



London, November 30, 2022

Risk Management Issues Associated with Gas Developments in SE Europe

Talking Points by **Costis Stambolis**, AA Dip (Grad), MA (Oxon)
Chairman and Executive Director,
Institute of Energy for SE Europe (IENE), Athens

INSTITUTE OF ENERGY
FOR SOUTH EAST EUROPE



The SE European Region Defined



- Core countries**
- Albania
 - Bosnia and Herzegovina
 - Bulgaria
 - Croatia
 - Cyprus
 - Greece
 - Hungary
 - Israel
 - Kosovo
 - Montenegro
 - North Macedonia
 - Romania
 - Serbia
 - Slovenia
 - Turkey

- Peripheral countries**
- Austria
 - Egypt
 - Italy
 - Lebanon
 - Moldova
 - Slovakia
 - Syria
 - Ukraine

IENE's Latest Major Study on SE Europe Covers all Aspects of Gas Developments: Exploration, Production, Infrastructure, Routes and Markets



Source: IENE

2020 Basic Energy Data for SE Europe, Including Turkey

Region	Final Oil Consumption (thousand tonnes)	Gas Inland Consumption (bcm/y)	Gross Electricity Production (TWh)
SE Europe	84,737.4 (20.6% of EU-27)	86.5 (21.6% of EU-27)	597.6 (21.4% of EU-27)
EU-27	411,530.4	399.6	2,786

Source: IENE study “SE Europe Energy Outlook 2021/2022”, Athens, 2022

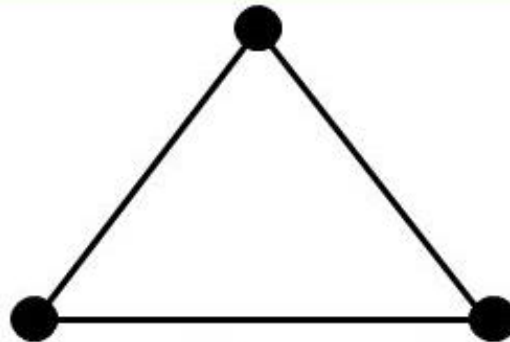
The Key Issue of Energy Security

- ❑ Following Russia's invasion in Ukraine and the negative impact on gas supply in Europe, attention is now drawn, once again, on energy security
- ❑ Efforts by the EU and individual governments are focusing on new gas suppliers and supply routes
- ❑ The need to expand the range of suppliers is inevitably having an effect on needed and planned gas infrastructure (i.e. main pipelines, interconnectors, LNG terminals, gas storage facilities)
- ❑ LNG is fast emerging as a credible (but expensive) gas supply alternative for Europe
- ❑ In addition, the delayed realisation that the EU needs to increase its own gas production capability, in order to reduce its huge import dependence, is putting back on the radar the hydrocarbon promising areas of the Black Sea, the Adriatic and the East
- ❑ The expansion of Europe's, and SE Europe's in particular, gas infrastructure at a time of growing concerns over the role of fossil fuels (even on a mid-term basis) on account of climate change dangers they supposedly pose, is impacting economic, political and environmental risk.
- ❑ The threat of "stranded assets" is used by banks to block financing of fossil fuel related projects while environmentalists attack gas infrastructure projects since, according to their hymn book, they contribute to climate induced catastrophe (read climate emergency)
- ❑ Hence, risks associated with gas projects are growing and they must be taken into account when planning infrastructure projects of any kind (i.e. gas interconnectors, main pipelines, regional, and town grids, gas storage, LNG terminals, etc.)

The Three Pillars of EU Energy Policy

COMPETITIVENESS

- complete single energy market
- cut Europe's energy bill
- create jobs
- boost R&D and create markets in which EU can become a global leader



SECURITY OF SUPPLY

- reduce Europe's dependence on energy imports
- help balance trade

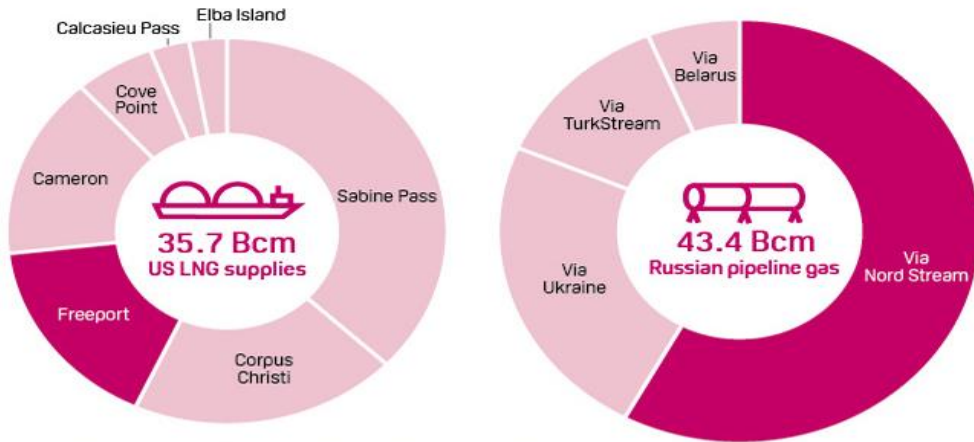
SUSTAINABILITY

- reduce environmental degradation and greenhouse gas emissions
- increase energy efficiency
- increase role for renewables

Europe on Brick of Gas Crisis as Russia Squeezes Market – Gas Has Emerged as a Strategic Energy Source

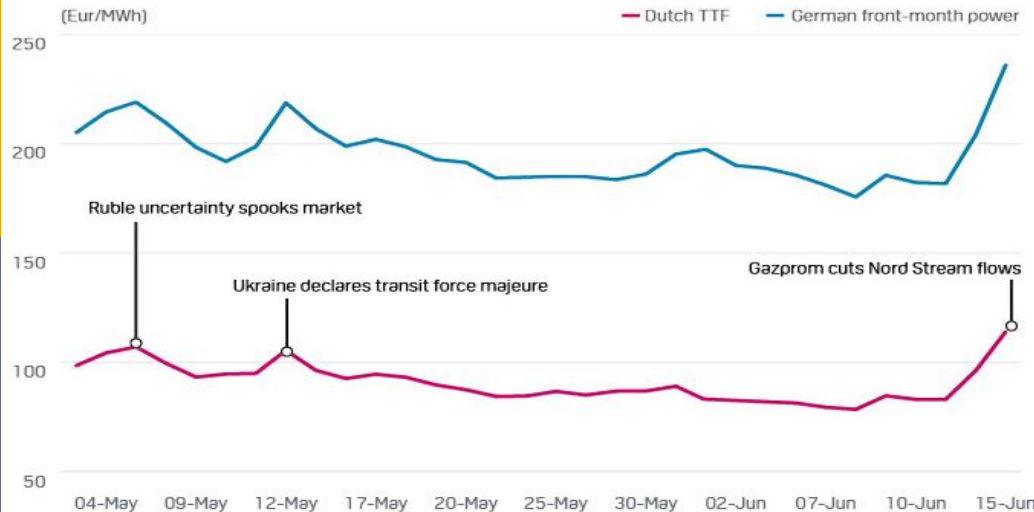
Freeport LNG key to US LNG supply to Europe*, Nord Stream provides bulk of Russian pipeline gas**

(Bcm, 2022 year-to-date)



*US LNG supplies to EU + UK, **Russian supplies entering at EU borders

TTF month-ahead gas price jumps on Nord Stream cuts, power follows suit



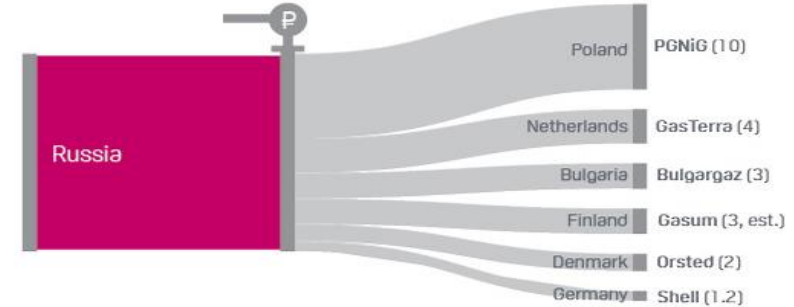
S&P Global
Commodity Insights

Source: S&P Global Commodity Insights, GIE, EEX

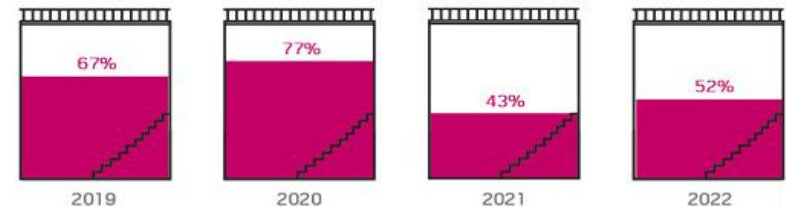
Copyright © 2022 by S&P Global Inc. All rights reserved.

Gazprom cuts off supplies to six buyers on ruble payment dispute

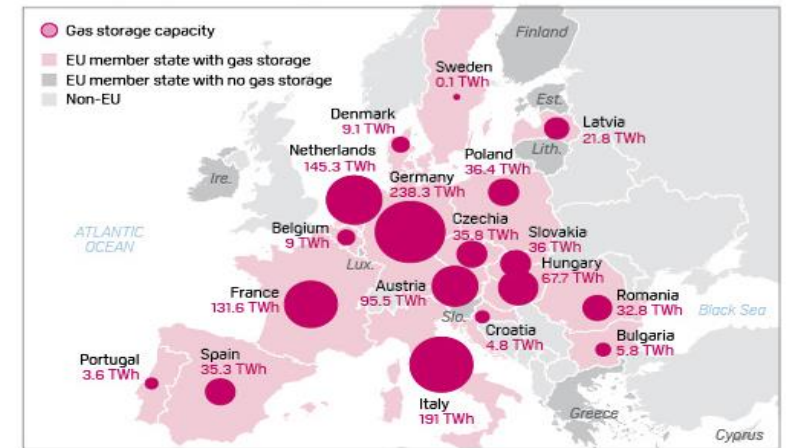
(Bcm/year)



European gas storage still only 52% full as of mid-June

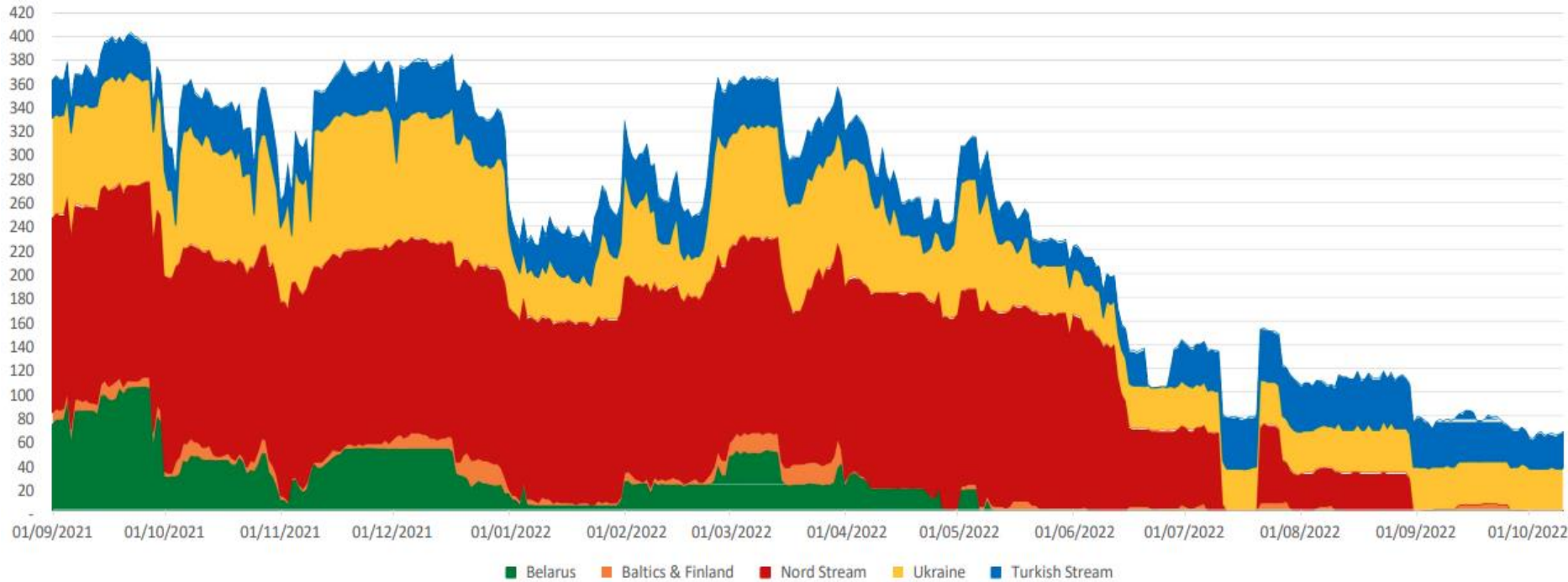


Gas storage capacities among EU member states



Developed by Stuart Elliott, designed by Reynaldo Dizon

Since the Summer of 2021, Russian Gas Exports to Europe Are Declining - Russian Pipeline Gas Will Europe Continue to Receive?



Sources: ENTSOG Transparency Platform; Eurostat; Gas Infrastructure Europe (AGSI); Kpler LNG Platform

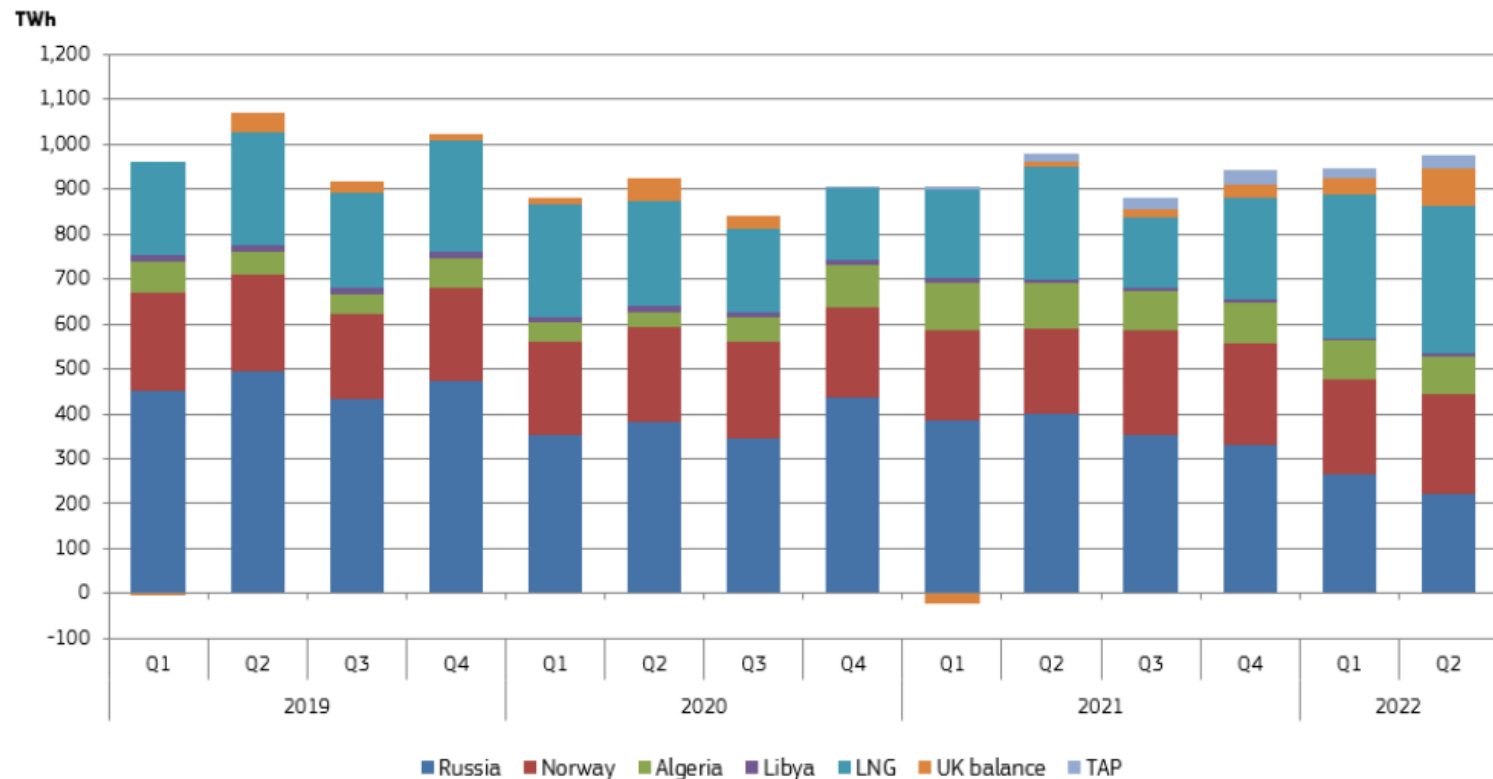
EU Imports of Natural Gas by Source

EU-27 Gas Data (2021)

Gas consumption: 412 bcm
 Gas production: 50.6 bcm
 Net gas imports: 337.5 bcm
 LNG imports: 80 bcm

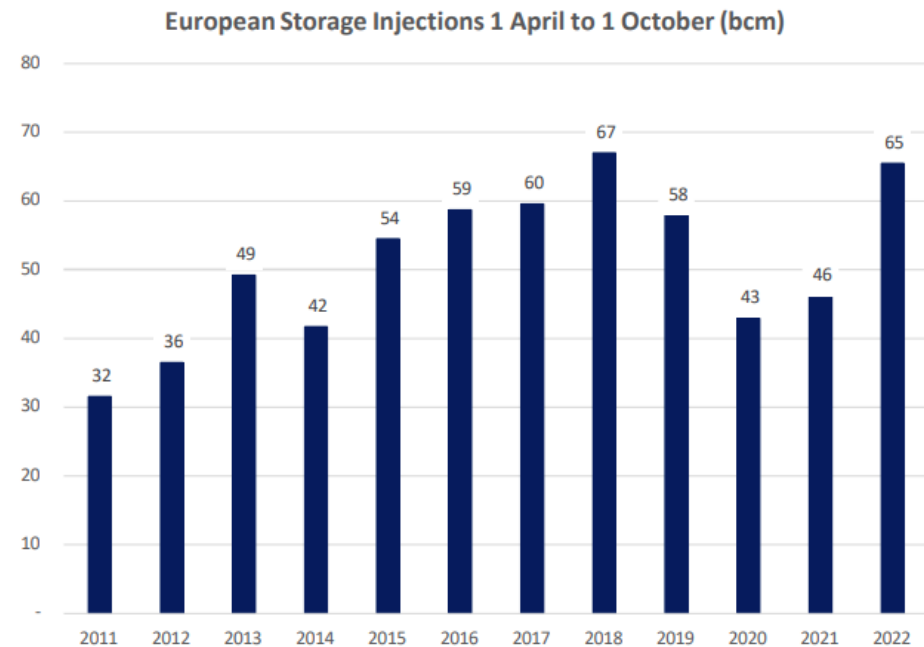
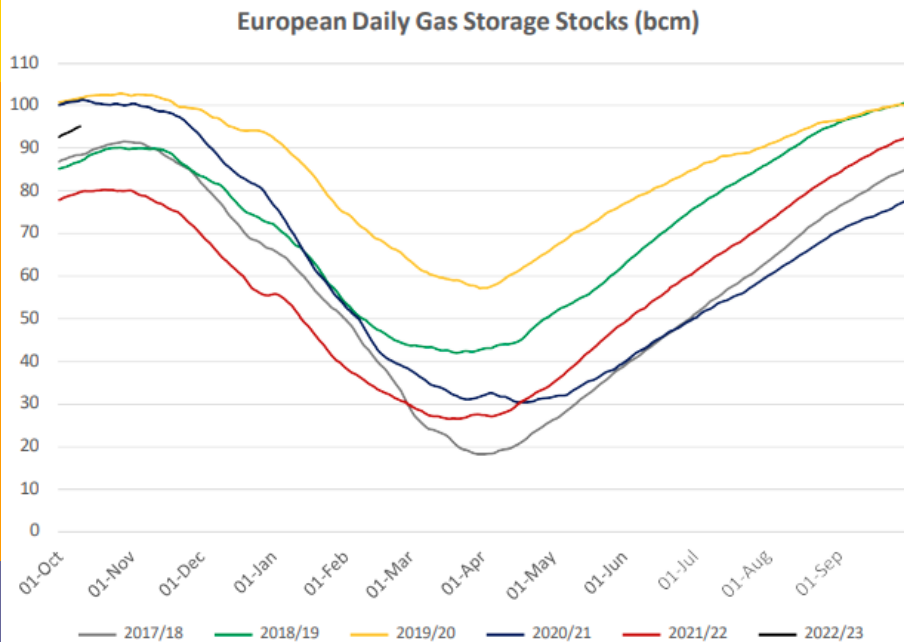
In 2021, the EU imported 58 bcm of Russian gas via Nord Stream, 37 bcm via the Ukrainian route, 33 bcm via the Belarus transit and 9 bcm via the Turk Stream.

Total = 137 bcm



Source: European Commission

European Gas Storage: This Winter and 2023/24



Sources: ENTSOG Transparency Platform; Eurostat; Gas Infrastructure Europe (AGSI); Kpler LNG Platform

The Role of LNG

- ❑ LNG is efficient to transport over long distances where pipelines do not exist (LNG volume about 1/600th the volume of Natural Gas)
- ❑ Cost efficient for transportation
- ❑ Reduces refuelling frequency comparing to natural gas forms e.g. CNG (LNG has an energy density comparable to diesel fuel)
- ❑ Generates less greenhouse gas comparing to other liquid or solid fuels → a clean complete burning fuel
- ❑ Comparing to Diesel as fuel for HDV it emits 7% to 15% less and comparing to Marine Diesel Oil LNG emits 25% less
- ❑ Fully complies with the latest requirements set in the applicable regulations for all applications road, rail and aviation transportation as well maritime
- ❑ Boil off Gas by the industry makes it more challenging
- ❑ LNG as fuel in maritime gives the opportunity to energy independence of the vessel at the ports (not depending on the shore grid connection-many times not compatible) where electricity production is required for the vessel's facilities
- ❑ LNG fuelled engines have up to 50% less noise emissions than diesel engines (minus 3 to 5 dB on average).
- ❑ The standardisation and the documentation produced and published by the international gas industry (CEN, ISO and GIIGNL for example), make it a proven safe technology for storage, transportation and usage for the equipment/devices and the operatives.
- ❑ LNG performs well towards achieving the EU strategies and the industry for a decarbonized, a low-carbon energy reducing the harmful effects to climate

The Growing Importance of LNG in SE Europe

- Today, there are **6 LNG importing terminals in operation** across SE Europe:
 - 2 land based and 2 FSRU in Turkey
 - 1 FSRU in Croatia (Krk)
 - 1 land based in Greece (Revithoussa)

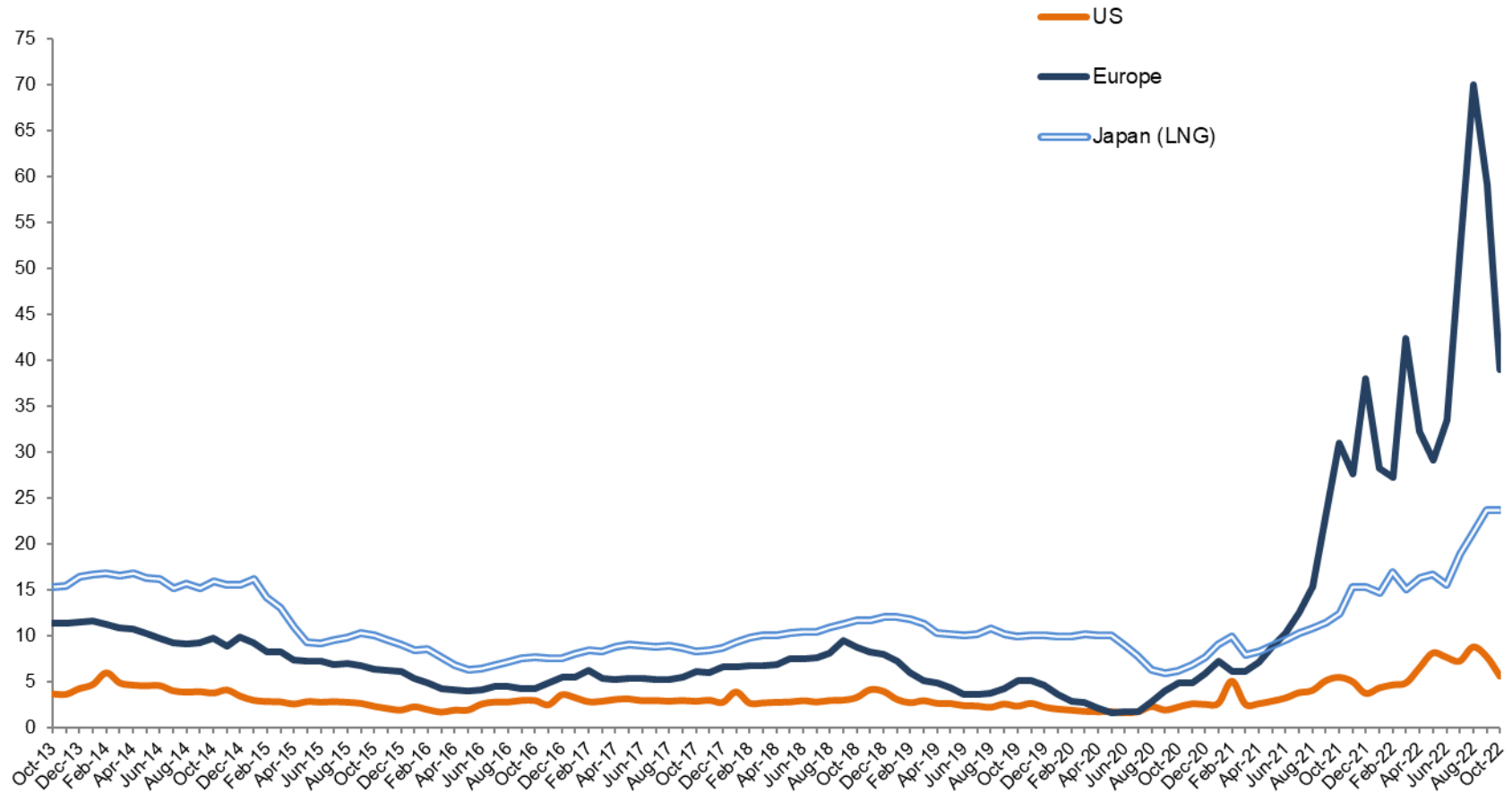
- By 2025, a number of **new LNG terminals** will be added:
 - 1 FSRU in Turkey (Gulf of Saros)
 - 2 FSRU in Greece (Alexandroupolis and Dioryga Gas)
 - 1 FSRU in Cyprus (Vassilikos)

LNG Terminals in SE Europe



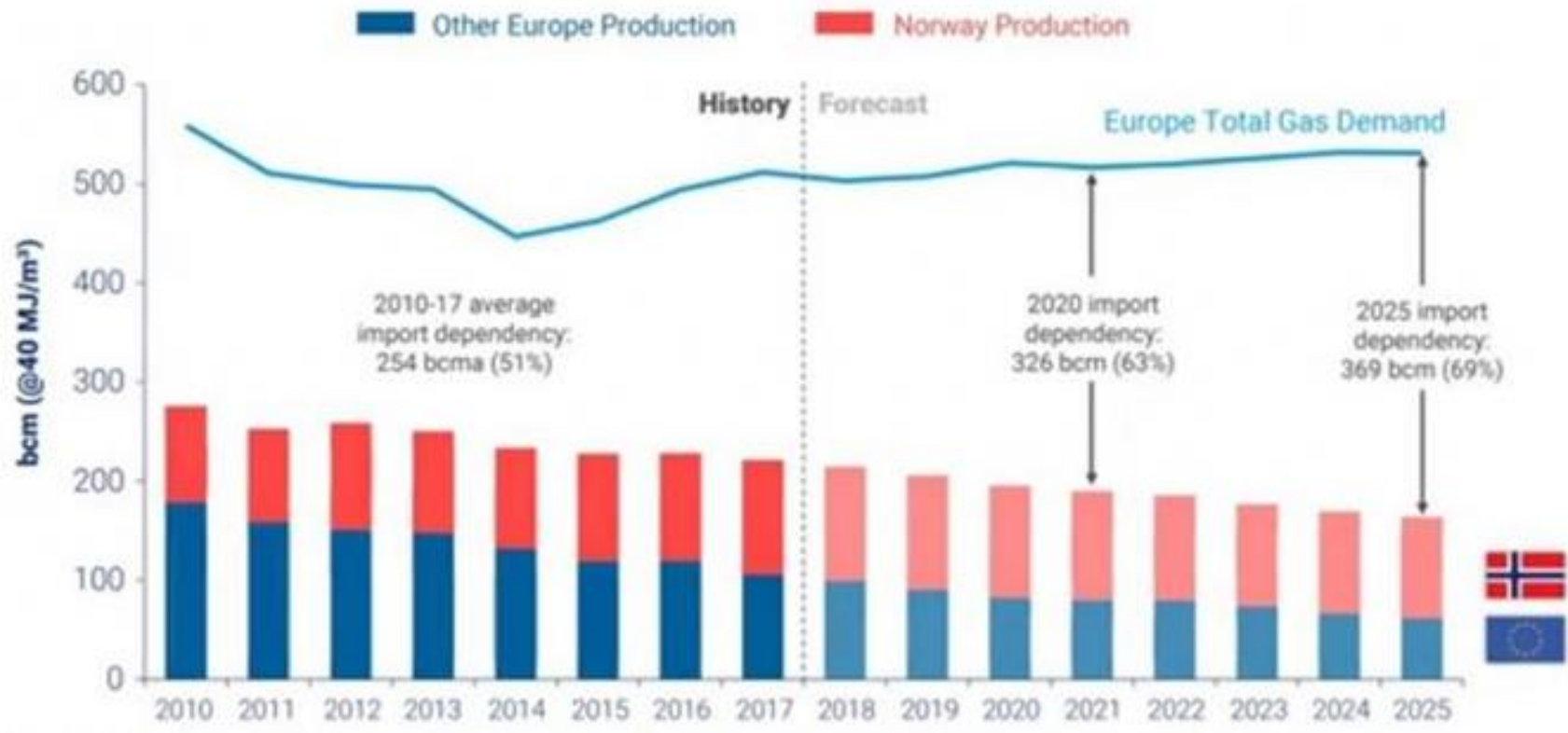
Natural Gas Prices

\$US/mmbtu



Source: World Bank

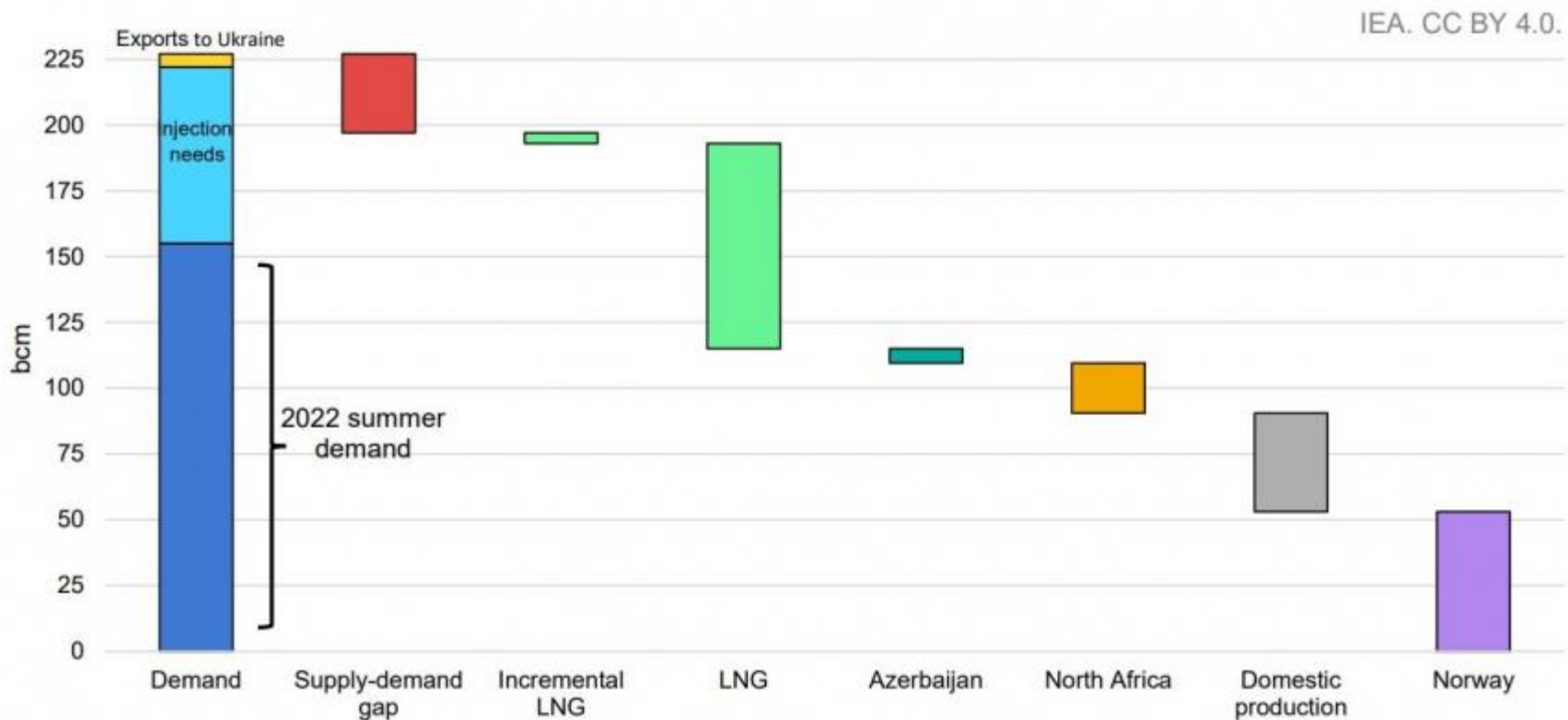
Europe's Gas Demand-Supply Gap (I)



Source: Wood Mackenzie

Europe's Gas Demand-Supply Gap (II)

Breakdown of the summer 2023 natural gas balance of the European Union and the United Kingdom in case of full cessation of Russian flows and limited LNG availability, April – September 2023



Gas Market Developments in SE Europe (I)

- ❑ Natural gas is a relatively new fuel for SE Europe, while a number of countries, especially in the West Balkans, do not yet include gas in their energy mix or they are using minimal quantities.
- ❑ In this sense, gas markets in SE Europe are still undergoing a development phase. Currently, the gas sector in SE Europe faces significant challenges which are mainly related to the ongoing process of market transformation within the EU but also as a result of global developments, where the fast rise of LNG is testing market norms.
- ❑ Introducing gas in some countries where no gas infrastructure exists yet will be a real challenge as is the case of Albania, Montenegro and Kosovo, whereas in the case of North Macedonia and Bosnia- Herzegovina a major expansion of its gas grid will need to be undertaken.
- ❑ A big challenge in the case of Kosovo, Montenegro and Bosnia - Herzegovina, and to a lesser extent for Albania, will be the use of gas for power generation. Such a development will come about following the application of mandatory CO2 emission charges and the urge to lower generation costs from coal/lignite stations.

Gas Market Developments in SE Europe (II)

- ❑ The SE European region is a heterogeneous gas market. At the extremes it contains large mature markets (i.e. Turkey, Romania) and countries with no market at all (i.e. Albania, Montenegro or Cyprus). Apart from Romania, which is a gas producer, they were strongly dependent on a single supplier, Gazprom.

- ❑ Another significant barrier to market development was that most of the countries were poorly interconnected due to lack of gas infrastructure connections. As a consequence, access to third party and diverse gas supply sources are limited.

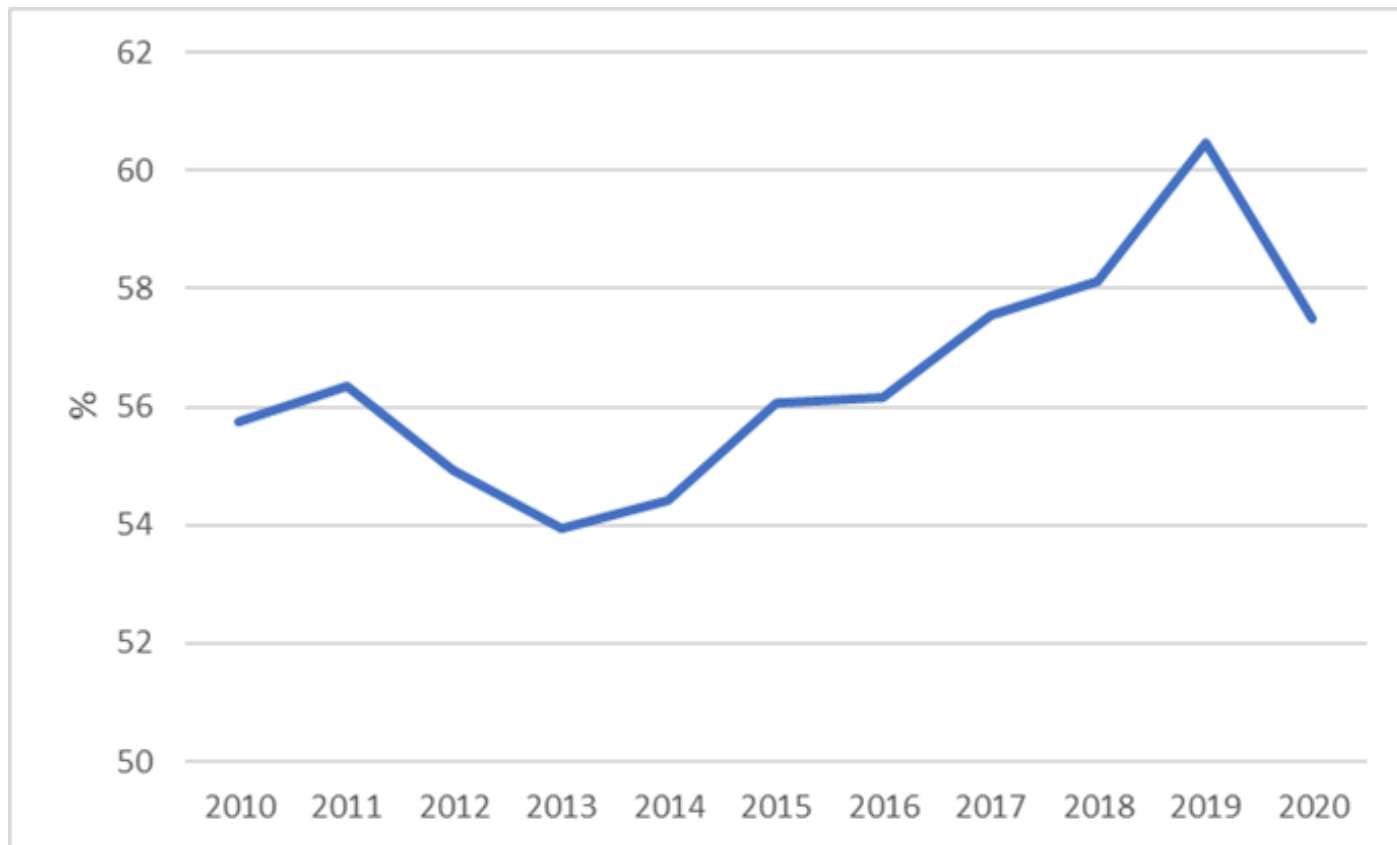
- ❑ Lack of interconnectivity also hinders the completion of internal gas market requirements of the EU and leads to a high degree of dependence thus undermining the Security of Supply (SoS).

Key Regional Energy Issues

- Energy Security in SE Europe (I)

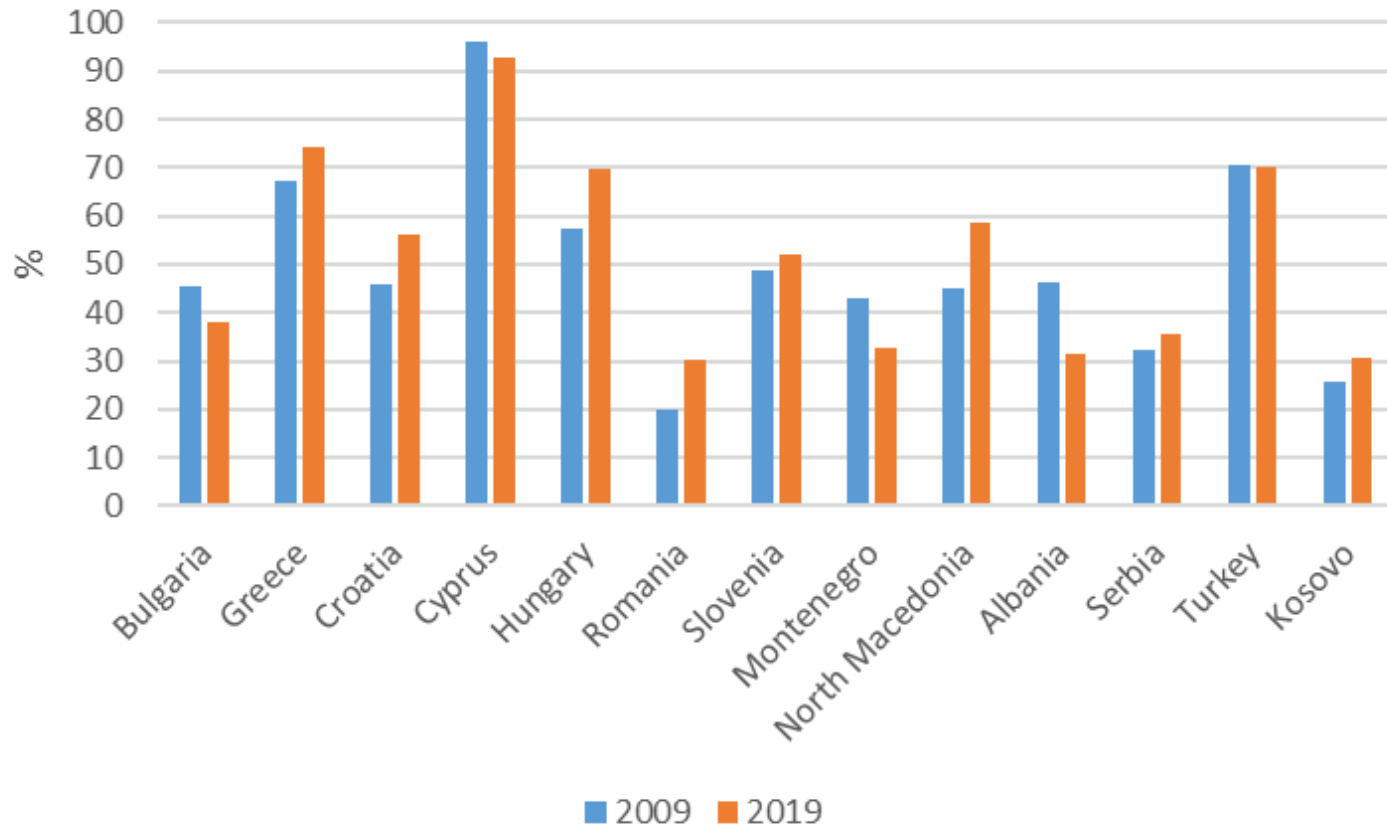
- **Energy security is a complex issue** and as such cannot be considered in isolation.
 - SE Europe, because of its geography, its proximity to high-risk conflict zones (i.e. Syria, Iraq, Ukraine), refugee flow from the Middle East and North Africa and the location of some of its countries (i.e. Turkey, Greece, Romania) at vital energy supply entry points, faces **higher energy security threats** than the rest of Europe.
- There is a need to strengthen available mechanisms
 - The **strengthening of Emergency and Solidarity Mechanisms** and the **maintenance of adequate oil, coal and gas stocks**, constitute a short- to medium-term relief solution.
 - The achievement of a **balanced energy mix** provides the best long-term option in enhancing energy security both at country and regional level.
- Security of **supply/demand** and **differentiation of supply sources**
 - In the case of gas, it is becoming more important and pressing compared to other fuel sources, such as electricity, oil, coal and possibly uranium.
 - Gas is a primary area of concern largely because of its rather inflexible transmission method, mainly by means of pipelines.

Evolution of the EU Energy Dependence (%) over 2010-2020



Sources: Eurostat, IENE

Energy Dependence in SE Europe (2009 and 2019)



Source: IENE study “SE Europe Energy Outlook 2021/2022”, Athens, 2022

Overview of Underground Gas Storage Facilities in SE Europe, 2018

	Number of UGS Facilities	Working gas capacity (bcm)	Max. withdrawal rate (mcm/d)
<i>In Operation</i>			
Bulgaria	1	0.6	4
Croatia	1	0.6	7
Romania	8	3.1	32
Serbia	1	0.5	5
Turkey	2	3.4	45
Total	13	8.2	93
<i>Under Construction</i>			
Serbia	1	0.3	5
Turkey	3	6.5	110
Total	4	6.8	115
<i>Planned</i>			
Bulgaria	1	0.5	4.6
Croatia	1	-	2.4
Greece	1	0.4	4.0
Romania	4	1.2	9.3
Turkey	3	5.5	57.6
Total	10	7.6	77.9
<i>Potential</i>			
Albania	2	1.3	6.5
Bosnia and Herzegovina	1	0.1	1.9
Turkey	1	1.0	16.1
Total	4	2.4	24.5

Energy Security in SE Europe (II)

- Security of **transportation**, shipment of **oil and gas**
 - Gas deliveries were twice disrupted (i.e. 2006 and 2009) with the shipment of Russian gas, through Ukraine, to Europe but also from Turkey and Greece (i.e. 2011 and 2016).
- **Smooth supply of electricity** and urgent need to connect various island groups to the mainland grid
 - Mitigation of possible power supply failures and shortfalls and minimization of environmental impact through the retirement of fuel oil or diesel powered electricity generators on several islands.
- **Effective protection of energy infrastructure**
 - Mitigation of terrorist threats and advanced level of safety against of physical hazards (e.g. hurricanes, floods, earthquakes) and cyber threats (*IENE organised an Ad hoc meeting for energy security on March 15, 2017*).
- The various vulnerable key energy infrastructure locations in SE Europe constitute **potential energy security hot spots** and as such should be properly identified, while also crisis management plans must be prepared in order to meet any emergencies (e.g. physical hazards, large-scale industrial accidents or terrorist actions).

Energy Security - Towards a Redefinition of the South Corridor (I)

- Meanwhile, several gas exploration projects are in the development stage in the **East Mediterranean** region, with important gas discoveries such as the Leviathan and Tamar fields in Israel, Zohr in Egypt and Aphrodite (which borders with Zohr) in Cyprus's EEZ.
- A number of alternative plans are under discussion for channeling this gas to Turkey, for local consumption, but also to Europe proper for transit to the continent's main gas markets. These plans include gas pipelines, liquefaction plants for LNG export and FSRU terminals to be tied up into the TANAP-TAP system
- Another option apart of TAP – TANAP system is the **East Med Pipeline** which again, due to the significant technical challenges, could also accommodate limited quantities of gas in the regions of 8.0 to 12.0 BCM's per year. Meanwhile, EC is actively exploring the possibility of massively increasing the member countries' LNG capabilities as part of Energy Union priorities, despite the recent negative stance from the US.

Towards a Redefinition of the South Corridor (II)

- ❑ The **Turkish Stream** is also a vital gas supply route. Furthermore, the Turkish Stream pipeline raises the prospect for the **stalled ITGI** natural gas pipeline to be built. ITGI (Greece-Italy Gas Interconnector) has also been included in the European Commission's latest PCI list although it is not linked as yet to any particular gas supplier. Russia's latest proposal for natural gas supply to Europe via the Greek-Turkish border could incorporate ITGI into its plan.
- ❑ Alongside of the East – West route, the **Vertical Corridor** is a gas system that will facilitate the connection between existing national gas grids and other gas infrastructure in East Balkans in order to secure easy gas transiting, thus contributing to energy security and market liquidity. Such a gas system (which will bring together national grids, underground gas storage facilities, interconnectors, LNG terminals) will form an important new corridor from South to North whose operation will be fully aligned with EU Directives and European energy policy.

An Expanded South Gas Corridor



Note: The TANAP, TAP, Turk Stream and IGB have been completed, while BRUA is still under construction. The IAP, the IGI Poseidon in connection with East Med pipeline, the Vertical Corridor and the IGF are still in the study phase. Blue Stream and Trans Balkan are existing pipelines.

Existing and Planned Gas Interconnections and LNG Facilities in Greece and the Region

□ Gas Interconnections

- **Interconnector Greece-Bulgaria (IGB)** (*in operation*)
- **Interconnector Greece-Turkey (IGT)** (*in operation*)
- **Interconnector Greece-North Macedonia (IGNM)** (*under development*)
- **East Med** (*under development*)
- **Interconnector Greece-Italy (IGI)** (*under development*)

□ LNG Facilities

- **Revithoussa LNG Terminal** (*in operation, since 2001*)
- **Alexandroupolis FSRU** (*under construction, end of 2023*)
- **Dioryga FSRU** (*under development, 2024*)
- **Volos FSRU** (*under development, 2025*)

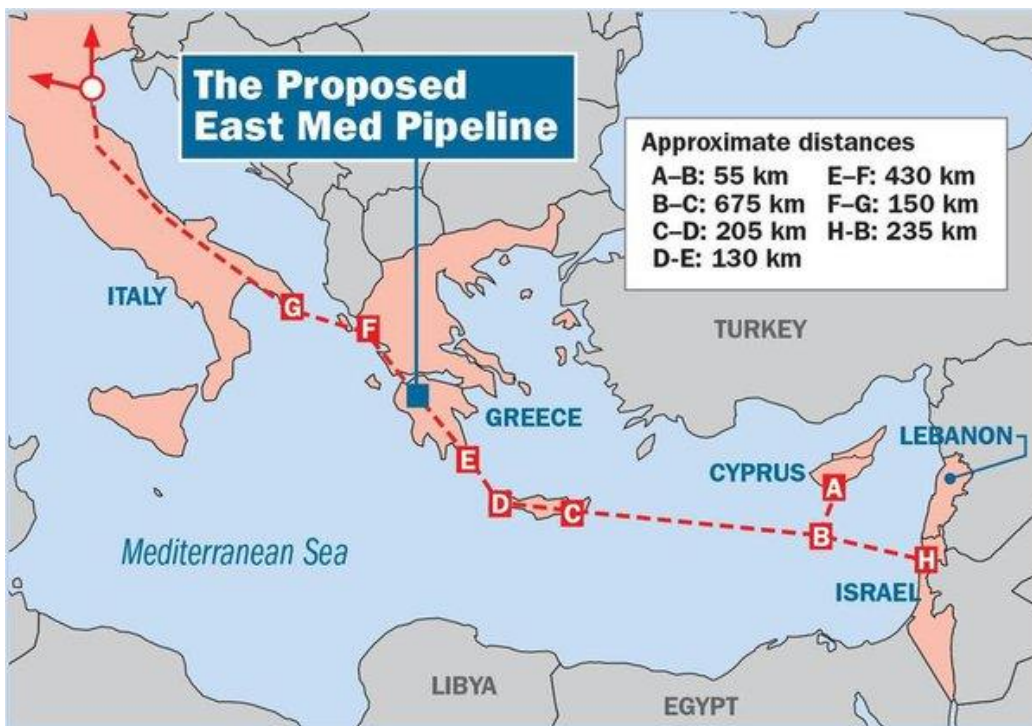
Interconnector Greece-Bulgaria (IGB) (In Operation)



IGB	
Length	182 km
Diameter	32-inch (813 mm) pipes
Capacity	3-5 bcm/y

Source: IGB AD

East Med and Interconnector Greece-Italy (IGI) Poseidon (Conceptual Stage)



East Med	
Length	1,300 km (offshore) 600 km (onshore)
Diameter	32-inch (813 mm) and 48-inch (1,200 mm) pipes
Capacity	10-20 bcm/y

IGI	
Length	216 km
Diameter	32-inch (813 mm) pipes
Capacity	14-20 bcm/y

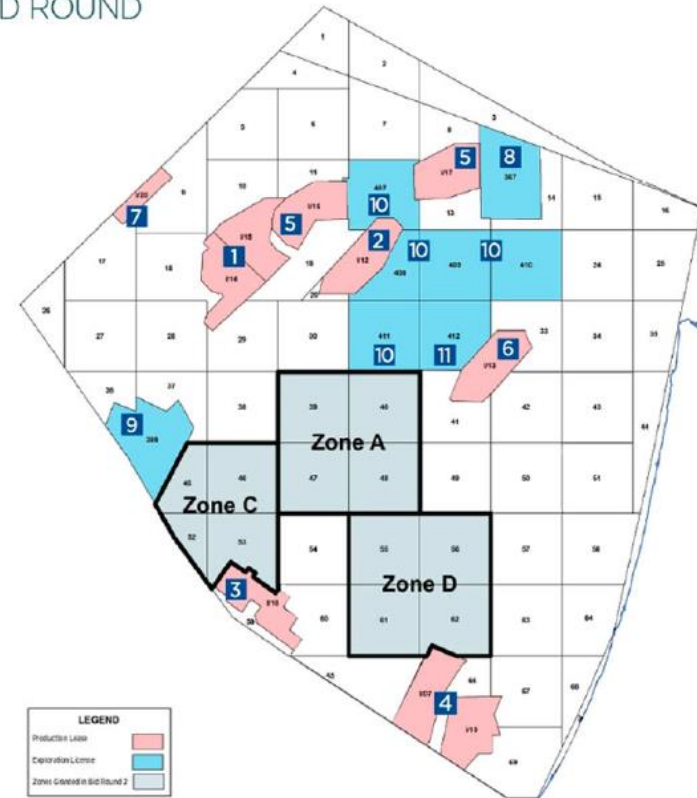
Source: DEPA

Gas Exploration and Production Licenses Offshore Israel

GAS FIELDS & EXPLORATION LICENSES OFFSHORE ISRAEL

1 LEVIATHAN GAS FIELD Discovered - 2010 Operator - Noble Energy	8 ALON D License granted: 2009 Operator: Noble Energy
2 TAMAR AND TAMAR SW Discovered - 2009 Operator - Noble Energy	9 ROYEE License granted: 2013 Operator: Edison International SPA
3 SHIMSHON GAS FIELD Discovered - 2012 Operator - AGR/Isramco	10 LICENSES 12, 21, 22, 23, 31 Licenses granted: 2018 Operator: Energean Israel Limited
4 MARI B AND NOA GAS FIELDS Discovered - 1999-2000 Operator - Noble Energy	11 LICENSE 32 License granted: 2018 Operator: Indus East Mediterranean Exploration Ltd
5 KARISH AND TANIN GAS FIELDS Discovered - 2012-2013 Operator - Energean Oil & Gas	ZONES A + C Licenses granted: 2019 (2nd Offshore Bid Round) Operator: Capricorn Offshore Exploration Ltd
6 DALIT GAS FIELD Discovered - 2009 Operator - Noble Energy	ZONE D License granted: 2019 (2nd Offshore Bid Round) Operator: Energean Israel Limited
7 APHRODITE/ISHAI GAS FIELD Discovered - 2012 Operator - AGR/Nammax	

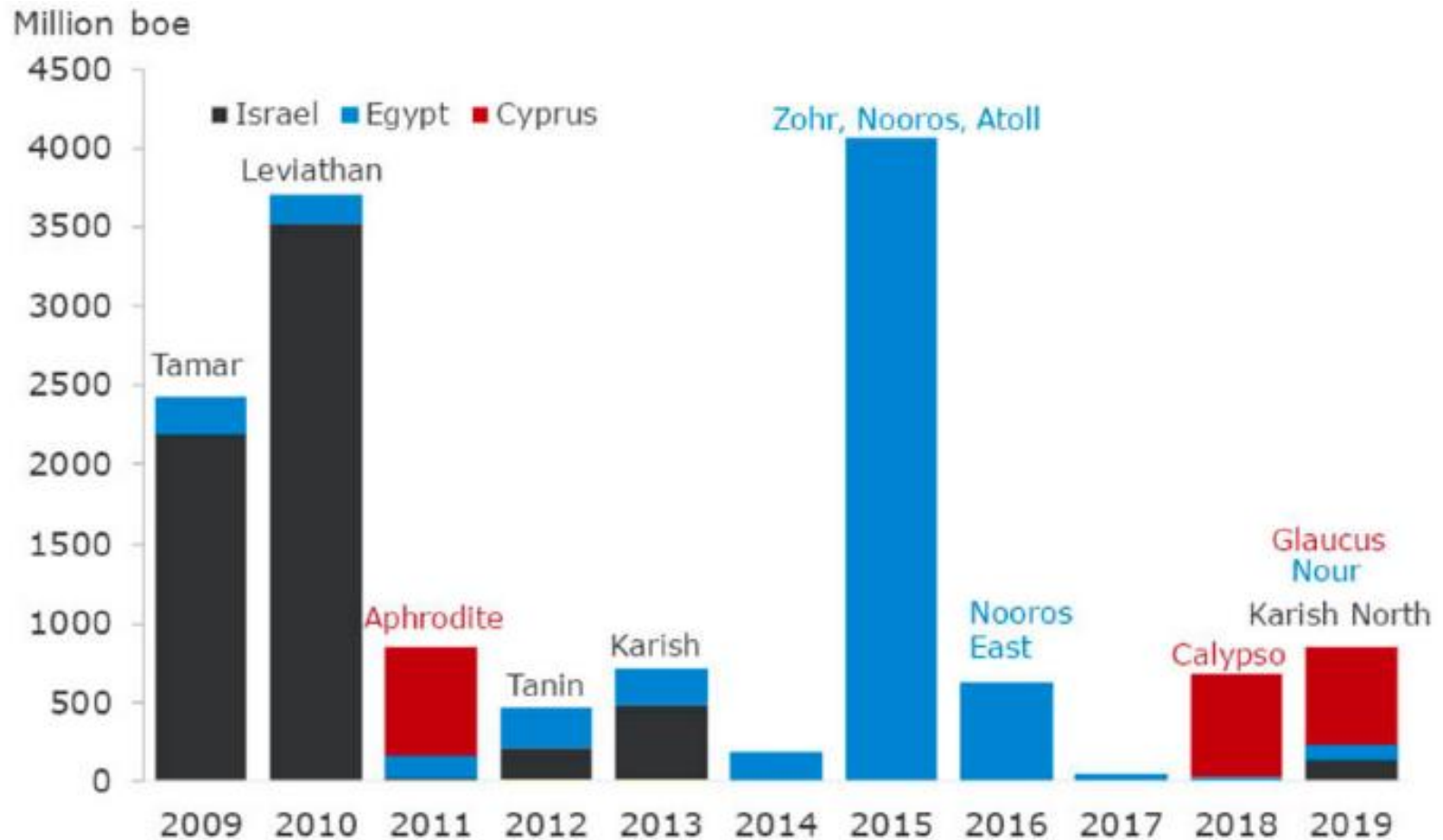
UPDATED MAP OF ISRAEL'S EEZ AFTER COMPLETION OF 2ND OFFSHORE BID ROUND



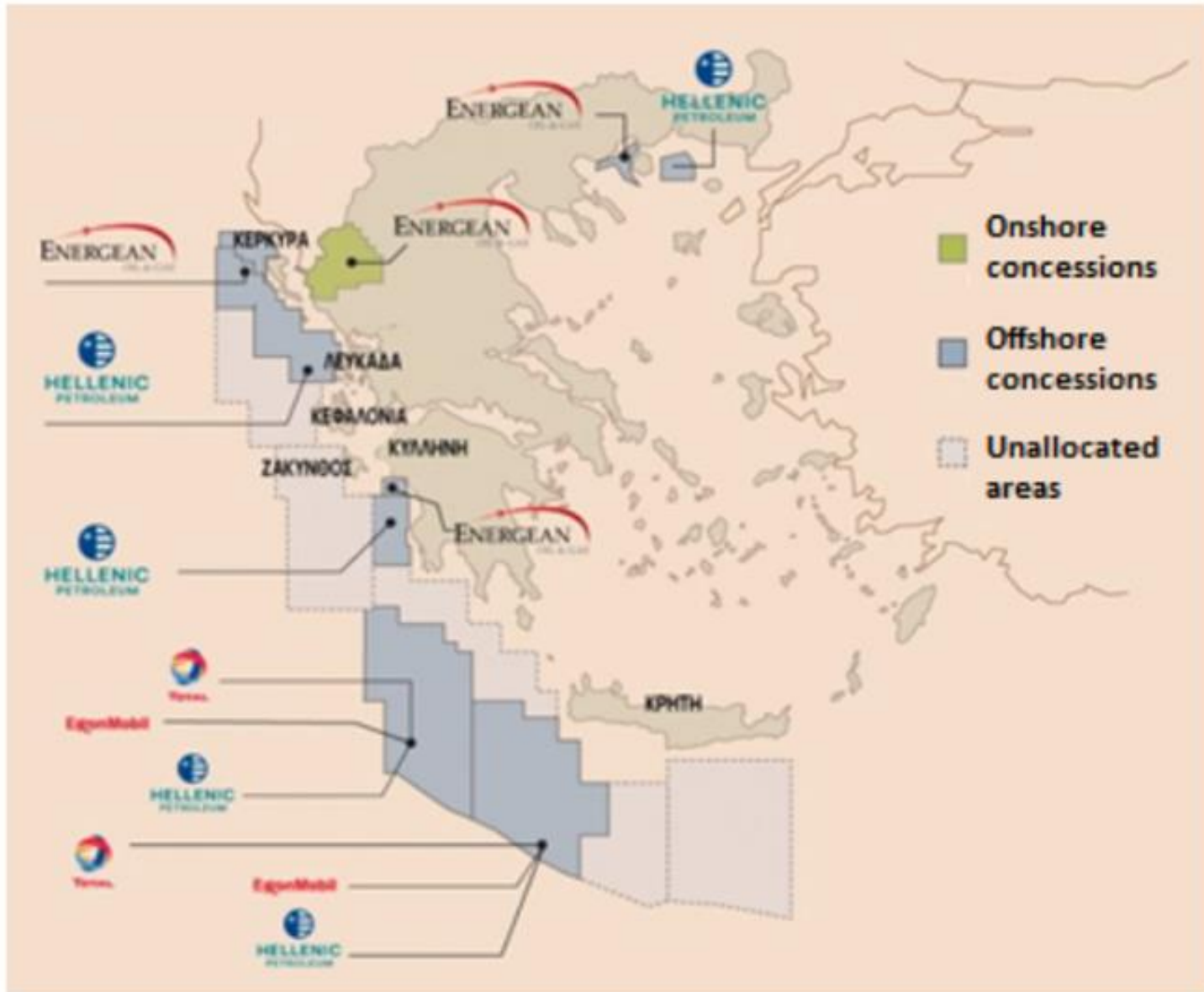
Offshore Exploration Licenses Granted by Cyprus and Current Gas Discoveries



Natural Gas Discoveries in the Eastern Mediterranean Over the Past Decade

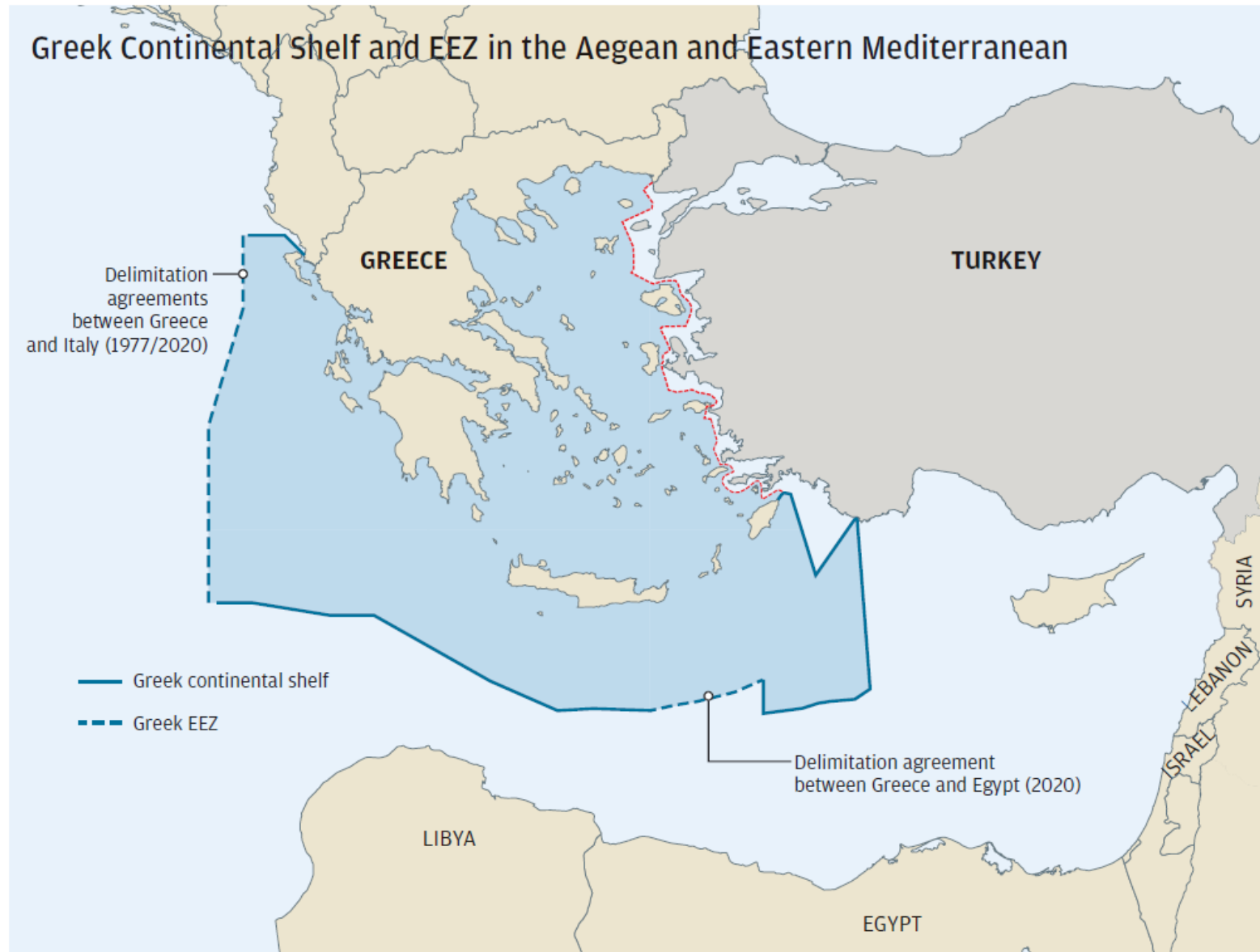


Current Status of Concessions in Greece



Source: HHRM

Greece's EEZ



Risk Management Related to Gas in SE Europe

- Hydrocarbon exploration: stable regulatory and legal framework for seismic surveys **political, environmental and financial risk** (long paypack period)
- Expansion of existing and planned new gas infrastructure projects (e.g. East Med, Vertical Corridor) → **political, environmental and financial risk** (long paypack period)
- Impacts associated with global warming**
- Cyber threats**
- Trade-related risks (tariffs and production expenses)**
- Employee Recruitment and Retention**
- Natural disasters and other catastrophic events**

Concluding Remarks

- ❑ Natural gas will continue to play key role in the global energy balance, maintaining a strong share in global energy demand by 2040
- ❑ The transformation of national and regional energy markets and the move towards RES systems favour gas use as it provides safe and reliable base load
- ❑ Given the crucial role of gas in power generation and increased use for domestic and industrial uses, there is a positive demand outlook in SE Europe over the medium term
- ❑ Long-term prospects for gas demand also look positive in the region, given the broader decarbonisation effort, especially in power generation
- ❑ Most governments and industries in SE Europe look upon gas as the fastest and most effective way to decarbonize, especially if considered in relation to the introduction of hydrogen and biomethane over the coming years



INSTITUTE OF ENERGY
FOR SOUTH-EAST EUROPE

The background of the slide is a dark blue image of a globe showing city lights at night. Overlaid on the globe are numerous glowing blue lines that represent energy transmission or a network, curving and connecting across the continents.

*Thank you
for your attention!*

www.iene.eu
cstambolis@iene.gr