Key Strategic Choices for Greece's Energy Sector

A presentation by Costis Stambolis,
Chairman and Executive Director at IENE

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INSTITUTE OF ENERGY
FOR SOUTH EAST EUROPE

Presentation Outline

1. Greece and SE Europe
2. The Energy Mix – Growing Energy Dependence
3. Oil & Gas
4. Electricity
5. Renewables and Energy Efficiency
6. Investment Challenges
7. Key Strategic Choices

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

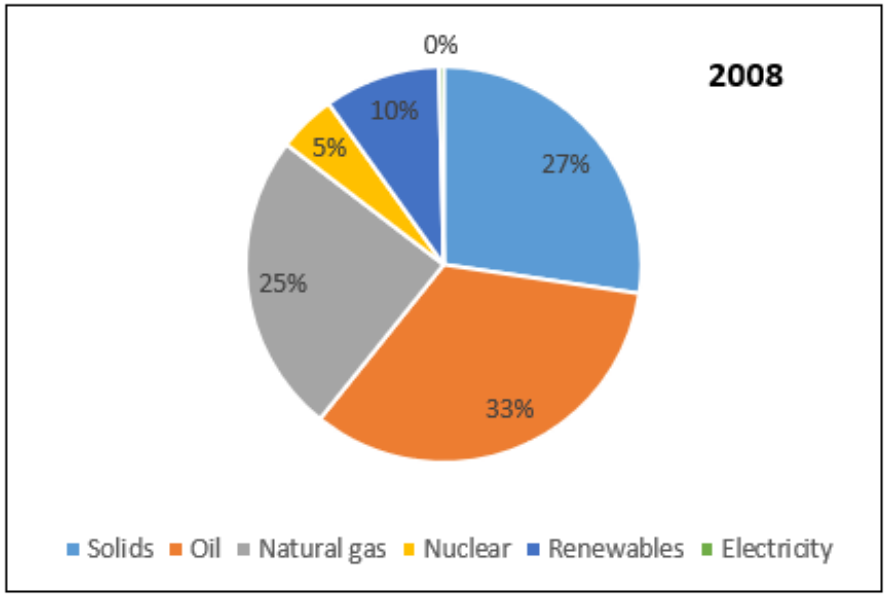
- Austria
- Egypt
- Italy
- Lebanon
- Moldova
- Slovakia
- Syria
- Ukraine

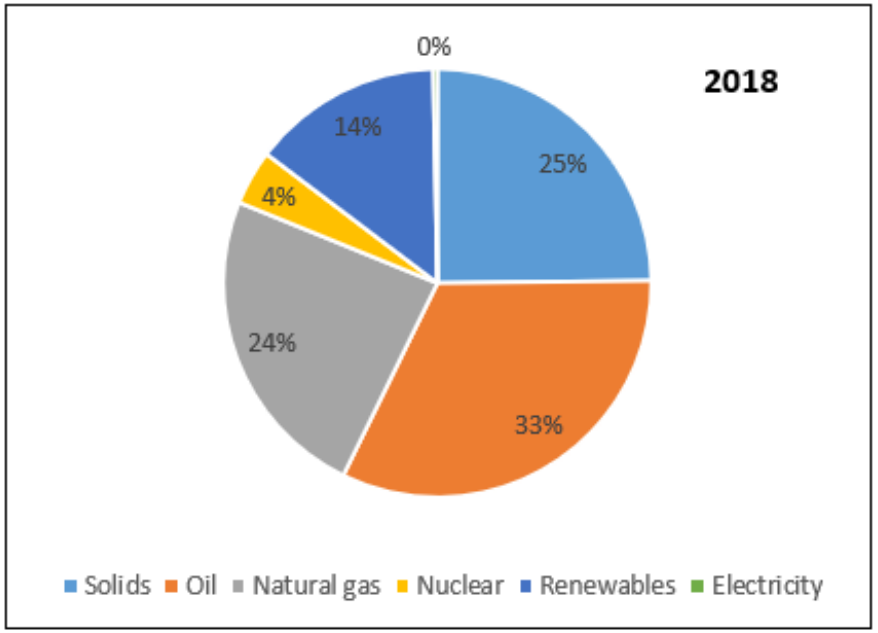
Source: IENE

SE Europe and the Role of Greece

- SEE is a region of great strategic interest to the rest of Europe both in the context of political stability and as an energy viaduct.
- From an economic perspective, SEE, part of Europe's main land mass, presents serious investment and business development potential.
- From an economic and geopolitical point the region is divided between the EU Member States (Greece, Bulgaria, Albania, Croatia, Slovenia and Cyprus), the West Balkans (WB6) and Turkey
- Turkey is a case by itself. Whereas until recently it was widely assumed that it will eventually form part of Europe, such a prospect now looks remote as strong centrifugal forces are at play.
- Greece being the oldest EU Member state, with the most advanced advanced economy plays key role in the economic, defence and energy affairs of the region
- Greece provides the south gateway to SEE while it presents important investment and business opportunities

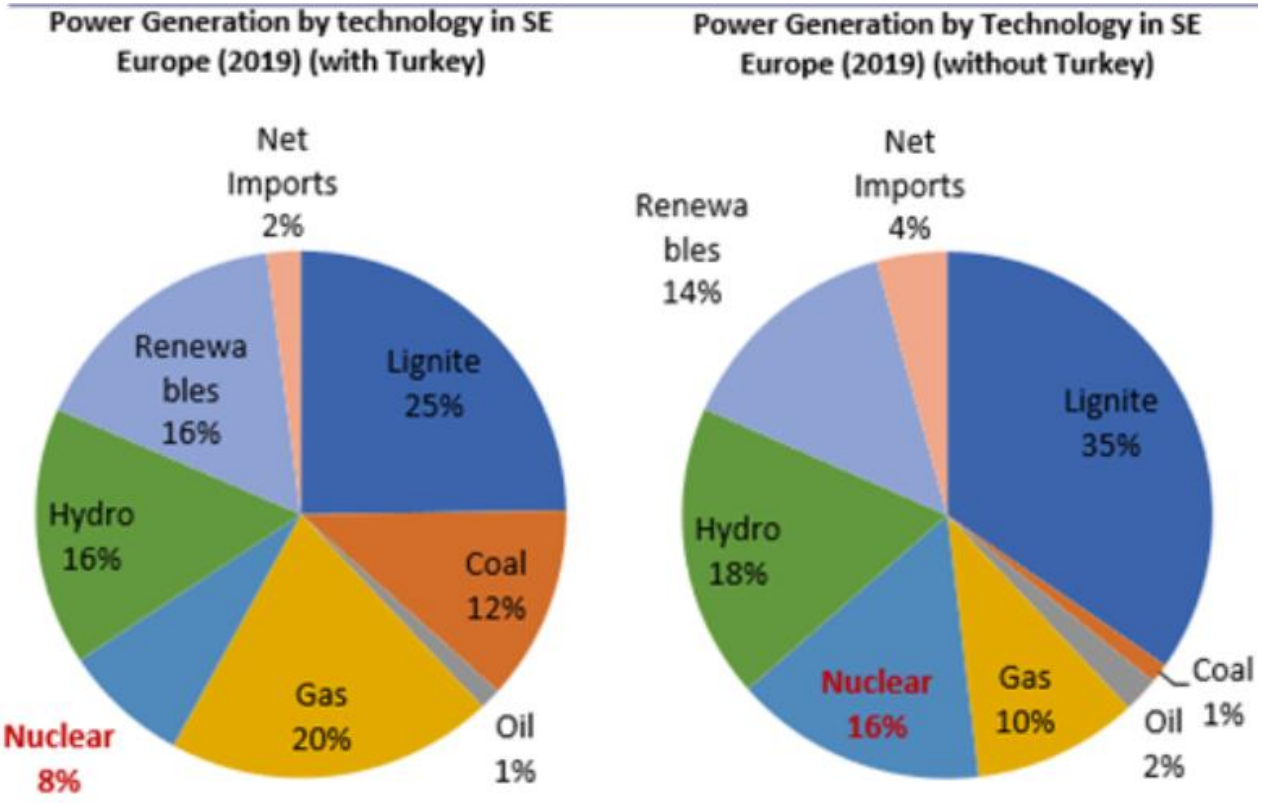
SE Europe: Gross Inland Consumption by Source, Including Turkey (2008 and 2018)





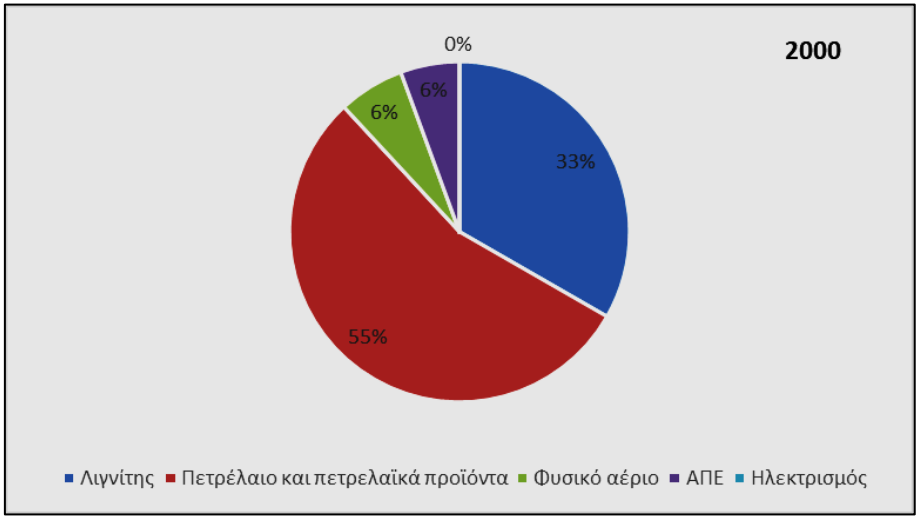
Source: IENE

SE Europe's Power Generation Mix, **With and Without Turkey** (2019)

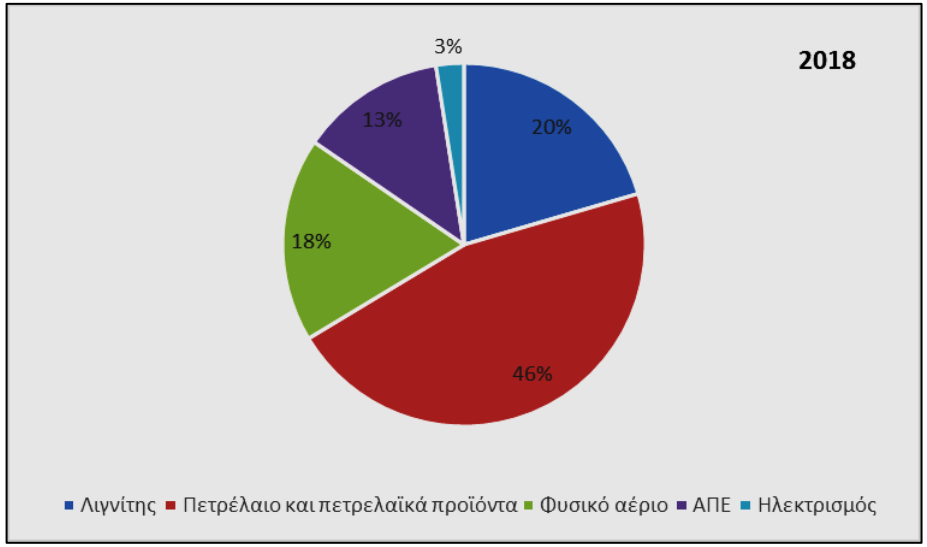


Source: IENE

Συνολική Παροχή Πρωτογενούς Ενέργειας στην Ελλάδα, 2000 και 2018
Total Primary Energy Supply in Greece, 2000 and 2018

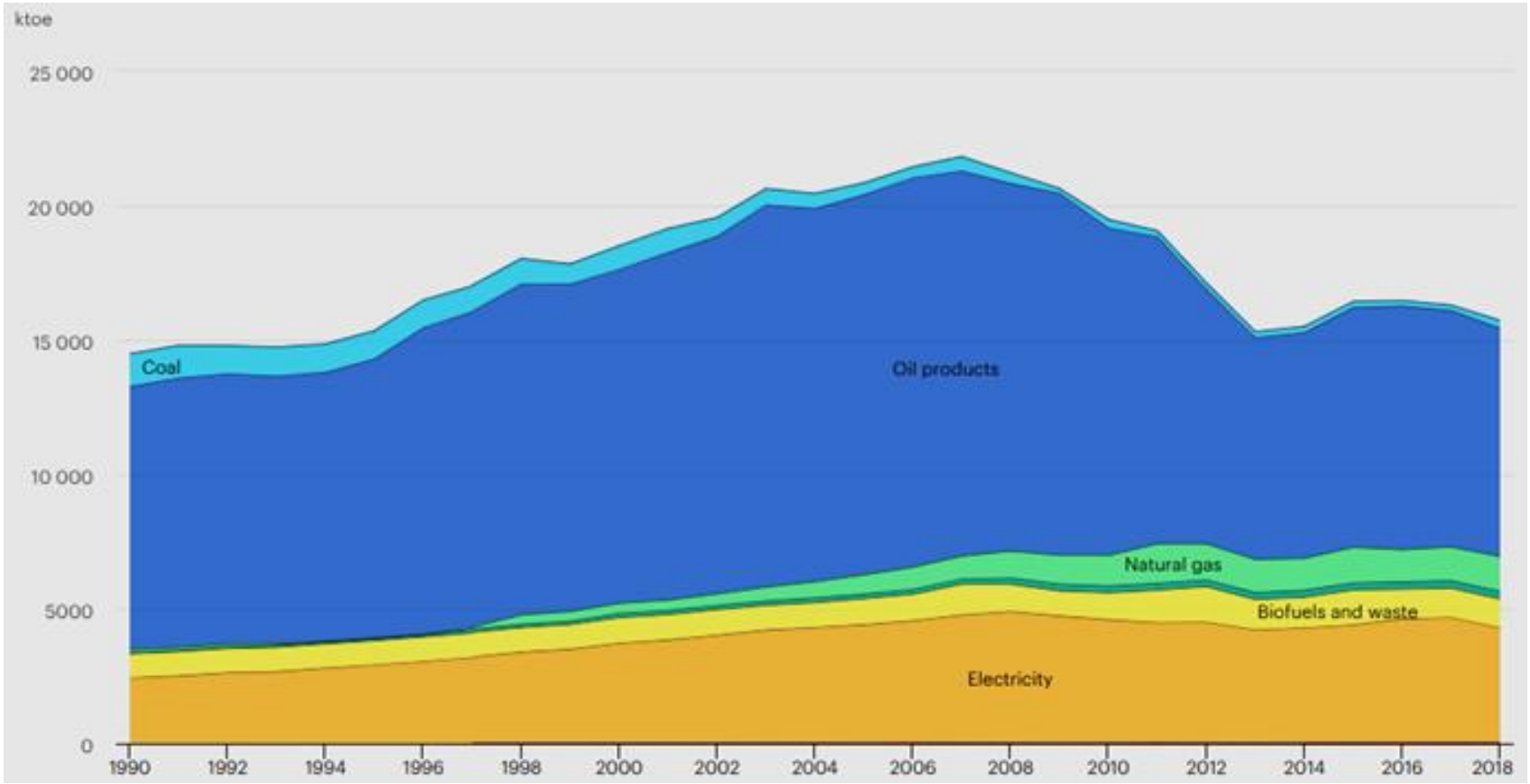


Στην Ελλάδα, η μετάβαση προς την απολιγνιτοποίηση μέχρι στιγμής επιτυγχάνεται μέσω της σημαντικής μείωσης του μεριδίου του λιγνίτη και της αύξησης των αντίστοιχων μεριδίων του φυσικού αερίου και των ΑΠΕ.



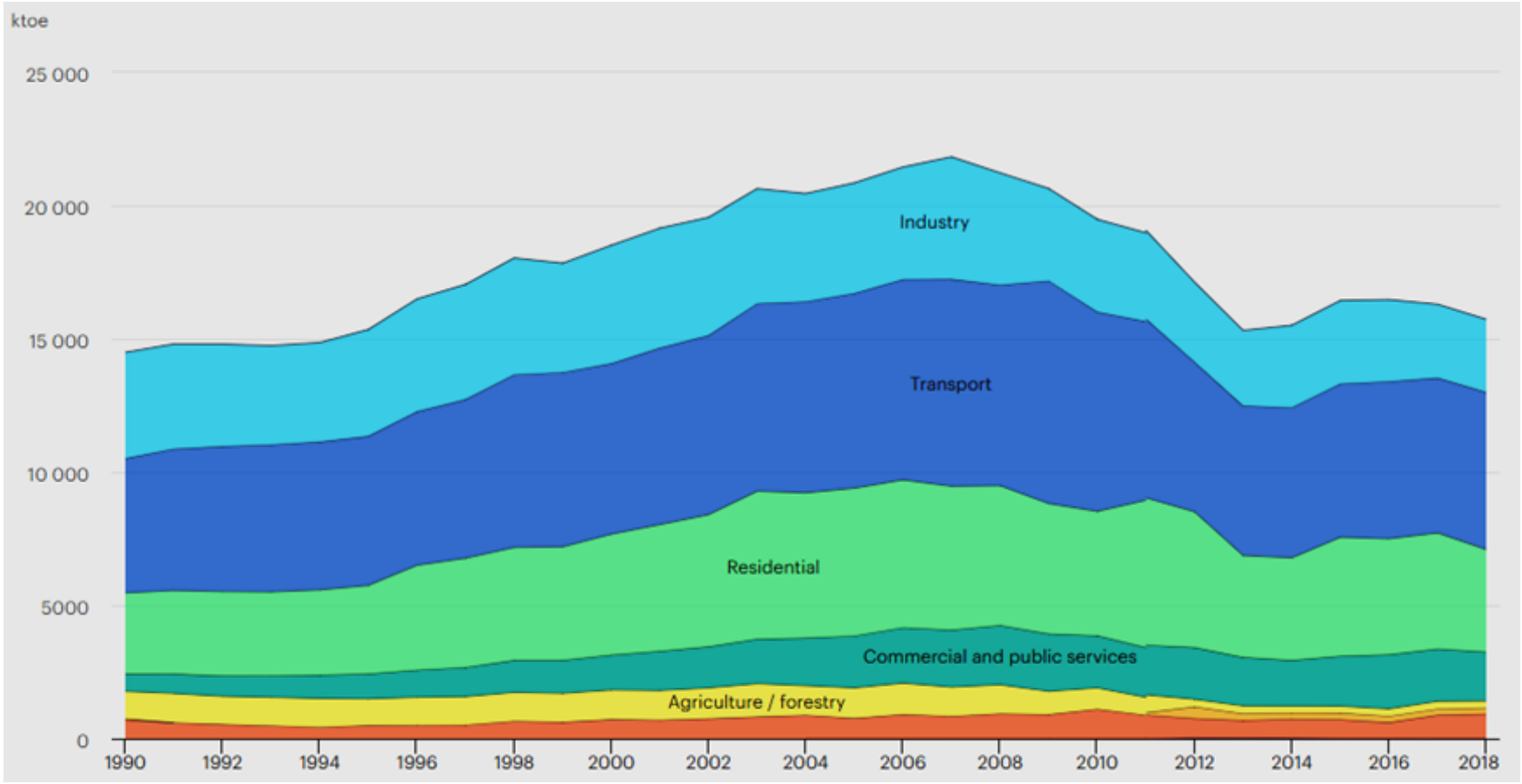
Πηγή: IEA

Τελική Κατανάλωση Ενέργειας ανά Καύσιμο στην Ελλάδα, 1990-2018
Final Energy Consumption per Fuel in Greece, 1990-2018



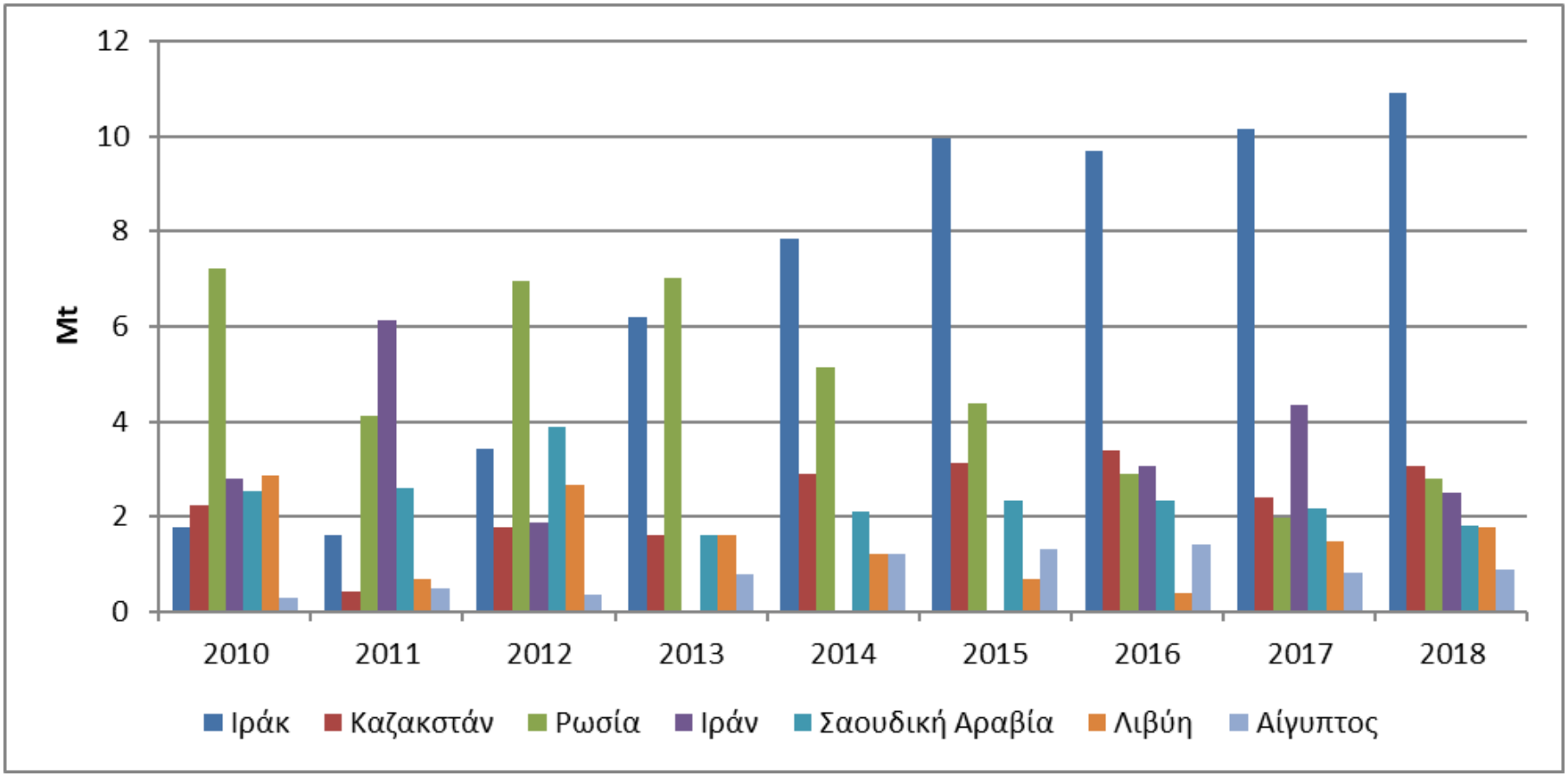
Πηγή: IEA

Τελική Κατανάλωση Ενέργειας ανά Τομέα στην Ελλάδα, 1990-2018
Final Energy Consumption per Sector in Greece, 1990-2018



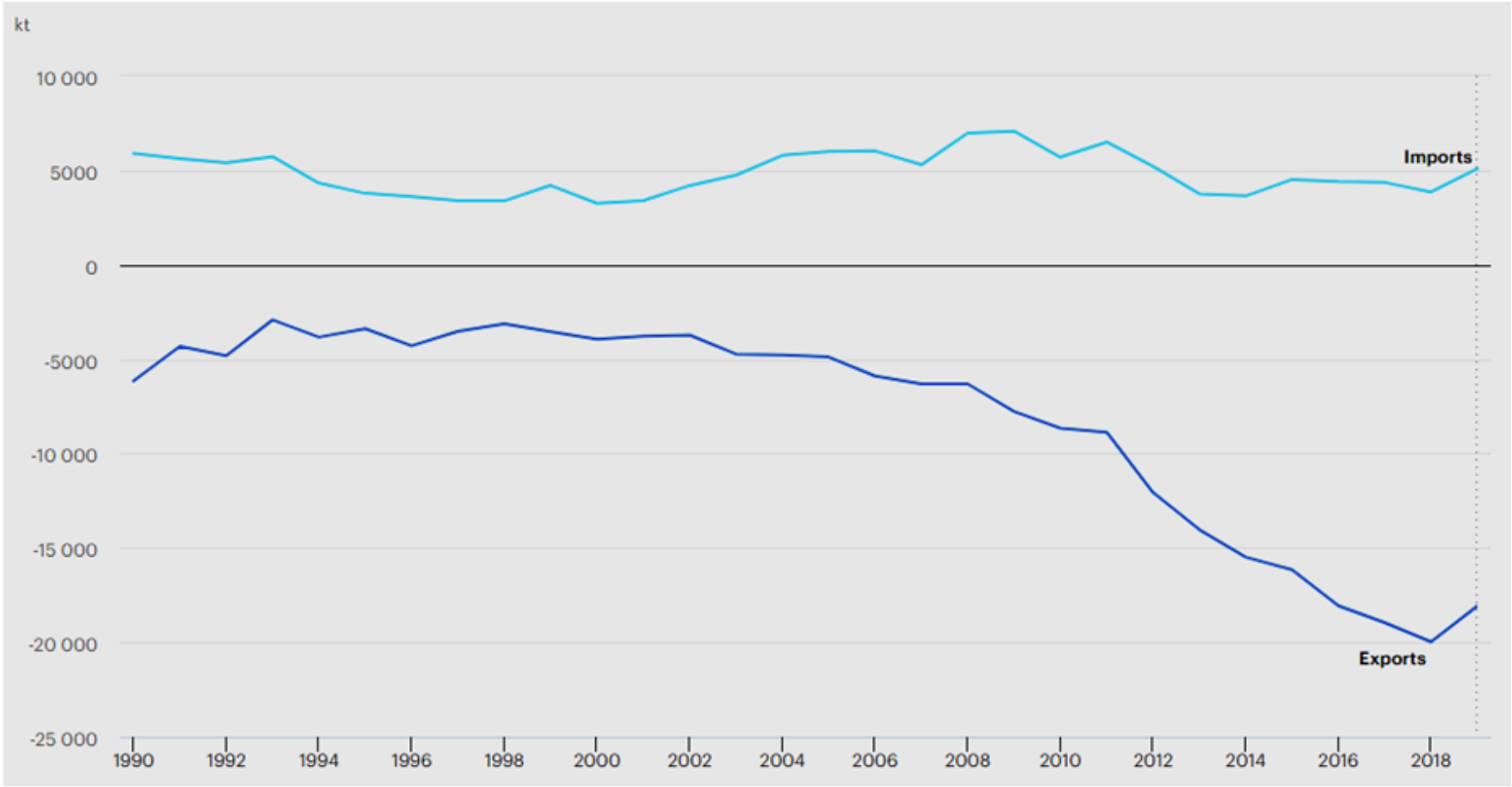
Πηγή: IEA

Εισαγωγές Αργού Πετρελαίου της Ελλάδας ανά Χώρα, 2010-2018
Greece's Oil Imports per Country, 2010-2018



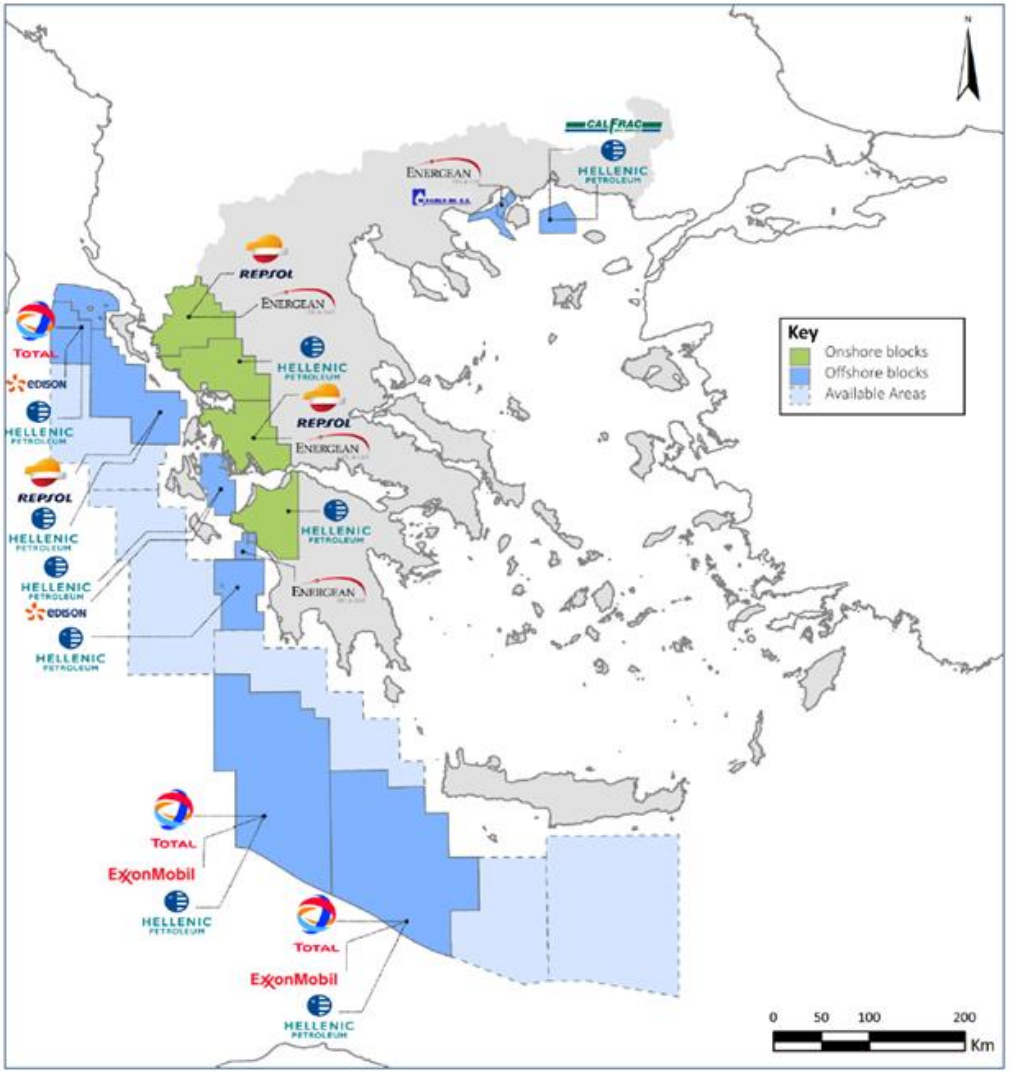
Πηγή: ΥΠΕΝ

Εισαγωγές και Εξαγωγές Πετρελαϊκών Προϊόντων στην Ελλάδα, 1990-2019
Greece's Imports and Exports of Petroleum Products, 1990-2019



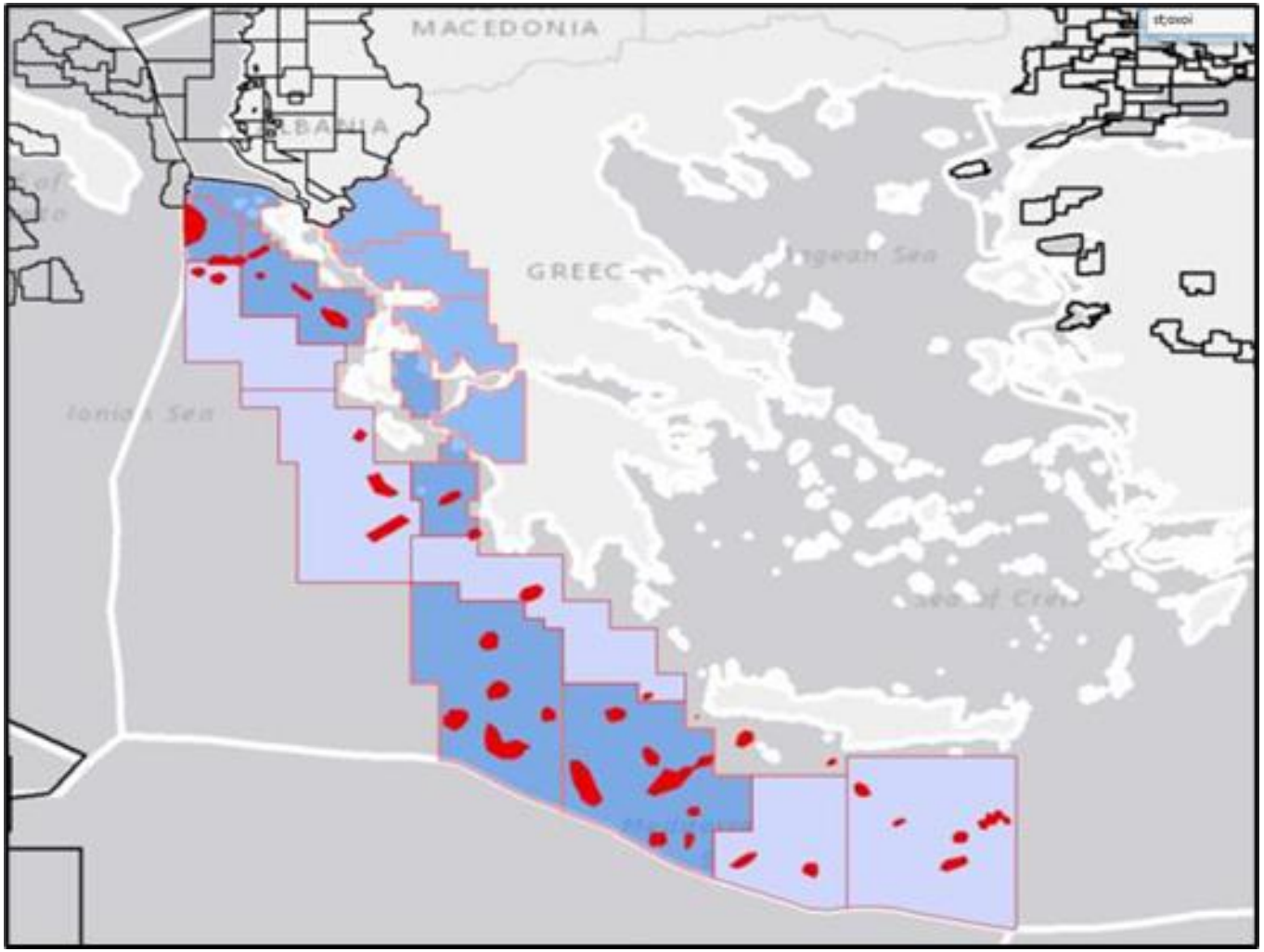
Πηγή: IEA

Περιοχές Παραχωρήσεων στην Ελλάδα, Δεκέμβριος 2019
Concession Areas in Greece, December 2019



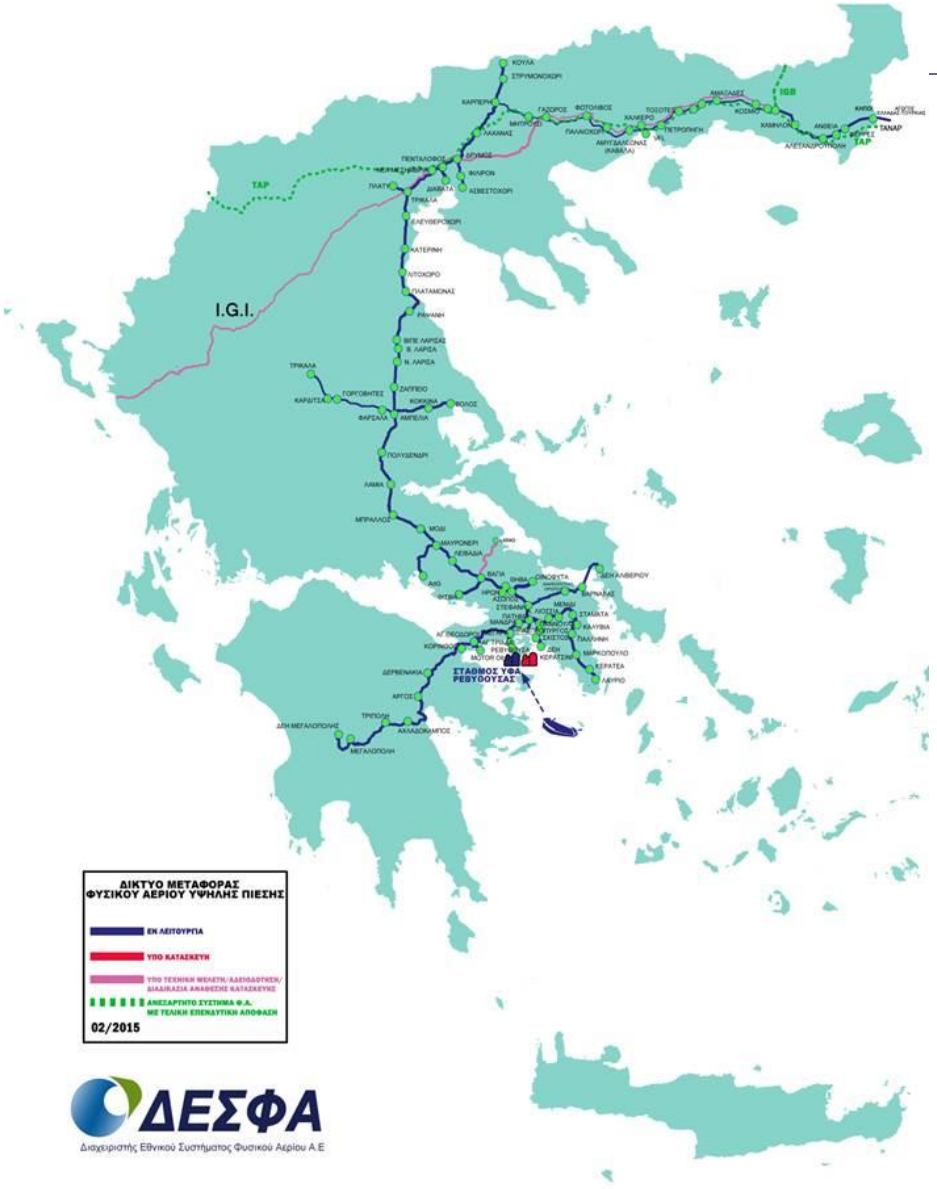
Πηγή: ΕΔΕΥ

Στόχοι Κοιτασμάτων Υδρογονανθράκων σε Ιόνιο και Κρήτη, 2019
Hydrocarbon Target Areas in Ionio and Crete, 2019



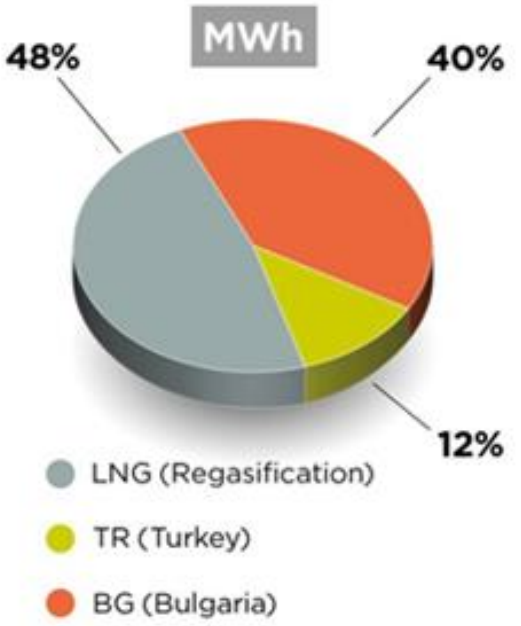
Πηγή: ΕΔΕΥ

Υποδομές Φυσικού Αερίου: Εθνικό Σύστημα Αγωγών Φυσικού Αερίου
Gas Infrastructure: Greece's National Natural Gas System



Κατανάλωση Φυσικού Αερίου στην Ελλάδα, 2019
Greece's Natural Gas Consumption, 2019

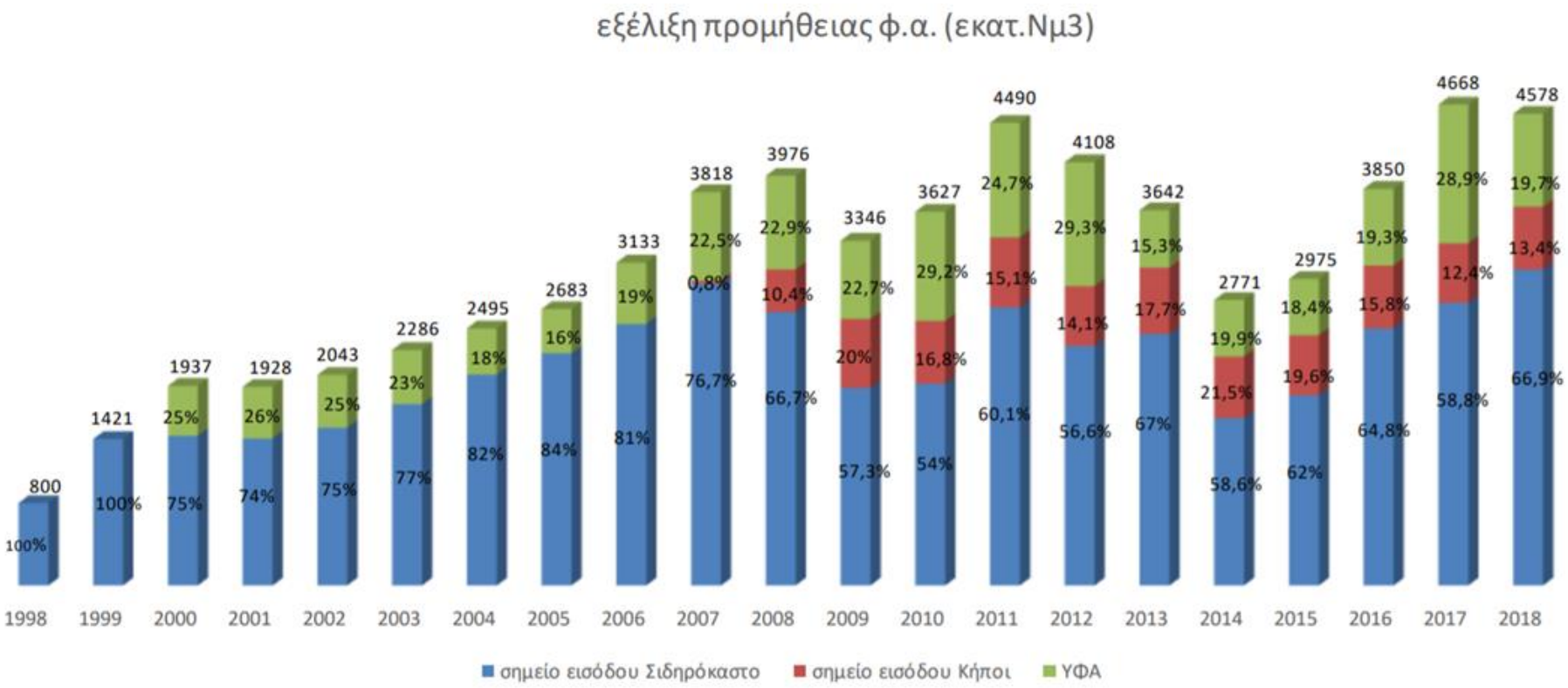
	MWh	Nm³
Natural Gas Consumption	57.407.326	4.943.457.468
Natural Gas Imports		
LNG (Regasification)	31.008.180	2.635.382.903
TR (Turkey)	8.108.942	695.244.866
BG (Bulgaria)	25.667.513	2.261.454.873
Natural Gas Exports		
BG (Bulgaria)	7.701.872	678.579.018



DESFA

Πηγή: ΔΕΣΦΑ

Εισαγωγές Φυσικού Αερίου στην Ελλάδα, 1998-2018
Greece's Natural Gas Imports, 1998-2018

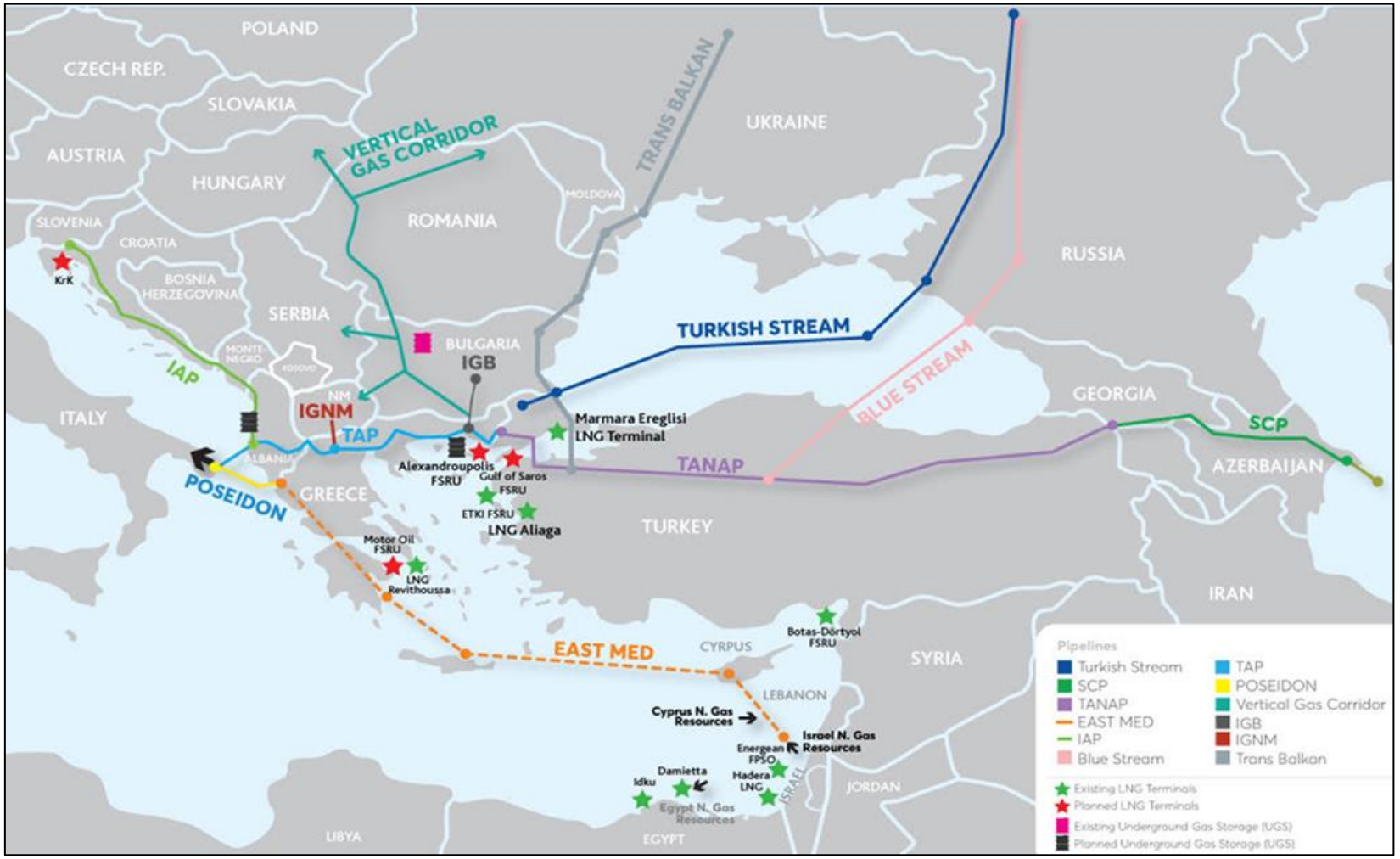


Πηγή: ΔΕΣΦΑ

Τερματικός Σταθμός LNG στη Ρεβυθούσα
Revithoussa LNG Terminal

Πηγή: ΔΕΣΦΑ

Ένας Διευρυμένος Νότιος Διάδρομος
An Expanded South Gas Corridor



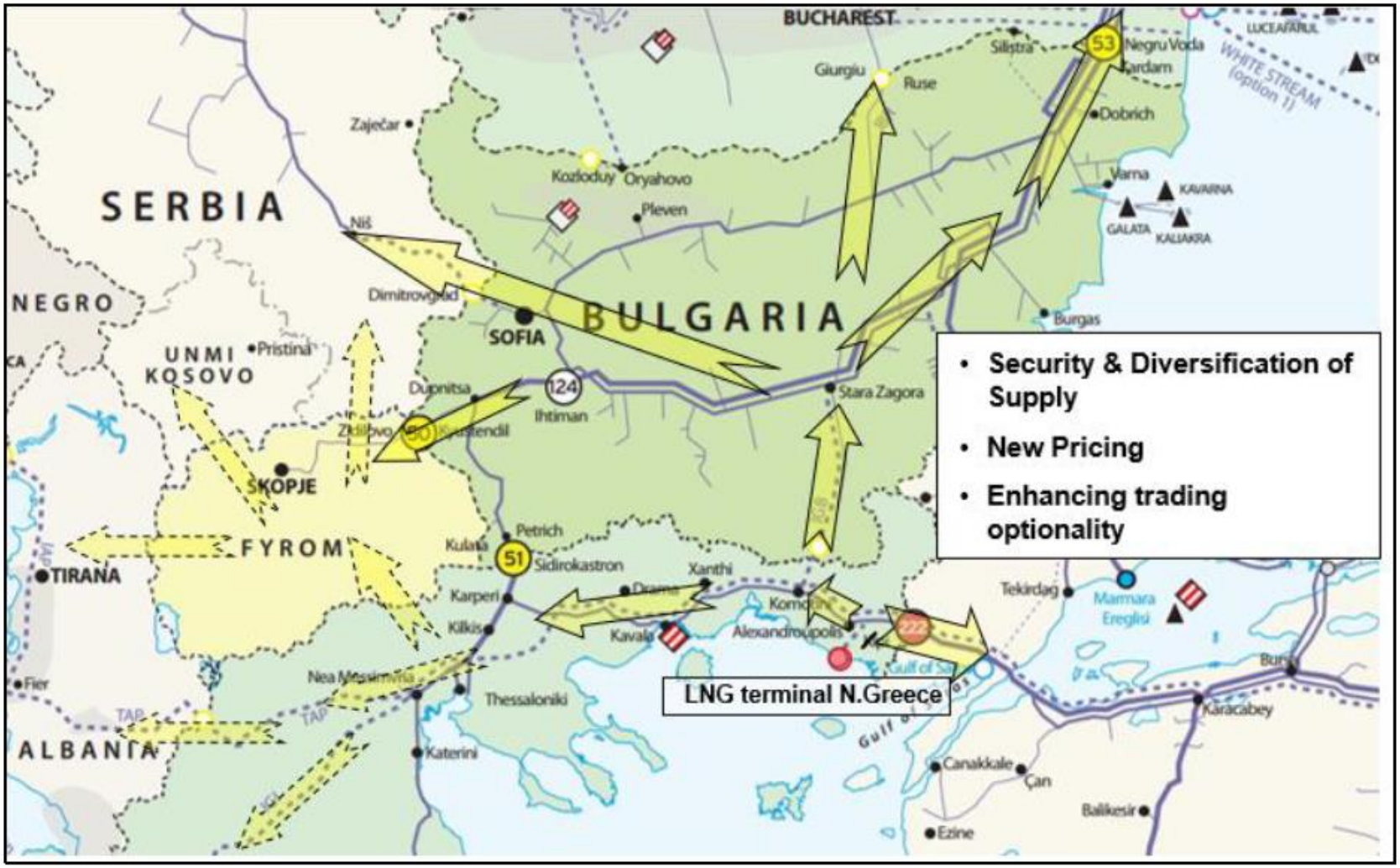
Σημείωση: Οι αγωγοί TANAP, TAP και Turkish Stream έχουν ολοκληρωθεί, ενώ οι αγωγοί BRUA και IGB είναι υπό κατασκευή. Οι αγωγοί IAP, IGI Poseidon, East Med και IGNM βρίσκονται ακόμη στο στάδιο της μελέτης. Οι Blue Stream και Trans Balkan είναι υφιστάμενοι αγωγοί.

Πηγή: ΙΕΝΕ

FSRU Alexandroupolis

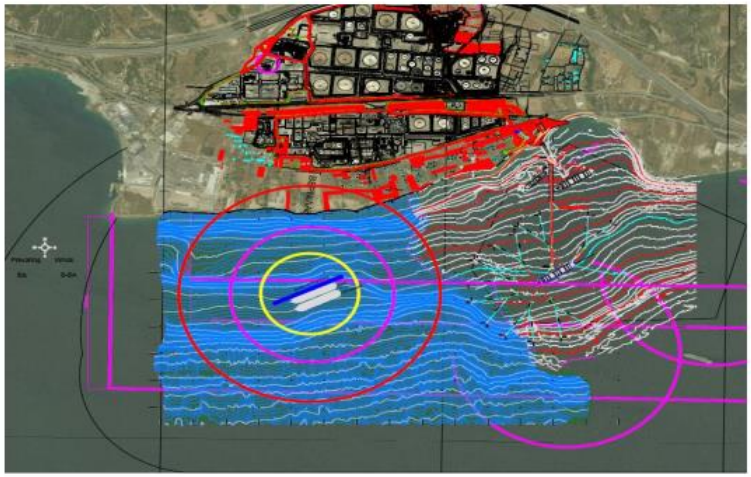
Πηγή: IENE

Το FSRU στην Αλεξανδρούπολη
The Alexandroupolis FSRU



Πηγή: Gastrade

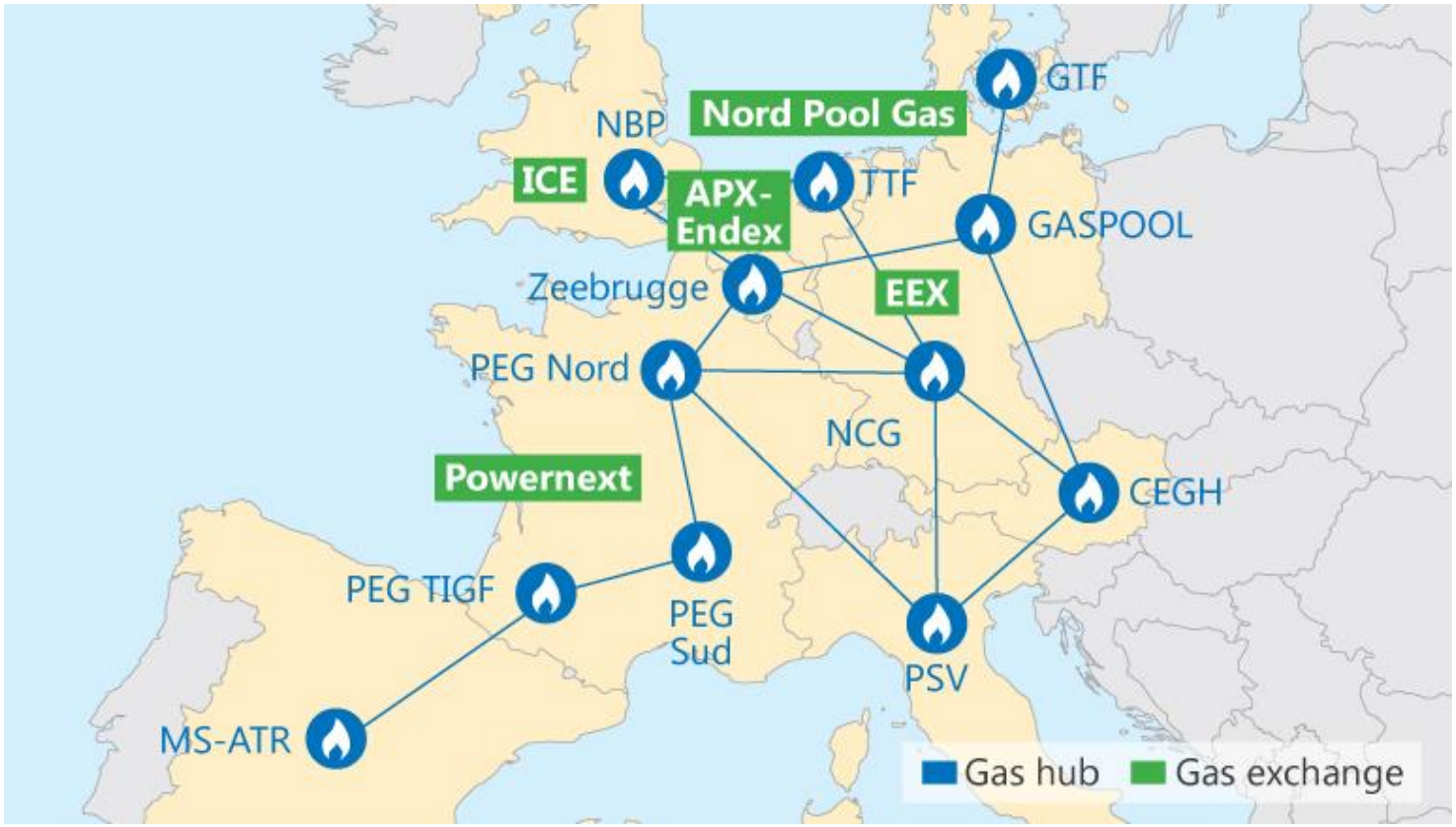
Διώρυγα Gas FSRU
Dioryga Gas FSRU



Πηγή: Motor Oil

Ευρωπαϊκά Gas Hubs και Χρηματιστήρια
European Gas Hubs and Exchanges

- Σήμερα, δεν υπάρχει **κανένας κόμβος εμπορίας φυσικού αερίου (gas trading hub)** ανατολικά και νοτιοανατολικά της Βιέννης, όπου το CEGH θα μπορούσε να αποτελέσει σημείο αναφοράς για την προώθηση της εμπορίας φυσικού αερίου στη ΝΑ Ευρώπη.



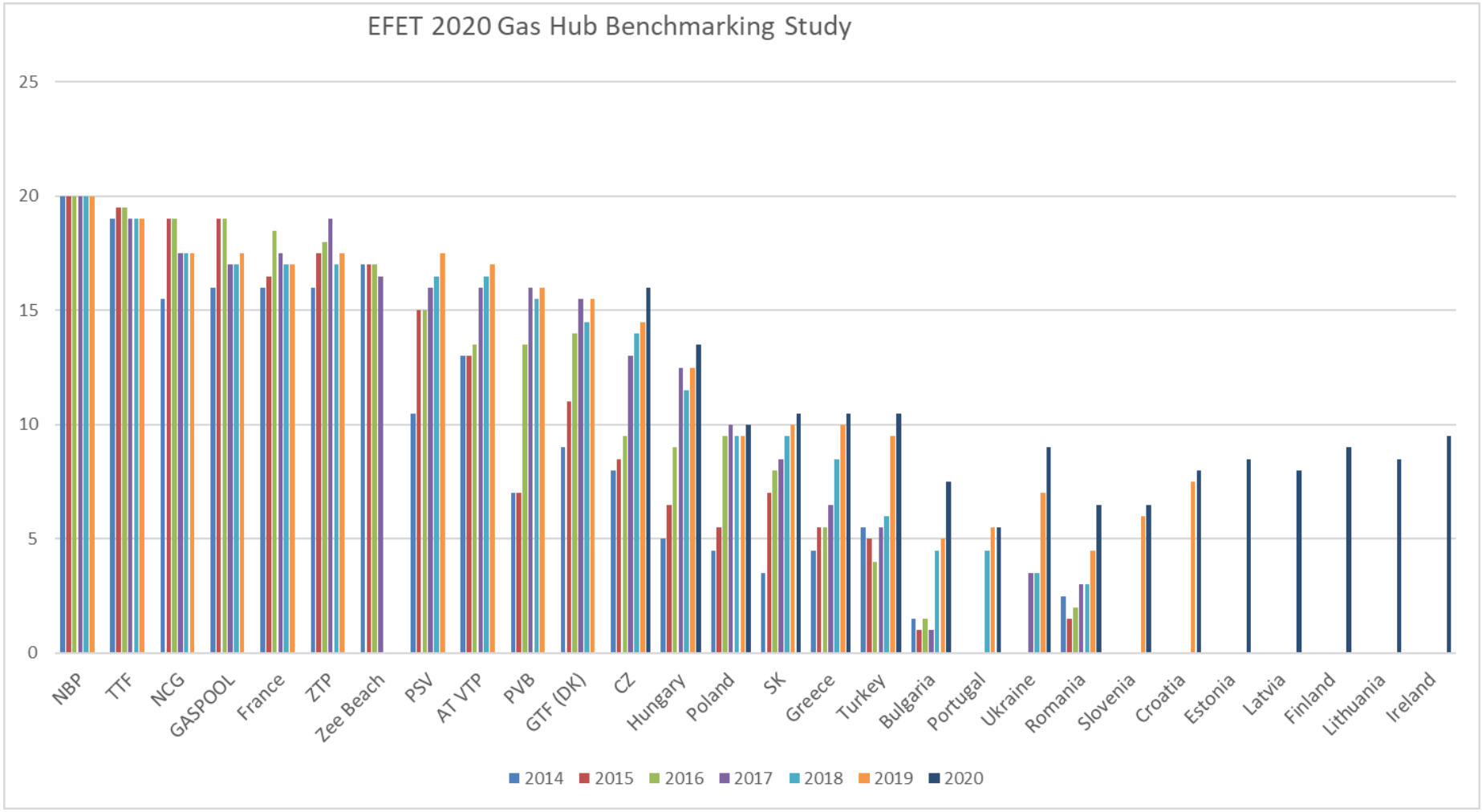
Πηγή: Interfax Global Energy

Ποσότητες Φ. Αερίου που θα Διέρχονται Μέσω Ελλάδας, 2021-2030
Anticipated Gas Volumes Through Greece, 2021-2030

Έργα Φυσικού Αερίου	Ποσότητες
Μέσω TAP	**10.0 bcm** το 2021 (1.0 bcm στην Ελλάδα, 1.0 bcm στην Βουλγαρία και 8.0 bcm στην Ιταλία) με προοπτική (2030) **20.0 bcm** (2.5 bcm στην Ελλάδα, 1.5 bcm στην Βουλγαρία και 16.0 bcm στην Ιταλία)
Μέσω IGB	**1.0 bcm** (2021) με προοπτική **4.0 bcm** (2030)
Μέσω IGNM	**0.5 bcm** (2023) με προοπτική **1.5 bcm** (2030)
Μέσω Ρεβυθούσας	**1.5 bcm** (2021) με προοπτική **3.0 bcm** (2030)
Μέσω FSRU Αλεξανδρούπολης	**1.5 bcm** (2022) με προοπτική **4.0 bcm** (2030)
Μέσω East Med	**0.0 bcm** (2021) με προοπτική **10.0 bcm** (2030)

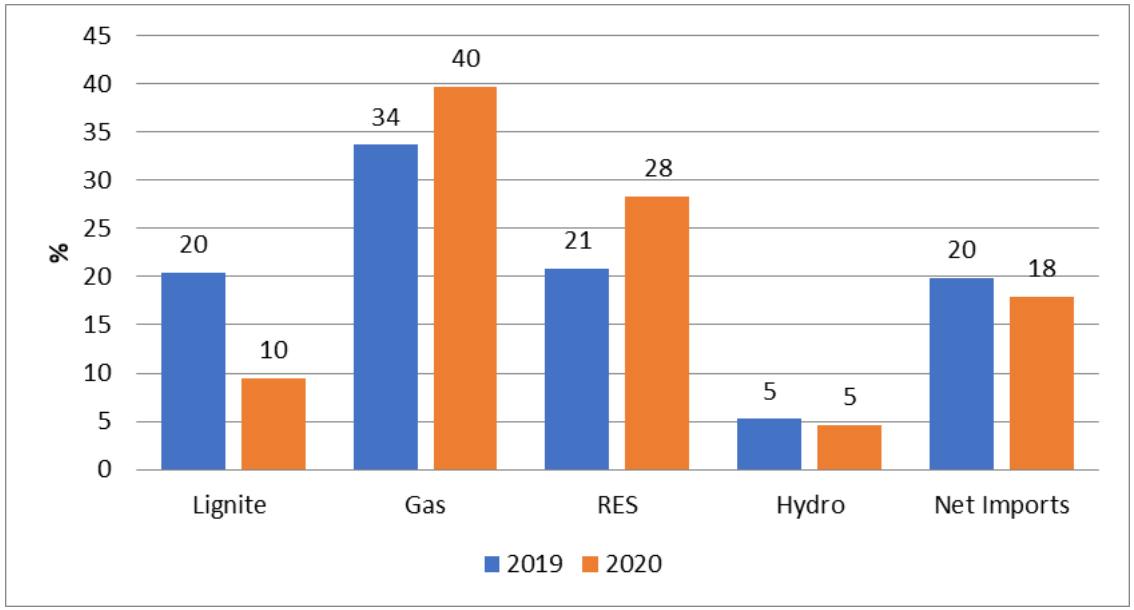
- Βάσει των ανωτέρω, η εκτίμηση είναι ότι σε πρώτη φάση (2021) θα διακινούνται μέσω Ελλάδος **13.0-14.0 bcm** επιπλέον ποσότητες, από ότι σήμερα, προς διάφορες κατευθύνσεις, ενώ το 2030 οι ποσότητες αυτές μπορεί να έχουν φτάσει τα **30.0 bcm**, το οποίο αντιστοιχεί στο 6.0% περίπου της Ευρωπαϊκής ζήτησης φ. αερίου.

Ετήσια Αποτελέσματα 2020 του EFET
EFET's Annual Scorecard 2020



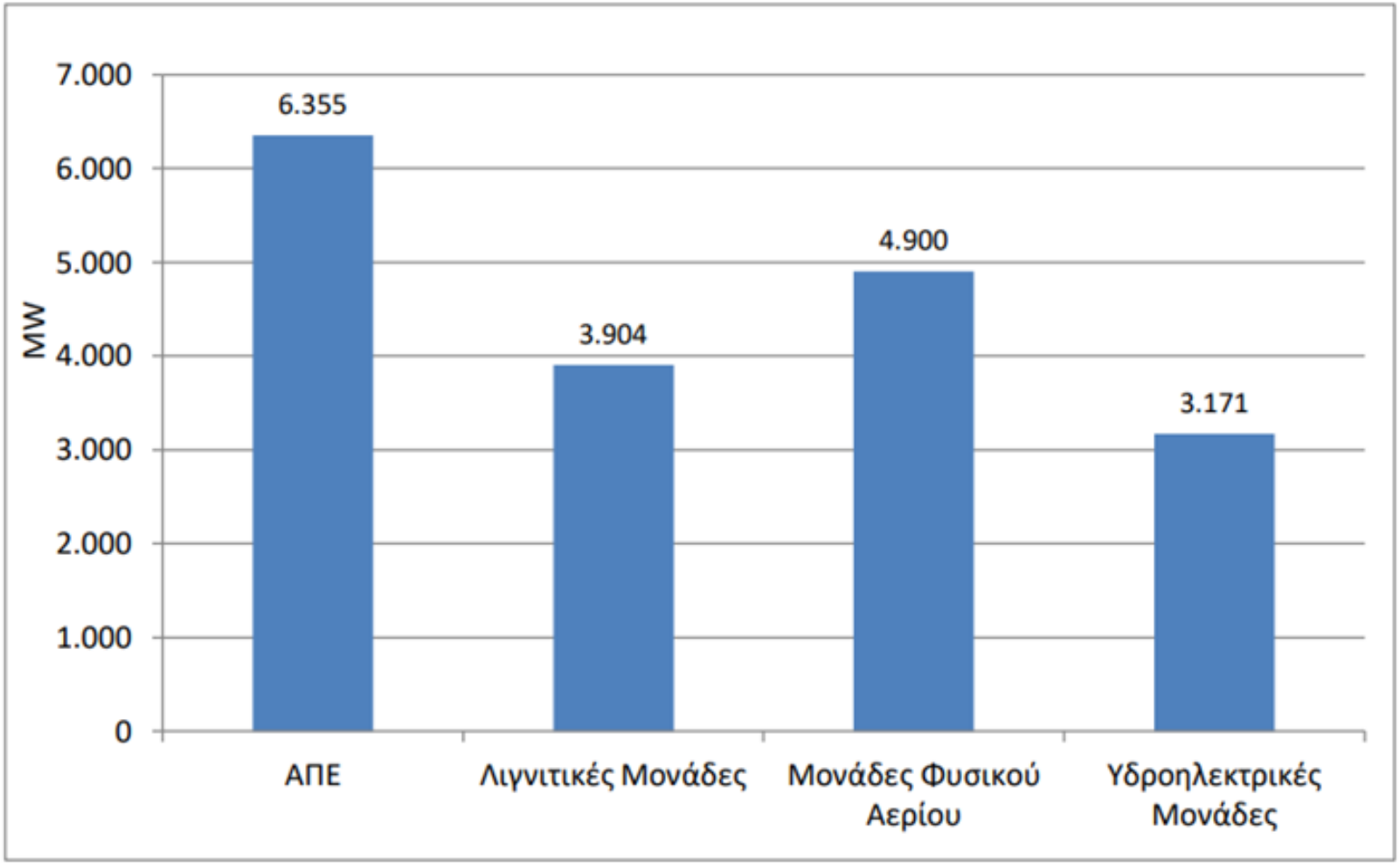
Πηγή: EFET

Fuel Mix in Greece's Electricity Generation, 2019 and 2020



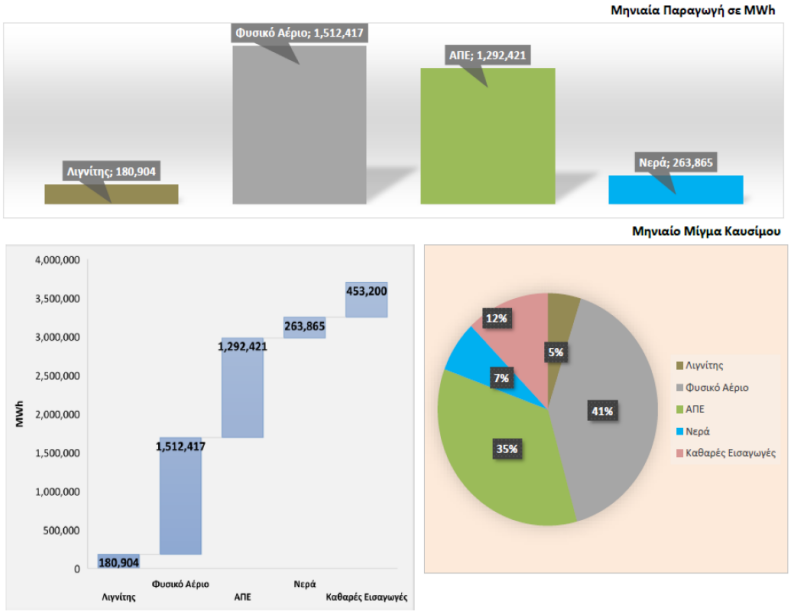
Source: IENE

Συνολική Εγκατεστημένη Ισχύς Μονάδων ανά Καύσιμο στο Διασυνδεδεμένο Σύστημα της Ελλάδας, 2019
Total Installed Capacity (GW) of Units per Fuel in Greece's Mainland Interconnected System, 2019

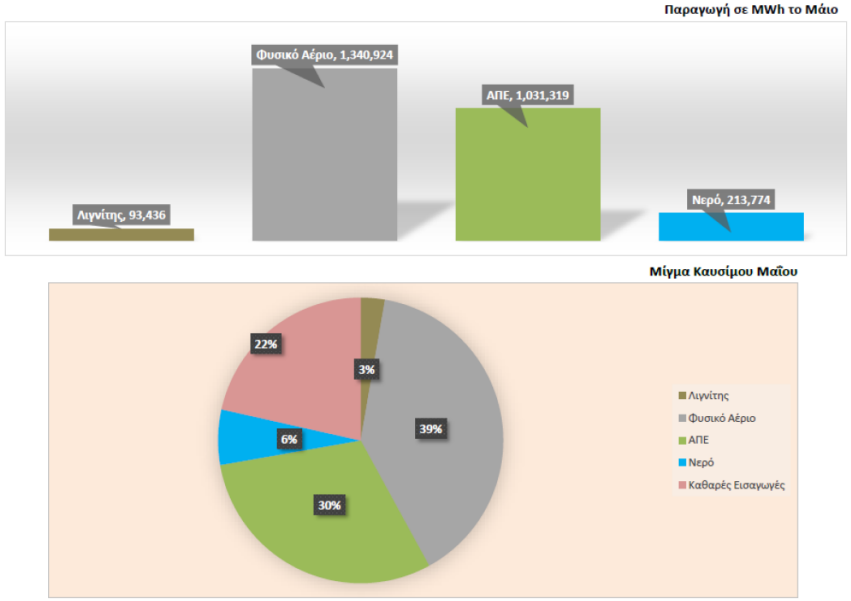


Πηγή: ΕΧΕ

Greece's Energy Production (MWh) and Fuel Mix



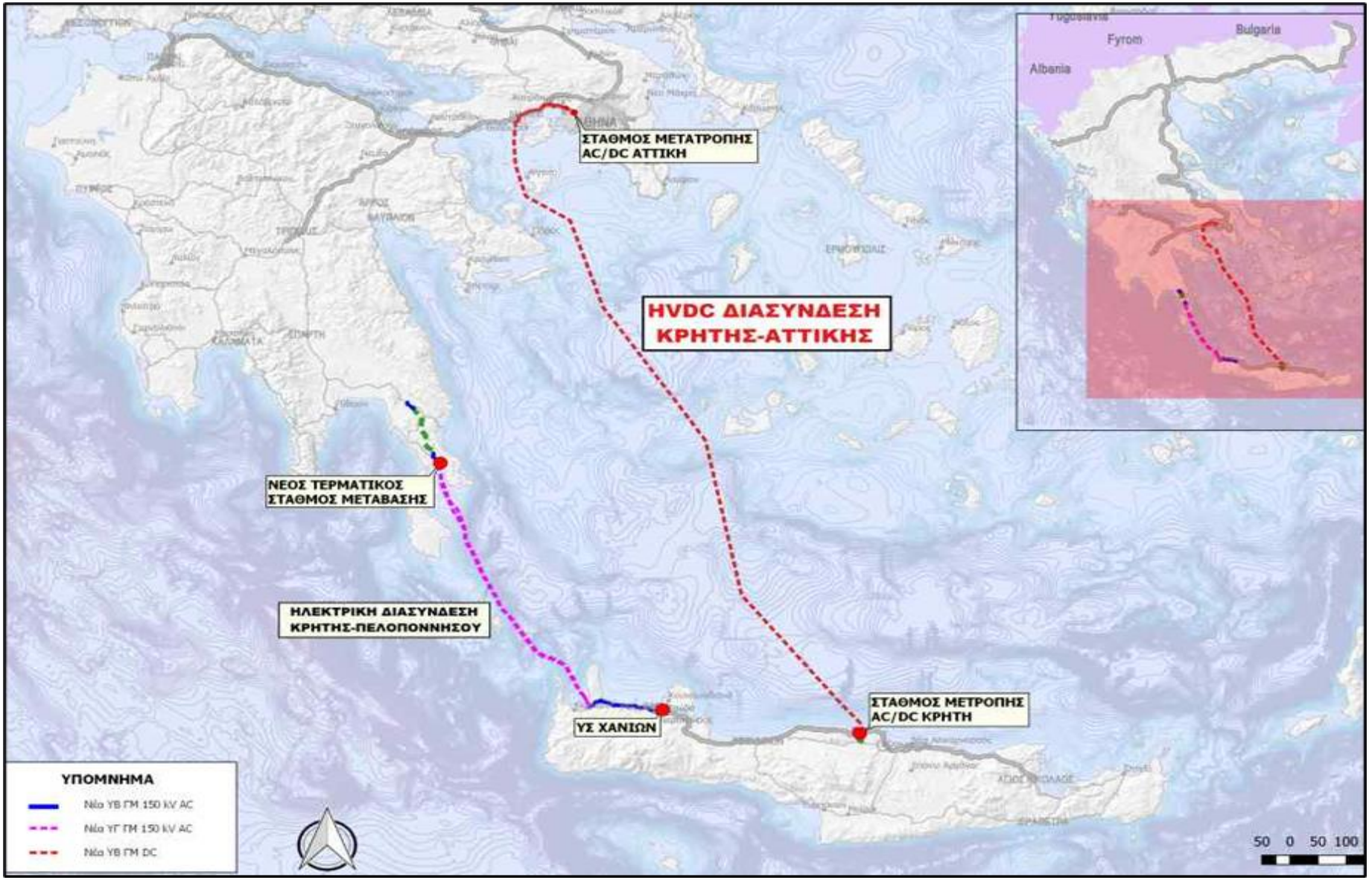
May 2021



May 2020

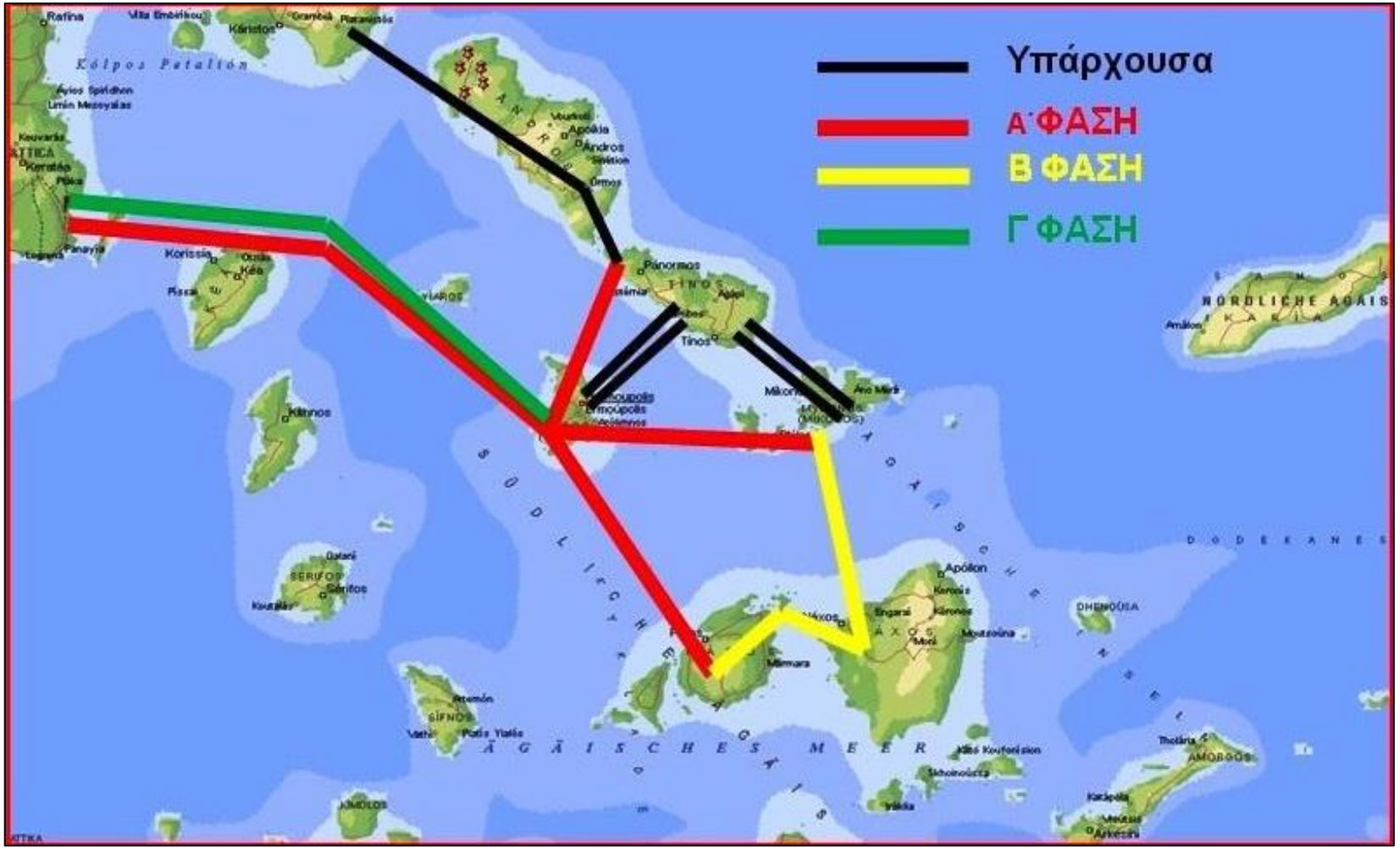
Source: IENE

Ηλεκτρικές Διασυνδέσεις της Κρήτης με το Ηπειρωτικό Σύστημα της Ελλάδας
Electricity Interconnection of Crete with the Country's Mainland Interconnected System



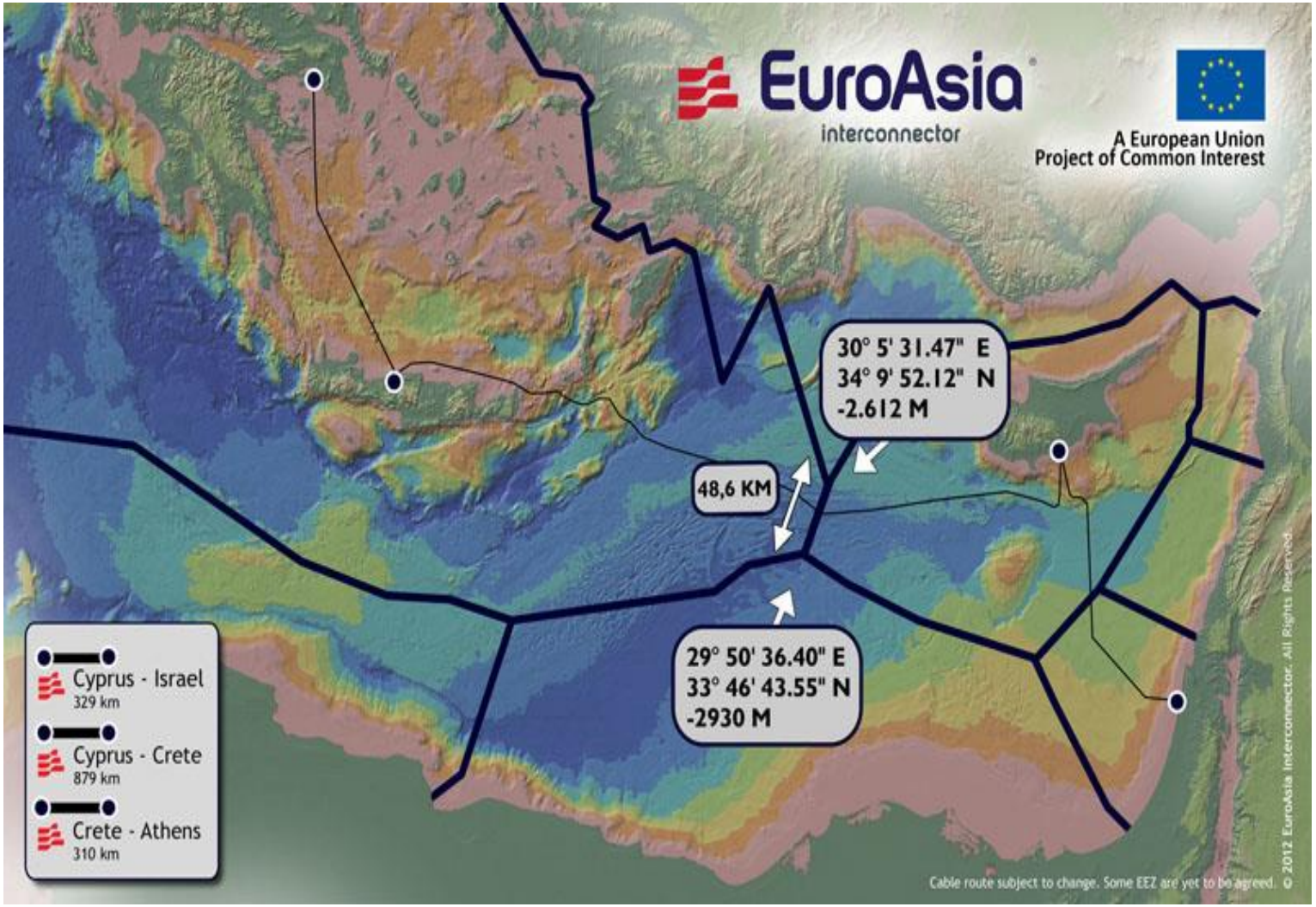
Πηγή: Αριάδνη Interconnection

Ηλεκτρικές Διασυνδέσεις των Κυκλάδων
Cyclades Islands Electricity Interconnection



Πηγή: ΑΔΜΗΕ

EuroAsia Interconnector

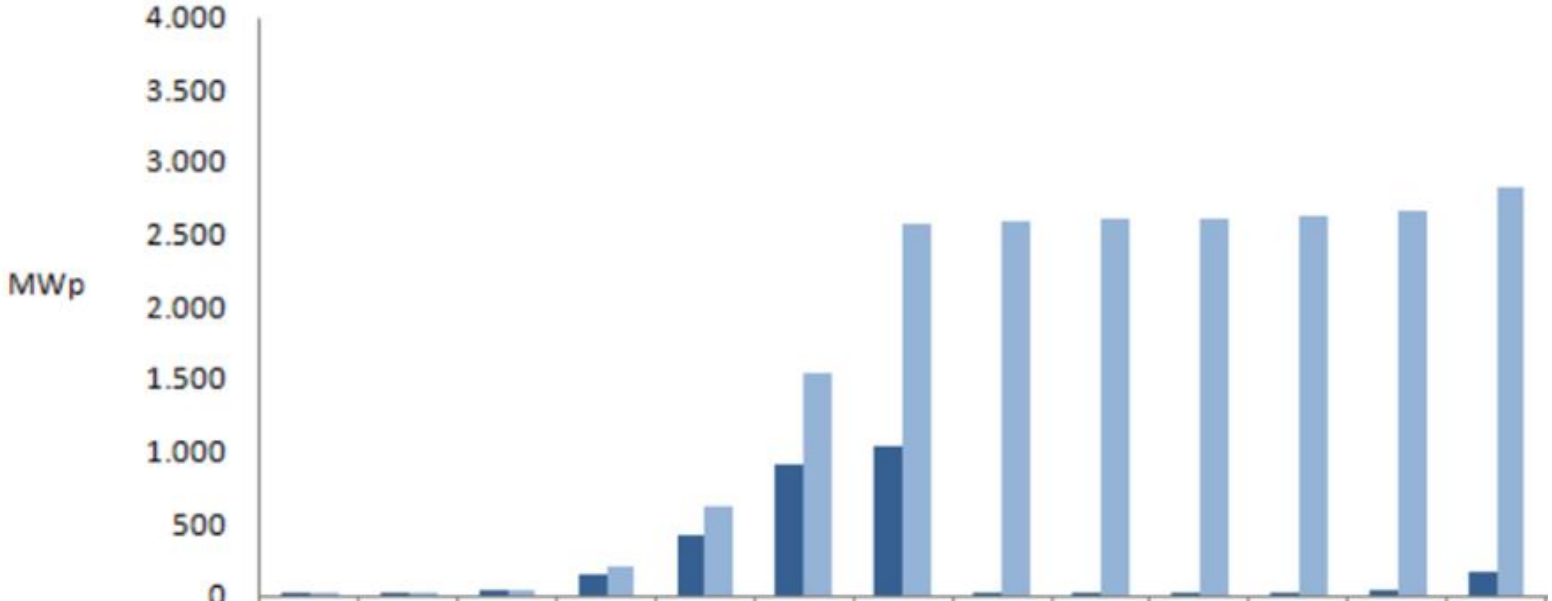


Πηγή: EuroAsia Interconnector

RES Penetration in Greece's Electricity Mix (1/2)

- Over the last 15 years or so we have seen a steady increase of RES's contribution in the country's electricity mix.
- With RES comprising wind, solar PV, biogas and small hydro
- If we look closer over the last 3 years we see a rise from 18% participation in the electricity mix in 2018 to 21% in 2019 rising to 28% in 2020.
- At the same time, as expected, we see a rise in natural gas use from 20% in 2018 to 28% in 2020.
- The question arises as to the upper limit of RES penetration without substantial increase of energy storage
- The main challenge ahead for higher RES use for power generation on Greece is the increase of large hydro availability and pumped storage in particular since no major addition of installed capacity is foreseen before 2025/2026.

Εγκατεστημένη Ισχύς (MW) Φωτοβολταϊκών στην Ελλάδα, 2007-2019
Greece's Installed Capacity (MW) of Solar PV, 2007-2019



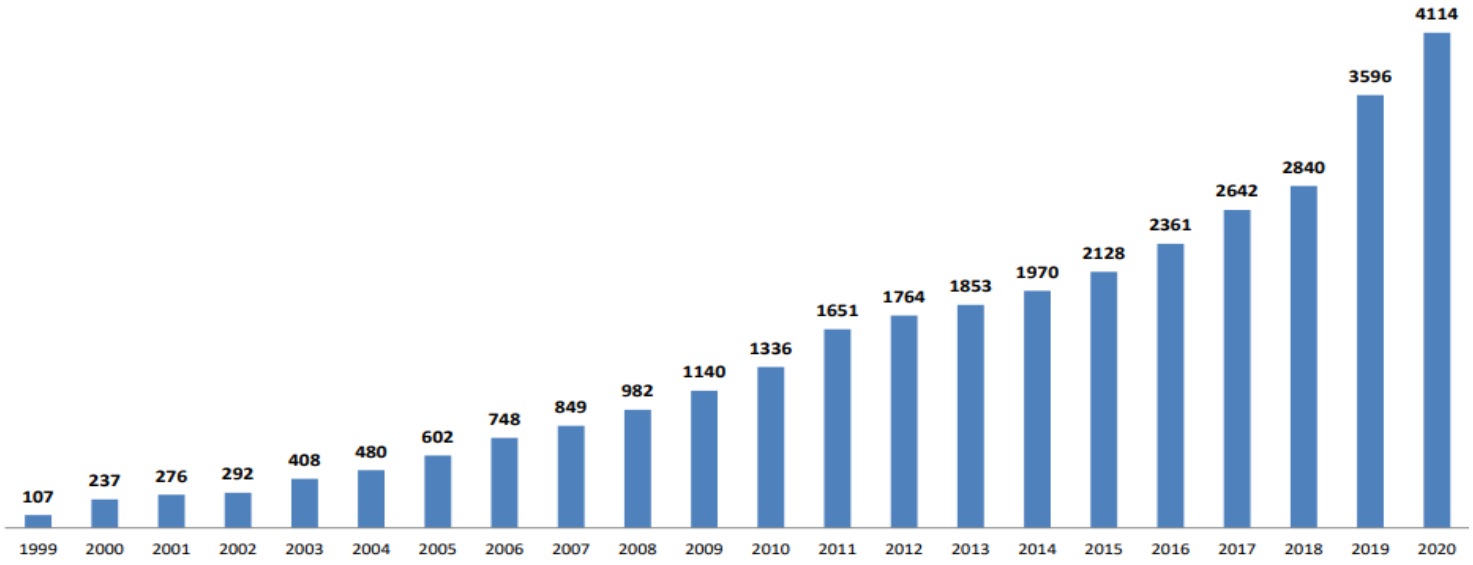
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Ετήσια εγκατεστημένη ισχύς	2	10	35	152	426	912	1.043	17	10	5,4	12,9	43,1	160
Συνολική εγκατεστημένη ισχύς	2	12	47	199	625	1.537	2.579	2.596	2.607	2.612	2.625	2.668	2.828

Πηγή: ΣΕΦ

Installed RES Capacity in Greece, 2020

HWEA Wind Energy Statistics – 2020

Total capacity to the grid (MW) per year

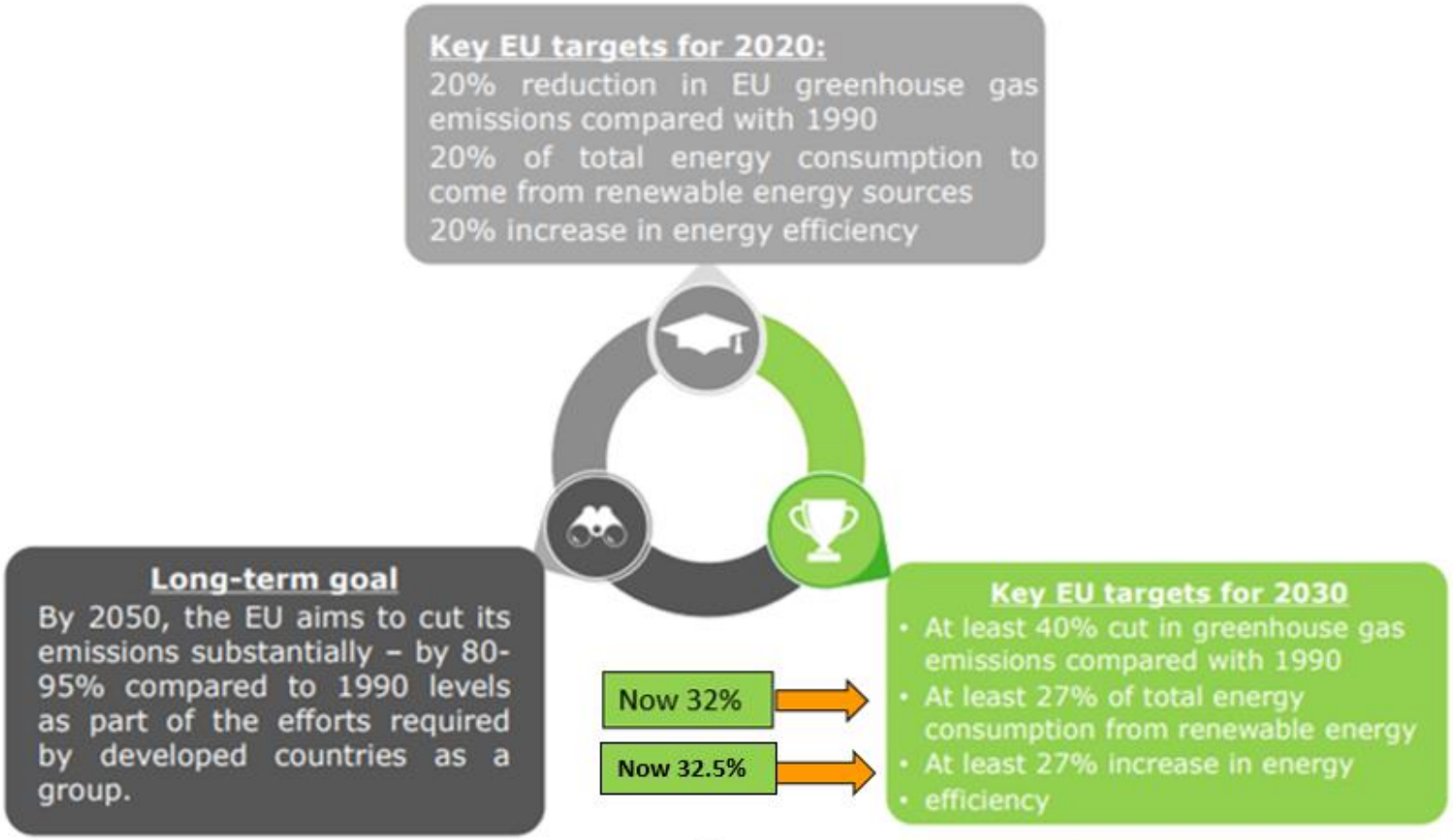


The HWEA Wind Energy Statistics take into account the wind capacity which is in commercial or test operation in Greece and are based on sources from the market actors. HWEA has made effort to crosscheck and confirm the data. However, HWEA does not guarantee the accuracy of them and do not undertake any relevant liability.

RES Penetration in Greece's Electricity Mix (2/2)

- The introduction of battery storage although anticipated with 1.5 – 2.0 GW planned by 2023/2024 is not expected to lead to much higher RES use – but instead will help with peak shaving and also help achieve better distribution of RES output over 24hour period.
- Higher use of natural gas, more electricity imports from neighboring countries and bigger penetration of RES are the main characteristics of Greece's changing electricity mix.
- As more RES capacity, together with energy storage, are expected over the next years it is safe to predict that by 2030 Greece will be able to double its RES's input into its energy mix (ie. 40%) and also attain even higher RES contribution into the electricity mix (>60%).

Πλαίσιο Ενεργειακής Πολιτικής της ΕΕ (2020, 2030 και 2050)
EU Energy Policy Framework (2020, 2030 and 2050)



Πηγή: Ευρωπαϊκή Επιτροπή

Greece's National Objectives in the Context of the NECP

Year of objective: 2030	Final NECP	Initial NECP draft	New NECP objectives compared to EU objectives
RES share in gross final energy consumption	≥35%	31%	More ambitious than the corresponding core EU objective of 32%
RES share in gross final electricity consumption	≈61-64%	56%	
Final energy consumption	≈16.1-16.5 Mtoe (≥38% compared to the 2007 predictions)	18.1 Mtoe (32%) (referring to 17.3 Mtoe without ambient heat)	More ambitious than the corresponding core EU objective of 32.5% and attainment of the objective on the basis of a new EU indicator for reducing consumption compared to 2017
Share of lignite in power generation	0%	16.5%	
Reduced GHG	≥42% compared to 1990, ≥56% compared to 2005	33% compared to 1990, 49% compared to 2005	Identical with core EU objectives and overperformance compared to national commitments in non-ETS sectors

Source: Greece's National Energy and Climate Plan

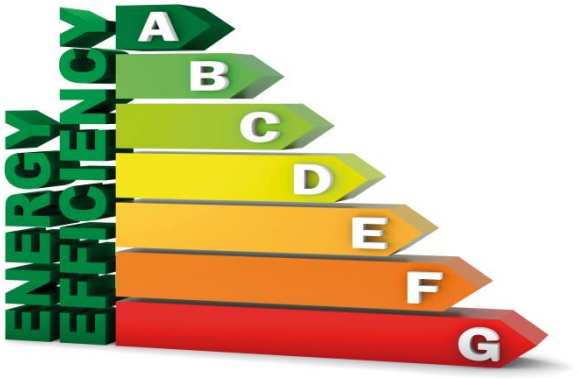
Σημαντικές Ενεργειακές Επενδυτικές Προοπτικές στην Ελλάδα, 2020-2030
Key Energy Investment Prospects in Greece, 2020-2030

Έρευνα και Παραγωγή Υδρογονανθράκων

Έργα ΑΠΕ

Έργα Υποδομών Φυσικού Αερίου και Ηλεκτρισμού

Έργα Ενεργειακής Αποδοτικότητας



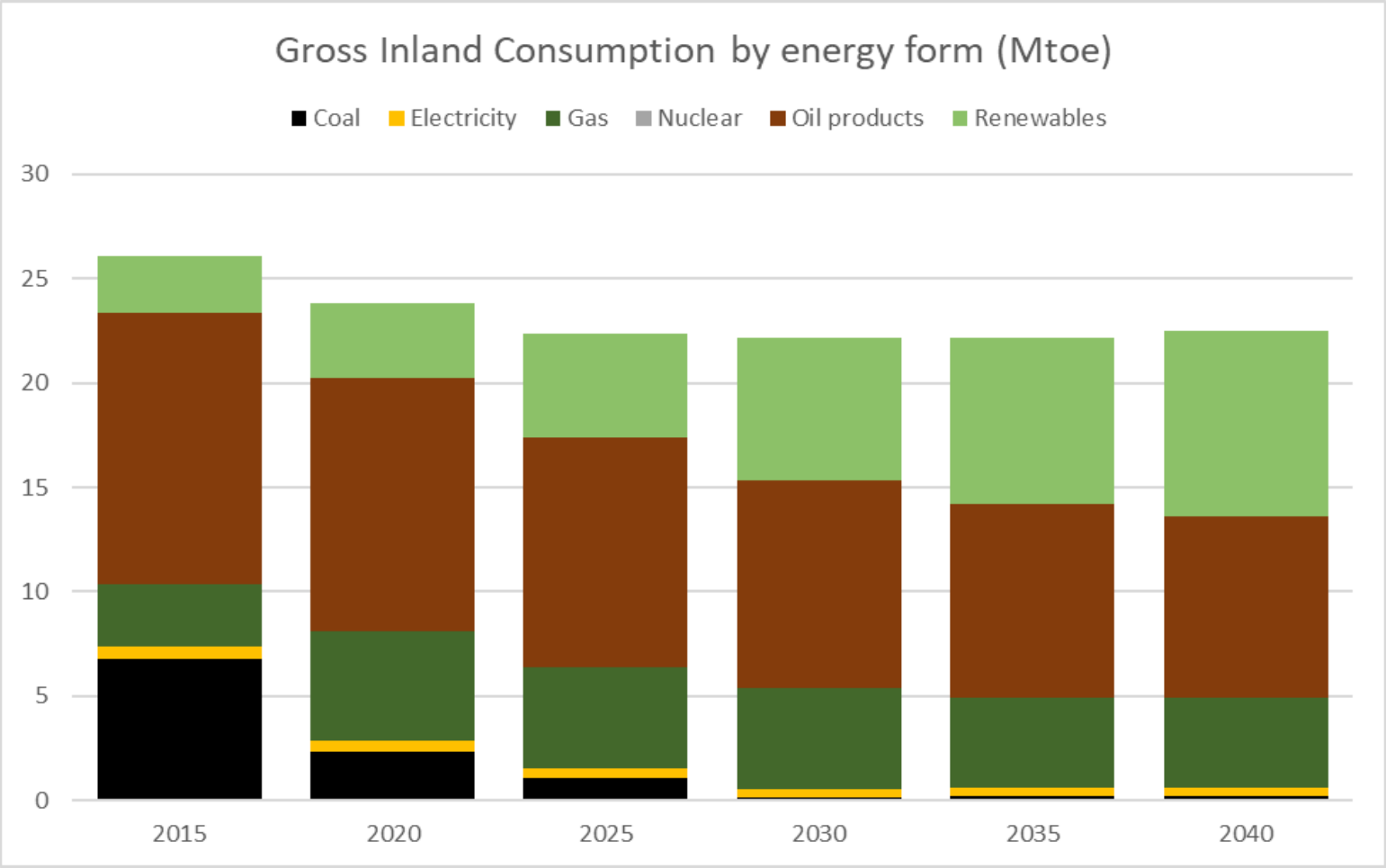
Greece's Anticipated Energy Investments, 2020-2030

	Expected Investments in million €
Oil	7,700
Natural Gas	2,800
Electricity	21,200
Energy Efficiency	11,000
Residential and Commercial Solar Power Applications	1,500
Research & Innovation	1,000
Total	***45,200***

* With RES and Storage ~13.000 GW

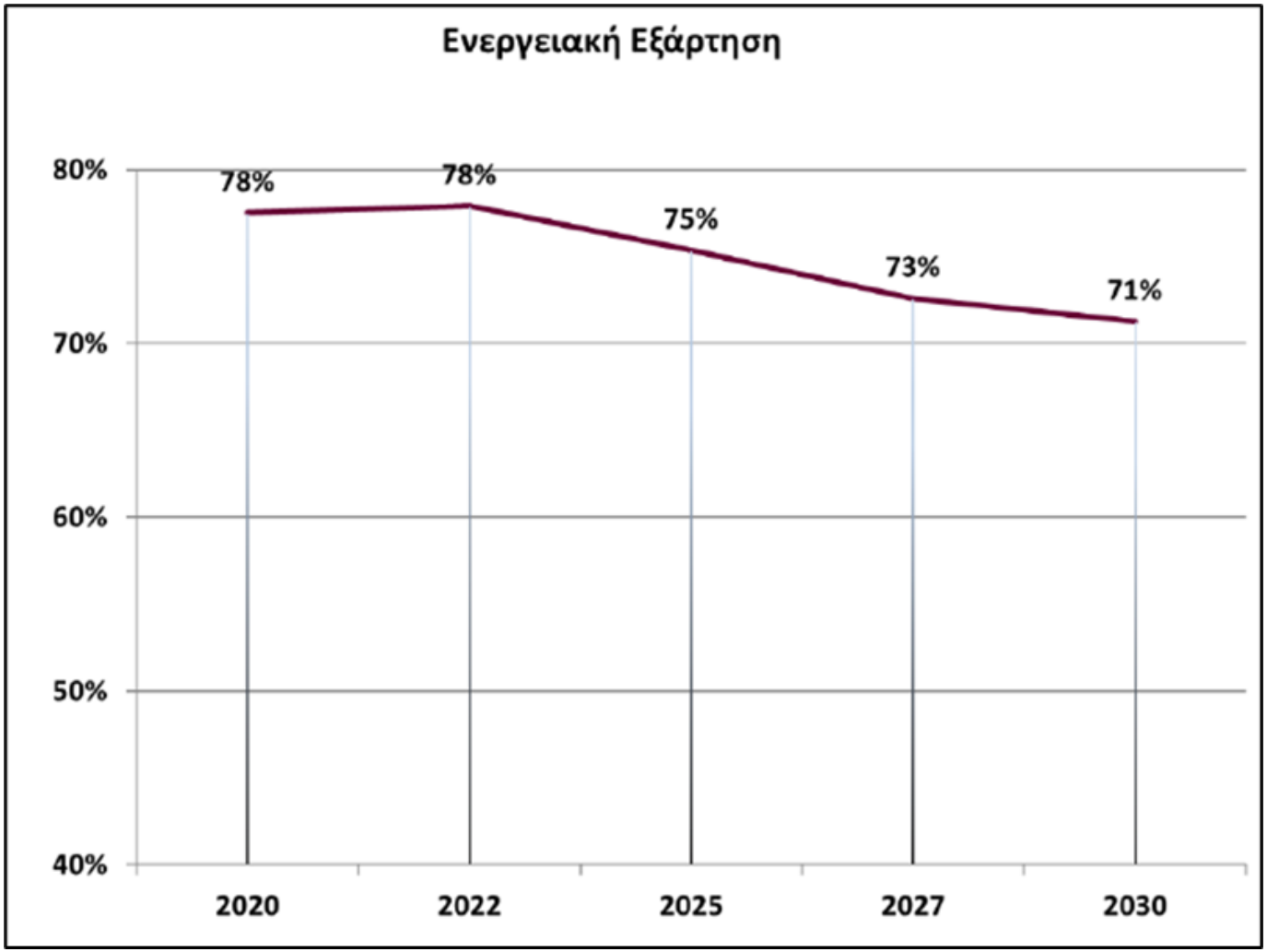
Source: IENE's Annual Report 2020 on Greece's Energy Sector

Greece: Gross Inland Consumption (2015-2040)



Source: IENE's "SEE Energy Outlook 2020/2021"

Εξέλιξη Ενεργειακής Εξάρτησης (%) της Ελλάδας Έως το 2030
Evolution of Greece's Energy Dependence (%) by 2030



Πηγή: ΕΣΕΚ

Greece's Key Strategic Challenges

1. Decarbonisation by gradually retiring 4.0 GW of lignite power plants (government target by 2028) in compliance with EU and Paris Agreement goals
2. Reduce energy dependency by curtailing oil and gas imports
3. Develop own oil and gas resources so as to cover majority of home needs and realise exports to Europe
4. Further develop Renewable Energy Sources, especially solar (PV and thermal), wind (onshore and offshore), geothermal (high enthalpy), biomas/biogas, hydro (small and large plants)
5. Improve energy efficiency, especially in buildings
6. Advance further competition in electricity and gas markets
7. Further develop oil, gas and electricity trading by becoming regional trading hub
8. Attract sizeable FDI in the energy sector

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