"Green Energy Investment Challenges in SE Europe"

10th Green Energy Investments Forum

16th International Conference on Energy and Climate Change

Organised by PROMITHEASnet,

Energy and Climate Change Policy Centre (KEPA), University of Athens

Athens, October 11, 2023

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INSTITUTE OF ENERGY
FOR SOUTH EAST EUROPE

Introductory Remarks

- This is a short presentation focusing on Decarbonisation in SE Europe and the Green Investment outlook
- The geographical area which is covered is described in the map which follows and defines the SE European Region: Core countries and Peripheral Countries
- The IENE follows systematically the core countries in terms of energy and economic statistics, energy flows,investment and geopolitical developments
- The figures and information which are included in this presentation are drawn from the Institute's extensive data base and from its flagship publication, the " SE Europe Energy Outlook 2022"
- The IENE is an independent non governmental and non profit organisation which works across the entire SEE region. The Institute is funded by its partners and by the energy industry in the various countries it operates. The IENE publishes regularly its findings through various publications but also through its official web site, www.IENE.eu

The SE European Region Defined

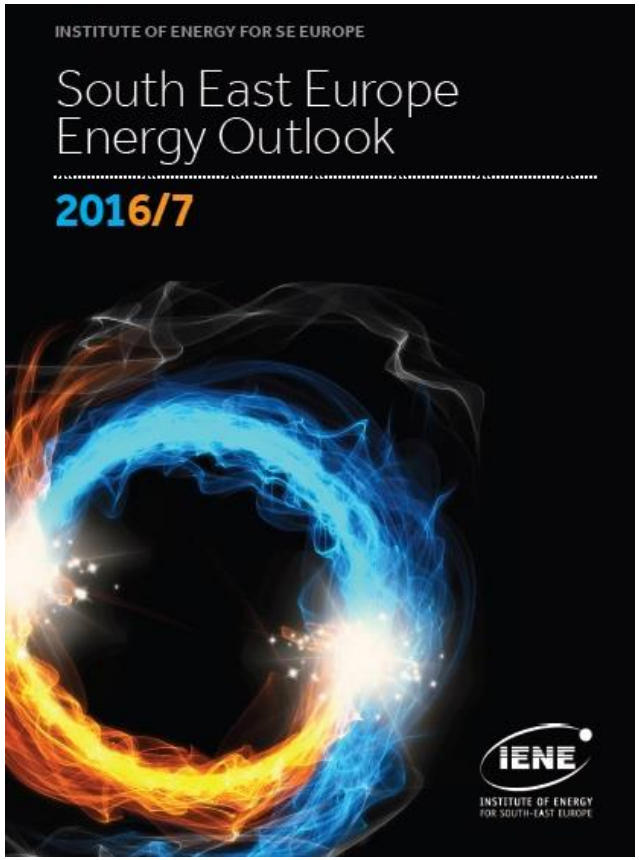
Core countries

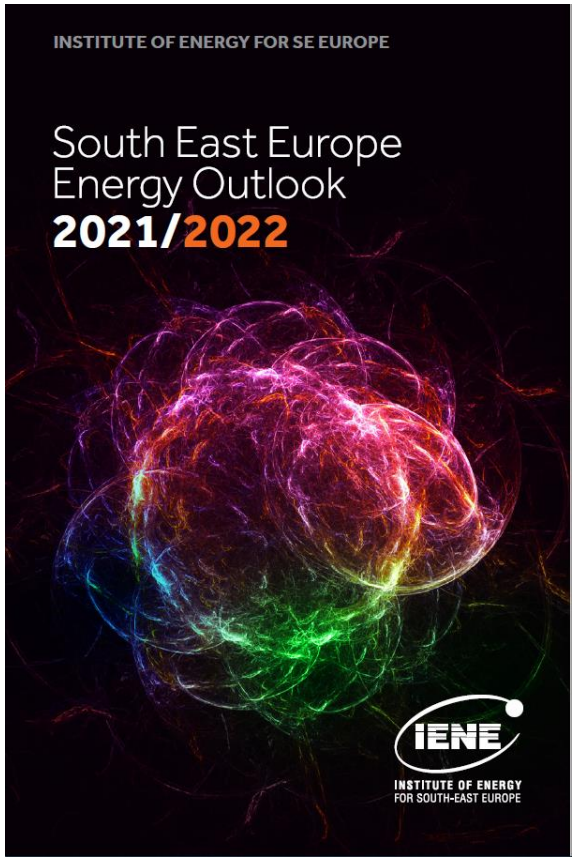
- Albania
- Bosnia and Herzegovina
- Bulgaria
- Croatia
- Cyprus
- Greece
- Hungary
- Israel
- Kosovo
- Montenegro
- North Macedonia
- Romania
- Serbia
- Slovenia
- Turkey

Peripheral countries

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

SE Europe Energy Outlook





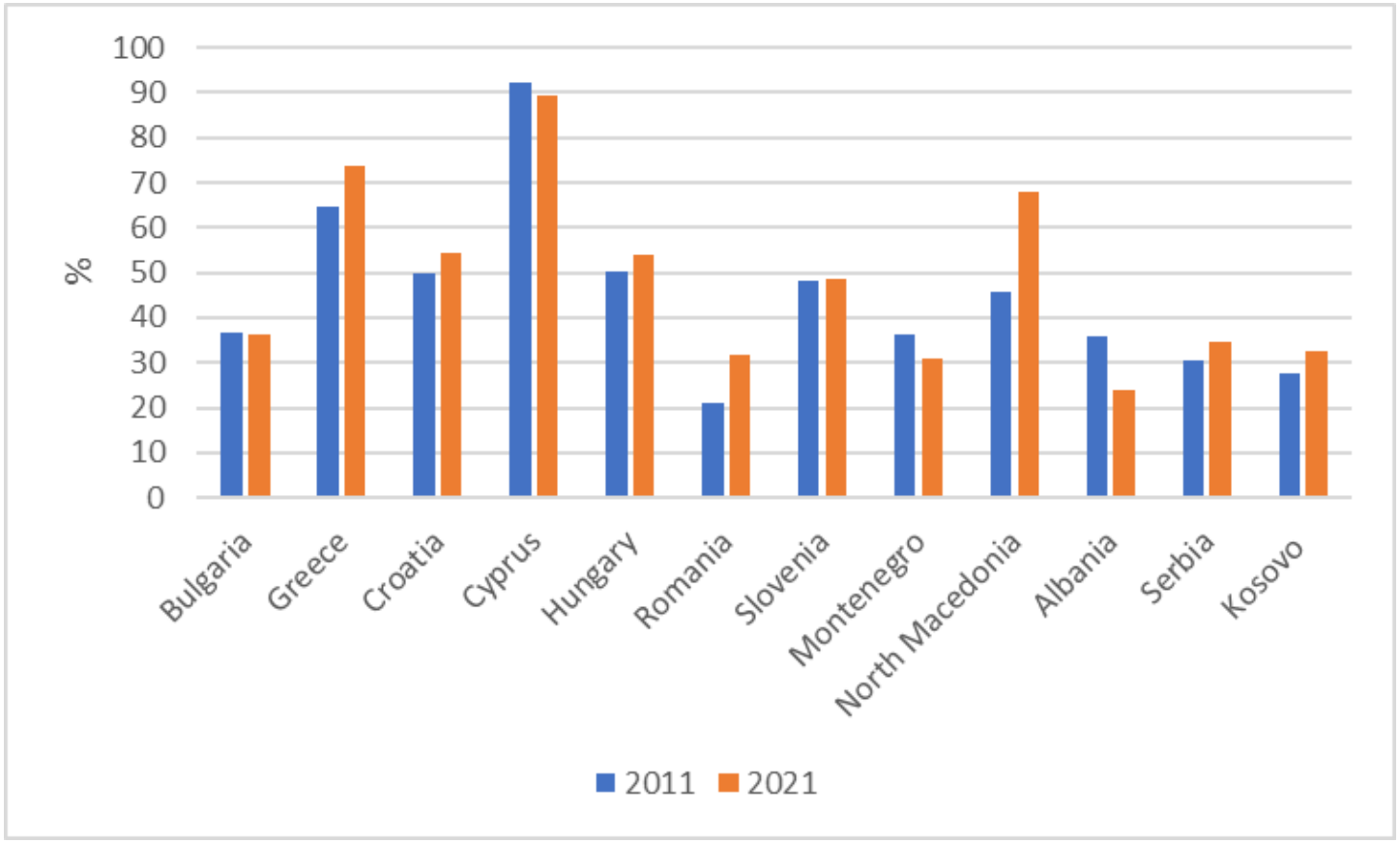
2020 Basic Energy Data for SE Europe, Including Turkey

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 magnitude of the region's oil, gas and electricity consumption is not insignificant compared to the total numbers involved at EU level.

High Energy Dependence in SE Europe (2011 and 2021)



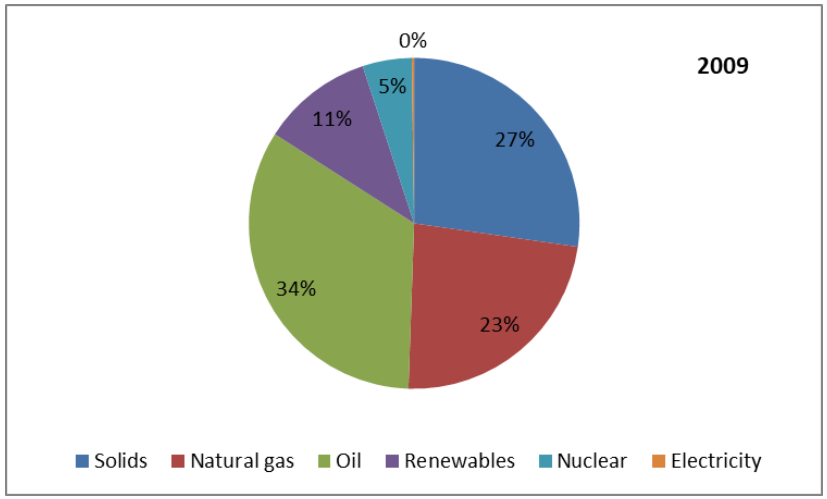
Sources: Eurostat, IENE

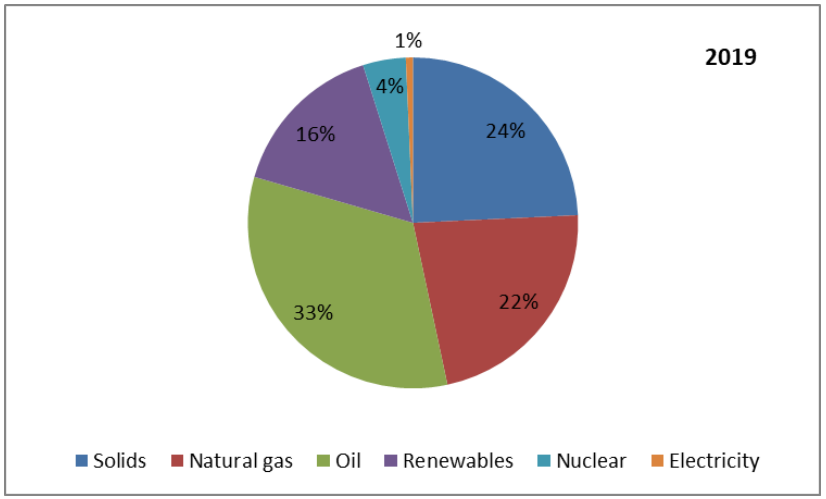
Key Regional Energy Issues

The following stand out as key issues of the regional energy landscape:

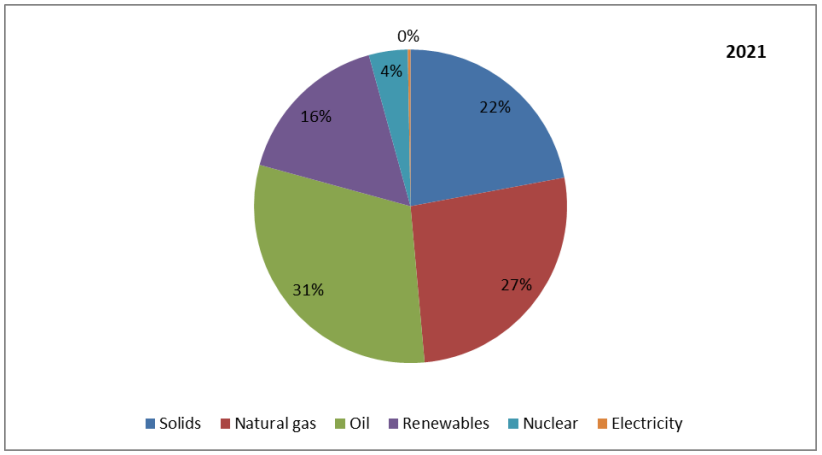
- High oil and gas import dependence (87% for oil and 82% for gas in 2021)
- SEE's path towards decarbonization is uncertain and fraught with difficulties
- Coal/lignite is and will continue for sometime to be relevant in the region
- These is marked divergence between EU and SEE energy strategies
- RES growth impeded due to past and present policy failures and electricity grid constraints
- SEE is more energy security vulnerable than the rest of Europe
- Gas has emerged as a strategic fuel during latest energy crisis, especially LNG
- Electricity's newcomer gas alters the supply balance
- Lack of adequate electricity and gas interconnections
- Nuclear remains a viable option for SEE power generation
- The quest for a more balanced energy mix could be the answer to several key issues (i.e. energy security, decarbonization)

SE Europe's Energy Mix, Including Turkey, 2009, 2019 and 2021 - High Oil and Gas Import Dependence



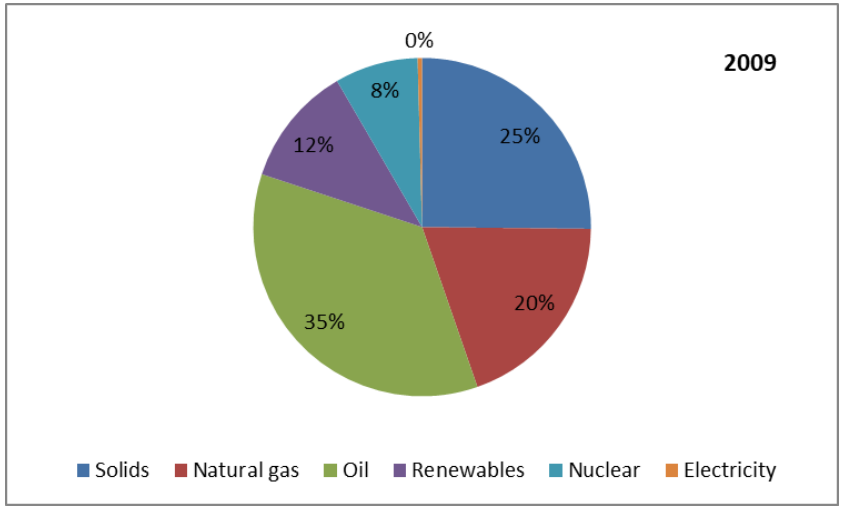


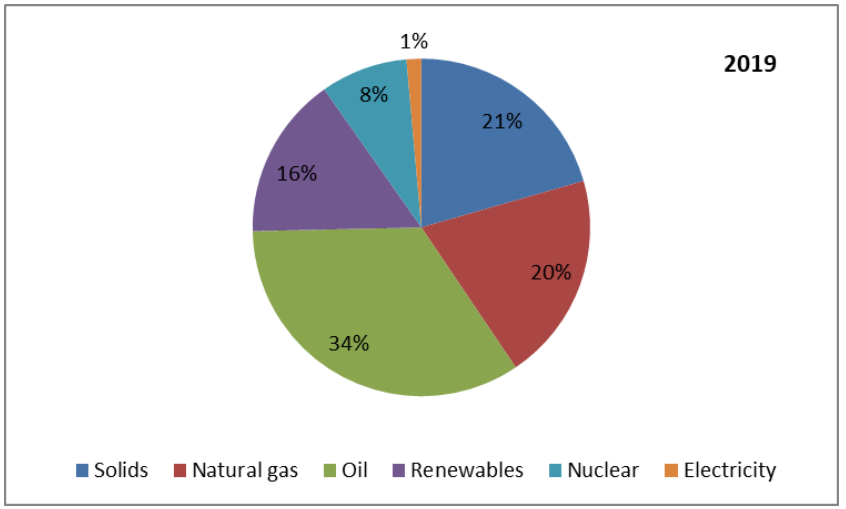
Over the last 10 years, we notice decreased solid fuel use, a marginal increase in gas consumption, a marginal drop in oil use, much higher RES deployment and less nuclear use.



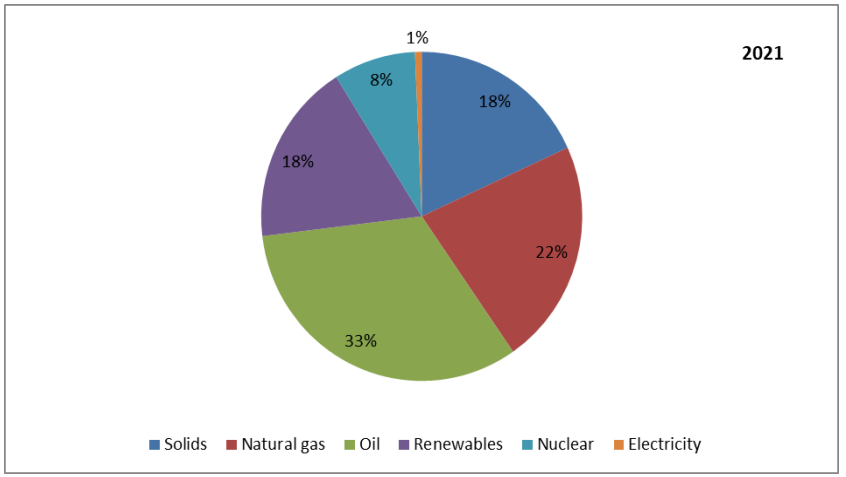
Source: Eurostat

SE Europe's Energy Mix, Without Turkey, 2009, 2019 and 2021 - High Oil and Gas Import Dependence





Over the last 10 years, we see considerably less solid fuel use, higher gas consumption, marginally less oil use, much higher RES deployment and steady nuclear use.



Source: Eurostat

Key Regional Energy Issues – Decarbonisation in SE Europe

Challenges and Trends Towards SE Europe's Decarbonisation:

- The **coal predicament** of SE Europe – the region's great dependence on coal-fired power generation vs GHG emission reduction targets
  - According to IENE estimates, the **share of solid fuels to power generation** is anticipated to **increase steadily** in several countries of the region (most notably in Serbia, Kosovo, Croatia, Bosnia and Herzegovina, Montenegro and Turkey) over the next 10-15 years, as they will struggle to meet increased demand.
  - **North Macedonia and Serbia are the second most coal dependent countries after Kosovo at regional level**, while proposed lignite-based/coal-fired power plants in Bosnia and Herzegovina and Serbia would not be in line with EU climate targets, and would downgrade the solar PV, wind, hydropower, and biomass opportunities in the region.
  - **Effective climate change policies in SE Europe have not been implemented so far**, but there is still room for change in order to avoid becoming further "locked in" to the use of fossil fuels.
  - In SE Europe, **economic development**, largely based on the utilization of indigenous lignite/coal resources, **will have to be reconciled with COP 26 commitments**. Therefore, the planning of clean-cut and compatible long-term energy and economic strategies becomes a real challenge.
    - A lot more analytical and assessment work (e.g. examine CCS/CCU options) needs to be undertaken before introducing realistic policies for decarbonisation.

Coal-fired Power Capacity by Country (MW) in SE Europe – July 2023

Country	Announced	Pre-permit	Permitted	Announced + Pre-permit + Permitted	Construction	Shelved	Operating	Mothballed	Cancelled 2010-2023	Retired 2000-2023
Albania	0	0	0	0	0	0	0	0	800	0
Bosnia and Herzegovina	0	1.450	0	1.450	0	1.130	2.090	0	2.620	0
Bulgaria	0	0	0	0	0	0	4.569	540	2.660	1.380
Croatia	0	0	0	0	0	0	217	125	1.300	0
Greece	0	0	0	0	0	0	2.885	0	1.250	3.053
Hungary	0	0	0	0	0	0	944	250	3.080	515
Kosovo	0	0	0	0	0	0	1.290	0	830	190
Montenegro	0	0	0	0	0	0	225	0	1.664	0
North Macedonia	0	0	0	0	0	0	824	0	730	0
Romania	0	0	0	0	0	0	2.295	660	5.705	4.780
Serbia	0	0	0	0	350	1.350	4.435	32	1.445	0
Slovenia	0	0	0	0	0	0	1.069	0	0	535
Türkiye	1.000	1.388	2.920	5.308	145	4.320	20.453	400	89.068	0

Source: EndCoal

EU Energy Policy Framework: How Does This Stand for SE Europe? (I)

- It seems that an **inverted pyramid arrangement** has been developed in SE Europe, compared to pursued official Energy Union policies and stated targets as economic development, at any cost, remains number one priority for most countries.

- The energy policy priorities in broad terms for SEE would appear as follows:
  - Further large-scale development of **coal and lignite resources** by a number of countries without any real recourse CCS/CSU provisions and plans
  - Further development of **electricity and gas interconnections in order to maximise cross border trade**
  - Promotion of **oil and gas exploration activities (onshore and offshore)** aiming towards maximizing production in the mid- and long-term
  - Further development of **renewables** in all application areas (i.e. solar, wind, biomass, hydro and geothermal) without necessarily aiming to adhere to specific targets (set by the EU)
  - Promotion of **energy efficiency**, focusing primarily on the building sector, incentivized by EU and green fund financing facilities
  - **Diversification** of supply routes and suppliers in order to secure future gas supplies
  - Reduction of CO_2 emission levels (least of priorities)

EU Energy Policy Framework: How Does This Stand for SE Europe? (II)

- In spite of EU's ambitious targets set for its member countries in the region, **progress towards decarbonization has been extremely slow to say the least**, with the exception of Greece, with a number of countries actually proceeding with the construction of new lignite fueled plants (e.g. Türkiye, Kosovo, Bosnia-Herzegovina and Serbia).

- These countries continue to view their energy future aligned with the **continuing exploitation of their abundant indigenous coal resources which cover a substantial part of base load needs.**

- Although there is ample EU support for large-scale use of RES and energy efficiency schemes, **no such support or encouragement exists for the further use of nuclear generated power which could cover the region's growing energy requirements.**

Decarbonisation and Related Technologies

- Decarbonisation in the region can be pursued in two parallel streams:
  - through **policy**, which incorporates the aforementioned energy mix issue and economic assessment through which the rate of decarbonization is determined.
    - The main question arising therefore is **how the rate of decarbonization can be related to economic development and what the investment implications are** and
  - through **technology**, whose degree of deployment depends on the policies to be implemented and could contribute significantly towards decarbonisation through, for instance, the use of CCS/CCU or dual-fuel power plants.
- There is no agreed regional roadmap towards decarbonisation, while cooperation between the countries in the region focus on energy security.
- There is an urgent need to introduce latest technologies in order to improve decarbonisation efforts, energy efficiency and upgrade operation of existing networks (e.g. CCUS, solar thermal systems, power electronics, energy storage)

Energy Demand and Supply Projections in SEE - Methodology (I)

- In the context of the "SEE Energy Outlook" and given the amount of data collected and analysed, it is important to be in a position to estimate future demand and supply trends under certain assumptions.
- The **TIMES model** was used for estimating future demand and supply trends.
  - It combines two different, but complementary, systematic approaches to energy modelling: a technical engineering approach and an economic approach. TIMES is a technology rich, bottom-up model generator, which uses linear-programming to produce a least-cost energy system, optimized according to a number of user constraints, over medium to long-term time horizons.
- 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.**

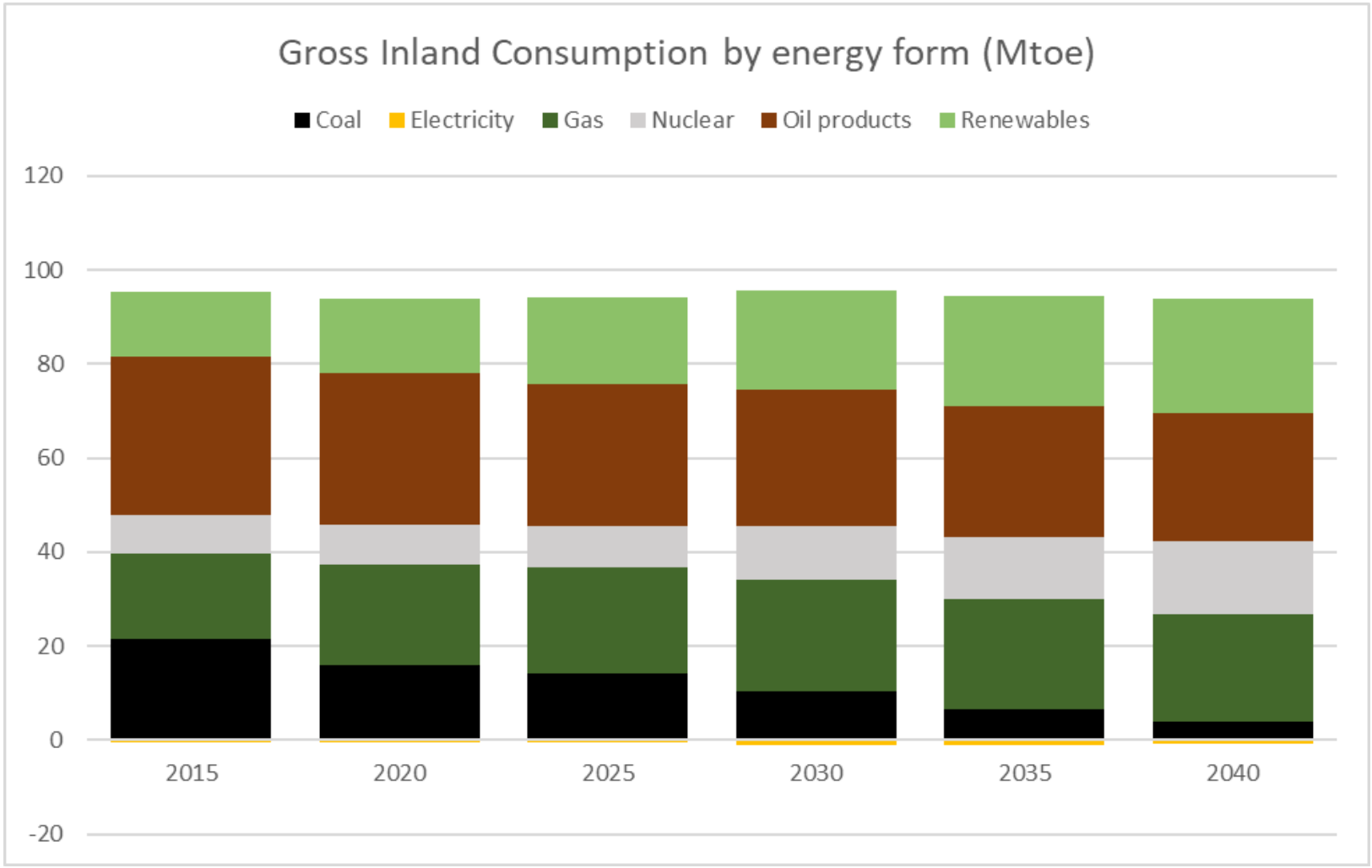
Energy Demand and Supply Projections in SEE - Methodology (II)

- The analysis has been conducted by means of a review of the **most recent published sources** at country and regional level. **Data have been extracted, converted and in some cases processed, and used to generate six main energy and climate indicators at country level:**
  - Net import by energy commodity.
  - Gross Inland Consumption (GIC) by energy commodity.
  - Electricity generation by type.
  - Final Energy Consumption (FEC) by energy commodity.
  - Final energy consumption by sector.
  - GHG emissions (excluding LULUCF) with the GDP evolution.
- **Additional indicators and analyses** were derived from the combination of the above-mentioned basic information; for example, intensities were calculated as ratios (e.g. FEC over GDP or GHG emissions over GIC).
- A **consistency check of the data** has been carried out to validate and keep full consistency over the reported energy chains (energy imports - gross inland consumption – transformation sector - final energy consumption – related GHG emissions). In some cases, it was necessary to make a **few inserts or adjustments to the original data to fill in some gaps**.

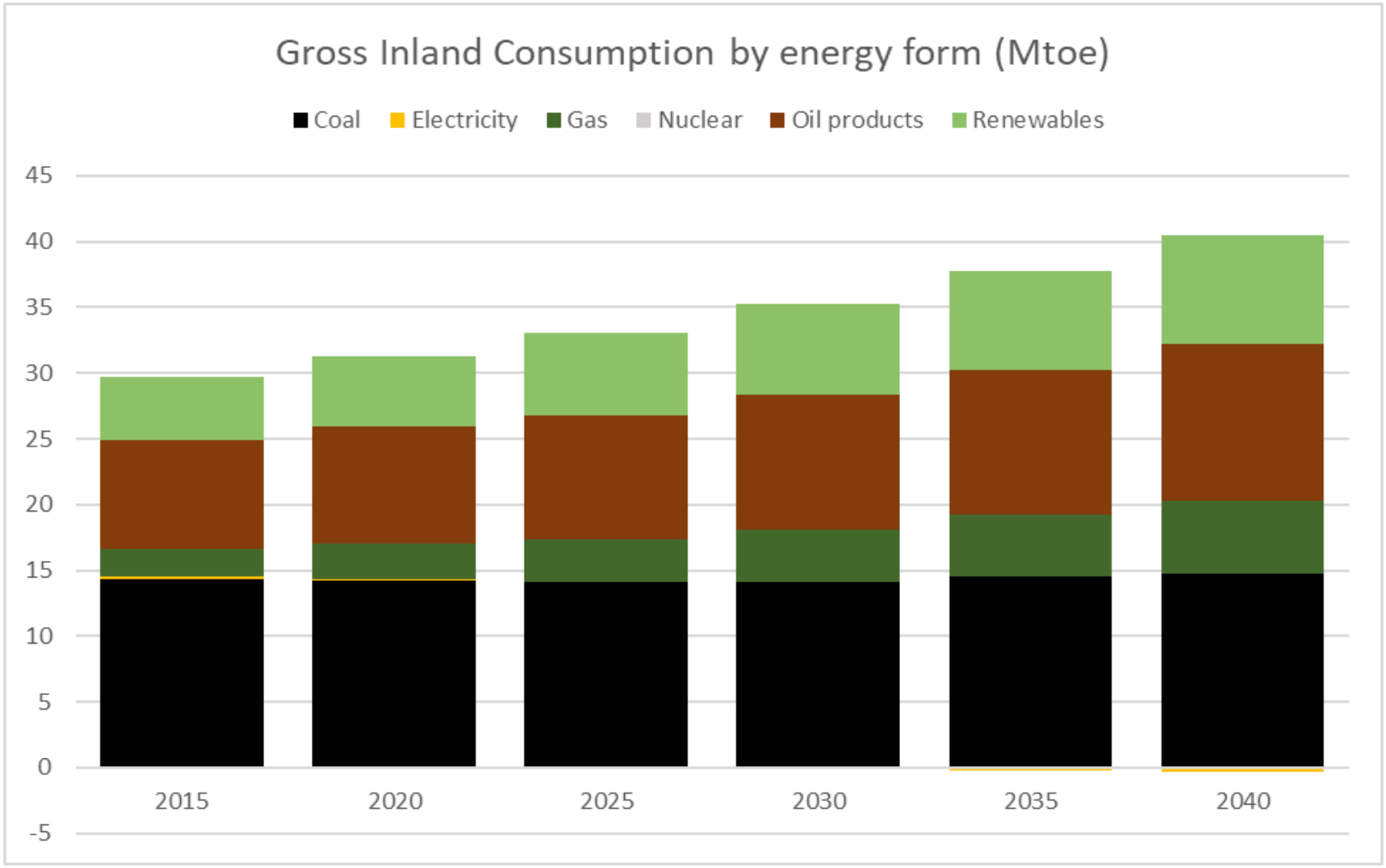
Scenario Results per Group of Countries

- **Results are presented per Group of Countries - EU Member States, West Balkans and Turkey**
- 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.

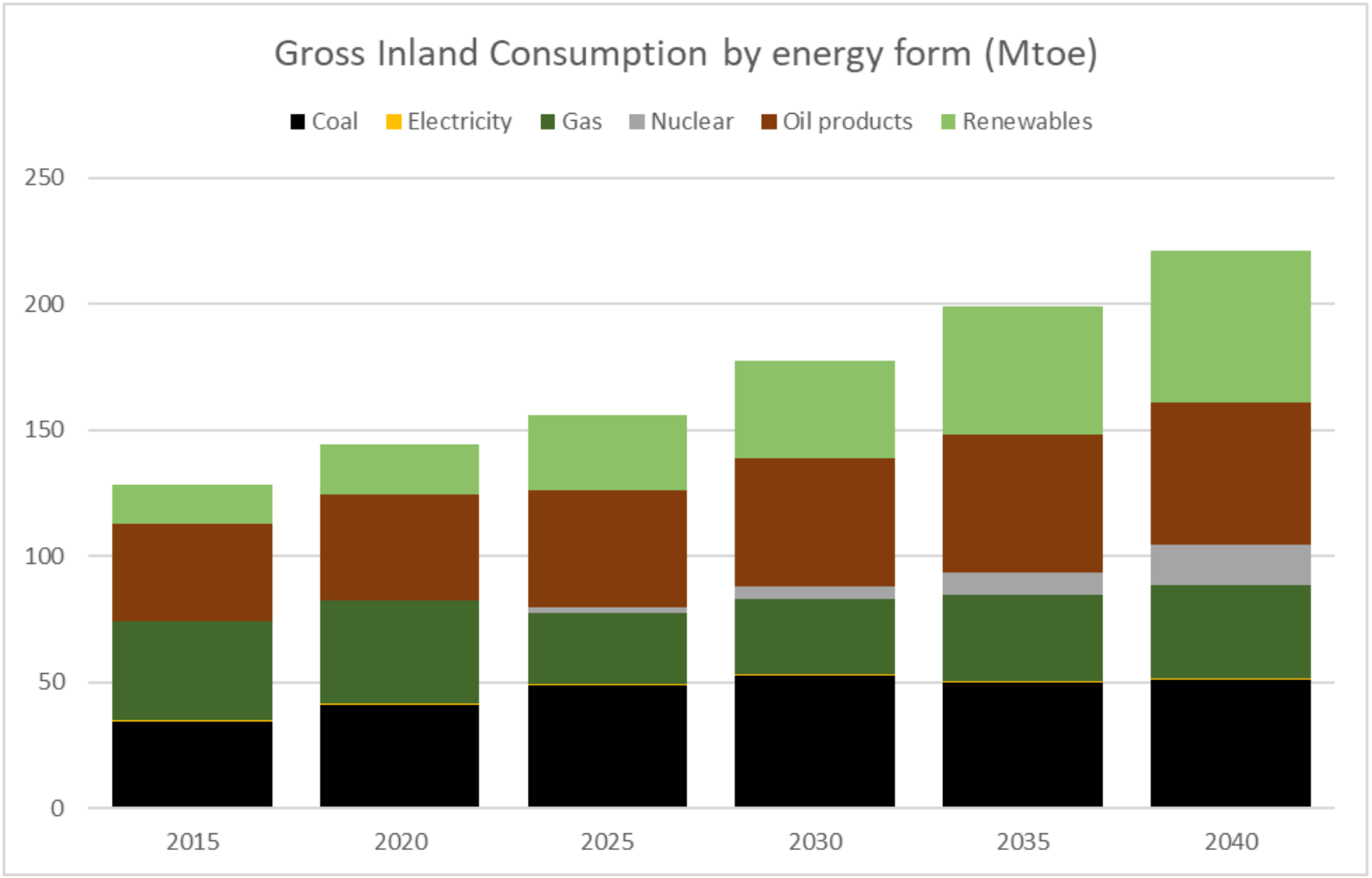
EU Member States in SE Europe: Gross Inland Consumption (2015-2040)



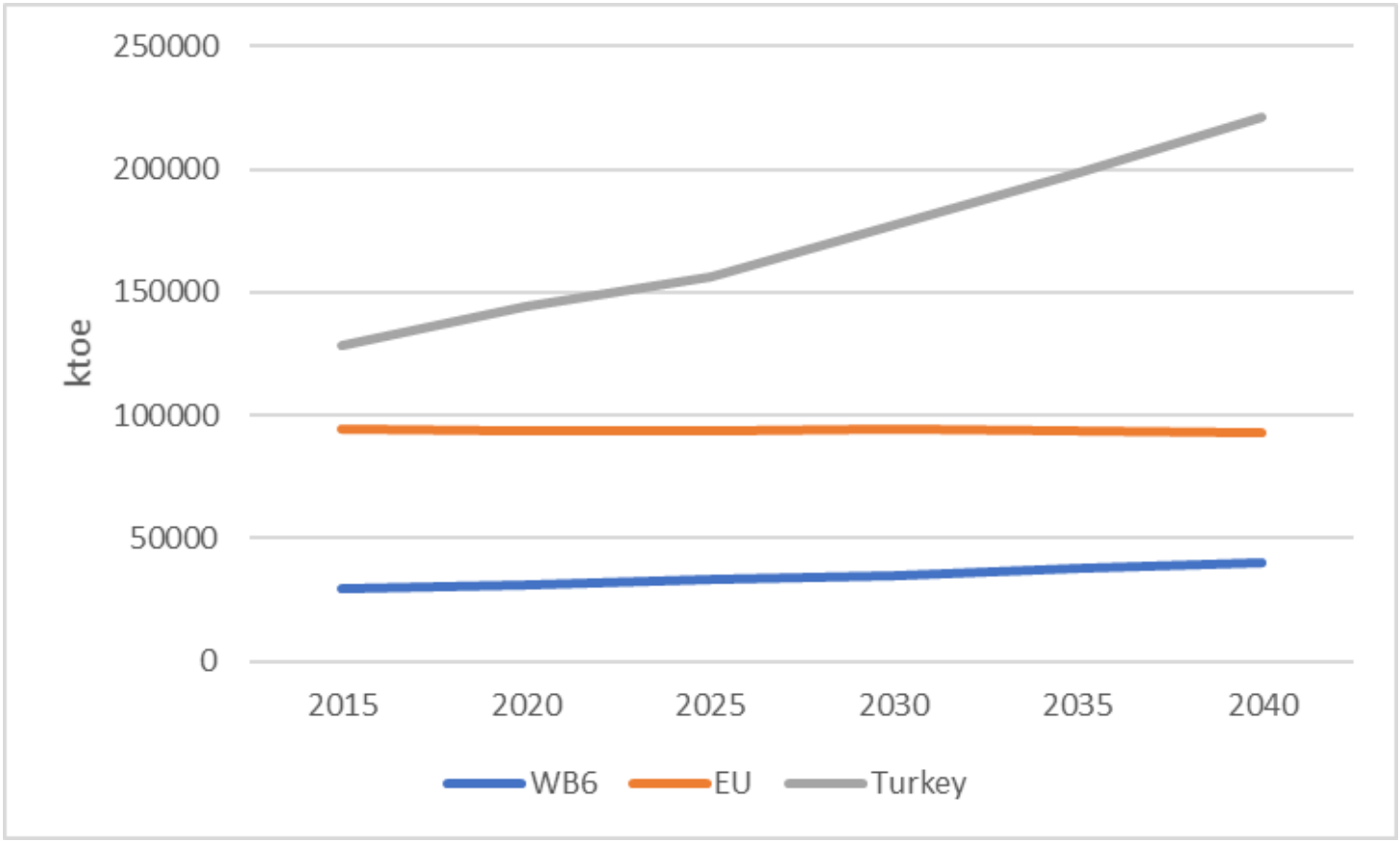
Western Balkan Countries: Gross Inland Consumption (2015-2040)



Turkey: Gross Inland Consumption (2015-2040)



Gross Inland Consumption in SE Europe per Group of Countries (2015-2040)



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.
- Compared to investment estimates made in the 2017 edition of IENE's "SEE Energy Outlook", the current estimates for energy related investments in SEE are much higher (+€137.5 billion) for the 13 country reference group, indicating strong interest for investments in the region.

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.

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.

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