THE SPANISH ELECTRICITY SYSTEM

PRELIMINARY REPORT

2019

Committed to intelligent energy

RED ELÉCTRICA DE ESPAÑA

TABLE OF CONTENTS

This preliminary report presents the **provisional** statistical data regarding the behaviour of the Spanish electricity system during 2019. Information prepared using data as at 10 January 2020.

ELECTRICITY BALANCE, INSTALLED POWER CAPACITY AND TRANSMISSION GRID

The complete set of generating facilities in Spain is increasingly renewable. During 2019 the installed power capacity of renewable origin has experienced a growth of 13.4% with the entry into operation of almost 6,500 new "green" MWs. As a result, renewable energy already represents 50% of the total generation capacity installed in Spain.

After 4 consecutive years of continued growth, electricity demand in Spain in 2019 was slightly lower than that of the previous year.

264,550 GWh
NATIONAL DEMAND 2019

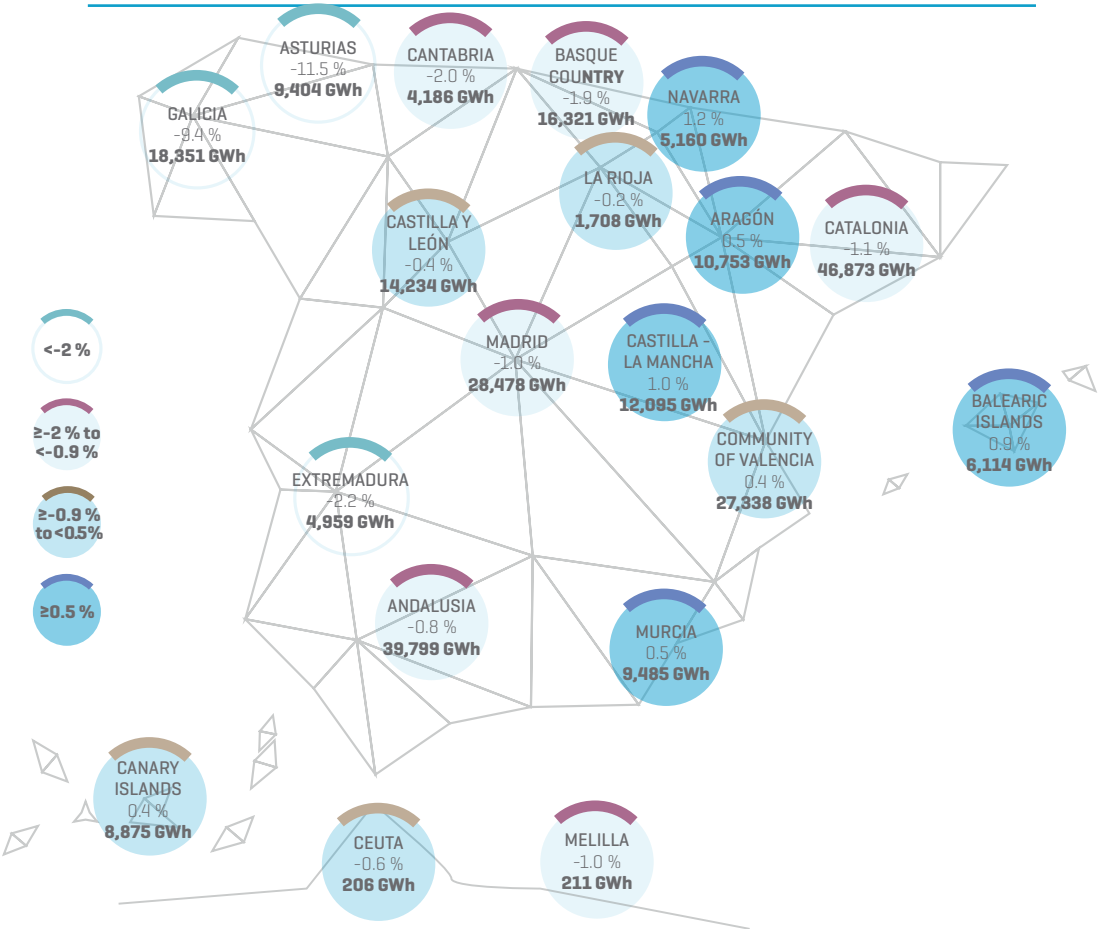
-1.6 %
COMPARED TO 2018

Demand for electricity in Spain has suffered a slight setback after continued growth over the previous four years. Specifically, demand in 2019 reached 264,550 GWh, 1.6% less than in 2018.

Regarding generation, noteworthy is the strong decrease in the share of coal in the generation mix, which dropped 66% in 2019. In terms of international exchanges, imports exceeded exports by 6,862 GWh.

Coal closed 2019 registering the lowest level ever regarding its contribution to the national generation structure.

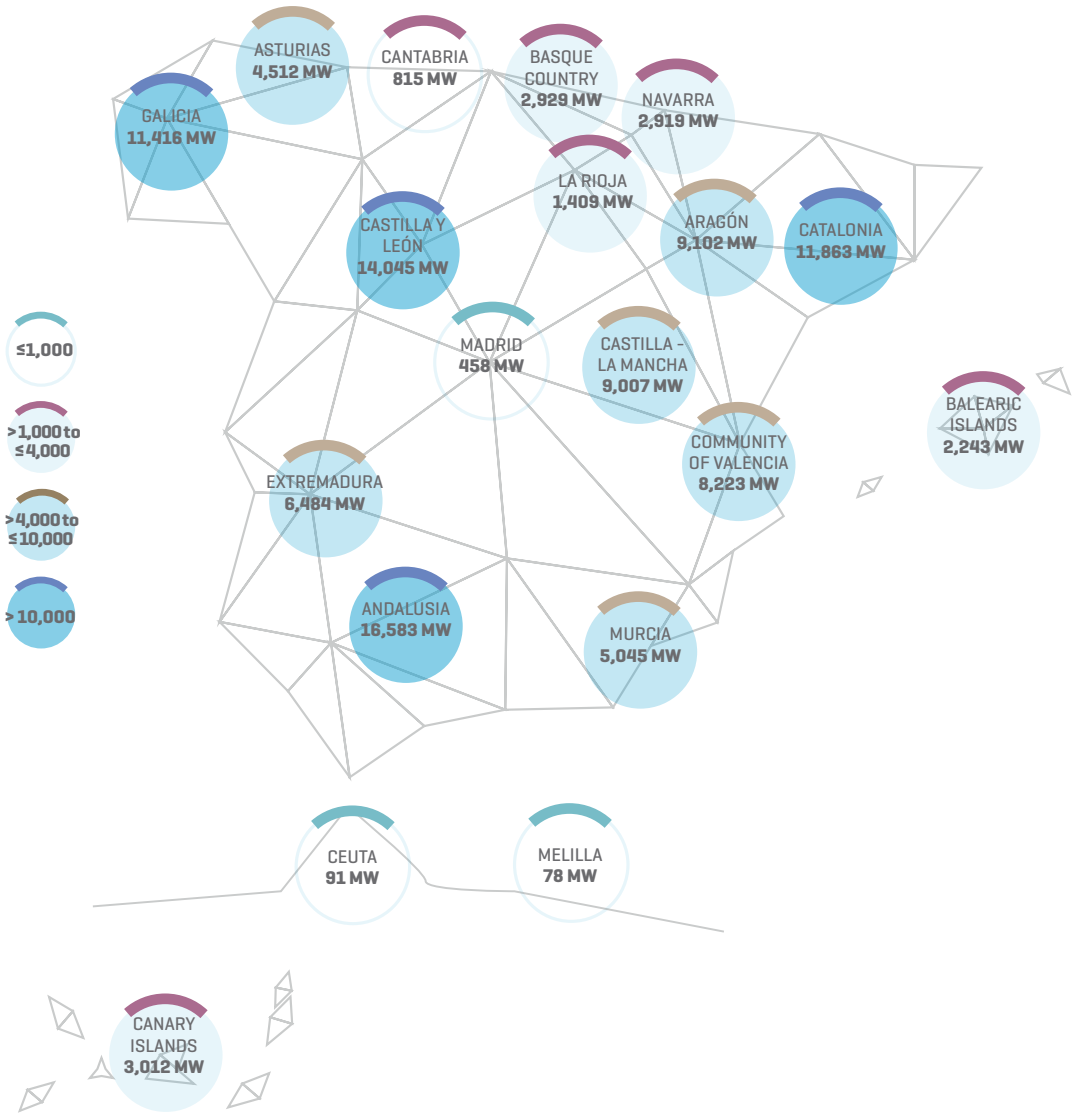
Electricity demand by autonomous community and its variation with respect to the previous year GWh and %



In 2019, the installed power capacity of **the complete set of generating facilities in Spain** grew for the second consecutive year, closing the year at 110,226 MW, a value that is 5.9% more than the previous year, mainly due to an increase of 13.4% in installed renewable power capacity.

Noteworthy is the increase in solar photovoltaic power capacity, which in 2019 grew 88.3% with regard to 2018 values.

Installed power capacity by autonomous community ***MW***



TRANSMISSION GRID

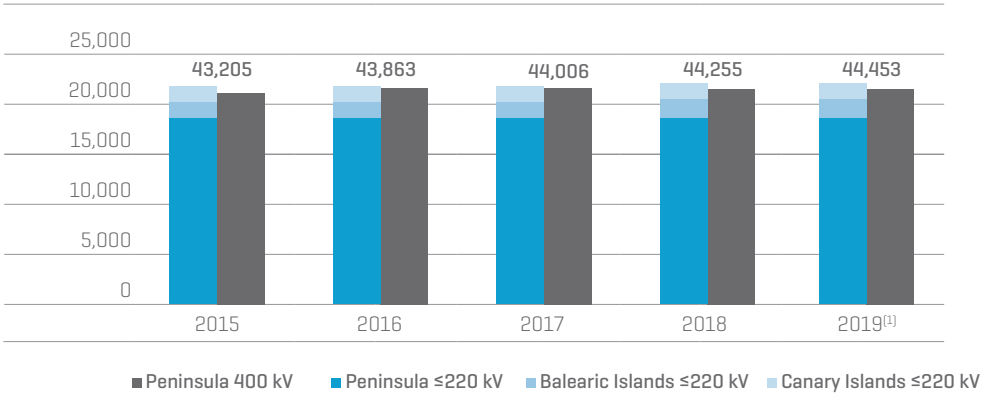
198

KM OF NEW CIRCUIT COMMISSIONED IN 2019

According to provisional data, the development of the electricity transmission grid in Spain during 2019 registered an increase of 198 km of new circuit and 1,355 MVA of new transformer capacity which together help bolster the reliability of the transmission grid and the degree of grid meshing in order to guarantee security of supply.

Evolution of the electricity transmission grid in Spain

km of circuit



Provisional data pending audit (currently in progress).
(1) Cumulative figures regarding kilometres of circuit as at 31 December of each year. Includes the transmission grid assets of those utility companies whose electricity distribution facilities are considered as an integral part of the overall transmission grid infrastructure nationwide.

Electricity transmission grid facilities in Spain

	400 kV	≤ 220 kV			
	Peninsula	**Peninsula**	**Balearic Islands**	**Canary Islands**	**Total**
Total circuit (km)	**21,736**	**19,295**	**1,873**	**1,549**	**44,453**
Overhead lines (km)	21,619	18,545	1,141	1,235	42,541
Submarine cable (km)	29	236	540	30	835
Underground cable (km)	88	513	192	283	1,077
Transformer capacity (MVA)	**84,864**	**1,563**	**3,838**	**3,470**	**93,735**

Provisional data pending audit (currently in progress).
(1) Cumulative figures regarding kilometres of circuit as at 31 December of each year. Includes the transmission grid assets of those utility companies whose electricity distribution facilities are considered as an integral part of the overall transmission grid infrastructure nationwide.

PENINSULAR SYSTEM

Regarding demand coverage, noteworthy is the strong increase in the contribution of the combined cycles and the continued decrease in coal-fired generation. For its part, nuclear followed by wind have been the technologies that have contributed most to meeting this coverage.

Electricity demand on the Spanish Peninsula suffers a setback after 4 years showing a positive trend. Around 39% of total generation has been obtained using renewable energy technologies.

249,144
GWh
PENINSULAR DEMAND 2019

39 %
OF TOTAL GENERATION IN THE PENINSULAR SYSTEM WAS RENEWABLE

Evolution of electricity demand on the spanish peninsula

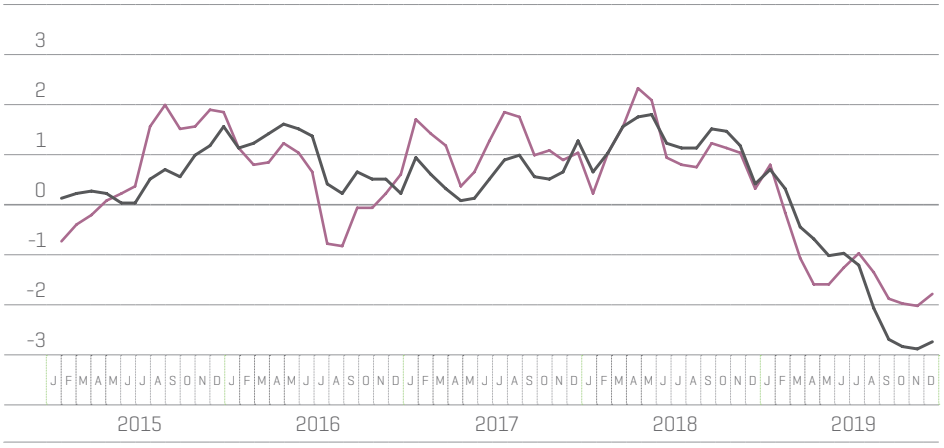
	Demand (measured at power station busbars)		Components (%)		
	GWh	Δ Annual (%)	Working days	Temperature	Adjusted
2015	247,970	2.0	-0.1	0.4	1.7
2016	249,680	0.7	0.3	0.1	0.3
2017	252,506	1.1	-0.1	-0.2	1.4
2018	253,566	0.4	-0.3	0.2	0.5
2019	**249,144**	**-1.7**	**0.7**	**0.2**	**-2.7**

Monthly variation in peninsular electricity demand. 2019 %

	Monthly	Cumulative		Monthly	Cumulative
January	3.1	3.1	July	2.3	-1.5
February	-5.3	-1.0	August	-3.7	-1.8
March	-6.1	-2.7	September	-3.9	-2.0
April	-2.1	-2.5	October	-0.8	-1.9
May	-0.9	-2.2	November	-0.5	-1.8
June	-1.8	-2.2	December	-1.5	-1.7

Variation with respect to the same month the previous year.

Annual variation in peninsular electricity demand. Rolling year %



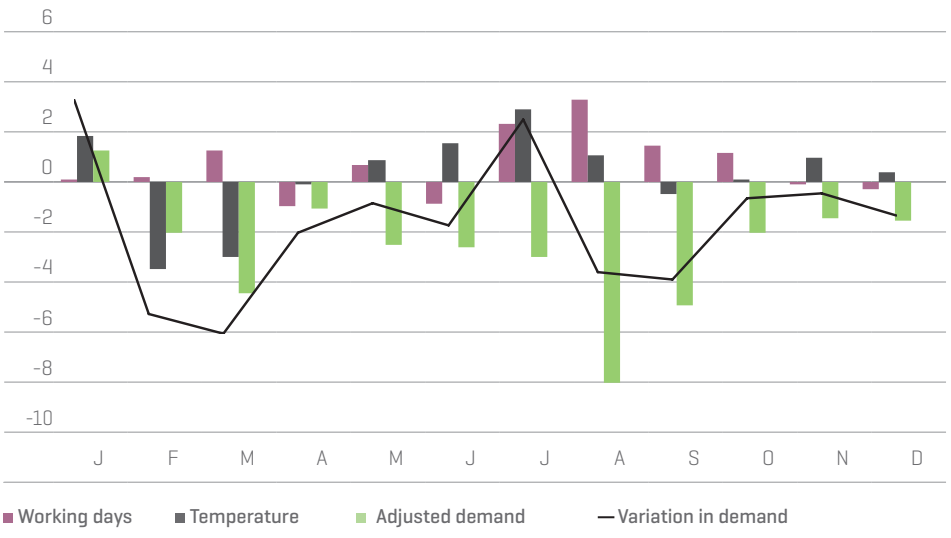
Peninsular electricity demand, according to provisional data, closed 2019 at 249,144 GWh, a fall of 1.7% compared to the previous year. After factoring in the influence of seasonal patterns and working days, the annual variation rate of the demand is estimated at -2.7%.

249,144
GWh
PENINSULAR DEMAND
2019

-1.7 %
COMPARED TO
2018

Temperatures have had an impact of 0.2% on the evolution of consumption.

Components of the monthly variation in peninsular electricity demand. 2019 %



The **Red Eléctrica Index** (IRE) is an electricity consumption indicator whose objective is to provide in advance the data regarding the evolution of the demand of large power consumers. In 2019, the composition of the working calendar had a positive impact of 0.1 percentage points on the evolution of the IRE, while temperature levels increased the evolution of the IRE by 0.3%. After having factored in the influence of both elements, the general index decreased by 4.6% year-on-year, a figure which represents the second negative variation of the index since 2013.

By sector, the industrial sector showed a downward trend, closing the year with a percentage of -6.3%, compared to the adjusted decrease of -2.5% in 2018, while the services sector showed an adjusted variation of -0.4%, compared to the adjusted growth of 0.6% in 2018.

-4.6 %

IRE (ADJUSTED DEMAND OF LARGE POWER CONSUMERS)

IRE: 2019 variation breakdown *%*

	Gross	Working days	Temperature	Adjusted
General	**-4.2**	**0.1**	**0.3**	**-4.6**
Industrial	-6.0	0.1	0.2	-6.3
Services	-0.2	0.1	0.1	-0.4
Other	-1.2	0.0	0.7	-1.9

Monthly evolution of the adjusted ire. Rolling year *%*

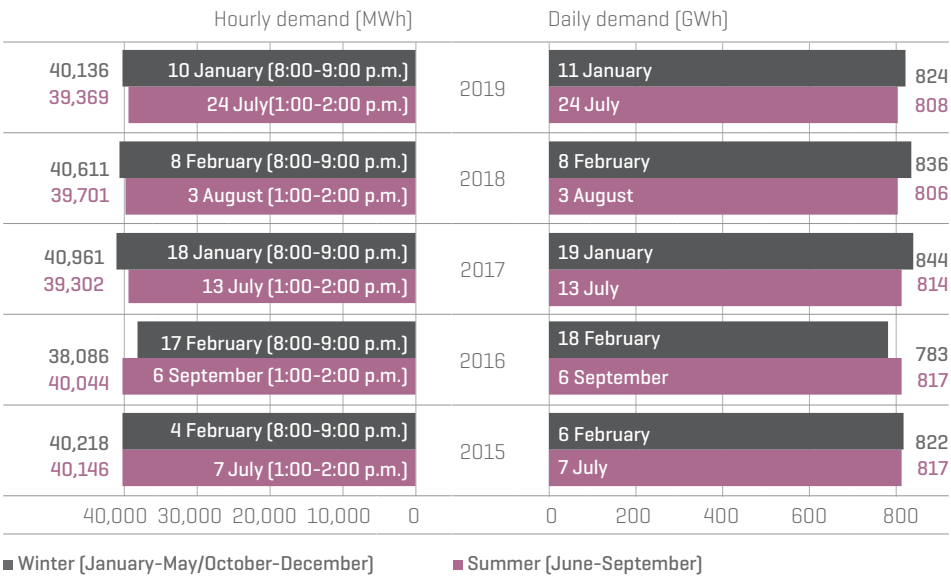
The maximum **instantaneous power**, at the time of drafting this report, was recorded on 22 January at 8:08 p.m. when it reached 40,455 MW, a value 1.2% lower than the previous year's maximum recorded in February, but still far from the all-time record of 45,450 MW set in December 2007. The maximum hourly demand was registered on 10 January between 8:00 and 9:00 p.m., when it reached 40,136 MWh, a value 1.2% lower than the maximum for 2018.

40,455 MW
MAXIMUM INSTANTANEOUS POWER

22 JANUARY
8:08 P.M.

-1.2 %
COMPARED TO THE MAXIMUM OF 2018

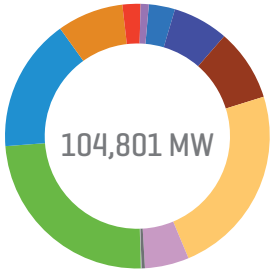
Maximum annual peninsular demand values



Regarding **demand coverage**, the most noteworthy was the increase in the contribution of combined cycle (20.1% compared to 10.2% the previous year) and the decrease in the contribution of coal (4.2% compared to 13.5% in 2018). As for the technologies that have contributed most to demand coverage, nuclear has again ranked first with a contribution of 22%, followed by wind with 20.9%. It should also be noted that close to 2.7% of the demand was covered by energy imported from other countries.

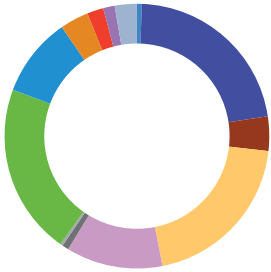
Installed power capacity on the peninsula as at 31 december 2019 %

Nuclear	6.8 %	Wind	24.1 %
Coal	8.8 %	Hydro	16.3 %
Combined cycle	23.4 %	Solar photovoltaic	8.2 %
Cogeneration	5.5 %	Solar thermal	2.2 %
Non-renewable waste	0.4 %	Other renewables	1.0 %
Pumped-storage	3.2 %	Renewable waste	0.1 %



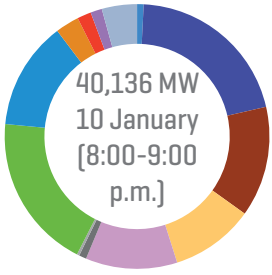
Electricity demand coverage on the peninsula. 2019 %

Nuclear	22.0 %	Wind	20.9 %
Coal	4.2 %	Hydro	9.7 %
Combined cycle	20.1 %	Solar photovoltaic	3.5 %
Cogeneration	11.8 %	Solar thermal	2.0 %
Non-renewable waste	0.8 %	Other renewables	1.4 %
Pumped-storage [1]	0.6 %	Renewable waste	0.3 %
		Import balance of international exchanges	2.7 %



Electricity demand coverage. Maximum hourly demand coverage on the peninsula. 2019 %

Nuclear	17.6 %	Wind	25.2 %
Coal	11.0 %	Hydro	14.6 %
Combined cycle	14.4 %	Solar thermal	0.1 %
Cogeneration	9.7 %	Other renewables	1.1 %
Non-renewable waste	0.7 %	Renewable waste	0.2 %
Pumped-storage [1]	3.1 %	Import balance of international exchanges	2.3 %



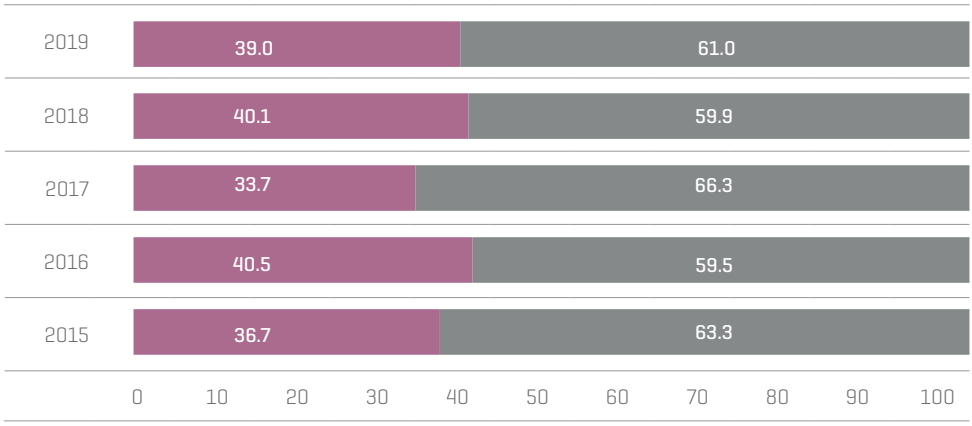
(1) Pure pumped storage + estimated mixed pumped storage,

39 %

SHARE OF RENEWABLES IN THE TOTAL ELECTRICITY GENERATION

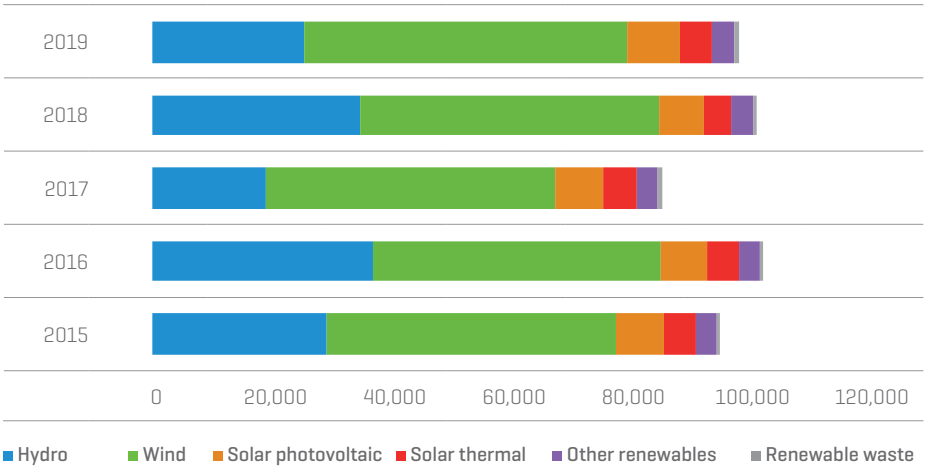
Renewable energy decreased its share to 39% in the overall annual electricity generation, compared to 40.1% the previous year. This decrease was due mainly to a lower contribution of hydro (-27.6% compared to 2018). On the other hand, wind energy grew 8.4%, helping it maintain its ranking as the second source of electricity generation in 2019.

Evolution of renewable and non-renewable peninsular electricity generation (%)

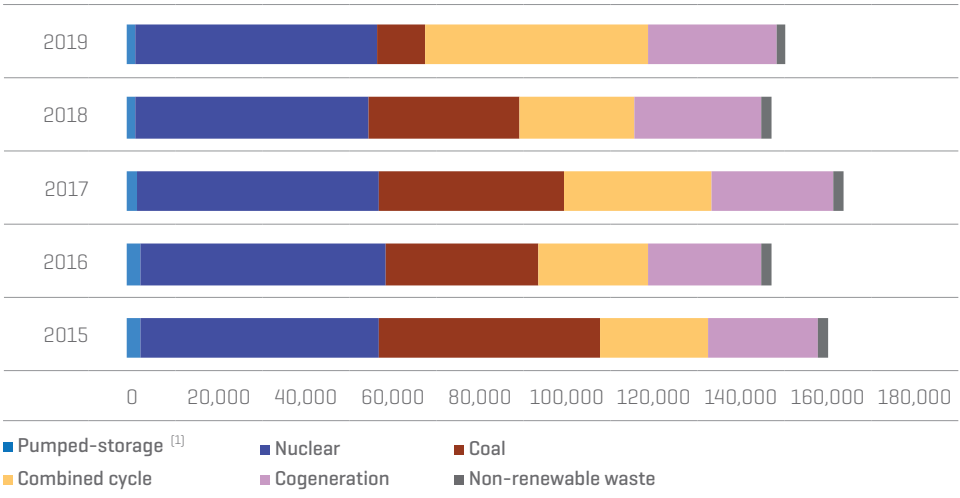


Renewable: hydro, wind, solar photovoltaic, solar thermal, other renewable and renewable waste.
Non-renewable: pumped storage, nuclear, coal, fuel/gas, combined cycle, cogeneration and non-renewable waste.

Evolution of renewable electricity generation on the peninsula *GWh*



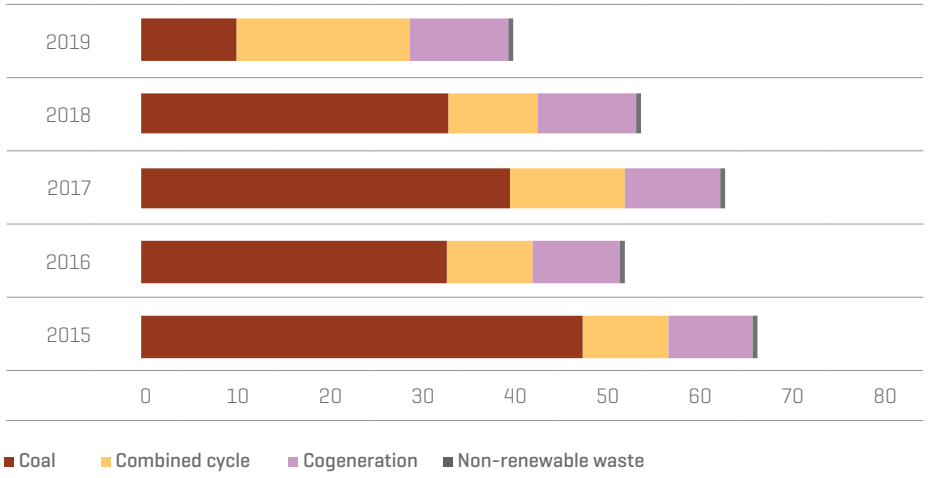
Evolution of non-renewable electricity generation on the peninsula *GWh*



(1) Pure pumped storage + estimated mixed pumped storage.

CO_2 emissions derived from electricity generation decrease thanks to the lower generation volume from coal-fired stations.

Evolution of CO_2 emissions associated with electricity generation on the peninsula *Million tCO_2*



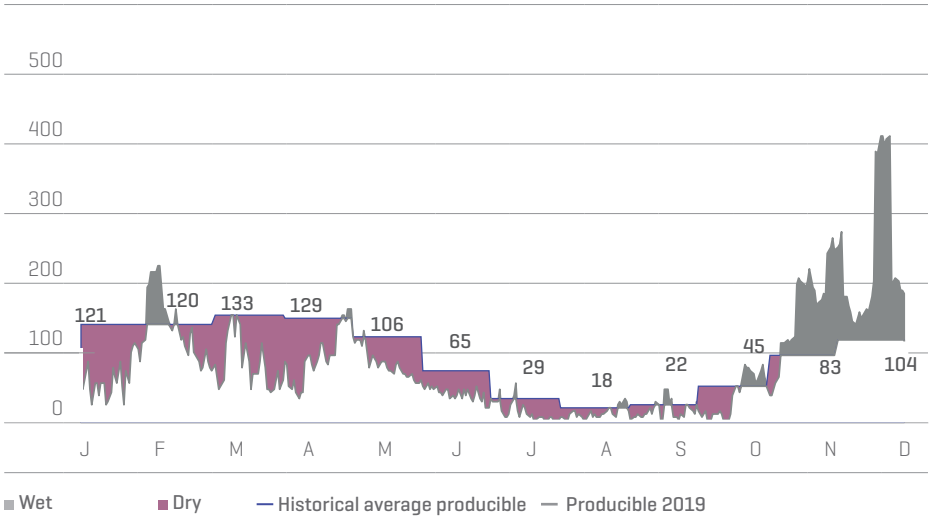
According to provisional data, producible hydroelectric registered a value of 25,971 GWh, a value 0.9% higher than the historical average value and 30.6% lower than that registered in 2018. Hydroelectric reserves of the complete set of reservoirs closed 2019 with a fill level of 51% of their total capacity.

Producible hydroelectric was 30.6% lower than the value registered in 2018.

Producible hydroelectric energy on the peninsula

	GWh	Index	Probability of being exceeded (%)
2015	25,141	0.8	79.0
2016	34,667	1.1	37.3
2017	15,972	0.5	99.3
2018	37,403	1.3	17.2
2019	**25,971**	**0.9**	**63.8**

Daily producible hydroelectric energy on the peninsula in 2019 compared with the historical average producible GWh

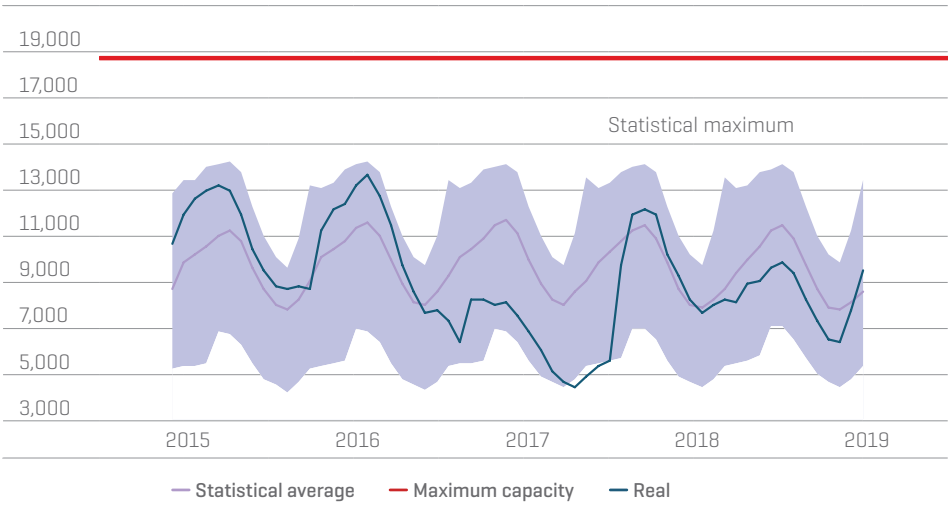


51 %
HYDROELECTRIC RESERVES

Peninsular hydroelectric reserves as at 31 december 2019

		2018		2019	
	Capacity	**GWh**	**% Fill level**	**GWh**	**% Fill level**
Annual management regime	8,967	4,717	52.6	5,895	65.7
Hyper-annual management regime	9,571	3,456	36.1	3,557	37.2
Total	**18,538**	**8,172**	**44.1**	**9,452**	**51.0**

Evolution of peninsular hydroelectric reserves *GWh*

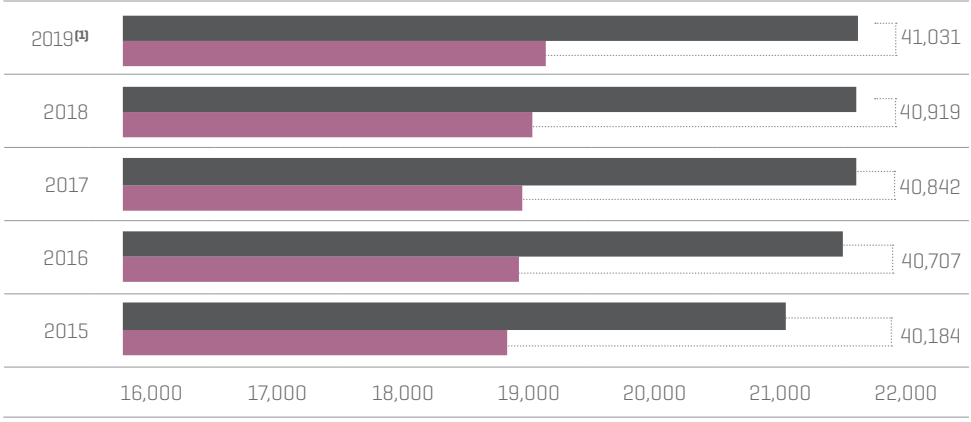


Statistical maximum and minimum: average of the maximum and minimum values of the last 20 years.

Strengthening of the transmission grid with the commissioning of new kilometres of electricity line to ensure a safe and efficient supply

According to provisional data, the peninsular electricity transmission grid registered an increase of 112 km of circuit during 2019 (10 km of 400 kV and 102 km of 220 kV), bringing the total km of circuit in the peninsular transmission grid at year-end to 41,031 km.

Evolution of the peninsular transmission grid ***km of circuit***



(1) Provisional data pending audit (currently in progress).
Cumulative figures regarding kilometres of circuit as at 31 December of each year. Includes the transmission grid assets of those utility companies whose electricity distribution facilities are considered as an integral part of the overall transmission grid infrastructure nationwide.,

Evolution of the electricity transmission grid on the peninsula

	2015	2016	2017	2018	2019 (1)
Circuit 400 kV (km)	21,181	21,616	21,725	21,727	**21,736**
Circuit ≤ 220 kV (km)	19,004	19,092	19,117	19,192	**19,295**
Transformer capacity (MVA)	82,195	82,795	83,345	85,627	**86,427**

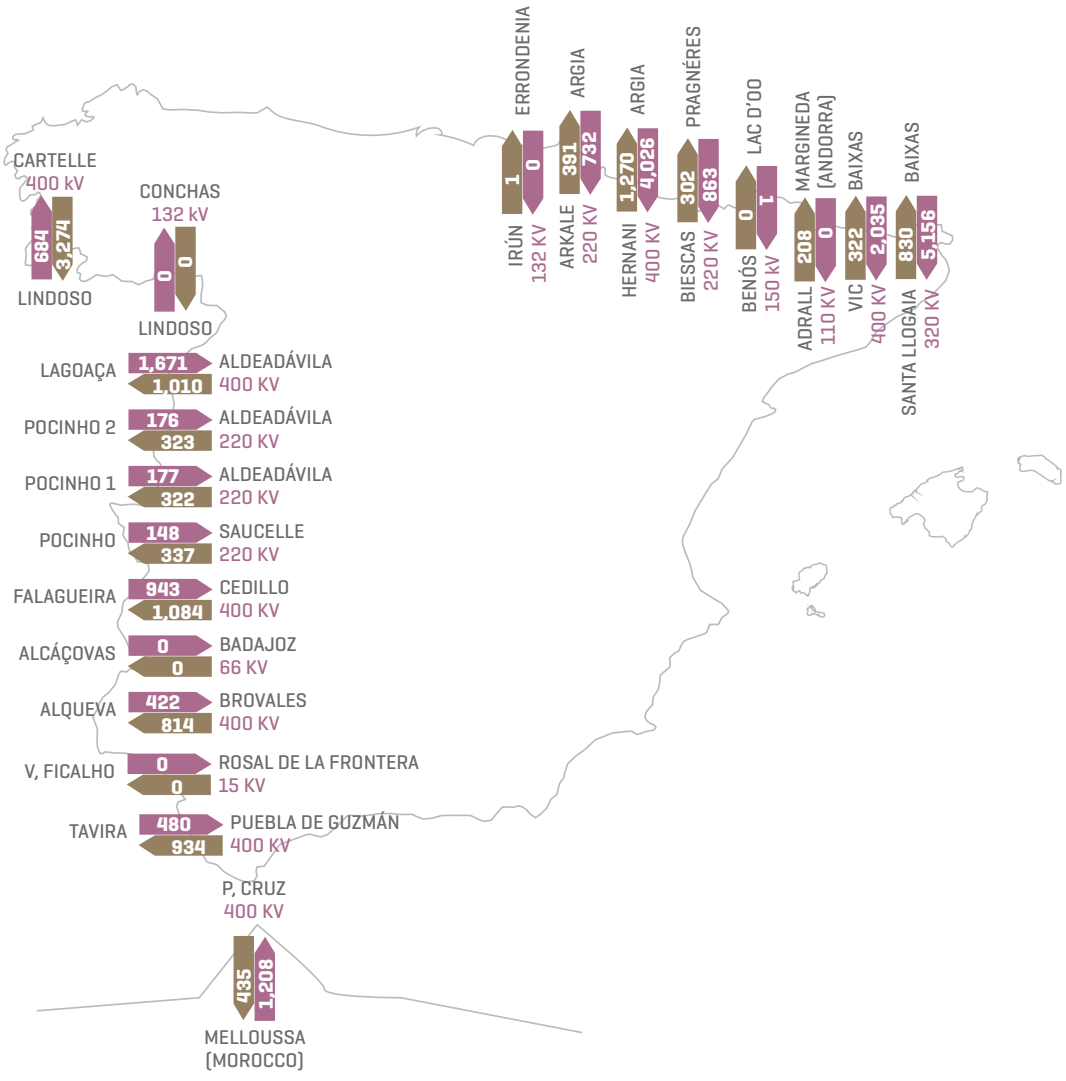
(1) Provisional data pending audit (currently in progress).
Cumulative figures regarding kilometres of circuit and transformer capacity as at 31 December of each year. Includes the transmission grid assets of those utility companies whose electricity distribution facilities are considered as an integral part of the overall transmission grid infrastructure nationwide.

Balance of international physical electrical energy exchanges *GWh*

	France	Portugal	Andorra	Morocco	Total
2015	7,324	-2,266	-264	-4,927	-133
2016	7,802	5,086	-278	-4,951	7,658
2017	12,465	2,685	-233	-5,748	9,169
2018	12,047	2,655	-210	-3,389	11,102
2019	**9,697**	**-3,399**	**-208**	**773**	**6,862**

Positive value: importer balance; Negative value: exporter balance

International physical electrical energy exchanges. 2019 *GWh*




3

NON-PENINSULAR SYSTEMS

In 2019, the energy transferred from the Peninsula, through the link with the Balearic Islands, has grown by more than 37% compared to 2018, representing 28% of the annual demand of the archipelago.

Electricity demand grew in the Balearic Islands and the Canary Islands, while they fell in Ceuta and Melilla. The electricity system of the Canary Islands covered more than 16.3% of its demand with renewables, the highest value ever registered to date, and a significant value for an isolated electricity system.

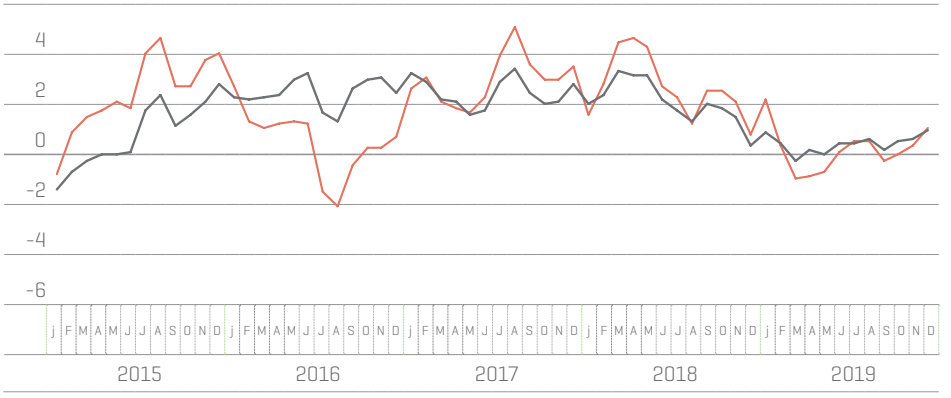
15,406
GWh
ELECTRICITY DEMAND IN NON-PENINSULAR SYSTEMS 2019

+0.6 %
COMPARED TO 2018

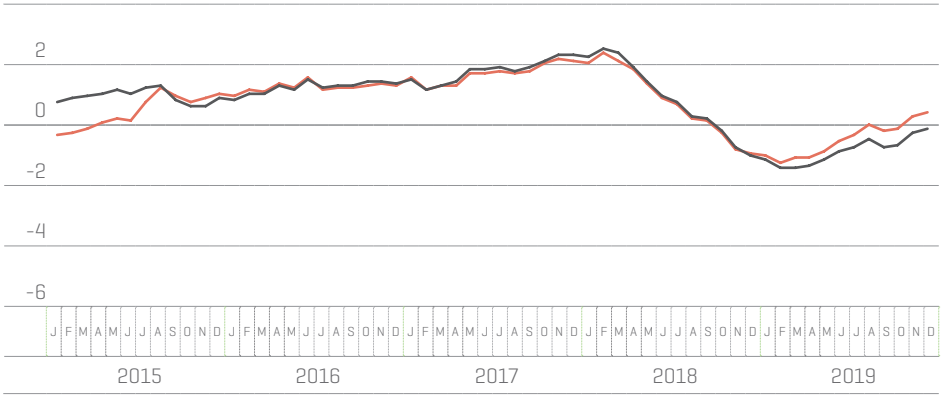
Evolution of non-peninsular electricity demand

	Balearic Islands		Canary Islands		Ceuta		Melilla	
	GWh	Δ Annual (%)	GWh	Δ Annual (%)	GWh	Δ Annual (%)	GWh	Δ Annual (%)
2015	5,788	3.8	8,633	1.0	204	-3.9	213	1.6
2016	5,823	0.6	8,744	1.3	211	3.3	208	-2.3
2017	6,016	3.3	8,931	2.1	203	-3.7	210	1.0
2018	6,057	0.7	8,842	-1.0	207	2.2	213	1.2
2019	**6,114**	**0.9**	**8,875**	**0.4**	**206**	**-0.6**	**211**	**-1.0**

Annual variation of electricity demand. Balearic islands. Rolling year %



Annual variation of electricity demand. Canary islands. Rolling year %



More than 28% of the demand of the Balearic Islands was covered by energy transferred from the Spanish Peninsula

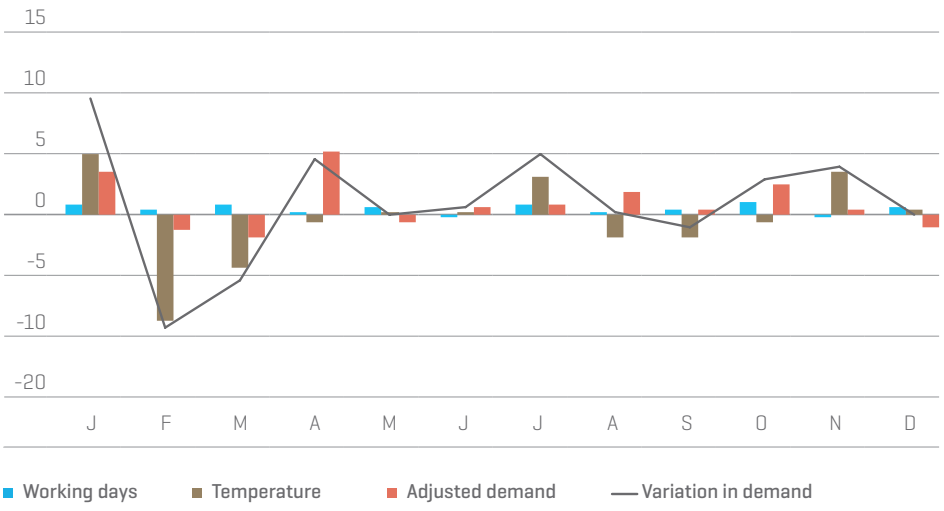
Electricity demand on the Balearic Islands closed 2019 at 6,144 GWh, representing a growth of 0.9% compared to 2018.

In 2019 the energy transferred from the Peninsula, through the link with the Balearic Islands, has grown more than 37% compared to 2018.

6,114 GWh
DEMAND ON THE BALEARIC ISLANDS 2019

+0.9 %
COMPARED TO 2018

Components of the variation in monthly electricity demand. Balearic Islands. 2019



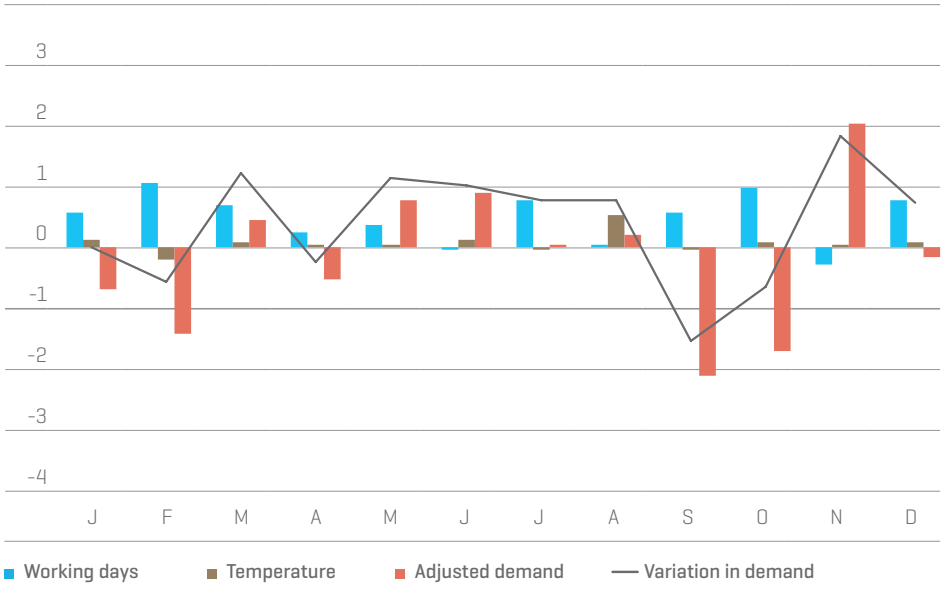
Electricity demand on the Canary Islands closed 2019 at 8,875 GWh, representing an increase of 0.4% with respect to 2018.

After factoring in the influence of seasonal patterns and working days, a negative 0.2% variation in demand is estimated.

8,875
GWh
DEMAND ON THE CANARY ISLANDS 2019

+0.4 %
COMPARED TO 2018

Components of the variation in monthly electricity demand. Canary islands. 2019



The **maximum hourly demand on the Balearic Islands** occurred on 9 August, between 1:00 and 2:00 p.m., when it reached 1,286 MWh, a value 2.2% lower than the 2018 maximum recorded on 6 August, between 1:00 and 2:00 p.m.

The **maximum hourly demand in the Canary Islands** was recorded on 2 October, between 8:00 and 9:00 p.m., with 1,372 MWh, a value 2.3% lower than the maximum of 2018 registered on 8 February, between 8:00 and 9:00 p.m.

Monthly variation of non-peninsular electricity demand. 2019 %

	Balearic Islands	Canary Islands	Ceuta	Melilla
January	9.4	0.0	-3.8	1.9
February	-9.2	-0.6	-6.3	-6.3
March	-5.4	1.2	-5.6	-0.5
April	4.6	-0.3	-6.7	-3.0
May	0.1	1.2	2.5	2.8
June	0.6	1.0	4.1	0.3
July	4.9	0.8	5.9	4.5
August	0.1	0.8	5.3	-0.6
September	-0.9	-1.6	-2.6	-4.1
October	3.0	-0.7	-1.0	-0.9
November	4.0	1.9	-1.3	-2.2
December	-0.1	0.7	2.4	-4.0

Variation with respect to the same period of the previous year.

Maximum annual demand values (non-peninsular systems)

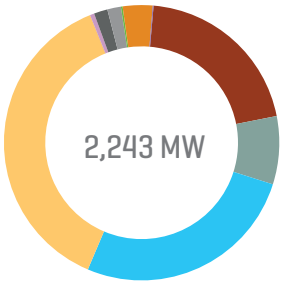
	Hourly demand (MWh)		Daily demand (GWh)	
983	1 October (8:00-9:00 p.m.)	Balearic Islands	1 October	18,890
1,286	9 August (1:00-2:00 p.m.)		9 August	25,705
1,372	2 October (8:00-9:00 p.m.)	Canary Islands	2 October	26,825
1,344	30 September (8:00-9:00 p.m.)		19 August	26,682
34	23 January (8:00-9:00 p.m.)	Ceuta	23 January	636
34	6 September (1:00-2:00 p.m.)		1 August	661
36	22 January (9:00-10:00 p.m.)	Melilla	22 January	648
39	21 August (1:00-2:00 p.m.)		8 August	755

■ Winter (January-May/October-December) ■ Summer (June-September)

Installed power capacity of non-peninsular systems remained stable in all systems. The Balearic Islands registered a decrease of 1.8%, while the Canary Islands registered an increase of 0.3%. The decrease in the Balearic Islands is due to the decommissioning of three generating units located in the fuel/gas station in Ibiza and that totalled 43 MW. In terms of **demand coverage**, the most significant difference compared to the previous year is the lower share of coal-fired generation in the Balearic Islands (nearly sixteen percentage points less than in 2018). Of note is that renewable energy covered more than 16.3% of the demand in the Canary Islands, the highest value ever registered to date, and a significant value for an isolated electricity system.

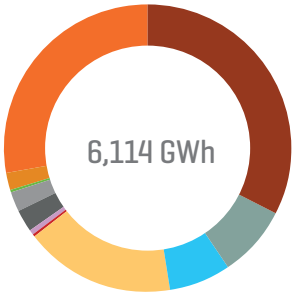
Installed power capacity as at 31 december 2019. Balearic islands %

Coal	20.8 %	Non-renewable waste	1.7 %
Diesel generators	6.2 %	Renewable waste	1.7 %
Gas turbine	27.0 %	Wind	0.2 %
Combined cycle	38.2 %	Solar photovoltaic	3.6 %
Cogeneration	0.5 %	Other renewables	0.1 %



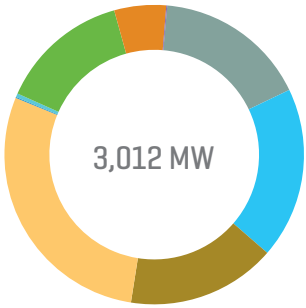
Electricity demand coverage. Balearic islands. 2019 %

Coal	32.6 %	Non-renewable waste	2.4 %
Diesel generators	7.6 %	Renewable waste	2.4 %
Gas turbine	7.2 %	Wind	0.1 %
Combined cycle	17.1 %	Solar photovoltaic	2.0 %
Auxiliary generation	0.3 %	Spanish Peninsula-Balearic Islands link	27.7 %
Cogeneration	0.6 %		



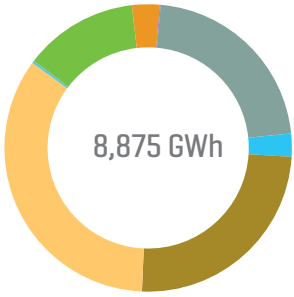
Installed power capacity as at 31 december 2019. Canary islands %

Diesel generators	16.5 %	Hydro-wind	0.4 %
Gas turbine	18.5 %	Wind	14.2 %
Gas turbine	16.0 %	Solar photovoltaic	5.5 %
Combined cycle	28.7 %	Other renewables	0.1 %
		Hydro	0.1 %



Electricity demand coverage. Canary islands. 2019 %

Diesel generators	22.0 %	Hydro-wind	0.3 %
Gas turbine	2.6 %	Wind	12.8 %
Gas turbine	24.7 %	Solar photovoltaic	3.1 %
Combined cycle	34.4 %	Other renewables	0.1 %



Evolution of the non-peninsular electricity transmission grid

		2015	2016	2017	2018	2019 [1]
Circuit 220 kV (km)	Balearic Islands	431	432	432	432	448
	Canary Islands	216	220	220	239	239
	Total	**647**	**652**	**652**	**671**	**687**
Circuit 132 kV (km)	Balearic Islands	346	472	472	517	520
	Canary Islands	-	-	-	67	125
	Total	**346**	**472**	**472**	**584**	**645**
Circuit ≤ 132 kV (km)	Balearic Islands	897	897	905	905	905
	Canary Islands	1,131	1,134	1,135	1,176	1,184
	Total	**2,028**	**2,031**	**2,040**	**2,081**	**2,090**
Transformer capacity (MVA)	Balearic Islands	3,463	3,463	3,463	3,463	3,838
	Canary Islands	2,250	2,250	2,810	3,310	3,470
	Total	**5,713**	**5,713**	**6,273**	**6,773**	**7,308**

(1) Provisional data pending audit (currently in progress).
Cumulative figures regarding kilometres of circuit and transformer capacity as at 31 December 2019. Includes the transmission grid assets of those utility companies whose electricity distribution facilities are considered as an integral part of the overall transmission grid infrastructure nationwide.

GLOSSARY OF TERMS[1]

HYDROELECTRIC RESERVES OF A RESERVOIR

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 management regime reservoirs are those in which complete drainage would take place in less than one year, supposing the reservoir is at its maximum fill-level. Hyper-annual management regime reservoirs are those in which the complete drainage time takes more than one year.

INTERNATIONAL PHYSICAL ELECTRICITY EXCHANGES

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.

NON-RENEWABLE ENERGIES

Those obtained from fossil fuels (liquid or solid) and their derivatives. Includes pumped-storage, nuclear, coal, fuel/gas, combined cycle, cogeneration and non-renewable waste.

PRODUCIBLE HYDROELECTRIC ENERGY

Maximum quantity of electricity 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 generation of electricity have been subtracted.

PRODUCIBLE HYDROELECTRIC INDEX

Quotient between the producible energy and the average producible energy, both related to the same period and to the same hydroelectric system. A producible hydroelectric index less than 1 indicates it was a dry period, while if it is greater than 1 is indicates a wet period.

PUMPED STORAGE CONSUMPTION

Energy that pumped storage hydroelectric power stations use to elevate water from a lower reservoir to the upper one in order to be subsequently used to generate hydroelectric energy.

RENEWABLE ENERGY

Those obtained from natural resources and also from both industrial and urban waste. These different types of energy sources include hydro, hydro-wind, wind, solar photovoltaic, solar thermal, biogas, biomass, marine energy, geothermal and renewable waste.

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 voltage, which fulfil any of the following functions: power transmission, international/cross- border interconnections and, as appropriate, the interconnections with the Spanish insular and non-peninsular electricity systems.

[1] For further information regarding terms, you can consult the glossary published on our web: https://www.ree.es/en/glossary

Published by
RED ELÉCTRICA DE ESPAÑA
Paseo del Conde de los Gaitanes. 177
28109 Alcobendas (Madrid)
Tel, 91 650 85 00
Fax, 91 640 45 42
www.ree.es

Co-ordination of the publication
Corporate Image and Brand Department

Technical co-ordination
Department of Access to Information on the Electricity System

Design and layout

gosban reporting

Other data regarding this publication
Publication date: January 2020

English translation by
Wayman English International
www.waymanenglish.com

This English version is a translation of the original and authentic Spanish text found in the 'EL SISTEMA ELÉCTRICO ESPAÑOL – AVANCE 2019' report, originally issued in Spanish. In the event of any discrepancy, the Spanish-language version shall prevail.

Paseo del Conde
de los Gaitanes. 177
28109 Alcobendas (Madrid)
www.ree.es