

SOFIA
UNIVERSITY



ST. KLIMENT
OHRIDSKI
EST. 1888

The background of the cover features a blurred image of a fountain with multiple jets of water. Overlaid on this is a white line graph with a black outline, showing a fluctuating upward trend that ends in an arrowhead pointing towards the top right. The bottom half of the cover is a solid dark purple color.

Factors influencing natural gas price developments in Bulgaria

Sofia University St. Kliment Ohridski, 2023

FACULTY OF ECONOMICS AND BUSINESS ADMINISTRATION

AUTHORS **Michail Yanev**

PhD Candidate at Department for Industrial Economics and Management,
Sofia University St. Kliment Ohridski

Krasimir Zhivachki

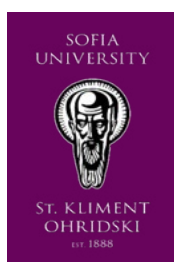
Association of Energy Traders in Bulgaria

Dr. Boyko Nitsov

Contributor in chapter 2

EDITOR **Dr. Mariya Trifonova**

Faculty of Economics and Business Administration (FEBA)



Sofia, 2023

Sofia University St. Kliment Ohridski

Cover photo: Canva

CONTENTS

	List of Figures	4
	Abbreviations	5
1	Introduction	6
2	Fundamentals of Bulgarian Natural Gas Market	8
2.1	Bulgaria playing an increasingly strategic role in the regional gas market	8
2.2	Infrastructure	11
2.3	Demand structure	14
2.4	Supply structure	16
2.5	Price setting mechanism	21
3	Ex-post Evaluation of Natural Gas Price Dynamics in Bulgaria	23
3.1	Methodology	26
3.2	Market Factors Influencing Bulgarian Natural Gas Price Dynamics	26
3.2.1	Factors influencing Balkan Gas Hub prices	27
3.2.2	Factors influencing regulated prices in Bulgaria	30
3.2.3	Price elasticity of natural gas demand	31
4	Future Outlook	34

LIST OF FIGURES

Figure 1: Gas pipeline scale effects on average cost of transportation	9
Figure 2: Natural gas flows in the SEE region through Bulgaria	10
Figure 3: Bulgarian natural gas infrastructure	12
Figure 4: Natural gas pipelines in the SEE region	13
Figure 5: Cross-border transmission and consumption of natural gas in Bulgaria	14
Figure 6: Consumption of natural gas by sector in Bulgaria	15
Figure 7: Projected final energy demand in the Bulgarian economy based on current plans of the policy-makers and discussions in the Energy Transition Commission.	15
Figure 8: Natural gas supply structure in Bulgaria in 2022.	17
Figure 9: Natural gas supplies by sources (2017-2021)	18
Figure 10: Key natural gas market players in 2022.	19
Figure 11: Bulgargaz sales of natural gas by segments	20
Figure 12: Share of gas release programme-related volumes in the total volume traded at the Balkan Gas Hub in a given year.	20
Figure 13: Number of companies trading at the Balkan Gas Hub	20
Figure 14: Deviation of the regulated natural gas prices in Bulgaria from the TTF Futures Index (2018-2022)	24
Figure 15: Natural gas price dynamics in Bulgaria in the three price formation periods (2018-2022)	25
Figure 16: Natural gas hub prices' development (2019-2022)	28
Figure 17: Russian gas exports to Europe in relation to TTF index (2018-2022)	28
Figure 18: Temperature effects on natural gas consumption in Bulgaria	31
Figure 19: Monthly natural gas consumption in Bulgaria (2018-2022)	32
Figure 20: Monthly price evaluation of energy commodities and inflation in Bulgaria	33

LIST OF TABLES

Table 1: Natural gas supply routes to Southeast Europe	8
Table 2: Correlation strength between market factors and natural gas prices and consumption in Bulgaria	30

ABBREVIATIONS

ACTI	Average cost of transportation index
bcm	Billion cubic meters of natural gas
BCMY	Billion cubic meters per year
BGH	Balkan Gas Hub
BGN	Bulgarian Lev (national currency)
CO₂	Carbon dioxide
DSO	Distribution system operator
EC	European Commission
EJ	Exajoule
ENTSOG	European Network of Transmission System Operators for Gas
EU	European Union
EUR	Euro
EWRC	Energy and Water Regulatory Commission
FEBA	Faculty of Economics and Business Administration
GRP	Gas Release Program
HICP	Harmonised index of consumer prices
ICGB	Gas Interconnector Greece–Bulgaria
JKM	Japan Korea Marker
km	Kilometer(s)
LNG	Liquefied natural gas
mcm	Million cubic meter(s)
MWh	Megawatt hours
SEE	Southeast Europe
TANAP	Trans-Anatolian Natural Gas Pipeline
TAP	Trans Adriatic Pipeline
TTF	Title Transfer Facility (Virtual Trading Point for natural gas in the Netherlands)
TWh	Terawatt hours
UGS	Underground gas storage
USD	US Dollar (national currency)
VTP	Virtual trading point

1 INTRODUCTION

As the COVID-19 pandemic receded, the global economy experienced a rebound, leading to an increase in energy demand during the autumn of 2021. However, this surge in demand coincided with a tight liquified natural gas (LNG) market and higher costs of CO₂ allowances, setting the stage for a challenging energy landscape in Europe. The continent entered the winter of 2021/22 with relatively low gas storage volumes and supply shortages, further driving up energy prices. The situation was exacerbated by the Russian invasion of Ukraine, which disrupted natural gas imports to Europe, resulting in gas prices surging up to tenfold compared to the previous year. In 2022, the Dutch Title Transfer Facility (TTF) Index reached record peaks, escalating from EUR 12/MWh in January 2020 to EUR 350/MWh at the end of 2022¹.

The impact of these events extended beyond the European natural gas sector. As natural gas constitutes 20% of the EU's electricity mix and has been the only fossil fuel experiencing growth over the past two decades² electricity prices were also strongly influenced. In the absence of natural gas availability, coal-based power generation witnessed a temporary upward trend. This shift increased the demand for CO₂ quotas, pushing CO₂ prices higher due to the higher emissions associated with coal power plants compared to natural gas power plants.

Moreover, challenges arose from emerging nuclear-power unavailability, droughts, and limited hydro power generation, amplifying the effects of the tightened gas market. These events revealed the high level of Europe's exposure to natural gas prices, given that natural gas represents around 40% of the EU's total final energy consumption as of the beginning of 2022³. Consequently, the price of gas, whether consumed directly for residential or industrial purposes or indirectly for electricity production, accounted for approximately 60% of the energy bill paid by residential

¹ TTF Front month statistics.

² [Ember \(2023\): Global Electricity Review 2023.](#)

³ [European Energy Agency \(2022\): A 10-Point Plan to Reduce the European Union's Reliance on Russian Natural Gas.](#)

In 2022, Bulgarian industrial consumers paid four to ten times higher for gas supplies and six to ten times more for electricity.

and industrial customers in Europe⁴. The pay-as-clear system, where natural gas determines the price of electricity, exacerbated the energy crisis's burden on consumers.

Although to large extent being external to the Bulgarian economy, the country also faced similar consequences. As part of the European Energy Union, Bulgaria experienced the effects of the energy crisis unfolding in the common EU market. In 2022, Bulgarian industrial consumers paid four to ten times higher for gas supplies and six to ten times more

for electricity. The Bulgarian population experienced **inflation levels assessed at four to five times higher**, primarily driven by the surge in commodity prices. This energy crisis served as a wakeup call for Bulgaria to reduce its reliance on Russia as the sole supplier of natural gas and unlock transformation in its industrial sector.

The following paper sheds light on the fundamentals of the Bulgarian natural gas market and its national specifics. By analyzing **market and non-market factors that influenced natural gas price dynamics in recent years using statistical methods**, we seek to understand the underlying drivers of energy price fluctuations.

Looking ahead, the Bulgarian gas sector has experienced noteworthy developments, including the complete diversification of Russian supplies and the initiation of significant projects. Notably, the completion of the ICGB interconnector with Greece and the ongoing expansion of the gas storage facility in Chiren have marked a mini revolution in the sector. Additionally, the possibility of the gas link with Serbia becoming operational by the end of the year offers further potential for the country's energy landscape. However, despite these advancements, a closer examination reveals that some challenges persist. The progress in infrastructure projects can be attributed more to Brussels' efforts to diversify supplies after the onset of the war in Ukraine rather than internal initiatives by Bulgarian politicians. Nonetheless, the energy crises have prompted industrial companies in Bulgaria to

consider technology shifts and reduce their consumption of natural gas. While industrial production rose by 2% in the first quarter of 2023 compared to the same period in 2022, there was a significant decrease in natural gas demand of more than 30% as a consequence of the price shocks⁵.

In the following sections, we will delve into the complexities and developments in the Bulgarian natural gas sector, **analyzing key market trends and outlining future expectations for the country's energy landscape.**

Nonetheless, the energy crises have prompted industrial companies in Bulgaria to consider technology shifts and reduce their consumption of natural gas.

⁴ [Deloitte \(2022\): Facing the electricity crisis in Europe. Is it time for emergency intervention or a full revamp?](#)

⁵ [OECD Data \(2023\): Industrial production](#) and [Eurostat \(2023\): Supply, transformation and consumption of gas](#)

2 FUNDAMENTALS OF BULGARIAN NATURAL GAS MARKET

2.1 Bulgaria playing an increasingly strategic role in the regional gas market

Bulgaria has historically faced challenges in domestic natural gas production due to the absence of proven reserves sufficient for large-scale gas production. As a result, the country has heavily relied on gas imports to meet its energy needs. The **gas markets in Southeast Europe (SEE) are not well integrated**, leading to deliveries from sources further up the supply chain, over which SEE businesses have limited influence. The most easily accessible natural gas fields to the region through pipelines are primarily located in Russia (Volga-Urals and Western Siberia), the Caspian Sea region, and the Eastern Mediterranean. However, political barriers currently restrict access to resources in Iraq and Iran. While Turkmenistan has the potential to supply gas to Europe through pipelines connected to Russia and Iran, the current

limitations include the ban on transit of non-Russian gas in Russia and sanctions against Iran. Greece possesses an LNG regasification terminal, offering the opportunity for regasified LNG to reach Bulgaria through possible reverse flows or gas swaps. Nevertheless, these opportunities are not available to other countries in the region, making Bulgaria increasingly pivotal as an entry point for both regasified LNG from Greece and pipeline supply from Russia. As a strategic gate-

...making Bulgaria increasingly pivotal as an entry point for both regasified LNG from Greece and pipeline supply from Russia

Table 1: Natural gas supply routes to Southeast Europe

	Local production	By pipeline	Liquefied natural gas	Consumption, EJ (2021)
BULGARIA	Marginal	Main delivery method	Marginal	0.12
CROATIA	Main delivery method (up to 1w/3 of the demand)	Main delivery method	Main delivery method	0.10
GREECE	Marginal	Main delivery method	Main delivery method	0.25
NORTH MACEDONIA	Not available	Only one delivery method	Not available	0.01
ROMANIA	Main delivery method (up to 3/4 of the demand)	Important delivery method	Not available	0.41

way for gas imports, Bulgaria assumes a critical role in ensuring energy security and diversification within the region. The country's position as a key entry point for both LNG and pipeline gas highlights its importance in mitigating supply uncertainties and fostering energy stability in SEE.

Taking into account the magnitude of the gas import market in the SEE region and the absence of robust intersystem connections, the countries within this area face substantial challenges when striving to access the supply market. This lack of interconnectedness leaves **SEE nations with limited bargaining power during negotiations with potential suppliers**. Consequently, they are confronted with the dual hurdles of market size and pipeline capacity constraints, thereby necessitating strategic considerations to effectively navigate these intricacies.

The Bulgarian natural gas market underwent a significant transformation in the past year, breaking away from a decades-long national business model heavily re-

INFOBOX

Natural Gas Market

Infrastructure Size Fundamentals

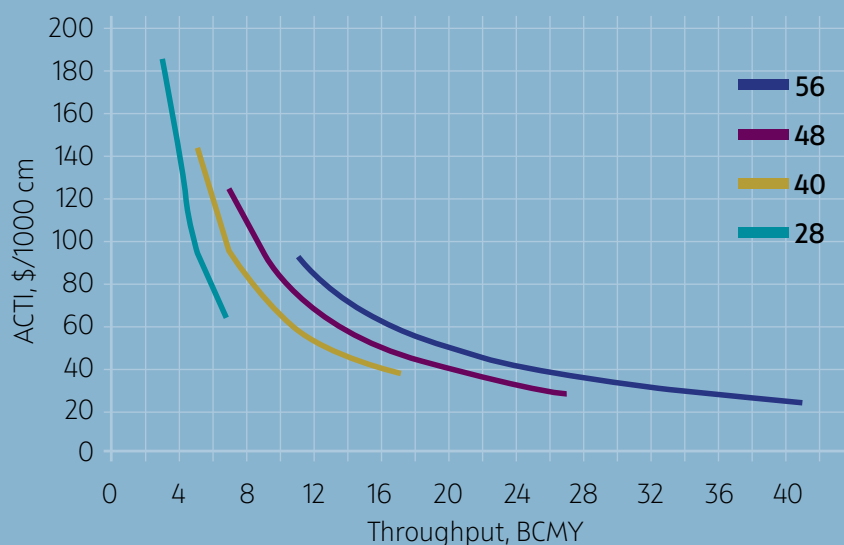


Figure 1: Gas pipeline scale effects on average cost of transportation.

Source: Nitzov, B. in Hetland, J. and Teimuraz, G. (2004)*

Figure 1 illustrates the fundamental relationships between market size and the feasibility of supplying that market through pipelines of varying capacities. The scenario depicted considers pipelines of 28, 40, 48, and 56 inches, all operating at high pressures (100/140 bar), with a gas delivery distance of 3 000 km. Upon assessing the distance to potential supply fields, it becomes apparent that a relatively modest pipeline with limited capacity (28-32 inches) would be adequate to fulfill the import demands of the

SEE region. However, this efficiency would come at the cost of higher transportation expenses per unit, approximately 2-3 times more than pipelines with larger diameters and capacities. Nonetheless, the feasibility of the latter option is constrained, as pipelines with greater diameter and capacity would struggle to maintain high load factors. Although investment would be directed towards constructing these pipelines, their utilization would be suboptimal, resulting in a diminished return on investment*.

* Hetland, J., & Gochitashvili, T. (Eds.). (2004). Security of natural gas supply through transit countries (Vol. 149). Springer Science & Business Media.

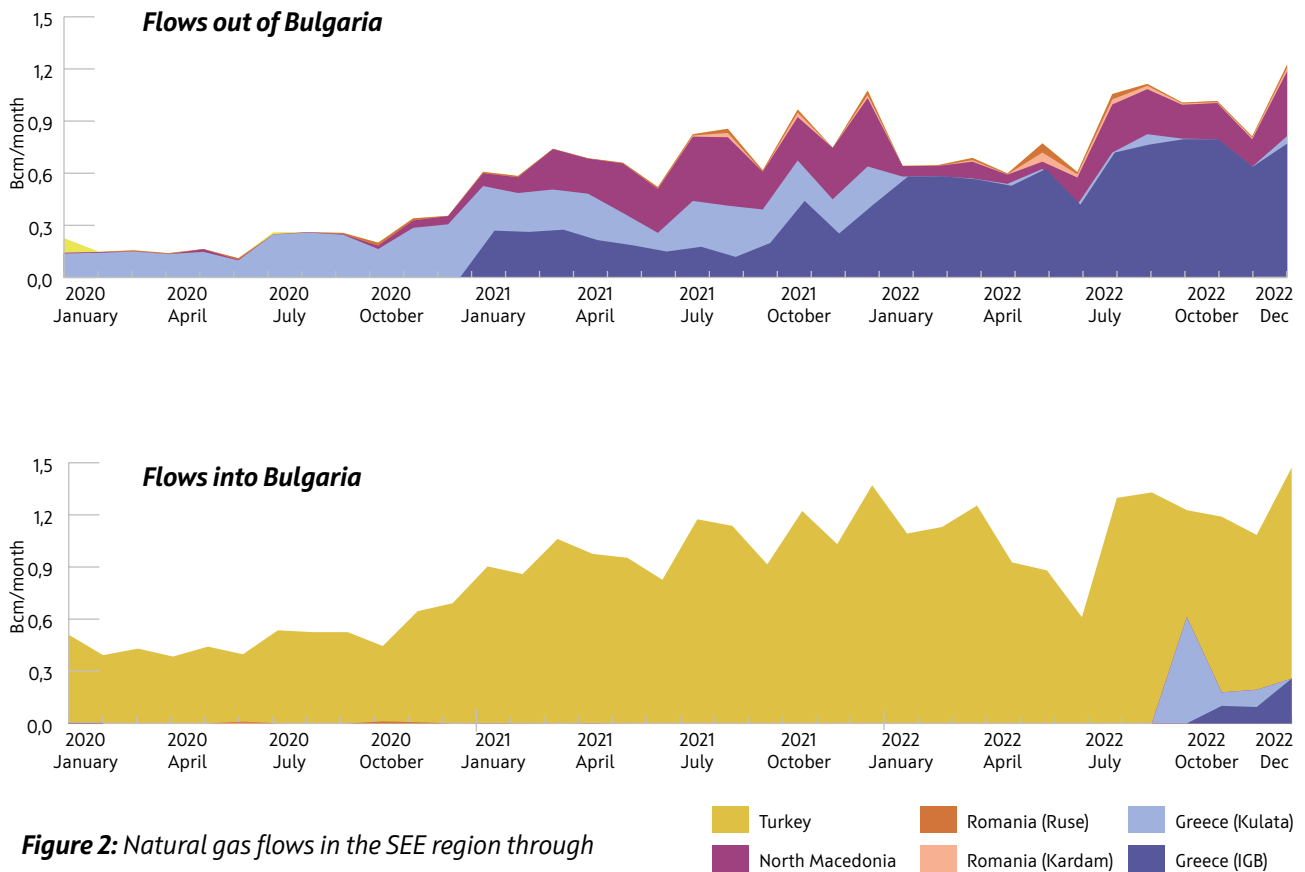


Figure 2: Natural gas flows in the SEE region through Bulgaria; Source: Baringa

liant on Russia, characterized by a singular route and a dominant supply source. For an extended period, Gazprom and its subsidiaries held the role of the sole supplier and primary consumer of transit capacity, governed by long-term contracts encompassing both transit capacity and the delivered product. The regulatory framework is overseen by the Ministry of Energy, with natural gas pricing structured around a formula that utilizes reference prices for refined oil products. These contracts also feature “take or pay” stipulations.

The initiation of the TurkStream pipeline in 2020 propelled Bulgaria into an increasingly pivotal position within the SEE region...

The initiation of the TurkStream pipeline in 2020 propelled Bulgaria into an increasingly pivotal position within the SEE region, emerging as a critical entry point for Russian gas into SEE, particularly for flows directed via the TurkStream pipeline to Serbia and Hungary. Following Russia’s incursion into Ukraine, the countries in the region adopted three alternative strategies to mitigate short- and medium-term gas shortages. These strategies encompass the utilization

of gas pipelines not physically connected to Russia, augmenting additional LNG import capacities, and expanding domestic gas production facilities. The latter option holds particular relevance for Romania, which boasts substantial gas reserves. Furthermore, the completion of the Interconnector Greece-Bulgaria Pipeline (IGCB) in 2022 facilitated the connection of Greece’s and Bulgaria’s gas networks, enabling the entire SEE region to diversify its gas procurement. The initial capacity of this pipeline is estimated at approximately 29 TWh per year, with potential expansion to up to 49 TWh per year. This expanding regional interconnection, with Bulgaria serving as an LNG entry point, enables countries in the area to reduce their dependency on Russian gas.

2.2

Infrastructure

Central to understanding Bulgaria's natural gas market is a thorough **examination of its local and regional infrastructure**, where the availability of natural gas hinges on supply routes and the intricate pipeline network. Historically, Bulgaria's natural gas infrastructure fostered a situation of excessive dependence, creating a relationship wherein **the country relied heavily on a single supply source through a sole route (monopoly)**.

This positioning resulted in a weak negotiating stance with the solitary supplier, who also acted as the sole client for pipeline transit capacity (monopsony).

This positioning resulted in a weak negotiating stance with the solitary supplier, who also acted as the sole client for pipeline transit capacity (monopsony). Compounded by the inability to use gas transmission pipelines in reverse (before 2019) and the frequent lack of access to

pipeline capacity by the countries they traversed, the risk of supply disruptions and the inability to manage emergencies due to substantial interruptions in the supply became evident. In Bulgaria's case, **the risk of supply disruptions translates into an diminished return on investment⁶**.

Since 2019 with the establishment of reverse flow and increased capacity at the interconnection point between Bulgaria and Greece, Bulgaria has diversified its sources, importing natural gas from Greece. The imported gas includes Russian gas or LNG delivered through the Revithoussa LNG terminal. Additionally, the supply of Azeri natural gas from Shah Deniz 2 field through TANAP and TAP, entering the same interconnection point with Greece, began in 2021. **In early 2022, with infrastructure improvements in place, Bulgaria secured supplies from a range of origins**, encompassing Gazprom Export OOO, an Azerbaijani company, LNG shipments from the United States via Greece and Türkiye, and natural gas acquisitions from regional traders at the Virtual Trading Point.

The Bulgarian natural gas infrastructure encompasses a transmission and distribution network, along with an underground gas storage (UGS) facility, as illustrated by Figure 3. The transmission network is comprised of two parts: the transit gas pipeline system and the national gas transmission network. The former ensures the transit of natural gas to neighboring countries such as Turkey, Romania, Greece, Serbia, and North Macedonia. The Trans-Balkan gas pipeline, initiated during the Soviet era, reached an entrance capacity of about 25 billion cubic meters (bcm) per year in Bulgaria by 1988 through two lines. Its route originates in Russia, traversing Ukraine, Moldova, and Romania, and branching off within Bulgaria towards Turkey, Greece, and North Macedonia. The national gas transmission network conveys natural gas to consumers within Bulgaria. These two networks are interconnected and are collectively regarded as the national transmission network. The operation of the transmission network is overseen by the incumbent entity, Bulgartransgaz. The overall extent of the gas transmission networks managed by Bulgartransgaz,

⁶ Nitzov, B. (2013): [Risk-based assessment of energy security: A case from Europe, calculation based on Gambler's Ruin Analysis](#)



Figure 3: Bulgarian natural gas infrastructure

The transmission network is comprised of two parts: the transit gas pipeline system and the national gas transmission network.

as of the conclusion of 2021, spans 3 276 km and includes pipeline branches, alongside eleven compressor stations. The transmission network directly links large industries and district heating plants, the primary consumers of natural gas within the country. On a regional scale, Bulgaria plays a significant role as a transit country, ensuring gas imports to its neighboring nations.

The **distribution network** is primarily developed, owned, and operated by Distribution System Operators (DSOs). Many of these DSOs are the exclusive suppliers to consumers linked to their respective networks. Currently, there are 24 active DSOs in the country. The Bulgarian distribution networks, spanning 5 461 km as of 2021, have exhibited steady growth in recent years. Constructed over the last two decades, these networks are relatively new. However, as they are still undergoing development, they frequently operate below their design capacity.

A crucial facet of the gas infrastructure is the **Chiren Underground Gas Storage (UGS)**, situated in the northwestern part of the country. This facility, with a capacity of 0.5 bcm, serves as Bulgaria's sole UGS. It plays a pivotal role in accommodating the seasonal fluctuations in natural gas consumption within the nation. Fur-

thermore, the gas storage facility aids in balancing gas supply and maintaining the stability of the gas transmission system. Presently, the Chiren UGS primarily functions as a locally significant gas storage facility, addressing the country's requirements during consumption shifts and ensuring supply security. The current storage capacity can fulfill around 25-30% of the daily demands during the colder winter months.

The Turkish Stream Gas Pipeline



Figure 4: Natural gas pipelines in the SEE region; Source: DW.com

In 2020, the construction of the "Turkish Stream" gas pipeline was completed through the Black Sea from Russia to Türkiye, and the use of the Trans-Balkan gas pipeline was discontinued for deliveries to the neighboring country. On January 1, 2021, the "Balkan Stream" gas pipeline between Türkiye and Serbia was put into operation in Bulgaria, at great expense. Balkan Stream partially uses the assets of the Trans-Balkan gas pipeline (those between the border and Provadia) in a reverse mode.

In Bulgaria, the fees owed by Gazprom for the use of transit capacity along the Trans-Balkan route were canceled. It is quite obvious that the commissioning of the Balkan Stream did very little to change the way business was conducted in Bulgaria, and that the main consequences affected Ukraine (which was cut off from Russia's gas transit business to Southeast Europe) and Türkiye (which gained a direct connection with Russia). In both cases, the main beneficiaries of the "change" were Gazprom and the Russian government, who could use greater influence against Ukraine.

2.3

Demand structure

Bulgaria's annual domestic consumption within the natural gas market typically ranges between 3.0 to 3.5 bcm. In contrast, foreign gas transits encompass a broader range of 17.8 to 7.8 bcm annually. This indicates that **the country has allocated a significant investment, over EUR 1.5 billion for the last 5 years⁷, in assets, that surpass multiple times the requirements for its own domestic demand.**

The **primary beneficiaries of natural gas utilization within Bulgaria are the district heating plants and the industrial sector.** Its role in power generation is relatively minor, and its presence in residential and commercial sectors remains limited. Notably, Bulgaria relies heavily on natural gas imports due to the absence of significant natural gas reserves that have been explored and exploited within its territory. While indications of natural gas fields exist in North Bulgaria and the offshore zone of the Black Sea, no substantial commercialization has occurred.

The dominant supplier within both the regulated and liberalized markets is the incumbent entity, Bulgargaz EAD

The structure of the natural gas market in Bulgaria displays **partial liberalization**. This delineates two coexisting market segments: the regulated market and the free (liberalized) market. The Energy and Water Regulatory Commission (EWRC), also known as the Regulator, is responsible for determining administrative prices at the regulated market segment. These regulated prices are applied to customers of DSOs and district heating plants. Concurrently, all market participants can engage in transactions at negotiable prices, forming the liberalized gas market in Bulgaria. According to the Bulgarian Energy Act, transactions within the liberalized market for products with a delivery period of up to one year must be exclusively conducted on a natural gas exchange. It is pertinent to note that the dominant supplier within both the regulated and liberalized markets is the incumbent entity, Bulgargaz EAD.

participants can engage in transactions at negotiable prices, forming the liberalized gas market in Bulgaria. According to the Bulgarian Energy Act, transactions within the liberalized market for products with a delivery period of up to one year must be exclusively conducted on a natural gas exchange. It is pertinent to note that the dominant supplier within both the regulated and liberalized markets is the incumbent entity, Bulgargaz EAD.

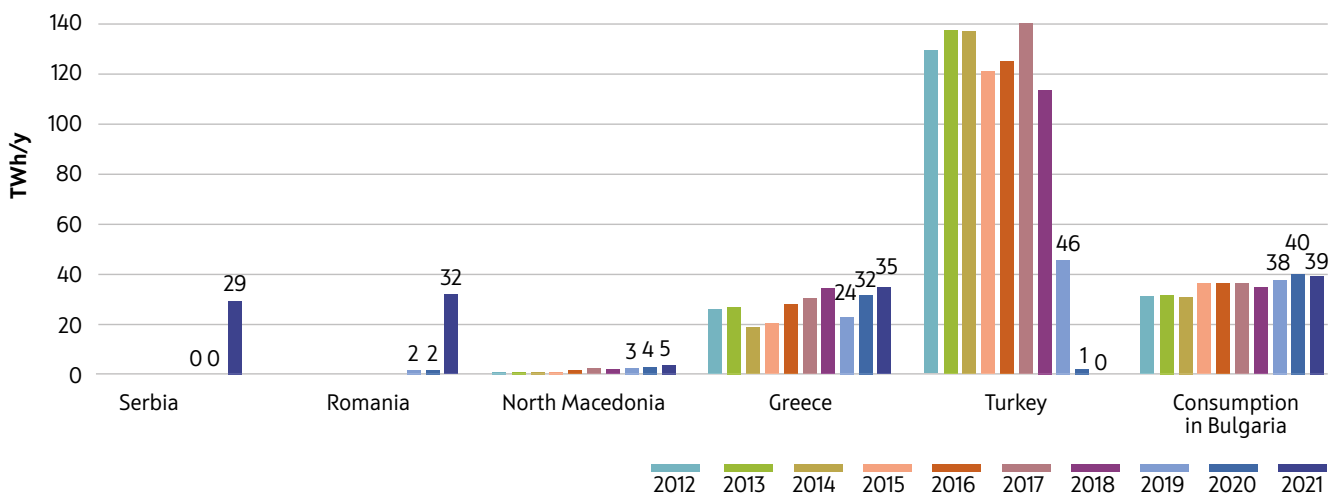


Figure 5: Cross-border transmission and consumption of natural gas in Bulgaria

⁷ Estimate of the chairman of Bulgarian association natural gas

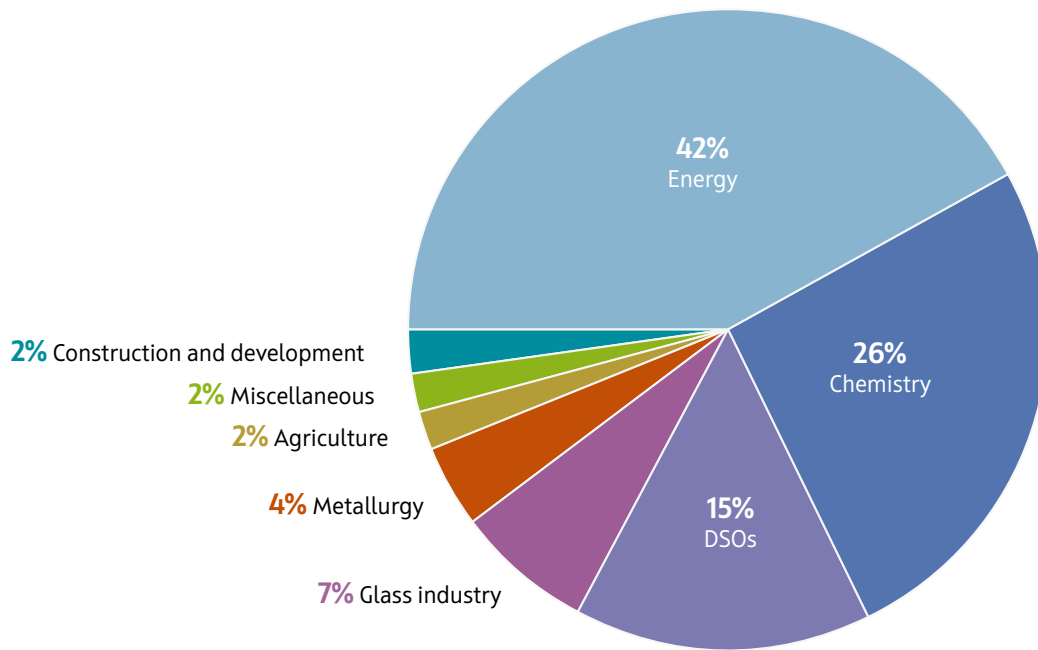


Figure 6:
Consumption of natural gas by sector in Bulgaria*

Following the war in Ukraine and the energy crises impact, there has been a notable shift in Bulgaria's government approach towards natural gas utilization and capacity expansion. Despite the restoration of prices to pre-crisis levels, policy-makers have exhibited a hesitancy to embark on new natural gas capacity projects in the power sector. These changes are rooted in discussions taking place within the national Energy Transition Commissions, as well as the emergence of viable technological alternatives. The prospect of replacing natural gas with hydrogen, e-fuels and alternative biofuels in industrial processes, coupled with efforts to transition away from its use in the Lukoil oil refinery and district heating systems,

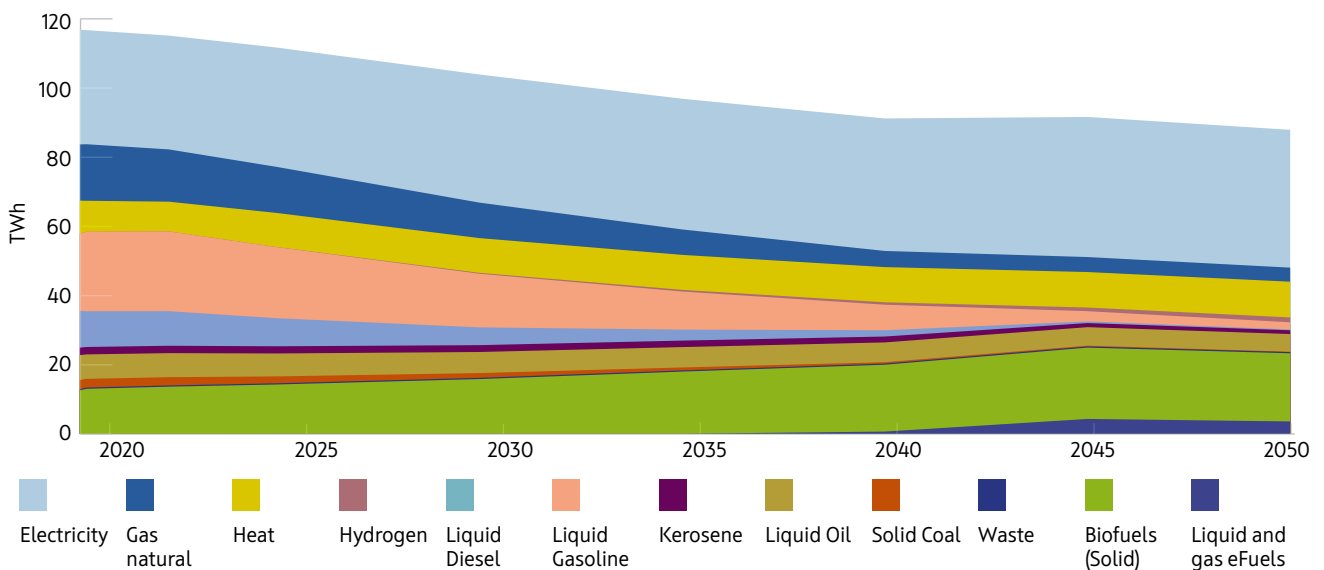


Figure 7: Projected final energy demand in the Bulgarian economy based on current plans of the policy-makers and discussions in the Energy Transition Commission.

* The consumption of natural gas by sector is based on the sales of Bulgargaz in 2021, which had market

Estimates suggest a reduction of approximately 35% by 2030 and a substantial drop of around 74% by 2050

holds significant potential for transforming Bulgaria's current energy demand structure. Forecasts stemming from these discussions and prospects of the deployment of technological advancements indicate that significant decline in natural gas consumption is possible by the mid-century. Estimates suggest a reduction of approximately 35% by 2030 and a substantial drop of around 74% by 2050, relative to current consumption levels, as depicted by Figure 7. Currently, the use of natural gas accounts for about 14% of the

primary energy consumption in Bulgaria and according to the discussed scenarios it will drop off to 5 % until 2050. This anticipated trajectory underscores Bulgaria's commitment to diversifying its energy sources and embracing more sustainable options in the face of evolving geopolitical and environmental dynamics.

2.4 Supply structure

The Bulgarian natural gas supply structure, visualized on the figure below, is predominantly shaped by Bulgargaz EAD, a public provider responsible for distributing gas to end suppliers and customers connected to the gas transmission network. This entity holds a multifaceted role as a primary supplier on the liberalized market, liquidity provider, natural gas trader, and market maker on natural gas exchanges. Complementing this, Bulgartransgaz EAD operates as a combined operator, overseeing gas transmission, storage, and balancing. It takes charge of both the national gas transmission network and the gas transmission network for transit transmission.

In addition, two extractive companies within Bulgaria engage in sales to end customers, gas distribution firms, and traders. Notably, these extractive companies have yet to participate in selling natural gas quantities on organized natural gas exchange markets. The role of the gas traders in Bulgaria encompasses concluding gas supply transactions with a diverse array of entities, including Bulgargaz EAD, end suppliers, end consumers, other gas traders, production companies, gas storage facilities, and gas transmission and distribution network operators. Furthermore, gas distribution companies undertake the responsibility of natural gas distribution and supply, catering to end suppliers and delivering natural gas to customers linked to the distribution networks within their respective licensed territories. This delineates the composition of the natural gas market in Bulgaria, encompassing non-household and household consumers connected to the gas transmission and distribution networks.

The primary share of natural gas that caters to Bulgaria's demand is sourced from imports, while a minute fraction is derived from local extraction, accounting for less than 1% of the overall consumption. Gazprom has maintained an exclusive role as the solitary supplier of natural gas to Bulgaria since 1976. Prior to 2019, a stag-

The primary share of natural gas that caters to Bulgaria's demand is sourced from imports

gering 99% of the natural gas imports were reliant on a single entity—Gazprom export OOO (see Figure 9). This rendered **Bulgaria predominantly dependent on Russian gas, subject to a long-term supply contract through a singular supply route via Ukraine, consequently distancing itself from the European**

spot markets. Consequently, the gas crisis of 2009, marked by the curtailment of Russian supplies to Ukraine and beyond, profoundly impacted Bulgaria, leaving it among the hardest-hit EU Member States. This event prompted the nation to prioritize the security of gas supplies, necessitating diversification of supply sources and endorsing local exploration and production activities. Despite these aims, diversification projects experienced notable delays, necessitating a decade to establish supply from alternative routes and suppliers.

Since 2019, following the enhancement of reverse flow capabilities and increased capacity at the interconnection point (IP Kulata - Sidirokastro) between Bulgaria and Greece, Bulgaria initiated the import of natural gas from Greece. The source of this gas could either be Russian or LNG, delivered via the Revithoussa LNG terminal in Greece. Additionally, in 2021, the introduction of Azeri natural gas from the Shah Deniz 2 field through TANAP and TAP commenced, entering the same interconnection point with Greece. Nonetheless, deliveries of Azeri gas remained below the agreed volumes of 1 bcm due to the incomplete Interconnector Greece-Bulgaria (ICGB), which was stipulated as a contractual supply point. As a result, the period between January 2021 and October 2022 witnessed Azerbaijan's gas supply chan-

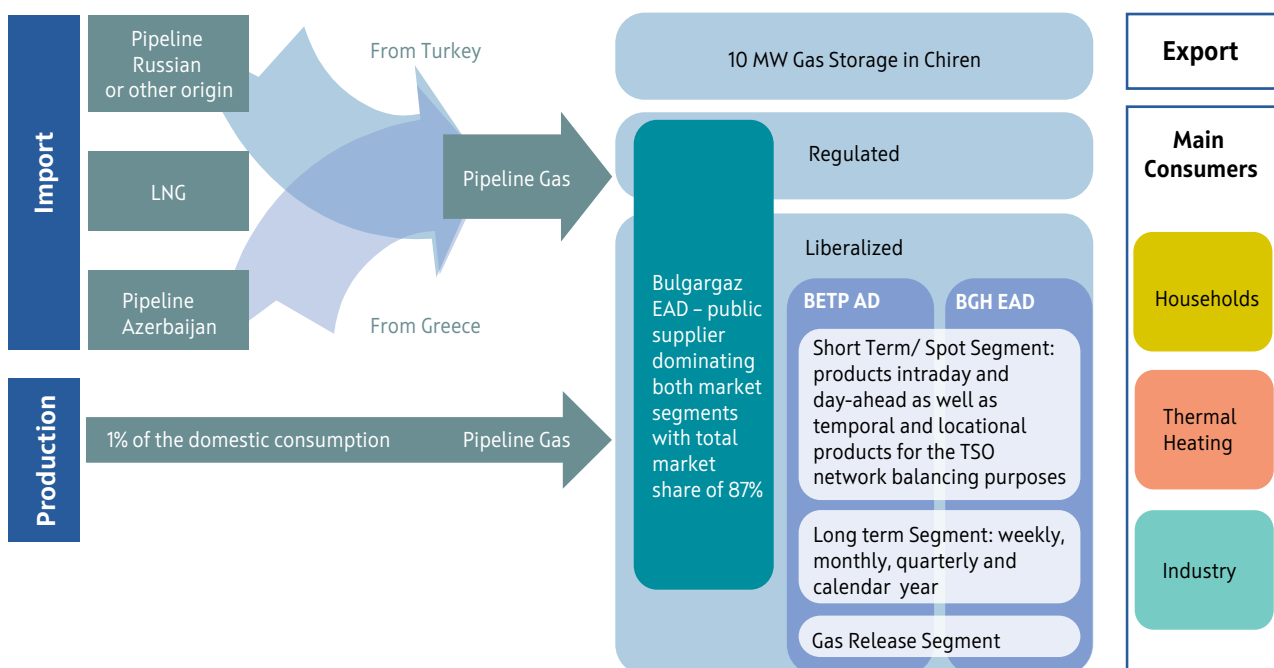


Figure 8: Natural gas supply structure in Bulgaria in 2022. **Source:** FEBA

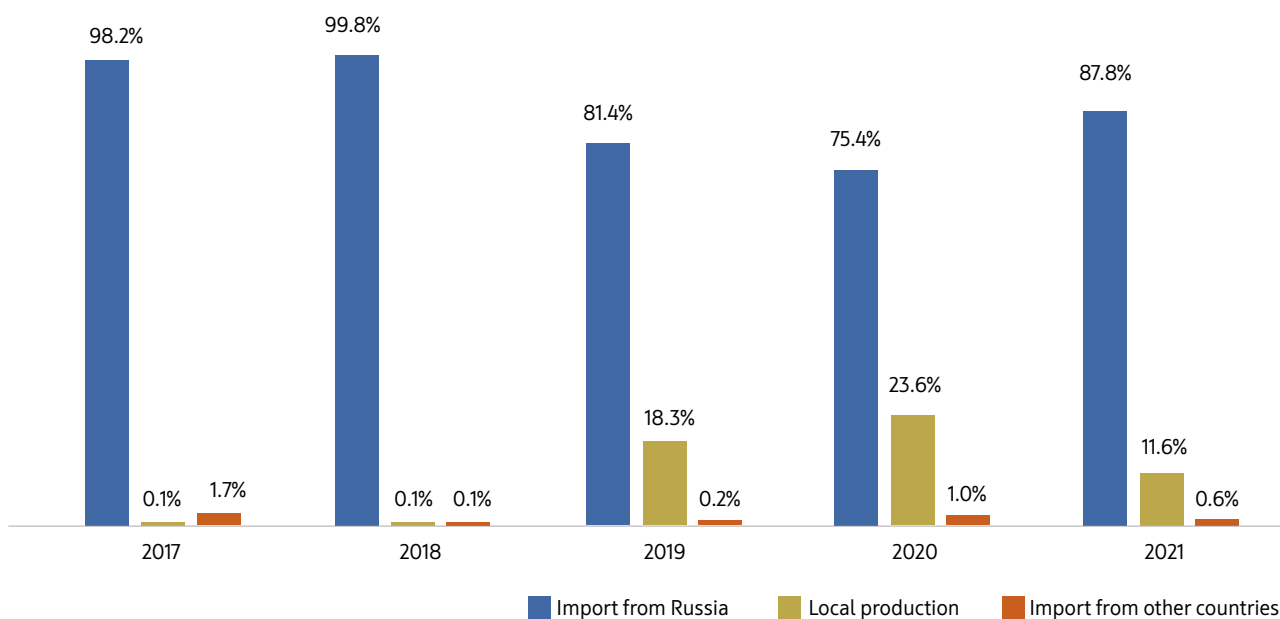


Figure 9: Natural gas supplies by sources (2017-2021)

neled through the temporary point of delivery at Kulata – Sidirokastro, albeit not in full volume. In 2022, Bulgargaz’s natural gas procurement for the domestic market encompassed contracts with Gazprom Export OOO, an Azerbaijani company, LNG deliveries from the United States via Greece and Türkiye, and natural gas at the Virtual Trading Point (VTP) sourced from regional traders.

Despite advancements in regulatory and market reform, Bulgaria continues to lag behind in terms of efficient market liberalization. The gas market remains substantially concentrated, with limited wholesale competition. The incumbent state-owned entity Bulgargaz EAD preserves its dominant position, commanding a considerable 93% share of the domestic natural gas market under both regulated and freely negotiated (liberalized) prices as of 2022. This company plays a pivotal role as the primary natural gas supplier in Bulgaria, thereby exerting significant market influence. Bulgargaz’s regulated and freely negotiated prices function as the prevailing benchmarks within the nation, with traders typically relying on TTF price quotes from the Netherlands as a regional standard for LNG pricing.

The entry of potential competitors into the market is hampered by unfavorable conditions, perpetuating a lack of substantial competition. In response to pressures from regulatory authorities and in the wake of fines totaling EUR 77 million levied on Bulgargaz and Bulgartransgaz, Bulgaria introduced the **Gas Release Programme (GRP)** in 2019. Its main objective was to augment market liquidity by mandating Bulgargaz to make significant quantities of gas accessible to third parties through auctions on the national trading platform.

In 2021, Bulgargaz has sold natural gas to four main segments – regulated market, liberalized market, under gas release programme and for balancing. The largest quantities were for the liberalized market, followed by the regulated market.

Key Natural Gas Market Players in Bulgaria

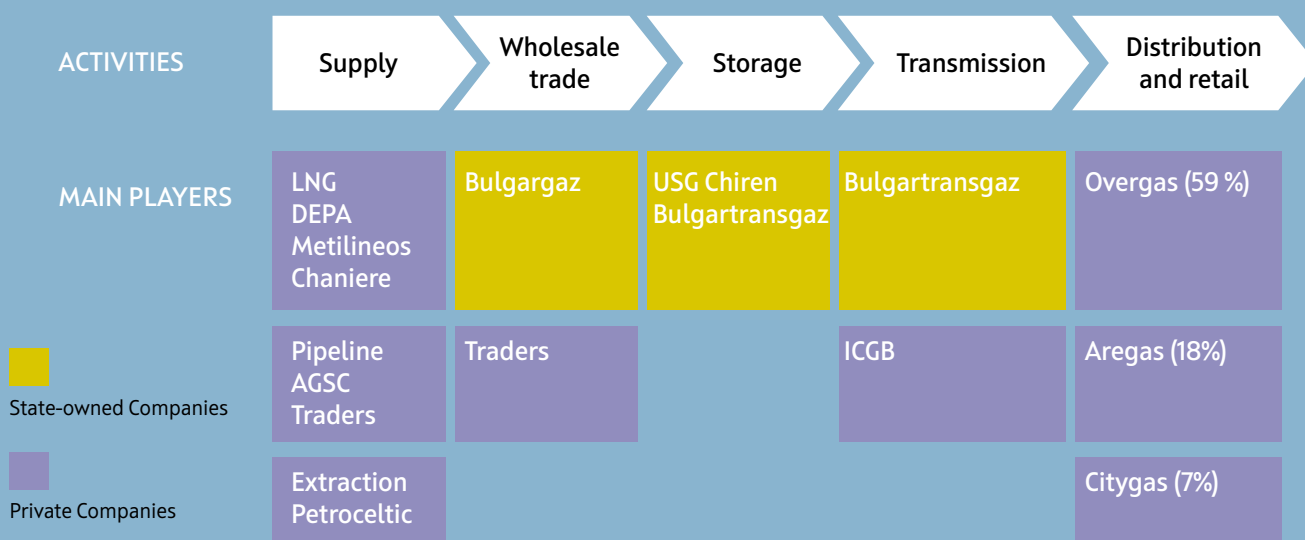


Figure 10: Key natural gas market players in 2022. Source: FEBA

- **Bulgargaz EAD** – public provider (supplier) in Bulgaria, providing gas supplies to end suppliers and customers connected to the gas transmission network at prices regulated by EWRC. Bulgargaz is also the main supplier on the liberalized market, a liquidity provider, natural gas trader and market maker on the natural gas exchanges;
- **Bulgartransgaz EAD** – combined operator, responsible for gas transmission, gas storage and balancing; Bulgartransgaz EAD is a combined gas operator, performing natural gas transmission and storage activities. The company is the owner and operator of the national gas transmission network (NGTN) and gas transmission network for transit transmission (GTTN).
- Two extractive companies on the territory of Bulgaria. **Oil and Gas Exploration and Production AD** and **Petroceltic Bulgaria EOOD** (sell to end customer, gas distribution companies and traders). The extractive companies did not offer or sell natural gas quantities on the organized natural gas exchange market
- **Gas traders** – concluding gas supply transactions with Bulgargaz EAD, end suppliers, end consumers, other gas traders, production companies, gas storage facilities and with gas transmission and distribution network operators, import and export natural gas;
- **Gas distribution companies** – performing activities “natural gas distribution” and “natural gas supply by end supplier” supplying natural gas to customers connected to the distribution networks in the respective licensed territories;
- Non-household and household **consumers** connected to the gas transmission and distribution networks.

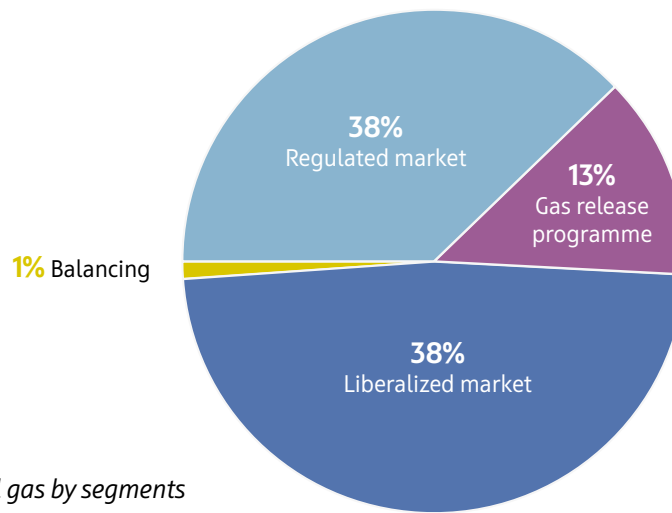


Figure 11: Bulgargaz sales of natural gas by segments

In 2022, a decrease is observed in the consumption on the regulated and liberalized market due to the soaring natural gas prices leading to a demand reduction and an increase in the quantities under the Gas Release Programme by 48% to 6 342 GWh.

Gas Release Programme

INFOBOX

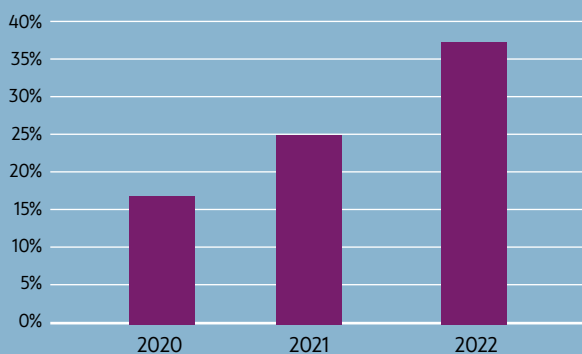


Figure 12: Share of gas release programme-related volumes in the total volume traded at the Balkan Gas Hub in a given year.

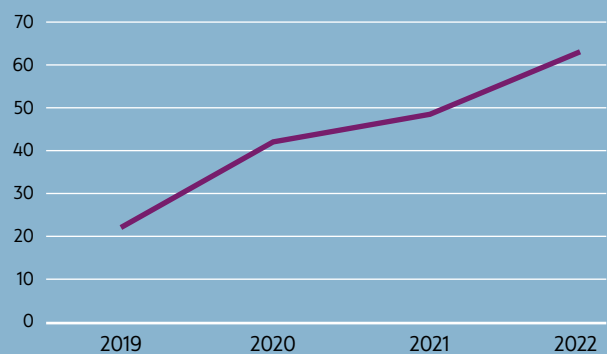


Figure 13: Number of companies trading at the Balkan Gas Hub; **Source:** Balkan Gas Hub data

Originally introduced in 2019 as a voluntary amendment to the national Energy Act, the programme sought to increase market liquidity and create a competitive environment through the release and sale of designated natural gas quantities on the organized exchange market. The GRP aimed to facilitate market development and liquidity by involving various market participants, including registered traders and large industrial consumers, in trading activities. Following the introduction of the GRP, the number of concluded transactions and traded quantities in the spot and forward market segments have been increasing on the Balkan Gas Hub, a Bulgarian gas exchange. There has been a growing number of market participants registered on the exchange and actively operating in

the Bulgarian gas market. However, in a recent development, the Bulgarian Parliament enacted legislation suspending the Gas Release Programme in December 2022. The abolishment of this program has raised concerns within the industry and the institutions on EU level. The former incumbent, Bulgargaz, stands to gain from this suspension, potentially placing other companies at a disadvantage, which could result in their withdrawal from the market due to an inability to secure gas at competitive prices. Consequently, prices for end-customers may rise over time as competitive offers lose their incentive. The move is likely to hinder market transparency and impair the determination of a "fair price" for natural gas in Bulgaria.

2.5

Price setting mechanism

In Europe, there has been a notable shift from oil-indexed pricing to “gas-on-gas” competition, where prices reflect multiple sellers and buyers of natural gas on spot markets, driven by increased competition between different gas sources. This transition has been marked by a focus on supply and demand dynamics, leading to prices being actively traded on gas hubs. The market-based pricing allows market participants in the EU to take advantage of periods of lower-cost supply. However, the situation in Bulgaria is distinctive. The country’s pricing is significantly influenced by long-term supply contracts, indexed to European and American natural gas hubs, petroleum products or and derivatives, in contrast to the market-driven pricing prevalent in the broader European context. On one hand, such as pricing mechanism might provide stability and predictability for consumers, ensuring that prices are not solely subject to market volatility. On the other hand, market-based pricing allows for more immediate reflection of supply and demand dynamics, potentially resulting in more efficient price signals and encouraging competition among suppliers. This could lead to lower prices for consumers when market conditions are favorable.

The pricing mechanism employed by Bulgargaz remains consistent across various market segments including the regulated market, liberalized market, and GRP. Notably, the average price difference between the liberalized and regulated markets has been relatively small, with a margin of 0.12 EUR/MWh observed between January 2021 and October 2022, favoring the regulated market as the more affordable option. This minor variance, which was most prominent in 2022, reflects Bulgargaz’s pricing of natural gas within the range of 56 to 181 EUR/MWh.⁸ Worth

mentioning is that the pricing of natural gas under GRP is updated monthly and largely based on the regulated price, introducing a dynamic aspect to the transactions within this program.

The current price model in Bulgaria is significantly influenced by the long-term natural gas supply contracts concluded by Bulgargaz. To gain insight into recent pricing trends, it is essential to examine

The current price model in Bulgaria is significantly influenced by the long-term natural gas supply contracts concluded by Bulgargaz.

how these contracts have evolved over time. There are three distinct pricing periods: January 2013 - March 2020, March 2020 - April 2022, and April 2022 - present. Each period is characterized by specific features in the pricing mechanism, resulting from the import contracts negotiated by Bulgargaz. Notably, earlier periods have not been extensively reviewed due to a lack of comprehensive pricing information on Russian gas. Nevertheless, it is worth noting that until 1997 Gazprom supplied gas at a relatively low fixed price, as an in-kind payment for construction works performed in the Soviet Union days. Ten years prior to its term Gazprom forced the termination of this agreement. After 1997, experts believe **Gazprom has**

⁸ Prices at which Bulgargaz sells on the free market and under regulated conditions to end suppliers and district heating operators. Source: [Bulgargaz](#)

been charging excessive prices, based on an arcane formula, thrust upon Bulgaria on the strength of Gazprom's position as the only available supplier.⁹

The evolution of Bulgaria's gas pricing mechanisms can be categorized as follows:

1. Price formation based on petroleum and gasoil (2013 - 2020)

During this period, Bulgaria's natural gas imports were governed by a 10-year supply contract inked in 2012 between Bulgargaz EOOD and Gazprom Export OOO. This contract correlated wholesale import prices with heavy fuel oil, gasoil, and the USD/BGN exchange rate. The "take-or-pay" stipulation¹⁰ was a key aspect of this accord, accompanied by a transit fee for gas transportation through Romania via the Trans-Balkan pipeline. Almost all consumers in Bulgaria were supplied under regulated prices reflecting the contracted provisions until 2019.

This era witnessed elevated natural gas prices for Bulgaria, driven by its dependency on Russian gas and limited supplier diversification. The sole dependence on Russian gas only single gas import route has led to conclusion by the European Commission (EC) that Bulgaria (together with several other Member States) might have been subject to an unfair pricing policy by charging prices to wholesalers that were significantly higher than competitive Western European gas hub and restricting the free flow of gas within the Internal EU market. As a result of the open legal case AT.39816, changes were made to the price setting mechanism and re-export or re-sale of Russian-originated gas was permitted. Additionally, Gazprom refrained from making claims for damages resulting from the termination of the South Stream project with its Bulgarian counterparts.

2. Price formation based on EU gas hubs price dynamics (2020 – Q1 2022)

Following the EC's intervention, a transformation took place in gas pricing dynamics. The Bulgarian side initiated renegotiations of the long-term contract with Gazprom, seeking alignment with pricing benchmarks established by continental hubs. Furthermore, border prices of major European countries like Germany, France, and Italy also transitioned to the new pricing models. Gazprom was obligated to reevaluate the gas price formula due to commitments made to the European Commission. These commitments stemmed from an antitrust investigation by the EC into Gazprom Export OOO's abuse of its dominant position in several Eastern European countries, including Bulgaria.

Despite these changes, Gazprom Export OOO continued to be the primary supplier of natural gas to Bulgaria throughout 2020 and 2021. A significant portion of the imported natural gas continued to be priced based on the TTF index, while the influence of factors such as heavy fuel oil, gasoil, and the exchange rate be-

⁹ [Bulgarian energy experts' joint comments on proposed settlement with PJSC Gazprom and Gazprom export LLC in case № at 39816](#)

¹⁰ The "take-or-pay" stipulation is a contractual provision between the buyer and the seller under which the buyer commits to purchasing a minimum predetermined amount of natural gas over a specified period, typically a year. If the buyer fails to take delivery of the agreed-upon volume, they are still required to pay for it as per the contract terms. Conversely, if the buyer takes more than the stipulated volume, they must pay for the excess gas beyond the minimum commitment. This arrangement is primarily designed to provide a level of revenue predictability and security for the gas supplier.

tween BGN and the USD decreased. About 80% of the contracted quantities, totaling 3 bcm/year, operated under a “take-or-pay” clause. The introduction of the newly constructed TurkStream pipeline at the interconnection point Strandzha 2/Malkoclar provided a fresh supply route. This development, along with the inclusion of Azerbaijani gas, led to a more diversified supply mix, exerting an impact on wholesale prices in Bulgaria. Notably, from 2021 to 2022, Bulgaria also started importing natural gas from Azerbaijan, which was priced against petroleum and the US dollar, making it more cost-effective compared to gas from Gazprom Export OOO. This factor contributed to a reduction in overall wholesale prices in Bulgaria in relation to the benchmark hub in the Netherlands.

3. Price formation based on diversified supply (Q1 2022 – Ongoing)

The most recent phase reflects a blend of different pricing mechanisms, with a strong influence from LNG quotations closely linked to TTF hub prices. Competition within the LNG market has enabled Bulgaria to secure discounts on cargoes priced against the TTF index, leading to a notable increase in LNG supply. Consequently, LNG has come to represent around two-thirds of Bulgaria’s wholesale demand by the end of 2022. Additionally, imports from Azerbaijan’s Shah Deniz 2

field and regional traders have further diversified the supply landscape.

Bulgaria’s journey through various pricing mechanisms also reflects the transition from overreliance on a single source and pricing formula to a more diverse and competitive market. All these processes have implications not only for the economy but also for the national energy security and sustainability.

Bulgaria’s journey through various pricing mechanisms also reflects the transition from overreliance on a single source and pricing formula to a more diverse and competitive market.

3 Ex-post Evaluation of Natural Gas Price Dynamics in Bulgaria

This chapter provides an ex-post evaluation of the natural gas price dynamics observed in Bulgaria over the past five years. It identifies both market and non-market factors and explains their impacts within each of the predefined price formation periods, as discussed in the preceding chapter. The trajectory under analysis has been marked by shifts in pricing mechanisms, regulatory reforms, market liberalization, and geopolitical events. The transition from oil-price indexing to EU gas hub-based pricing, coupled with the establishment of the Bulgarian Balkan Gas Hub exchange platform and further steps towards market liberalization, has significantly transformed the dynamics of the country’s gas market. Additionally, the Russian invasion of Ukraine and its ensuing repercussions added another layer of volatility, underscoring Bulgaria’s interdependence with the broader European gas

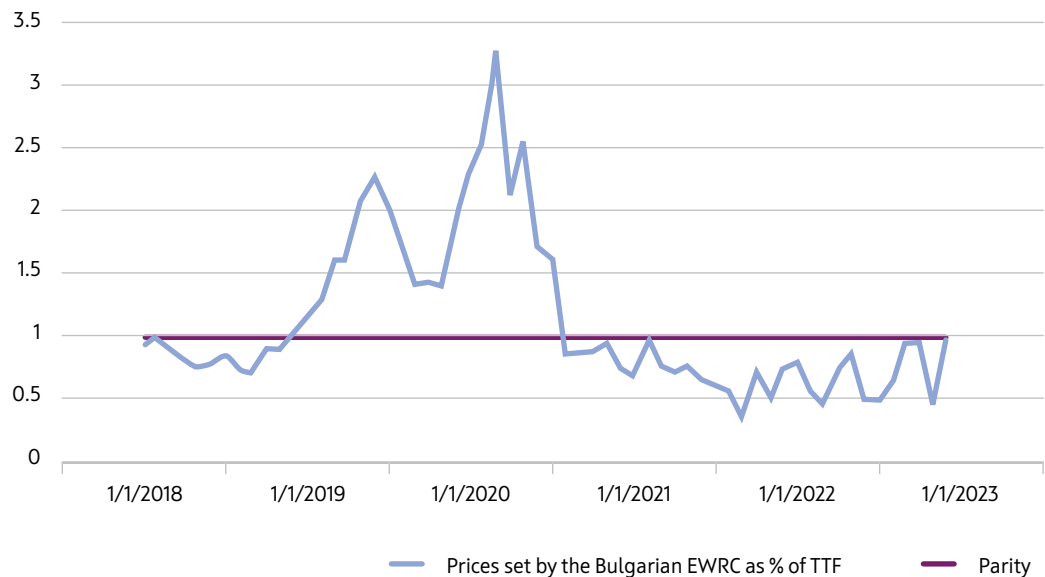


Figure 14: Deviation of the regulated natural gas prices in Bulgaria from the TTF Futures Index (2018-2022)
Source: FEBA based on TTF 1 Month Futures, EWRC Regulatory Decisions

markets. As Bulgaria continues to navigate these dynamic forces, a comprehensive understanding of the determinants of gas prices becomes pivotal for effective policy and strategic decision-making within the natural gas sector.

Prior to March 2020, the determination of administered prices, regulated by the national energy regulator, was tethered to oil-price indexing. Consequently, regulated prices frequently deviated significantly from the market prices on the TTF gas hub, as illustrated in Figure 14. While regulated prices in 2018 exhibited an annual average that was 13% lower than the TTF index, this trend reversed in the following years. In both 2019 and 2020, Bulgarian consumers faced average charges that were 67% and 70% higher respectively for each year, compared to competitive price benchmarks of liquid Western European gas hubs (for a more detailed depiction of the monthly values, refer to the price deviations presented in Figure 15). According to EC’s quarterly report on natural gas, in 2019 Bulgaria has become the country buying the most expensive gas in the EU.¹¹

A pivotal juncture emerged in March 2020 when the administered price became linked to prices on Western European gas hubs. This transition was the result of negotiated reductions in natural gas prices for Bulgaria following discussions between Bulgargaz EAD and Gazprom Export OOO, leading to greater alignment between the two indicators. Concurrently, the launch of the Balkan Gas Hub in 2019 and the inception of a liberalized natural gas market in early 2020 reshaped the landscape of Bulgaria’s gas industry. An effective change occurred from August 2020, when the monthly values began trending below TTF future values. Nevertheless, this shift proved inadequate to offset the initial discrepancy, resulting in an initial increase of over 100% above EU prices during the first five months of the year

¹¹ [European Commission \(2019\): Quarterly report on European gas markets](#). Q3 2019. Market Observatory for Energy DG Energy

and culminating in a 70% annual price escalation for 2020.

During the subsequent price formation periods (2021-2022), both regulated and wholesale gas prices in Bulgaria demonstrated a downward trend compared to the EU average. Notably, the annual average for 2021 exhibited a reduction of 32%, followed by a decrease of 30% in 2022. These trends mirrored adjustments in Bulgaria's market dynamics and its integration into the broader European context.

Furthermore, the Russian invasion of Ukraine and Gazprom's subsequent cessation of gas supply to EU countries, one of the first among them being Bulgaria, introduced a fresh layer of complexity to the pricing landscape. This sudden change resonated throughout Europe, exerting substantial influence on expectations and prices on the regional natural gas markets. Notably, Bulgaria's gas price dynamics closely mirrored those of the EU, albeit with a slight lag of a few days.

Figure 15 illustrates the unjust price advantage that Gazprom exploited in Bulgaria from 2018 to 2020, when prices within the country were at times twice as high as those in the TTF market. It also portrays the impact of the European Commission's decision, which led to contract renegotiations in 2020. Additionally, the figure highlights how limited progress has been made in terms of mitigating risks for Bulgarian entities trading gas prior to the 2022 shock. This is particularly evident concerning supply diversification and the implementation of contractual terms aligned with the realities of the global gas industry.

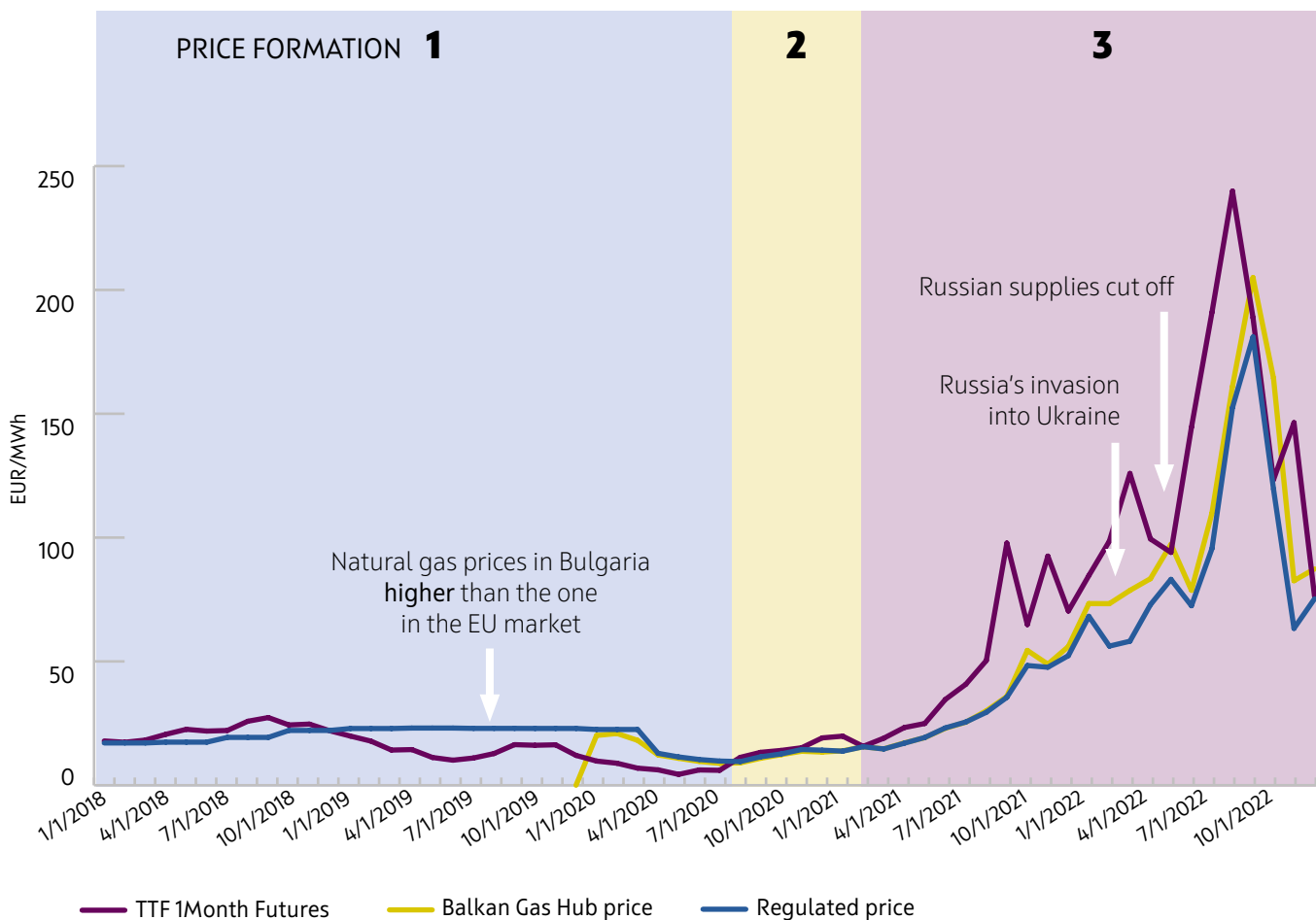


Figure 15: Natural gas price dynamics in Bulgaria in the three price formation periods (2018-2022)

Source: FEBA based on TTF 1 Month Futures, Balkan Gas Hub, EWRC Regulatory decisions

3.1 Methodology

The methodology employed in this data analysis involves a comprehensive compilation of data from diverse sources. To examine the natural gas price dynamics in Bulgaria, several datasets were collected. The administered natural gas prices within Bulgaria were obtained from the EWRC, which regularly publishes its monthly decisions regarding the approval of regulated natural gas prices. These prices reflect the rates at which the public supplier Bulgargaz EAD delivers gas to end suppliers and district heating operators. For the day-ahead prices of the Balkan Gas Hub, direct extraction was performed from the official website of the exchange platform.

External data sources were also utilized to provide additional insights. Data related to TTF 1-month futures, URALS crude oil spot prices, and LNG JKM (Japan Korea Marker) futures were acquired from the investing.com website. Historical records of the EUR/USD exchange rate were downloaded from Yahoo Finance. To provide a broader context, Eurostat supplied data regarding Bulgaria's inland natural gas consumption. Moreover, historical records of average above-ground temperatures were sourced from the US National Center for Environmental Information. Information on gas storage was extracted from the Gas Infrastructure Europe website, while details concerning gas volume pipeline transit were procured from the ENT-SOG transparency platform. This transit data encompassed the transport of Russian gas to Europe through various pipelines, including Nord Stream, Turk Stream, the Yamal pipeline, and the Ukraine-to-Slovakia pipeline (Transgas).

The gathered dataset underwent rigorous analysis utilizing correlation, cointegration, and linear regression techniques to extract meaningful insights. Notably, the timeframe for data analysis spanned from January 1, 2018, to December 31, 2022, covering various indicators. It is important to note that the initiation of the Balkan Gas Hub on January 1, 2020, marked the commencement of the time-series data for day-ahead prices from this particular source.

3.2 Market Factors Influencing Bulgarian Natural Gas Price Dynamics

Market factors for natural gas price dynamics refer to the various elements that influence the fluctuations of natural gas prices in a specific market. These factors are by interactions between buyers and sellers, influenced by market forces such as consumer preferences, competition, and economic conditions. Market factors are often quantifiable and measurable and directly impact prices and quantities exchanged in the marketplace. In the context of natural gas economics, major supply-side factors influencing prices encompass:

- Amount of natural gas production
- Level of natural gas in storage
- Volumes of natural gas imports and exports

Three major demand-side factors affect prices:

- Weather Variability
- Level of economic growth
- Availability and prices of other fuels

Due to constraints in natural gas supply infrastructure and the limited ability of consumers to swiftly switch to alternative fuels, short-term changes in demand or supply, such as reduced supply of natural gas from Russia to the EU countries can lead to substantial fluctuations in natural gas prices. This phenomenon is particularly evident during the winter months when heating demand surges.

3.2.1

Factors influencing Balkan Gas Hub prices

The first targeted indicator of interest pertains to the daily percentage change of the Balkan Gas Hub's intra-day natural gas price. Notably, the period until the end of 2020 is characterized by low volatility and a scarcely noticeable trend. However, starting from the beginning of 2021, a discernible increase in volatility becomes evident. Towards the end of 2021, there is an abrupt shift towards a defined upward trend accompanied by clusters of heightened volatility, specifically observed in January-February 2021, June 2021, October 2021, December 2021, January, and March 2022.

Conducting an additive seasonal decomposition for both the price levels and the percentage changes of gas prices reveals that **there is no significant seasonal component**. Conversely, Figure 16 illustrates that the BGH exhibits a strong cointegration with the European TTF index and the Asian JKM, signifying their synchronous movement and underscoring the globalized nature of the natural gas market. Given the notable degree of market integration within European gas markets, prices tend to follow similar trends across various gas hubs. While there is no strong correlation observed when considering the changes in prices, this discrepancy could potentially result from 1 to 2 days lags between each of the price indicators.

Balkan Gas Hub price dynamics exhibits a strong cointegration with the European TTF index and the Asian JKM with 1 to 2 days lags.

To delve deeper into the causal relationships, Granger causality tests were executed. These tests were pivotal in ascertaining whether fluctuations in one indicator precede shifts in another indicator over time. The results of these tests indicated that the movements in TTF 1M futures exhibit Granger-causal influence over both the JKM and the BGH day-ahead prices. This intriguing finding can be rationalized by the substantial disruptions caused by the Russian invasion in Ukraine and the consequential actions taken by the Russian government and Gazprom. These geopolitical events severely disrupted the European gas market by constricting supply across the region. Consequently, scarcity led to heightened prices not only within Europe but globally, as evidenced by both the JKM and the Henry Hub natural gas spot prices.

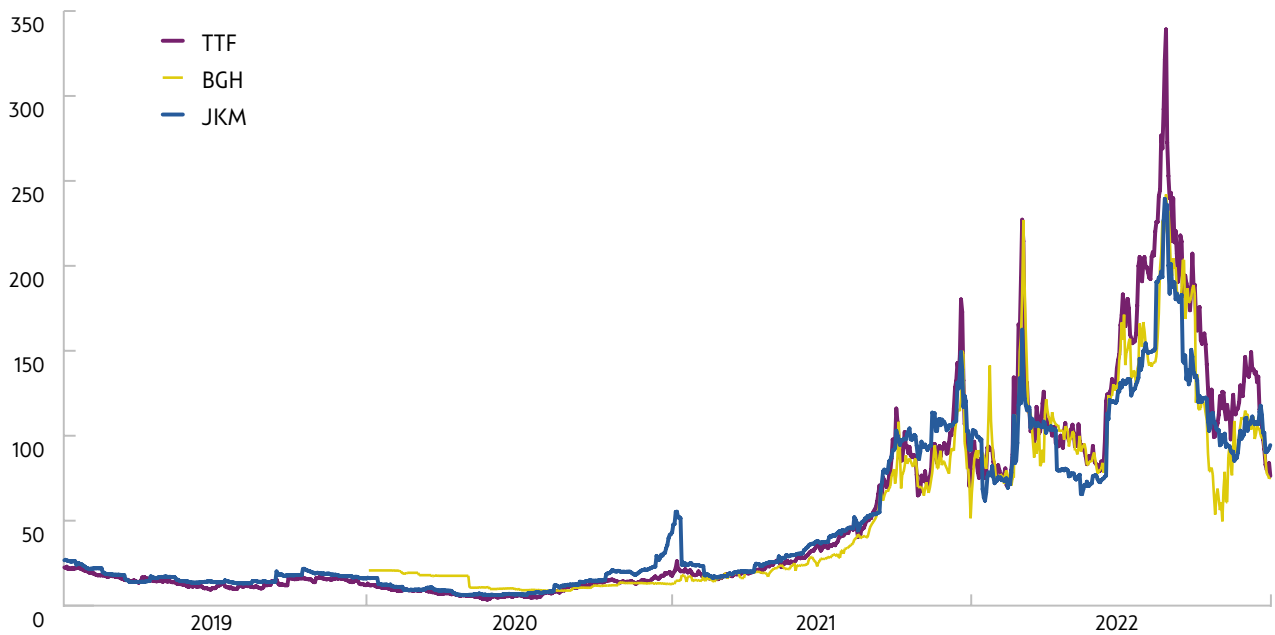


Figure 16: Natural gas hub prices' development (2019-2022)

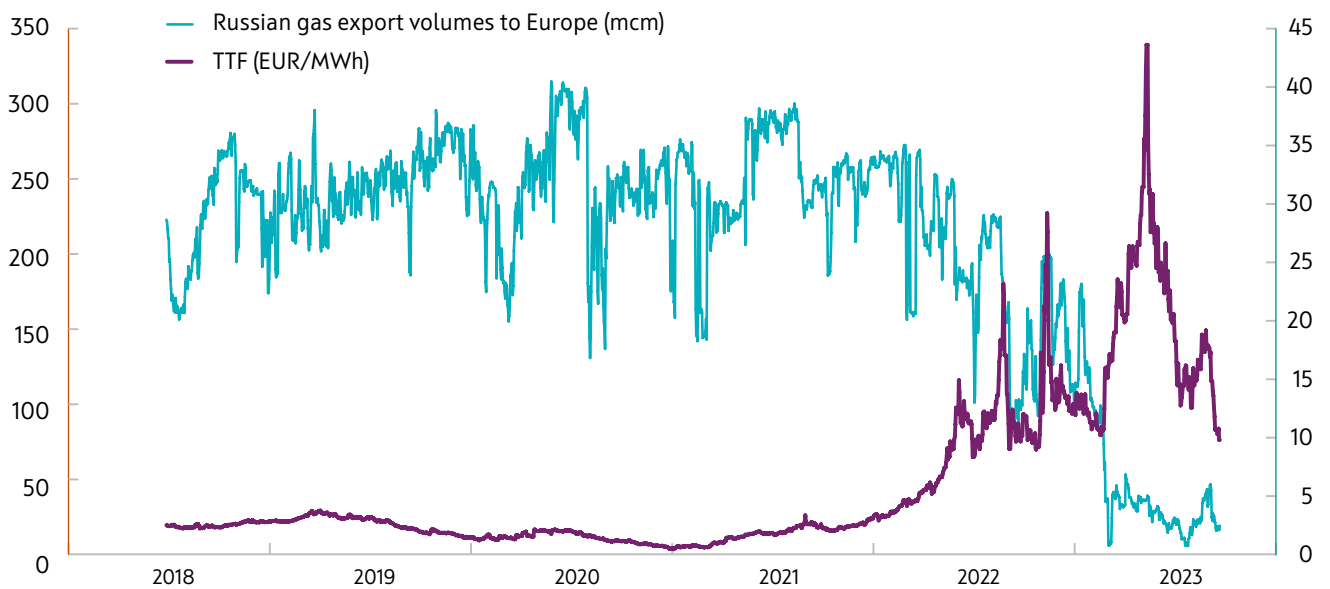


Figure 17: Russian gas exports to Europe in relation to TTF index (2018-2022)

The TTF index explains 97% of the price variations on the Bulgarian gas market.

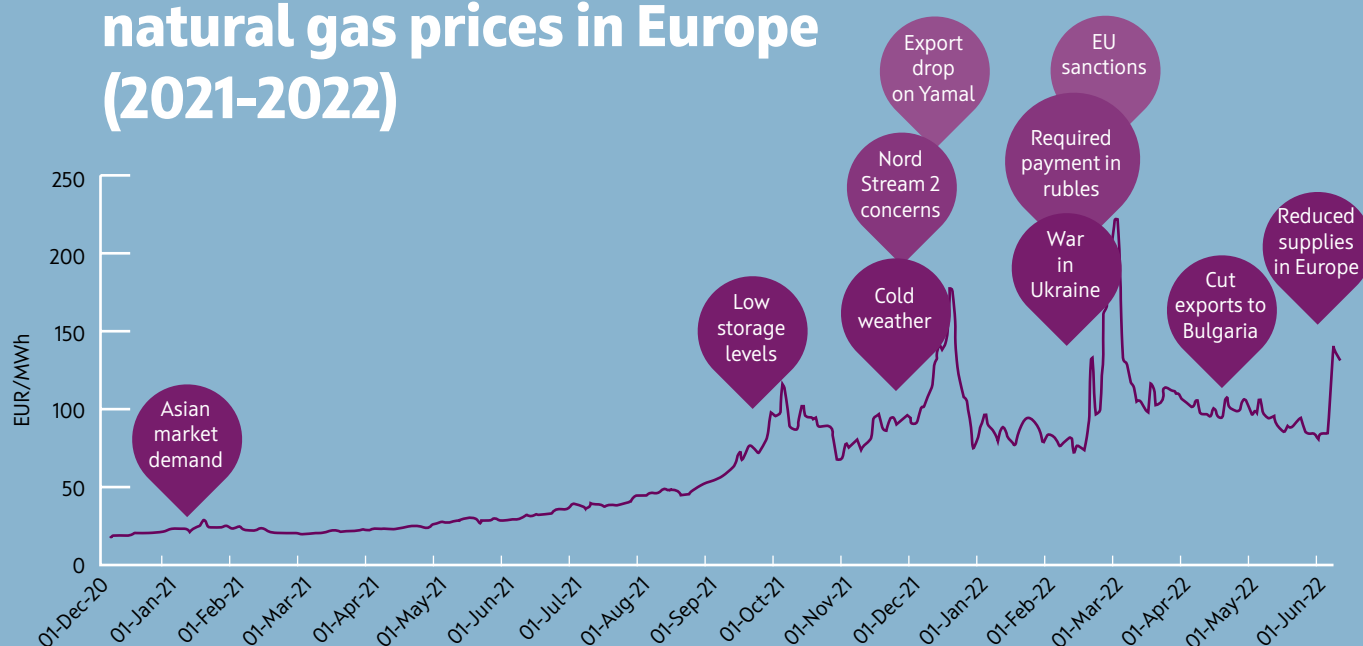
Particularly in 2022, global natural gas prices were profoundly impacted by the dynamics in the European market. As a result, factors influencing supply and demand on the TTF also hold an equivalent impact on the BGH. The TTF index

explains 97% of the price variations on the Bulgarian gas market. Analyzing the correlation strength between market factors and natural gas prices reveals that **the most significant effects are exerted by Russian pipeline imports to the EU and correlation with EUR/USD exchange rate.** Russian gas pipeline exports dwindled to 53% of their 2018-20 average due to substantial reductions in exports to Europe. Meanwhile, Russian natural gas production in the latter half of 2022 was

15% lower than the 2018-20 average, primarily attributed to the inability to redirect pipeline exports to China and Turkey. The reduction in Russian natural gas production and exports witnessed by Europe, consequently leading to a strong correlation between the dynamics of Russian pipeline imports and both hub prices and regulated prices in Bulgaria. On the other hand, over-reliance of large European economies such as Germany and Italy on Russian gas has also resulted in energy-driven inflation being significantly higher in Europe than other economies, notably the US, which depreciated the euro relative to the US dollar. Conversely, the United States witnessed a surge in production in the first ten months of 2022, reaching record levels that were 12% higher than the 2017-2021 average. Although exports to Europe remained limited due to the ongoing outage of the Freeport LNG export terminal, during the third quarter of 2022, Europe absorbed two-thirds of US LNG exports, a significant increase from the same quarter of 2021. Meanwhile, China's LNG imports plummeted by 85% due to reduced natural gas demand amidst COVID-19 restrictions, contributing to the alleviation of LNG shortages. At the beginning of 2023, warm weather and a sharp downward shift in demand contributed to the fall in prices at the European gas markets.

Non-market factors influencing natural gas prices in Europe (2021-2022)

INFOBOX



The figure depicted offers a succinct portrayal of the profound impact that non-market factors hold over the dynamics of natural gas prices in the EU markets. Geopolitical tensions and policy shifts, particularly those reshaping the energy interactions between the EU and Russia, have emerged as pivotal forces shaping the contours of the wholesale gas landscape. Specifically, the suspension of the Nord Stream 2 pipeline project and the intensifying discord centered around Ukraine, epitomized by the deployment and subsequent invasion of Russian troops, have generated far-reaching consequences that transcend the traditional ebb and flow of demand and supply.

This visual representation serves as a stark reminder of the intricate interplay between energy markets and global geopolitical currents, underscoring the potent influence that external factors can wield over market dynamics. The heightened volatility of gas prices witnessed in the latter months of 2021 and 2022 stands as a testament to the substantial role played by these non-market dynamics. As such, this analysis presents a compelling and illustrative case study, underlining the imperative of incorporating both market and non-market considerations in the scrutiny of energy market trends and their resultant outcomes.

3.2.2 Factors influencing regulated prices in Bulgaria

In the process of conducting a regression analysis to discern the determinants of administratively set natural gas prices in Bulgaria, a statistically significant correlation was found solely between the administratively determined prices within the country and the TTF 1M futures. This connection elucidated around 30% of the fluctuations observed in the regulated market prices. This outcome can be attributed to a sequence of structural shifts that transpired within the Bulgarian and, to some extent, the broader European market between 2018 and 2022. It's noteworthy that in 2022, merely a fraction of the price escalations witnessed on the EU gas hubs translated to the regulated gas prices in Bulgaria. These regulated prices were intentionally maintained below the levels of the EU and BGH hub prices and exhibited a delay of approximately one month in responding to market signals.

Even when considering a confluence of factors, including hub price volatility, temperature variations, storage levels, consumption patterns, and pertinent dummy variables (e.g., gas supply interruptions to Bulgaria and Poland, exchange rates), the cumulative impact could only account for a meager 37% of the variance in the administered price. However, certain ambiguities, like the quantities and pricing of Azerbaijani gas, further contribute to the intricate nature of the pricing framework.

The table below presents several noteworthy findings. It becomes evident that various indicators demonstrate co-movement – notably the TTF 1M futures, the EUR/USD exchange rate, and the URALS Crude Oil Price. Establishing a clear cause-and-effect relationship among these indicators is complex due to their susceptibility to a multitude of global factors. However, a strong correlation exists between the TTF 1M futures and the Russian pipeline gas imports into the EU, suggesting a poten-

Table 2: Correlation strength between market factors and natural gas prices and consumption in Bulgaria

Indicator	KEVR Gas Prices (Administratively determined)	TTF 1 - Month Futures	EUR/USD FX Rate	URALS Crude Oil Price	Average Temperature	Gas Storage	Russian Pipeline Imports into the EU
KEVR		Strong	Strong (-)	Medium	Weak	None	Strong (-)
TTF 1 - Month Futures			Strong (-)	Medium	None	None	Strong (-)
Gas Consumption	Weak (-)	Weak (-)	Medium	Weak (-)	Strong	Weak (-)	Weak (-)

Note: Correlation coefficients below 0.25 were considered weak, between 0.25 and 0.75 medium and above 0.75 strong. The variables are differenced and standardized with zero mean and unit standard deviation.

Source: FEBA

tially causal connection. Given the robust correlation between the administratively set price in Bulgaria and the TTF 1M futures, it is unsurprising that the former also exhibits significant correlations with the EUR/USD exchange rate and the Russian gas imports, albeit to a lesser extent with the URALS Crude oil prices. This latter observation may indeed indicate a tangible causal link, particularly concerning the oil-indexation pricing policy that was in effect until March 2020.

3.2.3 Price elasticity of natural gas demand

One potential explanation for the relatively weak correlation between the regulated natural gas prices in Bulgaria and the TTF 1M futures could be attributed to the **inelastic demand for natural gas**. As elaborated upon in Chapter 2, a substantial portion of the fossil fuel traded on the regulated market is primarily used for heating purposes, and due to the absence of short-term alternatives, demand is not anticipated to experience a significant decrease in response to price hikes. Conversely, consumption exhibits a robust correlation with average temperatures, further underscoring that higher consumption occurs during colder months.

In Bulgaria, the overall inland natural gas consumption demonstrates a seasonal pattern, with end-users' behavior closely tied to weather conditions.

In Bulgaria, the overall inland natural gas consumption demonstrates a seasonal pattern, with end-users' behavior closely tied to weather conditions. Consequently, demand levels maintain a relative consistency over the years, punctuated by predictable seasonal variations. The consumption curve illustrated in Figure 8 illustrates peaks ranging from 350 to 400 million cubic meters per month during the coldest periods of December and January, and troughs of approximately 150 million cubic meters per month during the summer months.

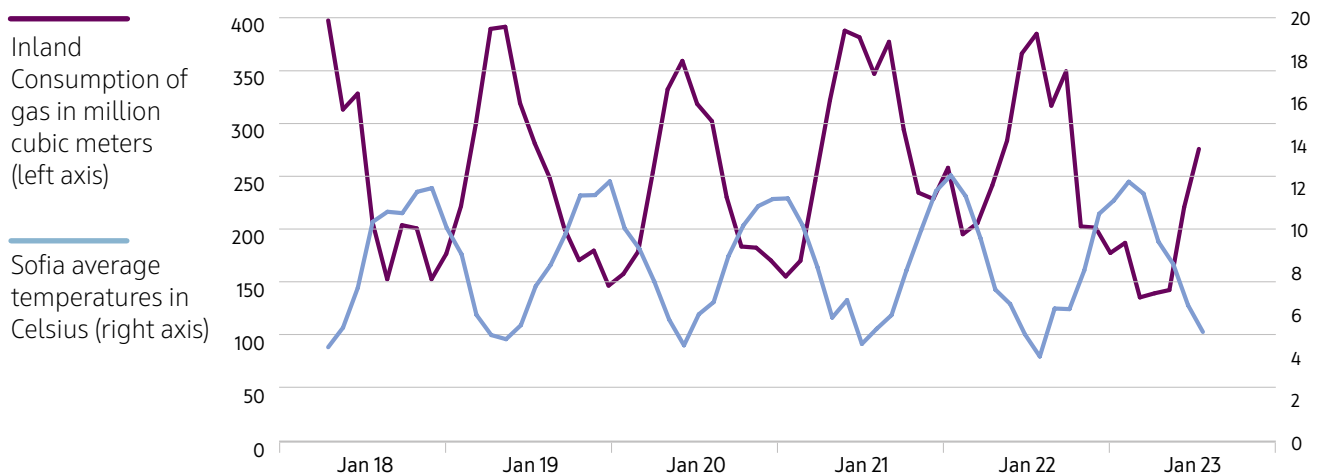


Figure 18: Temperature effects on natural gas consumption in Bulgaria

Source: FEBA based on Eurostat and US National Center for Environmental Information

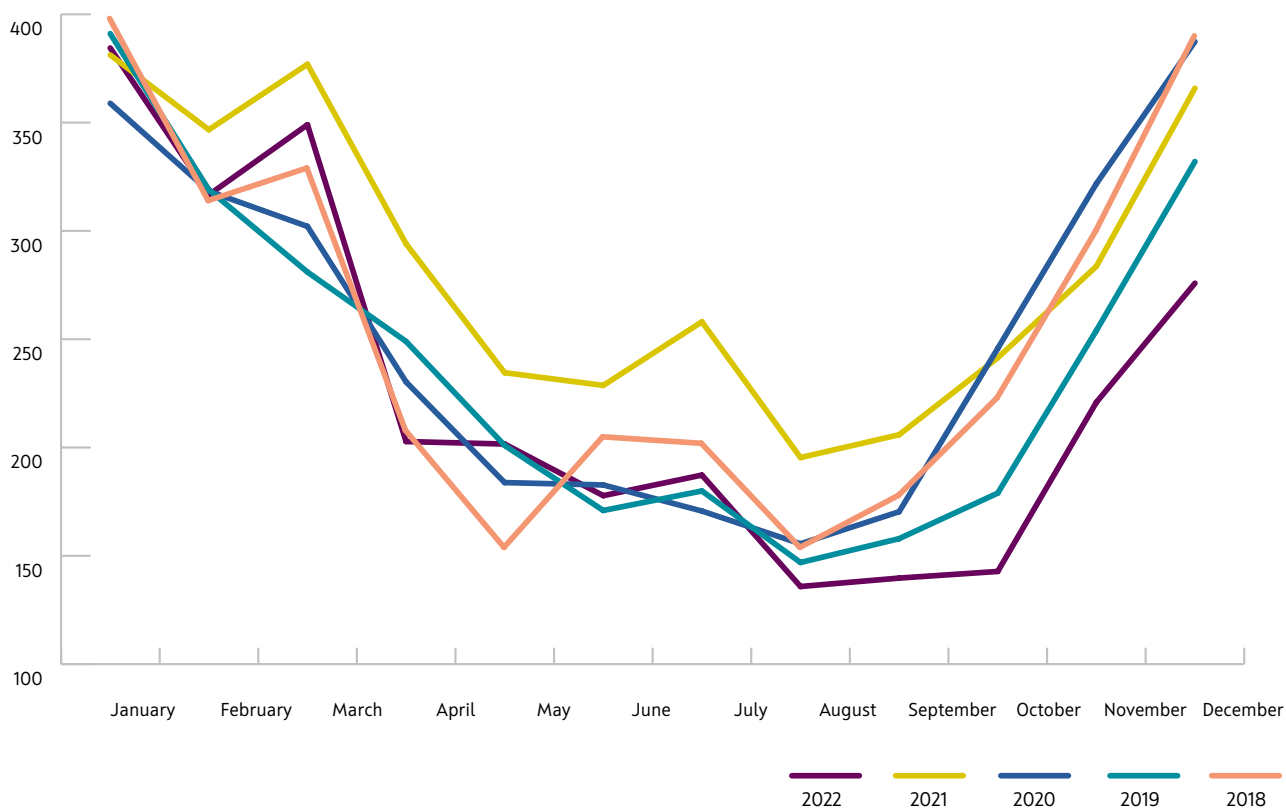
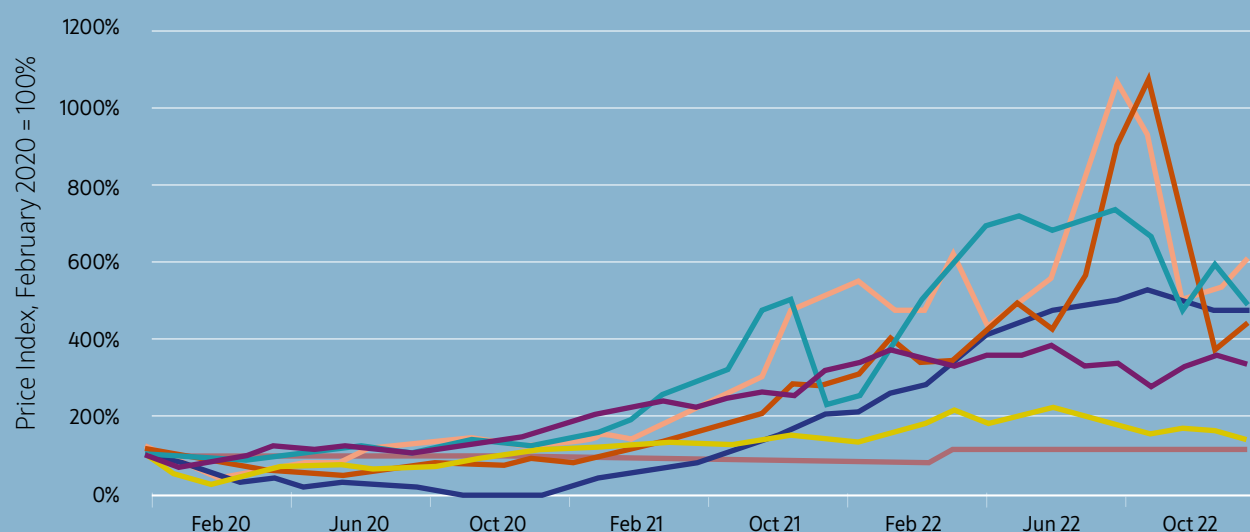


Figure 19: Monthly natural gas consumption in Bulgaria (2018-2022)

Amidst the backdrop of the energy crisis that unfolded across Europe during the winter of 2022/2023, a remarkable anomaly surfaced. Despite a temperature profile resembling that of previous winters, **December 2022 experienced an unprecedented drop in consumption**, reaching a record-low level of 276 million cubic meters. This deviation challenges the conventional notion that a decline in consumption was solely a consequence of severe winter conditions.

The consumption of natural gas in Bulgaria has remained relatively steady and even increased during the period from 2020 to 2021. The price surge in 2021 and early 2022 seemed to have little impact on it, indicating a perceived insensitivity of consumption to price fluctuations. However, this perception changed drastically with **the extreme prices observed from July to September 2022, resulting in a sharp decline in gas consumption in Bulgaria**. It will be essential to monitor whether this change stems from a substitution of gas with alternative energy sources or temporary restrictions on consumption for industrial and domestic purposes. Regardless of the underlying cause, the events of the past two years have significantly altered consumer perceptions regarding price predictability and the reliability of natural gas supplies. Consequently, various enterprises and even households have begun to adapt to this new gas reality.

Effects of the energy crises on the annual HICP inflation in Bulgaria



Natural gas (regulated price)	x 4 - 10
Coal (Rotterdam)	x 6 - 10
Electricity	x 5 - 7
Coal (BG lignite)	x 4 - 5
Oil (Brent)	x 1.5
Inflation (BG CPI)	x 3
CO ₂ (ETS Futures)	x 0.13

Figure 20: Monthly price evaluation of energy commodities and inflation in Bulgaria

Source: FEBA

As part of the European Energy Union, Bulgaria experienced the effects of the energy crisis unfolding in the common EU market. In 2022, Bulgarian industrial consumers paid four to ten times higher for gas supplies and six to ten times more for electricity. The Bulgarian population experienced inflation levels assessed at four to five times higher, primarily driven by the surge in commodity prices.

When comparing the end of 2021 to the end of 2022, there was a notable 21% increase in producer prices, predominantly driven by elevated inflation within the electricity generation, distribution, heating, and gas sectors. This contrasts with the manufacturing sector, where inflation aligned more closely with the headline figure. On the consumer side, prices experienced a 14.2% inflation rate. Despite this, the contribution of electricity, gas, and other fuels to the headline inflation remained relatively modest. This can be attributed to the relatively lower weights of gas products within the overall consumer basket. In this context, the highest contributions were associated with electricity and heat energy, though they still accounted for a mere 0.31% of the total contribution to headline inflation.

Within the category of "other fuels for personal transport equipment," encompassing LNG, LPG, and methane, a decrease was observed compared to November 2021. This specific category also made a negative contribution to the headline inflation, further shaping the intricate dynamics of price fluctuations.

4

Future Outlook

Bulgaria's experience in the gas business reveals a critical aspect concerning its supply dynamics – the nation is still ensnared in the trap of dependence on a sole supplier through a single route. Progress may remain elusive unless trading mechanisms are reformed to align with the realities of evolving European and global gas markets. A pressing need exists for greater integration of the national markets in Southeastern Europe to match the scale of the gas business higher up the supply chain. Rather than solely focusing inward on the domestic market and relying on trade virtualization, emphasis should shift towards ensuring that gas producers (other than Gazprom) and traders are incentivized and empowered to physically deliver gas to the markets in Southeastern Europe, reflecting the entire supply chain economics from source to entry points in Bulgaria.

Nonetheless, the impact of long-term supply contracts on gas prices can be advantageous or detrimental. Notably, contracts like the one with Gazprom Export OOO, linked to petroleum derivatives prior to 2020, led to significantly higher gas prices for Bulgaria in comparison to other European countries where hub-related pricing mechanisms were predominant. Similar development is observed at the moment with declining natural gas prices on the European exchanges. Bulgarian consumers also benefit from this decline, but with a month delay and not in full. Such contracts, despite price diversification, limit the benefits when European gas or petroleum indexes experience sharp declines, thereby hindering the immediate benefits of downward price movements on natural gas hubs for over 90% of participants in the Bulgarian market.

Despite encountering challenges, Bulgaria has successfully taken significant strides towards diversifying its supply sources and reshaping pricing structures. These efforts were notably expedited by the disruption in Russian supply. Key achievements encompass the establishment of the ICGB interconnector, facilitating gas deliveries from Azerbaijan, as well as the substantial increase in LNG imports from terminals in Greece and Turkey. Collaborations with regional traders have been instrumental, while access to neighboring infrastructure has provided added leverage. Furthermore, the inception of new projects is augmenting the drive for diversification.

Bulgaria's commitment to enhancing supply diversity is reflected in its ongoing initiatives. The objectives span broader access to LNG through the Alexandroupolis terminal, amplifying the potential for gas export to other Balkan nations and central Europe via the new Bulgaria-Serbia interconnection, and potentially a connection to North Macedonia. Storage capacity is set to expand significantly, with plans to double the capacity of the existing storage facility in Chiren. Additionally, arrangements with the Turkish operator Botaş will enable access to alternative gas terminals and associated infrastructure.

The culmination of these endeavors is projected to yield tangible outcomes. It is envisaged that by 2024, Bulgaria's natural gas blend will comprise approximately one-third Azeri gas, another third derived from LNG cargoes received at Alexandroupolis and Revitusa, and the remaining third sourced from Turkey, both through pipeline and LNG routes.

However, the market's liberalization remains constrained, because Bulgargaz EAD remains the dominant supplier and counterparty in long-term agreements. The lack of sufficient interconnection capacity, alongside regulated prices similar to liberalized market prices, inhibits new entrants. While alternative deliveries by traders became feasible in 2019, they constitute a limited share of the market. Regardless of the sources Bulgargaz obtains gas from, consumers remain tied to its supply. True diversification should extend to provider options and pricing mechanisms accessible to end customers.

The gradual alignment of price gaps between regional benchmarks can be attributed to increased LNG flows and a shift away from contracted prices. Yet, Bulgaria, connected to the global gas market, lacks a clear domestic consumption plan. The absence of a policy decision on natural gas's role in the future energy mix stifles its potential and growth as a decarbonization option. As the country navigates long-term contracts, a comprehensive vision of gas demand development, potential for transitioning to alternative fuels, and plans for electrification becomes crucial, safeguarding against uncertain energy futures.

In the journey toward a more resilient and adaptable gas market, Bulgaria must prioritize policy clarity, supplier diversification, and pricing mechanisms that reflect market dynamics. The nation's ability to overcome dependence, embrace diversification, and cater to evolving energy landscapes will shape its energy security and economic resilience in the years to come.

Factors influencing natural gas price developments in Bulgaria

Sofia University St. Kliment Ohridski, 2023

FACULTY OF ECONOMICS AND BUSINESS ADMINISTRATION

SOFIA
UNIVERSITY



ST. KLIMENT
OHRIDSKI
EST. 1888