

THE SPANISH
ELECTRICITY SYSTEM

preliminary report

20
14



RED
ELÉCTRICA
DE ESPAÑA



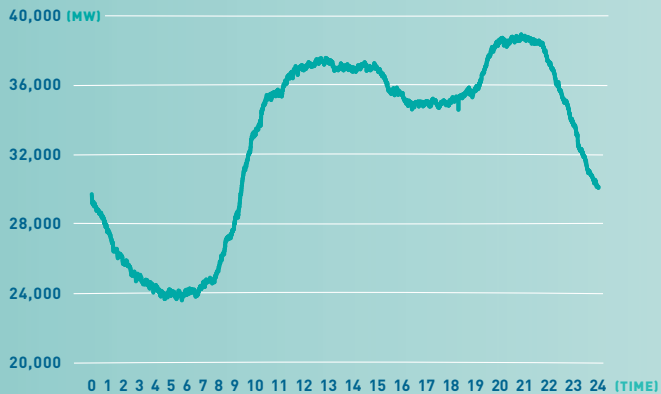
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Provisional data:
Year end based on data estimated as at 19 December

THE SPANISH
ELECTRICITY SYSTEM

preliminary report [2014]

Load curve for the 04.02.2014
MAXIMUM HOURLY POWER DEMAND



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In this report the **provisional** statistics are published regarding the behaviour of the Spanish electricity system during 2014.

Peninsular system

The peninsular demand for **electrical energy** closed the year at 243,486 GWh, 1.2 % lower than that in 2013. Factoring in the effects of seasonal and working patterns, demand that is mainly attributable to economic activity, reduced the rate of descent to 0.2%, representing a substantially smaller decline than the fall recorded last year which stood at 2.2 %.

The maximum **instantaneous power** recorded in the year occurred at 8:18 pm on Wednesday 4 February when it reached a value of 39,948 MW, this value was lower (3.3 %) than the maximum figure recorded the previous year and 14.3 % below the record of 45,450 MW reached on 17 December 2007. The maximum hourly demand was also recorded on 4 February (between 8:00 pm and 9:00 pm) at 38,666 MWh, 13.8 % below the all-time high recorded in 2007.

The **installed power capacity** on the Spanish Peninsula remained virtually unchanged from the previous year and closed 2014 at 102,259 MW, 122 MW (0.1 %) less than in December 2013. The largest variation recorded was that of coal, which reduced its contribution by 159 MW, as a result of the closure of the Escucha power station. The remaining technologies had no power variations or the variations were little significant.

Producible hydroelectric stood at 32,655 GWh, 18% higher than the average historical value and is practically the same as the 2013 value. **Hydroelectric reserves**, for the complete set of reservoirs, ended 2014 with level close to 63 % of their total capacity compared to 58 % last year.

Regarding **demand coverage**, nuclear covered 21.9 % (21.2 % in 2013), wind 20.4 % (21.2 % in 2013), coal 16.4 % (14.6 % in 2013), hydroelectric 15.4 % (14.2 % in 2013) and cogeneration 10.4 % (12.5 % in 2013). Technologies with a contribution of less than 10 % were combined cycle at 8.5 % (one point less than the previous year), and solar thermal and renewable thermal which have jointly covered 7 % of the demand, a contribution similar to that of 2013.

Renewable energies have continued to maintain a prominent role in the overall production of energy in the electricity system covering 42.8 % of the total production (42.2 % in 2013). In absolute terms, renewable generation fell by 1.0 % regarding the previous year, mainly due to the 6.1 % drop in wind production. Despite this decline, it should be noted that wind power was the technology that made the largest contribution towards the total energy production in the Spanish Peninsula electricity system in the months of January, February and November.

[] INTRODUCCIÓN



Regarding **CO₂** emissions from the peninsular electricity sector, the increase in production from coal-fired power stations was offset by generation from renewable sources, resulting in an emissions balance of 60.4 million tonnes in 2014, a value similar to the 60.1 million tonnes registered in 2013.

The electricity exchange through the **Spanish Peninsula-Balearic Islands** interconnection registered an export balance to the Balearic Islands of 1,293 GWh that has enabled 23.2 % of the demand of the Balearic Islands' electricity system to be covered from the mainland.

For yet another year, the balance of **international electricity exchanges** has continued to be as exporter, reaching a value of 3,543 GWh in 2014, 47.4 % less than 2013. Exports stood at 15,772 GWh (16,936 GWh in 2013) and imports at 12,228 GWh (10,204 in 2013).

Non-peninsular systems

Annual demand for electricity in the set of **non-peninsular systems** fell by 0.9 % in 2014 as compared to the previous year. By system, the registered falls were 1.7 % in the Balearic Islands, 0.5 % in the Canary Islands, while Ceuta and Melilla grew by 5.4 % and 0.3% respectively.

Installed power capacity has also remained in these systems at levels similar to 2013, except for the Canary Islands where noteworthy was the incorporation of 12 MW on the island of El Hierro, corresponding to a new power station that combines wind and pumped storage (included in the balance as hydro-wind).

Transmission grid infrastructure

Regarding **transmission infrastructure**, 621 km of new lines were commissioned in 2014, meaning that at the end of the year the national transmission grid totalled 42,760 km of circuit. Furthermore, transformer capacity rose by 3,535 MVA, increasing the total national transformer capacity to 84,779 MVA.

Amongst the projects concluded in 2014, noteworthy is the Brovales-Guildford 400 kV line (237 km), which completes the construction of the Almaraz-Guillena axis; whose main objective is to ensure the quality of supply of the demand expected in the regions of Extremadura and Andalusia. In addition, this axis gives continuity to the Puebla de Guzmán-Tavira 400 kV line, the new interconnection line with Portugal, commissioned in 2014.



ELECTRICITY BALANCE, INSTALLED POWER CAPACITY AND TRANSMISSION GRID

[1]

Annual electrical energy balance (1)

	Peninsular system		Non-peninsular system		National total	
	GWh	% 14/13	GWh	% 14/13	GWh	% 14/13
Hydro	35,685	5.0	0	-	35,685	5.0
Nuclear	57,179	0.6	-	-	57,179	0.6
Coal	43,859	10.2	2,405	-7.2	46,264	9.1
Fuel/gas (2)	-	-	6,620	-5.5	6,620	-5.5
Combined cycle (3)	21,979	-12.4	3,890	8.6	25,869	-9.8
Consumption in generation (4)	-6,518	4.0	-742	-5.4	-7,260	2.9
Hydro-wind	-	-	1	-	1	-
Other hydro (5)	7,053	-0.7	3	14.5	7,056	-0.6
Wind	51,032	-6.1	407	10.2	51,439	-6.0
Solar photovoltaic	7,801	-1.5	410	0.2	8,211	-1.4
Solar thermoelectric	5,013	12.9	-	-	5,013	12.9
Renewable thermal	4,739	-6.4	10	11.7	4,749	-6.4
Cogeneration and other	25,903	-19.1	283	9.1	26,186	-18.9
Net production	253,724	-2.5	13,288	-1.1	267,012	-2.5
Pumped storage consumption	-5,403	-9.3	-	-	-5,403	-9.3
Peninsula-Balearic Islands' link (6)	-1,293	1.9	1,293	1.9	0	-
International exchanges (7)	-3,543	-47.4	-	-	-3,543	-47.4
Demand (b.c.-at power station busbars)	243,486	-1.2	14,581	-0.9	258,067	-1.2

(1) Allocation of generation units based on primary fuel. (2) Generation from auxiliary generation units is included in the Balearic Islands' electricity system. (3) Includes operation in open cycle mode. (4) Consumption in generation corresponding to hydro, nuclear, coal, fuel/gas and combined cycle production. (5) Includes all those units less than 50 MW that do not belong to a hydro unit (UGH). (6) Positive value: incoming energy; negative value: outgoing energy. (7) Positive value: importer balance; negative value: exporter balance.

Installed power capacity as at 31 December

	Peninsular system		Non-peninsular system		National total	
	MW	% 14/13	MW	% 14/13	MW	% 14/13
Hydro	17,786	0.0	1	0.0	17,787	0.0
Nuclear	7,866	0.0	-	-	7,866	0.0
Coal	10,972	-1.4	510	0.0	11,482	-1.4
Fuel/gas	520	0.0	2,979	0.0	3,498	0.0
Combined cycle (1)	25,353	0.0	1,854	0.0	27,206	0.0
Hydro-wind	-	-	12	-	12	-
Other hydro (2)	2,105	0.0	0,5	0.0	2,106	0.0
Wind	22,845	0.0	158	0.0	23,002	0.0
Solar photovoltaic	4,428	0.1	244	0.5	4,672	0.1
Solar thermoelectric	2,300	0.0	-	-	2,300	0.0
Renewable thermal	1,010	3.6	5	0.0	1,016	3.6
Cogeneration and other	7,075	-0.1	121	0.0	7,196	-0.1
Total	102,259	-0.1	5,884	0.2	108,142	-0.1

(1) Includes operation in open cycle mode. (2) Includes all those units less than 50 MW that do not belong to a hydro unit (UGH).

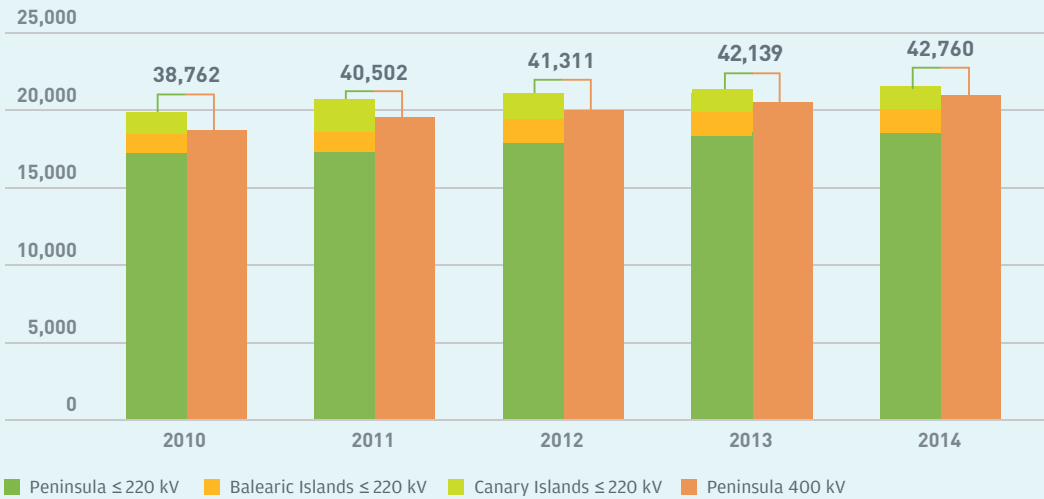
Source: National Commission for Markets and Competition (CNMC) on data regarding power of other hydro, wind, solar photovoltaic, solar thermoelectric, renewable thermal, cogeneration and other.

[1]

ELECTRICITY BALANCE, INSTALLED POWER CAPACITY AND TRANSMISSION GRID

Evolution of the transmission grid in Spain

km



Transmission grid installations in Spain

	400 kV Peninsula	Peninsula	Balearic Isl.	≤ 220 kV Canary Isl.	Total
Total lines (km)	21,094	18,832	1,545	1,289	42,760
Overhead lines (km)	21,039	18,114	1,089	1,023	41,265
Submarine cable (km)	29	236	306	30	601
Underground cable (km)	26	482	150	237	895
Transformer capacity (MVA)	79,808	63	2,908	2,000	84,779

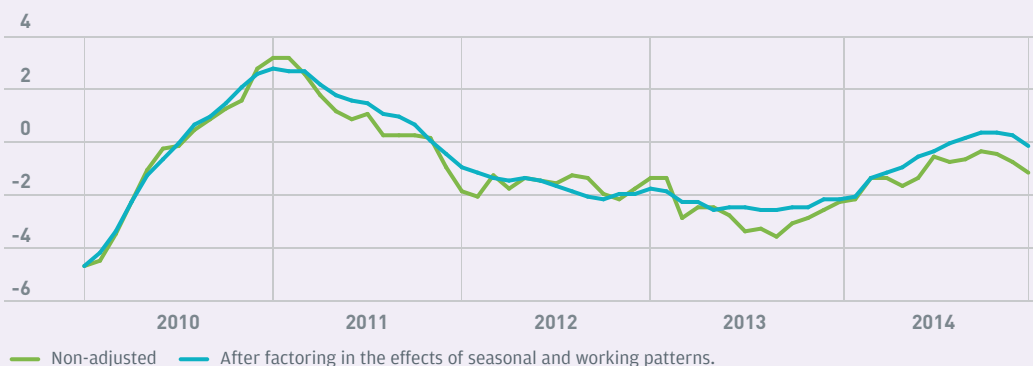
Data relating to km of circuit and transformer capacity as at 31 December 2014.

Evolution of demand

Año	GWh	Δ Annual (%)	Δ Adjusted annual (*) (%)
2010	260,530	3.1	2.7
2011	255,631	-1.9	-1.0
2012	252,083	-1.4	-1.8
2013	246,372	-2.3	-2.2
2014	243,486	-1.2	-0.2

(*) Adjusted as a result of factoring in the effect of seasonal and working patterns.

Annual demand growth (rolling year)



Monthly demand growth

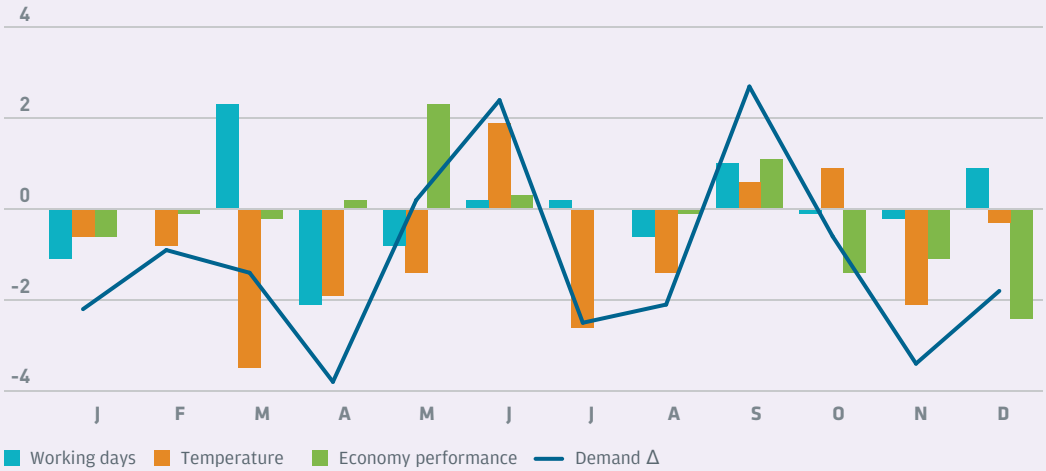
	J	F	M	A	M	J	J	A	S	O	N	D
Monthly	-2.2	-0.9	-1.4	-3.8	0.2	2.4	-2.5	-2.1	2.7	-0.6	-3.4	-1.8
Cummulative	-2.2	-1.6	-1.5	-2.0	-1.6	-1.0	-1.2	-1.3	-0.9	-0.9	-1.1	-1.2

Variations as compared to same month of previous year.

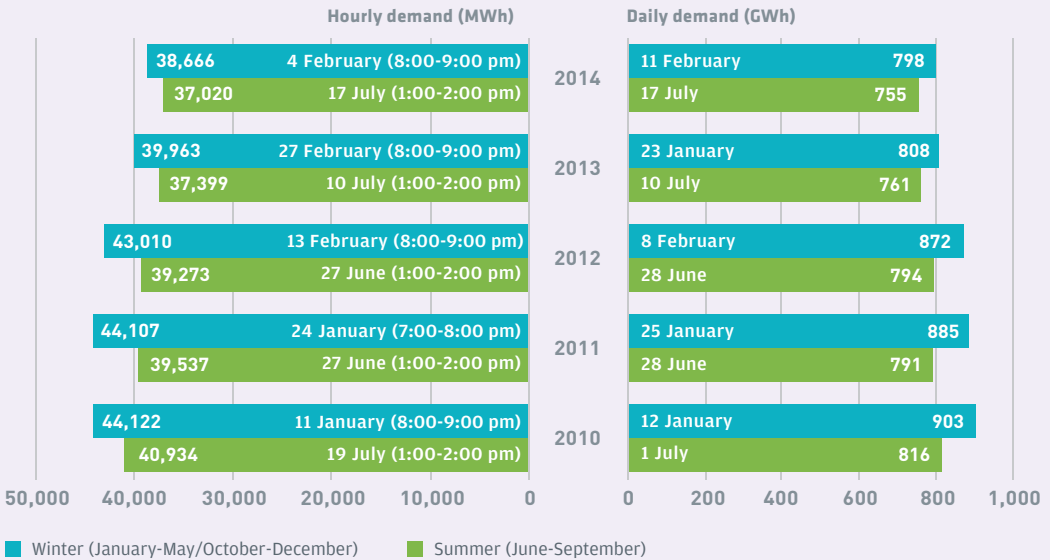
[2] PENINSULAR SYSTEM 2.1 Demand

Components of the monthly demand growth

%



Maximum hourly and daily demand

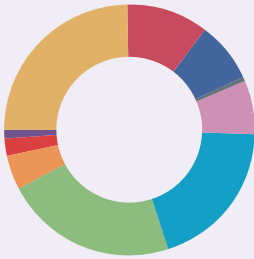


PENINSULAR SYSTEM

2.1 Demand

[2]

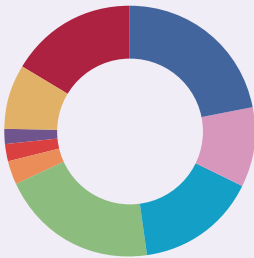
Installed power capacity as at 31 December (102,259 MW)



- Combined cycle **24.8 %**
- Coal **10.7 %**
- Nuclear **7.7 %**
- Fuel/gas **0.5 %**
- Cogeneration and other **7.0 %**
- Hydro (1) **19.5 %**
- Wind **22.3 %**
- Solar photovoltaic **4.3 %**
- Solar thermoelectric **2.2 %**
- Renewable thermal **1.0 %**

(1) Includes pure pumped storage (2,747 MW).

Spanish peninsula electricity demand coverage 2014

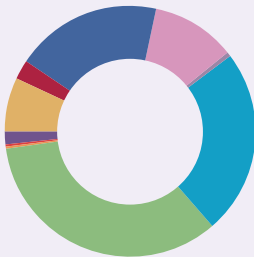


- Combined cycle **8.5 %**
- Coal **16.4 %**
- Nuclear **21.9 %**
- Cogeneration and other **10.4 %**
- Hydro (1) **15.4 %**
- Wind **20.4 %**
- Solar photovoltaic **3.1 %**
- Solar thermoelectric **2.0 %**
- Renewable thermal **1.9 %**

(1) Pumped storage not included.

Maximum peak power demand coverage 38,666 MW

4 February 2014 (8:00-9:00 pm)



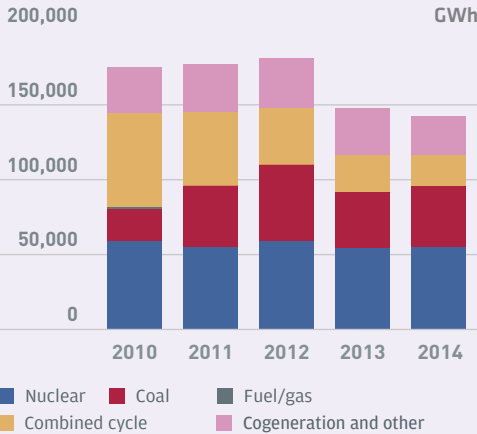
- Combined cycle **7.0 %**
- Coal **2.5 %**
- Nuclear **18.9 %**
- Cogeneration and other **10.8 %**
- Importer balance regarding international exchanges **0.6 %**
- Hydro (1) **24.0 %**
- Wind **34.5 %**
- Solar photovoltaic **0.1 %**
- Solar thermoelectric **0.1 %**
- Renewable thermal **1.5 %**

(1) Pumped storage not included.

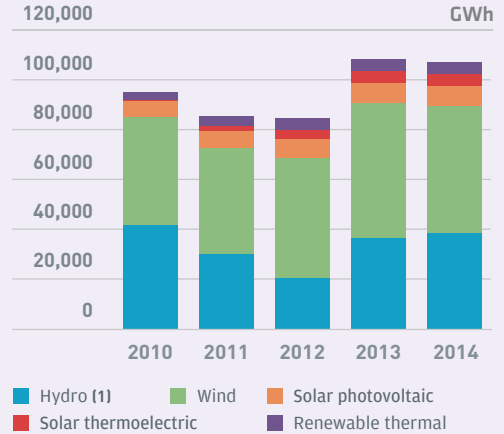
[2] PENINSULAR SYSTEM

2.1 Demand

Evolution of production from non-renewable energy sources

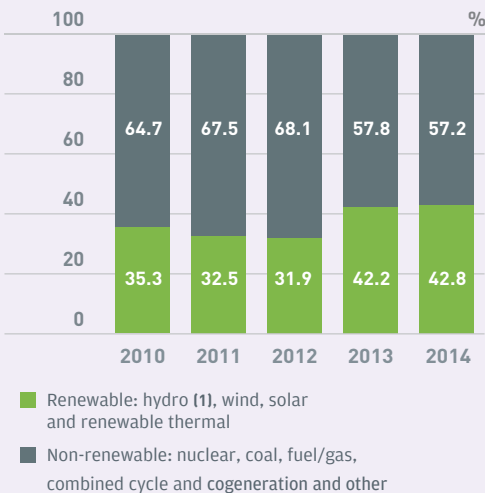


Evolution of production from renewable energy sources

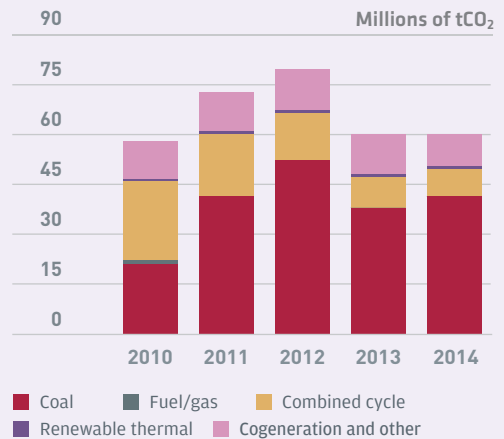


(1) Pumped storage not included.

Evolution of renewable and non-renewable generation



Evolution of CO₂ emissions associated to electricity generation on the peninsula



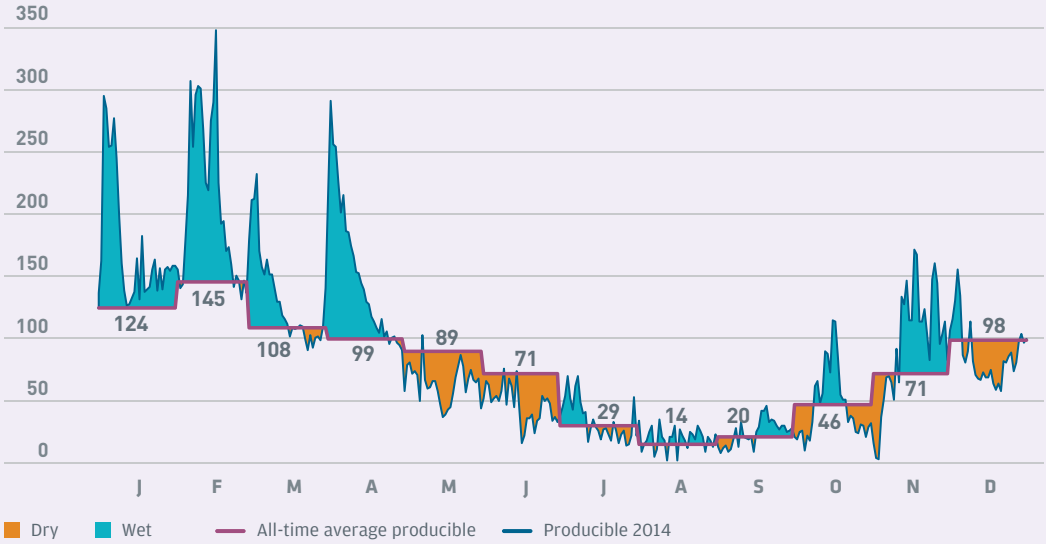
(1) Pumped storage not included.

PENINSULAR SYSTEM 2.2 Hydroelectric energy

[2]

Daily producible hydroelectric energy compared with the all-time average producible

GWh



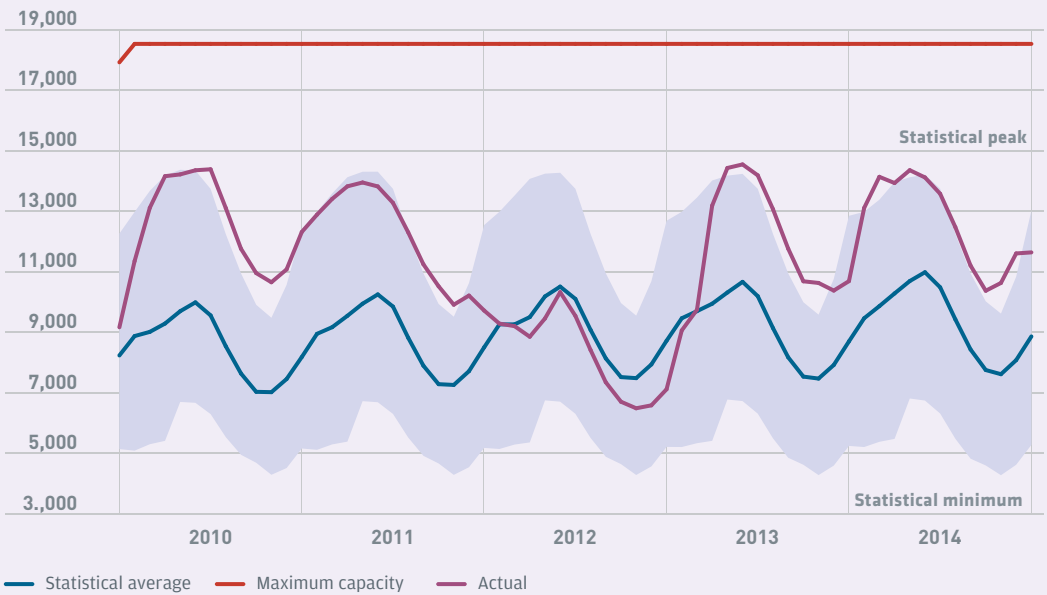
Annual producible hydroelectric energy

Year	GWh	Index	Probability of being exceeded (%)
2010	36,174	1.29	16
2011	22,506	0.81	74
2012	12,722	0.46	100
2013	32,631	1.18	25
2014	32,655	1.18	25

[2] PENINSULAR SYSTEM 2.2 Hydroelectric energy

Evolution of hydroelectric reserves

GWh



Statistical maximum and minimum: average of the maximum and minimum values of the last 20 years.

Hydroelectric reserves as at 31 December

	Capacity	2013		2014	
		GWh	% of maximum capacity	GWh	% of maximum capacity
Annual regime	8,967	4,658	51.9	5,460	60.9
Hyperannual	9,571	6,009	62.8	6,161	64.4
Overall	18,538	10,667	57.5	11,621	62.7

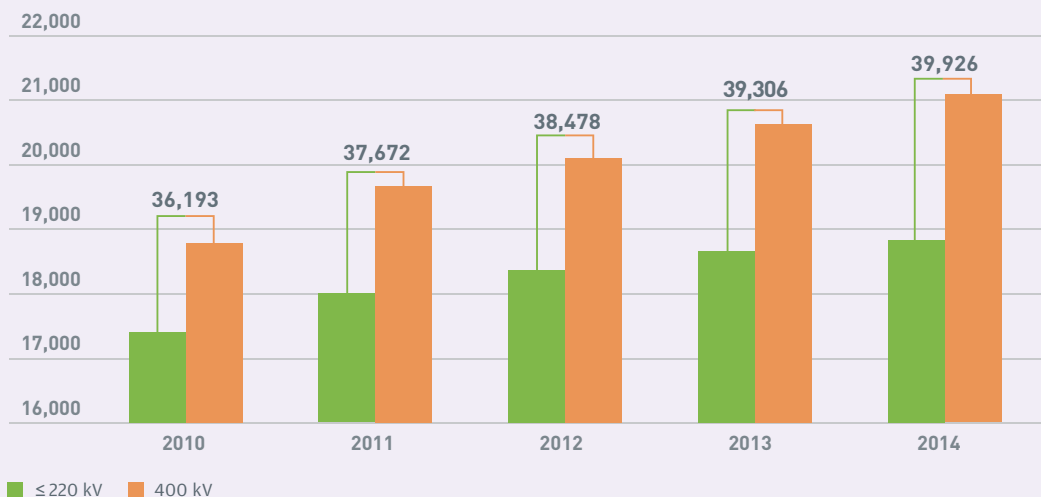
PENINSULAR SYSTEM

2.3 Transmission grid infrastructure

[2]

Evolution of the transmission grid

km



Evolution of the transmission system and transformer capacity

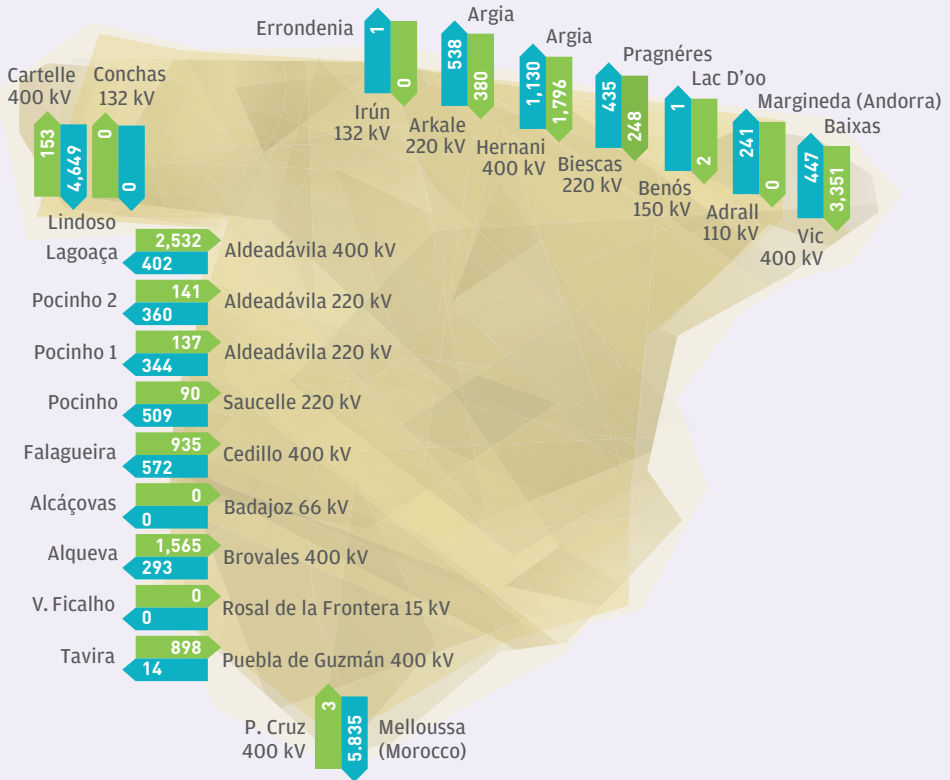
	2010	2011	2012	2013	2014
Km of 400 kV circuit	18,792	19,671	20,109	20,639	21,094
Km of ≤ 220 kV circuit	17,401	18,001	18,370	18,667	18,832
Transformer capacity (MVA)	66,596	68,996	74,596	76,871	79,871

[2] PENINSULAR SYSTEM

2.4 International exchanges

Map of international physical energy exchanges

GWh



Balance of international physical energy exchanges

GWh

	France	Portugal	Andorra	Morocco	Total
2010	-1,531	-2,634	-264	-3,903	-8,333
2011	1,524	-2,814	-306	-4,495	-6,090
2012	1,883	-7,897	-286	-4,900	-11,200
2013	1,708	-2,777	-287	-5,376	-6,732
2014	3,224	-694	-241	-5,832	-3,543

Positive value: import balance; negative value: export balance.

NON-PENINSULAR SYSTEMS

3.1 Demand

3

Electrical energy balance (1)

	Balearic Islands		Canary Islands		Ceuta		Melilla	
	GWh	14/13 %	GWh	14/13 %	GWh	14/13 %	GWh	14/13 %
Hydro	-	-	-	-	-	-	-	-
Coal	2,405	-7.2	-	-	-	-	-	-
Diesel engines	692	-9.8	2,260	3.2	231	4.7	214	-0.5
Gas turbines	601	14.3	364	-4.3	0.1	-67.7	0.8	731.7
Steam turbines	-	-	2,250	-16.6	-	-	-	-
Fuel/gas	1,292	0.0	4,874	-7.5	231	4.7	215	-0.2
Combined cycle (2)	461	3.2	3,429	9.4	-	-	-	-
Auxiliary generation (3)	8	11.5	-	-	-	-	-	-
Consumption in generation (4)	-287	-8.2	-422	-3.5	-18	-3.3	-14	-1.2
Wind-hydro	-	-	1	-	-	-	-	-
Other hydro	-	-	3	14.5	-	-	-	-
Wind	5	-14.2	401	10.6	-	-	-	-
Solar photovoltaic	125	2.6	285	-0.8	-	-	0.1	-22.2
Renewable thermal	2	161.4	8	-1.5	-	-	-	-
Cogeneration and other	274	9.1	-	-	-	-	9	10.4
Net production	4,286	-2.7	8,579	-0.5	213	5.4	210	0.3
Peninsula-Balearics link (5)	1,293	1.9	-	-	-	-	-	-
Demand (b.c.-at power station busbars)	5,579	-1.7	8,579	-0.5	213	5.4	210	0.3

(1) Allocation of generation units based on primary fuel. (2) Uses fuel oil and diesel as primary fuel. Includes operation in open cycle mode. (3) Emergency generators installed temporarily in specific zones to cover a deficit in generation. (4) Consumption in generation corresponding to hydro, coal, fuel+gas, combined cycle and auxiliary production. (5) Positive value: incoming energy; negative value: outgoing energy.

Installed power capacity as at 31 December

	Balearic Islands		Canary Islands		Ceuta		Melilla	
	MW	14/13 %	MW	14/13 %	MW	14/13 %	MW	14/13 %
Hydro	-	-	1	0,0	-	-	-	-
Coal	510	0.0	-	-	-	-	-	-
Diesel engines	199	0.0	566	0.0	83	0.0	70	0.0
Gas turbines	678	0.0	639	0.0	16	0.0	15	0.0
Steam turbines	-	-	713	0.0	-	-	-	-
Fuel/gas	877	0.0	1,918	0.0	99	0.0	85	0.0
Combined cycle (1)	934	0.0	920	0.0	-	-	-	-
Auxiliary generation (2)	0	-	0	-	-	-	-	-
Wind-hydro	-	-	12	-	-	-	-	-
Other hydro	-	-	0,5	0.0	-	-	-	-
Wind	4	0.0	154	0.0	-	-	-	-
Solar photovoltaic	78	0.1	166	0.6	-	-	0,1	0.0
Renewable thermal	2	0.0	3	0.0	-	-	-	-
Cogeneration and other	86	0.0	33	0.0	-	-	2	0.0
Total	2,490	0.0	3,208	0.4	99	0.0	87	0.0

(1) Includes operation in open cycle mode. (2) Emergency generators installed temporarily in specific zones to cover a deficit in generation.

Source: National Commission for Markets and Competition (CNMC) on data regarding power of other hydro, wind, solar photovoltaic, renewable thermal, cogeneration and other.

[3]

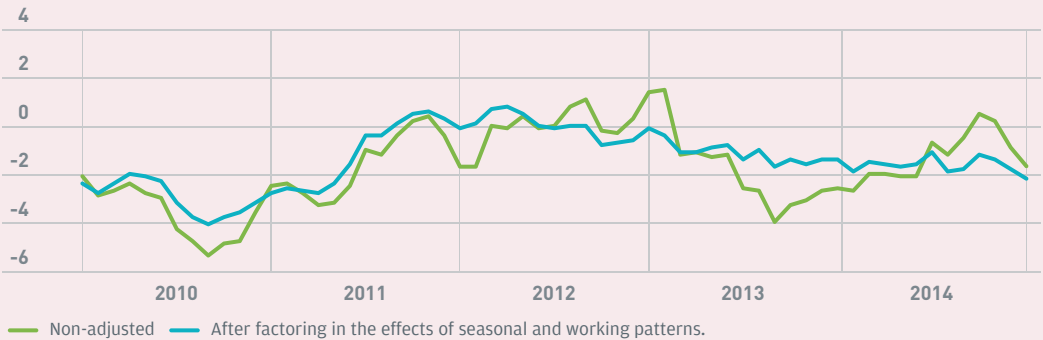
NON-PENINSULAR SYSTEMS 3.1 Demand

Evolution of demand

	Balearic Islands		Canary Islands		Ceuta		Melilla	
	GWh	Δ Annual (%)	GWh	Δ Annual (%)	GWh	Δ Annual (%)	GWh	Δ Annual (%)
2010	5,840	-2.5	8,895	-2.3	218	2.8	213	3.6
2011	5,743	-1.7	8,870	-0.3	203	-6.7	215	0.7
2012	5,823	1.4	8,893	0.3	212	4.5	217	1.1
2013	5,674	-2.6	8,624	-3.0	202	-4.8	210	-3.5
2014	5,579	-1.7	8,579	-0.5	213	5.4	210	0.3

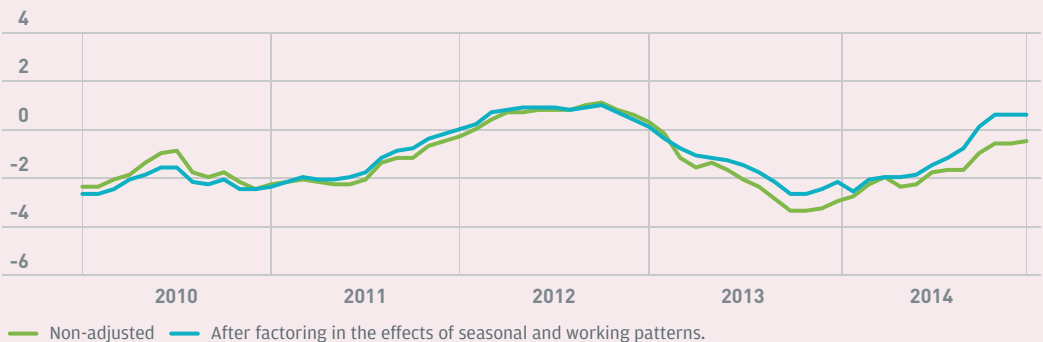
Annual demand growth: Balearic Islands (rolling year)

%



Annual demand growth: Canary Islands (rolling year)

%



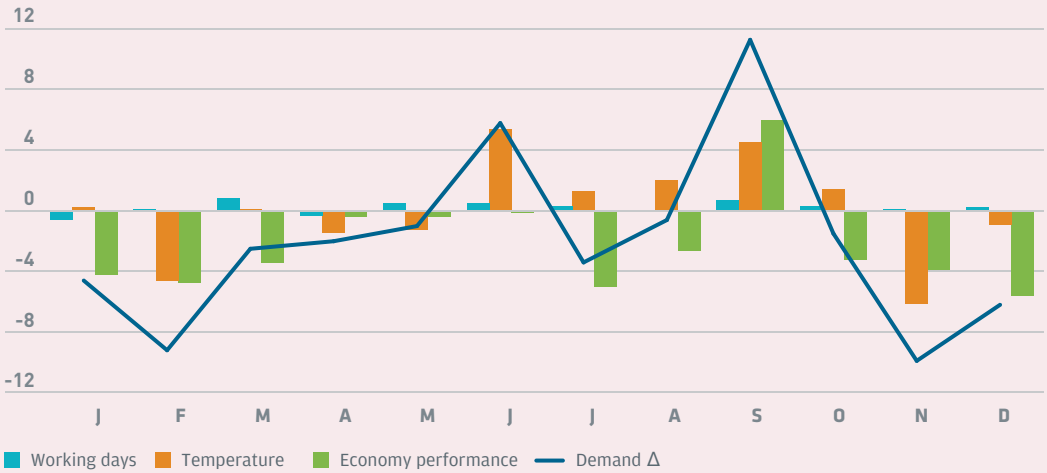
NON-PENINSULAR SYSTEMS

3.1 Demand

[3]

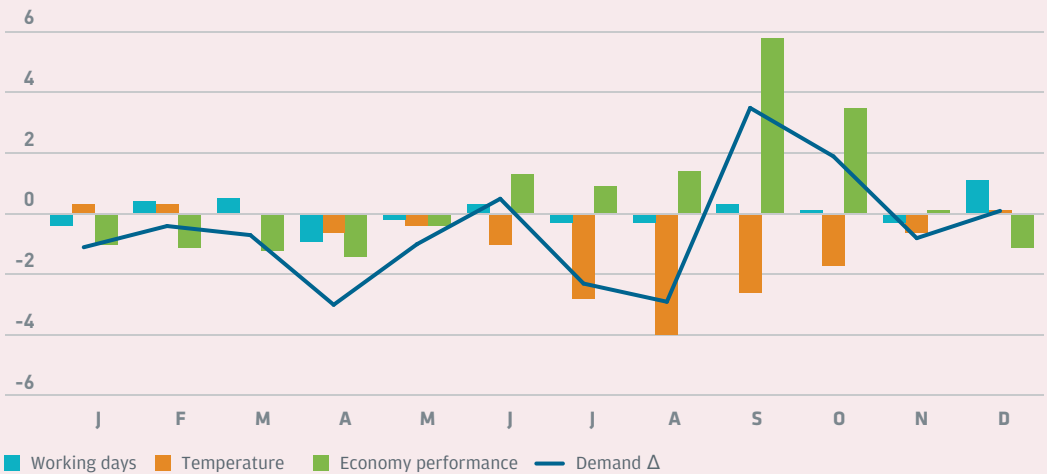
Components of the monthly demand growth: Balearic Islands

%



Components of the monthly demand growth: Canary Islands

%



[3] NON-PENINSULAR SYSTEMS

3.1 Demand

Monthly demand growth

%

	J	F	M	A	M	J	J	A	S	O	N	D
Balearic Islands	-4.6	-9.2	-2.5	-2.0	-1.0	5.8	-3.4	-0.6	11.3	-1.5	-9.9	-6.2
Canary Islands	-1.1	-0.4	-0.7	-3.0	-1.0	0.5	-2.3	-2.9	3.5	1.9	-0.7	0.1
Ceuta	5.0	10.7	15.1	1.5	8.8	9.8	2.3	-1.7	6.9	7.4	3.1	-1.2
Melilla	0.6	-0.5	3.6	-1.0	-0.6	3.8	-0.2	-2.6	2.3	-0.6	2.0	-2.8

Variations as compared to same month of previous year.

Maximum hourly and daily demand

Hourly demand (MWh)

877	2 October (8:00-9:00 pm)
1,150	11 August (21-22 h)
1,365	23 October (8:00-9:00 pm)
1,322	16 September (8:00-9:00 pm)
37	21 January (8:00-9:00 pm)
37	1 September (1:00-2:00 pm)
35	29 January (8:00-9:00 pm)
38	29 August (1:00-2:00 pm)

Daily demand (MWh)

Balearic Islands	1 October	16,477
	11 August	23,145
Canary Islands	28 October	26,411
	16 September	26,091
Ceuta	15 December	679
	1 September	671
Melilla	4 diciembre	632
	29 August	728

■ Winter (January-May/October-December)

■ Summer (June-September)

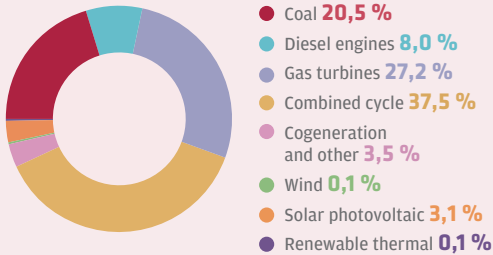
NON-PENINSULAR SYSTEMS

3.1 Demand

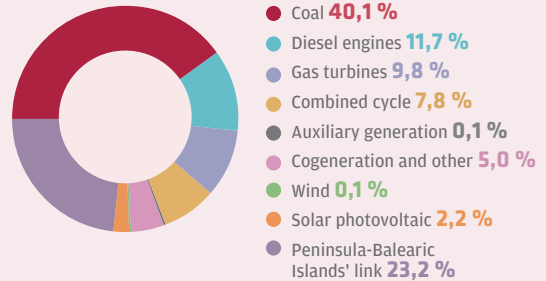
[3]

BALEARIC ISLANDS

Installed power capacity as at 31 December 2014 (2,490 MW)

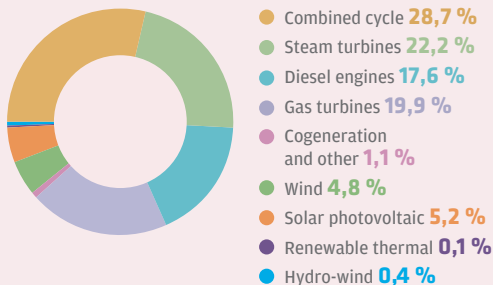


Demand coverage

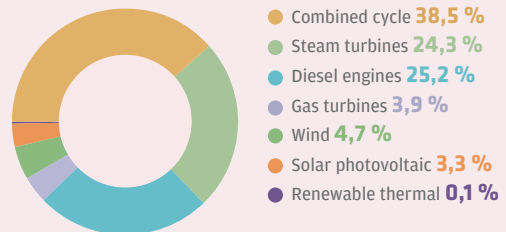


CANARY ISLANDS

Installed power capacity as at 31 December 2014 (3,208 MW)



Demand coverage



[3] NON-PENINSULAR SYSTEMS

3.2 Transmission grid infrastructure

Evolution of the transmission system and transformer capacity

		2010	2011	2012	2013	2014
Km of 220 kV circuit	Balearic Islands	185	430	430	430	431
	Canary Islands	163	163	163	163	163
	Total	348	594	594	594	595
Km of 132 kV circuit	Balearic Islands	206	220	220	220	220
	Canary Islands	-	-	-	-	-
	Total	206	220	220	220	220
Km of < 132 kV circuit	Balearic Islands	890	890	893	893	894
	Canary Islands	1,126	1,126	1,126	1,126	1,126
	Total	2,015	2,016	2,019	2,019	2,019
Transformer Capacity (MVA)	Balearic Islands	1,998	2,248	2,408	2,748	2,908
	Canary Islands	1,625	1,625	1,625	1,625	2,000
	Total	3,623	3,873	4,033	4,373	4,908





TERMINOLOGY INDEX



Closed-cycle pumped storage. Production of electrical energy carried out by the hydroelectric power stations whose higher elevation reservoir does not receive any type of natural contributions of water, but uses water solely from the lower elevation reservoir.

Consumption in generation. Energy used by the auxiliary elements of power stations, necessary for the everyday functioning of the production facilities.

Hydroelectric reserves. The hydroelectric reserve of a reservoir is the quantity of electricity that could be produced in its own power station and in all the power stations situated downstream, with the total drainage of its current useable water reserves and providing that drainage occurs without natural contributions. The annual regime reservoirs are those in which complete drainage would take place in less than one year. Hyperannual regime reservoirs are those in which the total drainage time takes more than one year.

Hydro unit (UGH). Each set of hydroelectric power stations belonging to the same catchment basin and to the same individual holder.

Instantaneous power. Instantaneous power is the energy absorbed by the demand at any given moment of time.

Net generation. Production of energy measured at the generator terminals, minus the consumption in the auxiliary services and the losses in the transformers.

Non-renewable energies. Those obtained from fossil fuels (liquid or solid) and their derivatives.

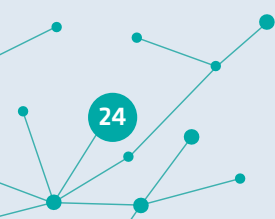
Physical electricity exchanges (Intl.) The movements of energy which have taken place via international interconnection lines during a given period of time. It includes the loop flow of energy as a consequence of the grid design.

Producible hydroelectric energy. Maximum quantity of electrical energy that theoretically could be produced considering the water supplies registered during a specific period of time and once the supplies used for irrigation or uses other than the production of electrical energy have been deducted.

Producible hydroelectric index. This is the quotient between the producible energy and the average producible energy, both related to the same period and to the same hydroelectric equipment.

Renewable energies. Those obtained from natural resources and also from both industrial and urban waste. These different types of energy sources include biogas, biomass, wind, hydroelectric, marine-hydroelectric, solar and industrial/urban residues.

Transmission grid. The complete set of lines, switchyards/facilities, transformers and other electrical elements with voltages greater than or equal to 220 kV, and those other facilities, regardless of their power, which fulfil transmission functions, international interconnections and the interconnections with the Spanish insular and non-peninsular electricity systems.





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