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RENEWABLE ENERGY MARKET ANALYSIS

SOUTHEAST EUROPE

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ABOUT IRENA

The International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future and serves as the principal platform for international co-operation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy. IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy, in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity.

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DISCLAIMER

* *Throughout this report, this designation is without prejudice to positions on status and in line with the United Nations Security Council Resolution 1244 (1999).*

TABLE OF CONTENTS

LISTS OF FIGURES, TABLES AND BOXES

LIST OF FIGURES

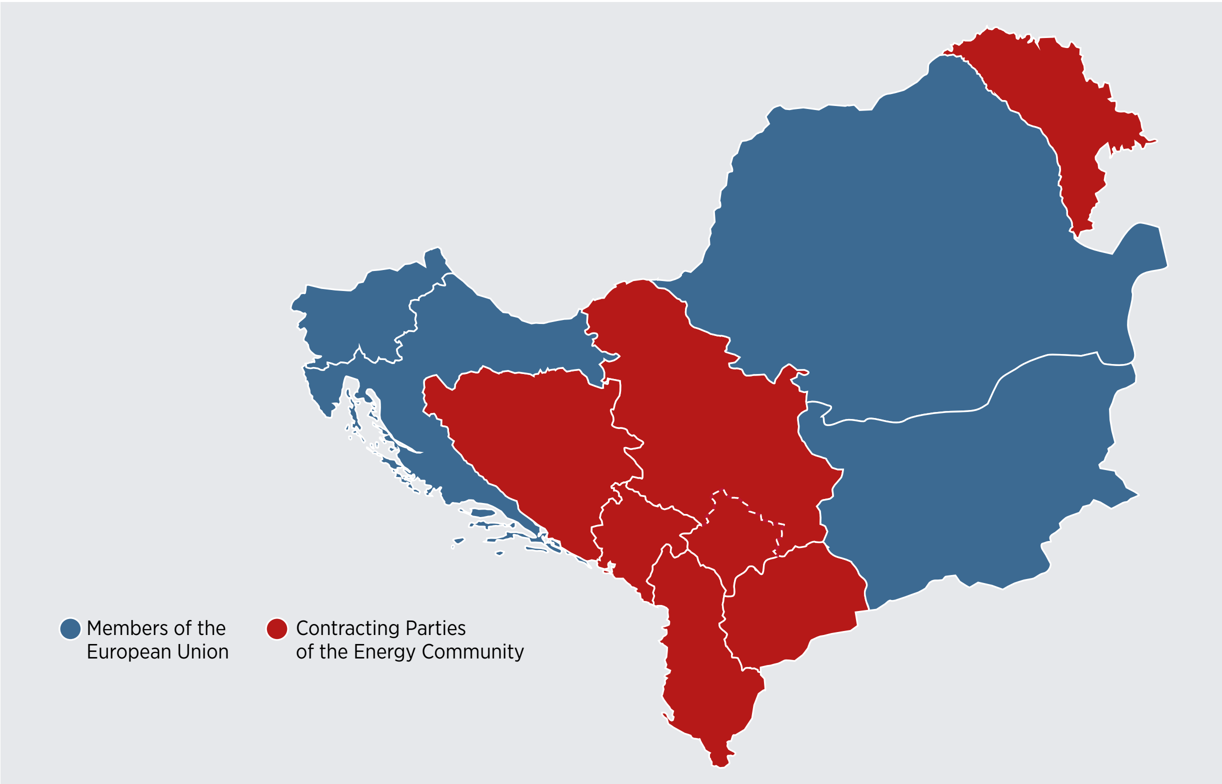
LIST OF TABLES

LIST OF BOXES

ABBREVIATIONS

AICS: Italian Cooperation Development Agency
BAU: Business-as-usual
bcm: Billion cubic metres
BDR: Biogas Done Right
BREP: Balkan Renewable Energy Program
CDB: China Development Bank
CEFTA: Central European Free Trade Agreement
CHP: Combined heat and power
CO_2: Carbon dioxide
DAM: Day-ahead market
DC: Direct current
DFI: Development finance institution
DH: District heating
E3ME: Energy-Environment-Economy Global Macro-Economic
EBRD: European Bank for Reconstruction and Development
EEFF: Energy Efficiency Financing Facility
EERSF: Energy Efficiency and Renewable Sources Fund
EIB: European Investment Bank
ENTSO-E: European Network of Transmission System Operators for Electricity
ENTSO-G: European Network of Transmission System Operators for Gas
ESCO: Energy savings company
EU: European Union
EUR: Euro
EnC: Energy Community
FDI: Foreign direct investment
FiP: Feed-in premium
FiT: Feed-in tariff
GBEP: Global Bioenergy Partnership
GCF: Green Climate Fund
GDP: Gross domestic product
GEF: Global Environment Facility
GGF: Green Growth Fund
GHG: Greenhouse gas
GIZ: German Agency for International Cooperation
GJ: Gigajoule
GSE: Gestore dei Servizi Energetici (Italy)
GW: Gigawatt
GWh: Gigawatt-hour
H&C: Heating and cooling
Ha: Hectare
ICT: Information and communication technology
IDA: International Development Association
IFC: International Finance Corporation
IPS: Integrated Power System
KfW: Kreditanstalt für Wiederaufbau (Germany)
Km/h: Kilometres per hour
Ktoe: Kilotonnes of oil equivalent
kW: Kilowatt
KWh: Kilowatt hours
LCOE: Levelised cost of electricity
$\mu g/m^3$: MIcrograms per cubic metre
MJ: Megajoule
MoU: Memorandum of Understanding
m/s: Metres per second
Mt: Million tonne
MW: Megawatt
N2O: Nitrous oxide
NDC: Nationally Determined Contribution
NECP: National Energy and Climate Plan
NGO: Non-governmental organisation
NLC: National Licensing Centre (Albania)
NOx: Nitrogen oxide
NREAP: National Renewable Energy Action Plan
O&M: Operation and maintenance
OECD: Organisation for Economic Co-operation and Development
OPIC: Overseas Private Investment Corporation
PCI: Project of Common Interest
PJ: Petajoule
PM2.5: Fine particulate matter
PM10: Coarse particulate matter
PPA: Power purchase agreement
PV: Photovoltaic
R&D: Research and development
R/P: Reserves-to-production ratio
RCC: Regional Cooperation Council
RED: Renewable Energy Directive
REEP: Regional Energy Efficiency Programme
RES: Renewable energy supply
SEE: Southeast Europe
SO2: Sulfur dioxide
SWIF: Solar World Invest Fund
T&D: Transmission and distribution
TFEC: Total final energy consumption
TJ: Terajoule
TPES: Total primary energy supply
TSO: Transmission system operator
TWh: Terawatt hours
UNDP: United Nations Development Programme
UPS: Unified Power System
USAID: United States Agency for International Development
USD: United States dollar
USEA: United States Energy Association
VAT: Value-added tax
VRE: Variable renewable energy
WACC: Weighted-average cost of capital
WBIF: Western Balkans Investment Framework
WHO: World Health Organization

ABOUT THE REPORT



IRENA's *Renewable Energy Market Analysis* series captures the wealth of knowledge and experience in different regions. It identifies emerging trends and themes at the intersection of public policy and market development. The previous editions covered the Gulf Cooperation Council (GCC) (2016 and 2019), Latin America (2016) and Southeast Asia (2018).

This edition focuses on Southeast Europe. The economies analysed are:

- The European Union member states (EU SEE): Bulgaria, Croatia, Romania and Slovenia;
- The Contracting Parties of the Energy Community (non-EU SEE): Albania, Bosnia and Herzegovina, Kosovo*, Montenegro, North Macedonia, the Republic of Moldova and Serbia.

The term "Western Balkans", throughout this report, refers to Albania, Bosnia and Herzegovina, Kosovo*, Montenegro, North Macedonia and Serbia.

Chapter 1 describes macroeconomic and social trends in the region, such as economic growth and employment levels. **Chapter 2** analyses the region's energy sector landscape, focusing on trends in supply and consumption. **Chapter 3** delves into the region's renewable energy potential, analyses the latest trends in costs and deployment, and discusses targets and the policy frameworks in place to support the deployment of renewables across power generation and all end-use sectors. **Chapter 4** focuses on the biomass potential in the region, as a provider of clean, modern renewable energy for power generation, heating for buildings and biofuels. **Chapter 5** analyses the last decade of investment trends, the evolution of the capital mix, and the financial barriers for renewable energy in the region. **Chapter 6** presents the potential socio-economic impacts of the energy transition in the region.

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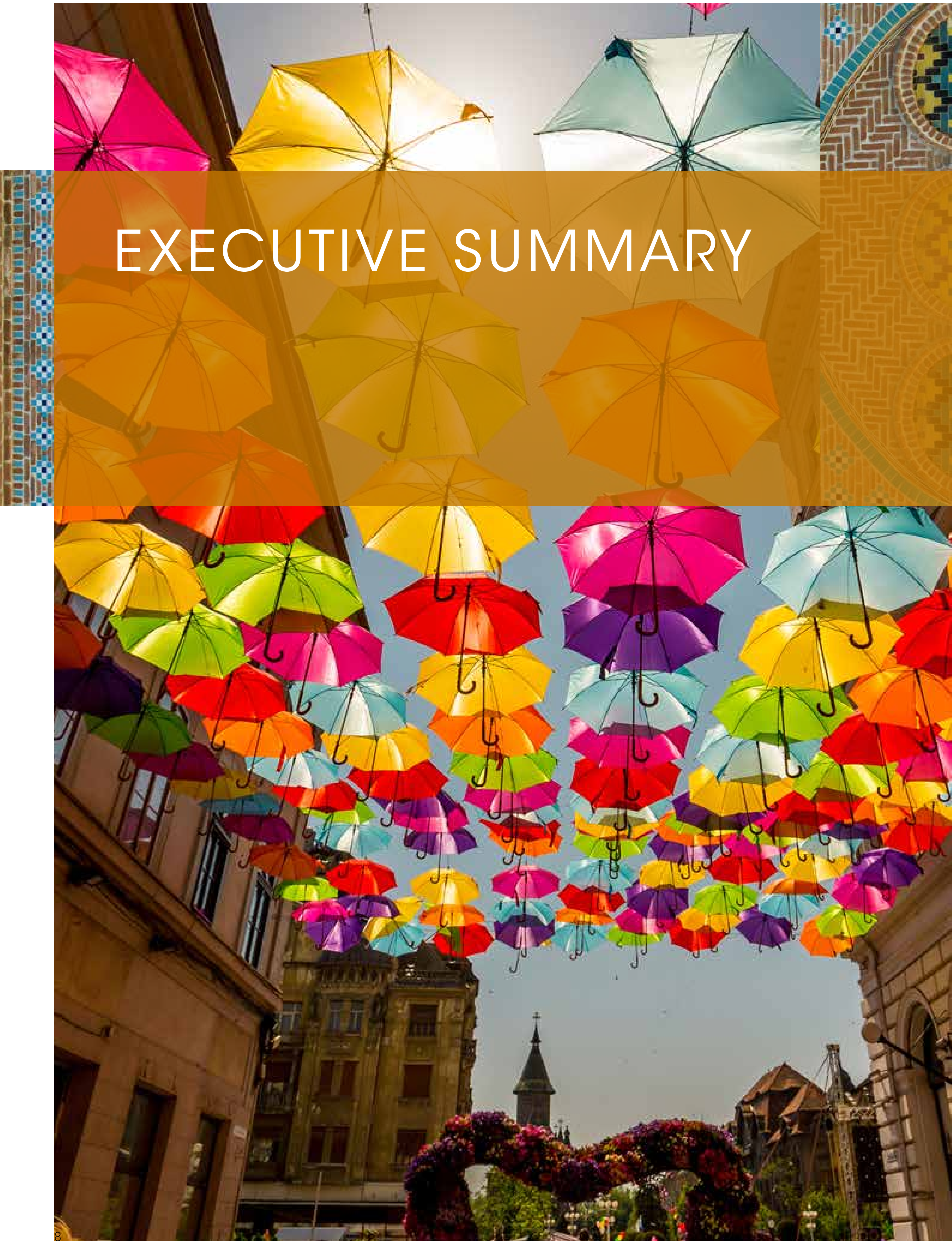


EXECUTIVE SUMMARY

While closely sharing many historical ties, the economies of Southeast Europe (SEE) are, in contrast, quite diverse. In terms of economic strength, a clear distinction can be made between the European Union (EU) member states and the Contracting Parties of the Energy Community (EnC). The gross domestic product (GDP) per capita values, for example, show clear differences: the average GDP per capita in the EU part of the region is more than double the average of the non-EU part. Overall, the SEE economies have an average GDP per capita more than three times lower than the EU average.

In general, inequalities exist across the region among the mountainous regions and coastal areas and large cities. Whereas highly educated and skilled employees in urban regions benefit from better infrastructure development, the inhabitants of rural areas have significantly lower incomes and are more susceptible to energy vulnerability or poverty.

Moreover, divisions between younger and older generations, skilled and unskilled workers, the private and public sectors, and uneven access to education exacerbate the inequalities. These are the challenges SEE faces in its labour markets. Although unemployment has been declining, the rate remains particularly high in the region. Across the Contracting Parties of the EnC, less than 40% of the working-age population was employed in 2015, in comparison with an average of 65.4% in the EU.

As a result of the lack of professional opportunities for young professionals, SEE suffers from high rates of emigration. Driven by emigration, the current regional population of about 54 million individuals is expected to decline to 45.6 million by mid-2050.

While the urban areas provide more economic solidity, the cities of the SEE region are some of the most polluted settlements of Europe. The use of solid fossil fuels for power generation, traditional biomass for heating and the presence of an old fleet of vehicles exacerbate air pollution in the region.

The energy transition in SEE may play a decisive role in fostering socio-economic development and tackling the presented issues. It will involve the phase-out of the aged fossil fuel plants and the introduction of larger shares of renewable energy in SEE's power and energy sectors.

EXECUTIVE SUMMARY

THE ENERGY LANDSCAPE

Renewable energy already plays a significant role in SEE, in particular in the form of hydropower and bioenergy. Indeed, SEE boasts an installed hydropower capacity of more than 22 GW with the potential to significantly increase this capacity. Yet, while hydropower is vital in reducing the region's dependence on fossil fuels, this key electricity source must be developed sustainably.

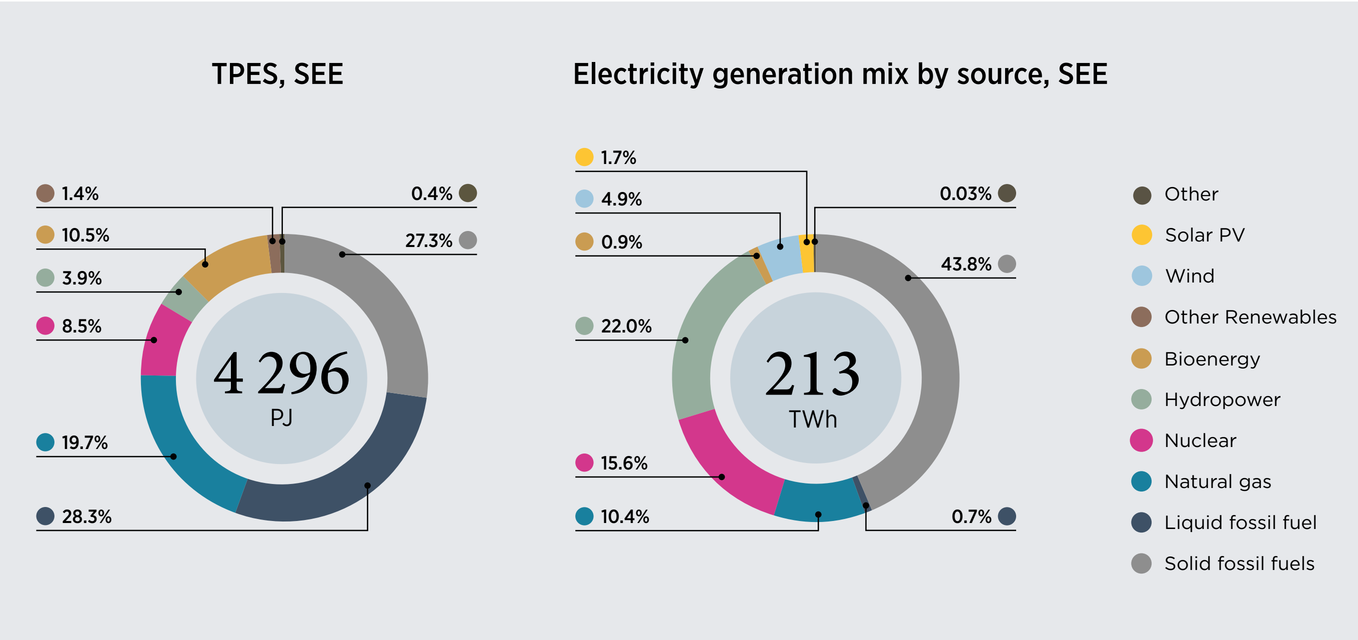
Similarly, the region's bioenergy use is vast, thanks to the large forested area. Traditional bioenergy constitutes a large portion of the total energy demand in all of SEE and plays a vital role as a direct source of heat for its residential buildings. A shift from polluting traditional bioenergy to modern bioenergy is necessary, however.

The region is endowed with good wind resources, too, with the wind blowing at average speeds between 5.5 metres per second (m/s) and 6.7 m/s.[1] Solar radiation is also relatively substantial, in particular in the southern part of SEE (Albania, Bulgaria and North Macedonia). The technical potential of utility-scale variable renewables in SEE reaches as high as 1 680 petajoules (PJ).

Oil represents the largest share in total primary energy supply (TPES), with 28% of the total, followed by solid fossil fuels – mainly locally supplied lignite – with 27%, natural gas (20%) and biomass (11%) (Figure S.1).

Currently, the power sector of the region is heavily reliant on an ageing fleet of lignite power plants, which produced 43% of the 231 terawatt hours (TWh) generated in 2017. The ageing infrastructure of these

Figure S.1 Total primary energy supply and electricity generation mix by source, SEE, 2017



Source: IRENA (2019a)

1 | At heights of 100 metres

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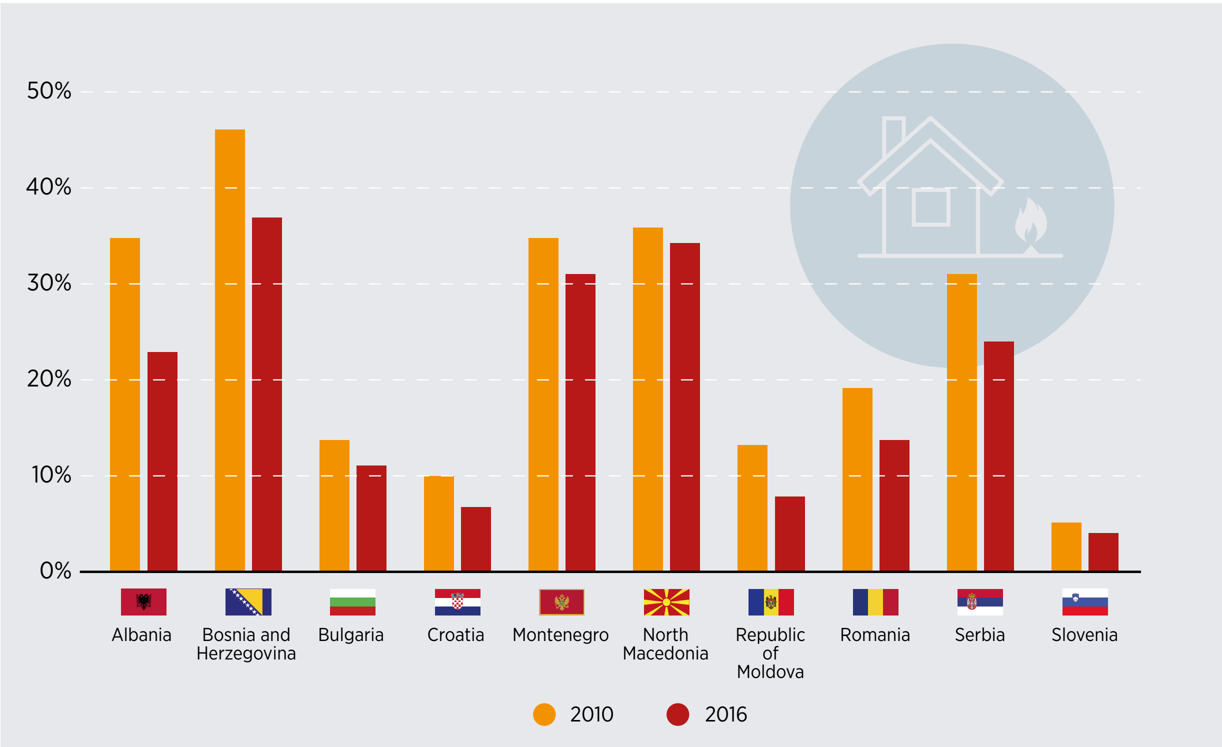
facilities and their negative environmental impact reveal the need for the rapid phasing out of older plants and suspension or improvement of more recent ones.

The region's total final energy consumption (TFEC) was around 2 720 PJ in 2017. The residential sector is the largest consumer, with a 32% share of TFEC. A large part of the energy consumed in the residential sector comes from biomass, which offers an economic solution for heating residential buildings. The use of biomass in the residential sector is, however, mostly in inefficient cooking and heating appliances, which are a major source of local air pollution and health problems. Improving access to clean solutions for cooking and heating is a priority under the Sustainable Energy for All Initiative of the United Nations. Yet, in SEE, there are still many households lacking access to clean solutions – over 30% in some cases (Figure S.2). Slow progress in deploying modern bioenergy indicates both the presence of significant barriers, and that current policy measures are insufficient to stimulate deployment of renewable energy-based solutions.

Figure S.2 Share of households without access to clean cooking solutions, SEE, 2010 and 2016



Note: No data for Kosovo.*
Source: World Bank (2019)

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EXECUTIVE SUMMARY

ENABLING POLICY AND INVESTMENT FRAMEWORKS FOR RENEWABLE ENERGY

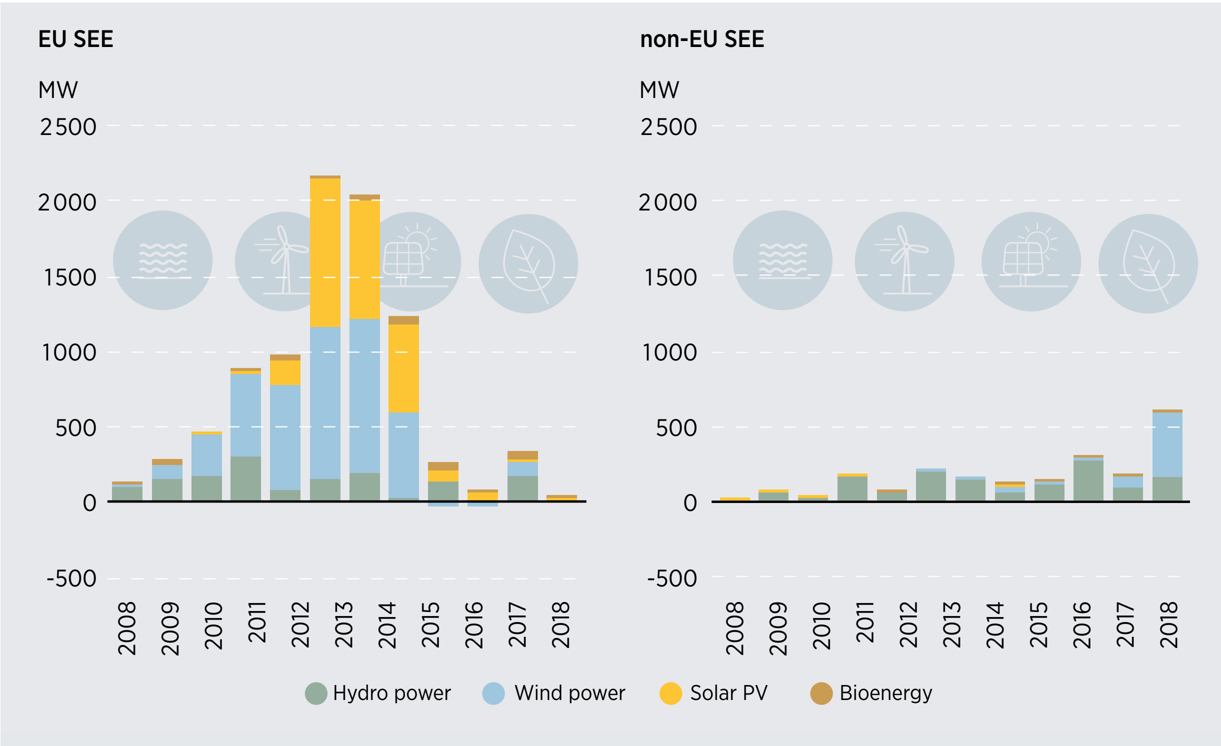
Most renewable energy capacity is concentrated in the EU member states of SEE, while the rest of the region has been relatively slow to roll out such projects (Figure S.3). The EU member states benefited from the early adoption of medium-term, technology-specific targets for renewable energy and the introduction of dedicated supporting policies.

The most common policy support instruments in the EU are auctions and tariff mechanisms for utility-scale and residential plants.

Nowadays, every government in SEE has adopted renewable energy targets, as a result of international agreements, including the Renewable Energy Directive (RED) and the Energy Community Treaty. Targets had a profound effect on the region's renewable energy environment. RED and the related National Renewable Energy Action Plans (NREAPs) have been powerful catalysts for the deployment of renewable energy technologies and their integration into power sectors around the EU.

SEE, like most regions in the world, still lacks a comprehensive legal framework supporting renewables in the heating, cooling and transport sectors. As the use of traditional biomass is widespread, the pace of

Figure S.3 Annual additional renewable energy capacity, EU SEE (left), non-EU SEE (right), 2008-2018



Source: IRENA (2019a)

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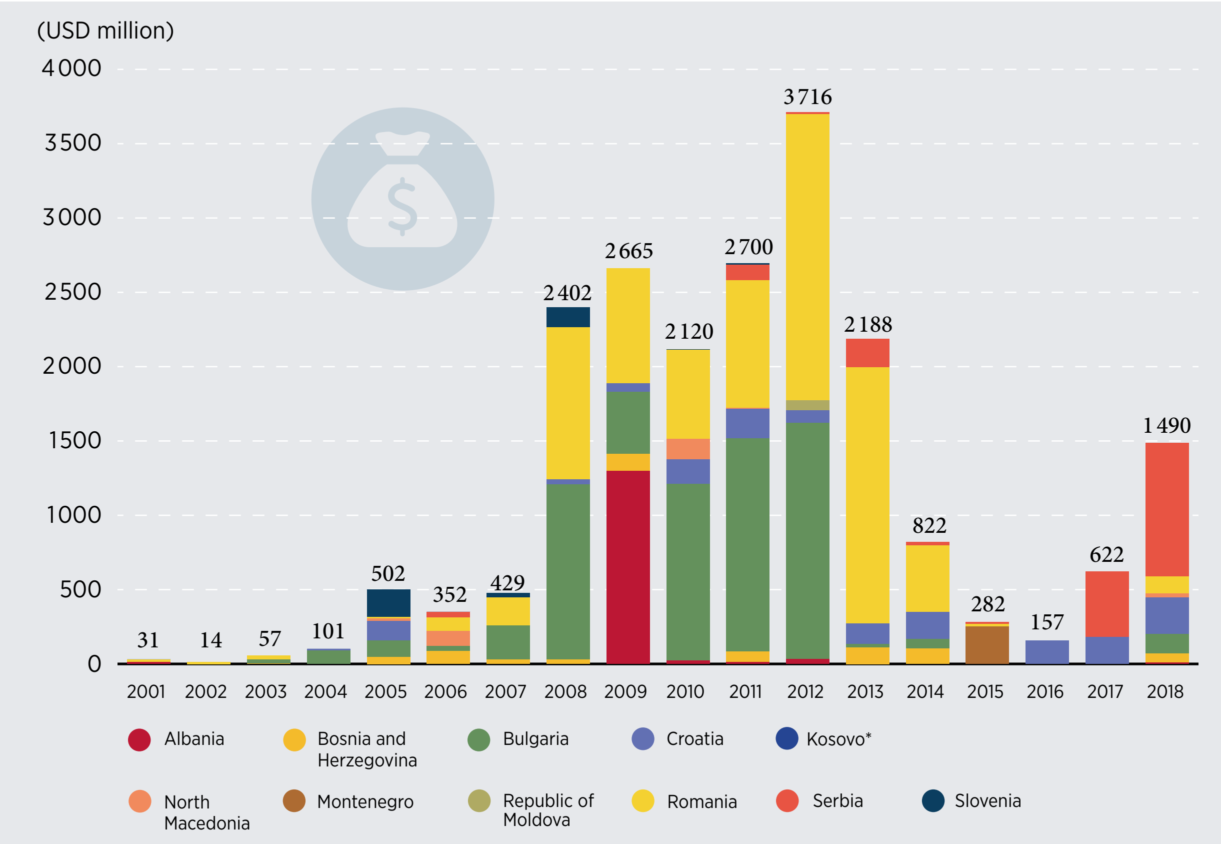
adoption of modern renewables and energy efficiency measures should be accelerated to guarantee the decarbonisation of the heating sector. Dedicated policy interventions are needed to overcome a variety of economic barriers (*e.g.*, access to finance for the procurement of modern appliances) and non-economic barriers (*e.g.*, low consumer confidence).

An enabling environment, with appropriate policies, is conducive to attracting investments in the renewable energy sector. Between 2001 and 2018, SEE received USD 20.7 billion in renewable energy investment, excluding large-scale hydro (Figure S.4). Regional investment has grown from non-existent in 2001 to its 2012 peak of USD 3.7 billion. In 2018, the total renewable energy investment in SEE was USD 1.49 billion. Overall, renewable energy investment remains fragile in SEE.

The changing pattern of investment can be attributed to the presence (or lack thereof) of dedicated supporting policies. Without stable policy and regulatory frameworks, regional investment in renewable energy will continue to be sporadic. Reducing the cost of capital and offering more harmonised approaches across national markets would also provide an additional boost in investment for a region with vast renewable energy resources to fully realise its potential.

Figure S.4 Investment in renewable energy by year and economy, SEE, 2001-2018



Source: BNEF (2019)

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SOCIO-ECONOMIC IMPACT OF THE ENERGY TRANSITION

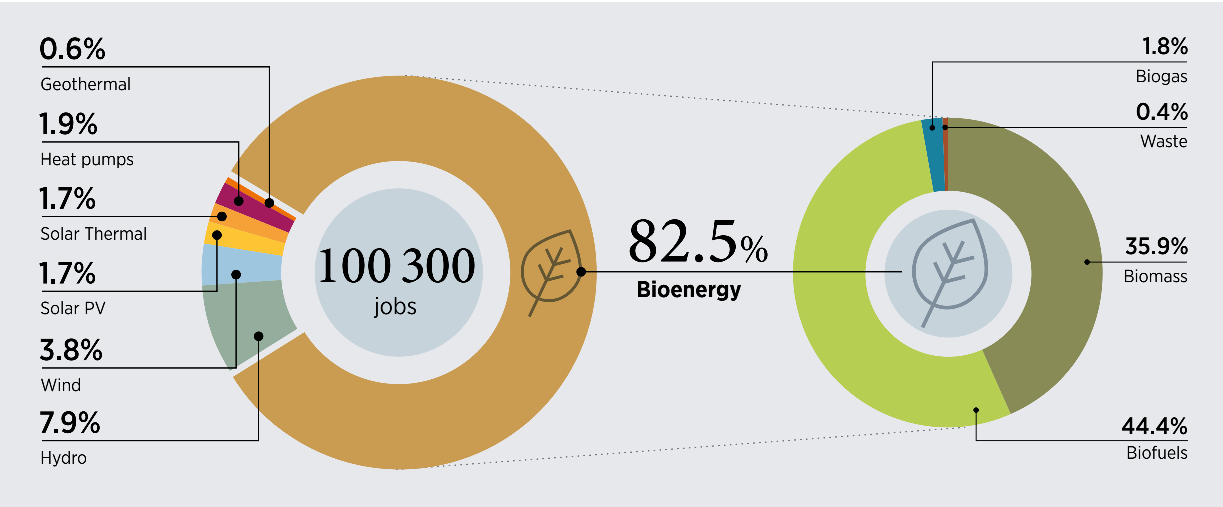
In SEE, the energy transition can stimulate substantial economic activity and benefit society at large, in terms of GDP and jobs creation.

The positive economic impact of the energy transition is related to a higher level of investment in renewable energy and energy efficiency. IRENA estimates that the adoption of an energy mix based on these technologies would provide, in the region, a cumulative GDP gain amounting to USD 485 billion over the business as usual case, between 2019 and 2050.

In 2017, renewable energy employment reached 100 300 jobs in SEE's EU member states (Bulgaria, Croatia, Romania and Slovenia). A significant portion of those jobs came from the bioenergy sector (82%). In comparison, hydropower only employs about 8 000 people, despite accounting for a larger portion of power generation (Figure S.5).

Although the transition towards sustainable energy will imply a shift from fossil fuel-related employment, jobs in the wider energy sector will not suffer due to the increase of energy transition-related employment. Maximising the positive impact of renewable energy policies calls for the adoption of a holistic approach that considers the impacts of energy policies within the energy sector and in the larger, socio-economic sphere.

Figure S.5 Share of direct and indirect jobs in the renewable energy sector, EU-SEE, 2017



Source: EurObserv'ER (2018)

THE WAY FORWARD

The next decade could prove to be a pivotal one for the energy sector in SEE. The region possesses considerable potential for developing renewable energy and improving energy efficiency. To harness this potential and fully achieve the energy transition, the region will need to set new targets, ensure sustained investment in variable renewable energy technologies, develop its modern biomass industry and introduce a holistic policy framework.

International agreements such as RED, the Energy Community Treaty, and the Paris Agreement have provided the stimulus for changes that emphasise the decarbonisation of the energy sector and the larger deployment of renewables.

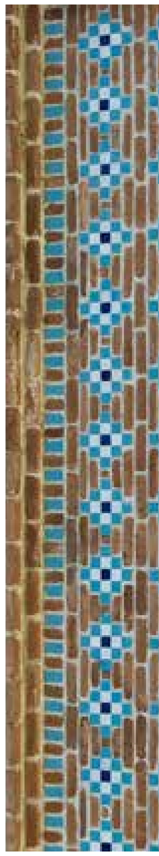
The RED 2020 targets have been important catalysts for the deployment of renewable energy technologies. Once these targets were met, however, some governments reduced their support for renewable energy. The adoption of the second EU Renewable Energy Directive (RED II) gives governments in SEE the opportunity to update and reset those targets. Well-defined renewable energy goals provide a clear signal to investors that there is a national commitment to decarbonise the energy sector.

Meanwhile, many SEE economies have often overlooked solar PV and wind in their energy plans, favouring more conventional technologies, which are perceived as less expensive. Now, however, with solar PV and wind reaching cost-competitiveness with conventional sources, their business case is gaining traction. Yet, to continue driving down the cost and attracting investment, an enabling environment must be in place.

Bioenergy is an essential component of the impending low carbon energy sector. Bioenergy can provide significant environmental benefits, assist in improving energy security and diversity and also provide economic development opportunities for rural communities. While the potential for modern bioenergy production in the region is substantial, large-scale supply chains need to be better developed.

Bioenergy can provide modern solutions for the energy transition across all end-uses, from the improved use of modern bioenergy in the residential sector to the production of biogas for power and heat generation. The use of biofuels is a viable option that can improve the economy and quality of life in SEE – and for the region's more vulnerable and rural populations, in particular.

In an age of urgent climate and sustainability action, for the energy transition to succeed, policies must be based on an integrated assessment of the interactions among the evolving energy sector, the wider economy and natural systems. To fully achieve the energy transition in the region, policies will have to go beyond mere direct support of renewable energy and should be rooted in a recognition of the socio-economic impact of the energy sector as a whole.



BACKGROUND

01

While closely sharing many historical ties, the economies of Southeast Europe (SEE)[2] are, in contrast, very diverse. The region's cultural richness is reflected in the region's landscapes which range from vibrant, international cities to rural areas. Across the region, areas that are fertile and rich in natural resources stand in contrast to areas of barren, mountainous terrain.

At the same time, the current regional population of about 54 million,[3] or about 0.7% of the world's total inhabitants, is expected to decline to 45.6 million by mid-2050 (PRB, 2018). Declining birth rates and – most importantly – emigration are the main drivers for this fall.

Meanwhile, regional gross domestic product (GDP) reached USD 522 billion in 2018 and is currently growing at about 3.8% per year (Table 1.1). Yet, while SEE has around one-tenth of the EU-28 population, its GDP per capita is equivalent to 26% of EU-28 values (Table 1.1).

The region's recent history is an important influence on its socio-economic configuration. Most of the jurisdictions were signatories to the Warsaw Pact, or were part of the Federal Republic of Yugoslavia, which was composed of modern-day Bosnia and Herzegovina, Croatia, Kosovo*, Montenegro, North Macedonia, Serbia and Slovenia.

In 2004, Slovenia was the region's first member acceding the European Union (EU). Romania and Bulgaria followed in 2007 and Croatia in 2013. Currently, Montenegro and Serbia are official candidate countries aspiring to join the EU and have opened accession talks, with some accession chapters already resolved. Albania and North Macedonia have also obtained official EU candidate status, but accession talks have not yet started.

Bosnia and Herzegovina has been a potential candidate[4] since 2003. Kosovo* is also a potential candidate for EU accession. The Republic of Moldova has so far not been granted potential candidate status, but is part of an association agreement signed in 2014 with the EU.

2 | Southeast Europe includes Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Kosovo, Montenegro, North Macedonia, the Republic of Moldova, Romania, Serbia and Slovenia.*

3 | As of mid-2018.

4 | The term "potential candidate" refers to countries/entities with clear prospects of joining the EU in the future, but which have not yet been granted candidate country status. Candidate status implies the opening of formal accession negotiations.

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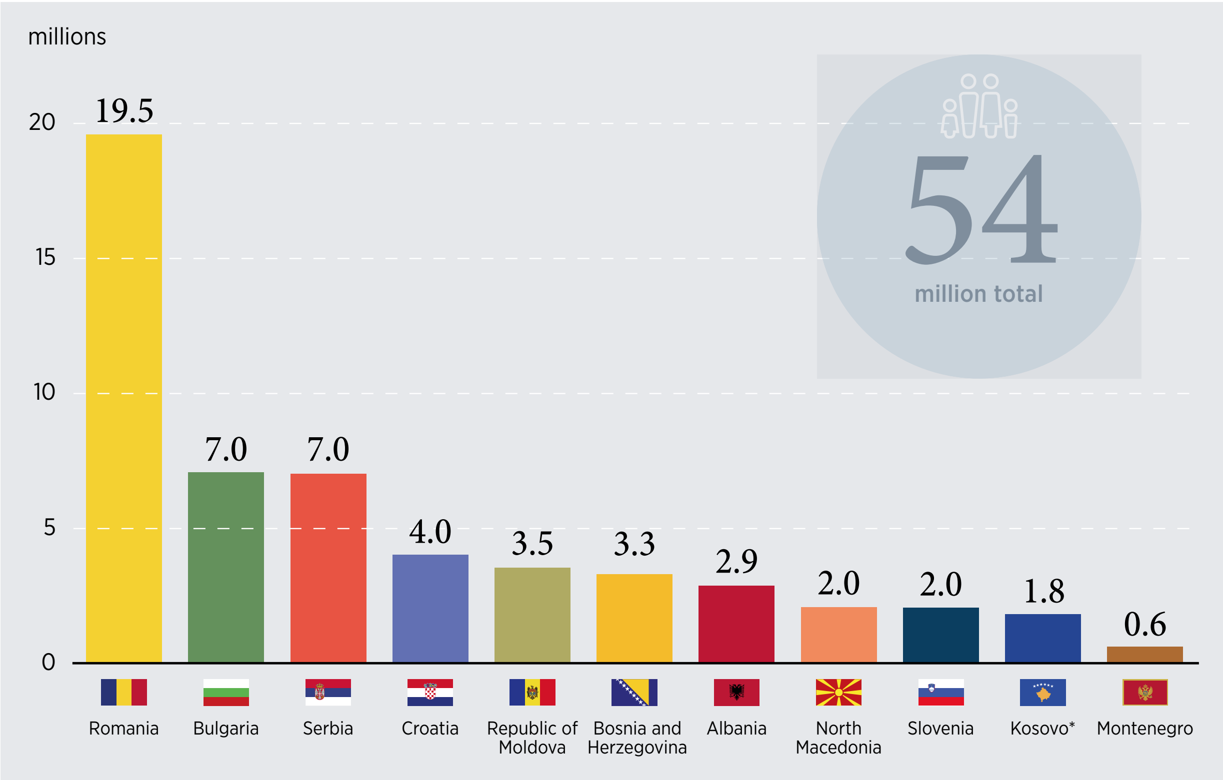
01

1.1 MACROECONOMIC OVERVIEW

SEE is demographically and economically very diverse. Romania is by far the most populated country of the region, with its 19.5 million inhabitants representing 36% of the region's population. The country also accounts for 43% of the region's GDP (Table 1.1). About 7 million people live in Bulgaria, with a similar number in Serbia. Croatia, the Republic of Moldova, Bosnia and Herzegovina, Albania, North Macedonia, Slovenia and Kosovo* range between 1.8 and 4 million inhabitants. Montenegro is the smallest country, with just over 620 000 inhabitants (Figure 1.1).

The four EU member states – Bulgaria, Croatia, Romania and Slovenia – have the highest GDPs per capita, headed by Slovenia, which has 75% of the EU average. All non-EU economies have lower GDP per capita values. The EU-28 average GDP per capita is more than three times higher than the SEE regional average (Table 1.1).

Figure 1.1 Population in SEE, 2018



Source: World Bank (2019)

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Table 1.1 Macroeconomic indicators, SEE, 2018

	Population (million)	GDP (billion USD)	GDP per capita (USD)	GDP growth
Albania	2.9	14.55	5 016.51	4.0
Bosnia and Herzegovina	3.3	20.13	6 100.16	3.1
Bulgaria	7.0	60.77	8 681.02	3.1
Croatia	4.0	64.90	15 829.25	2.6
Kosovo*	1.8	7.74	4 299.17	4.1
Montenegro	0.6	5.12	8 532.97	4.9
North Macedonia	2.0	11.24	5 350.51	2.7
Republic of Moldova	3.5	9.52	2 719.33	4.0
Romania	19.5	224.63	11 519.44	4.1
Serbia	7.0	48.04	6 862.92	4.3
Slovenia	2.0	55.32	26 343.15	4.5
SEE	53.9	521.95	9 665.70	3.8
Non-EU SEE	21.2	116.33	5 410.74	3.9
EU SEE	32.7	405.62	12 328.78	3.8
EU	512.5	19 193.10	37 449.95	2.0

Source: World Bank (2019)
Note: All GDP numbers in current USD.

ECONOMIC GROWTH

Throughout the past few decades, GDP growth in SEE has been very volatile, with economic performance and robustness towards external crises changing significantly.

Following the political transformations and conflicts of the 1990s, which led to a sharp economic decline, the region experienced rising growth trends between 1997 and 2002 (Figure 1.2). The period between 2003 and 2008 represented an economic boom, with high growth rates across the region. This was supported by large inflows of finance for businesses and households via international bank credits (Bartlett and Prica, 2012).

Like most other regions of the world, SEE was also hit by the financial crisis in 2007/08 (Figure 1.2). The strongly integrated EU SEE economies were affected the most and for the longest period, compared to the non-EU economies. Croatia, for example, experienced negative GDP growth rates until 2015 and only recently recovered, whereas other economies in the region recovered earlier.

In general, SEE growth rates have been rising again since 2010, but remained below the pre-crisis level until 2018.[5] Overall, growth in most parts of the SEE remains fragile.

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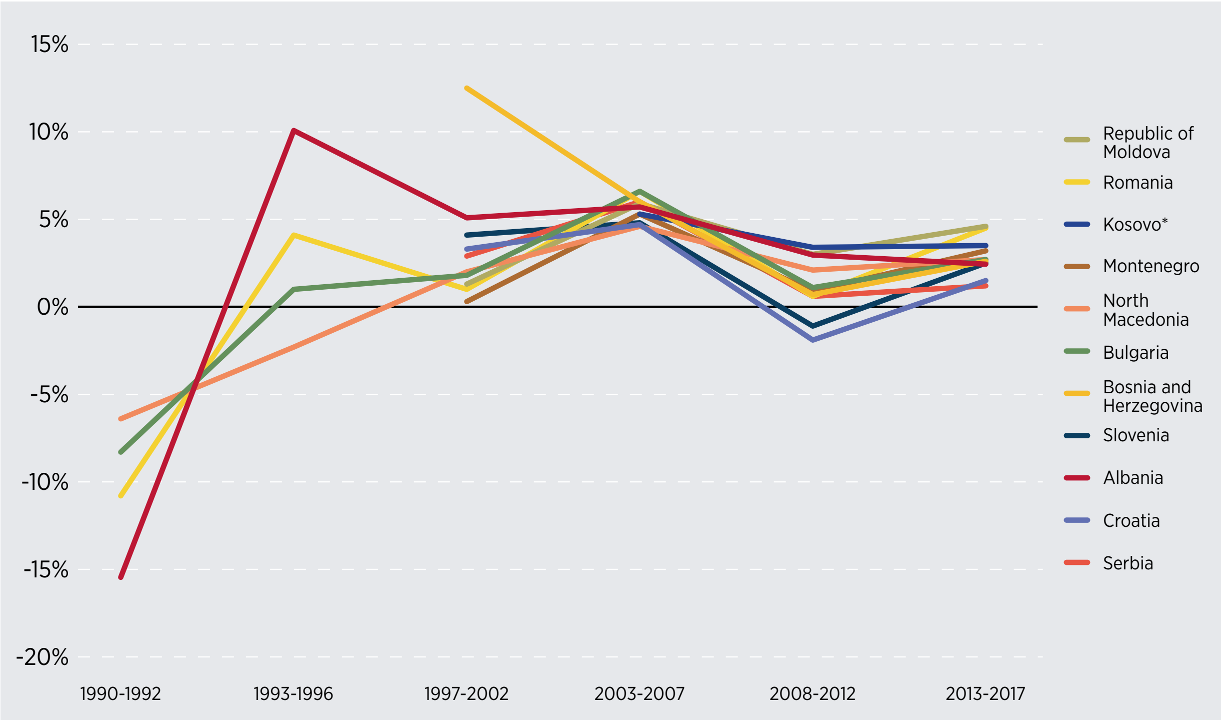
5 | The Republic of Moldova has recently experienced strong economic recovery, following an economic crisis in 2014-2015.

01

Figure 1.2 Average GDP growth rate in SEE



Source: World Bank (2019)

In the period from 2013 to 2018, the region experienced overall rising growth trends. This was mainly built on higher public spending on infrastructure projects, as well as increased private consumption, which was sustained by rising employment, growing credit to households and higher wages.

Several SEE economies, including Bulgaria, Bosnia and Herzegovina, Kosovo*, North Macedonia, and Montenegro, export base metal and mineral commodities and therefore benefited additionally from the rise in global commodity prices.

In 2018, the fastest-growing economies were Montenegro followed by Slovenia, Serbia and Kosovo*. All SEE economies have been growing faster than the EU average (Table 1.1). This trend is expected to continue, but the inefficient public sector, the obsolete infrastructure and the limited connectivity between neighbouring countries remain major barriers to growth in SEE (World Bank, 2018a-b).

ECONOMIC STRUCTURE

Since the early 1990s, the economic structure in SEE has undergone a rapid and profound transformation. Conflicts and economic blockades have negatively impacted the economies of most SEE economies at some point, while the market liberalisation and reduced trade restrictions have also challenged many national industries – particularly those with low efficiency rates.

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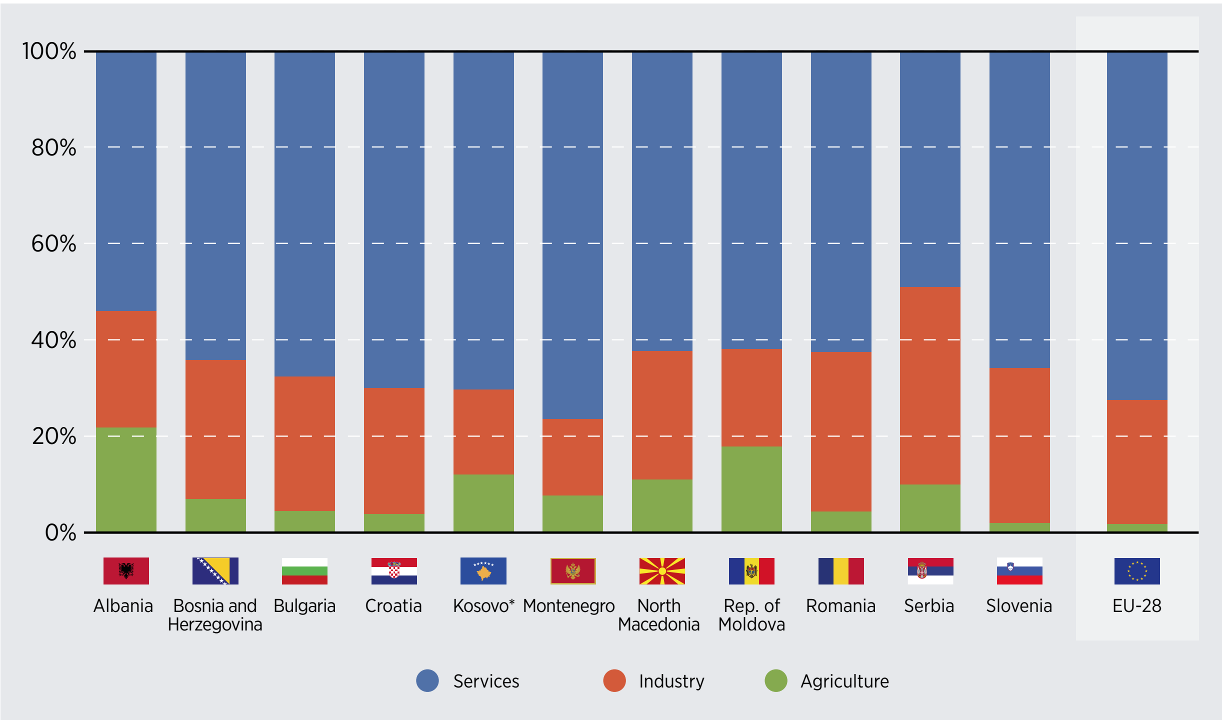
Privatisations have often resulted in closures and, as a result, the industrial sector, which in 1990 accounted for nearly 50% of the national GDP of most SEE economies, has shrunk drastically. Following this industrial decline, industrial policy measures became focused on directing investment into existing enterprises, with little incentive provided for research and development (R&D). The consequences of this approach still affect the current situation, as R&D remains comparably low and competitiveness is weak (World Bank, 2019).

Simultaneously, the role of agriculture also declined within the region. The resulting reallocation of labour has supported growth, due to the generally low added value of agriculture. In some economies, however, the restructuring was particularly thorough and caused strong social changes – such as an accelerating trend towards urbanisation.

In 2017, over 80% of new jobs within the Balkan region were created in services, with strong growth in retail and wholesale trade, tourism, information and communication technology, and the public sector, mainly driven by increased public spending and consumption (World Bank, 2019). Only in Kosovo* industry is still the most important sector for employment growth.

In terms of the relative strengths of economic sectors, a clear distinction can be made between EU and non-EU economies: Figure 1.3 shows the particularly low importance of the agricultural sector in Slovenia, Croatia, Bulgaria and Romania.

Figure 1.3 Sectoral composition of GDP, SEE, 2017



Source: CIA (2018)

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01

TRADE AND ECONOMIC INTEGRATION

The volumes and value of traded goods and services have increased in SEE throughout the past few years. The two main drivers have been the increased demand of the region's most important trading partner, the EU, and increased commodity prices. The share of trade with the EU, in comparison with all external trade, ranges between 41.1% in Kosovo* to 70.6% in North Macedonia (EC, 2017a). Apart from the EU, SEE's most important trading partners are other European economies, Turkey and the Russian Federation. Within the region, Slovenia's economy is the most dependent on foreign trade, with its combined imports and exports amounting to around 120% of GDP.

The region's export products cover a wide range of goods and services, from clothing in Bosnia and Herzegovina to chemical products in North Macedonia. This minimises direct competition among SEE economies.

During the 1990s, trade between neighbouring economies was strongly limited, although since the 2000s, intra-regional trade has increased strongly due to two major initiatives.

The first is the Central European Free Trade Agreement (CEFTA), the parties of which are Albania, Bosnia and Herzegovina, North Macedonia, the Republic of Moldova, Montenegro, Serbia and Kosovo*. CEFTA aims to reduce trade barriers. Founded in 1992, CEFTA can also be seen as preparation for the EU accession – with some current EU member states (Poland, the Czech Republic, Bulgaria, Croatia and Slovakia) indeed former members of CEFTA, leaving on their EU accession.

The second initiative is the Regional Cooperation Council (RCC), which since 2008 has promoted regional co-operation between the EU and SEE. The RCC has 46 participants, including most European countries, international organisations and financial institutions. The RCC's current SEE 2020 plan, entitled "Jobs and Prosperity in a European Perspective," entails measures to increase intra-regional trade volumes, boost GDP per capita and create 1 million new jobs. In addition to economic growth, the initiative aims to increase regional stability (RCC, 2018).

Inflows of foreign direct investment (FDI) have fostered growth in SEE over the past years. They have contributed to the creation of jobs, enabled technology transfers and assisted the reduction of the current account deficits that exist in most economies of the region. To promote FDI, political support has been given to export-oriented investments with high-technology content, in particular.

Montenegro still attracts by far the most FDI per capita within the region (Figure 1.4), despite a declining trend. The country benefits from high inflows into the real estate and tourism sectors, which comprised 15% of Montenegro's GDP in 2017 (World Bank, 2018c). Over the last few years, the vast majority of investment has come from EU member countries (more than 60%) followed by the Russian Federation (below 10% since 2014).

Slovenia now ranks second in the region in terms of FDI per capita, after a sharp increase in recent years, followed by Serbia, Albania and Croatia. Across the SEE region, FDI is stagnating at a comparably low level – and one that is insufficient to secure stable long-term growth. At the same time, compared to the EU as a whole, FDI per capita rates in SEE economies only reach 53% of the EU average (UNCTAD, 2018).

FDI in the Western Balkan region concentrates in particular on real estate (20%), followed by renewable energy (17%) and coal (14%). Most FDI originates from the EU member countries Germany, Italy and Austria; further investments have been made by companies from the Russian Federation, United Arab Emirates, United States and Turkey (World Bank, 2018a).

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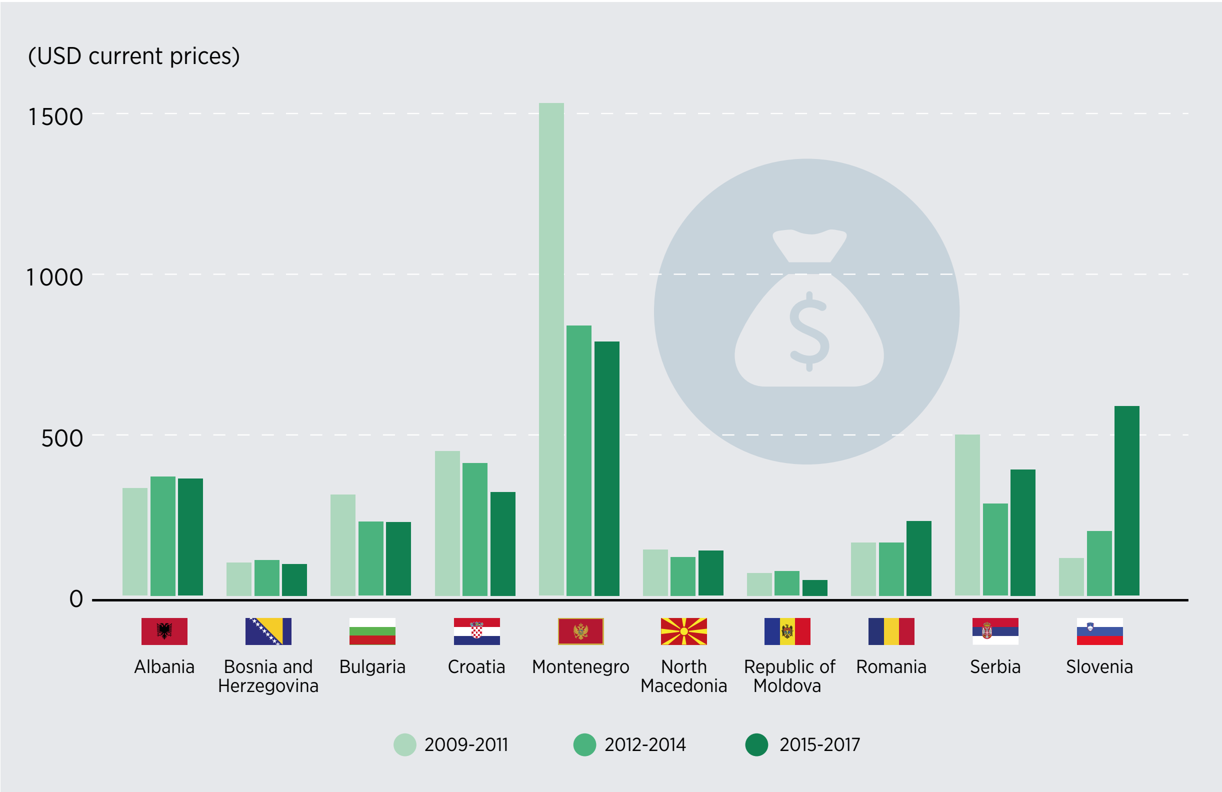
Figure 1.4 FDI per capita, SEE, 2009-2017



Note: Kosovo's data are not available.*
Source: UNCTAD (2018)

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01

1.2 SOCIO-ECONOMIC CHALLENGES

The SEE region faces various socio-economic challenges that affect social cohesion, political stability and investment. The following sections present two of the most important of these challenges.

INEQUALITY AND LINES OF DIVISION

Large parts of SEE are dominated by mountains, posing a challenge for agriculture and infrastructure development. This also drives urbanisation, with cities being the main drivers for economic growth, job creation and prosperity.

Yet, whereas Bulgaria, Croatia and Montenegro have experienced strong urbanisation over the past 20 years, the share of urban population has declined in the Republic of Moldova – from 44.5% in 2000 to 42.6% in 2017, the lowest in the region. With the exception of Bulgaria, the share of urban population across all SEE economies remains well below the EU average of 75.6%.

In general, in terms of per capita income, inequalities exist between mountainous regions that are difficult to access on the one hand, and coastal areas and large cities on the other. Whereas the highly educated and skilled employees in urban regions benefit from FDI-driven projects, the inhabitants of rural areas have significantly lower incomes. Moreover, divisions between younger and older generations, skilled and unskilled workers, and the private and public sectors lead to inequality. The region's income inequality, however, is comparable to that of the EU in general (World Bank, 2018a).

EDUCATION, UNEMPLOYMENT AND EMIGRATION

Access to education and its overall level differs strongly between the economies of SEE. Additionally, within economies, a large divergence exists between urban and rural regions.

Overall, in SEE, a relatively high proportion of children – 5% – do not attend primary school. Two EU member countries – Romania and Bulgaria – have particularly high shares (10% and 6% by 2017, respectively), while among non-EU economies the Republic of Moldova has a high value (9% in 2018) (World Bank, 2019).

SEE economies also currently face several structural challenges in their labour markets.

Although unemployment has been declining across the region, rates remain particularly high in Bosnia and Herzegovina (25%), Kosovo* (22%) and North Macedonia (21%) (World Bank, 2019). Across the Western Balkans (Albania, Bosnia and Herzegovina, North Macedonia, Montenegro, Kosovo* and Serbia), only 38.4% of the working age population was employed in 2015, in comparison with an EU-28 average of 65.4% and an Organisation for Economic Co-operation and Development (OECD) average of 67.6%.

Moreover, high inequalities in the employment structure exist within economies. For example, in the northern part of Montenegro, unemployment rates are 11 times higher than in the coastal zone (World Bank, 2018a). The prevalence of seasonal work is one major explanatory factor. Furthermore, in SEE, youth unemployment rates are twice as high as the general average. These are highest in Bosnia and Herzegovina, with around 68% in 2016, followed by North Macedonia, with 50%. A major structural challenge lies in the low level of female labour market participation, which is around 25 percentage points lower than the rate for males. These figures reveal considerable unused potential, negatively affecting economic growth.

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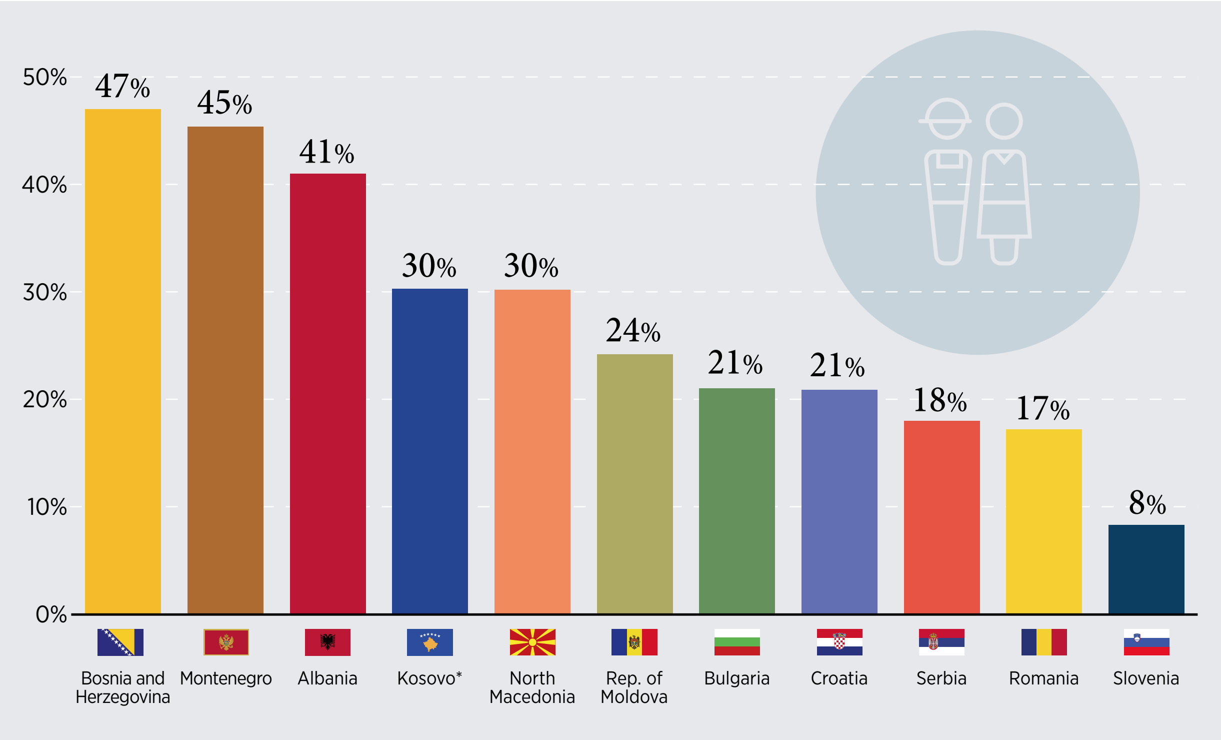
The SEE economies also show high rates of emigration, with this doubling between 1990 and 2015 (World Bank, 2019). A lack of professional opportunities for young people is the main driver for migration, with a large part of the population of Bosnia and Herzegovina, Montenegro and Albania living abroad in 2017, mostly to seek better employment opportunities somewhere else in Europe (Figure 1.5). EU accession has also intensified emigration from Bulgaria, Croatia and Romania.

This indicates a loss of human capital, lowering the home economies' development potential (brain drain). Workers trained in the health and education sector are leading the exodus, followed by engineers, information-technology experts and vocationally trained workers. On the other hand, expatriate workers are responsible for considerable amounts of personal remittances (current private transfers from migrant workers resident in a different country), fostering consumption and economic activity. In 2017, remittances were a significant contributor to GDP in some of the SEE economies, such as the Republic of Moldova (20.2% of GDP), Bosnia and Herzegovina (11.2%), and Kosovo* (11.2%) (World Bank, 2019)

Figure 1.5 Stock of emigrants as percentage of population, SEE, 2017



Source: World Bank (2019)

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1.3 THE ROLE OF ENERGY IN FOSTERING GROWTH

Affordable, clean and secure energy is a primer for economic growth and socio-economic development. Indeed, renewable energy and energy efficiency have already proved to be tools in increasing incomes, improving the quality of urban life and fighting poverty and unemployment.

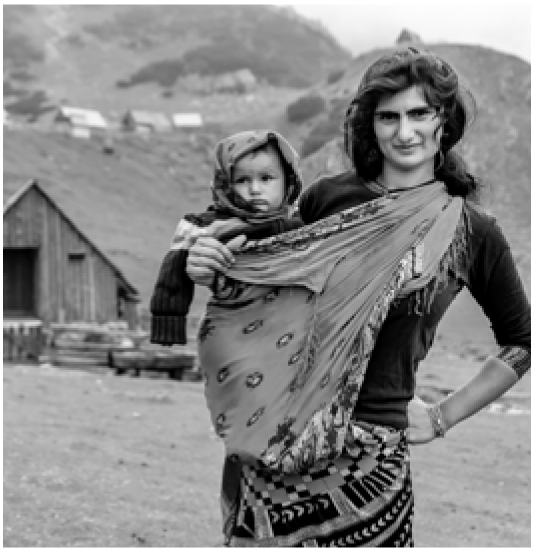
Currently, the region relies strongly on locally sourced energy, mostly solid fossil fuels, while depending on imports of oil and gas. While this approach guaranteed relatively cheap and secure energy in the past, it also raises questions about long-term sustainability and the impact on climate and health.

As a consequence of long-lasting conflicts, cross-border co-operation is challenging in SEE. Regional economic and political co-operation has increased in the past decade, with the support of the EU. This co-operation encompasses a variety of fields – including the energy domain, under the framework of the Energy Community (EnC) (Box 1.1).

In recent decades, the EU member states of the region have also adopted several policies and measures to support renewable energy. With part of the region thus aligning its energy sector to EU regulations, a key challenge lies in modernising the regional energy sector while pursuing other critical socio-economic and environmental objectives. These include maintaining affordable and secure energy, reducing the environmental and health impacts of the energy supply, and improving the quality of life for vulnerable populations.

This close interlinkage between energy and socio-economic development has prompted many governments in the region to re-evaluate the structures of their energy sector. This has included paying attention to power market design and co-operation in the power grid. At the same time, there has been a strong social push towards recognition of the environmental and health impact of energy generation.

The next chapter details the energy sector landscape in SEE, analysing key energy supply and consumption trends from the past decade as well as the diversity of structures in the regional energy markets.



Box 1.1 The Energy Community

The Energy Community (EnC) was founded by a treaty signed in Athens in October 2005 and has been in force since July 2006. Albania, Bosnia and Herzegovina, Kosovo*, Georgia, North Macedonia, the Republic of Moldova, Montenegro, Serbia and Ukraine are Contracting Parties of the EnC.

The key objective of the EnC is to extend the rules and principles of the EU internal energy market to the SEE, the Black Sea region and beyond. This is being done to create an integrated pan-European energy market based on a common legally binding framework.

All Contracting Parties of the EnC made legally binding commitments to implement core pieces of EU energy legislation, known as the *acquis communautaire*. The list of these *acquis* constantly evolves in order to keep track of ongoing EU regulation. It also includes the areas of electricity, gas, energy efficiency, environment, renewable energy, statistics, oil emergency stocks and infrastructure regulation.

Additionally, the EnC instruments include regional exchange fora, technical assistance, and expert advice in targeted projects and research. The success of the EnC's work is also already visible: Contracting Parties regularly report on common projects, as well as on their successes in homogenising legislation with EU directives and regulation.

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THE ENERGY SECTOR LANDSCAPE

02

The energy sector landscape of SEE consists of heterogeneous national contexts, with these strongly shaped by the availability of natural resources and the region's history. The stepwise split-up of Yugoslavia, for example, resulted in the fragmentation of a former common energy system (IEA, 2008), with this still visible in the current power grid structure.

This chapter provides an overview of the current status of the energy sector in SEE. It covers fossil fuel resource endowments, the composition of the region's primary energy supply and consumption and concludes with the common regulatory framework under which the region operates.

2.1. PRIMARY ENERGY SUPPLY

SEE has few fossil fuel resources apart from lignite, with some 4.6% of the world's total reserves present in the region. Serbia has reserves of 7 112 million tonnes (Mt), Bosnia and Herzegovina and Bulgaria have around 2 000 Mt each, while Kosovo* holds some 1 564 Mt. Albania, North Macedonia, Slovenia and Romania hold smaller reserves, ranging between 522 Mt and 280 Mt, in decreasing order. Less carbon intensive hard coal reserves are relatively small, with the main endowment in Serbia (402 Mt), Bulgaria (192 Mt) and Montenegro (142 Mt). The reserves-to-production ratio (R/P) index is particularly high for Serbia and Bosnia and Herzegovina, where it is estimated to reach close to 200 years (Table 2.1).

Most of SEE's natural gas and oil is imported, given non-significant domestic reserves. The exception is Romania, which holds over 60% of the region's oil reserves and 80% of its gas. In the early 1980s, Romania was estimated to be rich in terms of hydrocarbon resources, but its gas reserves have strongly decreased since, due to rapid depletion and re-evaluation. Reserves fell from 713 billion cubic metres (bcm) in 1980 to less than 100 bcm in 2017. Albania and Serbia are endowed with 24 Mt and 11 Mt of oil, respectively, while Croatia and Bulgaria have 10 Mt and 2 Mt (Table 2.1).

Meanwhile, the SEE region sits on rich and partially untapped renewable resources, which are presented in Chapter 3.

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Table 2.1 Fossil fuel reserves, SEE, 2017

	Crude oil		Natural gas		Hard coal	Lignite	
	Reserves	R/P	Reserves	R/P	Reserves	Reserves	R/P
	Mt	years	bcm	years	Mt	Mt	years
Albania	24	23	0.1	2.5	-	522	0
Bulgaria	2	15	4	44	192	2 174	69
Bosnia and Herzegovina	0	0	0	0	-	2 264	186
Croatia	10	13	9	6	-	0	0
Kosovo*	-	-	-	0	-	1 564	-
North Macedonia	0	-	0	0	0	332	61
Montenegro	-	-	-	0	142	0	0
Republic of Moldova	0	-	1	0	-	-	0
Romania	82	21	99	10	11	280	13
Serbia	11	11	6	12	402	7 112	185
Slovenia	<1	-	0	0	56	315	95
SEE	129	-	112	-	803	14 563	-
% of world	0.05	-	0.6	-	1.1	4.6	-
	Source: Enerdata (2018a-g and 2017a-c)		*Source: Cornot-Gandolphe (2017); Lecarpentier (2017)*		*Source: BGR (2017)*	*Source: BGR (2017)*	

Note: "-" means no data available.

R/P ratio in years, based on 2016 production.

No R/P ratio determined for hard coal since no or very little hard coal production is reported in the national energy balances

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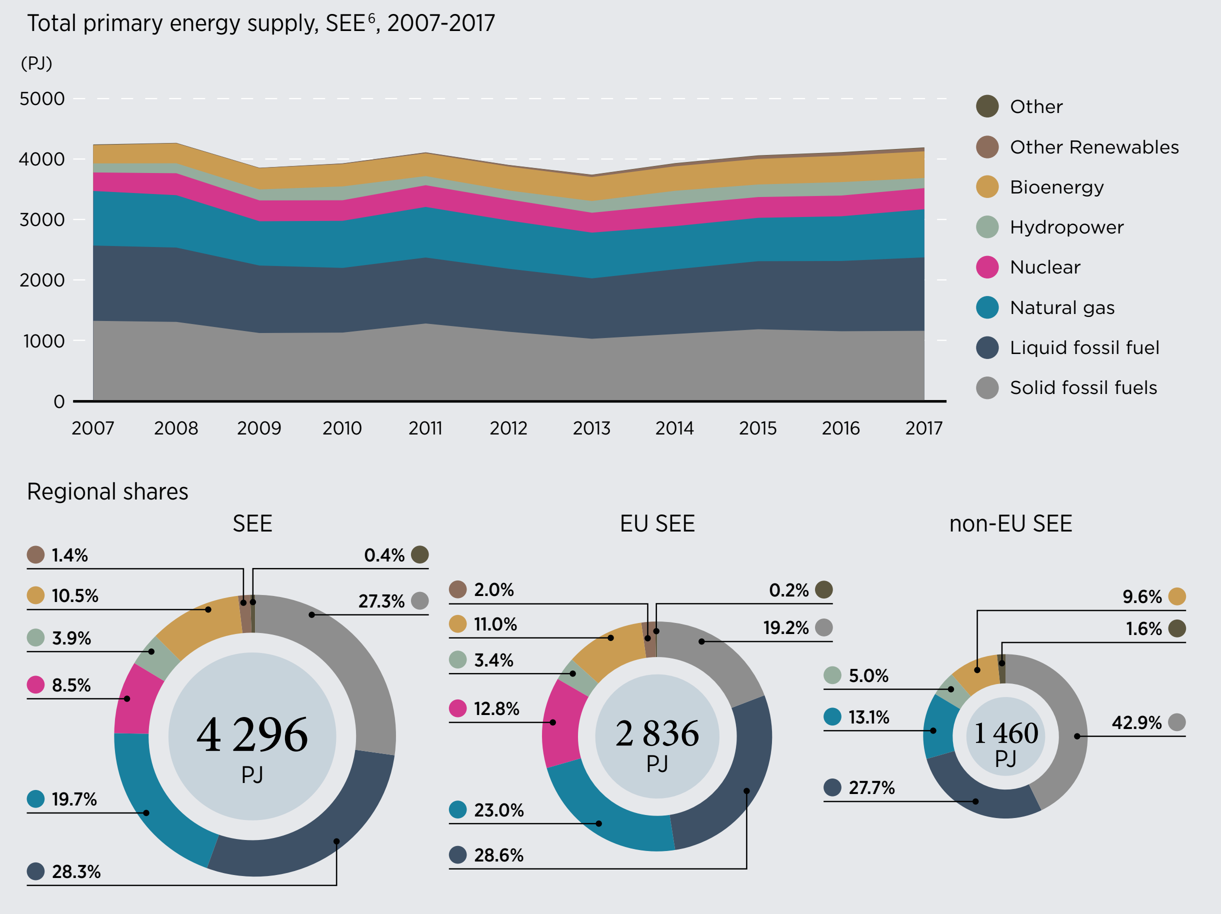
In most of SEE, total primary energy supply (TPES) has remained stable or declined over the past two decades.

With the deep recession of the early 1990s, economic decline caused a reduction in TPES, as almost all energy intensive industries closed. High inefficiencies also persisted in the poorly maintained energy system, although these were increasingly addressed after 2000. In addition, the four EU countries – Bulgaria, Croatia, Slovenia and Romania – experienced a considerable decline in TPES as a consequence of the financial crisis in 2008 and the implementation of energy efficiency measures.

Over the last decade, the energy mix of the TPES has not changed visibly, with fossil fuel providing the bulk of the energy supply (Figure 2.1). Oil represents the largest share in TPES (28%), followed by solid fossil fuels (27%; mainly locally supplied lignite), natural gas (20%) and biomass (11%). At a regional level, however, the energy mix strongly diverges between SEE economies (Figure 2.1) – often closely relating to the availability of domestic energy sources.

Figure 2.1 TPES in SEE, 2007-2017 (top) and regional shares, 2017 (below) (PJ*)



Source: IRENA (2019a)

** PJ = petajoule*

6 *Bosnia and Herzegovina and Republic of Moldova are not included in the time series due to a lack of historic data.*

02

Lignite, due to its poor transportability, is almost exclusively used in the power and district heating (DH) sectors. Indeed, Bosnia and Herzegovina, Kosovo*, North Macedonia and Serbia cover significant shares of their energy demand with this fuel source. In Kosovo*, demand for lignite has been growing in recent years, too, due to the absence of access to alternative forms of conventional energy and an increase in demand.

In the region, crude oil and its derivatives are predominantly used in the strongly growing transport sector and in industry. During the last decade, power generation from oil has been entirely replaced by other sources. Oil demand in the residential sector for space and water heating has also declined significantly (Figure 2.8).

Natural gas is significant in only a few SEE economies. Gas consumption is limited by poor or missing infrastructure, poor domestic reserves, concerns about security of supply and the lack of a relevant gas trading hub in the region. With the financial support of the EU, a new liquefied natural gas terminal is currently being built on the island of Krk, Croatia. Another terminal is planned for Romania's Black Sea coast.

Meanwhile, with 11% of the TPES, bioenergy has remarkable importance in SEE. It is mostly used in the residential sector, showing that a significant proportion of the population relies on traditional biomass for space heating and cooking (Chapter 4 provides an overview of the SEE bioenergy sector).

2.2 ELECTRICITY SECTOR

Key elements of the region's energy infrastructure are dated and need replacement within the next decade. Indeed, the age of SEE's power plants – which were insufficiently maintained in the 1990s, have high carbon intensity and lack diversity in power supply – is now creating serious technical and political challenges.

The strong exploitation of emission-intensive indigenous lignite resources will have to be reconciled with national climate commitments and local air pollution improvement. The urgent need for widespread rehabilitation and replacement of the aging infrastructure, combined with a high import dependency, may, however, open doors for investment in renewable energy generation.

The shrinking cost of renewable energy and the introduction of renewable energy and energy efficiency targets are encouraging a rethinking of the way energy is generated, distributed and consumed in the region.

Since the early 2000s, electricity demand has grown slightly in SEE, mostly due to the electrification of the industrial sector. This has offset the reduction in demand caused by energy efficiency measures. In all the economies of the region, a stable or slightly increasing energy demand is also predicted in energy strategies.

Hydropower is the most deployed technology in terms of installed capacity, with 35% of total installed capacity, followed by solid fossil fuels (hard coal and lignite) with 32%, nuclear with 12%, and onshore wind with 8% (Table 2.2).

In 2017, 213 terawatt hours (TWh) of electricity were generated in SEE. After taking into account the export balance, the self-consumption of power plants, transmission and distribution losses, 168 TWh were available for final energy consumption.

The most relevant sources for power generation were solid fossil fuel, mainly lignite (44%), hydropower (22%) and nuclear (16%). Large differences exist

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Table 2.2 Installed capacity by source, SEE, 2018 (MW)

	Solid fossil fuels	Liquid fossil fuels	Natural gas	Nuclear	Hydro-power	Pure pumped hydro (non-RE)	Wind	Solar photo-voltaic (PV)	Bio-energy	Geo-thermal	Total
Albania	–	98	–	–	2 132	–	–	1	–	–	**2 231**
Bosnia and Herzegovina	2 156	–	–	–	2 233	420	51	19	9	–	**4 888**
Bulgaria	3 221	–	512	1 967	3 372	864	698	1 036	52	–	**11 722**
Croatia	325	950	743	–	2 206	–	582	61	104	–	**4 970**
Kosovo*	1 288	–	–	–	96	–	37	7	–	–	**1 428**
Montenegro	225	–	–	–	653	–	118	3	–	–	**1 000**
North Macedonia	825	–	258	–	674	–	37	21	8	–	**1 823**
Republic of Moldova	1 600	420	940	–	64	–	27	4	6	–	**3061**
Romania	5 805	–	5 142	1 300	6 692	92	3 030	1 377	141	0.05	**23 578**
Serbia	4 349	–	3	–	3 081	614	374	10	15	–	**8 446**
Slovenia	796	50	423	688	1 347	180	5	266	62	–	**3 817**
Total	**20 590**	**1 518**	**8 021**	**3 955**	**22 549**	**2 170**	**4 959**	**2 805**	**396**	**0.05**	**66 962**

Source: IRENA (2019a)

between regions, with non-EU economies having electricity generation provided mainly by lignite and hydropower (Figure 2.2).

A significant number of the region's larger power plants are relatively old. About 7.7 gigawatts (GW), or 12% of large generator capacity, is older than 50 years and the average age of coal- and oil-fired plants was 41 years in 2018 (Enerdata, 2018a-g).

Lignite and hard coal play a fundamental role in economies with vast domestic resource endowment. Most notably, in 2017, domestic coal and lignite were responsible for 96% of electricity generation in Kosovo*, 75% in Bosnia and Herzegovina, 71% in Serbia, 54% in North Macedonia, 54% in Montenegro and 45% in Bulgaria.

Despite climate and environmental challenges, in Bosnia and Herzegovina, Kosovo*, Montenegro, North Macedonia, Romania and Serbia, investment in 7.5 GW of new coal power plants and replacement plants is currently under consideration (Global Coal Plant Tracker; 2018, CEE Bankwatch Network, 2019, 2018a-b).

In Slovenia and Bosnia and Herzegovina, two disputed lignite power plant units – TE Šoštanj 6, with 600 megawatts (MW), and EFT Stanari, with 300 MW – started operation in 2015 and 2016, respectively. Meanwhile, between 2010 and 2018, 10.3 GW of announced or permitted coal power plants was cancelled, switched to gas or had its construction halted (Global Coal Plant Tracker, 2018).

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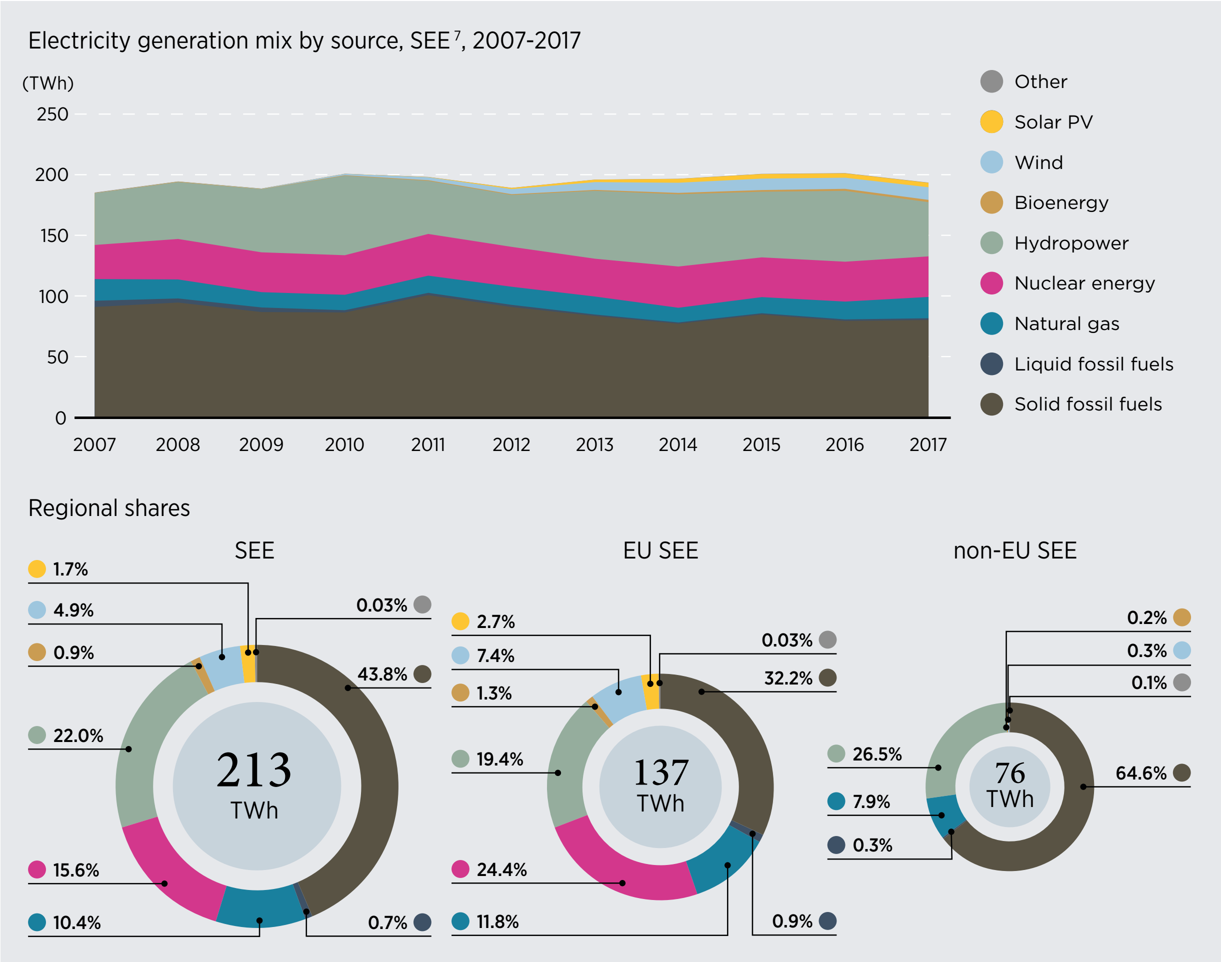
Figure 2.2 Electricity generation mix by source, SEE, 2007-2017 (top) and regional shares, 2017 (below)



Source: IRENA (2019a)

Gas-fired power generation represents a small share of overall generation in SEE (10%), except for the Republic of Moldova, where gas accounted for 93% of power generation in 2017. The country holds minimal domestic natural gas resources. With the exception of Croatia (25%), in all other systems, the gas share in power generation is either low or practically non-existent.

Nuclear power plants, with 15% of SEE's total generation in 2016, are operational in Bulgaria, Romania and Slovenia, with the latter operating a plant jointly with Croatia. Bulgaria and Romania have plans for additional nuclear generation capacity.

Renewable energy accounts for 44% of the installed capacity (2018) and around 29% of the generation (2017). Variable renewable energy (VRE) sources, however, still have very low shares of total generation, with 1.7% for solar photovoltaic (PV) and 4.9% for wind, concentrated in the EU area. VRE's low share has slowed the adoption of system flexibility measures (see Box 2.1).[8]

7 Bosnia and Herzegovina and Republic of Moldova are not included in the time series due to a lack of historic data.

8 More in depth discussion on renewable energy installed capacity in Chapter 3.

Box 2.1 System integration of renewables in SEE region

With the exception of Bulgaria and Romania, the SEE power systems are currently characterised by low shares of wind and solar PV. These low levels of VRE have slowed the discussion to introduce system integration measures.

Regional transmission system operators (TSOs) tend to be conservative regarding the volume of VRE that can be integrated into the system. In Bulgaria, for example, renewable generators are exposed to rules limiting generation to specific times of day and an upper ceiling on the amount of electricity eligible for feed-in support. The fact that small- and medium-scale wind and solar plants connect to the medium- or low-voltage grid, instead of the high-voltage grid, also raises concerns for grid operators.

Yet, low confidence in the grid's capacity to host VRE is a global issue, often preceding VRE deployment. As TSOs and system operators become acquainted with the technologies, however, previous concerns about the grid's inability to host VRE are often deflated (IEA, 2017a).

The deployment of VRE technology is also hindered by the low level of exchange between regional power markets. Improved regional interconnections, data exchange and power trading help to ensure security of supply, along with higher shares of VRE. The aggregation of generation and demand over larger spatial areas can also support a further reduction of costs. Indeed, expanding any power generation technology in a small and isolated market requires more back-up generation than in a large system, which further increases costs for customers in the former. Initiatives to improve interconnectivity between the SEE's jurisdictions are presented in the section on energy regulation (Chapter 2.4).

For the integration of VRE, the region's energy systems can greatly benefit from the presence of large shares of hydropower. In an interconnected system, hydropower with storage complements wind and solar (IRENA, 2017a). Reservoir hydropower may operate as a flexibility provider for the system, given its great ability to adapt power output and the ability to store excess energy.[9] Hydropower can therefore support the deployment of solar and wind resources, guaranteeing the needed system flexibility for large shares of VRE generation.

Pumped hydro storage capacities exist in most power systems of SEE. As of 2018, however, less than 10% of the region's installed hydropower (equal to 2.1 GW) was equipped with pumping capacity – by comparison, Italy had 33%. Given the potential for large hydropower, the regional expertise and the increasing penetration of VRE, pump storage can become a valuable and cost-effective source of flexibility for the European grid. Plans for new pumped storage units now exist, amounting to a total capacity of around 5 GW. Serbia has the largest share of this, with 2.8 GW.[10]

The comparatively low shares of VRE generation and availability of pumped hydro storage in most SEE jurisdictions slows down investment in alternative flexibility options, but a large potential exists through complementarity between hydropower and other renewable energy sources.

Electrochemical storage devices and demand-side management resources only exists at a pilot level in SEE. In 2018 the first battery storage system, with a capacity of 1 MW, was installed in Romania, while the first pilot projects were implemented in Bulgaria.

9 Hydropower can directly store electricity when equipped with pumps and indirectly by reducing power output in times of high VRE generation.

10 The Djerdap-III (2 100 MW) and Bistrica (680 MW) power plants.

02

ELECTRICITY TRADE

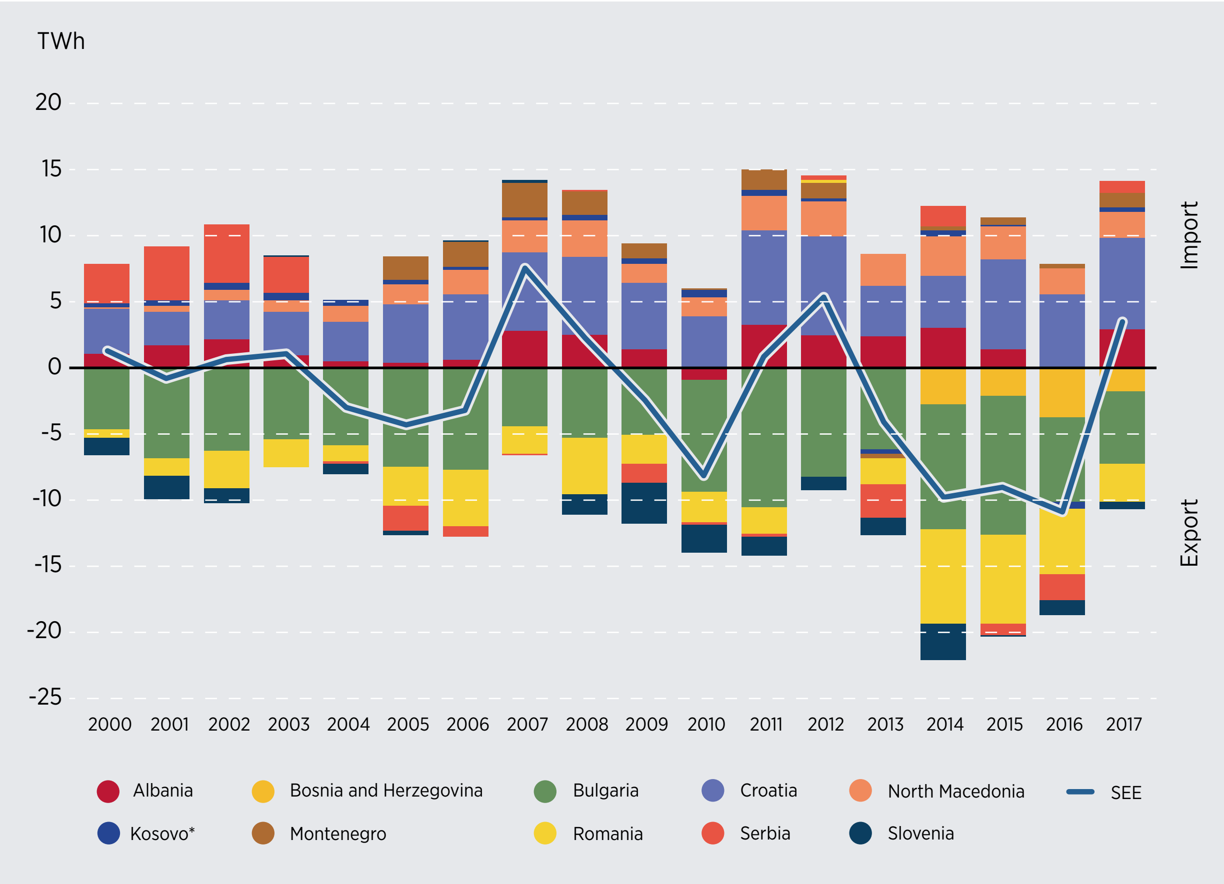
Past regional fragmentation hindered co-operation in joint energy projects and transmission infrastructure. Consequently, the level of cross-border exchange of electricity is still small compared to Western and Central Europe.

Over the years, the three countries operating nuclear power plants – Bulgaria, Romania and Slovenia – have been the most important electricity exporters in the region. In contrast, three countries have stood out for electricity imports: Albania, Croatia, and North Macedonia (Figure 2.3).

One of the main reasons for strong yearly variations in the cross-country electricity trade is the comparatively high share taken by hydropower. This implies a dependency on precipitation levels, making electricity supply in countries like Albania more vulnerable to climate change.

Indeed, Albania's ability to meet domestic electricity demand has varied greatly, depending on the hydrological situation. In 2010 and 2016, both particularly rainy years in the Balkans, the country met demand domestically, while in the dry years 2011, 2012 and 2017, it had to import relatively large amounts of electricity (Figure 2.3).

Figure 2.3 Electricity trade, SEE, 2000-2017



Note: The Republic of Moldova is not included, as its power system is not synchronised with the rest of the SEE region.
Source: Eurostat (2018)

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Although Albania is the extreme case, others, such as Croatia and Montenegro, face similar issues. North Macedonia imports a high share of its electricity consumption due to a lack of domestic generation capacity. This has decreased by about 25% in the last ten years, with the government facing challenges in attracting large-scale investments.

Overall, the region shifted from being a net importer in the early 1990s to being a net exporter after 2000, underlying strong yearly variations, depending on precipitation levels. In the past, Greece, Turkey and Italy have been major importers of electricity from the region, whereas electricity was imported mostly from Austria and Hungary into the better-connected SEE economies, Croatia and Slovenia. Moreover, by the end of 2019, a submarine direct current (DC) cable connecting Italy and Montenegro should be operational, which is likely to result in further exports of relatively cheap electricity from SEE.

Grid frequency in almost all systems of the region is synchronised in the Continental Europe Synchronous Area. The Republic of Moldova is the only jurisdiction in SEE that is part of the IPS/UPS[11] synchronous transmission system that also includes Russia and Ukraine, among others. No exchange of electricity currently take place between the Republic of Moldova and the rest of SEE. A new DC line (DC lines can connect two asynchronous areas) between the Republic of Moldova and Romania is planned (IRENA, 2019b).

ELECTRICITY PRICING

In 2018, electricity prices, including taxes and levies, were significantly lower in non-EU economies than in EU member (Figure 2.4). In the Republic of Moldova, however, regulated household prices have been rising continuously, due to increasing gas prices and the devaluation of the national currency.

In general, though, SEE electricity prices are among the lowest in Europe, which can partly be explained by the subsidies most systems place on power. A 2019 study by the EnC Secretariat, for example, evaluated the direct and indirect coal subsidies for the EnC Contracting Parties (EnC, 2019a). This showed that residential electricity prices, once direct and indirect subsidies were considered, would be up to 30% higher than currently, if these subsidies were removed.

Over the past 28 years, prices have been rising – by 500% in North Macedonia, for example (Bouzarovski, 2013). As SEE economies shift their market regulations towards liberalisation, price increases are also expected to continue (Robić *et al.*, 2016; Robić, 2016). At the same time, with the establishment of a cross-border electricity trade, price convergence will occur, up to the limit of transmission capacities. Thus, designing a market able to protect energy-vulnerable people within this process of market liberalisation is of great importance.

11 Integrated Power System (IPS)/Unified Power System (UPS) – the network linking the system of the Russian Federation (UPS) with many of its neighbours (IPS).

** This designation is without prejudice to positions on status and in line with the United Nations Security Council Resolution 1244 (1999).*

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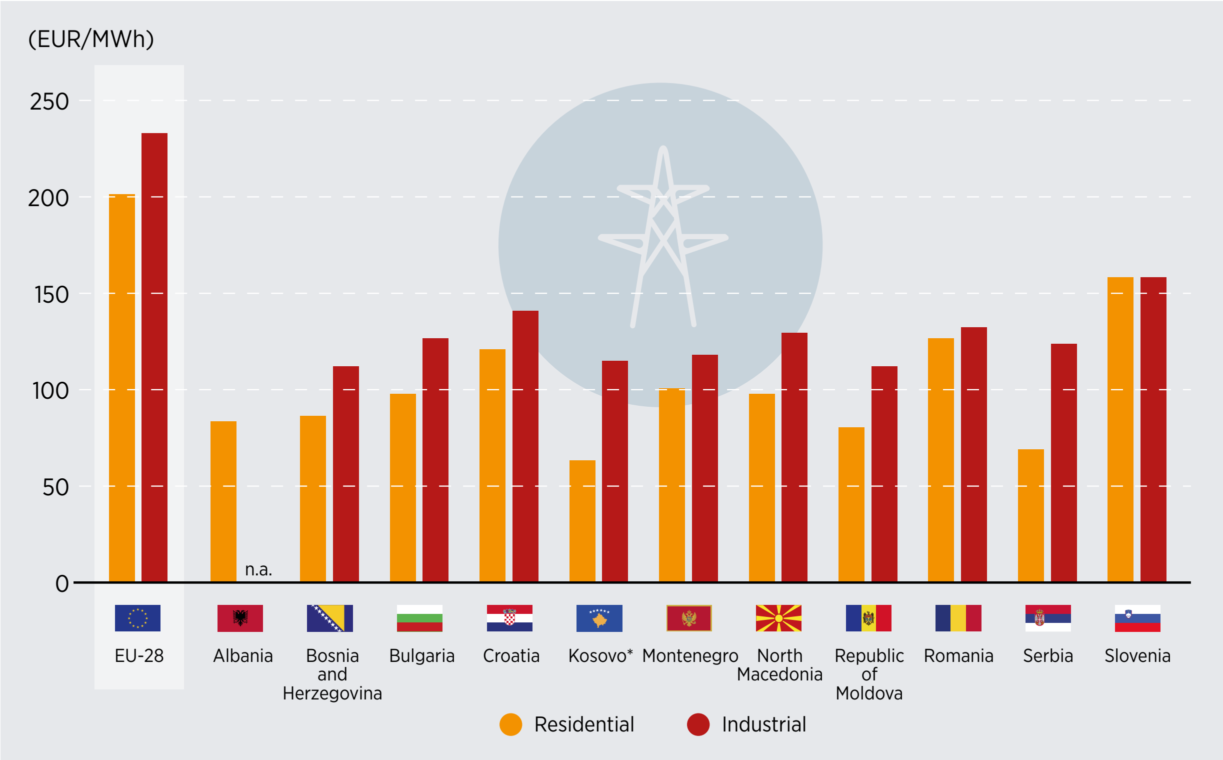
Figure 2.4 Electricity prices for households and industrial consumers, SEE, 2017 – second semester



Note: Electricity prices for household consumers, with a consumption between 1 000 and 2 499 kWh, and for non-household consumers, with a consumption between 500 and 2 000 MWh.

Source: Eurostat (2018)

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2.3 FINAL ENERGY CONSUMPTION

Total final energy consumption (TFEC) refers to the energy consumed by end-users, such as households, industry and transport, while it excludes the energy used by the energy sector itself.

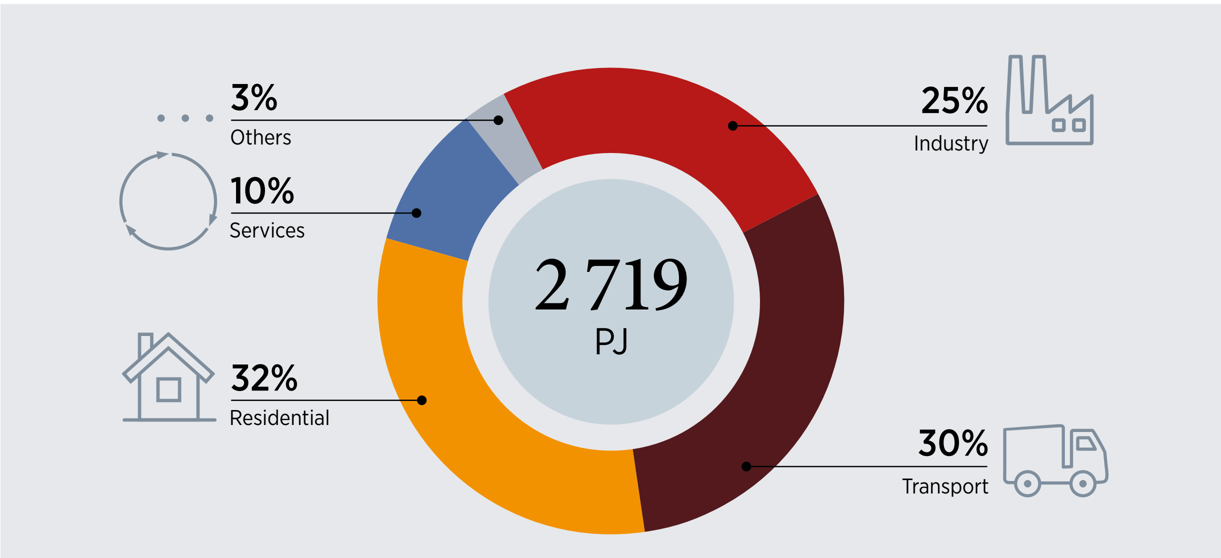
Between 2012 and 2016, as well as between 2000 and 2010, TFEC in SEE experienced stable growth rates. The residential sector is the largest consumer, with a 32% share of TFEC by 2016, and represents a significant opportunity to achieve energy savings (REN21/UNECE, 2015).

Over the same two periods, energy consumption in the transport sector rose strongly, reaching 30% of TFEC in 2017. Cumulatively, the industrial, transport and residential sectors accounted for 87% of TFEC that year (Figure 2.5).

Bioenergy is the most common form of renewable energy used by final consumers, mainly in residential heating. The three most relevant sectors are analysed in detail in the sections below.

Currently, final energy consumption levels per capita diverge strongly throughout the region (Figure 2.6) but are mostly well below the EU average.

Figure 2.5 Final energy consumption by sector, SEE, 2017



Source: IRENA (2019a)

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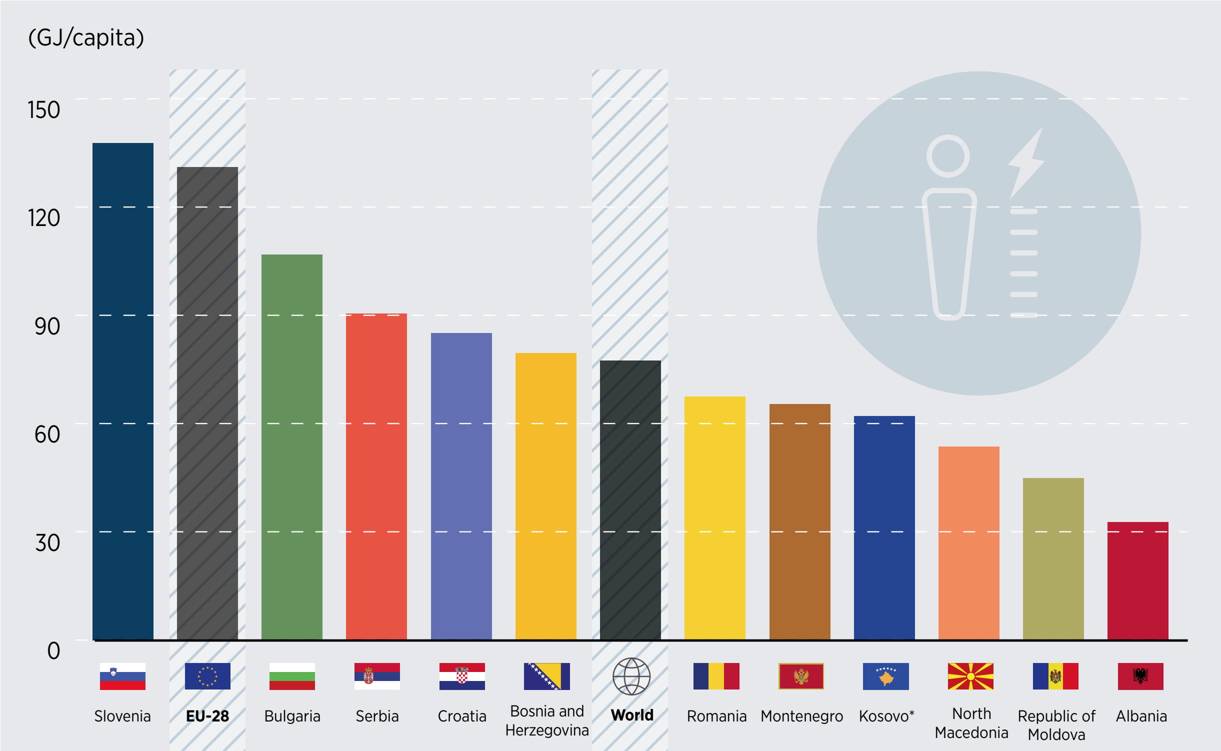
Figure 2.6 Energy consumption per capita, SEE, 2017



GJ = Gigagjoule
Source: World Bank (2019)

INDUSTRY

The main energy types employed in SEE's industrial sector are electricity and natural gas, followed by oil and coal (Figure 2.7).

Industrial consumption ranges, between economies, from 17.5% (Croatia) and 28% (Bulgaria) of the TFEC. Industrial processes have been increasingly electrified in all the economies of SEE, with the share of electricity in total energy demand increasing from 17% in 1990 to 31.5% in 2017. Low electricity prices resulting from lignite, hydro and nuclear generation have strengthened this trend. The rising market share taken by electricity was also at the expense of gas, which saw its sectoral share of TFEC decline steadily over the same period, from 50% to 30%. As domestic gas reserves have been rapidly declining, rising prices have made it unattractive for industries to rely on the fuel. A significant share of today's gas consumption comes from the non-energy use in fertiliser plants in Bulgaria, Croatia, Romania and Serbia. Often, these industries benefit from government protection or subsidies, due to their domestic importance and low competitiveness.

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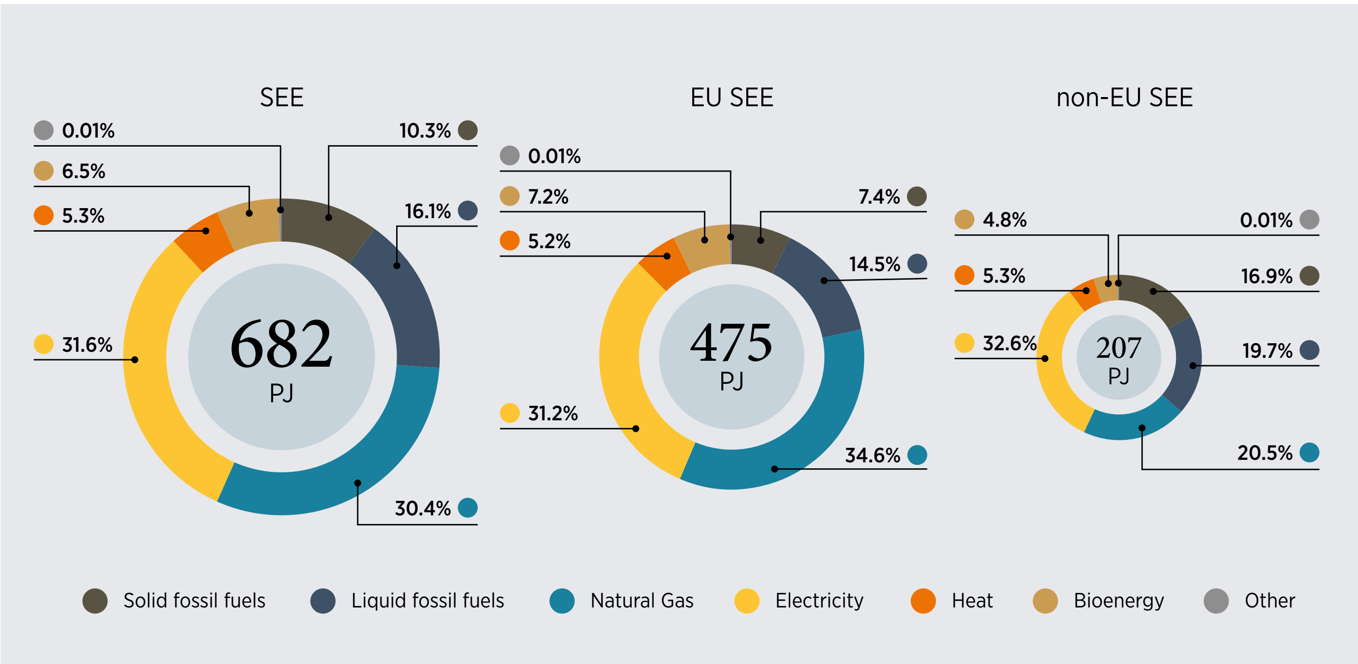
In 2017, only 6.5% of the industrial sector's consumed energy came from renewable sources. Bioenergy was almost the only renewable energy solution in this sector, accounting for 99% of total renewables. Breaking down industry's final energy consumption, it appears that industrial sectors with the natural availability of this source have opted to utilise it for their own needs. Some 70% of the bioenergy is consumed in the wood, wood products, paper, pulp, print and food industries, which manufacture wood and other bio-based products on a daily basis.

Figure 2.7 Energy consumption in the industrial sector by energy carrier, SEE (left), EU SEE (centre) and non-EU SEE (right), 2017



Source: IRENA (2019a)

02

HOUSEHOLDS

In 2017, the residential sector accounted for 32% of the region's TFEC. The sector's shares ranged from 23% in Slovenia to 45% in the Republic of Moldova.

Across the region, biomass plays a major role in residential sector heating (Figure 2.8). Its share has increased considerably throughout the past 25 years, accounting for 39% of regional residential TFEC in 2017 – an amount equal to 861 PJ, ranging from 26% of residential consumption in Albania to 60% in Kosovo*.

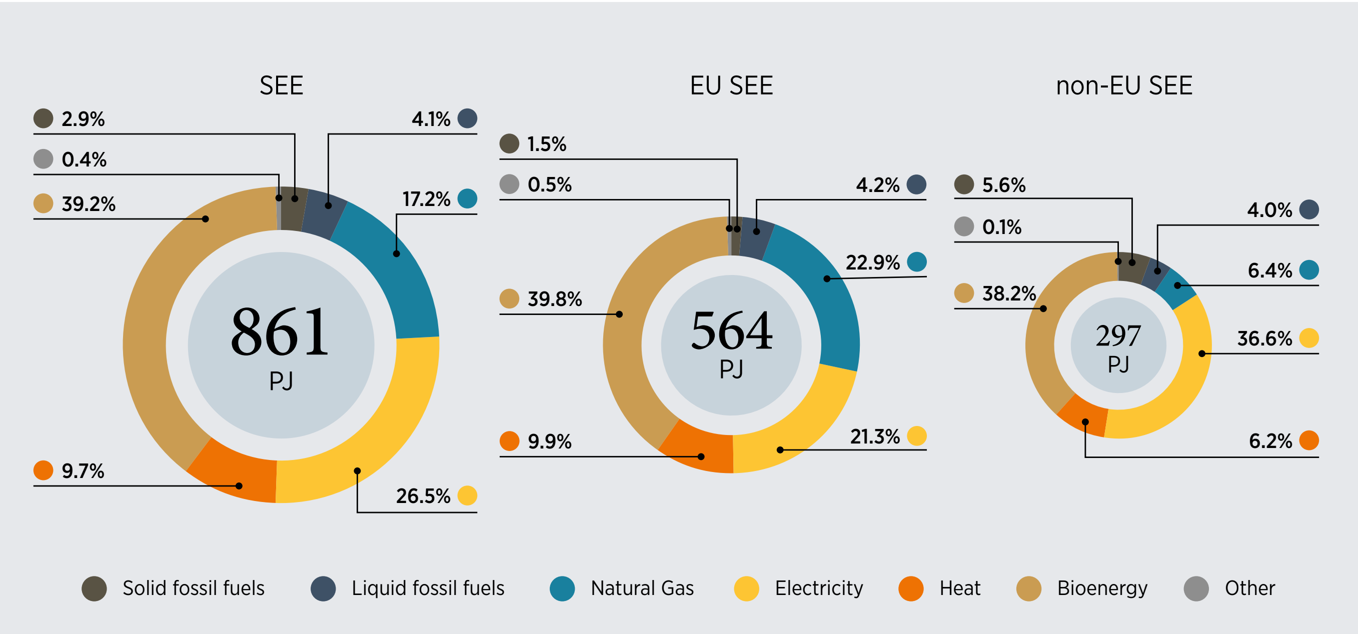
District Heating (DH) networks play an important role in all SEE economies, except for Albania, Montenegro and Kosovo*. In Serbia, after a period of poor maintenance in the 1990s, the share of DH in energy consumption began increasing again in 2001, due to the refurbishment of many networks.

Currently, most of SEE's DH systems are still operated on lignite and gas. Yet, this infrastructure could potentially integrate renewables – such as biomass, solar and geothermal energy – into the heating sector on a system-wide level.

Gas is used as a source of domestic space heating in Bosnia and Herzegovina, Croatia, the Republic of Moldova, Romania, Serbia and Slovenia. Bulgaria and Serbia are the only countries that employ coal for domestic space heating to a significant degree.

In the region overall, oil has decreased to 4% of residential TFEC, taking only small shares of domestic energy consumption, mainly in Albania, Croatia and Slovenia.

Figure 2.8 Energy consumption in the residential sector by energy carrier (PJ), SEE (left), EU SEE (centre) and non-EU SEE (right), 2017



Source: IRENA (2019a)

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The direct contribution of renewable energy sources other than biomass to residential energy demand is marginal. Solar thermal resources are scarcely used in the region, accounting for less than 0.2% of the TFEC, or 1.5 PJ. The highest share is in Albania, where solar thermal accounts for 1.2% of residential energy demand. In comparison, solar thermal collectors provide 5% of the energy consumed in households in Greece. Given the good level of solar resources, in particular in the southern part of the region, solar water heating can provide a significant contribution to meeting residential energy demand.

02

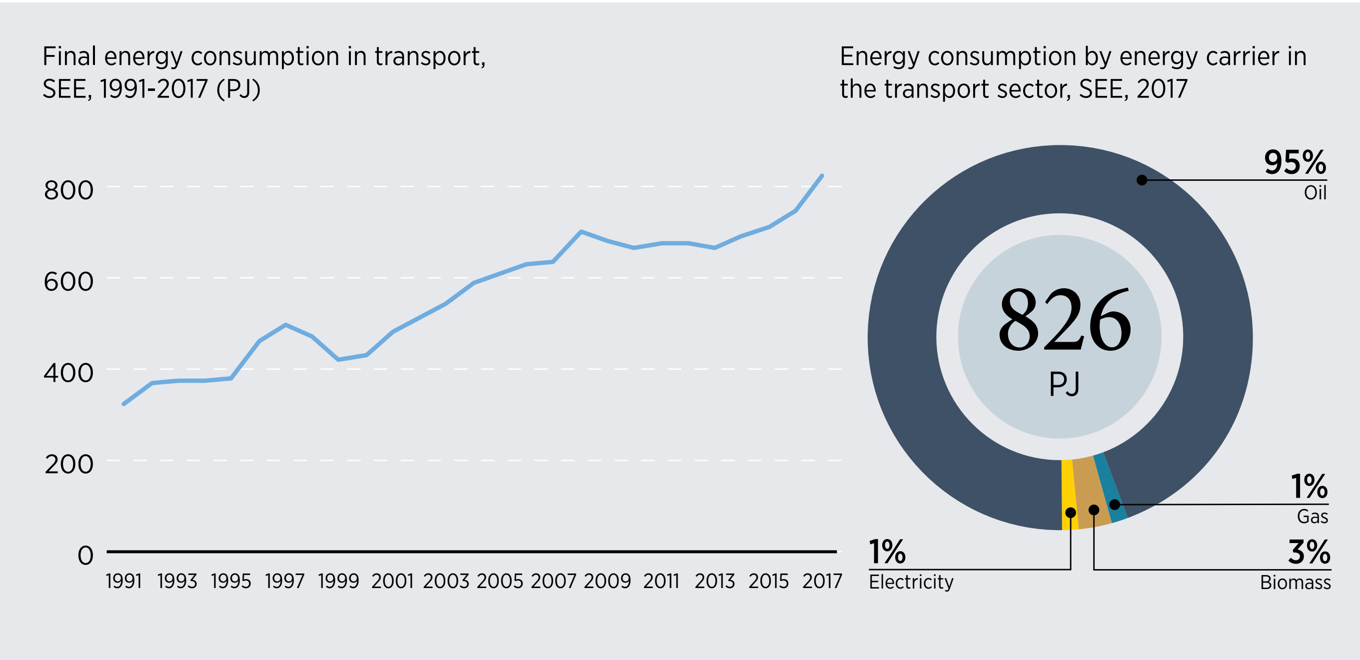
TRANSPORT

Energy consumption in the SEE transport sector has steadily increased over the past 25 years and was the largest energy consumer in 2017, accounting for 30% of TFEC, or 826 PJ. Rising rates of car ownership – resulting from the increased purchasing power of consumers – and new mobility patterns amongst younger generations have reinforced this development. By jurisdiction, transport's share of TFEC ranges between 23% in the Republic of Moldova and 40% in Albania. As in most regions of the world, the transport sector in SEE relies almost exclusively on oil (Figure 2.9).

Railway infrastructure exists in all the jurisdictions of the region, but has limited infrastructure, especially outside the EU. In general, development of railway infrastructure lags behind road infrastructure. Insufficient funding and a low level of maintenance, compared to previous years, have contributed to the current poor condition of the region's railway system. Transnational lines, for example, are few. To break the rapidly increasing trend of fossil fuel consumption in the transport sector, public transportation and the railway system in particular need to be strengthened.

The share of renewable energy in transport fuels is small (3%) and concentrated in a few economies: only Albania (10%), Romania (6%) and Bulgaria (5%) have achieved a significant share of biofuel in road transport.

Figure 2.9 Energy consumption in the transport sector, SEE, 2017



Note: Bosnia and Herzegovina and Republic of Moldova are not included in the time series due to a lack of historic data.
Source: IRENA (2019a)

2.4 ENERGY REGULATION

The following section describes the energy regulation that affects the energy sector in SEE.

REGULATORY FRAMEWORK

EU member states, as well as Contracting Parties of the EnC, are strongly influenced in their institutional setups by the Energy Liberalisation Packages of the EU. Table 2.3 provides an overview of energy regulators and TSOs, as well as other important institutions involved in governing the region's energy sector. Importantly, in only five economies (Bosnia and Herzegovina, Croatia, Montenegro, Romania and Slovenia) is the function of power market operator performed by an entity independent from the TSOs.

At the core of these EU-driven legal obligations stands the creation of a competitive and non-discriminatory internal energy market. Their aim is to increase competition in electricity generation by establishing liquid cross-border markets, given that many SEE economies lack the critical size to establish a liquid market within their own territory. This should increase attractiveness for investments and introduce competition on supply side to lower consumer prices within the region. Until recently, vertically integrated utilities have been the prevalent electricity market structure in SEE. Their transition to a liberalised electricity market would require a profound and challenging system transformation in most power systems in the region. The conventional approach is to unbundle generation, transmission, distribution and supply, thus enabling competition. Objective, non-discriminatory and transparent third-party access to the transmission and distribution networks based on regulated tariffs is another key pillar for the creation of a competitive electricity market. Moreover, prices in wholesale and retail markets would also need to be deregulated. Table 2.4 provides an overview of the ongoing implementation of electricity market reform.

Enhanced regional co operation could provide cost-effective options in dealing with generation adequacy and in ensuring a secure supply of electricity, gas and oil. To enable optimal functioning of internal electricity and gas market, market rules were unified across the region and the roles and responsibilities of market participants and regulators clarified with the adoption of Network Codes.

The European Network of Transmission System Operators for Electricity (ENTSO-E)[12] and for Gas (ENTSO-G) represent European TSOs and foster their co operation. Projects of Common Interest (PCIs) are key cross border infrastructure projects that have a significant impact on energy markets and market integration. By defining PCIs, EU investments in electricity and gas transmission capacity can be channelled.

Currently, complete market coupling between the SEE economies remains largely at the planning stage. Meanwhile, the EnC has been actively promoting

12 ENTSO-E covers the energy networks of SEE, except for the Republic of Moldova.

02

Table 2.3 Institutions of the energy sector in SEE

	Power market operator	**Energy regulator**	**Renewable energy agency**	**Energy efficiency agency**	**TSO**
Albania	Transmission System Operator – OST	Energy Regulatory Authority (ERE)	No	Energy Efficiency Agency	OST
Bulgaria	Electricity System Operator EAD (TSO)	Energy and Water Regulatory Commission	Sustainable Energy Development Agency		Electricity System Operator EAD
Croatia	Croatian Energy Market Operator	Croatian Energy Regulation Agency	No	No	Croatian Transmission System Operator (HOPS)
Bosnia and Herzegovina	Independent System Operator (NOS BiH)	**State level:** Electricity Regulatory Commission (SERC) **Entities level:** Regulatory Commission for Energy in Federation of Bosnia and Herzegovina (FERC) Regulatory Commission for Energy of Republika Srpska (RERS)	**State level:** No Federation of Bosnia and Herzegovina: The operator for renewable energy sources and efficient cogeneration Republika Srpska: Elektroprivreda Republike Srpske	No	Elektroprenos BiH
Kosovo*	Transmission, System and Market Operator (KOSTT) (TSO)	Energy Regulatory Office (ERO)	No	Kosovo* Agency for Energy Efficiency	Transmission, System and Market Operator (KOSTT)
North Macedonia	Electricity Transmission System Operator of Macedonia (MEPSO) (TSO)	Energy Regulatory Commission of the Republic of North Macedonia (ERC)	Energy Agency of the Republic of North Macedonia		Electricity Transmission System Operator of Macedonia (MEPSO)
Montenegro	Montenegro Electricity Market Operator (COTEE) (TSO)	Energy Regulatory Authority (RAE)	No	No	Montenegrin Electricity Transmission System (CGES)
Republic of Moldova	No	National Agency for Energy Regulation (ANRE)	Energy Efficiency Agency		Moldelectrica
Romania	Romanian Electricity and Gas Market Operator (OPCOM)	Romanian Energy Regulatory Authority (ANRE)	No	No	Transelectrica
Serbia	Elektromreža Srbije (EMS) (TSO)	Energy Agency of the Republic of Serbia (AERS)	No	No	Elektromreža Srbije (EMS)
Slovenia	Borzen – Slovenian Power Market Operator	Energy Agency of the Republic of Slovenia (AGEN-RS)	No	No	Electricity Transmission System Operator (ELES)

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Table 2.4 State of the market reforms in 2018

		Grids		Wholesale market		Retail market
		Transmission	Distribution	Share of largest generator (2016)		
EU member states	Bulgaria			n/a		[1]
	Croatia			80.7%		
	Romania			28.5%		
	Slovenia			53.9%		
Contracting Parties of the Energy Community	Albania			n/a	[2]	[3]
	Bosnia and Herzegovina			43.9%	[4]	
	Montenegro			97.7%		
	North Macedonia			81.3%		
	Kosovo*			96.0%		[5]
	Republic of Moldova			80.5%		[6]
	Serbia	[7]		98.9%		

Legend		
	Legal and functional unbundling	Deregulated prices
	Partly unbundled	Partly deregulated prices
	Bundled ownership	Regulated prices

Notes

[1] Only one supplier in each region, regulated prices for households and small and medium enterprises.
[2] Regulated wholesale prices and power purchase agreements are still applied by use of public service obligations.
[3] Regulated prices for households and all customers, except some of those connected to medium voltage, remain under regulated supply.
[4] Regulated wholesale prices still apply in Republika Srpska.
[5] Prices deregulated for the supply of high voltage customers only.
[6] Only three suppliers out of twenty are supplying at unregulated price.
[7] Serbia's regulator, AERS, certified the TSO as unbundled; however, the Energy Community Secretariat concluded that compliance has not yet been fulfilled (EnC, 2019a, 2017).

Source: Eurostat (2018); EnC (2019b, 2018a)

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02

the establishment of a common, regional electricity market consisting of Albania, Bosnia and Herzegovina, Kosovo*, North Macedonia, Montenegro and Serbia via the so-called "Western Balkan Six Initiative".

In addition, in July 2018, under an initiative by the United States Energy Association (USEA) and the United States Agency for International Development (USAID), a Memorandum of Understanding (MoU) was signed between the TSOs and market operators of eight SEE economies (Albania, Bosnia and Herzegovina, Croatia, Kosovo*, North Macedonia, Montenegro, Serbia and Slovenia). The MoU covers sharing of data on generation, transmission and the electricity market, with the aim of optimising regional network operations and attracting international investments.

The TSOs of Albania, Bulgaria and North Macedonia have also signed an MoU which envisages the coupling of their day-ahead markets (DAMs). Currently, North Macedonia and Albania do not have a power exchange. North Macedonia and Bulgaria have already signed an MoU for DAM coupling, which envisages the market coupling from 2020 (BGE, 2019a). Bulgaria has amended its energy law to abolish a fee levied on exports of electricity, in what will remove obstacles to trade with EnC Contracting Parties and pave the way for the future market coupling with North Macedonia.

2.5 ENERGY SECURITY

At present, SEE is highly dependent on oil and gas imports, with 2016 seeing 65% of total consumption imported.

National import dependency varies between 22% and 71%, depending on the availability of coal. Seven out of the 11 jurisdictions of the region also import over 95% of their oil and gas demand, which makes them vulnerable to of energy price fluctuations, listed in foreign currency (Figure 2.10).

In the case of natural gas, security of supply is potentially threatened by low diversification and dependency on the network infrastructure. This is specifically the case with gas infrastructure that is dependent on a single source of supply, with potential import interruption (due to technical, commercial or geopolitical reasons). Oil import dependency is less of an issue, given its higher transport flexibility.

Better interconnections and a higher share of renewables, combined with efforts to promote energy efficiency, are some of the ways to address the energy dependency challenge.

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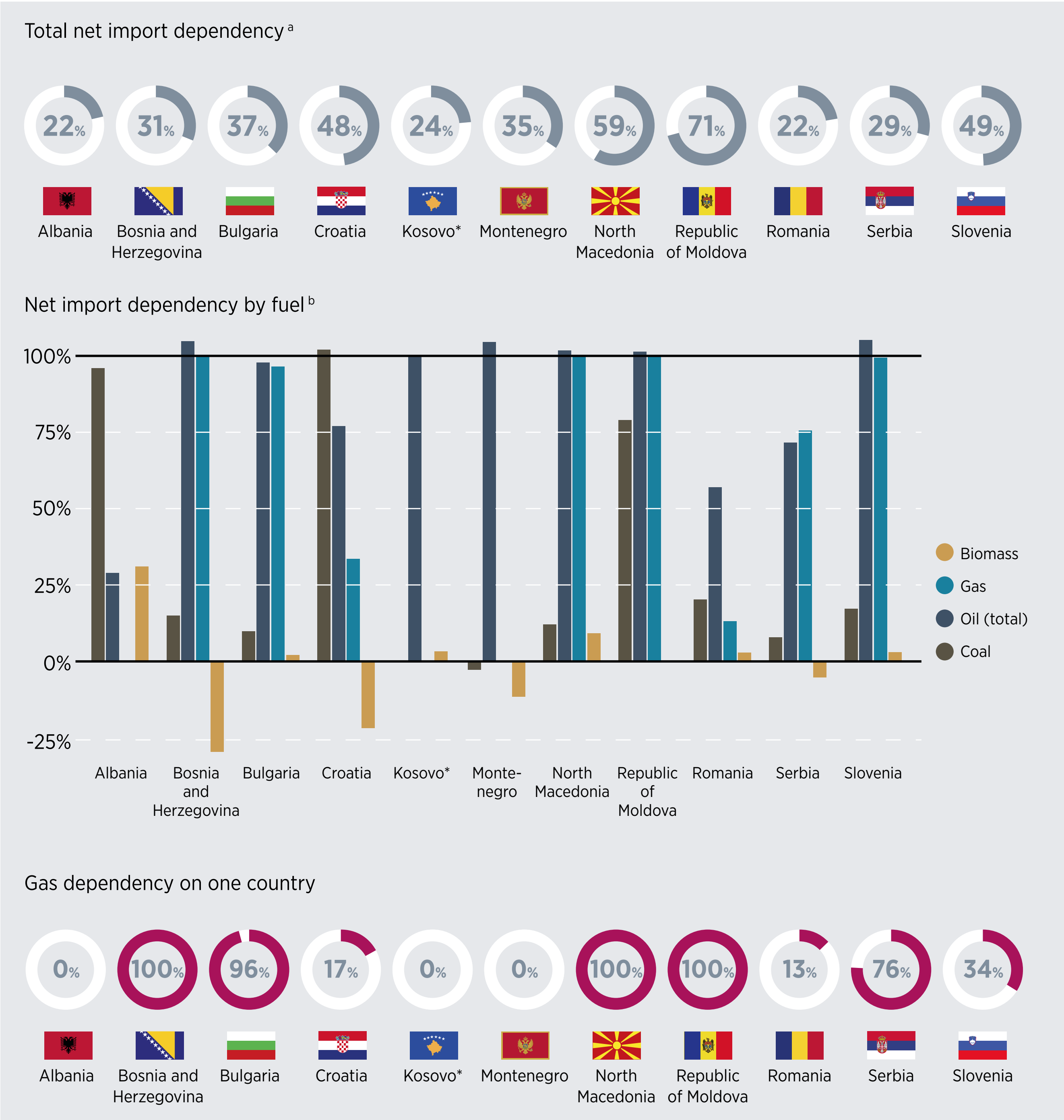
Figure 2.10 Fuel import dependency



Source: Eurostat (2018)

a *Defined as share of net imports of all energy carriers on gross inland consumption.*

b *Defined as share of net imports on gross inland consumption of specified fuel; note that a dependency rate above 100% relates to the build-up of stocks.*

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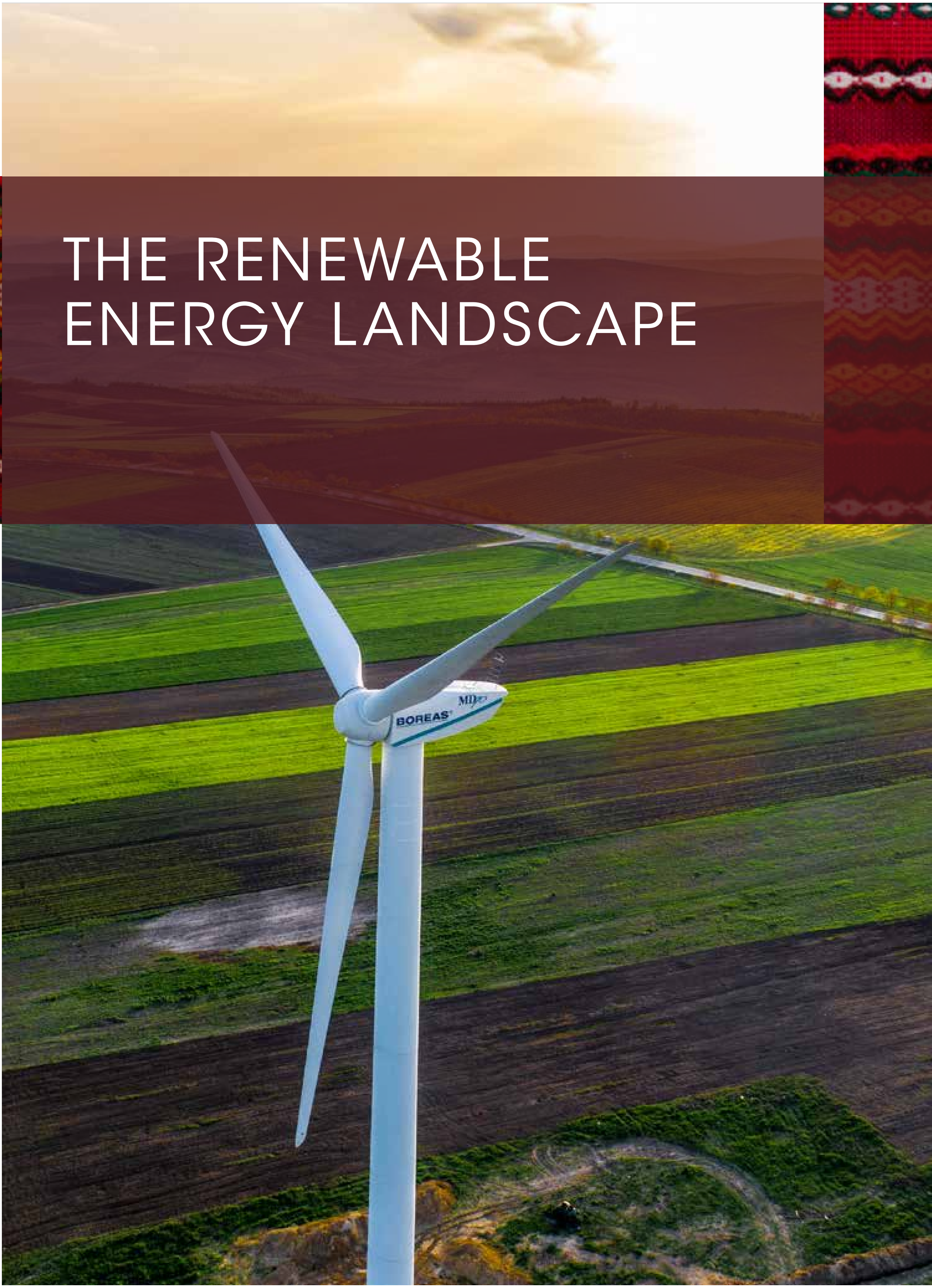
THE RENEWABLE ENERGY LANDSCAPE



SEE has abundant renewable energy resources, with their use already part of many inhabitants' daily lives. Indeed, thanks to considerable installed hydropower capacity and the extensive use of biomass in residential heating, the SEE economies use a higher proportion of renewable energy than the EU average.

This chapter provides an overview of the renewable energy sector across SEE, including regional potential, costs, policies and the barriers to further deployment.

3.1. RENEWABLE ENERGY POTENTIAL AND COSTS

Historically, the region's power generation profile has been significantly shaped by large hydropower plants, while heating needs have mainly been covered by the large biomass endowment. The overall estimated unexploited potential for renewable energy is still substantial, however. This section explores that potential and the costs of the renewable energy technologies in the region, with the exception of biomass, for which a separate chapter is dedicated.

RENEWABLE ENERGY POTENTIAL

IRENA has undertaken an analysis on cost-competitive renewable energy in SEE (IRENA/JRUL, 2017), which carried out a systematic assessment of the region's overall renewable electricity potential.

The analysis found that SEE sits on rich and partially untapped renewable energy resources.

Despite having an installed hydropower capacity of more than 22 GW, the region still has the largest remaining unexploited hydropower potential in Europe, as its river catchments have remained largely undeveloped. The technical potential of hydropower is estimated to be 522 PJ per year (Table 3.1).

While up to 140 large (above 10 MW of capacity) greenfield hydropower plants and more than 2 700 small projects (each below 10 MW of capacity) are in the production pipeline, the sustainability of these projects has sometimes been questioned (BGE, 2019b; WBIF, 2019b, 2018a; DW, 2019). In the last couple of years, opposition to the construction of small hydropower plants has been growing, mainly in Albania, Bosnia and Herzegovina, Croatia and Serbia. Local stakeholders and non governmental organisations (NGOs) have called for a set of principles for sustainable hydropower to be respected, with one of these principles being the prioritisation of investment in rehabilitating existing plants.

03

In 2016, the EU commissioned a study on hydropower for the Western Balkans. This was aimed at defining how to develop the region's hydropower potential in a way that balances energy generation, flood protection and environmental concerns. The study concluded that the first, immediate priority for investment should be the rehabilitation and increased efficiency of existing hydropower plants, in combination with ecological restoration measures. This would safeguard the existing capacity and generation that hydropower currently contributes to the region's energy mix. The study concluded that the development of greenfield projects should be limited to hydropower plants, as the contribution of small plants to energy production is extremely limited, while their impact on the environment can be severe. Western Balkan waterways provide the region's inhabitants with many services that are essential to their livelihoods. Hydropower must therefore be developed in compliance with the highest standards of ecological preservation (WBIF, 2018a). Some refurbishment and modernisation is already taking place, at, for example, the Iron Gate 2 hydropower plant in Serbia.

Global horizontal irradiance, a key parameter in solar PV installation, is higher in the southern part of the region, where it reaches over 4.5 kilowatt hours per square metre per day (kWh/m^2/day). Solar resources in the northern part are more modest, down to 3 kWh/m^2/day, but in line with or better than other European countries with large PV deployment, such as Germany (Figure 3.1). The utility-scale solar technical potential of the SEE region is estimated at around 245 PJ (Table 3.1).

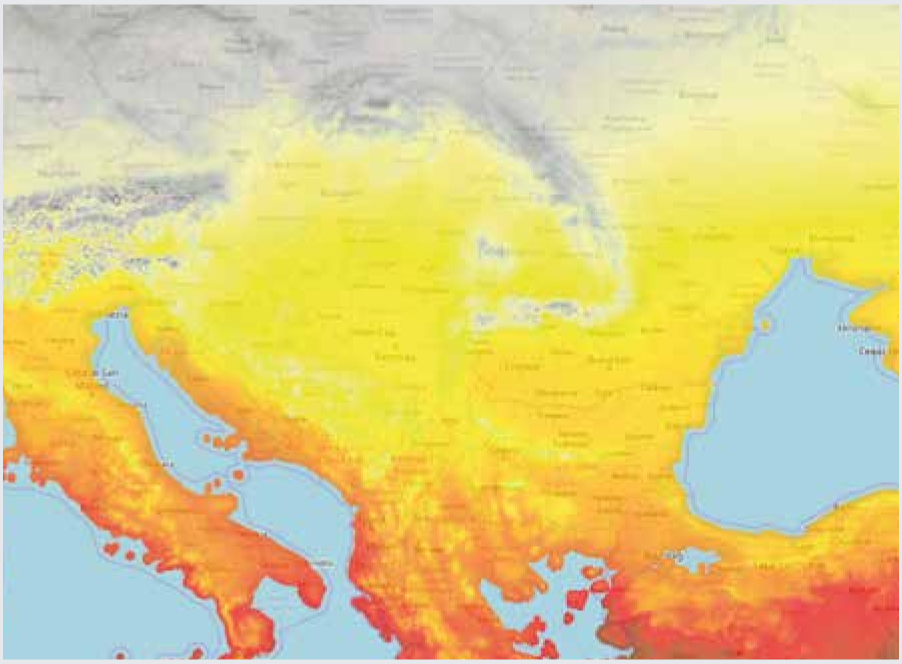
The whole region is endowed with good wind resources, with wind blowing at average speeds of between 5.5 metres per second (m/s) and 7 m/s, at 100 metre height. The mountainous and coastal landscape increases the variation in wind resource across the region, with higher average wind speeds in coastal areas and at high altitudes. The Eastern coast of the region (Republic of Moldova and Romania) enjoys the best wind resources, with average wind speeds of 6 m/s to 7 m/s(Figure 3.1). The Adriatic coast (Albania, Bosnia and Herzegovina, Croatia, Montenegro and Slovenia) enjoys similar average wind speeds, but this area is also regularly hit by winds that gust between 150 and 200 kilometres per hour (known as the "Bora"). This adds additional stress on wind turbines. Wind energy is not harvested at its full potential, however, as in nearby countries with similar wind resources, with the exception of harvesting in the EU member states of the region.

The technical potential of SEE's wind energy currently is estimated at 1 436 PJ (Table 3.1).

Notably, the presence of a good technical potential is a necessary but not sufficient condition for deployment. Other aspects to consider are the economic limits to supply, the market constraint and the presence of appropriate supply chains.

Figure 3.1 Solar resources in the SEE region and surrounding countries

Global horizontal irradiance

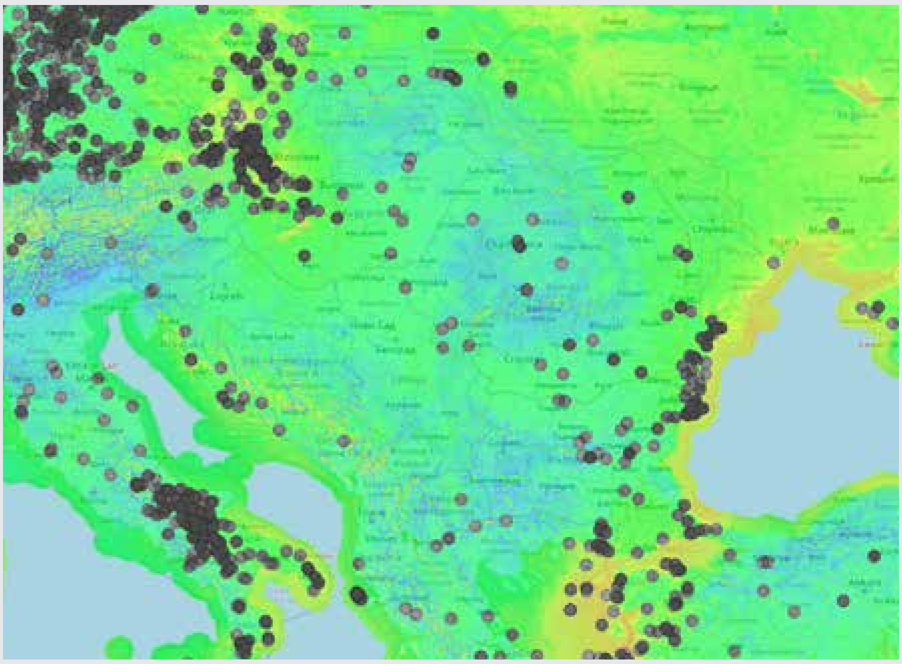


- 2.34-2.58 kWh/m²/day
- 2.58-2.83 kWh/m²/day
- 2.83-3.08 kWh/m²/day
- 3.08-3.32 kWh/m²/day
- 3.32-3.57 kWh/m²/day
- 3.57-3.81 kWh/m²/day
- 3.81-4.06 kWh/m²/day
- 4.06-4.30 kWh/m²/day
- 4.30-4.55 kWh/m²/day

Source: IRENA (2019c)

Figure 3.2 Wind speed and wind power plants in the SEE region and surrounding countries

Wind speed at 100 metre height and wind power plants



- 2 m/s
- 3 m/s
- 4 m/s
- 5 m/s
- 6 m/s
- 7 m/s
- 8 m/s
- Wind power plants

Source: IRENA (2019c)

03

Table 3.1 Technical potential in the region for utility-scale solar PV, wind and hydropower in the power sector (TJ)

	Utility-scale solar PV	Onshore wind	Hydropower
Albania	13 342	49 154	56 059
Bosnia and Herzegovina	14 886	94 810	88 193
Bulgaria	36 468	190 264	48 071
Croatia	15 682	104 951	30 600
Kosovo*	3 006	13 860	4 853
Montenegro	3 874	23 332	18 079
North Macedonia	8 014	27 558	14 421
Republic of Moldova	21 758	180 450	12 099
Romania	92 902	554 522	136 800
Serbia	33 509	188 590	64 800
Slovenia	1 613	8 266	58 539
SEE	245 052	1 436 156	532 515

TJ = Terajoule
Source: IRENA/JRUL (2017)

** This designation is without prejudice to positions on status and in line with the United Nations Security Council Resolution 1244 (1999).*

COST COMPETITIVENESS OF RENEWABLES IN SEE

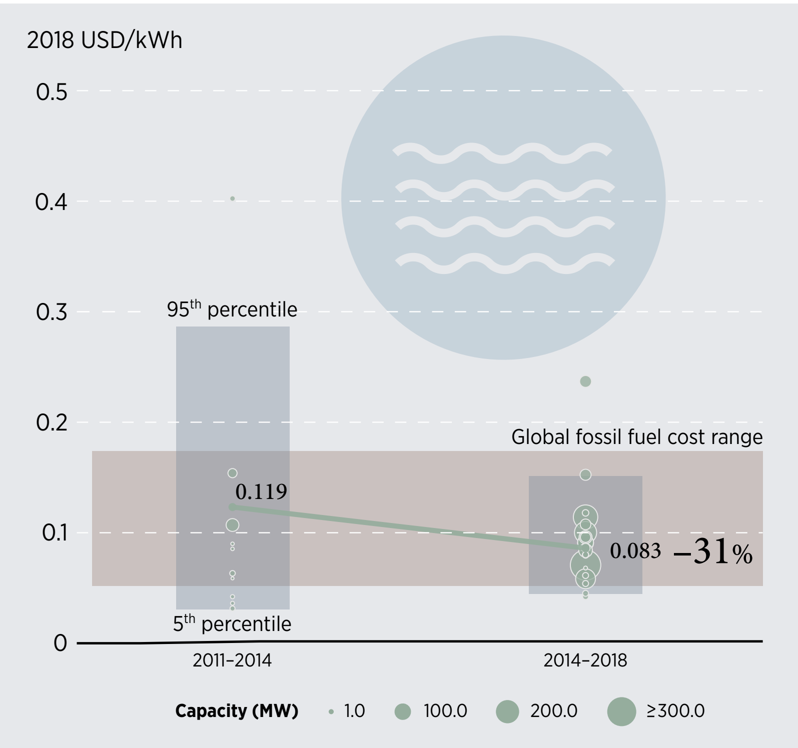
Renewables have become the lowest-cost source of new power generation in many parts of the world, with costs continuing to fall for solar and wind technologies. Hydropower is now not alone in providing cheaper electricity than fossil fuels (IRENA, 2019d).

In SEE, however, the market remains very undeveloped. Between 2011 and 2014, SEE installed 3.9 GW of onshore wind and 2.7 GW of solar PV. During this period, the deployment of these modern technologies was more than four times higher than for the more mature hydropower technology. After this promising start, however, project development stagnated, with the scale of deployment falling significantly between 2015 and 2018. During that time, combined onshore wind and solar PV additional capacity decreased by 88%, compared to the period 2011-14.

Hydropower

Hydropower is a very cost-competitive option for new power. Data from the IRENA Renewable Cost Database show that the weighted-average levelised cost of electricity (LCOE)[13] from hydropower in SEE decreased by a third from the 2011 to 2014 period to the 2015 to 2018 period. During the latter three years, the weighted-average LCOE of hydropower in the region was USD 0.083/kWh (Figure 3.3).

Figure 3.3 LCOE for utility-scale hydropower, SEE, 2011-2018



Source: IRENA (2019d)

13 *The LCOE of a given technology is the ratio of lifetime costs to lifetime electricity generation, both of which are discounted back to a common year using a discount rate that reflects the average cost of capital. Here, LCOE results are calculated excluding any financial support and using a fixed assumption of a real cost of capital of 7.5%, unless explicitly mentioned. All LCOE calculations exclude the impact of any financial support.*

03

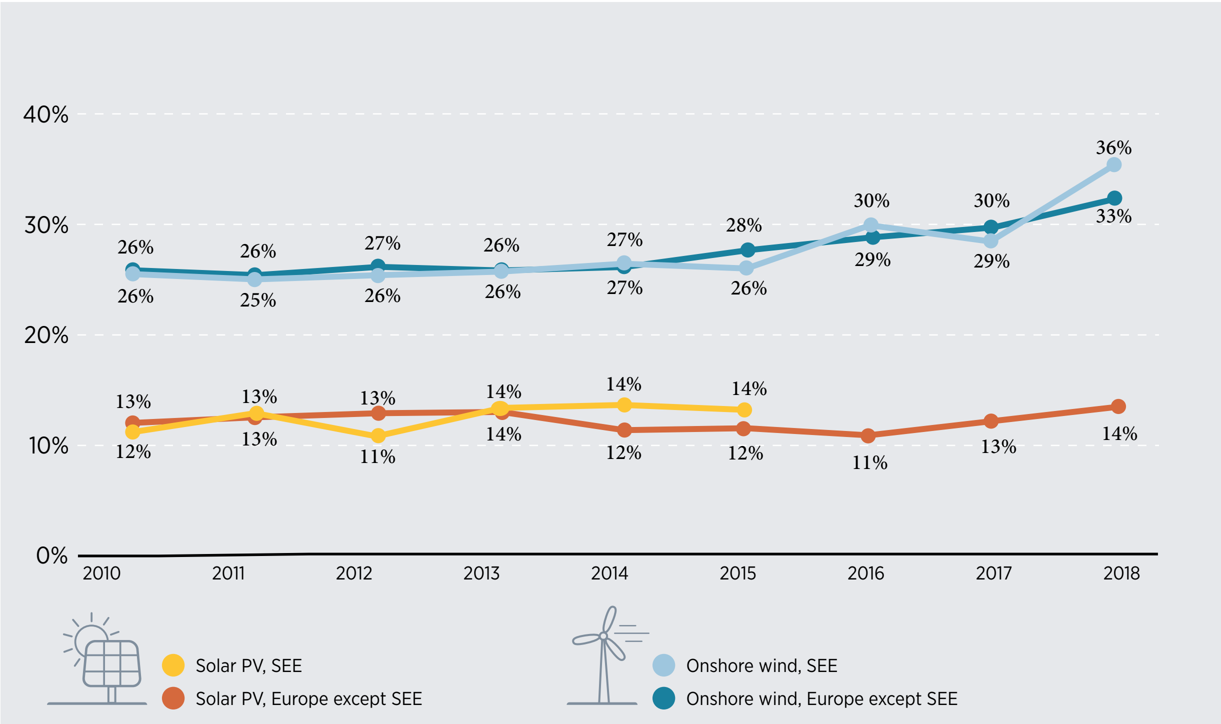
Solar PV and onshore wind

Available data for projects in the IRENA Renewable Cost Database indicate that the capacity factor[14] of utility-scale solar PV and onshore wind projects in SEE has been historically in line with the values achieved in other European countries. In addition, the weighted-average capacity factor has shown a slight upward trend, across the region (Figure 3.4).

Although the low level of deployment poses challenges to data collection in the region, the central value for solar PV total installed costs during 2018 can be estimated at around USD 1 215/kW (about 10% higher than the weighted-average of European countries outside SEE). Meawhile, more competitive G20 countries have reported costs below USD 1 000/kW (Figure 3.5).

Assuming a 7.5% cost of capital, the range of total installed costs for solar PV can translate into an LCOE range of between USD 0.093 and USD 0.130/kWh. For SEE, a central LCOE value of USD 0.105/kWh can be estimated for 2018, about 5% higher than the weighted-average value for European markets outside SEE (Figure 3.6).

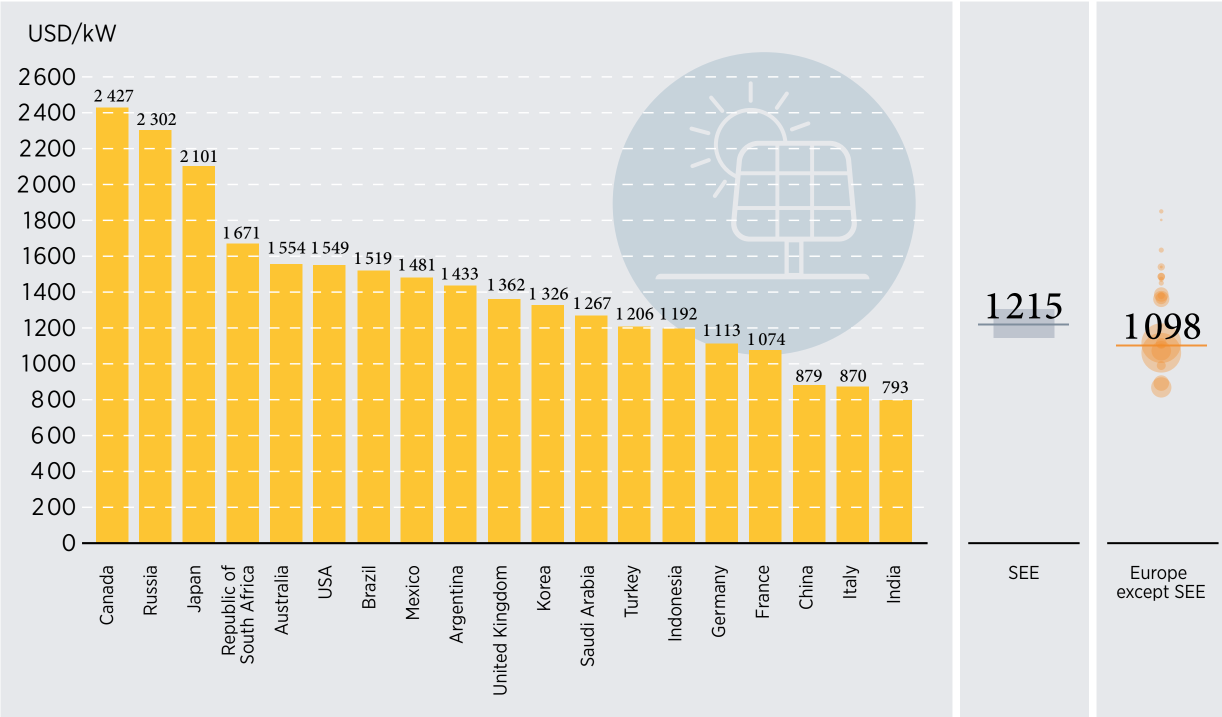
Figure 3.4 Average capacity factor trends, SEE compared with the rest of Europe, 2010-18



Source: IRENA (2019d)

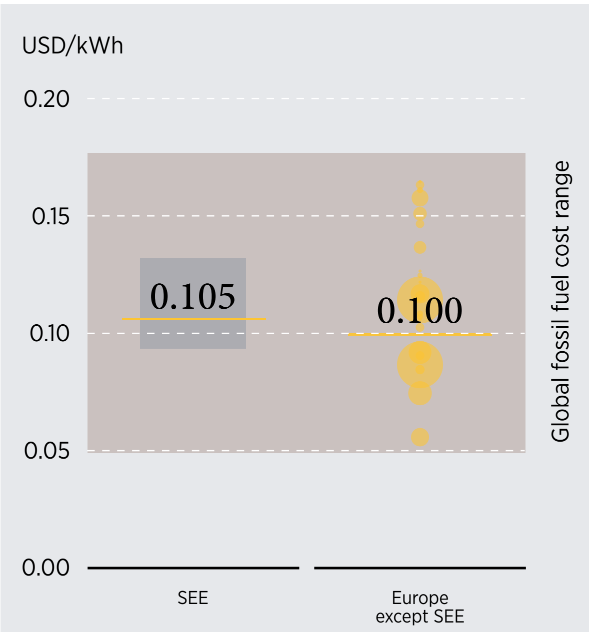
14 The capacity factor is the ratio between the average power generated and the rated peak power.

Figure 3.5 Solar PV average installed costs, G20, SEE, and rest of Europe, 2018



Source: IRENA (2019d)

Figure 3.6 LCOE for utility-scale solar PV, SEE compared to the rest of Europe, 2018



Source: IRENA (2019d)

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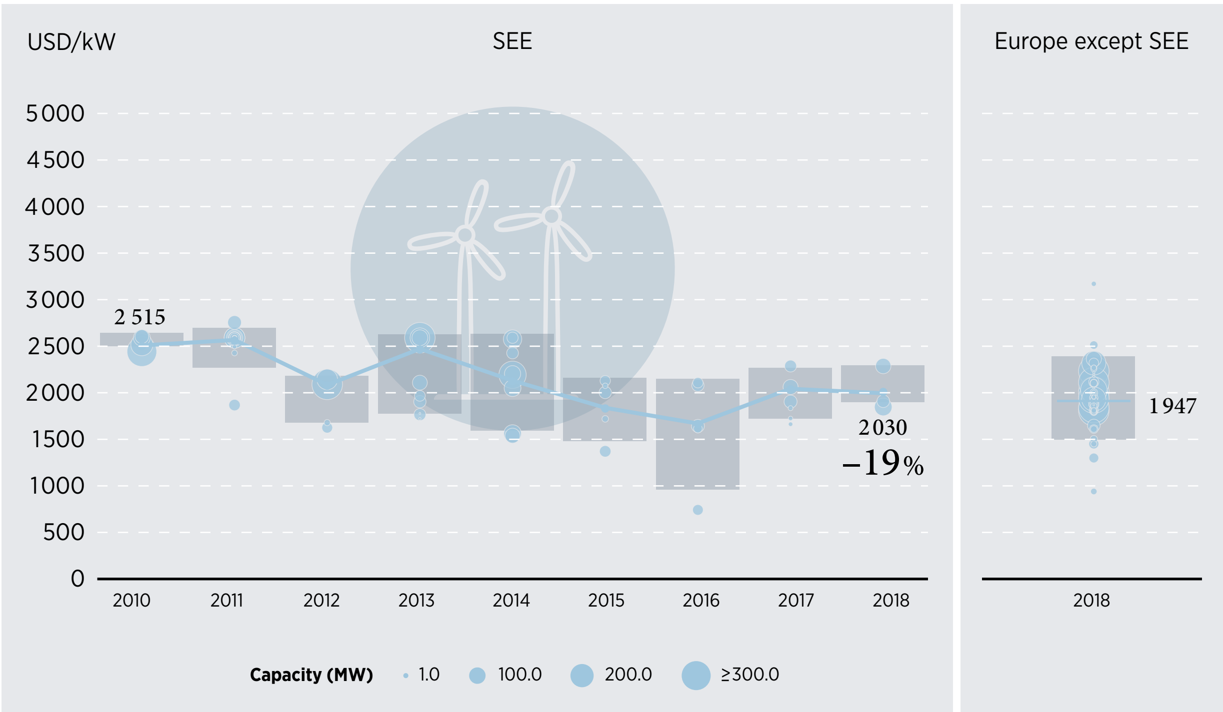
Driven by a global trend in falling turbine and balance of project costs, total installed costs in SEE have decreased 19% since 2010. The weighted-average value in 2018 was USD 2 030/kW, 4% higher than in European markets outside SEE (Figure 3.7).

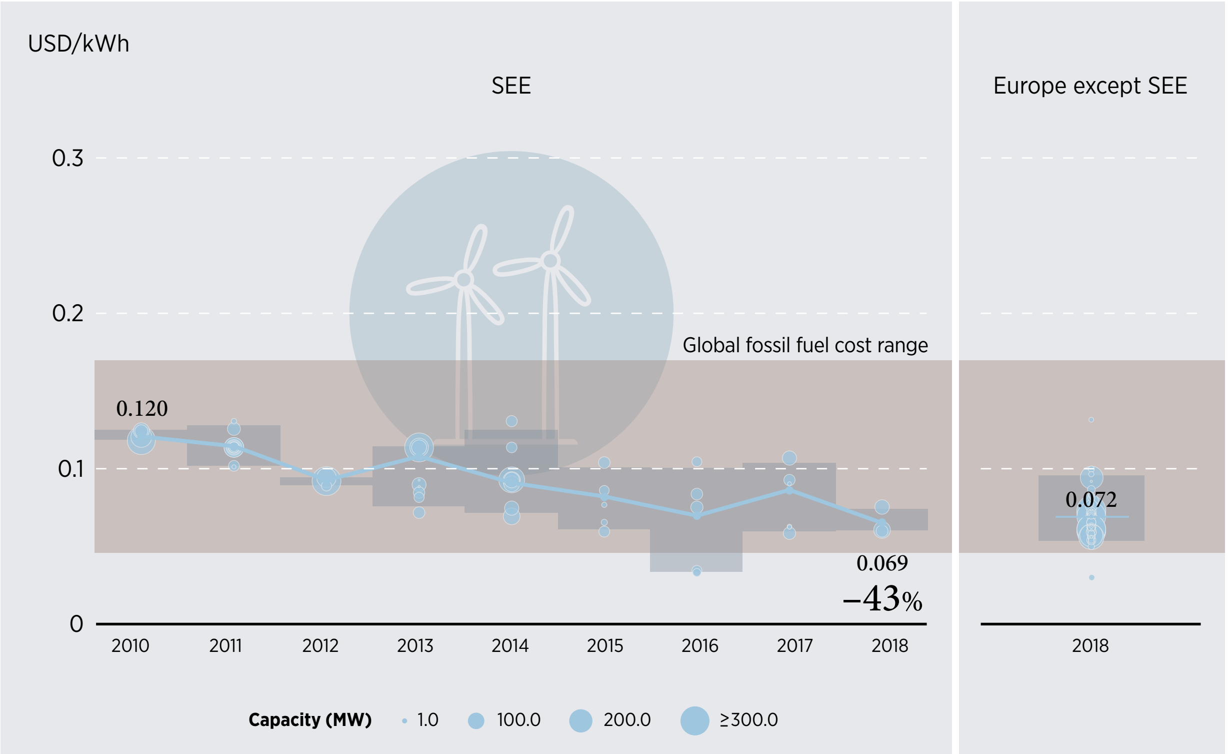
The abundance of wind resources in the region has enabled onshore wind to become an increasingly cost competitive source of new power generation, with suitable locations being developed in recent years. The weighted-average LCOE of onshore wind projects commissioned in SEE during 2018 was USD 0.069/kWh, 43% lower than for those commissioned during 2010 and the lowest since then, and 4% lower than the weighted-average for projects in other European countries (Figure 3.8).

Figure 3.7 Total installed costs for onshore wind, SEE compared to the rest of Europe, 2010-2018



Source: IRENA, 2019d

Figure 3.8 LCOE for projects and global weighted-average values for onshore wind, SEE compared to the rest of Europe, 2010-2018



Source: IRENA (2019d)

Solar PV and onshore wind cost trends

With falling costs for solar and wind technologies expected to continue, SEE could benefit greatly from further developing its vast potential. Both solar PV and wind generation can be even more cost effective than shown so far in this analysis, provided access to a low cost of capital becomes more prevalent in SEE.

Assuming central estimates for current total installed costs and capacity factors and a 2.5% weighted-average cost of capital (WACC), the LCOE of onshore wind can be as low as USD 0.045/kWh. This would undercut the global fossil fuel cost range estimate. By 2025, assuming a total installed cost reduction of about 19% for the region, resulting in total installed costs of USD 1 650/kW, the LCOE of onshore wind could undercut the global fossil fuel cost range, even at a 5% WACC. At a 2.5% WACC, the LCOE of onshore wind could be as low as USD 0.039/kWh (Figure 3.9).

Though solar PV can already be generated at competitive levels in SEE, its cost effectiveness would increase as access to a lower cost of capital increases. Even at current total installed costs and a 2.5% WACC, the LCOE of solar PV could be as low as USD 0.075/kWh (38% lower than its value at a 10% WACC).

In addition, if, as expected, total installed costs for solar PV in the region continue to decline, even more competitive LCOE levels could be achieved in the future. Solar PV module costs are expected to continue to become cheaper as module efficiencies increase and process improvements in ingot and wafer

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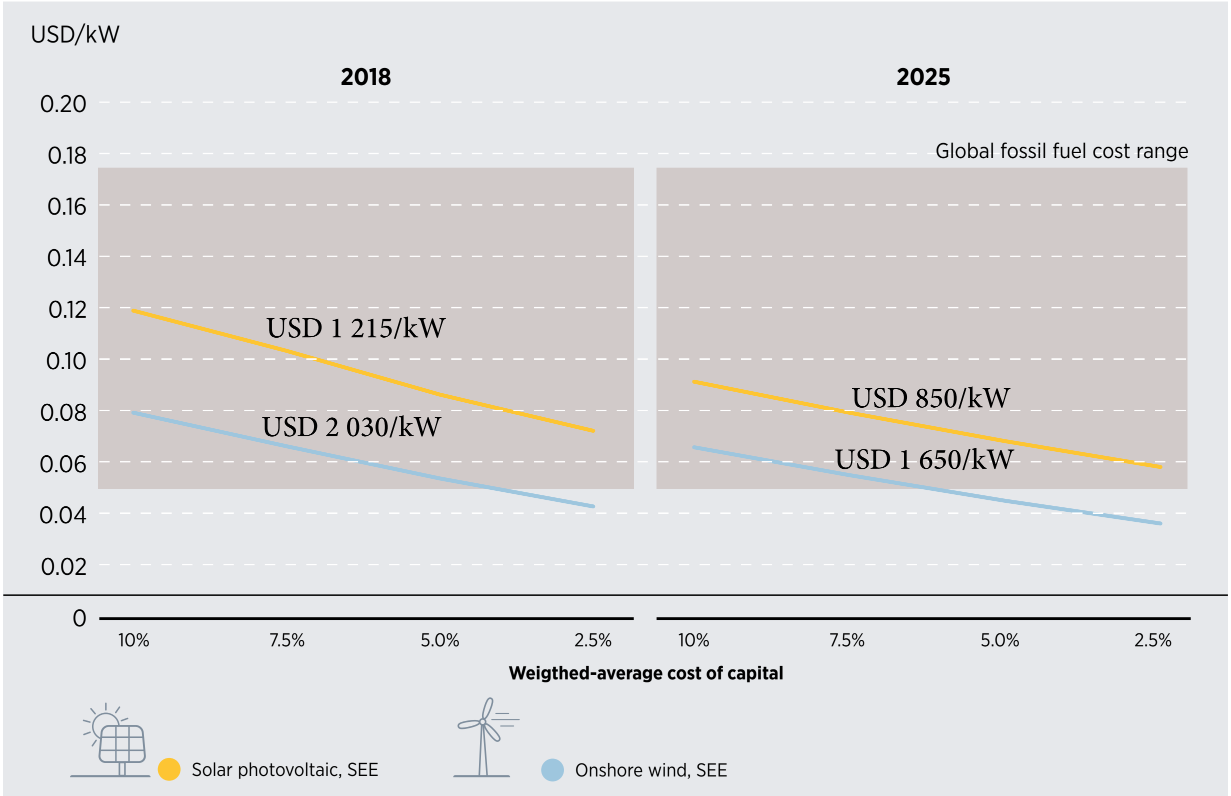
Figure 3.9 Solar PV and onshore wind LCOE sensitivity to WACC and total installed costs levels in SEE



Source: IRENA, 2019d

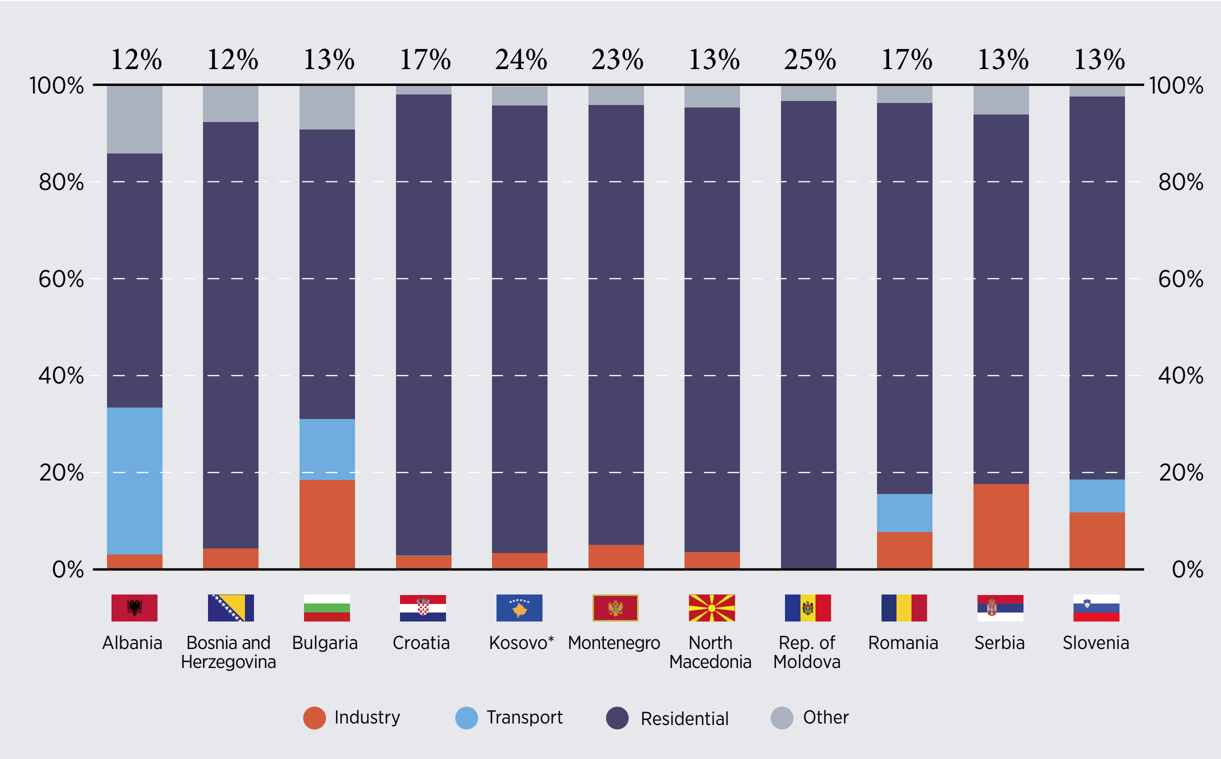
manufacturing continue. In addition to this, lower balance of system costs (including installation costs) can be expected with increased market maturity. Assuming total installed costs by 2025 in SEE of USD 850/kW, the LCOE of solar PV could range between USD 0.061 and USD 0.093/kWh, depending on the cost of capital.

3.2 CURRENT ROLE OF RENEWABLE ENERGY

As mentioned in previous chapters, renewable energy already plays an important role in the region's energy supply. Substantial differences exist between economies in the region, however. At a national level, the share of renewable energy sources (RES) in the TFEC varies between 12% in Albania and Bosnia and Herzegovina and 25% in the Republic of Moldova (Figure 3.10).

Biomass represents 10.5% of TPES (two-thirds of the region's total RES), followed by hydropower, with 5.2%. VREs are also present, but provide only a minor part of TPES.

Figure 3.10 Shares of renewable energy in TFEC and end-uses, SEE, 2017



Source: IRENA (2019a)

Hydropower plays an important role in power generation. For example, in 2017, Albania generated almost all of its electricity from this source,[15] while Montenegro generated 41% and Croatia 45%. Also displaying a high share of hydropower in their power generation mix are Serbia with 25%, Bosnia and Herzegovina (24%), Slovenia (24%) and Romania (23%). Yearly shares of hydropower, however, depend partially on the climate and hydrology and can vary from year to year. In contrast to Western and Central Europe, further development of new hydropower generation capacity is still taking place in SEE. A large pipeline of new projects is present, ready to unlock the region's major potential with this resource. However, widespread opposition from some local stakeholders is present, due to the environmental impact of the construction of new plants (Section 3.1).

As for wind energy, it only supplied 53% of the region's electricity in 2017, despite the boom in instillation between 2010 and 2014 (Figure 3.11). This surge was driven by supportive policies. In Romania, for example, a green certificates incentive scheme attracted international investors, with installed wind capacity increasing from 5 MW in 2008 to 3 244 MW in 2014. However, a series of abrupt changes and the phasing out of incentives across the region resulted

15 This ratio is also because a 98 MW power plant was under conversion to become a combined cycle gas turbine power plant.

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03

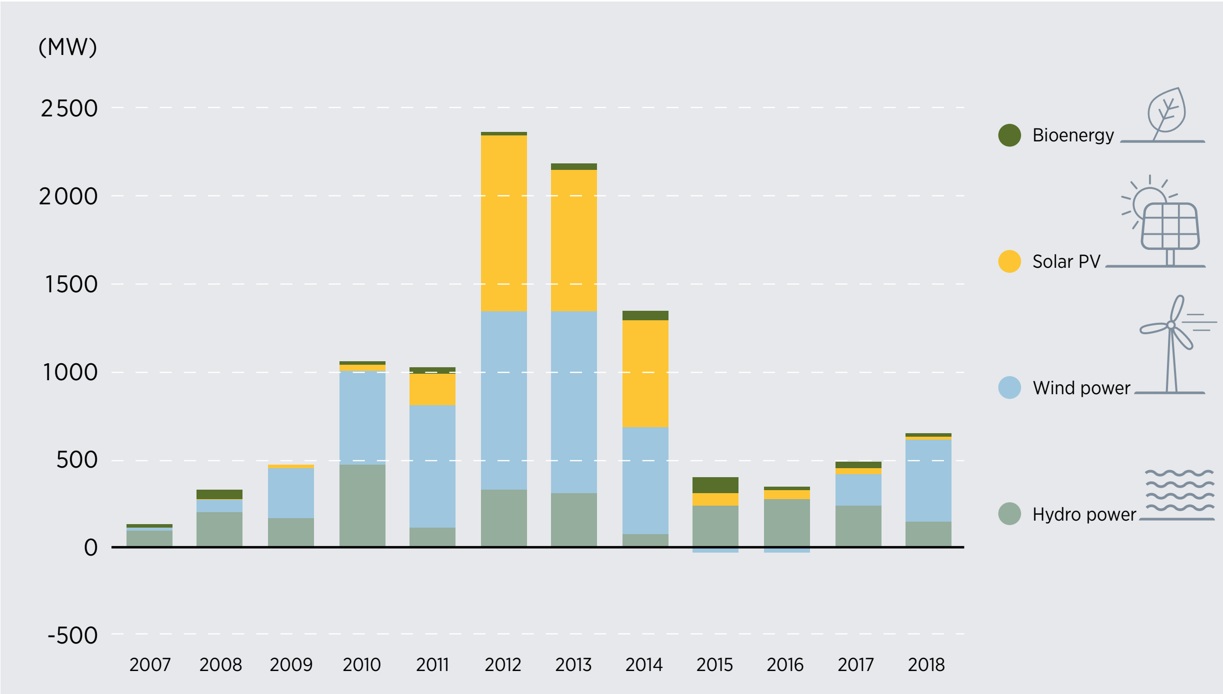
in a collapse of new investments between 2015 and 2017 (Figure 2.4). In the non-EU part of the region, the first significant, large-scale projects came on line in North Macedonia in 2014 and Montenegro in 2017, with other SEE economies following.

Solar PV currently plays a minor role in SEE, accounting for less than 2% of total power generation. The bulk of installation took place between 2012 and 2014 (Figure 3.11). Romania, which has the highest installed capacity, at around 1.4 GW (contributing to 2.8% of domestic power generation), currently faces stagnation in deployment. Bulgaria developed more than 1 GW of solar power between 2010 and 2013, but in the following years solar PV development decreased sharply.

The EU member states account therefore for the majority of the solar PV capacity in SEE (Table 2.2 and Figure 3.18). However, the trend may change as favourable policies have been adopted across the non-EU economies in the region. The Čibuk 1 wind farm, for example, is a 158 MW onshore wind farm commissioned in April 2019. It is the largest utility-scale commercial wind project in Serbia and the Western Balkans.

At the same time, bioenergy power generation capacity also had its growth concentrated in the EU member countries, after 2011. Yet, total installed capacity remains modest, rising from 31 MW in 2006 to 347 MW in 2017, generating less than 1% of the region's electricity. Much of this growth is due to deployment in Croatia and Romania.

Figure 3.11 Renewable energy capacity additions, SEE, 2007-2018



Source: IRENA, 2019a

3.3 RENEWABLE ENERGY POLICIES

Following the commencement of EU Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 – also known as the Renewable Energy Directive (RED) – member states of the EU became early adopters of various support measures, facilitating the deployment of renewable capacity. Later, the Contracting Parties of the Energy Community (EnC) adopted the RED and are now in various stages of formulating supporting policies for the deployment of renewable energy technologies.

The power sector has received much more attention and dedicated policies than the heating and transport sectors. While this is the trend across Europe and globally (IRENA/IEA/REN21, 2018), the adoption of modern technologies for household heating in SEE holds a special importance as a means of addressing energy poverty and air pollution (Chapter 6). Decarbonisation of the transport sector is also a slow process, due to the slow uptake of EU rules for biofuel sustainability and the absence of alternative policies for sustainable transportation.

This section provides an overview of the status of plans and supporting policies for renewable energy deployment.

SETTING TARGETS

Renewable energy targets have become a defining feature of the global policy landscape. Nearly all the countries around the world had adopted at least one type of target by 2018, up from 43 countries in 2005 (REN21, 2019).

All the economies in the SEE region have adopted renewable energy targets, as a result of international agreements. These include the RED, the EnC Treaty and the Paris Agreement.

The EU's RED and National Renewable Energy Action Plans

The RED establishes an overall policy framework for the promotion of energy from renewable sources within the EU. It requires that at least 20% of the EU's TFEC comes from renewables by 2020. All EU member states must also ensure that at least 10% of their transport fuels come from renewable sources by the same date.

The RED sets differentiated binding national targets for all EU member states. These have been based not on physical potential, but rather on existing renewable energy production and GDP. This has led to misalignments between national targets and cost-effective potentials (Gachechiladze, 2016).

EU member states were required to set out how they plan to meet these targets and the general course of their renewable energy policy in National Renewable Energy Action Plans (NREAPs). Bulgaria, Romania and Slovenia submitted their NREAPs in 2010; Croatia submitted its NREAP in October 2013, after it joined the EU. When the Ministerial Council of the EnC adopted the RED in 2012, the Contracting Parties of the EnC agreed also on renewable energy targets on gross final energy consumption by 2020. Starting from 2013, the EnC Contracting Parties submitted their NREAPs. Table 3.2 presents the shares of renewable energy in final consumption in the baseline year of each NREAP and the 2020 targets for SEE. These goals range from 16% in Bulgaria to 40% in Bosnia and Herzegovina.

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Table 3.2 Shares of renewable energy in final consumption in baseline year of NREAPs and adopted targets, SEE region

	Baseline year	Baseline year share	2020 target
Albania	2009	31.2%	38.0%
Bosnia and Herzegovina	2009	34.0%	40.0%
Bulgaria	2005	9.4%	16.0%
Croatia	2005	12.6%	20.1%
North Macedonia	2009	21.9% (17.2%)[16]	23.0%
Kosovo*	2009	18.9%	25.0%
Republic of Moldova	2009	11.9%	17.0%
Montenegro	2009	26.3%	33.0%
Romania	2005	17.8%	24.0%
Serbia	2009	21.2%	27.0%
Slovenia	2005	16.0%	25.0%

Source: EnC (2018a), EC (2019a)

While somewhat outdated, the NREAPs provide a snapshot of how most governments in the region proposed to meet their renewable energy targets, while also indicating the preferred technologies and intended strategies for deployment. As such, they provide a valuable way of understanding the varying levels of commitment and confidence of the different governments towards renewable energy technologies at the time of the NREAP's drafting.

Except for Bosnia and Herzegovina and Croatia, all the governments set higher increases in the power sector than in the heating and cooling (H&C) sector (Figure 3.12). Albania, Kosovo*, Montenegro and North Macedonia all notably foresaw that renewable energy deployment could not keep pace with the expected rise in demand for heating and cooling energy.

As in the rest of the world, the region's transport sector relies most heavily on energy dense fossil fuels, with a very limited share for renewables. The national targets converge because the RED imposes a 10% renewable energy target in the transport sector[17] (Figure 3.12).

The region's NREAPs principally focused on hydropower and biomass – both already used extensively in the region – and focused less on wind or solar PV, which were still emerging at the time of the NREAP drafting process. From the projected increase of 79 TWh in renewable energy final consumption in the region by 2020, 60.4% comes from biomass and 15% from hydropower.

16 In 2018, the 2020 RES target for North Macedonia was revised downwards based on updated biomass data recorded in official statistics.

17 The 10% target in the transport sector under the RED utilises a specific accounting method to value second-generation biofuels and renewable electricity, however.

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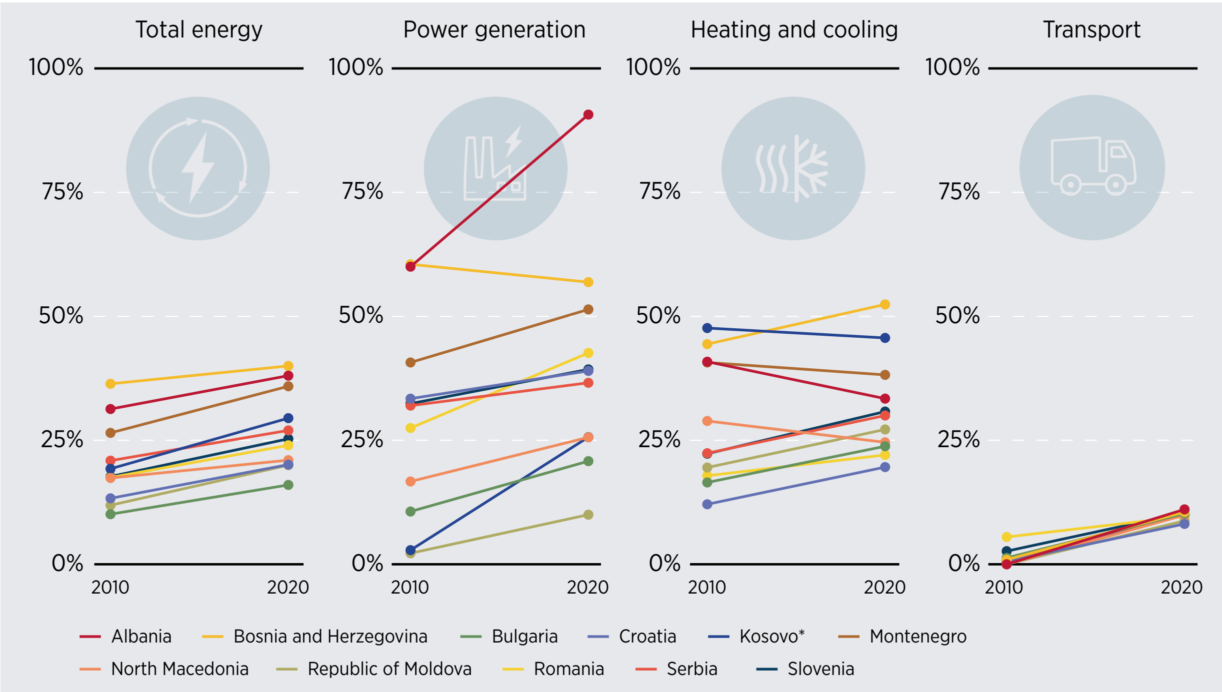
Figure 3.12 Renewable energy shares in final energy consumption, as envisioned in the NREAPs, SEE, 2010 and 2020



Based on: EC (2019a)

Romania is a notable exception, with almost 8 TWh of additional generation from wind energy planned. Among the EnC's contracting parties, Serbia's NREAP set the highest wind expansion target, at 1 TWh of additional generation from 2009 levels (Figure 3.13).

The low degree of ambition regarding wind and solar may be due to several factors. These include the potential risk of increasing electricity prices, system integration issues, and the lack of awareness regarding potential socio-economic benefits. In contrast, Montenegro's NREAP anticipates that biomass, biogas and landfill gas projects will create substantial numbers of direct and indirect jobs, as well as mobilise the forestry and agriculture sector, wood processing industry and waste management (MEK, 2013).

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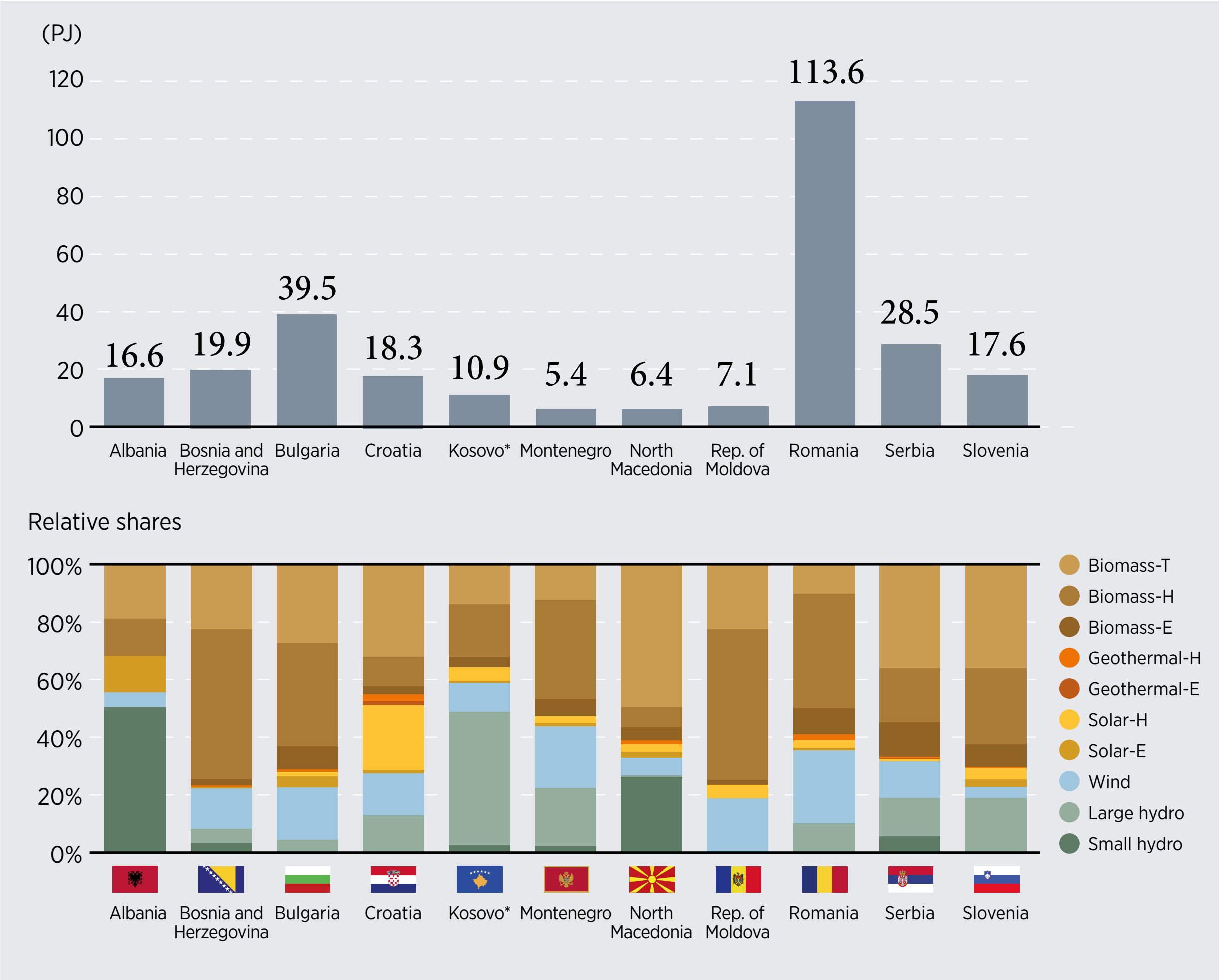
03

Figure 3.13 Cumulated additional RES consumption envisioned in the NREAPs by 2020, by source and sector, SEE



Note: E= electricity, H = heating, T = transport
Based on: EC (2019a)

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Nationally Determined Contributions

Apart from Kosovo*, all the region's jurisdictions have signed and ratified the UN Framework Convention on Climate Change and its Paris Agreement. As requested by the Paris Agreement, the SEE economies have submitted their Nationally Determined Contributions (NDCs), which outline their planned post-2020 climate actions. The NDCs focus on resource and energy efficiency gains, as well as on increased renewable energy use.

Although the SEE contributed only 0.7% of global carbon dioxide (CO_2)-equivalent emissions in 2016 (Global Carbon Atlas, 2018), they are already facing severe effects from climate change, such as droughts and floods, which are likely to increase with global warming.

Across the region, emissions declined in the 1990s, in line with the economic decline, but they have been rising again since the early 2000s. Emissions are also expected to continue growing in national business as usual (BAU) scenarios (WRI, 2018).

SEE's annual CO_2-equivalent per capita emissions still rank below the EU average of 6.4 tonnes, however. The highest values are in Bosnia and Herzegovina and Slovenia, which reach 6.3 and 6.2 tonnes, respectively; Bulgaria and Kosovo*, with 5.9 tonnes each; and Serbia, with 5.2 tonnes. All other SEE systems rank below the worldwide average of 5 tonnes. The lowest annual CO_2-equivalent emissions per capita are in Albania, with 1.9 tonnes, and Republic of Moldova, with 1.3 tonnes (World Bank, 2019). Both countries are characterised by economies in which agriculture plays a major role, while Albania's power generation is almost exclusively based on hydropower and Republic of Moldova's is mainly based on natural gas.

While all EU countries jointly pledged to reduce 40% of their 1990 emissions by 2030, the rest of the SEE region formulated individual climate targets, diverging in ambition and target categories.

The level of this ambition ranges from Bosnia and Herzegovina, which pledged relative reductions of 2% to 3%, compared to BAU scenarios, to North Macedonia, with reductions of 30% in comparison to BAU, and additional reductions of 6% conditional on the availability of financial assistance and technology transfer from other countries and international organisations (WRI, 2018).

The energy sector is a key contributor to greenhouse gas (GHG) emissions. The region therefore needs to restructure its energy profiles to comply with the Paris Agreement. Bosnia and Herzegovina and North Macedonia have both recognised the central role of renewables in achieving mitigation targets, including detailed renewable energy targets in their NDCs. Other examples, such as Montenegro and the Republic of Moldova, specifically mention the importance of renewable energy deployment for climate change mitigation, although they have not included quantified targets (IRENA, 2017b).

Integrated National Energy and Climate Plans

On 24 December 2018, Regulation 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action entered into force.

The goals of this new regulation include the implementation of measures to ensure that the objectives of the Energy Union are met. In particular, these include the EU's 2030 energy and climate targets, which contain a binding renewable energy target of at least 32% of TFEC, in addition to an energy efficiency target of at least 32.5%, with a possible upward revision in 2023. These goals will be achieved by aligning national objectives and policies with EU goals, while at the same time allowing individual cases to adapt flexibly to local conditions.

EU member states are required to develop integrated National Energy and Climate Plans (NECPs) for the period 2021-2030, and for every subsequent ten-year period. These are to be based on a common

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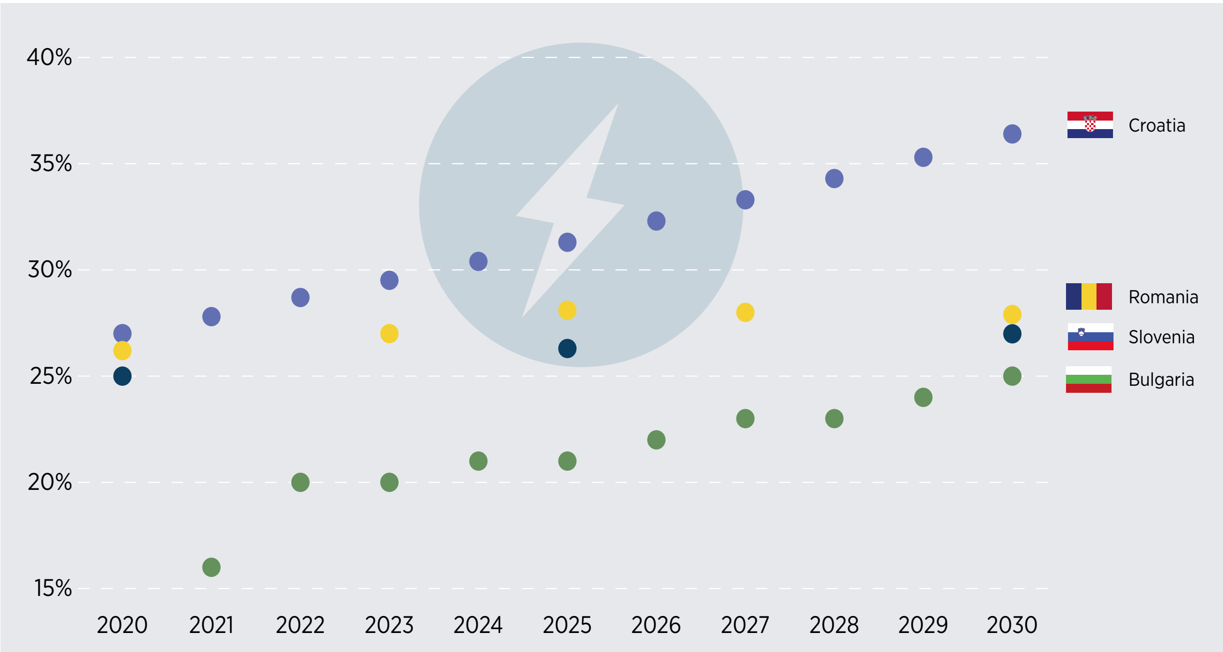
03

template and report on the progress made in their implementation. The NECPs should take a holistic approach and address in an integrated way five main dimensions: energy security, integrated energy markets, decarbonisation, energy efficiency and R&D.

The NECPs should also all be finalised by the end of 2019, with SEE's EU countries having already submitted their draft plans at time of writing. Bulgaria and Croatia plan to increase the share of RES in their final consumption by more than 9% by 2030, reaching 25% and 36.4%, respectively (Figure 3.14). More detail will be presented in the final NECPs (EC, 2019b).

In June 2018, the EnC adopted a recommendation on the development of NECPs, addressing the objectives of the Energy Union by the EnC's Contracting Parties, including the 2030 commitments. All the Contracting Parties had already started preparing their NECPs. Preparatory works for the adaptation and adoption the Energy and Climate Package including RED II and Governance regulation are under way in the EnC.

Figure 3.14 Share of RES in gross final energy consumption accordingly to the draft NECPs, EU-SEE, 2020-2030



Based on: EC (2019b)

Effect of planned targets

The RED and the NREAPs have been powerful drivers in the deployment of renewable energy technologies in Europe. Once RED targets are met, however, governments tend to reduce their effort and support for renewable energy.

These targets have been crucial to the deployment of renewables across the region. When Bulgaria, Romania and Slovenia submitted their NREAPs in 2010, for example, they enacted policies that helped them reach their set targets. These favourable policies, combined with a steep decrease in VRE costs, triggered an investment boom in wind and solar energy in the 2010-14 period (Figure 3.11).

Following that boom period, however, policy changes in Bulgaria and Romania caused investors to withdraw, with spillover effects across the entire region (IRENA/JRUL, 2017). Lingering policy uncertainties thus remain an important factor behind a lack of confidence in renewables amongst investors and banks.

In some cases, though, targets were achieved long before 2020. This was in part because new and improved visibility on actual energy consumption and production data made it possible to correct statistical records. Part of the early achievement of these targets was therefore due to retrospective changes in the data on solid biomass consumption in residential heating, as illustrated in Table 3.3. Bosnia and Herzegovina and North Macedonia are exceptions, with downward revisions of the biomass consumption in the heating sector.

Table 3.3 Examples of statistical revisions of the energy records

Croatia	Following biomass data revision, Croatia was shown to have exceeded its 20% target in its baseline year (2005), with a 23.79% share of renewable energy in gross final consumption.
Republic of Moldova	The Republic of Moldova, following biomass value revision, leapt to 26.85% of renewable energy in gross final energy consumption in 2016. The target of 17% by 2020 was therefore achieved ahead of time.
Montenegro	In Montenegro's NREAP, the share of energy from renewable sources in gross final consumption of energy in 2009 was originally set equal to 26.3%. In 2009, Montenegro surpassed its 33% renewable energy target for the first time, with a 39.4% share of RES.
Kosovo*	Kosovo* achieved 24.6% in its 2016 share of renewable energy in gross final energy consumption due to a revision in biomass consumption in households, rather than investment in renewable energy (only 82 MW of renewable energy power plants had been registered by the end of 2017).
Bosnia and Herzegovina	In Bosnia and Herzegovina, the downward revision of biomass numbers, along with limited investment in the deployment of renewable energy technology, revealed the distance between the country's commitments and its real status.
North Macedonia	North Macedonia's biomass revision was made after a consumption survey. Data were retro-actively revised downward to 2009, resulting in a lower 2009 baseline renewables share, 17.2%, compared to the 21.9% baseline taken into account during the 2020 renewables target setting. Following the downward revision of the country's biomass statistics, the EnC's Ministerial Council lowered North Macedonia's 2020 target from 28% to 23% in December 2018.

Source: EnC (2018a), EC (2019a)

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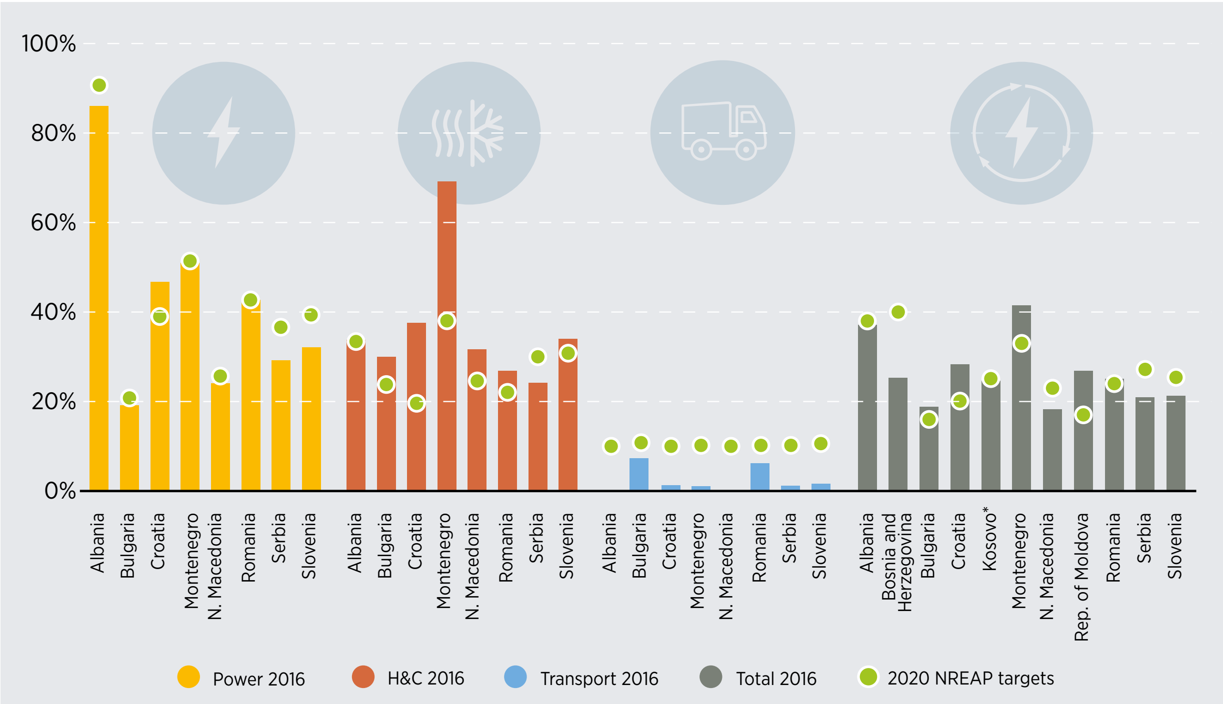
03

Since the statistical changes impacted biomass in particular, early achievements tended to focus on the H&C sector, with some success also in the power sector. Even in countries with high shares of renewable energy, however, the transport sector still lagged behind (Figure 3.15).

Following these early achievements, support for renewable energy has been widely reduced or halted. In January 2018, the government of Montenegro adopted a plan to stop the issuance of all licenses for renewable energy projects connected to the grid. In Romania, installations commissioned after 1 January 2017 cannot longer access the Green Certificate system.

Renewable energy has long been known to have positive effects on both the economy and public welfare. Benefits not captured by GDP include those to public health stemming from reduced air pollution, along with the reduced impact of climate change (IRENA, 2019e). As such, the achievement of NREAP targets should be considered an initial step in larger scale decarbonisation of the energy sector, harnessing economy wide benefits. The use of recurring targets, as envisioned in the NCEPs, could help governments keep pace with an evolving environment. Statistical revision could therefore become a tool for better cognisance of the energy sector, instead of a barrier to a more profound energy transition.

Figure 3.15 Sectorial comparison between 2020 targets and real 2016 renewable energy shares in TFEC



Note: Data availability varies by jurisdiction. Please note that the transport share refers to the sustainable biofuels as defined in the EU Directives.
Based on: EC (2019a), EnC (2018a) and Eurostat (2019)

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RENEWABLE ENERGY SUPPORT POLICIES

As previously mentioned, the adoption of support policies in SEE started in the EU member states. There, policies focused specifically on the power sector, in which renewable energy also benefits from the existence of established regulatory bodies.

Currently, the SEE economies are at various stages in the liberalisation of their energy sectors (Table 2.4). Power sector policies include auctions and administratively set premiums, or tariffs. Grid priority is granted across the region, and several jurisdictions have adopted or are considering adopting net metering schemes.

Outside the power sector, most SEE economies still lack a comprehensive legal framework supporting renewables in transport or in H&C (Table 3.4). These end uses account for 32% and 50% of total regional energy consumption, respectively. Some of the SEE economies have adopted more policies across all the sectors.

Renewable energy policies in the H&C sector

As in other regions in the world, regional policy makers have given the H&C sector much less attention than the power generation sector. While the use of traditional biomass for heating is widespread in SEE, the pace of adoption of modern renewables, such as modern biomass, geothermal and solar, could therefore be accelerated.

For this end, dedicated policy interventions are needed to overcome a variety of economic and non-economic barriers. Amongst the former group of obstacles is access to finance for the procurement of modern stoves, and amongst the latter is low consumer confidence. Only few governments formulated policies to support the use of renewable energy in the H&C sector, the most common policies being direct subsidies, in the form of grants or loans (Table 3.4 and Figure 3.16).

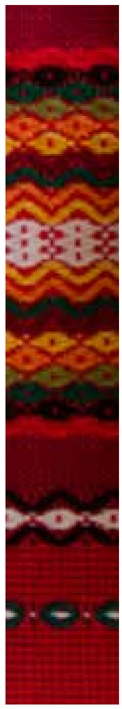

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Table 3.4 Renewable energy policies in SEE

	Targets		Power sector								Heating and cooling			Transport		
	NREAPS	NDCs	FiT or FiP	Auctions	Quota systems	Net metering	Grid preferential access	Preferred dispatch	One-stop-shop	Fiscal incentive	Fiscal incentives	Subsidies	Building codes	Biofuels quotas	Biofuel fiscal incentives	Electric mobility support
Albania	In place	In place	In place	In place		In place	In place	In place	In place	In place				In place	In place	
Bosnia and Herzegovina	In place	In place	In place	Considered			In place	In place						Considered		Considered
Bulgaria	In place	In place	In place				Removed			In place	In place		In place	In place		In place
Croatia	In place	In place	Removed	In place		Considered	In place	In place		In place		In place	In place	In place		In place
North Macedonia	In place	In place	In place	In place		Considered	In place	In place	In place		In place	In place				
Kosovo*	In place		In place	Considered			In place	In place								
Republic of Moldova	In place	In place	In place	In place		In place	In place	In place	Considered		In place	In place				In place
Montenegro	In place	In place	Removed	In place			In place					In place				
Romania	In place	In place	Considered		Removed	Considered		In place		In place		In place	In place	In place		In place
Serbia	In place	In place	In place	Considered			In place	In place	In place	In place						
Slovenia	In place	In place	Removed	In place			In place	In place	In place	In place		In place	In place	In place	In place	In place

In place

Considered, proposed, announced, in development, planned

Removed

Note:
FiP = feed-in premium;
FiT: feed-in tariff

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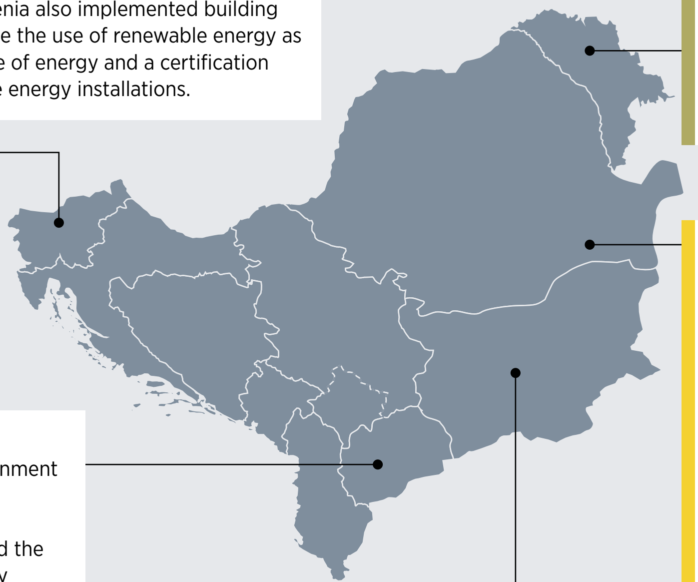
Figure 3.16 Selected renewable energy policies for H&C in SEE

Slovenia
The government provides funding for investments in renewable energy heating through public calls using the Slovenian Ecological Fund Eko Sklad, whose purpose is to provide financial supports for environmental projects. Slovenia also implemented building obligations to promote the use of renewable energy as buildings' main source of energy and a certification scheme for renewable energy installations.

Republic of Moldova
In the Republic of Moldova, biomass for heating benefit of a reduction of value-added tax (VAT) from 20% to 8% for the biomass raw materials and heat produced from biomass.



Romania
Heating technologies are supported by subsidies provided by national and European-backed funds. In particular, the Romanian Environmental Fund subsidises, among others, projects for the installation of heating systems using RES. The subsidy can cover up to 90% of a project's costs.

North Macedonia
Since 2016, the government has encouraged the development of solar thermal collectors and the use of pellet stoves by reducing the VAT rate from 18% to 5% .

Bulgaria
The Energy Efficiency and Renewable Sources Fund (EERSF) is a revolving fund that offers grants for projects to improve energy efficiency and deploy renewable energy sources in the heating sector.
A tax regulation mechanism provides exemption from property taxes for buildings with high energy performance for a longer period if renewable energy technologies are used in the building.

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03

Enhancing district heating potential

In some jurisdictions, district heating (DH) represents an important share of household energy consumption, reaching 14.1% in Bulgaria. Yet, while many buildings in larger cities across the region are connected to DH systems, these are often outdated and powered by gas, oil or coal, usually without individual metering or regulation. DH combined with renewable energy sources can therefore not only help meet rising urban energy needs, but also, reduce emissions and improve local air quality. DH systems already in place in SEE can also be upgraded to increase efficiency, allow metering and the use of biomass, solar and geothermal energy technologies. Accelerating the rise of renewable-based DH requires introducing policies and measures in key areas.

National and local policy makers can encourage and facilitate renewable energy adoption in DH by expanding renewable resource assessments and promoting projects for renewable energy technologies.

The Canton of Sarajevo, for example, developed a feasibility study for the improvement and decarbonisation of its urban DH network, with the co-operation of the Italian Ministry of Environment, Land and Sea Protection and the United Nations Development Programme (UNDP). The cantonal government selected a wood/gas project for which a concept design will be developed (Hadzikadic, 2019).

Renewables and energy efficiency measures

Many links exist between renewables and energy efficiency. As the delivery of energy services becomes more efficient, the provision of the same service requires less primary energy. This can lead to an increase in the share of renewables in the energy mix, if they have been granted priority.

Building codes can also implicitly support H&C from renewables by setting energy performance requirements. Although these mostly apply to new buildings, such performance targets can also provide an opportunity to align energy efficiency with renewable energy requirements. For example, in Croatia, building codes recognise the importance of energy performance requirements for individual types of buildings, and require developers to consider the energy performance of new buildings. Prior to preparing the main design for a building that must comply with the energy performance requirements, the designer must also prepare a study on alternative energy supply systems (usually renewable energy-based) and submit it to the investor. Because 85% of buildings were built without building codes, the greatest potential comes from renovation (Odysee-Mure, 2019).

Adoption of an energy efficiency metric

In order to properly address energy efficiency interventions in buildings, a proper energy efficiency metric is needed.

In the EU, the energy performance of buildings is estimated via an agreed methodology. The contracting parties of the EnC are also expected to adopt the same methodology, but while laws on energy performance in buildings have generally been adopted, the lack of secondary legislation is slowing progress. An exception is Serbia where, by the end of 2017, 2 000 buildings had been inspected. Programmes for building rehabilitation are also ongoing across the country (EnC, 2018b).

Yet, rapid progress in deploying renewable heating technologies in SEE may be difficult to achieve, due to slow rates of building renovation and in the turnover of H&C appliances. Improvements in the heating sector offer multiple benefits, however, ranging from reduced local air pollution to tackling energy poverty (see Chapter 6). Dedicated interventions, informed by a long-term strategy, can thus drive the decarbonisation of the H&C sector.

Renewable energy policies in the transport sector

Across SEE, energy consumption in the transport sector has been rising significantly in recent years, and has more than doubled between 1991 and 2017 (Figure 2.9).

Because of the high energy density and versatility of fossil fuels, and despite the very low efficiency of internal combustion engines, they continue to play a major role in transportation, worldwide. In the region, too, petroleum products represent more than 95% of total consumption in transport. The sustainability of the sector can therefore be improved by reducing its dependence on fossil fuels and the volume of traffic.

Achieving this decarbonisation depends on numerous types of policy intervention. These range from avoidance strategies to improving the modal mix. Examples of the former include efforts to reduce unnecessary travel, while examples of the latter include initiatives to increase the use of public transport. In addition, the use of renewables in the transport sector – whether those be biofuels, renewable energy based synthetic fuels, or electric vehicles powered with renewable electricity – is part of a larger policy challenge (IRENA/IEA/REN21, 2018).

03

In the European context, the RED gave great importance to the use of renewable energy in the transport sector. The directive mandated that all EU member states reach a target of 10% renewable energy in final transport energy consumption by 2020.[18] The same target has also been accepted by the EnC's contracting parties.

The most common ways to support renewable energy in transport have been via excise duty exemptions and/or biofuel quotas, accompanied by sustainability criteria.

- Excise duty is usually levied on all fuels, yet under this method, producers/users of biofuels may be fully or partially exempted. Slovenia, for example, has set the excise duty for all biofuels at 0%.
- Biofuel quota obligations are the most common biofuel support policies in Europe. They work by establishing a requirement for fossil fuel operators to supply, each year, a minimum quota of biofuels. This is determined as a percentage of the fuel supply, based on volume or energy content.

Sustainability criteria

The production and consumption of biofuels may raise concerns over their sustainability. The RED thus sets rigorous criteria for any biofuels used in reaching the mandatory target. Biofuels are considered to meet these criteria if they reduce GHG emissions without adversely affecting the environment or social sustainability.

All EU member states are also required to put in place a system to monitor and report on the sustainability of their biofuel consumption. In addition, Contracting Parties of the EnC have adopted the same target as EU member states in this regard. The implementation of the requirements of the RED with respect to sustainability criteria and certification of biofuels is, however, still a work in progress for most of this group. As a result, without a sustainability certification system in place, even the small amount of existing biofuel consumption in the region cannot be counted towards renewable energy targets. The adoption of support policies for biofuels has therefore been deferred, since their impact on reaching the RED target would be zero.

Progress in the use of biofuels is not expected to happen soon. In Croatia, for example, the draft NECP suggests that in 2020, the share of renewables in the transport sector will be 1.3% – just 0.1% more than the 2016 figure. The same draft report, however, foresees renewable energy accounting for almost 20% of the transport sector by 2040, with the existing policies.

While decarbonising the transport sector is key to decarbonising the energy sector, this is also a task that is larger than the adoption of biofuels. This requires fundamental changes in transport demand, major improvements in efficiency and changes in the overall energy infrastructure. In this context, the use of biofuels is a complement to a much larger effort to shift to a cleaner and more efficient transport sector, with the aim of reaching climate change targets.

18 The 10% target is calculated, however, using accounting tools that promote specific actions (e.g., double counting for waste-based biofuels). This reduces the effective deployment of RES-based solutions in the transport sector.

The SEE economies could adopt new instruments and policies at the national, sectoral and sub-national levels to reduce the transport sector's negative impact, regarding issues such as pollution. These new initiatives could include renewing the vehicle fleet, promoting a modal shift (from road to rail, for example), introducing cleaner technologies (such as electric vehicles and more performant internal combustion engines), and schemes to charge polluters for their emissions, internalising environmental costs.

Indeed, various policies have been introduced in the region to reduce the transport sector's emissions. Bosnia and Herzegovina have approved a State Action Plan on emission reductions from aviation; Serbia plans to increase the use of electric vehicles; Albania's Environmental Strategy contains emission targets and enforcement measures (such as vehicle emissions controls); meanwhile, cities like Belgrade and Tirana have launched plans for the more sustainable development of transport infrastructure (OECD, 2018).

Some countries around the world, such as Norway, have seen a relatively rapid uptake of electric vehicles. While this has not been the case in SEE, some governments individually support the building of charging stations for electric cars. In 2018, Romania announced a plan to install 200 000 charging stations over four years. Furthermore, individual subsidies for buying electric cars are in place in some jurisdictions, such as Croatia and Slovenia. Most of the region remains at the very beginning of the electrification of the vehicle fleet, however. As of early 2018, only 30 stations had been installed In Serbia, for example.

Renewable energy policies in the power sector

In the last decade, SEE governments have adopted various policy measures – most notably auctions and tariff mechanisms to support the deployment of utility-scale and residential plants (Figure 3.17).

Given the production capacity they have installed over the last decade and the maturity of their adopted policies, the EU member states have been leading renewable electricity deployment in the region (Figure 3.18). The setting of medium term, technology-specific targets for renewable energy and the introduction of dedicated production incentives are policies these countries have in common. Notably, both EU member states and the Contracting Parties of the EnC are required to follow the European Commission's Guidelines on State Aid for Environmental Protection and Energy for 2014-2020, which imposes auctions as the main instrument by which support may be awarded (Box 3.1).

Figure 3.17 Main instruments in place for renewable energy power plants

Croatia
A tender-based FiP has been adopted but not fully implemented. It was announced in mid-2019.

Serbia
The current support system is based on FiTs, however, plans for an auctions-based system are currently being drafted.

Romania
New installations have not been able to access the quota system (green certificates) since January 2017.

Republic of Moldova
Support for projects with a capacity of less than 1 MW is provided via FiTs, while the premiums for larger scale projects will be determined by forthcoming auctions.

Slovenia
A tender-based FiP is in place and has been running since 2016.

Bosnia
Both Republika Srpska and the Federation of Bosnia and Herzegovina have adopted FiTs. Republika Srpska has also adopted FiPs.

Montenegro
FiTs are in place. A project-specific tender has been launched.

Bulgaria
The FiT scheme has been terminated for RE producers with total installed capacity over 4 MW, replaced by the FiP scheme. FiTs are still in place for small-scale plants.

North Macedonia
FiTs are in place. The first project-specific auction for solar PV was open for bids in April 2019.

Albania
Albania was the first Contracting Party of the EnC economy in the region to launch an auction for a VRE power plant. The winning bid, announced in November 2018, is meant to provide energy at the price of EUR 59.9/MWh from a 100 MW solar PV plant.

Kosovo*
The support system is based on FiTs. The EBRD is currently helping design and implement wind auctions.

Notes:
FiT = Feed-in tariff
FiP = Feed-in premium
EBRD = European Bank for Reconstruction and Development

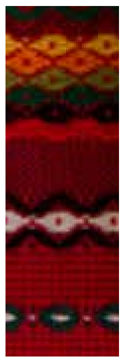

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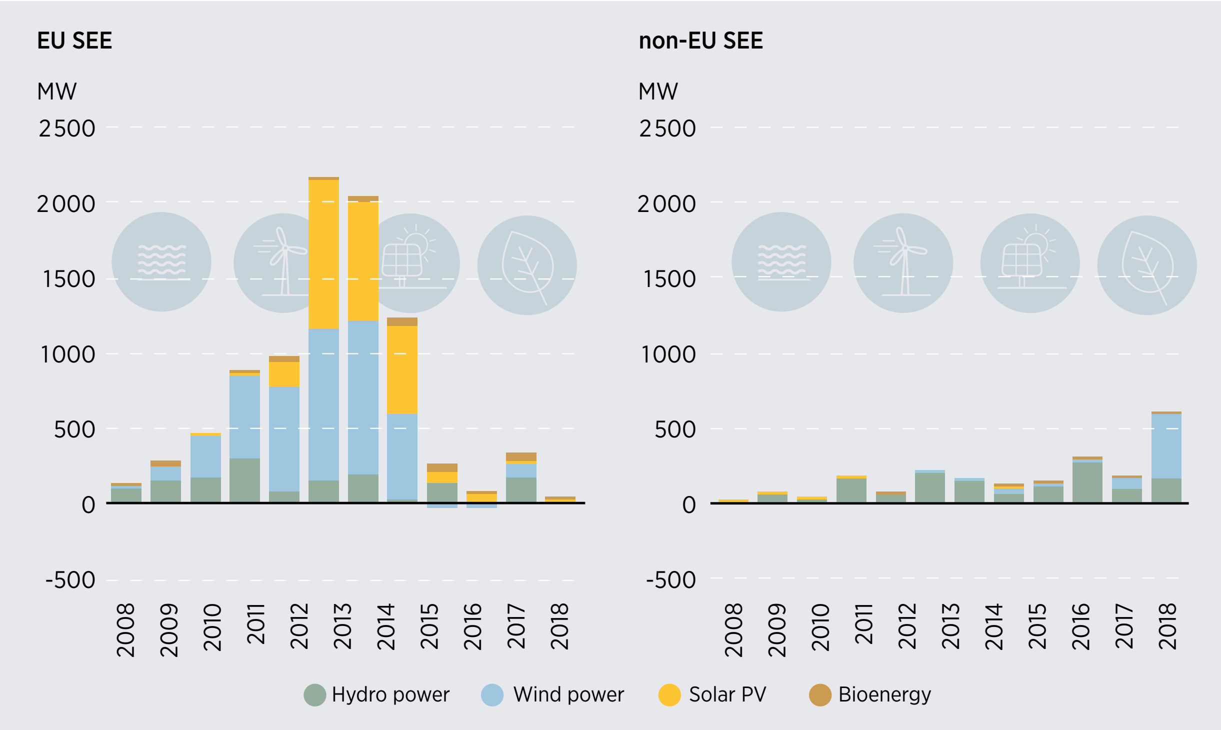
Figure 3.18 Annual additional RES capacity, EU-SEE (left), non-EU SEE (right), 2008-2018



Source: IRENA (2019a)

Given the early achievement of its NREAP target, Montenegro stopped issuing further licenses for grid-connected renewable energy projects in 2018, de facto halting a FiT scheme that had only supported 13 small hydro power plants and a 72 MW wind power plant (BGE, 2018c). The government continued to support the development of off-grid PV plants in the country's mountainous regions. Nonetheless, a tender was launched in 2018 for the construction of a 200 MW solar park in the municipality of Briska Gora, in the southernmost part of the country. A consortium of Finland's Fortum and Montenegrin power utility EPCG won the tender, by agreeing to pay an annual concession fee of EUR 0.33 (about USD 0.40) per square metre and by offering the conditions deemed best in terms of the number of newly created jobs, technical capacity, financial terms and the participation of domestic companies. The plant should be completed by 2022 (PV Magazine, 2018a; Renewablesnow, 2018a).

In Romania, in recent years, an energy quota obligation, coupled with a green certificate system for electricity generated from renewables, was the main support scheme in place. This permitted the installation of a large number of renewable energy systems. Yet, after January 2017, this quota regime was no longer available for new installations. The Romanian Energy Regulatory Authority (ANRE) has proposed replacing the renewable energy support scheme of green certificates with a new premium system that does not impact the final price of electricity paid by consumers (RES Legal, 2019; BR, 2018).

In Slovenia, a high FiT for solar PV plants led to a boom in installed capacity, with this amounting to 221 MW

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Box 3.1 EU guidelines for state aid

In 2014, the European Commission released its Guidelines on State Aid for Environmental Protection and Energy for 2014-2020. The document required member states that wanted to maintain support for renewable energy deployment to implement a pilot bidding process for part of their renewable energy capacity additions, in 2015 and 2016. Feed-in premiums (FiPs) or green certificates were the only forms of aid allowed, although feed in tariffs (FiTs) were still allowed for small-scale installations.

Starting in 2017, the document states that competitive bidding processes should apply to all new renewable electricity capacities, with a derogation if only one or a very limited number of projects/sites would be eligible for the aid. Technology-specific auction schemes remain possible "where a process open to all generators would lead to a suboptimal result". In such cases, member states must justify technology-specific auctions on the basis of the long-term resource potential, the need to achieve a diversified technology mix, grid stability concerns or system integration costs. Aid can still be granted without a competitive bidding process for installations below 1 MW, or for demonstration projects. This is not the case in wind, however, where the threshold is 6 MW or six generation units, nor for installations below 500 kW, or demonstration projects. EU member states remain free to decide on the type of support given (EC, 2014).

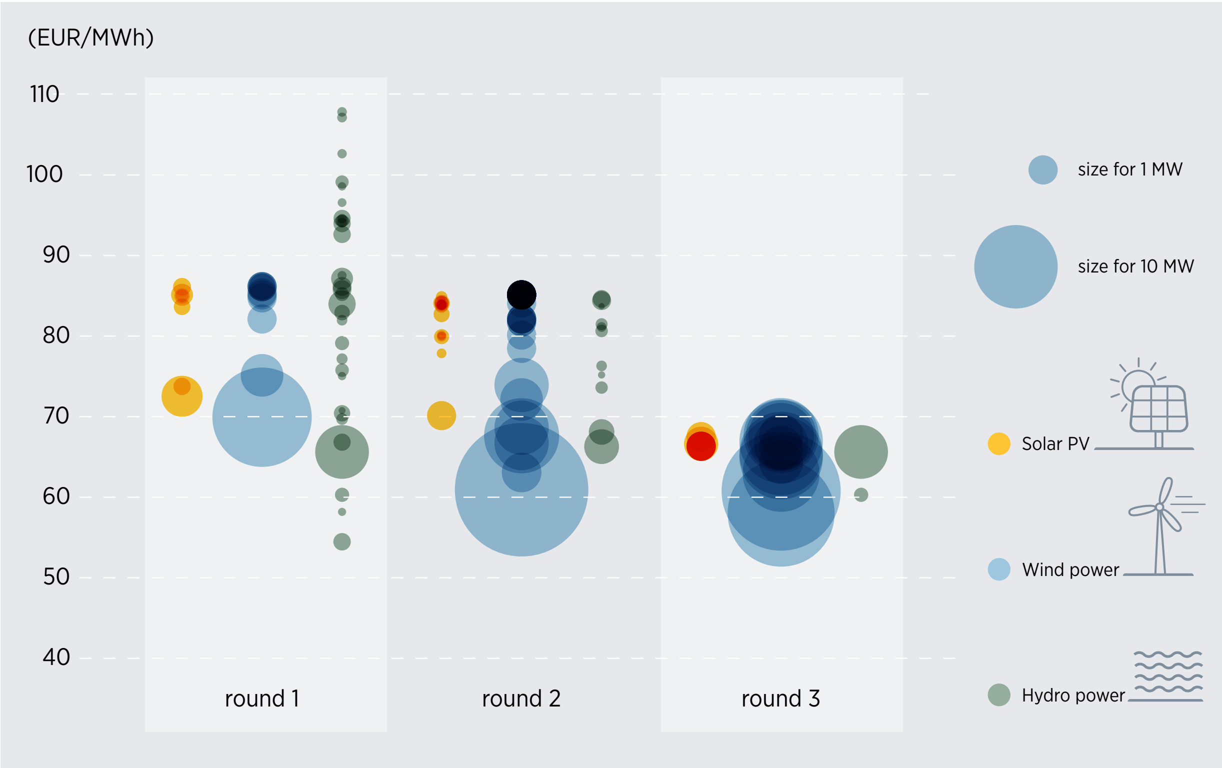
by late 2013, far exceeding the NREAP projection of 139 MW for 2020. In accordance with the European State Aid Guidelines, the country adopted competitive auctions as the instrument for setting prices for all its main support policies, and is now the region's front-runner in formulating successful auctions. Smaller projects receive a FiT (RES Legal, 2019; EnC, 2018a).

Auction rounds are called in Slovenia every year, each offering funds amounting to EUR 10 million (about USD 12 million) for allocation to the winning process. The three auction rounds held since 2016 have attracted close to 300 MW of renewable energy and combined heat and power (CHP) projects. In particular, the 2018 auction round awarded 129 MW for 41 projects, of which 109 MW was for 13 wind projects. The average price of winning bids fell from EUR 76/MWh (USD 82/MWh) to EUR 66/MWh (USD 73/MWh) in three years (Figure 3.19).

In Bulgaria, the largest addition of wind and solar PV capacity in the country took place in 2011-12, with some 1.5 GW added. This occurred when a FiT scheme with a high support level was in place at the same time as technology costs were falling, worldwide. This meant that investors were able to capture windfall profits.

Problems in the design and subsidy structure of the energy market, however, led to a rise in electricity prices, triggering public resistance and ultimately leading to the resignation of the government (Toshkin, 2016). This prompted a reform of the FiT scheme, limiting support to biomass plants and solar PV plants with a capacity of up to 30 kW. Since 2012, this reform has brought new investment in renewables to a standstill. A 2018 parliamentary proposal, however, includes a conversion of the FiT to a FiP for power plants with a capacity of 4 MW or above, although a legal standoff with the EU has so far blocked the implementation of this law (Globaldata, 2019a; Lexology, 2018).

Figure 3.19 Successful bids in Slovenian auctions (size of bubbles = size of plant)



Based on: Agen-rs (2019)

In Croatia, a FiT scheme served as main instrument until 2017. It had design issues as its support levy setting left the system underfinanced. Moreover, a capacity cap, which increased progressively from 1 MW in 2007 to 50 MW, did not reflect cost development and technical potential. Indeed, when the cap reached 12 MW, it became exhausted within a few minutes of opening on a first come first served basis (IRENA/JRUL, 2017). In January 2016, an auction law came onto the statute books, but this has still not been fully implemented, due to a lack of definition in numerous supporting regulations. In December 2018, the Croatian parliament adopted certain amendments to the Renewables Act, with these predicting that the first tender will be published during 2019 (Globaldata, 2019b).

In Albania, FiT schemes previously granted only to hydropower plants have been extended to solar PV projects of up to 2 MW and wind projects not exceeding 3 MW. Albania was the first non EU country in the region to launch an auction for a VRE power plant. The winning bid, announced in November 2018, is meant to provide energy at the price of EUR 59.9/MWh for a 50 MW solar PV capacity, valid for a period of 15 years. The project involves an additional capacity of 50 MW (for a total of 100 MW), without support (RES Legal, 2018; PV Magazine, 2018b).

In the Republic of Moldova, an administratively set FiT for small installations (with capacities below 4 MW in the case of wind and 1 MW for other technologies) are to be issued on a first come first served basis. The total capacity of those projects benefitting from FiTs is assumed to be 55 MW. The introduction of auctions, scheduled for the second half of 2019, is considered the most important change in the renewable energy sector. The government aims to organise technology-specific tenders for a total capacity of 113 MW (80 MW of which have been allocated for wind technology and 25 MW for solar PV power plants), which will guarantee fixed tariffs for 15 years (IRENA, 2019b).

Meanwhile, North Macedonia operates a FiT for small hydropower, wind, solar PV and biomass. The country's 2018 Energy Law introduced a FiP granted on a competitive basis, however, with this expected to be in place once a day-ahead trading platform is in place. Tenders are already being used for the construction of large hydropower plants. A tender also opened for bidding in April 2019 for the construction of 62 MW of solar power plants. A premium ceiling price is set to EUR 15/MWh, awarded for 15 years.

In Kosovo*, a FiT is in place to support small hydropower plants, wind, biomass, biogas and solar PV. Even with a generous FiT level, however, only 1 MW of solar PV had been deployed by the end of 2017. In 2019, the Ministry of Economic Development and the Energy Regulatory Office, with the support of the European Bank for Reconstruction and Development (EBRD), are undertaking an analysis of new requirements in order to enable implementation of a competitive support scheme for renewable energy.

In Serbia, the support system is based on a FiT scheme. An important feature of Serbian support policy is the power purchase agreement (PPA) model, which includes elements such as dispute resolution rules, protective change-in-law and force majeure clauses. The result is a consistent, comprehensive and bankable set of regulations to improve project feasibility (EnC, 2018a; BGE, 2016a). Serbia will soon switch to the auction system. Activities towards the design of auctions are ongoing, as of 2019. The proposed design draws technology-specific, sealed bid auctions without locational constraints, for at least 80 MW of solar PV and 450 MW of onshore wind by 2023 (Banjac, 2019).

Both entities of Bosnia and Herzegovina (Republika Srpska and the Federation of Bosnia and Herzegovina) support hydropower, solar PV, wind, biomass and biogas via dedicated mechanisms. Yet, while in the Federation of Bosnia and Herzegovina, only a FiT is available for renewable energy generators, in Republika Srpska generators can also apply for a FiP scheme. In March 2019, the parliament of Republika Srpska adopted a new law on renewable energy and efficient cogeneration, which abolishes FiTs for wind farms. Republika Srpska has also launched a procedure for awarding a concession contract for construction and operation of a 65 MW solar power plant in Ljubinje, with a projected total cost of around BAM 150 million (USD 89.4 million) (Reuters, 2018a).

FiT levels in the region vary considerably, depending on governments' cost evaluations and value estimations (Figure 3.20). To limit excessive spending, FiT schemes are accompanied by caps, which are often in line with NREAP targets. Table 3.5 indicates the maximum cumulative capacities for which generators of renewable power are eligible to receive tariff support.

Limits on funding for FiT support may prevent projects that qualify from being admitted to the support scheme. In a few cases, there is no explicit indication that the FiT will be maintained at a consistent level over time. Such uncertainty in FiT support brings risk to the financial profitability of renewable power plants for local and foreign investors.

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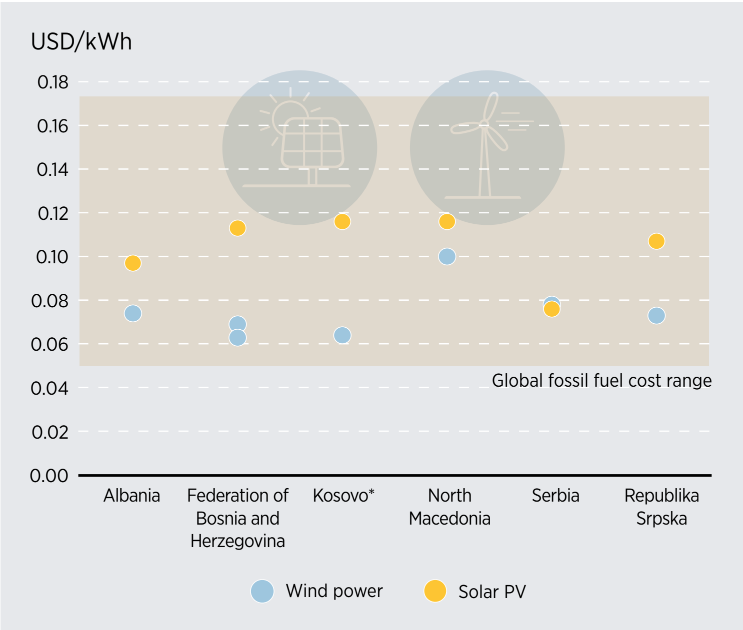
Figure 3.20 FiT levels for selected technologies and SEE economies



Note: FiT levels annualised for 20 years, with an interest rate of 7.5%.

Table 3.5 Caps to tariff schemes (MW)

	Bosnia and Herzegovina		North Macedonia	Kosovo*	Republic of Moldova	Serbia
	Republika Srpska	Federation of BiH				
Small hydropower	112.36	165		3		240
Solar PV	4.2	1	25	15	10	30
Wind	100	230	150	20	500	150
Biomass	10		10	5		20
Biogas	6.5		7	12		
Notes	*Cap to 2020, in line with NREAP*		*FiT Law, cap to 2025*	*FiT Law, cap to 2020*	*Government Decision No. 689 of 11 July 2018*	*FiT Law, no time limit*

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03

Net metering schemes

An alternative to feed in schemes in the promotion of renewable energy is the adoption of net metering. This allows the owner of a distributed energy system, such as a solar PV farm, to export any energy produced in excess of his or her own consumption to the utility grid, receiving a credit in kilowatt hours (kWh). These schemes are adopted to promote self-consumption and small-scale investment, without these leading to an excessive burden on the energy bill.

Net metering support is available, for example, in Albania, the Republic of Moldova and Slovenia. While the goal of the policy should be to encourage self-consumption, for these schemes, the netting frequency (the time period under which production and customer electricity consumption are summed and measured for billing purposes) is rather long and can be from one month to one year. This reduces the effectiveness of the scheme in terms of promoting system-friendly self-consumption, as the consumer is not pushed to consume as the energy from the solar system is immediately available. (IRENA/IEA/REN21, 2018; EnC, 2018a).

Net metering schemes (and self-consumption in general) face other barriers in the region, such as large share of non-energy costs and low retail energy prices that provide a limited incentive for self-consumption.

Institutional policies

Investments in renewable energy projects face both economic and non-economic barriers. While the first can be tackled with financing and other support measures, the non-economic barriers may require actions outside the realm of the energy sector itself.

Tackling administrative barriers

In most of the SEE region, complex administrative procedures and regulations hamper investment. In many cases, the commissioning of a renewable energy power plant involves many bureaucratic steps. These can include obtaining energy production and construction permits in circumstances where permitting processes are not transparent and streamlined and require the involvement of several institutions. Obtaining all the necessary documents can take a considerable long time, and responsible authorities are not usually required to respond to applications. Acquiring all the necessary permits for renewable energy projects is also expensive. Moreover, a lack of co-operation between the different ministries and agencies involved in energy policy, as well as between authorities at national and local levels, can cause additional costs and delays.

Administrative barriers for wind energy, in particular, result in a long project development period for these in Bosnia and Herzegovina, Kosovo* and Serbia. This leads to a higher risk perception by investors. The process slows power plant deployment and increases transaction costs.

The administrative problems involved in securing biomass for renewable energy projects pose an additional issue. Sufficient and reliable quantities of available biomass are needed on the market to enable stable long-term operation of biomass plants. In the absence of transparent and liquid biomass markets, administrative solutions are often complex and less efficient.

Dedicated agencies co-ordinating renewable energy and energy efficiency policies and promoting projects are also still rare on the SEE governmental side. To shorten procedures and increase the transparency of the licensing process, however, some EU member states have opted to create a "one-stop-shop". This solution has proven effective in facilitating and accelerating the planning and approval of renewable

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energy projects, with Italy's energy services manager, GSE (Gestore dei Servizi Energetici), providing a good example. In Albania, the National Licensing Centre (NLC) has been selected to act as a one-stop-shop for all concessions and authorisations for the construction of renewable energy power plants. In Kosovo*, an inter-institutional group has been set up to implement the creation of a one-stop shop for renewable energy projects, with Regulation No. 05/2018 on the establishment of one-stop shops for renewable energy resources approved in April 2018. This is expected to streamline and simplify existing permitting and licensing procedures. Croatia has meanwhile introduced an accelerated process for smaller, simpler projects (such as small integrated solar PV plants (EnC, 2018a).

Creating awareness

Another non-economic barrier in the region is the relatively low level of awareness of the potential and benefits of renewable energy. Bringing these to the attention of the stakeholders involved in the identification, development, financing, approving and regulating of renewable energy projects would therefore help achieve better results.

This lack of awareness affects the deployment and the cost of RES projects in several ways. It may lead to scepticism, or to the idea that renewables are expensive and unreliable compared to fossil fuels. A lack of experience in dealing with renewable projects may also lead to a longer authorisation process, while a low level of confidence amongst financial institutions about these projects may result in higher interest rates. In addition, consumers may be very reluctant to change their consumption behaviour unless this will tangibly improve their standard of living. All these effects of a lack of awareness are exhibited in various degrees in the region (Agora Energiewende, 2018).

At the same time, graduate and postgraduate programmes in sustainable energy management and environmental engineering are rare in the region, adding to a general lack of expertise and awareness.

Yet, two crucial factors in fostering the development of renewables in economies embarking on the energy transition are active public engagement and the building of basic trust in the economic benefits of the energy transition. Public acknowledgment of coal plant emissions and their related health issues has already sparked protests across the whole region, indicating that further recognition of the socio-economic benefits of the energy transition may create the public support necessary for renewable energy and energy efficiency programmes.

3.4 CONCLUSIONS

In the years ahead, SEE holds great potential for the deployment of renewable energy technologies, while already regional authorities have been taking the first important steps in the decarbonisation of their energy sectors.

FiT and FiP schemes were or are available across the region, and have been met with a varying degree of success. Moves towards the adoption of auction systems are also being taken across the region, with some well-designed and successful examples of these now in place – such as in Albania and Slovenia. Regional authorities can also draw on the lessons learnt by neighbouring countries in adopting best practices.

Meanwhile, however, the H&C and transport sectors enjoy few supporting policies for the adoption of renewable energy solutions. More concerted action in these sectors may bring substantial benefits, decreasing energy dependency and improving the quality of life of the region's people.

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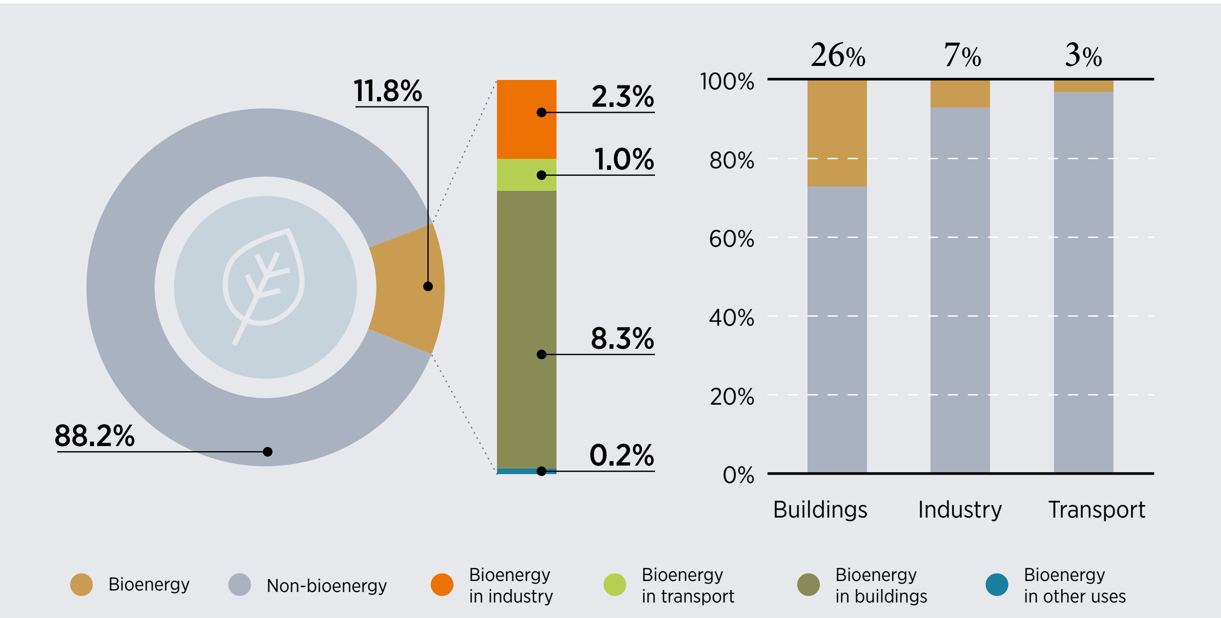
MODERN BIOENERGY SOLUTIONS

4.1 INTRODUCTION

GLOBAL CONTEXT

Bioenergy is the form of renewable energy that makes the biggest contribution to current global energy needs, supplying 11.8% of global TFEC in 2017. It provides 26% of needs for heating for buildings and 7% for industry, as well as 3% of energy needs for transport (Figure 4.1). A distinction must be made between "traditional biomass and "modern biomass" since the former provides the bulk of the heating needs in building (see Box 4.1).

Figure 4.1 Role of bioenergy in global final energy consumption, 2017



Source: IRENA (2019a)

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Global efforts to increase the use of bioenergy concentrate on ways to expand the clean and sustainable use of bioenergy. This is done by replacing traditional technologies with more modern and efficient ones and extending the use of bioenergy in other end-use sectors. (IRENA, 2019a; IEA, 2017b).

The expansion of sustainable bioenergy production and use will play a crucial role in future low carbon energy scenarios. In IRENA's REmap scenario, the increase in renewables and improvements in energy efficiency provide over 90% of the necessary energy-related CO_2 emission reductions to 2050. In this scenario, bioenergy provides 19% of total global energy needs for transport, 7% of energy for buildings (only in the form of modern bioenergy), 20% of energy needs for industry, and 14% of electricity generation (IRENA, 2019e).

SUSTAINABILITY AND BENEFITS OF BIOENERGY

Initiatives to encourage the uptake of bioenergy focus on sustainable solutions to shift from traditional to modern bioenergy. A co-ordinated international effort under the Global Bioenergy Partnership (GBEP) has led to the identification of the principal issues that can affect the environmental, economic and social dimensions of sustainability (FAO, 2011).

Box 4.1 Traditional and modern bioenergy

"Traditional bioenergy" involves the direct burning of organic material to produce heat. The traditional use covers around two-thirds of the current global use of biomass to meet energy needs for heating and cooking in households particularly in emerging and developing economies, but also in more developed economies, in low-efficiency devices. It is a significant source of indoor and outdoor air pollution with serious health impacts. This traditional use of biomass is often based on raw materials that are collected without regard to the sustainability of the supply and may contribute to deforestation.

"Modern bioenergy" technologies include the use of wood residues and other solid biomass materials in efficient combustion systems to produce heat and electricity and the production and use of biogas and liquid biofuels (bioethanol, biodiesel, etc.). Modern bioenergy provides a high level of GHG savings compared to conventional fossil fuels and may be produced from agricultural and other residues, to avoid potential impacts on food supply (IRENA, 2016a-b; IEA, 2017b).

The supply and use of bioenergy should respect sustainability criteria. For example, within the EU, mandatory sustainability criteria are included within the RED, which set out the conditions which must be met if biofuels are to count towards the targets under RED. The criteria also apply to Contracting Parties of the EnC. Criteria include CO_2 emission reduction, restrictions on the supply of biofuels and bioliquids from sensitive land, efficiency requirements and provisions to restrict direct and indirect land use impacts, including constraints on crop-based biofuels. There are also specific governance and reporting requirements that must be met (EC, 2018, 2017b). The RED II will also introduce sustainability for forestry feedstocks as well as GHG criteria for solid and gaseous biomass fuels.

Bioenergy, like other renewable technologies, can also make significant contributions to energy and environment policy objectives. Bioenergy can improve energy diversity and energy security by reducing dependence on imported fuels linked to volatile international energy markets and reducing import dependence. There are a number of specific benefits associated with bioenergy, such as its role in economic development, with 3.18 million jobs globally associated with bioenergy production, notably in rural areas and associated with feedstock production in the agricultural and forestry sectors (IRENA, 2019f).

The use of waste materials for energy can complement measures to improve water quality by using organic wastes to produce methane by anaerobic digestion. Waste management practices can also be improved, for example, by the collection and use of methane generated within landfill sites or by the use of municipal waste as an energy source.

4.2 CURRENT STATUS OF BIOENERGY IN THE SEE REGION

BIOENERGY IN PRIMARY ENERGY SUPPLY

Bioenergy constitutes a significant proportion of the TPES of the SEE region. In 2017, it exceeded 6% in all the cases and reached 20% in the Republic of Moldova (Figure 4.2). The supply of bioenergy is dominated by solid biomass which accounts for most of total bioenergy supply. Apart from that, biogas, municipal solid waste and biofuel make a small contribution (Figure 4.2).

BIOENERGY IN ELECTRICITY PRODUCTION

The generation of electricity from biomass in the region grew significantly between 2007, when production only occurred in Croatia and Slovenia and amounted to 156 GWh, and 2017 when it totalled 1 906 GWh and was more widely distributed (Figure 4.3). Growth has been concentrated in countries within the EU, with few developments in EnC Contracting Parties. However, biomass generation still only makes a small contribution to overall electricity supply, equal to 0.8%.

More than 84% of bioelectricity in the region is produced in cogeneration plants.

BIOENERGY FOR HEAT

Bioenergy plays an important role as a direct source of heat for residential buildings, and also makes a smaller contribution in industry. It also contributes to the fuels used in DH in some cases and thus makes an additional contribution in buildings and in industry.

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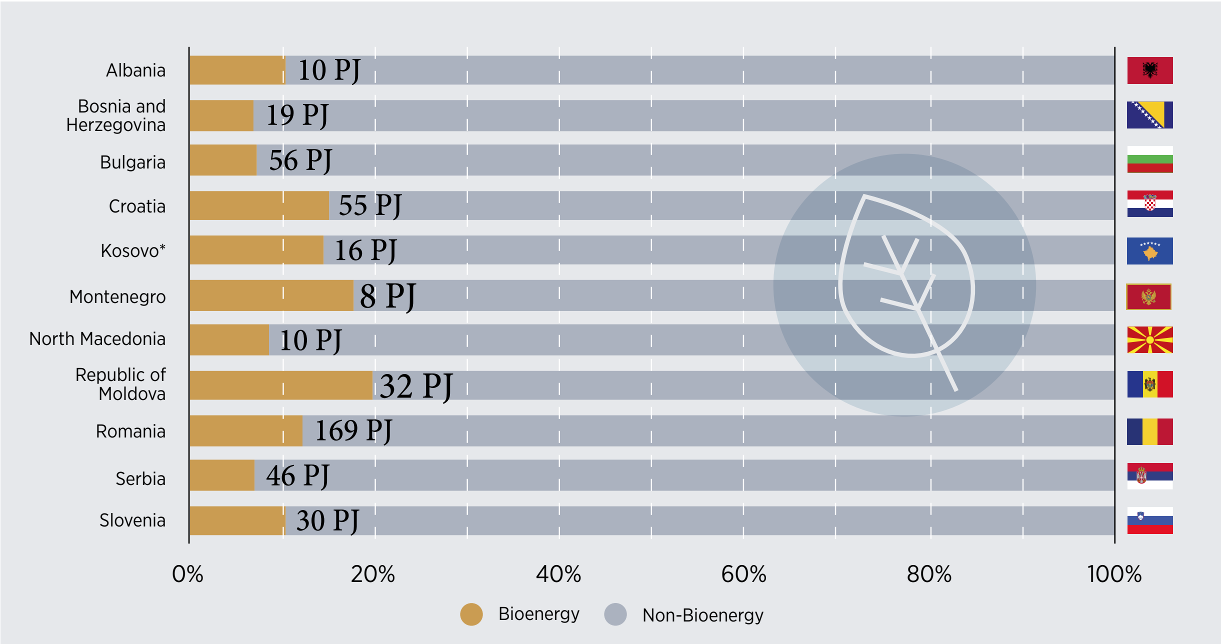
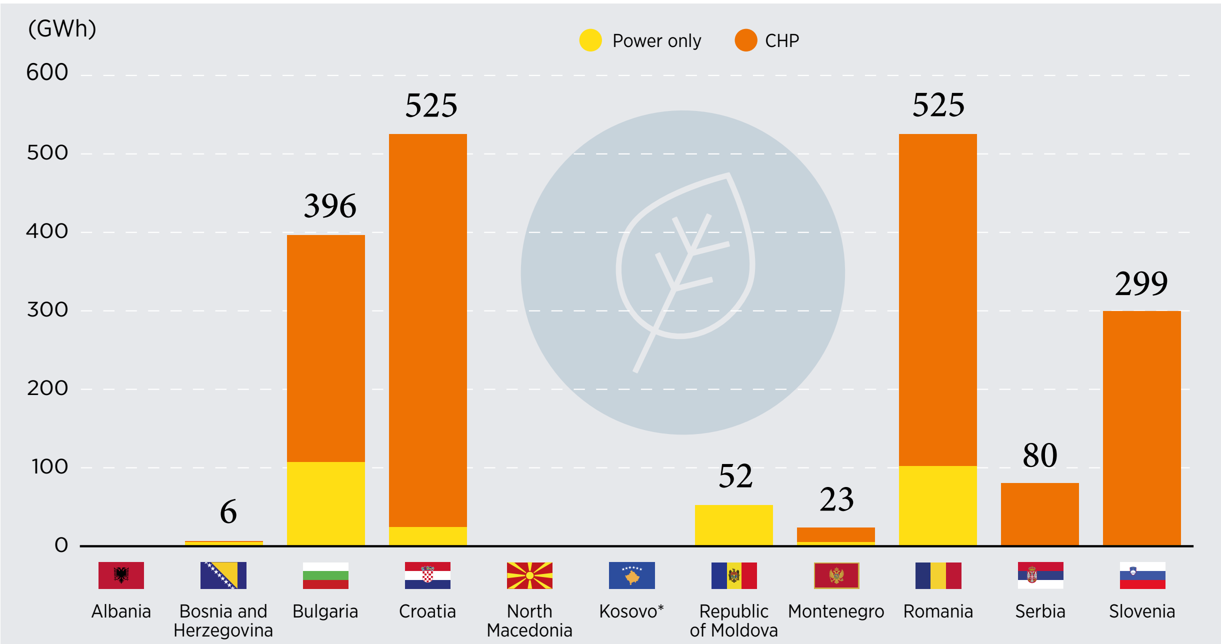
Figure 4.2 Contribution of bioenergy to TPES, SEE, 2017



Source: IRENA (2019a)

Figure 4.3 Electricity generation from biomass by power plant type, SEE, 2017



Source: IRENA (2019a)

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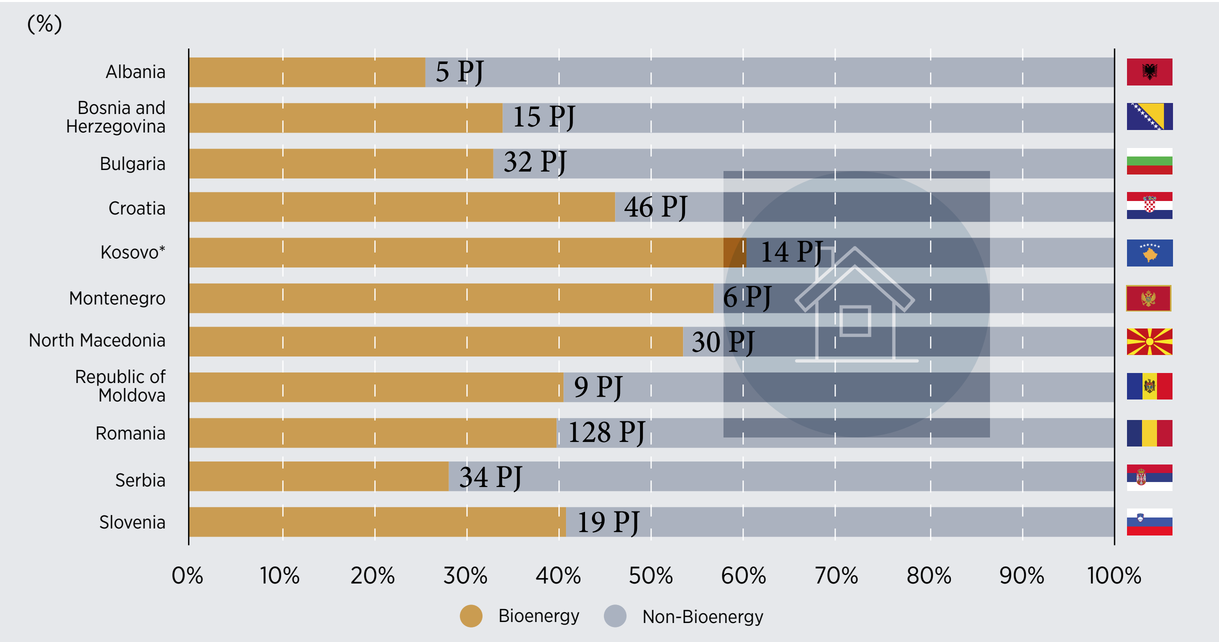
Residential sector

In the region, bioenergy is primarily used for heating in the residential sector, which in 2017 accounted for 80% of total bioenergy use. Bioenergy provided 40% of residential heating demand in 2017 and over 50% in Kosovo*, Montenegro and North Macedonia (see Figure 4.4); the proportion remains high in all other cases.

The use of solid biomass in the residential sector is mostly in inefficient cooking and heating appliances that are a major source of local air pollution and of health problems (World Bank, 2017). Improving the access to clean solutions for cooking and heating is a priority under the UN's Sustainable Energy for All Initiative. In the focus economies, there are still many households lacking clean energy access (for example access to electricity, gas or modern efficient biomass systems) – over 30% in some cases (Figure 4.5).

This compares to the situation in Ukraine, where only 4% of the households lack access to clean cooking. In the EU-28, only four EU countries have a lack of access figure above 0%: 7% in Estonia, 5% in Latvia, 4% in Greece and 3% in the Czech Republic (World Bank, 2019).

Figure 4.4 Contribution of bioenergy to total residential energy demand, SEE, 2017



Source: IRENA (2019a)

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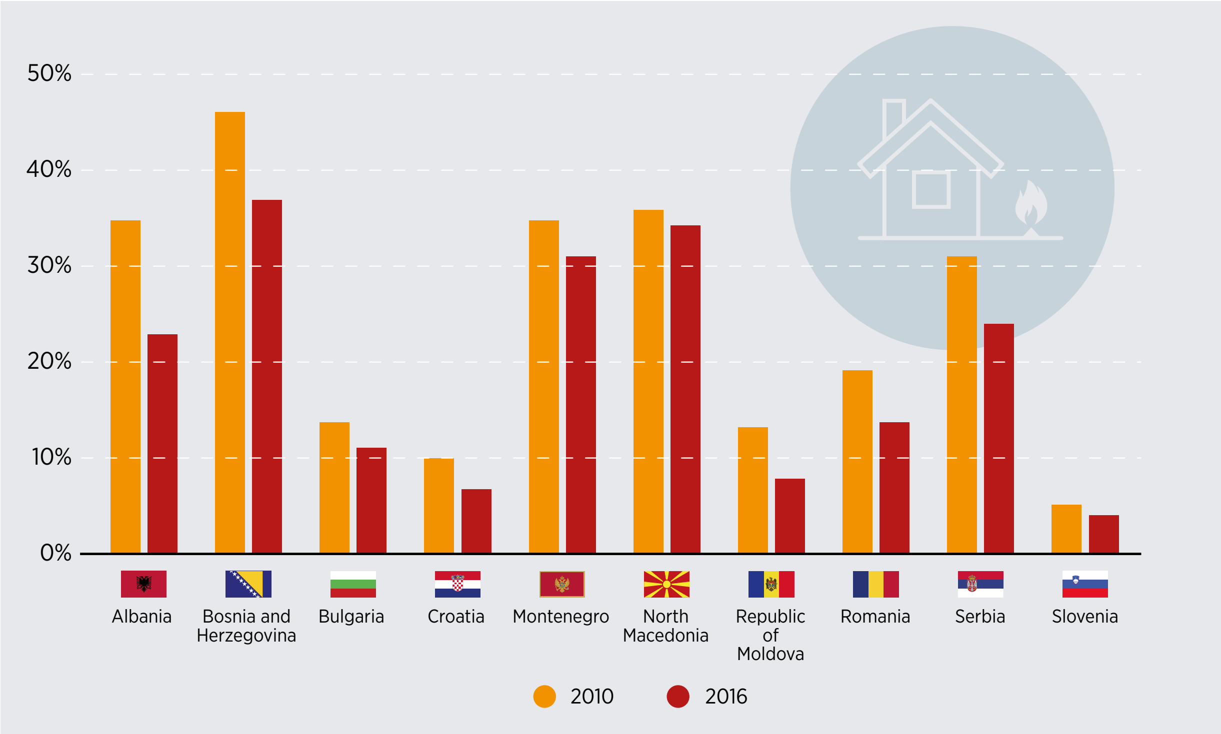
Figure 4.5 Share of households without access to clean cooking solutions, 2010 and 2016



Note: no data for Kosovo.*
Source: World Bank (2019)

Industry

Bioenergy also contributes to industrial heating needs, ranging from 0.2% in the Republic of Moldova to nearly 10% in Bulgaria, where the paper and pulp industry play an important role.

District heating

DH still plays a significant role in the energy economy the SEE region, except for Albania and Montenegro. DH systems provide energy for both residential heating and for industrial purposes. The proportion of residential heating provided by DH is around 10%, with 15% in Bulgaria, 14% Serbia and 8.5% in the Republic of Moldova (IRENA, 2019a). Many DH systems in the region are reported to be in poor condition with high distribution losses and low overall efficiency (Robić, 2016).

DH provides a significant opportunity to use biomass fuels either in stand-alone operation or co-fired with fossil fuels such as coal.

The proportion of the total DH currently supplied by biomass fuels ranges from zero to almost 12% in Bosnia and Herzegovina, 15% in Croatia and over 17% in Slovenia (Figure 4.6). Switching more DH systems to biomass fuels in conjunction with system refurbishment and efficiency improvements may be a priority opportunity for increasing bioenergy use in some cases.

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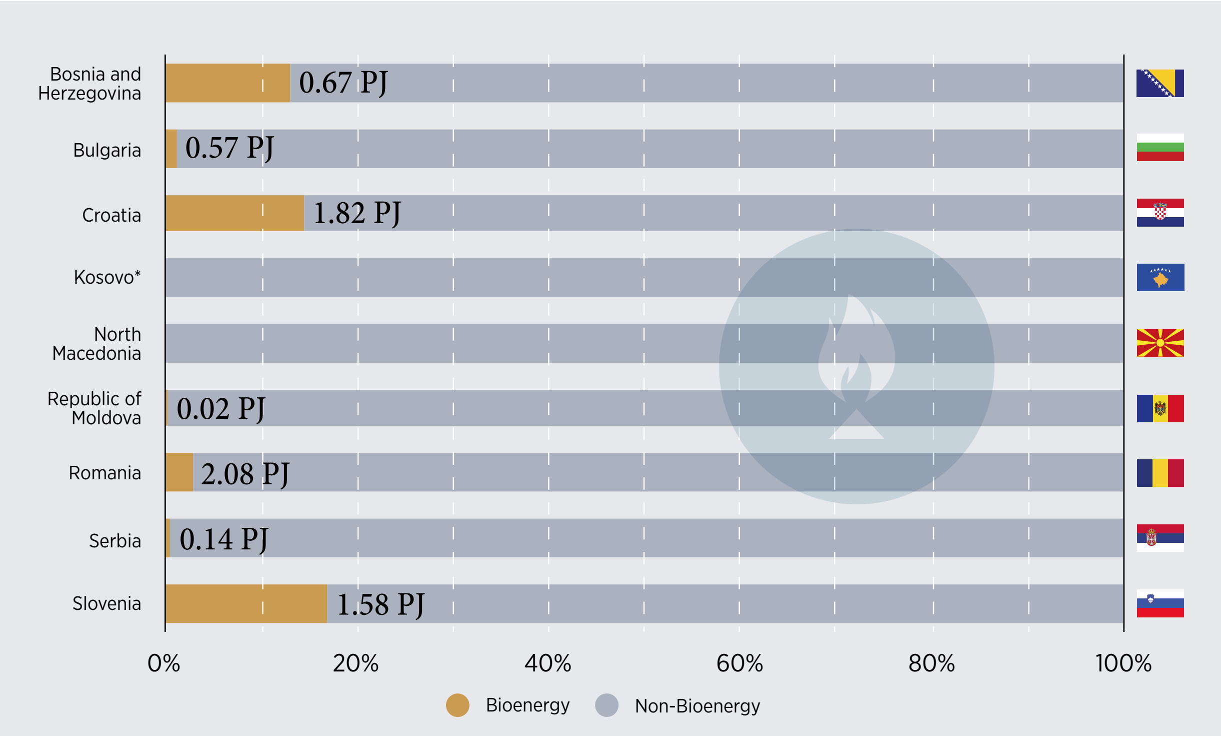
Figure 4.6 Contribution of bioenergy to district heating, SEE, 2017



Source: IRENA (2019a)

BIOENERGY FOR TRANSPORT

All the SEE economies have a commitment (under the RED or as part of the EnC Treaty requirements) to meet 10% of transport fuel needs by 2020 from renewable sources, and biofuels are the most promising way to meet these requirements. Currently, biofuels play a role in the transport sector in only three of the focus economies. Bioethanol is used in Bulgaria and Romania, and biodiesel in Albania, Bulgaria and Romania.

In Albania, 3.2 PJ of imported biofuel was used in the road transport sector in 2017, blended with 31.3 PJ of conventional diesel fuel. This supply has been developed rapidly (starting in 2014 and doubling between 2015 and 2016). This amount is however not counted toward the 2020 target as Albania has not introduced sustainability regime and a certification scheme for biofuels (EnC, 2019b). In Bulgaria, 6.7 PJ of biofuels were used in the transport sector in 2016, providing 4.9% of transport energy demand, and 4 PJ of biofuels were produced domestically.

In Romania, 12.5 PJ of biofuels were used in the transport sector in 2017, providing 4.8% of transport energy needs, and 58% of the biofuel was produced domestically.

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04

4.3 POTENTIAL AND COSTS

So far, other than the use of biomass for residential heating, there has been little progress in developing the more modern and sustainable bioenergy options in the region. There exists significant potential to expand the sector. This section explores the longer-term potential for bioenergy in the region based on estimates of the potential sustainable supply of feedstock materials.

POTENTIAL SUPPLY OF BIOMASS FEEDSTOCKS FOR ENERGY PURPOSES

Current potential

The potential supply of biomass which can be used for energy purposes in a country depends on the physical supply of potential raw materials and how these may evolve over time. This will be influenced by changes in the ways waste and residue is generated and treated, the changing patterns of agricultural and forestry production and the constraints to supply.

A number of studies have considered the potential supply for the region. A comprehensive one is the S2Biom study undertaken for the European Commission (S2Biom, 2017a) (Box 4.2).

Table 4.2 summarises the results of the S2Biom study for estimates of the potential for biomass supply potential in 2020 within the study's "baseline scenario". This represents a technical rather than an economic potential (Figure 3.2). Analysis within the study shows that the costs of the materials close to their point of production are in the range of USD 3.6-6/GJ.

Box 4.2 S2Biom study

The S2Biom study (S2Biom, 2017a-c) has estimated – in a consistent way – the potential for bioenergy supply for each of the SEE economies. It also applied sustainability criteria consistent with the provisions of the EU's RED. The study takes account of projected changes in agriculture, forestry and waste generation and management practice, and looked in detail at potential supply from a wide range of forestry and agricultural resources including from the production of energy crops, along with those associated with municipal and other similar wastes.

The report distinguishes between many specific types of raw material. The main categories are summarised in Table 4.1 with some examples of the resources included.

Table 4.1 S2Biom feedstock categories

Category	Biomass sources
Forest production	Wood from final fellings and thinnings
Forestry residues	Logging residues and stumps
Biomass crops	Miscanthus, canary grass, shirt rotation coppice including willow, poplar and eucalyptus, and other perennial crops
Agricultural residues	Rice, cereal oilseed, rape and sunflower straw, sugarbeet leaves, woody and orchard prunings including from vineyards, fruit, olive citrus and nut plantations; unused grassland cuttings
Wood industry residues	Including sawmill residues such as sawdust and other residues from wood-based industries
Residues from the paper and pulp industries	Bark and black liquor
Food industry residues	Residues including rice husks, olive stones, grape and bran residues
Biowastes and post-consumer wood wastes	Biodegradable wastes from food production and use, park and garden waste and post-consumer wood waste

Source: S2Biom (2017b)

Table 4.2 Summary of cellulosic biomass technical potential based on S2Biom – baseline scenario 2020 (PJ)

	Forest production	Forest residues	Biomass crops	Agri and woody residues	Sawmill and wood processing residues	Pulp and paper residues	Food industry residues	Biowaste	Total
Albania	17	3	20	6	1	0	0	10	**57**
Bosnia and Herzegovina	54	5	72	2	13	2	0	10	**159**
Bulgaria	61	15	74	128	9	3	6	11	**308**
Croatia	61	4	1	41	8	0	2	11	**128**
Kosovo*	16	2	38	5	0	0	0	0	**61**
Montenegro	18	1	2	0	2	0	0	2	**26**
North Macedonia	19	2	15	5	1	0	1	6	**48**
Republic of Moldova	8	1	25	3	2	0	0	8	**47**
Romania	268	37	279	298	82	0	15	59	**1 037**
Serbia	63	7	33	114	6	0	4	22	**250**
Slovenia	85	7	0	5	11	0	1	6	**115**
Total	**670**	**82**	**561**	**609**	**134**	**5**	**31**	**145**	**2 237**

Source: S2Biom 2017c

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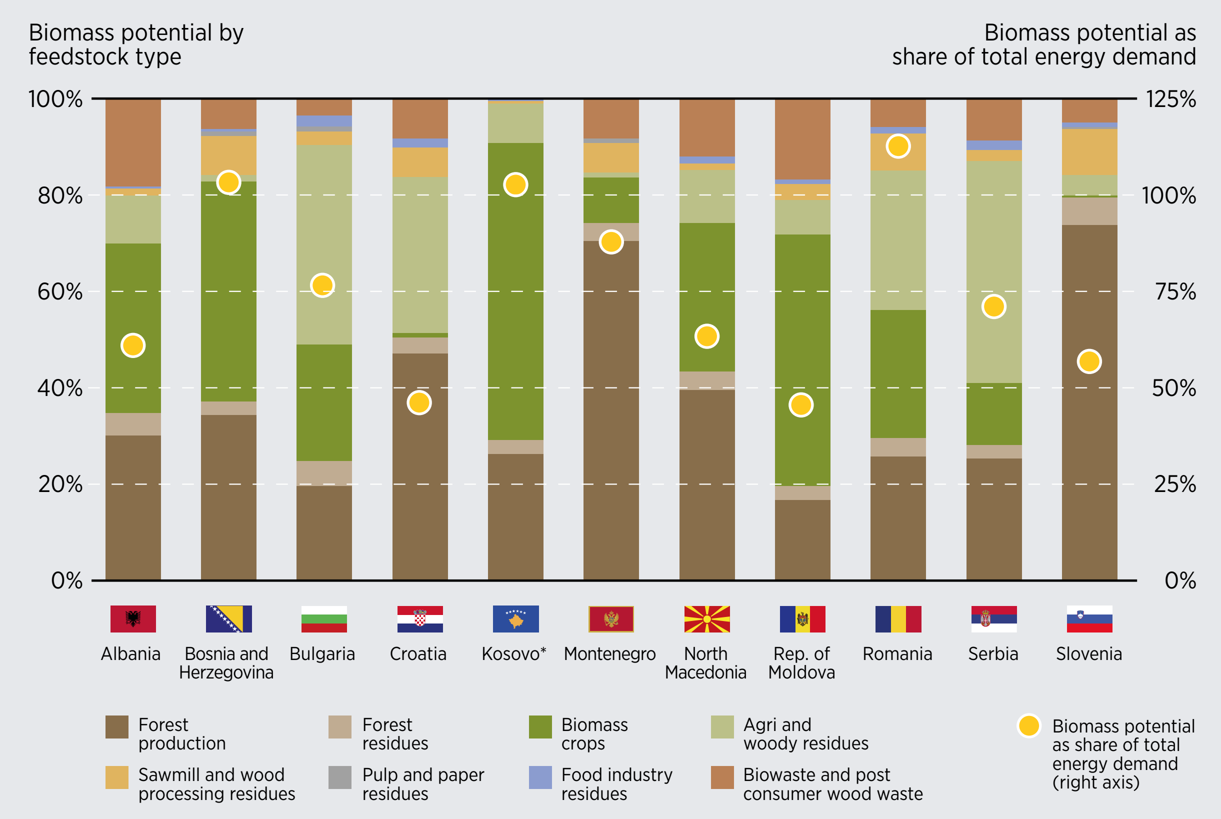
04

Nearly half the potential resource is concentrated in Romania, which covers the larger part of the region. In some cases, agricultural wastes are the most significant sources, while in others there is significant potential for forestry or energy crops (Figure 4.7). This potential represents a substantial proportion of the total primary energy demand. This is on average over 86% and even over 100% in Bosnia and Herzegovina, Kosovo* and Romania.

Since this study is aligned with the provisions and strategic direction of the RED, it concentrates on the production of cellulosic biomass sources rather than on the potential for production of other crops that could be used for energy production (sugar beet, oil and cereal crops). It also does not consider the quantities of materials such as animal manures suitable for biogas or biomethane production. A study by the European Commission's Joint Research Centre has made a detailed estimate of the potential of biogas from animal manures for Europe (EC JRC, 2018). It concludes that for the SEE region the realistic energy potential of the gas that could be produced amounts to some 46 PJ, and that this could generate some 4 TWh of electricity.

Figure 4.7 Relative importance of different biomass sources and 2020 potential as share of energy demand, SEE



Source: S2Biom (2017c)

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The potential for increased supply of bioenergy feedstock in the longer term

The estimates of bioenergy potential from the S2Biom study are based on the expected trends in agriculture and forestry over the period to 2030 and beyond, assuming current models and practices prevail. Changes to today's agricultural practices could yield significant improvements in crop yields, while improvements in food chain efficiencies could reduce primary agricultural production requirements, thereby expanding both food and fuel supply in a sustainable fashion and avoiding emissions associated with direct and indirect land-use change (IRENA, 2016b-c).

The main measures which could lead to such improvements include boosting yields of food crops and associated residues on existing farmland. Further yield improvements could free up farmland for biofuel crops. It may also be possible to reduce the losses and waste in the food chain to secure additional farmland for biofuel crops and to improve livestock management for available pastureland to be utilised for biofuels crops (IRENA, 2016c).

Finally, innovations are underway which could lead to enhanced production of materials potentially suitable for bioenergy (IRENA, 2019g). For example, maintaining the yields of the crop fractions used as food while increasing overall biomass yields allows the higher quantities of co-products to be used as raw materials for energy or other non-food purposes. Another approach is to add additional crop rotations between the main food crops ("catch crops") which can provide additional non-food feedstocks. For example, the use of Brassica carinata as a catch crop between corn crops is being demonstrated at a large scale in Uruguay (UPM, 2017).

COSTS OF BIOENERGY

The costs of bioenergy are strongly influenced by the feedstock cost as delivered to the user site, which is in turn affected by how far the material must be transported. Bioenergy power generation costs can vary widely (with LCOE ranging from USD 0.04 to 0.25/kWh within Europe) (IRENA, 2019d). The costs and the efficiency of conversion are very dependent on scale. Small plants may have conversion efficiencies as low as 15%, while larger plants can achieve 40% efficiencies (IEA, 2017b). The costs of generation also depend on whether and how much heat can be recovered in CHP systems, and on the value of the heat as well on the operating regime and the cost of capital. Costs must therefore be calculated for specific project circumstances. Given that bioenergy combustion technologies are very well established, the scope for significant cost reduction is limited.

The efficiency and cost of producing heat from biomass are also heavily dependent on feedstock costs, but are much less scale dependent, with high net efficiencies achievable even on a small scale in well-designed plants. However, costs depend on the heat load, with higher loads such as those in industry favouring low costs. Analysis indicates that solid biomass systems can be particularly cost effective in such applications (IEA, 2014).

The costs of advanced biofuels can be compared with those of conventional biofuels such as starch/sugar-based ethanol and FAME-type biodiesel. The price of ethanol is strongly linked to corn prices, and in Rotterdam, the hub of European biofuels, prices were reported between EUR 18 and EUR 26/MWh (Flach *et al.*, 2018). European biodiesel prices have been in the range of EUR 19 to EUR 28/GJ (Neste, 2019).

04

4.4 BARRIERS TO ACTION AND POLICIES

POLICY FRAMEWORKS

The analysis above shows that there is significant potential for producing and using bioenergy in a sustainable way in the region. Biomass could help meet regional energy and environmental objectives and, at the same time, address many other social and environmental issues.

However, progress in deploying modern sustainable bioenergy technology has been very slow. This indicates that there are significant barriers to increased sustainable and modern deployment and that current policy and regulatory measures aimed at off-setting these barriers are insufficient to stimulate investment.

Appropriate policy and regulation are needed to support the transition from traditional to modern bioenergy and to increase the use of biomass in different sectors. A sound policy and regulatory environment, in line with state-of-the-art policy design (IRENA/IEA/REN21, 2018), should include:

- A long-term, stable policy and regulatory framework that provides certainty about the market with clear and specific targets for the use of renewables. Appropriate and solid levels of revenue should make the investment potentially profitable and provide sufficient revenue certainty to attract finance at competitive terms (such as long-term PPAs for power generation or other long-term off-take agreements);
- The establishment of a "levelling the playing field" framework as far as bioenergy or other renewable and low-carbon technologies are concerned. This could be achieved through the reduction or abolition of subsidies for the production and use of fossil fuels, and the wider introduction and improvement of ways of pricing in the environmental externalities caused by fossil fuel use, through a carbon pricing regime;
- Ensuring that producers have access to the relevant markets (e.g., to be able to legally produce and sell bioelectricity, access the grid under reasonable conditions, or to access the transport fuel market);
- Measures to avoid non-financial barriers to deployment, such as appropriate and clear regulations relating to planning, environmental permitting and energy market access.

Bioenergy technologies pose some additional policy and regulatory issues (IEA, 2017b). These include the need:

- To have stringent but stable sustainability governance regimes, which insist on proven and globally accepted good bioenergy practices and policy instruments to promote them;
- To put in place transparent and appropriate environmental safeguards for emissions to air and water from bioenergy plants;
- To recognise the social benefits of bioenergy, such as rural employment and income, and the contribution that bioenergy can make to energy security and diversity;
- For appropriate regulations relating to the integration of bioenergy (for example, the regulations and standards that apply to biofuel/gasoline or diesel blends).

The policy frameworks in place in the region contain some important elements of the policy portfolios listed above. For example, there are clear targets for bioenergy spelled out in NREAPs. In many SEE economies there are tariffs for bio-electricity.

The use of waste-based bioenergy feedstocks contributes to efforts to improve waste management by reducing landfilling, helping to control landfill gas emissions, and improving the quality of liquid discharges. However, the economics of such systems depends heavily on financial benefits from the environmental positives – for example, as a gate fee for waste-to-energy plants, from avoided effluent discharge payments. In most jurisdictions in the region, waste regulation practices are not advanced. With such income streams unavailable, waste-based projects tend to be unprofitable.

While there are clear targets for the deployment of biofuels in the transport sector and blending mandates have been put in place, there are not always penalties on fuel distributors who do not comply with the mandate or mechanisms for offsetting or sharing any additional costs associated with the use of biofuels. Therefore, there may be no commercial reason for fuel distributors to include biofuels in their fuel supply. There are also no regulatory arrangements for assuring sustainability of the biofuels feedstocks, in line with the requirements of the RED.

SUPPLY CHAIN RISKS

Some bioenergy projects need to secure long-term and economic fuel supply. This is less challenging for projects based on waste or residue already collected or generated as part of a production process (for example, wood residues generated in a sawmill). It becomes much more complex when materials such as residues have to be collected to supply a bioenergy conversion plant, maybe from hundreds or even thousands of suppliers (IRENA, 2019h).

In areas where large-scale industrial farming is rare, and where much of agriculture involves very small farms, which are used principally to provide food for the occupiers, biomass for energy harvesting may be more challenging.

In Albania, a substantial portion of agricultural production remains subsistence-oriented. The farm size is on average 1.2 hectares (ha). Roughly 25% of farms have less than 0.5 ha, 64% have from 0.6 ha to 2 ha, while 11% of farms have more than 2 ha of land. In Bosnia and Herzegovina over 50% of agriculture holdings are estimated to be less than 2 ha. State firms are much larger but are either operating under severe constraints or are inoperable due to the incomplete process of privatisation.

In Croatia, "community-owned farms" were broken up at the end of state ownership and are now in private ownership. The average family farm size is about 3 ha, and less than 3 000 farms have a size greater than 20 ha of agricultural area.

In Kosovo*, 53% of the land (1.1 million ha) is agricultural, which on average is divided into farm sizes of 1.5 ha. An estimated 80% of the farms are between 0.5 and 2 ha (Denvir, Bauen and Paunotsou, 2015). In the Republic of Moldova, the land was privatised after independence, and ownership was distributed to eligible citizens. The average family was entitled to plots of between 1.5 and 2.5 ha (FAO, 2000).

Putting in place large-scale supply chains involving the agriculture and forestry sector will be a very significant problem which is likely to constrain the deployment of such projects in the short to medium term. This will be especially so, given the lack of experience of deploying the conversion technologies such as those for large-scale production of power or biofuels (using conventional or advanced technologies) in the region, and market uncertainties due to the lack of supportive policy frameworks.

Such issues can be avoided by initially concentrating on short-term efforts to expand the use of bioenergy in the region on projects which can be based on feedstocks with shorter and less complex supply chains. For example, supply chains based on wastes and process residues should be favoured while investigating the potential for more complex supply chains and gradually developing the capacity to harness the substantial volumes of feedstock which are available in principle.

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04

4.5 OPPORTUNITIES

There is a wide range of opportunities for bioenergy in the region based on technologies available now, and as new technologies mature these opportunities will grow. But given the current slow progress and regional circumstances, the best approach in the medium term may be to concentrate on a small number of solutions based on well-established technologies, which could be deployed in the region and would bring substantial non-energy benefits. This section, therefore, concentrates on identifying a number of such opportunities, but also highlighting the steps which will be required to unlock the potential.

The opportunity areas chosen for detailed suggestions are:

1) the improved use of bioenergy in the residential sector and in DH;
2) the use of waste materials for energy in CHP systems, along with biogas production;
3) the use of biofuels from conventional feedstocks and processes (opening the way for more advanced technologies).

BIOMASS IN THE RESIDENTIAL SECTOR

As discussed above, traditional bioenergy plays a significant role in the provision of residential heating in the region. Traditional bioenergy is generally related to poorly designed appliances with very low efficiency and high levels of emissions, which in turn contribute to poor indoor and outdoor air quality and hence to significant health problems.

The extensive use of these fuels is an evident symptom of significant energy poverty in the region. The reasons for this situation are complex but include the low levels of income in many of the cases, coupled with the very poor state of many buildings and the consequent poor energy efficiency performance which pushes up energy requirements (Robić, 2016). In part, the situation has been aggravated by a move from social pricing, with energy provided as a social good, often via DH, to more market based pricing coupled with a reduction in the use of DH (which often themselves involved systems in a poor state of repair, with low efficiencies and using polluting oil-fired systems). These developments have made energy from other sources beyond the means of many consumers and contributed to maintaining and increasing the inefficient use of biomass.

Along with other options – such as using other forms of cleaner energy such as electricity, natural gas or liquefied petroleum gas – switching to more efficient biomass boilers can reduce emissions and the amount of fuelwood which is needed to meet heat demands. But this needs to be part of a more comprehensive package of measures including a concerted effort to improve building energy efficiency through improving building fabric, insulation levels, glazing and draught proofing. Such measures will reduce fuel needs drastically and have significant health and environmental benefits. There are also opportunities, where appropriate, to promote the use of efficient DH, either by refurbishing existing grids or by building new ones and exploring the efficient use of biomass fuels in such grids.

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The performance of biomass combustion systems is critically dependent on fuel quality – wet or contaminated fuels lead to very poor emissions performance. Therefore, the increased use of wood for heating also requires demonstration of the supply of wood fuels which meet well-defined quality standards and stringent sustainability criteria.

The European Commission, UNDP, GIZ (*German International Cooperation Agency*) and other organisations have supported many SEE Governments in improving the use of biomass in the residential and public buildings. With support from the EU's BioVill project (a project supported under the Horizon 2020 initiative), a number of bio-villages have been established in Macedonia, Romania, Serbia and Slovenia, where village-scale DH systems have been installed. For example, in Pokupsko, Croatia, a 1 MW biomass boiler and a 1.2 km long DH network provide heat to public buildings (elementary school, municipal administrative building, church), commercial buildings and households in the centre of the municipality (BioVill, 2016).[19]

In Moldova, in the first phase of the UNDP's energy and biomass project (2011-2014), public institutions in 126 villages were connected to biomass heating systems, and modern biomass heating systems were installed in 143 public buildings, such as schools, kindergartens and community centres. One million euros were provided for the purchase of biomass fuel production and processing equipment through a leasing mechanism, and more than 600 families were able to purchase modern biomass boilers, with EUR 1 300 of the investment costs being reimbursed through project funds. In a second phase (2015 2018), 79 biomass heating systems were installed in public institutions, and 121 schools, kindergartens, community centres and hospitals now have modern biomass heating systems (UNDP, 2018).

There is a large amount of production of pelletised wood fuels in the region. A 2014 survey showed the existence of 245 producers of wood pellets in SEE and Slovakia, 116 of which were located in Bulgaria and Serbia. The total capacity for wood pellet production was estimated at 2.2 million tonnes in 2013 with 1.36 million tons of pelletised wood actually produced. Nearly 80% of the pellets produced in the region are exported because the pellet stove market is undeveloped in all jurisdictions except Slovenia, while all the economies in the region import natural gas. The region certainly has the potential to reduce import dependence by stimulating the installation of pellet stoves; moreover, the average price of exported pellets is significantly lower than the average price of imported natural gas (Glavonjíc et al., 2015). In 2017, Serbia reduced the VAT on wood briquettes and pellets from 20% to 10%, aligning with the VAT pending on natural gas (KPMG, 2017).

Promoting the use of pellet stoves would, therefore, be beneficial for the local economies, which can benefit from a large, already existing and underutilised supply chain.

Some of the key actions that may enable improved use of bioenergy for heating in the region include the following measures:

- Identifying efficient and sustainable biomass supply chains, including wood industry residues, forestry by-products and energy crops industry, and economic routes to pellet fuel production;
- Promoting measures which provide access to clean heating solutions and to tackling energy poverty, including improving the energy efficiency of the building stock, use of electricity and gas fuels, and refurbishment and improvement in efficiency of DH networks;
- Encouraging the development and deployment of more efficient biomass systems for CHP and for direct heating such as those using pelletised wood.

19 Other examples of new DH networks are presented in Chapter 5.

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04

USING WASTE FOR ENERGY

Wastes can be used to produce energy either by the use of "dry" waste materials, such as municipal solid waste, to produce heat and/or electricity, or through the use of other materials to produce biogas. The production and use of energy from waste materials is less expensive than using dedicated crops and can play an important role in improving environmental performance by diverting material from the waste chain, and by improving safety and air quality while also reducing GHG emissions.

The use of municipal solid waste as an energy source offers a solution to problems associated with landfilling of wastes and has been one of the main solutions within Europe enabling delivery of the targets associated with the Landfill Directive. In 2016, 128 million tonnes of waste were treated in this way in the EU-28 (Eurostat, 2019).

The plants can produce heat and power and are particularly adapted to provide heat for DH schemes. However, much care has to be taken with the design and operation of such plants to ensure that the emissions to air from the plants conform to very high standards. This means that the capital costs of the plant are high. The costs of energy only become affordable when a very high credit is given for the waste disposal function. This means that the plants are paid for every tonne of waste that they use as fuel – a negative fuel cost or "gate-fee" which in some cases exceeds EUR 100/tonne. Within the focus region, waste to energy plays a significant role so far only in Bulgaria and Romania.

Biogas production can reduce the organic content of liquid waste streams and complement efforts to improve water quality. The GHG balance of such systems is favourable because it reduces potential methane emissions. In the region, sewage gas plants are present only in Croatia and Bulgaria.

Biogas production is a well-established and fully commercial technology and is widely deployed within EU countries. Germany is the leading country with nearly 9 000 plants in operation. However, considerable know-how is needed to be sure that projects are successful – for example by adapting operating conditions according to the specific feedstocks available.

Biogas production is not yet extensively deployed within the region, although production has been growing from low levels. Some examples of its deployment in the region include:

- A 250-kW anaerobic digestion facility at a Croatian pig farm producing heat, power and fertiliser. The facility uses slurry from a newly erected pigsty with 130 sows and 2 800 porkers (Bioenergy Insights, 2016);
- A CHP system has been installed at a wastewater treatment plant at Jesenice plant in the northwest of Slovenia to generate electricity and heat from dirty methane gas being emitted at the site (Bioenergy Insights, 2015);
- The first anaerobic digestion facility in North Macedonia is located at a cattle farm in the city of Bitola (Waste Management World, 2016).
- A sugar producing company in Drochia (Republic of Moldova) will convert waste resulting from the extraction of sugar from beets to biogas (further used to generate power and heat) and organic fertilisers (Bioenergy Insights, 2013);

In order to foster the widespread deployment of these technologies, a two-pronged approach consisting of progressive environmental legislation discouraging pollution is needed – for example, constraints on landfill gas emissions, increasing disposal costs for wastewater and gradually increasing costs of waste disposal to landfill. Moreover, reasonable and long-term income streams, such as PPAs for power produced through a FiT or awarded through technology-specific competitive processes, are needed to secure investments.

Once the technologies are established in the region through the use of waste materials, there may be significant scope for further expansion of biogas production by using agricultural residues (respecting

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the need to use some of the materials for animal feed, and restricting residue removal so as to conserve soil quality) or by using suitable energy crops as in nearby EU countries. In Italy, for example, farmers are planting a catch crop between main crops such as maize and using the product as raw material for biogas production. This "better use of biogas" concept produces renewable energy and provides additional rural income without displacing food crops (Box 4.3), and this technique could be adapted for the SEE region. There is also potential for growing energy crops which can be used as feedstocks for digestion on marginal and unproductive land.

Some of the key actions that may enable improved production and use of biogas in the region include the following measures:

- Progressive waste and pollution legislation which provides a supplementary income to energy producers;
- Provide adequate and certain long-term income streams to investors through PPAs;
- Establish clear guidelines and regulation governing emissions from waste to energy and biogas plants to air, land and water;
- Evaluate the long-term potential to extend the production of biogas from catch-crops.

Box 4.3 Biogas Done Right

The Biogas Done Right (BDR) concept was originally developed and demonstrated by Italian farmers motivated by the Italian Biogas Association (ART Fuels Forum, 2018). Conventional biogas production is based on a mixture of feedstocks which may include waste materials, agricultural residues from sources such as animal husbandry and crop residues, and some crops such as maize or silage. Such systems can generate significant GHG savings when properly managed, and the digestate can be used as a fertiliser and soil conditioner. However, the use of crop materials is expensive. It may also take up land previously used for food production, therefore leading to emissions associated with indirect land-use change. The use of the residues as fertilisers can lead to enhanced emissions of gasses such as ammonia.

To avoid such impacts, the BDR systems include some or all of the following features:

- Production of sustainable biomethane from animal manure, agricultural residues and agro-industrial by-products;
- Double cropping with a primary crop for food or feed and a secondary crop for energy production with crop rotation;
- Year-round covered soils avoiding soil erosion and nitrogen emission (air emission and leaching), enhancing soil structure and organic carbon content;
- A shift from deep ploughing and chemical fertilisation to precision farming with minimum tillage (strip tillage, no tillage) to conserve soil carbon and soil moisture;
- Regular use of digestate as organic fertiliser, increasing fertility and soil carbon content (minimised input of chemical fertilisers);
- Optimised fertilisation and irrigation on growing fields;
- Inclusion of legumes to fix nitrogen and temporary grass to reduce nitrous oxide (N_2O) emissions.

The combined impact of all these measures allows additional biogas production without any reduction of food production and enhanced GHG performance while optimising the value of the digestate as a fertiliser and soil conditioner (including improving the soil carbon content) and reducing ammonia emissions.

The BDR concept has been demonstrated in Italy and some other countries with similar climates to parts of the SEE region. It can be applied in other regions, but the detailed implementation may need to be adapted to the climate and to the agricultural practices in place.

04

BIOFUELS

The 2020 biofuel RED target can only be met by importing biofuels from international markets, due to the low level of local biofuels production capacity in the region and the lack of feedstock supply chains. This negates the potential benefits in terms of rural development that could be stimulated by biofuels production. The gradual development of biofuels production capacity and consumption within the region may be considered.

In 2015 the EnC Secretariat set up a project to support its signatory parties in putting in place the necessary measures to develop biofuels (Denvir, Bauen and Paunotsou, 2015). The main barriers identified were the absence of a regulatory framework which obliges fuel suppliers to include biofuels in their fuels, and for mechanisms for paying any price difference between fossil fuel and biofuels. In addition, the measures necessary to comply with relevant sustainability criteria in RED are not yet in place. None of the case studies currently have significant biofuel manufacturing capacities. While there is potential to produce the biofuels within the region, the necessary supply chains and production and distribution infrastructure are so far absent.

Legal and regulatory framework

While in several cases SEE governments had set biofuels obligations, these obligations were not fully integrated into national legislation. Even when they were, there were no penalties on transport fuel distributors for not complying. In addition, there are no mechanisms for compensating for any additional costs associated with blending biofuels. In the absence of these requirements, there is no commercial reason for companies to blend in biofuels (Denvir, Bauen and Paunotsou, 2015). Experience from other countries shows the need to adopt compliance measures with the blending requirements, for example in the form of substantial fines.

Providing tax or duty rebates on biofuels may help to reduce the additional costs. However, since it has a negative impact on national tax revenues, sharing the burden on the fuel users is being increasingly used. This raises questions on the aggravation of fuel and energy poverty (Chapter 6).

Sustainability governance

An appropriate legislative and regulatory framework must be in place to ensure the sustainability of biofuels, along with a national system for verification that the sustainability requirements have been met. A national system for verification of sustainability criteria must be in place, alongside a clear definition of the information needed to ensure the fulfilment of the sustainability criteria.

Putting in place these detailed requirements requires significant administrative capacity. The RED was designed for EU member countries, but for non-EU SEE economies the requirement of the national system may be a barrier. If a more tailored approach to biofuels policies was adopted, this would allow such a complex system to be built up in stages.

Supply chains

In 2017, 24 PJ of biofuels were consumed in the region; only 50%, however, was produced in the country of use (almost entirely in Bulgaria and Romania), and the rest was imported. The biofuels produced in the region use some imported feedstocks and are primarily exported to markets outside the region.

There are crops suitable for conversion to biofuels – for example, cereal, oil and sugar crops – along with some waste products (such as used cooking oil) which could serve as feedstocks. There are also substantial areas of land which are not in productive use, or where productivity is low. Notwithstanding the problems associated with small farms and a very disaggregated farming sector, there is undoubtedly scope for further production of feedstocks for bioethanol or biodiesel production.

Conducting resource assessments would help to determine the scope for increasing the potential feedstock supply, especially in the light of the potential for bringing back agricultural land into production and in improving overall agricultural yields. Such an evaluation could be a precursor to the establishment of realistic domestic biofuels mandates.

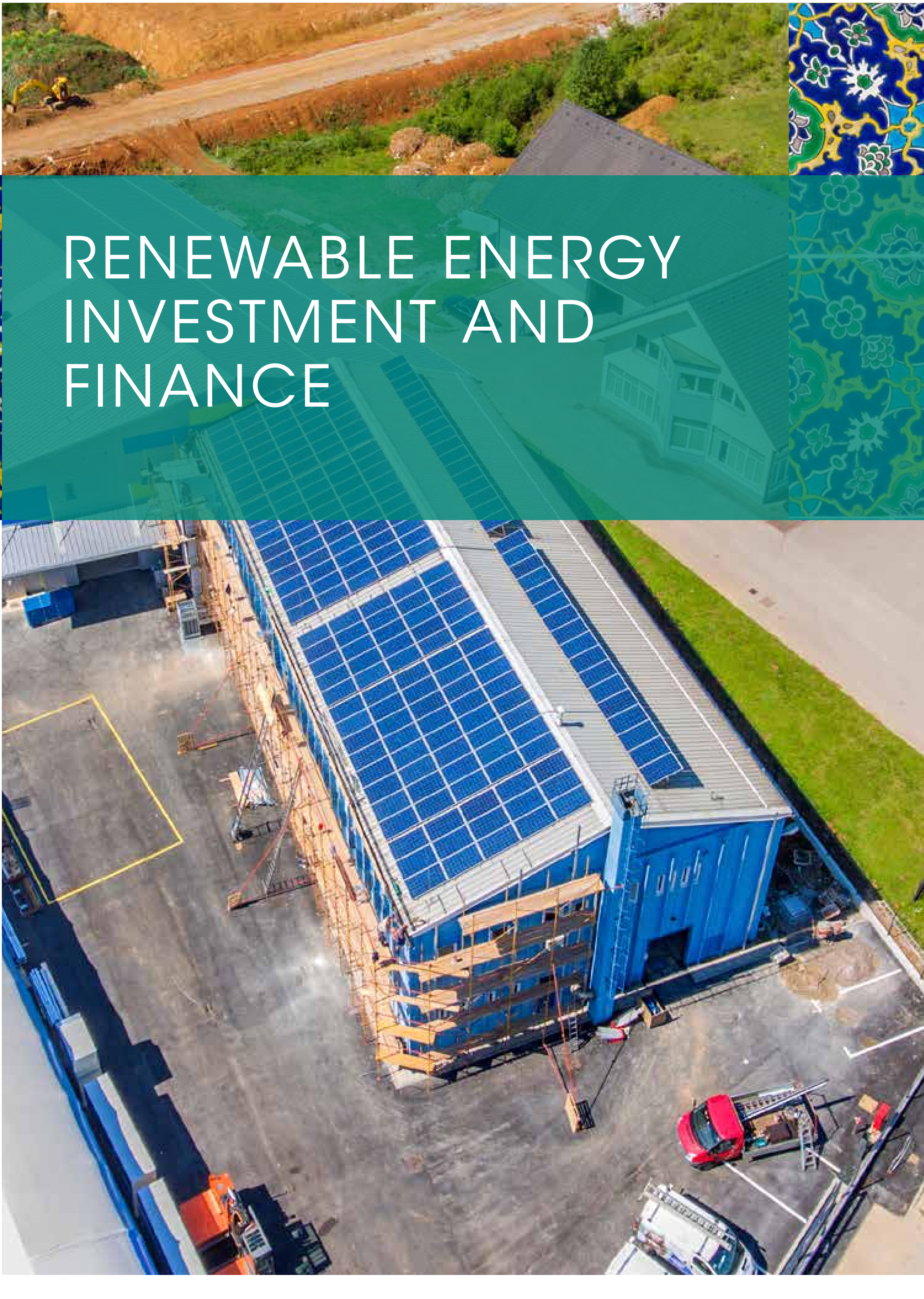
The large cellulosic material potential in the region (Table 4.2) could in principle also be used for biofuels production via advanced biofuels technologies. Based on Clariant's technology, one large-scale plant is currently being constructed in Romania and will produce 50 000 tonnes of ethanol from cellulosic cereal residues, using around 250 000 tonnes of wheat straw (and other grain residues) sourced from local farmers. By-products from the process will be used for the generation of renewable energy with the goal of making the plant independent from fossil energy sources (Clariant, 2017). A further large-scale plant is also being built in Slovakia, with an annual production capacity of 50 000 tons (Biofuels Digest, 2017). While the plant is not located in the SEE region, it could still have beneficial effects, as the region employs more than 50 000 workers in the biofuel sector, which entails the production and supply of the feedstock (Chapter 6).

Given the widespread availability of cellulosic feedstocks in the SEE region, there is considerable scope for replicating such plants both to supply local fuel needs, but also to serve growing demand being stimulated within the EU by RED II.

Croatia has recently introduced a specific mandate for such advanced biofuels products, with the government approving a specific 0.1% blending mandate within an overall 7% mandate for conventional biofuels and with a potential to increase the level if sufficient fuels are available (Biofuels Digest, 2018).

Some of the key actions that may enable improved feedstock supply, production and use of sustainable biofuels in the region include the following measures:

- Identifying the potential for additional production of feedstocks to produce conventional and advanced biofuels;
- Establishing local roadmaps and targets which are realistic in terms of the potential to develop local feedstock supply and processing capacity, with measures to assist the development of appropriate supply chains and production facilities;
- Putting in place the measures necessary to comply with relevant sustainability criteria;
- Developing a regulatory framework to compel fuel suppliers to blend biofuels in their fuels or else suffer significant penalties.



RENEWABLE ENERGY INVESTMENT AND FINANCE

The renewable energy market in SEE has experienced progressive growth. An overview of the investment and finance landscape demonstrates the challenges the sector has encountered over the past two decades, during both periods of growth and slowdown. This chapter investigates the trends and barriers to deployment and the capital mix of renewable energy financing in the region.

5.1 RENEWABLE ENERGY INVESTMENT IN SEE

During the period 2001-2018, SEE benefitted from USD 20.7 billion in renewable energy investment, excluding investment in large hydropower projects. Based on disclosed transactions only, an estimated 94% of investment went to power-sector projects, while about 5% went to the transport sector and 1% to the heat sector (BNEF, 2019).

Regional investment grew between 2001 and 2012, going from USD 31 million in 2001 to a peak of more than USD 3.7 billion in 2012. The period from 2013 to 2016 saw a sharp reduction in annual investment, which dropped to USD 157 million in 2016. Investment in the region has recovered in the last two years: in 2018, renewable energy investment in SEE reached almost USD 1.5 billion, representing 0.5% of global annual investment. This recovery has been mainly driven by increased activity in Serbia and Croatia, followed by Bulgaria and Romania (Figure 5.1) (BNEF, 2019).

Regional investment trends were particularly affected by changes occurring in a few large economies in the region. Thanks to the renewable energy support mechanisms in place (Chapter 3), Romania and Bulgaria attracted about 70% of the cumulative investment between 2001 and 2018. The next 20% was invested in Serbia, Croatia and Albania, with the remaining jurisdictions in SEE attracting only a small fraction (3% or less) of cumulative investment in this period (BNEF, 2019).

Bulgaria and Romania have both seen a significant slowdown in investment over the past years, following the phase-out of supporting policies (Chapter 3). Serbia is catching up, with increased investment in 2017 and 2018, thanks to an improved policy and regulatory framework and the relatively large size of its market.

Although trends in 2017 and 2018 seemed to suggest that renewable energy investment in SEE was growing again, the size of the market makes it dependent on a few large deals that determine the overall landscape in the region. Policy and regulatory changes have been influencing investment activity over the past two decades, and governments continue to hold the key to future investment growth in the region.

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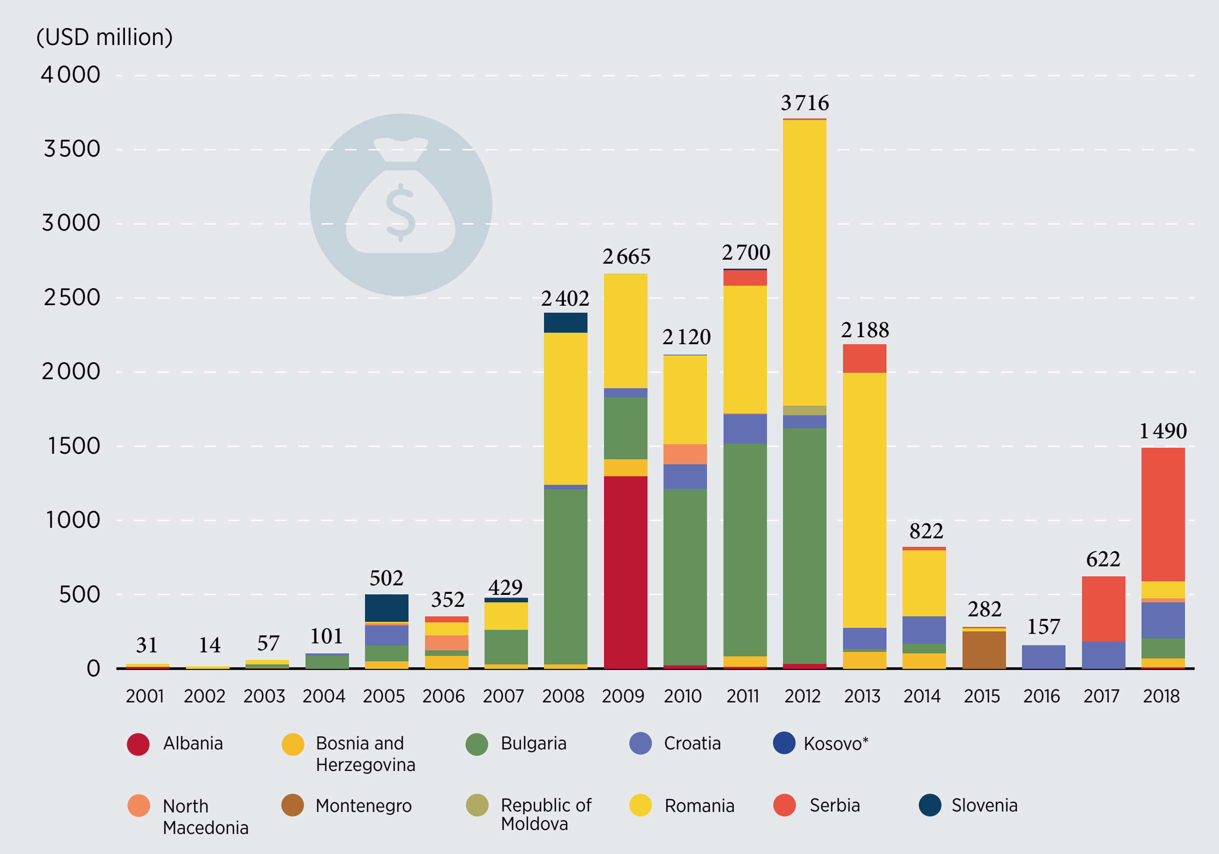
Figure 5.1 Investment in renewable energy by year and economy, SEE, 2001-2018



Source: BNEF (2019). Data exclude large hydropower projects (i.e., larger than 50 MW).

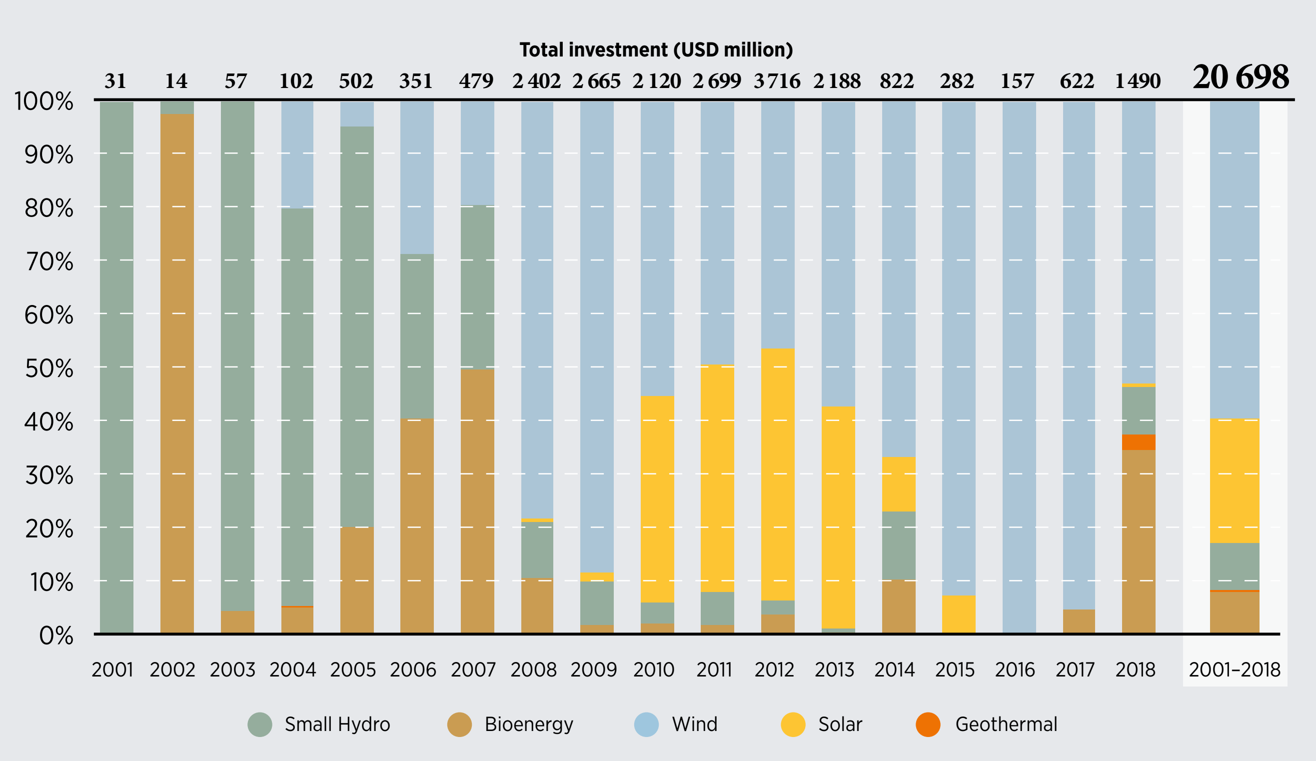
In terms of technologies, wind is clearly dominating the picture with 60% of the total cumulative investment between 2001 and 2018, followed by solar with 23%. Next are small hydropower (9%) and bioenergy (8%). Geothermal accounted for less than 1% of the total (Figure 5.2). A change in technological trends can be noted: while in the first half of the 2000s small hydropower and bioenergy were the main beneficiaries of the funding, this has gradually changed to the benefit of wind, predominantly, and then solar.

Solar PV projects have seen a few new investments in the past two years, with the largest utility-scale PV tender in Bosnia and Herzegovina amounting to almost USD 90 million and a smaller 6.5 MW solar PV plant on the Croatian island of Cres. Upcoming auctions should promote more investment in this technology.

Renewable energy projects can benefit from the phase out of international financial institutions from coal projects, even if the region is still witnessing the expansion and financing of new coal plants (Box 5.1)

** This designation is without prejudice to positions on status and in line with the United Nations Security Council Resolution 1244 (1999).*

Figure 5.2 Shares of annual investment by technology, SEE, 2001-2018



Source: BNEF (2019). Data exclude large hydropower projects (i.e., larger than 50 MW).

Box 5.1 Expanding and financing of new coal power in SEE

Because international financial institutions are phasing out financing for coal-based power plants, the region is turning to other sources to finance continued expansion of its coal and nuclear power generation. Coal projects received significant support, for example, from China, which has been re-engaging in SEE on the back of its Belt and Road Initiative, a massive network of infrastructure and connectivity projects. Coal projects are part of a USD 13 billion line of credit for infrastructure projects in Central Europe and SEE that China initiated in 2013.

The continued expansion of coal-based power generation raises a number of concerns. The environmental impacts of the projects are well known, as are the negative health impacts for local populations.

The coal power plant projects also carry economic and political risks, as the concerned utilities take out loans for projects that are at risk of becoming stranded assets in the future as renewables become cheaper and more diffuse. Importantly, financing for coal power is diverting funds that could be used to power renewable energy capacity expansion in the region.

Source: CEE Bankwatch Network (2018a), Reuters (2017)

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5.2 CAPITAL MIX OF RENEWABLE ENERGY INVESTMENTS

The SEE market remains fragmented and the total amount of investment based on national developments and individual deals varies. Investors are appealing to governments to stabilise policy and regulatory frameworks to boost the region's renewable energy investment. While private investors are slowly entering the region's renewable energy market, public finance institutions still play a key role in the investment landscape.

PUBLIC FINANCE

International and domestic public finance institutions have been driving renewable energy investment in SEE over the past two decades.

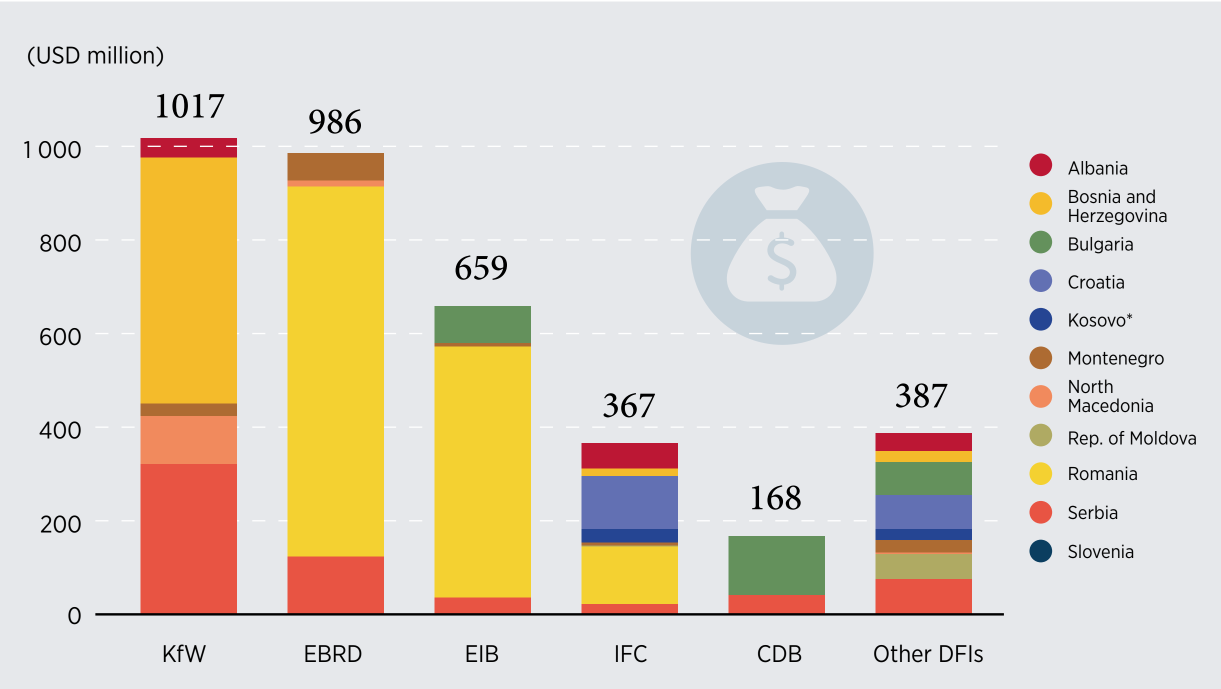
The renewable energy sector is the second-highest recipient of FDI (16% of greenfield investment) in the Western Balkans, preceded by real estate (20%) and followed closely by coal (14%) (World Bank, 2018a). The FDI to the region has mainly originated from EU-28 countries like Austria, Germany, Italy and the Netherlands. Russia, the United Arab Emirates, the United States and Turkey have also invested in the region's renewable energy sector. Meanwhile, development finance institutions (DFIs) have supported the region's energy sector development with a focus on energy efficiency and renewable energy.

INTERNATIONAL PUBLIC FINANCE INSTITUTIONS

Bilateral and multilateral DFIs are active in the market and have provided a sizeable share of the renewable energy investment thus far. A total of USD 3.2 billion invested by DFIs during 2001-2018 can be tracked, representing 17% of the total renewable energy investment in the region during the same period (IRENA, 2019i). Top investors in this period were the German development bank KfW (USD 1 017 million), followed by the European Bank for Reconstruction and Development (EBRD) (USD 986 million), the European Investment Bank (EIB) (USD 659 million), the Word Bank Group (WBG) (USD 367 million) and the China Development Bank (CDB) (USD 168 million) (Figure 5.3). Other public finance institutions active in the region include the Dutch development bank FMO, German government institutions, the International Development Association (IDA) and the Overseas Private Investment Corporation (OPIC).

European development banks such as EBRD and EIB are actively looking for renewable energy investment opportunities in the region and have committed to the transition towards sustainable, low-carbon economies in the region. KfW provided a USD 93.29 million loan to Bosnia and Herzegovina's first wind farm project, the 50.6 MW Mesihovina. The project was commissioned in early 2018 and marked an important turn for a country with a coal-dominated energy mix (Reuters, 2018b).

Figure 5.3 Cumulative renewable energy investment by key international public finance institutions and by economy, 2001-2018



Source: IRENA (2019i)

** This designation is without prejudice to positions on status and in line with the United Nations Security Council Resolution 1244 (1999).*

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Accounting for only 5% of the cumulative renewable energy investment of the international public finance institutions between 2001 and 2016, China has been showing increasing interest in the region in recent years (Box 5.1). Chinese financing is increasing in the renewable energy sector through hydropower projects. One of the first projects, initiated in the early 2000s, is an 82 MW hydropower plant in Kozjak, North Macedonia built by Chinese Water and Electric Corporation. CDB debt-funded three deals in the Romanian market and is now discussing additional financing for 12 hydropower stations in North Macedonia. Chinese financing is currently under discussion for a hydropower project at Buk Bijela in Bosnia and Herzegovina (AidData, 2017; Renewablesnow, 2018a; Geoeconomic Forum, 2018; BGE, 2018a).

In terms of technology, wind received USD 1.6 billion from DFIs during the period 2001-2017, or 45% of the total cumulative investment. Hydropower, both large and small scale, was next, receiving USD 411 million, or 11% of the total. Solar took third place with USD 281 million invested (or 8%), followed by bioenergy (USD 204 million) and geothermal (USD 4 million) (see Figure 5.4) (IRENA, 2019i).

DFIs not only finance renewable energy in the region; they also contribute significantly in terms of technical assistance. In the Republic of Moldova, 200 000 people in 235 communities are benefiting from an EU-financed project implemented by the UNDP. The fund mainly addresses buildings in situations of energy poverty, where optimal levels of heating are not possible due to the cost of energy. The project has been funding the installation of efficient, biomass-based heating devices in the residential sector and in public buildings, such as schools. The use of biomass is meant to create a market for the local industry, reducing the need to import energy for heating while strengthening the local economy. So far, 187 systems have been installed and another 40 are currently being built (UNDP, 2018).

In the municipality of Pale, in Bosnia and Herzegovina, the EBRD has supported the modernisation and expansion of a DH system through a loan of EUR 4.5 million (USD 5.12 million) (EBRD, 2013). The project included the introduction of modern, compact individual heating substations equipped with heat meters at the level of the buildings and the introduction of heat metering at the apartment level, together with the installation of thermostats on each radiator. The investment was also supported by a grant of up to EUR 1.5 million (USD 1.7 million) from the European Western Balkans Joint Fund under the Western Balkans Investment Framework, and a EUR 500 000 grant from the EBRD Shareholder Special Fund.

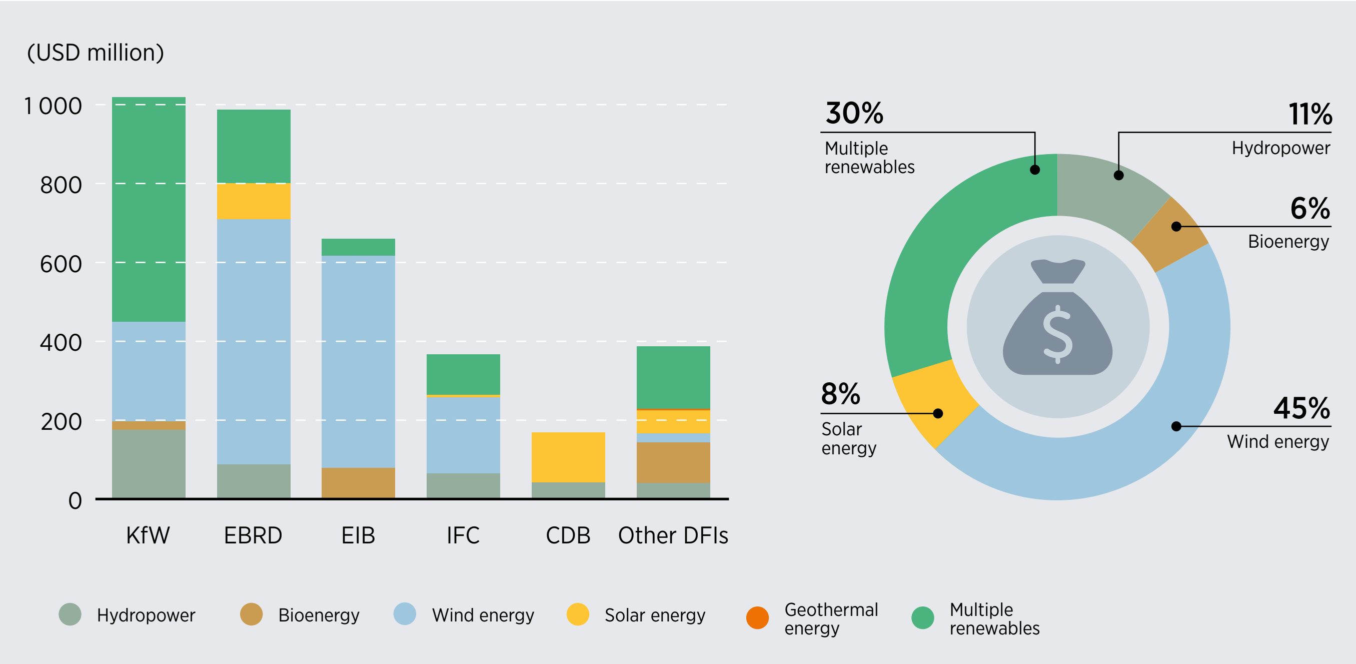
Similarly, the EBRD is providing a EUR 8.3 million (USD 9 million) loan to a DH company in the city of Banja Luka (Bosnia and Herzegovina) which is the builder, owner and operator of a 49 MW plant fired by wood biomass. The construction of the new biomass plant and upgrades to the existing central heating system will result in the reduction of around 80 000 tonnes of CO_2 emissions a year (EBRD, 2018b). Together, these funding interventions supported the growth of the local market for biomass to energy solution providers.

Many different initiatives and projects are in place in the region involving different development banks, such as EBRD, EIB and the World Bank. A detailed table of the programmes and initiatives is presented in the Annex (Table A.1).

LOCAL PUBLIC FUNDS

Local public institutions are progressively building up their capacity to finance domestic renewable energy. The region has so far seen both domestic public direct investment (e.g., grants provided for renewable projects) and local government spending to support policies to promote the deployment of renewable energy (e.g., FiTs). Croatia and North Macedonia have developed different support schemes. Selected local public funds and programmes financing renewable energy are presented in Table 5.1. The available financing by public funds is most frequently disbursed in the form of grants which may originate from DFI activity.

Figure 5.4 Investment in renewable energy by key international public finance institutions and technology, SEE, 2001-2018



Source: IRENA (2019i)

Table 5.1 Selected local public funds and programmes financing renewable energy

	Implementing agency	Type of support scheme	Budget
Croatia	Agency for Agriculture, Fisheries and Rural Development (APPRRR)	Grants for farmers to develop facilities for the production of electricity and/or heat energy from renewable energy source	EUR 20.2 million (USD 23 million)
	Environmental Protection and Energy Efficiency Fund (EPEEF)	Grants for individuals to install rooftop PV systems	EUR 30 million (USD 33 million)
	Ministry of Environmental Protection and Energy	Promotion of Energy Efficiency and the Use of Renewable Energy Sources in Enterprises	EUR 100 million (USD 110 million)
North Macedonia	Ministry of Finance	Municipal Services Improvement – grants available for PV systems in 35 municipalities	EUR 1.8 million (USD 2 million)
	Ministry of Economy	Subsidies for solar thermal panels to households	Approximately EUR 1 million (USD 1.1 million)

Source: BGE (2018b, 2018d-e, 2017a, 2016b)

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PRIVATE FINANCE

Private equity and capital markets

Given the high risk-perception of renewable energy in the region (Section 5.3), equity financing is the preferred method of financing. The ratio of debt-funded to equity-funded projects in the region is 1 to 4, with equity financing strongly prevailing. In the onshore wind segment, as much as 50% of the required investment in EU SEE was provided through equity (Diacore, 2016).

The number of projects financed clearly correlates with government support mechanisms, particularly in Bulgaria and Romania. A considerable surge in activity was recorded between 2010 and 2014 following changes in the regulatory frameworks in these two countries.

The main equity investors in the region are developers and utilities. More than 230 private developers have funded renewable energy projects in the region since 2001 (BNEF, 2019). However, only a handful of them have been able to secure more than five deals, with the rest securing less than that. A few local developers are listed on stock exchanges in Bulgaria, Croatia and Slovenia, with the purpose of attracting capital locally and internationally. About 45 local developers are active in Bulgaria, Croatia, Romania, Serbia and Slovenia.

Regarding utilities, over 100 have invested in the region – about two-thirds were international utilities (BNEF, 2019). In North Macedonia, state-owned power utility ELEM was one of the equity investors in the country's first wind park in Bogoslovec (BGE, 2017b).

Private equity currently plays a limited role in the region, but there is room for growth and to complement existing sources of finance for renewable energy.

Solar World Invest Fund (SWIF), a Luxembourg-based private equity fund, took over Chinese ReneSola's two PV plants in Sliven, Bulgaria and is exploring opportunities in Romania (BGE, 2016c). EnerCap Power Fund I LP, managed by Enercap Capital Partners, is a specialist clean energy investor and adviser with a focus on Central and Eastern Europe (EMPEA, 2015). This closed-end ten-year fund amounting to USD 111 million invested in renewable energy projects in Croatia.

Debt financing by private finance institutions

Domestic and international commercial banks are progressively growing their presence in the region. About 20% of projects that achieved financial closure between 2001 and 2018 received private debt financing, and 4% of these projects had some form of involvement from DFIs along with commercial banks. In terms of technology, about 43% of projects funded were in wind, followed by solar (38%), small hydropower (15%), bioenergy (0.3%) and geothermal (0.1%) (BNEF, 2019).

In terms of presence, Italy's Unicredit dominates with about 20 projects in Bulgaria, Croatia, Romania and Serbia. Other particularly active international commercial banks include Austria's Erste Group Bank and France's Société Générale. A growing number of domestic commercial banks are active in debt financing of renewable energy projects. Bulgaria and Romania are the two most active countries followed by Croatia, the Republic of Moldova and Serbia.

BLENDED FINANCE, CLIMATE FINANCE AND GREEN BONDS

Blended finance

In the SEE context, in addition to stable and supportive frameworks, a blended finance approach – the practice of combining official development assistance with other private or public resources to leverage additional funds from other actors – can help projects overcome financing barriers at the development stage and mobilise private investment and technology providers. Funding from institutions that have a privileged relationship with governments helps to attract private funding because perceived risks are reduced. Hence, the region could benefit from the emergence of some blended financing facilities. So far, two initiatives involving renewables have been implemented, though with limited success.

The Western Balkans Investment Framework (WBIF) is the region's blended finance facility. In operation since 2009, the WBIF is a joint initiative of the European Commission and 20 development partners funding several sectors of the economy, including renewable energy. With a total grant value of EUR 176 million excluding cancellations, energy is WBIF's second most active sector. The WBIF awards, based on competitive procedures, grants for infrastructure project preparation activities as well as for investments. In renewable energy, WBIF focused on sustainable hydropower and conducted assessments of biomass for heating potential in the region in 2017.

In addition, the EU is using the Green for Growth Fund (GGF) to channel its investment in renewable energy and energy efficiency to SEE. The GGF is a unique public-private partnership initiated by the EIB and KfW in 2009. It provides refinancing and technical assistance to financial institutions (local commercial banks, non-bank financial institutions such as microfinance institutions and leasing companies, etc.) providing loans to households, businesses, municipalities and the public sector for energy efficiency measures or renewable energy projects. In addition, the GGF can provide direct financing to renewable energy projects, including solar, small hydro, small wind and biomass. So far, the GGF has funded small-scale hydropower in Albania, provided residential credit lines for renewable energy in North Macedonia and approved a senior debt facility (EUR 20 million or USD 23 million) for commercial banks in Serbia to support 200 MW of the total of 500 MW of wind energy planned in Serbia based on its 2020 target (GGF, 2017a-b).

Climate finance

Climate change is already having an impact in SEE as evidenced by extreme weather events such as floods and droughts, causing significant negative economic impacts. In 2014, flooding caused USD 2 billion in damages and losses in Bosnia and Herzegovina (Van Gelder, 2018). Despite this, climate finance for renewable energy projects is relatively underused.

The Green Climate Fund (GCF), which so far has committed USD 4.6 billion to 93 projects worldwide, has only four renewable energy projects in SEE (GCF, 2017). Serbia is included in one of the largest funding facilities by GCF, Scaling Up Private Sector Climate Finance through Local Financial Institutions, which was approved at the end of 2017. The programme establishes new financing facilities with local financial institutions. Subsequently, these facilities will support private sector investment in high performance climate technologies, including renewable energy. EBRD is the public finance partner for the programme, through which Serbia will receive financing for renewable energy development (GCF, 2016). GCF is contributing USD 378 million to this USD 1.4 billion programme to support thousands of individual investments in technologies that reduce emissions and enhance resilience to climate change.

In parallel, the GCF has initiated a dialogue with the region to expand its portfolio of climate mitigation and

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Table 5.2 Renewable energy projects implemented by GEF in SEE

Country	Description	Grant (USD million)	Co-financing (USD million)
Bosnia and Herzegovina	Biomass Energy for Employment and Energy Security Project	0.97	1.62
Croatia	Renewable Energy Resources Project	5.50	3.00
North Macedonia	Mini-Hydropower Project	0.75	2.54
	Development of Mini-Hydropower Plants	1.50	4.90
	Sustainable Energy Program	5.50	26.70
Republic of Moldova	Renewable Energy from Agricultural Wastes	0.97	1.65
	Biogas Generation from Animal Manure Pilot Project	0.98	0.58
Slovenia	Removing Barriers to the Increased Use of Biomass as an Energy Source	4.30	7.90
Total		**20.47**	**48.90**

Source: GEF (2019)

adaptation projects and engagement. The GCF reports that it has so far committed USD 391.5 million of climate finance in Eastern Europe and Central Asia (GCF, 2018).

The region has been benefiting from grants and technical assistance provided by the Global Environment Facility (GEF), an international partnership of 183 countries, international institutions, civil society organisations, and the private sector, which addresses global environmental issues. Since its creation in 1992, the GEF has implemented eight renewable energy projects in SEE for a total amount of USD 69.37 million (see Table 5.2).

Green bonds

Green bonds are another avenue for the financing and refinancing of renewable energy projects. Green bonds are fixed-income financial instruments whose proceeds are earmarked for environmental or climate projects. They are similar to traditional bonds, with the main difference being that capital raised from green bonds fund clean energy, energy efficiency, low-carbon transport, smart grid, agriculture, forestry and natural resource mitigation or similar projects. Globally, green bond issuance has risen rapidly from just USD 36.6 billion in 2014 to USD 167.3 billion in 2018 (CBI, 2019, 2015).

Renewable energy projects in SEE have already benefited from green bonds. In Croatia, the International Finance Corporation (IFC) Green Bond Program supported the construction of a 34 MW wind farm in 2015 with a USD 24.9 million loan to meet Croatia's growing power demand and reduce reliance on imported energy (IFC, 2016). In Serbia, the IFC Green Bond Program supported the construction of a 42 MW wind farm in 2017 by lending EUR 19.1 million (USD 21.73 million) for one of the first wind farms in a country heavily dependent on coal-fired electricity generation (IFC, 2017, 2018, 2019).

In Slovenia, Gen-I Sonce, a subsidiary of electricity and gas distributor Gen-I, became a pioneer in Slovenia's green bond market with its EUR 14 million (USD 16 million) green bond issuance in 2017. The bond will finance energy efficiency and micro-solar projects (Invest Slovenia, 2017).

5.3 KEY ELEMENTS FOR RENEWABLE ENERGY INVESTMENT

Renewable energy investment in the region has both followed a fluctuating trajectory and been geographically concentrated. While Bulgaria and Romania led the region in absolute terms of investment, current trends are sluggish. Both countries experienced a significant boost in renewable energy investment on the back of supportive policies between 2010 and 2014, but they faced investor backlash and a sharp reduction in investments after their governments retracted these policies.

Other economies in the region are gaining ground as they address some of the barriers in investment – the most important being the high cost of capital in the region. Reducing the cost of capital and offering more harmonised approaches across smaller national markets could provide an additional boost for a region with important renewable energy potential.

The high cost of capital is due to two "layers" of risk premiums that are at play in the region. First, renewable energy projects are more capital intensive and seen as riskier than conventional energy projects. Second, investment risk is perceived to be higher in the SEE region than in the rest of Europe due to country level political and off-taker risks, which contribute substantially to the higher cost of capital and add to the risk perception related to PPAs exposed to local currency fluctuations. Other barriers relate to political instability and delays in adoption of the supporting polices.

Policy and regulatory frameworks need to become more robust, stable and predictable to reduce the policy, currency and off-taker risk. Some progress can be observed such as the creation of a robust PPA framework in Serbia and the establishment of clear criteria and procedures for construction and grid connection in North Macedonia.

Addressing the higher cost of capital barrier will require continued collaboration between financial actors. DFIs play an important role in stimulating market creation, while private finance institutions, capital markets and private equity are slowly growing their activities in the renewable sector. Increasing the use of public-private partnerships between DFIs and foreign and local financiers can be beneficial via blended finance (on-lending, co-financing) and the issuance of innovative instruments (e.g., green bonds). Public finance should also focus on the provision of de-risking mechanisms as a tool to lower risk premiums and leverage private capital.

Finally, another element to be considered is the small scale of the national markets in the region. Excluding Bulgaria, Romania, Croatia and Serbia, the market size of the other economies is limited, and developers and investors generally enter renewable energy markets that have potential for growth and scale. As a result, investors may look at the region as a whole rather than its individual parts, so the retraction or delay of renewable energy strategies by a major economy or a cluster of economies within the region may be to the detriment of the entire region. One way to increase the size of the market and raise the attractiveness of renewable energy projects for investors would be to harmonise national policies and regulations and to facilitate cross-border electricity trade (including market reforms; e.g., the introduction and possible coupling of electricity markets).

IN FOCUS:

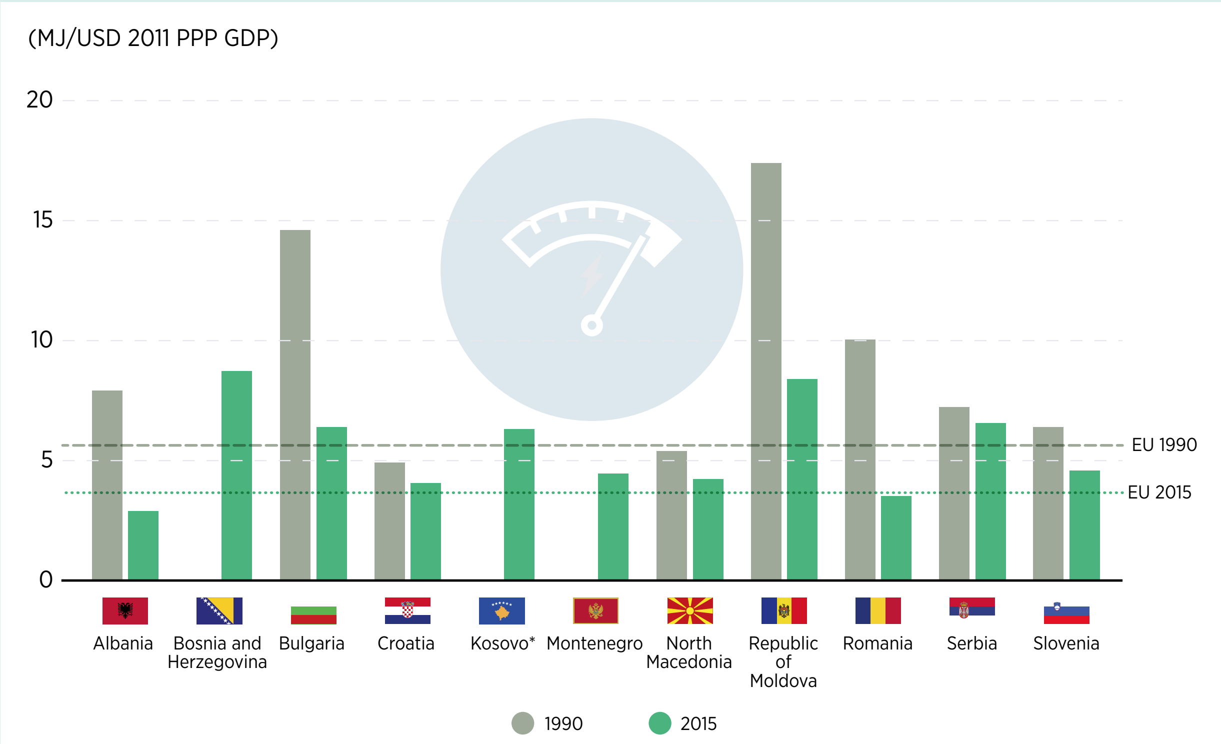
ENERGY EFFICIENCY IN SOUTHEAST EUROPE

Energy plays a decisive role in fostering socio-economic development. Energy availability and reliability determines production and consumption and has a strong influence on the security, health and well being of the population. Efficiency in the production and consumption of energy magnifies the impact of the energy sector on the overall system. Improving energy efficiency and further reducing energy intensity (defined as units of energy consumed to produce a unit of GDP) reduces environmental and climate impacts and energy costs.

Both in the power sector and in end-use sectors, important synergies exist between renewable energy and energy efficiency. While accelerated deployment of energy efficiency results in a reduction of energy demand, the same amount of renewable energy results in renewables securing a higher share of energy supply. Globally, the combination of renewable energy and energy efficiency has the potential to achieve 90% of the carbon reductions required to limit global temperature rise to a maximum of 2°C above pre-industrial levels (IRENA, 2019e).

Energy consumption in SEE has been characterised by high energy intensity for many decades. Figure 5.5 shows most SEE economies have decreased their energy intensity in the past. In total, however,

Figure 5.5 Energy intensity, SEE, 1990 and 2015



Source: World Bank (2019)
Note: PPP = Power Purchase Parity

the region still demonstrates significantly higher energy intensity rates than the EU. The Republic of Moldova had historically high energy intensity rates, which topped 22 megajoules (MJ)/USD in 1994. Very low energy prices caused high inefficiencies and few incentives for energy savings. The slowdown of heavy industries during the 1990s and increasing energy prices caused a strong decline.

The only country whose energy intensity has been lower than the EU-28 average over the last few years is Albania. A high share of non-industrialised agriculture and the prevalence of hydropower generation[20] in the country have contributed to this situation.

EU member countries are covered by ambitious EU energy efficiency policies and regulatory frameworks that entail a newly updated energy efficiency target. By 2030, energy efficiency in the EU has to improve by 32.5%. For now, the rest of the SEE economies need to comply with the energy efficiency requirements of the EnC, which is set for update and extension towards 2030 (EnC, 2019b, 2018a-b). The current framework is built around energy efficiency in buildings and products. Overall, the region is improving its framework and compliance with the various legislative measures that have been put in place.

In terms of immediate options for synergies between renewable energy and energy efficiency, buildings and agriculture are two end-use sectors where energy efficiency and renewable energy can benefit immediately from their innate synergies.

Buildings in the region represent around 50% of final energy consumption and a significant opportunity to achieve energy savings, in the range of 20% to 40% (REN21/UNECE, 2015). These buildings are subject to a regulatory framework introducing targets for energy efficiency. This can be coupled with the introduction of local renewable energy with the potential to decarbonise buildings' energy consumption.

Agriculture, despite the trends of its progressively declining share, can also benefit from a combination of energy efficiency and renewable energy measures to improve its competitiveness and sustainability footprint. The synergies can take the forms of agriculture feedstock for bioenergy projects as well as development of solar PV, micro-hydro and geothermal capacities to cover the electricity and heat demands of agricultural activities.

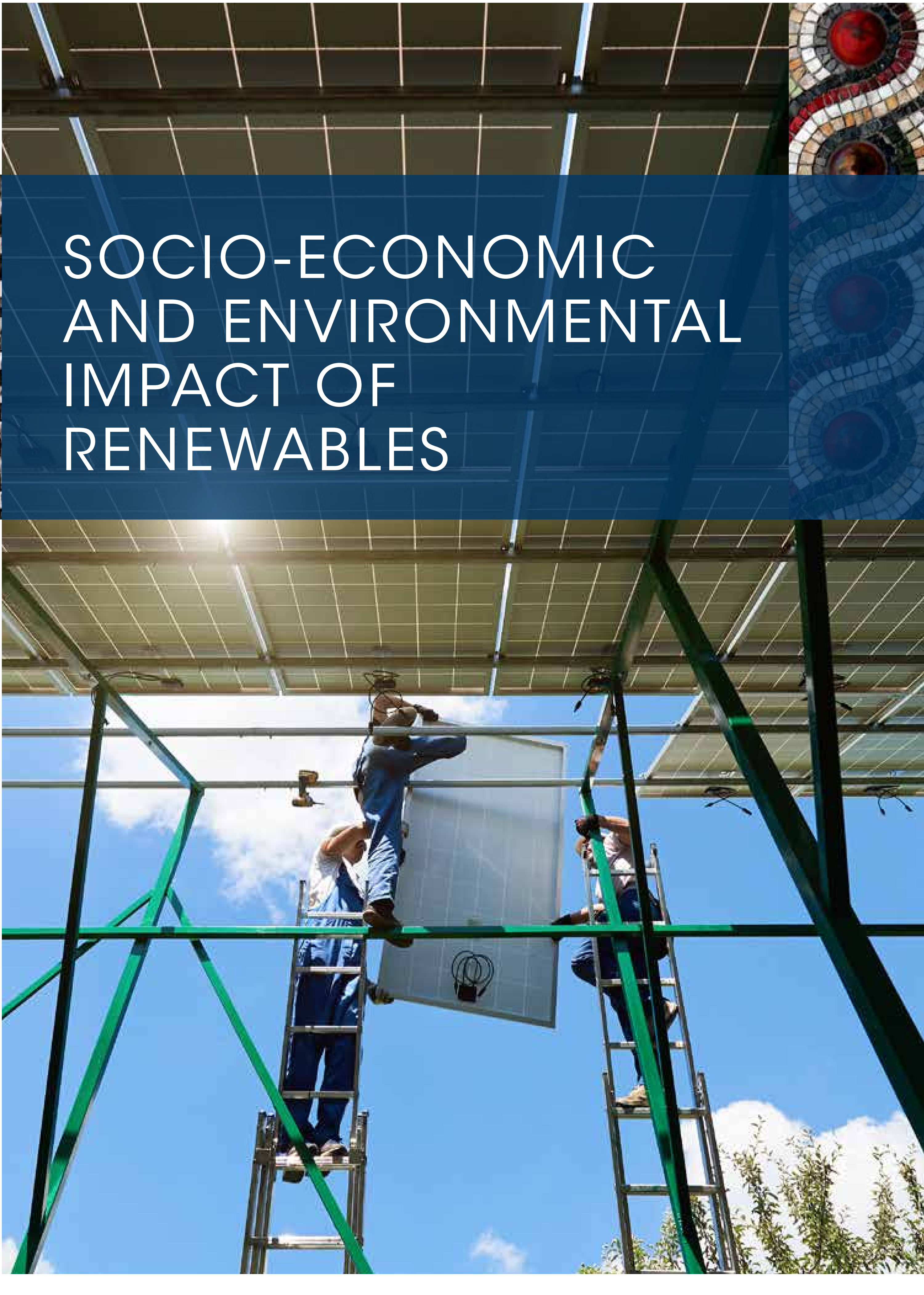
Significant efforts have been undertaken to improve their energy efficiency with a combination of financing support offered by DFIs and policy and regulatory measures that have been deployed in the region. Financing is an important part of the support measures that have been put in place in the region to encourage energy efficiency. DFIs have dedicated funds for the financing of long-term loans, may offer technical assistance and have offered direct support to energy efficiency projects over the past few decades. Commercial banks have been frequently used as vehicles for DFI financing, while the banks themselves have financed a smaller share of loans in the market. Altogether, from 2007 to 2016, DFIs provided more than USD 150 million towards the energy efficiency agenda in the Western Balkans alone (WBIF, 2018b). Disbursement of such large amounts, relative to the size of the region, was possible due to the creation of regional facilities and funds that channelled resources from several DFIs (the World Bank, EBRD, KfW, EU, etc.) towards the final commercial, industrial and residential beneficiaries.

Different funds pool the resources of several DFIs and connect them with local energy efficiency projects in SEE. Three examples of these vehicles are the Energy Efficiency Financing Facility (EEFF), Green Growth Fund (GGF) and Regional Energy Efficiency Programme (REEP). Together, these three funds offered more than EUR 500 million in loans dedicated to clean energy in the region.

20 In TPES, the energy efficiency of hydropower is 100%.

** This designation is without prejudice to positions on status and in line with the United Nations Security Council Resolution 1244 (1999).*

SOCIO-ECONOMIC AND ENVIRONMENTAL IMPACT OF RENEWABLES



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6.1 INTRODUCTION

Renewable energy cost reduction and the political push to reduce the impact on the climate of a fossil fuel-based world economy are prompting profound changes in the world's energy systems. These, in turn, are not isolated from their socio-economic framework. In fact, the energy transition implies a broader socio-economic change, with multiple impacts on everyday life.

The adoption of new energy technologies by actors who have formerly played the role of consumer (small and large) challenges the traditional economic framework used to value electricity. Moreover, the close interplay between the energy sector and the economy can produce multiple effects, for example in terms of GDP, employment and human welfare (IRENA, 2019e). The analysis presented in this chapter builds on IRENA's body of work focusing on measuring the socio-economic footprint of the energy transition (see Box 6.1).

Box 6.1 IRENA's work on the socio-economic impacts of renewable energy

The analysis of the drivers and dynamics underpinning the energy transition provides valuable insights into how the overall transition process could be shaped to improve its benefits.

Over the years, IRENA has analysed and documented the socio-economic and employment benefits of renewable energy and energy access in numerous reports (IRENA, 2019f, 2018a, 2017c, 2016d-e, 2015a, 2014, 2013, 2012). The *Leveraging Local Capacity* series (IRENA, 2018b, 2017d-e) examines the kinds of jobs created by renewable energy and suggests ways to build on existing industries.

The IRENA reports *Renewable energy benefits: Measuring the economics* (IRENA, 2016f), *Perspective of the energy transition: Investment needs for a low carbon energy system* (IRENA, 2017f) and *The global energy transformation: A roadmap to 2050* (IRENA, 2019e, 2018c) provide quantitative analyses of the global socio-economic impacts of an energy system based on renewable energy.

A subsequent report, *Measuring the socio-economic footprint of the energy transition: The role of supply chains* (IRENA, 2019h), explores the crosscutting aspects of the energy transition – such as in policies and benefits of achieving a low-carbon future. It also assesses the implications for the socio-economic system, via the positive benefits for local industries and employment.

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This chapter presents the socio-economic impact of the energy transition when deployed within the current socio-economic structure in SEE. The first sections take advantage of IRENA's quantitative analysis of the effects of the deployment of renewable energy. They investigate the regional effects of the energy transition in terms of GDP and employment levels.

Since the model is flexible and can be tailored to different geographical disaggregations, the version used for the IRENA (2019e) report includes SEE as a specific region. The specific results for SEE are illustrated in the following sections.

Following a quantitative socio-economic analysis, this chapter focuses on specific aspects of the SEE region, namely urban pollution and energy poverty. For both of these aspects, renewable energy technologies, coupled with energy efficiency solutions, can provide effective benefits.

The analysis of the benefits accrued by the deployment and use of renewable energy is an important exercise in providing valuable input for the decision-making process to support regional development. Policy makers can reap the benefits of the energy transition process by adopting initiatives to respond to new economic opportunities (e.g. build and strengthen domestic technology supply chains); by enacting measures for workers related to declining industries (e.g. retraining and social protection measures); and by recognising the beneficial role of renewable energy in the overall region.

6.2 THE ENERGY TRANSITION

This section explores impacts on GDP and employment levels in the SEE region. To do so, two scenarios from the E3ME model (Box 6.2) are compared.

- The **Reference Case** scenario considers the current and planned policies of different jurisdictions. It includes commitments made in NDCs and other planned targets. It presents a perspective based on governments' current projections and energy plans.
- The **REmap Case** is an IRENA scenario that includes the deployment of low-carbon technologies, based largely on renewable energy and energy efficiency, to generate a transformation of the global energy system that can limit the rise in global temperature. The scenario is focused on energy-related carbon dioxide emissions, which make up around two-thirds of global GHG emissions.

The REmap Case estimates that the share of electricity in global final energy use would increase from 19% to nearly 50%. Electromobility and electric heating would play increasing roles. To achieve the REmap scenario, the share of renewables in power generation would rise from 25% today to 86% in 2050. Total annual renewable power generation would rise from 7 000 TWh at present to 47 000 TWh by 2050 – a sevenfold increase (IRENA, 2019e).

The transformation is not limited to technologies. It will include socio-economic structures as well, primarily due to the inevitable feedback loops between them. Therefore, for a holistic analysis, IRENA uses an integrated Energy-Economy-Environment model to analyse the linkages between the energy system and the world's economies within a single quantitative framework.

SOCIO-ECONOMIC FOOTPRINT OF THE ENERGY TRANSFORMATION

The analysis shows that accelerating the deployment of renewable energy will fuel economic growth, create new employment opportunities, enhance human welfare and contribute to a climate-safe future. Across the world economy, by 2050, the REmap case brings about relative[23] GDP improvements of 2.5%. In cumulative terms from 2019 to 2050, the GDP gains of the REmap Case over the Reference Case add up to USD 99 trillion.

To gain insight into the structural elements underpinning the socio-economic footprint, the outcome is broken down into different drivers. The main macroeconomic drivers used to analyse GDP and employment footprints include investment, trade, tax changes, and indirect and induced effects (Box 6.3).

Box 6.2 The E3ME model

IRENA assesses the socio-economic footprint of the energy transition by adopting a macro-econometric approach. The REmap energy case, together with its associated investment costs and various policy assumptions, is used as exogenous inputs into a fully fledged global macro-econometric model. This takes into account the linkages between the energy system and the world's economies within a single and consistent quantitative framework.

The model used for the analysis is the Energy-Environment-Economy Global Macro-Economic (E3ME) model, developed by Cambridge Econometrics. E3ME simulates the economy based on post-Keynesian principles, in which behavioural parameters are estimated from historical time series data. Interactions across sectors are based on input/output relations obtained from national economic statistics. E3ME links the economic, energy and environmental systems, so that changes in one area (such as electricity supply by technology) affect the others. The model is flexible and can be tailored to different technological, sectoral and geographical disaggregations. The version used includes 24 different electricity generation technologies, 45 economic sectors and 59 countries/regions globally.

The basic structure of the version of E3ME used is illustrated in Figure 6.1. A full description of the energy sector of each country, derived from the REmap analysis, has been fed into the model (right-hand side of the figure). Energy sector cost data from the REmap transition roadmap, such as investment in power generation, energy efficiency, transmission and distribution (T&D) grids, and energy flexibility, as well as carbon taxes and fossil fuel subsidy phase-out, have also been provided as input to the model (left-hand side of the figure). The central part of the figure shows how the main components of E3ME fit together, with arrows showing linkages. For the purposes of this analysis, the links feeding into the energy system have been disabled (dotted grey arrows in the figure), since the energy sector parameters (*e.g.*, installed capacities, energy mixes) are exogenously provided from REmap.

The model has a proven track record of policy and policy-relevant projects. Those projects include the official assessments of the EU 2030 climate and energy targets and the long-term Energy Roadmap, and contributions to the Intergovernmental Panel on Climate Change on the economic impact of climate change mitigation.

23 The results are presented as the different outcomes up to 2050 between the two scenarios.

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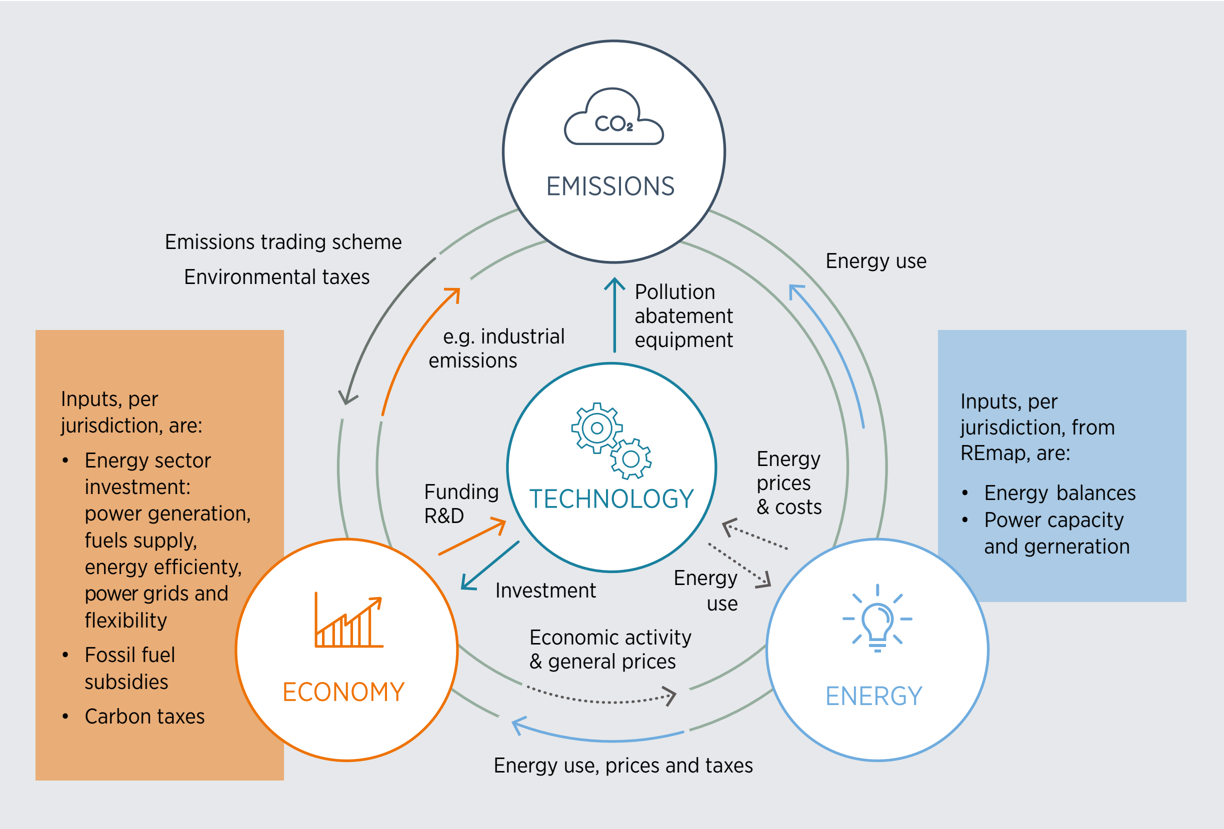
Figure 6.1 IRENA's macroeconomic analysis methodology: REmap results feeding into the E3ME model



Source: IRENA (2018c)

GDP impact

As in the case globally, the energy transformation in the SEE region has a positive GDP footprint, mainly driven by induced effects (carbon taxation). Compared to the Reference Case, the REmap Case boosts GDP, peaking around 2040 with a 2% improvement over the Reference Case. After 2040, under the REmap Case, GDP gains steadily decline to a 1% improvement over the Reference Case by 2050. This implies a cumulative GDP gain under the REmap Case amounting to USD 485 billion over the Reference Case, from 2019 to 2050 (Figure 6.2).

The investment driver provides a positive but frontloaded contribution, becoming relatively small from 2030 onward. Investments in energy efficiency and renewable energy power generation provide a consistently positive GDP stimulus throughout the forecast period. Moderately positive induced investment effects follow more positive economic results in the region, contributing to outweighing the negative impact from crowding out in other sectors of the economy.

The changes in consumer expenditure dominate the overall GDP footprint. The dominant elements in this driver are carbon taxes and the accompanying

Box 6.3 Drivers and their role

- **Investment:** This driver depicts the impact of the investment required for the energy transition (including investments in power generation, T&D, backup and energy efficiency). Additional investment in transition-related technologies will have a positive impact on employment and, through additional household incomes, lead to increases in household expenditure.
- **Changes in consumer expenditure due to tax rate changes:** The REmap modelling assumes governmental revenue balancing via income tax rate adjustments. A change in governmental tax take (whether via the carbon taxes or a reduction in tax associated with fossil fuel production) is compensated for by a change in income taxes (up if there is an overall decrease in government revenues and down if there is an increase). These adjust consumer incomes, and therefore expenditure, contributing to changes in overall GDP.
- **Changes in trade:** This driver shows the impact of changes in imports and exports on GDP. An increase of imports, or a reduction of exports, has a negative impact on GDP, while a decrease in imports or an increase in exports has the reverse effect.
- **Other changes in expenditure, including reallocations, indirect and induced effects:** This driver captures all other changes in consumer expenditure. It includes reallocations of expenditure (e.g., increased consumption of non-energy goods and services because of lower energy prices, leading to less expenditure on energy) and the GDP impacts of changes to aggregate consumer expenditure through indirect and induced effects.

revenue-balancing policies, whereby governments recycle revenues through changes in citizens' income tax rates. Without this carbon taxation, the GDP results would be negative from the 2020s onward. The assumed carbon taxation is consistent with a 2°C climate goal, which involves high carbon prices (going above USD 100 per tonne of CO_2 around 2025 and increasing further until 2050).

Carbon taxation and accompanying government revenue-balancing policies have a very positive impact on the resulting GDP and jobs footprints for the SEE region. Advancing the deployment of these policies could improve the carbon taxation scheme's socio-economic footprint, especially during the first half of the transition. The macro-benefits from this scheme can, however, produce negative socio-economic impacts by increasing inequalities if the benefits are not accompanied by the right policy framework.

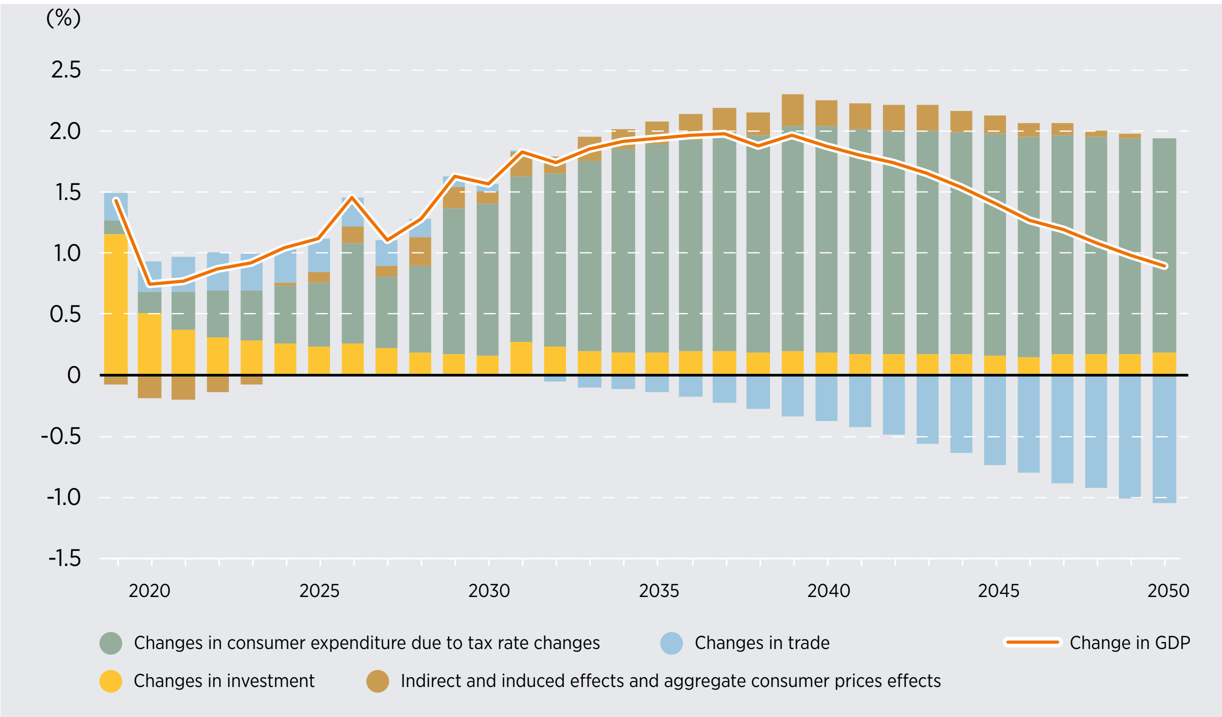
The trade driver has a positive but small contribution during the first years. It becomes increasingly negative from 2030, and from 2040 onwards it begins to dominate the downward trend in the overall GDP footprint.

Trade in fossil fuels dominates the trade driver. In the REmap Case, the export of refined fuels is halved (as global demand decreases) and in consequence the trade driver decreases.

Trade in other goods and services has a positive, but small contribution throughout the forecasted period. This is driven by positive trade effects across a range of non-energy sectors due to several factors, including relative price changes in international markets and an increase in import demand elsewhere.

An increased transition ambition with a focus on reinforcing domestic transition-related supply chains would allow the SEE region to reap higher benefits from the transition. In terms of GDP, this would allow for better compensation of the negative impacts from trade losses. Reinforcing domestic supply chains for transition-related equipment would allow countries and regions to reap the positive economic effects of the transition through increased and long-lasting induced and indirect effects, providing resiliency and contributing positively to the trade balance.

Figure 6.2 Energy transition footprint of the SEE region in terms of GDP, REmap Case compared to Reference Case, 2019-2050



Employment impact

The role of renewable energy in job creation

Job creation is a top priority for governments in the SEE region. Renewable energy technologies are already creating jobs across the region and can lead to significant employment opportunities with continued deployment (EurObserv'ER, 2018).

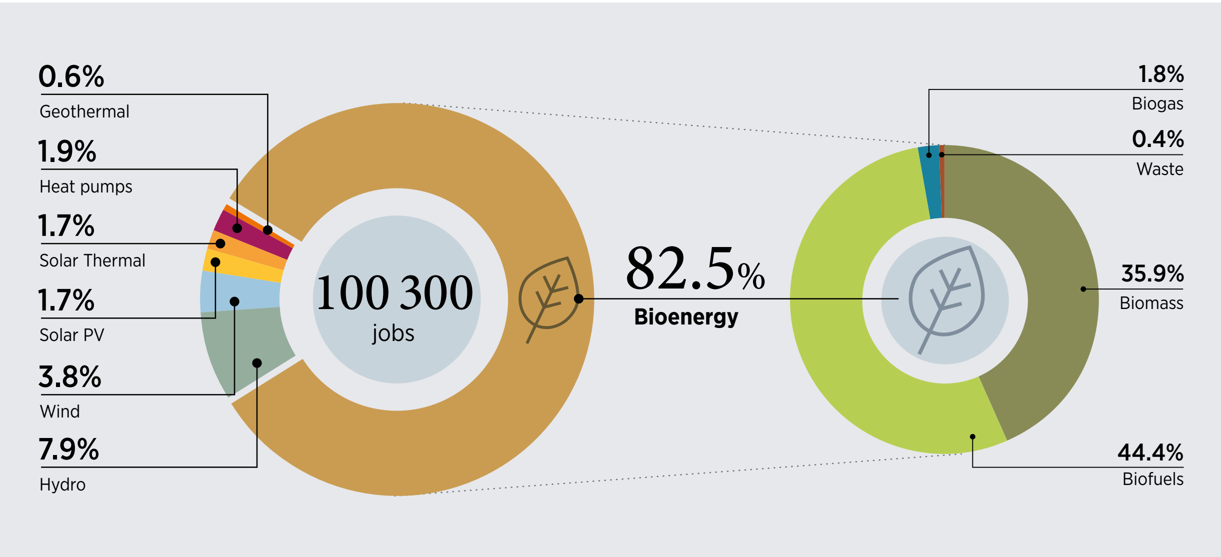
Employment trends are shaped by a wide range of technical, economic and policy-driven factors. Job creation dynamics are subject to geographic shifts in the production and installation of renewable energy equipment. Governmental policy, including the degree of commitment to transforming the energy sector, is a key factor. Where policies become less favourable to renewable energy, change abruptly or invite uncertainty, the result can be job losses or a lack of new job creation. On the other hand, expectations of adverse policy changes can lead project developers to accelerate projects that would otherwise be initiated later in order to beat a certain cut-off date (IRENA, 2019f; 2018a). This can explain surges and drops in job numbers.

In Bulgaria, Croatia, Romania and Slovenia the renewable energy sector reached a total of 100 300 jobs in 2017. A large portion (82%) of these jobs originate in the bioenergy sector, in particular biofuels and solid biomass. This is unsurprising given that technologies that use feedstock generate a relatively high number of jobs per megawatt-hour compared to technologies that do not involve the agricultural sector (Figure 6.3). In addition, the SEE region is a prominent centre of production of bioenergy feedstock.

Biofuels created 15 700 direct and indirect jobs in 2017 (mostly in Romania), in countertendency with the other RES technologies, which, cumulated, accounted for a decrease of 8 800 direct and indirect jobs in the same year. (EurObserv'ER, 2018)

Hydropower, which holds great promise for development in the SEE region and covers 19.4% of the power generation in the European Union part of the SEE region, is not a large employer, as it employed only about 8 000 personnel in 2017 (EurObserv'ER, 2018).

Figure 6.3 Share of direct and indirect jobs in renewable energy sector, EU SEE, 2017



Source: EurObserv'ER (2018)

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The construction of a 132 MW hydropower plant in Albania is expected to create 300 new jobs during construction, but only 45 jobs in the operation stage (WBIF, 2019b). In the long-term, the operation of hydropower plants is expected to be influenced by automation, which will require fewer personnel.

For an economy deploying renewable technologies, the potential to create jobs depends on the extent to which industry, along the different segments of the value chain, can employ people locally, leveraging existing economic activities or creating new ones. Notably, the core segments of the RES value chain are not limited to manufacturing, but entail many activities (such as project planning, procurement, transport, installation, operation and maintenance [O&M], and decommissioning) that can be easily localised. According to IRENA analysis, in its lifetime, a 50 MW solar PV plants needs 229 055 person-days, of which only 22% are in manufacturing and procurement activities, while 56% are in O&M. Similarly, of 144 420 person-days necessary in the lifetime of a 50 MW onshore wind farm, only 17% are needed for manufacturing and procurement, while 43% are dedicated to O&M (IRENA, 2017e-f).

An example of this phenomenon can be seen in the region. When Romania and Bulgaria enacted

supportive policies for renewable energy, local developers emerged as competitive players, thanks to good skill levels accompanied by a relatively low cost of labour. The phase-out of supporting policies did not result in a shutdown of these new companies. Some of them became international players, operating outside of the SEE region in countries with supportive policies.

As such, the deployment of renewable energy technologies can create jobs in the SEE region in economies that lack energy transition-related manufacturing industries. The materials for the construction of the same plants (cement, steel, etc.) and some of the electric and electronic components may also be procured locally, creating indirect jobs.

Employment levels in the energy transition

In the REmap Case, economy-wide employment grows across the SEE region compared to the Reference Case. Figure 6.4 shows the evolution of the relative difference of SEE employment between the REmap Case and the Reference Case. It peaks at 0.23% in 2040 and slightly decreases to 0.21% in 2050, resulting in nearly 50 000 additional jobs.

The trade driver has a positive impact: decreased trade in fossil fuels provides a negative but almost negligible impact on the jobs footprint throughout the forecast period. This contrasts starkly with the strongly negative impact on the GDP footprint, due to the low labour intensity in this sector. Trade in other goods and services has a positive and significant contribution throughout the forecast period, dominating the overall jobs footprint. This is driven by positive trade effects across a range of non-energy and high labour-intensity sectors, with exports increasing due to many factors including relative price changes in international markets and increasing import demand elsewhere.

The investment driver has an initially positive contribution that quickly becomes almost neutral before 2030 and increasingly negative thereafter. Investment in new assets has a positive contribution for the entire forecast period, gradually decreasing but dominating this driver until 2030. Electricity generation, however, provides a positive and increasing contribution as the transition progresses, but is relatively small compared to the other elements contributing to this driver. The reduction of fossil and refining activities, meanwhile, fuel extraction has an increasingly negative impact as the transition progresses and dominates this driver from 2030 onward.

The induced and indirect effects driver has a significantly negative impact during the first half of the transition, but becomes positive in the second half of the forecast period. The negative induced effects in the years to 2035 are due to sluggish responses in the labour market to the increased demand in the transition. The positive GDP effects associated with

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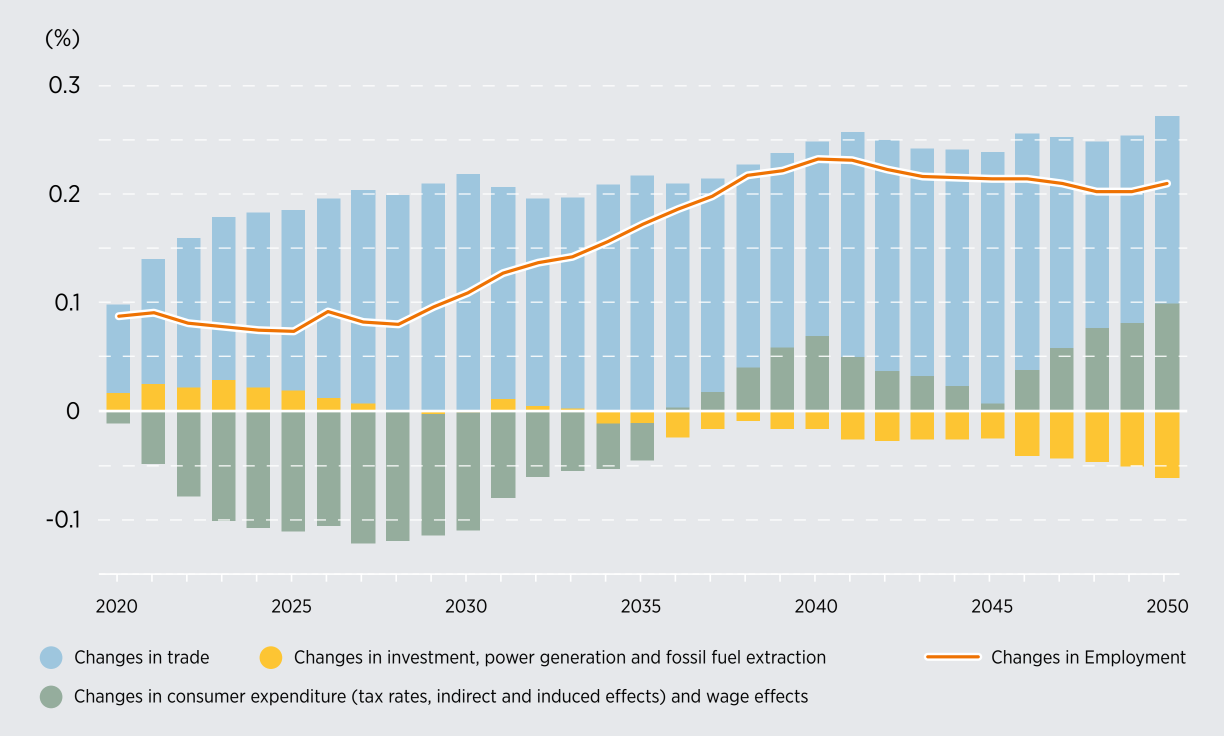
Figure 6.4 Energy transition footprint of the SEE region in terms of employment level, REmap Case compared to Reference Case, 2019-2050



increases in consumer expenditure (mainly carbon taxation and aggregate consumer prices) dominate the overall impact from this driver on the jobs footprint in the second half of the transition.

Holistic employment policies addressing economy-wide jobs – including but extending beyond energy sector jobs – can be a powerful tool to address negative employment impacts from the transition in the fossil fuel sector when accompanied by strong and deep domestic supply chains. In the case of SEE, negative employment effects are reversed through increased trade activity in high labour-intensity non-energy sectors. Employment policies should focus on sectors with high social value and sectors with export potential.

6.3 IMPROVING AIR QUALITY

Outdoor air pollution is a global issue, and policy makers and citizens have taken various actions to reduce the level of pollutants in the atmosphere in recent years. The energy sector, which involves the combustion of fossil fuels and traditional uses of bioenergy, is a major source of local air pollution, including sulphur dioxide (SO_2), nitrogen oxide (NO_X), and fine and coarse particulate matter ($PM_{2.5}$ and PM_{10}, respectively).

These pollutants can not only cause adverse human health effects, they can also cause reduced agricultural yields, damage to forests and fisheries (acid rain), and damage to buildings and infrastructure. The majority of adverse impacts, however, are found to be on human health (IRENA, 2016).

Worldwide, exposure to ambient (outdoor) air pollution causes 4.2 million preventable deaths every year (WHO, 2019). Air pollution externalities in 2013 were estimated to total USD 225 billion in lost labour income globally and about USD 5.11 trillion in welfare losses (WB and IHM, 2016). In comparison, the cost of the global energy supply is on the order of USD 5 trillion per year (IRENA, 2016a).

In Europe, emissions have decreased substantially for some pollutants (e.g. SO_X), resulting in improved air quality. Still, many Europeans live in areas where air pollution levels pose serious health risks. SEE, in particular, suffers from high concentration of pollutants in urban areas (Figure 6.5).

The main sources of pollutants across the region are power production from coal and industry, especially old installations lacking modern emission reduction systems, the traditional use of solid fuels for household heating during winter, and road traffic (due to high volumes of traffic, old and poorly maintained vehicle fleets and, in some cases, dense urbanisation with poor infrastructure) (MOEPP, 2017; ARSO, 2018; KEPA, 2012).

In SEE, with a population of 54 million, air pollution was considered to be responsible for around 46 000 preventable deaths in 2013 (WHO, 2016a). In economic terms, air pollution cost more than USD 55 billion in welfare losses and total forgone labour output (WB and IHM, 2016). This is equivalent to around 7% of the total GDP of the region.

Air pollution is a complex issue and is influenced by local factors. Therefore, there are specific areas where air pollution is more severe than elsewhere. Urban areas located in valleys can suffer from low-level temperature inversions which cause the stagnation of air pollution, prolonging the exposure to pollutants.

Cities nested in valleys are common in the SEE region (*e.g.*, Skopje and Sarajevo), and many of them are located close to coal power plants or industrial facilities. These cities may also have poor infrastructure for urban transportation and a large share of households utilising traditional biomass and, to a lesser extent, coal appliances for heating purposes. For these reasons, SEE cities are listed among some of the most polluted cities in Europe (Box 6.4), with values of pollution that exceed World Health Organization (WHO) air-quality guidance (Figure 6.6).

Because energy production and consumption are pivotal elements of air pollution in the SEE region, a switch towards cleaner energy solutions will improve air quality and reduce the economic and social effects of air pollution. Since the conversion from coal to gas of the CHP plant and the DH system in Sarajevo, air quality has improved in the Bosnian capital, which, however, still suffers from extremely high pollution levels (Hadžikadić, 2019).

A reduction in outdoor pollution is in itself a strong argument for adopting clean technologies. According to IRENA (2019e), the global savings from reduced externalities and avoided subsidies outweigh the additional energy system costs by a factor of three to seven, resulting in cumulative savings of USD 65 trillion to USD 160 trillion. Between 20% and 24% of the savings would come from reduced outdoor pollution. Most of these savings would be concentrated in areas with high levels of pollution, like SEE.

Current market design, however, does not adequately value the costs and savings of reduced air pollution. Energy is solely evaluated on the cost of its production and distribution, not for its long-lasting effects.

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Although this holds true around the world, it has additional importance in the SEE region, where parts of the population are widely affected by the effects of air pollution.

As people increasingly come to recognise the dangers of air pollution, protests about the issue are becoming more common across the region. This is true particularly in the Western Balkans, an area often associated with specific energy-related projects.

Effective regulations limiting air pollution via emission and fuel efficiency standards in transport and power plants is essential. While experience from several countries has shown that air pollution regulations may be expensive, ultimately they are cost-effective (IRENA, 2016a).

Action at the local level is crucial. One example of such action is the decision of the city of Skopje to offer a subsidy of EUR 500 (about USD 600) for the procurement of pellet stoves to households that are not already connected to the DH system and are using coal, wood or oil for heating. These stoves are a cleaner, more energy-efficient heating solution (MERM, 2016).

Enforcement of a larger-scale transition will require national governments to take the lead. However, while air pollution is typically a local issue, it can also create cross-boundary challenges in a region like SEE, with pollutants travelling long distances (ARSO, 2018). In such cases, transnational agreements on air pollution matters can become tools for more effective improvement of air quality.

Box 6.4 Pollution in selected SEE cities

Air pollution in SEE is a cause for serious concern. The WHO's guideline values are exceeded significantly, especially for particulate matter. The situation is worse in the largest urban settlements.

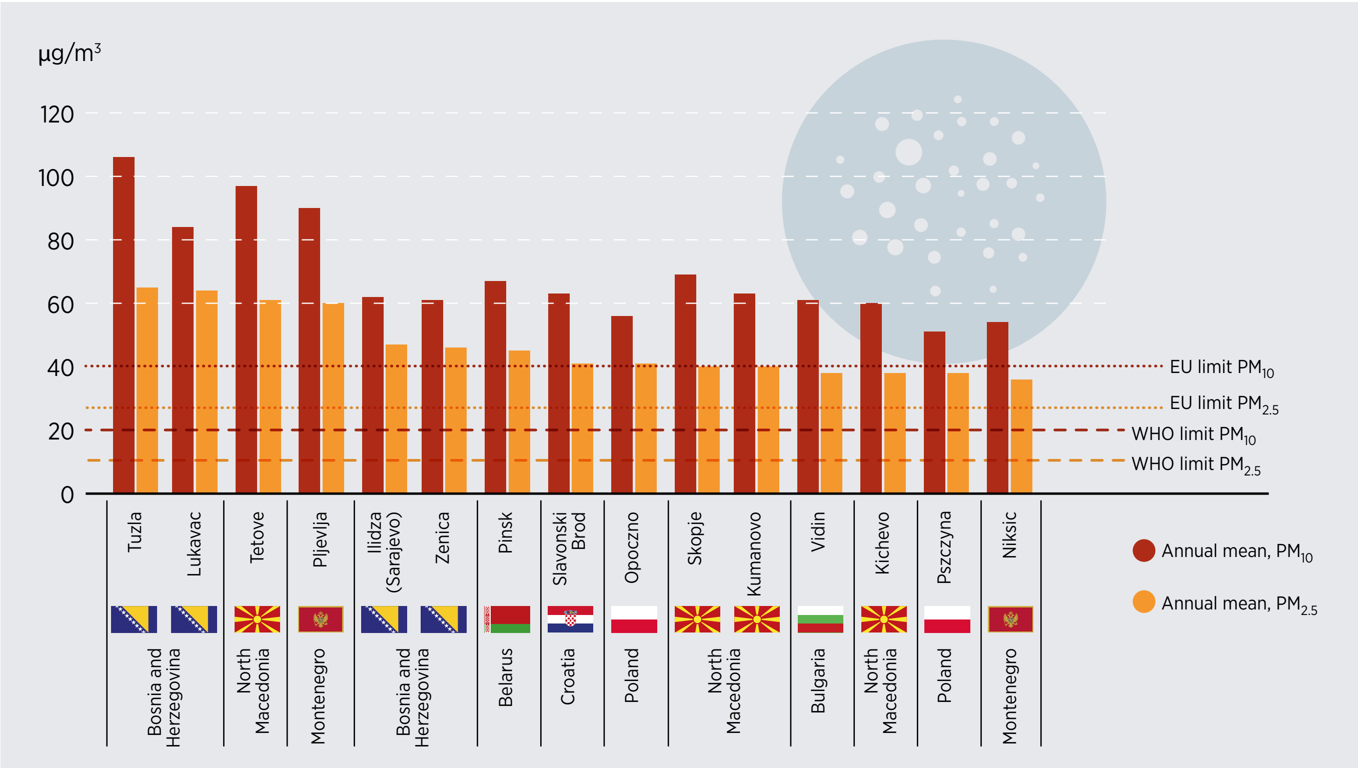
Tuzla and nearby **Lukavac** are cities in Bosnia and Herzegovina. The country's largest lignite power plant is located close to these two cities, which record the highest levels of particulate matter in all of Europe. Annual average $PM_{2.5}$ levels are six times higher than the WHO's air quality guideline limits, with deep impacts on the health of the cities' populations. Yet plans are in place to build a new 450 MW coal unit (Tuzla 7) in the same area with the decommissioning of old ones, with financing from the Export-Import Bank of China.

Tetovo is a city in northwestern North Macedonia. In 2016, the average value of $PM_{2.5}$ levels in the air was equal to 61 micrograms per cubic metre (μg/m^3) (WHO, 2019). The causes of the high pollution level include inadequate urban development, with a high population density of 330 inhabitants per square kilometre; heavy traffic; unregulated individual domestic heating; and construction activities. Industrial facilities close to the city exacerbate the situation. The topography of Tetovo has a significant impact, similar to other cities in the SEE region. The city is in fact in a basin with low air circulation, which allows pollutants to remain in place longer (IPH, 2015).

Pljevlja, in Montenegro, suffers from a similar situation, with an average value of $PM_{2.5}$ equal to 60 μg/m^3. In Pljevlja's case, the main contribution to local air emissions comes from combustion activities and the processes related to the extraction, handling and transport of solid fuels (the local coal mine). The highest contribution is associated with the 225 MW coal/lignite power plant (Trozzi *et al.*, 2013), which should be upgraded to comply with environmental obligations under the EnC Treaty (CEE Bankwatch Network, 2018b).

Figure 6.5 lists the cities with highest particulate matter average values in all Europe.

Figure 6.5 Top 15 cities by level of $PM_{2.5}$ levels, Europe, 2017



Source: WHO (2019)

6.4 ADDRESSING ENERGY POVERTY

The term "Energy poverty" covers a broad spectrum of negative effects on well-being, due to a lack of or insufficient access to modern technologies.

In a situation of energy poverty, a household is unable to secure a level and quality of domestic energy services sufficient for its social and material needs. This situation is accompanied by the use of dirty fuels (kerosene, traditional fuelwood), excessive time spent collecting them and low consumption of energy.

The EU does not have an official definition of energy poverty or energy vulnerability. European institutions are beginning to recognise, though, that energy poverty is on the rise and that there is no clear framework to deal with this problem. Still, the concept of energy poverty entered into the EU legal framework in the “Third Energy Package”, when the protection of vulnerable energy consumers was first defined with the goal of reducing energy poverty.

The Internal Market in Electricity Directive (2009/72/EC) states that “Energy regulators should also be granted the power to contribute to ensuring high standards of universal and public service in compliance with market opening, to the protection of vulnerable customers, and to the full effectiveness of consumer protection measures”. The mission of the Energy Poverty Observatory, a European Commission initiative, is to gather knowledge about energy poverty and disseminate information, policies and practices to tackle it.

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In the SEE region, energy poverty and vulnerable consumers are issues relevant to the energy system as a whole and are recognised and often addressed by policy makers. Without a unified definition of energy poverty, however, the number of households living in this situation cannot be properly quantified. Yet, the statistical data that describes some of the effects of energy poverty can help delineate the issue.

While the EU's average share of population with arrears in energy bills equals 10.5%, in the SEE region it ranges from 14.2% (Slovenia) to 70.5% (Montenegro) (EPOV, 2018; Robić, 2016). Meanwhile, 80% of Moldovans spend more than 10% of their budget on energy bills, with the average expenditure on energy equal to 17% of household income (World Bank, 2015).

Estimates indicate that 3 million out of a total 5 million households in the Western Balkans use outdated woodburning devices, a main indicator of energy poverty (RES Foundation, 2018). The high dependence on biomass and poor regulatory mechanisms also endanger local forest resources, which are subject to illegal logging and black-market sales (Robić, 2016). The use of traditional biomass substantially increases indoor air pollution levels, which in the SEE region caused around 23 000 preventable deaths in 2016 (WHO, 2016b).

Governments in the SEE region have taken steps to address energy vulnerability. The "Memorandum of Understanding on Social Issues" signed in 2007 has been the point of departure for the development of the social dimension of the EnC. Both EU and non-EU governments have adopted definitions of "vulnerable customers", and many of them provide some form of assistance to this population, mainly in the forms of cross-subsidisation, discounts on energy bills and protection from disconnection.

Renewable energy solutions can solve part of the energy poverty-related issues by improving the SEE region's livelihood.

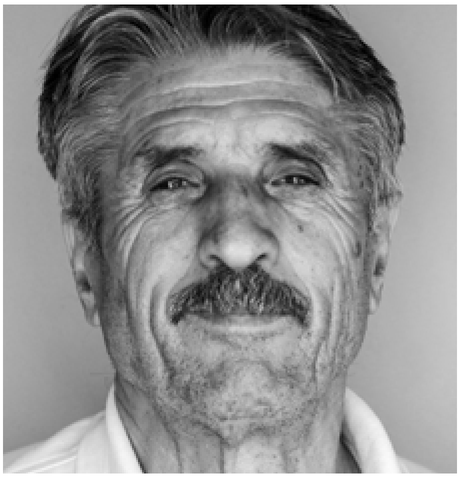
RENEWABLE ENERGY AND ENERGY AFFORDABILITY

The renewable energy transition will entail many changes to various aspects of the energy sector. If proper measures are not adopted, drastic changes to the energy sector may increase the number of energy-vulnerable, or energy-poor, households.

There is a growing wariness that power market liberalisation risks increasing energy prices to unsustainable levels for energy-vulnerable households (Robić, 2016; World Bank, 2015, 2013). Similarly, tariff increases due to RES support schemes can become an additional burden for the energy vulnerable. In terms of the energy transition, the time is clearly right to consider a holistic approach to reducing energy poverty in the SEE region.

The costs of energy intervention are customarily estimated from expected energy bills, or in terms of providing partial financial assistance for making the switch to modern and clean technologies. Closing the financial gap or paying increased energy bills may be infeasible for vulnerable households, however. In fact, low-income individuals often remain outside the scope of energy efficiency measures. Where there are many energy-vulnerable households, energy efficiency solutions should specifically target vulnerable customers.

Rapid change in the energy system calls for a new way of understanding renewable energy policies. The energy transition involves the transformation of the energy system and the socio-economic structure upon which it is built. Policies to support the transition need to adopt a holistic approach that accounts for these elements. As renewable energy technologies have transitioned from niche projects to mainstream policy, the policies that drive the transition must cover not just the deployment of renewables, but also their integration into the broader energy system and economy-wide policies that affect the sustainability and pace of the transition (IRENA/IEA/REN21, 2018). Consequently, the design of supportive policies for



renewable energy deployment in a situation of diffuse energy vulnerability or poverty must address energy affordability, which in turn depends on consumption patterns and the price of energy.

A more systematic approach is envisioned, for example, in legislation passed in North Macedonia. North Macedonia's National Energy Efficiency Action Plan clearly identifies long-term solutions to energy poverty issues and proposes energy efficiency measures to be implemented at the local and municipal levels. There are, however, no official statistics on actual implementation.

Intervention in consumption patterns is a more long-term solution to guarantee energy affordability. Current consumption patterns are shaped by past investment in infrastructure and housing policies.

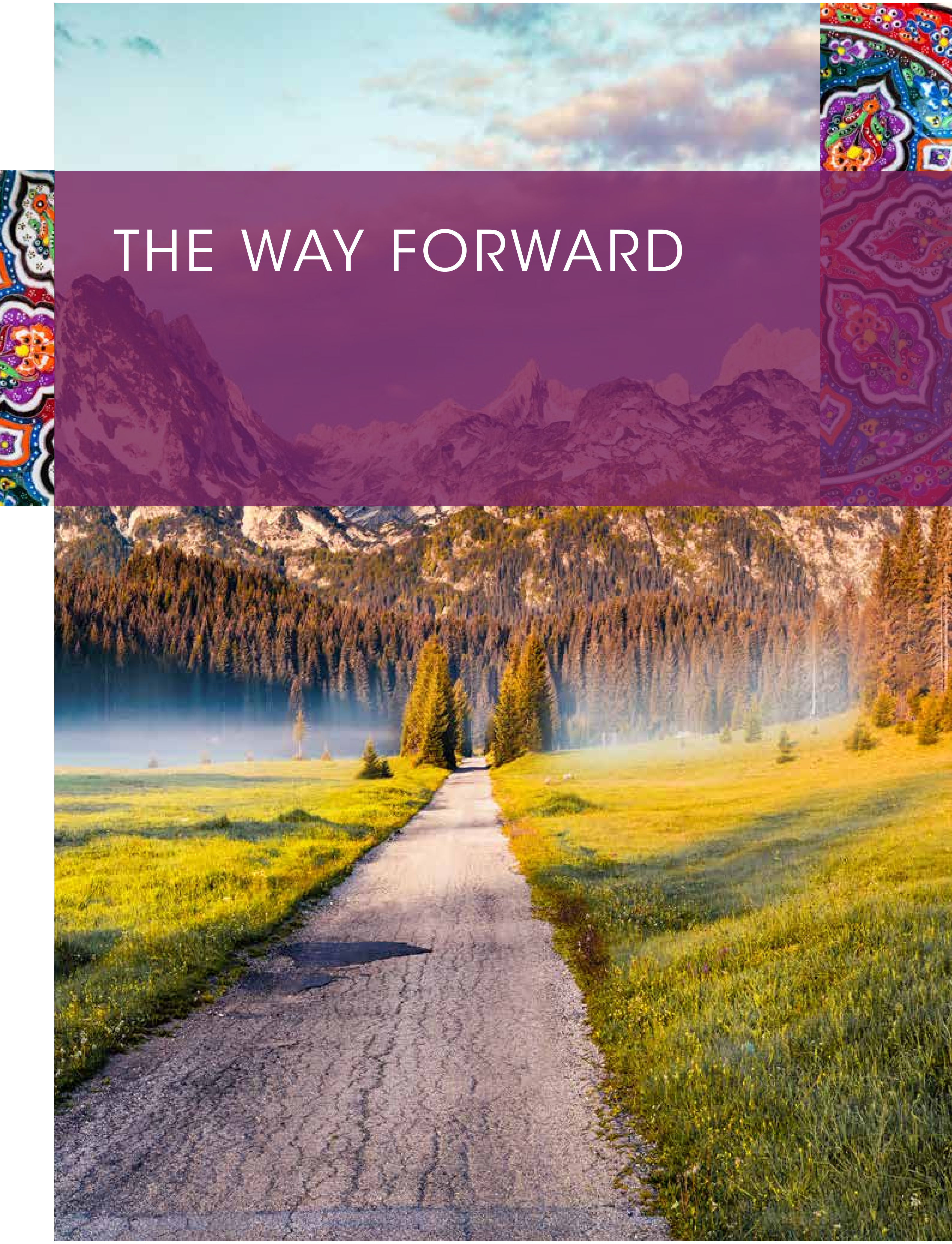
Energy efficiency measures are necessary in most energy-poor and energy-vulnerable households. Energy efficiency reduces energy consumption and improves the quality of life in dwellings (decreasing humidity and internal air pollution). Energy efficiency solutions do not refer solely to dwellings, but also to energy appliances. Energy efficiency measures also reduce the need for tariff subsidies, opening the fiscal space for greater investment in renewable energy and other clean technologies.

Modern biomass technologies can assist in reducing the exposure to power and fuel price variability, while improving indoor air quality and reducing the amount of biomass needed to heat a dwelling. Similarly, solar water heaters reduce exposure to fuel prices for the production of hot water, improving the livelihood of households.

An example of an intervention opportunity to alleviate energy poverty with renewable energy comes from Serbia. In Serbia, an estimated 57% of households with traditional stoves do not have the necessary funds to replace their obsolete heating devices, even thought 48% would be eager to replace them with modern solutions, if support were given (RES Foundation, 2018).

Financial subsidies may be needed to make modern renewable heating technologies affordable. Identifying hotspots of energy poverty and vulnerability allows for more targeted efforts that could result in more effective, tailored policies focused on the most significant issues, which may differ from region to region.

THE WAY FORWARD



The coming years could prove to be pivotal for the energy sector in SEE. The region possesses considerable renewable energy potential. With renewable energy reaching cost-competitiveness with conventional sources, the business case for renewable energy investment is experiencing increasing traction.

To ensure sustained investment in renewable energy it is essential to create an enabling environment by introducing appropriate dedicated policies. The region has indeed proved that it can attract investment when supporting measures are in place. These measures should go beyond mere direct support of renewable energy and include, in addition, system regulation and integration with the everyday life of energy consumers.

However, energy sector regulations in the region have historically been favourable to fossil fuels, even providing subsidies to assist their deployment. Reversing these regulations and creating favourable rules for renewable energy require large-scale reforms, some of which are already underway. International agreements such as the Energy Community Treaty, the EU Renewable Energy Directives and the Paris Agreement have provided some stimulus by emphasising decarbonisation of the energy sector and the larger deployment of renewables.

The combination of high renewable energy potential, decreasing renewable energy cost and new regulations in the energy sector makes SEE ideal for renewable energy deployment. However, sound policies rooted in the recognition of the socio-economic impact of the energy sector are needed to fully achieve the energy transition in the region.

RECOGNISING THE SOCIO-ECONOMIC AND ENVIRONMENTAL IMPACT OF THE ENERGY SECTOR

The energy sector is a centrepiece of any economy, with its significance not limited to the provision of energy for households and industries. The use and production of energy have associated effects at different levels of everyday life.

The most recognised external impact of the energy sector is on climate change and environmental pollution (e.g., the production of particulate matter by coal plants, the difference in water use due to hydropower plants, the disposal of nuclear waste). Fossil fuels harm the environment more than renewable energy sources in areas such as air pollution, water use and pollution, land use, damage to public health, and GHG emissions (IRENA, 2015, 2016a, 2018a, 2019c). Air pollution, in particular, is a significant problem in the SEE region, which is home to some of the most polluted cities in Europe. As pollution awareness increases, these cities will be looking for solutions to improve their air quality. Renewable energy solutions have been proving increasingly vital in this domain.

By ratifying the Paris Agreement, most SEE administrations have committed to limiting climate increases to well below 2°C. Although SEE contributed to only 0.7% of global carbon emissions in 2016 (Global Carbon Atlas, 2018), the region has already faced severe impacts from climate change, such as droughts and floods, with these likely to increase as this process continues. Emissions have a direct relationship with economic activity, declining in the 1990s with economic turmoil, but then rising since the early 2000s following economic recovery. Emissions are expected to keep growing in national, BAU scenarios (WRI, 2018).

As renewable energy gains a foothold in energy sectors around the world, the damaging impact of energy on the socio-economic system is reduced, demonstrating the magnitude of renewables' benefits in different areas. An increase in worldwide renewable energy deployment would lead to a rise in global GDP, job creation and human welfare (IRENA, 2018a, 2019c).

In an age of urgent climate and sustainability action, for the energy transition to succeed, policies must be based on an integrated assessment of the interactions between the evolving energy sector and the wider economy and natural systems. This includes the immediate establishment of long-term energy planning strategies, the definition of targets, and the adoption of policies and regulations that promote and shape the energy transition (IRENA/IEA/REN21, 2018).

SETTING NEW TARGETS

Successful renewable energy policies are reliant on well-defined renewable energy sector targets. These provide a clear signal to investors that there is a national commitment to the decarbonisation of the energy sector.

The EU Renewable Energy Directive (RED) 2020 targets have been powerful primers for the deployment of renewable energy technologies in SEE economies. Notably, however, some governments reduced their support for renewable energy once the RED 2020 targets had been met. In some cases, the achievement of the targets was also related to the retroactive recalculation of traditional biomass use in the residential sector.

The adoption of the second EU Renewable Energy Directive (RED II) gives governments in SEE the opportunity to update and reset those targets. These updated targets could be designed to make better use of the improved visibility of the energy sector, adopt adaptation measures and realign targets to reinvigorate renewable energy deployment.

IMPROVING THE USE OF BIOENERGY

Bioenergy is an essential component of the impending low carbon energy sector. Bioenergy can provide significant environmental benefits, assist in improving energy security and diversity and enhance economic development opportunities for rural communities. Bioenergy must be produced and used sustainably if these benefits are to be realised, and appropriate sustainability governance measures must be in place.

Bioenergy is widely used in SEE, providing over 15% of TFEC. Nearly all of this contribution, however, comes from the use of traditional biomass for residential heating. The use of bioenergy in low-efficiency combustion systems leads to poor indoor and outdoor air quality. The deployment of modern bioenergy has been hindered by the fact that current plans do not differentiate between modern and traditional biomass.

The potential for modern bioenergy in the region is substantial, but the supply chains needed to provide biomass on a large scale are not well developed. This represents a serious challenge, given the very small scale of much of the agriculture and forestry activities. This suggests that the more promising opportunities for developing the bioenergy sector in the area, at least in the short term, will lie in using forestry products and residues close to where they are generated.

Bioenergy can provide modern solutions for the energy transition across all end-uses, from the improved use of modern bioenergy in the residential sector to the production of biogas for power and heat generation. The use of biofuels is a viable option that can improve the economy and quality of life in the region – and for the more vulnerable and rural populations, in particular.

SEE is already home to different bioenergy-related companies, mostly involved in the production of feedstock for the European market (e.g., pellets and biofuels). Therefore, the region could leverage its existing capabilities to support the growth of internal demand for modern bioenergy solutions.

LEVERAGING HYDROPOWER POTENTIAL

Historically, hydropower has played a significant role in the production of electricity in SEE, with more than 22 GW of installed capacity as of December 2018. This represents 37% of all power generation and 79% of total renewable energy capacity (IRENA, 2019a).

The region is also endowed with many exploitable basins. Coinciding with increased renewable energy interest, the pipeline for hydro-based projects has enlarged. It is estimated that around 3 000 projects (most with capacities below 10 MW) are in development, reflecting the considerable experience of national energy sectors with this technology. Special attention should be given, however, to the environmental impact of greenfield hydropower plants. Public and institutional concerns have been raised regarding the sustainability of these new facilities, especially those that are located in biodiverse areas.

The majority of hydropower plants in the region were built more than 30 years ago. Ageing plants can create considerable risks if not properly maintained. Rehabilitating existing structures is thus an essential step in maintaining hydropower's contribution to power generation with little investment and limited environmental impact. Renovation of the current portfolio should precede new investments, as the benefit per unit of investment is higher.

As Europe undergoes an energy transition, wind and solar PV power plants will call for increased system flexibility. A source of system flexibility already successfully used around the world is pumped-storage hydropower. Currently, very little pumping capacity is deployed in the region compared to the rest of Europe. Given the regional potential for hydropower, the investment attractiveness of the technology and the benefits of the integration of VRE, system planners could consider incorporating this technology in future plans.

ATTRACTING INVESTMENT IN WIND AND SOLAR PV

Wind and solar PV have become mainstream technologies across the world, and many European countries have pioneered their integration in their energy sector. In the SEE region, only EU member states have deployed significant capacities of wind and solar PV. Nevertheless, the region is endowed with large technical potential, which could potentially reach 1 600 PJ (IRENA/JRUL, 2017).

Many SEE economies have often overlooked VRE technologies in their renewable energy plans, favouring the more traditional and established hydropower and biomass technologies, which were perceived as less expensive.

For SEE, a LCOE value of USD 0.105/kWh can be estimated for solar PV in 2018, about 5% higher than the weighted-average LCOE value for European markets outside SEE. The weighted-average LCOE of onshore wind projects commissioned in SEE during 2018 was USD 0.069/kWh. This value is 43% lower than for those commissioned during 2010 and the lowest since then, while 4% lower than the weighted-average for projects in other European countries. Even with a relatively high cost of capital, solar PV and onshore wind remain cost-competitive solutions for electricity generation in the region today, compared to generation from fossil fuels.

VRE technologies possess specific characteristics which may have deterred system operators and policy makers from taking action to integrate them into the power mix. To successfully and continuously deploy VRE technologies, the region may draw on experiences from other power systems. As the share of VRE grows and energy system stakeholders become more accustomed to the technologies, they become more adept at providing solutions to integration challenges at a low cost. At the same time, system integration measures should be linked to VRE policies, to reap the benefits of co-ordinated progress. Indeed, the rising share of VRE affects the power system in its technical, institutional and economic aspects, and policy makers need to consider the interplay between them.

INTRODUCING RENEWABLE ENERGY AS A PILLAR OF THE ENERGY AGENDA IN ALL END USES

Policy support for renewables in SEE continues to be focused on power generation, with efforts in the H&C and transport sectors significantly lagging behind. While complex and efficient policies such as auctions and net metering are being adopted in the power sector, no similar efforts can be identified in the H&C and transport sectors.

Traditional biomass is the most common renewable resource used for heating purposes. Fiscal and financial incentives can be used to reduce the capital costs of modern renewable-based heat and electrification technologies, creating a level playing field with fossil fuels and traditional biomass. DH systems can also assist decarbonisation of the heating sector.

In the transport sector, successful decarbonisation will depend on fundamental changes in the nature and structure of transport demand, efficiency improvements, and changes in the energy mix. This would entail a major behavioural change and an extended policy push. Sustainable biofuels can assist in reducing the carbon footprint of the sector.

HARNESSING ENERGY EFFICIENCY AS A FACILITATOR IN ALL END USES

It is widely recognised that renewables and energy efficiency are the key components of a successful energy transition. The synergy between renewable energy and energy efficiency is often overlooked, yet it can address the dual mandates of increasing efficiency while increasing the share of renewables.

Indeed, while SEE has made some progress in the renewable energy sector, measures for energy efficiency in the region still lag. The Western Balkans, in particular, exhibit very high energy intensity rates, substantially higher than in the rest of Europe.

Since 2009, members of the Energy Community have implemented three EU directives: the Energy Efficiency Directive, the Energy Performance of Buildings Directive and the Energy Labelling Directive. The adoption of these directives is ongoing and moderately advanced.

Retrofitting existing buildings could be the priority, followed by increasing energy efficiency standards for new buildings. Policies for energy efficiency could benefit energy vulnerable low-income households and collective regional development.

PHASING OUT OUTDATED TECHNOLOGIES

Solid fossil fuels (hard coal and lignite) provide 43% of the power generation and 3% of the heat production in SEE's residential sector. The region sits on large reserves of solid fossil fuels, in particular lignite, with this accounting for 4.6% of total world reserves in a region containing less than 1% of the global population (IRENA, 2019a; World Bank, 2019).

Historically, energy security and affordability concerns triggered a wave of coal projects, with hydropower plants built in the same period for the same reasons. As a result, in 2018, the average age of coal plants was 41 years. The ageing infrastructure of these facilities and their negative environmental impact reveal the need for the rapid phasing out of older plants and suspension or improvement of the more recent ones. However, several new coal power plants are now in various stages of deployment. This has raised concerns among the population, particularly those in affected areas.

Part of the planning process could be dedicated to re-determining the role of fossil fuel power plants, which will see their role reduced during the energy transition. In particular, the energy transition will require high levels of flexibility in the power system. System integration costs would decline if investments were oriented towards flexible power plants and other flexible resources.

ENHANCING ENERGY SECURITY

Energy security may be another driver of greater renewables deployment. In some areas of SEE, electricity and transmission networks have not always been able to secure sufficient, affordable and consistent supplies to businesses and consumers. Distributed generation from renewable energy, coupled with interventions to make the grid smarter, can provide an improvement in the reliability and affordability of electricity supply, benefiting socio-economic development and improving the regions' investment attractiveness.

Another aspect of energy security is the decrease in energy import dependency. At present, 65% of the regional energy supply comes from abroad, and often from just one supplier country. This is of great concern in the case of natural gas, which is very much dependent on infrastructure. As more energy is generated locally, the dependency on energy imported from other countries will decrease. The exploitation of domestic renewable energy resources is an effective approach to increase energy security.

INTRODUCING A BROADER POLICY FRAMEWORK

The administrations of SEE have taken some important decisions in establishing a dedicated policy framework for renewable energy.

This energy transition involves the transformation of the energy system and the socio-economic structure upon which it is built. As renewables have transitioned from niche to mainstream, the policies that drive the transition should not only cover the deployment of renewables, but also their integration into the broader energy and socio-economic system. To properly design the policy measures holistically, the effects of renewable energy on the whole regional and national system should be identified.

Direct policies and instruments to support the development and deployment of renewable energy technology and products are key to the uptake of these technologies. Policies such as auctions have demonstrated the possible correlation between investments and stable, clear and adaptable support policies.

Integrated measures are needed to ensure the development of the required infrastructure, promote sector coupling and support research, development and demonstration. SEE economies are committed to improving energy infrastructure, with considerable progress made in recent years. The pipeline of investments in energy infrastructure aims to improve energy security, including cross-border projects that link the energy systems of multiple countries. In the region, these measures may take the form of regulations that allow the large-scale integration of VRE.

Enabling policies are needed to level the playing field for renewables, ensuring that renewable energy can be a mature element of an energy system that has been redesigned to accommodate new participants. In this context, the SEE region can take an important first step by simplifying the procedures necessary for power plant deployment. The restructuring of fossil fuel subsidies will need to be confronted, with larger

shares of wind and solar PV requiring a comprehensive redesign of the power market. Since the redesign of the system will take a long time to become functional, it is important to plan now.

Measures to raise awareness are also necessary for all stakeholders. Awareness-raising programmes on renewable energy and energy efficiency would help to increase public engagement and ease the energy transition.

ENGAGING IN A JUST AND FAIR TRANSITION

IRENA estimates that shifting the regional energy system to renewables would grow the economy of SEE by 2% until 2040 and 1% from then until 2050, compared to a BAU case, translating into a cumulative gain of more than USD 485 billion. With the creation of new jobs in the renewable energy sector, the energy transition would also help tackle long-standing unemployment and brain drain issues. The inclusion of social welfare benefits, such as improvements in health and air quality, ensures that potential gains further outweigh additional costs.

To ensure that these costs and benefits are fairly distributed, the energy transformation has to be a “just transition”. This means that alternatives will need to be created for people trapped in coal dynamics through new economic opportunities, education and skills training and adequate social safety systems. Governments, administrations and local authorities will have to engineer new job opportunities for job losses caused by replacing fossil fuels with climate-safe power resources.

There is also already some evidence that policies that facilitate a just transition can help to address the serious socio-economic difficulties faced by communities of workers whose skills are made redundant by new technologies.

Measures that have been developed include the establishment of national or regional transition bodies, transition funds, on-the-job retraining programmes, infrastructure investments and relocation assistance. Spain recently provided an example of what can be achieved with enlightened leadership and progressive policies. The government has agreed with trade unions to shut down all coal mines by the end of 2019, while investing EUR 250 million in affected mining regions over the following decade (IRENA, 2019j).

A renewable energy transition entails a massive change in the energy sector. Yet, if proper measures are not adopted, such a swift and comprehensive change could increase the number of energy-vulnerable or energy-poor households. In regions that suffer from energy poverty, policies should therefore tailor clean technology measures so that the full range of benefits provided by the energy transition can be realised by those that stand to gain the most.

ANNEX

Table A.1 Examples of development partner programmes in renewable energy in SEE

Development partner/facility	Selected programmes and initiatives
European Bank for Reconstruction and Development	EBRD provides three financial instruments: large deals (power and utilities), framework programmes and technical assistance. EBRD is the main contributor to the Western Balkans Sustainable Energy Direct Financing Facility. This investment facility was established by the EBRD to provide debt financing for energy efficiency projects and small renewable energy projects implemented by private entities (in industry or in buildings used for commercial services) in the Western Balkans. Through National Sustainable Energy Financing Facilities (e.g., the Moldovan Sustainable Energy Finance Facility), the EBRD extends credit lines to local financial institutions which on-lend the funds to their clients, including small and medium-sized businesses, corporate clients and retail clients. EBRD has also been involved in supporting authorities in setting up support frameworks for renewable energy sources – in particular utility-scale renewable energy power plants, such as in Serbia.
European Investment Bank	EIB finances renewable energy through loans and technical assistance. EIB is a contributor to the Western Balkans Sustainable Energy Direct Financing Facility and Green Growth Fund, which support renewable energy projects in the region. EIB also finances renewable energy projects through intermediary finance, i.e., local commercial banks and investment funds.
German Agency for International Cooperation (GIZ)	GIZ has several projects supporting the development of national renewable energy markets and a more conducive environment that encourages the increased use of renewable energy. GIZ, through its regional project, is also supporting Contracting Parties of the Energy Community to develop the National Energy and Climate Plans.
International Finance Corporation	IFC's Balkan Renewable Energy Program (BREP) supported the development of a market for renewable energy in the region. The programme worked with governments, developers and local banks to establish an enabling legal environment. Country-level assistance was provided in Albania (Law on Renewable Energy 2013), Bosnia and Herzegovina (Law on Renewable Energy and Efficient Cogeneration and Law on Concessions) and Serbia (Decree on Feed-in-Tariffs, Preliminary PPA).
Italian Cooperation Development Agency	AICS funded technical assistance for renewable energy in Croatia (research on standardisation), North Macedonia (PPA), the Republic of Moldova (sustainable energy planning at the local level), Serbia (bioenergy for agriculture sector) and Albania (power system modernisation).
Kreditanstalt für Wiederaufbau	KfW funded several different projects in the region. Examples include the preparation of a regional wind atlas in addition to providing a loan for wind projects in Kosovo* and Bosnia and Herzegovina. KfW is supporting North Macedonia in a pilot project to construct the first wind farm in North Macedonia and the modernisation of two hydropower plants in Perucica (307 MW of nominal capacity) and Piva (342 MW) that play a key role in Montenegro's energy supply. In Serbia, a new project to improve the energy efficiency of schools will contribute to the reduction of energy demand.

** This designation is without prejudice to positions on status and in line with the United Nations Security Council Resolution 1244 (1999).*

Table A.1 Examples of development partner programmes in renewable energy in SEE (continued)

Development partner/facility	Selected programmes and initiatives
Regional Energy Efficiency Programme	REEP is an integrated package of finance, technical assistance and policy dialogue developed and funded by the EBRD and the European Commission and implemented jointly with the Energy Community Secretariat. REEP consists of three windows: 1) Support for policy dialogue and the development of the energy service company or energy savings company (ESCO) concept. Over 54 ESCO projects with an estimated investment volume of more than EUR 69 million have been supported. 2) Provision of funding and grants to financial institutions for on-lending to private and public sectors' energy efficiency and renewables projects. Of the allocated EUR 85 million, at least EUR 34.5 million had been signed in loan agreements by 2018. 3) Direct financing of larger renewables and energy efficiency projects of primarily industrial companies. EUR 25.9 million has been extended for the installation of 21.2 MW of renewable energy generation capacity.
United Nations Development Programme	UNDP operates country-level projects addressing renewable energy, including biomass (Bosnia and Herzegovina, Republic of Moldova and Serbia), energy co-operatives (Croatia), small hydropower developments (Montenegro) and solar thermal (Albania). UNDP support has had a positive impact, especially in smaller-sized markets: in Albania, the market for solar water heaters doubled between 2009 and 2012. In Moldova, UNDP supported the creation of a bioenergy sector with more than 70 briquette and pellet producers in October 2018.
Western Balkans Investment Framework	WBIF funded feasibility studies for several renewable energy projects in the region: Bosnia and Herzegovina (wind and hydropower), North Macedonia (wind) and Montenegro (power grid upgrades to enable renewable energy integration) as well as a regional study on biomass-based heating in the Western Balkans. WBIF is supported by several DFIs including the World Bank and EBRD.
World Bank	Technical assistance from the World Bank is channelled through WBIF and recently included a study on biomass-based heating in the Western Balkans. The World Bank has invested in solar (Bulgaria, Romania and Serbia), wind (Albania, Bulgaria, North Macedonia, Montenegro, Romania and Serbia) and biogas (Serbia) projects across the region.

Source: BGE (2016c), EBRD (2018b), Ecolex (2013a-b), GGF (2019), IENE (2012), IFC (2019), KfW (2019a-c), Mobias Banca (2019), REEP (2019), UNDP (2019, 2016), UNECE (2014), World bank (2017)

** This designation is without prejudice to positions on status and in line with the United Nations Security Council Resolution 1244 (1999).*

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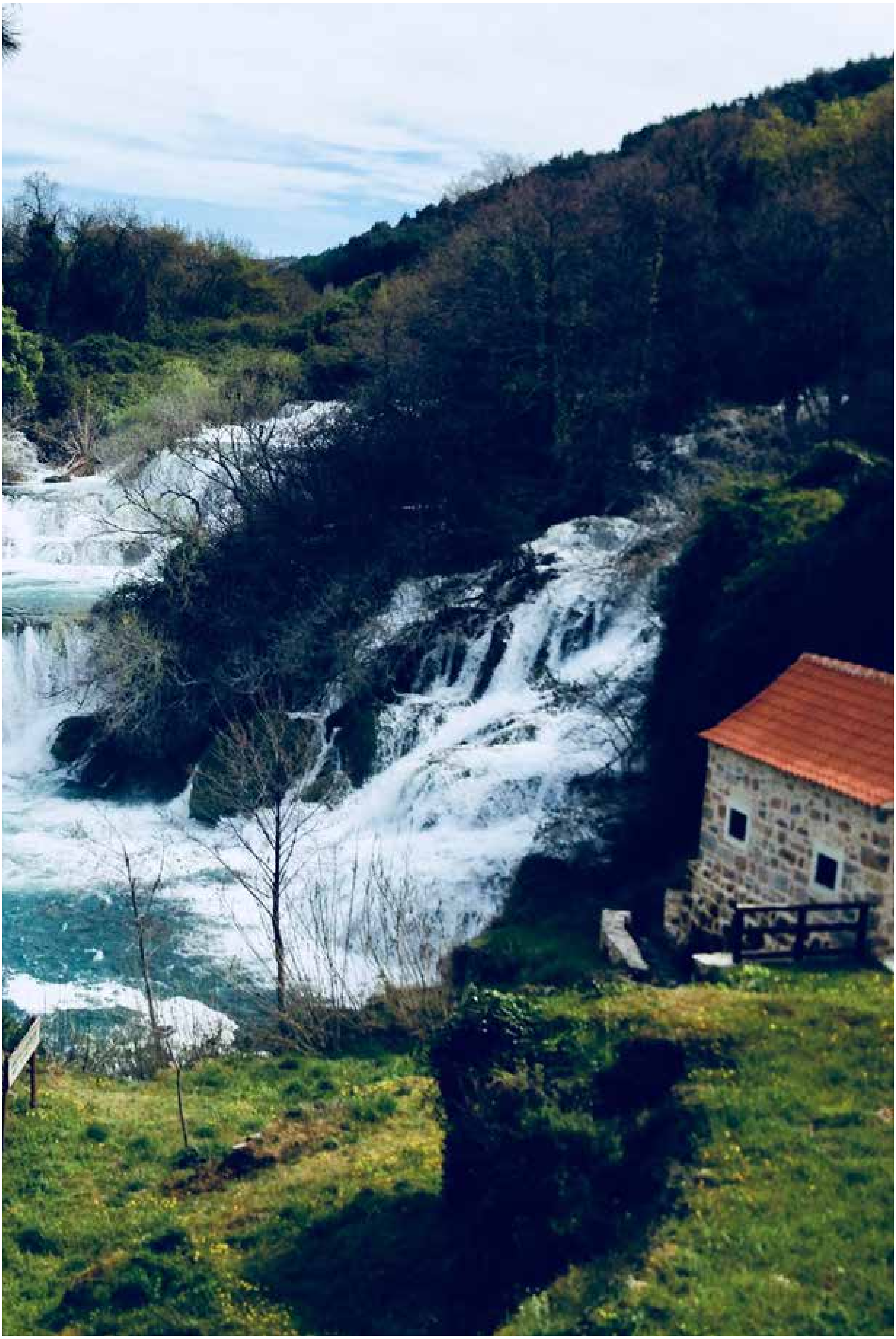

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