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BOSNIA AND HERZEGOVINA ENERGY POLICY ACTIVITY

REPORT ON ASSESSMENT OF POSSIBLE IMPACT OF NEW TRANSPORT AND LNG FACILITIES ON FINAL CUSTOMER TARIFFS – 2023 EDITION

JUNE 2023
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DT Global

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ACRONYMS AND ABBREVIATIONS

AT	Austria
BiH	Bosnia and Herzegovina
CEGH	Central European Gas Hub
CEGHIX	Central European Gas Hub Index
CIF	Cost, Insurance and Fright
CZ VTP	Czech Virtual Trading Point
EU	European Union
FBiH	Federation of Bosnia and Herzegovina
GCV	Gross Calorific Value
GOG	Gas-On-Gas Competition - competitive gas-on-gas price
HR	Croatia
HAG	Hungary – Austria pipeline
HERA	Croatian Energy Regulating Agency
HU	Hungary
JKM LNG	Platts Japan Korea Marker
NBP	National Balancing Point
NCG	NetConnect Germany
NCV	Net Calorific Value
OPE	Oil Price Escalation - an escalation formula related to the price of oil
OPI	Oil Price Indexation - an indexation formula related to the price of oil
OTC	Over-the-Counter - trade based on private bilateral agreements
PEG	Points d´Exchange de Gaz
UGS	Underground Gas Storage
PSV	Punto di Scambio Virtuale (Virtual Exchange Point)
THE	Trading Hub Europe
SI	Slovenia
RS	Republika Srpska
SRB	Serbia
ToP	Take-or-Pay
TYNDP	Ten-Year Network Development Plan
TTF	Title Transfer Facility
VTP	Virtual Trading Point
ZEE	Zeebrugge Hub
ZTP	Zeebrugge Trading Point

1. INTRODUCTION

Given the potential transmission pipeline projects in the Southeastern Europe (SEE) region (see Report no. 1 - Overview of Trans-European and Regional Natural Gas Pipeline Projects Relevant to the Security of Supply in Bosnia and Herzegovina (BiH), February 2019, USAID Energy Investment Activity [EIA]) and the potential interconnections of the BiH transmission system with neighboring countries (see Report no. 2 – Options for the Development of Interconnection Natural Gas Pipelines to Ensure Security of Supply in BiH, February 2019, USAID EIA), there are real opportunities to supply the natural gas market in BiH from new routes and new sources.

As for new supply routes, there is primarily the **Southern Interconnection** between BiH and Croatia (HR), on the route Zagvozd – Posušje – Novi Travnik, with a branch line to Mostar. It would enable the supply of gas to the BiH market using the new route of the interconnection gas pipeline and allow the gasification of new parts of BiH. It would also enable the use of natural gas from new supply sources, e.g., from the liquified natural gas (LNG) terminal on the island of Krk, which was constructed in late 2020 and commissioned in early 2021. Consequently, the use of the new interconnection and source would significantly raise the level of security of gas supply for all BiH consumers.

Another possible supply route is the **New Eastern Interconnection** between BiH and Serbia (SRB), on the route Indjija (SRB) - Bijeljina - Banja Luka - Novi Grad, which would connect to the existing transmission pipeline in SRB. However, the branch of the Turkish Stream (TurkStream) running through SRB, which has been in operation since the beginning of 2021, will connect to the existing transmission pipeline in several places, enabling a new supply route for BiH. The New Eastern Interconnection will connect to the existing gas pipeline Batajnica (SRB) – Sepak – Zvornik – Sarajevo – Zenica - Travnik via the Bijeljina – Janja - Sepak pipeline. In this case, BiH could be supplied via the new interconnection, but the constraints are the capacities of the existing gas pipelines, Sepak – Zvornik – Sarajevo – Zenica - Travnik and Bijeljina – Sepak. In addition, the source of natural gas would be the same (Russia), even though it would come through the new TurkStream route. This interconnection would raise the security of gas supply to BiH and allow the gasification of a significant area of BiH.

In addition to the above-mentioned interconnections, two more interconnections are mentioned in the development plans of the Croatian and BiH transport system operators, namely the **Northern Interconnection**, on the route Slavonski Brod (HR) – Bosanski Brod (BiH), and the **Western interconnection**, on the route Rakovica (HR) – Tržac (BiH). However, as these interconnections are in the initial stage of development, they are not further discussed in this report.

This report explains the impact the new interconnections would have on the final price of gas in BiH compared to the existing route and source of supply, focusing on the impact of the new source of natural gas from the Krk LNG terminal, as well as the transport options that would be made available, with calculations of transport costs and final prices for different scenarios.

The second chapter describes the differences between traditional long-term contracts, which are still used in the existing gas supply route from Russia through Hungary and SRB, and new types and methods of contracting that became relevant in liberalized markets where the rules adopted by the European Union's (EU) Third Energy Package apply.

The third chapter describes the gas supply possibilities available to a BiH gas trader for the purchase and transport of gas through HR, then for the purchase and transport of gas through SRB, and the possibility for the BiH trader to buy from HR traders, with the option of an offtake at the border between BiH and HR, or the border between BiH and SRB.

The fourth chapter provides examples of calculation of transmission tariffs for four (4) gas years[1] 2018-2019, 2019-2020, 2020-2021, and 2021-2022, for both outside BiH and in different entry-exit options within BiH, i.e., calculation of the final gas prices on the BiH market for six (6) different scenarios. These scenarios include the current gas purchase with capacity booking through Hungary and SRB, the option of gas supply through HR with one and two entry-exit zones, the purchase through SRB with one and two entry-exit zones, and finally, the option of supplying the Federation of Bosnia and Herzegovina (FBiH) through HR and Republika Srpska (RS) through SRB.

In conclusion, the calculation results of scenarios for all four (4) gas years are compared, the possibilities brought by the new Methodology for setting gas transmission tariffs in HR are presented, and a review is made of possible cost reductions (and consequently gas price reductions) through optimization of transport capacity booking.

[1] Gas year starts at 6 a.m. on October 1 of the current year and ends at 6 a.m. on October 1 of the next year.

2. THE NATURAL GAS MARKET

2.1 TRADITIONAL LONG-TERM CONTRACTS

Before 1960, international trade in natural gas (hereinafter: gas) was very limited. Gas was produced and consumed locally or regionally, primarily as a raw material for industry, and in some cases for heating purposes. There was no specific, widely applicable pricing formula.

After 1960, a reference price mechanism was introduced, tying the price of gas (from a gas pipeline or LNG source) through an index to the price of oil, which suited gas-producing countries and exporters (Russia), exporting to Europe due to the possibility of concluding bilateral interstate agreements.

Long-term take-or-pay (ToP) contracts between gas producers and domestic importers dominated the market, especially in Europe. The duration of the contracts ranged between 15 and 30 years. The ToP clause determined the quantity of gas the importer was obliged to offtake percentage wise (e.g., 80% or 90% of the total contracted quantities), and stipulated that the importer could not take more than the contracted deviation. If the importer took less than the agreed deviation, the contracted price would still have to be paid, and if the importer took more than the contracted plateau, e.g., higher than +10% or +20%, the excess quantities were subjected to a contractual penalty[2].

The ToP clause is not exclusively related to contracts with a reference price formula tied to trends in the price of oil and petroleum products, but is still used in contracts today, as will be discussed below.

Apart from the price of oil, the price of gas is also tied to the price of petroleum products, such as fuel oil. The contracted price is derived using sliding prices that are usually based on the price of fuel oil. Additionally, the importers generally use the same formulas in contracts with their customers (distributors)[3].

A typical long-term contract may, for example, follow the 6/3/3 rule, according to which the price of gas is determined based on a six-month average price of fuel oil calculated with a shift of three (3) months, while the calculated price is valid for gas supply for the next three (3) months. For example, the price for the period of October-December is determined based on the average price of fuel oil for the period January-June of the same year.

This type of formula is often called an oil price escalation (OPE). In OPE, the gas price consists of a basic initially contracted price multiplied by a coefficient represented by a fraction where the average of the actual prices of the selected basket of competing commodities in the defined previous period is the numerator, and the initially contracted prices of the basket of competing commodities is the denominator. The calculated index, which is then multiplied by the basic price of gas, can be higher or lower than one (1) and, accordingly, the gas price in the next billing period increases or decreases relative to the base price. For this reason, this type of price formula is often referred to in English as Oil Price Indexation (OPI). In the case of traditional long-term contracts, since they are concluded for a long period, negotiating changes; revising the base price (P_0) several times during the term of the contract was common practice.

[2] Energy Economics, Springer International Publishing 2017, Chapter 9 Markets for gaseous fuels, Subchapter 9.3. Gas Markets and Gas price formation.

[3] Ibid.

For illustration purposes, below is an example of a simple formula related to the price of petroleum products: gas oil and fuel oil. It should be noted that this specific formula below was created solely to serve as an example to facilitate understanding.

$$P_n = P_0 \times \left(A \times \frac{G}{G_0} + B \times \frac{F}{F_0} \right)$$

Base price

Index

Where:

P_n	Natural gas price in period "n"
P_0	Base (reference) price of natural gas (defined at the time of concluding the contract)
G	Average gas oil prices
F	Average fuel oil prices
G_o, F_o	Initial values of gas oil and fuel oil prices (defined at the time of concluding the contract)
A, B	Weighting factors → A + B = 1.0 (defined at the time of concluding the contract)

Data on the prices of petroleum products (Mediterranean market and Rotterdam) are published in specialized journals (Platts European Marketscan).

In the Western Balkans, there are other typical formulas such as 9/0/3, according to which the price of gas is determined on the first day of each quarter for the following quarter, based on the nine-month average price of oil/petroleum products from the previous period, or 3/0/1 according to which the price of gas is determined on the first day of each month for the current month based on the quarterly (three-month) average price of oil/petroleum products from the previous period.

As in the case of the ToP clause, it should be emphasized that the formula related to the price trends of oil or petroleum products is still in use (although the frequency of its use is significantly declining, as will be discussed below).

2.2 NATURAL GAS MARKET AFTER THE THIRD ENERGY PACKAGE

Gas trade, especially through gas trading hubs, initially developed in the United States in the 1980s. In the early 1990s, the change occurred in Europe with the United Kingdom introducing the American model – a liberalized natural gas market. In 1998, the European natural gas market divided: in northwest Europe, the gas price was determined based on supply and demand, while the oil formula remained the dominant price-setting method in the rest of Europe. Trade at gas trading hubs in Europe became more significant following the Third Energy Package. There are two types of gas hubs: physical and virtual.

Physical gas hubs are locations where gas pipelines, gas storage facilities, and LNG terminals physically converge and interconnect, thus enabling the exchange of gas through various gas pipelines. In continental Europe, the best-known gas hub is in Belgium, near Zeebrugge.

Virtual gas hubs are locations where part of a high-pressure gas network functions as an alternative to a high concentration of pipelines (at a single point) needed to form a physical gas hub. The gas trading point is defined by entries and exits to the gas transmission network through which traders can offtake or deliver gas, or suppliers can offtake it to supply their end-customers. Simply put, several individual points or locations are combined into one (agreed) virtual point.

The first virtual gas hub was launched in the United Kingdom (NBP - National Balancing Point) and the Netherlands (TTF - Title Transfer Facility). In the meantime, virtual gas hubs have been developed in other countries e.g., Belgium (ZTP – Zeebruge Trading Point), France (PEG - Points d´Exchange de Gaz, which combined earlier PEG North and TRS – Trading Region South), Germany (THE – Trading Hub Europe which combines earlier NCG - NetConnect Germany and Gaspool), Italy (PSV - Punto di Scambio Virtuale), Austria (CEGH - Central European Gas Hub).

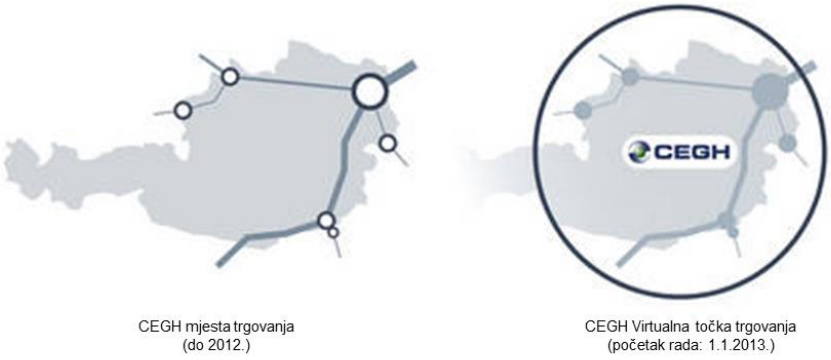
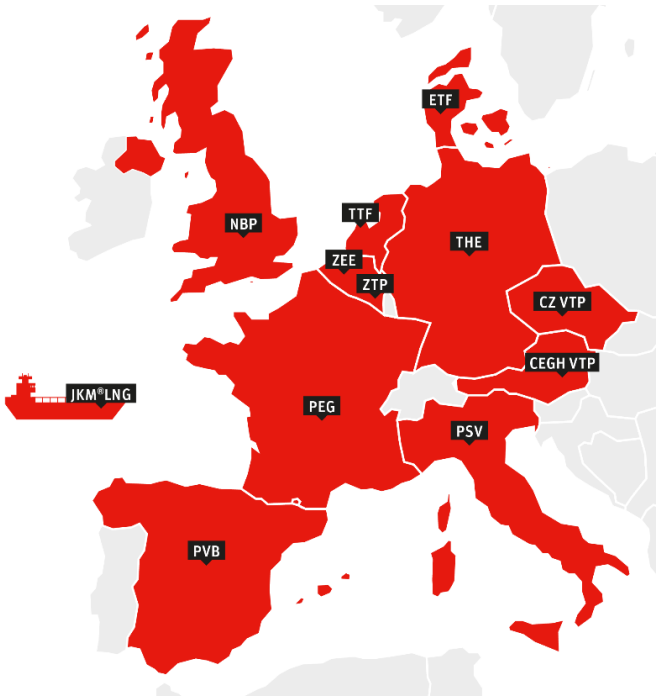


Figure 1 - Virtual Trading Point (VTP) in Austria [4]

Gas hubs can be places of natural gas delivery for trading based on bilateral agreements concluded on the Over-The-Counter (OTC) market (in which case price data is not public) or they can represent a trading location (and the corresponding delivery point) in case of trading on gas exchanges.

The purchase and sale of gas among traders does not have to take place exclusively through a gas exchange (where standardized products are traded, the identity of those offering and seeking are not publicly disclosed, price data is publicly disclosed, and contracts can be resold on the exchange); it can also take place through contracts concluded on the OTC market. Transactions on the OTC market are conducted bilaterally between two parties who know each other's identity and for a precisely specified supply profile, where price data is not publicly known but is subject to negotiations between the two parties involved. The negotiated price indirectly reflects the price signals from the gas exchange, or the contracted price formula can be linked to gas price indices from the selected gas exchange, while the gas hub may be the place of gas delivery; these contracts may not be resold without the consent of the other contracting party.

[4] Trading Location: CEGH-VTP (http://cegh.at/trading-location-cegh-vtp).



NBP - National Balancing Point (V)

TTF - Title Transfer Facility (V)

ZEE - Zeebrugge Hub (F)

ZTP – Zeebrugge Trading Point (V)

THE - Trading Hub Europe (V)

PEG - Point d'Echange de Gaz (V)

PSV - Punto di Scambio Virtuale (V)

PVB - Punto Virtual de Balance (V)

CZ VTP - Czech Virtual Trading Point (V)

CEGH - Central European Gas Hub(V)

JKM LNG – Platts Japan Korea Marker[5]

(F) - Physical gas hub

(V) – Virtual gas hub

Figure 2 - Major European gas hubs – members of the European Energy Exchange (EEX) [6]

Figure 3 is an overview of the market organization after the application of the Third Energy Package, after the organization of the liberalized gas market in general, including the structure of the total, final gas price (energy price plus service price).

The price of natural gas as a commodity is unregulated and based on supply and demand.

System services (i.e., transport/transit via gas pipelines, LNG terminal services and gas storage services) are provided based on regulated third party access at regulated prices (tariffs). Although these are, as a rule, natural monopolies, in some cases it is possible to choose different transit routes that have a different price due to different amounts of (regulated) costs.

Also, although the price of LNG terminals and underground gas storage (UGS) services is regulated, in some cases it is possible to choose the one with the lower (regulated) tariff if there are multiple suitable LNG terminals or UGS facilities in the area.

The price of the gas distribution service (if the customer is on the distribution system) is also provided based on regulated third party access with regulated prices (tariffs).

As noted above, market prices related to trading on gas hub exchanges, which are publicly disclosed, have become reference prices for gas contracts in order to separate long-term gas contracts from prices of oil and petroleum products.[7]

The price of gas is formed according to supply and demand (gas-on-gas competition, which is why this model is often called Gas-On-Gas Competition [GOG]) and the quantities are traded daily, monthly, seasonally, annually or for another specified period.

[5] JKM™ is an estimate of the reference price for physical spot LNG volumes and reflects the current market value of cargo delivered from the ship to Japan, South Korea, China and Taiwan.
[6] https://www.eex.com/en/markets/natural-gas
[7] Ibid.

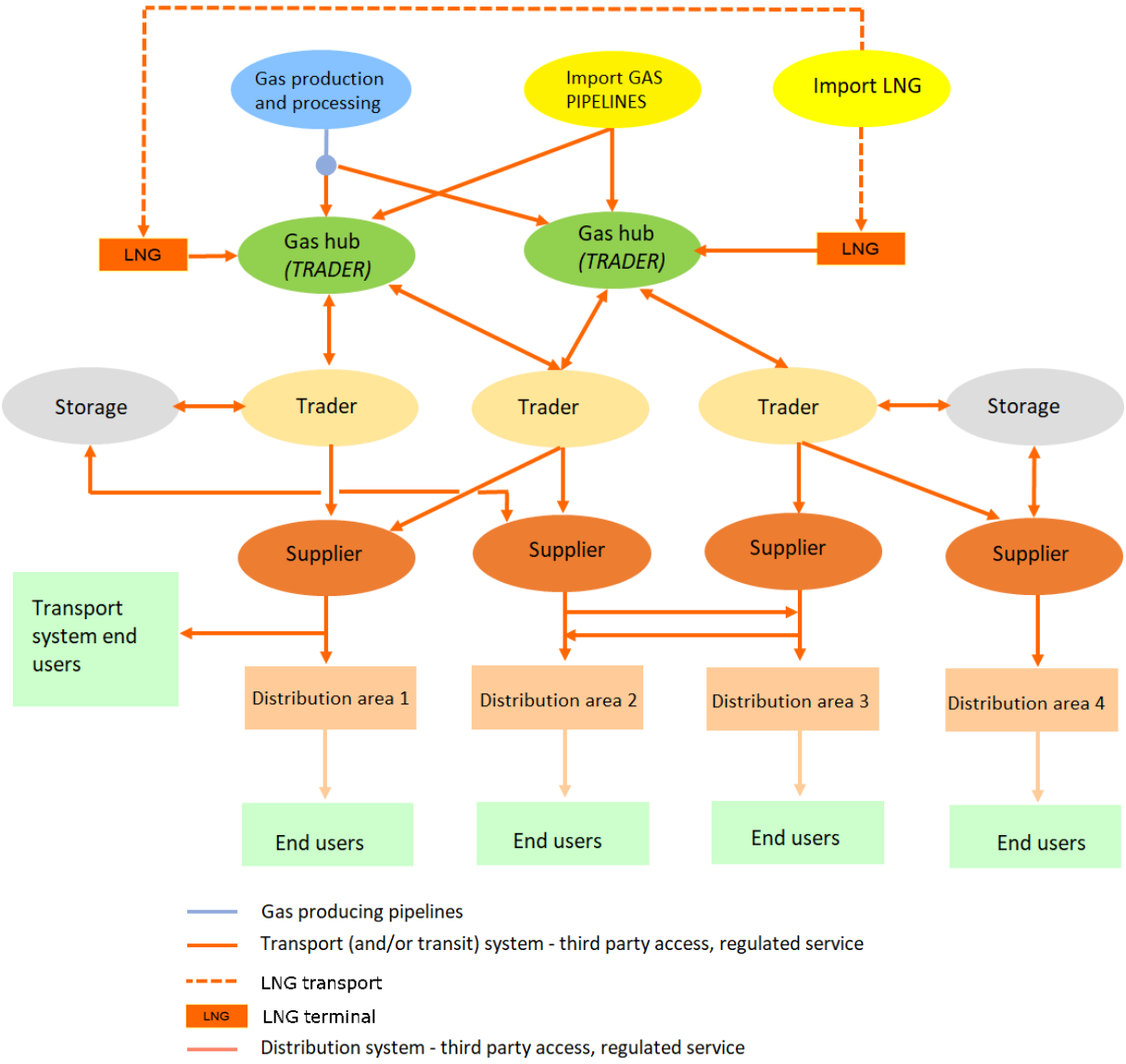


Figure 3 - Organization of a liberalized natural gas market [8]

A price that is determined based on GOG competition can be fixed or according to a formula, such as for determining monthly prices in long-term contracts. The gas price is tied to gas price indices on gas hub exchanges instead of price trends of competing commodities.

The fixed price, although fixed and unchangeable during the contract period, is determined at the time of contracting by supply and demand, which as a rule, refers to spot trade (next day delivery price) for short-term contracts. However, it can be determined for multi-monthly or multi-annual contracts, based on the valid prices for the observed contract period (Futures) e.g., month(s), quarter(s), season(s), year(s) at the time of concluding the contract.

As a rule, a fixed-price contract also contains a ToP clause with a contracted deviation requested by the buyer.

[8] D. Matić, S. Vulama, "Natural gas prices - When and how to contract? How to reduce risk and effective price?"- handouts from the workshop, INEEO, Faculty of Economics, University of Zagreb, Energy Academy, 2018.

It should be emphasized that the products traded on gas exchanges are standardized: "flat" products that involve 100% even delivery per hour with 100% ToP. If the buyer is looking for an offer for a profile other than flat quantities, then the gas price from the gas exchange would be increased by the indicated costs related to providing the necessary flexibility, such as storage.

Also, it should be emphasized that all prices on gas exchanges are expressed according to the gross calorific value (GCV) at 25/0°C.

Described below is a simplified example relating to a contract with a formula for determining the monthly gas price for a particular month ("n") based on spot prices (next day delivery price).

A typical formula consists of two parts:

(i) The gas exchange whose index is monitored, such as Austrian CEGH, German THE, Dutch TTF, and whether the calculation of the average monthly price for the current month is based on the Day-Ahead principle, which is the average monthly gas price calculated after the current month based on the actual spot prices realized in each day of the current month as their arithmetic or weighted mean. For the calculation of the weighted mean, the spot price for each day observed within the month of delivery is multiplied by the delivered daily quantity for that day.

(ii) Added to this is the "Spread" (trader's or supplier's premium), which includes all costs of the trader or supplier to the point of delivery except those separately specified in the contract, such as the costs of transport or distribution by the national gas system. However, in principle, the costs may be included in the "Spread," along with the trader's or supplier's margin. The contracted "Spread" is a fixed amount for the entire duration of the contract.

An example of a general simplified form of the price formula is provided below:

$$P_n = P_{CEGH(n)} + Spread$$

$$P_n = P_{TTF(n)} + Spread$$

Where:

P_n	Natural gas price in period "n"
$P_{CEGH(n)}$	Prices of the selected price index from the gas exchange at the CEGH gas hub in the period "n"
	Note: The same principle applies to exchanges at other gas hubs: e.g., TTF, THE.
Spread	The fixed premium on the price (includes costs of system services, risk premium, and seller's margin)

It should be noted that these contracts may also have a ToP clause, if part of the fixed costs, e.g., transit, is included in the Spread.

A typical index used in the Western Balkans area when it comes to spot prices is the Central European Gas Hub Index (CEGHIX), which is a daily reference price calculated based on the weighted average of the quantities and prices of all Day-Ahead transactions that day.

Thus, with this type of gas formula, the Spread is contracted at a fixed amount, while the final gas price is determined by following the natural gas price trends on the gas exchange to which the contracted amount of the Spread is then added.

As an additional element, the formula may also include a conversion coefficient for converting gross GCV into net calorific value gas (NCV), if necessary, depending on the market where the purchased gas is offered.

Thus, the natural gas price trends for the customer depend on supply and demand, which also result in fluctuations (in this case, of the spot price) on the gas exchange.

To illustrate this trend, below is an example of the dynamics of spot price fluctuations (in this case the CEGHIX index trends) in the period from June 1, 2012, to June 1, 2023.

It can be observed that until the Covid-19 pandemic was declared, spot price movements were relatively stable and within a certain framework. The only exceptions were the sharp price increases from early March 2018 caused by sudden cold weather coming from a Siberian cold front, when the price for March 2, 2018, increased to around 55 EUR/MWh (GCV), was excluded.

After the introduction of the lockdown, the observed spot price fell below 5 EUR / MWh (GCV) because of reduced demand compared to supply. After the exit from "lockdown," an increase in prices were caused by several factors, from economic (e.g., increase in demand for natural gas due to rapid economic recovery not accompanied by a corresponding increase on the supply side) to political (e.g., problems related to Nord Stream 2 and the war in Ukraine). Due to war operations in Ukraine, the observed spot price reached a value of over 312 EUR / MWh (GCV) in one day (March 8, 2022), practically a tenfold value compared to the stable average from the time before the declaration of the Covid-19 pandemic. These are elements that have disrupted the classic supply-demand relations.

As mentioned above, price formulas tied to the price of oil and petroleum products are still in use, but there has been a significant decrease in their share. Europe is one of the regions where the most significant changes in gas pricing models have taken place. While in 2005, the share of the OPE formula in gas prices at the wholesale level was 78%, while 15 years later, this share dropped to approximately 20%, which is a direct consequence of gas market liberalization and an increasing number of liquid gas hubs.

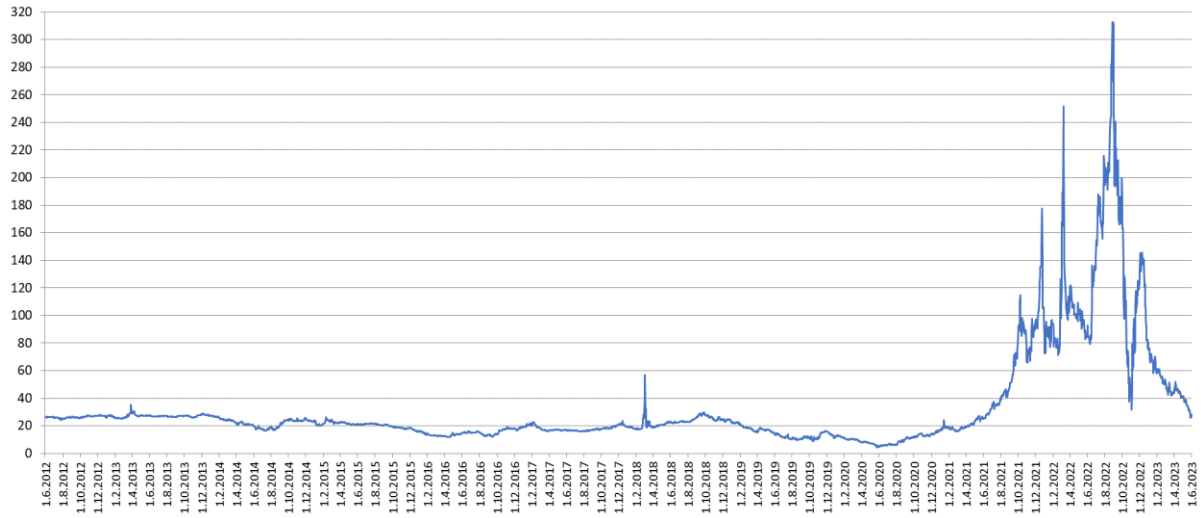


Figure 4 - CEGH gas hub spot price from June 2012 to June 2023 (EUR/MWh (GCV)) [9]

Gas hubs' liquidity is measured as the ratio between the quantity traded and the quantity delivered, which is also called the "churn factor." In the past, OPE was mainly used for long-term ToP

[9] https://www.cegh.at/en/exchange-market/market-data/?product=aheadMarket&market=AT

contracts, the main shortcomings of which were lack of transparency and reduced liquidity of the spot market, which in turn inhibited competition.

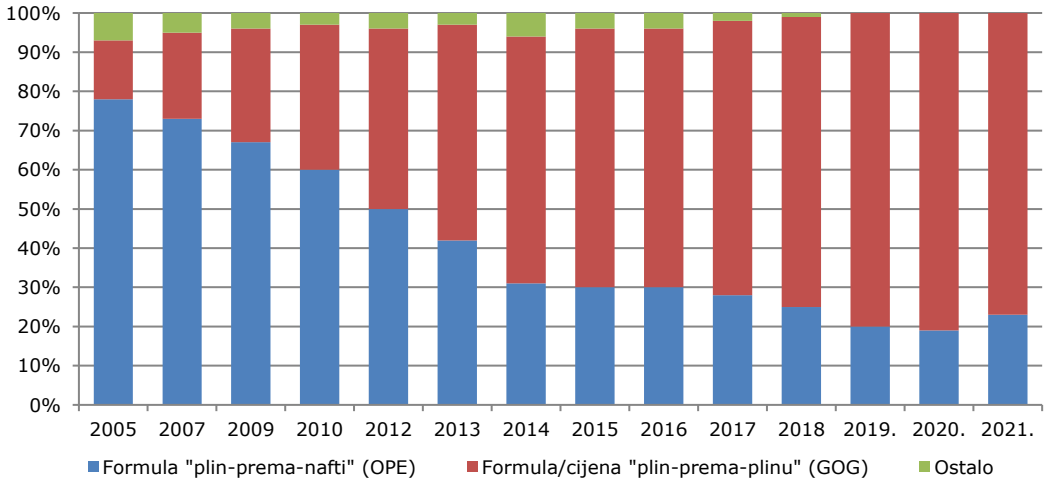


Figure 5 - Shares of individual price models at the wholesale level in Europe in 2005-2021 [10]

The share of the price model that reflects GOG competition when the price of natural gas is formed based on supply and demand by trading at gas hubs, increased in the same period in Europe from 15% in 2005 to approximately 80% after 15 years.

These changes are due to many factors during the observed period. There has been a decrease in the number of gas import contracts with an index tied to the price of oil or petroleum products, which were replaced by spot-based imports and an increase in volumes traded at gas hubs. Not only have the physical quantities of gas traded increased, but also the gas has been resold several times on the gas exchange before being consumed by the end-customer. Further, clauses in existing long-term contracts were changed to include an index based on spot prices from contractually defined gas hubs to some extent or even 100%, while reducing the amount required to offtake based on the "take or pay" principle. When changing the terms of existing long-term contracts, hybrid (or combined) price formulas were introduced, where the index tied to the price of oil or petroleum products was partially retained, while the remaining part was linked to a gas price from gas hubs.

The increase of the share of the GOG price model is also due to a gradual drop in the share of domestic production, for which the price was indexed to the price of oil or petroleum products, and an increased share of imports through gas pipelines or LNG, where new contracts are, as a rule, indexed to the market price of gas (GOG competition).

Given that the above-mentioned overview refers to Europe as a whole, the overview from the same source related to Southeast Europe is presented below[11].

In the same period, the share of the escalation formulaOPE) in wholesale gas prices in Southeast Europe is approximately stable (from 33% to 41%) while the share of the price model that reflects gas-to-gas competition (GOG competition) is gradually growing at the expense of other pricing

[10] IGU, Wholesale Gas Price Survey 2022 Edition

[11] Includes countries: Bosnia and Herzegovina, Bulgaria, Croatia, Northern Macedonia, Serbia, and Slovenia

models (the majority of which are regulated prices[12]) with an increase in the share from 0% in 2010 to approximately 60% in 2021.

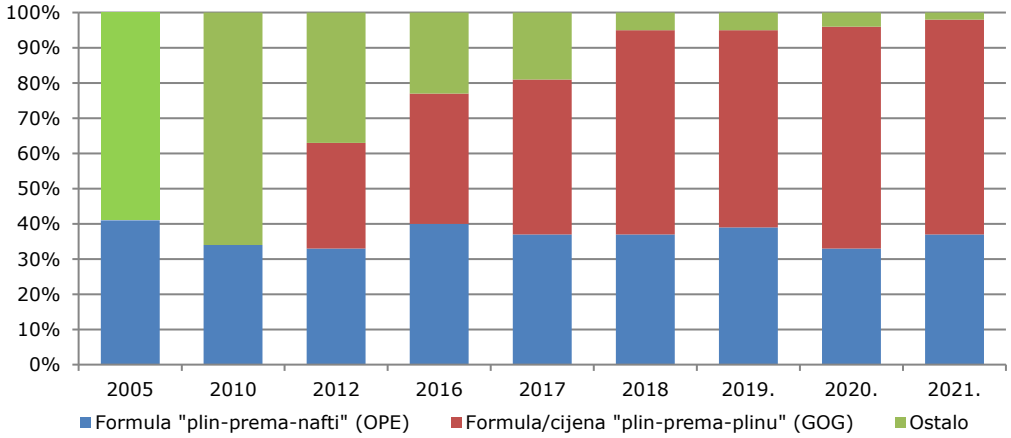


Figure 6 - Trends in the share of wholesale price models in Southeast Europe 2005-2021[13]

[12] The so-called model RCS = Regulation: Cost of Service - The price is set or approved by the formal regulatory authority or possibly the Ministry, but the level is set to cover the "cost of service", including return on investment and a reasonable rate of return.

[13] IGU, Wholesale gas price survey 2022 edition

3. GAS PROCUREMENT OPTIONS FOR BIH AFTER THE CONSTRUCTION OF THE SOUTHERN INTERCONNECTION

As mentioned in the Introduction, there is a real possibility that the Southern Interconnection between BiH and HR will be constructed. Its completion and commissioning will significantly alter the current situation and relationships between stakeholders in the natural gas market in BiH. This will primarily affect the relations between existing gas traders/importers and suppliers, on the one hand, and end users and customers, on the other. Namely, the relationships between stakeholders are defined by how gas for the BiH market will be procured; currently, gas is mostly imported into BiH based on long-term contracts with Gazprom at the Beregovo delivery point on the Ukrainian-Hungarian border, and long-term contracts for transmission services through Hungary and SRB. Implementing the Southern interconnection project will significantly change existing relationships between stakeholders, bringing new possibilities to the BiH gas market.

Above all, the new interconnection will enable access to new sources of gas procurement. It will be possible to contract the purchase of gas at the most liquid virtual gas hub in this part of Europe, the Central European Gas Hub (CEGH) in Austria, as described in Section 2.2 above. Gas will also be available for purchase in the markets of neighboring countries, e.g., at VTP in Croatia, or through direct bilateral sales contracts. The third option for procuring gas will be by contracting procurement of LNG through the Krk LNG terminal, which started operation on January 1, 2021.

In addition to purchasing the commodity natural gas, transmission capacity through transit countries will also need to be booked in order to have the gas delivered to the BiH market. In the case of LNG, a form of natural gas that is most susceptible to relations and changes in the global natural gas free market, which also means that it affords the highest degree of freedom in procurement, it will also be necessary to book capacities for receiving, short-term storage, regasification and delivery from the Krk LNG terminal (respecting the Decision of the Government of the Republic of HR on increasing the capacity of the LNG terminal on the island of Krk, considering that the existing capacity of the terminal is fully leased as of the gas year 2036-2037).

Below is an overview of some options and possibilities available to BiH traders.

3.1 OPTION 1 – BIH TRADER CONTRACTS THE PURCHASE AND TRANSMISSION OF GAS THROUGH HR

Considering the fact that BiH is not currently a member of the EU, in order for a BiH trader to be able to trade in gas in HR, the necessary preconditions for the BiH trader are that a company for trading in natural gas is founded and registered in HR under the BiH trader's ownership and that this Croatian company obtains a license from the Croatian Energy Regulatory Agency (HERA) for carrying out the energy activity of natural gas supply (which includes natural gas trading), or just a license for carrying out the energy activity of natural gas trading, in which case the company will not be able to supply gas to end customers in the territory of HR.

Only after obtaining a Croatian energy license for supply (or trading), the company owned by the BiH trader will be able to trade in natural gas in the territory of HR and book transmission capacities in the pipeline network and regasification capacities at the LNG terminal. However, since the company is now registered and licensed in an EU member state, it will be able to trade in gas (and book gas infrastructure capacities) in all EU countries. This will, of course, require meeting a few other specific requirements for each national market, but it will no longer require opening and

registering a separate company in other countries in whose territories the trader wishes to trade in gas and whose gas infrastructure the trader wishes to use.

Theoretically, this will enable multiple ways of trading and using transmission capacities to deliver gas through the Southern Interconnection to the BiH market. These possibilities are listed and briefly described below.

Variant 1.1 - Trade at CEGH and transmission via AT-HU-HR

The company, registered and licensed in HR (owned by the BiH trader as described above), registers for trading at CEGH (meeting all the requirements for traders set by this exchange[14]) where trading in natural gas is enabled in line with all the open market standards and rules as described in section 2.2.

Afterwards, transmission capacity is booked at the entry to the Austrian transmission system (HAG pipeline), then joint exit/entry capacity at the AT-HU Mosonmagyarovar interconnection, then further downstream the joint exit/entry capacity at the HU-HR Dravaszerdahely interconnection, and finally the exit capacity from the Croatian transmission system at the future HR-BiH Imotski/Posušje interconnection[15].

In this way, the daughter-company from HR formally sells (while abiding by all legally prescribed customs and tax procedures) the gas purchased at the CEGH and transported via Austria, Hungary and HR to its parent company, i.e., the gas trader from BiH. The gas trader from BiH will be obliged to book the capacity at the entry to the BiH transmission system at the Southern Interconnection and subsequently the exit capacities to all its customers.

Variant 1.2 – Purchase of gas at CEGH and transmission via AT-SI-HR

The only difference compared to the variant described above is the transmission route: after capacity is booked at the entry to the Austrian transmission system (TAG and SOL pipelines), joint exit/entry capacity is booked at the AT-SI Murfeld interconnection, and then further downstream exit/entry capacity is booked at the SI-HR Rogatec interconnection.

Everything else, including purchasing the gas at CEGH and booking exit capacity from HR and entry capacity into the BiH system, remains the same.

Variant 1.3 - Purchase of gas at VTP in HR and transmission via the HR-BiH Southern Interconnection

Given that gas trade has developed in a fully open market in HR since 2012, with the application of all relevant EU rules and the practice of contracting gas prices according to a formula tied to the price of gas at the exchange (as a rule, this is CEGH, the closest and most liquid virtual gas trading hub), through the daughter-company registered and licensed in HR, the BiH trader can purchase gas directly at the Virtual Trading Point (VTP) in Croatia.

In this way, through bilateral sales contracts concluded with another gas trader registered and licensed in HR (and, in theory, with any other gas trader from an EU member state that has booked transmission capacities at one of the two above-mentioned interconnections, SI-HR or HU-HR), the BiH trader (through the daughter-company in HR) can purchase gas that is already in the Croatian transmission system. In that case, it will be sufficient to book exit capacity in HR at the future

[14] See conditions described on the website https://www.cegh.at/en/become-a-member/.

[15] This report will treat exit from HR separately from entry into BiH, because there is still no obligation to join capacities at interconnections between EU member states and Energy Community member states. If EU Directive rules on joining capacities become applicable to these interconnections in the meantime, subsequent versions of this report will further clarify and describe these changes.

Southern Interconnection to offtake gas (or, as described above, the gas is formally sold) into the BiH transmission system.

This way of trading, by purchase at VTP in HR, ensures the BiH trader will avoid all the trading risks at CEGH and the need to book capacities in all upstream transmission systems. Of course, the risk will be charged to the buyer in the Spread, i.e., the difference charged compared to the price of gas at the exchange, which makes up the final sales price of gas as defined by the formula in the bilateral agreement. See explanation in section 2.2.

Additionally, in this way, the gas trader daughter-company in HR owned by the BiH trader will have no influence over whether the gas was procured by the seller at CEGH, for example, or somewhere else outside HR, whether it was bought or produced in HR, whether the seller withdrew the gas from a UGS whose capacities it had booked, or whether the gas arrived from the LNG terminal following regasification. Sellers set the price; even if it is linked to a hub price (e.g., CEGH), there is always the Spread part of the price, which may differ from trader to trader. This means that two offers, set by the same formula and even using the same hub price, can have a different Spread amount, ultimately resulting in two different prices from which to choose. The buyer is not aware of the source of the gas or what the profit margins are; rather, the buyer choice is based on the best offer based on price and other conditions included in the offer (such as flexibility, ToP conditions, currency and/or exchange rate and terms of payment).

Variant 1.4 - Purchase of gas through the LNG terminal in HR and transmission through the HR-BiH Southern Interconnection

Given that the daughter-company from HR, owned by the BiH trader, is registered and licensed for gas trading, it can freely access all gas infrastructure in HR. This means that it can purchase LNG from an international trader (and, for example, with Cost, Insurance and Freight [CIF] parity, meaning that LNG will be delivered at the entry to the LNG terminal) and book regasification capacity of the Krk LNG terminal, including LNG cargo transfer, short-term storage, regasification and delivery into the gas transmission system.

In order to deliver gas to BiH, transmission capacity needs to be booked at the entry point to the HR transmission system from the LNG terminal, and at the exit point on the future HR-BiH Imotski Southern Interconnection. Subsequently, capacities in the BiH transmission system will need to be booked at the entry point of the HR-BiH Southern Interconnection at Posušje, and at all exits from the transmission system towards customers.

This enables the trader to trade, i.e., buy LNG directly from the world market and sell it following regasification in the HR market, as well as the BiH market. It should be noted that this is the most complicated and riskiest option for buying gas, as it requires substantial financial collateral and related risks and costs, and a lot of experience and knowledge in international LNG trading, which is specific and complicated. It also has the highest profit margins, i.e., the lowest input costs for the commodity (natural gas).

Variant 1.5 - Purchase of gas at the HR-BiH Southern Interconnection entry point in Posušje

This manner of purchasing natural gas is the simplest for a BiH trader wanting to offer gas in the BiH market. In this case, the trader's role is limited to booking capacity at the HR-BiH Southern Interconnection entry point into the BiH system in Posušje.

However, in this way, and as described above, the BiH trader is not aware of the source of gas or its cost for the seller, meaning that the profit margin achieved by the seller, contained in the total Spread price, is also unknown to the buyer. Consequently, this could mean that this would be the highest of all prices considered under Option 1, because all the risk, and therefore all the potential

profit, remains with the seller. However, in the free market the buyer can choose offers from different sellers.

Transmission variants are shown below in Figure 7.

Figure 7 - Overview of variants under Option 1 [16]

In conclusion, for the BiH trader, the highest profit, and therefore the lowest input price that can be achieved on the BiH market, comes with Variants 1.1, 1.2, and 1.4. On the other hand, it also carries the greatest exposure to risk (especially when buying LNG, as described under Variant 1.4, while variants 1.1 and 1.2 depend on the gas transmission tariffs in HU and SI).

The lowest risk, which, as expected, comes with a somewhat higher price of gas procurement, is found in Variant 1.5 – purchase at the entry point to BiH at the Southern Interconnection, while Variant 1.3 – purchase at VTP in HR, is a solution with an acceptable ratio of risk (registration and licensing of daughter-company in HR and booking of transmission capacity) to the possibility of negotiating with traders active in the gas market in HR.

[16] www.www.entsog.eu/maps#, diagram added by the author.

3.2 OPTION 2 – BIH TRADER CONTRACTS THE PURCHASE AND TRANSMISSION OF GAS THROUGH SRB

Currently, the only gas supply route for BiH is through the existing interconnection between SRB and BiH in Zvornik. This route also comes with all the limitations regarding the physical state and capacities of the existing interconnection pipeline Batajnica – Zvornik – Sarajevo – Zenica, as well as the Serbian transmission system[17].

A new eastern interconnection SRB-BiH is planned with the route Indjija – Macvanski Prnjavor – SRB/BiH border - Bijeljina - Banja Luka - Novi Grad, as defined by the "Agreement on the construction of the gas pipeline New Eastern Interconnection Republika Srpska / BiH and the Republic of SRB" signed between Srbijagas and Gas-Res in March 2021[18]. This project will enable additional gas supply to the BiH market by connecting to the Balkan Stream - a section of the Turkish Stream that enters SRB via Bulgaria and enables significant gas transit further to Hungary[19].

It should be noted that according to available information, the Bulgaria-SRB interconnection of the Balkan Stream pipeline was built and commissioned at the beginning of 2021[20], which transferred SRB's gas import from that direction; and from the beginning of April 2021, all gas imports to BiH through the existing interconnection with SRB were transferred to the Balkan branch of the Turkish Stream[21].

The extent to which all the above will affect the possibility of booking capacity at the entry to SRB at the interconnection with Hungary, including resolving SRB's dispute with the Energy Community for not allowing third-party access to the SRB-Hungary interconnection[22], will be addressed in future editions of this report.

However, for the purposes of this report, all variants will be examined theoretically where a BiH trader buys gas on the free market in the surrounding region and transports it through SRB to BiH. Therefore, investments in the construction of the New Eastern Interconnection have not been taken into account in the calculations.

Variant 2.1 - Purchase of gas at CEGH and transmission via AT-HU-SRB

As explained in section 3.1, a BiH trader can register and license a company for gas trading in an EU member state, allowing the trader to access CEGH and trading, i.e., purchasing gas in line with the principles described in section 2.2.

After that, capacity will need to be booked at the entry to the Austrian transmission system, as well as joint capacity at the AT-HU interconnection and exit capacity from Hungary towards SRB.

Assuming that it is possible to book capacity (i.e., to have booking capacity available) on the entry side of the interconnection in SRB[23], which would be done by a company owned by a BiH trader,

[17] See, explanations given in Report No. 2 – Options for Developing Interconnection Pipelines to Ensure Security of Supply in BiH, February 2019, USAID EIA.
[18] https://www.srbijagas.com/?p=11723.
[19] https://fgsz.hu/en/about-fgsz/news/developments-of-the-serbian-hungarian-gas-interconnector.html.
[20] https://portalnovosti.com/balkanski-put-plina.
[21] https://www.index.hr/vijesti/clanak/bih-od-danas-plin-dobiva-turskim-tokom-to-bi-moglo-dovesti-do-sankcija-sada/2265544.aspx.
[22] The Energy Community Secretariat opened a case ECS 13/17 against SRB in relation to the unjustified exclusion of the Horgoš entry point from unrestricted third-party access regime and from open capacity-allocation procedure (https://www.energy-community.org/legal/cases/2017/case1317RS.html).
[23] As far as is known for the observed period, it was not possible to book the capacity at the entry point in Serbia, i.e., there was no available capacity.

that company, according to the current rules on the operation of natural gas transmission system[24], point 9.3., needs to be registered with the Transmission System Operator (TSO) and the Business Register Agency in SRB in order to be able to book (i.e., access the system); then the gas would enter the transport system of SRB. The same company, registered in SRB, would then book exit capacity on the interconnection with BiH, and the BiH trader would book entry capacity on the BiH side of the interconnection and exit capacity towards customers, i.e., end consumers.

For this Variant, a BiH trader must set up a company in the EU for trading at CEGH, and a company in SRB to book interconnection capacities.

Variant 2.2 - Purchase of gas at VTP in HR and transmission via HR-HU-SRB

The above-mentioned daughter-company registered and licensed in an EU member state can purchase gas in the HR market, or at the Croatian transmission system VTP. Through the daughter-company, the BiH trader can trade with gas sellers that have portfolios of gas produced in HR, purchased at CEGH and/or the surrounding area, or from LNG sources.

Joint capacity at the HR-HU interconnection will need to be booked, as well as exit capacity from Hungary towards SRB.

The next step is the same as in the previous variant, where the other daughter-company registered and licensed in SRB books the entry capacity from Hungary and exit capacity towards BiH, while the BiH trader books entry and exit capacity in BiH.

Variant 2.3 - Purchase of gas at VTP in HU and transmission via HU-SRB

The next possibility available to the daughter-company registered and licensed in the EU is purchasing gas at the VTP in Hungary. Similar to Variant 2.2, it can be assumed that the Hungarian gas trader has a gas portfolio with a mix of gas produced in Hungary, or bought in surrounding markets (CEGH, HR, and Romania), as well as gas from LNG sources (two Hungarian companies, MET and MVM, have booked capacities at the Krk LNG terminal through their Croatian daughter-companies).

Capacity will then have to be booked at the exit from Hungary at the interconnection with SRB, as well as entry and exit capacity by the other daughter-company registered and licensed in SRB, while the BiH trader will book entry capacity at the interconnection with SRB and exit capacity to customers.

For this Variant, a BiH trader must set up a company in the EU, for trading at VTP in HU, and a company in SRB to book interconnection capacities.

Variant 2.4 - Purchase of gas in SRB and transmission via SRB-BiH

For the purposes of this report, we have included a theoretical variant of purchasing gas in the Serbian market and booking exit capacity at the SRB-BiH interconnection, which would be done by the daughter-company registered and licensed in SRB.

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[24] JP Srbijagas, Rules on the operation of natural gas transmission system July 10, 2013, http://www.transportgas-srbija.rs/wp-content/uploads/2013-08-16-Pravila-rada-TS-PrGas-SG-74-2013.pdf
Decision on amendments to the rules on the operation of the natural gas transmission system - ("Official Gazette of RS" No. 14/14) http://www.transportgas-srbija.rs/wp-content/uploads/2014-02-15-Pravila-rada-TS-PG-Srbijagas-izmena-SG-14-14.pdf,
Decision on amendments to the rules on the operation of the natural gas transmission system - this decision was published on the Agency's website on 30.01.2015. http://www.transportgas-srbija.rs/wp-content/uploads/2015-01-30-pravila-o-radu-transport-Izmena-i-dopuna-Srbijagas.pdf.

In a further step, the BiH trader will book entry capacity at the interconnection with SRB on the BiH side, as well as exit capacities to customers.

Variant 2.5 – Purchase of gas at the entry of the SRB-BiH interconnection (existing and/or New Eastern Interconnection)

Similar to the variant from the previous section, the BiH trader would book capacity at the entry to the BiH transmission system on the interconnection with SRB (sub-variants are possible at the existing and/or New Eastern Interconnection) and would conclude a sales contract for purchasing gas with a trader from SRB.

While this variant precludes upstream risk, it also precludes the opportunities of free trade, which means that all the risk is incorporated by the seller into the Spread. As a result, this variant is likely to have the highest gas price.

Figure 8 shows the transmission routes for Option 2 of gas procurement for BiH.

Figure 8 - Overview of variants under Option 2 [25]

In conclusion, the option of procuring new quantities of gas for the BiH market through SRB is unlikely to be realistically feasible. The biggest obstacles are the current impossibility of booking

[25] *Op. cit., fn. 9.*

capacity at the entry to SRB from the interconnection with Hungary and the limited capacity at the existing SRB-BiH interconnection.

However, for the purposes of this report, and hypothetically assuming that all variants in this section would be feasible, we can draw conclusions similar to those in section 3.1. The most profitable variant, and therefore with possibly the lowest price in the BiH market, is variant 2.1 – purchase at CEGH and transmission via AT-HU-SRB. However, it also carries the most risk for the BiH trader and the need to establish no less than two daughter-companies, one in an EU member state and one in SRB.

Variants 2.2 and 2.3, which involve purchase of gas in the Croatian and Hungarian markets, provide sufficient opportunity for negotiation with gas traders operating in the Croatian and Hungarian markets who can be expected to have wide-ranging gas portfolios to meet the needs of traders from BiH. However, the BiH trader would take on the risk of transmission capacity booking logistics through daughter-companies in an EU member state and in SRB, but with a relatively favorable expected price on the BiH market.

Finally, the last two variants, 2.4 and 2.5, carry the least risk for the BiH trader, but limit access to the market and choice of better offers, which also means that the highest prices of gas can be expected, in comparison to other variants from Option 2.

4. EXAMPLES OF GAS PRICE CALCULATIONS FOR DIFFERENT SUPPLY SCENARIOS FOR BIH

Given below are calculations of gas prices up to entry into BiH, specifically, prices at (i) the exit from HR (when gas is purchased at VTP Croatia [but the source of gas is CEGH, with transit via Austria and Slovenia] and exit from HR is booked at interconnections in line with published tariffs, and (ii) at the exit from SRB, where the source is also CEGH, but transit is through Austria, Hungary, and SRB. Hypothetical costs for transmission within BiH for multiple scenarios were added to the prices at the entry to BiH. The results are the end price for the variant of procuring gas via HR with one and two entry-exit zones; procurement via SRB with one and two entry-exit zones; and finally, the variant where FBiH is supplied via HR and RS is supplied via SRB.

The following input data and assumptions were used:

- The period taken for the initial analysis was the gas year 2018 – 2019, which covers the period from October 1, 2018, at 6 a.m. to October 1, 2019, at 6 a.m. The gas year was also used for booking gas transmission and transit.
- The consumption profile, or, more precisely, consumption per month in the observed period and maximum daily consumption in each month at the level of the whole of BiH, was approximated based on the Sarajevogas curve and estimated total gas consumption in BiH of 206 million Sm³, which can be found in the table below.

Table 1 - Consumption Profile for Gas Year 2018 – 2019 - Sarajevogas

Period	2018.			2019.							
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
MWh	82,186	151,472	253,754	274,086	205,315	153,584	92,968	70,663	21,056	18,898	18,263	22,285
Max MWh/day	4,936	8,551	9,930	11,203	8,949	7,281	4,951	5,460	1,189	695	650	1,034

Total: 1,364,531 MWh

Period	2018.		
	Oct	Nov	Dec
Sm³	8,682,691	16,002,588	26,808,500
Max Sm³/day	521,521	903,384	1,049,074

Period	2019.								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Sm³	28,956,507	21,690,969	16,225,805	9,821,817	7,465,324	2,224,561	1,996,576	1,929,488	2,354,404
Max Sm³/day	1,183,527	945,396	769,263	523,071	576,851	125,641	73,455	68,639	109,265

Total: 144,159,231 Sm³

Table 2 - Estimated consumption Profile for Gas Year 2018 – 2019 - BiH

Period	2018.			2019.							
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
MWh	117,441	216,449	362,609	391,662	293,390	219,468	132,849	100,975	30,089	27,005	26,098	31,845
Max MWh/day	7,054	12,219	14,190	16,008	12,787	10,405	7,075	7,802	1,699	994	928	1,478

Total: 1,949,882 MWh

Period	2018.		
	Oct	Nov	Dec
Sm³	12,407,352	22,867,305	38,308,688
Max Sm³/day	745,241	1,290,913	1,499,100

Period	2019.								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Sm³	41,378,137	30,995,863	23,186,277	14,035,135	10,667,765	3,178,843	2,853,059	2,757,191	3,364,385
Max Sm³/day	1,691,231	1,350,947	1,099,258	747,455	824,307	179,539	104,966	98,083	156,136

Total: 206,000,000 Sm³

- It should be noted that the above is an approximation and differs from the actual consumption profile (because of industry consumers using gas for technological processes, in addition to heating), but in the absence of data needed at the level of the whole system, this approximation was used to develop comparisons of possible scenarios. The lower heating value used for calculation was 1 Sm³ = 9.465444 kWh.
- Customers were treated as separate, and the price was calculated for the individual profile, without optimization (in the sense of being part of a larger portfolio of a trader and possibly subject to the portfolio effect).
- The CEGH in Austria was used as the source of gas since it is the gas hub of primary relevance for this region.
- Transit capacity booking was based on the month with the highest daily consumption, specifically January 2019, when it amounted to 16,008 MWh or 1,691,231 Sm³.
- Optimizing transmission (or transit) capacity booking was developed as an additional scenario. When booking transmission capacity on an annual basis (meaning for the gas year), it is possible to book lower capacity than what would be needed with peak daily consumption, and then buy additional quarterly and/or monthly capacity as needed to keep transmission costs to a minimum. This manner of booking means that pipeline capacity will be optimally used and lowers the costs. It is, therefore, recommended to always optimize capacity booking, as this can result in significant savings.
- The average price of gas was calculated based on the following formula:

$$P_n = (CEGHIX\text{-}AA_n + Spread) \times 1.1$$ [EUR/MWh (NCV)]

Where:

P_n	Natural gas price in month "n" [EUR/MWh (NCV)]
CEGHIX-AA_n	Arithmetic mean of all CEGHIX (Day-Ahead) prices in month "n" [EUR/MWh (GCV)]
Spread	Costs of system services (transit/transmission, storage, risk premiums, trader's margin) [EUR/MWh (GCV)]
1.1	Coefficient for conversion of GCV (25/0°C) into NCV (15/15°C)

GCV denotes Gross Calorific Value (higher heating value), while NCV denotes Net Calorific Value (lower heating value).

The calculated prices for all 12 months of the gas year are multiplied with the corresponding monthly consumption values, and then the total costs of gas are divided by the total quantity of gas, thus arriving at the "equivalent average fixed price" for the entire period.

- For the sake of comparison, estimated prices were calculated in USD/1,000 Sm^3 (and rounded to the nearest whole number), with the following assumptions: $1m^3$ = 9.465444 kWh, 1 EUR = 1.119 USD (annual average for 2019, whereas average exchange rates for each month of the gas year would apply, so this amount is approximate).

4.1 CALCULATION FOR THE GAS YEAR 2018-2019

4.1.1 GAS PRICE AT THE EXIT FROM HR FOR THE GAS YEAR 2018-2019

The price of natural gas at the virtual trading point in Croatia (VTP Croatia) was calculated, and the exit price from HR at interconnections was based on published tariffs.

The results were as follows:

Spread amounts:

a) Spread = 5.819 EUR/MWh (GCV) – with transit capacity booking based on highest daily consumption month
b) Spread = 4.623 EUR/MWh (GCV) – with optimized transit capacity booking

The difference in Spread amounts is due to the difference in transmission costs (or tariffs) to VTP Croatia in the total Spread amount: transmission (i.e., transit) costs to VTP Croatia account for close to 85% when capacity is booked, based on the highest daily consumption month, whereas they account for 81% of the total Spread in the case of optimizing a transmission transit capacity booking.

The total price of gas at VTP Croatia (already expressed in NCV) is:

a) 29.483 EUR/MWh (NCV) (312.28 USD/1,000 Sm^3 (NCV)) – with transit capacity booking based on highest daily consumption month
b) 28.155 EUR/MWh (NCV) (298.21 USD/1,000 Sm^3 (NCV)) – with optimized transit capacity booking

The above price at VTP Croatia for this customer, i.e., this profile, can also be expected when the source of the gas is not CEGH but LNG Krk; otherwise the price may be somewhat lower. Namely, a trader sourcing gas from LNG Krk will not sell that gas at VTP Croatia on a cost-plus basis but based on parity with CEGH as the source. In other words, he will calculate the possible price for the customer with CEGH as the source and the transmission through the pipelines, then offer a

somewhat lower price to get the contract (therefore, the CEGH source price remains the main reference).

The price at the exit from HR was also calculated. **It should be noted that transmission tariffs for the exit from HR at that time were exceptionally high**. Today, transport tariffs have been reduced and the methodology is harmonized with the methodologies of the European Union so that the tariff for exit from HR from January 1, 2021, is equal to the exit tariff in HR.

In the observed period, the price at the exit point from HR at the interconnection is:

a) 29.483 (gas at VTP Croatia) + 6.058 (exit HR) = 35.541 EUR/MWh (NCV) (376,44 USD/1,000 Sm^3 (NCV)) – with transmission booking in HR based on highest daily consumption month
b) 28.155 (gas at VTP Croatia) + 4.702 (exit HR) = 32.857 EUR/MWh (NCV) (348.02 USD/1,000 Sm^3 (NCV)) – with optimized transmission booking in HR

Therefore, by optimizing transmission, for this profile, at VTP Croatia about 2.6 million EUR could be saved ((29.483-28.155) EUR/MWh x 1.949.882 MWh = 2.6 million EUR). Optimization of transmission would also result in lower exit tariffs from HR (4.702 vs 6.058 EUR/MWh). Total savings through optimization are then 5.2 million EUR ((35.541-32.857) EUR/MWh x 1.949.882 MWh = 5.2 million EUR).

As mentioned earlier, from January 1, 2021, HR has been applying the new Methodology for determining gas transmission tariff rates in HR, which has led to the establishment of uniform rules at the EU level on the method of determining and structuring gas transportation tariffs. New tariffs, calculated according to the new methodology, are also in use.

Given below are few descriptions of provisions that indicate a decreasing trend in transmission tariffs (both for exits in HR and exits from HR).

a) The new Methodology determines the framework based on which HERA analyzes the cost-efficiency of existing material assets of the operator, considering the indicator for transmission system capacity usage in order to determine the approved share of regulated assets. The proposed indicator for transmission system capacity usage for the years in the regulated period is the ratio of planned maximum transmission system exit capacity usage and total technical transmission system exit capacity is applied. These provisions enable the regulated assets to include the approved portion of the transmission system operator's realized investments from previous periods when rules for expanded capacity were not applied in a way that was aligned with expressed market demand, but that were shown in time to not generate expected or sufficient interest. Therefore, this approach corrects the possibility for transmission system users bearing the costs of such investments and unused assets. Without applying this approach, if the full value of assets were to be recognized even though the expected economic benefit is not derived from them, transmission tariffs in HR would be among the highest in the EU. This would negatively impact the competitiveness of the Croatian transmission system, as well as that of linked gas infrastructure.
b) The new Methodology removed previous commodity charges, so that the approved revenue of the operator is collected exclusively based on booked transmission system capacity. This further increases the importance of proper planning and optimization of transmission system capacity booking.
c) The new Methodology equalizes the exit tariff rates at the interconnection and exit tariff rates in HR. This is of particular importance. Namely, while the measure under point A above foresees reducing the overall transmission tariff, this measure eliminates with the disproportionate relationship between the exit tariff within HR and the exit tariff from HR.

Therefore, according to the above, there is a significant reduction of the tariff for exit from HR starting in 2021 compared to the previous one. On December 28, 2020, HERA adopted a new Decision on the number of tariffs for gas transport for the years of the third regulatory period (2021-2025). Regular periodic amendments to this report in the upcoming period will include new transmission price and cost calculations in line with the newly set tariffs.

As opposed to elements to reduce the tariff, the new methodology introduces an additional transmission cost element, specifically the security of supply charge. Namely, the Liquefied Natural Gas Terminal Act stipulates that HERA can determine the amount and manner of collection of a charge for security of natural gas supply in HR that will benefit the implementation of the Krk LNG terminal project. HERA determines the amount of the security of supply charge based on the application of the transmission system operator, which is in turn based on the LNG terminal operator's proposal in the event of lower LNG terminal capacity booking than planned, or lower expected revenues of the LNG terminal operator than the planned approved revenues as set by HERA's decision.

The current capacity booking at the LNG terminal on the island of Krk indicates that there will be no need to activate the charge. Namely, booking 1.1 billion m³ per year is the minimum to make the terminal economically viable, but the existing terminal capacity is fully leased by the gas year 2036 - 2037.

4.1.2 GAS PRICE AT THE EXIT POINT FROM SRB FOR THE GAS YEAR 2018-2019

The CEGH gas hub was again taken as the source, with transit via Austria and Hungary. The transit costs included in the Spread refer to costs at the exit from Hungary, or up to entry into SRB. Based on this Spread calculation, the formula given in the introduction was used to calculate the "equivalent average fixed price" for the entire observed period. Costs of transit through SRB (with the assumption that entry and exit in SRB could be booked, i.e., that sufficient capacity would be available for a third party) were added to this price to calculate the total price of natural gas at the exit from SRB towards BiH.

The results were as follows:

Spread amounts:

a) Spread = 4.832 EUR/MWh (GCV) – with transit capacity booking based on highest daily consumption month
b) Spread = 3.082 EUR/MWh (GCV) – with optimized transit capacity booking

In the total Spread amount, transmission (i.e., transit) costs including exit from Hungary account for close to 81% when capacity is booked based on the highest daily consumption month, whereas they account for 71% of the total Spread in the case of optimizing transmission (i.e., transit) capacity booking.

The total price of gas at the exit from Hungary, i.e., up to entry into SRB (already expressed in NCV) is:

a) 28.387 EUR/MWh (NCV) (300.67 USD/1,000 Sm³ (NCV)) – with transit capacity booking based on the highest daily consumption month
b) 26.445 EUR/MWh (NCV) (280.10 USD/1,000 Sm³ (NCV)) – with optimized transit capacity booking

As previously stated, the price of natural gas at the exit from SRB, i.e., up to entry into BiH was also calculated. The costs of transport (i.e., transit) through SRB are calculated according to the current

valid and available tariffs for access to the natural gas transport system from 2015[26]. The calculation itself has been verified by using the tariff calculator published on the Transportgas Serbia Novi Sad's website[27].

The price at the exit from SRB, given all of the above assumptions, is:

a) 28.387 (gas at the exit from Hungary, i.e., entry into SRB) + 6.048 (transit through SRB) = 34.435 EUR/MWh (NCV) (364.73 USD/1,000 Sm^3 (NCV)) – with transit capacity booking based on highest daily consumption month
b) 26.445 (gas at the exit from Hungary, i.e., entry into SRB) + 3.773 (transit through SRB) = 30.218 EUR/MWh (NCV) (320.06 USD/1,000 Sm^3 (NCV)) – with optimized transit capacity booking.

Therefore, it follows that by optimizing transmission, this profile stands to save around 3.8 million EUR at the exit from Hungary, or up to as much as 8.2 million EUR at the exit from SRB.

4.1.3 GAS PRICES DEPENDING ON THE SUPPLY ROUTE FOR THE GAS YEAR 2018-2019

In order to compare gas purchase prices at the exit from the transmission system for Sarajevogas from different supply routes, the transmission network tariffs (gas transport cost) in BiH had to be calculated. For that purpose, an Excel-based software application has been developed – the Transportation Tariff Tool. The Transportation Tariff Tool calculates the tariff for each transmission network user based on the overall transmission network characteristics and the capacity and consumption of the user. The tariffs are collected from network users to cover the costs incurred by the three (3) TSOs in BiH (BH Gas, Sarajevogas Istocno Sarajevo and Gas Promet).

The Transportation Tariff Tool can calculate network tariffs for two different options:

- BiH as one entry-exit zone
- BiH as two entry-exit zones: FBiH and RS

In the case of one entry-exit zone, the cost of all three (3) TSOs are distributed among all network users in BiH. In the case of two entry-exit zones, the network costs of the two TSOs in RS are only distributed among network users in the RS, and the network costs of the one TSO in FBiH are distributed among network users in the FBiH (more information on transmission network tariffs can be found in USAID EIA Report on Gas Transportation Network Tariffs, September 2019).

The Transportation Tariff Tool calculates tariffs based on a firm annual capacity booking.

In the table below, the second column displays the cost of gas transmission in BiH for Sarajevogas as calculated by the Transportation Tariff Tool and includes the Southern Interconnection investment. This analysis was conducted as a case study for Sarajevogas.

The third column displays the prices of gas up to entry into BiH that were shown in the previous two sections, but converted into BAM/Sm^3. It should be noted again that the prices of gas depend significantly on the consumption curve, i.e., on monthly offtake quantities. Furthermore, this price of gas, does not account for trader portfolio optimization either at VTP Croatia or at the SRB border, so it is reasonable to expect this price to be somewhat lower. The fourth column is the sum of columns 2 and 3.

[26] "Decision on the price of access to the natural gas transport system," January 26, 2015, PE "Srbijagas."
[27] http://www.transportgas-srbija.rs/sr/za-korisnike/kalkulator-za-zakup-kapaciteta/.

Table 3 – Gas prices for Sarajevogas (max booked cap.) for 2018-2019

Scenarios	Transmission cost for Sarajevogas (entry + exit + quantity charge within BiH) BAM/Sm³	Price of gas up to entry into BiH BAM/Sm³	Total purchase price of gas for Sarajevogas BAM/Sm³
1	*2*	*3*	*4=2+3*
1. Purchase price for Sarajevogas from Aug 1, 2017 to Apr 30, 2019 from May 1, 2019 to Dec 31, 2019 *Weighted average price for the gas year 2018-2019*[28]			0.4950 0.6400 0.5110
2. Procurement of gas via HR – single entry-exit zone for entire BiH	0.0784	0.6580	0.7364
3. Procurement of gas via HR – two entry-exit zones (FBiH and RS)	0.0675	0.6580	0.7255
4. Procurement of gas via SRB – single entry-exit zone for entire BiH	0.0784	0.6375	0.7159
5. Procurement of gas via SRB – two entry-exit zones (FBiH and RS)	0.1138	0.6375	0.7513
6. FBiH supplied via HR, and RS via two entry-exit zones (FBiH and RS)	0.0887	0.6580	0.7467

When considering procurement of gas via HR – single entry-exit zone for entire BiH and via HR – two entry-exit zones (FBiH and RS), then the price of gas at the entry point to BiH is the same for both cases, as described in section 4.1.1; but transmission costs within BiH are different.

When considering procurement of gas via SRB – single entry-exit zone for entire BiH and via SRB – two entry-exit zones (FBiH and RS), then the price of gas at the entry point to BiH is the same for both cases, as described in section 4.1.2; but transmission costs within BiH are different.

When considering the supply of FBiH via HR and RS via two entry-exit zones (FBiH and RS), then the gas price for FBiH was the one calculated in section 4.1.1.

For the sake of comparison, transmission costs within BiH via SRB without investment into the Southern Interconnection and the purchase price of gas for Sarajevogas for the same period are also shown.

[28] The weighted average price was calculated based on the consumption profile, on which the price and the cost of transport were determined.

Table 4 - Gas prices for Sarajevogas (max booked cap.) for 2018-2019 (no South I.)

Scenarios	Transmission cost for Sarajevogas (entry + exit + quantity charge within BiH) BAM/Sm³	Price of gas up to entry into BiH BAM/Sm³	Total purchase price of gas for Sarajevogas BAM/Sm³
1	*2*	*3*	*4=2+3*
Purchase price for Sarajevogas from Aug 1, 2017 to Apr 30, 2019 from May 1, 2019 to Dec 31, 2019 *Weighted average price for the gas year 2018-2019*			0.4950 0.6400 0.5110
Procurement of gas via SRB – single entry-exit zone for entire BiH	0.0461	0.6375	0.6836
Procurement of gas via SRB – two entry-exit zones (FBiH and RS)	0.0713	0.6375	0.7088

Error! Reference source not found. below displays a comparison of the purchase price (at the entry to BiH), including investment in the Southern Interconnection, for Sarajevogas if transmission capacity were optimized up to entry into BiH. The data for gas transmission within BiH is the same as in **Error! Reference source not found.** and are based on firm annual capacity booking in BiH, and not on optimization of transport capacity used. In other words, the calculation of transport costs in BiH is based only on the annual booking of maximum quantities and the option of quarterly, monthly, and daily booking was not used. Data in column 3 was taken from analyses in sections 4.1.1 and 4.1.2 and converted into BAM/Sm³.

Table 5 - Gas prices for Sarajevogas (optimized booked cap.) for 2018-2019

Scenarios	Transmission cost for Sarajevogas (entry + exit + quantity charge within BiH) BAM/Sm³	Price of gas up to entry into BiH with optimized transmission capacity BAM/Sm³	Total purchase price of gas for Sarajevogas BAM/Sm³
1	*2*	*3*	*4=2+3*

1. Purchase price for Sarajevogas from Aug 1, 2017 to Apr 30, 2019 from May 1, 2019 to Dec 31, 2019 *Weighted average price for the gas year 2018-2019*			0.4950 0.6400 0,5110
2. Procurement of gas via HR – single entry-exit zone for entire BiH	0.0784	0.6083	0.6867
3. Procurement of gas via HR – two entry-exit zones (FBiH and RS)	0.0675	0.6083	0.6758
4. Procurement of gas via SRB – single entry-exit zone for entire BiH	0.0784	0.5577	0.6361
5. Procurement of gas via SRB – two entry-exit zones (FBiH and RS)	0.1138	0.5577	0.6715
6. FBiH supplied via HR, and RS via two entry-exit zones (FBiH and RS)	0.0887	0.6083	0.6970

As in the previous example, given below is the cost of transmission within BiH via SRB without the Southern Interconnection investment, and the purchase price of gas for Sarajevogas that includes optimized transmission capacity up to entry into BiH for the same period.

Table 6 - Gas prices for Sarajevogas (optimized booked cap.) for 2018-2019 (no South I.)

Scenarios	**Transmission cost for Sarajevogas (entry + exit + quantity charge within BiH) BAM/Sm^3**	**Price of gas up to entry into BiH with optimized transmission capacity BAM/Sm^3**	**Total purchase price of gas for Sarajevogas BAM/Sm^3**
1	***2***	***3***	***4=2+3***
Purchase price for Sarajevogas from Aug 1, 2017 to Apr 30, 2019 from May 1, 2019 to Dec 31, 2019 *Weighted average price for the gas year 2018-2019*			0.4950 0.6400 0,5110
Procurement of gas via SRB – single entry-exit zone for entire BiH	0.0461	0.5577	0.6038

Procurement of gas via SRB – two entry-exit zones (FBiH and RS)	0.0713	0.5577	0.6290

4.2 CALCULATION FOR THE GAS YEAR 2019–2020

The calculation for the gas year 2019-2020 was made for the same options for which the calculation for the gas year 2018-2019 was made, with the same basic input data or assumptions. The following additional assumptions were also used in this case:

- For gas year 2019-2020, the same consumption profile as gas year 2018-2019 was used. The booking of transit capacity is based on the month with the highest daily consumption is (specifically, the consumption value for the month of January 2019 is also assumed for the month of January 2020). In this way, it is possible to monitor price trends depending solely on price movements at the CEGH gas hub and the amount of (regulated) tariffs for system services, i.e., in such a way that the results obtained are mutually comparable.
- For comparison, in this case, the approximate amounts of prices in USD / 1,000 Sm^3 (and rounded to the nearest whole number) were calculated with the following assumptions: 1 m^3 = 9, 465444 kWh, 1 EUR = 1.1395 USD (annual average for 2020; however, one should look at average exchange rates by months of gas years, so this price in USD/1,000Sm^3 is an approximation).

4.2.1 GAS PRICE AT THE EXIT FROM HR FOR THE GAS YEAR 2019-2020

In this case, the price of natural gas was calculated at the virtual trading point in Croatia (VTP - Croatia) and the exit from HR at the interconnections according to the published tariffs.

The results obtained are as follows:

> Spread amounts to:
> a) Spread = 5.364 EUR / MWh (GCV) – with booking of transit capacity based on the month with the highest daily consumption; or
> b) Spread = 4.257 EUR / MWh (GCV) - with optimization of booked transit capacity

In the total amount of Spread, the costs of transport (i.e., transit) to VTP Croatia amount to approximately 83% in the case of capacity booking according to the month with the highest daily consumption, or 79% in the case of optimizing transport (i.e., transit) capacity in its booking.

The total gas price at VTP Croatia (already expressed in NCV) is:

> a) 18,393 EUR / MWh (NCV) (198,38 USD / 1,000 Sm^3 (NCV)) - with booking of transit capacity according to the month with the highest daily consumption; and
>
> b) 17,164 EUR / MWh (NCV) (185.13 USD / 1,000 Sm^3 (NCV)) - with optimization of booked transit capacity.

Transport tariffs for exit from HR are declining and are lower than in the gas year 2018-2019; and, with the new methodology for determining the number of tariffs for gas transport in HR from January 1, 2021, transport tariffs for exits from HR and transport tariffs for exits in HR are equal, as already mentioned in Chapter 4.1.

The price at the exit from HR at the interconnection in the analyzed period is:

a) 18,393 (gas on VTP HR) + 4,924 (exit HR) = 23,317 EUR / MWh (NCV) (251.49 USD / 1,000 Sm³ (NCV)) - with booking and transport in HR according to the month with the highest daily consumption.

b) 17,164 (gas on VTP HR) + 3,783 (exit HR) = 20,947 EUR / MWh (NCV) (225.93 USD / 1,000 Sm³ (NCV)) - with optimization of booked transport capacity in HR.

By optimizing booking of transport capacity, about 2.4 million EUR can be saved for VTP Croatia (18,393 - 17,164) EUR / MWh x 1,949,882 MWh = 2.4 million EUR for this profile. Optimizing transport would also result in lower exit tariffs from HR (3,783 instead of 4,924 EUR / MWh). Total savings by optimizing transport are as much as 4.6 million EUR (23,317 - 20,947) EUR / MWh x 1,949,882 MWh = 4.6 million EUR).

4.2.2 GAS PRICE AT THE EXIT FROM SRB FOR THE GAS YEAR 2019-2020

In this case, the CEGH gas hub, with transit through Austria and Hungary, is also envisaged as a source of gas supply. The transit costs included in the Spread refer to the costs at the exit from Hungary, i.e., to the entrance to SRB. Based on the Spread thus calculated, using the formula given in the introduction, an "equivalent average fixed price" was calculated for the entire observed period. The costs of transit through SRB were added to the calculated price (assuming that it was possible to book entry and exit in SRB, i.e., that there is enough capacity for a third party) to obtain the total price of natural gas at the exit from SRB to BiH.

The results obtained are as follows:

Spread amounts to:
a) Spread = 3,027 EUR / MWh (GCV) - with booking of transit capacity according to the month with the highest daily consumption
b) Spread = 2,091 EUR / MWh (GCV) - with optimization of booked transit capacity

In the total amount of Spread, transport costs (i.e., transit) including exit from Hungary amount to approximately 70% in case of capacity booking according to the month with the highest daily consumption, or 57% in case of optimization of transport (i.e., transit) capacity in its booking.

The total price of gas at the exit from Hungary or at the entrance to SRB (already expressed in NCV) is:

a) 15,799 EUR / MWh (NCV) (170.41 USD / 1,000 Sm³ (NCV)) - with booking of transit capacity according to the month with the highest daily consumption; or
b) 14,760 EUR / MWh (NCV) (159.20 USD / 1,000 Sm³ (NCV)) - with optimization of booked transit capacity.

As previously stated, in this case as well, the price of natural gas at the exit from SRB, i.e., to the entrance to BiH, was calculated. The costs of transport (i.e., transit) through SRB are calculated according to the current valid and available tariffs for access to the natural gas transport system from 2015[29]. The calculation itself has been verified by comparing it with the result obtained by using the tariff calculator published on Transportgas Serbia Novi Sad's website.[30]

The price at the exit from SRB, with all of the above assumptions, is:

[29] "Decision on the price of access to the natural gas transport system" of January 26, 2015, PE "Srbijagas."
[30] http://www.transportgas-srbija.rs/sr/za-korisnike/kalkulator-za-zakup-kapaciteta/.

a) 15,799 (gas at the exit from Hungary or at the entrance to SRB) + 6,097 (transit through SRB) = 21,896 EUR / MWh (NCV) (236.17 USD / 1,000 Sm³ (NCV)) - with booking of transit according to the month with the highest daily consumption
b) 14,760 (gas at the exit from Hungary or at the entrance to SRB) + 3,801 (transit through SRB) = 18,561 EUR / MWh (NCV) (200.19 USD / 1,000 Sm³ (NCV)) - with optimization of booked transit capacity.

Therefore, by optimizing the booking of transport capacity, about 2.0 million EUR can be saved for this profile at the exit of Hungary, i.e., a total of 4.5 million EUR at the exit from SRB.

4.2.3 GAS PRICES DEPENDING ON THE SUPPLY ROUTE FOR THE GAS YEAR 2019-2020

Chapter 4.1.3 presented gas year 2018-2019's purchase price of gas for the entry to BiH for Sarajevogas from different supply routes, while this chapter gives the same overview for all scenarios for the gas year 2019-2020.

The second column of table below shows the cost of gas transport in BiH for Sarajevogas, which was calculated using the Transport Tariff Tool and includes the Southern Interconnection investment. The analysis was conducted as a case study for Sarajevogas.

The third column shows the gas prices until entry to BiH, which were shown in the previous two sections, but converted into BAM/Sm³. The price of gas, as mentioned earlier, does not consider the optimization of the portfolio of traders neither on VTP Croatia nor on the border with SRB, so it is reasonable to expect a slightly lower price than the one stated here. The fourth column is the sum of columns 2 and 3.

Table 7 - Gas prices for Sarajevogas (max booked cap.) for 2019-2020

Scenarios	Transmission cost for Sarajevogas (entry + exit + quantity charge within BiH) BAM/Sm³	Price of gas up to entry into BiH BAM/Sm³	Total purchase price of gas for Sarajevogas BAM/Sm³
1	*2*	*3*	*4=2+3*
1. Purchase price for Sarajevogas from May 1, 2019 to Dec 31, 2019 from Jan 1, 2020 to Apr 30, 2020 from May 1, 2020 to Dec 31, 2020 *Weighted average price for the gas year 2019-2020*			0.6400 0.5850 0.5700 0.6030
2. Procurement of gas via HR – single entry-exit zone for entire BiH	0.0784	0.4317	0.5101
3. Procurement of gas via HR – two entry-exit zones (FBiH and RS)	0.0675	0,4317	0.4992
4. Procurement of gas via SRB – single entry-exit zone for entire BiH	0.0784	0.4054	0.4838

5. Procurement of gas via SRB – two entry-exit zones (FBiH and RS)	0.1138	0.4054	0.5192
6. FBiH supplied via HR, and RS via two entry-exit zones (FBiH and RS)	0.0887	0.4317	0.5204

For the case of gas supply through HR - whole BiH one entry-exit zone and the case of gas supply through HR - two entry-exit zones (FBiH and RS), the price of gas on the entry to BiH is the same for both cases and is described in chapter 4.2.1, while transport costs are different within BiH.

For the case of gas supply through SRB - whole BiH one entry-exit zone and the case of gas supply through SRB - two entry-exit zones (FBiH and RS), the price of gas on the entry to BiH is the same and is described in chapter 4.2.2, while transport costs are different within BiH.

If FBiH was supplied through HR and the RS through two entry-exit zones (FBiH and RS), then in this case the gas price calculated in Chapter 4.2.1 would be taken for FBiH.

For comparison, the cost of transport within BiH through SRB without investment in the Southern interconnection is shown below, as well as the purchase price of gas for Sarajevogas in the mentioned period.

Table 8 - Gas prices for Sarajevogas (max booked cap.) for 2019-2020 (no South I.)

Scenarios	**Transmission cost for Sarajevogas (entry + exit + quantity charge within BiH) BAM/Sm³**	**Price of gas up to entry into BiH BAM/Sm³**	**Total purchase price of gas for Sarajevogas BAM/Sm³**
1	***2***	***3***	***4=2+3***
Purchase price for Sarajevogas from May 1, 2019 to Dec 31, 2019 from Jan 1, 2020 to Apr 30, 2020 from May 1, 2020 to Dec 31, 2020 *Weighted average price for the gas year 2019-2020*			0.6400 0.5850 0.5700 0.6030
Procurement of gas via SRB – single entry-exit zone for entire BiH	0.0461	0.4054	0.4515
Procurement of gas via SRB – two entry-exit zones (FBiH and RS)	0.0713	0.4054	0.4767

Table 9 below compares the purchase price of gas (at the entry to BiH) for Sarajevogas, including the investment in the Southern Interconnection, when the booking of transport capacity all the way to the entry to BiH would be optimized. Data related to gas transport within BiH are the same as in Table 3 and are based on the maximum booking of capacity within BiH, and not on the optimization of transport used. In other words, the calculation of transport costs in BiH is based only on the annual booking of maximum quantities and the option of quarterly, monthly and daily booking were not used. The data in column 3 are taken from the analyses shown in sections 4.2.1 and 4.2.2 and converted to BAM/Sm.³

Table 9 – Gas prices for Sarajevogas (optimized booked cap.) for 2019-2020

Scenarios	Transmission cost for Sarajevogas (entry + exit + quantity charge within BiH) BAM/Sm^3	Price of gas up to entry into BiH with optimized transmission capacity BAM/Sm^3	Total purchase price of gas for Sarajevogas BAM/Sm^3
1	*2*	*3*	*4=2+3*
1. Purchase price for Sarajevogas from May 1, 2019 to Dec 31, 2019 from Jan 1, 2020 to Apr 30, 2020 from May 1, 2020 to Dec 31, 2020 *Weighted average price for the gas year 2019-2020*			0.6400 0.5850 0.5700 0.6030
2. Procurement of gas via HR – single entry-exit zone for entire BiH	0.0784	0.3878	0.4662
3. Procurement of gas via HR – two entry-exit zones (FbiH and RS)	0.0675	0.3878	0.4553
4. Procurement of gas via SRB – single entry-exit zone for entire BiH	0.0784	0.3436	0.4220
5. Procurement of gas via SRB – two entry-exit zones (FbiH and RS)	0.1138	0.3436	0.4574
6. FbiH supplied via HR, and RS via two entry-exit zones (FbiH and RS)	0.0887	0.3878	0.4765

As in the previous case, the cost of transport within BiH when it comes to gas procurement through SRB without investment in the Southern Interconnection is shown below, as well as the purchase price of gas for Sarajevogas, which includes optimized transport capacity to BiH for the period.

Table 10 – Gas prices for Sarajevogas (optimized booked cap.) for 2019-2020 (no South I.)

Scenarios	Transmission cost for Sarajevogas (entry + exit + quantity charge within BiH) BAM/Sm^3	Price of gas up to entry into BiH with optimized transmission capacity BAM/Sm^3	Total purchase price of gas for Sarajevogas BAM/Sm^3
1	*2*	*3*	*4=2+3*
Purchase price for Sarajevogas from May 1, 2019 to Dec 31, 2019 from Jan 1, 2020 to Apr 30, 2020 from May 1, 2020 to Dec 31, 2020 *Weighted average price for the gas year 2019-2020*			0.6400 0.5850 0.5700 0.6030
Procurement of gas via SRB – single entry-exit zone for entire BiH	0.0461	0.3436	0.3897
Procurement of gas via SRB – two entry-exit zones (FbiH and RS)	0.0713	0.3436	0.4149

4.3 CALCULATION FOR THE GAS YEAR 2020-2021

The calculation for the gas year 2020-2021 was made for the same options for which the calculation for the gas year 2018-2019 was made, with the same basic input data or assumptions. The following additional assumptions were also used in this case:

- For gas year 2020-2021, the same consumption profile as gas year 2018-2019 was used. The booking of transit capacity is based on the month with the highest daily consumption is (specifically, the consumption value for the month of January 2019 is also assumed for the month of January 2021). In this way, it is possible to monitor price trends depending solely on price movements at the CEGH gas hub and the amount of (regulated) tariffs for system services, i.e., in such a way that the results obtained are mutually comparable.
- For comparison, in this case, the approximate amounts of prices in USD / 1,000 Sm^3 (and rounded to the nearest whole number) were calculated with the following assumptions: 1 m^3 = 9,465444 kWh, 1 EUR = 1.1824 USD (annual average for 2021; however, one should look at average exchange rates by months of gas years, so this price in USD/1,000Sm^3 is an approximation).

4.3.1 GAS PRICE AT THE EXIT FROM HR FOR THE GAS YEAR 2020-2021

In this case, the price of natural gas was calculated at VTP Croatia and the exit from HR at the interconnections according to the published tariffs.

The results obtained are as follows:

> Spread amounts to:
> a) Spread = 5,246 EUR / MWh (GCV) – with booking of transit capacity based on the month with the highest daily consumption; or
> b) Spread = 4,161 EUR / MWh (GCV) - with optimization of booked transit capacity

In the total amount of Spread, the costs of transport (i.e., transit) to VTP Croatia amount to approximately 83% in the case of capacity booking according to the month with the highest daily consumption, or 78% in the case of optimizing transport (i.e., transit) capacity in its booking.

The total gas price at VTP Croatia (already expressed in NCV) is:

> a) 26,623 EUR / MWh (NCV) (297.96 USD / 1,000 Sm^3 (NCV)) - with booking of transit capacity according to the month with the highest daily consumption; and
>
> b) 25,419 EUR / MWh (NCV) (284.49 USD / 1,000 Sm^3 (NCV)) - with optimization of booked transit capacity.

Transport tariffs for exit from HR are declining and are even two times lower than in the gas year 2019-2020, as a result of the introduction of the new methodology for determining the number of tariffs for gas transport in HR from January 1, 2021. With this methodology the transport tariffs for exits from HR and transport tariffs for exits in HR are equal, as already mentioned in Chapter 4.1.

The price at the exit from HR at the interconnection in the analyzed period is:

> a) 26,623 (gas on VTP HR) + 2,431 (exit HR) = 29,054 EUR / MWh (NCV) (325.17 USD / 1,000 Sm^3 (NCV)) - with booking and transport in HR according to the month with the highest daily consumption.

b) 25,419 (gas on VTP HR) + 1,999 (exit HR) = 27,418 EUR / MWh (NCV) (306.86 USD / 1,000 Sm³ (NCV)) - with optimization of booked transport capacity in HR.

By optimizing booking of transport capacity, about 2.3 million EUR can be saved for VTP Croatia (26,623 – 25,419) EUR / MWh x 1,949,882 MWh = 2.3 million EUR for this profile. Optimizing transport would also result in lower exit tariffs from HR (1,999 instead of 2,431 EUR / MWh). Total savings by optimizing transport are as much as 3.2 million EUR (29,054 – 27,418) EUR / MWh x 1,949,882 MWh = 3.2 million EUR).

4.3.2 GAS PRICE AT THE EXIT FROM SRB FOR THE GAS YEAR 2020-2021

In this case, the CEGH gas hub, with transit through Austria and Hungary, is also envisaged as a source of gas supply. The transit costs included in the Spread refer to the costs at the exit from Hungary, i.e., to the entrance to SRB. Based on this calculated Spread, using the formula given in the introduction, an "equivalent average fixed price" was calculated for the entire observed period. The costs of transit through SRB were added to the calculated price (assuming that it was possible to book entry and exit in SRB, i.e., that there is enough capacity for a third party) to obtain the total price of natural gas at the exit from SRB to BiH.

The results obtained are as follows:

Spread amounts to:
a) Spread = 2,864 EUR / MWh (GCV) - with booking of transit capacity according to the month with the highest daily consumption
b) Spread = 2,081 EUR / MWh (GCV) - with optimization of booked transit capacity

In the total amount of Spread, transport costs (i.e., transit) including exit from Hungary amount to approximately 69% in case of capacity booking according to the month with the highest daily consumption, or 57% in case of optimization of transport (i.e., transit) capacity in its booking.

The total price of gas at the exit from Hungary or at the entrance to SRB (already expressed in NCV) is:

a) 23,979 EUR / MWh (NCV) (268.37 USD / 1,000 Sm³ (NCV)) - with booking of transit capacity according to the month with the highest daily consumption; or
b) 23,110 EUR / MWh (NCV) (258.65 USD / 1,000 Sm³ (NCV)) - with optimization of booked transit capacity.

As previously stated, in this case as well, the price of natural gas at the exit from SRB, i.e., to the entrance to BiH, was calculated. For the period until July 1, 2021, the costs of transport (i.e., transit) through SRB are calculated according to the currently valid and available tariffs for access to the natural gas transport system from 2015[31], while for the period from July 1 to October 1, 2021, the costs were calculated according to the "Decision on the price of access to the natural gas transport system" from July 1, 2021[32]. The calculation itself has been verified by comparing it with the result obtained by using the tariff calculator published Transportgas Serbia Novi Sad's website[33].

With all the above assumptions, the price at the exit from SRB is:

[31] "Decision on the price of access to the natural gas transport system" of January 26, 2015, PE "Srbijagas."
[32] „Decision on the price of access to the natural gas transport system"Transportgas Srbija http://www.transportgas-srbija.rs/wp-content/uploads/Odluka-o-cenama-pristupa-sistemu-01.juli-2021.pdf
[33] http://www.transportgas-srbija.rs/sr/za-korisnike/kalkulator-za-zakup-kapaciteta/.

a) 23,979 (gas at the exit from Hungary or at the entrance to SRB) + 5,468 (transit through SRB) = 29,447 EUR / MWh (NCV) (329.57 USD / 1,000 Sm³ (NCV)) – with booking of transit according to the month with the highest daily consumption
b) 23,110 (gas at the exit from Hungary or at the entrance to SRB) + 3,735 (transit through SRB) = 26,845 EUR / MWh (NCV) (300.45 USD / 1,000 Sm³ (NCV)) – with optimization of booked transit capacity.

Therefore, by optimizing the booking of transport capacity, about 1.7 million EUR can be saved for this profile at the exit of Hungary, i.e., a total of 3.3 million EUR at the exit from SRB.

4.3.3 GAS PRICES DEPENDING ON THE SUPPLY ROUTE FOR THE GAS YEAR 2020-2021

Chapter 4.1.3 presented gas year 2018-2019's purchase price of gas for the entry to BiH for Sarajevogas from different supply routes and chapter 4.2.3 presented the same for all scenarios for gas year 2019-2020. This chapter provides the same overview for all scenarios for the year 2020-2021.

The second column of table below shows the cost of gas transport in BiH for Sarajevogas, which was calculated using the Transport Tariff Tool and includes the Southern Interconnection investment. The analysis was conducted as a case study for Sarajevogas.

The third column shows the gas prices until entry to BiH, which were shown in the previous two sections, but converted into BAM / Sm³. The price of gas, as mentioned earlier, does not consider the optimization of the portfolio of traders neither on VTP Croatia nor on the border with SRB, so it is reasonable to expect a slightly lower price than the one stated here. The fourth column is the sum of columns 2 and 3.

Table 11 - Gas prices for Sarajevogas (max booked cap.) for 2020-2021

Scenarios	Transmission cost for Sarajevogas (entry + exit + quantity charge within BiH) BAM/Sm³	Price of gas up to entry into BiH BAM/Sm³	Total purchase price of gas for Sarajevogas BAM/Sm³
1	*2*	*3*	*4=2+3*
1. Purchase price for Sarajevogas from May 1, 2020 to Dec 31, 2020 from Jan 1, 2021 to Dec 1, 2021 *Weighted average price for the gas year 2020-2021*			 0.5700 0.5250 0.5411
2. Procurement of gas via HR – single entry-exit zone for entire BiH	0.0784	0.5379	0.6163
3. Procurement of gas via HR – two entry-exit zones (FBiH and RS)	0.0675	0, 5379	0.6065
4. Procurement of gas via SRB – single entry-exit zone for entire BiH	0.0784	0.5451	0.6235
5. Procurement of gas via SRB – two entry-exit zones (FBiH and RS)	0.1138	0. 5451	0.6589
6. FBiH supplied via HR, and RS via two entry-exit zones (FBiH and RS)	0.0887	0.5379	0.6265

For the case of gas supply through HR - whole BiH one entry-exit zone and the case of gas supply through HR - two entry-exit zones (FBiH and RS), the price of gas on the entry to BiH is the same for both cases and is described in chapter 4.3.1, while transport costs are different within BiH.

For the case of gas supply through SRB - whole BiH one entry-exit zone and the case of gas supply through SRB - two entry-exit zones (FBiH and RS), the price of gas on the entry to BiH is the same and is described in chapter 4.3.2, while transport costs are different within BiH.

If FBiH was supplied through HR, and the RS through two entry-exit zones (FBiH and RS), then in this case the gas price calculated in Chapter 4.3.1 would be taken for FBiH.

For comparison, the cost of transport within BiH through SRB without investment in the Southern interconnection is shown below, as well as the purchase price of gas for Sarajevogas for the mentioned period.

Table 12 - Gas prices for Sarajevogas (max booked cap.) for 2020-2021 (no South I.)

Scenarios	**Transmission cost for Sarajevogas (entry + exit + quantity charge within BiH) BAM/Sm³**	**Price of gas up to entry into BiH BAM/Sm³**	**Total purchase price of gas for Sarajevogas BAM/Sm³**
1	***2***	***3***	***4=2+3***
1. Purchase price for Sarajevogas from May 1, 2020 to Dec 31, 2020 from Jan 1, 2021 to Dec 1, 2021 *Weighted average price for the gas year 2020-2021*			0.5700 0.5250 0.5411
Procurement of gas via SRB – single entry-exit zone for entire BiH	0.0461	0.5451	0.5912
Procurement of gas via SRB – two entry-exit zones (FBiH and RS)	0.0713	0.5451	0.6164

Table 13 below compares the purchase price of gas (at the entry to BiH) for Sarajevogas, including the investment in the Southern Interconnection, when the booking of transport capacity all the way to the entry to BiH would be optimized. Data related to gas transport within BiH are the same as in Table 3 and are based on the maximum booking of capacity within BiH, and not on the optimization of transport use. In other words, the calculation of transport costs in BiH is based only on the annual booking of maximum quantities and the option of quarterly, monthly and daily booking were not used. The data in column 3 are taken from the analyses shown in sections 4.3.1 and 4.3.2 and converted to BAM/Sm.³

Table 13 - Gas prices for Sarajevogas (optimized booked cap.) for 2020-2021

Scenarios	Transmission cost for Sarajevogas (entry + exit + quantity charge within BiH) BAM/Sm^3	Price of gas up to entry into BiH with optimized transmission capacity BAM/Sm^3	Total purchase price of gas for Sarajevogas BAM/Sm^3
1	*2*	*3*	*4=2+3*
1. Purchase price for Sarajevogas 01.05.20 – 31.12.20 01.01.21 – 01.12.21 *Weighted average price for the gas year 2020-2021*			0.5700 0.5250 0.5411
2. Procurement of gas via HR – single entry-exit zone for entire BiH	0.0784	0.5076	0.5886
3. Procurement of gas via HR – two entry-exit zones (FBiH and RS)	0.0675	0.5076	0.5751
4. Procurement of gas via SRB – single entry-exit zone for entire BiH	0.0784	0.4970	0.5754
5. Procurement of gas via SRB – two entry-exit zones (FBiH and RS)	0.1138	0.4970	0.6108
6. FBiH supplied via HR, and RS via two entry-exit zones (FBiH and RS)	0.0887	0.5076	0.5963

As in the previous case, the cost of transport within BiH when it comes to gas procurement through SRB without investment in the Southern Interconnection is shown below in Table 14, as well as the purchase price of gas for Sarajevogas, which includes optimized transport capacity to BiH for the period.

Table 14 - Gas prices for Sarajevogas (optimized booked cap.) for 2020-2021 (no South I.)

Scenarios	Transmission cost for Sarajevogas (entry + exit + quantity charge within BiH) BAM/Sm^3	Price of gas up to entry into BiH with optimized transmission capacity BAM/Sm^3	Total purchase price of gas for Sarajevogas BAM/Sm^3
1	*2*	*3*	*4=2+3*
1. Purchase price for Sarajevogas 01.05.20 – 31.12.20 01.01.21 – 01.12.21 *Weighted average price for the gas year 2020-2021*			0.5700 0.5250 0.5411
Procurement of gas via SRB – single entry-exit zone for entire BiH	0.0461	0.4970	0.5431
Procurement of gas via SRB – two entry-exit zones (FBiH and RS)	0.0713	0.4970	0.5683

4.4 CALCULATION FOR THE GAS YEAR 2021-2022

The calculation for the gas year 2021-2022 was made for the same options for which the calculation for the gas year 2018-2019 was made, with the same basic input data or assumptions. In this case, the following additional input assumptions were also used:

- For gas year 2020-2022, the same consumption profile as gas year 2018-2019. The booking of transit capacity is based on the month with the highest daily consumption is (specifically, the consumption value for the month of January 2019 is also assumed for the month of January 2022). In this way, it is possible to monitor price trends depending solely on price movements at the CEGH gas hub and the amount of (regulated) tariffs for system services, i.e., in such a way that the results obtained are mutually comparable.
- For comparison, in this case, the approximate amounts of prices in USD / 1,000 Sm^3 (and rounded to the nearest whole number) were calculated with the following assumptions: 1 m^3 = 9,465444 kWh, 1 EUR = 1.0515 USD (annual average for 2022; however, one should look at average exchange rates by months of gas years, so this price in USD/1,000Sm^3 is an approximation).

4.4.1 GAS PRICE AT THE EXIT FROM HR FOR THE GAS YEAR 2021-2022

In this case, the price of natural gas was calculated at VTP Croatia and the exit from HR at the interconnections according to the published tariffs.

The results obtained are as follows:

Spread amounts to:
a) Spread = 4,184 EUR / MWh (GCV) – with booking of transit capacity based on the month with the highest daily consumption; or
b) Spread = 3,571 EUR / MWh (GCV) - with optimization of booked transit capacity

In the total amount of Spread, the costs of transport (i.e., transit) to VTP Croatia amount to approximately 78% in the case of capacity booking according to the month with the highest daily consumption, or 75% in the case of optimizing transport (i.e., transit) capacity in its booking.

The total gas price at VTP Croatia (already expressed in NCV) is:

a) 118,605 EUR / MWh (NCV) (1,180.47 USD / 1,000 Sm^3 (NCV)) - with booking of transit capacity according to the month with the highest daily consumption; and

b) 117,924 EUR / MWh (NCV) (1,173.69 USD / 1,000 Sm^3 (NCV)) - with optimization of booked transit capacity.

The new methodology for determining the amount of tariff items for gas transportation in HR is effective from January 1, 2021. According to this methodology, the transport tariffs for the exit from HR and the transport tariffs for the exit to HR are equalized, as mentioned in Chapter 4.1.

The price at the exit from HR at the interconnection in the analyzed period is:

a) 118,605 (gas on VTP HR) + 1,159 (exit HR) = 119,764 EUR / MWh (NCV) (1,192.00 USD / 1,000 Sm^3 (NCV)) - with booking and transport in HR according to the month with the highest daily consumption.

b) 117,924 (gas on VTP HR) + 1,021 (exit HR) = 118,945 EUR / MWh (NCV) (1,183.85 USD / 1,000 Sm^3 (NCV)) - with optimization of booked transport capacity in HR.

By optimizing booking of transport capacity, about 1.3 million EUR can be saved for VTP Croatia (118,605-117,924) EUR / MWh x 1,949,882 MWh = 1.3 million EUR for this profile. Optimizing transport would also result in lower exit tariffs from HR (1,021 instead of 1,159 EUR / MWh). Total savings by optimizing transport are as much as EUR 1.6 million [119,764 - 118,945) EUR / MWh x 1,949,882 MWh = 1,6 million EUR.

With the increase in gas prices on the European market, the total purchase price of gas calculated here has increased significantly in gas year 2021-2022 compared to previous gas years. Thus, the share of transport costs in the total purchase price has dropped significantly and accounts now for only 4%, while that share amounted was approximately 25% in gas year 2020-2021, approximately 42% gas year 2019- 2020, and approximately 33% in gas year 2018-2019.

4.4.2 GAS PRICE AT THE EXIT FROM SRB FOR THE GAS YEAR 2020-2021

In this case, the CEGH gas hub, with transit through Austria and Hungary, is also envisaged as a source of gas supply. The transit costs included in the Spread refer to the costs at the exit from Hungary, i.e., to the entrance to SRB. Based on this calculated Spread, using the formula given in the introduction, an "equivalent average fixed price" was calculated for the entire observed period. The costs of transit through SRB were added to the calculated price (assuming that it was possible to book entry and exit in SRB, i.e., that there is enough capacity for a third party) to obtain the total price of natural gas at the exit from SRB to BiH.

The results obtained are as follows:

> Spread amounts to:
> a) Spread = 3,046 EUR / MWh (GCV) - with booking of transit capacity according to the month with the highest daily consumption
> b) Spread = 2,223 EUR / MWh (GCV) - with optimization of booked transit capacity

In the total amount of Spread, transport costs (i.e., transit) including exit from Hungary amount to approximately 70% in case of capacity booking according to the month with the highest daily consumption, or 59% in case of optimization of transport (i.e., transit) capacity in its booking.

The total price of gas at the exit from Hungary or at the entrance to SRB (already expressed in NCV) is:

> a) 117,341 EUR / MWh (NCV) (1,167.88 USD / 1,000 Sm^3 (NCV)) - with booking of transit capacity according to the month with the highest daily consumption; or
> b) 116,428 EUR / MWh (NCV) (1,158.80 USD / 1,000 Sm^3 (NCV)) - with optimization of booked transit capacity.

As previously stated, in this case as well, the price of natural gas at the exit from SRB, i.e., to the entrance to BiH, was calculated. For the period from October 1, 2021, to October 1, 2023, the costs of transport (i.e., transit) through SRBare calculated according to the "Decision on the price of access to the natural gas transport system" from July, 2021[34]. The calculation itself has been compared to and is in accordance with the tariff calculator published Transportgas Srbija Novi Sad's website[35].

With all the above assumptions, the price at the exit from SRB is:

> a) 117,341 (gas at the exit from Hungary or at the entrance to SRB) + 3,879 (transit through SRB) = 121,220 EUR / MWh (NCV) (1,206,50 USD / 1,000 Sm^3 (NCV)) - with booking of transit according to the month with the highest daily consumption

[34] "Decision on the price of access to the natural gas transport system" Transportgas Srbija, http://www.transportgas-srbija.rs/wp-content/uploads/Odluka-o-cenama-pristupa-sistemu-01.juli-2021.pdf
[35] http://www.transportgas-srbija.rs/sr/za-korisnike/kalkulator-za-zakup-kapaciteta/.

b) 116,428 (gas at the exit from Hungary or at the entrance to SRB) + 2,553 (transit through SRB) = 118,981 EUR / MWh (NCV) (1,184.21 USD / 1,000 Sm³ (NCV)) - with optimization of booked transit capacity.

Therefore, by optimizing the booking of transport capacity, about 1.3 million EUR can be saved for this profile at the exit of Hungary, i.e., a total of 2.6 million EUR at the exit from SRB.

With the increase of gas prices on the European market, the total purchase price of gas calculated here has increased significantly in gas year 2021-2022 compared to previous gas years. Thus, the share of transport costs in the total purchase price has dropped significantly and accounts now for only 5%, while that share amounted to approximately 26% in gas year 2020-2021, approximately 39% in gas year 2019-2020, and approximately 30% in gas year 2018-2019.

4.4.3 GAS PRICES DEPENDING ON THE SUPPLY ROUTE FOR THE GAS YEAR 2021-2022

Chapter 4.1.3 a presented gas year 2018-2019's purchase price of gas for the entry to BiH for Sarajevogas from different supply routes, while chapter 4.2.3 and chapter 4.3.3 presented the same for all scenarios for gas years 2019-2020 and 2020-2021, respectively. This chapter provides the same overview for all scenarios for the gas year 2021-2022.

The second column of table below shows the cost of gas transport in BiH for Sarajevogas, which was calculated using the Transport Tariff Tool and includes the Southern Interconnection investment. The analysis was conducted as a case study for Sarajevogas.

The third column shows the gas prices until entry to BiH, which were shown in the previous two sections, but converted into BAM/Sm³. The price of gas, as mentioned earlier, does not consider the optimization of the portfolio of traders neither on VTP Croatia nor on the border with SRB, so it is reasonable to expect a slightly lower price than the one stated here. The fourth column is the sum of columns 2 and 3.

Table 15 - Gas prices for Sarajevogas (max booked cap.) for 2021-2022

Scenarios	Transmission cost for Sarajevogas (entry + exit + quantity charge within BiH) BAM/Sm³	Price of gas up to entry into BiH BAM/Sm³	Total purchase price of gas for Sarajevogas BAM/Sm³
1	*2*	*3*	*4=2+3*
1. Purchase price for Sarajevogas 01.10.21 - 01.12.21 01.12.21 - 01.01.22 01.01.22 - 01.04.22 01.04.22. - 01.07.22 01.07.22 - 01.10.22 *Weighted average price for the gas year 2021-2022*			 0.5250 0.6390 0.7050 0.8490 1.0380 *0.6959*
2. Procurement of gas via HR – single entry-exit zone for entire BiH	0.0784	2.2172	2.2956
3. Procurement of gas via HR – two entry-exit zones (FBiH and RS)	0.0675	2.2172	2.2847
4. Procurement of gas via SRB – single entry-exit zone for entire BiH	0.0784	2.2441	2.3225

5. Procurement of gas via SRB – two entry-exit zones (FBiH and RS)	0.1138	2.2441	2.3579
6. FBiH supplied via HR, and RS via two entry-exit zones (FBiH and RS)	0.0887	2.2172	2.3059

For the case of gas supply through HR - whole BiH one entry-exit zone and the case of gas supply through HR - two entry-exit zones (FBiH and RS), the price of gas on the entry to BiH is the same for both cases and is described in chapter 4.4.1, while transport costs are different within BiH.

For the case of gas supply through SRB - whole BiH one entry-exit zone and the case of gas supply through SRB - two entry-exit zones (FBiH and RS), the price of gas on the entry to BiH is the same and is described in chapter 4.4.2, while transport costs are different within BiH.

If FBiH was supplied through HR, and the RS through two entry-exit zones (FBiH and RS), then in this case the gas price calculated in Chapter 4.4.1 would be taken for FBiH.

For comparison, the cost of transport within BiH through SRB without investment in the Southern interconnection is shown below, as well as the purchase price of gas for Sarajevogas for the mentioned period.

Table 16 - Gas prices for Sarajevogas (max booked cap.) for 2021-2022 (no South I.)

Scenarios	Transmission cost for Sarajevogas (entry + exit + quantity charge within BiH) BAM/Sm³	Price of gas up to entry into BiH BAM/Sm³	Total purchase price of gas for Sarajevogas BAM/Sm³
1	*2*	*3*	*4=2+3*
Purchase price for Sarajevogas 01.10.21 - 01.12.21 01.12.21 - 01.01.22 01.01.22 - 01.04.22 01.04.22. - 01.07.22 01.07.22 - 01.10.22 *Weighted average price for the gas year 2021-2022*			 0.5250 0.6390 0.7050 0.8490 1.0380 *0.6959*
Procurement of gas via SRB – single entry-exit zone for entire BiH	0.0461	2.2441	2.2902
Procurement of gas via SRB – two entry-exit zones (FBiH and RS)	0.0713	2.2441	2.3154

Table 137 below compares the purchase price of gas (at the entry to BiH) for Sarajevogas, including the investment in the Southern Interconnection, when the booking of transport capacity all the way to the entry to BiH would be optimized. Data related to gas transport within BiH are the same as in Table 3 and are based on the maximum booking of capacity within BiH, and not on the optimization of transport use. In other words, the calculation of transport costs in BiH is based only on the annual booking of maximum quantities and the option of quarterly, monthly and daily booking were not used. The data in column 3 are taken from the analyses shown in sections 4.4.1 and 4.4.2 and converted to BAM/Sm.³

Table 17 - Gas prices for Sarajevogas (optimized booked cap.) for 2021-2022

Scenarios	Transmission cost for Sarajevogas (entry + exit + quantity charge within BiH) BAM/Sm^3	Price of gas up to entry into BiH with optimized transmission capacity BAM/Sm^3	Total purchase price of gas for Sarajevogas BAM/Sm^3
1	*2*	*3*	*4=2+3*
Purchase price for Sarajevogas 01.10.21 - 01.12.21 01.12.21 - 01.01.22 01.01.22 - 01.04.22 01.04.22. - 01.07.22 01.07.22 - 01.10.22 *Weighted average price for the gas year 2021-2022*			 0.5250 0.6390 0.7050 0.8490 1.0380 *0.6959*
2. Procurement of gas via HR – single entry-exit zone for entire BiH	0.0784	2.2020	2.2804
3. Procurement of gas via HR – two entry-exit zones (FBiH and RS)	0.0675	2.2020	2.2695
4. Procurement of gas via SRB – single entry-exit zone for entire BiH	0.0784	2.2027	2.2811
5. Procurement of gas via SRB – two entry-exit zones (FBiH and RS)	0.1138	2.2027	2.3165
6. FBiH supplied via HR, and RS via two entry-exit zones (FBiH and RS)	0.0887	2.2020	2.2907

As in the previous case, the cost of transport within BiH when it comes to gas procurement through SRB without investment in the Southern Interconnection is shown below in Table 18, as well as the purchase price of gas for Sarajevogas, which includes optimized transport capacity to BiH for the period.

Table 18 - Gas prices for Sarajevogas (optimized booked cap.) for 2021-2022 (no South I.)

Scenarios	Transmission cost for Sarajevogas (entry + exit + quantity charge within BiH) BAM/Sm^3	Price of gas up to entry into BiH with optimized transmission capacity BAM/Sm^3	Total purchase price of gas for Sarajevogas BAM/Sm^3
1	*2*	*3*	*4=2+3*
Purchase price for Sarajevogas 01.10.21 - 01.12.21 01.12.21 - 01.01.22 01.01.22 - 01.04.22 01.04.22. - 01.07.22 01.07.22 - 01.10.22 *Weighted average price for the gas year 2021-2022*			 0.5250 0.6390 0.7050 0.8490 1.0380 *0.6959*
Procurement of gas via SRB – single entry-exit zone for entire BiH	0.0461	2.2027	2.2488
Procurement of gas via SRB – two entry-exit zones (FBiH and RS)	0.0713	2.2027	2.2740

4.5 RESULT COMPARISON

The purchase price of gas for the next day on the stock exchange at the CEGH gas hub fell in gas year 2019-2020 compared to gas year 2018-2019, while in gas year 2020-2021 it was higher compared to gas year 2019-2020, but lower compared to gas year 2018-2019. Due to the crisis caused by the war in Ukraine and disruptions in gas supply routes, the price of gas for the next day on the exchange at the CEGH gas hub has increased significantly in gas year 2021-2022.

The purchase price of gas at the CEGH gas hub used in the analysis was obtained by calculating the arithmetic mean of all CEGHIX price indexes in the observed month of the gas year and multiplying it by the total projected amount of gas in the same month. The obtained results are summed up and divided by the predicted total amount of gas in that gas year. The obtained purchase price at the CEGH gas hub is then analyzed, and, according to the price gas formula, increased by the Spread amount and multiplied by 1.11 to convert it from GCV to NCV. It is then increased by any other potential costs of transit to BiH and transport costs to Sarajevo, which then all together represent the weighted purchase price of gas for Sarajevogas.

Specifically, the purchase price at the CEGH gas node calculated as mentioned above was 20,742 EUR/MWh (GCV) in the gas year 2018-2019, 11,206 EUR / MWh (FCH) in gas year 2019-2020, and 18,739 EUR/MWh (FCH) in gas year 2020-2021. Meanwhile in gas year 2021-2022, it jumped over five times compared to the previous gas year and amounted to 102,667 EUR/MWh (GCV).

In Figure 9 and Figure 10 below, for gas year 2019-2020 the purchase price of gas for Sarajevogas would be lower in all projected scenarios compared to the weighted average purchase price of gas that Sarajevogas paid in gas year 2019-2020. The reason for this is the reduction in the price of gas at the CEGH gas hub as well as reduced transport costs, mostly in HR. It can also be noted that for gas year 2018-2019 and 2020-2021, the purchase price of gas for Sarajevogas would have been higher in all projected scenarios compared to the weighted average purchase price of gas that Sarajevogas paid in gas years 2018-2019 and 2020-2021. Additionally in gas year 2021-2022, the purchase price of gas for Sarajevogas would be higher in all predicted scenarios compared to the weighted purchase price of gas that Sarajevogas had in gas year 2021-2022.

Therefore, if gas were imported via HR and Slovenia from the CEGH gas hub in Austria, and if the maximum capacities on the entire route were booked, the purchase price of gas for Sarajevogas would be as follows (see Figure 9):

- For gas year 2019-2020, it would be lower than the weighted average purchase price of gas for gas year 2019-2020 by an average of 16% depending on the scenario (from 14% to 17%),
- For gas year 2020-2021, it would be higher than the weighted average purchase price of gas for gas year 2020-2021 by an average of 14% depending on the scenario (from 12% to 16%),
- For gas year 2021-2022, it would be higher than the weighted average purchase price of gas for gas year 2021-2022 by an average of 230% depending on the scenario (from 228% to 231%).

According to Figure 10, for optimized transport to the entry to BiH, the purchase price of gas for Sarajevogas would be:

- lower by an average of 23% depending on the scenario (from 21% to 25%) for gas year 2019-2020;
- higher by an average of 8% depending on the scenario (from 6% to 10%) for gas year 2020-2023,
- higher by an average of 228% depending on the scenario (from 226% to 229%) for gas year 2021-2022.

In addition, if gas would be imported via Hungary and SRB from the CEGH gas hub in Austria, and if the maximum capacity on the entire route would be booked, the purchase price of gas for Sarajevogas would be as follows (see Figure 9):

- For gas year 2019-2020, it would be lower than the weighted average purchase price of gas for gas year 2019-2020 by an average of 20% depending on the scenario (from 14% to 25%),
- For gas year 2020-2021, it would be higher than the weighted average purchase price of gas for gas year 2020-2021 by an average of 15% depending on the scenario (from 9% to 22%),
- For gas year 2021-2022, it would be higher than the weighted average purchase price of gas for gas year 2021-2022 by an average of 233% depending on the scenario (from 229% to 239%).

According to Figure 10, for optimized transport to the entry to BiH, the purchase price of gas for Sarajevogas would be:

- lower by an average of 30% depending on the scenario (from 24% to 35%) for gas year 2019-2020,
- higher by an average of 6% depending on the scenario (from 0% to 13%) for gas year 2020-2021,
- higher by an average of 228% depending on the scenario (from 223% to 233%) for gas year 2021-2022.

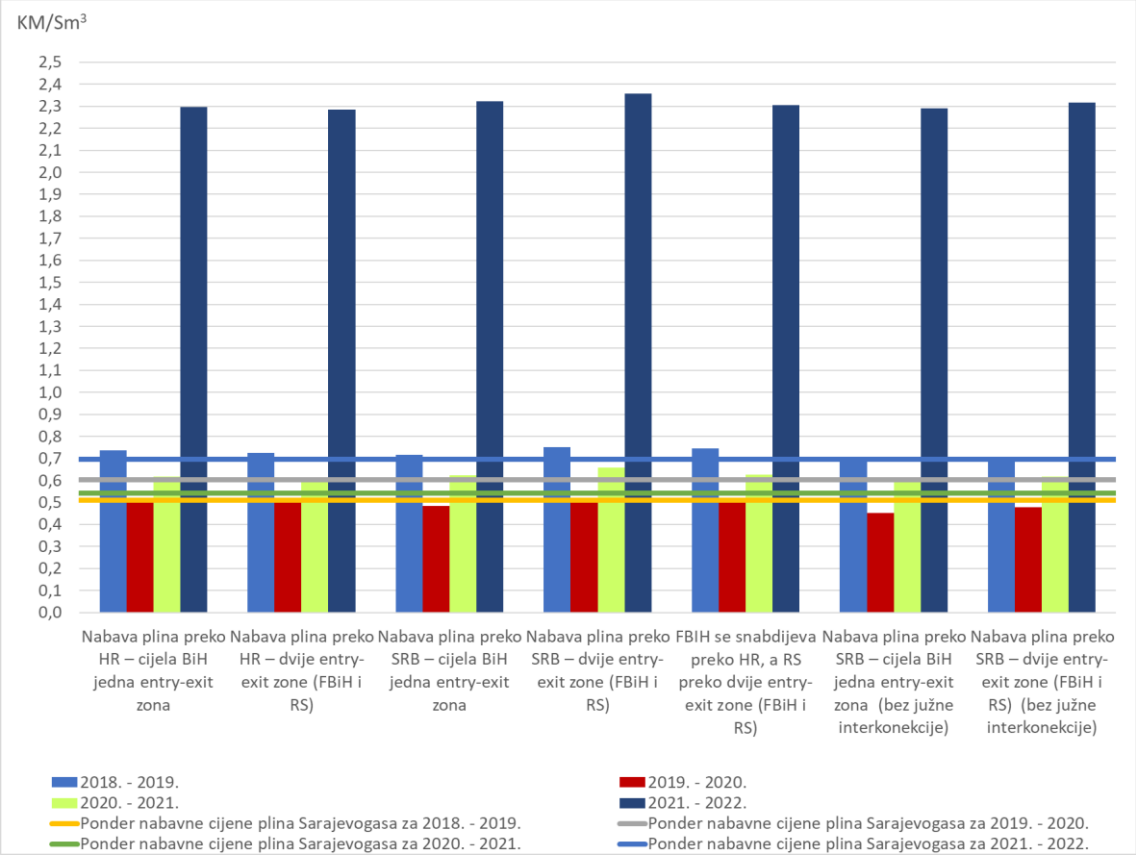

Figure 9 - Gas prices for Sarajevogas (max booked cap.) for 2018-2019, 2019-2020, 2020-2021 and 2021-2022

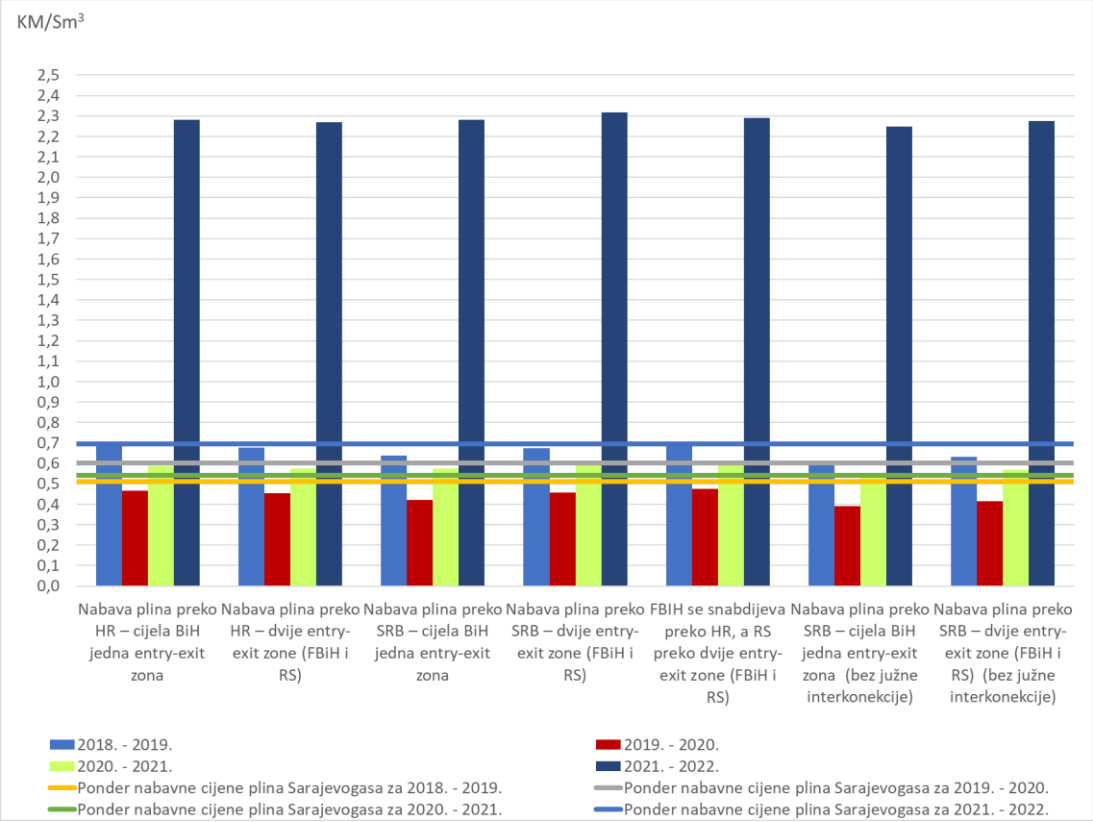

Figure 10 - Gas prices for Sarajevogas (optimized booked cap.) for 2018-2019, 2019-2020, 2020-2021, 2021-2022

5. CONCLUSION

This report has addressed the potential of new natural gas infrastructure in the region, combined with purchasing natural gas on the competitive market, increasing the security of natural gas supply, and with the potential of decreasing natural gas prices for BiH end users. The main conclusion is that, according to the results of this theoretical model in stable market conditions, by combining the open market purchase of natural gas with advantages from the expanding natural gas infrastructure, it is indeed possible to lower prices for BiH end users. This conclusion comes with caveats that the actual monthly consumption for the entire country and the degree of seasonality must be known and accurate, and that market conditions are stable in terms of not distorting supply and demand in the European market caused by external influences. This paper was calculated for the total quantities needed by BiH based on a limited, approximated consumption curve developed from Sarajevogas' consumption curve, which is extremely seasonal and resulted in a fairly high gas price because of the high seasonality. If complete data was used, the actual consumption would likely show a more favorable, flatter curve, with less seasonality due to the industrial consumption in Zenica and the consumption of a big industrial consumer in the RS being almost 80% of the total consumption of the RS.

As indicated, the above applies in stable market conditions, i.e., in conditions of not disrupting supply and demand relationships on the European market caused by external influences. Disrupted supply and demand relations, which are primarily caused by the crisis over the supply routes as a consequence of the war in Ukraine, resulted in a significant increase of the natural gas purchase price in gas year 2021-2022. However, this case (related to the issue of security of supply) particularly emphasized the importance of the interconnectedness of the European gas market in terms of

pipeline interconnections and LNG terminals. In terms of the region, the growing role of the LNG terminal on the island of Krk needs to be noted, as well[36].

It is emphasized that the gas price calculations in this report are theoretical for several reasons. If a gas formula related to a particular gas hub's spot price is used, this does not automatically mean that the trader/supplier will procure the required daily quantities of gas at the gas hub's spot market. Just like the oil formula in Europe and the world in general, which used to be tied to the price of heating oil that was then a competitive energy source in the heating oil market, today's traders/suppliers can set their prices based on what their competitors in the liberalized gas market offer. Thus, producers can tie the price of gas from their own production in long-term contracts to the spot price from a particular gas hub. In Europe, there has also been a trend of changes in clauses of existing long-term contracts to include spot-price indexing from specific gas hubs for some share of purchased quantities or even 100% of purchased quantities[37].

Elements from commercial bilateral gas sale contracts (not only long-term but also commercial contracts in general) and specific price formulas or prices are not publicly available as they are business secrets. Therefore, the CEGH was selected as a gas source, as it is the most relevant regional gas hub, and its price data is publicly available. In the given examples, it is assumed that the trader will set the price based on what the competition can offer (using gas prices from the CEGH gas hub with transport costs to VTP Croatia). The price at VTP Croatia, based on CEGH prices, can be expected even in cases where the gas source is not CEGH, but rather Krk LNG Terminal. For example, a trader whose source of gas is the Krk LNG Terminal will sell gas at VTP Croatia on parity to CEGH as a source. In other words, the trader will calculate the price the buyer would pay at the CEGH, add pipeline transportation costs, and offer a slightly lower price to win the contract. Therefore, the statement from Chapter 4 of this report[38] that the CEGH gas hub is the gas source in gas price calculations should not be taken literally, but rather that the CEGH gas hub is a source for the reference gas price.

The gas price calculations in this report are theoretical because it is methodologically incorrect to mix the past and the future, i.e., future transport tariffs in BiH and past gas consumption. However, since some input data had to be estimated, such as transport tariffs for future interconnections in BiH, for other input data (market prices, transport tariffs in transit countries and final prices for Sarajevogas), historical data was used to reduce the number of assumptions instead of adding assumptions about future gas prices and transport tariffs in transit countries. In this way it is possible, at least in terms of market prices and transit tariffs, to repeat the calculation every year and observe trends. Finally, the hypothetical consumption profile for BiH is analyzed in this paper;

[36] On August 8, 2022, the Government of the Republic of Croatia adopted a decision to increase the capacity of the LNG terminal on the island of Krk with the aim of increasing the capacity from the existing 2.9 to 6.1 billion m^3 per year.

[37] The Greek gas company DEPA, which controls about 40% of the gas market in Greece, negotiated new terms in supply contracts with Russian Gazprom in early 2020. The revised contract limits oil-indexed gas prices to 60% of total purchased quantities, and the price of the remaining 40% of gas quantities are determined according to the Dutch gas trading platform TTF. The contract expires in 2026, with the option to extend it for another 10 years. Bulgaria has negotiated gas hub prices in contracts with Gazprom through a process at the European Commission - Directorate General for Competition (DG COMP). In Turkey, the existing long-term contracts with the oil formula have expired. The contracts are for gas consumption of 16 bcm/year of which 8 bcm/year is with Gazprom. Half of 16 bcm/year contracts are with BOTAS – a Turkish state-owned company, and the other half are with private importers. Negotiations of new long-term contracts were also the basis of prices, including gas formulas related to gas hubs.

[38] Chapter 4, sentence: "The Central European Gas Hub (CEGH) in Austria was used as the source of gas (being the gas hub of primary relevance for this region)."

however, this does not mean that CEGH would be the only source of gas for the entire consumption profile.

In the observed theoretical examples based on the conducted analysis, available consumption data, estimated consumption curve, and available transmission tariff data for individual countries, the price of gas up to entry into BiH through HR and Slovenia could be reduced by approximately 7% if transmission capacities were to be optimized in gas year 2018-2019, approximately 10% in gas year 2019-2020, around 6% for gas year 2020-2021, and approximately 0.7% for gas year 2020-2021.

It is important to note that the adoption of a new methodology for determining the number of tariffs for gas transport in HR (in the part of the costs related to gas transportation) has enabled the export of gas from HR at twice the lower rate than in previous years.

By optimizing transport through Hungary and SRB, it would also be possible to reduce the price of gas on the entry to BiH by approximately 14% in gas year 2018-2019, approximately 18% in gas year 2019-2020, around 10% in gas year 2020-2021, and approximately 2% in gas year 2021-2022.

Regarding the purchase price of gas at the CEGH gas hub calculated for the observed consumption profile, it was 46% lower in gas year 2019-2020 compared to gas year 2018-2019. In gas year 2020-2021, this purchase price was 67% higher compared to gas year 2019-2020, and 10% lower compared to gas year 2018-2019. In gas year 2021-2022, the purchase price was 395% higher compared to the initially observed price for gas year 2018-2019 and 448% higher compared to the previous gas year 2020-2021.

In conclusion, it should be noted that every new supply route, every new interconnection and source of gas supply brings with it new opportunities to develop the free market for natural gas in BiH. From experience in the region, e.g., the recent development of the transmission system in HR and the opening of another HR-HU interconnection, and especially after the expected commissioning of the LNG terminal, a thorough transformation can be seen in the relationships between all market participants, both traders/suppliers towards customers, as well as relationships among them. The loss of influence on the part of traditional domestic producers and monopoly-holding traders has significantly altered their relationship towards customers. Customers have, for their part, become aware of their ability to choose and their role and power in the open market. Within a very short period, all of this has changed the relations and characteristics of the market, transforming it from a supply-driven market (when traders impose conditions and the sales price) to a demand-driven market (when customers set the main terms of purchase). However, we must not overlook the fact that new free market possibilities come with responsibilities, both for traders and for customers, to educate themselves and ensure that they can best meet their needs and plans under these new conditions.

The importance of the interconnectedness of the European gas market was further highlighted in the context of the current crisis caused by the war in Ukraine. This situation caused changes in the existing sources and directions of supply and, although there was an increase in the prices of natural gas on the European market, as a result the security of gas supply was maintained.

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