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NATURAL GAS AND THE DYNAMICS OF THE ENERGY MARKET – EASTERN EUROPE[3]

The paper looks into natural gas as a factor influencing the dynamics of the energy market in Eastern Europe. The energy market as such is in fact the correlation between various interrelated markets which have different effects on the final consumers' prices and on the inflation. The Eastern European energy market is currently one of the fastest-growing energy markets. It consists of resource-rich and transit countries (Belarus, Bulgaria, Czech Republic, Hungary, Poland, Moldova, Romania, Russia, Slovakia and Ukraine) with a population of roughly 291 million people, that contributes significantly to the world's energy consumption and security. The dynamics of this market depend on the new infrastructure for transiting and storing natural gas as well as the big undergoing investments in renewable energy infrastructure.
Keywords: energy market; natural gas; inflation; de-carbonization; Eastern Europe
JEL: Q4; R1; V1

1. Introduction to the Political and Economic Context

In Europe, the energy demand is currently the highest for the last 25 years. Added to this come the constraints and risks because of the drop in the supply of Russian gas.

The gradual increase from 2010 to 2020 in the demand for natural gas, in Eastern Europe was influenced by factors such as economic development, population growth, and increased energy consumption.

Another factor is the process of energy transition in some Eastern European countries that began to shift away from more carbon-intensive fuels, like coal, toward cleaner alternatives, including natural gas. This transition was often driven by environmental concerns and efforts to reduce greenhouse gas emissions.

Infrastructure development investments were made in natural gas infrastructure, including pipelines and liquefied natural gas (LNG) terminals, to expand the availability and

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accessibility of natural gas in the region. Improved infrastructure facilitated the transportation and distribution of natural gas.

Heating and Industrial players use natural gas and it also continues to be used for heating in residential and commercial buildings. Its versatility and relatively low cost made it an attractive choice for these applications. Energy Efficiency: Natural gas was employed in combined heat and power (CHP) systems, which offer high energy efficiency by simultaneously generating electricity and heat. These systems were utilized in various sectors, including district heating and industrial facilities.

Eastern European countries increasingly integrated their energy markets and collaborated on energy projects. This integration aimed to enhance the reliability of natural gas supplies and provide access to diversified sources.

Geopolitical factors, including concerns about energy dependence on certain suppliers, motivated some Eastern European countries to seek alternative natural gas sources and routes.

Further growth in gas demand is predicted in the whole of Europe within the short future, despite and because of the new policies to de-carbonize the economy. The internal EU production of natural gas trend is though not at all encouraging and urges for an increase of import.

Eastern Europe is traditionally a big importer of oil and natural gas from Russia, which makes the area highly vulnerable to the current Russia-Ukraine conflict.

Eastern Europe depends heavily on Russian gas to meet its needs, around 40% -50% of its supply mix but higher in some southern and eastern countries. Russian gas to Europe has increased since the 1980s (Parpulova, 2022).

The political changes in Europe's leadership and the escalation of the conflict resulted in an overall change of attitude towards Russian gas and petrol. Germany halted the certification of Nord Stream 2. The European gas prices rose by 28% week-on-week 1, and power prices rose by 38%.

Such increases put Eastern Europe's economy at risk of serious inflation. The connection between price levels in energy markets and inflation in the European Union is complex and can be influenced by various factors.

Energy is a fundamental input cost for many industries and households. When energy prices rise, it can lead to higher production costs for businesses, which may, in turn, be passed on to consumers in the form of higher prices for goods and services. This can contribute to overall inflation in the economy.

During the period between 2020-2022, energy continued to be a significant input cost for various industries and households across the European Union (Eurostat, 2022). Energy is a fundamental component of economic activity, and its cost can have a substantial impact on businesses and consumers. Here are some key points related to the role of energy as an input cost for the period 2020-2022: electricity (33.2%) and natural gas (32.7%) accounted for two-thirds of final energy consumption in the EU's industry sector. The remaining energy

products represented much smaller shares: oil and petroleum products (excluding biofuel) represented 9.8%, renewables and biofuels 9.7%, and solid fossil fuels accounted for 6.4%. (European Commission, 2022).

The countries from Eastern Europe are likely to be most significantly impacted by the gas stagnation, because of large Russian gas dependency and the use of an energy mix that is dominated by Russian gas. The upward trend of the prices of oil and gas imposed by the conflict in Ukraine faces Europe with one of the worst economic shocks since the 1970s. The remaining reliance on fossil fuels has caused energy prices in Europe to spiral out of control completely (Parpulova, 2022).

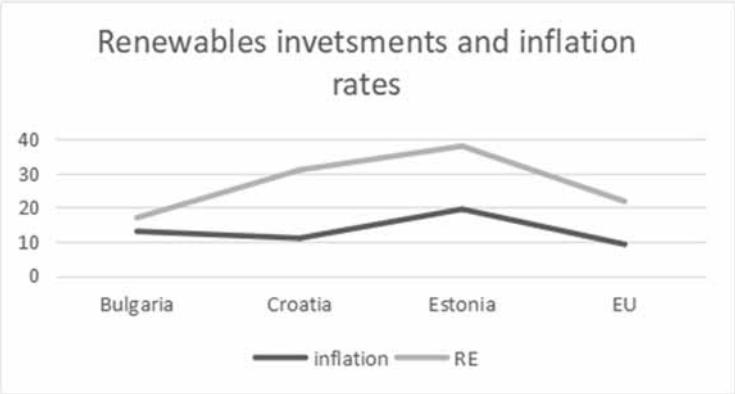
Cross-section experts are warning that the countries in Eastern Europe will be dragged into a deep recession if Russia puts a halt on gas supplies into Europe (International Energy Agency, March 2023).

There are two ways to mitigate escalation: one is to choose to replace Russian supplies with alternative sources or the other way is to decrease the usage of Russian oil and gas.

The EU leadership are throwing significant efforts and funding to lower its dependence on Russian gas by two-thirds before the end of this year and end imports completely by 2030. Such plans are bold as there is always the risk of Russia cutting off vital supplies more quickly which won't allow Europe any time for adjusting. The energy in the euro area is generated from natural gas (25% at least). One-third thus gas the bloc's imports from Russia.

Trying to mitigate the dependency risk (dependency from imports from Russia), most Eastern European countries are undertaking big investments in renewables. Looking closely at the statistics, there seems to be a trend that shows that these investments are also catalyzing inflation rates at least for the last 12 to 18 months since this process has been frantically encouraged by the policy-makers (Danielski, 2021).

Figure 1. Renewable investments and inflation rates



Source: Eurostat 2022.

Green power needs to be efficiently integrated into the wholesale market in order to reach the final consumer. This means short-term power trading needs to adapt to the specific characteristics of renewables. Over the past years, the energy markets have demonstrated their suitability to integrate additional renewable volumes whilst minimizing price impacts (Renewable Market Watch, 2018).

Energy is a vital input for all economic activities and everyday life. Modern economies globally rely on the extensive use of fossil fuels, the main contributor to climate change. Energy markets are facing the long-term challenge of moving towards a net zero future. The energy market has been quite challenged in terms of predictability for the last year 18 months. The expectations are that this transition will generate significant public expenditure and as a result, the different markets are reacting by increasing the prices.

After a significant increase in prices that started before the Russian invasion of Ukraine, but skyrocketed through the second semester of 2022, electricity and gas prices are now stabilizing. The prices of energy rose due to an increase in the price of natural gas, which is considered the marginal fuel. This happened because the imports from Russia decreased, and other importers were sought. The energy market is priced after the marginal fuel, which means that the price of natural gas affects the prices of the electricity market. Mechanisms were constructed in most of the Eastern European countries to alleviate the pressure on consumers, and the subsidies were one of these.

In the first half of 2023, average household electricity prices in the EU continued to show an increase compared with the same period in 2022, from €25.3 per 100 kWh to €28.9 per 100 kWh. Average gas prices also increased compared with the same period in 2022, from €8.6 per 100 kWh to €11.9 per 100 kWh in the first half of 2023. These prices are the highest recorded by Eurostat (Eurostat, Q1, 2023).

The price without taxes on electricity and natural gas is now decreasing.

Compared with the first half of 2022, in the first half of 2023 the share of taxes in electricity bills dropped from 23% to 19% (-4%) and in the gas bill from 27% to 19% (-8%), with all EU countries having in place governmental allowances and subsidies or reducing taxes and levies to mitigate high-energy costs.

High natural gas and electricity prices have had a significant impact on inflation, economic growth, living standards and wider policy goals such as decarbonisation.

2. Energy Market Specifics and Inflation

The energy market has been in the focus of public attention, especially in the countries in Eastern Europe for the last two years. Globally energy prices are soaring due to an overall natural gas shortage. During such a turbulent time, it’s important to have a good understanding of energy markets so one can make the best decisions for any type of organization (or government) both operationally and financially. Knowing what the energy market is about and how does it function will help make choices, such as regulated or

deregulated energy markets, and more (Anderson, 2022) at Sustainability and Energy Management Simplified.

Energy markets can be highly volatile, with prices subject to fluctuations due to factors such as supply and demand dynamics, geopolitical events, weather conditions, and energy policy changes. These price fluctuations can have a direct impact on inflation as they affect the cost of living for consumers and the cost of production for businesses.

The extent to which changes in energy prices affect inflation depends on the degree of pass-through from energy costs to other parts of the economy. If businesses are able to pass on higher energy costs to consumers, it can lead to a more direct link between energy prices and inflation.

The European Central Bank's (ECB) response to managing inflation generated by the volatile energy market was based on the perception that the energy price increases are transitory or temporary.

In 2021, the European Central Bank (ECB) faced the challenge of managing inflation and economic recovery in the context of higher energy costs and the ongoing impact of the COVID-19 pandemic.

The ECB maintained its monetary policy stance throughout 2021. This included keeping policy interest rates at historically low levels, with the main refinancing rate at 0.00% and the deposit rate at -0.50%. These low-interest rates were intended to support borrowing, spending, and economic activity, including addressing any potential inflationary pressures resulting from higher energy costs.

The ECB conducted a strategy review in 2021, culminating in a new inflation target announcement. The ECB revised its target to aim for inflation of 2% over the medium term, with a symmetric approach that allowed for temporary deviations above or below the target. This adjustment provided the ECB with flexibility in responding to inflation dynamics, including those influenced by energy price fluctuations.

The ECB acknowledged the potential impact of higher energy costs on short-term inflation but emphasized its focus on medium-term trends and its willingness to take action if necessary. It closely monitored economic developments and the impact of energy prices on overall inflation. Its decisions and responses were data-dependent, taking into account the broader economic context and the ongoing challenges posed by the pandemic.

The ECB continued to integrate climate change considerations into its policy framework. While not specific to energy costs, these efforts aimed to address longer-term sustainability and environmental risks.

It's important to note that the ECB's actions in response to higher energy costs in 2021 were part of its broader efforts to achieve its price stability mandate and support economic recovery in the EU.

At the same time, the current global energy crisis has placed electricity security and affordability high on the political agenda in all EU countries, including the planned infrastructure investments in the energy sector.

3. Infrastructure – the Blood Vessels of the Energy Market

Thanks to the TEN-E policy (Trans-European Networks for Energy) and the financial support through the Connecting Europe Facility, cohesion funds, and other instruments, several new gas pipelines, interconnectors and LNG terminals in Central-Eastern and South Eastern Europe have come online.

The EU has successfully supported enabling reverse flows on most of the existing interconnections in the region, including those with Ukraine and Moldova; The region is no longer isolated, as the new infrastructure opened access to new regional supply sources (such as direct access to pipeline gas from the Caspian region and access to the global LNG market from the Świnoujście LNG terminal and the Krk FSRU, and shortly from Alexandroupolis FSRU), increased market integration, and enhanced risk preparedness and resilience even in extreme demand conditions (Arsalane, 2021) (net zero 2050).

3.1. Projects of Common Interest in energy infrastructure in the Central and South-Eastern region. Achievements in electricity infrastructure

Several cross-border transmission infrastructure projects in Bulgaria have been completed, as well as an interconnection between Slovenia, Hungary, and Croatia. Two new interconnectors between Slovakia and Hungary have also been completed;

Sincro.Grid (CEF grant of 42 million EUR), a smart grid project between Slovenia and Croatia, has successfully introduced innovative control tools and organization models on top of infrastructure investments enabling cross-sector integration and consumer engagement.

These achievements have prepared the infrastructure in the region to also integrate significant volumes of renewable energy generation for which there is plenty of potential.

3.2. Way forward

The remaining priority infrastructure investments in the region, which are set to be finalized in 2023, are the IBS (gas interconnector between Serbia and Bulgaria) and the construction of the Alexandroupolis FSRU and FSRU terminal in Vassiliko, Cyprus. The latter will effectively end the gas isolation of Cyprus, allowing the country to connect to the global LNG market and diversify its imported energy sources and fuels.

The planned expansion of several underground gas storage facilities in Chiren, Bulgaria (CEF grant of 79 million EUR), as well as in Bilciuresti, Romania (CEF grant of 38 million EUR), and Greece is expected to significantly contribute to enhancing the security of supply and market integration in South-East Europe.

More electricity interconnections are being developed and finalized. For instance, after having finalized the Bulgarian section of the Greece – Bulgaria electricity interconnector (CEF grant of 28 million EUR), the project is expected in operation in 2023.

Other key electricity interconnector projects are expected to be completed in the coming years, notably the Trans- Balkan Electricity Corridor, the Romanian section of the Black Sea Corridor between Romania and Bulgaria, or the Mid Continental East Corridor between Romania and Serbia as well as Euro-Asia, undersea cable from Israel to Crete via Cyprus.

Total funding under the Connecting Europe Facility (CEF) for the region: 2.86 billion EURO.

Total funding under the European Energy Program for Recovery (EEPR) for the region amounts to 234 million EURO.

4. Renewable Energy Sources

Speaking of the capacity for integrating significant volumes of renewable energy generation in the region we need to look slightly broader than just Eastern Europe- the CESEC region (Central and South Eastern Europe).

Electricity from RES is expected to reach shares of either 49% or 53.1% in the CESEC electricity mix by 2030, depending on whether the reference NECP (National Energy Climate Plans) or the Green Deal targets are implemented (ECORYS report, February 2022).

By 2050 electricity from RES is expected to reach either 75-77% or 85-87% of the regional electricity mix, in reference of the Green Deal scenarios.

Member States (MS) of the CESEC region, compared to the non-EU Member State counterparts: to reach the Green Deal targets, RES power generation in the EU Member States would need to slightly more than double, whereas, for the non-EU Member States, the increase should be at least four-fold. Power from photovoltaic systems – both centralized and decentralized – stands out as the largest contributor to the future energy mix. Onshore wind is a close second largest contributor (ECORYS report, February 2022).

The reality is though that the transition towards a carbon-neutral society is a polarizing topic within the EU especially because of the actual fact that the countries face very different problems and want to fulfil these new policies in the context of existing patterns of uneven development. Although the climate crisis threatens our quality of life, the transition towards de-carbonization is slow.

5. Price-Risk Management and Electricity Regulation and Balancing in Eastern Europe – Major Part in the Performance of the Energy Market

In a number of EEA Member States and Energy Community Contracting Parties, key functions are related to the Transmission System Operators (entities operating independently from the other electricity market players and are responsible for the bulk transmission of electric power on the main high voltage electric networks). The tasks of these third parties, include, among others, facilitation of balancing markets, imbalance calculation and settlement, data publication related to electricity balancing markets and issuing of the rules related to balancing markets. These tasks underpin the electricity market and represent the

link between the physical exchange of electricity among market participants and the financial outcomes (Europex, 2022). This is the Association of European Energy Exchanges, the business association for energy exchanges, market operators and delegated operators in Europe.

The efficient regulating and balancing by definition, supports effective, liquid, secure and transparent European wholesale energy markets. It works to promote the competitiveness of European energy markets and to ensure that the European financial services framework appropriately addresses the special characteristics of the energy commodity derivatives markets and their participants. This allows for proper price risk management and contributes to the energy transition in Europe.

Price risk management, especially, plays a crucial role in the energy transition in Europe by providing stability and predictability to the energy markets. The energy transition refers to the shift from fossil fuels to renewable energy sources and the implementation of more sustainable and environmentally friendly energy systems.

There are different instruments, used in Eastern Europe, where the markets are extremely price sensitive. Some of them are:

- Investment Incentives: Renewable energy projects, such as wind farms and solar power plants, require significant upfront investments. Investors and project developers need certainty regarding future revenue streams to justify these investments. Price risk management tools, such as long-term power purchase agreements (PPAs) and hedging strategies, provide this certainty by locking in prices for the sale of renewable energy over extended periods. This encourages more investment in renewable energy infrastructure.
- Integration of Renewable Energy: Renewable energy sources like wind and solar are inherently variable. Managing the price risk associated with their intermittency is essential for grid stability. Energy markets use price risk management tools like spot and forward contracts to balance supply and demand and ensure a reliable energy supply, even with intermittent renewables in the mix.
- Risk Mitigation for Utilities: Traditional utilities with a mix of conventional and renewable assets can use price risk management to mitigate the volatility of energy prices. By hedging against price fluctuations, utilities can stabilize their revenue streams, making it easier to invest in and support the growth of renewable energy assets.
- Market Development: Well-developed energy markets with effective price risk management mechanisms attract more participants, including renewable energy developers, investors, and consumers. This increased market activity can lead to greater competition, innovation, and cost reductions in the renewable energy sector.
- Consumer Protection: Price risk management tools can also protect energy consumers from extreme price spikes in volatile markets. This ensures that consumers can access affordable and reliable energy, which is essential for the acceptance and support of the energy transition.
- Regulatory Framework: Effective price risk management often requires a supportive regulatory framework. Governments and regulators can play a crucial role in promoting

the use of risk management tools, setting standards for transparency and fairness in energy markets, and incentivizing the adoption of renewable energy.

In summary, price risk management is an essential component of the energy transition in Eastern Europe. It provides the stability and confidence necessary for investors, utilities, and consumers to engage in renewable energy projects and helps ensure the reliable integration of renewable energy into the grid. As Europe continues to transition towards a more sustainable and low-carbon energy system, effective price risk management will remain a key enabler of this transformation.

6. Eastern European Energy Market (EEEM)

The European Union has become the world's fastest growing energy market and also the biggest gas import market. It possesses a range of energy import sources.

The Eastern European energy market (EEEM) is currently one of the fastest-growing energy markets. It consists of resource-rich and transit countries (Belarus, Bulgaria, Czech Republic, Hungary, Poland, Moldova, Romania, Russia, Slovakia, Ukraine) with a population of roughly 291 million people, that contribute significantly to world energy security (Mousavi, 2021).

The European Energy Exchange (EEX) offering for the Eastern European power markets, comprises Bulgaria, Czech Republic, Hungary, Poland, Serbia, Slovakia, Slovenia and Romania. Since the migration of Power Exchange Central Europe (PXE) products onto the EEX platform in 2017, liquidity in cleared power futures within the Central South Eastern Europe region has almost doubled each year thereafter.

In 2019, EEX achieved a record trading volume of 185 TWh, up from 102 TWh in 2018. The trade has doubled from 2018 to 2020. Some of these economies though while being under the same roof tend to face very diverse challenges when it involves their energy supply balance (Riediger, 2021).

It is a continuing argument by energy experts when discussing East European and Turkish gas markets that the region lacks the infrastructure to assist wean itself off Russian imports. However, with new importing terminals for liquefied fossil fuel being added, new transmission corridors established, and interconnection capacity expanded, discussing the region's lack of interconnectivity is actually yesterday’s argument.

Countries like Bulgaria, Poland and also the Check Republic are heavily reliant upon coal mining to balance their energy markets and to keep the costs bearable both for the consumers and for the industry. Nevertheless, their economies are still swept by the energy railing prices and suffer badly from the increases.

7. EEEM and the Inflation Rates

Going back to the natural gas crisis that occurred during 2021-2022, it had a significant impact on the European Union as a whole, not only in terms of energy security but also in its repercussions on the day-ahead electricity markets and, subsequently, final electricity prices and inflation. To understand this link in more detail and draw relevant conclusions, let's look into the intricacies of this situation.

7.1. Dependency on Natural Gas

The EEEM countries heavily rely on natural gas as a primary energy source, especially for electricity generation. Gas-fired power plants play a crucial role in balancing the grid and providing electricity during peak demand. As a result, fluctuations in natural gas prices directly affect the energy market.

Dependency on natural gas in Eastern Europe is a significant aspect of the region's energy landscape. Natural gas plays a vital role in the energy mix of these countries and this dependency has several key implications:

- Electricity Generation: Natural gas is a crucial source of energy for electricity generation. Gas-fired power plants provide a flexible and reliable source of electricity, particularly during periods of peak demand. They can quickly respond to fluctuations in demand, making them an essential part of the energy grid.
- Heating and Industry: Natural gas is also widely used for heating in residential, commercial, and industrial applications. It is a preferred energy source in many industries due to its high energy content and relatively low environmental impact when compared to some other fossil fuels.
- Import Reliance: Eastern Europe is heavily reliant on natural gas imports. While some EU countries produce significant amounts of natural gas domestically, others depend on imports from countries like Russia, Norway, and Algeria. This import dependence raises concerns about energy security and geopolitical vulnerabilities.
- Energy Transition Challenges: The EU's ambitious climate change – de-carbonization efforts require a shift away from fossil fuels, including natural gas, which can be a complex and costly endeavour.
- Interconnected Energy Markets: The interconnectedness of energy markets in the EU means that disruptions or fluctuations in natural gas supply can have a cascading effect on other energy markets, such as electricity. This interdependence highlights the need for diversification and resilience in the energy sector.
- Price Volatility: Natural gas prices can be subject to significant volatility due to factors like geopolitical tensions, supply disruptions, and changes in global demand. This volatility can have direct and immediate impacts on energy costs for consumers and businesses.

- Energy Security Concerns: Diversifying gas supply sources and routes and investing in infrastructure such as liquefied natural gas (LNG) terminals and pipelines are strategies to enhance energy security.

Dependency on natural gas is a complex issue with both advantages and challenges. While natural gas has been an important energy source, its role is evolving as the EU seeks to reduce emissions and enhance energy security. The transition to cleaner and more diversified energy sources is a significant focus, and managing this transition is a key element of the EU's energy policy.

7.2. Interconnected Markets

The European energy market is highly interconnected, with electricity markets closely linked to the natural gas market. This interconnection is not only on a national level but also across borders, as part of the larger European energy network. This means that changes in one market can have immediate and far-reaching effects on the other.

The interconnectedness of European energy markets, where changes in one market can have immediate and far-reaching effects on another.

For instance, cross-border Electricity Trade: European countries have established interconnected electricity grids that allow for cross-border electricity trade. This facilitates the sharing of electricity resources across countries. For example, the European Network of Transmission System Operators for Electricity (ENTSO-E) coordinates electricity transmission and market operation across 42 European countries. (The UK Energy Research Centre (UKERC), 2022)

Gas-to-Power Link: The link between natural gas and electricity markets is evident in the gas-to-power relationship. When natural gas prices rise, it becomes more expensive to generate electricity using gas-fired power plants. As a result, electricity generators may switch to alternative sources like coal or renewables, affecting both the natural gas and electricity markets.

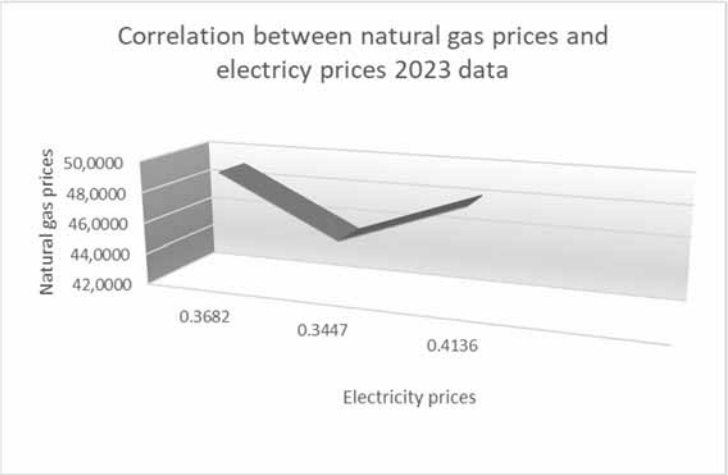
Market Coupling: The European Union has promoted market coupling, a practice where different electricity markets in neighbouring countries are linked, making it possible to buy and sell electricity across borders. This coupling relies on the availability of generation capacity and transmission infrastructure, which is often fueled by natural gas power plants.

Renewable Energy Integration: The fluctuating nature of renewable energy sources, such as wind and solar, has increased the need for flexible natural gas power plants to balance the grid. As more renewables are integrated into the energy mix, the relationship between gas and electricity markets becomes even more critical for grid stability.

Impact of Gas Supply Disruptions: When there are supply disruptions or geopolitical tensions affecting natural gas imports, this can lead to concerns about electricity generation. Gas-fired power plants may face reduced availability of fuel, potentially leading to increased reliance on alternative energy sources or higher electricity prices.

Price Correlation: The correlation between natural gas and electricity prices is well-documented. Historical data often shows that changes in natural gas prices are followed by corresponding changes in electricity prices, especially in markets where gas-fired generation is significant.

Figure 2. Correlation between natural gas prices and electricity prices



Source: Eurostat, 2023.

The interconnectedness of European energy markets, particularly between natural gas and electricity, is supported by the operation of cross-border electricity trade, the impact of gas supply disruptions on electricity generation, and the historical correlation between gas and electricity prices. This interconnection is a fundamental aspect of the European energy landscape, and changes in one market can indeed have immediate and far-reaching effects on the other, underscoring the need for coordinated and balanced energy policies in the region.

7.3. Price Correlation

Natural gas prices often serve as a benchmark for electricity prices. When natural gas prices rise, it becomes more expensive to generate electricity using gas, leading to higher electricity prices. Conversely, when gas prices fall, electricity prices tend to follow suit. This strong correlation can be observed in day-ahead electricity market prices.

To illustrate the relationship between natural gas prices and electricity prices, I can provide some statistics:

- Natural Gas Prices: Let's consider a hypothetical increase in natural gas prices
- Natural Gas Price in 2020: $2.50 per MMBtu
- Natural Gas Price in 2021: $3.50 per MMBtu

Electricity Prices: Corresponding to the rise in natural gas prices, electricity prices can increase due to the higher cost of fuel for gas-fired power plants. Here's a simplified example

- Average Residential Electricity Price in 2020: 10 cents per kWh
- Average Residential Electricity Price in 2021: 12 cents per kWh

In this hypothetical scenario, when natural gas prices increased from $2.50 to $3.50 per MMBtu, electricity prices for residential consumers increased from 10 cents to 12 cents per kWh. This illustrates the correlation between natural gas and electricity prices, with the rise in gas prices leading to higher electricity prices.

However, it's important to note that the relationship between natural gas and electricity prices can be influenced by various factors, including the energy mix, electricity market dynamics, and regulatory policies. Additionally, not all electricity generation relies on natural gas, as the energy mix includes coal, renewables, nuclear, and other sources, which can also impact electricity prices.

During the whole of 2022, the worth of energy within the EU has been a number one topic for all. The reasons behind this escalation of energy prices are many, but two key ones were:

- not enough oil and natural gas supplies
- limited internal production, especially of natural gas

These two factors caused instability within the markets, and energy prices were rising every day.

European gas futures have broken record after record last year, as Russia capped flows to the region even as cargoes of liquefied fossil fuel were diverted to Asia. Soaring energy costs helped send Eurozone inflation at very high levels, according to Q1 to Q4 figures in 2021.

Energy prices have a significant impact on inflation in the Eurozone. Energy prices are a component of the Consumer Price Index (CPI), which is a commonly used measure of inflation. When energy prices rise, it can lead to higher overall inflation, as it increases the cost of living for consumers and the production costs for businesses.

7.4. Energy prices and Eurozone inflation are interconnected.

Direct Impact on CPI: Energy prices, particularly oil and natural gas prices, are directly included in the basket of goods and services used to calculate the CPI. When energy prices increase, the cost of items such as gasoline, heating, and electricity also rises, leading to an increase in the overall CPI.

Indirect Impact on Production Costs: Energy is a fundamental input in many production processes across various industries. When energy prices rise, it can increase the cost of production for businesses. These increased production costs can be passed on to consumers in the form of higher prices for goods and services, contributing to inflation.

Consumer Spending: Higher energy prices can reduce consumers' disposable income, as more of their income is allocated to paying for energy-related expenses. This can lead to

reduced consumer spending on other goods and services, which can have a broader impact on the economy and inflation.

Supply Chain Effects: Rising energy prices can affect transportation costs and supply chains, potentially leading to higher prices for goods and services due to increased logistics expenses.

Inflation Expectations: If consumers and businesses expect energy prices to continue rising, it can influence their inflation expectations. Expectations of higher future prices can lead to demand-side inflationary pressures as people rush to purchase goods and services before prices increase further.

Monetary Policy Response: the European Central Bank (ECB), adjusted its monetary policy in response to changes in energy prices and inflation. The energy-driven inflationary pressures were considered deemed temporary and the choice was not to raise interest rates aggressively.

It's important to note that energy prices can be volatile and subject to various external factors. Therefore, their impact on inflation in the Eurozone can vary over time. Central banks and policymakers closely monitor energy prices and their effects on inflation when making decisions about monetary policy and economic stability.

7.5. How do we form electricity prices? Cost of Electricity

It depends on several factors, such as:

Fuel Cost: The major cost of generating electricity is the cost of the fuel. Different energy sources can be used.

Building Cost: Another key is the cost of building the power plant itself. A plant may be very expensive to build, but the low cost of the fuel can make the electricity economical to produce. Nuclear power plants, for example, are very expensive to build, but their fuel—uranium—is inexpensive. Coal-fired plants, on the other hand, are cheaper to build, but their fuel—coal—is more expensive.

Efficiency: When figuring cost, you must also consider a plant's efficiency. Efficiency is the amount of useful energy you get out of a system (National Energy Education Development Project, 2019).

In general, today's power plants use three units of fuel to produce one unit of electricity. Most of the lost energy is waste heat. A typical coal plant burns about 4,500 tons of coal each day. About two-thirds of the chemical energy in the coal (3,000 tons) is lost as it is converted first to thermal energy, then to motion energy, and finally to electrical energy.

Gas is a major supply element for the production of electricity. According to 2021 figures and statistics world gas consumption is growing to 4.2 trillion. cubic meters.

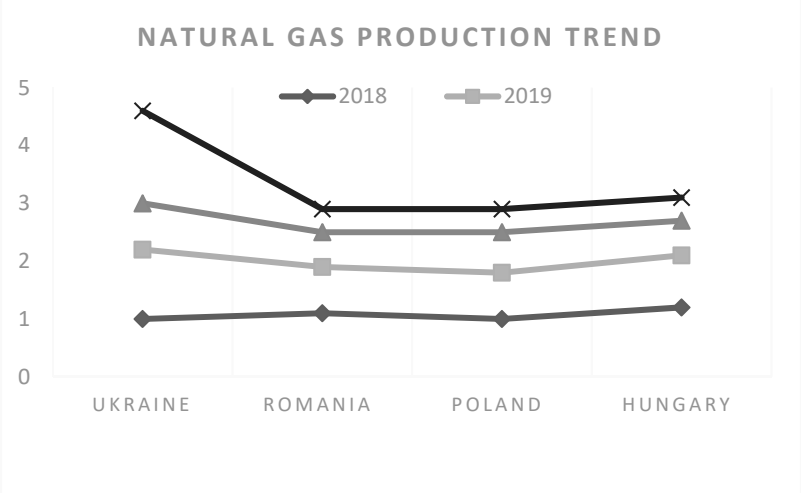
Natural gas is considered a relatively cleaner fossil fuel compared to coal and oil, and it is often used for electricity generation, heating, and industrial processes. It's also seen as a transitional energy source as countries work to reduce carbon emissions. Natural gas has

often been viewed as a bridge fuel during this transition due to its lower carbon emissions compared to coal and oil.

Natural gas is commonly used for heating homes and buildings in Europe, especially in the colder regions. It's also an essential energy source for various industrial processes.

Further growth in gas demand is predicted in Europe within the short future, despite and because of policies to decarbonize the economy. The internal EU production of natural gas trend is not encouraging and urges for an increase in import.

Figure 3. Natural Gas production trend in some Eastern European countries



Source: Global Data, Upstream analytic

8. External to Eastern Europe Factors Affecting the Energy Market

The Organization of Petroleum Exporting Countries (OPEC) and its partners have been urged to extend the oil extraction volumes, so as to smooth down the energy prices. This is because the highest crude prices in seven years threaten the world economic recovery with an inflationary surge worldwide. The costs are near $85 a barrel in London, whipped up by a world energy crunch centred in fossil fuel markets.

OPEC seems reluctant to attend to the demand and the counterargument is that the extra oil barrels would do nothing to alleviate the energy crisis when the actual shortfall is in gas supplies. Fuel demand remains liable to ongoing outbreaks of COVID-19, and oil markets are in any case likely to return to surplus early next year, without taking any extra measures to fill in a very gap within the energy market.

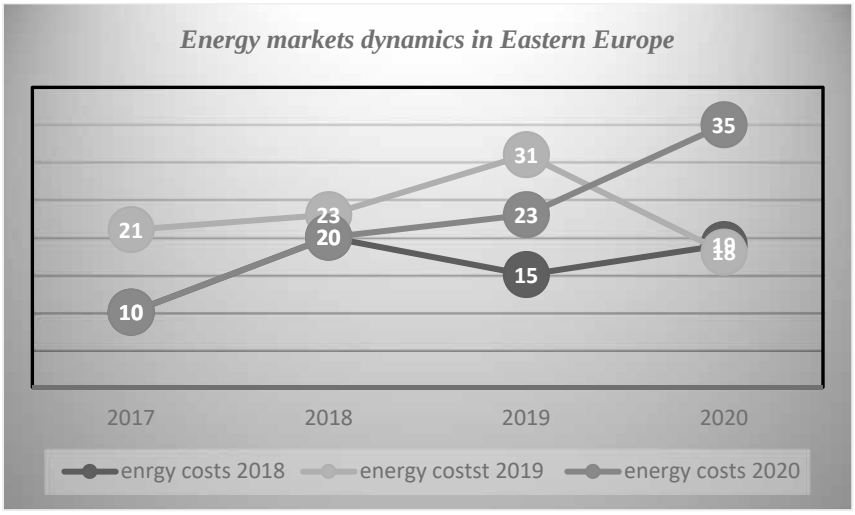
In Europe, the energy demand has been the highest for the last 25 years. The consumption influenced by different boosters has grown steadily in Europe with an arithmetic progression.

$$a_{n+1} = a_n + d$$

(a_n- year n consumption, d- progression factor)

Further risk and constraint come from the drop in the supply of Russian gas. The market was roiled in early trading, with benchmark gas futures surging the maximum amount of 15% before paring gains, as Russian gas started flowing eastward from Germany to Poland.

Figure 4. Energy Markets Dynamics in Eastern Europe



Source: https://www.eex.com/en/markets/power-derivatives-market/csee-power-markets.

Russian gas shipments entering Germany's Mallnow compressor station dropped to zero at the start of November this year, consistent with data from grid operator Gascade. Russian gas transit to the European Union via Ukraine also dropped. Natural gas and power prices remain triple the standard levels for this point of the year. There has been an unprecedented increase in global gas prices (Mazneva, Shiryaevskaya, Almeida, 2021).

The other factor that stirs the energy market is the European actions for climate protection and the rather optimistic counting on renewable sources, the assembly of which, however, is unstable, and therefore the promotion of the abandonment of coal and other fossil fuels lacks economic justification, especially in the near future.

Due to the actual fact that an efficiently functioning internal gas market is the key to the security of supply throughout the European Union, a plan is needed to strengthen the cooperation between Member States in relevant risk groups:

Group 1:

States belonging to the chance group: Belgium, Check Republic, Germany, Estonia, Latvia, Lithuania, Luxembourg, The Netherlands, Poland and Slovakia.

Group 2:

States belonging to the danger group: Bulgaria, Cyprus, Germany, Greece, Croatia, Italy, Luxembourg, Hungary, Austria, Poland, Romania, Slovenia and Slovakia.

At present, countries from Ukraine in the north to the Balkans and Turkey in the south –all face very diverse and different challenges.

9. The four big challenges to the energy markets in Eastern Europe

9.1. The first challenge

The first challenge relates to meeting the net zero emission target. This concept is a central part of efforts to mitigate climate change and limit global warming to well below 2 degrees Celsius above pre-industrial levels, as outlined in the Paris Agreement.

Key elements of a net-zero emission target include Greenhouse Gas Emissions Reduction. The primary focus of a net-zero target is on reducing greenhouse gas emissions, including carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O), which are the main drivers of climate change. Emissions can come from various sectors, including energy, transportation, industry, agriculture, and land use.

This suggests that countries like Romania, Bulgaria, Greece, Turkey, and Ukraine, where between 30-40% of electricity generation remains supported by lignite or coal, should frantically look for alternatives.

Conservative estimates by ICIS (Independent Commodity Intelligence Services) show that a minimum of another 6.5 GW of recent gas-fired capacity is needed in Bulgaria, Greece, and Romania to exchange coal-fired generation within the following ten to fifteen years. This might be additionally to more fossil fuel being required as distribution zones expand to incorporate more consumers (Sabadus, 2020).

In other words, gas will remain a very important fuel regionally for an additional decade, if less.

9.2. The second challenge

The second challenge is a way to access the abundance of diverse gas imports in southern countries like Greece and Turkey.

The Turkish gate. Turkey lies adjacent to countries or regions possessing some 71.8 percent of the world's proven gas reserves (111.88 trillion cubic meters out of total world proven reserves of 155.78 bcm) and a few 72.7 percent of the world's proven oil reserves 762.7 billion barrels out of total world proven reserves of 1,047 bn barrels (Roberts, 2020).

Gas Transit Issues are of vital importance for the energy balance in Eastern Europe. The European Union is already the world's biggest gas import market while it's also one of the world's fastest-growing energy markets. It possesses a range of energy import sources, notably Russia and Algeria but is of course seeking to diversify supplies. Turkey's role is potentially very important as it furnishes a natural corridor through which gas from a good

sort of suppliers in an arc from the Caspian through the centre East and also the Gulf to Egypt can access the growing EU market by pipeline. The EU already receives huge quantities of gas from three main sources – Russia, the sea and geographical regions.

9.3. The third challenge

Addressing this question also will help solve the third challenge, which relates to storing volumes. The foremost important type of gas storage is in underground reservoirs. There are three principal types: depleted gas reservoirs, aquifer reservoirs and salt cavern reservoirs. Each of those types has distinct physical and economic characteristics which govern the suitability of a selected form of storage type.

Gas storage operators are increasingly positioning themselves on new markets as first as backup for variable wind and alternative energy. It is a future energy system where electricity and gas are going to be more closely integrated (Simon, 2019).

With 1,200 terawatt hours (TWh) of existing capacity in Europe, the potential of gas storage is indeed massive. But the road to such a hybrid energy system is paved with uncertainty.

Bulgaria’s strategic location makes it a good hub for passing along fossil fuel to the remainder of Europe. Bulgarian section of the Black Sea called the Galata Exploration Block. Situated 22 km (13.7 miles) offshore near the town of Varna, Galata could be a prime gas storage option with a capacity of two.2 billion cubic meters (bcm), which is such as about 70 per cent of the annual gas demand in Bulgaria. The proposal for an offshore gas storage facility near the town of Varna, specifically in the area of Galata, could have significant implications for Bulgaria's energy security and gas supply.

The development of an offshore gas storage facility near Varna, Galata, with a substantial capacity could offer significant benefits to Bulgaria's energy security and gas supply management. It would provide a strategic asset for the country, allowing it to better cope with variations in gas demand, improve energy resilience, and diversify its gas supply sources and routes. However, such projects also come with regulatory, environmental, and stakeholder considerations that need to be carefully managed during the planning and development phases.

Storing fossil fuel in former, depleted gas fields is among the foremost cost-effective and technically sound ways to stockpile large energy reserves and protect against unexpected supply, demand and price fluctuations.

Ukraine, with its 30 billion cubic meters of capacity, could offer this space for storage. Indeed, Ukraine has already become Europe’s storage hub in 2020, when the number of nonresident companies, mainly from Central and Western Europe, rose to 81 compared to only seven in 2018.

Ukraine, Moldova, and Romania are keen to tap new sources of supplies imported within the south, Bulgaria, Greece, and Turkey and are going to be looking to ship volumes northwards.

9.4. The fourth challenge

This ends up in a fourth challenge, which relates to guaranteeing a bidirectional transit corridor that will not only facilitate flexible flows but also allow countries to realize or retain transit revenue. Securing transit revenue may be a challenge in itself because most regional countries saw a crucial source of money dry out when Russia's Gazprom diverted exports to the newly commissioned TurkStream corridor on January 1, 2020.

Securing transit routes is a very complex investment for each country. There should always be a risk analysis. These countries should invest in:

- Analyzing pipeline infrastructure to identify vulnerabilities
- Engineering solutions to reduce the likelihood of potential damaging risks or cyber-attacks
- Preparing a road map for improving the overall infrastructure efficiency

Ukraine, Moldova, and Romania were among the largest losers, with the Romanian gear operator, Transgaz, even reporting a 9% year-on-year loss in profits during the primary nine months of 2020 because of this diverted transit.

To meet the four key challenges, regional countries including Ukraine, Moldova, Romania, Bulgaria, Greece, and Turkey must add unison to satisfy mutual interests. The Energy Community, an establishment designed to increase EU rules to neighbouring markets, has already recognized the importance of integrating this region.

The integration refers to the physical infrastructure that may allow gas to flow freely and flexibly across the region. Although the region benefits from two new transmission routes, Turk-Stream 1 and a couple of together with the Southern Gas Corridor, neither can satisfy its integration needs.

Part of the vital infrastructure that would facilitate market integration and satisfy the interests of individual countries is the Trans-Balkan pipeline. The Trans-Balkan Pipeline, also known as the TBP or the Trans-Balkan Oil Pipeline, is a network of pipelines that transport crude oil from the Black Sea region to destinations in Europe, primarily in the Balkans and Central Europe. It plays a crucial role in the transportation of oil from countries such as Russia and Kazakhstan to European markets. It is located near most Turkish LNG terminals. It also has enough capacity to serve the whole region at transit fees that might be significantly reduced.

10. Conclusions

In conclusion. Energy is at the core of sustainable development. Energy security strategies are needed factoring in the specifics of the different parts of Europe. These strategies should be geared toward balancing economic development with environmental sustainability, while respecting social values.

The effective energy infrastructure could become the backbone of a well-supplied integrated region. All it takes is for individual countries to think beyond national interests, acknowledge shared challenges and goals, and unite along similar rules (Sabadus, 2020).

Currently, the transition towards a carbon-neutral society will be a polarizing topic and sometimes benefits already privileged citizens. This example makes the energy market during this part of Europe very difficult to create a prognosis on its concerning midterm trends. Additionally, to any or all this is often the actual fact that there are existing challenges across the region like aged infrastructure, high energy intensity, low energy efficiency, untapped energy potential and poorly functioning regional energy markets.

Moreover, rising inequalities create boundaries between European citizens and hinder the sensation of ownership over environmental and carbon-neutral policies. The rising energy prices tend to cause an inflation spur in the Eastern European countries that coincides with the EU push towards de-carbonization and as a result, the citizens in these countries suffer hugely. Some governments are starting to rethink the option of utilizing nuclear power technologies to help maintain the balance between the environment and social and economic justice.

Energy prices are proven to spur inflation being it on a temporary basis. The effort for synergy in the energy strategies of the countries in Eastern Europe that share similar challenges is very worthwhile.

The energy market dynamics of Eastern Europe are influenced by a combination of factors:

- Geopolitics. Dependency on Russian Energy. Many Eastern European countries historically have been heavily reliant on Russian energy imports, particularly natural gas and oil. This dependence on a single supplier, namely Russia's Gazprom, has raised energy security concerns and made these countries vulnerable to political and price-related disputes. Geopolitical tensions in the region, including conflicts and disputes with neighbouring countries, can impact energy supply routes and pricing. Political factors can sometimes lead to disruptions in energy flows.
- Energy sources. Diversification Efforts: In response to concerns about energy security, Eastern European countries have been working to diversify their energy sources and supply routes. This includes efforts to reduce reliance on Russian gas by seeking alternative suppliers and exploring options like liquefied natural gas (LNG) terminals and interconnectors with neighbouring countries.
- Renewable Energy Growth: Eastern European countries have been increasing their investment in renewable energy sources, such as wind, solar, and biomass. Government incentives, EU directives, and environmental goals have driven the growth of renewables in the region. Eastern European countries have set various renewable energy targets and commitments as part of their efforts to reduce carbon emissions and meet EU renewable energy directives. These targets influence investment in renewables.
- Interconnectivity: Enhancing cross-border energy infrastructure and interconnectivity with neighbouring countries is essential for diversifying supply options and improving

energy market flexibility. Projects such as gas pipelines and electricity interconnectors have been developed to facilitate regional energy trade.

- EU Energy Market Integration: Many Eastern European countries are part of the European Union (EU) or have close ties to the EU's energy market. This integration requires alignment with EU energy policies and regulations, fostering a more competitive and interconnected energy market.
- Nuclear Energy: Several Eastern European countries, including Hungary, Slovakia, and the Czech Republic, rely on nuclear power for a significant portion of their electricity generation. The modernization and expansion of existing nuclear facilities have been under consideration.
- Energy Price Volatility: Energy prices can be subject to volatility due to factors like changes in global oil and gas prices, geopolitical events, and fluctuations in currency exchange rates. This volatility can affect energy costs for both consumers and businesses.
- Regulatory Frameworks: The regulatory frameworks in Eastern European countries play a significant role in shaping the energy market. They govern issues such as energy pricing, market competition, and environmental standards.
- Energy Transition Challenges: Transitioning from fossil fuels to cleaner energy sources can be challenging and costly. Many Eastern European countries face the task of modernizing their energy infrastructure and addressing social and economic implications.

These dynamics in the energy market of Eastern Europe reflect the region's evolving energy landscape, influenced by global energy trends, EU policies, and efforts to enhance energy security and sustainability. It's important to note that specific circumstances and priorities may vary from one country to another within Eastern Europe.

Therefore, the countries from Eastern Europe should put in place national measures and reforms to put forward a package of measures to help protect vulnerable consumers and businesses, which is also compatible with the principles of the Internal Energy Market. These principles include free price formation based on supply and demand in European wholesale energy markets and unhindered cross-border trade between Member States.

References

Arsalane, Y. (June 2021). available at: https://racetozero.unfccc.int/wp content/uploads/2021/06/NetZeroby2050-ARoadmapfortheGlobalEnergySector.pdf.

Bloomberg P.L. (2021). OPEC+ Expected to Ignore U.S. Calls for Extra Oil This Week. available at: https://www.bnnbloomberg.ca/opec-expected-to-ignore-u-s-calls-for-extra-oil-this-week.

Danielsk, R. (2021). available at: https://www.epexspot.com/en/about.

European Commission. (February, 2022). available at: https://www.ecorys.com/sites/default/files/2022-05/CESEC.pdf.

Europex – Association of European Energy Exchanges. (Aug 16, 2018). available at: https://www.europex.org/about/energy-markets/.

International Energy Agency. (March, 2023). available at: https://www.iea.org/events/electricity-market-report-july-2023.

Mazneva, E., Shiryaevskaya, A., Almeida, I. (Nov.2021). EU Gas Surges on Disturbance to Russian Shipments. available at: https://www.bloombergquint.com/business/eu-gas-surges-as-russian.

Mousavi, F., Asadi, S. (2021). Energy Storage in Energy Markets (May 2021). available at: https://www.sciencedirect.com/topics/engineering/energy-market.

National Energy Education development Project. (2019). available at: Users/ASUS/Downloads/Intermediate-Energy-Infobook-1.pdf.

Parpulova, N., Zinoviev, V. (2022). Economic Alternatives for the Transport and Energy Sector in the Crisis with Energy Supplies. Dialogue, Tsenov Academy of Economics (Tsenov Academy of Economics).

Renewable Market Watch. (10th June 2018). Central East and South East Europe Solar Photovoltaic (PV) Power Market Outlook 2018÷2027. available at:https://ineaconsulting.eu/en/blog-en/central-east-and-south-east-europe-solar-photovoltaic.

Riediger, S. (2021). European Power Derivatives, "Central and South-Eastern European Power Markets". available at: https://www.eex.com/en/markets/power-derivatives-market/csee-power-markets.

Roberts, J. (2020). The Turkish gate: Energy transit and security issues. available at: https://esiweb.org/pdf/esi_turkey_tpq_id_13.pdf.

Sabadus, A. (December 17, 2020). Why East European gas markets should integrate. available at:https://www.atlanticcouncil.org/blogs/ukrainealert/why-east-european-gas-markets-should-integrate/.

Simon, F. (May 2019). The evolving role of gas storage in Europe. available at: https://www.euractiv.com/section/energy/news/the-evolving-role-of-gas-storage-in-europe/.

Sustainability and Energy Management Simplified. (October 6, 2021). available at: https://watchwire.ai/what-are-energy-markets/.