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Cătalin-Laurențiu Rotaru[1]
Diana Timiș[2]
Giani-Ionel Grădinaru[3]

EMPOWERING ENERGY RESILIENCE: FORECASTING ROMANIAN ELECTRICITY MARKET AMIDST GEOPOLITICAL SHIFTS[4]

The significant increase in natural gas prices as a result of the conflict in Ukraine has deeply affected energy supplies and prices in European markets, including the electricity market. This context led to discussions within the European Commission regarding the need to reform electricity markets. This research aims to analyze the electricity price situation from the perspective of causes, effects and measures proposed by the European Commission. At the same time, it aims to develop a forecasting model for the volatile electricity market for Romania, highlighting the influence of factors such as geopolitical crises and government decisions. This information is crucial for energy decision-making and for developing effective strategies to manage risk and volatility.
Keywords: Energy transition; predictive model; energy price; European Commission
JEL: Q28; Q43; Q47

1. Introduction

In her 2022 State of the European Union address, President Ursula von der Leyen emphasized the need to reform electricity markets. The current design of the market was considered inadequate to meet the needs of consumers, which required a review. A significant increase in natural gas prices as a result of the conflict in Ukraine has had a significant impact on energy supply and prices in European markets. This significant increase in gas prices has also been felt in wholesale electricity markets, leading to electricity prices well above the historical average. In this situation, the European Commission initiated discussions on the need to reform electricity markets (European Commission, 2022a).

On the background of these developments, concerns have arisen about the ability of current market design to effectively support the energy transition and minimize costs to society. The

[1] *Cătălin-Laurențiu Rotaru, PhD student, The Bucharest University of Economic Studies, e-mail: rotarucstalin@gmail.com.*
[2] *Diana Timiș, PhD student, The Bucharest University of Economic Studies, e-mail: diana.timis10@gmail.com.*
[3] *Giani Ionel Grădinaru, professor, Institute of National Economy-Romanian Academy, e-mail: giani.gradinaru@gmail.com.*
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decarbonisation of the energy sector has necessitated extensive investment in new low-carbon generation capacity, as well as flexible resources and hard-to-manage emissions reductions. In addition, the expansion of renewables has put downward pressure on electricity prices, raising concerns about the incentives for investment in the sector. Investments in flexibility and firm capacity have also faced challenges in being adequately rewarded within the current market design, which has increased concerns about the security of electricity supply (Fabra, 2023).

The objective of this research is to highlight the electricity price situation from the point of view of causes and effects through specialized literature, and at the same time to underline the proposals and strategies of the European Commission's measures to reform the electricity markets. It will also detail how this contributes to efficient and fair outcomes, including aspects of long-term contracts and how they apply to different technologies.

In the second part of the research, we will focus on the collection and analysis of data taken from the OPCOM platform, for the period 2021.01.01 – 2023.08.31, in particular the average daily value of ROPEX_DAM_BASE_PZU. The main objective of this analysis is to discover a forecasting model for the volatile electricity market, given the importance of energy to a nation's economic progress. This data is processed and analyzed using programs such as Python and the Auto Time Series library for forecasting, while Tableau software is used to maximize data visualization. To ensure the accuracy of the forecasting model, outliers are removed and the seasonality of the time series is tested. The analysis aims to highlight that the price of electricity is influenced by factors such as geopolitical crises and government decisions, as well as seasonally fluctuating demand. A deep understanding of the behaviour of the electricity market and the factors influencing it is provided through the research created. This information is essential for energy decision-making and for establishing effective strategies for managing risk and volatility.

For the analysis, we considered Romania as an ideal case study due to the diverse mix that includes natural gas, nuclear power, hydropower, wind power, solar power and coal. At the same time, the transition to renewable energy, the strategic location, infrastructure, policies and regulations regarding the gradual elimination of coal until 2032 strengthen Romania's position in the European energy market, being a successful model in terms of the transition to a green and sustainable economy (Koltsaklis et al., 2020). On the other hand, by accessing the modernization fund that allocates up to 70% of the budget for investments in renewable energy production, huge support is offered to this industry and ensures the development of this sector. The project includes investments in the construction of photovoltaic parks and combined cycle gas turbines and envisages the development of several ecologically efficient sources. Another important program for the development of the energy sector in Romania is the National Recovery and Resilience Plan which pursues three major country objectives that contribute to European objectives, investments in green energy which has a budget of 1.7 billion USD, increasing the resilience and flexibility of the system energy and support for technology innovation (Filis, Leal-Arcas, 2023). All these measures are primarily aimed at reducing greenhouse gas emissions, but also improving energy security, which is why the energy market in Romania is an interesting case to address in the analysis (Dumitran et al., 2024).

2. Literature Review

Russia's invasion of Ukraine in February 2022 sent shockwaves across Europe and revealed the continent's painful dependence on a geopolitical adversary. Energy is closely linked to this ongoing confrontation: Europe aims to phase out fossil fuel imports from Russia, while Russia in turn has significantly reduced gas supplies to some countries and cut off flows to others. Given the historical tensions between ensuring the security of supply and other social objectives, we analyze energy policy responses to the crisis so far in terms of environmental sustainability, energy equity and social justice (Gatto, Mattera, Panarello, 2024). This approach reveals strong potential for an acceleration of green energy supply in Europe, but also brings complications for fossil fuel phasing out, negative side effects for sustainable transitions, significant implications for energy equity in Europe and beyond, and a return relative to the state as an energy actor. The reframing of energy as a geopolitical security concern during this acute crisis has tended to obscure and minimize other energy policy goals, raising a number of difficult questions for policymakers seeking sustainable and equitable transitions (Kuzemko et al., 2022).

Regarding the behaviour of energy price fluctuations and the impact that shocks have on actors in various markets, Martin-Valmayor, Gil-Alana and Infante (2023) developed research paying attention to key European markets such as Germany, France, Italy, Great Britain and Spain, but also with a relevant comparison with the United States and Japan. The purpose of this investigation is to assess the persistence and mean reversion of prices using a fractional integration model. According to the empirical results, there is evidence of a mean reversion trend in all the European states analyzed, although small variations are noted between the various markets. These variations do not appear to be correlated with the specific energy production strategies adopted by each country. As a result, it is suggested that, following recent energy disruptions, prices will return to natural market levels without the need for further policy interventions. Also, the researchers indicate the possibility of expanding the study by including non-linear structures.

The European Commission has taken several initiatives to address the rise in electricity prices in the European Union. After significant price increases, exacerbated by factors such as increased global energy demand and geopolitical tensions, the Commission implemented emergency measures and proposed long-term strategies to mitigate the impact on consumers and businesses (Vezzoni, 2023). Emergency interventions include regulations to address high energy prices, such as imposing temporary revenue caps on electricity producers and implementing a solidarity contribution to redistribute excess profits to energy consumers. In addition, coordinated gas demand reduction measures were introduced to reduce pressure on the energy market and stabilize prices.

To ensure long-term energy security and affordability, the Commission has proposed comprehensive strategies such as the REPowerEU plan. This plan aims to reduce dependence on Russian fossil fuels, promote energy conservation, encourage clean energy production and diversify energy sources. It also includes measures to accelerate the deployment of renewable energy sources and to speed up the processes of obtaining authorizations for renewable energy projects. While energy prices have seen a significant rise in the European Union, the European Commission has moved quickly to address the issue. In 2021, a number of

emergency measures were implemented, and during 2022 and 2023 several regulations and strategic initiatives were proposed and adopted to manage high energy prices and ensure energy security and affordability. From the introduction of solidarity measures to the proposal of long-term strategies, the European Commission has demonstrated its commitment to managing the energy crisis and promoting a sustainable energy transition (European Commission, 2021).

At the heart of the discussion, the strategies and policies presented underline the essential link between energy and climate security in Europe. The REPowerEU strategy places particular emphasis on accelerating the transition to clean energy through measures such as increasing targets for renewables and doubling solar capacity. In countries such as Germany, Denmark, the Netherlands, the United Kingdom, France and Italy, plans to accelerate renewable energy projects and decarbonize the thermal sector are underway, with a particular focus on electrification by promoting heat pumps. In addition, there is a strong commitment to developing renewable hydrogen infrastructure, with countries such as Germany and the UK making progress in this direction. At the same time, nuclear power is becoming increasingly relevant in some European countries as part of clean energy supply strategies, although it remains a subject of debate and faces ecological challenges. The main thrust of these initiatives is to reduce dependence on fossil fuels, especially those from external sources, by accelerating the adoption of cleaner and more sustainable energy sources. This transition to renewables, nuclear and hydrogen is seen as a crucial means of improving energy security and reducing the risks associated with fossil fuel imports, especially in the context of geopolitical concerns (European Commission, 2022b). However, it also highlights the need for significant integration measures to ensure the reliability of renewables and the importance of recycling within renewable supply chains to reduce pressure on critical mineral resources.

European financial instruments have been successfully implemented in countries such as Bulgaria regarding the development of renewable energy sources and implicitly climate change (Kirova, 2024). To date, the National Recovery and Resilience Plan and Partnership Agreement for 2021-2027 demonstrate that there is a significant positive impact on the fiscal balance at the national level. These projects support the economy and provide added value, especially to countries with smaller state budgets that cannot afford major investments in innovation (Gradinaru and Maricut, 2023). Forecasts show that EU funding and national co-financing of green technologies have a net impact of between 0.6 and 1% of GDP for the period 2021-2027. On the other hand, there is also expected a positive impact on Bulgarian revenues of 0.7% and 1.3% of GDP (Paliova, 2024). In this context where the projects carried out at the level of the European Commission bring real added value to developing countries, it is necessary to pay more attention to non-performing loans and the risks that come with the increase of the state's debt in general. The main recommendations that help the stability of the financial market are the strengthening of transparency and supervision and the prevention of non-performing loans (Morina, Kilaj, Alija, 2024). In the case of fraud prevention, predictive analytics methods are helpful and are now widely used in banks.

Another program developed by the European Commission is the Just Transition Mechanism (JTM) which is a key tool to ensure a fair transition to a climate-neutral economy, allocating around €55 billion between 2021-2027 for the most affected. With three pillars, the JTM

comprises a 19.2 billion euro Just Transition Fund, an InvestEU "Just Transition" program that should mobilize 10-15 billion euros and a Public Sector Loan Facility with the aim of mobilising 18.5 billion euros. Territorial Just Transition Plans delineate eligible regions, outline challenges and specify objectives until 2030. The Just Transition Platform acts as a central support system, providing technical assistance and promoting knowledge exchange between stakeholders. Beneficiaries include people vulnerable to transition, carbon-intensive industries and Member States heavily dependent on fossil fuels, facilitating labour transition, economic diversification and sustainable infrastructure development. Through all these initiatives, the Commission primarily emphasizes the role of energy efficiency in reducing energy consumption and energy bills. Initiatives to increase the EU's energy efficiency target and facilitate investment in energy-efficient technologies are key components of the Commission's strategy to tackle high electricity prices while promoting sustainability and resilience in the EU energy market (European Commission, 2023).

In the paper entitled "Europe's energy crisis: Are geopolitical risks in source countries of fossil fuels accelerating the transition to renewable energy", Erik Hille investigates the relationship between geopolitical risks (GPR) in fossil fuel-supplying countries and the adoption of renewable energy (RE) in importing countries of fossil fuels, focusing on energy cost implications. Data from 1991-2021 are used to examine how the GPR influences the transition to RE in Europe. The study reveals a significant correlation between GPRs, especially those related to coal and natural gas imports, and the promotion of RE in Europe. Rising electricity prices and increased dependence on fossil fuel imports, especially coal, magnify the effects of GPR on RE adoption. Interestingly, in the case of natural gas, high dependence on imports appears to diminish the influence of GPR on RE adoption, indicating the flexibility of natural gas plants in supplementing intermittent RE sources. These findings highlight the policy implications of the relationship between GPR and RE adoption, highlighting the need for a more secure and sustainable energy strategy in Europe. Europe's dependence on fossil fuel imports is exposed as a vulnerability in the context of energy crises, suggesting that the influence of the GPR should stimulate Europe to accelerate the transition to RE sources in a faster and more predictable way.

In Owjimehr, Meybodi and Jamshidi's study (2023), the relationship between geopolitical risk (GPR) and energy efficiency in 18 European countries during the period 1991-2020 was investigated. Using several methods, including the Dumitrescu Hurlin panel causality test, the quantile regression model with instrumental variables (RQVI) and the Envelope Analysis of Data (AED), the impact of RGP on energy efficiency was analyzed. The results indicate that RGPs have a positive effect on energy efficiency, especially when the level of RGPs is more pronounced. Countries with higher energy efficiency appear to be better prepared to manage geopolitical risks due to their investments in energy infrastructure, especially in renewable energy technologies. A unidirectional causality relationship between RGP to energy prices was also identified, suggesting that RGPs can affect energy efficiency through changes in energy prices. In addition, a unidirectional causality relationship between energy prices to energy efficiency was found. This suggests that the positive impact of RGP on energy efficiency can be amplified by increasing the use of renewable energy sources and by concerns about the security of energy supply in the context of the environmental factor.

According to the Energy report carried out by the International Trade Administration 2024 in Romania, thanks to prosumers, there was a decrease in electricity consumption in 2023, compared to 2022, as follows: electricity 5%, residential consumption 13.6% and public lighting 20,4%. The aggregate installed capacity of prosumers doubled on July 1, 2023, reaching 973 MW. However, there is still huge potential for growth in the electricity market. The National Recovery and Resilience Plan has specific targets in Romania and closely follows the safe development of critical programs that enhance growth potential through necessary investments and specific reforms. At the same time, the modernization fund supports over 45 proposals in related fields such as network modernization or energy efficiency. According to the report, we find the Transelectrica company responsible for the proper functioning of the market and the security of the energy transport system, overseeing the activities of supplying and generating electricity. At the national level in 2022 according to the National Energy Regulatory Agency, 53TWh were produced while 5.9TWh were imported. In the context of the COVID-19 crisis, the European Commission has built this financial instrument to help European states access funds in order to support the ecological transition and the circular economy. The European Green Pact shows that Romania has a long-term perspective regarding the transition to a green economy through projects such as Neptun Deep. According to the analyses carried out, it is expected that this country project will produce 30 times more electricity than Romania's annual consumption.

3. Methodology

The current analysis is developed in accordance with the specialized literature, based on the following pillars: Collection of Data taken from the OPCOM platform; Descriptive analysis; Removal of outliers and removal of seasonality, if applicable; Forecasting outliers over a week using a new fitted series to discover a forecasting model for the volatile electricity market, as energy is intrinsically linked to progress and is a crucial element in a nation's economic advancement (Gozgor et al., 2018).

In order to fulfil the first objective, the value for the time interval 2021.01.01 – 2023.08.31 was taken.ROPEX_DAM_BASE_PZU for PZU represents the average of the auctioned prices for energy from the 24 hours for the electricity price related to the next day, being calculated according to the following formula:

$$\text{ROPEX_DAM_BASE}_{PZU} = \frac{\sum_{j=1}^{24} PZU\ Price}{24}$$

This period was chosen due to the impact that the change in the price of energy had on the social and geopolitical environment, from November 2023.08.31, the price of energy starting to stabilize.

The programs used to analyze the data series are Python, for processing and forecasting the data, the latter being made with the help of the Auto Times Series library, which represents a machine learning model that, after running, chooses the best prediction model through parameterization optimality of the model. According to Li et al., 2023, the appropriate choice of models and parameter adjustment in the machine learning process is important to achieve optimal performance in data management. Furthermore, for the purpose of creating graphs,

Tableau software is used, which also contributes to maximizing the percentage of data visualization.

The ROPEX_DAM_BASE_PZU index is also updated depending on the day on which the transition from summertime to wintertime takes place. On the day when the time change takes place, the number to which the division is made is 23, in the case of the change to winter time and 25, for the day when the change to summer time is made. It is expressed in lei/MWh.

The first objective is represented by the descriptive analysis of both ROPEX_DAM_BASE_PZU, which is unadjusted to the Consumer Price Index, and its price, with the adjustment that has very high volatility, including for the days when it is not influenced by geopolitical events, such as the war in Ukraine, or government decisions, such as its capping. In addition to these, the research also includes an exhaustive description of ROPEX_DAM_BASE_PZU.

Due to the inflation phenomenon, the data series is adjusted with the Consumer Price Index, taken from the website of the Statistics Institute of Romania. August 2023 was chosen as the reference month, along with the following formula:

$$\mathrm{ROPEX}_{\mathrm{DAM}_{\mathrm{BASE}_{PZU}}} * IPC\ lunar\ \%_{\ August\ vs.\ prior\ month}$$

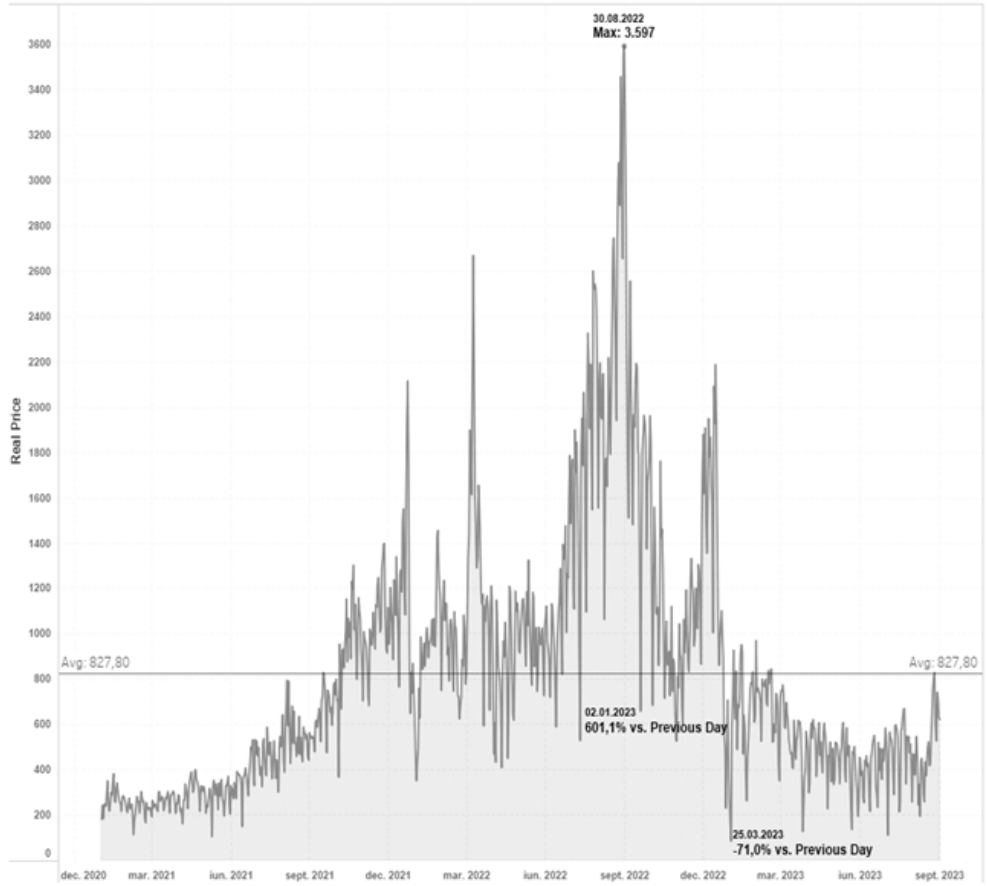
To be able to have the highest accuracy of the model, although the machine learning algorithm eliminates seasonality and outliers, it is recommended, according to its documentation, that they be eliminated from the beginning of the analysis. Thus, in the first instance, outliers will be removed by detecting them, using the Interquartile Range, and they will be replaced using the Moving Average. Outliers are removed by the Interquartile Range as it is a robust statistical method that is not influenced by the general distribution of the data and replaced by the Moving Average as it will reduce smoothing and noise and preserve data integrity. The next step is to test the seasonality of the time series by applying the ACF test. At this level, if the time series used shows seasonality, its differentiation will be applied.

The final stage to accomplish the second objective is to forecast ROPEX_DAM_BASE_PZU for a period of 7 days using the Auto Time Series machine learning algorithm and observing its behaviour. Thus, it will be possible to conclude whether the model can predict the sentiment of the energy market in Romania.

4. Results

The technological evolution, along with the imprint that electricity puts on the daily activities in the lives of individuals, has transformed electricity into a fundamental pillar of our society. Thus, the evolution of the values from the period 2021.01.01 – 2023.08.31 will be analyzed, in order to understand the development of the energy price, as well as the causes that led to the surprising increase in its price during the analyzed period. The evolution of the time series is represented in Figure 1.

Figure 1. PZU real price evolution from 1 jan. 2021 to 31 aug. 2023



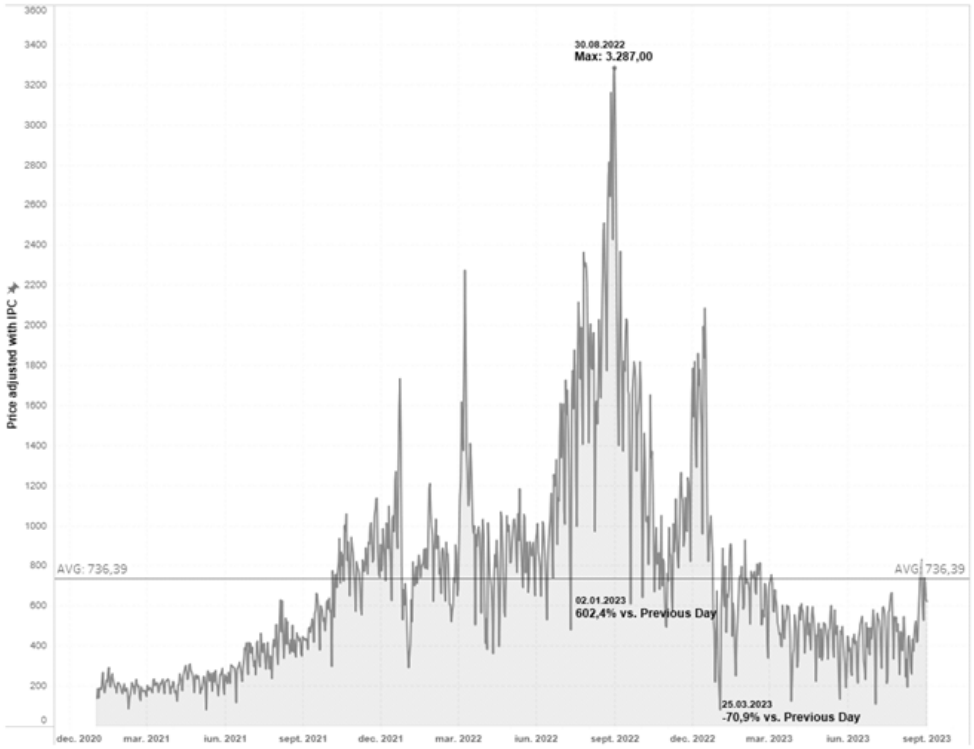
Source: Authors' representation in Tableau based on the OPCOM energy database.

The average daily price of electricity listed on the OPCOM energy exchange for the next day has periods of very high volatility. In general, the time intervals in which it experienced exponential increases were the winter months, such as December 2021, where the price of electricity was 2119 lei/MWh or the month of December 2022, which maintained a maximum similar to the month of the year previous, respectively 2191 lei/MWh. The longest period of growth, however, is correlated with the war in Ukraine. For example, at the beginning of the armed conflict, a slight increase was observed, while throughout the summer of 2022, the price began to rise uncontrollably, as sanctions on Russia intensified, with the price reaching, on the 30th of August, 2022, to the historical maximum of 3597 lei/MWh. However, autumn brought a sudden drop and a normalization of its volatility, maintained after the winter of 2022. The volatility of the data series is visible, with the price of electricity increasing even 6 times in one day compared to the previous day, respectively by 617 % on the 2nd of January, 2023 compared to the 1st of January, 2023. This increase can also be explained by the

celebration of the "New Year", a period during which electricity auctions on the OPCOM market are reduced. In terms of the difference in decline between the current day and the previous day, the volatility is lower with the difference being -71%. For the analyzed period, the average daily PZU is 827.80 lei/MWh.

The analyzed period has very high inflation values. The real price is updated with the Consumer Price Index, a visible update in the evolution of the graph in Figure 2.

Figure 2. PZU adjusted price with Consumer Price Index evolution from 1 January 2021 to 31 August 2023



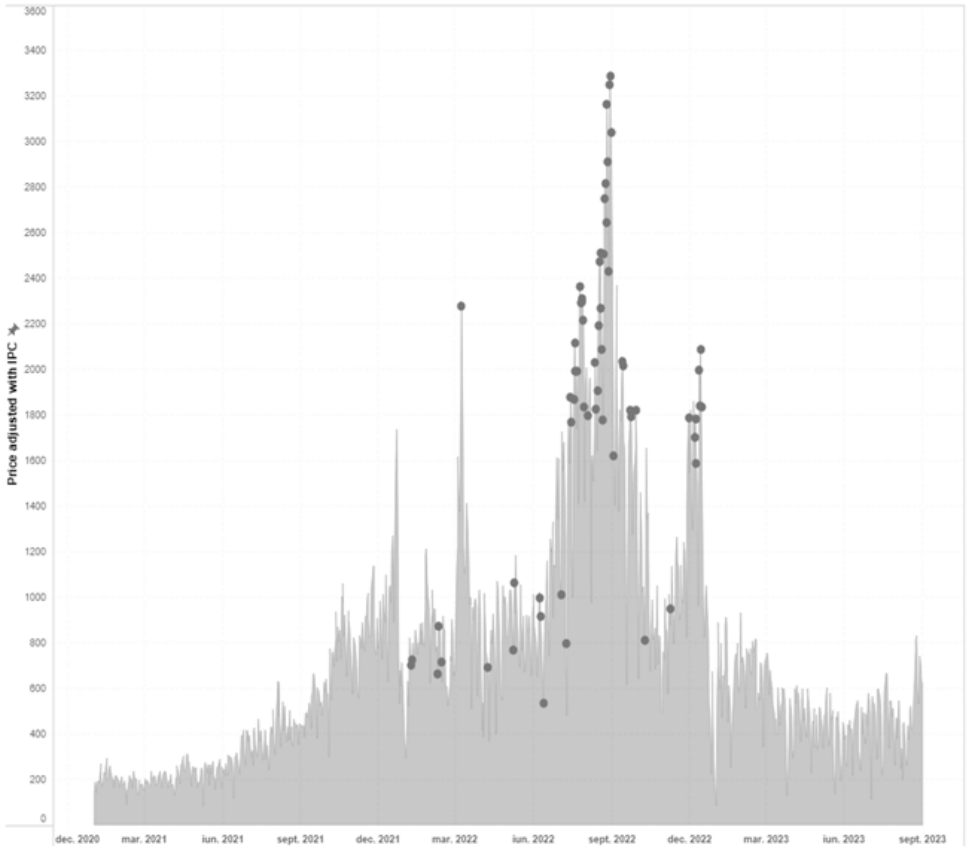
Source: Authors' representation in Tableau based on the OPCOM energy database.

Currently, inflation has caused the cost of electricity to rise by 8.6%. Looking towards the maximum of the analyzed time series, before the update with the consumer price index, the maximum value was 3597 lei/MWh. Following the time series update, the new value is 3287 lei/MWh. From an average point of view, inflation devalued the value of money by 11% compared to the Real price not updated with the Consumer Price Index, the new average being 736.39 lei/MWh.

In both the Real Price and CPI Adjusted price developments, the average is heavily influenced by periods of high volatility created by war and the need for electricity in winter when demand is much higher. For the optimal forecasting of the time series over a period of

7 days, it is necessary to identify the outliers present. Their distinction will be made using the method of elimination, through the Interquartile Range and, subsequently, by replacing them, using the moving average. Outliers are to be recognized from the updated CPI data series. Outlier removal with IQR (Interquartile Range) is a method used in data analysis to identify and treat extreme values in a data set. Initially, the 1st quartile and the 3rd quartile are calculated, followed by the determination of the IQR by differentiating the 3rd quartile from the 1st quartile. Values outside the upper (Q1 + 1.5 * IQR) and lower (Q1 – 1.5 * IQR) limits represent outliers, as found in Figure 3.

Figure no. 3. PZU adjusted price with Consumer Price Index evolution and outliers from 1 Jan. 2021 to 31 Aug. 2023



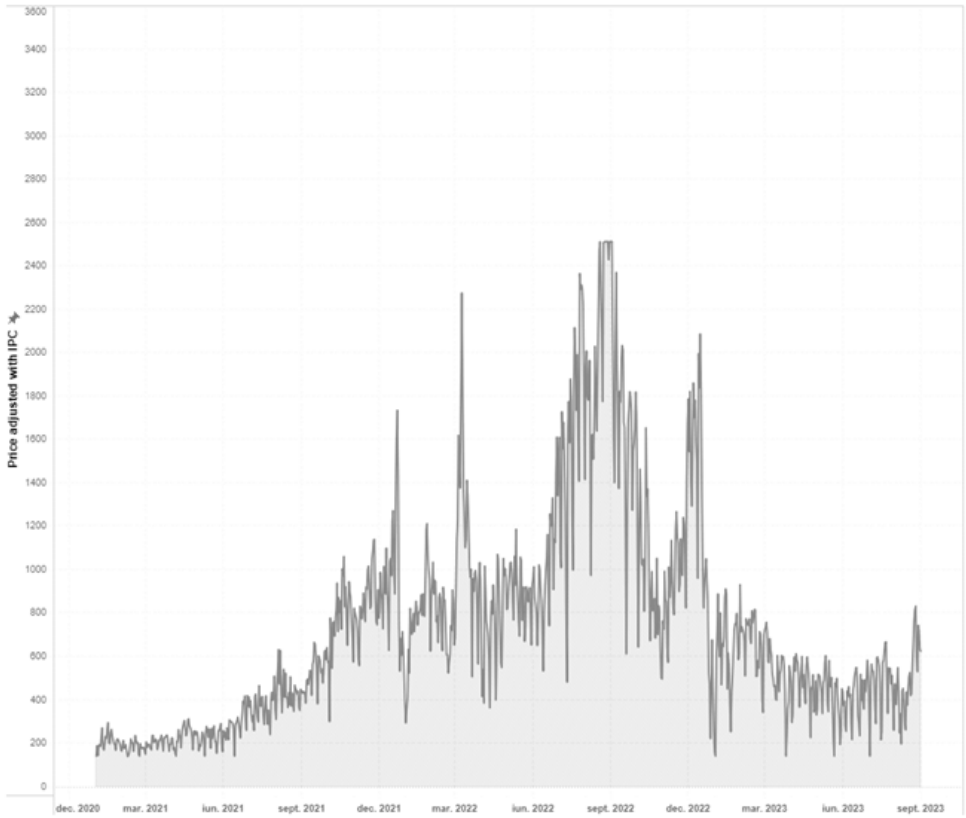
Source: Authors' representation in Tableau based on the OPCOM energy database.

Most of the outliers are found during the peak periods of electricity prices, such as the war in Ukraine that generated the Energy Crisis or around the period November – December 2022. In the data series there are 62 values with the quality of outliers. For these, the moving average will be used as a replacement, the method being preferred because the moving

average provides a more robust estimate of the central tendency of the data compared to a simple mean or median. It analyzes the neighborhood of data points.

The Moving Average of the data series is 626. Therefore, the values identified as outliers will be replaced with the value 626, the new data series being represented in Figure 4.

Figure 4. PZU adjusted price with Consumer Price Index evolution and outliers corrected from 1 January 2021 to 31 August 2023

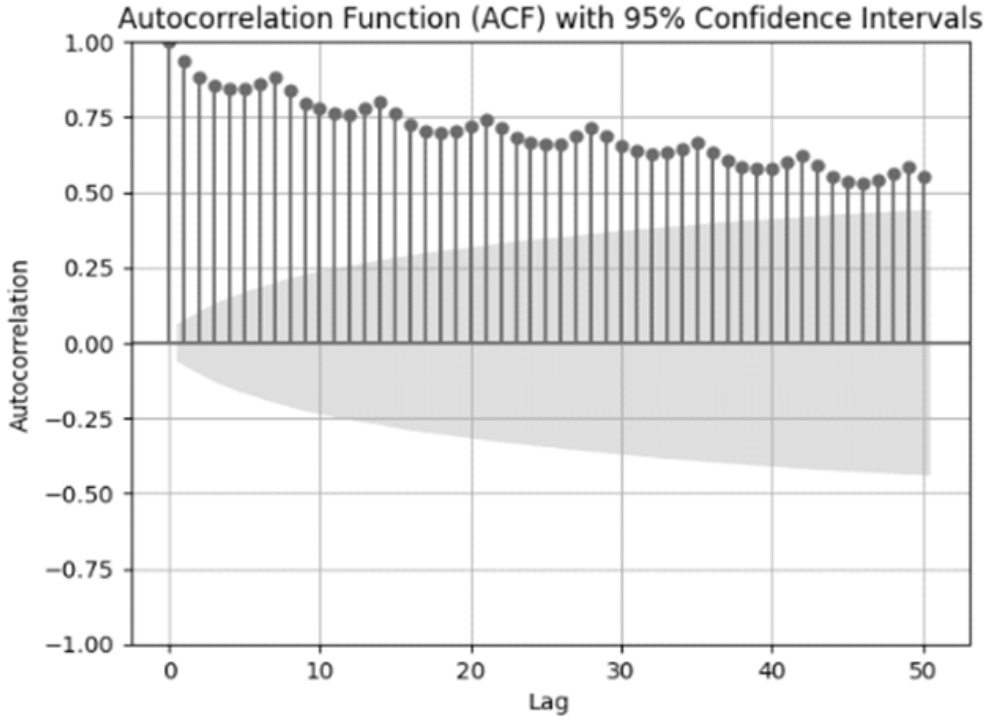


Source: Authors' representation in Tableau based on the OPCOM energy database.

Following the change of the outliers, the extreme values during the energy crisis in the summer of 2022 were flattened. Thus, the influence of the crisis on the prediction of the data series for the next 7 days is reduced.

Based on the new data series without outliers, the seasonality of the time series will be tested using the ACF test for a number of 50 lags at a confidence interval Alpha = 0.05, being represented in Figure 5, through the Autocorrelation of Errors graph.

Figure 5. Sesonality ACF Test



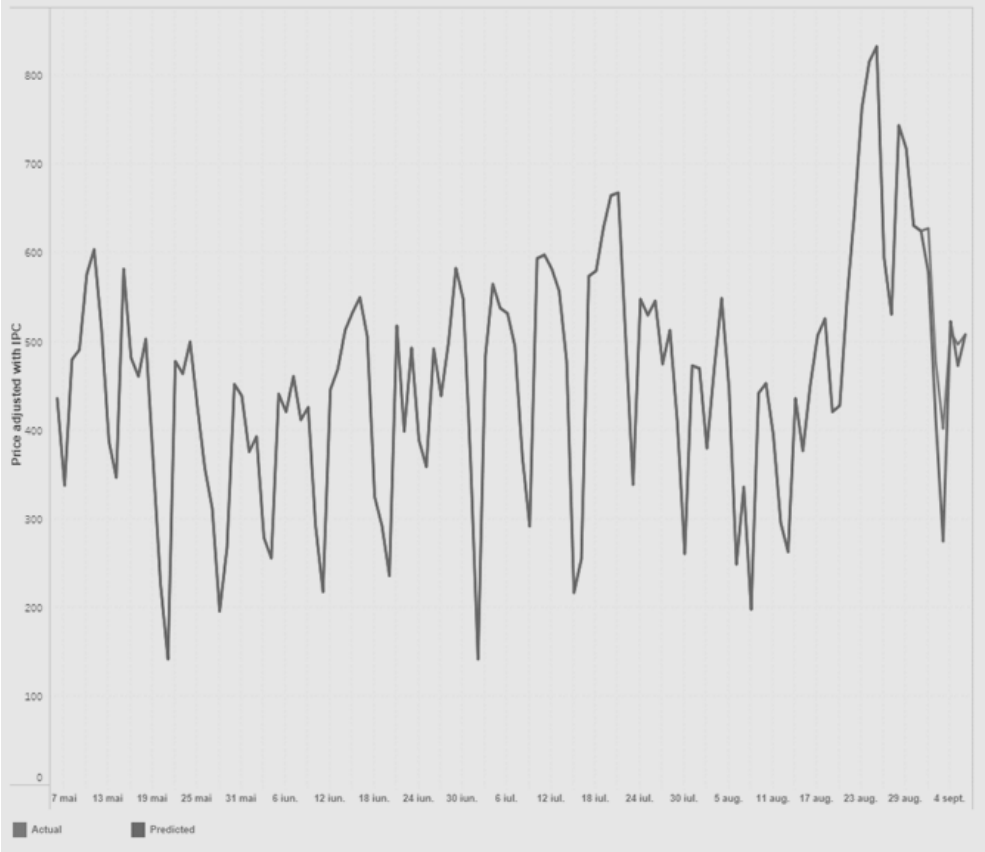
Source: Authors' representation in Python based on the OPCOM energy database.

If the significant peaks in the ACF plot exceed the upper confidence interval (alpha = 0.05), then the lags at which seasonality is detected are printed. The lags represent the seasonal patterns in the data. In the case of Figure 6, no seasonality is detected. Thus, the forecasting of the data can continue, without any modelling of the seasonality of the data being necessary.

Since the price of electricity has a very high volatility, therefore Auto Times Series will be used, which is a machine learning algorithm that runs several forecasting models including Last Value Naive; Average Value Naive; GLS and Seasonal Naive; ETS selects the algorithm that performs best and makes the forecast in question.

The period for which the forecast is desired is only 7 days, because the data are daily and only for a period of approximately 3 years, but also the possibility that after 7 days, the RMSE value for the forecast will decrease considerably. After running the Auto Times Series algorithm, the model selected for forecasting by it is Last Value Naive, also known as Naive Forecasting, which has the role of making predictions for future moments, by using the most recently observed value as a forecast. In other words, the next data point in the time series is assumed to be the same as the most recent observation. Results for the period 1.09.2023-07.09.2023 were also retrieved, in order to compare the current results with the prediction results. These are presented in figure no. 5:

Figure 6. PZU Forecast Price on 7 days evolution using Auto TS



Source: Authors' representation in Tableau based on the OPCOM energy database

In the first two days, the algorithm performs close to the current values. Only in the case of steep drops, such as on the 9th of March, 2023 and the 9th of May, 2023, the algorithm fails to predict close to the real values of ROPEX_DAM_BASE$_{PZU}$. On the last day, on the 7th of September, 2023, the algorithm predicts the same value as the current one, namely 508 lei/MWh. The mean Average Error is 42 units, the value being still quite high, due to sudden changes in the price of energy. In order to make it possible to decrease the Mean Average Error towards 0, in order to ensure increased accuracy compared to the current one, which is low due to electricity price volatility, the data interval should be increased, or data taken at the hourly level, instead of those taken at the daily level.

5. Conclusion

Russia's invasion of Ukraine in February 2022 caused an uproar across Europe and highlighted the continent's vulnerability to geopolitical factors. This situation has underlined

the close interdependence between energy and politics, with Europe trying to reduce dependence on Russian fossil fuels, while Russia has limited gas supplies to some regions and cut off supplies to others. The energy policy response to this crisis has highlighted the need to balance environmental, energy equity and social justice objectives. While the transition to green energy has promising potential, it also brings complications in phasing out fossil fuels and raises questions of equity and geopolitics in Europe.

Regarding energy prices, recent studies have analyzed their behaviour and the impact that shocks have had on European markets. The conclusions show that prices will return to natural levels without further policy intervention. Faced with these challenges, the European Commission has stepped in quickly with emergency measures and long-term strategies to manage high prices and ensure energy security. The REPowerEU Plan and the Just Transition Mechanism are examples of comprehensive responses to these challenges, aiming to reduce dependence on fossil fuels and promote renewable energy. In the context of these initiatives, the importance of a sustainable energy strategy in Europe, which ensures energy and climate security, is recognized. Coordination at the European level is essential for managing energy crises and promoting a fair and sustainable transition.

The developed analysis highlighted the fact that the price of energy experienced significant fluctuations, being influenced by factors such as geopolitical events, such as the conflict in Ukraine. The high volatility of the price has made it difficult to forecast, with some forecasting models, such as Last Value Naive, approaching true values only under certain circumstances. Removal of outliers and adjustment of data for inflation were necessary to ensure an accurate analysis. The methods used included using Python for data processing and forecasting, as well as Tableau for data visualization. The results show that despite modelling and adjustment efforts, forecasts had limited accuracy in the context of sudden energy price fluctuations. It is obvious that factors such as inflation and geopolitical events have a significant impact on the electricity market in Romania. Despite the challenges, the analysis underlined the continued importance of developing accurate forecasting models and methods to manage risks and ensure stability in the energy market.

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