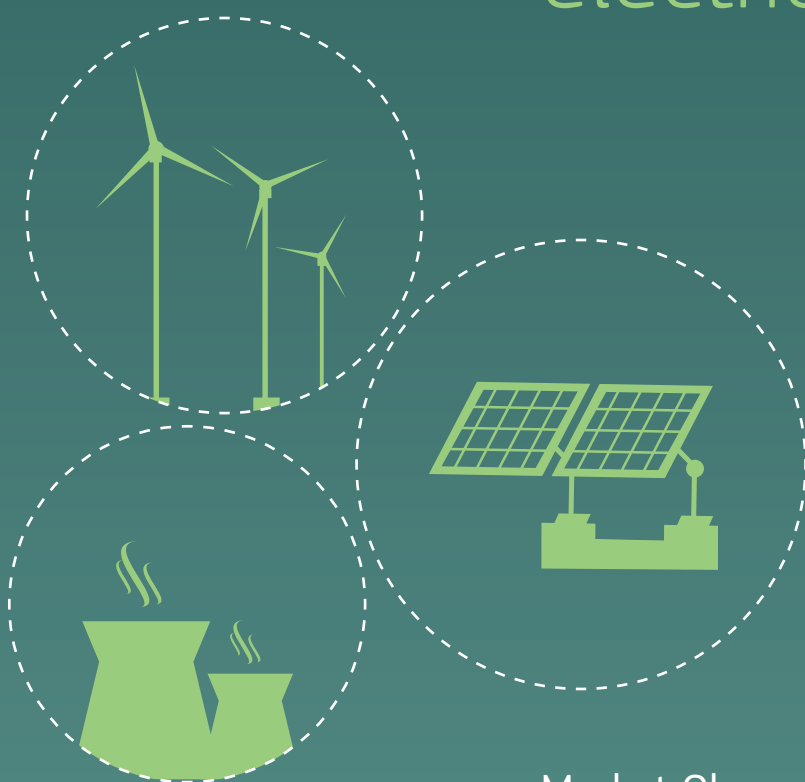


Quarterly report

On European electricity markets



Market Observatory for Energy
DG Energy

Volume 16

(issue 1, covering first quarter of 2023)

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HIGHLIGHTS OF THE REPORT

- **The first quarter of 2023 was marked by improved market fundamentals that supported a fall in wholesale electricity prices, after the highs of the third and fourth quarter of 2022.** Lower gas prices thanks to higher levels of LNG imports, high storage levels and milder weather, combined with further reduction in demand and a sustained renewable generation, helped to alleviate wholesale electricity prices across EU markets. The gradual recovering of the nuclear fleet and an improved hydro output, helped to ease pressure in the market.
- **Improved market fundamentals supported a fall in wholesale electricity prices in European markets in Q1 2023. In Q1 2023, the European Power Benchmark averaged 122 €/MWh, 40% lower than in Q1 2022.** On a yearly basis, twenty-six wholesale electricity markets in the European Union experienced a decline in prices (ranging from -57% to -11%). The largest year-on-year price falls in Member States were registered in Spain and Portugal (-57%) and France and Croatia (-43%). Italy and Greece reported the highest quarterly average prices (158 and 157 €/MWh, respectively), 37% and 34% lower than in Q1 2022. The lowest quarterly average prices during Q4 2022 were recorded in Sweden at 68 €/MWh.
- **Electricity consumption in the EU fell (-6%) compared with last year's levels in Q1 2023,** following milder weather, combined with demand destruction and behavioural changes. **Demand levels for the first quarter of 2023 were also well below the 2017-2021 range, registering the lowest value in February 2023.**
- **In Q1 2023, reduced electricity demand combined with strong renewables generation, supported a drop in fossil fuel generation in the mix. The share of renewables increased to 41% in Q1 2023** (from 36% in Q1 2022), while the share of fossil fuels fell to 35% (from 39% in Q1 2022). In Q1 2023, hydropower improved its output by 15% (+10 TWh), onshore wind generation rose by 6% (+6 TWh), and solar increased by 8% (+2 TWh). The combined solar and wind generation increased by 5% in Q1 2023 (+8 TWh). Despite improved availability of the nuclear fleet, nuclear output in Q1 2023 fell by 7% (-13 TWh) when compared with Q1 2022.
- **Fossil fuel generation dropped by 15% (-40 TWh) in Q1 2023,** supported by lower demand and sustained renewables generation. In total, coal-fired generation fell by 13% (-15 TWh), whereas less CO₂-intensive gas generation dropped by 19% (-24 TWh).
- **Carbon prices were 87 €/tCO₂ in Q1 2023, which was 5% higher than Q1 2022.** Prices were volatile and approached the 100 €/tCO₂ mark in February. High European Union Allowances (EUA) prices in 2022, were still insufficient to support coal-to-gas fuel switching in power generation, due to exceptionally high gas prices through most of the year. High carbon prices, combined with lower gas prices, created favourable conditions for a shift from coal to gas generation, after nearly one year and half of uneconomical conditions for gas vis-à-vis coal power plants.
- **The decrease in wholesale prices registered in Q1 2023 alleviated pressure on household electricity retail prices across the EU.** Retail electricity prices for household costumers in EU capital cities were still up by 15% in Q1 2023, compared with the same quarter in 2022. However, retail prices in Q1 2023 Prices were still 14% lower than in Q4 2022.
- **Close to 475,000 new EVs were registered in the EU in Q1 2023,** an increase of 12% in comparison with same quarter in 2022. Demand for electrically vehicles (EVs) positioned Q1 2023 as the fourth highest quarterly figure on record. Q1 2023 numbers translated into a 19% of market share, lower than China, but twice the market share registered in the United States.
- **The number of hours with negative wholesale prices in Q1 2023 (145) was 34% higher than in Q1 2022.** Most of negative hourly price instances occurred in January (92), during periods of high renewable generation and low electricity demand (weekends and holidays).

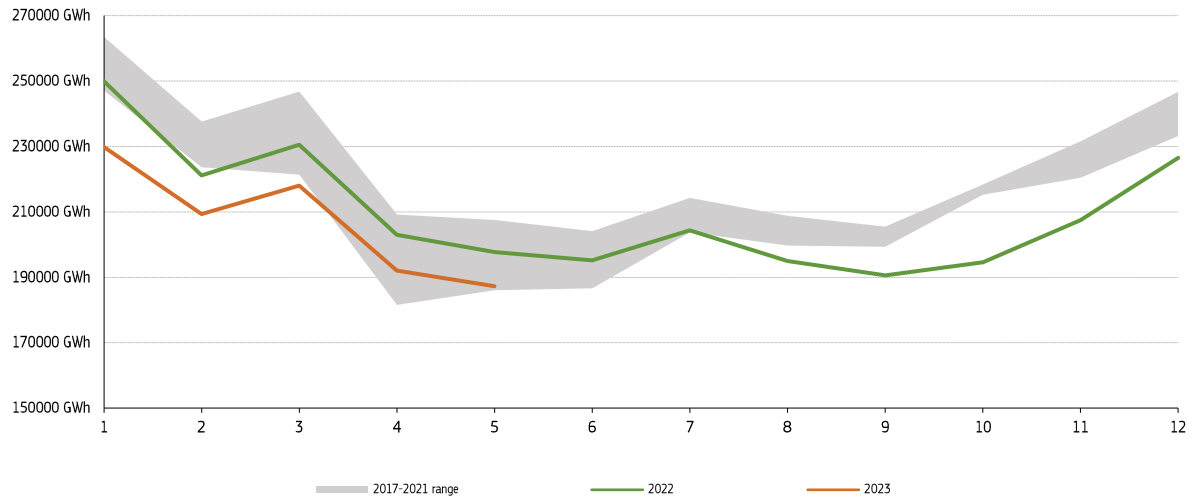
Methodological Note: The rapid changes in gas and electricity markets happening through the energy transition as well as the significant restructuring of the EU's energy supply following the energy crisis, call for reviewing the Quarterly Reports of the European Electricity and Gas Markets so as to make them best fit for purpose. The aim is to ensure a more timely publication, modernise presentation, increase data transparency and an easier access to the data used to produce the reports. All this should increase usability for readers. The process of the review is planned to be carried out gradually attending the feedback we receive on it. As the Commission advances with its review, the quarterly reports will progressively reflect the methodological, technical, and editing changes as well as the comments received from stakeholders.

1 Electricity market fundamentals

1.1 Demand side factors

- The total actual load in the EU dropped 6% compared with last year's levels in Q1 2023, following the impact of warmer-than-average weather, combined with the aftermath of the industrial demand reduction due to high prices in 2022 and behavioural changes. Demand levels for the first quarter of 2023 were also well below the 2017-2021 range, registering the lowest value in February.

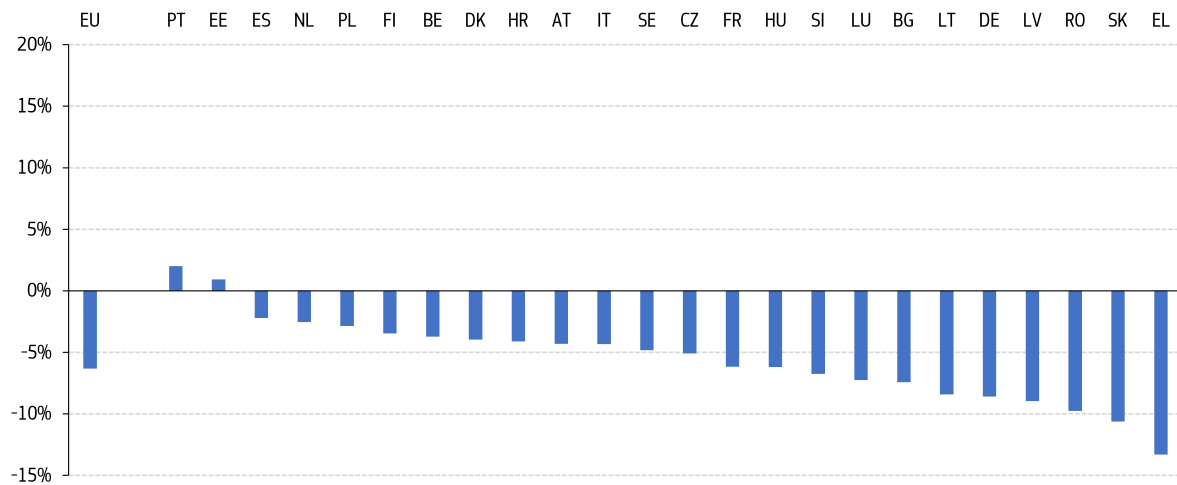
Figure 1 – Monthly EU actual total load of electricity



Source: ENTSO-E

- Figure 2** sums up changes in electricity actual total load over Q1 2023, compared to Q1 2022. EU electricity demand in almost all Member States. Twenty-two Member States registered decreases in electricity demand, the biggest of which occurred in Greece (-13%), Slovakia (-11%) and Romania (-10%). By contrast, Portugal (+2%) and Estonia (+1%) registered slight increases.

Figure 2 – Annual changes in electricity actual total load by Member State

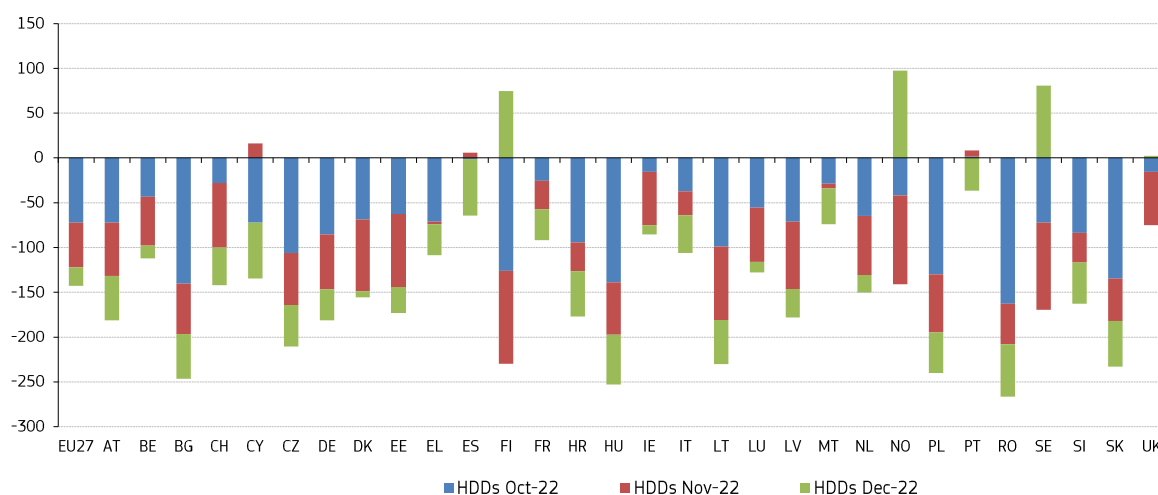


Source: ENTSO-E

Overall, among other relevant factors, the mild weather helped keeping the energy price situation from worsening during the first quarter of 2021.

- **Figure 3** illustrates the monthly deviation of actual Heating Degree Days (HDDs) from the long-term average (a period between 1979 and the last calendar year completed) in Q1 2023. EU-wide, the reference quarter was warmer than the historical range, registering 139 HDDs below the long-term average (concentrated mainly in October). In general, temperatures during Q1 2023 were approximately 1.6°C higher than usual, mainly due to warmer weather in January. Practically all MS experienced warmer-than-usual weather conditions, with the exception of Nordic countries in March, where cold temperatures were registered. During the reference quarter, all three months registered warmer-than-average temperatures. In particular, January had the highest number of deviations from the average levels. Overall, among other relevant factors, the mild weather helped keeping the energy price situation from worsening during the first quarter of 2021.

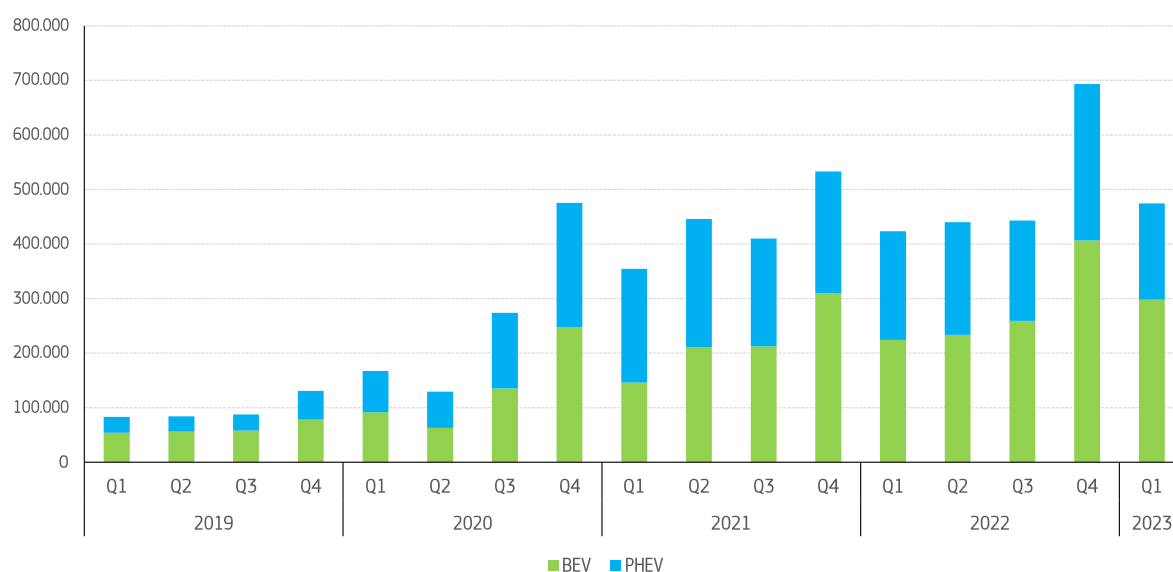
Figure 3 – Deviation of actual heating days from the long-term average in January-March 2023



Source: JRC. The colder the weather, the higher the number of HDDs. The hotter the weather, the higher the number of CDDs

- **Figure 5** shows that almost 475,000 new EVs were registered in the EU in Q1 2023 (+12% compared with Q1 2023). This is the fourth highest quarterly figure on record and translates into a 19% market share; lower than China (32%), but twice the market share registered in the United States (9%). The battery electric vehicles segment continued to grow (+33% year-on-year close to 300,000). However, the demand for plug-in hybrid vehicles registered a decrease (-11% year-on-year to more than 175,000). Hybrid electric vehicles (not chargeable) sales amounted to more than 660,000, registering an increase of 17% compared with Q1 2022.

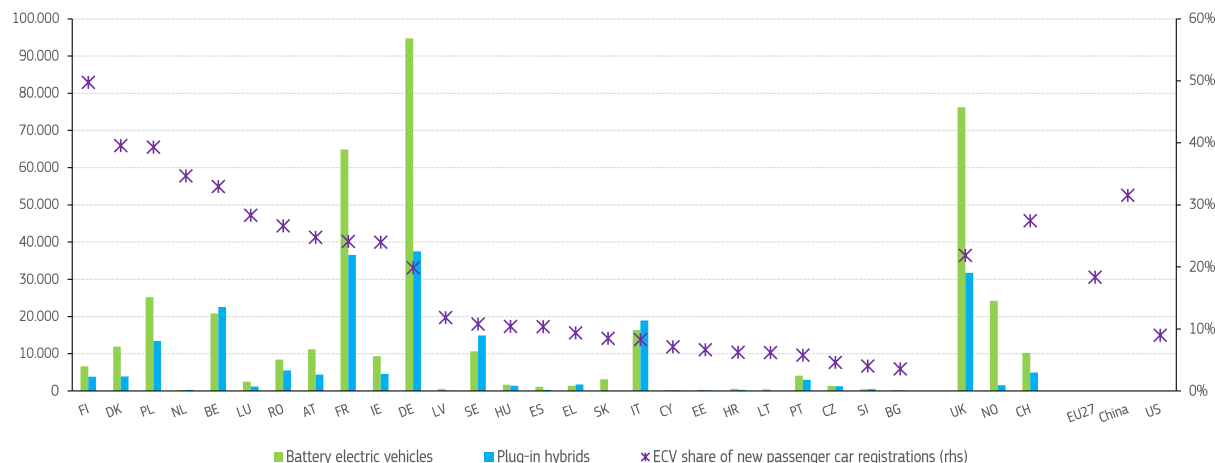
Figure 4 – Quarterly EV sales in the EU



Source: ACEA

- The highest EV penetration was observed for another quarter in Sweden where 56% of the cars sold in Q1 2023 were EVs. In addition, in Finland, half of the passenger cars sold could be plugged (50%), followed by Denmark (40%), and the Netherlands (39%). Germany retained the position of the largest individual market (more than 132,000 EV sales in Q1 2023) followed by France, where sales amounted to more than 101,000 new EVs in the reference quarter.

Figure 5 – Electrically chargeable passenger vehicle (EV) sales in selected countries in Q1 2023

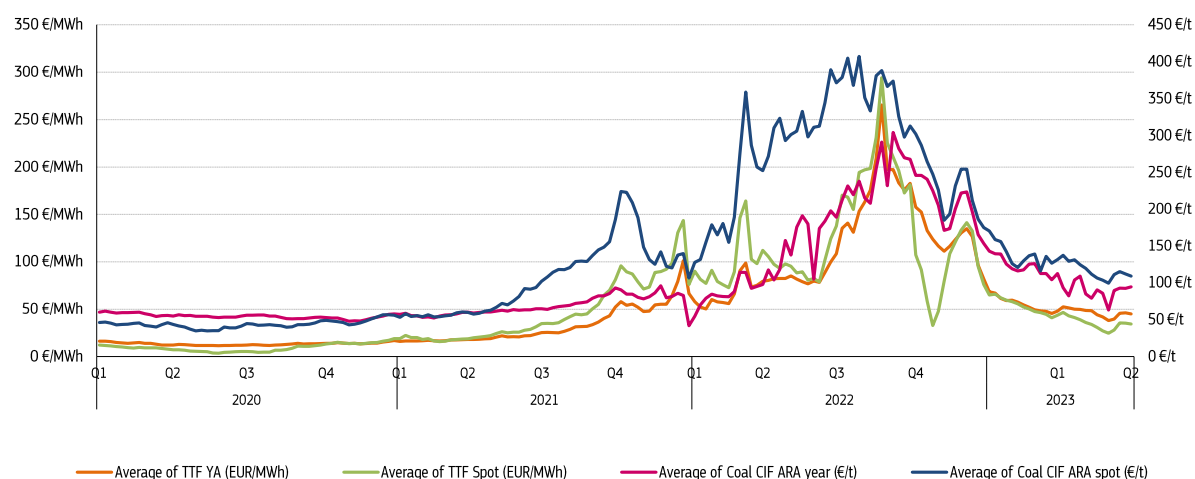


Source: ACEA, CPCA, BloombergNEF

1.2 Supply side factors

- **Figure 6** reports on developments in European coal and gas prices. Spot and forward prices remained at downward trend for most part of Q1 2023, driven by improved market fundamentals (i.e. high storage levels, reduced demand and additional LNG regasification capacities in Europe). Spot gas prices averaged 53 €/MWh in Q1 2023, 44% lower than the previous quarter (Q4 2022) and 46 lower than prices in Q1 2022. TTF day-ahead prices remained aligned with TTF forward contracts (month and year ahead) during Q3 2021. Year-ahead prices averaged 55 €/MWh in Q1 2023, 56% lower than in Q4 2022 and 18% lower than a year ago (Q1 2022). Forward prices registered a contango during Q2 2023, which increased towards the end of the quarter.
- Thermal coal spot prices, represented by the CIF ARA contract, fell to 137 €/t in Q1 2023 (from 234 €/t recorded in the previous quarter). Prices fell by 41% compared with the previous quarter (Q4 2022) and amounted for a fall of 34% compared with Q1 2022. Coal price was on a marked decreasing trend since September, supported by coal-to-gas switch on lower gas prices and reduced demand.

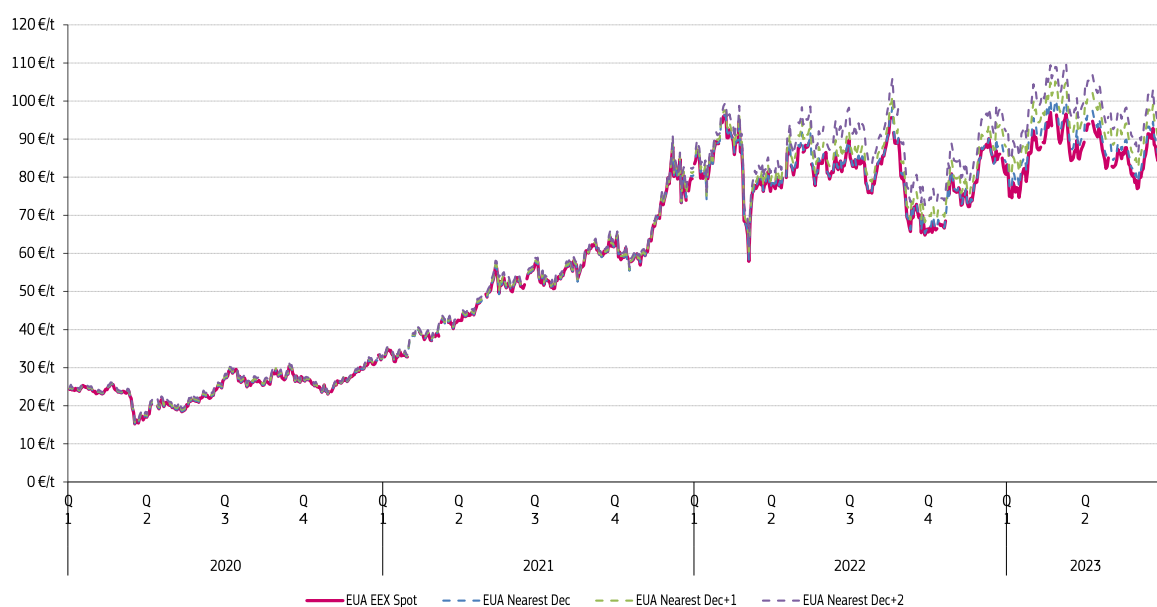
Figure 6 – Weekly evolution of spot and year-ahead coal and gas prices



Source: S&P Global Platts

- The European market for emission allowances, shown in **Figure 7**, continued to register high levels of price volatility in Q1 2023, getting close to the 100 €/tCO₂ mark in February (97 €/tCO₂ on 21 February). The average spot price of CO₂ in Q1 2023 (87 €/tCO₂) registered an increase of 5% compared with Q1 2022 and a 12% rise in relation to the previous quarter (Q4 2022). The nearest-December contract averaged 90 €/tCO₂ in Q1 2023, while the nearest-december +1 and +2 contracts, registered an average of 94 and 99 €/tCO₂, respectively. Falling gas prices in Q1 2023 are supporting coal-to-gas fuel switch, thanks to high carbon prices which put coal and lignite power plants at a greater disadvantage against their less polluting gas-fired competitors (see **Figure 16**).

Figure 7 – Evolution of EU emission allowance spot and future prices from 2020



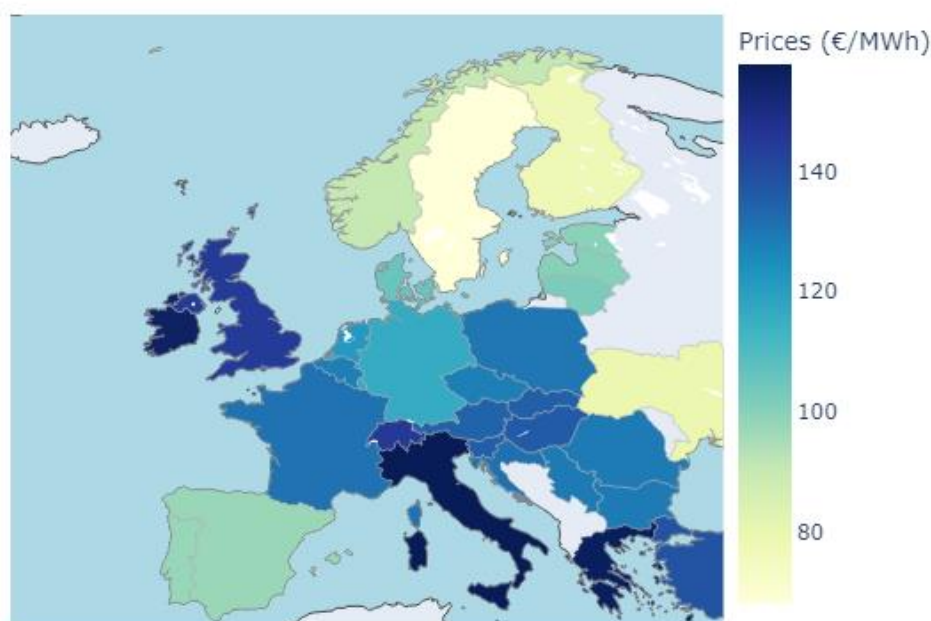
Source: S&P Global Platts

2 European wholesale markets

2.1 European wholesale electricity markets and their international comparison

- The map on the next page (**Figure 8**) shows average day-ahead wholesale electricity prices across Europe in Q1 2023. The average day-ahead wholesale electricity prices across Europe in Q1 2023 were lower than in the previous quarter. Lower gas prices and reduced electricity demand from consumers and industries, along with warmer-than-average temperatures supported falling prices. Higher renewables generation, together with improved nuclear fleet availability, also released some pressure on wholesale electricity markets during Q1 2023.
- On a yearly basis, twenty-six wholesale European Union Member States experienced a decline in wholesale electricity prices (ranging from -57% to -11%¹), while one MS registered an increase of 7% in Q1 2023. The largest year-on-year price falls in Member States were registered in Spain and Portugal (-57%) and France and Croatia (-43%). Conversely, Sweden experienced an increase in prices in Q1 2023, compared with Q1 2022 (+7%).
- Italy and Greece reported the highest quarterly average prices (158 and 157 €/MWh, respectively), 37% and 34% lower than in Q1 2022. Ireland became the third most expensive market with an average baseload price of 156 €/MWh, which was 30% lower compared to the same period last year. The lowest quarterly average prices during Q4 2022 were recorded in Sweden at 68 €/MWh, 7% higher than in Q1 2022.
- The European Power Benchmark averaged 122 €/MWh in Q1 2023, 40% lower on yearly basis. Compared to Q4 2022, the quarterly average price fell by 35%.
- **Figure 9** shows the European Power Benchmark of nine markets, including the lowest and highest regional prices in Europe represented by the two boundary lines of the shaded area, as well as the relative standard deviation of regional prices. The relative standard deviation metric shows that Q1 2023 divergence levels fell from the increases registered during Q4 2022, as almost every market registered a relatively similar decrease in prices during the reference quarter. Annex 4, provides graphics of the monthly evolution of regional prices in Europe.

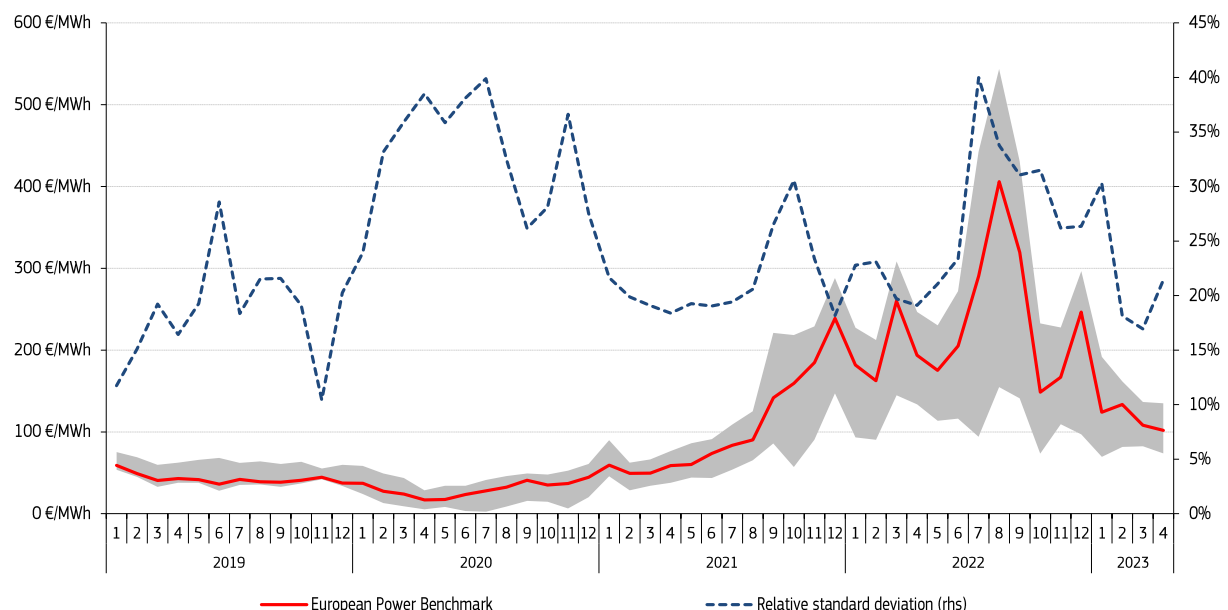
Figure 8 – Comparison of average wholesale baseload electricity prices, first quarter of 2023



Source: European wholesale power exchanges, government agencies and intermediaries

¹ Two EU MS registered decreases over 50%, while eight MS saw a decrease of over 40%, compared to Q1 2022.

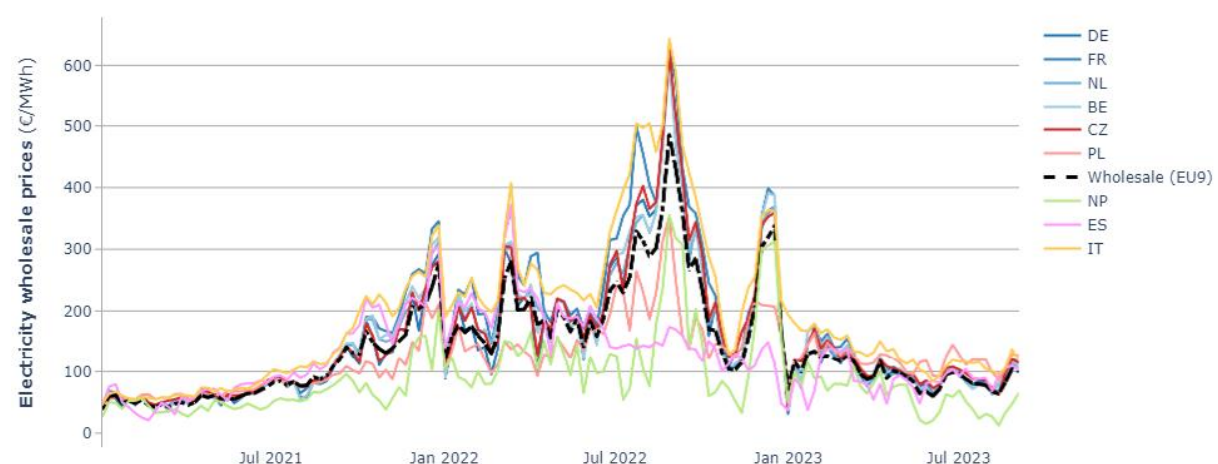
Figure 9 - The evolution of the lowest and the highest regional wholesale electricity prices in the European day-ahead markets and the relative standard deviation of the regional prices



Source: S&P Global Platts, European power exchanges. The shaded area delineates the spectrum of prices across European regions.

- Figure 10** presents the evolution of weekly average electricity wholesale prices in nine selected European markets. Thanks to demand reduction and mild weather, Germany, France and the Netherlands decreased their coal-fired and gas-fired output, registered a fall in prices. The French nuclear fleet, despite the need for additional outages, improved its availability in Q1 2023, which helped to decrease pressure on prices and reversing back power flows into the historical net exporting position of France. Strong renewable generation combined with the fossil-fuel cost adjustment mechanism ('Iberian exception') supported lower prices, averaging 98 €/MWh during the reference quarter. The measure was rarely activated during Q1 2023 (due to prices lower than the subsidy price) and it was de facto inactive during March 2023. At 85 €/MWh, prices in Northern Europe remained lower than in the continent, albeit a lower year-on-year reduction in prices (-22%) due to a relatively colder weather, leading to a lower reduction in electricity demand. Central Eastern Europe markets followed prices in Central Western Europe, although prices in Poland managed to remain slightly below than the average.

Figure 10 – Weekly average electricity wholesale prices in nine selected European markets



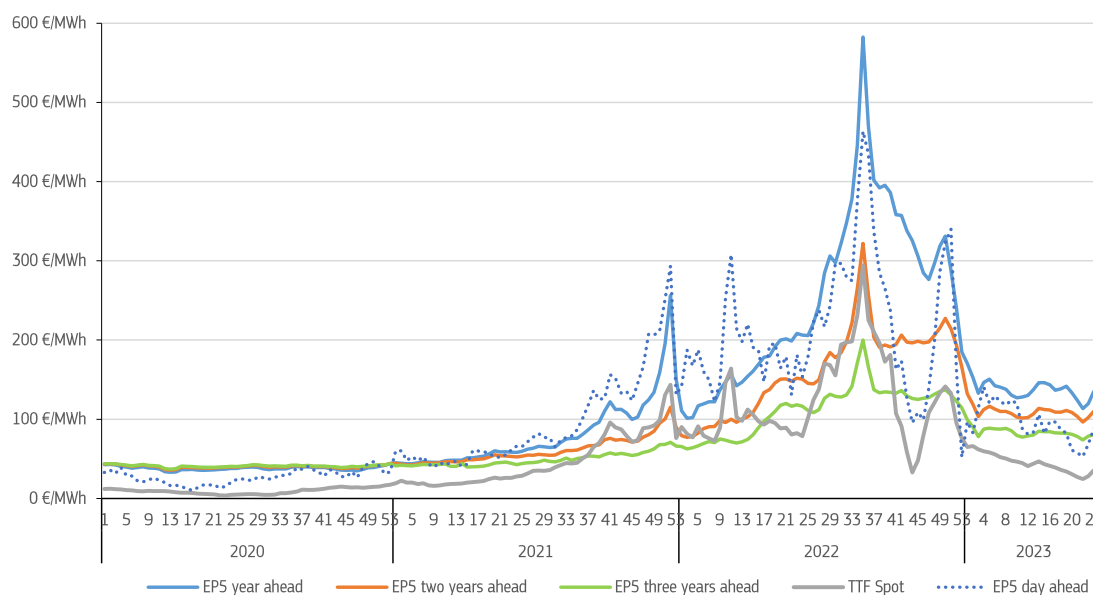
Source: S&P Global Platts, European power exchanges, ENER

- Figure 11**, shows how gas prices (TTF spot price) have been driving expectations of future electricity prices since the first quarter of 2021. In line with TTF price developments, the year ahead power benchmark has been falling

since mid-December 2022 following favourable fundamentals of the TTF. This trend continued into the first part of the second quarter of 2023.

- During the first week of Q1 2023, the weekly average electricity year-ahead, two-year ahead and three-year ahead contracts were respectively 170 €/MWh, 132 €/MWh and 99 €/MWh, whereas during the last week of March, these three values were at lower levels (137 €/MWh, 106 €/MWh and 80 €/MWh). The discount of the weekly average of the year-ahead contract to the spot market oscillated between -7 €/MWh and -70 €/MWh during Q1 2023. The contango of year-ahead prices for most of the reference quarter reflected the risks of potential tightness in the market, which did not materialise in the first quarter of 2023.

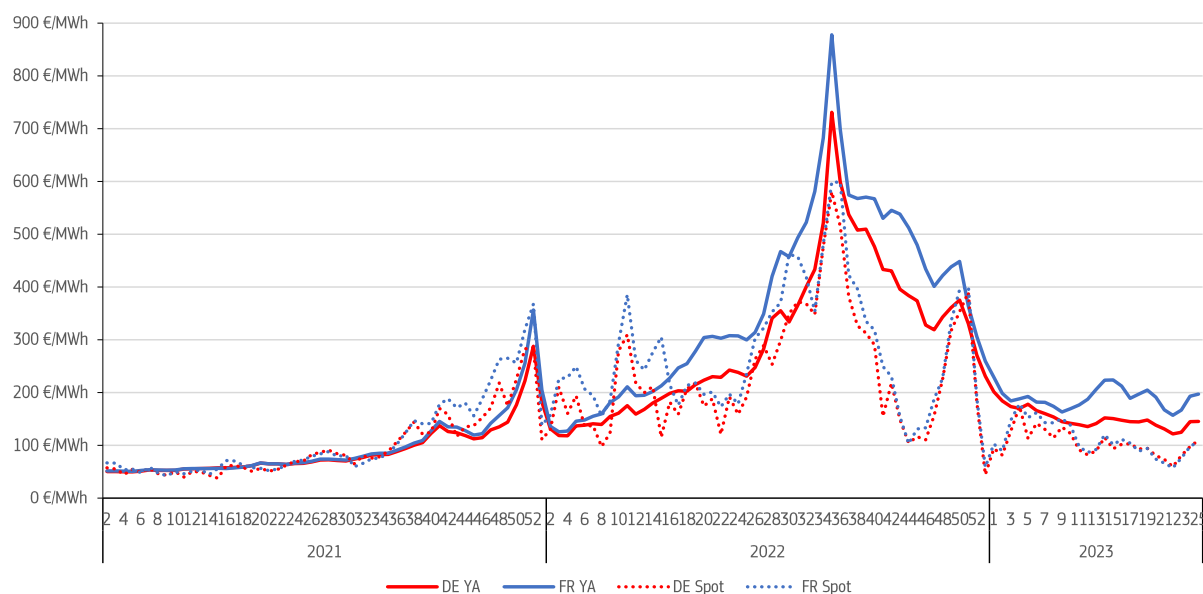
Figure 11 – Weekly futures baseload prices – weighted average of selected European markets



Source: S&P Global Platts.

- **Figure 12** shows the evolution of year-ahead contracts of Germany and France, together with their equivalent spot (day-ahead) prices. The divergence between the two forward contracts has been increasing since the beginning of 2022, reflecting structural differences between the two markets (i.e. the high proportion of French nuclear power plants under maintenance and the relevance of wind generation when can cover a significant part of the demand at times in Germany). The French premium over the German forward contract can also reflect worries over the availability of the French nuclear fleet. The premium of the French contract over their German equivalent contract peaked at 65 €/MWh in the last week of March and it reached a low of 11 €/MWh during the third week of January.

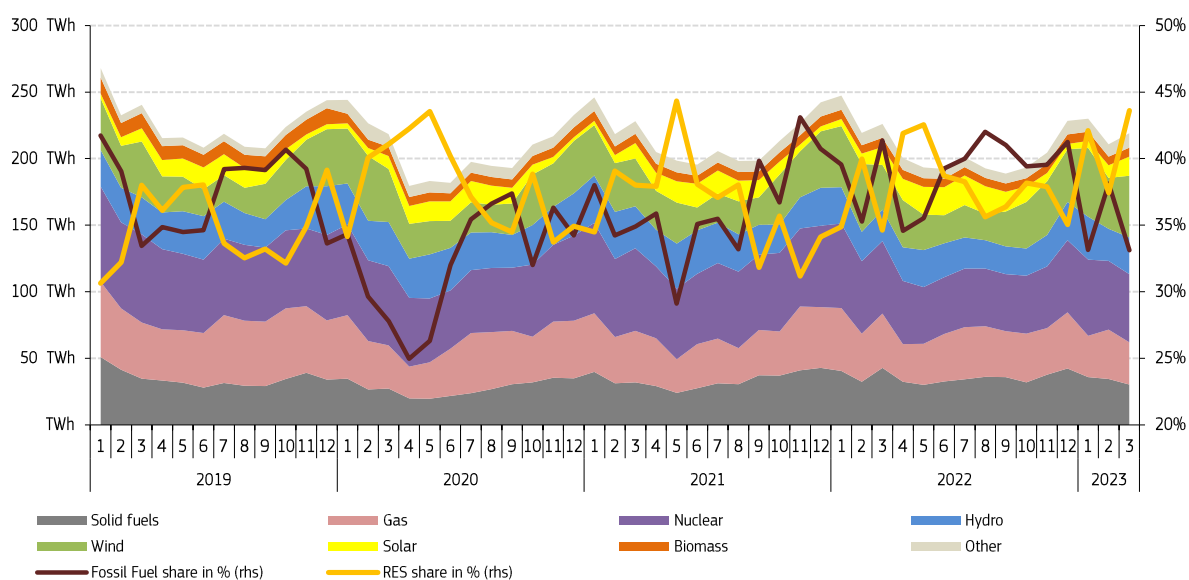
Figure 12 – Weekly German and French year-ahead contracts



Source: S&P Global Platts.

- **Figure 13** shows the monthly evolution of the electricity mix in the EU. In Q1 2023, reduced electricity demand and relevant increase in renewable generation, supported the decrease in fossil fuels generation in the mix. Renewables managed to increase their share to 41% (from 36% in Q1 2022). The share of electricity generated by burning coal, gas and oil (fossil fuel generation) fell to 35% in Q1 2023 (from 39% in Q1 2022). Nuclear generation improved its availability during Q1 2023, vis-à-vis Q4 2022, despite delays in scheduled maintenance and new unplanned outages in France. The share of nuclear generation in Q1 2023 was 24%, slightly below Q1 2022 (25%).

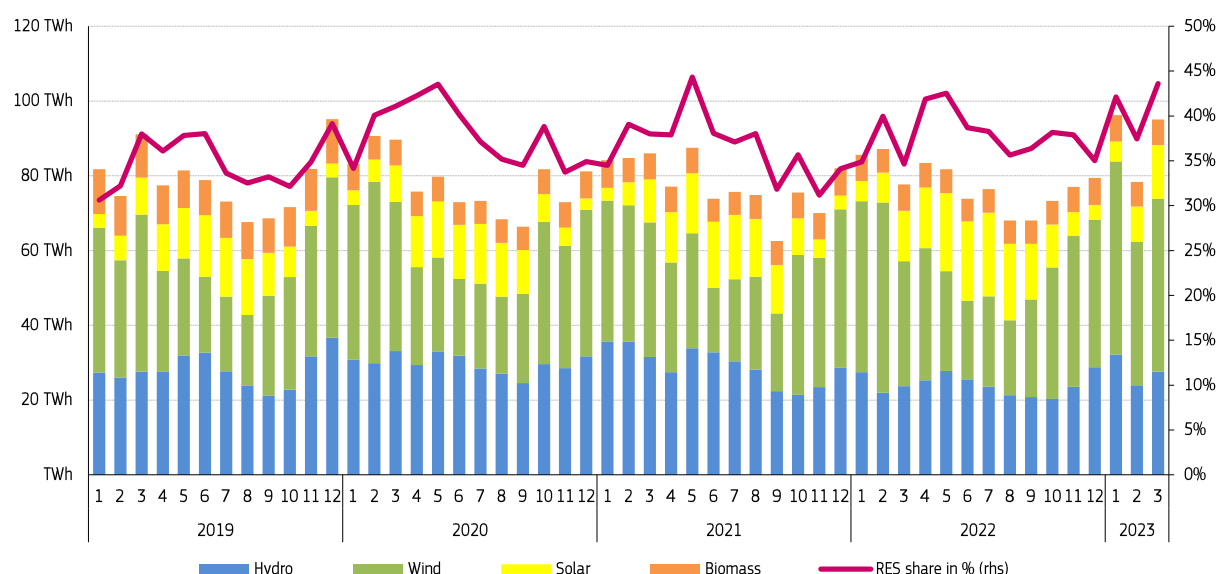
Figure 13 – Monthly electricity generation mix in the EU



Source: ENTSO-E. Fossil fuel share calculation covers power generation from coal, lignite, gas and oil.

- **Figure 14** depicts the evolution of monthly renewable generation in the EU, alongside its share in the electricity generation mix. The growth in renewable penetration during Q1 2023 was supported mainly by +15% of improved hydropower (+10 TWh), +6% of wind onshore (+6 TWh) and +8% of solar (+2 TWh) generation, in comparison with Q1 2022. Wind and solar generation together were higher than gas-fired generation in Q1 2023.

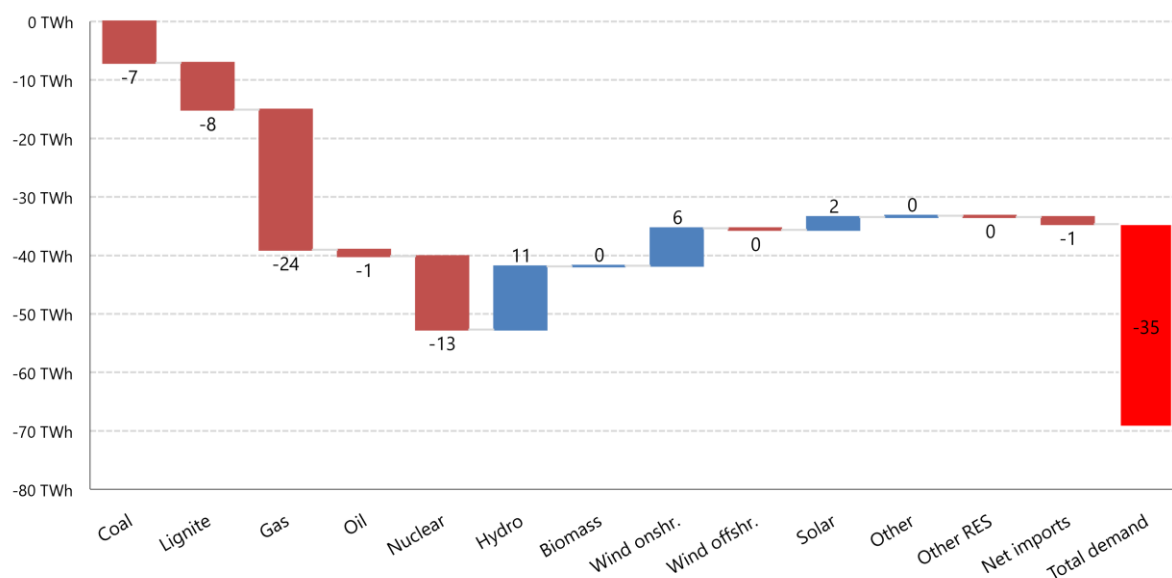
Figure 14 – Monthly renewable generation in the EU and the share of renewables in the power mix



Source: ENTSO-E. Data represent net generation.

- **Figure 15** visualises changes in the EU27 electricity generation, imports and consumption in Q1 2023 compared to Q1 2022. Warmer-than-average weather during winter and the aftermath of the unprecedented prices registered in 2022, supported a reduction in power demand during the reference quarter. The demand reduction supported less fossil generation: gas-fired generation fell by 24 TWh (-19%), while coal and lignite decreased their output by 7 TWh (-12%) and 8 TWh (-14%), respectively in Q1 2023 (a total drop of 13% and -15 TWh combined). Overall, fossil fuel generation fell by 15% (-40 TWh) in Q1 2023. Nuclear output fell by 13 TWh (-7%) in Q1 2023, which were able to be covered by the surplus of hydro, wind and solar generation.

Figure 15 – Changes in power generation in the EU between Q1 2022 and Q1 2023

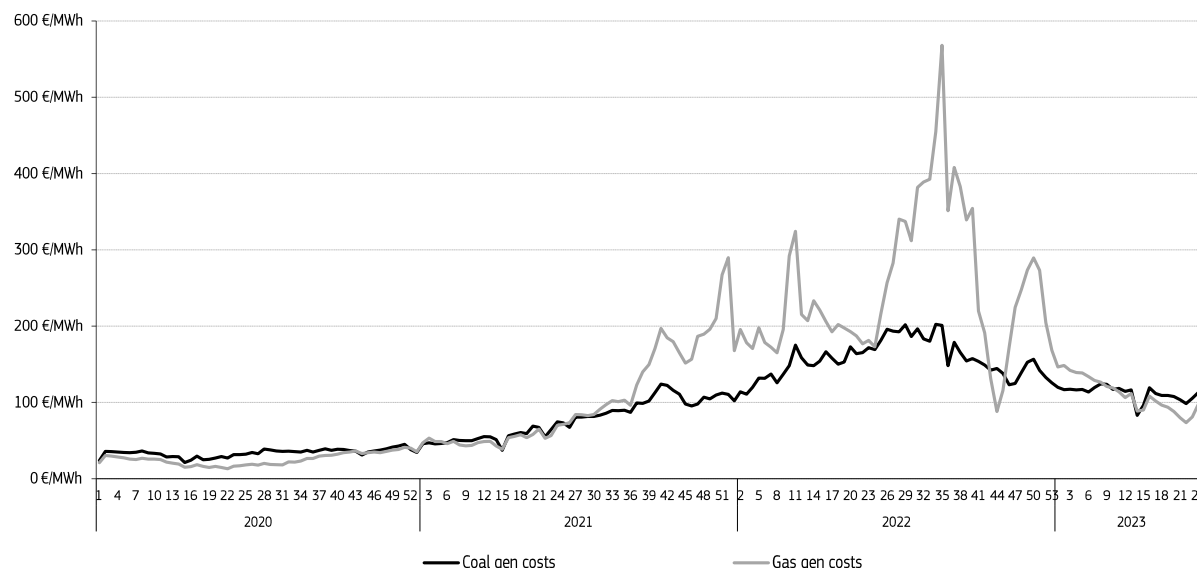


Source: ENTSO-E. Data represent net generation

- **Figure 16** shows the impact of gas prices on estimated gas and coal-fired generation variable costs for estimated average power plants (fuel and emission allowances costs). 2022 was marked by unprecedented gas prices which impacted heavily on gas-fired generation costs, offsetting the effect of the increase in coal and carbon prices on

coal-fired generation costs. However, since the second half of December 2022, gas prices experienced a decline while carbon prices remained relatively high. This created favourable conditions for a shift from coal to gas, after nearly one year and half of uneconomical conditions for coal-to-gas fuel switch. The trend continued well into Q2 2023, with gas market fundamentals supporting lower gas prices.

Figure 16 – Variable generation costs of coal- and gas-fired power plants

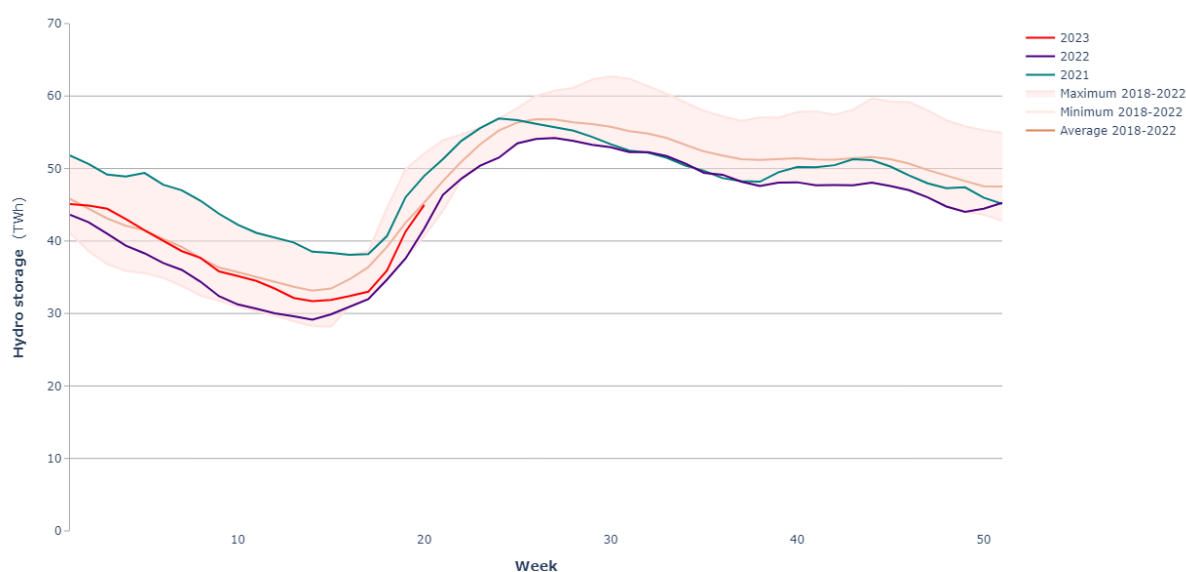


Source: S&P Platts, ENER

Note: Thermal efficiency values used for coal- and gas-fired plants were 41% and 55% respectively. Emissions intensity values used were 0.85 and 0.37 tCO₂e/MWh respectively for coal- and gas-fired generation.

- **Figure 17** shows the sum of 2023 levels of hydro reservoirs in the reported markets. In Q1 2023, the overall sum of hydropower reservoirs was recovering from the low levels registered in Q1 2022. During the last week of June, levels remained within the 5-year average, evolving according to the seasonal developments.

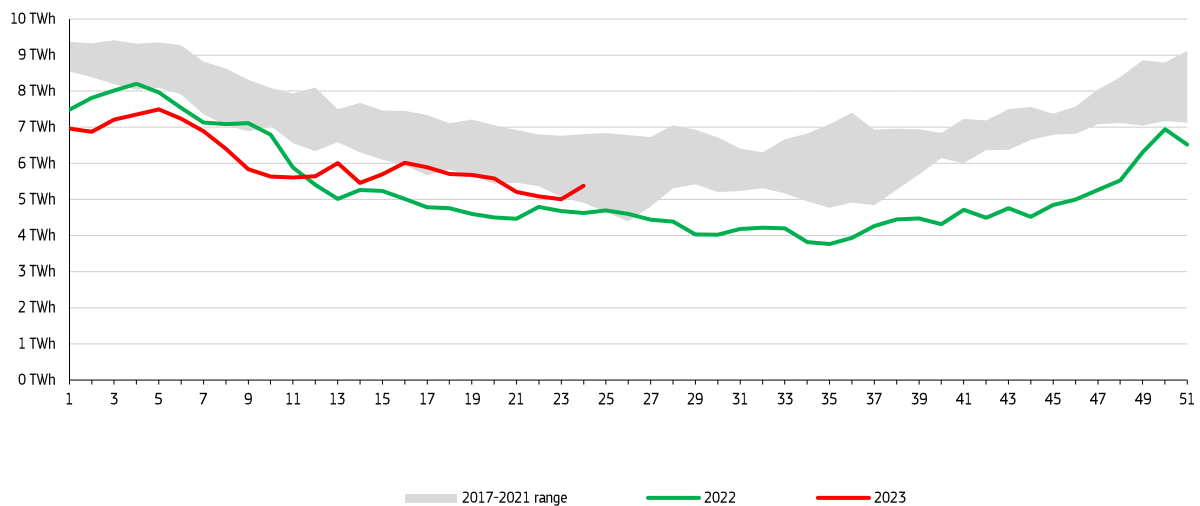
Figure 17 – Aggregated EU hydropower reservoirs



Source: ENTSO-E. Aggregated hydropower reservoirs for Austria, Bulgaria, Spain, Finland, France, Greece, Hungary, Italy, Lithuania, Latvia, Portugal, Romania and Sweden.

- As shown in **Figure 18**, French nuclear output amounted to 86 TWh in Q1 2023 and was down by 2% (-2 TWh) year-on-year. However, nuclear generation recovered in Q2 2023 compared with the low levels of Q2 2022. The French nuclear output in 2022 (279 TWh) was the lowest since 1998. In February 2023, EDF confirmed its nuclear availability for the year between 300 and 330 TWh, as the fleet experienced a high number of outages combined with scheduled maintenance in 2022.

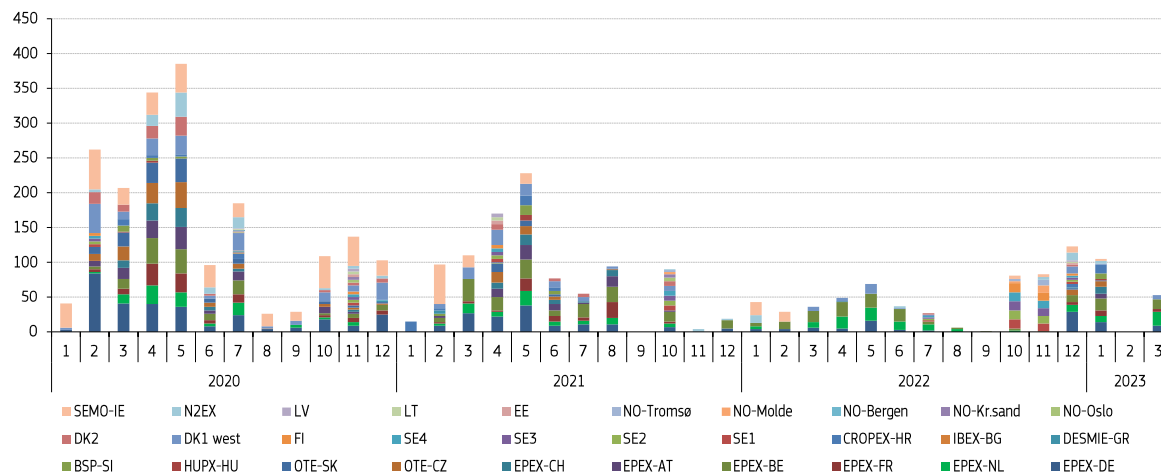
Figure 18 – Weekly nuclear electricity generation in France



Source: ENTSO-E

- Figure 19** shows the monthly frequency of the occurrence of negative hourly wholesale electricity prices in selected European markets. Negative hourly prices usually appear when demand for electricity is lower than expected and when variable renewable generation is abundant, combined with ongoing relatively non-flexible large baseload power generation (e.g.: nuclear or lignite). In such cases, conventional power plants offer their output for a negative price in an effort to avoid switching the unit off and having to go through the costly and high-maintenance operation of restarting the facility when they want to enter the market again.
- The number of hours with negative wholesale prices in Q1 2023 (145) was 34% higher in the observed bidding zones than in the previous first quarter. Most of the falls into negative territory occurred in January (92) and took place in days when low consumption coincided with high renewable generation. Demand reduction registered in Q1 2023 may also have influenced the occurrence of negative prices. The highest number of negative prices (88) was recorded on 1 January, when weak demand and mild weather, combined with strong wind speed, pushed Central Western Europe (DE, NL, FR, BE, AT, CH) and Central Eastern Europe markets (CZ, SK, HU and SI) below zero during several hours of the day. Notably, 14 hours of that day registered negative prices in Germany and Belgium.

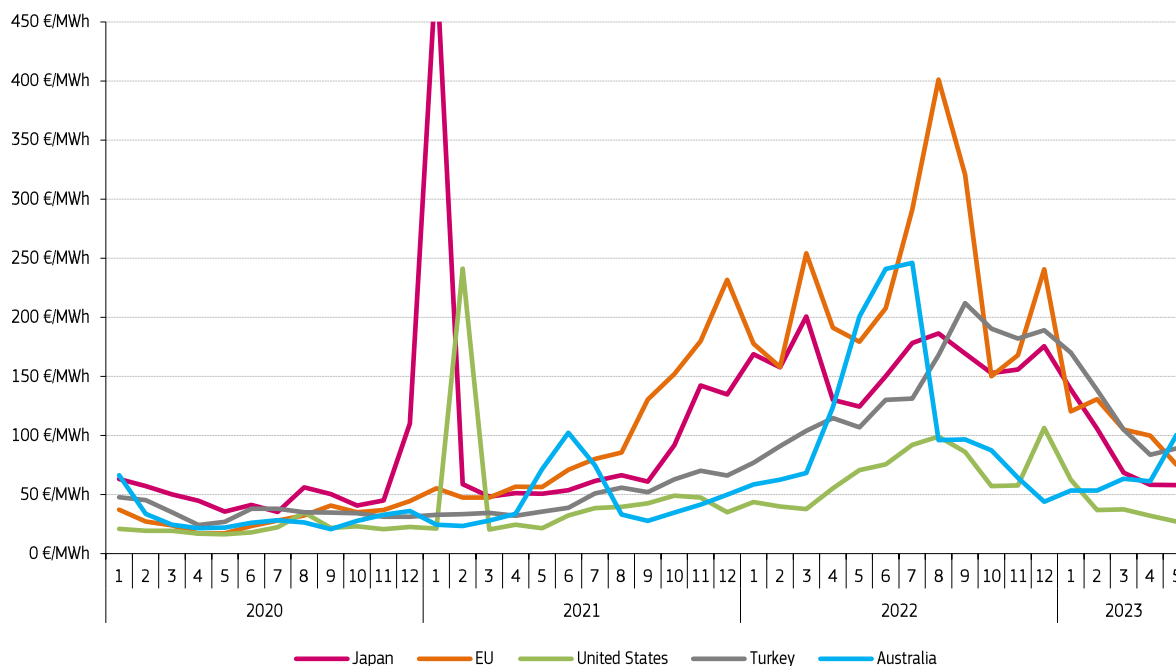
Figure 19 – Number of negative hourly wholesale prices on selected day-ahead trading platforms.



Source: Platts, ENTSO-E.

- **Figure 20** compares price developments in wholesale electricity markets of selected major economies. Most markets saw power prices easing due to year-on-year improved fundamentals in global energy markets. In particular, lower Q1 2023 gas and coal international prices and overall demand reduction, contributed to reduce pressure on markets.
- In the U.S., wholesale electricity prices fell in most of the analysed regional wholesale markets supported by lower Henry Hub prices. California was the exception in Q1 2023, as prices rose by 139% compared with Q1 2022. The rest of the analysed markets, registered year-on-year falls in prices within the range of 25-35%.
- In Japan, lower international LNG prices, combined with a drop in power demand and below-average temperatures, supported a decrease of 41% of Q1 2023 prices, compared with Q1 2022. Japan relies heavily on fossil-fuel power generation, and it is one of the most important LNG buyers in the global market.
- In Australia, wholesale electricity prices fell by 10% year-on-year in Q1 2023, progressively returning to historical levels, after the highs registered in 2022. However, divergence of prices between the northern and southern regions of the National Electricity Market (NEM) remains in place. Regional average wholesale prices were in the range of 56 AUD/MWh in Victoria and 104 AUD/MWh in Queensland.

Figure 20 – Monthly average wholesale electricity prices in international markets (D-A markets)

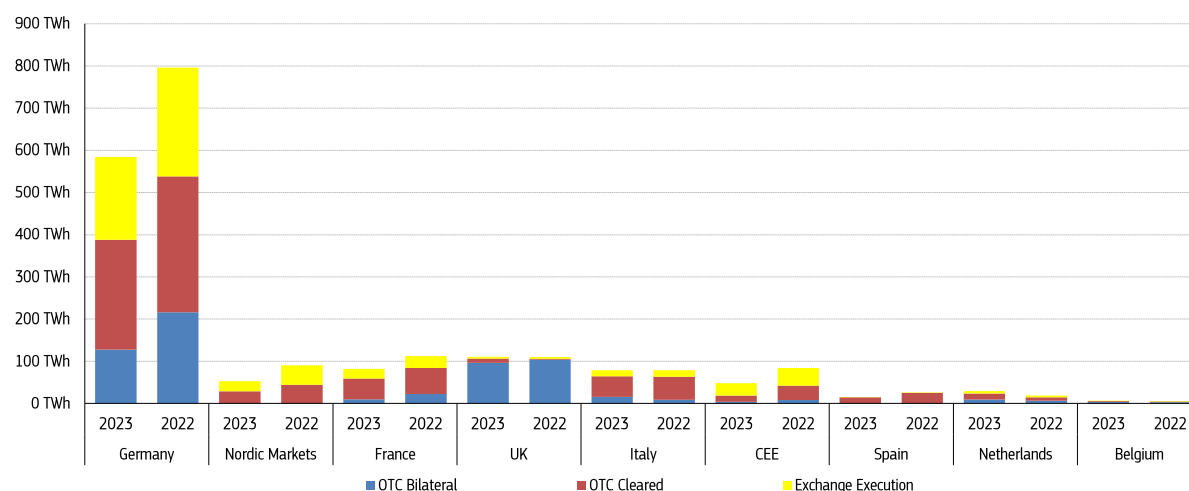


Source: European Power Benchmark, JPEX (Japan), AEMO (Australia), Energy Exchange Istanbul (Turkey) and the average of selected PJM West, ERCOT, MISO Illinois and CAISO regional wholesale hubs in the United States.

2.2 Traded volumes and cross border flows

- **Figure 21** shows annual changes of traded volumes of electricity in the main European markets up to February 2023, including exchange-executed trade and over-the-counter (OTC) trade. For another reporting period, most markets and regions witnessed a year-on-year decline in trading activity (-24%). The decrease in total traded volumes (-315 TWh) reflects the magnitude of the falling trend in trading activity in the electricity sector. Activity dropped significantly in OTC contracts (-23%) and exchanges (-26%) in the total traded volumes under observation during the first two months of 2023. The total traded volume in all markets under observation fell by 24% to 1007 TWh.
- Despite falls in traded volume, Germany was by far the largest and most liquid European market, as total volumes reached 584 TWh (equivalent to 58% of the total traded volumes under observation). Overall, total activity fell (-27%) in Germany during the reporting period. In Germany, the market share of exchanges experienced an increase (+2 p.p.) while the OTC contracts share decreased compared with the equivalent period in 2022.
- Overall, the market share of power exchanges remained at 30% during the reporting period. Overall, exchange-based trading volumes decreased by 103 TWh (-26%). The OTC segment traded 213 TWh less of volume in the reporting period.

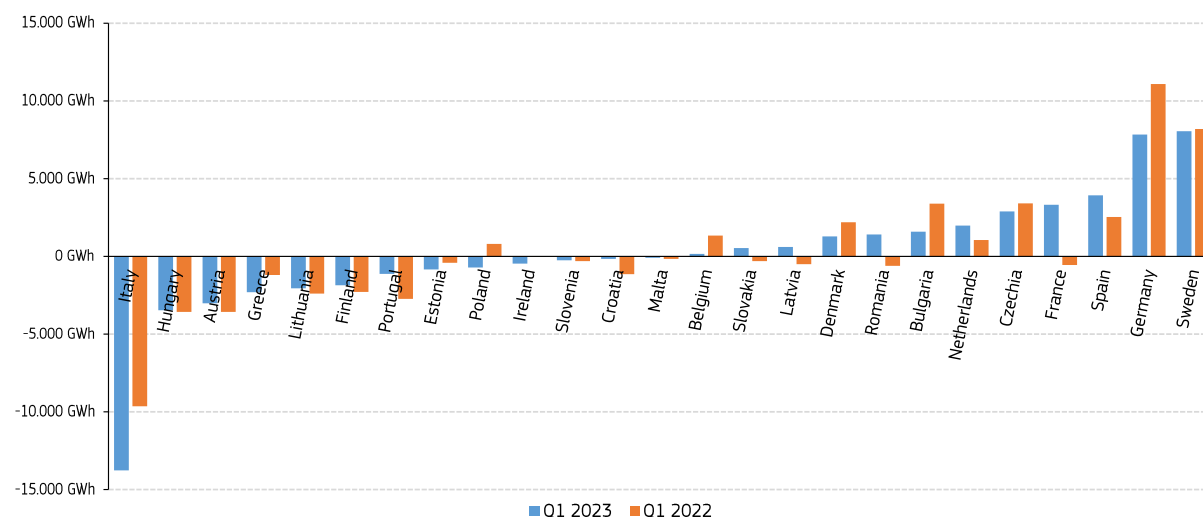
Figure 21 – Annual change in traded volume of electricity on the most liquid European markets



Source: Platts, wholesale power markets, Trayport, London Energy Brokers Association (LEBA) and DG ENER computations

- **Figure 22** compares net balances of physical electricity flows among EU Member States in Q1 2023 and Q1 2022. The net trading position in Q1 2023 was more balanced and closer to historical behaviour than in 2022, where normal flows reversed in some key markets.
- France managed to reverse the 2022 trend and go back to its position as a net exporter during Q1 2023 (3 TWh), albeit still low compared with historical values of previous years. Sweden was the primary net exporter in the EU during Q1 2023 (8 TWh), thanks to a discount in wholesale electricity prices due to nuclear and hydro generation vis-à-vis Finland, the Baltic countries and other continental European markets. The list is followed by Germany, with almost 8 TWh of net exports during the reference quarter. Germany became the second net exporter in the EU due to a decrease in demand and a surplus of wind generation. Italy remained as the larger net importer in the EU (-14 TWh). Hungary and Austria recorded both net imports of -4 TWh and -3 TWh, respectively in Q1 2023.

Figure 22 – Member States' net scheduled commercial export/import positions within the EU in Q1 2023 and Q1 2022

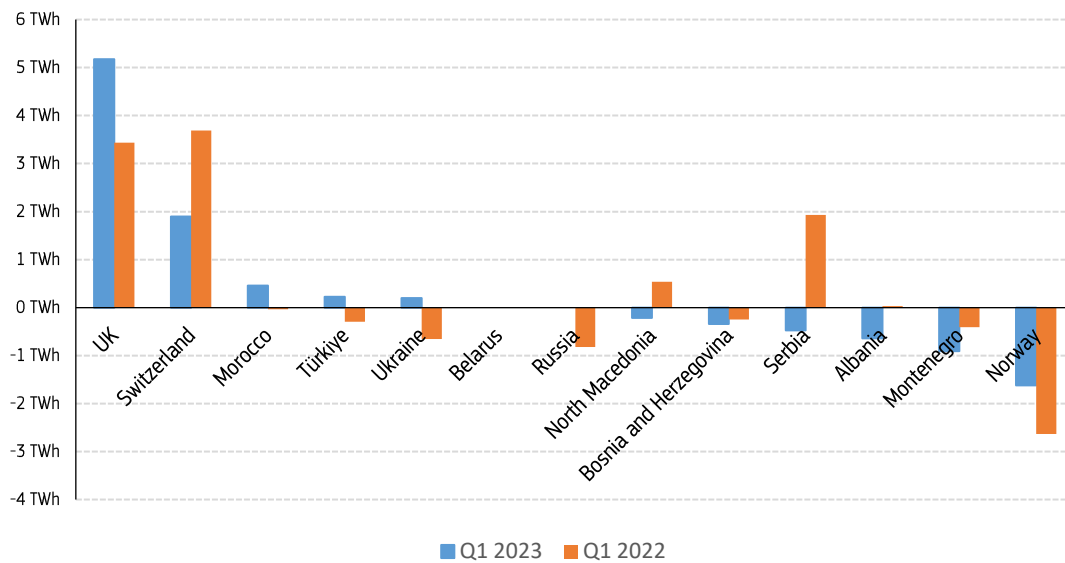


Source: Scheduled Commercial flows ENTSO-E, TSOs

- **Figure 23** Error! Reference source not found. shows netted electricity exchanges with EU neighbours in Q1 2023. Great Britain returned to its traditional position of net importer during Q1 2023 (5 TWh). Norway retained its position as main net exporter to the EU (-2 TWh), despite a decrease of 40% of net exports compared with Q1 2022 (-3 TWh). Net exports from the EU to Ukraine registered 0.2 TWh in Q1 2023. Commercial exchanges of electricity between Continental Europe and Ukraine/Moldova started in June 2022, after the successful synchronisation of the power systems. Ukraine halted exports to Continental Europe after the massive Russian attacks of their energy

infrastructure in October 2022. Since then, the TSOs of Continental Europe have regularly increased the capacity available for trading. [ENTSO-E](#) indicated that on 18 April 2023, the trade capacity has been increased to more than 1 GW.

Figure 23 – Extra-EU electricity commercial scheduled exchanges in Q1 2023 and Q1 2022 – netted



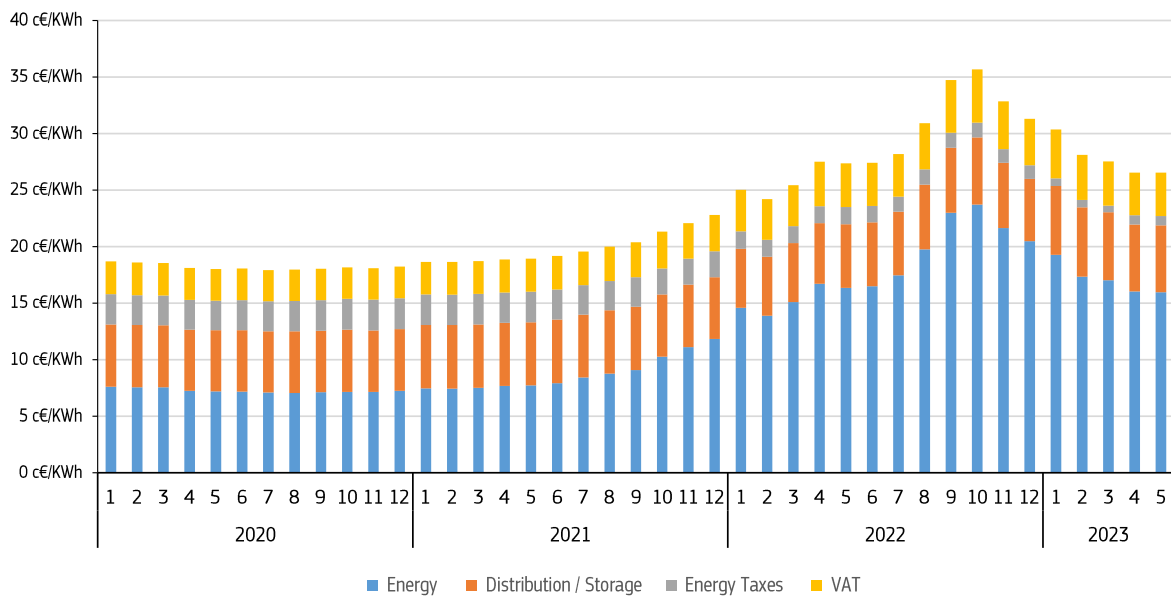
Source: Scheduled Commercial Flows ENTSO-E, TSOs. Negative values indicate net imports to the EU.

3 Retail markets

3.1 Retail electricity markets in the EU

- Increasing wholesale prices in 2022 put upward pressure on retail prices, as high wholesale prices were passed through into consumer contracts. Government interventions in some Member States alleviated the bill for consumers. The decrease in wholesale prices registered in Q1 2023 alleviated pressure on retail prices across the EU.
- Figure 24** shows the monthly evolution of the EU average residential retail electricity prices over the last few years. The average retail electricity prices for household costumers in EU capital cities was at 28.7 c€/kWh in Q1 2023, up by 15% compared with Q1 2022. However, prices during the months of the first quarter registered consecutive falls, as a result of lower wholesale prices. Prices in Q1 2023 were 14% lower than in Q4 2022.

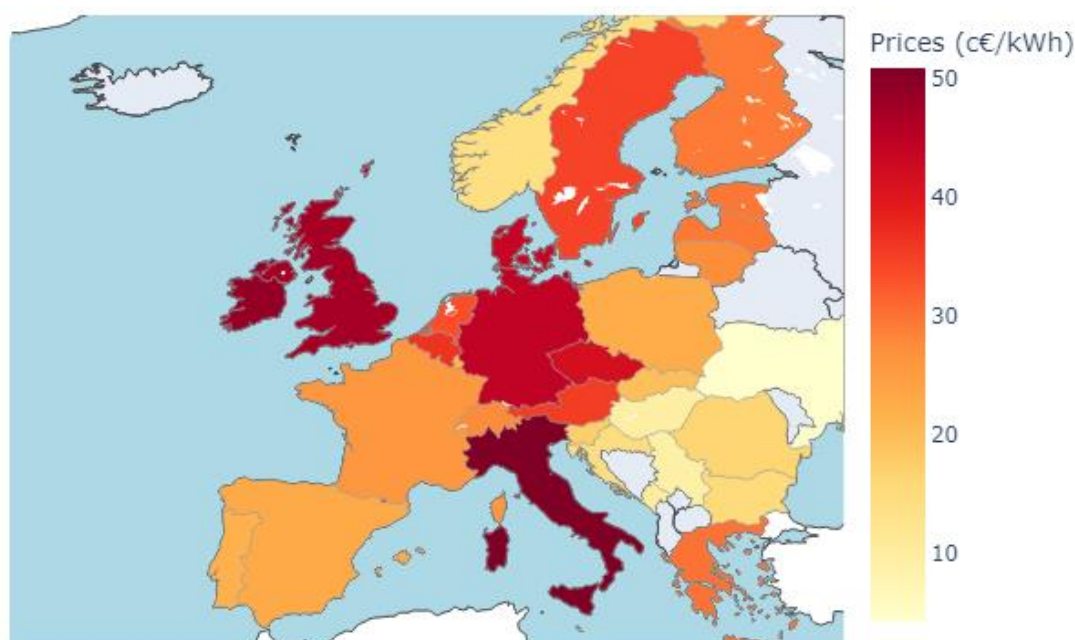
Figure 24 – Monthly average electricity price in the EU, paid by typical household customers.



Source: Vaasaett

- Figure 25** shows the average quarterly electricity prices paid by households in capital cities in EU Member States and other European countries with typical annual consumption.

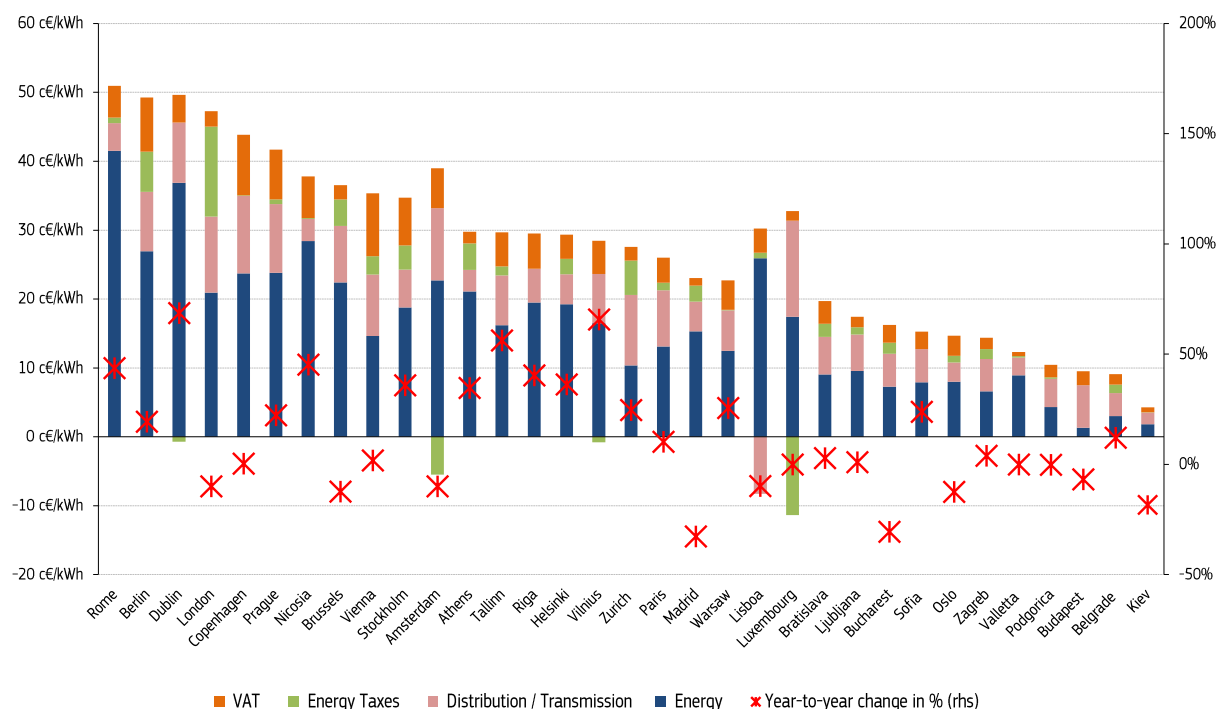
Figure 25 – Comparison of average household retail electricity prices in European capitals, first quarter of 2023



Source: Vaasaett

- Figure 26** shows retail electricity prices for representative household consumers in European capital cities, and their composition divided into four categories (energy, network charges, energy taxes and the value added tax). The highest quarterly prices were observed in Rome, Berlin and Dublin (51.0, 49.2 and 48.9 c€/kWh, respectively). In Q1 2023, the energy component share surpassed 50% of the total retail price in 22 EU capitals, up from 16 in Q1 2022. The energy component share is highest in Rome (82%), Nicosia and Dublin (75%). Amsterdam, Vilnius, Luxembourg, and Lisbon, represent a special case as explained below. The lowest prices among EU capitals were recorded in Budapest (9.5 c€/kWh), Valletta (12.3 c€/kWh) and Zagreb (14.4 c€/kWh). EU-wide, retail prices started a steep climb since September 2021. Moreover, pushed by high wholesale prices, retail prices kept increasing throughout the year, intensifying the pressure on inflation throughout 2022. A peak in retail prices for electricity consumers was registered in October 2022. Since then, retail electricity prices have followed a falling trend, stabilising as of May 2023.
- The tax reduction subcomponent (tax credit) that applies to electricity customers in the Netherlands is currently higher than the annual energy tax amount that corresponds to a typical residential customer in Amsterdam. Even in cases when the tax credit is higher than the tax amount, the customers still receive the full credit as a discount from their overall annual bill. In practice, this has resulted in a negative value of the Dutch tax component in the price breakdown. This development has also significantly reduced household electricity prices countrywide, and contributed to the unusual effect in which the lower the consumption, the lower the price per kWh. Similarly, consumers in Vilnius and Luxembourg receive a tax refund in their energy tax. Lisbon consumers receive a refund for the use of energy infrastructure, following a reduction in network access tariffs.

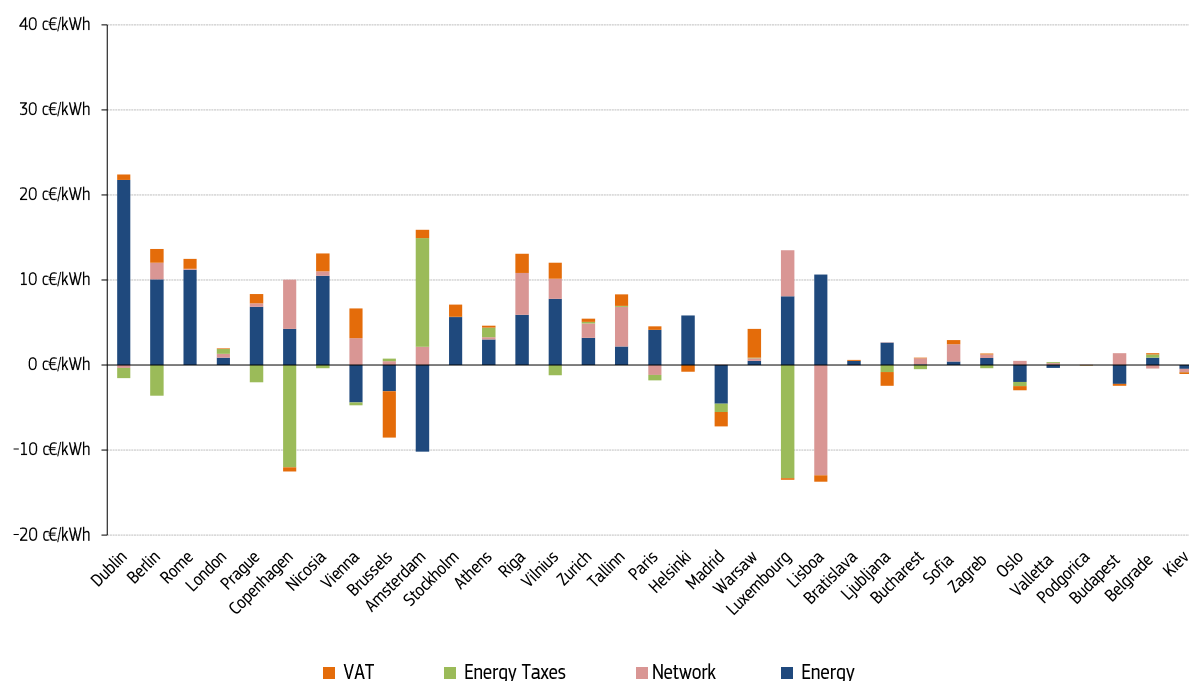
Figure 26 – The Household Energy Price Index (HEPI) in European capital cities in Eurocents per kWh, Q1 2023



Source: Vaasaett

- Compared to the same month of the previous year, the largest price increase in relative terms in Europe in Q1 2023 was observed in Dublin (+69%), Vilnius (+65%) and Tallin (+56%). As shown in **Figure 27**, rising prices were driven by higher wholesale prices than a year before in most of the EU capitals. Eight of the twenty-seven EU capitals reported prices lower or unchanged, compared to the same quarter of the previous year, with Madrid (-33%), Bucharest (-30%) and Brussels (-12%) posting the largest relative drops. Households in these capitals benefited mainly from a reduction in the energy component.

Figure 27 – Year-on-year change in electricity prices by cost components in the European capital cities comparing Q1 2023 with Q1 2022

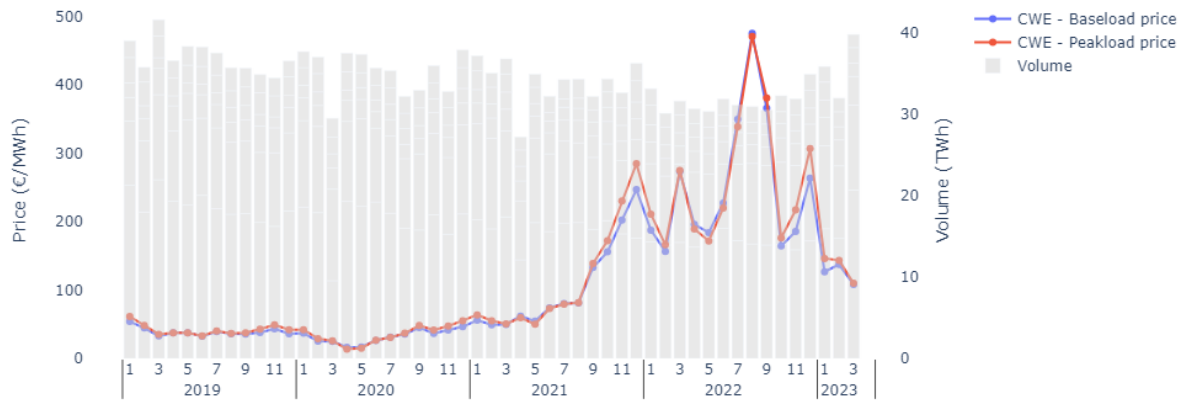


Source: Vaasaett

4 Annex - Regional wholesale markets

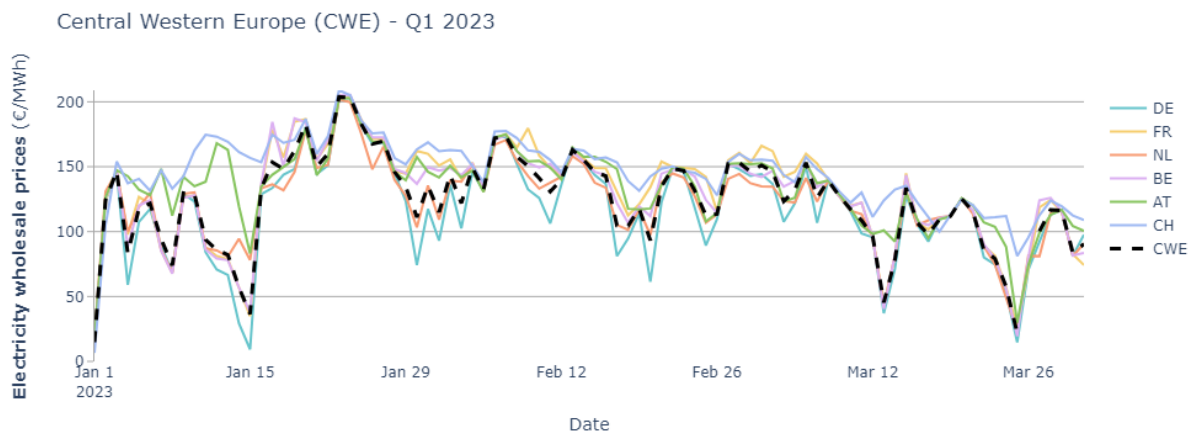
4.1 Central Western Europe (Austria, Belgium, France, Germany, Luxembourg, the Netherlands, Switzerland)

Figure 28 – Monthly exchange traded volumes of day-ahead contracts and monthly average prices in Central Western Europe



Source: S&P Global Platts, ENTSO-E, EPEX.

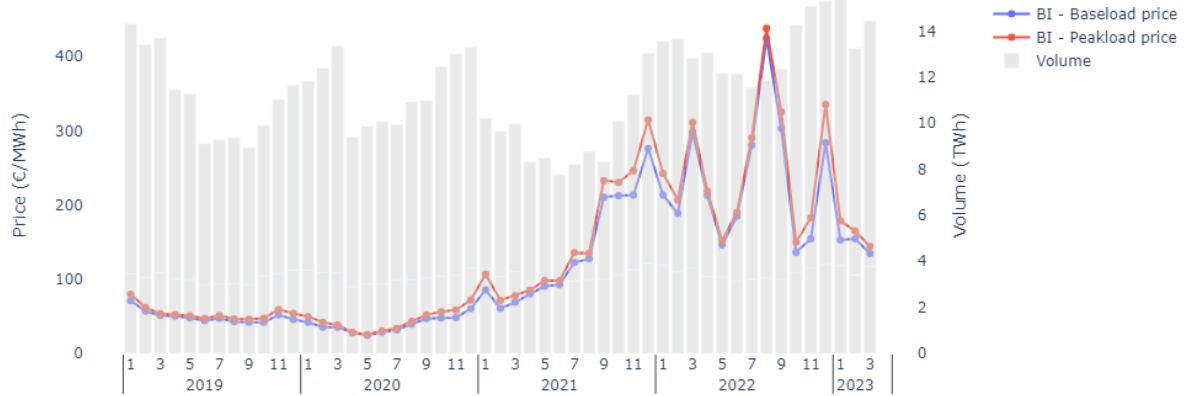
Figure 29 – Daily average power prices on the day-ahead market in the CWE region



Source: S&P Platts, ENTSO-E, EPEX

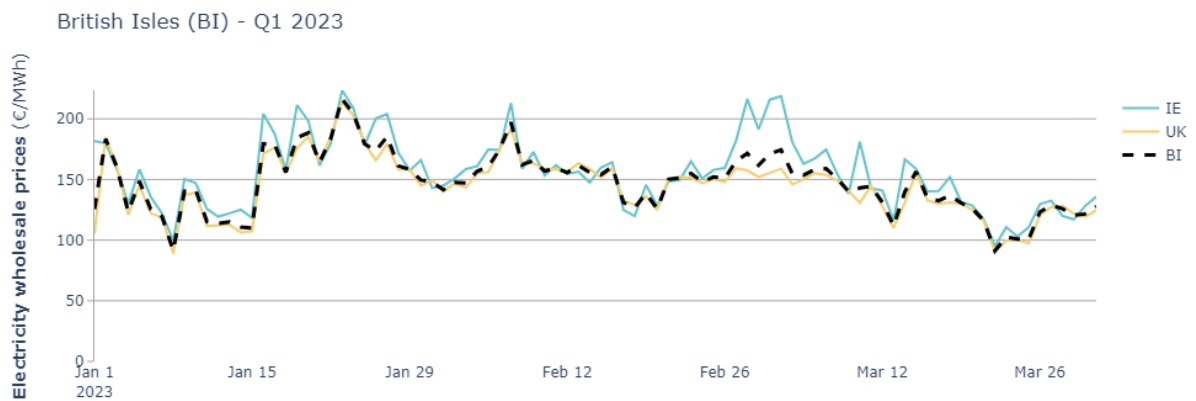
4.2 British Isles (GB, Ireland)

Figure 30 – Monthly exchange traded volumes of day-ahead contracts and monthly average prices in Great Britain and Ireland



Source: Nord Pool N2EX, SEMO, Utility Regulator

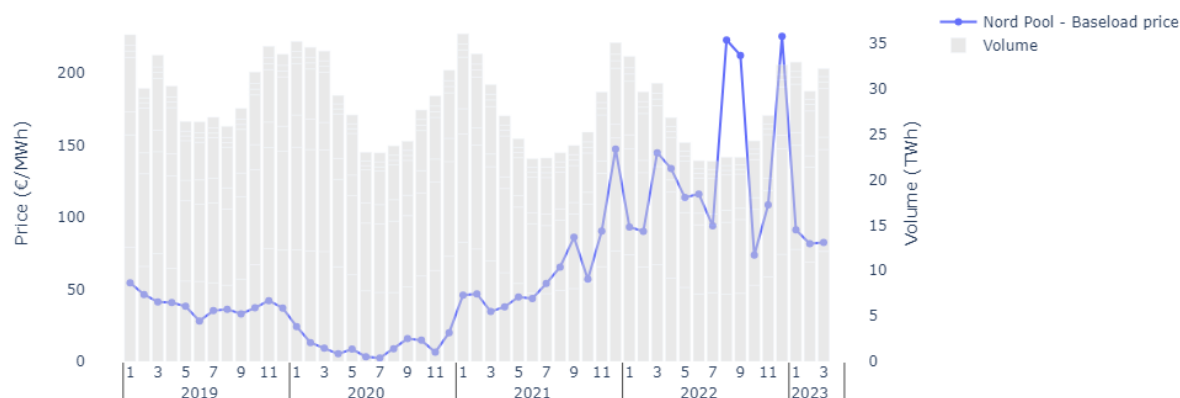
Figure 31 – Daily average electricity prices on the day-ahead market in Great Britain and Ireland



Source: Nord Pool N2EX, SEMO

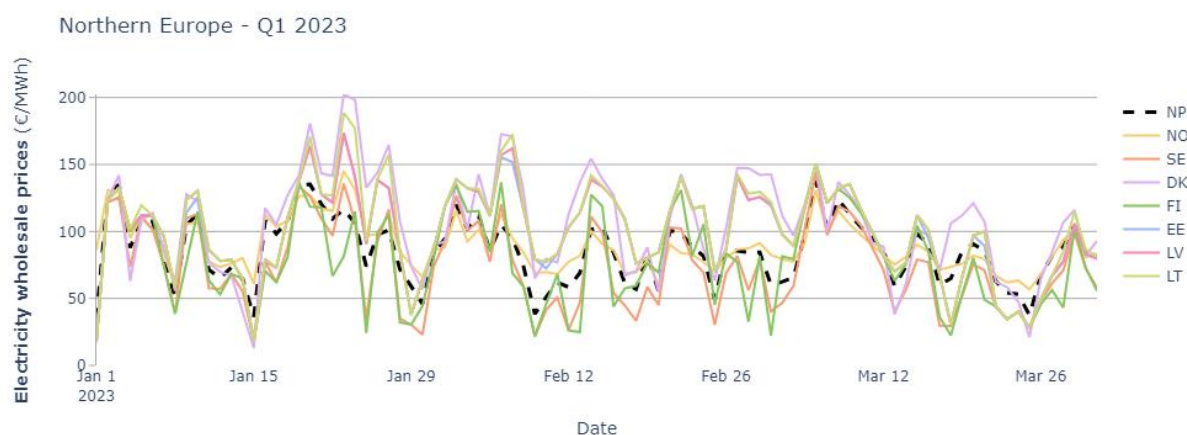
4.3 Northern Europe (Denmark, Estonia, Finland, Latvia, Lithuania, Sweden, Norway)

Figure 32 – Monthly electricity exchange traded volumes and the average day-ahead wholesale prices in Northern Europe



Source: S&P Global Platts, Nord Pool spot market

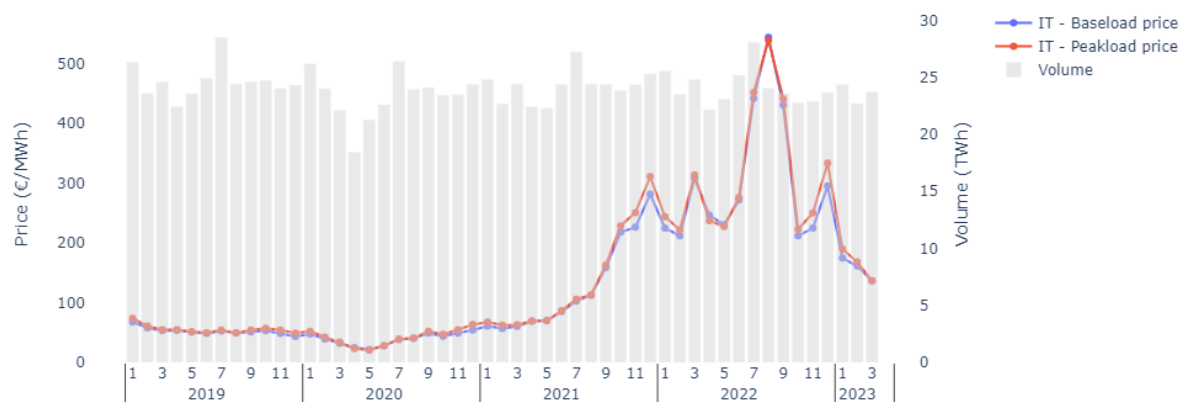
Figure 33 – Daily average regional prices and the system price on the day-ahead market in the Nordic region



Source: S&P Global Platts, Nord Pool spot market

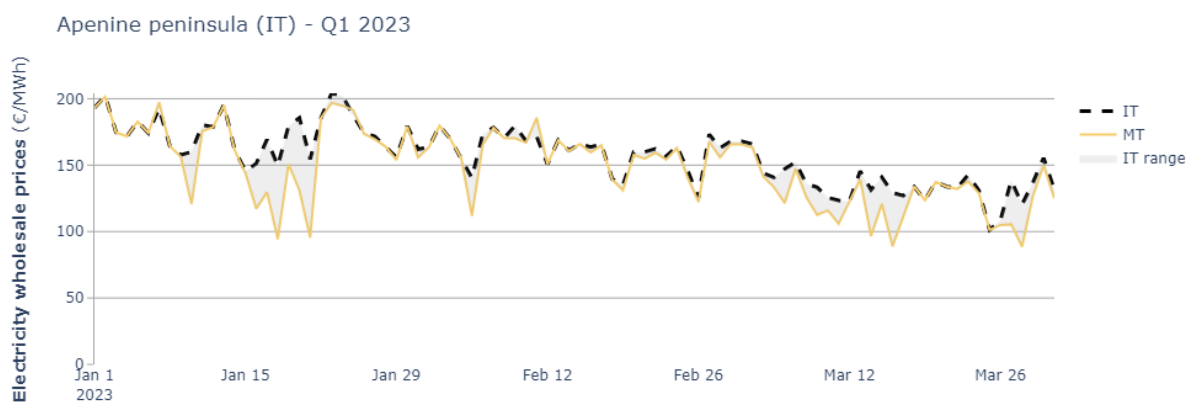
4.4 Apennine Peninsula (Italy, Malta)

Figure 34 – Monthly electricity exchange traded volumes and average day-ahead wholesale prices in Italy



Source: GME (IPEX)

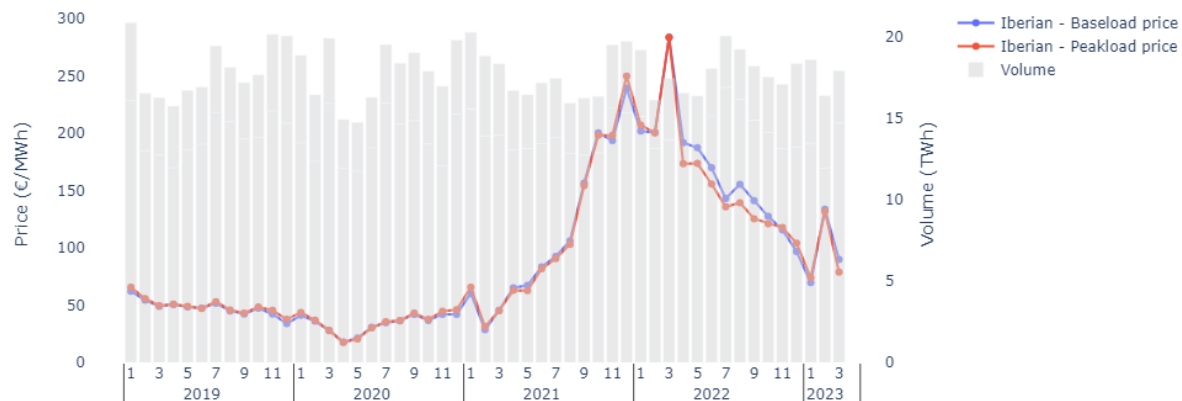
Figure 35 – Daily average electricity prices in the Italian day-ahead market, within the range of different area prices



Source: GME (IPEX)

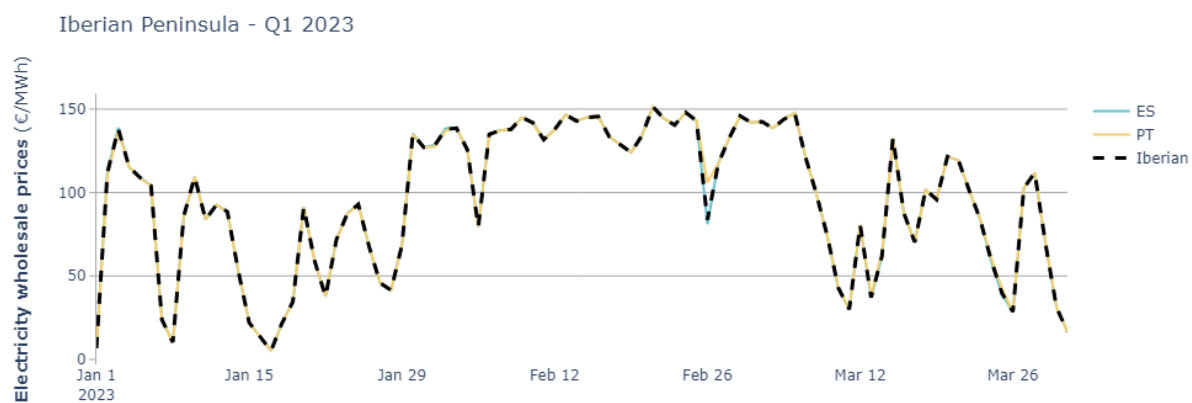
4.5 Iberian Peninsula (Spain and Portugal)

Figure 36 – Monthly electricity exchange traded volumes and average day-ahead prices in the Iberian Peninsula



Source: S&P Global Platts, OMEL, DGEG

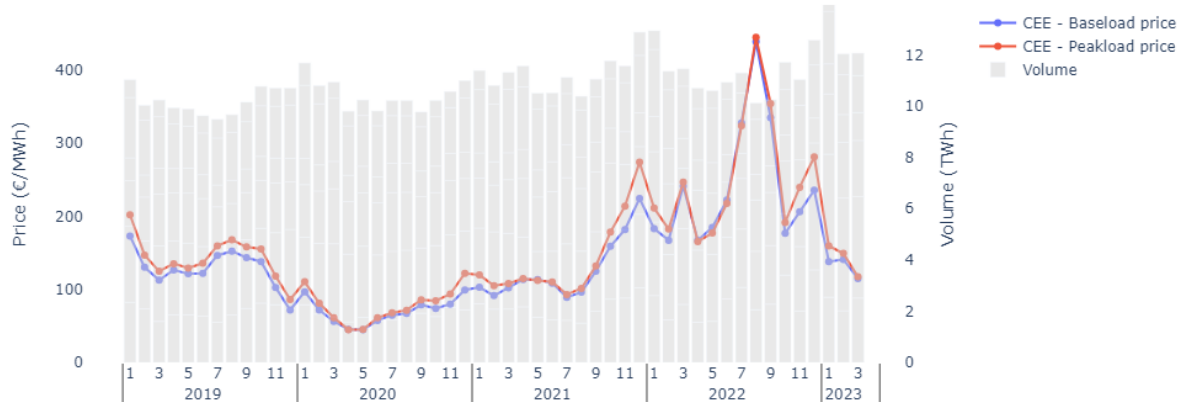
Figure 37 – Daily average electricity prices on the day-ahead market in the Iberian Peninsula



Source: S&P Global Platts, OMEL, DGEG

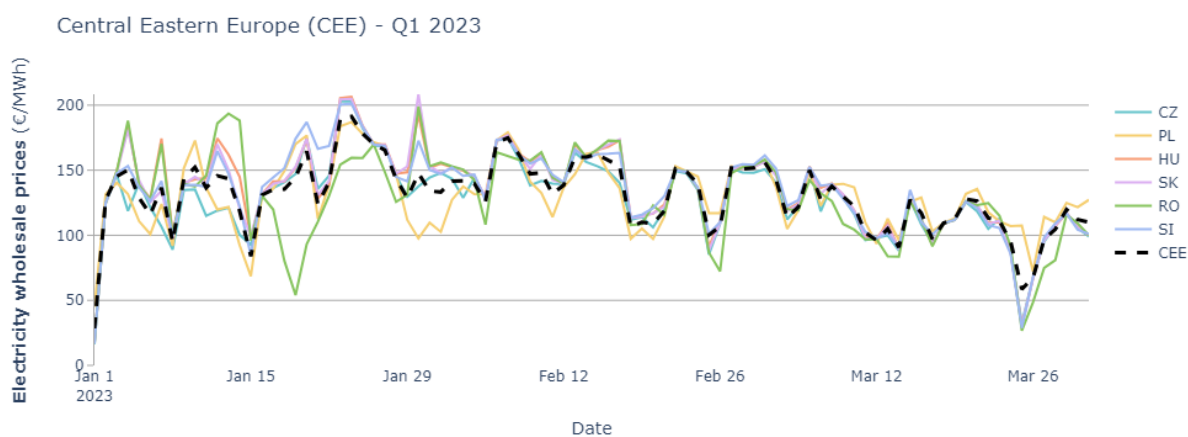
4.6 Central Eastern Europe (Czechia, Hungary, Poland, Romania, Slovakia, Slovenia)

Figure 38 – Monthly electricity exchange traded volumes and average day-ahead prices in Central Eastern Europe (CEE)



Source: Regional power exchanges, Central and Eastern Europe (CEE), CEE: CZ, HU, RO, PL, SK, SI

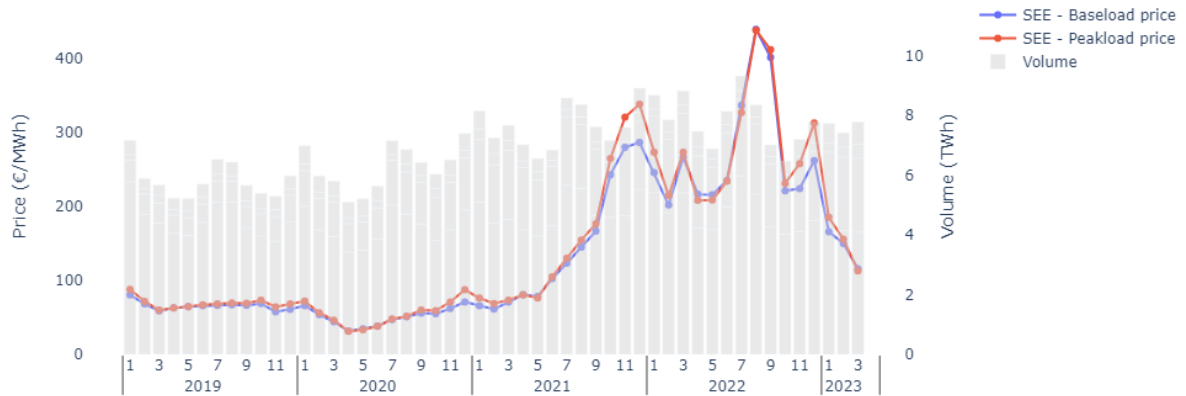
Figure 39 – Daily average power prices on the day-ahead market in the CEE region



Source: Regional power exchanges

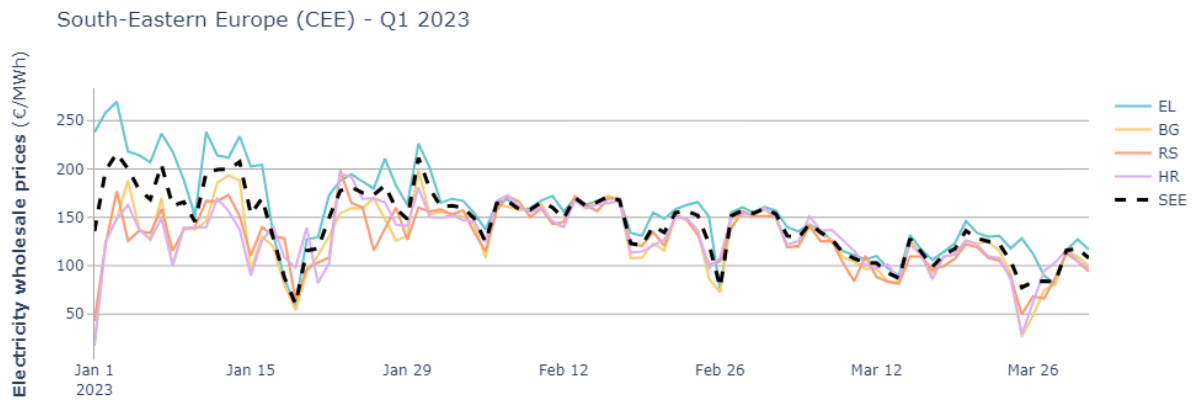
4.7 South-Eastern Europe (Bulgaria, Croatia, Greece and Serbia)

Figure 40 – Monthly traded volumes and baseload prices in South-Eastern Europe (SEE)



Source: ENTSO-E, IBEX, LAGIE, CROPEX, SEEPEX

Figure 41 – Daily average power prices on the day-ahead market in Bulgaria, Croatia, Greece and Serbia



Source: ENTSO-E, IBEX, LAGIE, SEEPEX, CROPEX

Glossary

Backwardation occurs when the closer-to-maturity contract is priced higher than the contract which matures at a later stage.

Contango: A situation of contango arises when the closer to maturity contract has a lower price than the contract which is longer to maturity on the forward curve.

Emission allowances' spot prices are defined as prices for an allowance traded on the secondary market and with a date of delivery in the nearest December.

European Power Benchmark (EPB9) is a replacement of the former Platt's PEP index discontinued at the end of 2016, computed as weighted average of nine representative European markets' (Belgium, Czechia, France, Italy, Germany, Netherlands, Spain, the United Kingdom and the Nord Pool system price) day-ahead contracts.

EPS is a consumption-weighted baseload benchmark of five most advanced markets offering a 3-year visibility into the future Markets included in the benchmark are France, Germany, the Netherlands, Spain and Nord Pool. Prices are weighted according to the consumption levels in individual markets. Forward prices are rolled over towards the end of each year, meaning that the year-ahead benchmark in 2021 shows the price for 2022; and the year-ahead curve in 2022, in turn, shows baseload prices for delivery in 2023.

Flow against price differentials (FAPDs): By combining hourly price and flow data, FAPDs are designed to give a measure of the consistency of economic decisions of market participants in the context of close to real time operation of electrical systems.

With the closure of the day-ahead markets (D-1), the prices for each hourly slot of day D are known by market participants. Based on the information from the power exchanges of two neighbouring areas, market participants can establish hourly price differentials. Later in D-1, market participants also nominate commercial schedules for day D. An event named 'flow against price differentials' (FAPD) occurs when commercial nominations for cross border capacities are such that power is set to flow from a higher price area to a lower price area. The FAPD chart in this quarterly report provides detailed information on adverse flows, presenting the ratio of the number of hours with adverse flows to the number of total trading hours in a quarter.

Relative standard deviation is the ratio of standard deviation (measuring the dispersion within a statistical set of values from the mean) and the mean (statistical average) of the given set of values. It measures in percentage how the data points of the dataset are close to the mean (the higher is the standard deviation, the higher is the dispersion). Relative standard deviation enables to compare the dispersion of values of different magnitudes, as by dividing the standard deviation by the average the impact of absolute values is eliminated, making possible the comparison of different time series on a single chart.

Retail prices paid by households include all taxes, levies, fees and charges. Prices paid by industrial customers exclude VAT and recoverable taxes. Monthly retail electricity prices are estimated by using Harmonised Consumer Price Indices (HICP) based on bi-annual retail energy price data from Eurostat.

Tariff deficit expresses the difference between the price (called a tariff) that a *regulated utility*, such as an electricity producer is allowed to charge and its generation cost per unit.