro sources sharply declined (-10.1%).
Imports of electricity from neighbouring countries increased by 4.2%, while exports were up by as much as 63.9%.

Electricity Demand on the Italian Grid

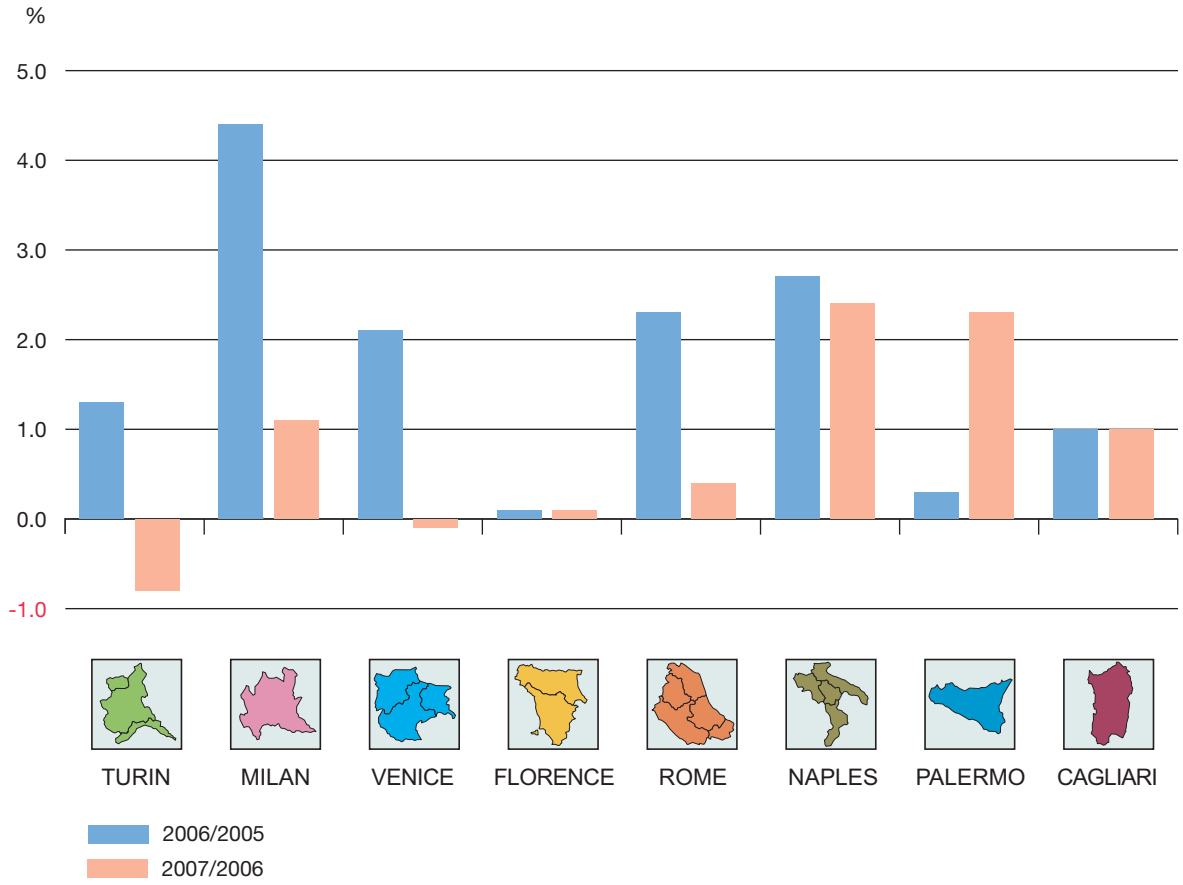
Trend and Coverage



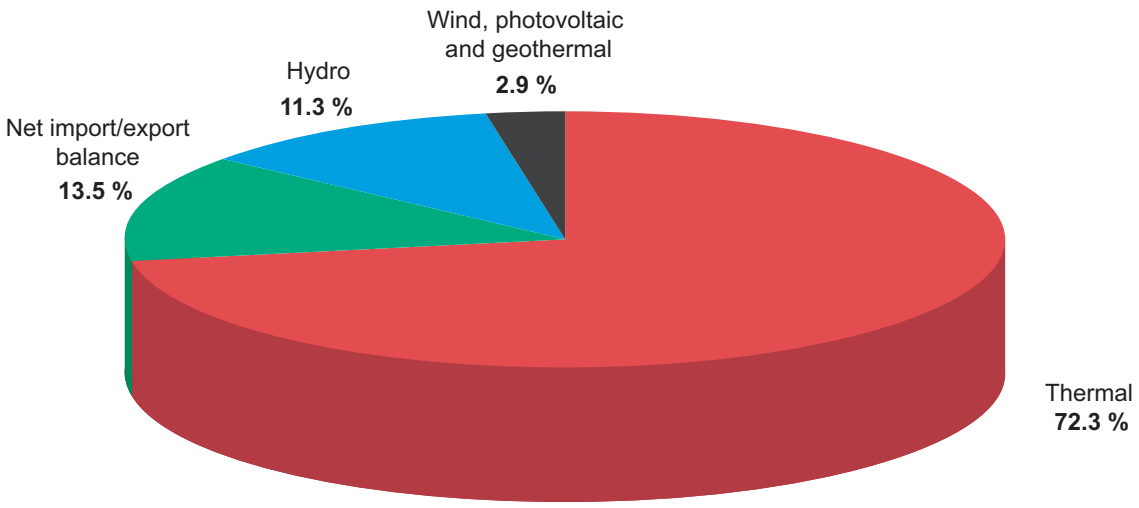
Monthly and Cyclical Percentage Variations



Percentage Variations by Regional Area



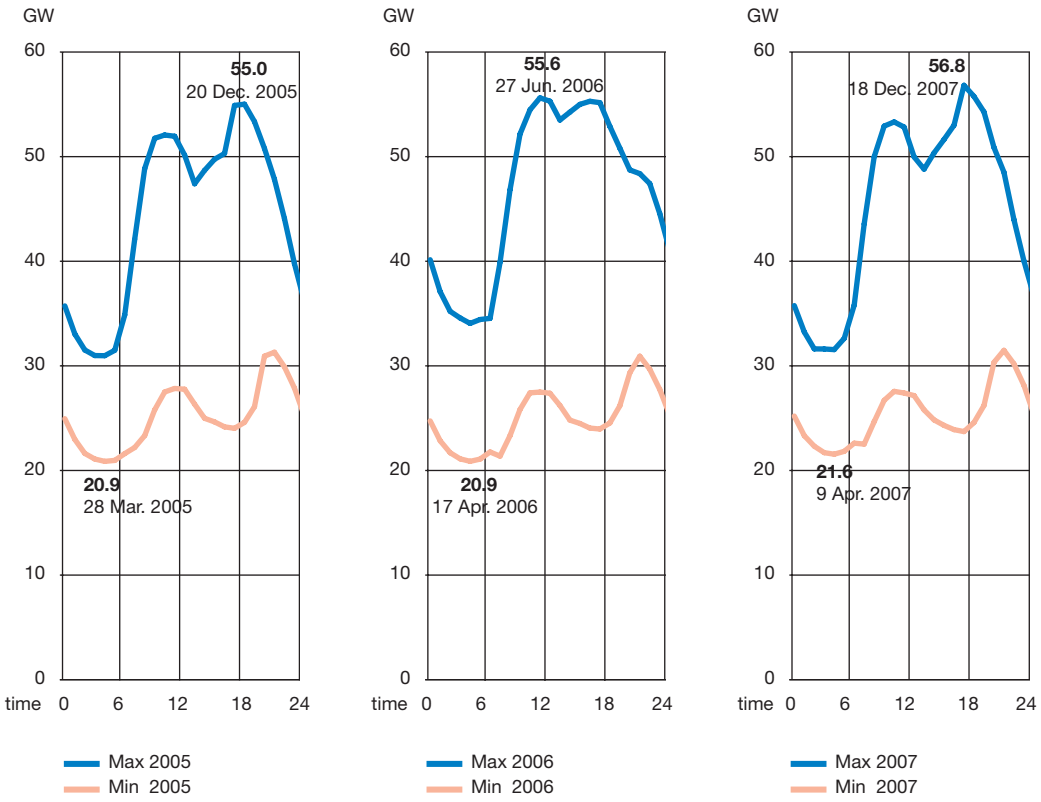
Components (%) of Electricity Supply Side *



** % net of electricity consumed by auxiliary services of the production and by pumping.*

Hourly Load Demand on the Italian Grid

Load Curve on Maximum and Minimum Peak Days



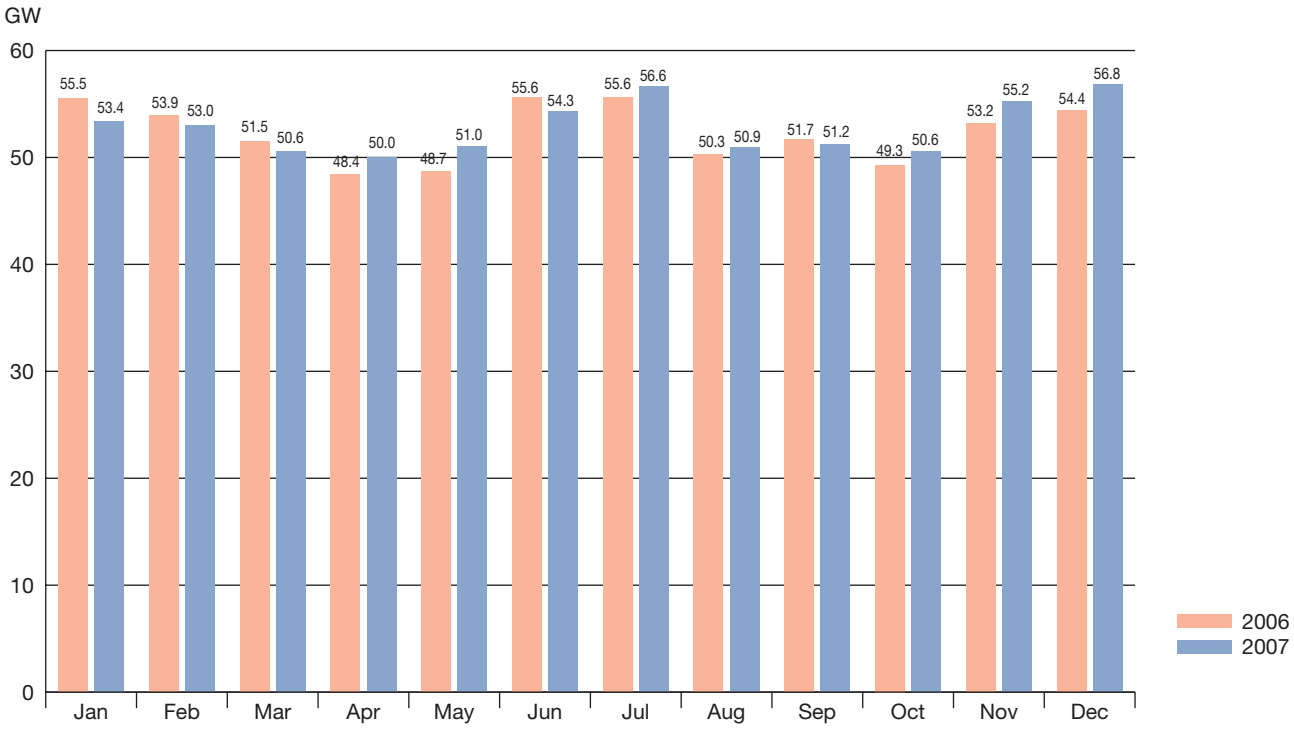
Daily Values – 2007

	MAX		MIN	
	GW	**Date-Time**	**GW**	**Date-Time**
LOAD				
Gross thermal production	48.2	18 December 17:00	18.2	9 April 16:00
Gross hydro production	11.8	13 July 11:00	1.1	18 November 05:00
Hourly peak load	56.8	18 December 17:00	21.6	9 April 04:00
	GWh	**Date**	**GWh**	**Date**
ENERGY				
Gross thermal production	1,021.0	18 December	470.6	8 April
Gross hydro production	186.2	19 June	49.5	28 October
Daily electricity demand	1,142.1	20 July	608.2	9 April

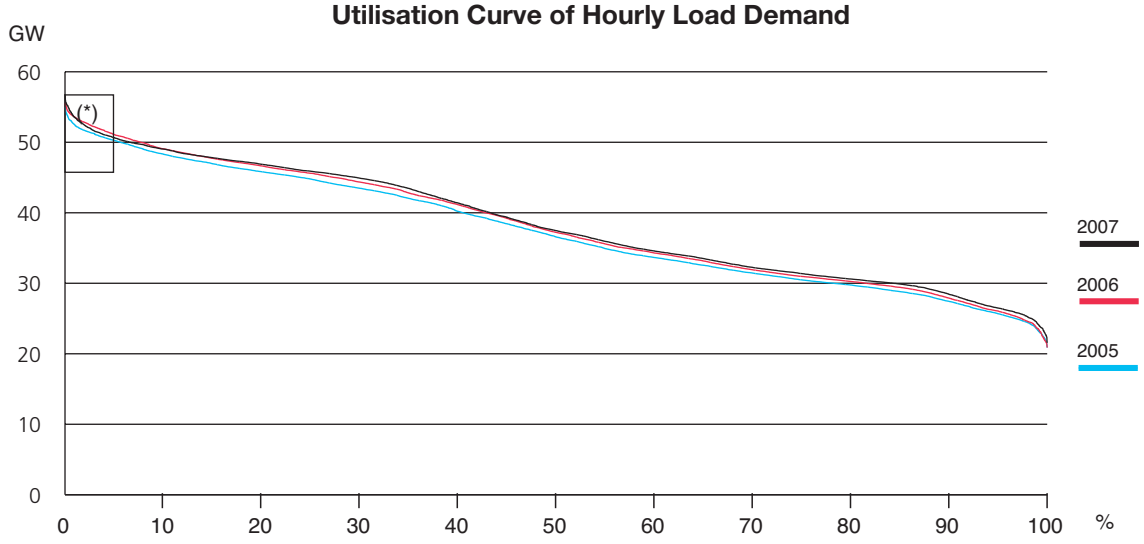
N.B.: Data are net of electricity consumed by auxiliary services and by pumping.

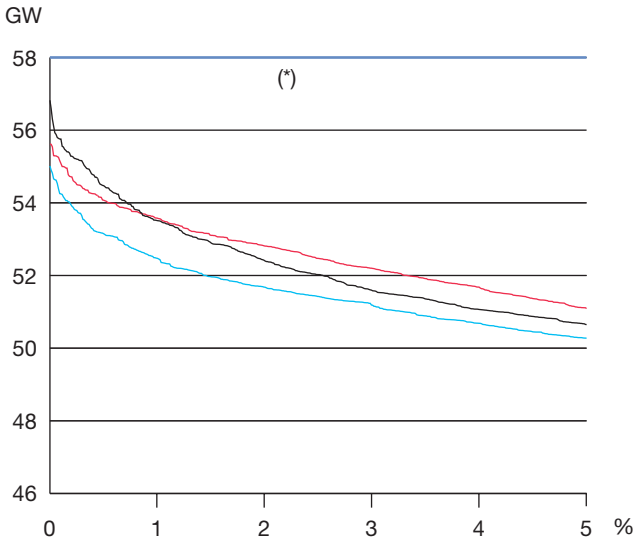
In 2007, **electricity demand on the national power system** had a new all-time peak of 56,822 MW at 17:00 of Tuesday, 18 December (+2.2% on the previous year).
In the Summer period, owing to the torrid heat especially in the last ten days of July, electricity demand on the national power grid had repeated peaks in various areas of the country.
At 11:00 of Friday, 20 July, with 56,589 MW, a new all-time Summer peak was recorded. The peak was up by 1.7% on the previous one (55,619 MW, at 11:00 of Tuesday, 27 June 2006). On the same day, also the daily electricity demand had an all-time peak of 1,142.1 GWh (+2.5% on 2006).

Peak Loads by Month



Utilisation Curve of Hourly Load Demand





N.B.: Data are net of electricity consumed by auxiliary services and by pumping.

Weekly Maximum Values of Load and Energy

Weekly Maximum Values of Load

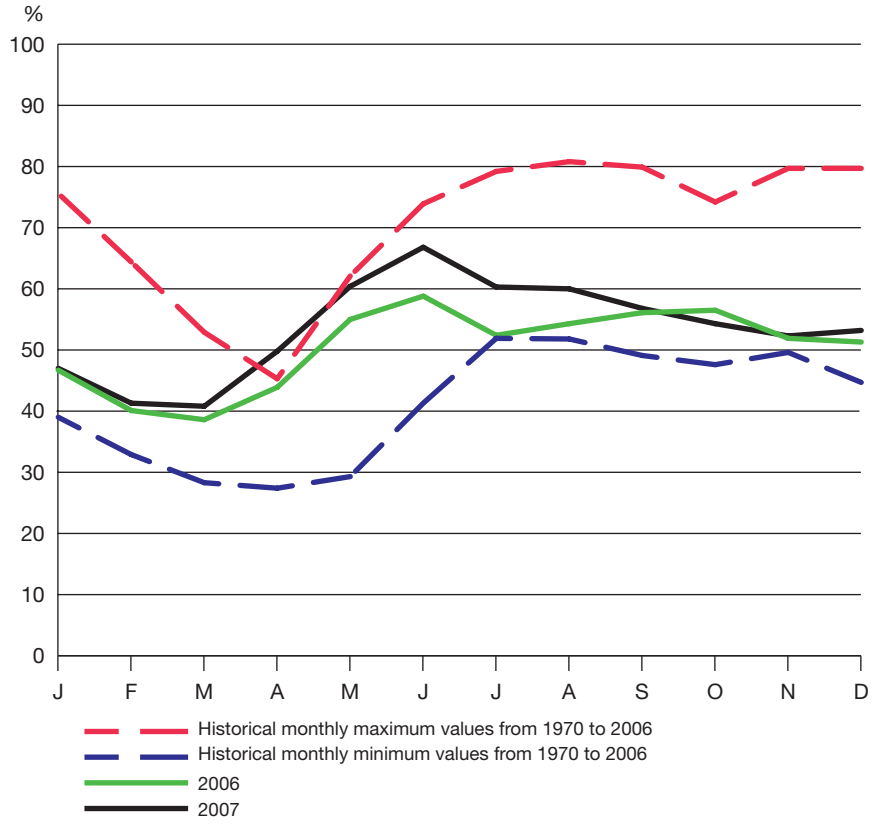
Weekly Maximum Values of Energy

The **weekly load curve of electricity supplied** shows the maximum values of load and energy recorded on the Italian power grid in each of the 52 weeks of 2007. The diagrams clearly show low demand values during the Easter, August and year-end holidays.

Hydro Power Plants

Energy Capability Factor

Fullness Factor of Hydro Reservoirs at the end of Each Month



The **monthly energy capability factor** had a fairly variable performance: except in June, its percentage values were always below the corresponding values recorded throughout 2007.
In May, this factor had an all-time minimum vs. its multi-year average.
The **yearly energy capability factor** (ratio of the energy capability in the current year to the average multi-year reference value) was lower than the corresponding value of the previous year. This confirms the low use of hydro resources due to scarce rainfall in Winter and Spring.

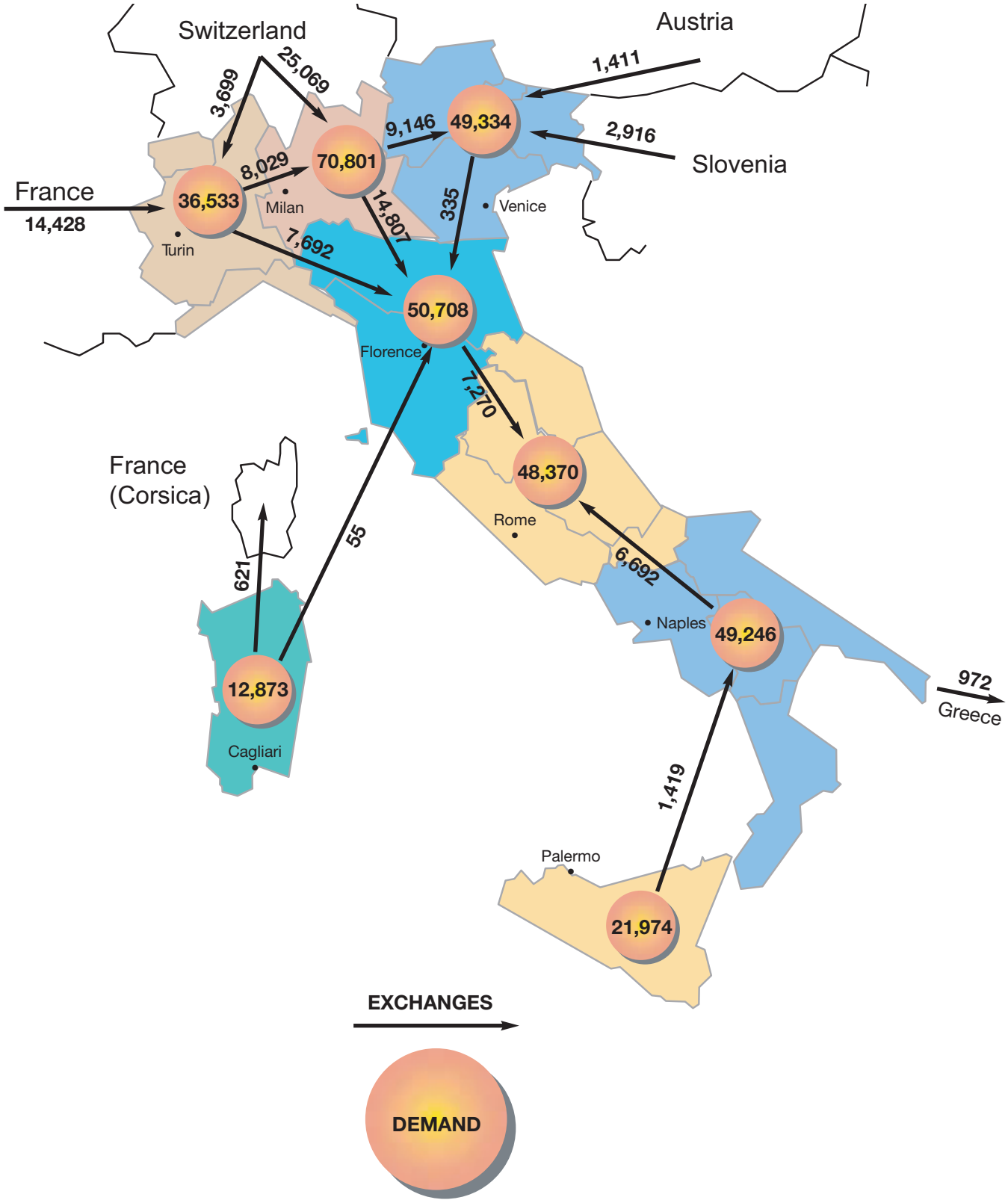
Energy not Supplied (MWh) to the 380-220-150-132 kV Grid

Regional Area	YEAR 2007	YEAR 2006
Turin	54.65	210.38
Milan	293.78	160.95
Venice	119.56	129.68
Florence	237.70	144.80
Rome	109.70	372.07
Naples	1,769.08	252.35
Palermo	1,089.94	848.70
Cagliari	861.42	199.77
Total	4,535.83	2,318.70

Maximum Load Flows between Geographical Areas (MW)

	FRANCE	SWITZERLAND	AUSTRIA	SLOVENIA	GREECE	NORTH ▼ FLORENCE	FLORENCE ▼ ROME	ROME ▼ NAPLES	PALERMO ▼ NAPLES	FLORENCE ▼ CAGLIARI
	12 Oct. 2007 8:00	30 Apr. 2007 20:00	20 Nov. 2007 16:00	27 Nov. 2007 10:00	15 May 2007 3:00	28 Nov. 2007 17:00	25 Jul. 2007 5:00	13 Dec. 2007 8:00	25 Jun. 2007 18:00	13 Jul. 2007 9:00
FRANCE	2,948	1,857	526	1,429	1,201	1,291	1,145	818	1,964	1,789
SWITZERLAND	3,366	4,825	1,055	2,527	2,624	3,369	3,518	1,833	3,851	3,530
AUSTRIA	244	97	317	0	145	0	183	190	201	266
SLOVENIA	212	403	483	1,265	32	1,071	164	222	154	512
GREECE	0	0	99	0	- 522	96	- 508	0	- 207	0
NORTH ► FLORENCE	3,023	4,455	2,720	4,242	2,973	5,672	3,880	519	3,923	4,109
FLORENCE ► ROME	1,048	2,566	- 411	1,305	2,203	1,927	2,947	- 1,623	867	798
ROME ► NAPLES	- 1,292	- 93	- 986	- 876	816	- 731	1,615	- 3,360	205	- 1,496
PALERMO ► NAPLES	97	18	0	225	55	200	40	181	- 835	274
FLORENCE ► CAGLIARI	- 172	85	50	92	- 99	119	- 175	- 85	93	270

Balance of Physical Exchanges of Electricity (GWh)



The **balance of physical exchanges of electricity** mainly shows the energy flows between the various areas of the Italian power system. Note the high flows going from Lombardia towards Triveneto (Trentino-Veneto-Friuli Venezia Giulia) and then converging, in part, towards central Italy. A 380-kV transmission link between Sicilia and mainland Italy provides secure operation of the Sicilia and Calabria power system.

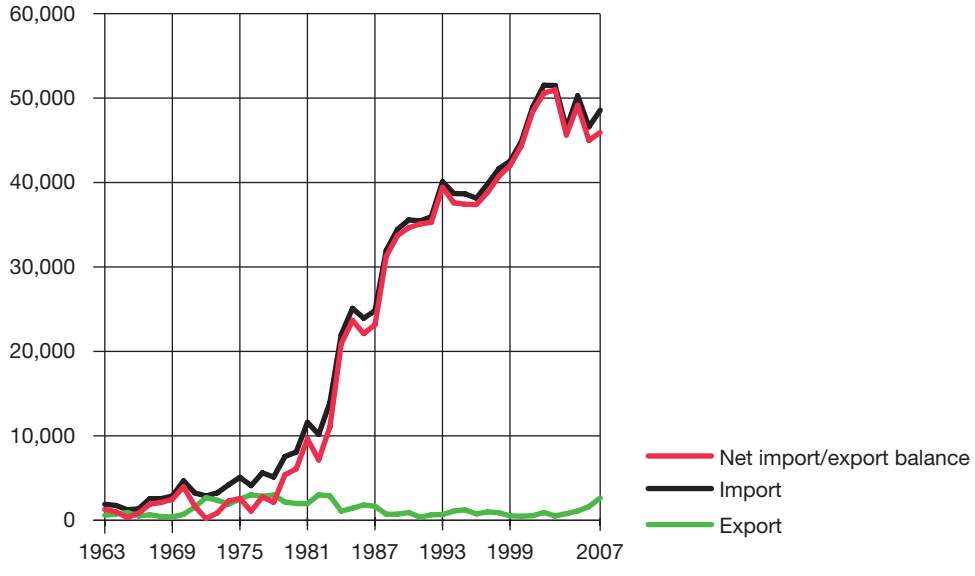
Physical Exchanges of Electricity between Italy and Neighbouring Countries

(GWh)

2006	Electricity imported to Italy from						Electricity exported from Italy to						Net import/export balance
	France	Switzerland	Austria	Slovenia	Greece	TOTAL	France	Switzerland	Austria	Slovenia	Greece	TOTAL	
January	695.1	1,060.4	76.6	418.2	167.7	2,418.0	122.3	148.3	3.2	2.0	3.8	279.6	2,138.4
February	696.5	1,090.0	90.6	476.6	48.6	2,402.3	103.2	128.1	1.0	0.7	0.0	233.0	2,169.3
March	1,046.0	1,412.7	112.9	564.6	221.4	3,357.6	100.1	96.8	0.2	1.9	0.0	199.0	3,158.6
April	1,617.3	2,164.7	114.2	699.4	173.2	4,768.8	35.8	0.0	0.0	0.0	3.3	39.1	4,729.7
May	1,443.8	2,064.3	141.3	590.0	149.0	4,388.4	41.9	1.8	0.0	0.0	0.2	43.9	4,344.5
June	1,372.6	2,180.1	111.1	518.3	18.1	4,200.2	43.2	4.5	0.0	0.0	3.7	51.4	4,148.8
July	1,255.5	2,119.6	128.9	443.5	6.8	3,954.3	53.2	28.2	0.0	0.8	13.1	95.3	3,859.0
August	861.7	1,757.8	135.3	288.4	3.7	3,046.9	32.1	1.6	0.0	1.1	73.7	108.5	2,938.4
September	1,399.8	2,231.6	115.2	204.6	34.1	3,985.3	33.0	0.7	0.0	4.6	47.5	85.8	3,899.5
October	1,622.6	2,738.9	133.2	414.6	51.0	4,960.3	35.9	4.5	0.0	0.1	69.3	109.8	4,850.5
November	1,552.9	2,473.6	125.8	392.3	40.8	4,585.4	46.7	1.0	0.0	1.2	98.7	147.6	4,437.8
December	1,382.5	2,609.0	133.9	372.5	30.3	4,528.2	76.6	1.1	0.0	0.2	139.9	217.8	4,310.4
YEAR	**14,946.3**	**23,902.7**	**1,419.0**	**5,383.0**	**944.7**	**46,595.7**	**724.0**	**416.6**	**4.4**	**12.6**	**453.2**	**1,610.8**	**44,984.9**

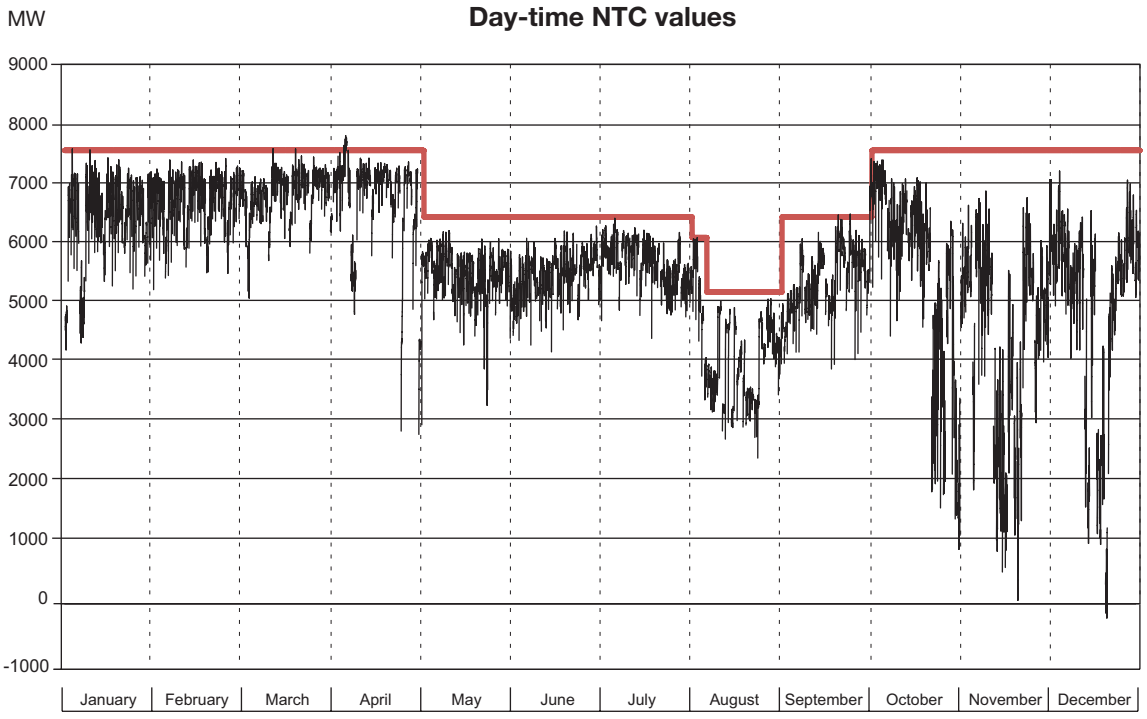
2007	Electricity imported to Italy from						Electricity exported from Italy to						Net import/export balance
	France	Switzerland	Austria	Slovenia	Greece	TOTAL	France	Switzerland	Austria	Slovenia	Greece	TOTAL	
January	1,294.3	2,798.4	121.5	355.9	0.3	4,570.4	86.6	0.3	0.0	1.0	124.5	212.4	4,358.0
February	1,328.0	2,526.5	108.4	265.8	0.8	4,229.5	67.3	0.2	0.0	0.3	127.4	195.2	4,034.3
March	1,470.2	2,836.2	124.6	433.2	4.9	4,869.1	70.4	0.6	0.0	0.0	95.5	166.5	4,702.6
April	1,419.9	2,765.0	117.9	396.2	17.2	4,716.2	58.9	0.0	0.0	1.3	74.6	134.8	4,581.4
May	1,342.7	2,500.9	129.8	84.1	5.0	4,062.5	64.8	0.3	0.0	67.8	146.8	279.7	3,782.8
June	1,389.2	2,463.3	111.2	26.4	1.8	3,991.9	36.0	7.3	0.0	112.8	106.3	262.4	3,729.5
July	1,390.0	2,584.1	140.0	193.1	0.3	4,307.5	95.0	0.6	0.0	11.1	200.8	307.5	4,000.0
August	1,125.4	1,915.6	98.5	44.1	0.0	3,183.6	128.5	1.6	0.0	77.6	46.1	253.8	2,929.8
September	1,125.4	2,255.7	129.1	211.1	45.2	3,766.5	72.0	0.5	0.0	4.0	84.4	160.9	3,605.6
October	1,222.6	2,326.5	124.1	298.0	15.2	3,986.4	68.3	4.3	0.0	4.1	98.2	174.9	3,811.5
November	886.5	1,720.4	77.4	479.3	31.1	3,194.7	185.0	27.9	0.0	0.0	12.3	225.2	2,969.5
December	965.5	2,137.2	128.2	419.0	41.9	3,691.8	220.0	19.5	0.0	9.1	17.8	266.4	3,425.4
YEAR	**14,959.7**	**28,829.8**	**1,410.7**	**3,206.2**	**163.7**	**48,570.1**	**1,152.8**	**63.1**	**0.0**	**289.1**	**1,134.7**	**2,639.7**	**45,930.4**

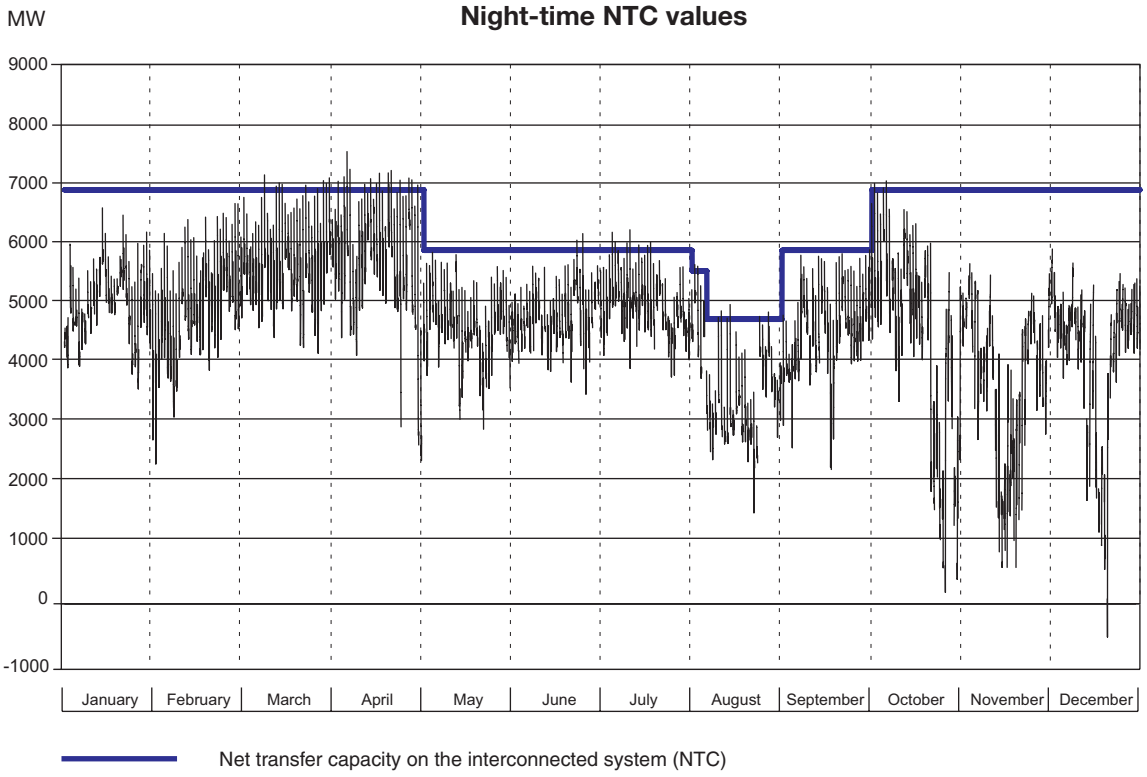
Physical Exchanges of Electricity between Italy and Neighbouring Countries from 1963 to 2007 (GWh)



In the course of 2007, the **balance of physical exchanges of electricity** with neighbouring countries increased, reaching an actual value of 45.9 billion kWh, i.e. up by 2.1% on the previous year.

Time Curves of Net Import/Export Balance





The red line shows the **limit value of the maximum transfer capacity on the interconnected system (NTC)**, whereas the blue one represents the minimum transfer capacity. The maximum transfer capacity in the Winter period ranged daily from 7,490 to 6,840 MW. In the Summer period (May-September 2007, excluding August), the range was 6,390-5,840 MW. In August, the range was 6,050-4,700 MW. From the last quarter of 2007, exports rose significantly and their overall value was up by as much as 63.9% on the previous year.

Grid Facilities Entered into Operation (New or Renovated)

Thermal Power Plants			
Erg NuCe Sud	gas turbine 4	95.4 MVA	ERG Petroli
Termini Imerese	gas turbine 6.3	288 MVA	Enel Produzione
Calenia di Sparanise	unit 2	170 MVA	Calenia Energia
Alba Power	gas turbine 1	63.5 MVA	Alba Power
Vado Ligure	gas turbine 51	300 MVA	Tirreno Power
Simeri Crichi	gas turbine GT-G1 + gas turbine GT-G2	(323 + 323) MVA	Edison
Turbigo	unit 4 + gas turbine G + gas turbine H	(370 + 319 + 319) MVA	Edipower
Acea Electrabel di Leinì	unit 1 + gas turbine A	(160 + 300) MVA	Acea Electrabel Produzione S.p.A.
EON Livorno Ferraris	unit ST + gas turbine GT1 + gas turbine GT2	(296 + 300 + 300) MVA	E.ON. Italia Produzione S.p.A.
Whirpool Europe	gas turbine GA	12.5 MVA	Whirpool Europe S.r.l.
Rizziconi	gas turbine 1	300 MVA	Rizziconi Energia

Hydro Power Plants			
SIED Calcinere	unit 1 + unit 2 + unit 3 + unit 4	(13 + 13 + 13 + 6) MVA	SIED S.p.A.

Renewable-Energy Power Plants			
Castelnuovo di Conza	wind	10 MW	Edison Energie Speciali S.p.A.
Monte Narbone	wind	96 MW	Enipower S.r.l. Wind Power Sud S.r.l.
S. Ninfa	wind	32.3 MW	Enel Produzione S.p.A.
Aerofonte	wind	72 MW	Soc. Aerofonte S.r.l.
Lecce Tre	wind	36 MW	P. E. Salentino S.M. D'Aurio S.r.l.
Fri-El	wind	36 MW	Fri-El Ricigliano S.r.l.
Cadau	wind	21 MW	Energia Verde S.r.l.
Parco Eolico Marco Aurelio Severino	wind	44 MW	P. E. Marco Aurelio Severino S.r.l.
Eolo Puglia	wind	21 MW	Eolo Puglia
Parco Eolico Serra Pelata	wind	58 MW	Parco Eolico Serra Pelata S.r.l.
Parco Eolico Piano di Corda	wind	46 MW	Parco Eolico Piano di Corda S.r.l.
Parco Eolico Tempio Pausania	wind	70.5 MW	Eolo Tempio Pausania S.r.l.

Lines		
380 kV Matera electrical station-S.Sofia electrical station	220.29 km	Terna
380 kV S/E Leynì - C.le AceaElectrabel Leynì	6.1 km	AceaElectrabel Produzione S.p.A.
380 kV Ferrara-SEF Ferrara Nord electrical station	2.05 km	Società Enipower Ferrara
380 kV Trino power plant – EON Livorno Ferraris	1.905 km	E.ON
380 kV Rizziconi electrical station – Rizziconi Energia power plant	0.202 km	Rizziconi Energia
220 kV Acerra-Fibe	2.87 km	Terna
220 kV Colunga-S.Benedetto del Querceto	28.817 km	Terna
220 kV S.Benedetto del Querceto-Casellina	61.383 km	Terna
7 x 150 kV lines		Terna
4 x 150 kV lines		Enel Distribuzione
5 x 132 kV lines		Terna
2 x 132 kV lines		Enel Distribuzione

Stations/Substations	
380 kV Carpi Fossoli electrical station	Terna
380 kV unit – EON Livorno Ferraris power plant	E.ON.
380 kV unit – S.E.F. Ferrara power plant	S.E.F S.r.l.
220 kV S.Benedetto del Querceto electrical station	Terna
220 kV unit – Morigallo	Terna
150 kV unit – Piscioli	Terna
150 kV unit – Troia	Terna
150 kV HV/MV substation – Jacurso	Enel Distribuzione
150 kV HV/MV substation – Assoro	Enel Distribuzione
132 kV unit – Morigallo	Terna
132 kV unit – Castione Andevenno	Enel Distribuzione
132 kV unit – Sanfront	Enel Distribuzione
132 kV unit – Rossano	Enel Distribuzione

Transformers		
380/220 kV	1200 MVA	Terna
380/150 kV	250 MVA	Terna
380/132 kV	1000 MVA	Terna
220/150 kV	160 MVA	Terna
220/132 kV	410 MVA	Terna

Capacitor Banks		
Colunga	54 MVAR	Terna
Bulciago	54 MVAR	Terna
Misterbianco	54 MVAR	Terna
Salgareda	54 MVAR	Terna

Reactors		
Suvereto	200 MVAR	Terna
Dolo	200 MVAR	Terna
Valmontone	200 MVAR	Terna
Martignone	200 MVAR	Terna

Italian 380 kV Grid as of 31 December 2007

FACILITIES

- 380 kV substation (national transmission grid)
- Substation not belonging to national transmission grid
- Customer substation
- Thermal power plant
- Hydro power plant

LINES

- 380 kV line (national transmission grid)
- 380 kV line (not belonging to national transmission grid)
- 380 kV double-circuit line (national transmission grid)
- 400 kV DC line (national transmission grid)

0 110 220 kilometres

Legend

- The **electricity supplied** (or electricity demand) is the electricity to be injected into the grid for covering its net internal consumption. In the case of a national grid, it is equal to the sum of net electricity production and of imports from neighbouring countries, after deducting the electricity consumed by pumping and exports to neighbouring countries.
- The **trend variation** is the percentage change with respect to the same month or period of the previous year.
- The **gross electricity production** of a group of power plants in a given period is the sum of the amounts of electricity generated, measured at the terminals of electrical generators.
- The **electricity consumed by auxiliary services** is the sum of the electricity consumed by all the auxiliary services of power plants and of losses in the main transformers.
- The **net electricity production** is equal to the gross electricity production, after deducting the electricity consumed by auxiliary services and the losses in the main transformers.
- The **electricity consumed by pumping** is the electricity used for the sole purpose of pumping water and storing it for subsequent electricity generation.
- **Regional areas** consist of one or more neighbouring regions, which are grouped as follows:

  TURIN: Piemonte - Liguria - Valle d'Aosta

  MILAN: Lombardia

  VENICE: Friuli Venezia Giulia - Veneto - Trentino Alto Adige

  FLORENCE: Emilia Romagna - Toscana

  ROME: Lazio - Umbria - Abruzzo - Molise - Marche

  NAPLES: Campania - Puglia - Basilicata - Calabria

  PALERMO: Sicilia

  CAGLIARI: Sardegna

- The **hydro energy capability factor** is the ratio of the energy capability in a given period to the mean energy capability in the same period.

  The energy capability of a group of power plants in a given period is the maximum amount of electricity that all the inflows observed in the same period would enable them to generate under the most favourable conditions.

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