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# ELECTRICITY IN EUROPE 2016

SYNTHETIC OVERVIEW OF ELECTRIC SYSTEM CONSUMPTION,  
GENERATION AND EXCHANGES IN THE ENTSO-E AREA

European Network of  
Transmission System Operators  
for Electricity



**Electricity in Europe 2016 provides a synthetic overview of electric system consumption, generation and exchanges in ENTSO-E during a given year. It comments on the main evolutions in comparison to the previous year.**

**This 2016 edition is mainly based on provisional data as of 5 July 2017 delivered by ENTSO-E members and published on ENTSO-E’s “Power Statistics” webpage. It is complementary to the Statistical Factsheet. Note that Turkey is not included in the statistics.**

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# 1 EXECUTIVE SUMMARY: ENERGY TRANSITION IN PROGRESS

## ENTSO-E ELECTRICITY CONSUMPTION WAS STABLE IN 2016

The overall electricity consumption in the ENTSO-E perimeter reached 3,322 terawatt hours (TWh) in 2016. Compared with 2015<sup>1)</sup>, electricity consumption was slightly elevated (+0.6%).

In 2016, the peak load of the overall electrical system was reached on January 19th (549 gigawatts (GW)) during a cold wave, and was higher than the previous year (+22 GW). However, this is still below the historical maximum of 557 GW reached in February 2012, when an exceptionally cold spell struck the main part of Europe.

## RENEWABLE GENERATION CONTINUES TO INCREASE WHILST NUCLEAR GENERATION DECREASES

The net generating capacity (NGC) of nuclear has been stable since 2015. However, in 2016, mainly based on the unavailability of certain reactors in France, nuclear generation was 2.4% lower than the previous year. This reduction was partially compensated by the rise in hydro generation (+0.8%) and by usage of conventional power plants (+0.6%), despite fossil fuel capacity diminishing (3.4%).

The growth in renewable power has mainly been driven by solar generation, which rose by 9.8% in 2016. The combined effects of the development of solar farms (+6.4 GW installed capacity) and suitable solar conditions were substantially responsible for these figures. Although wind-generating capacity increased by 7.8%, wind generation decreased by 5.6% because of unsuitable wind conditions. In total, the capacity of renewable electricity sources (RES) (excluding hydro) amounted to 27.4% of the total NGC of ENTSO-E.

## INTERCONNECTED NETWORK ALLOWS EXCHANGE BALANCE OF COUNTRIES TO FLUCTUATE FROM YEAR TO YEAR

Even if the structure of exchanges is rather stable, the exchange balance of ENTSO-E countries can fluctuate based on border capacities, market prices, market coupling and development of renewables.

In 2016, eight countries within the ENTSO-E perimeter exported more than 10% of their annual national generation to neighbouring countries. Fifteen other countries within ENTSO-E imported more than 10% of their annual internal consumption needs from other ENTSO-E countries.

Exporting countries were primarily situated along a North-East to South-West axis. The ENTSO-E area had an import balance of 0.4 TWh in 2016.

<sup>1)</sup> Data from YS&AR 2015

# 2 CONSUMPTION

## EVOLUTION OF OVERALL ENTSO-E CONSUMPTION

### YEARLY ENERGY CONSUMPTION

In 2016, ENTSO-E consumption reached 3,322 TWh, which represented a stabilisation (+0.6%) compared to the previous year (Figure 1). This hides a variety of contrasted phenomenon. Amongst them:

- There have been two factors that had a positive effect on the growth of electricity consumption in 2016 – weather conditions and a continuously improving economic perspective.
- On the other hand, enhancements in the energy efficiency of buildings, lighting and appliance consumption have had a reducing impact on electricity demand.

The combination of these factors explains the stabilisation observed.

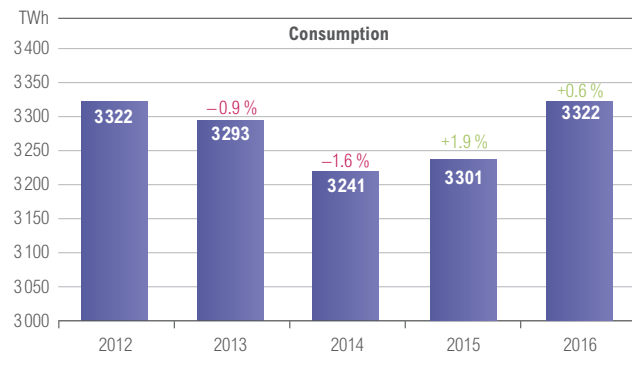


Figure 1: ENTSO-E electricity consumption between 2012 and 2016

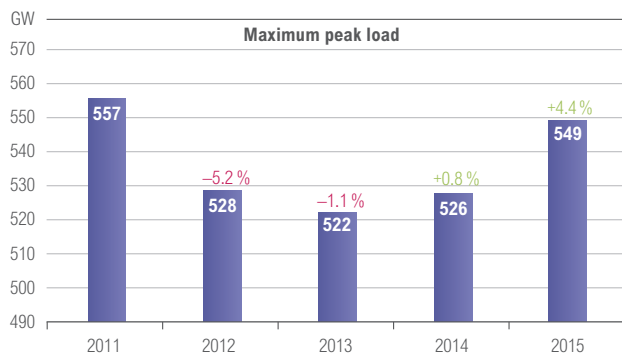


Figure 2: ENTSO-E maximum peak load in 2016.

## EVOLUTION OF CONSUMPTION PER COUNTRY

The majority of ENTSO-E countries experienced an increase of their consumption between 2015 and 2016.

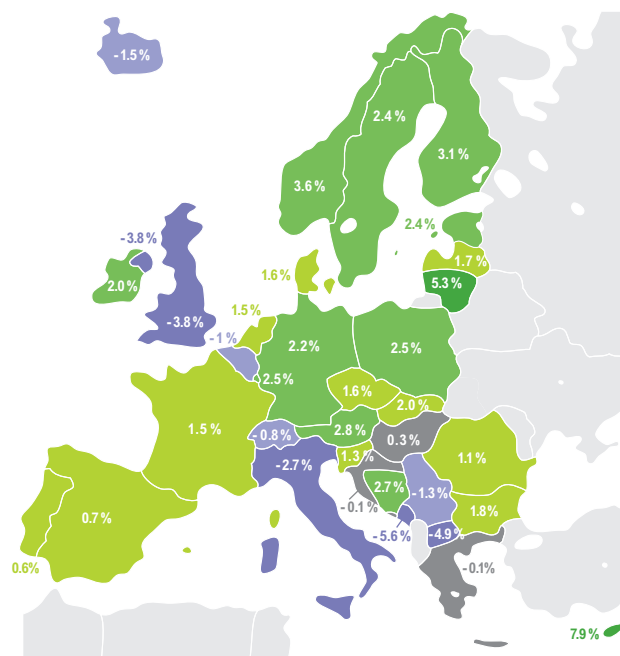


Figure 3: Evolution of ENTSO-E electricity consumption between 2015 and 2016.

## PEAK LOAD

Associated with the cold snap of January 2016, the peak load was higher than 2015 and reached 549 GW on 19 January 2016. This peak was still 9 GW lower than the peak load registered during the cold spell of February 2012.

## EVOLUTION OF ENTSO-E ELECTRICITY CONSUMPTION BETWEEN 2015 AND 2016



# 3 GENERATION

## EVOLUTION OF OVERALL ENTSO-E NET GENERATING CAPACITY <sup>2)</sup>

By the end of 2016, total ENTSO-E NGC was 1,058 GW. Whilst NGC was stable with respect to nuclear and hydraulic energy, non-hydro renewable energy sources rose by 20 GW (+7.4 %

compared to 2015) and represented 27.4 % of total NGC of ENTSO-E. In contrast, fossil fuel NGC was diminished by 3.4 %.

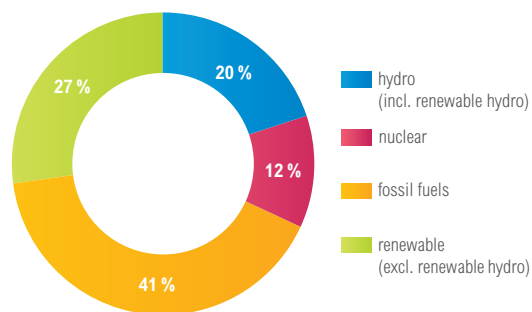
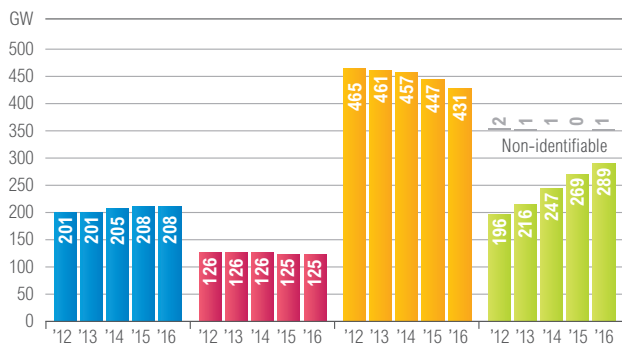


Figure 4: ENTSO-E net generating capacity in 2016.

<sup>2)</sup> NGC of a power station is the maximum electrical net active power it can produce continuously throughout a long period of operation in normal conditions.



## EVOLUTION OF OVERALL ENTSO-E ENERGY NET GENERATION

Whilst hydro and fossil fuel generation slightly increased by, respectively, 0.8 and 0.6%, nuclear generation decreased by 2.3% in 2016. At the same time, renewable (excluding hydro) generation

remained stable with a 5.6% wind generation decrease compensated by the increase in solar generation (+9.8%).

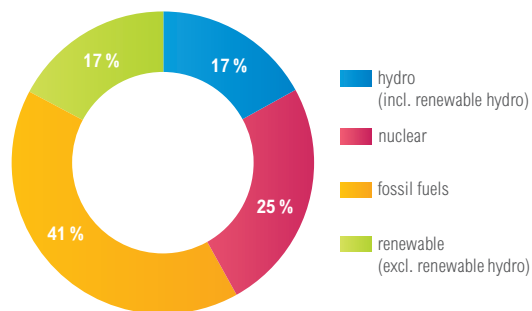
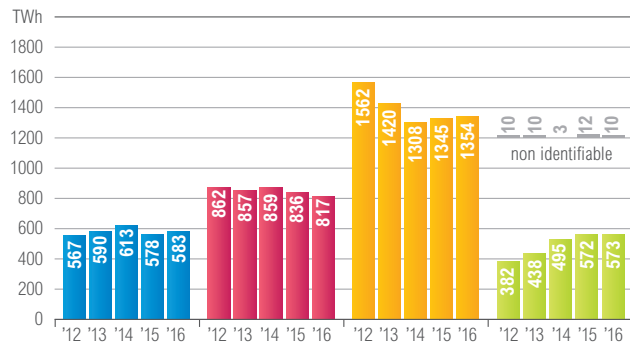


Figure 5: ENTSO-E net generation share in 2016.

# ENERGY NET GENERATION PER COUNTRY

## HYDRAULIC ENERGY

In Europe, hydraulic power plants are concentrated in the transalpine range, specifically the Carpathians and the Scandinavian countries, where hydraulic generation represents up to 96% of total national generation.

Although hydraulic capacities have not significantly evolved further, generation is highly dependent on rainfall and the market situation, which differ from one country to the next.

SHARE OF HYDRAULIC NET GENERATION WITHIN ENTSO-E IN 2016

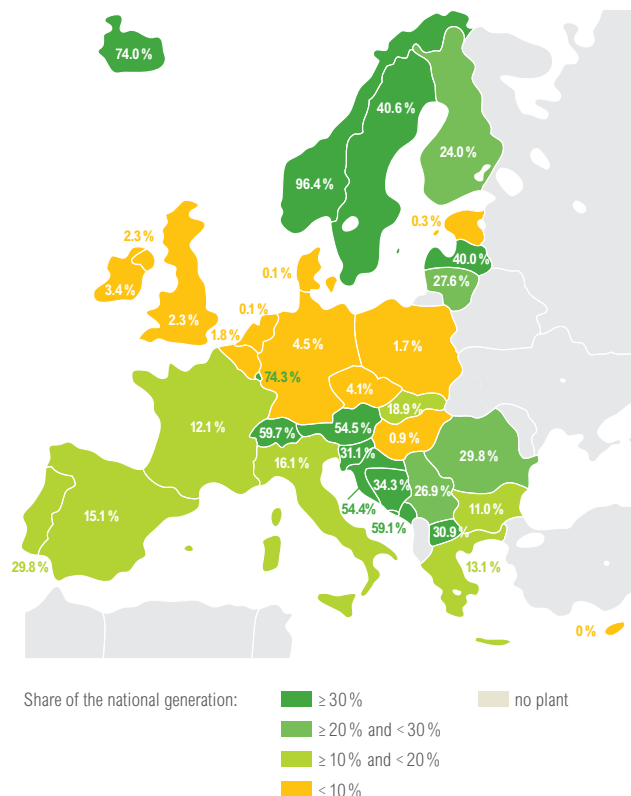


Figure 6: Share of hydraulic net generation within ENTSO-E in 2016.

EVOLUTION OF HYDRAULIC ENERGY NET GENERATION IN PERCENTAGE POINTS

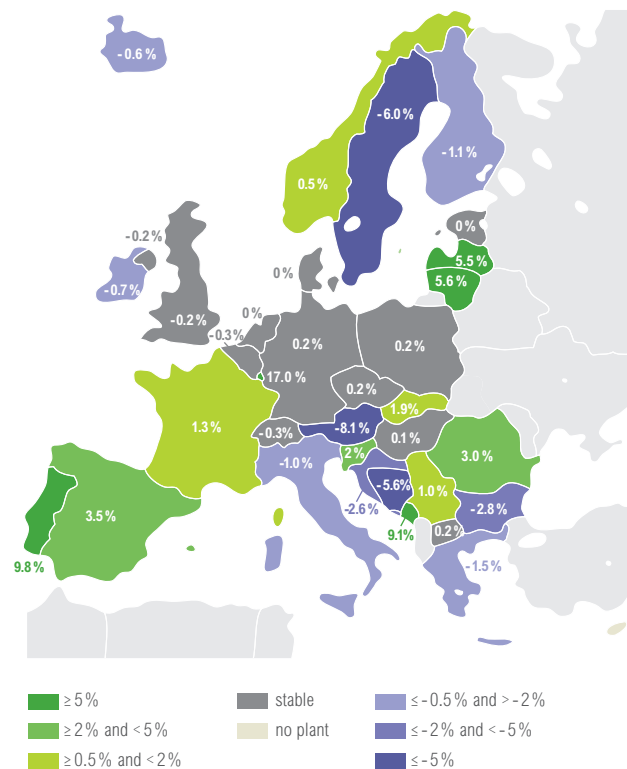


Figure 7: Evolution of hydraulic energy net generation across ENTSO-E in percentage points<sup>3)</sup>.

<sup>3)</sup> A percentage point (pp) is the arithmetic difference between two percentages (for example, from 4% to 7% is a 3 percentage point increase).

## NUCLEAR ENERGY

Power plant generation can fluctuate depending on market conditions and technical availability. For example, the reopening of certain reactors decommissioned in 2015 in Belgium led to a significant increase in nuclear generation (see Figure 9).

SHARE OF NUCLEAR ENERGY NET GENERATION IN 2016

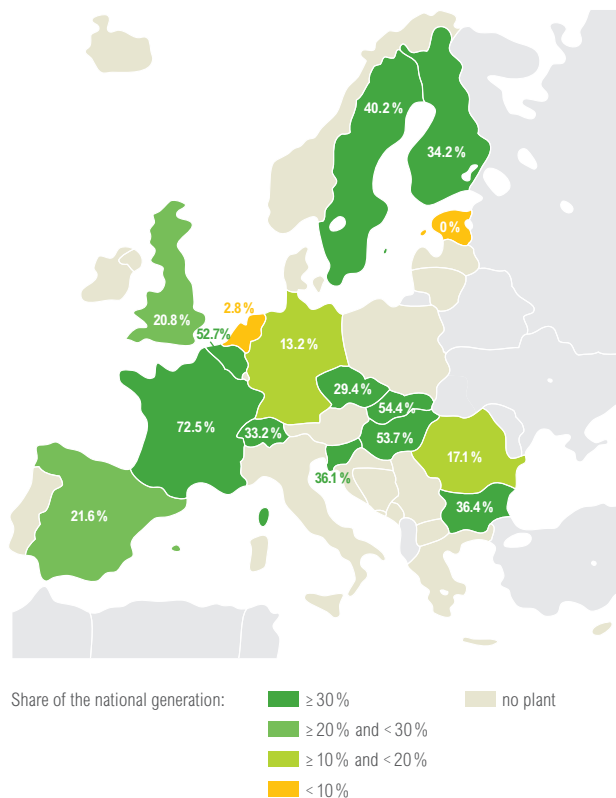


Figure 8: Share of nuclear energy net generation across ENTSO-E in 2016.

EVOLUTION OF NUCLEAR ENERGY NET GENERATION IN PERCENTAGE POINTS

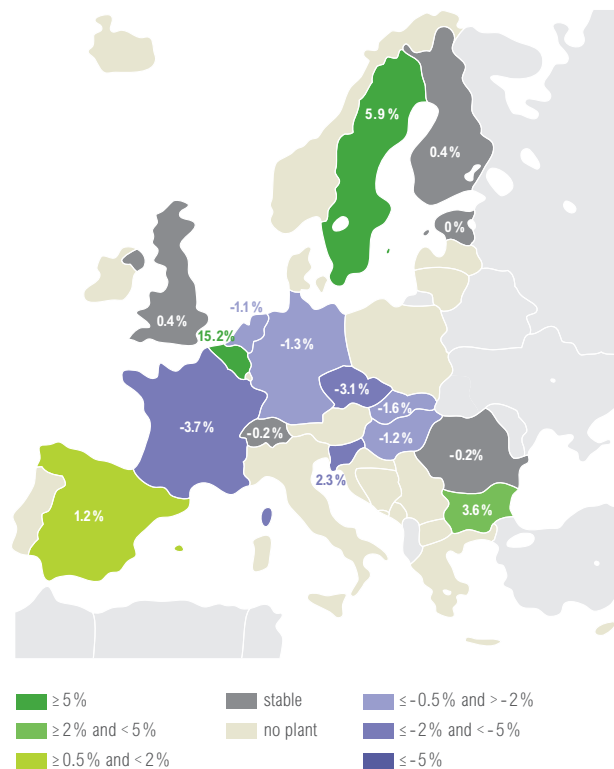


Figure 9: Evolution of nuclear energy net generation across ENTSO-E in percentage points.

## FOSSIL FUEL

Historically, fossil fuels have been the predominant electricity generation source for countries with no hydraulic resources or nuclear plants. In recent years, the share of electricity generation from fossil fuels has decreased across all European countries, which is associated with the development of RES generation and

the shutdown of particular thermal plants that do not meet European environmental standards. However, in 2016, fossil fuel generation slightly rose owing to a reduction in nuclear generation and low wind generation.

SHARE OF FOSSIL FUELS ENERGY NET GENERATION IN 2016

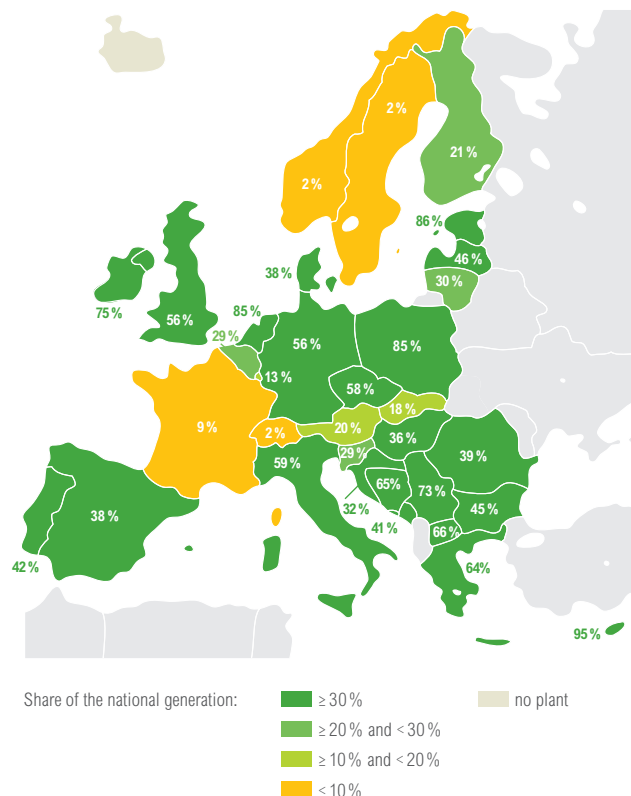


Figure 10: Share of fossil fuels energy net generation across ENTSO-E in 2016.

EVOLUTION OF FOSSIL FUELS ENERGY NET GENERATION IN PERCENTAGE POINTS

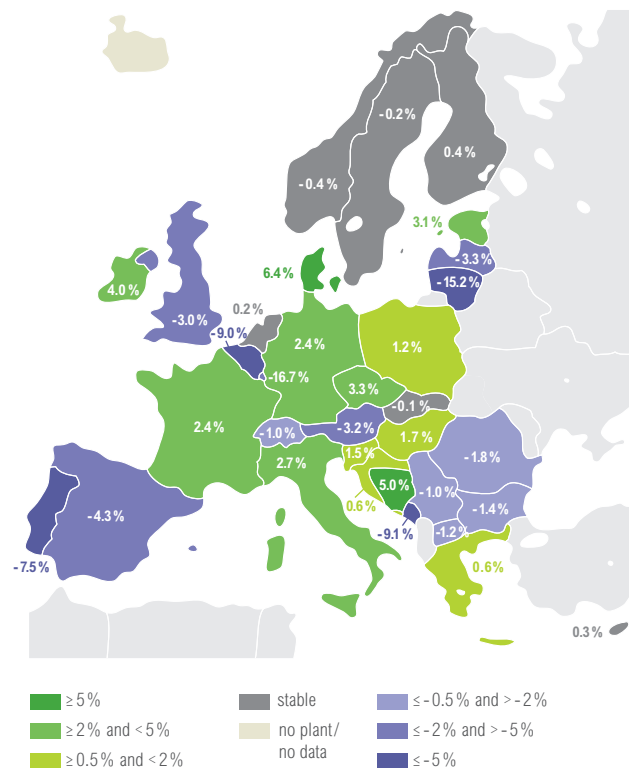


Figure 11: Evolution of fossil fuels energy net generation across ENTSO-E in percentage points.



## SOLAR ENERGY

Similar to wind power, the growth of solar energy (+10%) depends on the evolution of capacity (+6%) and weather

conditions. Germany, Italy and Spain represented 67 % of total ENTSO-E solar generation (105TWh) in 2016.

### SHARE OF SOLAR ENERGY NET GENERATION IN 2016

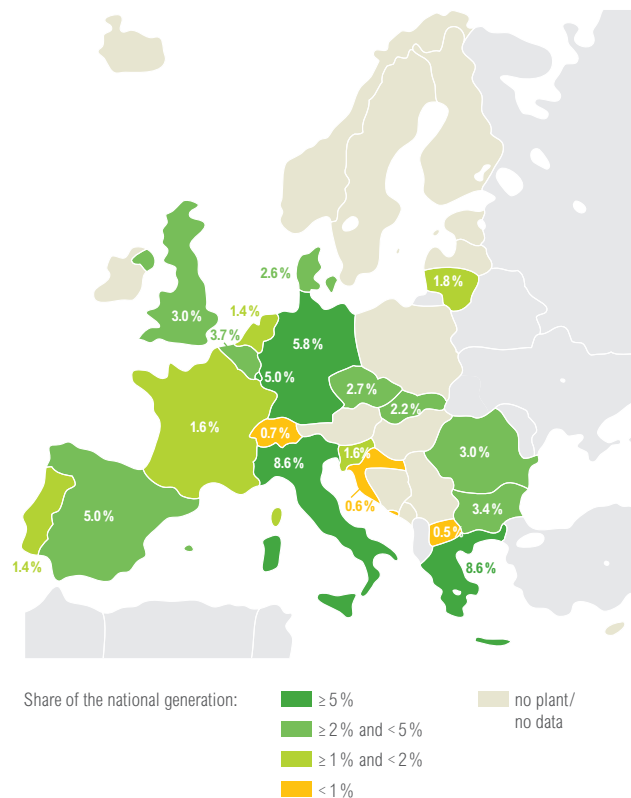


Figure 14: Share of solar energy net generation across ENTSO-E in 2016.

### EVOLUTION OF SOLAR ENERGY NET GENERATION IN PERCENTAGE POINTS

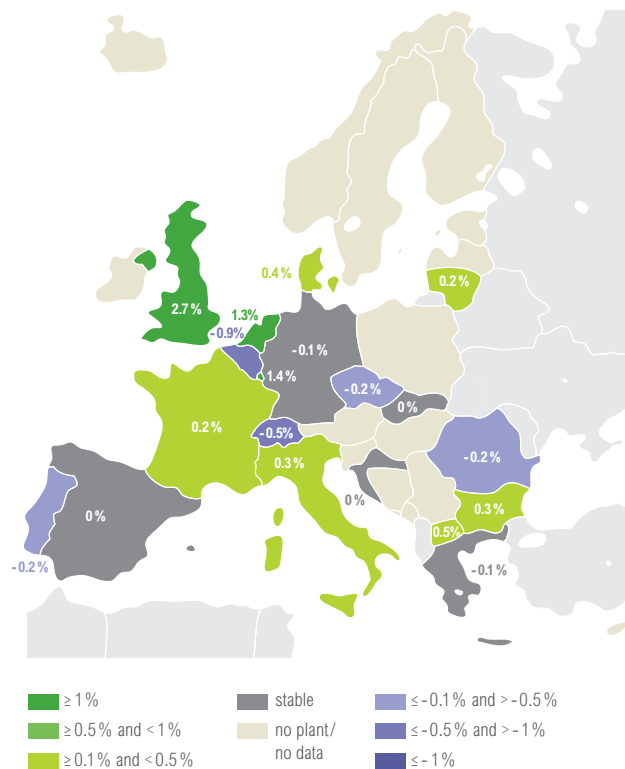


Figure 15: Evolution of solar energy net generation across ENTSO-E in percentage points.

## RENEWABLE NET GENERATION PER COUNTRY

33.4% of overall ENTSO-E consumption was covered by renewable generation. Without hydraulic generation, renewable generation represented 17.3% of total ENTSO-E consumption. The main contribution to this figure originates from solar and wind, which each alone account for 12.2% of consumption.

### SHARE OF CONSUMPTION COVERED BY RENEWABLE GENERATION IN 2016

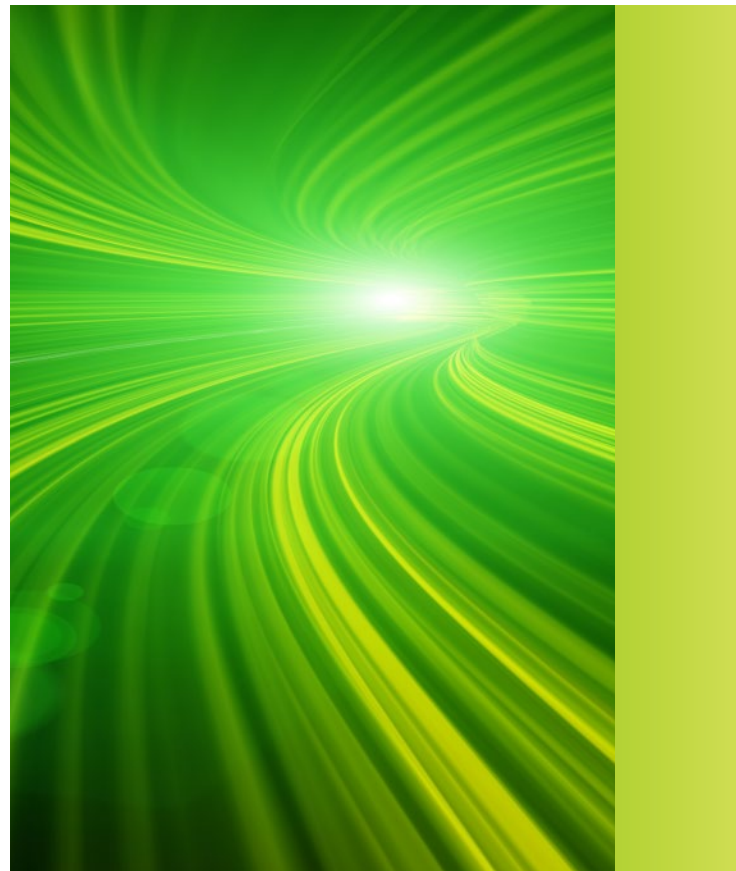
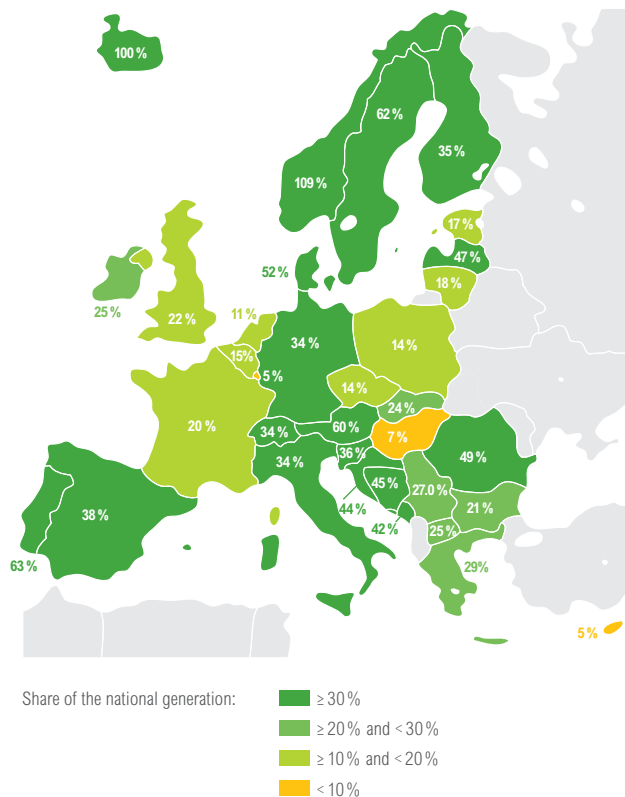


Figure 16: Share of consumption covered by renewable generation across ENTSO-E in 2016.

The background of the page is a vibrant, abstract digital composition. It features a dark blue sky with several bright, glowing blue light trails that curve and sweep across the frame. In the foreground and middle ground, there are complex wireframe structures in shades of blue and red, resembling architectural models or data networks. A prominent red light trail curves along the bottom right corner. The overall effect is one of high-tech energy and digital connectivity.

# 4 EXCHANGES



## EXCHANGE BALANCES PER COUNTRY

The exchange balance of a country can fluctuate from year to year, and this is linked to border capacities, market coupling and price influences, even if a number of countries are structurally importing or exporting.

EXCHANGE BALANCES IN 2016

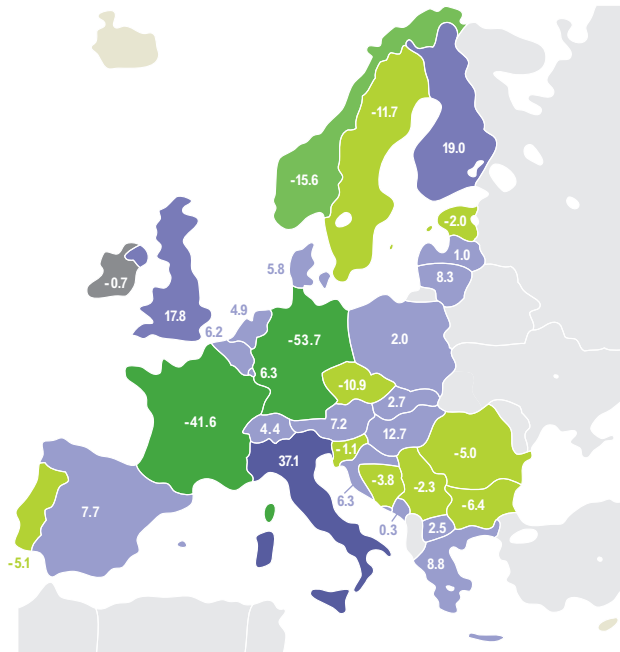


Figure 17: Exchange balances across ENTSO-E in 2016.

EVOLUTION OF EXCHANGE BALANCES BETWEEN 2015 AND 2016

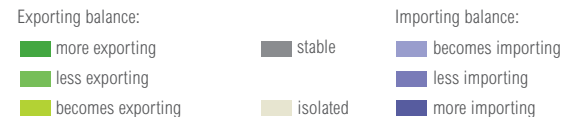
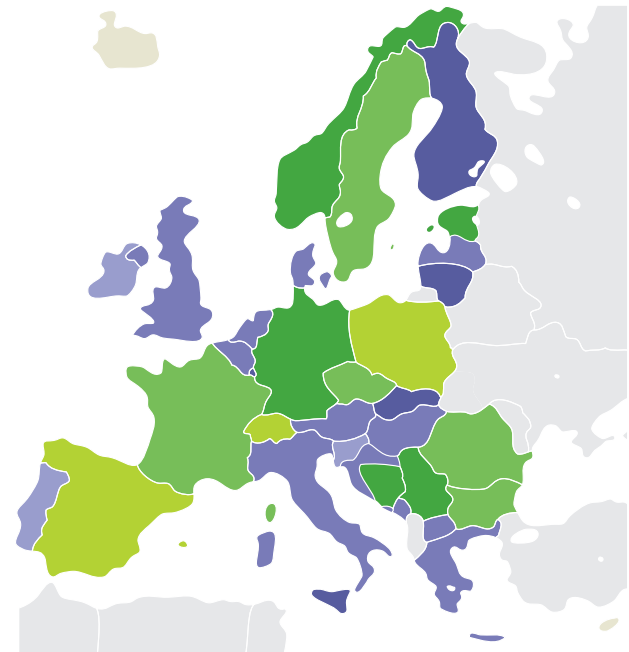


Figure 18: Evolution of exchange balances across ENTSO-E between 2015 and 2016<sup>4)</sup>.

4) The balance of electricity exchanges is the balance between the energy physically flowing in and out of a country. It equates to the balance of commercial transactions of each country (exports minus imports). However, in an interconnected system where electricity disperses through various paths, the energy's physical flow through a specific border between two countries usually differs from the commercial energy transactions between these two countries. Summing up net balances separately, whether positive or negative, gives the amount of net exports and imports of a country. Exports and imports can be driven by market conditions or adequacy needs.

## EXPORTED GENERATION

In 2016, eight countries of ENTSO-E's perimeter exported more than 10% of their annual national generation to neighbouring countries.

Figures 19 and 20 are based on “net exports” and “net imports” calculations, excluding transit and loop flows. The net balance of exchanges per country are calculated on an hourly basis.

### SHARE OF YEARLY GENERATION EXPORTED

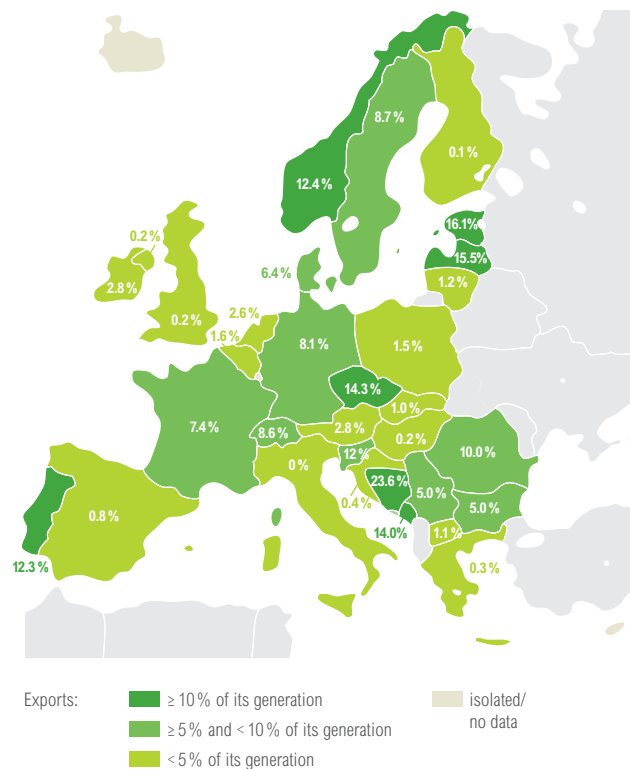


Figure 19: Share of yearly generation exported across ENTSO-E.

## IMPORTED GENERATION

In 2016, 15 ENTSO-E countries imported more than 10% of their annual internal consumption needs from other ENTSO-E countries.

### SHARE OF YEARLY CONSUMPTION COVERED BY NATIONAL GENERATION

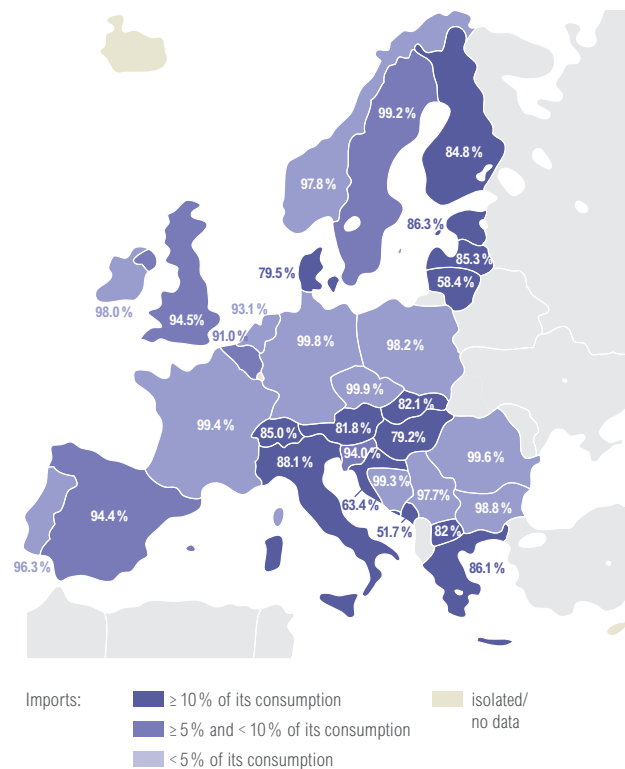


Figure 20: Share of yearly consumption covered by national generation across ENTSO-E.

## APPENDIX: DATA SOURCES AND REFERENCES

### SOURCE OF DATA:

Data for 2016 was taken from ENTSO-E's monthly statistics, whereas data from 2015 is based on ENTSO-E's yearly statistics. Data used for consumption, generation and exchange balance figures in Chapters 2, 3 and 4.1 was taken from ENTSO-E's statistical database ("Power Statistics"):

<https://www.entsoe.eu/data/statistics/>

Data employed for "net export" and "net import" calculations in Chapters 4.2 and 4.3 was taken from the ENTSO-E Transparency Platform:

<https://transparency.entsoe.eu/>

### OTHER RELATED ENTSO-E PUBLICATIONS:

#### Monthly statistics:

[www.entsoe.eu/publications/statistics/monthly-statistics/](http://www.entsoe.eu/publications/statistics/monthly-statistics/)

#### Statistical Factsheet:

[www.entsoe.eu/publications/general-publications/memo-entso-e-facts-figures/](http://www.entsoe.eu/publications/general-publications/memo-entso-e-facts-figures/)

#### Yearly Statistics & Adequacy Retrospect (YS&AR):

[www.entsoe.eu/publications/statistics/statistical-yearbooks/](http://www.entsoe.eu/publications/statistics/statistical-yearbooks/)

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