IEA In Depth Energy Policy Review of Greece

Athens, July 12-18, 2022

July 14, 2022

Contribution by the **Institute of Energy for SE Europe (IENE)**

INSTITUTE OF ENERGY
FOR SOUTH EAST EUROPE

A Partial Critique of Greece's Energy Policy

- The Institute of Energy for SE Europe (IENE) is a nonprofit independent organization active in the broad energy field across SE Europe. The Institute focuses on energy information documentation, energy analysis and policy formulation (see www.iene.eu for detailed information on IENE's background, activities and work).

- In the context of IEA's in Depth Energy Policy Review of Greece, IENE has prepared a number of comments focusing on:

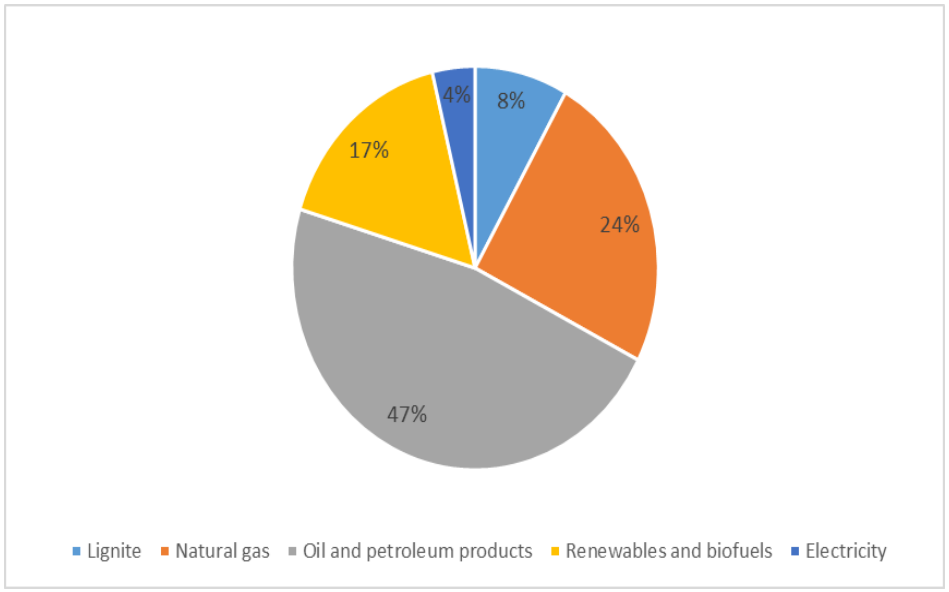
  - The lack of Energy Security considerations in the current Greek energy policy
  - Misguided energy transition targets for Greece's islands
  - Weak policy measures for Energy Efficiency in Public and Residential Buildings
  - Lack of support for Cogeneration of Heat + Power

A Partial Critique of Greece's Current Energy Policy (I)

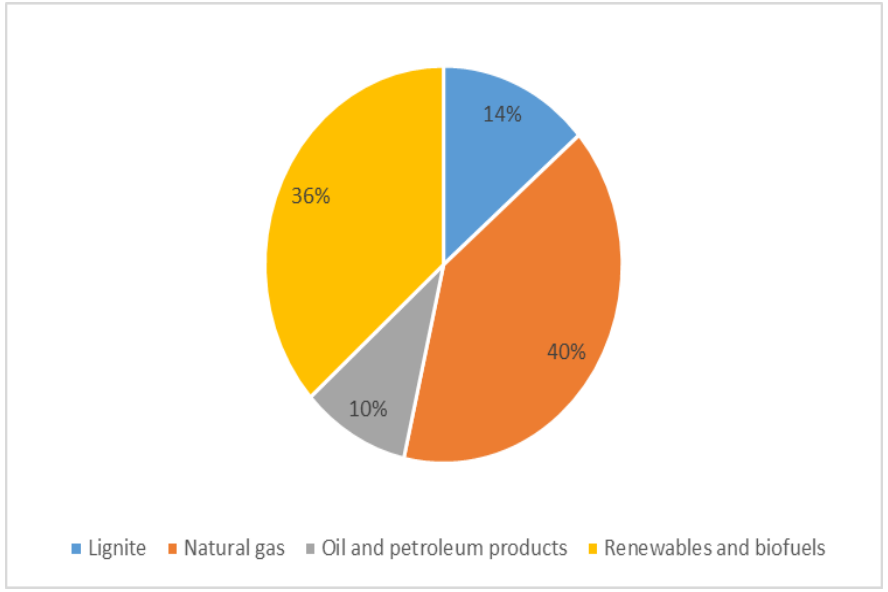
- The National Energy and Climate Plan (NECP) is considered to reflect Greece's current energy policy directions.
- The Plan places heavy emphasis on the development of RES and Energy Efficiency almost to the exclusion of everything else.
- Although Greece's energy mix is dominated by fossil fuels (oil, gas, lignite) which cover 87% (2019 figures), there is no actual policy in place dealing with oil and gas, i.e. the elephant in the room. For lignite, there is a tight decarbonisation plan which foresees phase out by 2028 (However, this is being revised entirely in view of latest crisis).
- If Greece is to reduce in the long term its dependence on imported oil and gas, there needs to be a plan on how to manage these resources as an integral part of the energy mix during energy transition.
- With regard to oil and in view of the fact that Greece has a substantial refining industry with a significant contribution to its economy and exports in particular, the need for a clearly defined policy on oil is absolutely essential.

Energy and Electricity Mix in Greece, 2020

Energy Mix in Greece



Electricity Mix in Greece

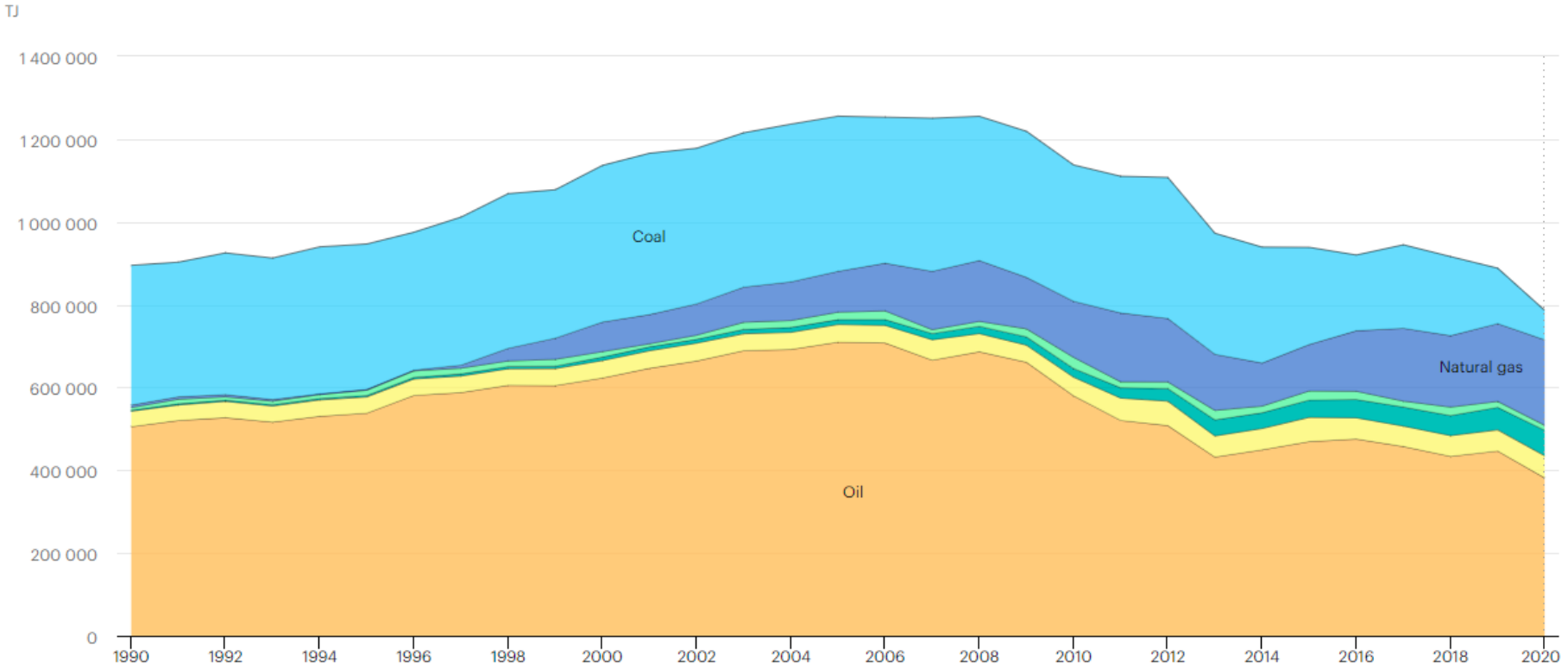


Source: Eurostat

A Partial Critique of Greece's Current Energy Policy (II)

- With gas being an indispensable fuel of the energy mix and an accepted part of the energy transition, it makes sense for Greece to develop ASAP its indigenous hydrocarbon resources, the greatest part of which (according to latest geological data) corresponds to gas (estimated at more than 3.0 tcm).
- By developing its indigenous gas resources, Greece will not only lessen its energy dependence but will also reap important economic benefits. There is a complete lack of clearly defined guidelines and a positive outlook for the development of the country's enormous gas resource base.
- In addition to its lack of addressing adequately the oil and gas aspects of the energy mix, the NECP does not consider in any depth the serious energy security issues involved in the functioning of the country's energy system.
- The complete lack of underground gas storage does not appear to be a problem nor the urgent need for the upgrading of certain cross-border electricity interconnections.
- Concerning energy efficiency, although the need to expand applications is well understood, there appears to be lack of urgency and lack of well-organised public campaigns and back up support services which will enable large segments of the population to adopt energy saving techniques. In addition, there is a need to raise public awareness beyond the building sector.

Total Energy Supply by Source in Greece, 1990-2020

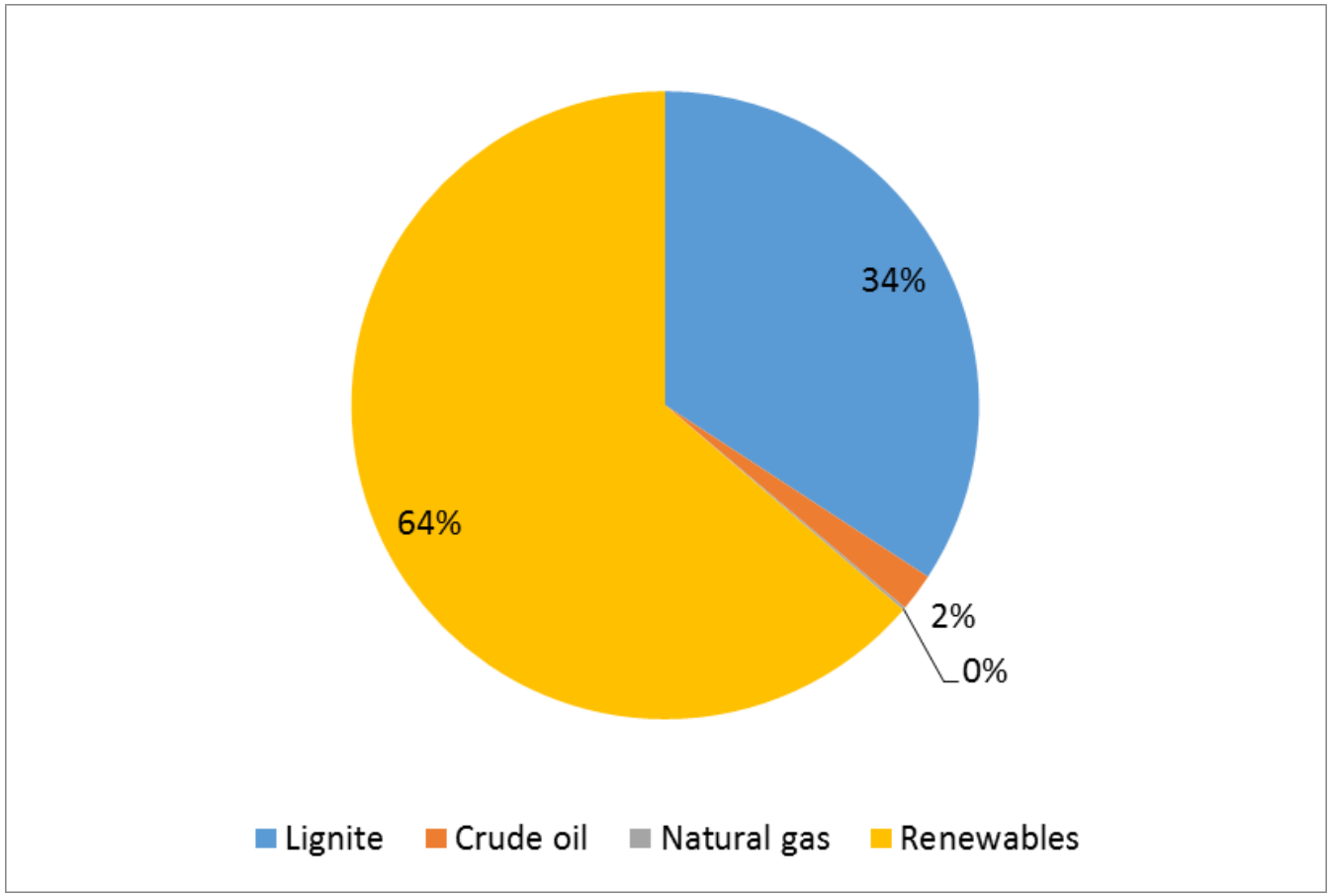


Source: IEA

Total Energy Supply and Energy Production in Greece

- In 2020, the **total primary energy supply** in Greece stood at 818 TJ, compared to 1,158 TJ in 2010.
  - **Oil and petroleum products** accounted for 47%, followed by **natural gas (25%), lignite (8.7%)** and **RES (15.6%)**, as shown in the following Figure.
  - This relationship of energy supply stands for the period between 2010 and 2020 and only after 2018, the share of natural gas is trying to surpass the share of coal (lignite).
- Domestic **primary energy production** decreased from 397 TJ in 2010 to 191 TJ in 2020, with substantial fall in the contribution of lignite and important increase in RES use.
  - **RES** has emerged as the country's main source of indigenous energy, accounting for 64% of domestic energy production in 2020. It should also be noted that the contribution of **lignite** reached about 34% of energy production, while the share of **crude oil** increased from 1.1% in 2010 to about 2% in 2020.

Primary Energy Production by Source in Greece, 2020



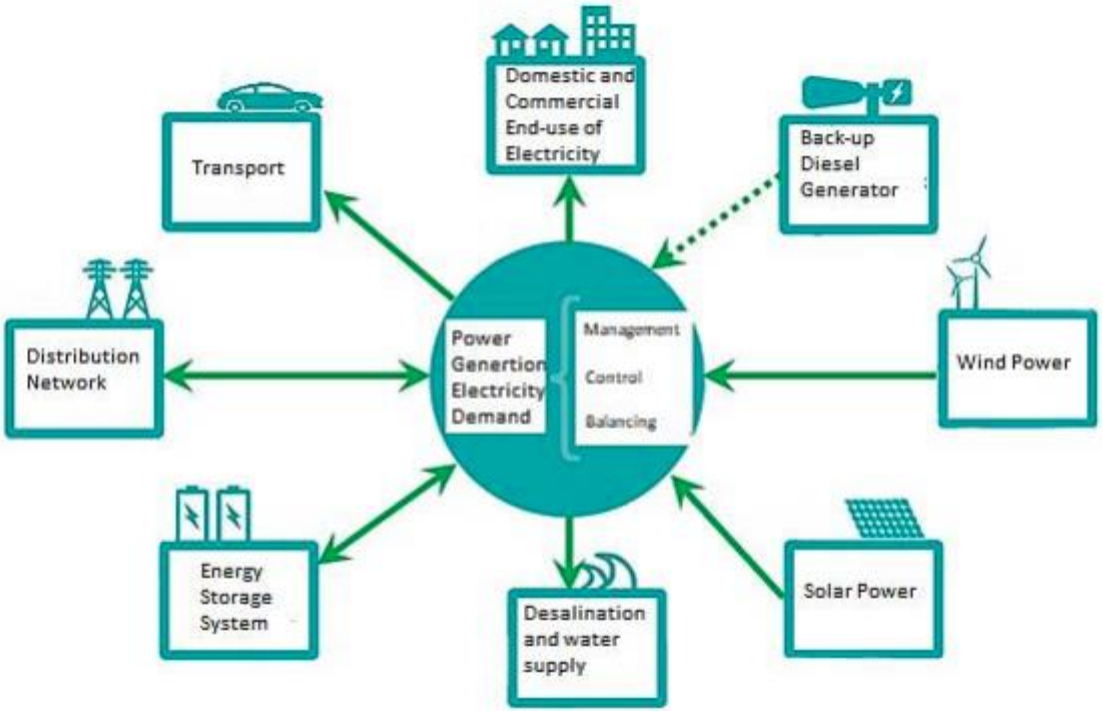
Source: IEA

Energy Transition in Greece's Islands: Another Failed Opportunity

- Over the last 5 years, a huge programme for interconnecting the various islands, until now, autonomous electricity system has been underway by IPTO.
- Apart from the energy security considerations of linking the islands' electricity network to the mainland interconnected system, there are important benefits in terms of economics (lower costs), the environment (zero emissions) and the opening for larger RES penetration on the various islands.
- The interconnection of Crete to the mainland is a case in point with the first stage (180 MW) already completed and the second one due to become operational by the end of 2023 (1000 MW).
- However, both in the case of the Cyclades islands (with most interconnections completed or under way) and in the case of Crete the current operational plan by HEDNO and IPTO (in the case of Crete) foresees retention of the fuel oil/diesel power units on all islands with only part of the electricity provided through the interconnected links.
- In the case of Crete, the use of the two interconnection HV links enables only 50% reduction of installed fuel oil power units on the island. Some 400 MW of oil fired units will keep operating until 2030.
- The issue of energy storage introduction in Crete in order to increase the use of RES but also maximise the input from the HV interconnections was addressed in a major study undertaken in 2021 by IENE on behalf of IPTO.
- Another important study by IENE, undertaken on its own initiative, concerned the energy transition for the island of Kastellorizo, one of Greece's most remote islands in the Dodecanese. Following a series of field visits, close collaboration with local entities and HEDNO, and using mathematical modelling, IENE has proposed a hybrid 2.5 MW solar, wind and storage system (2 MWhs x 2) capable of providing for 94% of the island needs with back up provided by two small 150 kw diesel units each (out of 8 currently in operation).
- If implemented, the Kastellorizo hybrid system could provide a reference for replication in Greece's 40 stand alone electricity systems currently operating on diesel and without any prospect for interconnection due to their remoteness.
- The Ministry of Energy and the government, although fully informed on the Kastellorizo study and its positive findings, chose to ignore it and instead opt for the introduction of electric vehicles in other small remote islands

IENE Study (M45):
The Design of a New Energy System for the Island of Kastellorizo

- **High Penetration of available RES in the energy mix**: Solar and Wind power
- **Uninterrupted electricity supply for all consumers:** Domestic and Commercial Consumption
- **Uninterrupted water supply:** uninterrupted coverage of electricity demand for desalination facilities (flexibility through demand response)
- **Electric Mobility:** coverage of EV charging demand



- **Improvement of Energy Efficiency:** Utilization of non-electric RES (solar thermal) applications, more energy efficient end-use devices, more efficient lamps for lighting of public spaces.
- **Use of Energy Storage system:** to achieve high RES penetration while ensuring security of supply. Lithium-ion battery storage systems were the primary focus due to their continuously decreasing cost, fast response (immediate high power supply) and sufficient storage capacity.

Greece's High Energy Dependence Undermines Energy Transition Efforts

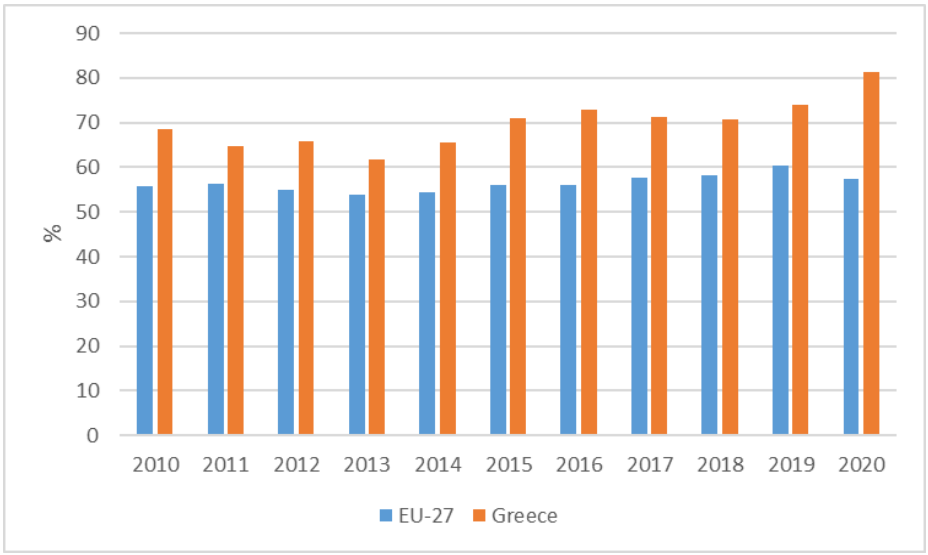
- As a result of high energy imports, Greece's energy dependence remains very high (i.e. 81.4% in 2020), compared to the European average (i.e. 57.5% in 2020), mainly in terms of oil and natural gas imports, and compared to Greece's energy dependence of 2017 which stood at 71.3%.

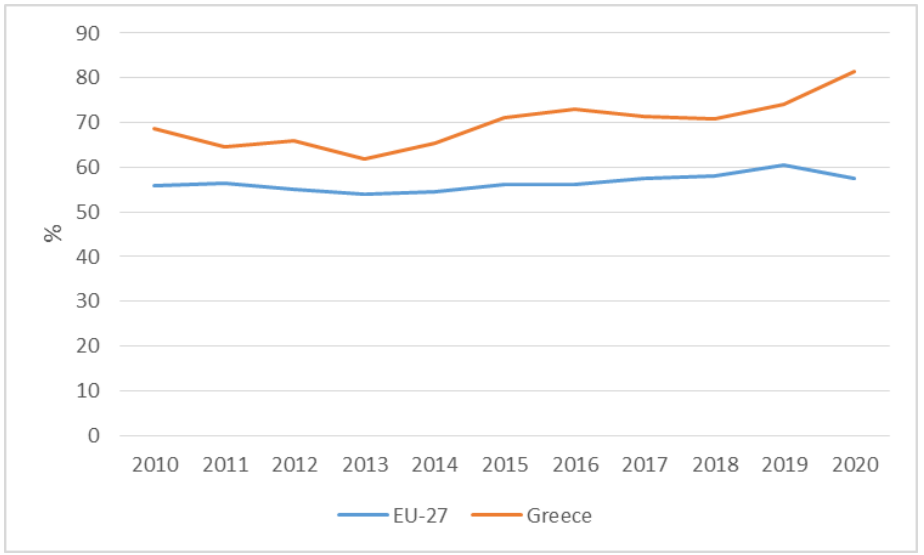
- Over a 11-year period (2010-2020), energy dependence in Greece is much higher than EU's average.

- Apart from 2019, this trend also stands for oil and petroleum products and natural gas.

- Over 2010-2020, Greece's dependence on solid fossil fuels is constantly fluctuating below EU's average.

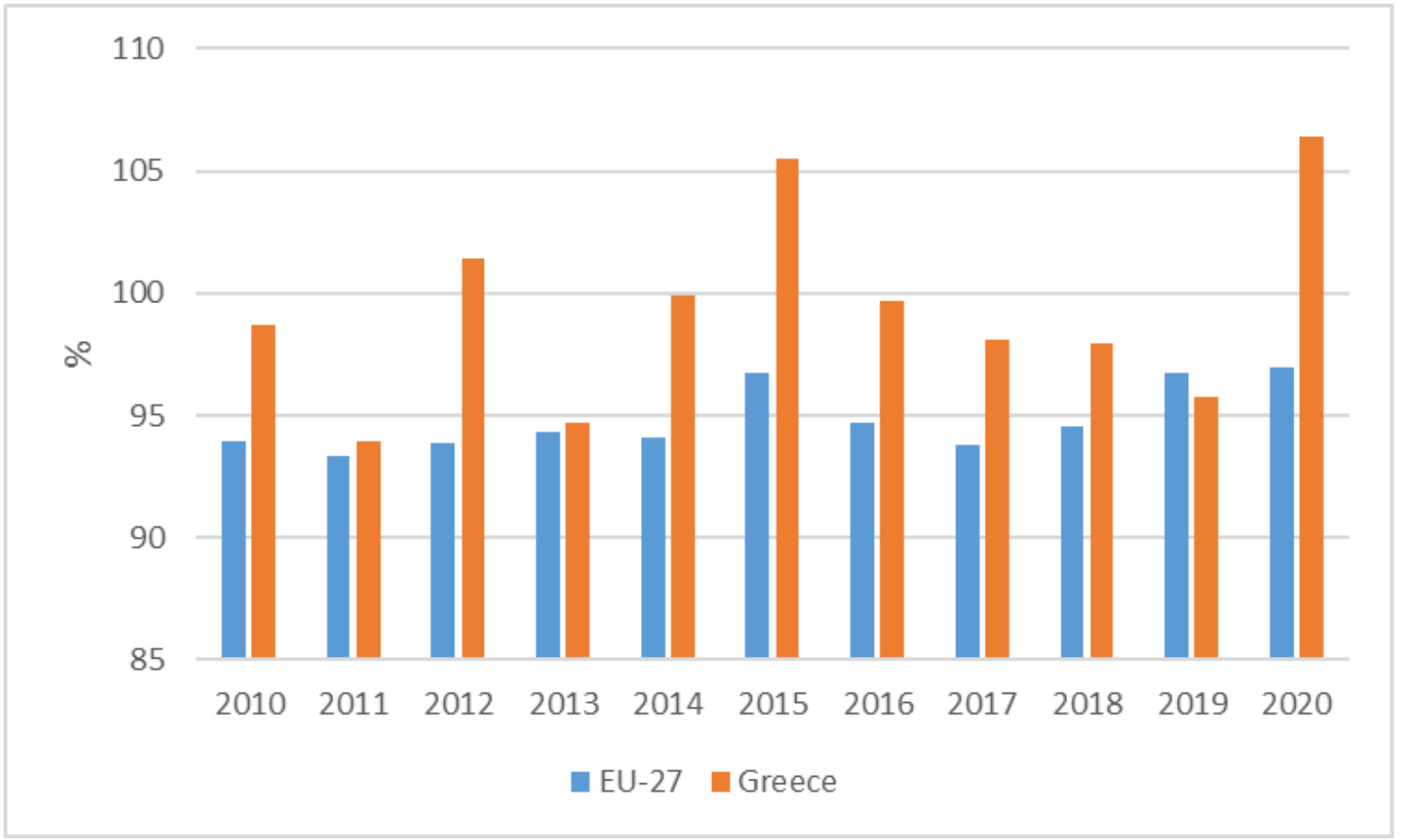
Energy Dependence in Greece and EU-27, 2010-2020





Source: Eurostat

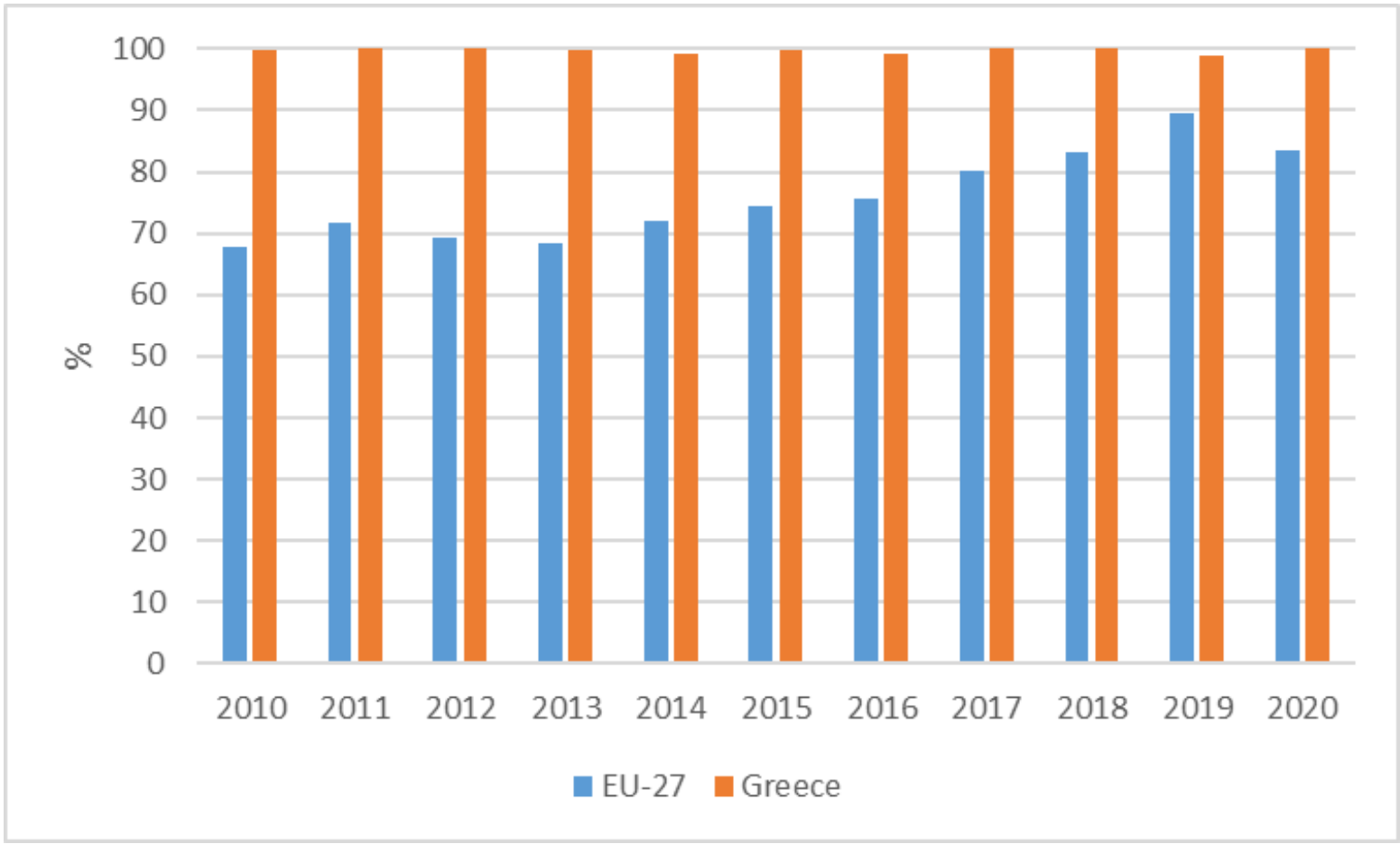
Dependence on Oil and Petroleum Products in Greece and EU-27, 2010-2020



Note: A dependency rate in excess of 100% relates to the build-up of stocks.

Source: Eurostat

Dependence on Natural Gas in Greece and EU-27, 2010-2020



Source: Eurostat

How Can Greece Enhance Its Energy Security? (I)

- As already stated, Greece is highly dependent on energy imports with its energy dependence rising constantly over the last 5 years.
- In 2020, the country's energy dependence reached an all time high of 81.4% compared to the European average of 57.5% (and Greece's 71.3% in 2017).
- In spite of significant inroads by RES into the electricity mix (In H2 2022, RES covered an average of 35% of power generation and large hydro contributed 6.0% compared to 30.0% + 8.0% in whole of 2021).
- Energy dependence has risen because of increased gas imports (to meet rising demand), significant oil imports and increased electricity imports from neighbouring countries.
- Although the reduction of energy dependence should have been a constant and non-negotiable target of energy policy, there is no mention at all of this dire situation in most policy papers nor is this reflected in official government policy. IENE had suggested as a prime target of Greece's energy policy the gradual reduction of the country's current energy dependence from the present high number to the average EU dependency (58%-60%). A suggestion that was totally ignored from the previous and the present government.

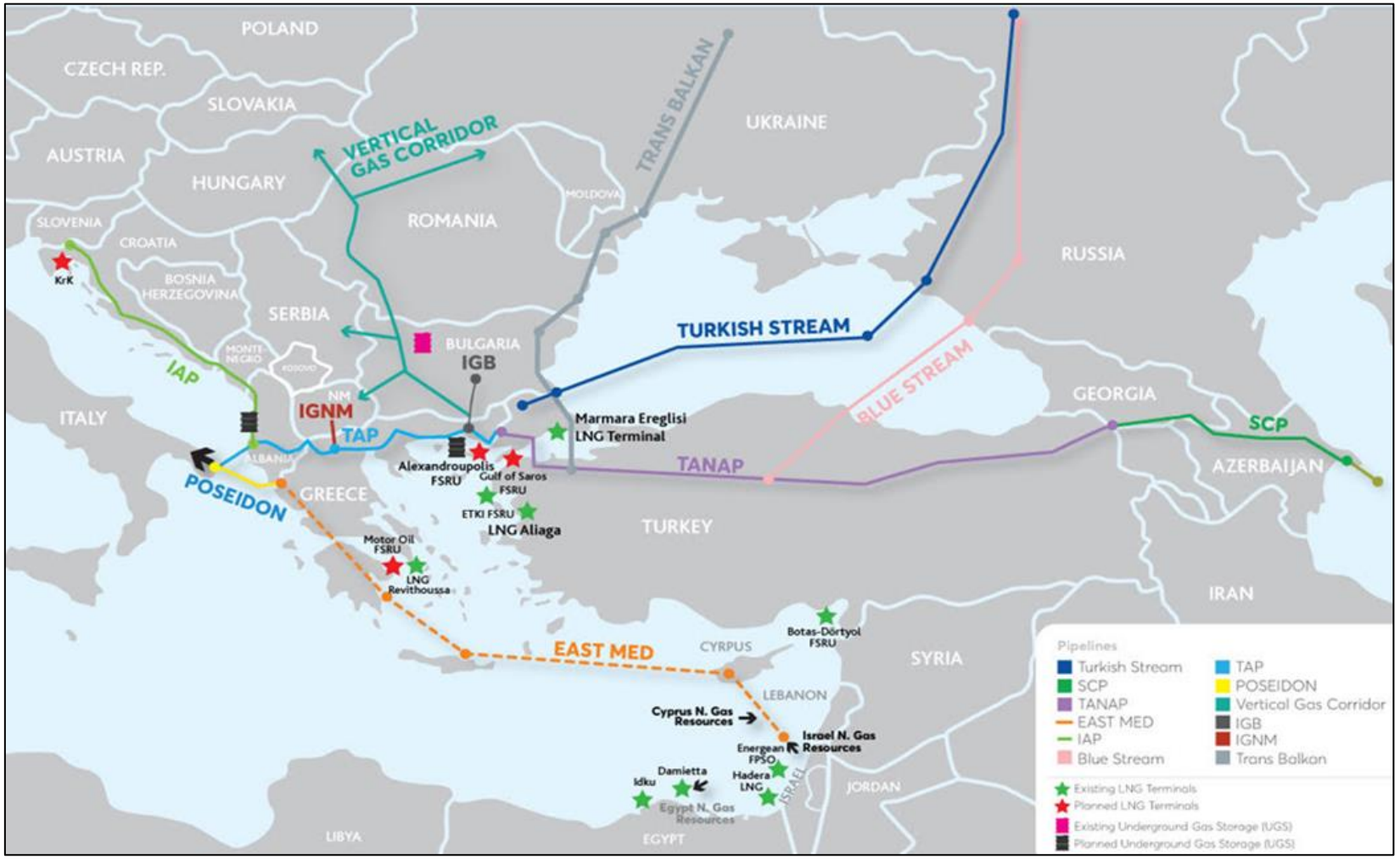
How Can Greece Enhance Its Energy Security? (II)

- A repeatedly (ad nausem) stated objective of Greece's energy policy is for Greece to become a major energy hub since by doing so it will solve all or most of its gas supply problems. IENE has raised its concerns on such goals since the notion of 'energy hub', on the strength of the number of pipelines and operating LNG terminals, is not necessarily compatible to the improvement of energy security.

- In order to lessen energy dependence, new policy priorities should be put in place which should aim at:
  - the reduction of the imported energy flows in parallel with
  - an increase of the indigenous energy sources, with emphasis on renewables, hydrocarbons and energy efficiency, mainly in transport and residential sectors and
  - the stabilization or the decline of the current share of lignite in the country's energy mix
  - the diversification of gas supply routes (see Expanded South Corridor)
  - The development of underground gas storage facilities

- Greece is already playing an active role in the development and operation of the South Gas Corridor, an expanded version which includes cross border interconnectors, UGS facilities, land-based LNG terminals, FSRUs and main gas pipelines (see map on next page).

An Expanded South Gas Corridor



Note: The TANAP, TAP and Turk Stream have been completed, while BRUA and IGB are still under construction. 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

Energy Efficiency: Public Buildings

Ambitious NECP:

- final total energy consumption not to exceed 16.5 Mtoe in 2030,
- primary energy consumption not to exceed 21.0 Mtoe in 2030,
- to attain cumulative energy savings (buildings + transport) of 7.3Mtoe in the period 2021- 2030,
- building renovations to cover, on an annual basis, 3% of the total heated floor area of central government buildings, by 2030

Specific measures are being planned for buildings with a view of implementing an ambitious plan for the renovation and improvement of the energy performance of the public buildings stock, through the participation of ESCOs and the renewal of end-of-life cycle buildings.

The **"ELECTRA" Program** is designed for public buildings, which is expected to launch by the end of July/August 2022.

Budget announced:

640 m€ where 470 m€ loan from EIB

140 m€ from Recovery & Resilience Fund and the subsidy between 50% up to max. 70%.

Difficulties:

- Energy prices (volatile environment)
- Continuous increase of the prices for the EE materials
- Lengthy procedures and difficulties for the state entities to fund the remaining 30% of the budget.

Energy Efficiency: Residential Buildings

- Targeted incentives are also being prepared for promoting energy efficiency measures in private buildings, by adopting an ambitious strategy for renovating the building stock in order to renovate 12-15% of the buildings by 2030 - NECP.
- Important Role of EXOIKONOMO (Save Energy) Program.
- Initially, for detached houses and/or single apartments buildings.
- Now (2021), apartment houses are included.

EXOIKONOMO No	YEAR	Beneficiaries	Budget (m€)	Pros/Cons (2021)
1	2011	8,102		Pros: - better designed than previous - 20.8% of beneficiaries from low-income (5-10 k€/yr) with a budget of 120 m€. - Creation of an e-platform to examine on-site the application Cons: - Bureaucracy for permits, etc. - Problems with the e-platform regarding the electronic identity of the building (EIB) (prerequisite) - Increase of the prices of the EE materials - Low participation of apartment buildings.
2	2012	36,971		
3	2018	37,305	502.99	
4	2019	20,975	778.01	
5	2020-21	36,364 (up to 50,000 including the apartment buildings)	632.00	

Cogeneration of Heat & Power

- In decline the past 10-12 years, mainly due to the economic crisis and its consequences.
- In 2018: 425 MW_e/926 MW_{th} of CHP were installed (Eurostat)
- L.4414/2016, Art.4, defined the FiTs for cogenerated electricity fed to the Network or the Grid at a constant value, depending on the used technology, in €/ MWh plus a natural gas correction coefficient (NG CC). This correction is introduced to adjust the price of cogenerated electricity from HECHP plants, based on the standard plant efficiency and the market gas price.
- There is a large HECHP unit in aluminum industry (110 MW_e), few in chemical industry (i.e. refineries), in DHS in six cities and notable number in primary economy (as glass greenhouses of 100 or more acres, with tomatoes, cucumbers, peppers, etc.).
- Not much support by the State, as many barriers exist. (i.e. 1.1 MW gas boiler can be changed in an industry without any permit, when 1.1 MW HECHP unit needs more than 2 years to be in full mode for operation…)
- The High-Efficiency Cogeneration of Heat and Power (HECHP) is characterized by the EU in various European directives, as an energy efficient technology. This is not fully understood by the Greek state.

Energy Investment Outlook Per Sector in **Greece** (2021-2030)

	Project sector	Description	Investment estimate (€ mn)
OIL	Upstream	• Field Exploration • Development of new oil and gas wells • and associated infrastructure	4,000
	Downstream	• Refining (upgrading) • Loading Terminals • Storage facilities • Crude / Product Pipeline(s)	1,800
GAS	Gas Network	• Grid development • Main intra country pipeline(s) • Small-scale LNG • Storage facilities • FSRU Terminals	2,000
ELECTRICITY	Power Generation	• Lignite • Gas • Large Hydro • Electricity Storage	4,000
	Electricity Grid	• New H/V transmission lines • Upgrading and expansion of existing grid	5,500
	RES	• Small Hydro • Wind farms • Photovoltaics • Concentrating Solar Power • Biomass/liquid biofuels • Geothermal	15,100
ENERGY EFFICIENCY		• Electric Vehicles • Energy upgrading of buildings	12,000
	Total anticipated investments by 2030		**44,400**

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

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