

CER Economic Note

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Energy Prices

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1. Introduction

The electrification of railway networks in Europe has become a key priority to reduce carbon emissions, improve energy efficiency, and modernize transportation infrastructure. This transition offers numerous benefits, including environmental advantages, enhanced energy efficiency, and improved performance. Electric trains produce fewer emissions than diesel counterparts, all the more so when powered by renewable energy, and are generally more energy-efficient, leading to lower operational costs. Additionally, electric trains can achieve higher speeds and better acceleration, contributing to an overall improvement in service quality.

As of 2022, approximately 56.9% of the EU's railway network ran on electrified lines, a substantial increase from 40.2% in 1990. European railway operators utilize this infrastructure very effectively. Today, 80.0% of the European railway traffic is running on electricity. As the biggest single electricity consumer in many countries, railway operators play a key role in decarbonizing energy by shifting to cleaner sources rather than relying on fossil fuels.

However, given the high electrification rate of rail, the sector is highly vulnerable to price shocks. For this reason, electricity markets have been under the scrutiny of CER since the global energy crisis unfolded in 2022. In April 2022, CER started collecting data on energy prices for railway undertakings (passenger and freight) and infrastructure managers through surveys administered to its members. Since that moment, data has been collected twice per year, with the most recent survey conducted in December 2024. CER is now performing a longitudinal analysis of the energy data collected in the past years to identify general trends that could highlight potential best practices and critical issues.

2. Evolution of energy prices in Europe

2.1. Electricity prices

Before presenting the results of the CER Energy Survey, we provide a general overview of the evolution of electricity prices in Europe to establish a framework for better understanding the railways sector situation.

Figure 1 displays the evolution of electricity prices for non-household consumers in Europe from 2007 onward across different consumption bands. We included the minimum and maximum consumption levels according to the Eurostat database classification: less than 20 MWh (ochre line) and more than 150,000 MWh (blue line), respectively. Additionally, we considered an intermediate consumption level, 500 to 1999 MWh, which, according to the European Commission, adequately represents medium-sized non-household consumers (red line).

The first thing that stands out is the sharp increase in electricity prices in the first semester of 2022 following Russia's invasion of Ukraine. Except for the highest consumption band, prices continued to rise in 2023. Secondly, prices have still not returned to pre-crisis levels. Lastly, prices have a regressive structure, meaning smaller consumers face higher electricity prices.

To facilitate comparisons across years and consumption bands, Figure 2 presents indexed prices, with 2015 S1 as the base year (100). It is immediately apparent that electricity prices reacted differently to the crisis depending on the consumption band. The largest



electricity consumers were significantly more affected than the others. Specifically, while electricity prices for bands IA and IC were 87% and 136% higher in the second semester of 2022 compared to the first semester of 2015, the highest consumption band experienced a 204% increase compared to the reference year.



Figure 1: Evolution of electricity prices in Europe

Note: Eurostat data on electricity prices for non-household consumers - bi-annual data from 2007 onwards (nrg_pc_205). Prices do not include taxes and levies and refer to the European Union (27 countries, from 2020).



Figure 2: Electricity price index in Europe

Note: Eurostat data on electricity prices for non-household consumers - bi-annual data from 2007 onwards (nrg_pc_205). Prices do not include taxes and levies and refer to the European Union (27 countries, from 2020). *Electricity Price Index* = $\left(\frac{Price in Current Year}{Price in Base Year}\right) \times 100$. The Electricity Price Index is 100 in 2015, the base year.



2.2. Electricity prices in 2024 S1

To look at the most recent picture, Figure 3 plots the latest available data on electricity prices from Eurostat, which refers to the first semester of 2024. Ireland displays the highest price, around 254.3 €/MWh, followed by Croatia, Hungary, and Luxembourg, which all present electricity prices above 200 €/MWh. Among the countries with the lowest electricity prices, less than 100 €/MWh, we find Bosnia and Herzegovina, Denmark, Finland, Georgia, Moldova, Montenegro, Norway, Sweden, and Türkiye.



Figure 3: Electricity prices in 2024 S1

Note: Eurostat data on electricity prices for non-household consumers - bi-annual data from 2007 onwards (nrg_pc_205). Prices do not include taxes and levies and refer to the European Union (27 countries, from 2020). Additionally, consumption from 500 MWh to 1 999 MWh (band IC) is considered. *Electricity Price Index* = $\left(\frac{Price in Current Year}{Price in Base Year}\right) \times 100$. The Electricity Price Index is 100 in 2015, the base year.

2.3. Taxes

On average, in the European Union (27 countries), electricity taxes - including energy and supply costs, network costs, and all other taxes, fees, levies, and charges - were around 25 \in /MWh in 2023. Among the countries with higher taxes, as shown in Figure 4, those exceeding 30 \in /MWh include Hungary, Liechtenstein, Ireland, Austria, and Slovakia. Conversely, Montenegro has the lowest taxes, below 10 \in /MWh. However, these taxes represent around 10% of electricity prices in each country.

Looking at the share of taxes in electricity prices, Figure 5, we can note that prices fluctuated slightly between 2019 and 2023, remaining within a narrow range of 9.6% to 10.2% across all consumption bands considered. Large consumers (band IG) experienced the most volatility, with a notable drop in 2020, a peak in 2021, and a subsequent decline in 2022 before rising again in 2023. Medium (band IC) and small consumers (band IA) followed a more stable trend, with a modest decline in 2022 before converging towards 10% in 2023.





Figure 4: Taxes components of electricity prices by countries in 2023

Note: Eurostat data on electricity prices components for non-household consumers - annual data (from 2007 onwards) (nrg_pc_205_c). The graph considers latest data available (2023) on consumption from 500 MWh to 1 999 (band IC) in the European Union (27 countries, from 2020). Taxes include energy and supply costs, network costs and any other kind of taxes, fees, levies, and charges.



Figure 5: Evolution of tax shares over electricity prices in Europe

Note: Eurostat data on electricity price components for non-household consumers – annual data (from 2007 onwards) (nrg_pc_205_c). The graph considers the latest available data (2023) for consumption between 500 MWh and 1,999 MWh (band IC) in the European Union (27 countries, from 2020). The share of taxes in the electricity price is calculated as the ratio of taxes to the total electricity price, including taxes and levies. Taxes include energy and supply costs, network costs, and any other taxes, fees, levies, or charges.



3. Results from the CER energy survey

Across the data collections, 40 different railway companies provided their inputs, with some companies being more consistent in their responses over time than others. Overall, the data spans 24 countries. More specifically, the data from infrastructure managers cover 14 countries, while the data from railway undertakings includes 21 countries (5 passengers only, 2 freight only, 14 both).

3.1. Electricity prices

The latest data indicates that railways remain highly exposed to volatility in electricity prices. Moreover, in the second half of 2024, the decreasing trend in prices that began after the peak in 2023 did not persist. Currently, railways pay, on average, more than 140 €/MWh for electricity traction, which is more than double the price of pre-crisis levels. Moreover, when comparing the data collected on traction electricity prices for railways from all editions of CER Energy Survey to the Eurostat prices for the highest consumption band (Band IG, representing consumption of 150,000 MWh and above) it emerges that average prices for Passenger Undertaking, Freight Undertaking, and Infrastructure Managers are higher for both semesters of 2023 and the first semester of 2024, for which the latest Eurostat data is available.

Despite this, in the last year, both railway undertakings and infrastructure managers reporting to the CER Energy Survey have become more optimistic about the future evolution of electricity prices. Figure 6 summarizes the evolution of future price expectations, which are defined as positive if the reported electricity price forecast is lower than the actual one and negative otherwise. Both infrastructure managers and railway undertakings have, in general, become more optimistic about electricity price forecasts. More specifically, the share of respondents expecting an increase in prices in the following month decreased from 80% for IMs and 87.5% for RUs in September 2022 to 33.3% and 11.1%, respectively, in December 2024.



Figure 6: Future price expectations

Note: data from CER Energy Survey. Percentages are calculated over the total number of responses for which both the current value and the forecast of electricity prices were available.

Due to consistency issues and incomplete data, we performed price trend analyses for only eight countries. From the latter, it emerged that only Italy and Austria have equal prices between Infrastructure Managers and Railway Undertakings. On the contrary, it is far more common for electricity prices to differ between IMs and RUs, and this is the case for Czech Republic, France, Hungary, Slovakia, Slovenia, and Switzerland. Finally, Croatia



represents a unique case, as it has maintained consistently low traction electricity prices, close to pre-crisis levels, across all surveys.

Austria and Italy

In September 2022, Austria benefitted from low electricity prices; however, these increased by 179% over the following year. Prices have since started to decline, but as of December 2024, they were still 132% higher than those in September 2022.

In Italy, characterized by highly volatile prices, electricity costs peaked in September 2022, while a declining trend initiated from April 2023, bringing the price below $100 \notin MWh$ in April 2024. However, this trend did not hold in December 2024, when prices increased again.

These results are in line with Eurostat data, which confirms Italy reached its peak in electricity prices in 2022 while Austria in 2023 and are linked to different electricity contract durations and expiries.

Czeck Republic, France, Hungary, Slovenia, Slovakia, and Switzerland

In the second half of 2022, the infrastructure manager in Czech Republic paid a very high electricity price. In following CER surveys, Czech IM reported declining prices, which were not sustained from April to December 2024, when prices were only 13% lower compared to September 2022.

Infrastructure managers' electricity prices in France increased consistently from September 2022 to April 2023 and continued to rise until October 2023. In 2024, prices showed a declining trend and, in December, were almost back to September 2022 levels.

Hungary displays the highest degree of price volatility and the highest prices in Europe. In September 2022, the infrastructure manager was already paying a substantially high price, which, nonetheless, increased by 92% by April 2023, when it peaked. Since then, a downward trend has begun, with prices falling and dropping below September 2022 levels by 19%. There is no clear pattern when looking at different prices paid by rail undertakings and the infrastructure manager. In the second part of 2022 and the first half of 2023, undertakings were paying a much higher price than the infrastructure manager, higher by 124% for freight in September 2022 and 29% for passengers in April 2023. This gap closed in October 2023, when undertakings and the infrastructure manager paid very similar prices, but reversed in April 2024, when passengers and freight undertakings were paying a lower price than the infrastructure manager, lower by 18% and 17%, respectively.

In April 2023, the infrastructure manager in Slovenia paid 80% more for electricity than in September 2022. Although a declining trend initiated in the second half of 2023 and the first half of 2024, prices increased again in December 2024, remaining 75% higher than in September 2022. There is no clear trend in the differences between the prices paid by railway undertakings and the infrastructure manager, even though these differences are often relevant. For example, in April 2023, freight undertakings paid 49% less than the infrastructure manager, whereas in April 2024, passenger undertakings had lower prices by 29% compared to the infrastructure manager.



In Slovakia, electricity prices for the infrastructure manager were exceptionally high in September 2022 but displayed a decreasing trend afterward, and by April 2024, they were 71% lower compared to 2022. However, as in many other countries, prices increased again in December 2024. Due to the lack of consistent data for passenger and freight undertakings, we can not detect potential differences in the prices they paid. However, we can note that in December 2024, passenger and freight undertakings paid 110% and 115% more than the infrastructure manager, respectively.

Finally, Switzerland has maintained a certain degree of price stability over the years. In April 2023, prices increased by 19% compared to September 2022 but remained stable for three consecutive CER survey editions. In December 2024, prices decreased and were almost back to September 2022 level, only 7 % higher.

3.2. Electricity contracts

We observe several differences between infrastructure managers and railway undertakings when looking at the duration and type of energy contracts they hold. Additionally, CER data collection revealed significant variability in both the duration and type of contracts over time.

In particular, infrastructure managers tend to have shorter contracts than railway undertakings, especially passenger ones. Most infrastructure managers reported having one-year contracts across all data collections. Some others reported a shift from relatively long contracts (2 or 3 years) to shorter, one-year contracts, causing the overall average contract duration to decrease over time.



Figure 7: Type of contracts

Note: data from CER Energy Survey. Percentages are calculated over the total number of respondents who provided an answer to the survey question on the energy contract type.

Across infrastructure managers, the most common form of energy contract is the one with variable prices, while fixed and mixed contracts are almost equally frequent over time. On the contrary, railway undertakings' choices of contracts exhibit a higher degree of variability, with the share of respondents indicating fixed contracts decreasing substantially from the second half of 2022 to that of 2023. Conversely, the share of mixed contracts combining fixed and variable prices has increased over the same period, suggesting that shifting toward more flexible contract options was one of the strategies companies adopted to face the severe effects of the energy crisis. By the end of 2024, there is no difference in the share of respondents reporting mixed and fixed contracts, while variable contracts appear more frequently.



The analysis also revealed that a few companies, particularly infrastructure managers, purchase electricity directly from the market. This approach may have been a strategy for these companies to cope with the significant and unsustainable rise in electricity prices experienced in recent years.

3.3. Support and measures to face the crisis

CER electricity price tracker also focused on measures and methods that supported railway companies in sustaining the electricity crisis. The most frequently reported form of assistance across all data collection periods was related to tax reductions, particularly in VAT and electricity taxes, especially noted in September 2022. By October 2023, the share of respondents reporting direct support, such as state aid and other similar measures, reached its highest level at around 22.5%. This point marked a record compared to earlier and later periods associated with support levels comprised between 10% and 15.5%. Risk hedging gained success over time, consisting of only 12.8% of responses in September 2022 and 21.4% in April 2024. This increase is likely related to the increasing number of companies directly buying electricity from the market. To manage the rising electricity prices, many companies also reported engaging in Power Purchase Agreements (PPAs), which accounted for 19.6% of overall measures reported in April 2024, alongside 20% of own electricity production in December 2024. Support measures have, overall, slightly increased since September 2022, reaching their highest intensity in April 2024.

	September 2022	April 2023	October 2023	April 2024	December 2024
Direct Support	15.4%	14.6%	22.5%	14.3%	10.3%
Price Cap	0.0%	22.0%	12.5%	12.5%	0.0%
Hedging	12.8%	17.1%	20.0%	21.4%	3.4%
Tax reduction	43.6%	19.5%	20.0%	17.9%	20.7%
Bill payment deferral	7.7%	4.9%	5.0%	1.8%	3.4%
PPA	7.7%	14.6%	10.0%	19.6%	3.4%
TAC reduction	7.7%	0.0%	2.5%	3.6%	31.0%
Own production	5.1%	7.3%	7.5%	8.9%	27.6%

Table 1: Support measures

Note: data from CER Energy Survey. The table shows the percentage of each type of support measure out of the total measures reported across different editions of the CER Energy Survey.

4. Results from the CER follow-up on energy

4.1 Price difference between railway undertaking and infrastructure manager

CER members note the different electricity consumption profile between railway undertaking and infrastructure manager and highlight the complexity in hedging strategies. Risk is managed differently: forward products vs spot products. In certain Member States there are regulated tariffs and taxation regime.



4.2 **Power Purchase Agreements (PPAs)**

CER members note that PPA are complex to negotiate and requires financial commitments. PPAs with green energy is interesting but further complicated due to higher risk and costs. It is important to consider the excess electricity under a PPA, which brings uncertainty for the companies. One need to compare longer-term costs of PPAs with the deployment of renewables directly to the company.

4.3 Solar energy in railways

The SNCF group aims to deploy power plants on its land and roofs in the coming years. The goal is to install 1 000 megawatt-peak photovoltaic capacity by 2030 (covering 1000ha), which is equal to 15-20% of our current consumption. SNCF Renouvelables was created in July 2023 and is the group subsidiary in charge of producing decarbonized electricity. More detailed information on this project can be found <u>here</u>.

Ferrovie dello Stato plans to invest €1.3 billion in a photovoltaic plant with an initial 1 gigawatt (GW) capacity that would cover 19% of its energy needs by 2029

4.4 Peak shaving by railway companies

Theoretically, using the battery as a flexibility to peak shaving could reduce energy costs for railways when charged with electricity purchased from BASELOAD at night, instead of being sold on the market, and discharged at peak train times. In practice, the business case for battery in the rail sector is so far not strong enough since they are very expensive and would require many batteries at the same time.

5. Conclusions

Electricity prices in Europe remain high despite a recent declining trend, providing little relief to households, businesses, and industries. The latest CER Energy Survey confirmed that railways remain highly exposed to volatility in electricity prices. Moreover, a declining price trend followed the 2023 peak but did not continue in the second half of 2024. According to the December 2024 survey, railways pay, on average, more than 140 €/MWh for electricity traction, which is more than double the price of pre-crisis levels. From 2023 average prices for Passenger Undertakings, Freight Undertakings, and Infrastructure Managers collected by CER Energy Survey were above Eurostat prices for the highest band of consumers.

Moreover, the CER electricity survey highlighted that tax reduction support measures, widely reported in September 2022, have been less common in the following years. At the same time, hedging strategies reporting increased over time, while PPAs were less common than expected.

As part of the new Clean Industrial Deal, on 26 February, the European Commission published an Affordable Energy Action Plan to reduce the burden on energy-intensive businesses and industries caused by high electricity prices. In its latest Communication, the Commission underlines that high electricity taxes increase bills without discouraging fossil fuel use over electricity, thereby slowing electrification and reducing demand. Additionally, it acknowledges that reducing taxation, such as VAT and energy taxes, has effectively helped contain energy costs during the recent energy crisis. For this reason, CER welcomes the European Commission's plan to complete the Energy Taxation revision and encourage Member States to ensure that electricity is taxed less than other energy



sources. Addressing taxation is one of the most effective and immediate ways to alleviate electricity-cost difficulties.

Secondly, CER welcomes the European Commission's pilot program, in partnership with the European Investment Bank, to boost the deployment of PPAs. Long-term electricity contracts can provide greater price stability, reduce the risks of price fluctuations, and encourage investments in renewable energy, which is cheaper in the long term. In addition, the Commission plans to provide guidance to Member States on designing effective contracts while supporting the development of European forward markets and increasing hedging opportunities.

In conclusion, the European Commission's initiatives and strategic partnerships offer promising steps toward addressing the persistent challenges that high electricity prices in Europe pose. This effort is vital for boosting competitiveness and achieving a fair, sustainable, clean transition and is particularly crucial for the railway sector, which plays a key role in decarbonizing transport. With 80% of railways already running on electricity, there is a significant potential for further electrification. Electric trains are more energy-efficient and produce fewer emissions than their diesel counterparts, even more so when powered by renewable energy. However, the sector remains highly vulnerable to price shocks due to its high electrification rate. Addressing this issue will be pivotal, especially considering that it is intrinsically connected and bound to the successful delivery of a fair and clean transition. The Commission's Action Plan could help secure a stable and sustainable energy future for railways and other energy-intensive industries and, in this way, ensure an equitable and clean transition.