

# The Role of Greece in Enhancing European Energy Security

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# European Energy Security

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**The key issues in European energy security concern:**

- (a) Supply of Energy Resources
- (b) Energy Transmission Routes

**The fuels under consideration include:**

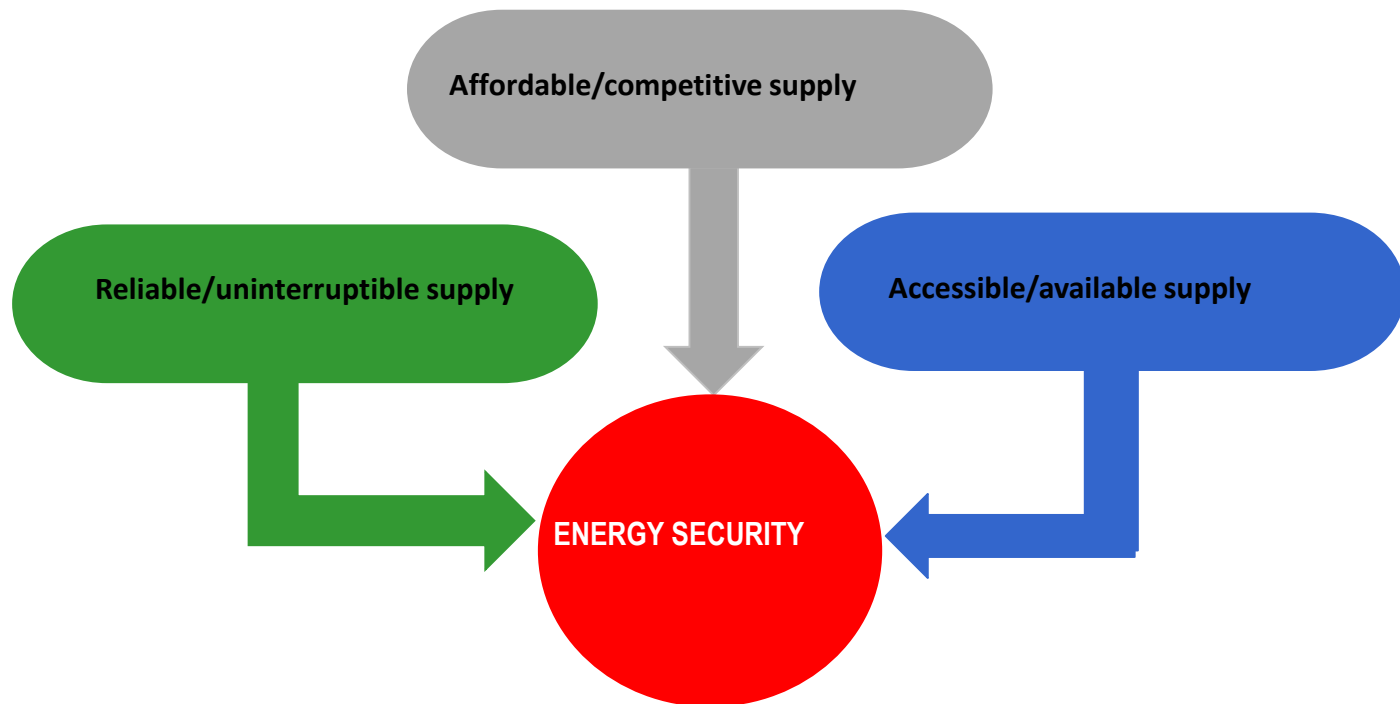
- Oil
- Electricity
- Gas

**The role of Greece in European Energy Security is key on account of the following two parameters:**

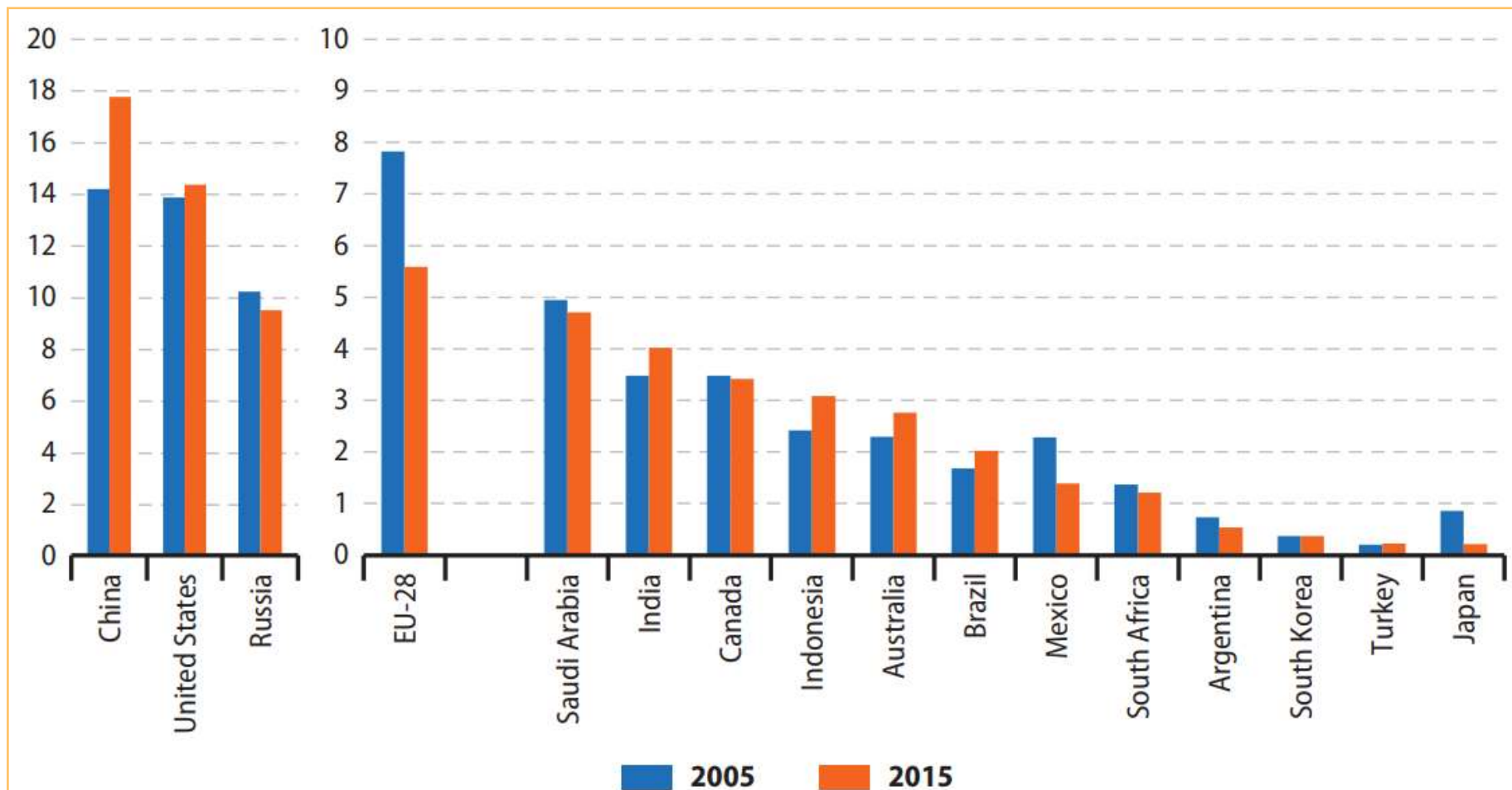
- Greece as a critical energy conduit
- Energy use in Greece
  - Improvement of own energy security system
  - Optimum energy mix and maximization of indigenous energy production

## Energy Security - Definition

- The International Energy Agency (IEA) defines energy security as “the uninterrupted availability of energy sources at an affordable price”.

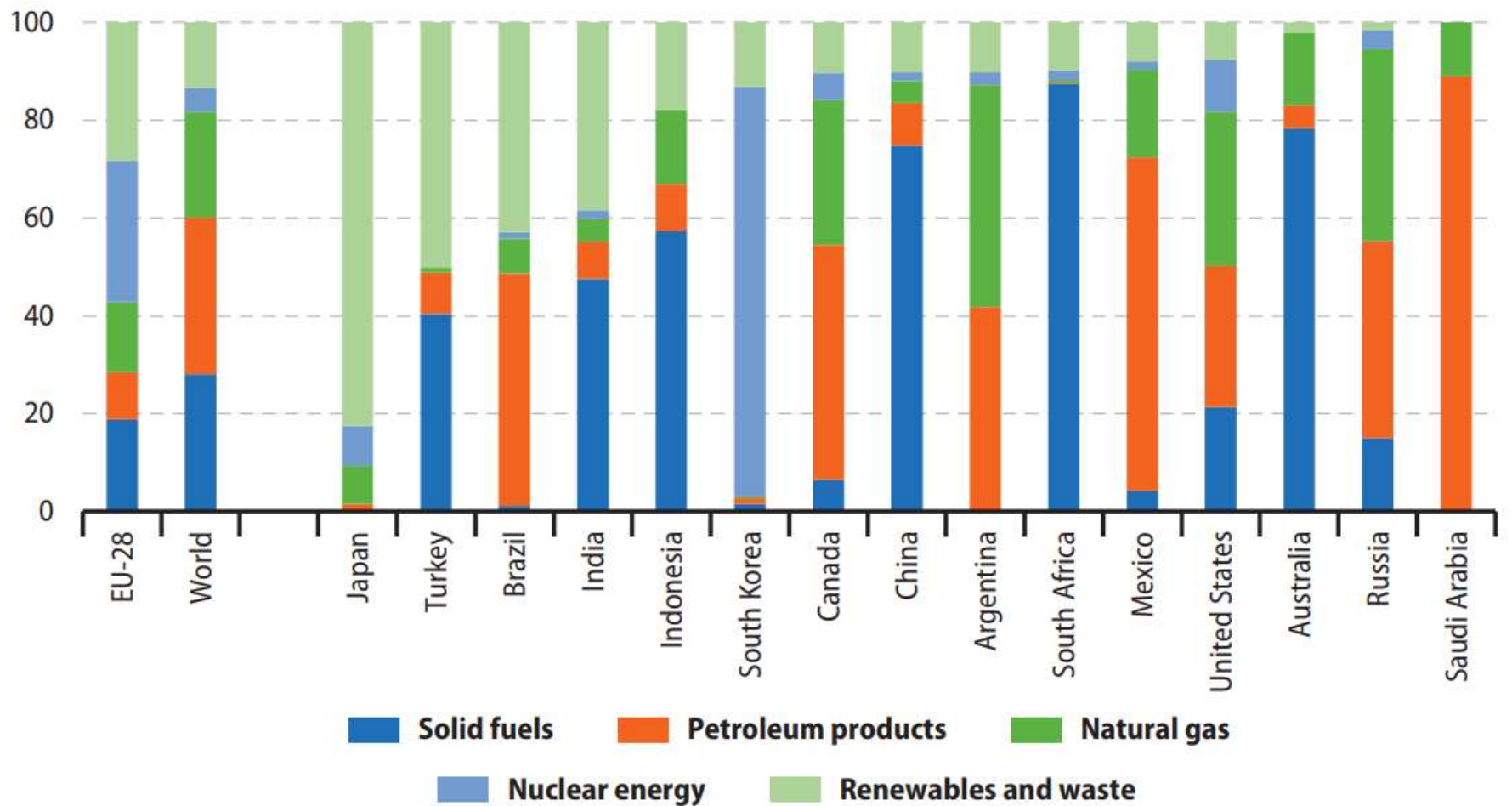


# Primary Energy Production (2005 and 2015) (% of World Total)



Note: different scales used for the two parts of the figure.

# Primary Production by Energy Type (Excluding Heat), 2015 (% of Total Production)



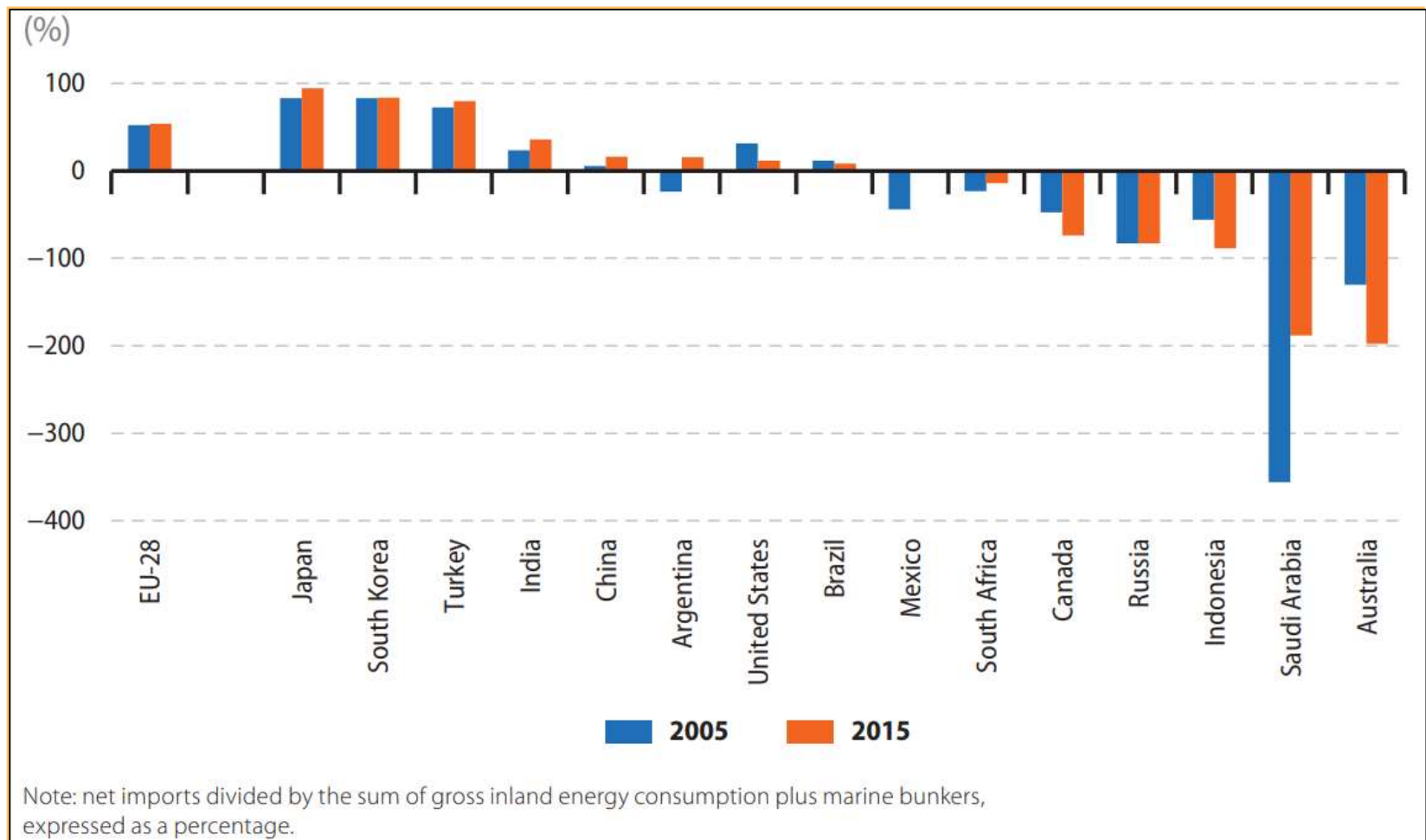
Note: ranked on the share of renewables and waste.

# Energy Imports and Exports (2015)

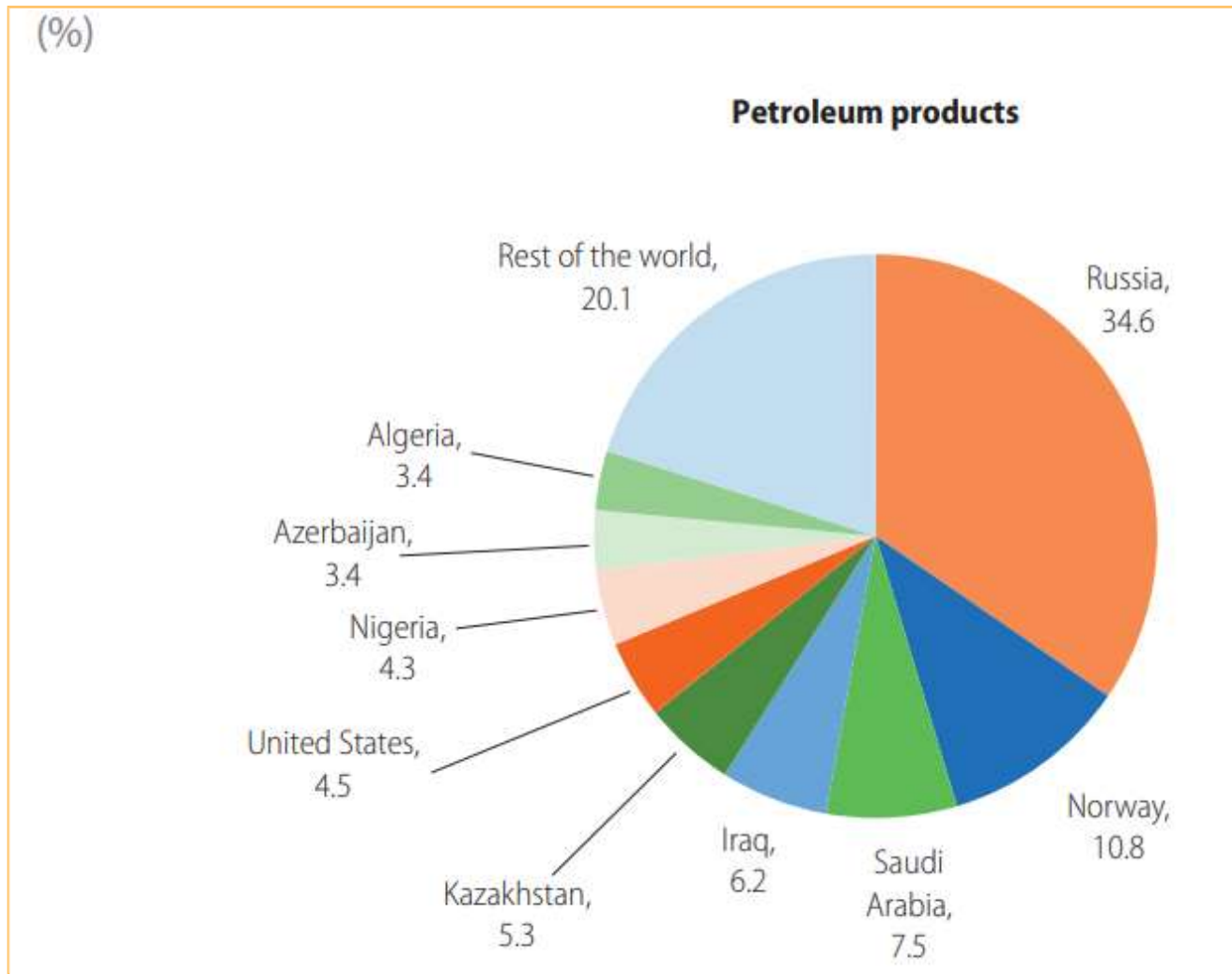
	Imports	Exports	Net imports (¹)	Analysis of gross imports by energy type				
				Solid fuels	Petroleum products	Gas	Renewables and waste	Electricity and heat
	(million toe)			(%)				
EU-28	1 479.6	577.6	902.0	10.2	63.2	23.2	1.1	2.4
World	5 307.9	5 395.5	–	14.9	67.1	16.4	0.4	1.2
Argentina	18.1	4.4	13.7	7.3	36.2	52.2	0.0	4.3
Australia	48.3	297.9	–249.6	0.3	89.0	10.6	0.0	0.0
Brazil	70.4	45.1	25.3	21.1	52.3	21.8	0.6	4.2
Canada	85.2	284.4	–199.2	6.0	72.9	19.1	1.1	0.9
China	547.0	58.0	489.0	19.9	71.1	8.9	0.0	0.1
India	371.3	64.5	306.8	32.1	63.2	4.6	0.0	0.1
Indonesia	53.7	253.0	–199.3	3.8	96.2	0.0	0.0	0.0
Japan	427.8	18.8	409.1	27.6	49.6	22.8	0.0	0.0
Mexico	70.7	72.2	–1.6	7.5	49.6	42.7	0.0	0.2
Russia	27.6	629.5	–601.9	51.8	19.9	26.2	0.0	2.1
Saudi Arabia	30.2	453.3	–423.1	0.0	100.0	0.0	0.0	0.0
South Africa	35.1	55.9	–20.8	1.7	85.9	9.2	0.0	3.2
South Korea	299.8	62.8	237.0	27.1	59.9	13.0	0.0	0.0
Turkey	112.2	8.6	103.6	19.6	44.3	35.5	0.0	0.5
United States	560.6	302.9	257.7	1.1	86.1	11.2	0.4	1.2

(¹) A negative value for net imports indicates that the country concerned is a net exporter.

# Energy Dependency (2005 and 2015)



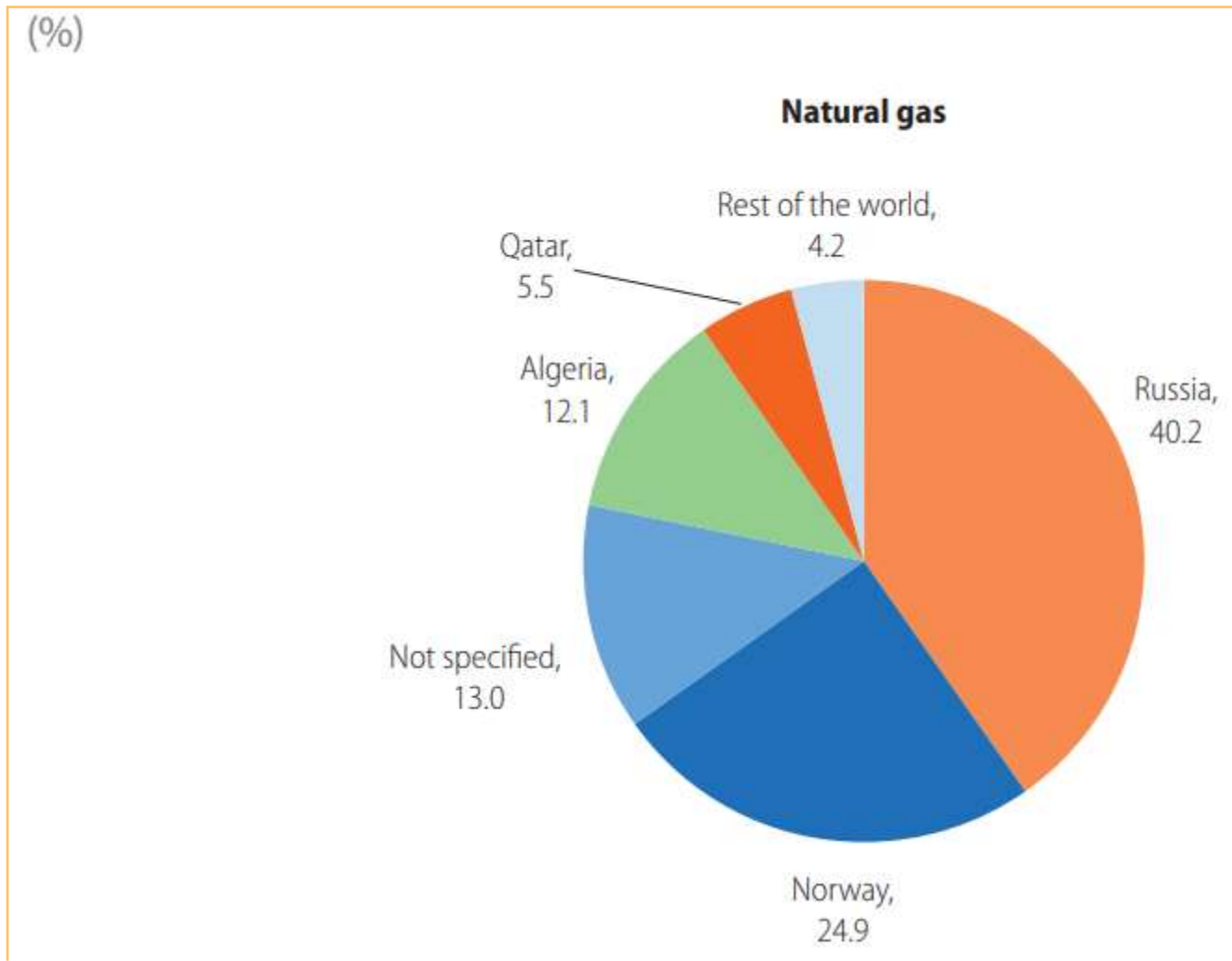
# Main Origins of Extra-EU Petroleum Products Imports, EU-28 (2016)



Sources: Eurostat and IEA

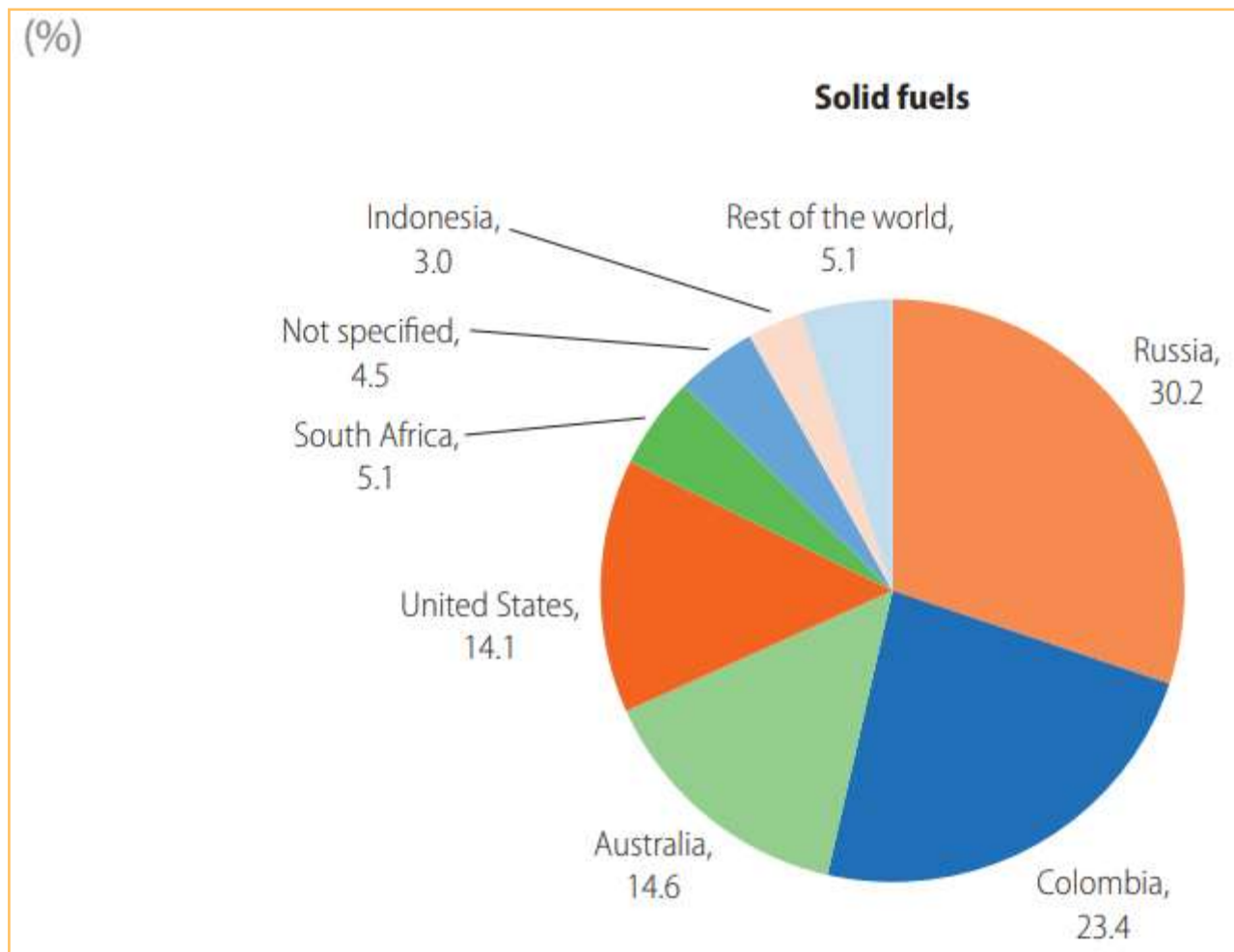


## Main Origins of Extra-EU Gas Imports, EU-28 (2016)



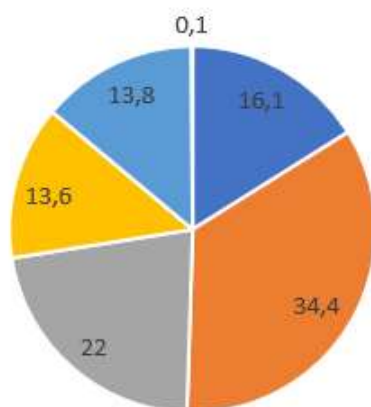
Sources: Eurostat and IEA

## Main Origins of Extra-EU Coal Imports, EU-28 (2016)



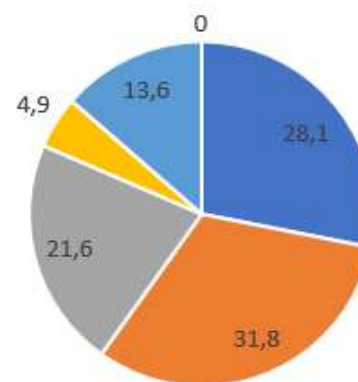
# Gross Inland Consumption (%) (2015)

**EU-28**  
(Total=1629,5 Mtoe)



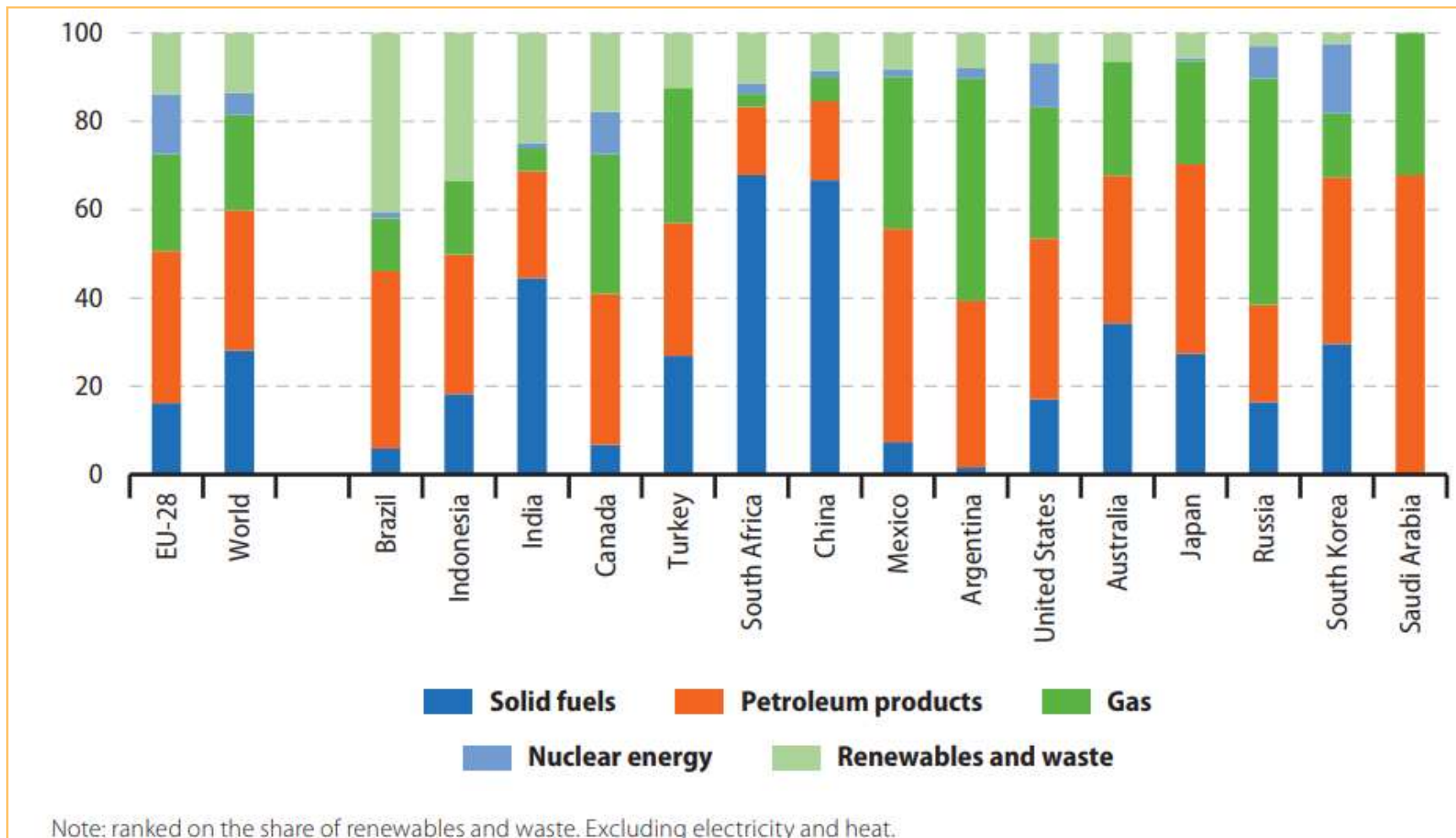
■ solid fuels ■ petroleum products ■ gas  
■ nuclear ■ renewables and waste ■ electricity and heat

**World**  
(Total=13647,4 Mtoe)

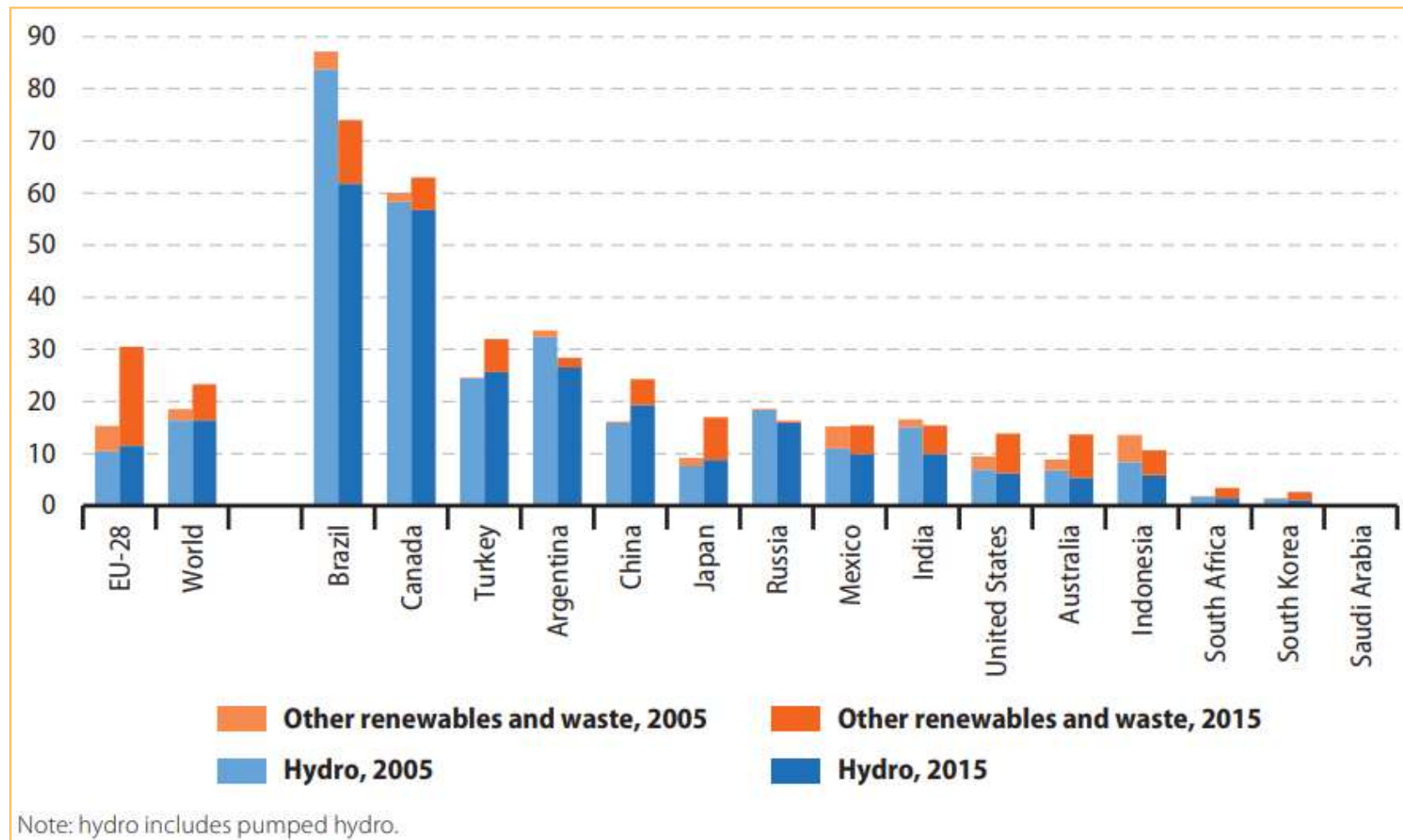


■ solid fuels ■ petroleum products ■ gas  
■ nuclear ■ renewables and waste ■ electricity and heat

# Gross Inland Consumption by Energy Type (2015) (% of Gross Inland Consumption)



# Renewables and Waste (2005 and 2015) (% of Gross Electricity Generation)



# European Energy Security: Diversification of Gas Supply Sources and Transportation Routes

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- ❑ Opening up a new South route to bring gas from **new supply sources** (other than Russian) to meet (then) rising European gas demand became an EC energy strategy priority in the early 2000's.
- ❑ The key objective, then as now, being the **diversification of gas supply sources and gas supply routes**.
- ❑ The South Corridor, in its present status, **satisfies the “route” diversification requirement**, but not necessarily the “supply” one.
- ❑ There is a **new architecture** to be considered in how the South Corridor is shaping up with multiple pipelines and LNG terminals, several entry points and a number of suppliers (e.g. Azerbaijan, Turkey basket, Russia, LNG).
- ❑ In view of the failure of securing sizeable gas quantities outside Russia and the changing architecture of the South Corridor, there is a need for a **wider debate** in order to redefine and reconsider priorities and expectations.

# An Expanded South Gas Corridor



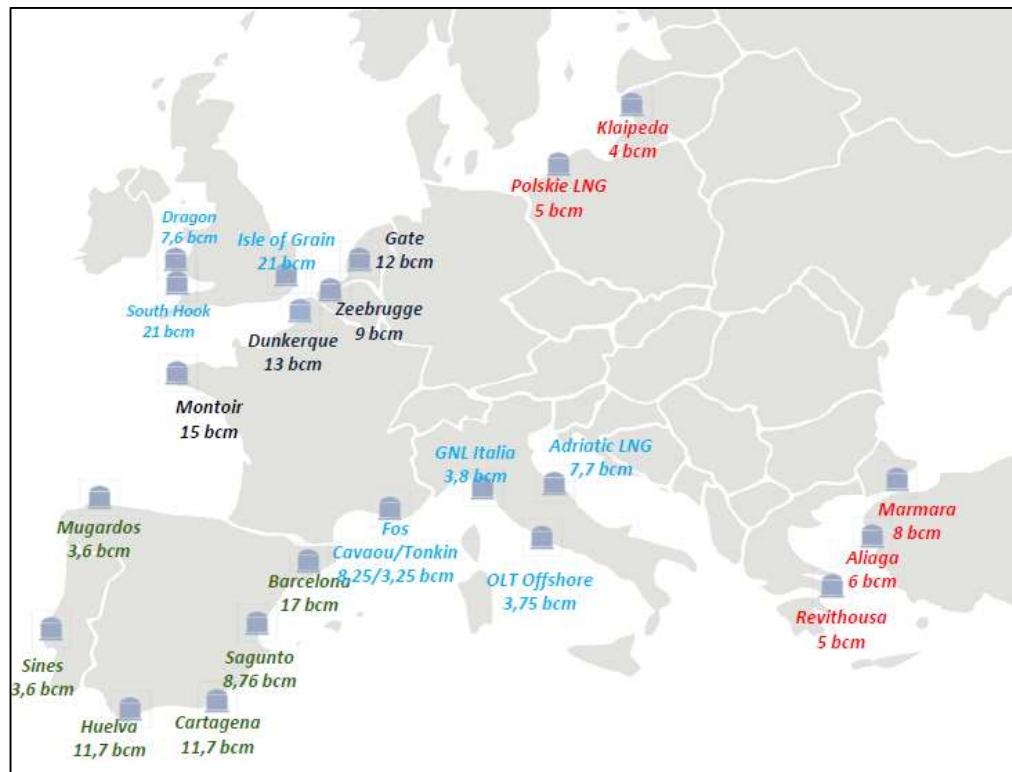
NB.: The TANAP and TAP gas pipelines as well as Turkish Stream are under construction, with IGB at an advanced planning stage with FID already taken. The IAP, the IGI Poseidon in connection with East Med pipeline and the Vertical Corridor and the IGF are still in the study phase. Blue Stream and Trans Balkan are existing pipelines.

Source: IENE (February 2018)



# Great Spare LNG Capacity in Europe

- **221 bcm capacity available** but many constraints
- **Markets with very limited liquidity**
- **Physical markets with limited interconnection, low liquidity and limited ability to absorb LNG**
- **Markets with high access costs, regulatory constraints, and/or volatile spreads markets to hedging hubs**
- OMV estimate suggests **40-50 bcm capacity in efficient price hedging locations**
- Of this, OMV estimates **>50% is already booked; >20-25 bcm offered**
- Fuel switch potential becomes limited in the EU as coal units phase out



Source: OMV Gas



# Turkish Stream (Under Construction)



Source: Gazprom

Turkish Stream	
Length	1,100 km
Diameter	Outer diameter of 32 inches (812.8 mm) and will be installed in water depths up to 7,220 ft (2,200 m).
Capacity	Two stretches: Each stretch will have a capacity of 15.75 bcm/y.
Anticipated Operational Date	2020

# Contribution of Russian Gas Deliveries to SEE After 2020 Remain Uncertain

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- According to repeated statements by Gazprom's senior executives over the last 18 months, gas exports via Ukraine and destined to SEE will cease from 31.12.2019.
- This means that Russian gas to Romania, Bulgaria, FYROM, Greece and Turkey will not be delivered via the currently positioned Trans Balkan Pipeline.
- Turkey will instead obtain its corresponding gas supplies exclusively via the new Turkish Stream Pipeline.
- Hence, Romania, Greece, Bulgaria and FYROM will only be able to obtain their gas supplies from Russia via Turkey, most likely, through a reverse flow operation of the Trans-Balkan Pipeline.
- Additional Gazprom exports to European markets via the Expanded South Corridor could be channeled in three ways:
  1. By booking capacity through TAP's second stage operation where +10 bcm could be accommodated. (This will be a blow to EU's gas supply diversification policy)
  2. Limited quantities via the Vertical Corridor
  3. Through a new (to be built) pipeline through Greece and Italy (i.e. revival of the old ITGI and Poseidon plan), which will certainly face stiff opposition from Brussels and the USA government.

# The TANAP-TAP System (Under Construction)

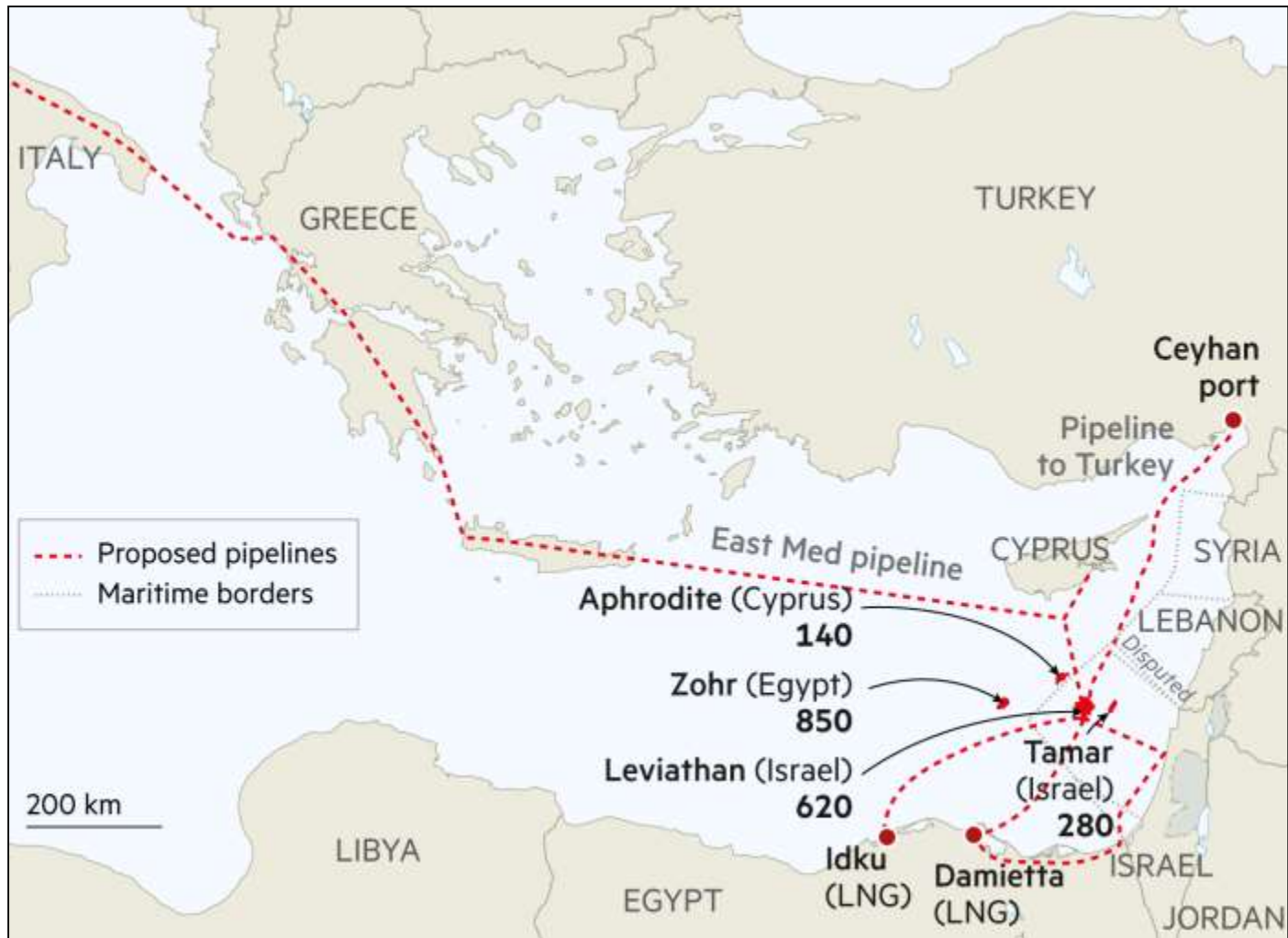


Source: TAP AG

TAP	
Length	878 km
Diameter	48-inch (1,200 mm) pipes
Capacity	10-20 bcm/y
Anticipated Operational Date	2020

TANAP	
Length	1,850 km
Diameter	48-or-56-inch (1,200 or 1,400 mm) pipes
Capacity	up to 31 bcm/y
Anticipated Operational Date	2019

## Recent Gas Discoveries in Offshore Eastern Mediterranean Could in the Long Term Provide an Alternative Gas Supply to Europe



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



Source: DEPA

East Med	
Length	1,300 km (offshore) 600 km (onshore)
Diameter	32-inch (813 mm) and 48-inch (1,200 mm) pipes
Capacity	up to 15 bcm/y
Anticipated Operational Date	2025

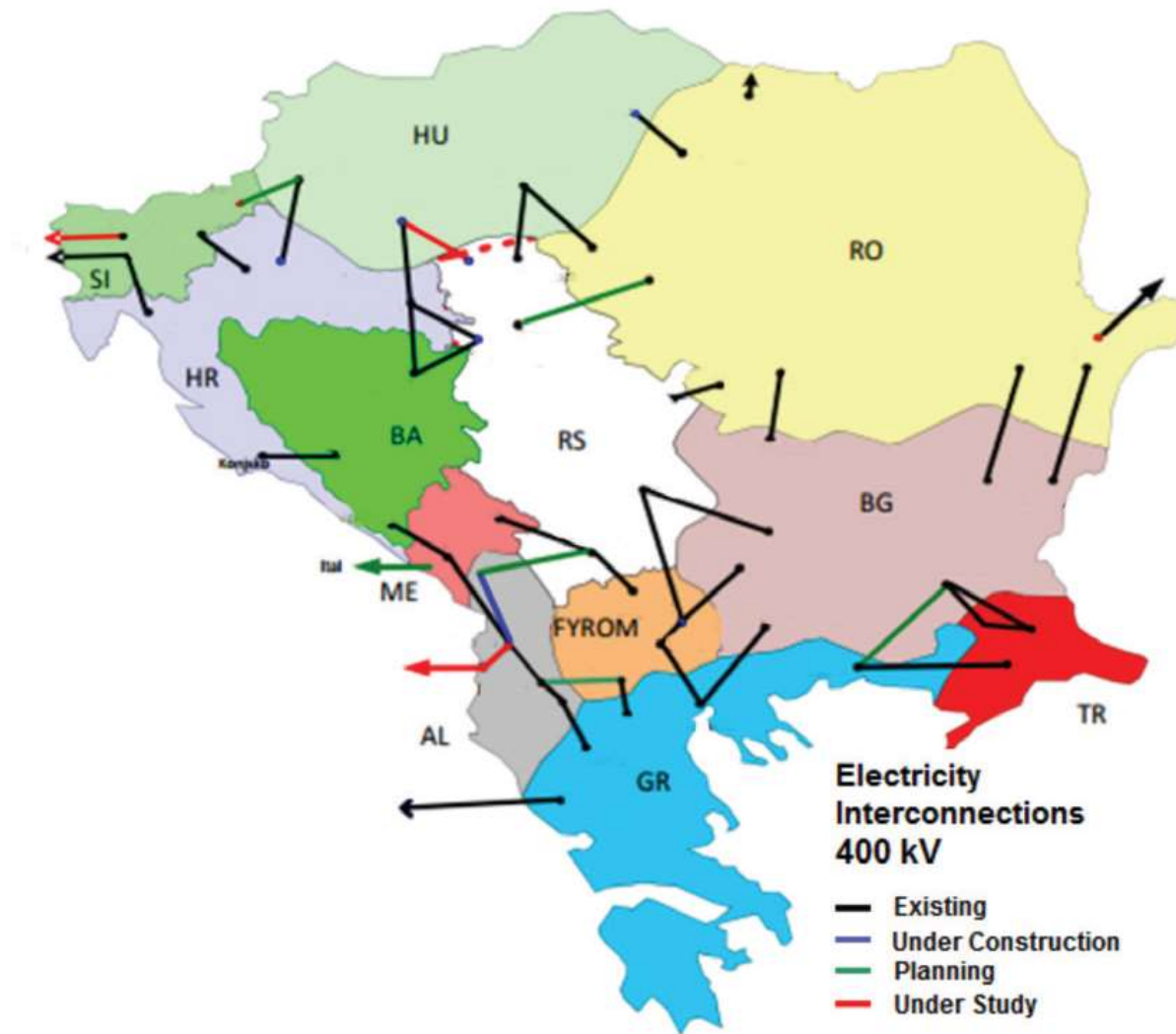
IGI	
Length	216 km
Diameter	32-inch (813 mm) pipes
Capacity	14-20 bcm/y
Anticipated Operational Date	2020

# European Energy Security – The Role of Greece

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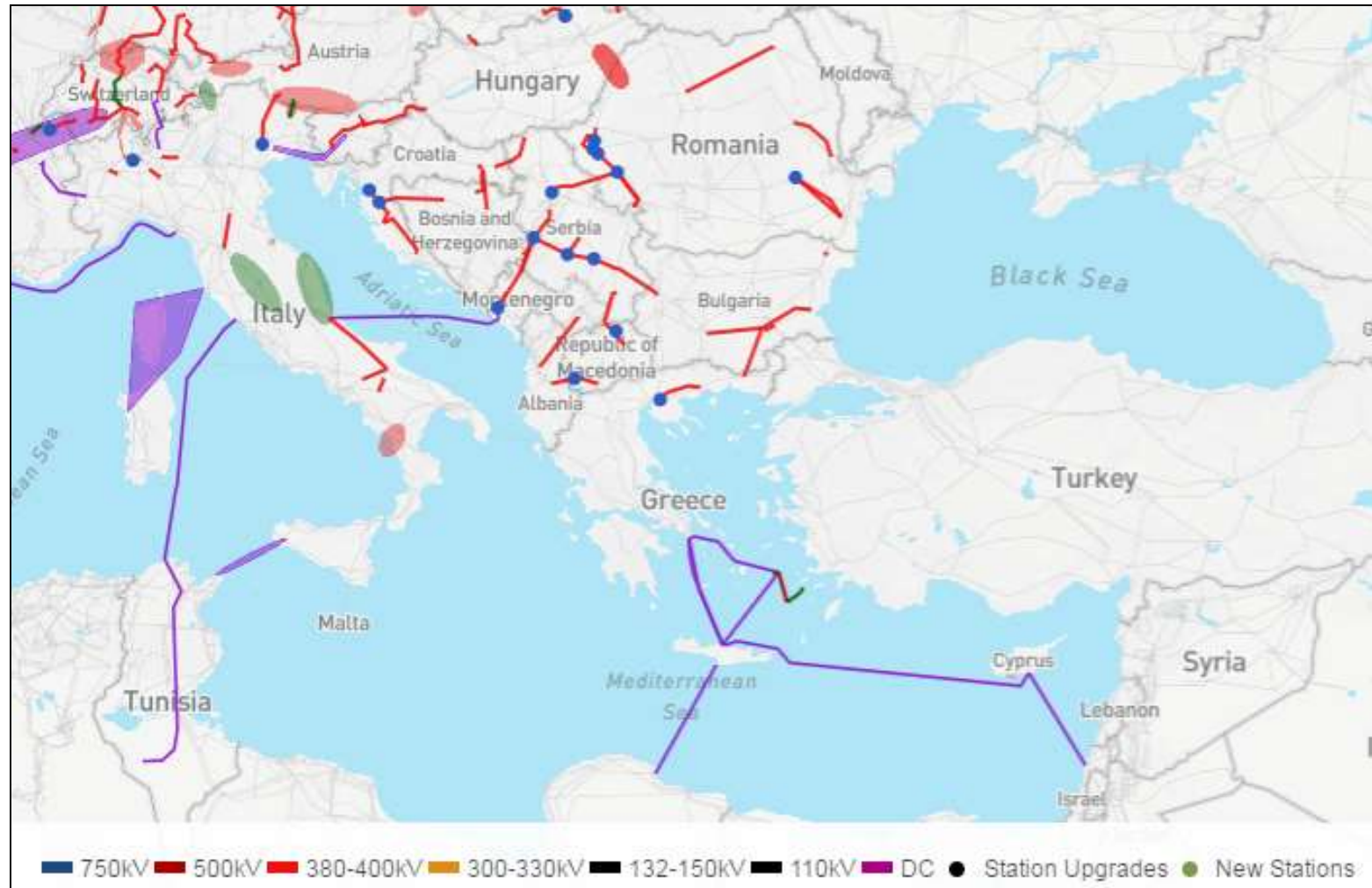
- Oil supply security provisions are in line with IEA and EU Directives.
- Cross border electricity transmission through international interconnections has greatly improved over the last 10 years following new HV interconnections with Turkey, FYROM, Bulgaria and Albania.
- Gas supply and transmission appears relatively diversified and more work is in progress in order to strengthen it:
  - Completion of Revithoussa LNG terminal expansion (2018)
  - Construction of TAP in progress to be completed by the second half of 2019
  - Interconnection Greece-Bulgaria. Construction to start early 2019 and to be completed by end 2020
  - FSRU terminal in Alexandroupolis to be ready by 2021
  - Underground gas storage in South Kavala to become available in 2021/2022
  - Interconnection Greece-FYROM under consideration and likely to be constructed by 2020/2021

# Electricity Interconnections in SE Europe





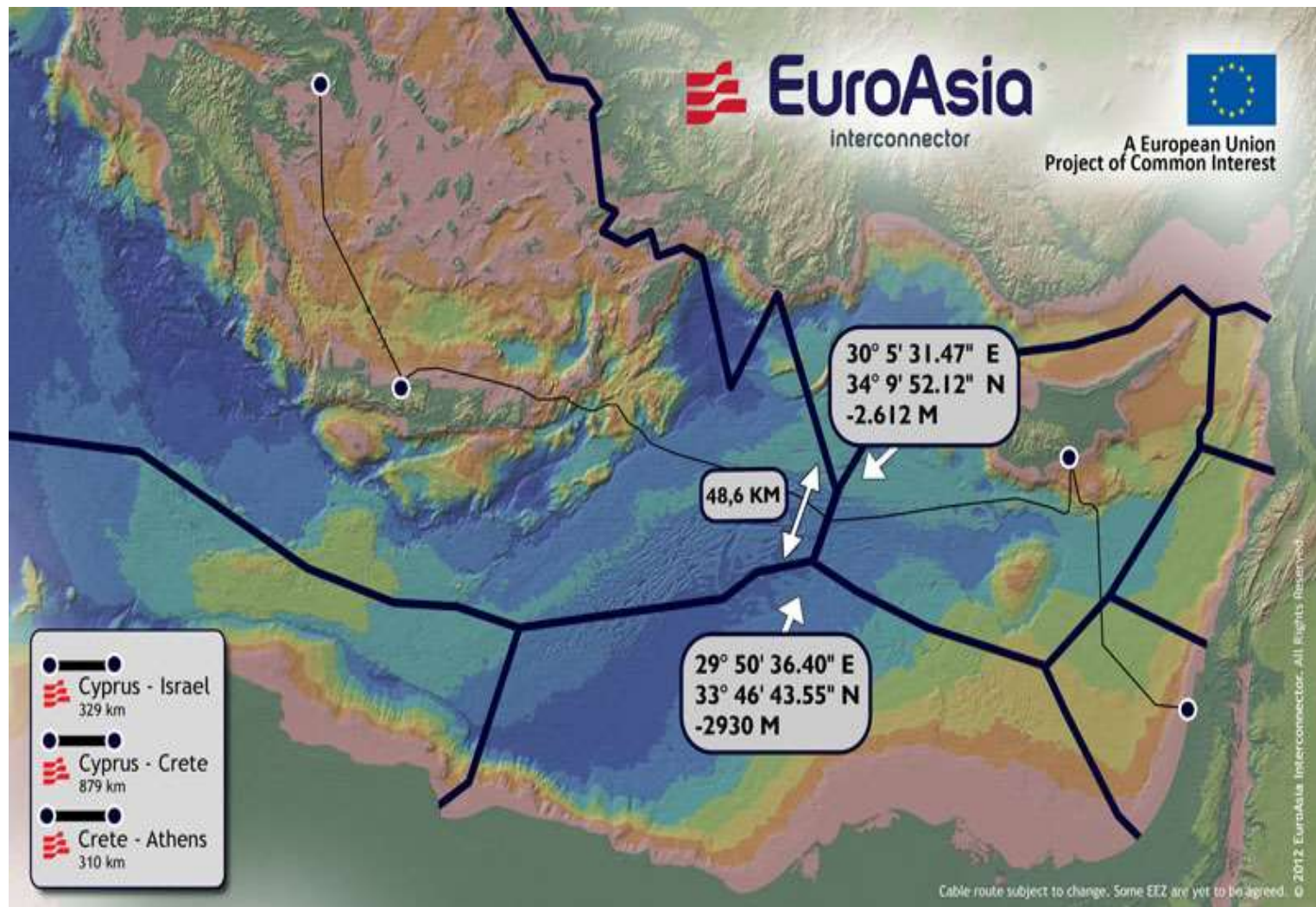
# ENTSO-E's 10-year Power Network Development Plan



Source: ENTSO-E



# EuroAsia Interconnector



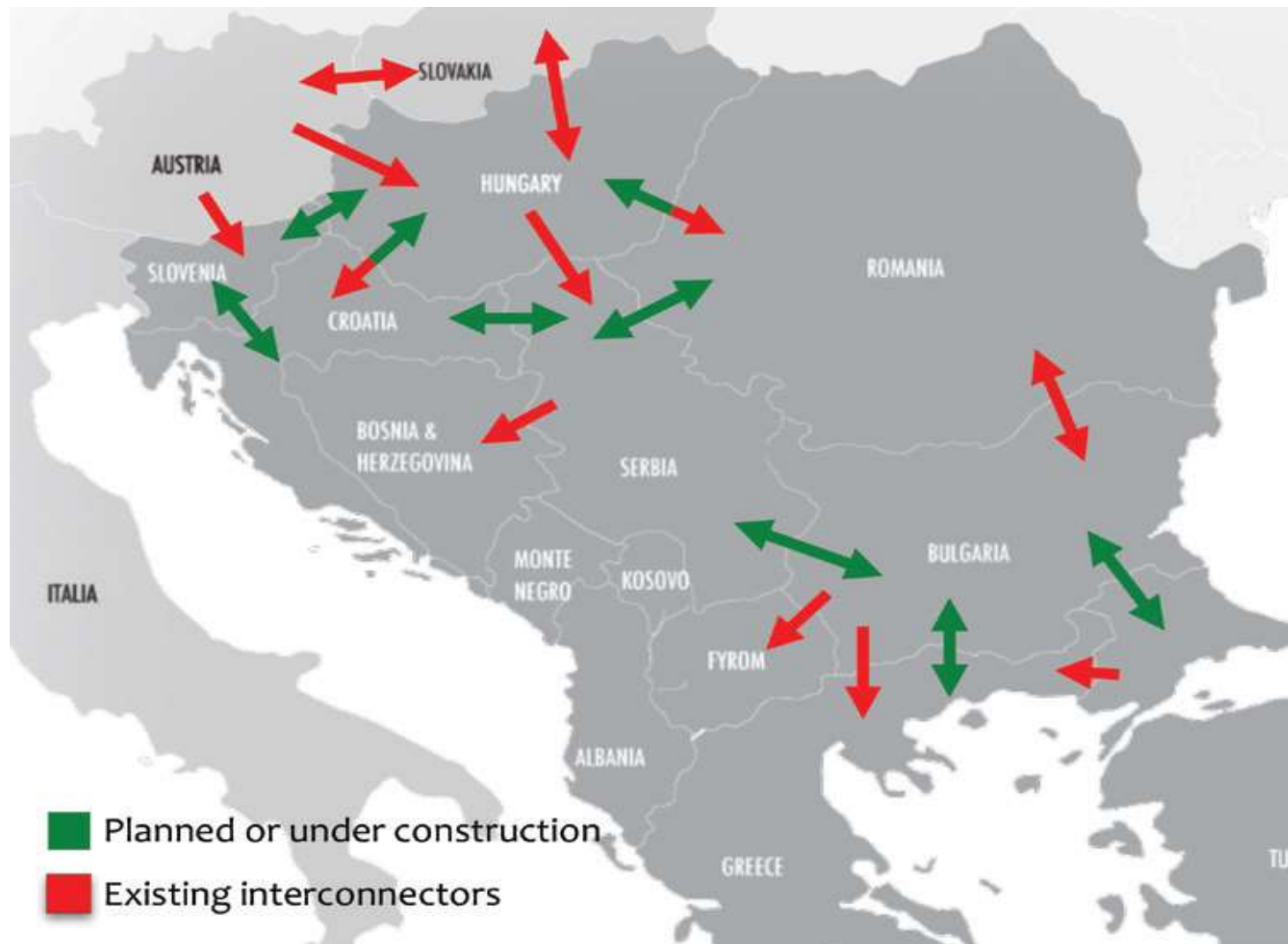
Source: EuroAsia Interconnector

# ENTSO-G's System Development Map



Source: ENTSO-G

# Gas Interconnections in SE Europe



Source: IENE study "South East Europe Energy Outlook 2016/2017", Athens, 2017



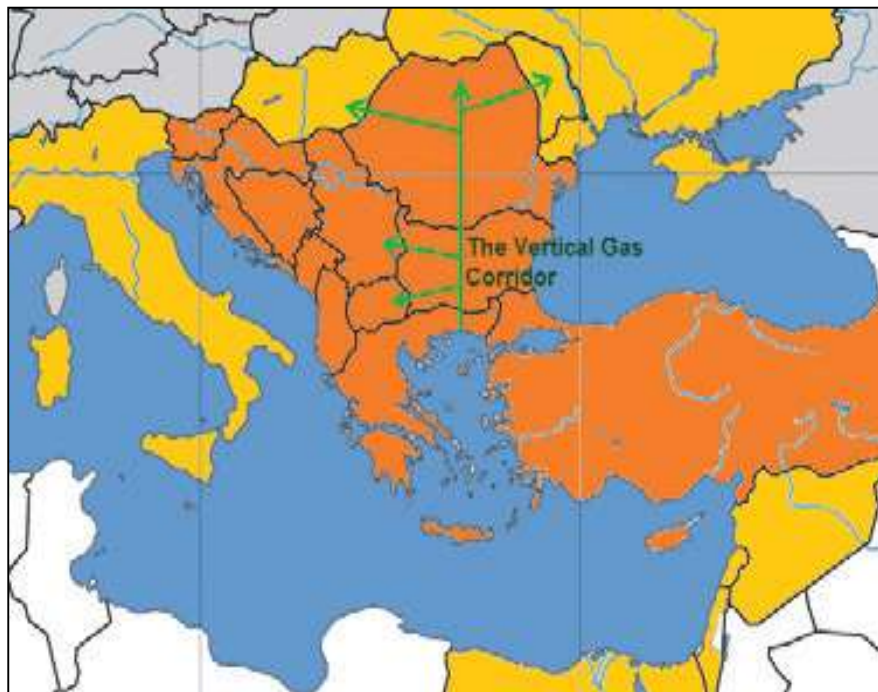
# Interconnector Greece-Bulgaria (IGB) (Implementation Stage)



IGB	
Length	182 km
Diameter	32-inch (813 mm) pipes
Capacity	3-5 bcm/y
Anticipated Operational Date	2020

Source: IGB AD

# Vertical Corridor and BRUA (Conceptual Stage)



Source: IENE



Source: European Commission

BRUA	
Length	843 km
Diameter	32-inch (813 mm) pipes
Capacity	.5 bcm/y transport capacity towards Bulgaria and 4.4 bcm/y towards Hungary
Anticipated Operational Date	2023

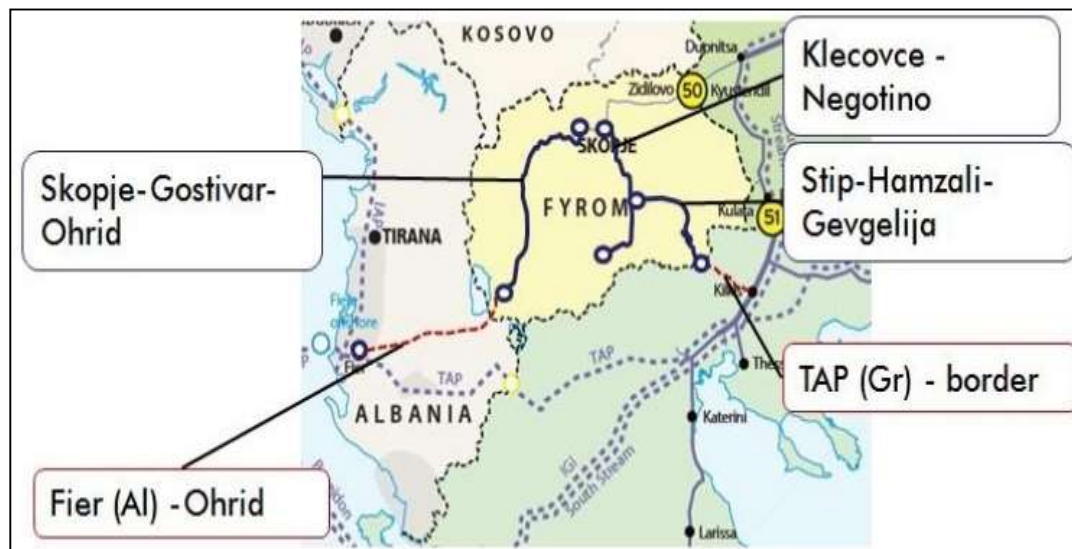
# Ionian Adriatic Pipeline (IAP) (Conceptual Stage)



IAP	
Length	540 km
Diameter	32-inch (813 mm) pipes
Capacity	up to 5 bcm/y
Anticipated Operational Date	2023

Source: Independent Balkan News Agency

# Interconnector Greece-FYROM (IGF) (Conceptual Stage)



IGF	
Length	115 km
Capacity	1.5 bcm/y
Anticipated Operational Date	2020

Sources: ENTSO-G map and ECA recommendations

# South Kavala Underground Gas Storage (Conceptual Stage)



South Kavala UGS	
Storage Facility Type	Aquifer
Capacity	0.36 bcm/y
Anticipated Operational Date	2022

Source: ENTSO-G



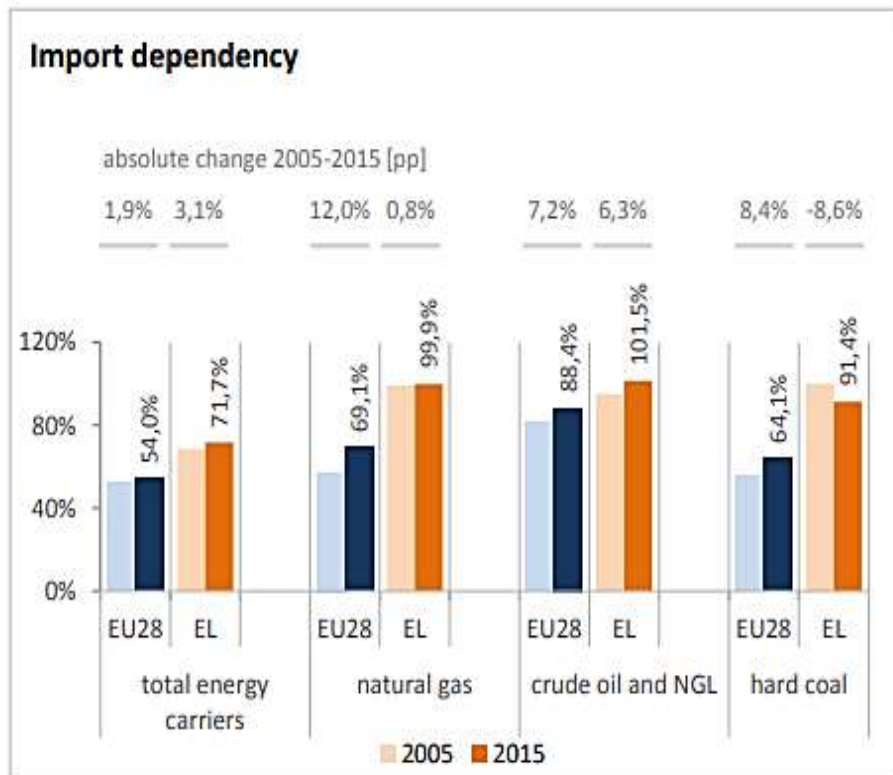
# Current Expansion of Revithoussa LNG Terminal (2<sup>nd</sup> Upgrade)



Source: DESFA

Expansion of Revithoussa LNG	
Capacity	<b>Storage capacity:</b> 225.000 m3 (currently, 130.000 m3) <b>Max Ship size:</b> 260.000 m3 (currently, 140.000 m3) with the addition of a 3rd tank
Anticipated Operational Date	2018

# Greece's Energy Dependence (2005 and 2015)



2015: Top non-EU suppliers for main energy carriers\*

Natural gas		Crude oil and NGL		Hard coal	
EL	EU28	EL	EU28	EL	EU28
Russia	Russia	Iraq	Russia	Russia	Russia
61,6%	37,3%	45,1%	28,8%	64,2%	29,1%
Turkey	Norway	Russia	Norway	Ukraine	Colombia
19,4%	32,8%	19,9%	12,4%	18,7%	24,3%
Algeria	Algeria	Kazakhstan	Nigeria	South Africa	United States
11,7%	10,7%	14,1%	8,3%	17,1%	16,0%

\*share in total imports for the MS and in total non-EU imports for the EU28

Source: Eurostat

# How Can Greece Help Improve its Energy Security?

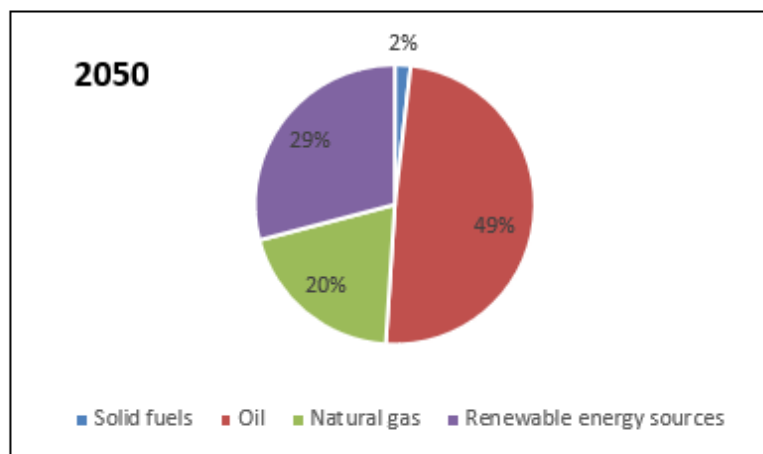
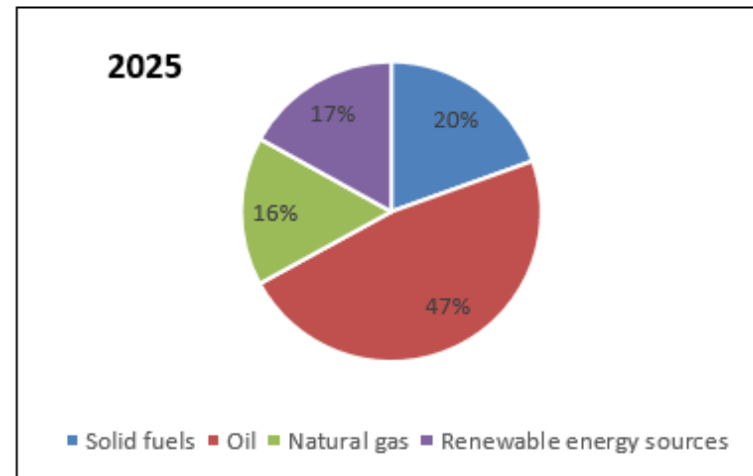
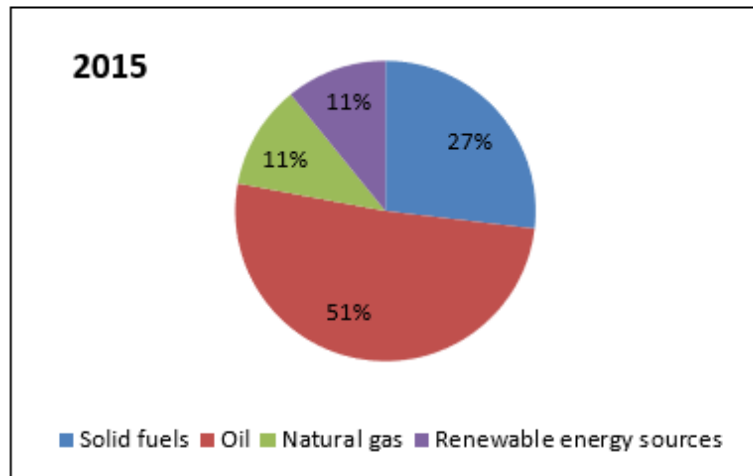
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The decline of Greece's **current energy dependence (i.e. 73.6% in 2016)** in order to bring it closer to the **European average (i.e. 54% in 2016)** must be a stable and non-negotiable target that can be achieved through:

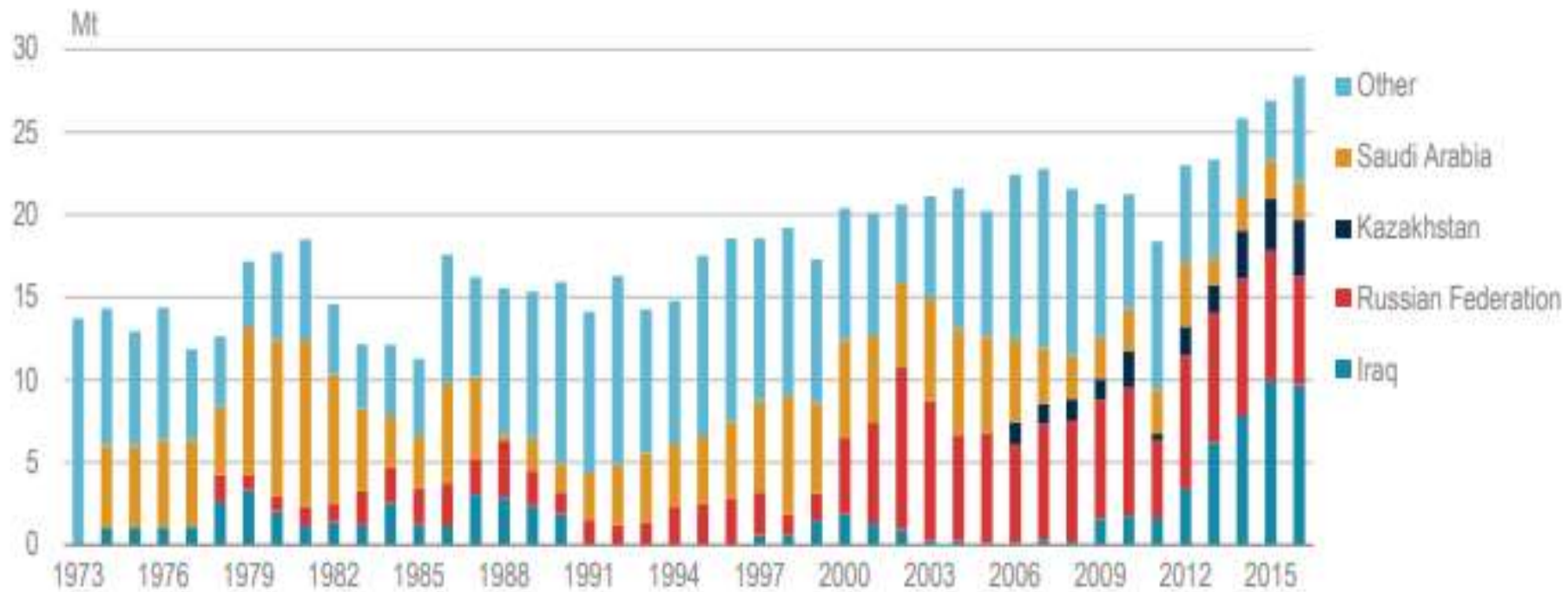
- the reduction of imported energy flows in parallel with
- an increase in domestic energy sources, with an emphasis on RES, hydrocarbons and energy efficiency, particularly in the transport and residential sectors and
- the stabilization or decrease of current lignite share in the country's energy mix

# Energy Use in Greece: Optimising its Energy Mix

**Gross Inland Consumption in Greece (2015, 2025 and 2050)**

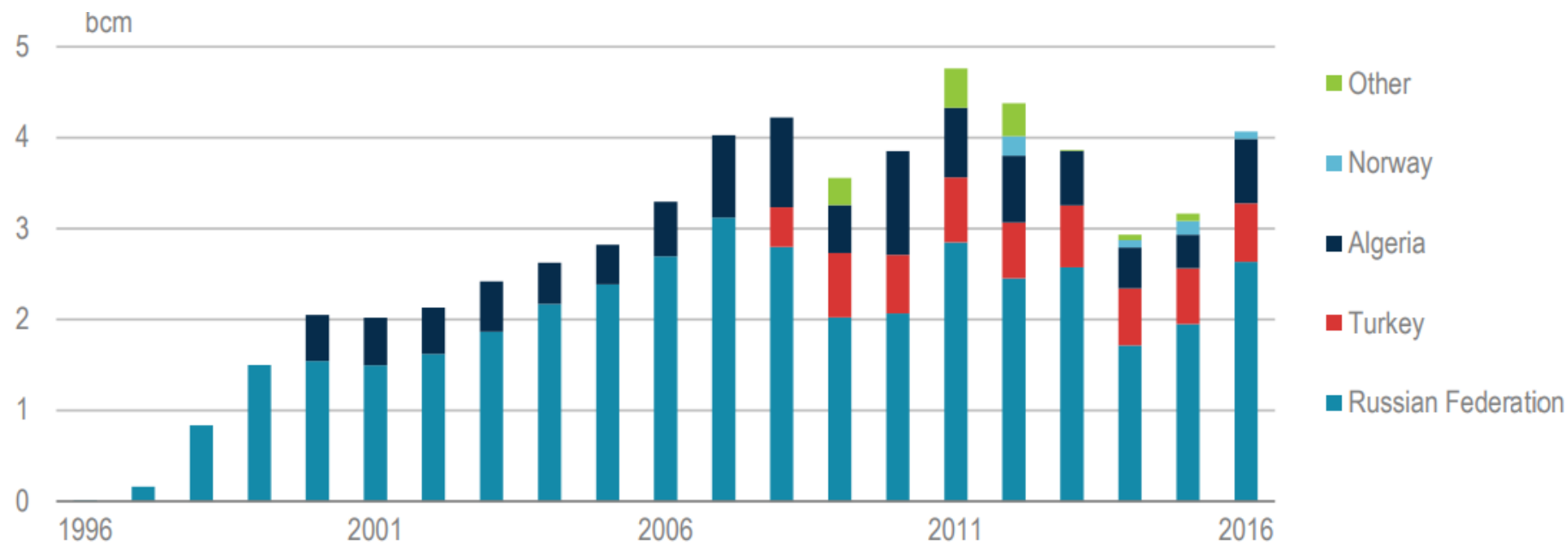


## Greece's Oil Imports by Country (1973-2016)



Note: Crude oil including natural gas liquids and feedstock. Data are provisional for 2016.

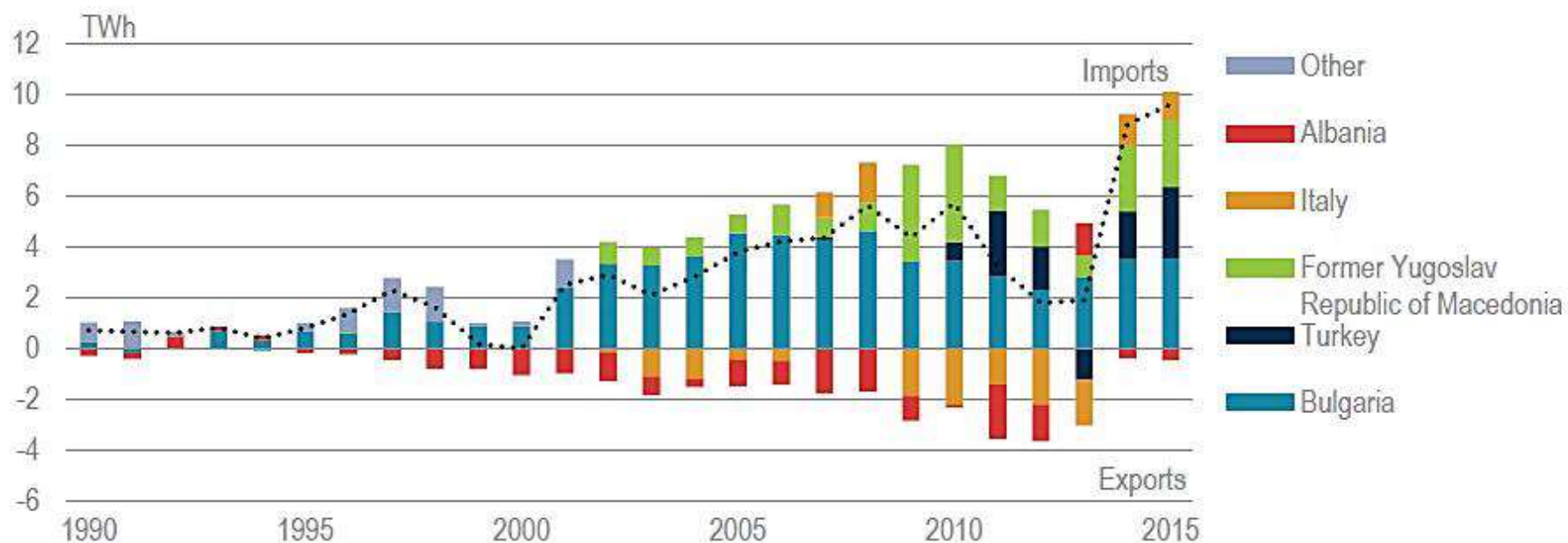
## Greece's Gas Imports by Country (1995-2016)



Note: Data are provisional for 2016.

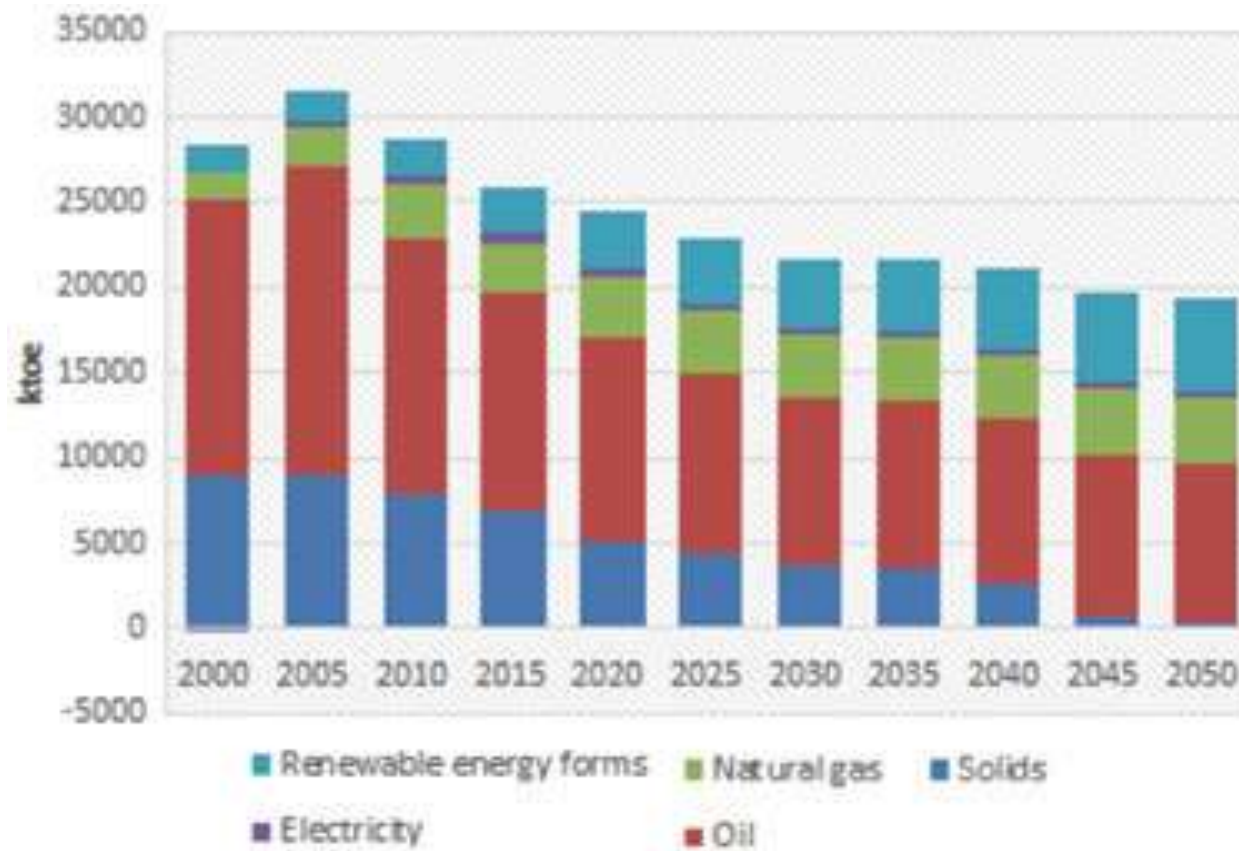
Source: Energy Policies of IEA Countries – Greece 2017 Review

# Greece's Electricity Imports and Exports by Country (1990-2015)



Source: Energy Policies of IEA Countries – Greece 2017 Review

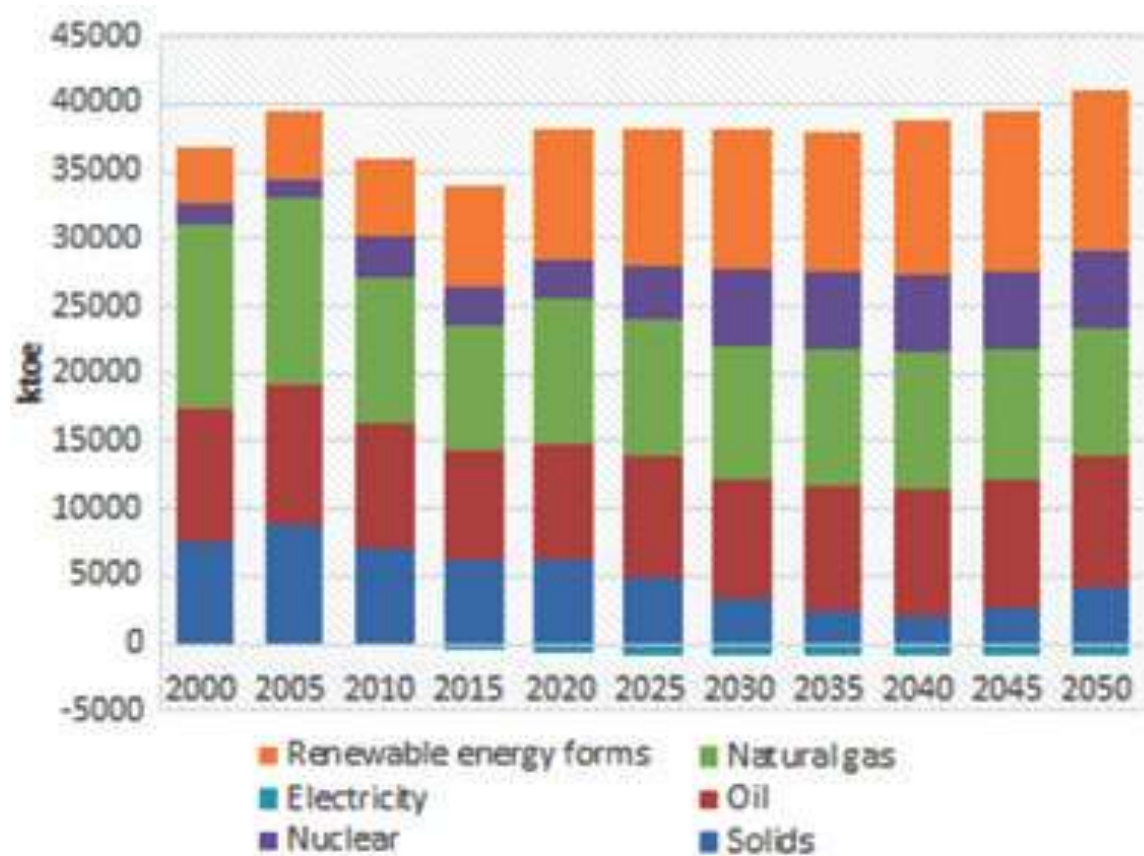
## Gross Inland Consumption in Greece (2000-2050)



Source: IENE "SE Europe Energy Outlook 2016/2017", Athens, Greece

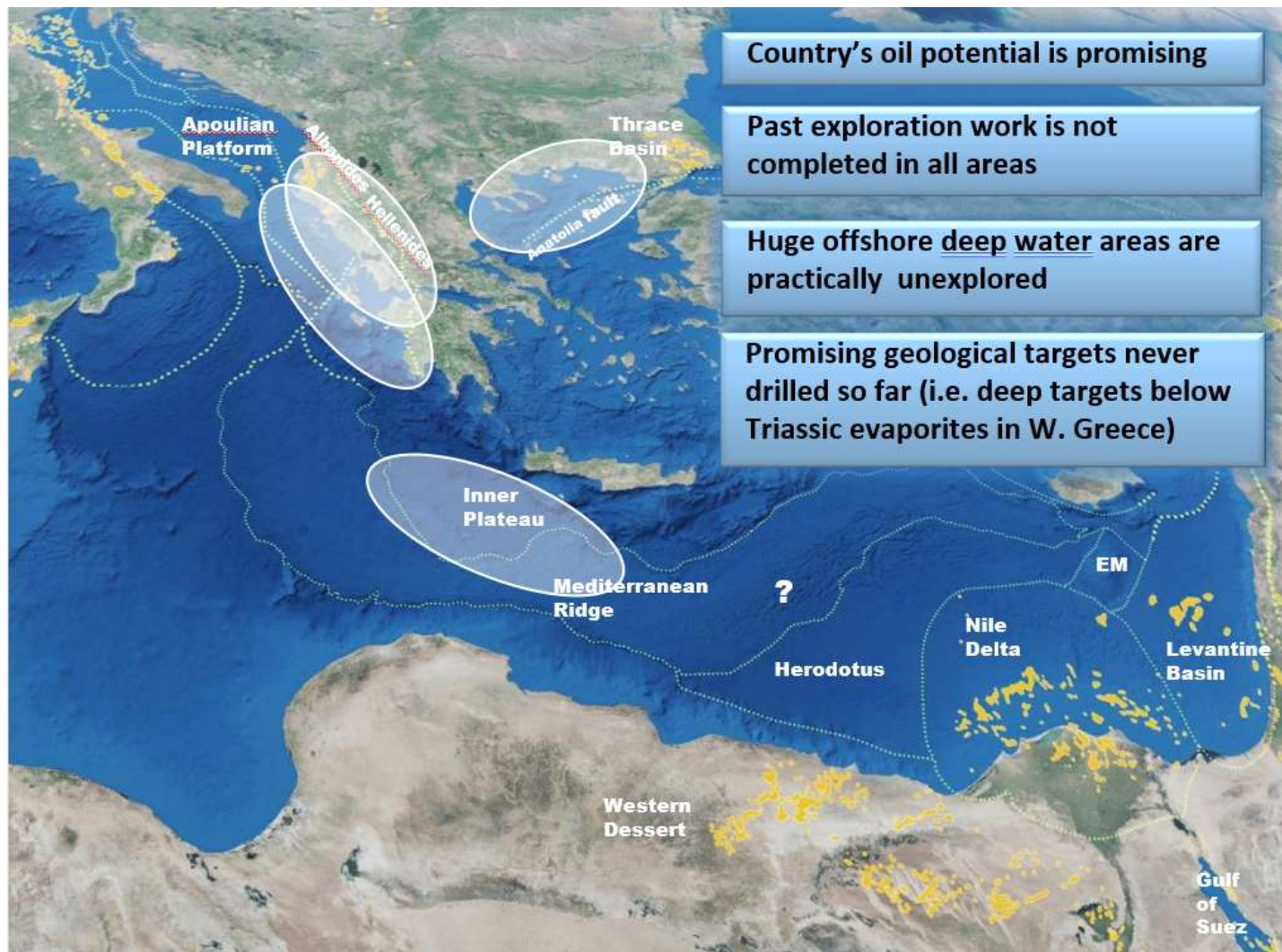


# Gross Inland Consumption in Romania (2000-2050)



Source: IENE "SE Europe Energy Outlook 2016/2017", Athens, Greece

# Hydrocarbon Activities in Greece (I)



Source: Hellenic Petroleum

## Hydrocarbon Activities in Greece (II)

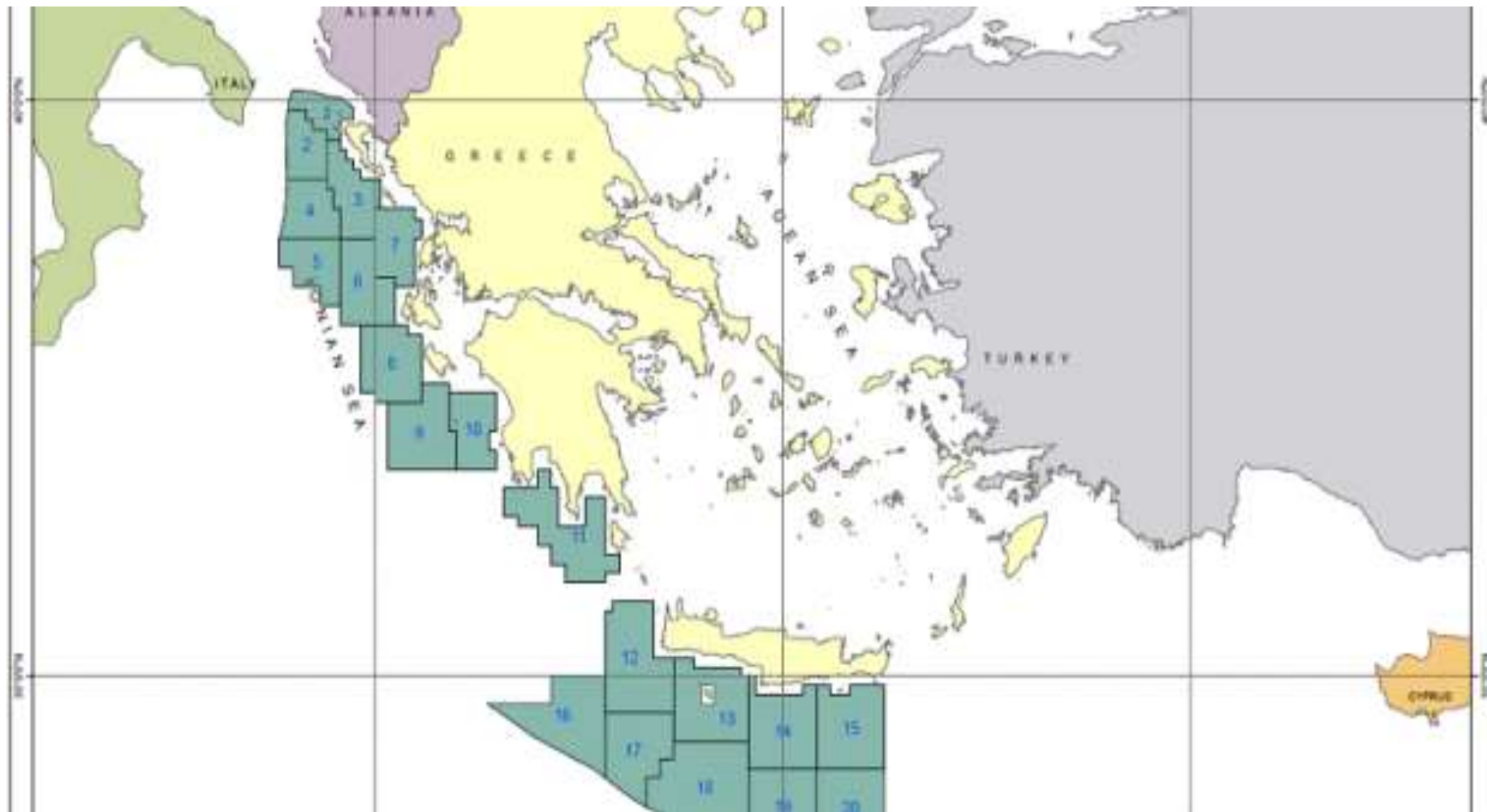
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Source: Hellenic Petroleum



## Hydrocarbon Activities in Greece (III)



Source: Greece's Energy Ministry

# How Can Greece Help Improve European Energy Security?

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- ❑ Greece, because of its **geographical position** and its **existing and planned energy infrastructure**, can play an important role in improving European energy security.
- ❑ At present and in the medium term (i.e. by 2022/2023), as a result of a cluster of major infrastructure projects in gas and electricity, currently under development, Greece could help **achieve energy route diversification and market integration**. These are two basic parameters in advancing energy security in the region.
- ❑ On a longer-term basis (i.e. by 2030), Greece could provide EU with **sizeable indigenous oil and gas resources**, which could augment the continent's limited production base, and thus help reduce European energy dependence.
- ❑ **However, Greece needs to carry out a lot more exploration work inland and offshore in its EEZ in order to discover and verify commercially exploitable hydrocarbon resources.**
- ❑ **Overall, Greece's contribution in enhancing European energy security could become increasingly important in view of continuing regional instability.**

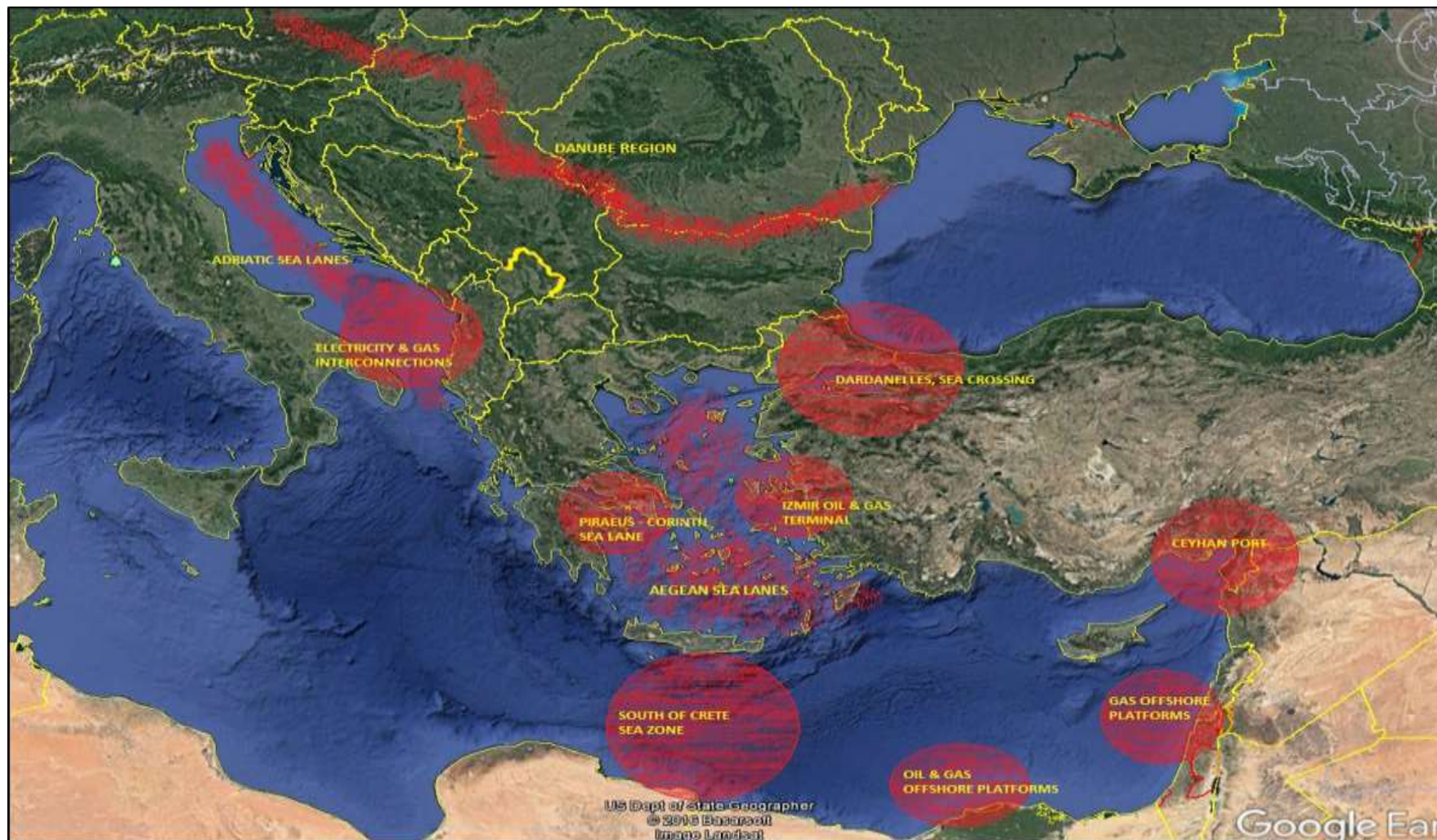
## Energy Security in SE Europe

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- 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 (*see following Map*), 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).



## Greece Plays Key Role in Ensuring SE Europe's Energy Security – Energy Security Hot Spots Have Lately Been Growing



**Thank you for  
your attention**

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