Understanding the Energy Mix, Key for the Development of RES in Greece and SE Europe

RENPOWER Greece 2022

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INSTITUTE OF ENERGY
FOR SOUTH EAST EUROPE

The SE European Region Defined

Core countries

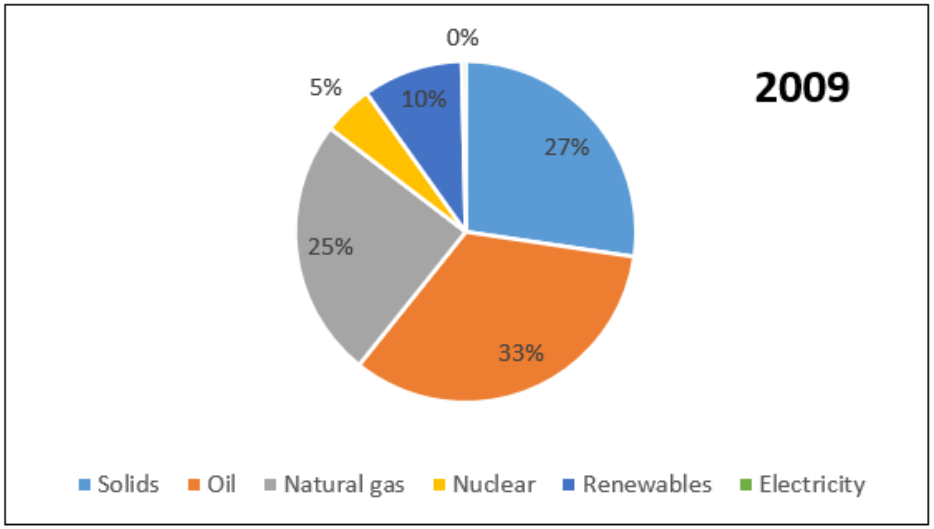
- Albania
- Bosnia and Herzegovina
- Bulgaria
- Croatia
- Cyprus
- Greece
- Hungary
- Israel
- Kosovo
- Montenegro
- North Macedonia
- Romania
- Serbia
- Slovenia
- Turkey

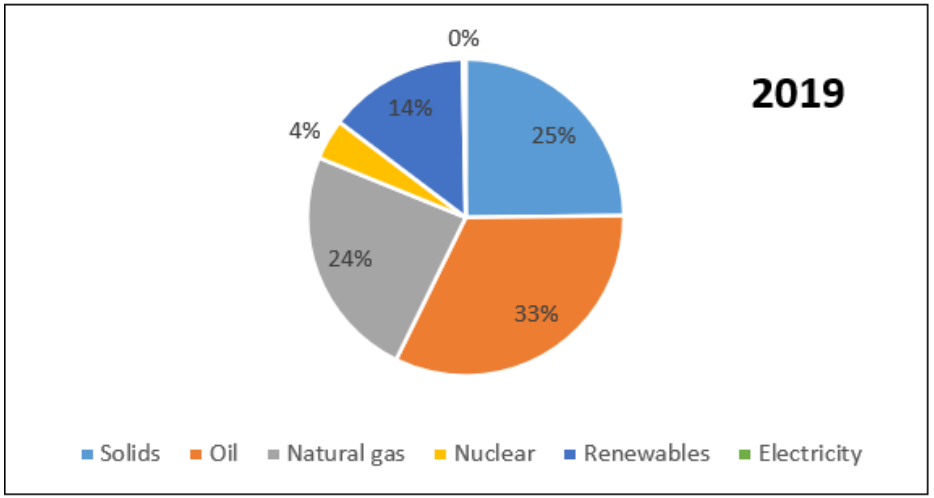
Peripheral countries

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

Source: IENE

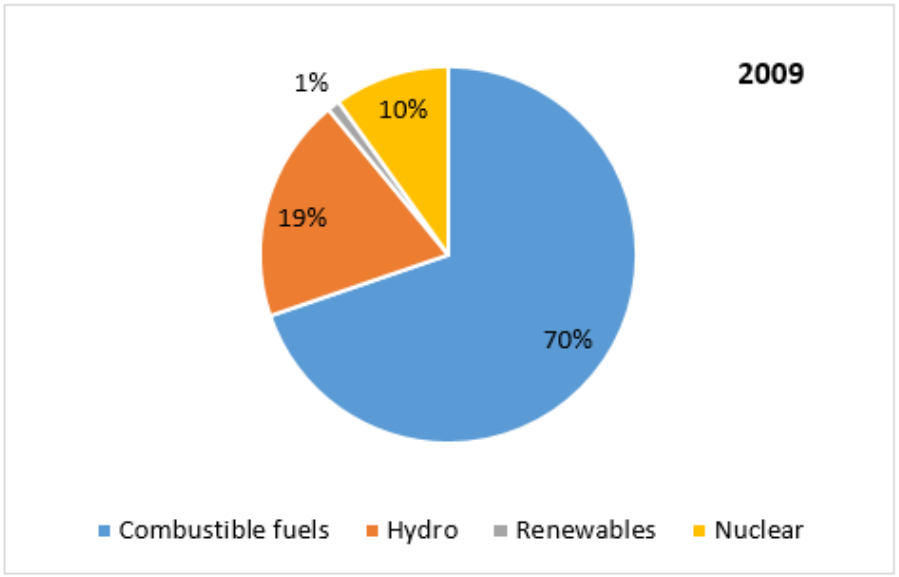
SE Europe's Energy Mix, **Including Turkey**, 2009 and 2019

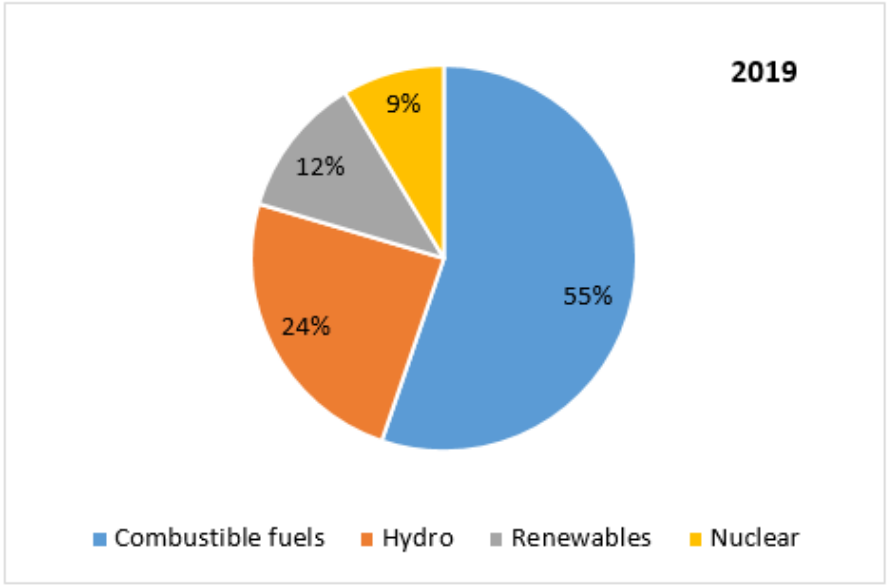




Source: Eurostat

SE Europe's Power Generation Mix, **Including Turkey**, 2009 and 2019

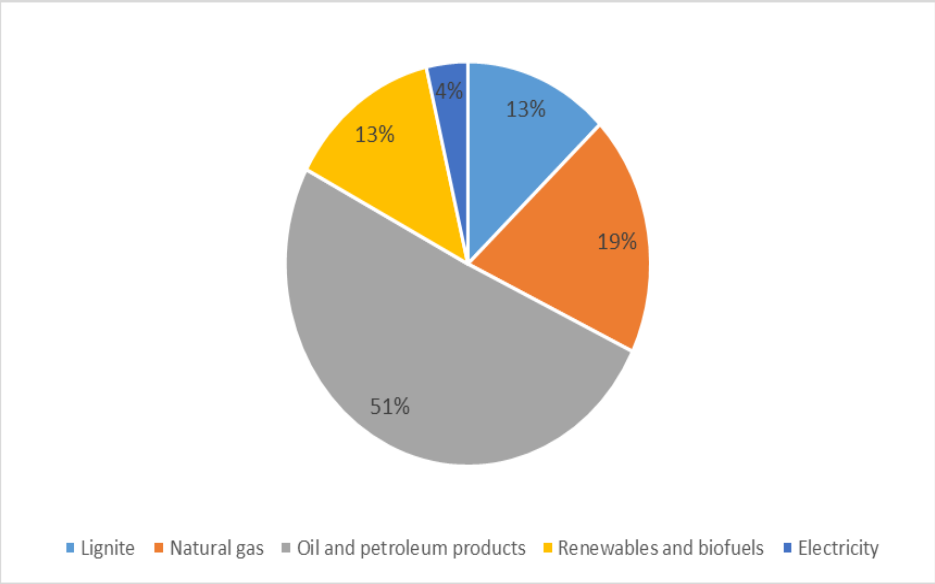




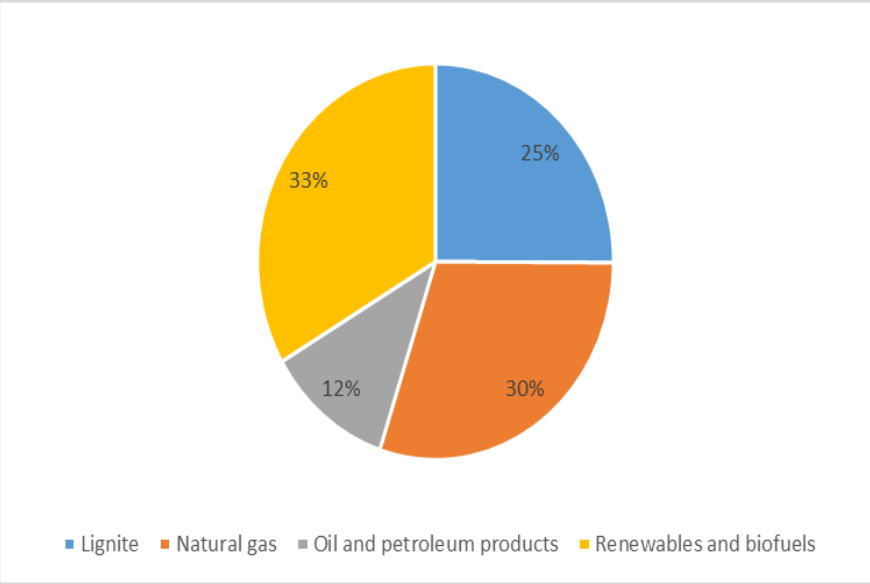
Sources: European Commission, IENE

Energy and Electricity Mix in Greece, 2019

Energy Mix in Greece



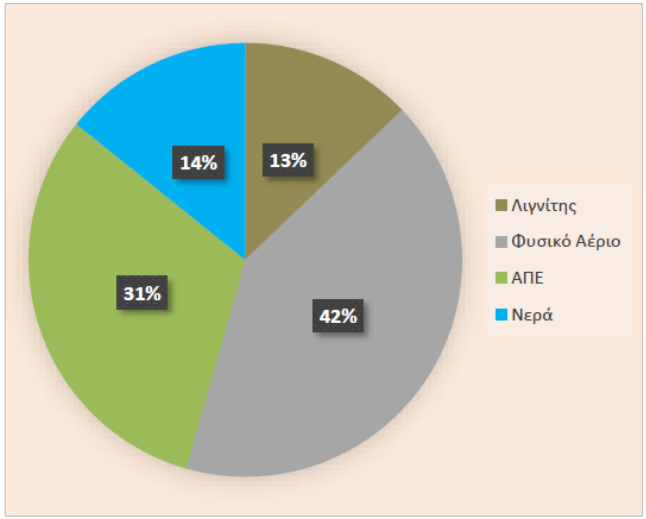
Electricity Mix in Greece



Source: Eurostat

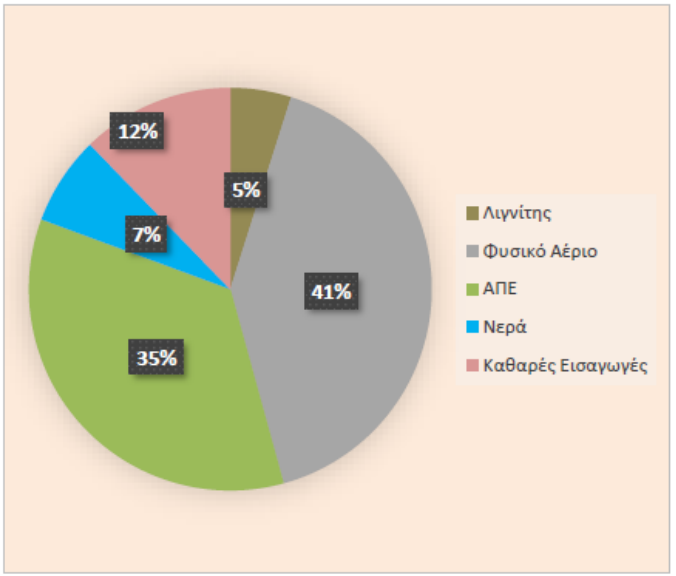
Fuel Mix per Month in Greece (I)

January 2021

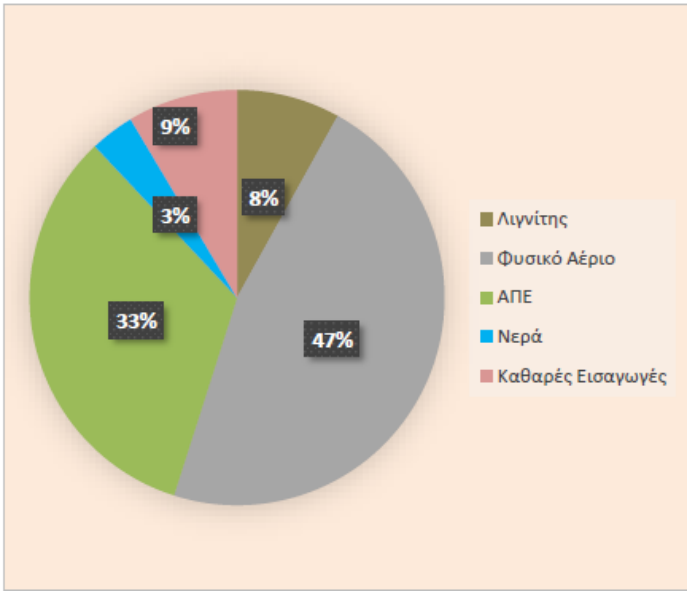


Στο γράφημα της πίτας δεν περιλαμβάνονται οι καθαρές εισαγωγές επειδή ήταν αρνητικές τον Ιανουάριο. Το ελληνικό Σύστημα ήταν εξαγωγικό.

May 2021



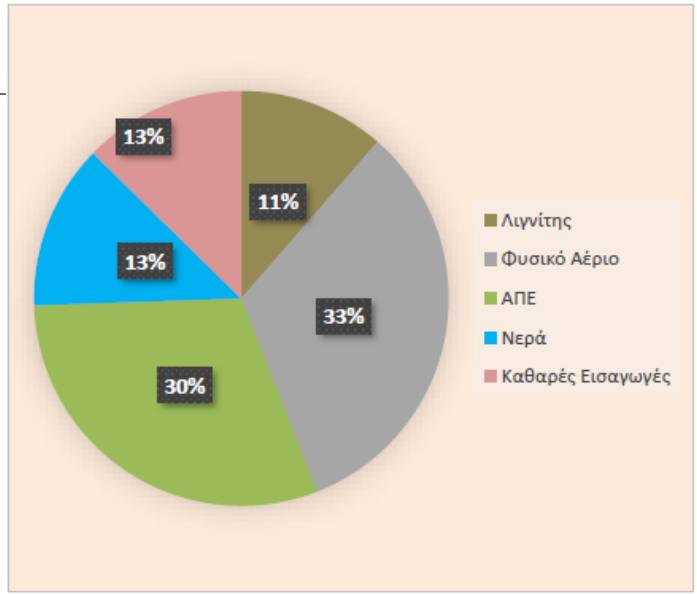
November 2021



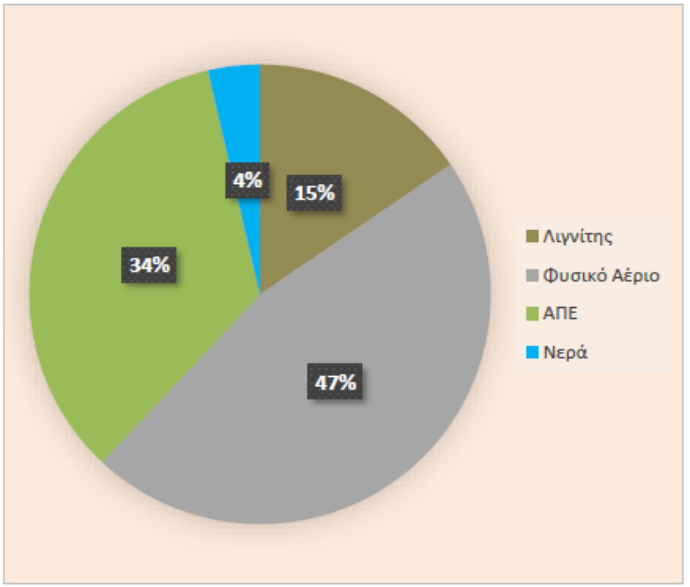
Sources: HEnEx, IENE

Fuel Mix per Month in Greece (II)

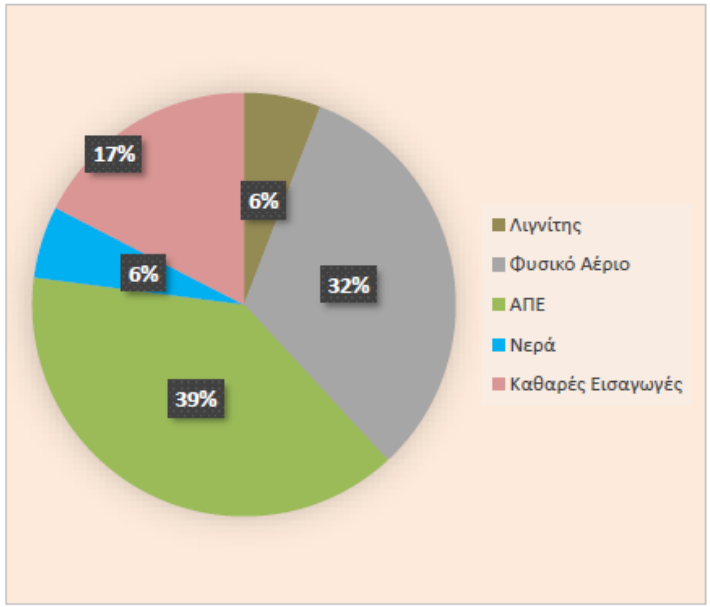
January 2022



March 2022



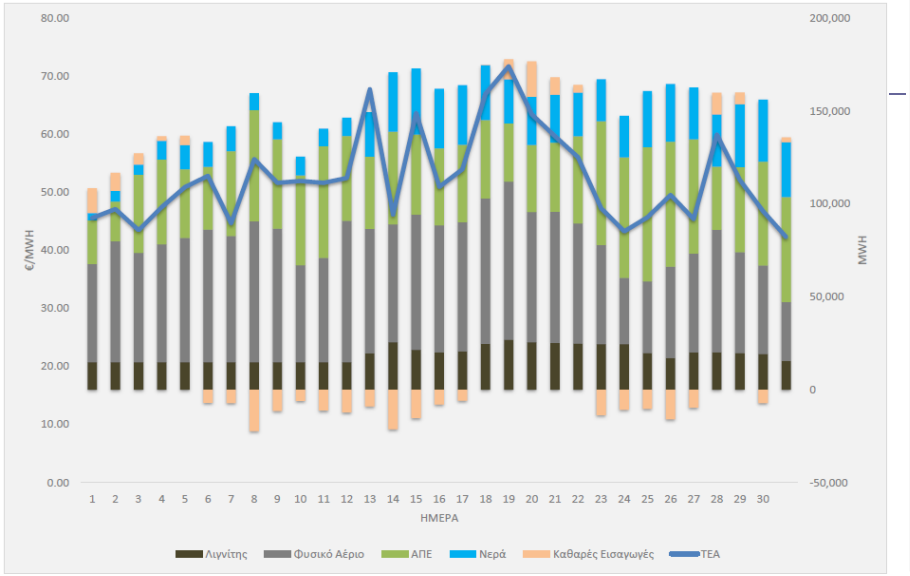
May 2022



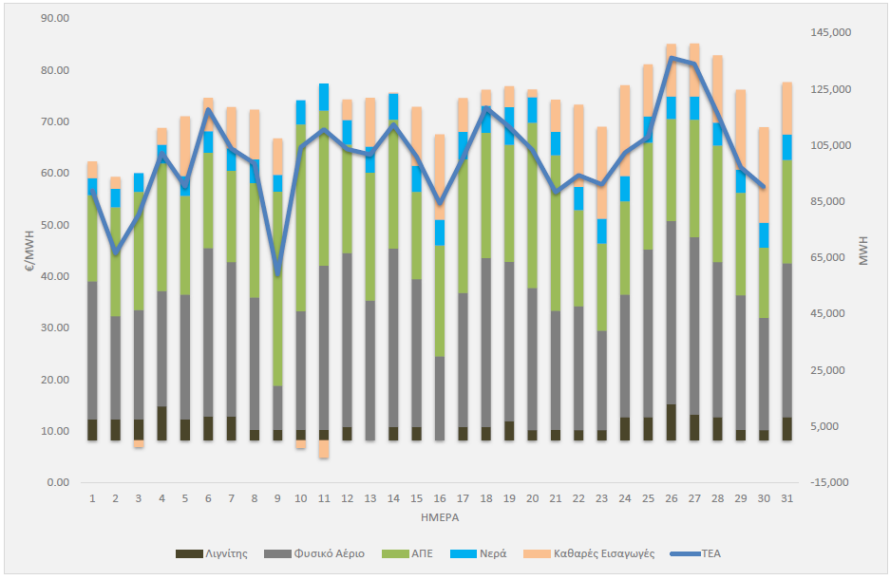
Sources: HEnEx, IENE

Fuel Mix per Day in Greece (I)

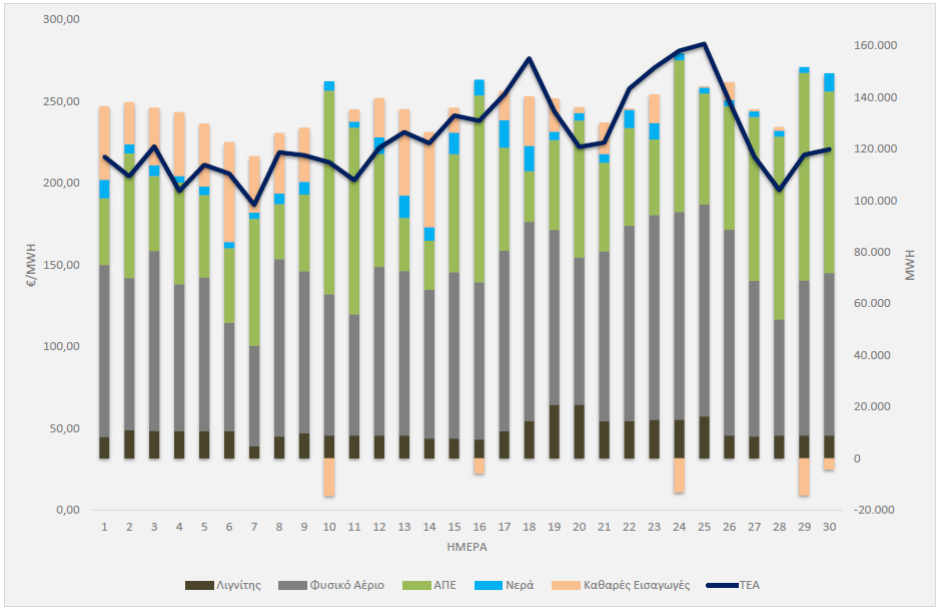
January 2021



May 2021



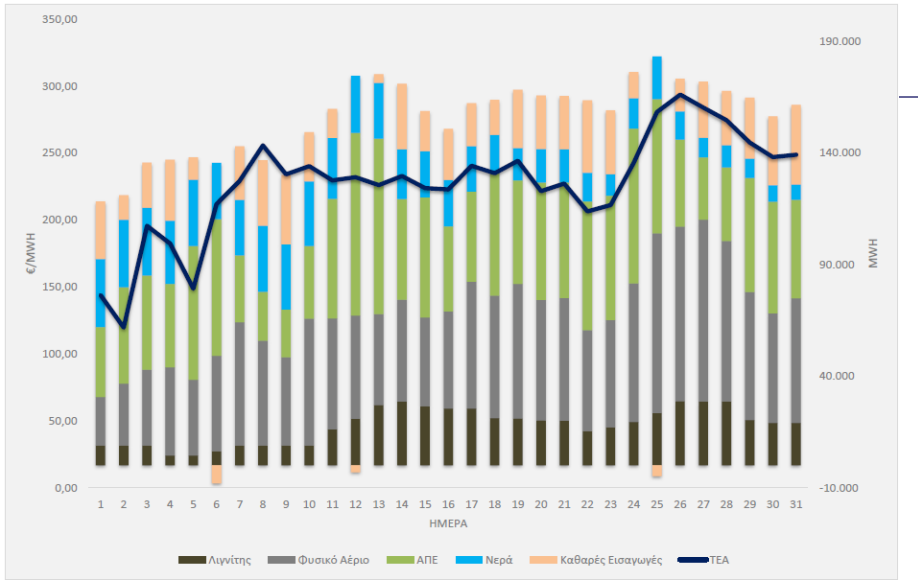
November 2021



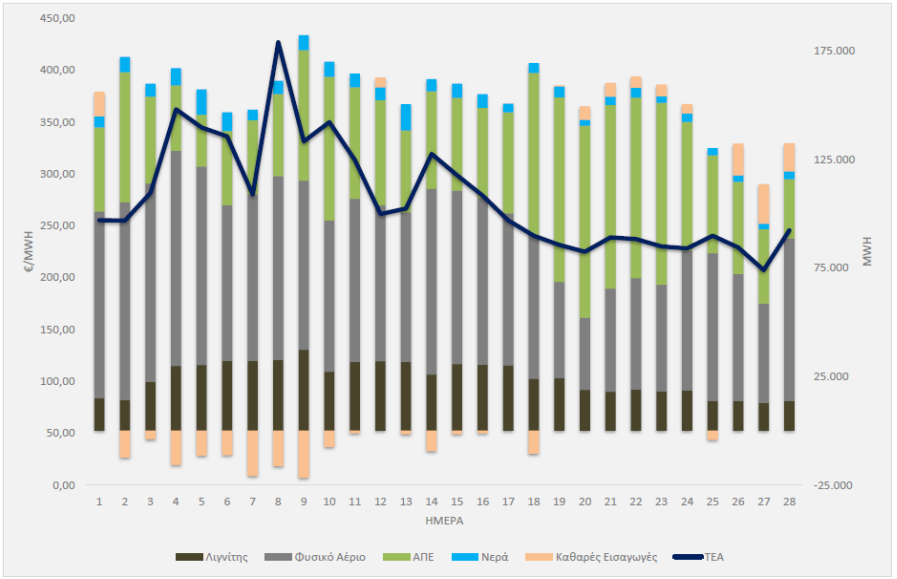
Sources: HEnEx, IENE

Fuel Mix per Day in Greece (II)

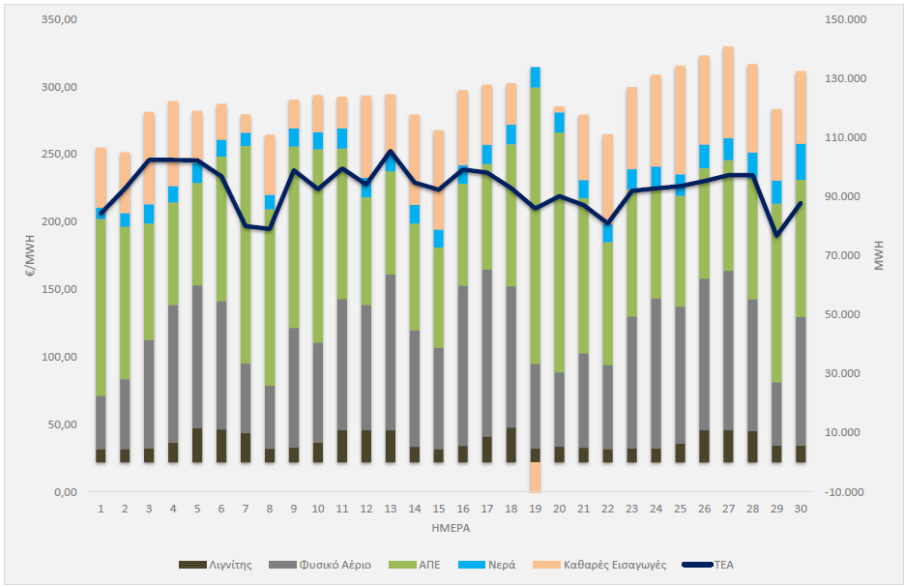
January 2022



March 2022



May 2022



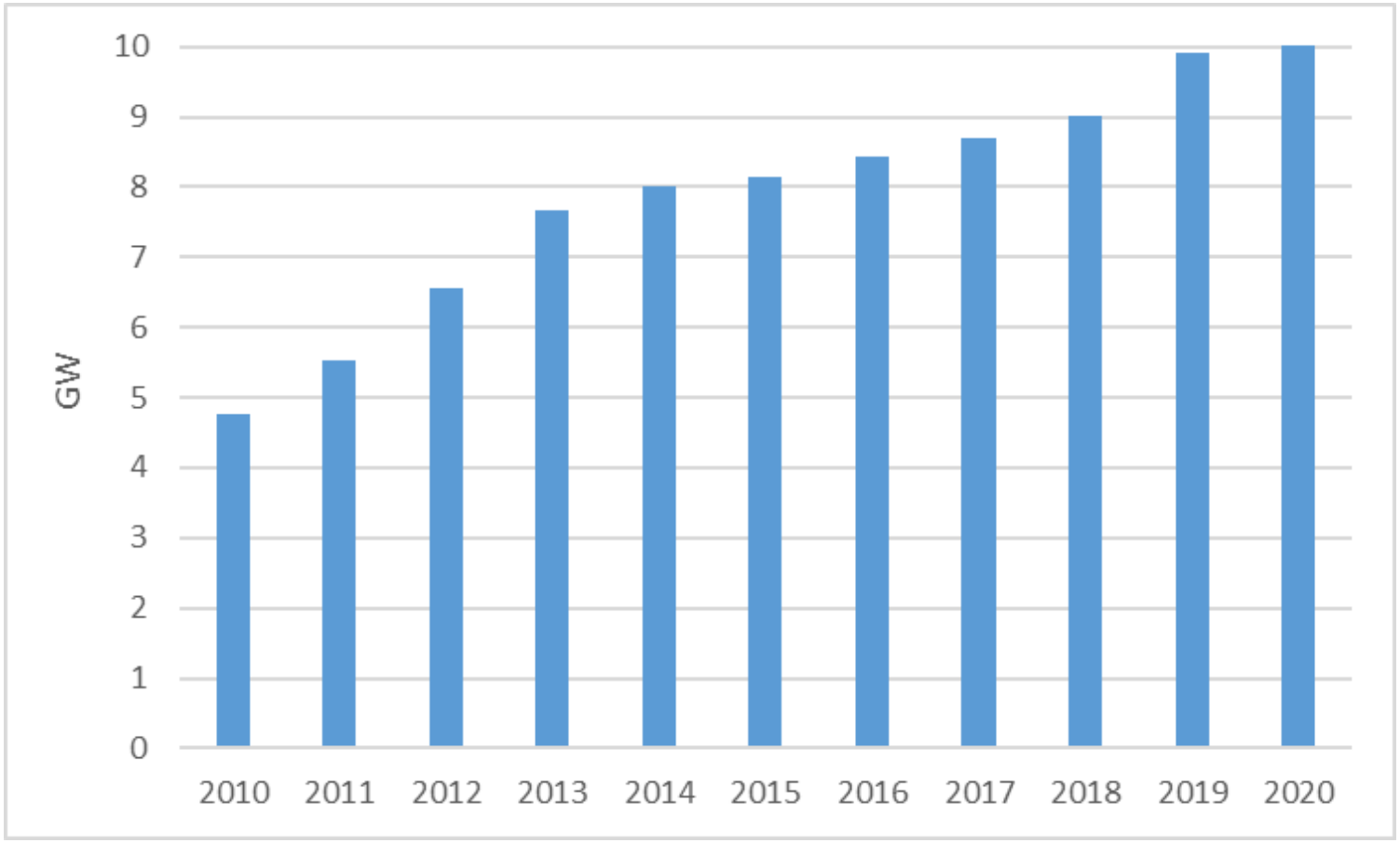
Sources: HEnEx, IENE

Installed RES Capacity (MW) in SE Europe, 2020

Country	Hydro	Wind	PV	Biomass/biogas	Geothermal	Total installed RES capacity
Albania	2,110	0	3	0	0	**2,113**
Bosnia and Herzegovina	2,000	135	20	3	0	**2,158**
Bulgaria	3,200	700	1,065	100	0	**5,065**
Croatia	2,200	738	70	77	16	**3,101**
Cyprus	0	158	129	10	0	**297**
Greece	3,400	4,000	3,000	83	0	**10,483**
Hungary	58	323	1,953	476	3	**2,813**
Kosovo	80	33	7	0	0	**120**
Montenegro	700	118	2	0	0	**820**
North Macedonia	692	37	26	11	0	**766**
Romania	6,600	3,040	1,380	133	0	**11,153**
Serbia	3,000	481	21	15	0	**3,517**
Slovenia	1,351	5	267	25	0	**1,648**
Turkey	29,200	8,056	6,700	877	1,550	**46,406**
Total	**54,591**	**17,824**	**14,643**	**1,810**	**1,569**	**90,460**

Source: IRENA

Installed RES Capacity in Greece, 2010-2020



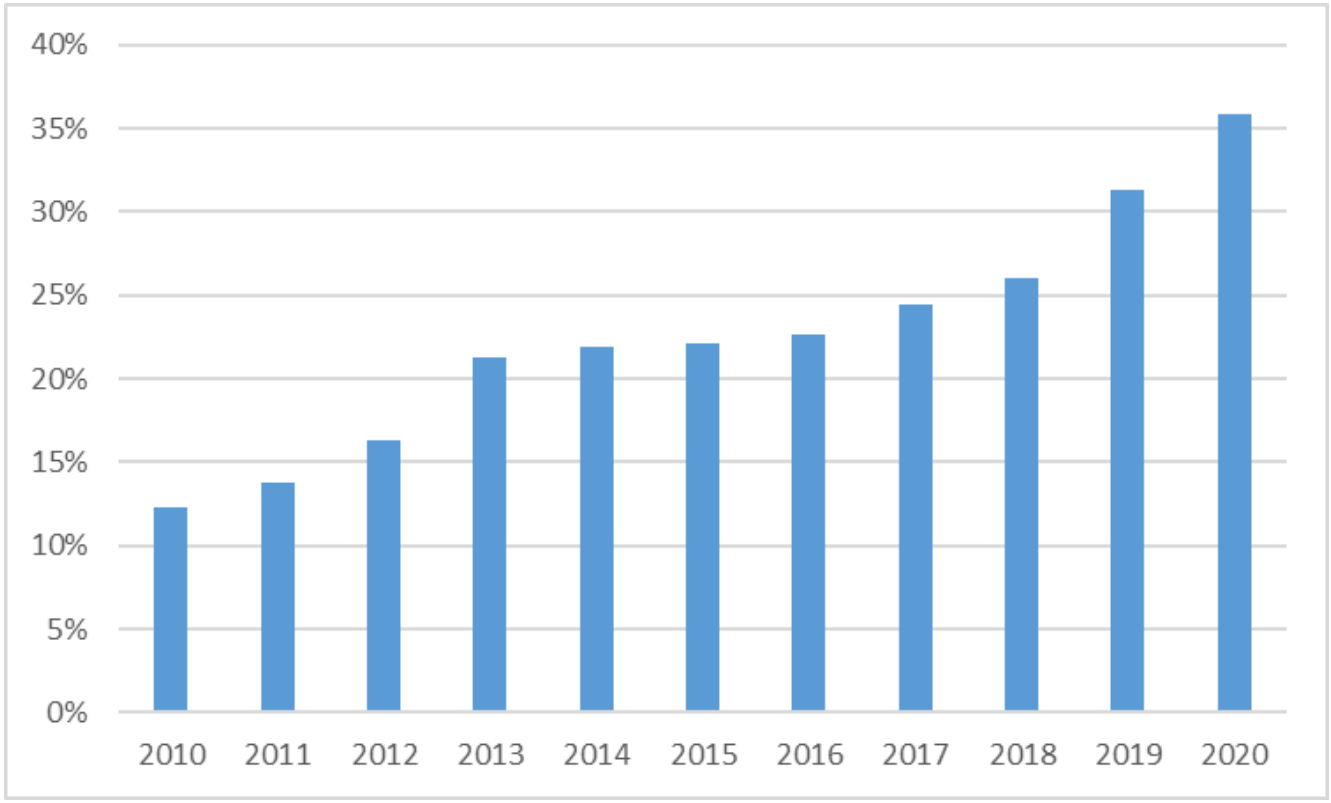
Source: IRENA

Share of RES in Electricity Generation in SE Europe, 2010-2020

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Bulgaria	12%	13%	16%	19%	19%	19%	19%	19%	22%	24%	24%
Greece	12%	14%	16%	21%	22%	22%	23%	24%	26%	31%	36%
Croatia	38%	38%	39%	42%	45%	45%	47%	46%	48%	50%	54%
Cyprus	1%	3%	5%	7%	7%	8%	9%	9%	9%	10%	12%
Hungary	7%	6%	6%	7%	7%	7%	7%	8%	8%	10%	12%
Romania	30%	31%	34%	38%	42%	43%	43%	42%	42%	43%	43%
Slovenia	32%	31%	32%	33%	34%	33%	32%	32%	32%	33%	35%
Montenegro	46%	42%	43%	49%	51%	50%	51%	50%	52%	54%	61%
North Macedonia	16%	15%	17%	18%	19%	22%	24%	25%	25%	24%	24%
Albania	75%	66%	72%	63%	71%	79%	82%	91%	92%	93%	100%
Serbia	28%	28%	29%	28%	30%	29%	29%	27%	29%	30%	31%
Bosnia and Herzegovina	41%	39%	37%	39%	41%	41%	41%	40%	41%	45%	
Kosovo	1%	1%	1%	2%	2%	2%	4%	4%	4%	5%	5%

Source: Eurostat

Share of RES in Electricity Generation in Greece, 2010-2020



Source: Eurostat

Cover of SE Europe Energy Outlook 2021/2022

Energy Demand and Supply Projections in SEE

- The projections for the development of the energy systems of the SEE countries under **a "Baseline" scenario** approach was considered appropriate in order to present the possible future pathways paved by current policies.

- The **most recently available studies** and the **official country submissions of strategic documents** (such as the Integrated National Energy and Climate Plans) were used in order to collect and analyse these projections.

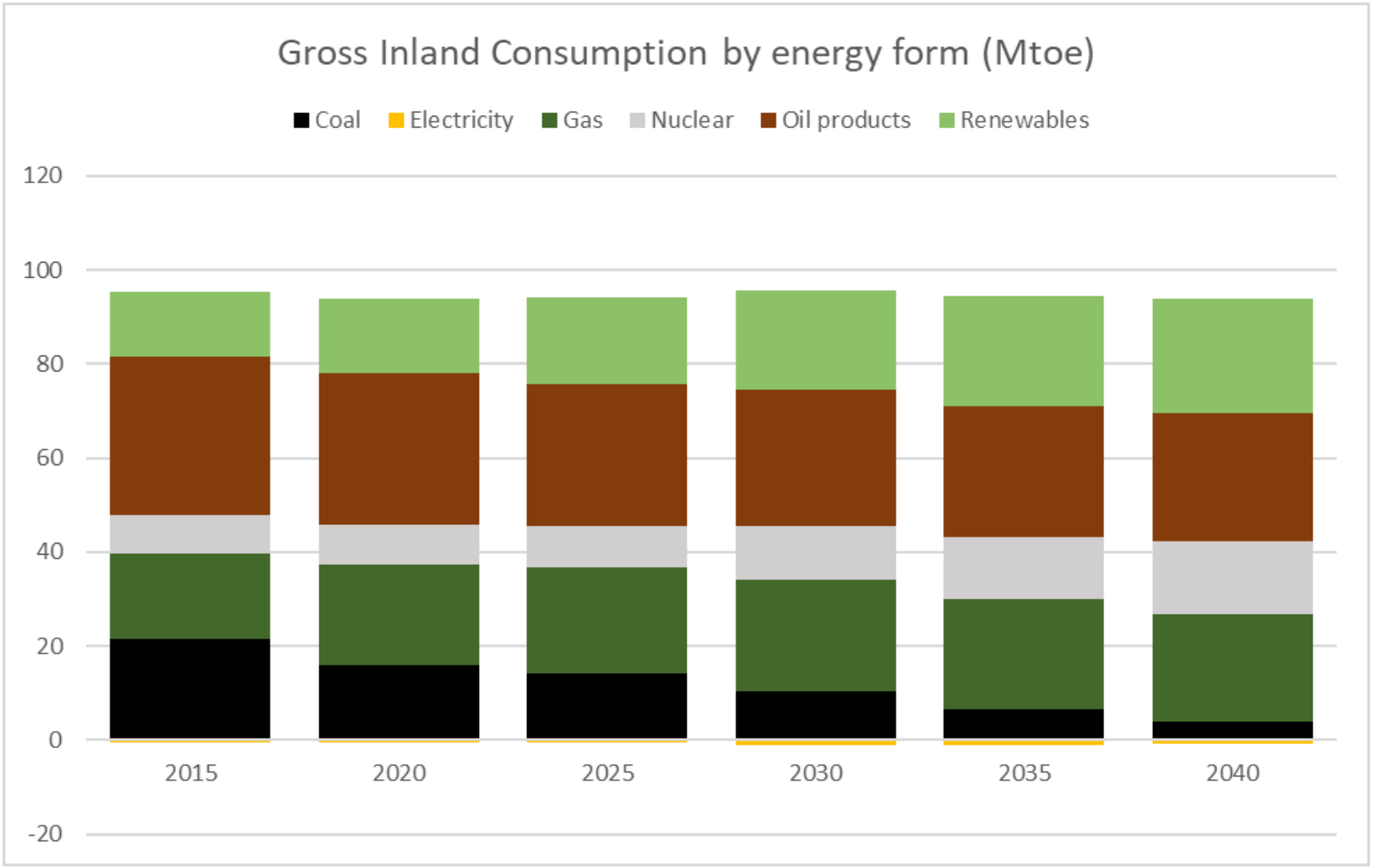
- The purpose is to present the evolution of the national energy systems corresponding to a **"where we are heading" storyline**, providing a simple but comprehensive picture of the energy and GHG emissions dynamics under the "current policy" efforts until 2040.

- **It should be noted that most of the available analyses do not include the effect of the COVID-19 pandemic and its possible long-term effects to the macroeconomic development and the energy systems of the countries in the region.**

Results per Group of Countries

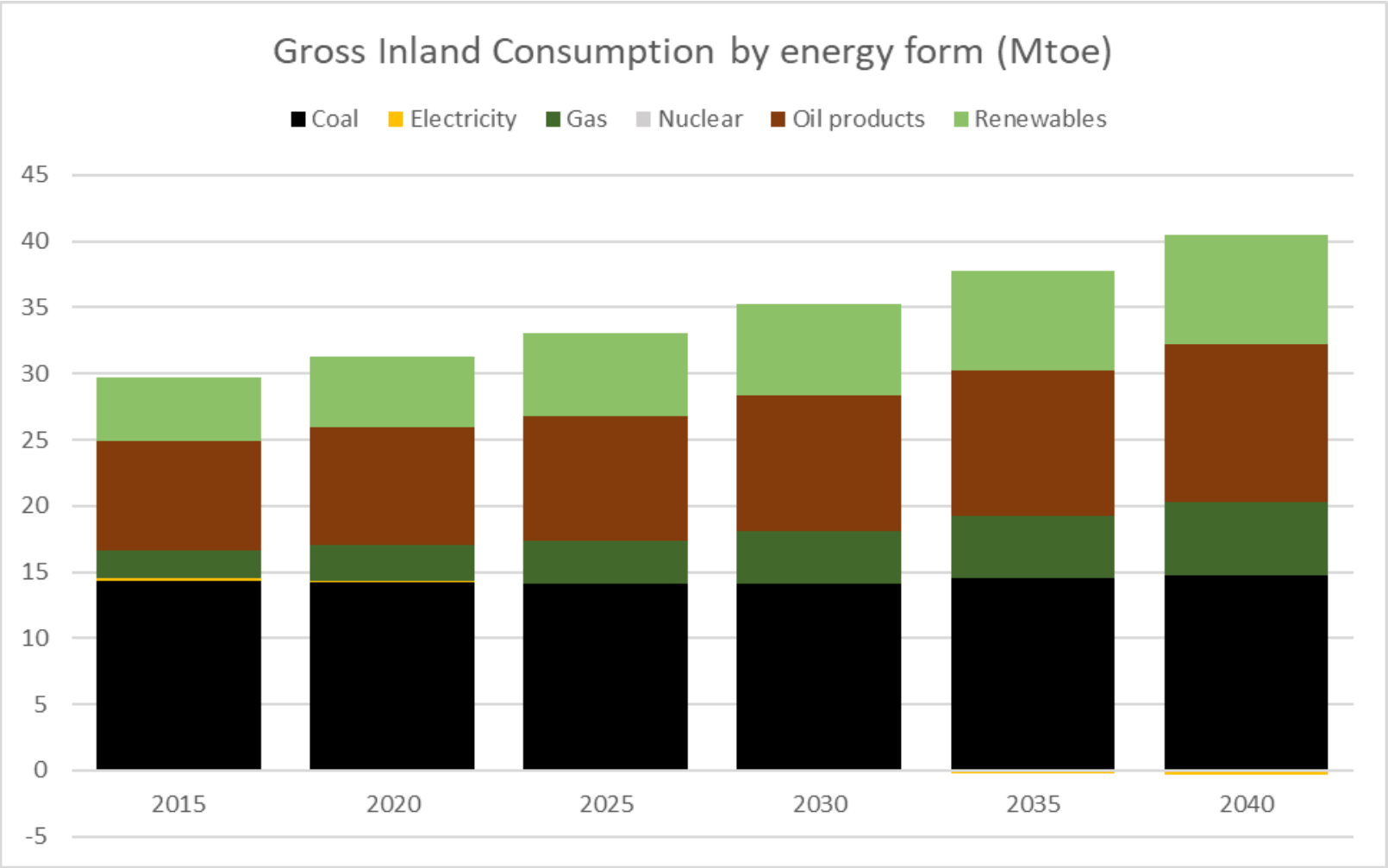
- Looking at the projection of the gross inland consumption in the **EU member states of the SEE region** (Bulgaria, Croatia, Cyprus, Greece, Romania, Slovenia), the overall tendency shows a stabilisation and even a small reduction in the time horizon to 2040.
  - The decrease of the use of coal is evident, reaching a minimum level by 2040 while oil products lose part of their share in the GIC. The winners to this change are renewable energy and nuclear energy. The group remains a net importer in the time horizon until 2040, but the import dependency is reduced between 2020 and 2030 and then stabilised at a level close to 42% until 2040. Crude oil and oil products cover the majority of imports (68% in 2040), imports of coal are reduced significantly, while imports of natural gas remain at a level close to 12 Mtoe after 2030.
- The projection of Gross Inland Consumption in the **six Western Balkan countries** (WB6: Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia and Serbia) presents a rather different story from that of the EU member states in the region.
  - Following the expected growth of GDP, GIC is projected to increase by almost 40% between 2015 and 2040, with the amount of coal being held almost constant, close to 15 Mtoe. Natural gas is the emerging fuel with a constant gradual increase, connected with the pipeline expansion projects in the Western Balkans region. Crude oil and oil products increase by 45% reaching 12 Mtoe in 2040, and renewable energy increases substantially (by 70%) to 8.3Mtoe in 2040, but still covers only 20% of the total GIC of the group of countries. The group remains a net importer of energy and furthermore, import dependency increases to a level of 42% in 2040 (from 33% in 2015). Crude oil and oil products cover the largest part of imports reaching almost 11 Mtoe by 2040 and the imports of natural gas are continuously increasing, reaching 5.4 Mtoe in 2040.
- In **Turkey**, gross inland consumption is projected to increase by more than 50% between 2020 and 2040. The role of renewable energy is seen to increase notably, reaching 28% of the GIC in 2040, the amount of coal remains at the level of 50 Mtoe with its relative contribution being reduced to 23% in 2040 and the contribution of natural gas is decreased to 17% of the GIC. Nuclear energy appears for the first time in the GIC of Turkey after 2025 with the operation of the Akkuyu nuclear power plant and is increasing until 2050, following the nuclear expansion program of the country.

EU Member States in SE Europe: Gross Inland Consumption (2015-2040)



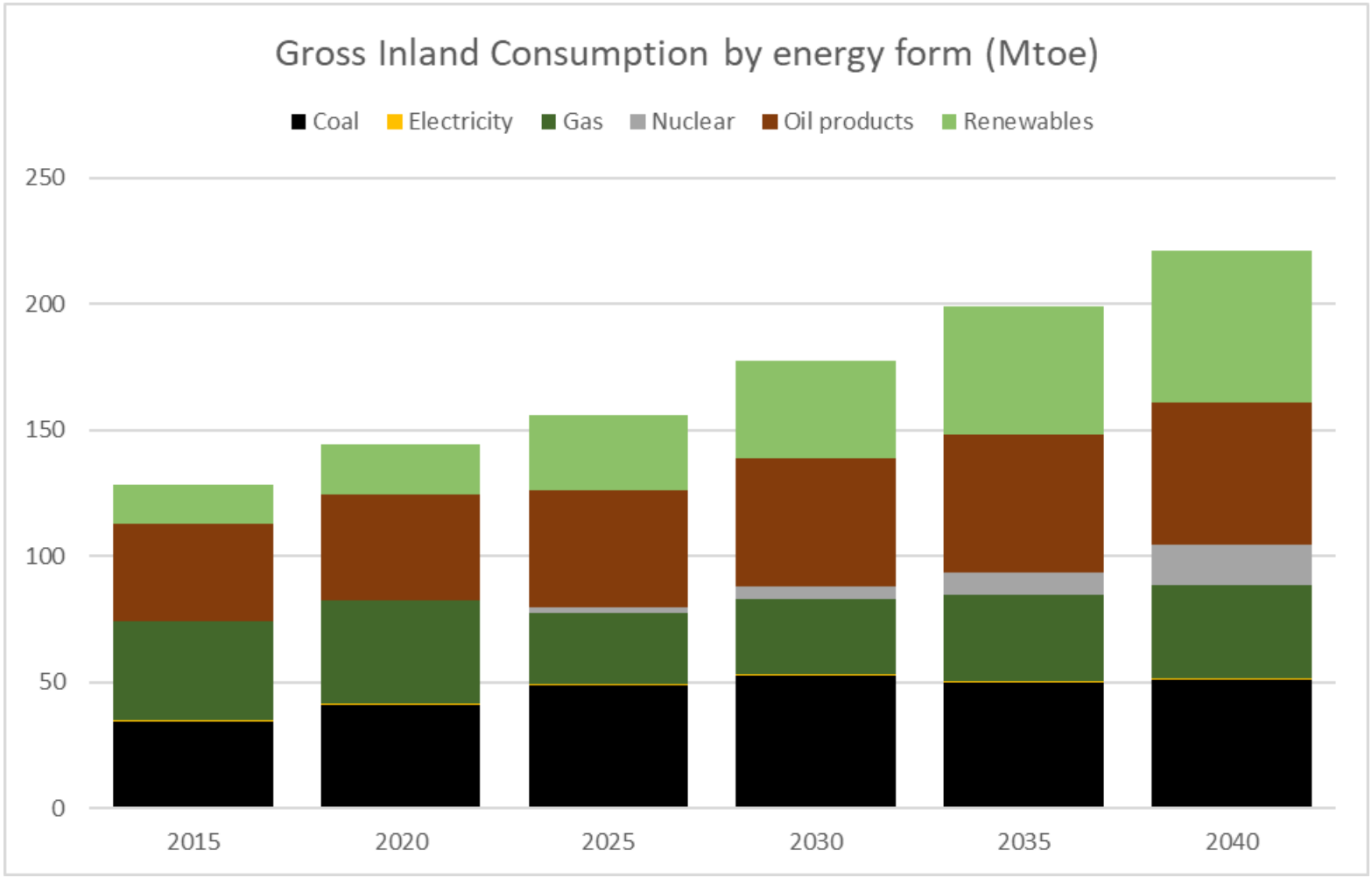
Source: IENE study “SE Europe Energy Outlook 2021/2022”, Athens, 2022

Western Balkan Countries: Gross Inland Consumption (2015-2040)



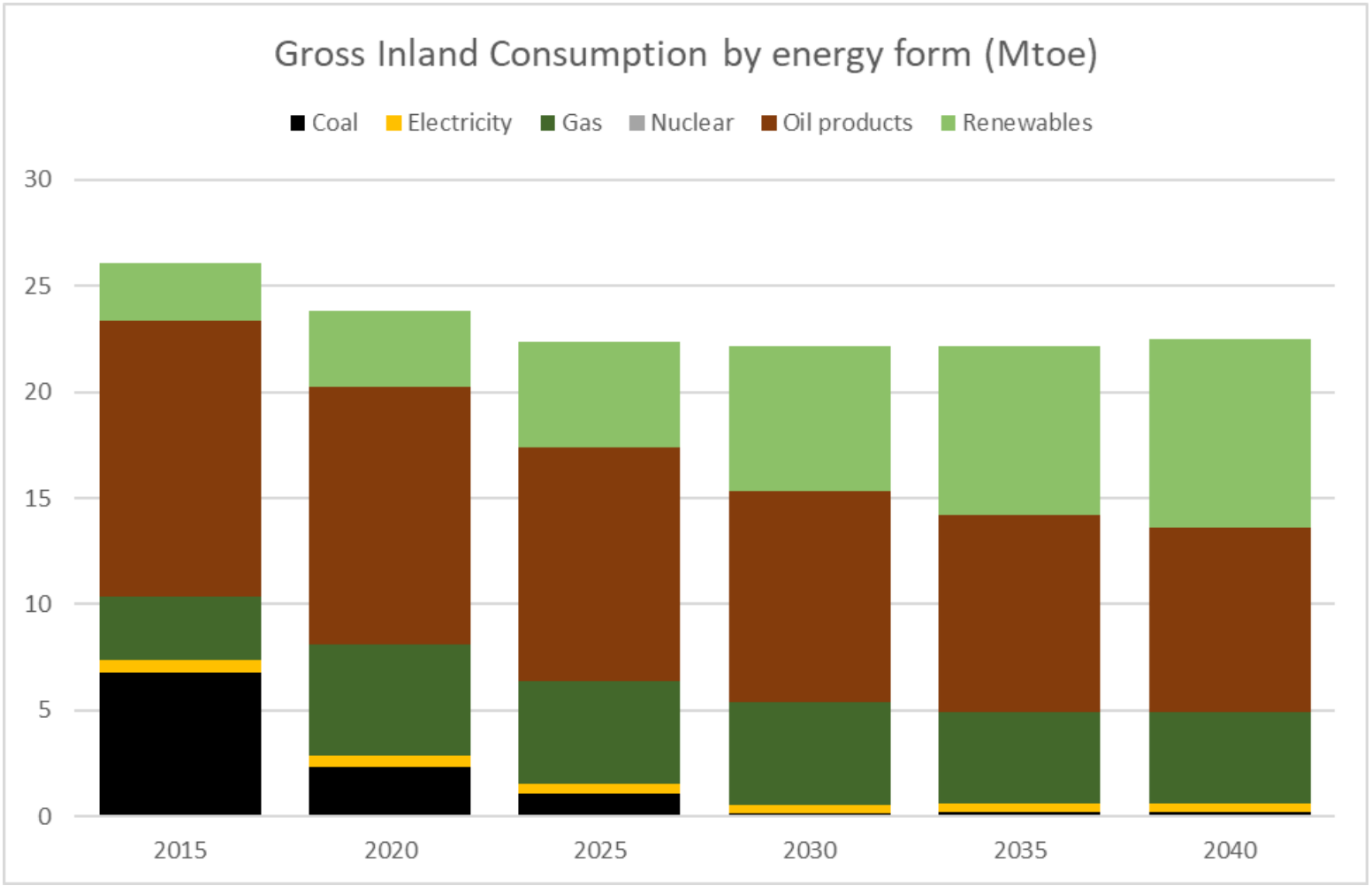
Source: IENE study “SE Europe Energy Outlook 2021/2022”, Athens, 2022

Turkey: Gross Inland Consumption (2015-2040)



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

Greece: Gross Inland Consumption (2015-2040)



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

SEE Energy Investment Outlook 2021-2030

- The **investment prospects** in the energy sector of SE Europe over the next 10 years can only be described as **positive**.

- In terms of planned investments, a group of **five countries (i.e. Turkey, Bulgaria, Romania, Serbia, Greece)** appear to be moving **much faster than others** in attracting the needed investment for a variety of energy projects, while progress in the rest of the countries is moving more slowly.

- The region as a whole can be considered as presenting **attractive business opportunities in almost all branches of the energy sector**. The present analysis shows that investment in the energy sector will be spread as follows between countries and interregional projects.

Findings of SEE Energy Investment Outlook Per Country (2021-2030)

Country	Estimated Investment (mn €) 2021 Estimate	Estimated Investment (mn €) 2017 Estimate	GDP growth 2021 (%) IMF World Economic Outlook	GDP growth annual projection to 2025 (%)
Albania	4,500	7,460	5.3	**3.5-4.5**
Bosnia and Herzegovina	9,400	8,722	2.8	**3-3.2**
Bulgaria	47,000	11,050	4.5	**3.1-4.5**
Croatia	21,000	8,525	6.3	**3.2-5.8**
Cyprus	16,200	7,350	4.8	**2.7-3.6**
Greece	44,400	23,300	6.5	**1.5-4.6**
Hungary	25,300	-	7.6	**2.6-5.1**
Israel	39,300	-	7.1	**3.2-4.1**
Kosovo	7,400	2,605	4.8	**n/a**
Montenegro	4,600	2,400	7.0	**2.9-5.6**
North Macedonia	10,400	3,400	4.0	**3.6-4.2**
Romania	50,100	20,630	7.0	**3.6-4.8**
Serbia	15,200	11,260	6.5	**4.0-4.5**
Slovenia	12,100	3,185	6.3	**2.9-4.6**
Turkey	130,000	124,935	9.0	**3.3**
TOTAL	**436,900**	**234,822**		

NB. Hungary and Israel were not included in the 2017 SEE Country Survey and hence no estimates have been prepared by IENE.

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

Findings of SEE Energy Investment Outlook Per Sector (2021-2030)

	Project sector	Description	2021 Investment estimate (€ mn)	2017 Investment estimate (€ mn)*
OIL	Upstream	• Field Exploration • Development of new oil and gas wells	63,000	38,790
	Downstream	• Refining (upgrading) • Loading Terminals • Storage facilities • Crude / Product Pipeline(s)		
GAS	Country Gas Network	• Grid development • Main intra country pipeline(s) • Storage facilities • FSRU and LNG Terminals	25,150	16,550
ELECTRICITY	Power Generation	• Lignite • Coal • Gas (including CHP) • Nuclear • Large Hydro	150,150	139,550
	Electricity Grid	• New H/V transmission lines • Upgrading and expansion of existing grid		
	RES	• Small Hydro • Wind farms • Photovoltaics • Concentrating Solar Power • Biomass (including liquid biofuels) • Geothermal	109,900	40,009
ENERGY EFFICIENCY		• Buildings • Industry • Electric vehicles	88,700	-
	Total anticipated investments by 2021-2030		436,900	234,822
	Gas infrastructure		23,303	33,350
	Electricity Interconnections		8,440	4,700
	Cross-border energy projects (total)		31,743	38,050
	Grand Total		**468,643**	**272,872**

*(1) This estimate refers to Scenario A as stated in SEE Energy Outlook 2016/2017, p. 1123-1124.
(2) No investment estimates for Energy Efficiency applications were provided in the SEE Energy Outlook 2016/2017.

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

Findings of 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

Sources of Finance

- The **main sources of finance** for planned energy infrastructure projects in SE Europe include:
  - Government/own resources
  - International Financial Institutions (IFIs)
    - European Commission
    - European Bank for Reconstruction and Development (EBRD)
    - European Investment Bank (EIB)
    - World Bank
    - German government-owned development bank KfW
    - European Western Balkans Joint Fund (EWBJF)
    - International Development Association (IDA)
  - Commercial banks/private investors
  - Financial facilities for investments in energy efficiency and renewable energy

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