EMBER

# Solar helps Europe's grid withstand extreme heat

**Multiple heatwaves and drought in summer 2026 have strained Europe's power grid, driving electricity demand and causing prices to spike. Yet grids have remained stable, fueled by record volumes of solar.**

**Published date:** 13 August 2026
**Author:** Chris Rosslowe

## About

This report examines how the June-July 2026 heatwaves and prolonged drought affected European power systems, focusing on four countries hit by extreme temperatures: France, Spain, Italy and Hungary. It analyses the impact on power demand, generation and prices, and explores solutions to maintain grid stability and limit price spikes as heatwaves become more frequent – particularly battery storage and demand-side flexibility.

# Summary

**Europe's increasingly frequent heatwaves are placing severe stress on electricity grids. Record solar output is helping to meet high demand, but increased flexibility will be needed to future-proof grids.**

In June and July 2026, successive heatwaves pushed temperatures above 40°C in many parts of Europe, driving up electricity demand as air conditioning use soared, while disrupting nuclear, gas, coal and hydropower generation.

Fortunately for Europe's grid stability, record solar output helped cover increased demand during daylight hours, with high prices and supply scarcity most pronounced in the evenings. As extreme heat becomes more common, governments and regulators will need to make greater use of proven solutions, including battery storage and demand response.

01 **Heatwaves increased daily power demand by up to a quarter.** Most countries, notably Hungary and Italy, experienced higher than usual summer demand during heatwave periods, mainly due to additional cooling needs.

02 **Solar production was up to 17% higher on heatwave days compared to other days in June and July.** This boost in solar output helped stabilise grids as other power sources struggled.

03 **Electricity market prices spiked to their highest levels in years, as high demand after sundown combined with high gas prices.** Day-ahead power prices in Italy and Spain reached their highest peaks since the gas crisis in winter of 2022/23.

Solar is already doing heavy lifting during heatwaves, but the real challenge starts after sundown. Battery storage is one of the clearest ways to make Europe's power system more resilient in hotter summers. As solar performs during heatwaves while other power sources struggle, storage can carry cheap electricity into the evening, when cooling demand is still high and the grid is most exposed to expensive thermal power.



**Dr Chris Rosslowe**
Senior Energy Analyst, Ember

# Heatwaves add demand and constrain supply on Europe's grid

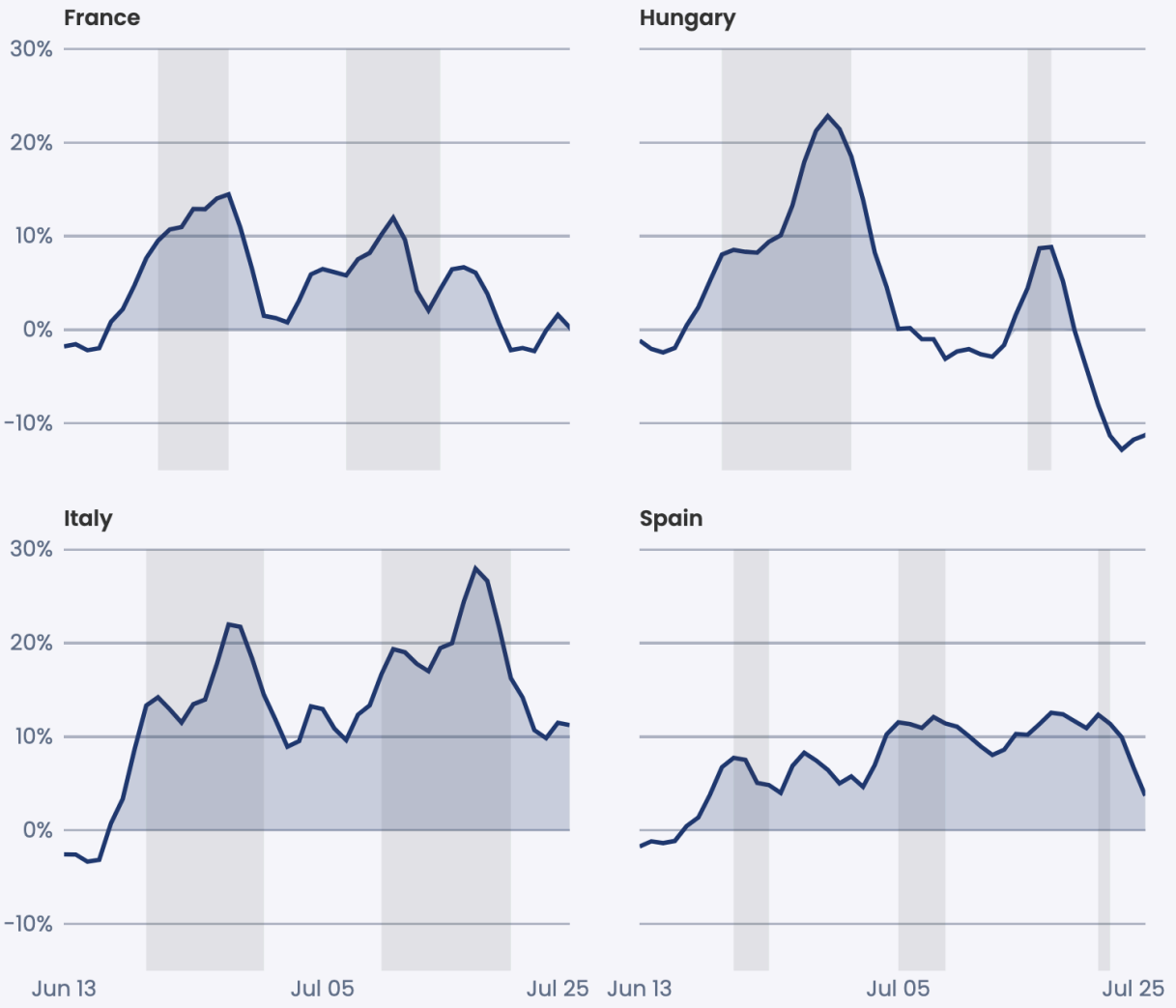
June and July delivered an unprecedented sequence of extreme heatwaves across Europe. France, Spain and Germany, among others, experienced their hottest June days on record. Local temperatures exceeded 40°C on consecutive days across swathes of Central and Eastern Europe in July, with August showing little sign of relief. This extreme heat, combined with a prolonged drought across much of the continent, has put Europe's power system to the test. Higher than expected demand combined with constraints to thermal and hydro power generation have increased power prices and their volatility.

## Electricity demand up to 28% higher on heatwave days

Prolonged high temperature periods had a major impact on electricity demand, primarily due to increased use of air conditioning. During heatwaves beginning in late June, daily power demand increased by as much as 28% in Italy, 23% in Hungary, 14% in France, and 13% in Spain, compared to the week preceding heatwaves (13-19 June), when temperatures were closer to seasonal averages. Peak demand also increased by up to 17% in Hungary, 14% in Italy, 11% in Spain and 9% in France.. However, it should be noted that peak demand levels in France and Hungary remained below their winter highs.

## Europe's heatwaves increased daily power demand by up to a quarter

Daily electricity demand (%), indexed to the week before heatwaves hit Europe (13-19 June)




Source: Ember hourly generation data, ERA5 - Copernicus • Indexed daily demand is shown as a 3-day rolling average. Heatwaves are defined as periods of consecutive days with average temperatures above 25°C, or 27°C in the case of Spain.

EMBER

The effects of extreme heat on power systems go beyond increased demand. Every type of power generation is impacted, potentially constraining supplies.

Grid equipment also has thermal limits. Overhead power lines, for example, can transmit less electricity when the ambient temperature is high, and other equipment, such as grid transformers, can overheat.

The consequences for consumers can be severe. Extreme temperatures caused a grid failure and blackout in the Northeast US in 2003. In June this year, an overheated transformer was responsible for the temporary disconnection of 70,000 consumers in Brittany, France. Fortunately, however, despite extremely challenging conditions, Europe avoided a major disruption to its power supplies.

## Heat and drought constrain nuclear, gas and coal power

As demand has risen, other power sources, particularly thermal and hydro power plants, have been constrained by environmental conditions. Thermal power plants, such as nuclear, gas or coal-fired power stations, are typically cooled using water drawn from rivers or seas. Extreme heat and drought therefore deliver a double blow, lowering the availability and effectiveness of cooling water when plants require it most.

In Hungary and Romania, record low Danube water levels have sharply reduced output from the countries' only nuclear power stations, which typically provide 40% and 15% of their respective electricity generation. Complete shutdowns may be necessary if water levels do not recover. A reactor in Switzerland also temporarily shut down in June because river temperatures were too high.

In France, Europe's largest nuclear power producer, environmental regulations prevent cooling water being discharged into rivers above a certain temperature, to protect aquatic life. This means reactors can be forced to shut down when river water exceeds a certain temperature. A maximum of 29 GW (43%) of French nuclear capacity was unavailable on 12 July 2026, which is similar to the maximum of summer 2025 (30 GW), but significantly less than the summer of

2022, when nearly two-thirds of capacity was unavailable. It is difficult to verify exactly how many outages are temperature related, but at least 11 GW of offline capacity on 12 July was marked as either "forced" or due to "environmental issues" by the plant operator, with a further 18 GW of reductions due to planned maintenance and other reasons. This means that the heatwave might have impacted up to 18% of France's nuclear capacity, compared to an estimated 15% in the June 2025 heatwave.

Gas-fired power plants were also affected. During the UK's record June heat, five plants reported output reductions, removing 2.5 GW from available supply. Analysts warned that water levels in Italy's Po river could limit up to 32% of the country's thermal power fleet, mostly gas-fired. Gas power plants in France also warned of limited availability amid record temperatures.

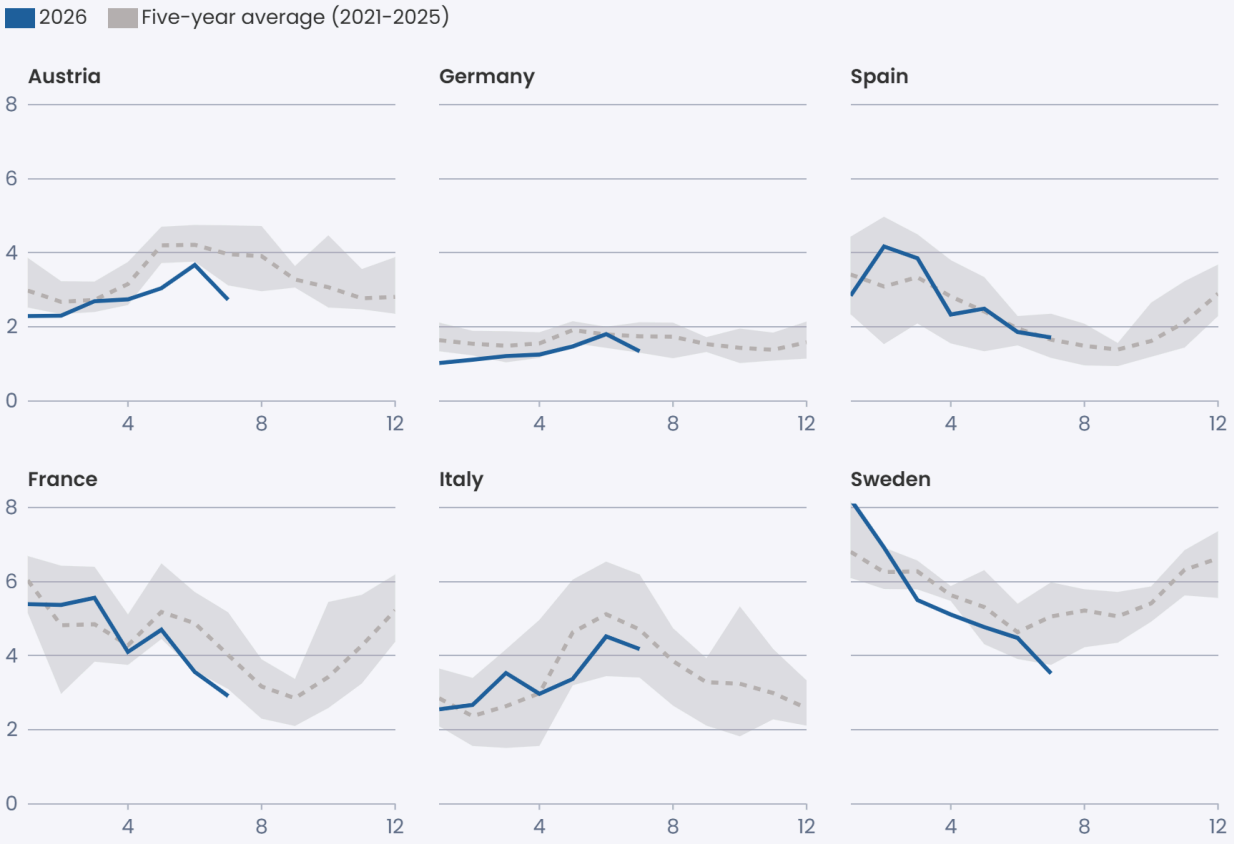
Coal generation also struggled. In Poland, critically low water levels in the Vistula limited cooling water supplies, forcing Enea to reduce output at Kozienice and Połaniec coal plants and removing around 1.3 GW from the power system. Low water levels in the Danube similarly forced Serbia's Kostolac coal plants to cut production.

## Drought takes EU hydropower to its lowest July level in a decade

In mid-July, much of Central, Eastern and Western Europe remained under some level of drought alert. July 2026 was France's hottest month and its third driest ever, following well below average precipitation in the European Alps during winter 2025/26. These prolonged dry conditions created exceptionally poor conditions for hydropower generation.

## European hydropower generation is below seasonal averages in nearly all major producing countries

Hydropower generation by month (TWh)



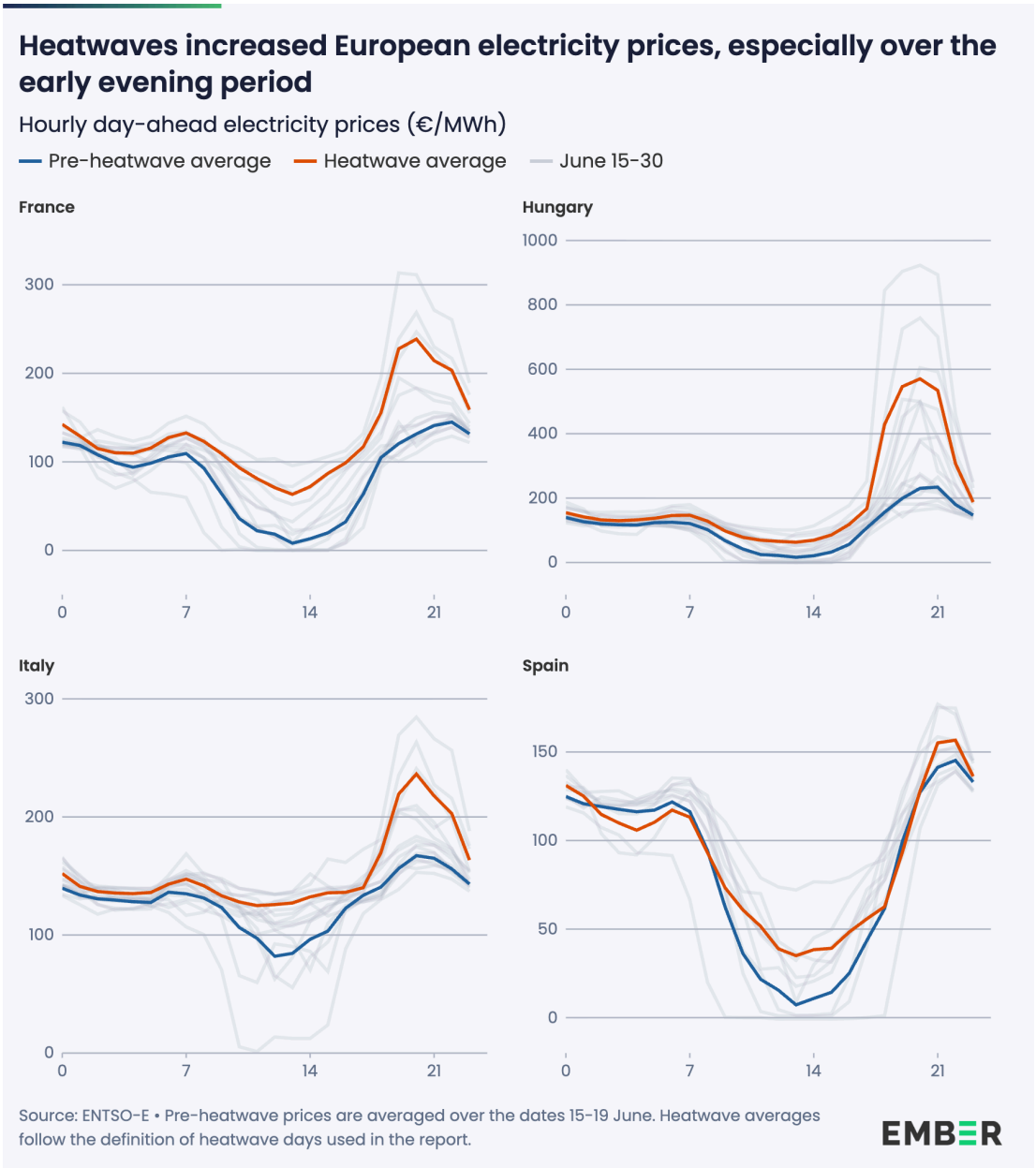

Source: Ember monthly generation data • Countries shown are the EU's six biggest hydropower producers. Shaded region shows the five-year monthly minimum and maximum (2021-2025)

EMBER

EU hydropower production was at its lowest level in at least a decade for May, June and July. In July, seven of the EU's eight largest producers – which together account for more than 90% of EU hydro generation – recorded output below their five-year averages. This shortage of hydropower has added to outages at thermal plants to create tight supply conditions in some markets.

## Power price levels and volatility rise as a result of high demand and supply constraints

All of the above-mentioned impacts have led to a dramatic rise of electricity prices. During the late-June and early-July heatwaves, average daily prices were 119% higher in Hungary, 44% higher in France, 13% higher in Italy and 7% higher in Spain than on comparable days in the preceding week.



Extreme price spikes have also occurred in the early evening period, with prices in some markets reaching their highest levels since the 2022 gas crisis. For example, on 24 June, electricity market (day-ahead) prices in France and Italy Italy reached €313/MWh and €285/MWh respectively - the highest in Italy since winter 2022/23. In Hungary, prices soared above €900/MWh on 30 June – their highest level since September 2024. Spain experienced a less severe June heatwave, with prices peaking at €177/MWh on 22 June, but rising further in July as more intense heat arrived, exceeding €250/MWh on 23 July for the first time since 2022.

These spikes reflected the combination of high demand, supply shortages and increased reliance on gas-fired generation in the early evening period when solar production declines but demand remains high. Price spikes were therefore also intensified by elevated gas prices, which have persisted since the start of the US-Israel war with Iran.

# Solar performs but extreme price spikes expose Europe's flexibility gap

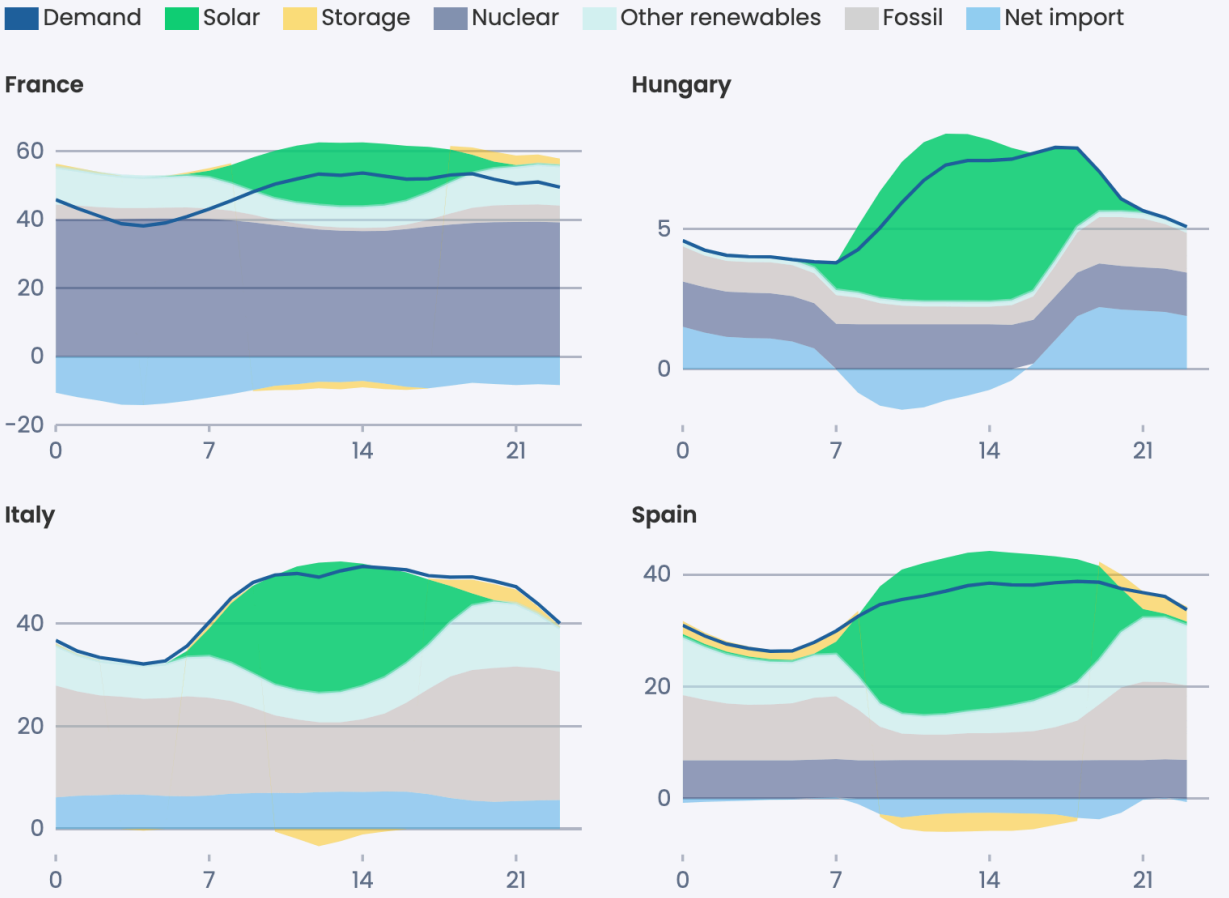
The weather systems that deliver heatwaves to Europe typically also bring clear and sunny conditions. Amid the many challenges caused by extreme temperatures, increased solar power output is a welcome benefit. As other power sources have struggled, record solar generation has helped stabilise European grids this summer. In June and July 2026, solar supplied 25% of EU electricity for the first months on record. Boosted solar generation helped limit price increases during daylight hours, but prices rose more sharply in the early evenings, signalling a lack of flexibility.

## Solar shines when air conditioning demand peaks

Solar was the only major power source to perform better than usual during Europe's heatwaves. Compared with other days in June and July, average daily solar generation during the heatwaves was 17% higher in France and Hungary, 5% higher in Spain. Across the EU, solar generation reached record levels in June (52 TWh) and July (55 TWh), providing 25% of generation in both months.

## Record-breaking solar helped to meet unusually high demand during Europe's heatwaves

Average hourly demand and generation by source during June and July heatwave days (GWh)




Source: Ember hourly generation data • Storage includes all storage types. Storage is not shown for Hungary as it is not reported as a separate category. Demand and generation do not exactly match because values shown are hourly averages.

EMBER

The benefit of solar during heatwaves comes not only from increased output, but also its timing, which largely overlaps with increased power demand for air conditioning. During the June heatwave, Ember estimated that a typical UK rooftop solar system produced enough to power a typical household air conditioning unit for five hours.

## Extreme price volatility signals need for power system flexibility

The extreme price spikes and widening price spreads seen during the heatwaves are a blaring signal for more power system flexibility. That could come from battery storage, demand response or increased interconnection between countries or regions. Some similar measures have already been deployed in reaction to the nuclear outages in Hungary and Romania, albeit in an emergency manner, with governments asking households and businesses to limit electricity consumption, especially in the early evening.

Battery storage is especially well suited to strengthen system security during Europe's increasingly hot summers. As solar is Europe's fastest-growing power source, additional storage could shift low-cost solar power into the evening, better aligning supply with cooling demand and reducing reliance on expensive thermal generation.

# Supporting materials

## Methodology

### Heatwave and pre-heatwave periods

For the purpose of estimating the increase in demand during heatwaves, a pre-heatwave reference period was used, spanning 13-19 June, when temperatures were closer to seasonal averages in the countries considered. Heatwave days were defined as consecutive periods of 2 or more days where average temperatures exceeded 25°C (in France, Hungary and Italy), or 27°C (in Spain, as average June and July temperatures are notably higher).

### Outages

The labelling of outages as either *"forced"* or *"planned"* is inconsistent. There is also no category for the exact outage reason. However, EDF frequently lists the reason for an outage as *"Causes externes liées à l'environnement ---------- Environmental issues"*. The exact wording of this message has changed in the past and there is also no way of verifying whether all outages due to environmental constraints are marked this way. For the French nuclear outages on 12 July 2026, we assumed that all outages marked either as *"forced"* or with *"Environmental issues"* as the stated reason were caused by the heatwave.

### Correction note

This report and a graphic within it originally stated that daily power demand during heatwaves increased by 26% in Hungary, 22% in Italy, 11% in France and 8% in Spain. The report and graphic have now been corrected to state that daily

electricity demand rose by up to 28% in Italy, 23% in Hungary, 14% in France and 13% in Spain. The error was caused by an undetected change in the labelling of power flows in ENTSO-E data for July and Terna switching their reporting of flows from MW to MWh.

## Acknowledgements

Leonard Heberer, Izabela Urbańska, Jivan Zhen Thiru, Paweł Czyżak, Chelsea Bruce-Lockhart, Claire Kaelin