Executive Summary

One of the main difficulties the IENE encountered when undertaking the project of compiling a comprehensive energy atlas for SE Europe was determining the boundaries of the region under study. This challenge was compounded by the fact that contributors to all previous SEE Outlook reports (2011, 2017, and 2021) —as well as the current edition—came not only from a variety of scientific disciplines and business backgrounds, but also from a wide range of countries, including Albania, Bulgaria, Croatia, Cyprus, Serbia, and Türkiye.

Defining SE Europe[1] as a distinct energy system is problematic, just as it is difficult to view it as a unified political sub-system within contemporary European geopolitics. Ultimately, the region that was delineated proved to be highly diverse in political, cultural, and economic terms, making it impossible to "separate" it from other, more cohesive and politically distinct areas such as the Middle East or the Former Soviet Union. These neighbouring regions also include major oil and gas producers that export energy to SE Europe, thereby creating both risks and opportunities. This enduring diversity and complexity remain among the defining features of SE Europe.

Map **The SE European Area Defined**

CORE COUNTRIES		PERIPHERAL COUNTRIES	
Albania	Hungary	Azerbaijan	Syria
Bosnia and Herzegovina	Montenegro	Ukraine	Lebanon
Bulgaria	Romania	Austria	Jordan
Croatia	Serbia	Italy	Egypt
Cyprus	Slovenia	Slovakia	
North Macedonia	Türkiye		
Greece	Israel		
Kosovo	Moldova		

[1] The region under study by IENE, consists of the following countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, North Macedonia, Greece, Kosovo, Hungary, Montenegro, Romania, Serbia, Moldova, Slovenia, Türkiye, and Israel.

A region, which has been moving slowly, but steadily over the last 20 years or so towards a new path of economic prosperity, political democratisation and geostrategic stability – if not yet – reconciliation, within a common European and Euro-Atlantic future.

The historical and political framework of the SEE region is detailed in Chapter 1, along with the role that energy can play in creating and deepening the economic synergies, which are necessary in order to keep the region both in peace and en route to a better and more integrated European future. West Balkans is recognised as an area of special significance within the broader SEE region.

The level of market liberalisation and integration, both within the area and between the region and the EU Member States that surround it, remains incomplete to the detriment of the region's economic/energy rehabilitation and the pace of its prospective inclusion into Euro-Atlantic institutions, and notably the European Union. This emerges as the major challenge and simultaneous impediment for the prospective inclusion of West Balkan states into the European Union as this is not merely an issue of economic underdevelopment.

Although the economies of the SEE region appear widely divergent in terms of structure and level of development, they share a number of challenges, which appear to be common to all. Chapter 2 highlights the economic development challenges of the region and also examines the key economic problems and opportunities facing the various countries.

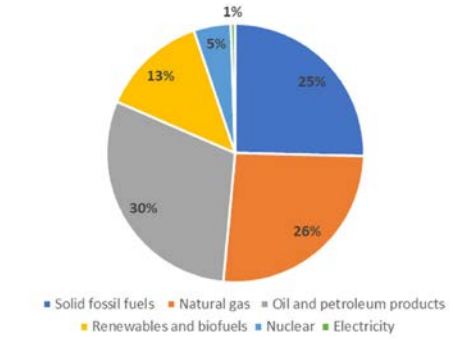
Today, energy policy formulation and decision making in the SE European region is facing tremendous challenges for a number of reasons (see Chapter 3), but primarily related to geography and security considerations, to the existence of abundant but largely unexplored indigenous energy resources, to the divergent demographics, to the great inequalities present in the economies of the various countries and last but not least because of the demands, made by the EU, both to member countries and Energy Community Contracting Parties, for decarbonisation commitments. There is growing concern among many countries in the region which view the aggressive green policies of the EU as an impediment to the economic development because of constantly rising electricity and gas costs which affect already the consumers.

In the group of 16 countries examined in the current "Outlook", seven are full members of the European Union and hence bound by means of current treaties and EU Directives to well-defined energy and environment related policies and specific targets, seven countries in the Western Balkans are Contracting Parties of the Energy Community and have hence embarked on the road of fully adapting their energy legislation to the Energy Acquis, and finally Türkiye and Israel, which have already achieved significant progress in adapting their legislation and market operation to EU requirements, in line with their Association Agreement with the EU.

Looking at the broad map of SE Europe, it is useful to examine the big picture and get acquainted with the key issues which confront the region's energy sector (see Chapter 4). These include the glacial change of the regional energy mix between 2013 and 2023, as shown in Figures 1 and 2, which in spite of the huge rise of renewables and large contribution of gas remains bound to high solid fuel consumption and sizable oil imports. Although there is less use of solid fuels, the retreat is not as big as anticipated so as to advance EU's decarbonisation agenda.

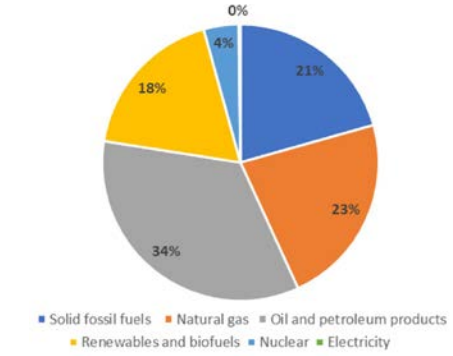
Therefore, there is a major policy challenge, which the governments of the countries concerned and the EC, sooner rather than later, will have to address.

Figure 1 **Gross Inland Consumption (%) in SE Europe, including Türkiye, 2013 (Total=251.6 Mtoe)**



Source:Eurostat, IENE

Figure 2 **Gross Inland Consumption (%) in SE Europe, including Türkiye, 2023 (Total=302.6 Mtoe)**



Source:Eurostat, IENE

Chapter 5, which is the largest one of the study, not only explains how the aforementioned key energy issues translate into policy imperatives at national level, but also offers a scholastically detailed presentation of the energy system and energy resources of each of the 16 SEE countries. The Chapter contains "Energy Profiles" for each country where a concise presentation of a country's basic political and economic data as well as the basic policymaking mechanisms in the energy sector are included. Each country's "Energy Profile" also analyzes the basic trends of the country's energy supply and demand. Following that, the country's energy policy is presented on a sector-by-sector basis starting with oil, natural gas, solid fuels, electricity, renewables, energy efficiency and combined heat and power. The Country Energy Profiles also include comprehensive data on energy imports and exports and on basic energy infrastructure.

There is also a group of countries which are termed as peripheral countries, with which the SEE region maintains close economic and trade relations including energy. These countries (i.e. Austria, Azerbaijan, Egypt, Italy, Lebanon, Slovakia, Syria, Jordan and Ukraine), also presented in Chapter 5, are important to the present "Outlook" study as they are associated, in terms of direct energy flows but also trade links, with the region. Each of these countries, for different reasons each, is important as they influence energy-related developments and related issues in the region.

In view of the geopolitical turmoil in the broader region and two parallel war fronts (Ukraine, Israel-Middel East) there are growing energy security concerns. Energy security in SE Europe is shaped by a combination of structural, market, and geopolitical factors, as analysed in Chapter 6. Key challenges include heavy dependence on imported oil and gas, underdeveloped infrastructure, limited cross-border interconnections, and small domestic markets, which increase the region's vulnerability to supply disruptions and price volatility. Oil supply and pricing remain highly sensitive to global market fluctuations, while gas supply is often concentrated from a few external sources, making the region prone to geopolitical risks and sudden price spikes. Electricity supply and prices are influenced by aging infrastructure, varying energy mixes, and limited integration between national markets, leading to periodic price disparities and reliability concerns. Consequently, the Energy Trilemma has returned as a convenient analytical tool in an effort to balance energy security, priorities, environmental protection and economic affordability.

In order to study energy demand and supply patterns, which are of prime concern with the aim to understand energy use on a regional basis a scenario approach has been adopted whereby certain assumptions have been formulated concerning basic parameters, which are likely to govern future energy demand and supply. These parameters include primarily economic, demographic and energy price information. In the present "Outlook" study, three scenarios

were selected for elaboration, namely the With Existing Measures (WEM) scenario, the With Additional Measures (WAM) scenario and the Net Zero (NZ) scenario, as analysed in **Chapter 7. Chapter 8** provides a comprehensive review of the hydrocarbon exploration and production in SE Europe, which has gained renewed attention and momentum following shifts in global energy policy expectations after President Trump's election in the USA. Chapter 9 covers the oil sector, including oil midstream and downstream (i.e. transportation, storage, refining and retail market activities in the various countries), while **Chapter 10** covers, among others, the regional gas sector, focusing on latest gas market developments, gas demand and supply situation as well as the vital role of LNG.

Currently, the electricity sector in SE Europe, as analysed in **Chapter 11**, faces several significant challenges that mainly derive from the ongoing process of market transformation but also the current economic climate, which is the basic driver behind demand. The industry structure, in terms of ownership and regulation framework, being under consideration for a long time, is currently changing in many countries facilitating market competition. The role of the state is reconsidered and the level of privatisation and liberalisation of electricity markets shapes the business environment in each country, creating new opportunities for market players, especially in the power generation and retail sector. The presence of new market entities (both old and newly established), like power producers, transmission/distribution system operators and retail suppliers, in each country illustrates the magnitude of changes that the gradual introduction of competition has brought about.

The main challenges include: (a) reform efforts for improving the power market model in line with EU Directives, (b) the continuing dominance in many countries' electricity markets of the present incumbent, (c) vulnerability to supply disruptions, (d) lack of diversification of power generation sources and (e) the observed low rate of switching supplier, which involves only eligible consumers who can exercise their right to switch supplier (mainly because of inertia as well as customers' poor awareness and mistrust of new incomers). Factors that have led, in many cases, to a power sector unable to be financially self-sustained, because of the high level of distribution losses, poor collection practices, high rates of illegal electricity usage and tariffs that do not reflect the cost structure.

Nuclear power in SE Europe is increasingly viewed as a potential solution for both energy security and decarbonisation, but its expansion faces both technical and non-technical obstacles that are analysed in **Chapter 12**. Small Modular Reactors (SMRs) are emerging as a promising alternative, as their smaller size, modular construction, and lower capital requirements make them more adaptable to SEE's energy systems, while offering local manufacturing opportunities and flexibility for integration with renewables and potential for faster deployment. Moreover, SE Europe as a whole, presents a huge potential for the further exploitation of Renewable Energy Sources (RES).

Today, although RES penetration is limited in SE Europe, the potential for the utilisation of all different forms of RES in the region is quite considerable, as it is clearly described in **Chapter 13**, which covers all different aspects of RES applications, including solar thermal, solar photovoltaic, wind, hydroelectric (both large hydro and small hydro stations), biomass and geothermal. Some countries, such as Greece, Israel, Türkiye and Cyprus, are very advanced by international standards in solar water heating with millions of installations in place, but less so in electricity generation from solar energy. Indeed, photovoltaics are slowly but steadily making their entry into local markets with Greece, Cyprus, Bulgaria, Romania and Türkiye in the forefront.

Wind applications are also on the rise with Greece, Türkiye, Romania and Bulgaria showing most activity. Hydroelectricity is a common denominator in RES development with almost all countries showing strong interest, especially those that are already using hydro to cover a substantial part of their electricity needs (i.e. Albania, and the rest of the Western Balkan countries, but also Greece and Türkiye).

Cogeneration of Heat and Power (CHP) in SE Europe represents a significant opportunity to improve energy efficiency, reduce greenhouse gas emissions, and enhance energy security by simultaneously producing electricity and useful heat from the same fuel source. CHP systems are particularly relevant for urban areas with district heating networks, as well as for industrial facilities that require both power and process heat. In SEE, however, wider deployment faces challenges such as outdated infrastructure, limited investment capacity, and regulatory frameworks that often favour conventional generation, as analysed in **Chapter 14**.

In addition, District Heating and Cooling (DHC), which is covered in **Chapter 15**, is a critical component of the region's energy transition, offering a pathway to greater efficiency and reduced emissions by centralising the production and distribution of thermal energy. Many SEE cities already rely on district heating networks, but much of the infrastructure is outdated, inefficient, and dependent on fossil fuels such as coal and natural gas. Energy efficiency and relevant application areas in SE Europe are discussed in **Chapter 16**, analysing the energy efficiency trends of the near past in industrial, household and transport sectors.

As described in **Chapter 17,** energy poverty in SE Europe remains a pressing socio-economic challenge, as a significant share of households struggle to afford adequate heating, cooling, and electricity services due to low incomes, inefficient housing, and high energy costs. Decarbonisation through hydrogen and Carbon Capture, Utilisation and Storage (CCUS) in SE Europe is increasingly seen as a strategic pathway to reduce emissions while maintaining energy security and industrial competitiveness, as analysed in **Chapter 18**. Hydrogen, particularly green hydrogen, offers opportunities for decarbonising hard-to-abate sectors such as heavy industry and transport, though challenges remain in scaling up production, building infrastructure, and lowering costs. CCUS, on the other hand, provides a transitional solution by capturing emissions from existing fossil-fuel power plants and industrial facilities, with potential for storage in geological formations across the region. Together, hydrogen and CCUS can complement renewable energy expansion, but their deployment in SEE is constrained by high capital requirements, limited policy frameworks, and the need for regional cooperation to develop cross-border infrastructure and markets.

Special energy topics (**Chapter 19**) is an innovative chapter of this SEEEO. It covers the growing role of electric vehicles (EVs), which are slowly penetrating the market but face barriers such as limited charging infrastructure, high upfront costs, and the need for supportive policies to accelerate adoption. At the same time, cyber security has become a critical concern as energy systems digitalise, with smart grids, IoT devices, and cross-border interconnections requiring robust protection against cyberattacks that could disrupt supply and undermine trust.

Moreover, the integration of artificial intelligence (AI) in energy offers transformative potential, from optimising grid management and forecasting demand to improving efficiency in renewable integration and predictive maintenance of assets. Together, these themes highlight both opportunities and vulnerabilities in SEE's energy transition, underscoring the importance of coordinated strategies that combine technological innovation with resilience and security.

The investment and business potential of the region is analysed and discussed in the final section of the study, in **Chapter 20**. Investment prospects in the broader SEE region for energy related basic infrastructure and energy projects across the board (i.e. electricity, natural gas, RES, thermal power plants, oil and gas exploration, energy efficiency) look positive over the next decade. There appears to be significant improvement in anticipated and planned projects and related investment from now on until 2035. The total investment potential in energy infrastructure and market development exceeds €700 billion and is considerably higher compared to the 2021-2030 period as examined in the previous SEE Energy Outlook 2021/2022.