

# WORKING PAPER

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## **NATURAL GAS IMPORT AND EXPORT ROUTES IN SOUTH-EAST EUROPE AND TURKEY**

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## ACRONYMS

**AERS** - Energy Agency of the Republic of Serbia  
**AIIB** - Asian Infrastructure Investment Bank  
**BCM** - Billion cubic meters  
**BOTAS** - Boru Hatlari Ile Petroleum Tasima Anonim Sirketi (Petroleum Pipeline Corporation)  
**BRUA** - Bulgaria-Romania-Hungary-Austria  
**BRUSKA**- Bulgaria-Romania-Hungary-Slovakia-Austria  
**EBRD** - European Bank for Reconstruction and Development  
**EITI** - Extractive Industries Transparency Initiative  
**EPDK** - Enerji Piyasasi Duzenleme Kurumu (Energy Market Regulatory Authority)  
**EU** - European Union  
**FGSZ** - Foldgaszallito Zrt. (Hungarian Gas Transmission System Operator)  
**FSRU** – Floating Storage and Regasification unit  
**GWh** - Gigawatt hour  
**HAG** - Hungaria-Austria-Gasleitung (Hungary-Austria Interconnector)  
**HUAT** - Hungary-Austria interconnector  
**IAP** - Ionian Adriatic Pipeline  
**IGB or ICGB** - Interconnector Greece-Bulgaria  
**IGI** - Interconnector Greece-Italy  
**ITB** - Interconnector Turkey-Bulgaria  
**ITGI** - Interconnector Turkey-Greece-Italy  
**KRG** - Kurdish Regional Government  
**KRI** - Kurdish Region of Iraq  
**LNG** - Liquefied Natural Gas  
**MCM** - Million cubic meters  
**MEKH** - Magyar Energetikai es Kozmu-szabalyozasi Hivatal (Hungarian Energy and Public Utility Regulatory Authority)  
**MMBTu** - Million British Thermal Units  
**MOL** - Mitsui Osk Lines  
**MTPA** - Metric Tonnes Per Annum  
**PCI** - Projects of Common Interest  
**PSV** - Punto di Scambio Virtuale (Virtual Trading Point)  
**SCP** - South Caucasus Pipeline  
**SCPx** - South Caucasus Pipeline Expansion  
**SGC** - Southern Gas Corridor  
**TANAP** - Trans-Anatolian Pipeline  
**TAP** - Trans-Adriatic Pipeline  
**TBP** - Trans-Balkan Pipeline  
**TSO** - Transmission System Operator  
**VTP** - Virtual Trading Point

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## INTRODUCTION

European countries have sought for the last three decades to diversify their sources and routes of gas supplies as a means to reduce their dependence on the traditional regional exporter, Russia.

In response, producers such as Azerbaijan, Cyprus, Iran, Iraq, Israel, Romania, Turkmenistan have expressed an interest, and were in turn encouraged by Brussels, to explore the possibility of exporting gas to European markets.

More recently, the buildup in global LNG supplies looks set to bring changes to the region as maritime countries such as Croatia, Greece and Turkey are either building new LNG importing capacity or have been expanding existing ones. Turkey especially has seen its LNG imports grow exponentially over the last year.

Russia, already the dominant regional supplier, has sought to retain and expand its role by signing new supply agreements with neighbouring countries, extending existing contracts or building new infrastructure.

Even though numerous projects have been proposed over the last three decades, some of them, such as Blue Stream 2, which was expected to carry Russian gas to Israel via Turkey, have been mothballed. In Blue Stream 2's case this was largely because Israel itself has made significant offshore discoveries, but also because of failing political negotiations between Turkey and Russia at the time.

Others, such as the EU-backed Southern Gas Corridor have been redesigned to suit new regional political or economic challenges. A number of projects will be commissioned by the end of this decade or in the early 2020s.

Although large quantities of the imported gas will be earmarked for central and eastern European markets, it is important to stress that most of them will depend on Turkey as a transit route.

Over the years, Turkey has interchangeably described itself as a gas hub or as a transit corridor, but has never succeeded in clarifying its regional role, nor has it drafted a strategy that would outline the long-term steps that it intends to take.

For the purpose of clarity, this paper acknowledges the central role played by Turkey in the upcoming projects and proposes to group them into three corridors reflecting the geographical direction of each route. Each of these import corridors is likely to be dominated by at least one major supply route that will reach Turkey and from where it would merge with export infrastructure to central, eastern or southern European markets.

Based on these considerations, this paper recognises the following three supply routes:

- **The North-South corridor** linking mainly Russian gas to Turkey, southern and central Europe. This supply corridor is likely to be dominated by TurkStream 1 and 2 and possibly the Trans-Balkan Pipeline.
- **The Caspian / Middle Eastern** corridor shipping Azerbaijani, Turkmen, Iranian, Iraqi gas to Turkey and further to southern European markets. This route will be dominated by TANAP/TAP.
- **A Mediterranean** corridor linking Cypriot and Israeli gas to European markets via a pipeline to Turkey (and onto eastern and central Europe) or Greece (and onto Italy either independently or as stated in May 2019 by Italian PM by connecting to TAP). This corridor could also include LNG supplies imported via Croatia, Greece and Turkey and exported to the region through existing infrastructure.

This paper proposes to examine the supplies and projects that are likely to be commissioned, both pipeline and LNG, describing the technical details, the stage of development they are currently at, and the implications for the region.

The discussion will be split into three parts:

1. **Pipeline imports:**
  - North – South corridor
  - Caspian / Middle Eastern corridor
  - Mediterranean corridor
2. **LNG imports:**
  - Croatia
  - Greece
  - Turkey
3. **Export pipelines:**
  - Pipelines directly linking to Turkey
  - Regional pipelines

Thus, the discussion in this paper is carried out from Turkey's point of view as most of the import pipelines and the pipelines that connect to them enter and exit Turkey. Once TurkStream is built and the Southern Gas Corridor is completed, Turkey will become the main transit route for gas to south-east Europe.

Therefore, the pipeline imports section focuses on TurkStream, TANAP, EastMed as the **main** import routes, although it discusses other options as well, and this is augmented by section 2 which focusses on LNG imports.

In the third section, I refer to the pipelines that will connect to these on the Turkish - EU border and ship the gas further into Europe. This third section is split into Russian exports and exports of other sources of gas. This is because South Stream Lite will be exclusively for Russian gas shipped via TurkStream, while although the other projects

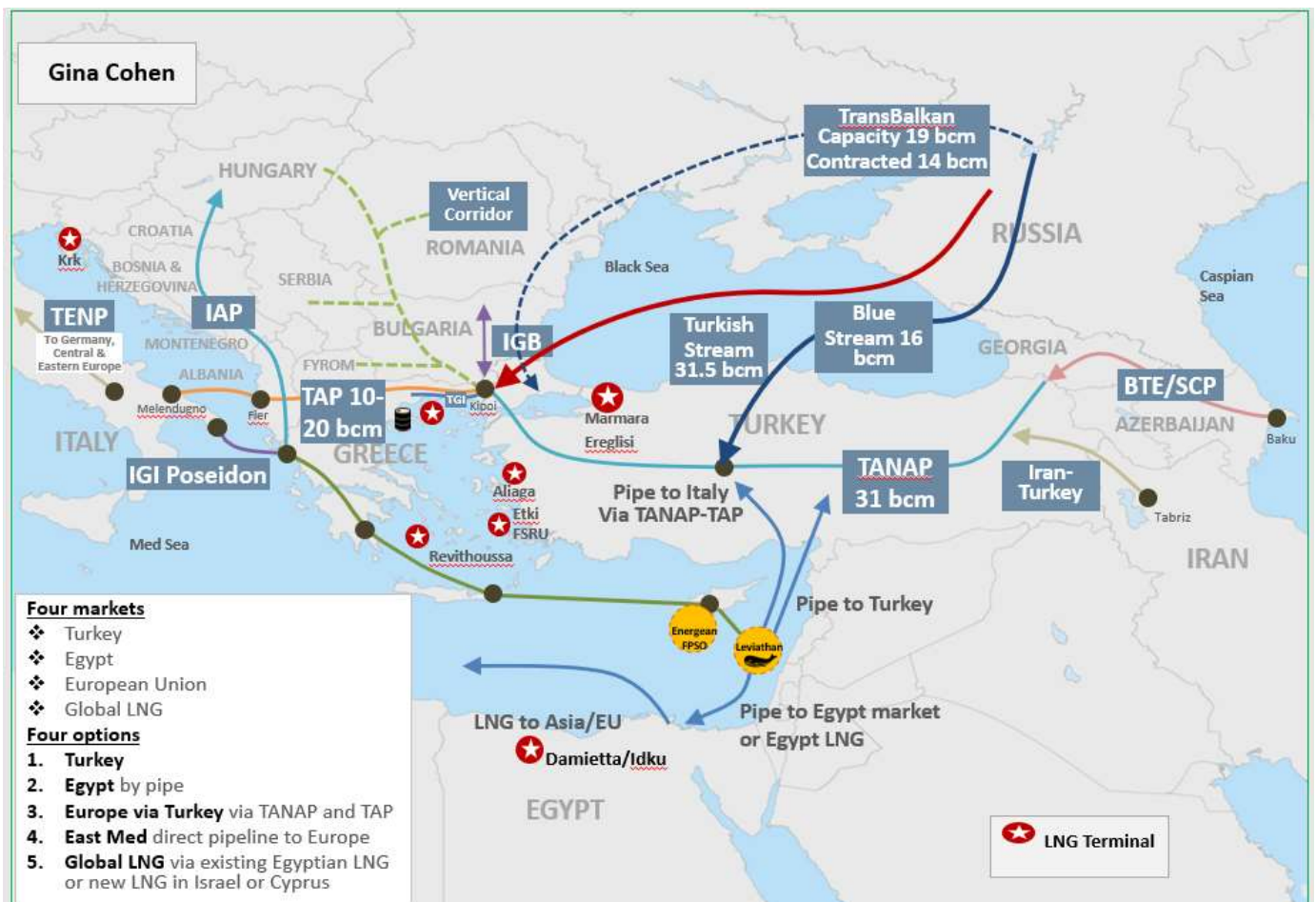
may carry Russian gas to Europe, they are flexible enough to include gas sourced elsewhere. Given Turkey's importance to the region, the paper will include in the annex section key data related to its import pipeline and LNG capacities as well as relevant information about its transmission system, and gas contracts.

# 1. IMPORT PIPELINES

## 1.1 The North-South corridor

This corridor features three large pipelines: **Blue Stream, the Trans-Balkan Pipeline (TBP) and TurkStream 1 and 2**. Although TBP has dominated the region since the 1980s, when Russia started to export natural gas to Turkey and the Balkans, this project may be phased out when the existing transit contract with Ukraine comes to an end in 2020. This means that all volumes hitherto transported by the TBP will be diverted to TurkStream 1 and 2, which will replace TBP as the dominant supply line on a north-south route.

This sub-section analyses the three key pipelines that ship/will be shipping Russian gas into Turkey and the upcoming export routes into Europe, as shown in the figure below.



Import and export routes linked to Turkey's northern corridor. Source: Gina Cohen



### 1.1.1 Blue Stream gas pipeline

Russian gas
Unidirectional
No third party access
In operation

<http://www.gazprom.com/projects/blue-stream/>

The Blue Stream pipeline links Russia to Turkey via the Black Sea and has a capacity of 16 bcm/year. The capacity could be increased to 19 bcm/year with added compression.

The pipeline was commissioned in December 2002 and the first volumes reached Turkey in 2003. The supply contract was signed for a period of 25 years. The pipeline feeds exclusively the Turkish gas market and volumes are imported exclusively by BOTAS. Flows are unidirectional - north to south.

It was built by the Netherlands-based Blue Stream Pipeline consortium, a joint venture between Russia's Gazprom and Italy's Eni. The consortium is the owner and operator of the Russian land section, the Beregovaya compressor station and the subsea section.

The Turkish land section as well as the Durusu metering station, where the pipeline enters the country are owned and operated by the Turkish incumbent BOTAS.

The financing of the line in Russia and under the Black Sea was carried out by Gazprom, while the financing and construction in Turkey was carried out by BOTAS.

The Blue Stream gas pipeline, with a total length of 1,213 km, was built as three main parts:

- On the Russian territory, a pipeline system between the Izobilnoye-Djubga with a total length of 370 km, consists of 308 km long 56-inch pipeline and 62 km long 48-inch pipeline.
- In the Black Sea, between Djubga and Samsun, there are two parallel lines of 24-inch diameter, each about 390 km in length.
- In the territory of Turkey, a pipeline system of 501 km long, 48-inch pipeline.

The Turkish part of the Blue Stream project starts from Samsun and reaches Ankara via Amasya, Corum and Kirikkale. It is connected to the Main Turkish Line near Polatli.



Blue Stream & TurkStream gas pipelines. Source: Gina Cohen

**1.1.2 The Trans-Balkan pipeline (Western Line) - before 2020.**

<p>Russian gas</p> <p>Unidirectional</p> <p>TPA (on BG-TR border)</p> <p>RF-UA-MD-RO-BG-TR-GR-NM</p>
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<http://www.gazpromexport.ru/en/partners/turkey/>

The Russia-Turkey Natural Gas Western Balkan Pipeline, enters the country at the Strandja-Malkoclar interconnection point on the Bulgarian-Turkish border.

The pipeline carries Russian gas via Ukraine, the Republic of Moldova, Romania and Bulgaria and supplies Turkey, Bulgaria, Greece and Northern Macedonia (former Yugoslav Republic of Macedonia).

In Turkey, the pipeline feeds the north-western Thrace region and most of the imported volumes are used to generate electricity at power plants in Hamitabat, Ambarli, Istanbul, Izmit, Bursa and Eskisehir and reaches Ankara.

It is 845 km long, and at its maximum when passing through Ukraine has a total capacity of 26.8 bcm/year. Flows are unidirectional - north to south.

Volumes contracted in Turkey by BOTAS and seven independent importers amount to 14 bcm/year. In February 1986, based on an intergovernmental agreement dated September 18, 1984, a contract was signed with Turkey's BOTAŞ for supplying up to 6 bcm of gas per year for over 25 years (1987-2011). The first deliveries of natural gas to Turkey from the Soviet Union began in June 1987. In 1998, a long-term contract was signed with BOTAŞ for supplying an additional 8 bcm per year via this route through 2022. In 2007, a total of 4 bcm/year were released from the BOTAŞ contract to four independent importers - Avrasya Gaz, Bosphorus Gaz, Enerco Enerji, Shell (contract release 1). In 2011 when the first supply contract expired, BOTAŞ did not renew it, allowing independent importers to sign separate long-term supply agreements with Gazprom (contract release 2). As of 2018, BOTAŞ was importing 4 bcm/year via the Trans-Balkan line. The remaining 10 bcm/year were imported by the companies listed below:

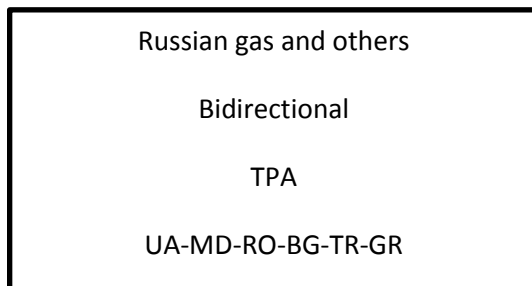
<b>Importer</b>	<b>Volume (bcm/year)</b>	<b>Expiry of contract</b>	<b>Contract release</b>
Enerco Enerji	2.5	2021	1
Bosphorus Gaz	0.75	2021	1
Avrasya Gaz	0.5	2021	1
Shell	0.25	2021	1
Akfel Gaz	2.25	2043	2
Bosphorus Gaz	1.75	2043	2
Kibar	1	2043	2
Bati Hatti	1	2036	2

*Volumes off-taken via the Trans-Balkan pipeline by independent importers. Source: Aura Sabadus database © 2019*

Supplies via the Trans-Balkan line to Turkey are due to be diverted when the existing transit contract between Gazprom and the Ukrainian incumbent expire at the end of 2019.

Flows will be diverted to TurkStream 1, which will have a capacity of 15.75 bcm/year and is due to be commissioned in 2020. This means that in addition to the 14 bcm/year currently imported via the Trans-Balkan pipeline and diverted to TurkStream 1, Turkey will receive an additional 1.75 bcm/year. It is not known whether contractual terms between Gazprom Export and existing Turkish importers (BOTAŞ and independent importers) will change.

### 1.1.3 Trans-Balkan pipeline (Western Line) - after 2020



Once volumes currently exported via the Trans-Balkan line are diverted to TurkStream 1, the existing Malkoclar-Strandja interconnection point will be used to export gas shipped via TurkStream 2 to Bulgaria and further to central Europe (see discussion below).



Source: Gina Cohen

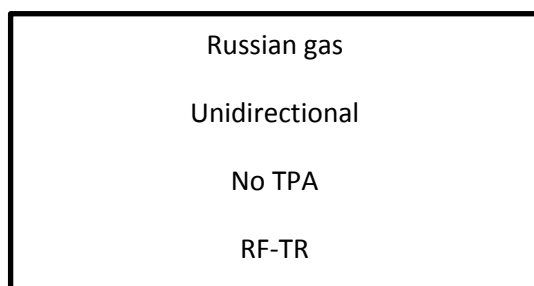
The remaining infrastructure connecting Ukraine to Bulgaria will become idle. The options for this part of the line are:

1. Decommission the infrastructure.
2. Upgrade the pipeline and establish a bidirectional north-south / south-north corridor between Turkey and Ukraine through upgrades and additional compression.

Assuming the second option is the one that is implemented, then control over the pipeline will be given to national transmission system operators (Bulgartransgaz for Bulgaria, Transgaz for Romania, Gas Transmission System Operator of Ukraine).

The operation of the pipeline will be carried out in accordance with the terms of EU network codes and the Third Energy Package in all relevant transit countries (Bulgaria, Romania, Republic of Moldova and Ukraine - the latter two under the terms of their Energy Community membership).

#### **1.1.4. TurkStream 1 and TurkStream 2**



<http://turkstream.info/>

The TurkStream corridor will be made up of two parallel lines - TurkStream 1 and TurkStream 2 - and will replace the South Stream project, which was shelved in December 2014 due to strong EU objections.

The two lines will have a 15.75 bcm/year capacity each and are estimated to cost \$12.7 billion in total.

The pipelines will link the Anapa compression station in Russia to Kiyikoy on the European side of Turkey. The offshore part of the pipeline from Russia to Turkey will cross the Black Sea bed, reaching a maximal depth of 2,200 m. Lines will be 32-inch and the walls of the pipeline will comprise 39mm of carbon manganese steel to enable it to withstand high pressures. The length of the offshore part will amount to 910 km. The TurkStream lines will make a landfall on the shore of the European part of Turkey near Kiyikoy.

TurkStream 1 will be feeding exclusively the Turkish gas market and its delivery point will be at Luleburgaz from where it will connect with BOTAS' main west-east transit line. This string is due to be commissioned in 2019.

TurkStream 2 will continue from Kiyikoy on to the Bulgarian border and is expected to link up with the existing Malkoclar-Strandja interconnection point currently on the Trans-Balkan line.

The offshore section was completed in 2018 and the pipeline is due to be commissioned in 2020.

The onshore section of the pipeline will be operated by a joint venture between BOTAS and Gazprom.

It is equally possible that Russia may be looking to export some volumes on to Greece via the Ipsala-Kipi interconnection point on the Turkish-Greek border. These volumes could be further exported to Italy via the Interconnector Turkey-Greece-Italy (ITGI) or TAP. (See discussion below on exports from Turkey to Europe). No details have

emerged yet regarding a possible Greek option for the export of TurkStream gas from Turkey.

## 1.2 The Caspian / Middle Eastern corridor

This corridor could include natural gas imported from Azerbaijan and Turkmenistan, Iran and Iraq. Turkey has a nominal 10 bcm/y import contract with Iran, but despite discussions, it has been unable to make progress on extending Iranian exports to the European market. Iraq and the Kurdish Region of Iraq (KRI) had been in talks about the possibility of exporting natural gas to Turkey and further to Europe, but negotiations are yet to materialise.

The only project that is shaping up and will approach completion in 2021 is the Southern Gas Corridor (SGC). SGC has already started to bring Azerbaijani natural gas to Turkey via the Trans-Anatolian Pipeline (TANAP) in 2018. TANAP will merge with TAP to bring additional Caspian gas to southern European market by the beginning of the new decade.

This section will discuss **SGC/TANAP** as well as the **Iranian** and **Iraqi** gas export routes.

### 1.2.1 The Southern Gas Corridor (SCPX/TANAP)

<https://www.tap-ag.com/the-pipeline/the-big-picture/southern-gas-corridor>

The Southern Gas Corridor is an EU-backed project which aims to bring 16 bcm/year, divided between 6 bcm/y to Turkey and 10 bcm/y to southern European markets. The volumes will be sourced from the second phase of the Caspian offshore Shah Deniz project in Azerbaijan (SH2).

The corridor stretches 3,500 km east to west from the Caspian Sea to Italy, transiting complex land territory over Georgia, Turkey, Greece, Albania and Italy.



*The Southern Gas Corridor (SGC). Source: Gina Cohen*

The project is made up of three key parts:

- The existing South Caucasus Pipeline (SCPx), which has been expanded to allow the export of natural gas from Azerbaijan into Turkey via Georgia.
- The Trans Anatolian Pipeline (TANAP) which was completed in 2018 and which transports gas from the Turkgozu entry point on the Turkish/Georgian border to the western Turkish delivery point at Eskisehir.
- The Trans Adriatic Pipeline (TAP), which will take the gas from the Ipsala/Kipin interconnection point on the Turkish-Greek border through Greece, into Albania and into southern Italy.

To meet Turkey's gas needs, negotiations were held with the Azerbaijan Government and the Shah Deniz Consortium, which has developed the Shah Deniz field of Azerbaijan, and an agreement, was signed on October 25, 2011 envisaging the supply of 6 bcm of Azeri gas annually to Turkey starting from 2018.

The contract effectively replaces Turkey's existing supply agreement for 6.6 bcm/year for supplies from the first phase of Shah Deniz, although the two contracts will run in parallel for a while as this first contract will end only in 2021 (see annex below for all supply contracts into Turkey).

In order to bring the gas to be produced in Azerbaijan to Turkey and Europe through Turkey, final investment decisions (FIDs) of the Shah Deniz Phase II development, the Southern Caucasus Pipeline Expansion Project (SCPx), TANAP and the Trans Adriatic Natural Gas Pipeline (TAP) with an initial total investment of \$45 billion (reduced to \$40 billion in June 2017), was taken at a ceremony held in Baku in December 2013.

- SCPx

The expansion of the South Caucasus Pipeline is part of the Shah Deniz Full Field Development project. This expansion involves the laying of a new pipeline across Azerbaijan and the construction of two new compressor stations in Georgia.

A Final Investment Decision on the South Caucasus Pipeline Expansion (SCPx) project was taken on 17 December 2013, coincident with Shah Deniz Stage 2. In the first quarter of 2017, SCPX activities continued successfully along the pipeline route across Azerbaijan and Georgia. The enhancements were completed in 2018.

- TANAP

TANAP, which was completed on June 19 2018 runs from the Turkish border with Georgia to Eskişehir provides gas from Shah Deniz. The line begins in the Turkish village of Turkgozu in the Posof district of Ardahan, passes through 20 provinces including Kars, Erzurum, Erzincan, Bayburt, Gumushane, Giresun, Sivas, Yozgat, Kirsehir, Kirikkale, Ankara, Eskisehir, Bilecik, Kutahya, Bursa, Balikesir, Canakkale, Tekirdag and Edirne until it ends at the Turkish border with Greece in the Ipsala district of Edirne. The filing of this line with test gas started April 2019, with first deliveries to Thrace starting in June 2019.

The off-take point for the Turkish gas market is located at Eskisehir where it joins the Turkish domestic transmission network. The pipeline continues west from Eskisehir and before reaching the Greek border at Ipsala/Kipi, it also runs 19 km under the Sea of Marmara.

The pipeline within Turkey reaches a total of 1,850 km, along with off-take stations and aboveground installations, including seven compressor stations. The line consists of 1,356 km of 56-inch line through Turkey to carry 6 bcm of gas to and through Turkey with the remaining primarily consisting of 48-inch line from the Western city of Eskisehir to the border with Greece at Ipsala/Kipi to ensure the delivery of 10 bcm/yr (out of the 16 bcm in the TANAP pipeline) to the European countries beyond Turkey.

TANAP has four phases of which FID has been taken for the first two:

- Phase 0, 2018 <6 BCm3/yr for Turkey. (CS-5 compressor station)
- Phase 1, 2020 <10 BCm3/yr transit & 6 BCm3/yr for Turkey. (+ CS-1)
- Phase 2, >2022 24 BCm3 total. (+ 2 CS plus upgrades)
- Phase 3, >2026 31 BCm3 total. (+ 3 CS plus upgrades)

The transportation tariff for gas delivered to Turkey is a costly \$79/'000 Sm3 (increased 1% annually from 2018) to Eskişehir and \$103 to Thrace (TANAP HGA of 26/5/2014). Delivered Shah Deniz 2 gas will be BOTAŞ's most expensive gas. TANAP's transit tariff for gas for Europe is a lower \$33/'000 Sm3, with it also receiving 5% of volumes shipped as fuel gas. (MoU of 7/6/2010).

Deliveries to Turkey started at a rate of 1-2 bcm/year in June 2018, rising to 4 bcm/year in year two and to the contracted 6 bcm/year by 2020, namely in year 3.

The full capacity of TANAP can be scaled up to 32 bcm/y with compressor capacity and if more gas is available such as from Azerbaijan to put into the system or if a trilateral agreement is signed between the EU, Azerbaijan and Turkmenistan to transmit Turkmenistan gas into the system. There is also the possibility of Iraq wanting to use the extra capacity in the line.





*TANAP technical details. Source: TANAP Company Website.*

At the dawn of the project, TANAP was first estimated to cost \$11.7 billion. But some successful procurement, project and financial management have reduced the cost down to \$7.99 billion. TANAP partners received \$3.75 billion in loans from international finance institutions including the World Bank, the European Bank of Reconstruction and Development (EBRD) and the Asian Infrastructure Investment Bank (AIIB). The European Union also provided a grant of \$10.2 million.

Moreover, the pipes used in the project were supplied by six Turkish manufacturers. Eighty percent of the pipes used in the project were purchased from Turkish suppliers, while twenty percent were imported from China.

The shareholders are Southern Gas Corridor (a subsidiary of SOFAZ, the sovereign wealth fund of Azerbaijan) 51%, SOCAR Turkey 7%, BOTAŞ 30%, BP 12%. EBRD, EIB and World Bank funding arranged.

- TAP

TAP is the third part of Southern Gas Corridor – Shah Deniz Stage 2 gas - to transport gas from Shah Deniz II field in Azerbaijan to Europe over 3,500 km.

The 878 km long TAP pipeline will connect with the Trans Anatolian Pipeline (TANAP) at the Turkish-Greek border at Kipoi, it will then cross Greece and Albania and the Adriatic Sea, before coming ashore in Southern Italy (this project will be discussed in further detail in section 3.2 below as it has the capacity to transmit both Russian and other sourced gas).

### **1.2.2 The Iranian Pipeline**

Turkey holds a supply contract with Iran, which was signed in 1996 and the first flows started to reach Turkey in 2001. The nominal contractual volumes have been 10 bcm/year, although Turkey has rarely imported quantities above 8 bcm/year.

The Eastern Anatolian Natural Gas Main Transmission Line is 1,490 km long and has a diameter ranging between 48-inch and 16-inch. It extends from Dogubayazit to Ankara via Erzurum, Sivas and Kayseri, and to Seydisehir, Konya.

By the end of June 2001, the entire pipeline system was ready to receive gas and with the completion of the Meter Station in Bazargan, Iran, the gas purchase from Iran started on 10 December 2001.

Over the years, Iran and Turkey have been in talks about the possibility of ramping up either imports from Iran itself or transited via Iran from Turkmenistan. Turkey had also signed an import contract with Turkmenistan, although the deal never materialized, largely because of political uncertainty over western sanctions against Iran.

Iranian gas exports to Turkey have been exempted from sanctions and in February 2014, there were talks that Ankara had awarded incentives amounting to Turkish Lira 13.8bn (€4.5bn at the time) to Turang Transit, a subsidiary of a petroleum products trading company, Som Petrol, to encourage imports from Iran and Turkmenistan that could be further exported to Europe. The company was expected to benefit from value-added tax exemptions amounting to TL11.5bn and customs duties exemptions of TL2.3bn. The tax breaks were likely to incentivise the company to speed up construction on the 1,720 km pipeline that was expected to carry 35 bcm/year from Iran to Europe via Turkey.

The company was granted a 30-year licence at the end of 2010 to build the pipeline from the Iranian border of Bazargan to Ipsala on the Turkish-Greek border. It was expected to prove within two years that it had finalised agreements with gas producers and had concluded the financing for the line. However, as of the date of writing this report, there was no confirmation that Turang Transit had been able to fulfil those terms.

Additional gas imports from Iran could change regional dynamics. Nevertheless, although Iran has the world's largest conventional gas reserves, it is unlikely to become a major player in Turkey and Europe on two accounts. Firstly, most of its volumes are located in the southern part of Iran and the country needs to build domestic infrastructure to transport it north. Secondly, and crucially, the country is now under renewed US sanctions over its alleged nuclear weapons programme, which is likely to bar it from acquiring required equipment, international assistance and financing to develop its vast reserves. In addition, Iranian gas is Turkey's most expensive source of gas.

### **1.2.3 The Iraq-KRI-Turkey pipeline**

So far there have been two options considered for the export of KRI or Iraqi gas to Turkey and further to Europe.

A first option had been considered by Turkish stakeholders for the construction of an interconnecting pipeline linking KRI to the Turkish domestic system, at Fish Khabour in the northern part of KRI.

An agreement was signed in 2013 between Ankara and Erbil, the capital of KRI, for the export of 10 bcm a year of natural gas to Turkey from the Bina Bawi and Miran basins. Genel Energy, the operator of the fields, was hoping to find a partner for the export project, however, plummeting oil prices and deteriorating political relations have had a negative impact on the development of the project.

Flows were meant to start in 2016 and reach 10 bcm by 2020. There were also plans to transport natural gas sourced in the south of Iraq, ship it up north through the existing infrastructure and merge this gas with KRI-sourced volumes before exporting them to Turkey.

At the end of April 2019, Genel Energy said it was negotiating updated terms for oil and gas exploitation in northern Iraq with the Kurdistan Regional Government, after an existing agreement lapsed.

Genel Energy said it was expecting to produce an estimated 250 million standard cubic feet/day of gas, equivalent to seven million cubic metres, from this field in an initial phase. The company said it and the KRG would fund this using revenue from oil produced by the field.

An existing production sharing agreement lapsed on 30 April 2019, although Genel Energy said the deal would be valid for another year. The company plans to secure a gas lifting agreement for Bina Bawi with the Kurdistan Regional Government within that period.

Genel said a separate gas lifting agreement at the Miran field was due to end on 31 May 2019 and the company expects this agreement to lapse as well. Miran is thought to hold around 200 bcm of gas, around 30 bcm less than Bina Bawi.

Gas exploration also attracted the attention of Russian oil company, Rosneft. The company signed in May 2018 an agreement with KRG to explore and potentially develop the region's gas reserves. It said it was also interested in building a 10 bcm/year pipeline to Turkey. Between 2016-2018, Rosneft paid about \$3.5bn to the KRG, including \$400m to develop five exploration blocks, \$1.8bn for control over the region's export pipeline and a \$1.2bn loan in pre-payment for oil produced by companies other than Rosneft.

Rosneft's involvement in KRI's oil and gas sectors may be part of Russia's wider Middle Eastern strategy, which Moscow sees as crucial to expanding its influence to the region. However, as of now, no concrete steps seem to have been taken towards the commissioning of a new export route from Iraq to Turkey and further to Europe.

### **1.3. The Mediterranean corridor**

Israel, which has proven reserves of one trillion cubic meters and whose Ministry of Energy states that there is a further two trillion cubic meters to be discovered, had been contemplating the possibility of exporting natural gas to Turkey via the construction of a 10 bcm/year bidirectional pipeline. If such a project were to be carried out, the pipeline would link Israel's gas fields to Turkey's southern Mediterranean region, passing via Cyprus' EEZ.

Most of the reserves in the Eastern Mediterranean have so far been discovered in Egypt, Israel and Cyprus, but other countries such as Lebanon and Syria (and maybe even Turkey) hope to find significant resources.

- Israel-Turkey pipeline

The proposed c-600km (28 – 32 inches) pipeline would be one of the cheapest and shortest routes for Israel to reach Europe, potentially opening up not only Turkey but also south-east European markets for exports.

Companies such as German-Turkish joint venture Enerjisa and Turkey's Turcas Petroleum and Zorlu had expressed an interest in the past to buy gas and participate in the construction of the pipeline. The project, however, remains in limbo mainly because of a political stand-off between Israel and Turkey. A pipeline from Israel to Turkey would also encounter obstacles linked to Turkey's fraught political relations with Cyprus, needing to pass via Cyprus' EEZ.



## Route Notes:

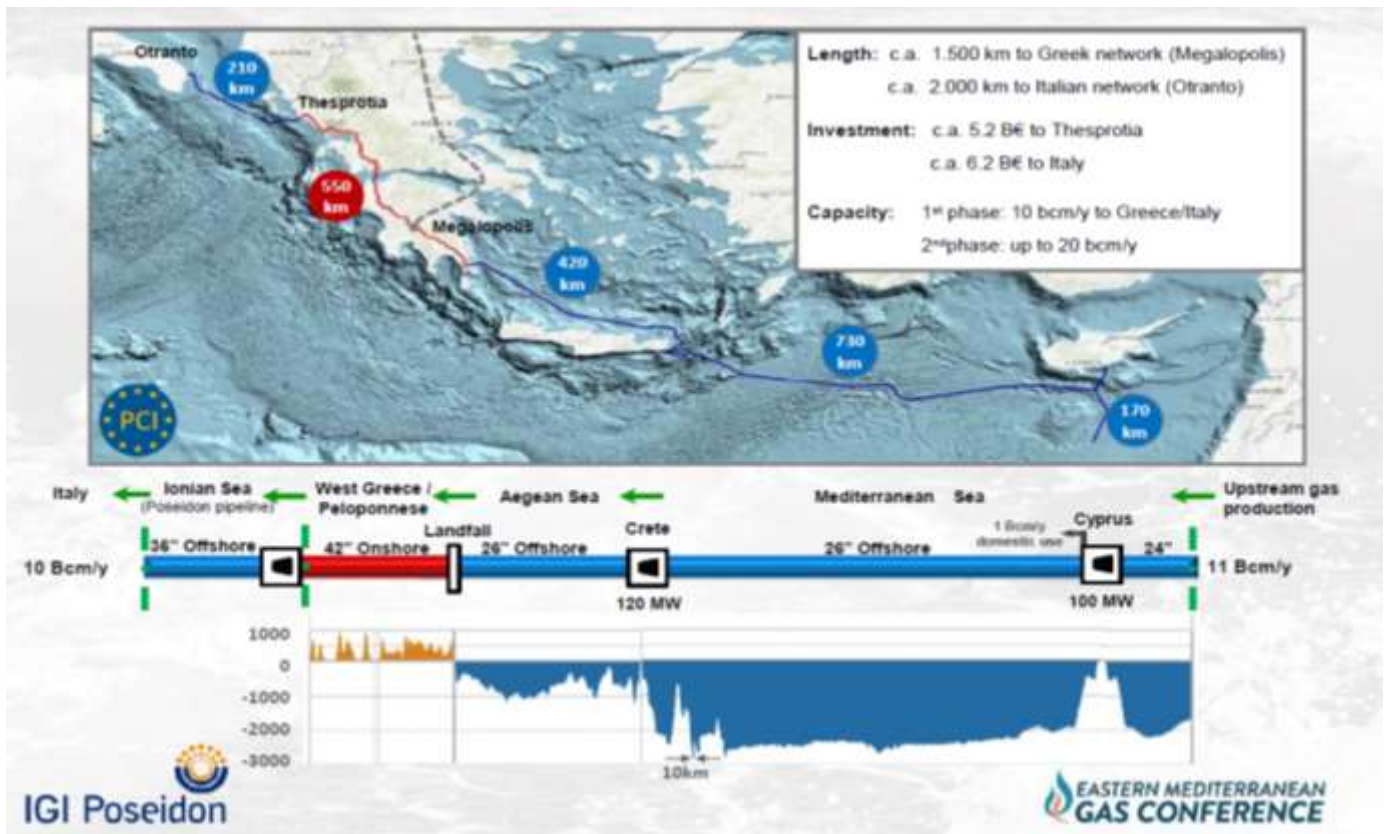
- Pipeline Length = 602km
- Pipeline MAOP = 3375psi; assumed arrival pressure 5-80 bar
- Maximum Water Depth = 2225m
- Pipeline Diameter/ Maximum Flow Rate:
  - 28in / 900mmscfd
  - 32in / 1300mmscfd
- Starting point: Leviathan Platform, Israel
- End Point: Iskenderun, Ceyhan, Mesin (end point TBD)
- Concept assumes 20 Pipeline / Cable crossings
- Pipe wall thicknesses vary based on water depth
- Pipe is ID coated
- Shore approach and dredging included. Backfilling only, no rock dumping.
- Preliminary route based on available bathymetric data. No multibeam or AUV data available for majority of the route.

*Proposed Israel-Turkey gas pipeline (Gina Cohen: PPP).*

- EastMed pipeline (Israel-Italy)

With the Turkish route being mothballed, Israel is currently mulling exports via Greece and further to Italy and into southeast Europe in what is known as the EastMed Pipeline project. The project has received the status of a Project of Common Interest by the EU and would link Israel's offshore blocks to Greece and Italy via Cyprus and Crete. The pipeline would also anticipate take in volumes produced at Cyprus offshore fields.

The project has the backing of Brussels, which has already contributed €34.5m for a feasibility study and of the US for reasons of political diversification for Europe, although the project still has to face challenges as it would be the longest subsea pipeline ever and would traverse a seismically active and topographically difficult seabed.



EastMed Pipeline. Source: IGI Poseidon (permission given to Gina Cohen to use)

The pipeline, which could have a capacity starting at 10 bcm/year (but could be expanded in phase 2 to 20 bcm/year), would also have to pass through ultra-deep and difficult subsea terrain, is at the FEED stage to be completed at the end of 2021. The FEED is to cost €69 million, 50% of which has been provided by the EU.

The EastMed pipeline is preliminarily designed to have exit points in Cyprus, Crete, mainland Greece as well as the connection point with the Poseidon pipeline. From this point, it would need to enter into the IGI line to be constructed as well. The EastMed project current design envisages a 1,300 km offshore pipeline and a 600 km onshore pipeline. The pipeline, starts from the new natural gas discoveries in the East Mediterranean region and comprises the following sections:

- 170 km offshore pipeline stretching from Israeli sources to Cyprus;
- 730 km offshore pipeline connecting Cyprus to Crete Island;
- 420 km offshore pipeline from Crete to mainland Greece (Peloponnese);
- 550 km onshore pipeline crossing Peloponnese and West Greece;
- 220 km offshore to Otranto Italy.

East Med Pipeline Project:

- Offshore/onshore pipeline of c.a. 2.000 km to Italian network
- Initially transport 10 bcm/y (possible expansion to 20 bcm/y)
- Estimated investment cost is €5.2 billion, based on a detailed feasibility study.



**Benefits to EU: EastMed Pipeline, offers benefits to EU energy security goals and competition in the short and medium term:**

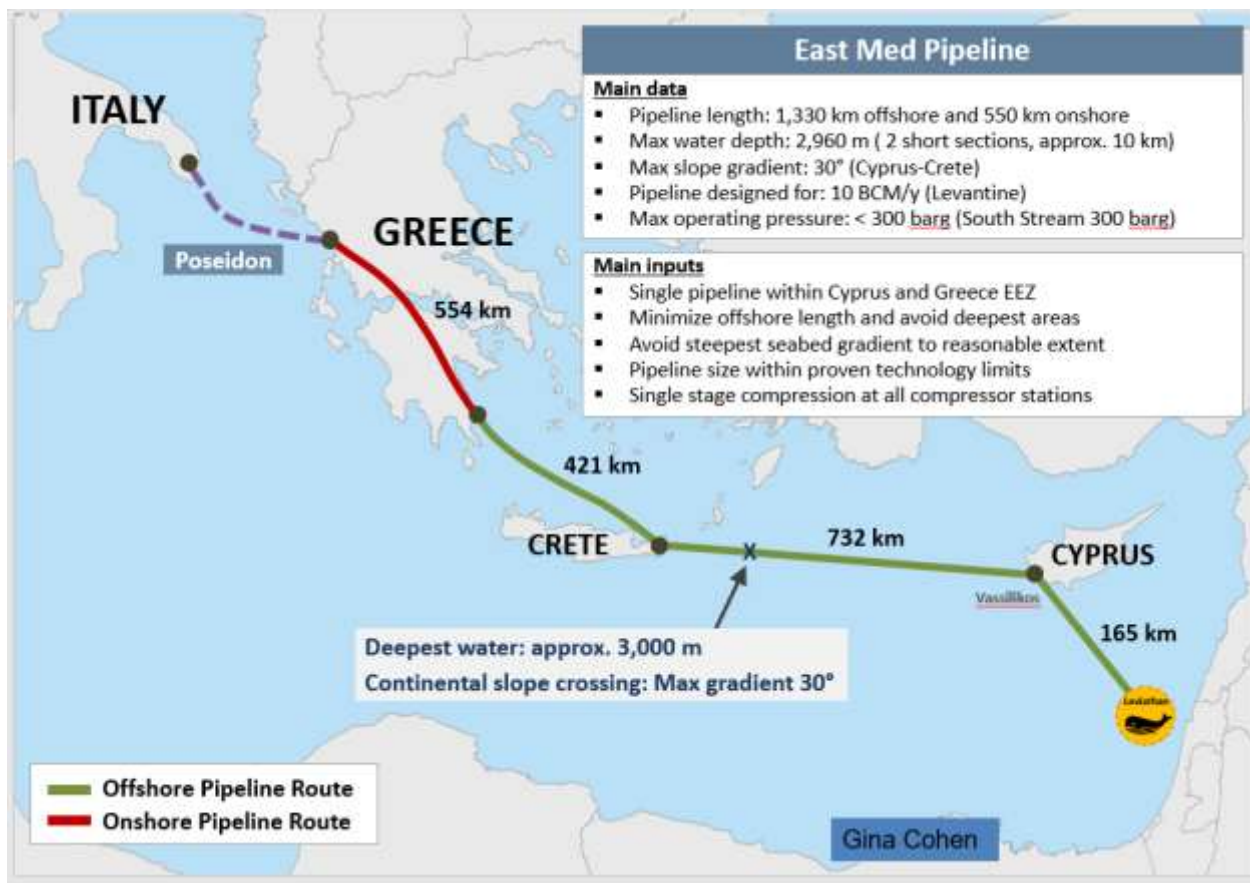
- Contribute to the Greek, Italian & European security of gas supply via diversification of sources.
- **Access to new sources not currently reaching EU MS**, by providing direct access to East Mediterranean gas
- **Ends isolation** of Cyprus with a direct physical connection to mainland Europe via Greece
- **Security of Supply** significantly mitigating the risk of demand curtailment in Greece, in case of disruption of its single largest infrastructure; increases the remaining flexibility in Greece and Italy, in case of peak demand and 2-weeks cold spell situation and of course of Cyprus;
- **Competition**, increases the diversification for Greece and Italy.
  
- Project **supported** by
  - National: IGA under finalization by Israel, Cyprus, Greece and Italy;
  - EU: PCI Label since 2013, included the current list of PCIs and EU CEF co-financing to support development activities;
  
- Progressing as follows
  - Feasibility (PRE-FEED) studies (50% co-financed by EU) successfully completed, including Reconnaissance Marine Survey that allowed a refinement of the preferred route and capex: results showed project is technically feasible, economically viable and commercially competitive
  - Project entered FEED phase 05.2018 – 12.2021 (€69M 50% co-financed by EU); FEED tenders started in June 2018
  - Contract award expected in 3Q 2019.
  - Competitiveness analyses performed during PRE-FEED studies, certified by a specialized company, showed that EastMed is complementary and competitive to other export option (LNG) from the region.
  - Expected COD: early 2025

Although the chances of success for this project are further complicated by Turkey's opposition to Cyprus' offshore gas exploration, because Turkish officials say that drilling would infringe on the rights of the breakaway Turkish Cyprus, as well as disputed rights regarding the EEZ (as Turkey claims that Cyprus only has territorial waters and therefore that part of the route would pass via Turkey's acclaimed EEZ), recent significant discoveries offshore Greek Cyprus could bring an important change.

In 2019, Cyprus announced a major discovery at the Glaucus field operated by the US-based ExxonMobil and Qatar Petroleum, in addition to a discovery made at the Eni and Total-operated Calypso block in 2018. The Glaucus block is thought to contain up to 226 bcm, and lies close to Egypt's Zohr field, which has 850 bcm, while the Calypso block may have around 141 bcm of gas. This is in addition to the Aphrodite field

discovered in 2011 that contains 124 bcm of gas and is operated by Noble Energy, with partners Royal Dutch Shell and Noble Energy. The gas from Aphrodite may be sent to Egypt's Idku LNG facilities, thus further distancing the option of construction a new built LNG facility in Cyprus which requires 10-15 tcf of proven (90%) reserves of gas to reach FID.

No project as ambitious and potentially profitable as the East Med pipeline comes without challenges. But its benefits are huge if it can outweigh the difficulties. An East Med pipeline will bring energy to Europe, enrich its own members and foster better relations between Israel and its neighbors.



*East Med Pipeline Project – Source: Gina Cohen*

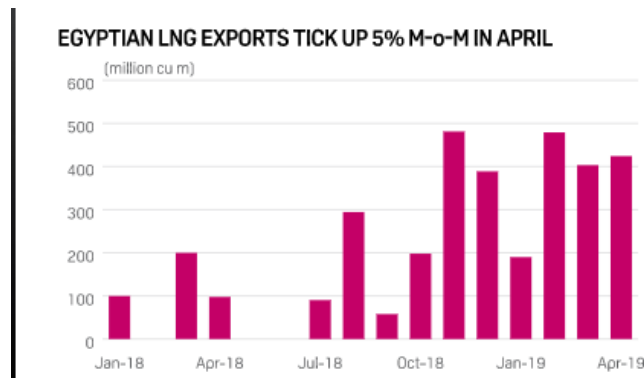
- Egypt LNG

Egypt has two exporting LNG terminals - Damietta and Idku - but in recent years it had been forced to import LNG volumes to cover soaring domestic demand coupled with lower production. Imports of LNG into Egypt ceased in September 2018, although one of the FSRUs will remain in country in case of future import needs. On the LNG export front, Damietta ceased LNG exports in February 2013 and Idku a year later.

Following the discovery of the 850 bcm Zohr field and the start of production in December 2017, Egypt has succeeded in ramping up domestic production and



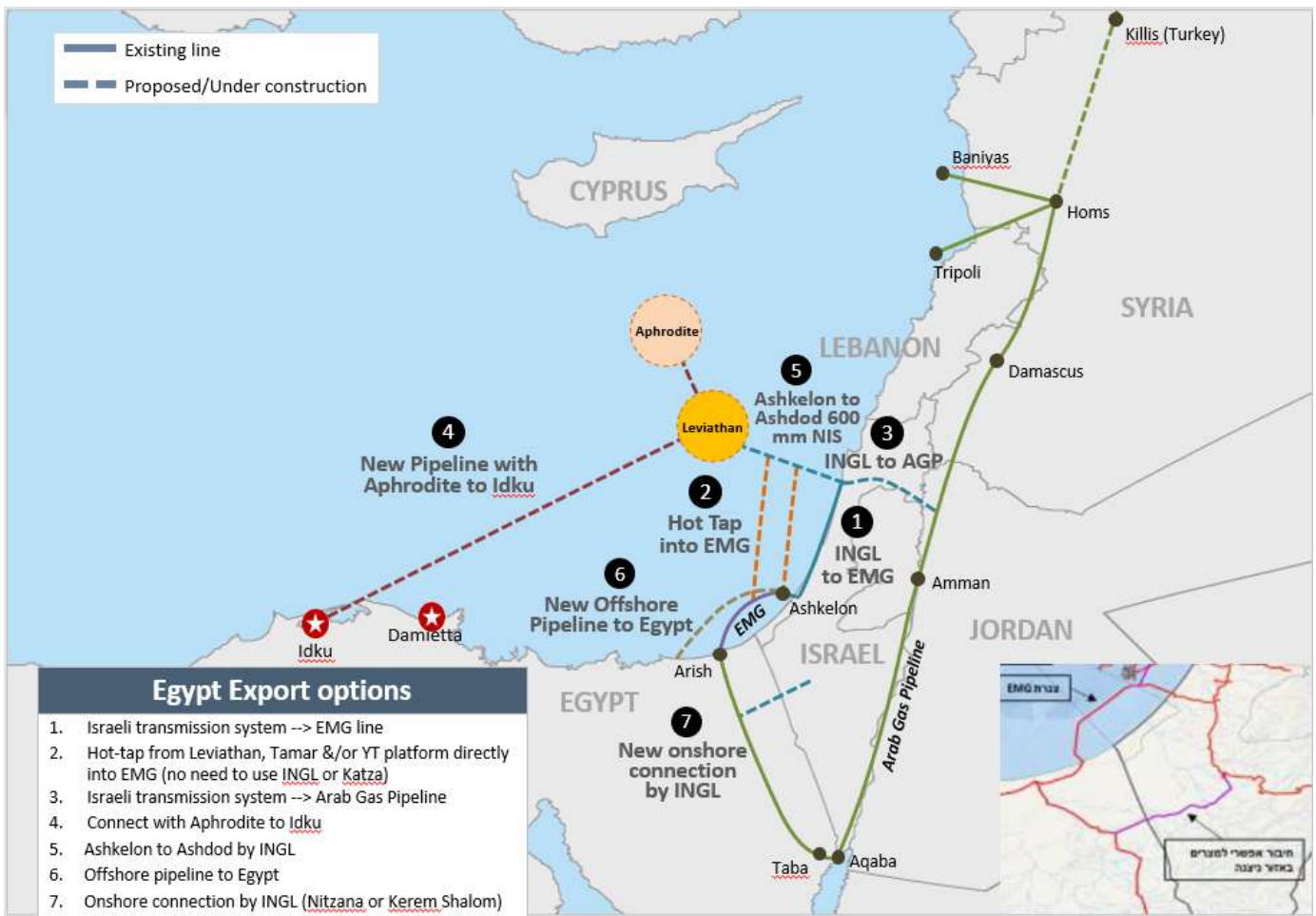
covering its demand. By January 2018, Idku has already started exporting a number of cargoes



According to ICIS, Egypt's LNG exports in February 2019 quadrupled year on year to 275,000 tonnes. Shipments tilted towards the Atlantic basin, after the Asian premium narrowed, with Turkey becoming the main destination for Egyptian cargoes, likely due to its geographical proximity.

The availability of these two liquefaction plants offers for now the only current route to market for East Mediterranean gas producers, providing a total export capacity of about 12.2 mtpa (plus volumes needed for operating the plant). Exports during this period however were done by Shell at a very competitive price, reaching only \$4.8/MMBtu FOB Idku in Q1 2019. By Q2 2019, Egyptian producer EGAS had awarded up to 13 cargoes for delivery in June and July. Pricing indications were by then below \$4.00/MMBtu, with several transactions tied either to the UK gas hub NBP, or discounted to the Dutch TTF. Sources indicated Gunvor, Trafigura, Vitol and Total as winners of the bids.

In addition, in March 2019 Delek Drilling said it was weighing up a potential investment in the Egyptian LNG facilities to bring its gas to international markets. Delek emphasized that its options in this respect included looking at buying liquefaction capacity, paying operators for liquefaction services and other undisclosed means of access at Egypt's two export plants (potentially selling feedgas to the facilities' operators).



*Egypt's Damietta and Idku LNG plants. Source: Gina Cohen*

The Leviathan gas field in Israel which will be developed by Q4 2019, together with the already developed Tamar field, have signed supply agreements for 64 bcm (32 bcm firm supplies from Leviathan and 32 bcm of interruptible supplies from Tamar) to a local private Egyptian company, Dolphinus to supply the Egyptian domestic market with first supplies from Tamar due in mid 2019 and supplies from Leviathan to start upon first gas from this field. Delek Drilling and Noble Energy are also partners in the 125 bcm Aphrodite field in neighbouring Cypriot waters, some of which has been earmarked for export to Egypt, with an inter-governmental agreement having already been signed and commercial negotiations currently being carried out, and to be completed imminently.

## 2. LNG IMPORTS

Although most central and eastern European countries are landlocked or have difficult access to the high seas, LNG could penetrate the region via two importing countries - Greece and Turkey - which have already expanded their existing facilities and could add new terminals in the mid term. A third country, Croatia, is also benefitting from EU support to build an LNG receiving terminal.

This section reviews the existing and potential terminals in Croatia, Greece and Turkey.

## **2.1 Croatia**

The floating storage and regasification LNG terminal will be located in Omisalj county on the Island of Krk in Croatia, North Adriatic. The Adria LNG terminal is expected to help towards the diversification of natural gas supply for central and south-eastern Europe. Construction on the terminal started in May 2019 and the terminal is expected to become operational by 2021.

This key cross-border infrastructure project to link EU energy systems - is intended to serve Croatia as well as neighboring markets. It is designed to reduce dependence on Russian gas by creating more import options in Central and Eastern Europe, where FSRUs have already opened in Poland and Lithuania.

But some observers remain skeptical, given lack of buyer interest to date. Croatian gas demand averages 2.5 Bcm-3 Bcm/yr, of which at least a third is covered by a 10-year deal for 1 Bcm/yr that Croatian gas company PPD signed with Russia in 2017. LNG Hrvatska is owned by HEP and Croatian gas transmission system operator Plinacro, and HEP and Croatian oil company INA are the only firms to have booked firm capacity. They are taking a combined 520 million cubic meters per day -- but critics say 1.5 Bcm/yr needs to be booked to make the project profitable.

In April 2019, Hungary said it was looking to purchase a 25% stake in the proposed Croatian LNG terminal but a potential deal would depend on ongoing negotiations and purchase of regasification capacity.

Hungarian gas demand totals over 10 Bcm/yr - three to four times Croatia's - and some 70% of its supplies come from Russia, with which a long-term contract is due to expire in 2021. In addition to Croatia, land-locked Hungary is eyeing new supplies from other sources, including regasified LNG from Italy, which would require a pipeline to be built from Slovenia. Romanian gas is a possibility, but Exxon Mobil and OMV have postponed a final investment decision on their giant Black Sea Neptun project amid uncertainties over terms, especially the gas price. Like the import terminals in Lithuania and Poland, that would give Hungary more leverage in future contract negotiations with Russia.

### **Technical details**

The technical capacity of the floating terminal will depend on the technical characteristics of the terminal, while the maximum annual delivery of natural gas is expected to be 2.6 bcm in the first stage of the project. The maximum annual delivery of natural gas will depend on the future pipeline development.



*KRK LNG terminal*

### **Financing**

The Croatian government and state-owned entities will finance most of the proposed Croatian LNG terminal, according to a government statement adopted in February 2019.

The total cost of the planned terminal at the island of Krk would be around €243m. This includes the charter cost for the FSRU which is estimated at €160m, the terminal's infrastructure estimated at €60m and expropriation cost amounting to €14m. The EU has disbursed €102m, the Croatian government will set aside €100m (€50m in 2019 and the same sum in 2020) while the remaining €32.6m will be allocated by the founders of LNG Croatia - HEP and national grid Plinarco.

### **Tender award**

In November 2018, project promoter LNG Croatia awarded the tender of the vessel to Golar Power, which will convert the 2005-built Golar Viking LNG carrier to an FSRU, with an estimated value of €159.6m.

State-owned energy incumbent HEP and national oil and gas producer INA only booked a total of 520 million cubic metres (mcm)/year binding capacity, while two other companies booked 300mcm/year conditional non-binding capacity during an open season which concluded in January 2019. The planned terminal requires 1.5 bcm/year to be economically feasible.

Most of the natural gas could be exported to Hungary as the Croatian market is saturated. Local production by Croatian INA covers up to 40% of the country's 2.5 bcm/year consumption, while private company PPD has a 1 bcm/year long-term agreement with Russia's Gazprom.

In February, project promoter LNG Croatia took a positive final investment decision on the planned 2.6 bcm/year terminal, following the government's decision on state funding.

## **2.2 Greece**

Greece currently has the Revithoussa onshore terminal and is in the process of reaching FID to develop an FSRU terminal at Alexandroupolis in the north of the country.

- **Revithoussa onshore LNG terminal**

For now, Revithoussa, is Greece's only LNG importing terminal and is located in the Gulf of Megara, west of Athens. It was completed in 1999 and is operated by the Greek transmission system operator, DESFA.

The terminal currently has a total capacity of 225,000 cubic metres (cbm) after it added a third storage tank at the end of December 2018, with regasification capacity jumping 40% to 20.2 million cu m/day, about 7 Bcm/year. Its current send-out is now 215GWh/day, equivalent to around 16mcm/day.

Algeria's Sonatrach is the main supplier to Revithoussa via its long-term contracts of 0.51-0.68 bcm/year until 2021. The terminal also receives vessels from Nigeria, reloads from France, the US, and recently from Egypt.

A European fund of Eur40 million (\$45 million) helped the project get off the ground.

The terminal benefits from third party access. Most of the capacity has been booked by the incumbent DEPA, which has a long-term supply contract with Algeria of up to 0.68 bcm annually until 2021. Other off-takers included Greece-based M&M Gas and Elpedison.



Source: ENSO-G, 2019

Despite the €135m expansion of the site, the terminal suffered from bottlenecks during the winter of 2018 because of storage obligations and shipping inefficiencies.

Nevertheless, Greece is increasingly positioning itself to become a regional LNG exporter.

DEPA was expected to deliver 1.5TWh of gas to Bulgaria in the second quarter of 2019, reportedly selling at a lower level than the country's main supplier, Gazprom, according to a statement by Bulgargaz. The Greek incumbent beat offers from Bulgarian trader Dexia and Swiss-based petrochemicals Kolmar group, which were expecting to sell LNG imported via Greece's Revithoussa terminal.

The exports to Bulgaria were also facilitated by the fact that the capacity of the Kulata/Sidirokasto point on the Greek-Bulgarian border increased from 10.57GWh/day to 46.54GWh/day from April 2019, which was around 4.16 million cubic metres.

- **Alexandroupolis FSRU**

This offshore terminal is expected to be stationed in the Sea of Thrace in northeast Greece close to the Bulgarian border and is designed to serve both the domestic and regional gas markets.

It will have a total storage of 170,000 cbm in addition to four regasification units. Construction was due to start in the second quarter of 2019, but in May 2019, Gastrade announced that the project timeline had been pushed back by six months because of regulatory and technical issues and that the final investment decision for the 6.1 bcm/year Alexandroupolis, Greece, floating LNG terminal had been postponed to the end of 2019.

The first stage of market tests took place at the end of last year as 20 companies submitted non-binding expressions of interest for a total of 12.2 bcm. The capacity that the companies bid for exceeded the terminal's expected capacity, which is due to be 5.5 bcm/year.

The second round of market tests is expected to take place in June 2019, later than previously expected. The second round of market tests will be binding and carried out under the supervision of the Greek regulator RAE. Another tender, also launched in January, for LNG ship builders and operators to express their interest in supplying the floating storage and regasification unit is ongoing as of the writing of this report. The tender included a request for storage capacity of 150,000-170,000 cu m and a peak gas sendout rate of up to 8.3 bcm/year (22.7 million cu m/day).

The FSRU along with the expanded Revithoussa onshore terminal will bring Greece's total storage capacity to 375,000 cbm, thus aiming to double Greece's LNG import capacity as the country looks to become a regional hub for onward gas delivery to Southeast Europe, in connection with the Interconnector Greece-Bulgaria pipeline.

The project is expected to be partly financed by some European and national government funds, due to its strategic role. The estimated cost of the terminal, including connection to the grid, is Eur380 million (\$424 million), including Eur240 million for the FSRU.

There are talks of establishing a second onshore terminal at Revithoussa, but so far this project remains at the discussion stage.

### **2.3 Turkey**

Turkey has more than doubled its LNG import capacity since 2017, bringing it to just over 40 bcm/year. Turkey's two onshore and two offshore terminals can now single-handedly cover just over 90% of Turkey's annual gas demand.

The four terminals include: Aliaga, Marmara Ereğlisi, Etki Liman FSRU (Çakmaklı) and Dört Yol FSRU. The LNG imported via these terminals could be exported via TAP (in the second phase of development), or via Turkey's pipeline interconnector with Greece as well as the Trans-Balkan pipeline once it becomes idle in 2020 as it is replaced by TurkStream.





Turkey's onshore and offshore terminals. Source: Gina Cohen

- **Aliaga terminal**

The onshore terminal is privately operated by EgeGaz Aliaga LNG terminal and is located on the Aegean Sea shore at Aliagaz-Izmir. It came into operation in 2006, but the first cargo was imported only in May 2009. Following expansion works in 2018, its send-out doubled to 40mcm/day, making it the biggest receiving terminal in Turkey.

The jetty allows vessels up to Q-Max capacity (11,000m<sup>3</sup>/h) to unload. The terminal has third party access, but historically, most of the capacity had been booked by BOTAS. Operators EgeGaz also import one to two cargoes annually, but the volumes are earmarked for the trucking business. The terminal can load LNG onto trucks.

- **Marmara Ereğlisi**

The 4.6 mtpa Marmara Ereğlisi import terminal was commissioned in 1994 and is located close to the major Turkish city of Istanbul and the Bosphorus Straits. The terminal is operated by Turkey's state-owned gas company BOTAS, which has long-term purchase contracts with Algeria for 4.4 bcm/year and Nigeria for 1.2 bcm/year, taking up most of the capacity.



The terminal has three LNG storage tanks of 85,000cbm capacity each. After several expansion works its current send-out stands at 37mcm/day. The terminal can also load LNG on up to 75 trucks per day. However, it is not clear from the BOTAS website whether this facility is in use or not.

The terminal offers third party access, but historically, most of the capacity has been booked by the incumbent BOTAS, which has had long-term supply contracts with Algeria and Nigeria. Mid-term contracts have also included supplies from Qatar and a mid-term agreement with Shell.

- **Etki Liman (Cakmakli) FSRU**

Turkey's first FSRU is the 3.8mtpa Cakmakli terminal, which arrived in the Aliaga industrial area in Turkey in December 2016, providing some relief to the gas system at a time of expected peak consumption.

Etki Liman Istletmeleri, a subsidiary of the Turkish construction group Kolin chartered the 145,000cbm Neptune FSRU from France's ENGIE for two years. Half of the FSRU's capacity has been booked by the Turkish state company BOTAS. The FSRU has regularly received cargoes since arrival, helping to alleviate Turkish winter gas consumption needs.

The FSRU has an annual gasification capacity of 5.14 bcm and a storage capacity of 142,862cbm.

The Neptune FSRU was expected to be replaced with the 170,000cbm Turquoise FSRU in 2019.

- **Dortyol FSRU**

The Dortyol port situated close to the Ceyhan oil terminal in the Mediterranean Sea hosts the world's largest FSRU. It can also be moved to the Gulf of Saros, close to the Thrace region in case of spiking demand in the north-western part of the country.

The land-based LNG terminals only receive Q-Flex. They do not have the storage fully to discharge a Q-Max. As their tanks empty, the rate falls slightly and it is hard to operate them 365 days a year. The Saros one has had real start up problems. They are only now tendering further connection lines to the grid, although it was officially opened in February 2018.

The 263,000cbm FSRU Challenger arrived at the location in 2018 and has been chartered by the Turkish incumbent BOTAS from Japanese shipping company Mitsui OSK lines (MOL) for a period of three years.

The vessel has an annual capacity of 2.7m tonnes of LNG and an estimated daily send-out capacity of 20 million cubic metres.

The FSRU was originally planned for Uruguay, but the development of LNG import infrastructure fell behind after two key project partners pulled out in 2015. Since its arrival in Turkey, the FSRU has been underused largely because demand in the Mediterranean region is reduced even during the winter months and there is insufficient infrastructure in the region to allow for the volumes to be easily shifted throughout the transmission system.

### **3. EXPORT PIPELINES**

This section discusses the export options for gas imported via Turkey, but earmarked for central, eastern or southern Europe, or gas that can be shipped to these parts of Europe without needing to transport the volumes across Turkey.

The first part of this section (3.1) will examine Russia's export options. The second part (3.2) will analyse export routes that can carry gas sourced from multiple regions (namely either Russian or other gas, such as East Med gas).

#### **3.1 Russia's export routes**

In recent years, Gazprom has been considering four options for getting its gas exported via TurkStream 2 into Europe, but it looks increasingly clear that Russia will opt to export its TurkStream gas to central Europe via Bulgaria and Serbia, although, Russia may consider the other options in the future. All the options for TurkStream 2 include:

- **Option 1** - An exit into Greece from Turkey through existing infrastructure. This was indeed the original plan. The plan was that TurkStream would extend into Europe via the revived ITGI-Poseidon pipeline that was to run from Turkey via Greece to Italy. The Greece to Italy sections would have to be built.

On 3 April 2017, Turkey passed the "Law Pertaining to the Approval of the Agreement between the Turkish Republic, the Hellenic Republic and the Republic of Italy Concerning the Development of the Turkey-Greece-Italy Gas Transportation Corridor." By doing this, Turkey approved the ITGI project, which is part of the ITGI. On 2 June 2017, an agreement was signed between Greek DEPA, Italian Edison and Gazprom relating to the transportation of Russian natural gas via TurkStream to Turkey, Greece and onwards to Italy.

Thus, Russia was considering at the time to export gas to Italy through the planned 10-20 bcm/year ITGI Poseidon pipeline. Back in 2017, Italy's national energy strategy was to support the ITGI Poseidon project for receiving gas from Russia and the East Med. They were hoping this project could bring up to 20 bcm of gas a year, which could be equally divided between Russian gas flowing through the second leg of the planned 31.5 bcm/year TurkStream and the proposed EastMed pipeline. However, after the elections of 2018, the new

Italian government opposed the project. In April 2019 Italian prime minister Giuseppe Conte suggested that the Poseidon project was not on the government's agenda, and added that instead a link could be compatible with TAP as the entry point. Italy's minister for the south, Barbara Lezzi, also noted that there was strong opposition for another pipeline passing through the southern Apulia region. Complicating matters, however, in a statement to ICIS of 18 April, the operators of the TAP project confirmed there were no plans to integrate it with the EastMed pipeline. In addition as one can see from this document, there will be multiple projects potentially vying for use of the capacity in TAP phase 2.

- **Option 2** - Another plan mentioned for the first time in January 2017 by Gazprom deputy CEO Alexander Medvedev, is to bring TurkStream 2 into Turkey, and from there TurkStream gas would book capacity into the TAP pipeline phase 2, also to Greece and Italy.

Options 1 and 2 above both suggest a Greek entry point from Turkey for the European string of TurkStream (namely TurkStream 2). This second option is now being examined by Gazprom as an alternative to their original plan (option 1), especially since Gazprom (and most experts) believe that Azerbaijan has limited extra resources to export more gas because of growing domestic demand. In 2017, Azerbaijan consumed 10.6 bcm of gas, and although it produced 17.7 bcm, it is already exporting 8.9 bcm a year, including 6.3 bcm to Turkey and some 2.1 bcm a year to Georgia and has thus had to import about 2 bcm a year. Local consumption will be increasing.

Indeed, even while it is preparing to launch substantial exports of natural gas to Europe, Azerbaijan is struggling with domestic fuel shortages. This former Soviet state, which emerged as a net exporter of gas in 2007, is now having to rely on imports of gas (e.g. from Turkmenistan and Iran) to cope with rising demand in its power sector. Azeri's problems with lack of gas supplies is compounded by the fact that the government has been artificially keeping low gas tariffs on the home market with wholesale gas prices at \$28 per 1,000 cubic meters in 2016 (namely below \$1 per MMBtu) down from \$40 a year earlier, although SOCAR had to pay UAE based field operator Bahar Energy almost \$140 per 1,000 cubic meters for gas at the wellhead in 2016.

Lifting domestic gas prices could help curb local consumption and incentivise further discoveries by SOCAR itself (e.g. development of the offshore Absheron field has been delayed because Total and SOCAR have failed to agree on a suitable price for off-take agreement). Thus, whether or not Azerbaijan will have more gas to export to Turkey and from Turkey to Europe using the TAP pipeline phase 2 depends very much on local policies in Azerbaijan.

- **Option 3** - There are two other options, which are the Bulgarian options. The first Bulgarian option is one that would consist of using the Bulgaria-Romania-Hungary corridor, which is due to be commissioned in 2020. The corridor is comprised of the Bulgaria-Romania and Romania-Hungary interconnector as

well as a new section linking the two interconnection points inside Romania. The corridor is partially financed by the EU and was initially designed to take gas imported in southern Europe as well as produced in the Black Sea further to central Europe. However, as Black Sea gas production is in doubt, the project could be used to sell Russian gas to Europe.

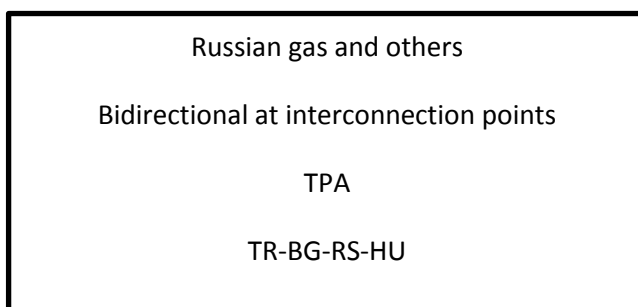
- **Option 4** – The second Bulgarian option is the possibility that the TurkStream pipeline enters Europe via the Black Sea at the Turkey/Bulgaria Border and from there go into Bulgaria from where it could either go to Greece and Italy (thus repeating the southern route of South Stream) or go to Austria (via Serbia and Hungary) (thus repeating the northern route of South Stream).

Hungary and Serbia signed a cooperation agreement on the construction and operation of a natural gas pipeline interconnector. An open season bidding round for cross-border capacity will be held in September 2019, with hopes to attract up to 10 Bcm/year in shipper commitments. In the event of a successful bidding process, construction should start in the summer of 2020, to be completed by the end of 2021. The proposed interconnector would be part of a Turkey-Bulgaria-Serbia-Hungary gas corridor, shipping Russian gas to southeastern and central Europe.

This latter option, also dubbed South Stream Lite has been gaining traction in 2018, and national transmission system operators in this country have already been conducting open seasons for long-term capacity reservation at key interconnection points. It is increasingly clear that this will be the export route for TurkStream 2 volumes earmarked for central Europe (this option is discussed in further detail below in section 3.1.1

The other three projects - ITGI, TAP, BRUA - are designed to transport gas sourced from other countries, although they may also be used for the transport of Russian gas in the future (and are thus discussed in section 3.2).

### **3.1.1 South Stream Lite (Turkey-Bulgaria-Serbia-Hungary)**



South Stream Lite follows the European route of the erstwhile South Stream project which aimed to ship Russian gas from Bulgaria to the central European Baumgarten hub in Austria, via Serbia and Hungary. The South Stream project was regarded as being non-compliant with European Union competition and energy legislation, in particular the Third Energy Package, and was finally cancelled in 2014.

Rather than making the landfall in Bulgaria as the South Stream had planned, thus being prone to EU gas legislation due to its entry in a EU country, South Stream Lite will connect first in non-EU member Turkey with TurkStream 2 on the Turkish-Bulgaria border and use the existing infrastructure from Turkey and in Bulgaria to transport the gas further into Serbia and on to Hungary.

Any additional infrastructure required for the transport of gas will be developed by national gas transmission system operators respectively in Bulgaria, Serbia and Hungary.

When finalised, the capacity of the entire corridor could reach 15 bcm/year. A determining factor will be the amount of gas Gazprom intends to sell along the route (from Bulgaria up to Hungary).

Bulgaria has a long-term contract for 2.9 bcm/y of gas from Russia – its only supplier – until 2022, but imported 3.2 bcm from Russia in 2016. Serbia increased the volume of its Russian imports from 1.5 bcm/y to 2 bcm/y in a deal signed with Gazprom in December 2017. Hungary imported 8.2 bcm from Russia in 2017.

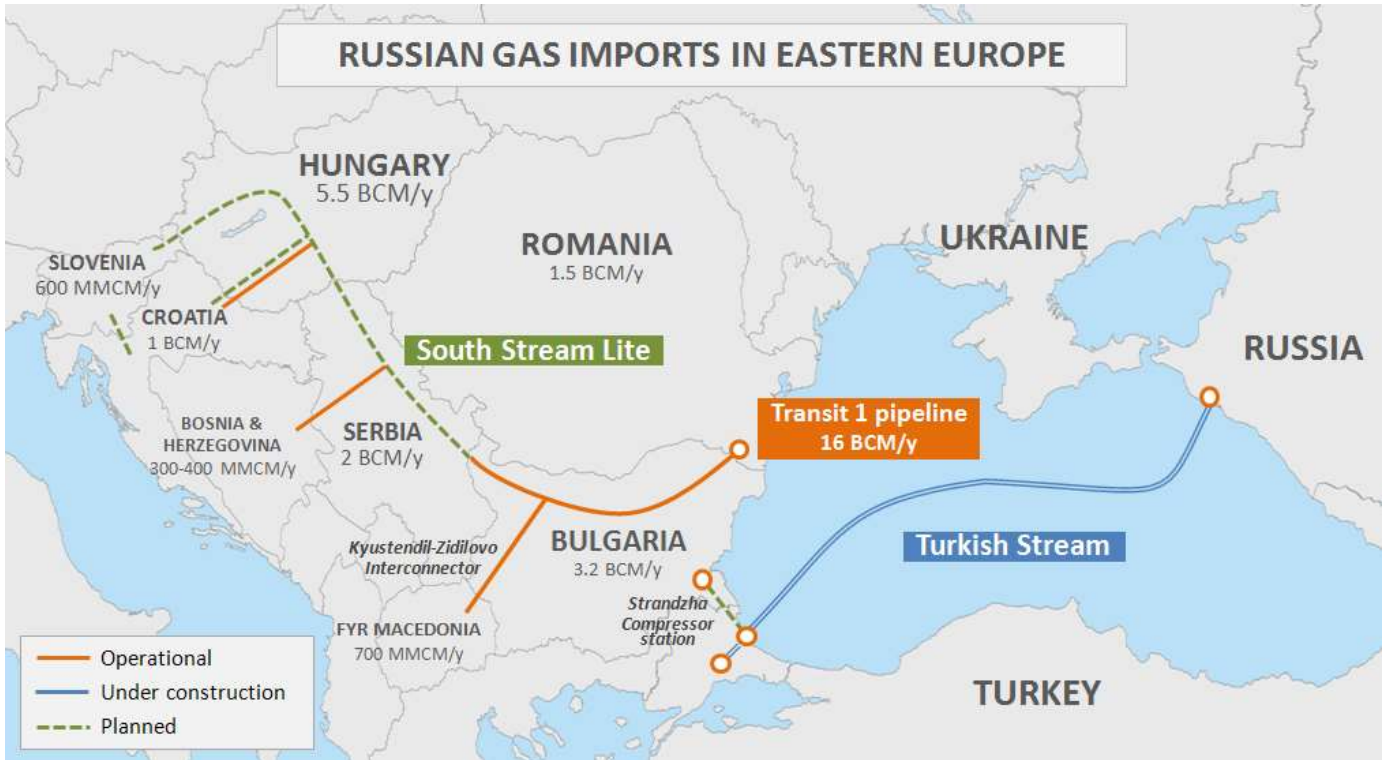
Bosnia and Herzegovina currently receive 300-400 million cubic metres (mcm) of Russian gas per year via Serbia. Northern Macedonia (former Yugoslav Republic of Macedonia) imported 70 mcm in 2016 through Bulgaria. Romania imported 1.5 bcm via Ukraine in 2016, and is already interconnected to Bulgaria and could receive TurkStream gas via that route.

Croatia – which receives gas via Hungary – signed a 10-year contract in 2017 for 1 bcm/y of gas. Slovenia receives around 600 mcm/year of Russian gas, but is not connected to Hungary or Croatia.

This represents a total of about 14 bcm/y of gas, almost equivalent to the 15.7 bcm/y capacity of Turkish Stream’s second line. Individual TSOs are required to organise open seasons to assess the level of interest for booking long-term capacity on the pipelines. The non-binding and binding stages of the open seasons are held by TSOs in Bulgaria, Serbia and Hungary.

<b>Countries</b>	<b>Russian volumes that could be off-taken (bcm/year)</b>
Bosnia and Herzegovina	0.4
Bulgaria	3
Croatia	1
Hungary	5.5

North Macedonia	0.07
Romania	2
Serbia	2
Slovenia	0.6



South Stream Lite. Source: Gina Cohen

- **Bulgarian link**

New infrastructure

Bulgaria is thus expected to be the main transit route for Russian gas exported via Turkey when the second string of the 15.75 bcm/year TurkStream pipeline is completed by the end of the decade.

The transit via Bulgaria will take place via a combination of existing infrastructure and a new pipeline linking the domestic network to the Serbian border.

Currently, Turkish companies hold import contracts with Gazprom Export amounting to 14 bcm/year via the Trans-Balkan (Western) line. Volumes to Turkey only via the western Malkoclar entry point on the Bulgarian border.



Source: Gina Cohen

Last year, the Bulgarian grid operator Bulgartransgaz, initiated the expansion of the Trans-Balkan Pipeline to allow for reverse flows from Turkey into Bulgaria, once the line is offline. As part of this project, it completed a 20-km extension of the Trans-Balkan Pipeline in the southeast of the country at the beginning of August 2018, increasing its capacity by 1.7 bcm/y, to around 16 bcm/y.

The TSO has also launched a tender for the design, construction and commissioning of an 11-km spur that will link the Trans-Balkan Pipeline’s Strandja compressor station to the Turkish gas grid.



Bulgarian section of South Stream  
Bulgarian connecting pipeline. Source: Bulgartransgaz.

At the beginning of 2019, Bulgartransgaz organised a tender for the construction of a 480-km pipeline linking the northeastern point of Varna/Provadia to the Kirovo-Zajecar interconnection point with Serbia.

At the beginning of April 2019, Bulgartransgaz announced that a consortium led by Saudi Arabia's Arkad Engineering won a tender to build the pipeline across Bulgaria. The group, which also includes a Milan-based joint venture between Arkad and Swiss-based ABB, offered to complete the project by the end of 2020 for 1.1 billion euros (\$1.24 billion), or within eight months for 1.29 billion euros.

### **Capacity booking**

In order to allow for the gas shipped via TurkStream 2 to be imported into the country, Bulgaria held an open season for long-term capacity at the Malkoclar-Strandja interconnection point with Turkey and at the Kirovo-Zajecar IP with Serbia.

A total of 289.5GWh/day/year of capacity was allocated on the Malkoclar-Strandja interconnection point on the Turkish-Bulgarian border in 2020 and 2021. The capacity will increase to 511GWh/day/year from 1 January 2022 for a period of 18 years.

Meanwhile, a total of 97GWh/day/year has been allocated on the Bulgarian-Serbian border in 2020 and 2021, which will increase to 318GWh/day/year from 1 January 2022 also for a period of 18 years.

The transmission tariff for the Turkish-Bulgarian border will be leva (Lv)344.25/MWh/day/year (€176.012/MWh/day/year calculated at the February 2019 exchange rate), and Lv584.69/MWh/day/year on the Bulgarian-Serbian border.

Bulgartransgaz said the capacity that had been offered on the two borders has now been booked. There were unconfirmed reports that 90% of the capacity had been booked for long-term supplies by three companies. One of these companies was thought to be Gazprom Export, while the other two were Gazprom-affiliated entities.

The TSO held two previous binding phases in January, but they ended in failure and Bulgartransgaz decided to reduce the transmission tariff by 3% and extend the period of transit from 15 to 20 years.

- **Serbian link**

As much as 14 bcm/year could be transited via Serbia from the Kirovo-Zajecar interconnection point with Bulgaria to the Kiskundorozsma border point with Hungary from 2020/2021.

Gazprom Export used its wholly owned Serbian TSO Gastrans to launch a non-binding open season in March 2018 for an interconnector across Serbia linking Bulgaria and Hungary. The project is scheduled to be completed by October 2019. At the end of



July, Gastrans asked Italian company Saipem to conduct engineering services and acquire permits for construction work for South Stream Lite.

Serbian energy regulator AERS granted third party access exemption on the pipeline, despite ten companies earlier showing non-binding interest. EU body Energy Community criticised the decision, noting that Serbia, as a contracting part of this institution, which is designed to extend the principles of free energy markets to non-EU states, was in breach of EU regulations.

Gastrans held a non-binding open season between 5 March-15 April 2018 where shippers registered high interest for capacity on the transit pipe, with around 44-49 million cubic metres (mcm)/day of capacity booked to enter the Serbian network from gas year 2019 to gas year 2038.

However, despite high private interest, Gastrans allocated 88% of the capacity to Gazprom Export and local Serbian company Srbijagas. Only 12% may be allocated to other companies. Gastrans has also been exempted by the regulator AERS from applying regulated transmission tariffs through the new pipeline as required by EU regulations.

At the end of April 2019, the EU's Energy Community sent a letter to Serbia, pointing out that it was not fulfilling its obligation to ensure third party access to the border with Hungary. The letter was the second stage in a dispute settlement procedure initiated by the body in July 2018.

The Energy Community said in July 2018 that the exclusion of the Horgos border point between Serbia and Hungary from capacity-allocation procedures, non-transparent tariffs and the failure to allow competition with Serbian state supplier Srbijagas violated EU law.

Srbijagas owns the infrastructure at the Hungarian border and is the major supplier to the country's gas market, which clashes with EU rules on unbundling. Serbia was given until 19 June 2019 to rectify its non-compliance.

Imports from Hungary along the Horgos border point are currently Serbia's only supply source.

- **Hungarian link**

Despite Gazprom's repeated claims that gas from the Turkish Stream pipeline will reach the European gas hub at Baumgarten in Austria, little progress has been made in bolstering links between Hungary and Austria to facilitate the additional gas flows. Thus, the lack of infrastructure linking Hungary to Austria suggests Gazprom may use South Stream Lite to serve only Hungary and the Balkans.

In contrast, the transmission system operators of Serbia, Hungary and Bulgaria have taken tangible steps towards building a pipeline through the Balkans. This suggests

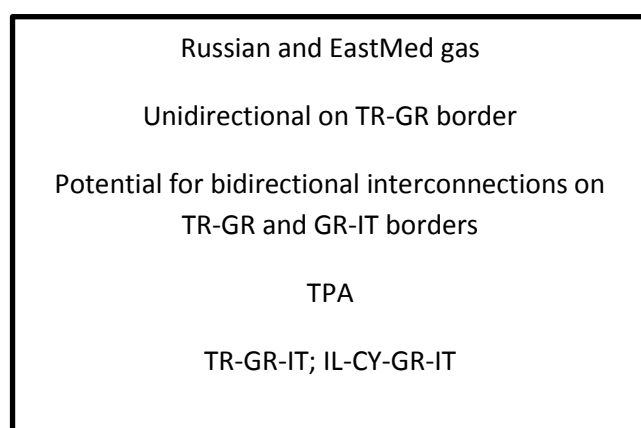
Gazprom does not expect to send its gas directly to Baumgarten but could supply eastern European states instead.

Hungary plans to be able to increase its imports from 5.5 bcm/year in 2017 to 8 bcm/year of Russian gas via a TurkStream pipeline spur by the end of 2019, signing relevant agreements with Russia's Gazprom as well as with Bulgaria and Serbia, which would transit the gas to Hungary. At the end of March 2019, the Hungarian Ministry of Foreign Affairs said the country was set to receive the first TurkStream volumes by the second half of 2021.

Hungary could re-export some of the volumes to Croatia, Romania, Slovakia, Slovenia and Ukraine, as well as Austria if the country expresses an interest.

### **3.2. Export routes for diverse gas imports**

#### **3.2.1 ITGI - Poseidon (Interconnector Turkey-Greece-Italy)**



ITGI was first mooted as part of the EU-backed Southern Gas Corridor and was expected to bring Caspian gas imported via Turkey to Greece and further to Italy.

The project is made up of two sections: the Turkish-Greek interconnection, which is in operation, and the Greek-Italian offshore link (IGI Poseidon), which is yet to be developed. In 2017, Turkey ratified an inter-governmental agreement with Greece concerning the development of the ITGI Poseidon natural gas transit route from Turkey to Greece and across the Adriatic to Italy.

The ratification opens the way for the ITGI Poseidon project to be developed to transit Russian gas slated to arrive in northwest Turkey via the planned TurkStream pipeline, and follows the signing in June 2017 of a cooperation agreement between Gazprom, Greek state gas company DEPA and Italy's Edison for reviving the long-stalled ITGI Poseidon pipeline project.

- **3.2.1.1 Turkey-Greece interconnection**

The first phase of the South European Gas Ring is the pipeline that interconnects the Turkish and Greek natural gas systems and enables to transport gas from Turkey to Greece (this is in fact currently the only existing export line from Turkey outwards and westwards, although as mentioned, the West Line could eventually be used to export gas if it is no longer used once TurkStream is online. The gas supplies come from the Caspian Sea, namely from Azerbaijan to Greece.

The length of the first section (Turkey-Greece) line is 296 km, out of which 210 km is in the Turkey section and 86 km is in the Greek section. The connection of the line is between Ipsala in Turkey and Kipi in Greece.

Capacity of the line is currently only 4.6 million cubic meters/day of which 2.5 mcm/day is already booked by the Turkish incumbent BOTAS for gas exports to Greece. The line has been in operation since November 2007. Very little of this line is being used currently, with Greece only buying below 1 bcm a year of gas from this route.

Compression on the Greek side has been upgraded, but BOTAS needs to follow suit, if it wished to expand the export capacity. The Greek gas transmission system operator DESFA had been in talks for more than three years with BOTAS to sign an interconnection agreement and to allow third party access on the Kipi-Ipsala interconnection point between Turkey and Greece.

There were expectations that BOTAS would collaborate with its Greek counterpart to coordinate key issues such as the nomination allocation procedure, the measurements of natural gas and the gas day on both sides of the border. BOTAS was due to provide information in 2018 with a view to prepare the process for the start of cross-border trading as early as July 2018. As the company failed to provide relevant information, counterparties hoped the Turkish state company would meet the September 2018 deadline ahead of the start of the new gas year in October 2018. BOTAS, however, also missed that target, as it did the November 2018 deadline when Turkish gas companies are typically expected to book annual capacity for the following year. There has not been any progress since.

Around 20GWh/day (1.9mcm/day) could be offered to third parties on the Greek side of the interconnector. The remaining 51GWh/day (4.8mcm/day) capacity is booked under long-term agreement by the Turkish incumbent BOTAS (out of which BOTAS only uses 2.5mcm/day).

Although the volumes are small, the start of cross-border trading would help Turkish and regional companies to trade with each other and pull Turkey out of isolation.

Under current arrangements, Turkish companies are restricted from importing or exporting natural gas regionally unless they fulfil a series of highly cumbersome conditions. Earlier in 2018, the Turkish parliament passed draft legislation that would liberalise spot gas imports and exports. The government was expected to approve it, but so far there are no indications that it may have done so.

▪ **3.2.1.2 Greece-Italy interconnection**

<http://www.igi-poseidon.com/en/poseidon>

The project has been planned to eventually link Greece to Italy and in this regard, an Intergovernmental Agreement was signed between Turkey, Greece and Italy on 26 July 2007.

Although there has been no progress on obtaining commitments for gas transportation in this sector, it is still considered that opportunities may arise for the realisation of the Italian connection of what is known as ITGI (Interconnector, Turkey, Greece, Italy),

The Greece to Italy section of the ITGI, namely the Poseidon line, is a project to be developed by IGI Poseidon, a JV between Greek DEPA and Italian Edison. IGI Poseidon is the offshore section of the Interconnector Turkish Greece Italy (ITGI), namely the offshore section between Greece and Italy (see above for further details of the IGI Poseidon project)..

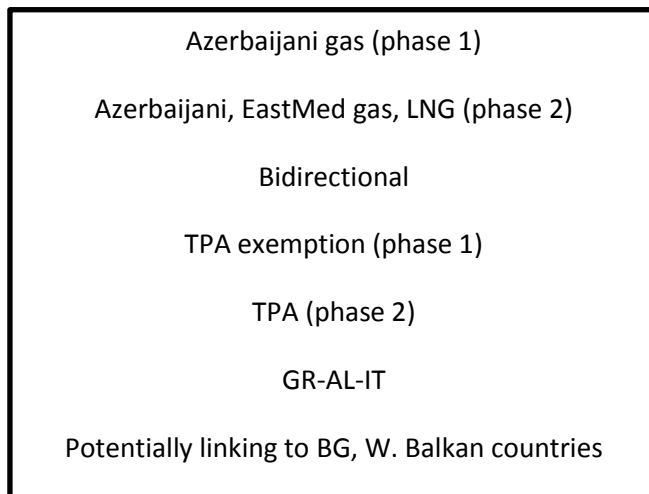
The design capacity is for 20 bcm/year to allow the transportation of gas from the Turkey/Greek border and from the Eastern Mediterranean region, if such gas is made available from the East Med offshore (Cyprus and Israeli gas, via Crete and mainland Greece).

ITGI Poseidon was initially proposed to bring Azeri gas to Europe, but it was shelved when the Shah Deniz consortium opted for TAP. The project was revived in 2016 by Gazprom, Edison and Greek system operator DEPA as a southern route for Russian gas.

The Poseidon Pipeline's current design envisages a 220 km long offshore pipeline. The pipeline's starting point is the compressor station, located in the area of Florovouni in Thesprotia (Epirus region). From the compressor station, the pipeline will continue to the Greek landfall from where it will cross the Greek shelf, descend the slope into the north Ionian Basin, ascend the Italian slope and finally reach the Italian landfall, east of Otranto. The pipeline will then continue up to the metering station within the boundaries of the municipality of Otranto where it will be connected to the Italian national gas transmission system.

If ITGI is to be commercially justifiable they would probably need additional gas from some other Southern Corridor source and that is why the group is pushing for the East Med gas into this line.

### 3.2.2. Trans-Adriatic Pipeline (TAP)



<https://www.tap-ag.com/the-pipeline/route-map>

TAP is the third part of the EU-backed Southern Gas Corridor to transport offshore gas from the second phase of Azerbaijan's Shah Deniz project to Europe over 3,500 km.

The Southern Gas Corridor (see separate discussion above) is made up of the expanded Southern Caucasus Gas Pipeline (SCPx), the Trans-Anatolian Pipeline (TANAP) and the Trans-Adriatic Pipeline (TAP).

The 878 km long TAP pipeline will connect with the Trans Anatolian Pipeline (TANAP) at the Turkish-Greek border at Kipi, it will then cross Greece and Albania and the Adriatic Sea, before coming ashore in Southern Italy. The offshore section of the pipeline will begin near the Albanian city of Fier and it will traverse the Adriatic Sea to tie into Italy's gas transportation network in Southern Italy.

The construction of the project started on 17 May 2016 and as of 17 May 2019, 87% was completed; its estimated cost is €4.5bn.



The first phase of the project which is due to be commissioned in 2021 will transport 10bcm/year.

*Trans-Adriatic Pipeline (TAP). Source: Gina Cohen*

TAP will be made up of the following sections:

- **Greece** - The pipeline in Greece will be approximately 550 km long, starting at Kipi near the Turkish-Greek border and finishing at the Greek border with Albania, southwest of Ieropigi.
- **Albania** - The pipeline in Albania will be approximately 215 km long, starting at Bilisht Qender in the Korca region, on the border with Greece. TAP's landfall in Albania will be located 17 km north-west of Fier, up to 400 metres inland from the shoreline. The offshore section in Albanian territorial waters will be about 37 km.
- **Adriatic Sea** - TAP's route across the Adriatic Sea will take the pipeline approximately 105 km along the seabed from the Albanian to the Italian coast. The deepest point of the pipeline below sea level will be 820 metres in the strait of Ontranto in the Adriatic Sea. Laying the pipes at depths of more than 800 metres allows the use of S-type lay barges. Pipes 12 metres long will be welded to the pipeline string on the deck of the barge. The steel outer pipe will have a diameter of 36 inches and a thickness of 20 to 34mm, depending on the depth of water. At depths of less than 300 metres, the pipe will be coated with concrete for protection from potential damage.
- **Italy** - TAP will make landfall in southern Italy, in Lecce, municipality of Melendugno, near San Foca. The offshore pipeline through Italian territorial waters will be about 25 km long while the onshore section will be approximately 8 km. The location was chosen after eleven alternative pipeline route assessments as the most feasible from environmental, safety and social perspectives.

## Technical details

The offshore segment will be 36 inches (0.91 metres). The thickness of the steel pipe wall will be 17.5 to 31 mm (there are four different classes of pipe).

The above-ground facilities will include two compressor stations, block valve stations and the pipeline receiving terminal in Italy. Two compressor stations, one near Kipi, in Greece, and the other on the Albanian coast near Fier, will be used to ensure gas transportation through the pipeline.

The first phase of the project is designed to carry 10 bcm/year, but this could be doubled in a second stage, if additional gas from the Caspian region, Russia or other sources included EastMed gas is sourced. If the project is upgraded in the future to 20 bcm/y, it would be necessary to construct two new compressor stations at Bilisht, Albania and Serres, Greece.

The pipeline will also have the so-called 'physical reverse flow' feature, allowing gas from Italy to be diverted to South East Europe if energy supplies are disrupted or more pipeline capacity is required to bring additional gas into the region.

## Third party access and pricing

The European Commission gave TAP a 20 year third party access exemption for the 10 bcm/year imported in the first phase. The Commission, however, also clearly stated that the extra capacity that would be created if TAP raised its capacity to 20 bcm/y, would have to be made available to any supplier. In any event, TAP stated in February 2017 that it was in a position to offer capacity on the line via open seasons to gauge interest among potential customers, and which gives equal access to any would-be supplier.

Since TAP benefits from a third party access exemption, the pipeline can only be used by the companies off-taking the gas through 25-year agreements.

Companies off-taking TAP gas	Country	Volumes (bcm/year)
Axpo	Switzerland	Not disclosed
Bulgargaz	Bulgaria	1
DEPA	Greece	1
Enel	Italy	Not disclosed
Engie	France	2.6
Hera	Italy	0.3
Shell	The Netherlands	1
Uniper	Germany	1.6

Most of the contracts signed by Italian companies are indexed to prices at Italy's PSV hub, while the contract to Greece has an element of indexation to the Austrian VTP.

TAP's shareholding partners include BP (20%), SOCAR (20%), Snam S.p.A. (20%), Fluxys (19%), Enagas (16%) and Axpo (5%).

### **Exporting possibilities**

Along its route, TAP can facilitate connections to a number of existing and proposed pipelines, ensuring that the Southern Gas Corridor opens up to many different energy markets. This will enable the delivery of Caspian gas to destinations throughout southeastern, central and western Europe.

TAP's routing can facilitate gas supply to several South Eastern European countries:

- Bulgaria
- Albania
- Bosnia and Herzegovina
- Montenegro
- Croatia

On completion, the 878 kilometer-long pipeline will provide an estimated 33% of Bulgaria's gas needs, 20% of Greece's requirements and approximately 10.5% for Italy.

### **Roadblocks and concerns**

The project has been beset by several problems including (1) environmental concerns in Italy, (2) the political stance of Azerbaijan on human rights and its withdrawal from the EITI scheme as well as (3) concerns about the ability of the Caspian country to supply the necessary volumes.

Shortly after coming to power in March 2018, three MPs from Italy's ruling Five Star Movement (M5S) lodged a complaint against TAP. They questioned the legitimacy of the construction site and the imminent removal of 448 olive trees in the area. The MPs main concern was the construction of a 3-metre-high protective fence around 'cluster 5' – one of the project's construction sites, which runs along an 8.2 km stretch between the coast and a receiving terminal west of Melendugno. The fence was authorised by Italy's minister of economic affairs with a decree on 14 March 2018, but M5S said that it violates landscape conservation laws.

Nevertheless, the legal and economic obstacles of halting a project two-thirds completed were seen as too big and expensive to be faced.

As mentioned, one of the other concerns regarding progress on TAP related to wider issues linked to Azerbaijan's withdrawal from the Extractive Industries Transparency Initiative (*EITI*) in March 2017 because of Western criticism of its human rights record. The pullout from the organisation designed to promote greater transparency about state revenues from energy extraction and mining, somewhat complicated Azerbaijan's moves to seek loans from international financial institutions that require adherence to EITI principles. Most analysts believe the damage was mainly



reputational. A western industry source said Azerbaijan was likely to meet requirements for revenue transparency.

The most serious concern however relates to Azerbaijan's ability to supply the volumes for the first and second phase of the Southern Gas Corridor. The country is expected to export a total 16 bcm/year (6 bcm/year to Turkey and 10 bcm/year to southern European markets) by the beginning of the new decade.

Azerbaijan has been experiencing a shortage of gas for exports, as indeed the country has limited extra resources to export more gas because of growing domestic demand and low prices in the local market.

In 2016, Azerbaijan consumed 10.6 bcm of gas, and although it produced 17.7 bcm, it is already exporting 8.9 bcm a year, including 6.3 bcm to Turkey and some 2 bcm a year to Georgia and has thus had to import about 2 bcm a year. Local consumption will be increasing.

Indeed, even while it was preparing to launch substantial exports of natural gas to Europe, Azerbaijan was struggling with domestic fuel shortages. This former Soviet state, which emerged as a net exporter of gas in 2007 had to restart imports of Russian gas in 2018.

Azerbaijan's problems with lack of gas supplies is compounded by the fact that the government has been artificially keeping low gas tariffs on the home market with wholesale gas prices at \$28 per 1,000 cubic meters in 2016 down (namely below \$1 per MMBTU) from \$40 a year earlier, although SOCAR had to pay UAE based field operator Bahar Energy almost \$140 per 1,000 cubic meters for gas at the well head in 2016.

Lifting domestic gas prices could help curb local consumption and incentivise further discoveries by SOCAR itself (e.g. development of the offshore Absheron field has been delayed because Total and Socar have failed to agree on a suitable price for their offtake agreement). Thus, whether or not Azerbaijan will have more gas to export to Turkey and from Turkey to Europe using the TAP pipeline phase 2 depends very much on local policies in Azerbaijan.

### **Additional sources of gas**

Considering that Azerbaijan may not be able to supply additional volumes for the second phase of the Southern Gas Corridor, TAP could explore multiple options including EastMed or Russian pipeline gas, or LNG from Turkey, Greece or Croatia.

National TSOs are expected to hold open seasons for the booking of capacity and interested parties should express an interest.

- EastMed gas

Volumes imported from Israel and Cyprus may try to seek to book some or all of the capacity in the second phase of the TAP project, as a route to export its gas to Europe. They could face however strong competition and political pressure from Russia's Gazprom, which could be a strong regional contender for this capacity.

- TAP, Russia and TurkStream 2

Russia is expecting to export 15.75 bcm/year via the second string of TurkStream 2 once it is commissioned in 2020.

Although there are strong indications that Gazprom would be interested in shipping most of these volumes to central Europe via the Bulgaria-Serbia-Hungary link, nevertheless, if Russia considers building additional strings in the TurkStream corridor, the gas could be shipped via the second stage of TAP to southern Europe and west Balkan countries.

TAP may provide an additional incentive for Gazprom to book capacity in its second stage particularly if TAP is further connected to the Ionian Adriatic Pipeline (IAP), which would allow it to expand into countries which have not benefited from gasification.

- LNG

Further volumes into TAP phase 2 could be supplied from regional LNG importing terminals in Turkey, Greece and Croatia (see above section on LNG imports into those 3 countries).

1. The export from Turkey would depend on Turkey lifting existing restrictions that it is bound by, according to the terms of its import contracts, on the export of natural gas to neighbouring countries.
2. Greece expanded the capacity of the Revithousa terminal in December 2018. The third storage tank at the Revithousa LNG import terminal began operations in December 2018. The tank was initially expected to come online in late November but operations were pushed back due to delays in commissioning.  
The expansion brought total storage capacity at the terminal to 205,000 cubic metres (cbm), making it easier to unload cargoes. Previously, the limited storage space meant that larger LNG carriers could only unload partial cargoes, potentially forcing them to wait near the port for the tanks to empty before delivering more.
3. The development of Croatia's Krk terminal was facing several uncertainties as of January 2019 amid insufficient capacity booking interest. The feasibility of the Croatian LNG project is largely dependent on whether Hungary will book sufficient capacity on the planned 2.6 bcm capacity floating storage regasification unit (FSRU) at the island of Krk.

In addition, TAP has entered into multiple Memoranda of Understanding and Cooperation (MoUC) with the developers of the proposed Ionian Adriatic Pipeline (IAP).

### **3.2.3 Ionian Adriatic Pipeline**

The IAP is a proposed 516 km long gas pipeline in Southeast Europe, which could have a total capacity of 5 bcm/year. It would run from Fier Albania through Montenegro, and Bosnia and Herzegovina, to Split in Croatia.

In Fier, IAP would be connected with the planned TAP, which has signed MOUs with developers of the IAP project, including Plinacro (Croatia), BH-Gas (Bosnia and Herzegovina), and governments of Montenegro and Albania.

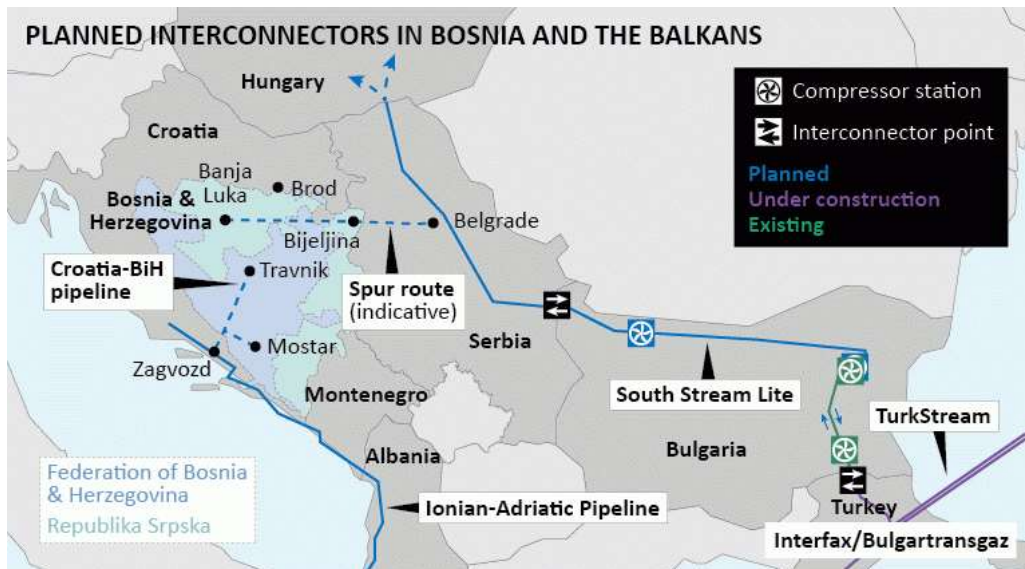
In Split, the pipeline would be connected with the existing gas transmission system of Croatia. In addition, it may be connected with other new gas infrastructure, including the proposed Adria LNG terminal in Krk.



*Ionian Adriatic Pipeline (IAP) Source: Gina Cohen*

In addition, on 18<sup>th</sup> July 2019, the planned pipeline between Croatia and Bosnia & Herzegovina received approval for a feasibility study and tender documents from the European Commission's Directorate-General for Neighbourhood and Enlargement, allowing it to move into the implementation phase.

The pipeline, known as the South Gas Interconnector, is expected to reduce Bosnia’s dependence on Russian gas from 2023 and would enable the country to import volumes from Azerbaijan and the Ionian-Adriatic Pipeline. Bosnia could also receive gas from Croatia’s Krk LNG terminal via the pipeline. However, the project has sparked division among Bosnia’s political entities, which could slow down its implementation.



*Interfax*

The project is set to stretch for 114 km and have a capacity of 0.5-1.0 billion cubic metres per year. It is planned to run from Zagvozd in the south of Croatia to Travnik in the centre of Bosnia, with an additional branch to Mostar. Completion is expected in 2023. The feasibility study will be led by Mott Macdonald and is set to be completed in the third quarter of 2020. The South Gas Interconnector would then be connected to the Ionian-Adriatic Pipeline (IAP), a 5 bcm/y route planned to stretch from Albania to Croatia through Montenegro and Bosnia. The pipeline has yet to reach an FID.

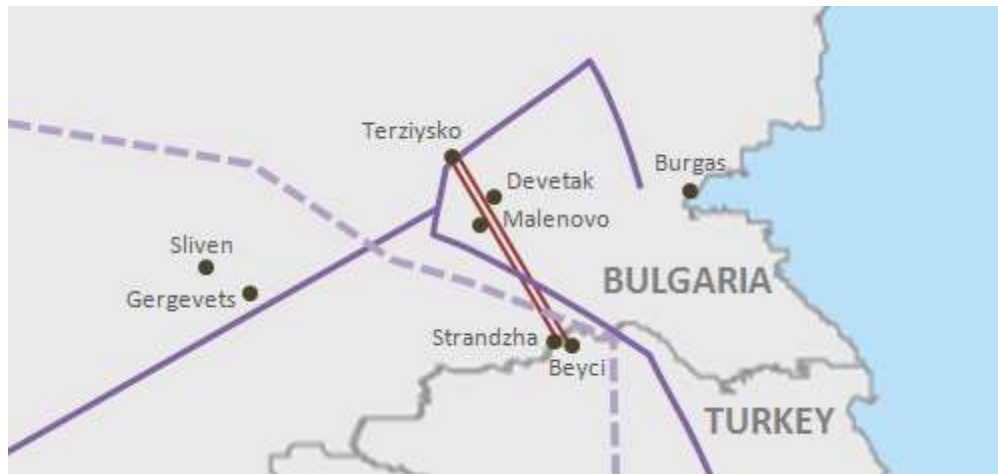
The pipeline is expected to cost around €100 million (\$112 million), which will be funded primarily by a loan obtained on favourable terms from the European Bank for Reconstruction and Development.

### **3.2.4 Interconnector Turkey-Bulgaria**

The interconnector project with Turkey is described as being key to Bulgaria's energy diversification efforts. It is listed among the EU's projects of common interest (PCI).

It would consist of a 77 km-long gas pipeline (75 km on Bulgarian territory and 2 km on Turkish territory) to carry up to 3 bcm of Caspian natural gas a year initially. The pipe diameter would be 28 inches; working pressure 75 Bar.

ITB has been in discussion for a while, but has not yet progressed to FID stage. Progress on this project has stalled because Turkey and Bulgaria could not agree on the exact capacity of the interconnector.



*Interconnector Turkey-Bulgaria. Source: Gina Cohen*

### **3.2.5 Interconnector Greece-Bulgaria (ICGB)**

#### **Technical features**

The 182 km, 32-inch, Greece-Bulgaria interconnector was granted its construction permit on the Bulgarian territory at the end of 2017 and construction on the link was due to start in mid-2018. In July 2019, Greece issued the long-awaited construction permit to the operator (ICGB) so that Construction work can now begin on Greek territory.

The interconnector is designed to transport up to 5 bcm/year in forward flow to Bulgaria and up to 2 bcm/year in reverse flow into Greece. It would allow gas from the second phase of Azerbaijan's Shah Deniz gas field to split off to supply Bulgaria and other markets via Greece. The interconnector could also be used to export to Bulgaria LNG sourced at the Alexandroupolis or Revithoussa terminals in Greece.

The present process of design, permitting procedures and financial structuring envisages the development of the 75-Bar IGB pipeline with a capacity of 3 bcm/year or 9.1 mcm/day of natural gas from Greece to Bulgaria, with the potential for an expansion up to 5 bcm/year, although the timeline for this is not clear. The company will hold a market test for allocating the extra 2 bcm/y at least six months before the pipeline's first phase starts up.

The IGB pipeline will also be equipped to offer physical reverse flow.



Source: Gina Cohen

**Third party access exemption** - Shipment of natural gas along the long-planned IGB pipeline, an interconnector between Greece and Bulgaria, will not be subject to standard EU rules on third party access and tariffs. The exemptions made by both national regulators and the European Commission in August last year will be in place for 25 years.

IGB is expected to be capable of delivering 2.7 bcm/year. Five companies have already booked capacity through the planned link, collectively booking 1.57 bcm/year.

The pipe is particularly crucial for Bulgarian incumbent Bulgargaz, which will begin taking delivery of Azerbaijani-sourced gas from 2020, which will flow to Europe via the TANAP and TAP pipes.

As well as bringing gas from Azerbaijan, the operator of the pipeline sees other sources of gas potentially feeding in. These, it said, include the planned LNG terminal at Alexandroupolis in Greece and gas from the East Mediterranean -- either via direct pipeline to Greece and LNG from Israel and Egypt.

Regulatory documents show that while an exemption has been given on the EU's standard ownership unbundling model, should the operator decide to offer short-term capacity to the market this would still have to follow the principles of the capacity allocation network code.

The Greece-Bulgaria interconnector is a spur off the TAP pipeline, and is designed to transport up to 3 Bcm/year in forward flow to Bulgaria -- with an option to be increased to 5 Bcm/year -- and up to 2 Bcm/year in reverse flow. ICGB will also have

to undertake a new market test within three years of the pipe’s opening, offering capacity up to 5 bcm/year. If any extra capacity is then developed this would not however be exempted from access rules.

The Greek and Bulgarian gas networks are already connected via the Sidirokastron point. Greek incumbent DEPA receives its Russian Gazprom-delivered gas through this point.

ICGB is a 50/50 joint venture between Bulgarian Energy Holdings, the state-owned parent company of Bulgarian grid operator Bulgartransgaz as well as Bulgargaz; and IGI Poseidon, an equal partnership between Edison and DEPA.

In May 2019, IGB has chosen after a tender Greece’s J&P AVAX to construct the pipeline for a price of €144,850,000. The contract is expected to be executed in 18 months after the start of the construction activities. Work on the construction of the line was supposed to commence in May 2019 but was delayed until September because of issues with the procurement process and was expected to be completed by November 2020, but will now not be ready until March 2021 at earliest.

Once it has signed the remaining procurement contracts, ICGB will face two further obstacles: gaining the approval of the Greek and the Bulgarian energy regulators for the network code on capacity allocation and the gas transport agreement.

There had been doubts as to whether the long-delayed project would ever be built given difficult project economics, but with construction now underway the project is finally set to be realized. The deadline for completion of the construction of the interconnector was set at 18 months after the start -- implying an end-date of November 2020. First gas is likely to flow only from 2021.

### **3.2.6. Bulgaria-Romania-Hungary, formerly known as BRUA**

Gas sourced in the Black Sea or via Turkey (phase 1)
Bidirectional
Made up of existing and new infrastructure

<https://www.ebrd.com/work-with-us/projects/psd/brua-pipeline.html>

In its original format, the 582 km bi-directional BRUA pipeline was expected to stretch south to north-west, linking Bulgaria to Austria, and aiming to help regional countries, which have historically relied on Russia, to diversify routes and supplies.





BRU(A). Source: Gina Cohen

Following a reassessment of the project by the Hungarian and Romanian transmission system operators and regulators in 2017, the TSOs decided to eliminate Austria as an end-destination for volumes sourced in southern Europe.

However, in April 2019, the European regulatory body, ACER ruled that the Hungarian gas grid operator FGSZ and Austrian counterpart Gas Connect would need to conduct an economic test on the Hungarian-Austrian border under the incremental capacity project. ACER ruled that the system operators would need to hold a binding bundled capacity marketing process for two offered capacity levels as part of the Hungary-Austria (HUAT) interconnector upgrade in accordance with the EU-wide capacity allocation mechanism network code. The economic test should analyse bookings between gas years 2024 and 2038.

ACER entered the process in November under EU rules in order to define the parameters of the economic test after the Hungarian regulator MEKH and Austria's E-Control failed to reach an agreement by 9 October 2018.

The incremental capacity project was aimed at upgrading capacity on the 14.4 million cubic metres/day capacity HAG pipeline, based on the results of the EU-wide demand assessment conducted by system operators from April to July 2017.

Initially, the capacity upgrade along the Mosonmagyaróvár border point was linked to the EU-backed Bulgaria-Romania-Hungary-Austria (BRUA) development, which aimed at delivering Romanian Black Sea volumes to the Austrian and western European markets via new infrastructure.

The results of the new economic test that Austria and Hungary are required to undertake will determine whether Austria will be included in the project or not.



E-Control approved the project proposal, but MEKH rejected it and decided to go ahead with the Hungary-Slovakia-Austria (HUSKAT) alternative capacity allocation process on the basis of cost efficiency and market demand.

BRU(A) could use gas sourced from Turkey (either Russian gas via TurkStream or any other volumes of different origin) or from the offshore Romanian or Bulgarian section of the Black Sea.

#### Technical details of BRUA

The BRU(A) corridor will be made up of existing interconnectors and new pipeline segments which will be built inside Romania. The EU has stated that the allocation of cash for this pipeline would be conditioned on Romania exporting gas. The country is the EU's third largest gas producer.

BRU(A)'s existing interconnectors will include:

- The Ruse-Giurgiu bidirectional link (Bulgaria-Romania) - capacity 1.5 bcm
- The Arad-Csanadpalota bidirectional link (Romania-Hungary) - annual capacity to increase from 1.75 bcm to 4.4 bcm.
- The two interconnectors are expected to be joined up through a new segment of infrastructure linking southern to western Romania. The Romanian gas grid operator Transgaz was also due to lay new sections of pipeline linking the eastern offshore Black Sea blocks to the corridor that heads west from the Bulgarian border.

The start date of commercial operations is 2022. The agreement for the construction of the BRUA pipeline was signed on November 28 2017 at a total cost of €479 million. Financing for the first phase is provided by a grant of €180 million, a €50 million European Investment Bank loan and an EBRD loan of €60 million. The pipeline is supposed to be inaugurated in two phases in 2019 and 2022.

#### Capacity booking

In 2019, the Romanian and Hungarian gas grid operators, Transgaz and FGSZ, were expecting to allocate capacity on the Arad-Csanadpalota interconnector from 2020 onwards as part of the Bulgaria-Romania-Hungary corridor. However, after a failed third economic test of the binding season, the two grid operators decided to postpone the fourth and final test to 30 May 2019, with the final results would be published on 13 June 2019. However on the 31<sup>st</sup> May, the transmission system operators (TSOs) of Hungary and Romania stated that they again extended the period for booking binding capacity on their sections of the Bulgaria-Romania-Hungary-Austria (BRUA) pipeline, suggesting FIDs on Black Sea gas projects remain some way off. Indeed, Hungarian TSO FGSZ and its Romanian counterpart, Transgaz, said that they would extend the fourth and final phase of the open season for booking binding capacity on the Hungary-Romania interconnection point until 1 October – four months later than the previous deadline of 30 May. All previous phases failed to generate sufficient bids.

During the third test, Transgaz and FGSZ offered 1,668,493/kWh/h/year (around 1.49 bcm/year) capacity in gas year 2020 in the direction of Hungary. The offered capacity for the gas year 2023-2029 period was set at 1,072,603/kWh/h/year (0.96 bcm/year), before rising to 4,648,063/kWh/h/year (4.21 bcm/year) from gas year 2030 to gas year 2036.

The import capacity into Romania was set at 3,149,722/kWh/h/year (2.8 bcm/year) in gas year 2022-2029. Then, the offered capacity was due to rise to 4,717,243/kWh/h/year (4.21 bcm/year) until gas year 2036.

The ROHU flagship project was expected to enable the delivery of Romanian onshore and Black Sea volumes to other western and central European markets.

The project requires the development of existing infrastructure on both sides of the border and the first phase of the development, allowing up to 1.75 bcm/year to Hungary, is expected to be completed in the fourth quarter of 2019.

## ANNEX

### Turkey's transmission, LNG/storage, import/export system

At a glance: Turkish system data valid as of 2018

- Total system length at the end of 2018 stood at 13,547 km
  - Total capacity (including storage) was 252mcm/day

- Congestion in the northwestern Thrace region
  - Congestion in southeastern Anatolia
- Required compressor stations to pump Iranian/Azeri gas from East to West

- One export interconnector
- Distribution network expanded to 78 out of 81 provinces
  - Gas demand declined year on year by 9%

- Total capacity to increase to 473mcm/day by 2023
- Export capacity to increase to 40mcm/day by 2021
- Gas demand to increase to 63bcm/year by 2030

OVERVIEW OF EXISTING AND UPCOMING PIPELINE, LNG AND STORAGE CAPACITIES

## Existing and upcoming import pipelines (in million standard cubic metres/day)

Entry point	Pipeline	Border point	2017	2018	2019	2020	2021	2022	2023
Malkoclar	Trans-Balkan	Bulgaria-Turkey	51.4*	51.4*	51.4*	14.7	14.7	14.7	14.7
Durusu	Blue Stream	Russian Federation - Turkey (via Black Sea)	48	48	48	48	48	48	48
Gurbulak	Iran-Eastern Anatolia	Iran-Turkey	28.5	28.5	28.5	28.5	28.5	28.5	28.5
Turkgozu	South-Caucasus Pipeline	Georgia-Turkey	19.1	19.1	19.1	19.1	19.1	19.1	19.1
Eskishehir	TANAP	Azerbaijan-Georgia-Turkey	0	5.7	11.3	14	16.4	16.4	16.4
Kiyikoy	TurkStream1	Russian Federation - Turkey (via Black Sea)	0	0	0	46.9	46.9	46.9	46.9

\*Actual volumes imported via this entry point were at 45.1mcm/day

## Existing and upcoming LNG and storage capacity (send-out in mscm/day)

Terminal/storage facility	2017	2018	2019	2020	2021	2022	2023
Marmara LNG (onshore)	22	37	37	37	37	37	37
Aliaga LNG (onshore)	30	40	40	40	40	40	40
Aliaga LNG (offshore)	20	14.1	14.1	14.1	20	20	20
Saros LNG (offshore)*	0	20	20	20	20	20	20
Dortyol LNG (offshore)*	0	20	20	20	20	20	20
Silivri (UGS)	25	25	25	50	75	75	75
Tuz Golu (UGS)	13	20	20	30	80	80	80

\*This is the same FSRU but can be used in two locations - Saros (NW Turkey) and Dortyol (Southern Turkey)

## Turkey's export interconnectors (in mscm/day)

Exit point	Pipeline	Border point	Direction	2017	2018	2019	2020	2021	2022	2023
Ipsala - Kipi	Interconnector	Turkey-Greece	Potential for bidirectional flows	6.7*	6.7*	6.7*	6.7*	6.7*	6.7*	6.7*
Malkoclar-Strandja	Trans-Balkan	Turkey-Bulgaria	Reverse flows	n/a	n/a	n/a	48.4	48.4	48.4	48.4

\* Of which 4.8mcm/day are currently allocated under a BOTAS long-term contract with Greek incumbent DEPA

## Turkey's proposed import/export pipelines (billion cubic metres/year)

Pipeline	Border	Capacity (bcm/year)	Exporting party(ies)	Direction	Completion date
Turkey-Bulgaria-Serbia	Bulgaria	17.6	N/A	Bidirectional	2021
Iraq	N. Iraq	10	TEC/Siyahkalem	Import	2020
Iraq	N.Iraq	30	Rosneft	Import	2020
Israel	Offshore	10	n/a	Bidirectional	n/a
ITB	Bulgaria	3	n/a	n/a	n/a
ITGI	Greece	11	n/a	Bidirectional	n/a
TAP	Greece	10	TPA	Export	2021

## Turkey Gas Supply Contracts



### Supply

#### Turkey has active import contracts totaling 60 BCM/year

	Volume, BCM3/yr	Date of Expiry	ToP	Price Basis	Importer
<b>Active</b>					
Qatargaz (LNG)	2.1	30/9/2020	n.a.	n.a.	BOTAŞ
Nigeria LNG (LNG)	1.3	1/10/2021	94%	Oil products	BOTAS
Gazprom, West 2 (now 5 contracts)	8.0	31/12/2021	80%	Oil products	BOTAS, private
AGSC, Azerbaijani Gas Supply Company, Phase 1	6.6	16/4/2021	80%	Oil products	BOTAS, Socar
Sonatrach, Algeria (LNG)	4.4	1/10/2024	93%	Arab oil basket	BOTAS
Gazprom/ENI, Black Sea	16.0	31/12/2025	80%	Oil products	BOTAS
NIGC, Iran	9.6	30/7/2026	85%	Oil products	BOTAS
AGSC, Phase 2	6.0	30/6/2033	85%	Oil products	BOTAS
Gazprom, West 1*	6.0	31/12/2042	80%	Oil products	Private
Azerbaijan (BIL)	0.15	2046	100%	n.a.	BOTAS
<b>Signed</b>					
Turkmenistan	15.6	(Not activated)	na	? Oil products	BOTAS
Spot LNG					

\* Original contract expired in 2011, with BOTAS taking extra gas 2012, then private sector extending the volumes under 4 new contracts.

Turkey also has memoranda of understanding for new supplies:

Suppliers	Year	Volume, BCM3/yr	IBS Comment
Egypt	2006	4.0	Doubtful availability
Qatar	2009	4.0	Price problems
Iraq (Baghdad)	2009	15.0	Overtaken by events
Iran	2009	20.0	Doubtful
Syria	2009	0.5-1.0	Doubtful
Iraq (Erbil)	2013	4 rising to 20	Costly gas processing

#### Supply options currently being discussed include:

*Iraq:* In November 2013 Turkey agreed with the KRG to import 4 BCM/yr starting 2017, rising to 20 BCM/yr by 2025. The term sheet set the price at \$7 per MMBtu. In September 2013, EMRA gave a license for Siyahkalem, a Turkish construction company, to import gas starting with 0.7 BCM, increasing to 3.2 BCM by 2033.

## NATURAL GAS IMPORT AND EXPORT ROUTES IN SOUTH-EAST EUROPE AND TURKEY



### **Gina Cohen**

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Gina Cohen has been working as a consultant in Israel and Palestine's gas markets since offshore exploration started there exactly 20 years ago. During this time, she has been involved in projects spanning the full natural gas chain. She is a lecturer at the Technion University's M.Sc. Program for Petroleum Engineers, is a consultant to international oil and gas companies operating in the Eastern Mediterranean, is the author of the Hebrew English energy lexicon ([www.hebrewenergy.com](http://www.hebrewenergy.com)) used by all professionals in the Israeli oil and gas sector and publishes articles in professional international oil and gas journals.

## The Institute of Energy for South East Europe (IENE)

The Institute of Energy for South East Europe (IENE) was founded in 2003 by a small group of independent professionals and business executives active in the energy sector of the region. The Institute, which has its headquarters in Athens, Greece, is a non-governmental and non-profit organization. The Institute's prime purpose is to constitute a permanent forum where energy issues can be discussed, analyzed, reformulated and presented to a broader audience, in unbiased, objective and credible terms. This is achieved thanks to the Institute's scientific standing, its managerial rectitude and the transparency of all its operations.

The Institute activities span all forms of energy including from hydrocarbons, solid fuels, electricity, nuclear, renewables to energy efficiency. The Institute is largely funded from its membership which includes both corporate entities and individual energy professionals.

One of IENE's key objectives is to participate in the formulation of energy policies, both at national and international level, within the broader region of South-East Europe. These policies focus on rationalizing the production and utilization of both conventional and renewable sources of energy. IENE is thus contributing towards the implementation of the European Union's sustainable strategy which combines social and economic development, security of supply and environmental protection. The Institute aspires to play a significant role in providing public opinion with factual and unbiased information on subjects concerning energy, the environment and sustainable development. Further information on the Institute, its mission and objectives and its activities can be found in [www.iene.eu](http://www.iene.eu)

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