FUTURE SKILL NEEDS IN THE ALBANIAN ENERGY SECTOR

Final report

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PREFACE

In November 2018 the European Training Foundation (ETF) launched an investigation into how global trends have an impact on developing and transition economies, and to explore the actions needed to prepare their labour forces in a changing world. The ETF conference 'Skills for the future: managing transition' concluded that monitoring and understanding how skills demand evolves in the face of technological and climate changes is an indispensable prerequisite for any informed policy response. Since then, a series of studies have been initiated to analyse future skill needs in selected economic sectors, including the agri-tech (Israel), the automotive (Turkey) and the agri-food (Morocco) sectors.[1]

This study on future skill needs in the Albanian energy sector is part of this series of sector studies, the scope of which includes looking into innovative niches and potential for further development. The study investigates how various drivers of change – principally technological – have an impact upon occupations and related skills in the sector and how education and training are being adapted to meet these changing needs. The rationale behind this choice is the importance of energy production for the Albanian economy and the need to understand the impact that the climate crisis and greening policies have on the demand for skills. The greening of the economy is promoted by the European Green Deal, with a roadmap to a cleaner, circular economy that reduces carbon emissions and supports biodiversity.

The study documents changes in occupations and related skills, driven by the restructuring of the sector, policies and regulations. Particular emphasis is given to the potential new technologes that will need to be mobilised to bring about the transformation of the sector. It does not include a calculation of the changes in the volume of employment and skills demand; rather, it provides qualitative information on occupations and related skills that will be needed in the energy sector. The study also provides information on how companies are adapting to those changes and are finding the skills they need on the market, and an indication of whether the supply of skills is keeping pace with technological advances in the sector. The ultimate aim is to raise awareness about the changing skills demand, identify pointers of change and stimulate a discussion among policy makers and practitioners in the field, so that the findings can be used to adapt education and training provision.

The study is based on a new methodological approach which combines traditional research methods (desk research, data analysis and interviews) with the use of big data text mining techniques. The use of big data analysis is gaining traction in skills research. Despite some limitations, it provides new insights as well as real-time information on recent trends. When combined with other methods – such as interviews with key stakeholders, statistical analysis of skill trends, etc. – it provides a powerful means of identifying emerging skill needs and the implication of these for education and training provision and reskilling workers within companies.

Fondazione Giacomo Brodolini Srl SB and Erre Quadro have been working with the ETF to conduct the sector studies. A group of international and national researchers from each respective country were brought together to work on these studies, in addition to the ETF's team of experts. The study in Albania was carried out between January-November 2021. This report was drafted by Riccardo Apreda, Liga Baltina, Riccardo Campolmi, Chiara Fratalia, Terence Hogarth and national expert Rodion Gjoka.

[1] See ETF (2020d). https://www.etf.europa.eu/sites/default/files/2020-11/future_of_skills_agri-tech_sector_in_israel.pdf; ETF (2021d). www.etf.europa.eu/en/publications-and-resources/publications/future-skills-case-study-automotive-sector-turkey; ETF (2021e). www.etf.europa.eu/en/publications-and-resources/publications/future-skills-case-study-agri-food-sector-morocco

Finally, the ETF's team of experts (Ummuhan Bardak, Romain Boitard and Anastasia Fetsi) provided extensive comments, suggestions and input at various stages of the study, and Ummuhan Bardak edited the final version of the report.

This report documents all the steps of the research process and presents the findings in detail, the ETF's goal being to raise awareness among all stakeholders in Albania, be they researchers, practitioners or policymakers, about the changing skills needs in the sector. The findings not only raise awareness, but also provide food for thought, especially in relation to the ability of the education and training system to respond to changing skills demand and to prepare workers for the new jobs and occupations that are likely to emerge. Shorter and more targeted publications (e.g. policy briefs, infographics) will follow at a later stage after all the case studies are completed.

Last but not least, the ETF would like to thank all the public and private institutions, companies and individuals in Albania for sharing information and their views on the topic (see the list in Annex 1). Special thanks go to INSTAT (National Statistical Office of Albania), which provided calculations of the Labour Force Survey (LFS) data regarding employment in the energy sector. This report would not have been possible without the valuable input and contributions of these country stakeholders, who also participated actively in the ETF's online workshop organised in March 2021 and in the ETF's webinar to disseminate and validate the results in July 2021.

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EXECUTIVE SUMMARY

The energy sector comprises all activities related to the production and supply of energy, including non-renewable (petroleum products, gas, nuclear, etc.) and renewable (e.g. hydropower, biofuels, solar and wind power) sources. It encompasses all phases, from exploration and extraction to transportation, refining and distribution of oil or gas reserves, oil and gas drilling, pipeline and refining, mining (coal, nuclear) and renewable energy. As such, it includes the electrical power industry, including electricity generation, electric power distribution networks and sales. From an occupational point of view, the focus is on all jobs and skills in the sector that might be affected by technological and non-technological changes.

According to Eurostat (2021), the total primary energy production of Albania was 1.7 million TOE[2] in 2019. Of this, the contribution of petroleum products was almost 58% of total production, followed by energy produced from renewables (36%). Solid fuels (e.g. wood, coal, charcoal, corn, wheat, rye, dry dung) constitute 3% of Albanian energy production, with another 3% coming from natural gas. A specific feature of Albania is that in 2019 it produced 89% of its electricity from renewable energy (hydropower), albeit with variations between the years. The country is a net importer of energy; almost 32% of its total energy consumption was imported in 2019. That same year, Albania recorded the highest share of final energy consumption in transport (around 40% of total energy consumption), followed by households (25%) and industry (17%). Around 37% of the country's energy consumption is derived from renewables (mainly hydroelectric power).

When defining employment in the sector, it is useful to refer to NACE, the standard statistical classification of economic activities in the EU, though a direct correlation between NACE sectors and the energy industry in its broadest sense does not exist. Given the characteristics of the energy sector in Albania (e.g. availability of hydroelectric power and construction of the Trans-Adriatic Gas Pipeline/TAP), employment statistics in the energy sector need to be extracted from the following NACE sectors: *B-Mining and quarrying, D- Electricity, gas, steam, and E- Water supply, sewerage, waste management*. Employment in these sectors gives only an approximation of the level of employment in the energy sector, and the numbers should be taken as indicative. Under no circumstances is the energy sector employment-intensive: out of the 1 265 000 people employed in Albania, around 27 300 were employed in energy sector in 2019 (around 2% of total employment). Men comprise the majority of the workforce, with women accounting for 16% of those working in the sector.

Despite accounting for a relatively small share of overall employment, the energy sector is strategically important given its role in maintaining modern life and providing the means to power the economy. It also plays a leading role in the drive to reduce carbon emissions and bring about a greener society. Although an analysis of patents revealed an absence of inventive activity in the sector at national level, the presence of many European companies working in the energy sector and the technologies imported from abroad give scope for investors to become involved in skilling the workforce. To meet increasing demand, the energy sector will need to adopt a structural shift towards renewable energy sources,

[2] The TOE (Tonne of Oil Equivalent) is a unit of energy defined as the amount of energy released by burning one tonne of crude oil. It is approximately 42 gigajoules or 11.630 megawatt-hours, although as different crude oils have different calorific values, the exact value is defined by convention; several slightly different definitions exist.

including new distrubition modalities and technologies that reduce energy consumption and mitigate the impact of using fossil fuels.

Albania is part of the Paris Climate Change Agreement signed in 2016, where each country offers 'intended nationally determined contributions (INDC)' and reports developments to the UN within the Framework Convention on Climate Change (UNFCCC), based on the enhanced transparent procedures. Accordingly, Albania submitted its INDC with a baseline of 0.02% of greenhouse gases (UNFCCC, 2016). It is committed to reducing CO_2 emissions compared with the baseline scenario in the period between 2016 and 2030 by 11.5%. This reduction should result in a 708 kT carbon-dioxide emission reduction by 2030.[3]

As an EU candidate country since 2014, Albania is in the process of transposing the *EU acquis* into its legislation. It has received bilateral EU support under the Instrument for Pre-accession Assistance (IPA II), a total of EUR 758 million in 2014-2020 (EC 2020b). The country is working towards aligning its energy policies on supply, infrastructure and distribution, liberalising its internal energy market, diversifying energy production sources including renewable energy, increasing energy efficiency and promoting trans-European and trans-regional networks (EC, 2020b). Albania's *Economic Reform Programme (ERP 2020-2022)* clearly recognises inefficiencies in the energy sector, including inadequate security in the energy supply. The country has adopted legislation on the liberalisation and unbundling of the gas and electricity markets in line with the EU's third energy package and implementation is progressing (EC 2020a).

On top of this, the European Commission adopted a comprehensive *Economic and Investment Plan for the Western Balkans* in October 2020, which aims to spur the long-term economic recovery of the region, support green and digital transitions and foster regional integration and convergence with the EU. Clean energy is among the six priority areas for investment (EC 2020c). Following the EU Green Deal, the *Sofia Declaration on the Green Agenda for the Western Balkans* was adopted in November 2020 during the EU-Western Balkans summit. This is to support and accelerate changes and processes across the region with the overarching goal of addressing climate change. Among the action points were prioritising energy efficiency across all sectors, increasing the share of renewable energy sources, and aligning with EU Climate Law and the EU Emissions Trading Scheme.

With respect to all these commitments, Albania has adopted framework legislation for electricity and gas in line with *the National Energy Strategy 2018-2030*, though implementation lags behind. It has also made progress in preparing the regulatory framework for renewable energy. The revised *National Renewable Energy Action Plan (NREAP) for 2018-2020* envisaged that 38% of the gross final energy consumption would come from renewable sources by 2020. The plans for diversification of Albania's electricity production away from hydropower and towards alternative sources of renewable energy go hand in hand with finalising the legal and functional unbundling of energy companies and removing legal obstacles to customers' rights to change their energy supplier, as well as improving the Energy Efficiency Law and adopting legislation relating to the Energy Performance of Buildings Directive.

Given its natural endowments, Albania has the potential to diversify its renewable energy sources. In addition to its hydropower potential (even if it is increasingly prone to fluctuating rainfall levels) and the planned gas connection of the Vlora power station to the Trans-Adriatic Pipeline (TAP), Albania enjoys

[3] kT (kiloton) is the unit of measurement, often calculated and reported as elemental carbon for carbon-dioxide emissions.

abundant solar irradiation and favourable wind speeds. But the greening of the energy sector is not without challenges. The expected increase in tourism and intensification of the agricultural sector, as well as the impact of climate change, may put additional strain on Albania's water resources (EC 2020a). To diversify its energy supply through exploiting wind, solar and geothermal sources, the Government introduced the National Action Plan on Renewable Energy Sources in 2019, which commits to adding 740MW of photovoltaic and wind energy. This shift has the potential to bring about substantial technological change and the demand for new skills from those working in the sector.

In summary, Albania is at a turning point in how it organises and operates its energy production and how it improves energy efficient consumption in response to technological innovation, climate change and globalisation. Key to achieving this goal is the decarbonisation of the sector. All these developments are leading to significant shifts in labour demand. New developments will require new competences and skills in the local labour market and changes to some existing occupational profiles. The shift towards a greener energy sector will be dependent upon a workforce with the skills to allow new technologies to be developed, implemented, operated and maintained. This study aims to provide new knowledge and evidence on emerging skills needs and changing occupational profiles in Albania's energy sector.

During the study, the following steps were taken to identify emerging skill needs in Albania's energy sector.

- Review of existing reports and analyses on the energy sector in Albania, its production and consumption patterns and related national policy framework.
- Analysis of employment statistics in the Albanian energy sector, which show the current position of the sector in terms of labour and skills demand.
- Big data analyses using text mining techniques to capture data on technological change and associated skill needs from a variety of sources (e.g. patents, scientific papers, policy papers, etc.).
- Comparing and matching the list of relevant technologies extracted from text mining to the related occupations and skills listed by the occupational databases of ESCO and O*NET, by using semantic matching algorithms.
- Focus group discussions with key stakeholders and bilateral interviews with selected companies in the Albanian energy sector to verify and refine the results of the previous steps.

Drivers of change and emerging technologies

The combination of big data analysis, insights from desk research, and feedback from the interviews identified the following drivers of change in the Albania's energy sector.

- Availability of energy sources. Albania already exploits its substantial hydropower resources, but there are studies pointing out that Albania will be one of the most water-stressed countries by 2040. In order to secure energy self-sufficiency, it is looking to take advantage of the substantial potential available to it from solar and wind sources. With the construction of the Trans-Adriatic Pipeline (TAP), natural gas will also become an increasingly available source of energy.
- Economic growth and increased energy consumption. During the pre-pandemic period, all Western Balkan countries were experiencing relatively rapid growth, which increased energy consumption. The energy consumption share of industry in Albania is still relatively low compared with that of Serbia and North Macedonia, and the majority of energy consumption comes from transportation and households. Assuming growth will resume in the post-pandemic period, the challenge will be to increase energy production and, simultaneously, increase the efficiency of energy use.

- Adequacy of infrastructure. A good level and efficiency in the energy infrastructure – both power plants and distribution pipelines/distribution grids – is vital for the functioning of the energy sector. Due to its geographical position, Albania is an important link for the distribution of energy resources from eastern Europe and Central Asia to end users in the Mediterranean area. That said, the energy infrastructure is considered obsolete and inefficient because of energy losses that require revamping activities for the purposes both of security and of better management.
- Environmental sustainability. Despite the fact that hydropower is a renewable energy source, the construction of the infrastructure necessary to produce energy leads to some collateral environmental impact. Water quality degradation and the frequency of floods are the major concerns associated with developing hydroelectric facilities. The use of water for energy production leads to rising temperatures in reservoirs, with consequences for the flora and fauna. Climate change also leads to warmer temperatures and lower levels of rainfall in the region with important implications for future energy supply.
- Albania's EU accession agenda. As summarised above, Albania has been a candidate to join the EU since 2014 and a party to the Paris Climate Agreement since 2016. Therefore, the country is in the process of transposing the *EU acquis* into its legislation, including energy policies and greening of the sector. As noted above, this requires the alignment of energy policies so that they are consistent with those of the EU.
- National policies and government support. The energy sector has been and is subject to various policy initiatives linked to creating an energy market, which will have implications for innovation and energy production (i.e. new legislation, incentives, investment permits (e.g. licences to build plants), controlled tariffs or incentives to foster the adoption of specific energy means, etc.). For example, the recent introduction of net metering with price parity (i.e. same price for the electricity given to and taken from grid) will bring a significant boost to the adoption of solar technologies.
- Importance of foreign investment. Building new power plants and updating the transmission and distribution infrastructure requires substantial investments. To date, there has been a substantial amount of foreign investment, mainly from traditional European energy companies, but also increasingly from the EU and international financial institutions such as the EBRD, the EIB and the World Bank. Yet, to take advantage of the great potential of the country these investments must transfer knowledge and know-how into local development.
- Technological innovation. Significant innovation is developed in renewable energy sources to improve effectiveness and efficiency along all steps of the energy production and transmission process. For instance, the use of floating solar panels installed in water reservoirs could represent an important direction for future investments. New technologies also bring control over processes and plants, e.g. monitoring with sensors and actuators installed in the field. Digitalisation is one of the key technological developments to support smarter and more efficient production, transmission and distribution of energy.
- Tools for management and control. Solutions for maximising plant efficiency and monitoring the quality of processes are at the basis of modern management standard procedures and are regulated through energy efficiency action plans. Monitoring the performance of plants ensures process control and identifies potential drifts of production. As noted above, one potential game-changer is the growing importance of digital technologies such as those related to smart grids.
- Energy efficiency improvement. Energy efficiency simply means using less energy to perform the same task, thus eliminating energy waste. There are enormous opportunities for efficiency improvements in every sector of the economy, starting from energy generation and distribution to

insulating buildings, transportation modes and industrial production. Improvements in energy efficiency are generally achieved by adopting more efficient technologies (and infrastructure) or by applying commonly accepted methods to reduce energy losses. Although this is beyond the energy sector itself, the study confirmed the high level of inefficiency along the energy chain of production-transmission-distribution in Albania.

Emerging technologies

The various drivers have implications for the types of technology used in the energy sector. The text mining analysis of the European patents (in the absence of national patents) revealed those listed below as the most commonly mentioned technologies. In particular, the analysis of patents showed that wind energy, solar energy and transmission & distribution are the first three most active areas of innovation, likely to increasingly come on stream in the future.

Wind energy: wind turbine generators, wind turbine blades, wind turbine towers, rotary shafts, wind turbine nacelles.

Solar energy: solar collectors, photovoltaic power generation systems, solar cell arrays, reflective layers, float energy collection devices.

Transmission & distribution: solutions for smart grid networks and technologies, power transmissions, shift devices, energy conversion devices, energy lift devices.

Thermal energy: turbines activated by steam or gas, heat pumps, heat exchangers, roaster modules & chambers.

Hydropower: pumps and systems related to the production of energy from water, water turbines, water wheels, hydraulic power units.

Oil and gas transportation: gas and transmission pipelines, branch pipelines, pipeline seal systems, gas pipeline networks, subsea pipelines.

Energy saving/ efficiency: control systems, display units for controlling, power consumption regulators, energy consumption controllers, meters, power efficiency controllers.

Emerging skill needs

The capacity of the energy sector to obtain the maximum benefit from new technologies and improve energy efficiency depends on the availability of skills to facilitate their introduction, use and maintenance. To identify the skills attached to the technologies listed above, a further round of text mining was undertaken, of an online database that contains detailed information on occupational skills profiles: the multilingual classification of European Competences, Skills, Qualification and Occupations (ESCO) database. Because ESCO does not contain emerging (future) jobs or new skill needs, another source – Wikipedia – was also used to identify emerging skills which are outside existing classifications.

The results of the text mining analysis, together with knowledge from interviews, revealed the following broad categories of occupations which are likely to be most affected by the introduction of new technical developments (including new types of energy production and distribution) and new greening policies.

- Technical or technology-related occupations (engineers in various technical fields, from more general profiles such as energy engineer to more specific occupations such as solar energy engineer; operators and technicians working in the hydroelectric field or in solar power plants; energy analysts but also electrical transmission system operators, wind turbine technicians and electricity distribution workers).

- Business services and related occupations (energy manager; renewable energy consultant and sales representatives; manufacturing, operations, and power plant managers).
- Expert positions for the reforms of the energy sector, for both non-renewable and renewable energy sources, weather forecasting, and particularly the expertise to improve energy efficiency in every sector of the economy, starting from energy generation and distribution to insulating buildings, transportation modes and industrial production.

The analysis shows that the professional and associate professional occupations most likely to be affected by technological changes are *energy engineer, mechanical engineer, civil engineer, electrical engineer, hydroelectric plant operator, solar power plant operator and wind energy engineer*. It is not just professional jobs that will be affected, but also medium-skilled technical occupations related to day-to-day operations such as *wind turbine technicians*, etc.

Looking at how the content of those jobs will develop over the short to medium term, it is necessary to identify the particular skills within the occupations that will be increasingly in demand. In relation to *energy engineers* for instance, there is a potentially wide range of areas where skills will need to be acquired to master the use of various technologies, such as more specific knowhow on solar energy. For now, the growth that the country intends to pursue will have to rely solely on technologies imported from abroad. If Albania is to take full advantage of its potential as a producer of energy from renewable sources, boosting its internal research and development capacity (and thus related occupations and competences) would be an important factor to consider.

New regulations for adapting to EU standards are boosting the creation of roles related to energy efficiency, administration and management. The importance of these roles, such as energy manager and energy analyst, was confirmed by both the big data analysis and the information collected from interviews. In addition, digitalisation is also leading to the emergence of new jobs in the energy sector: some new jobs are related to the introduction of automation and Industry 4.0, e.g. the role of ‘mechatronics’ in managing and controlling production, transmission and distribution; others are related to the introduction of information technology due to the Covid-19 pandemic outbreak, such as digital marketing or digital sales.

Responding to change: the views of stakeholders

The results from the interviews with key stakeholders revealed the following findings.

- There are several factors strongly affecting the development of the energy sector in Albania, from the necessity to diversify energy sources, to meeting increased energy consumption by end users. The complexities that arise in managing diversification and satisfying increased demand require long-term strategies to develop the skills likely to be increasingly in demand.
- At the same time, there are various factors that may constrain the growth of the energy sector, including shortages of people with key technical skills (especially practical skills or skills related to new energy sources) and the lack of integration between the public and private sectors. A common perception is that companies are not sufficiently involved in skills development because they lack awareness of the returns to be obtained from investing in new technologies and processes. At the same time, education and training curricula are sometimes regarded as being too theoretical and not sufficiently up to date with the latest technological developments.
- Although companies report a gap between demand and supply for all types of occupations (i.e. vacancies prove hard to fill), middle skilled technicians are the most difficult to recruit, together with managerial and sales staff with experience in the energy sector.

- The reasons indicated for the skill gaps are varied: concerns about the curricula (see above), retirement of experienced workers, emigration of qualified professionals, a lack of know-how transfer from international contractors, etc.
- Most companies meet their skill needs through training new recruits internally, and some through outsourcing activities. The interviews with energy companies revealed that they relied, to a significant degree, on outsourcing the expertise needed, sometimes from abroad.
- The importance of hybrid skills is confirmed as companies value 'soft' skills highly. The debate about future skill needs is not just about technical skills, but is about the mix of technical and soft skills. Additionally, workers increasingly need to be skilled across different technologies.
- Creating a sectoral committee for the energy sector would help to gather information from the key players on emerging skill needs and how these can be satisfied. There is also the possibility of adopting good practices from other countries with respect to effective skills development, the transfer of knowhow and the way in which the energy sector can work with the education and training sector.

Building on skills

The use of a mixed methodological approach (desk research, data analysis, data mining, interviews) has provided more nuanced information on emerging skill needs, but long-term skill identification techniques have their own shortcomings given the uncertainties experienced in today's world (particularly against the background of Covid-19). Considering the small proportion that employment in this sector represents, and the quickly changing technologies and political decisions, skills forecasting is not the only instrument of action: more efforts are needed to strengthen links between investors/companies and education and training providers (universities, VET schools); more opportunities should be provided by companies for work-based learning (including apprenticships); and, furthermore, training of the local workforce needs to be included as part of the investment package by European/foreign companies (at the moment they receive the license to operate in the country). Training provision needs to be enhanced through a series of measures that develop skills alongside the restructuring of the sector.

1. INTRODUCTION

This report is part of an ETF project designed to identify and analyse how technological and non-technological drivers of changes are disrupting the labour markets in the partner countries. Here, the focus is on the Albanian energy sector in order to understand the impact of the climate crisis and the resulting demand for green skills, the development of which is promoted by the EU's European Green Deal.

Albania is an upper-middle-income country which has undergone a significant political-economic transformation since the end of communist era in 1990 (World Bank, 2020a). Two recent shocks – the 2019 earthquake and the Covid-19 pandemic in 2020 – have destabilised the country's economic progress since the financial crisis in 2008. In Albania's energy sector, almost 60% of energy demand was met through fossil fuels in 2019, while less than 40% was met from renewable sources. On average, 62% of the annual electricity consumption is met from sources within Albania, with hydropower accounting for over 90% of domestic generation (World Bank Group Partnership, 2015). The remainder is met from imports. Over the long-term there are concerns regarding the ability of hydro sources to meet increasing demand arising from population growth, and sustainability is threatened by uncertainty about rainfall levels (European Commission, 2020).

To tackle the various issues, the Government has pursued a three-pronged approach to meeting energy demand: (i) introducing policies linked to the production and distribution of non-renewable energy sources (coal, oil, petroleum, natural gas and nuclear power); (ii) introducing policies linked to the production and distribution of renewable energy sources (hydropower, biofuels such as ethanol, wind power, solar power); and (iii) introducing policies to use energy more efficiently, prevent energy loss and mitigate the effects of climate change.

The shift towards energy policies with substantial technological advances is likely to result in a concomitant change in the demand for skills. This is where this study comes in, by providing an assessment of current and emerging skill demands through the use of a mixed research methodology. A detailed description of the methodology can be found in a separate report (ETF, 2021a) but a summary is provided in Chapter 2 for country specific aspects.

Chapter 3 starts with an overview of the Albanian economy and labour market characteristics and then focuses on the features of the energy sector, policies and actors, based on the literature review and a secondary analysis of official employment statistics. Chapter 4 analyses the main drivers of change affecting the sector and the evolving technology and innovation trends. Chapter 5 analyses the impact of technology trends on emerging skill needs by comparing and matching them with occupational job profiles. Chapter 6 reviews the skills bottlenecks that could prevent change from happening and discusses sector initiatives and training strategies put in place as a response.

The report also includes a list of the key stakeholders and companies in Albania that were consulted for the study (Annex 1), a ranking of occupations for energy sub-sectors (Annex 2), a glossary of terms relating to employment, skills and technology (Annex 3) and a bibliography.

2. METHODOLOGICAL APPROACH

This chapter gives a short summary of the sector definition and the key steps of the research methodology (Chapter 2.1); more detailed explanations on the methodology can be found in the ETF Methodological Note (ETF, 2021a). Country-specific aspects of the research methodology are discussed in Chapter 2.2, followed by a review of the main advantages and limitations of the study. The initial research questions, which provided the framework of the study, are shown in Box 1 below.

BOX 1: RESEARCH QUESTIONS IN THE STUDY

Questions about the state of development in the sector analysed

1. What is the relationship of the selected sub-sector to the whole sector and the broader economy (e.g. production, employment, export)?
2. What are the main drivers of change currently shaping the sector (e.g. trade, global value chains, new technologies, digital tools, climate change)?
3. What has driven/generated innovation in this part of the sector, and does it have the potential to have an influence on the rest of the sector?

Questions about the empirical evidence on the changes occurring in the sector

4. What are the ongoing changes observed in the sector in terms of production, storage and marketing, and business practices, labour and skills utilisation?
5. What are the main occupational profiles used in the sector? Has the content of some occupations evolved as a result of the above changes in the sector? If so, how?
6. Which new tasks and functions have emerged in the jobs and/or occupations in this sector? Which old ones have disappeared?
7. What are the differences in the job profiles in this innovative sector? What changes are observed in the profiles of new recruitments and job vacancies published?
8. What is the impact of these changes on labour and skills demands in the sector? Do changes require higher levels of the same skills or completely new sets of skills from workers?
9. How do these changes affect ‘skills utilisation’ and working conditions in the sector (e.g. salary, contracts, working hours, formality)?
10. How do businesses meet their new skills needs (new hiring, retraining, etc)? Are there any initiatives or cooperation of companies with education and training providers?

Questions about policy implications

11. Do technology, innovation and other changes push countries toward a higher added value and integration in the global value chain? Are skills contributing to this shift? If so, how?
12. Are there any spill-over effects from the changes in the overall broader sector? What context-specific and general lessons can be derived from these studies?

2.1 Energy sector definition and research steps

The energy sector or industry comprises the totality of activities related to the production and supply of energy (both non-renewable and renewable types). It encompasses all steps from exploration and extraction to transportation, refining and distribution in the case of fuels, as well as the electrical power industry, including electricity generation, electric power distribution and sales. It includes large (integrated) power utility companies and alternative/clean energy companies, as well as traditional industries such as the collection and distribution of firewood for cooking and heating.

When defining the perimeter of the investigation, it is useful to make reference to standard industrial classifications such as NACE (the Statistical Classification of Economic Activities in the European Community – see the glossary for more details). It is then possible to collate statistical data on workforce composition and the like from national statistical offices. However, general classifications may not reflect all the specificities in a country, and the rapid introduction of new technologies may have redefined some of the principal activities within a sector. Given the characteristics of the Albanian energy sector (e.g. the availability of hydroelectric power, the presence of an important gas pipeline – the Trans Adriatic Pipeline/TAP), the ideal definition of the sector is referred to according to the following NACE sub-sectors in the country:

- D 35 Electricity, gas, steam and air conditioning supply
- B 05 Mining of coal and lignite
- B 06 Extraction of crude petroleum and natural gas
- B 09 Mining support service activities
- E 36 Water collection, treatment and supply
- E 38 Waste collection, treatment and disposal activities; materials recovery
- E 39 Remediation activities and other waste management services
- F 42.9 Construction of water projects and other civil engineering projects
- H 49.5 Transport via pipeline

This list serves as a reminder that not all sub-sectors of NACE B, D and E are considered to be part of the energy sector. Furthermore, there are also other NACE sub-sectors which could be considered to be in the energy sector in Albania, such as H49.5 (Transport via pipeline) and F42.9 (Construction of water projects and other civil engineering projects). There were not sufficient employment statistics for each of these sub-sectors to give a reliable level of analysis, so the study opted to analyse the overall employment statistics from three NACE sectors (B,D,E), despite the shortcomings.

As the study needs to be forward-looking, a mixed-method approach was used, combining desk research, data analysis with data mining techniques, and interviews with stakeholders and companies as shown in Box 2 below. More detailed information of the methodology can be seen in the ETF Methodological Note (ETF, 2021a).

BOX 2: STEPS FOLLOWED IN THE STUDY'S MIXED-METHOD APPROACH

1. Review of existing reports and analyses on the energy sector in Albania, its production and consumption patterns and related national policy framework.
2. Analysis of employment statistics in the Albanian energy sector showing the current position of the sector in terms of labour and skills demand.
3. Big data analyses using text mining techniques to capture data on technological change and associated skill needs from a variety of sources (e.g. patents, scientific papers, policy papers, job vacancies, etc.).
4. Comparing and matching the list of relevant technologies extracted from text mining to the related occupations and skills listed by the occupational databases of ESCO and O*NET, by using semantic matching algorithms (see Annex 2 and 3).
5. Focus group discussions with key stakeholders and bilateral interviews with selected Albanian companies in the sector to verify and refine the results of the previous steps (see Annex 1).

2.2 Country-specific aspects

In the context of this study, patent data was taken from the official database of the European Patent Office, which contains over 120 million documents from around the world and is updated daily. For scientific papers, both Scopus (by Elsevier) and Web of Science (by Clarivate) were used, the two largest databases of peer-reviewed papers, where an equivalent study was performed on around 70 million scientific papers.

Scientific papers about Energy in Albania are sufficient in volume to study the drivers of change affecting this economic sector in the country. As for technologies, however, the study revealed that no Albanian company has filed any energy-related patent in the period of observation (1990-present). This may be related to the fact that investments in R&D were hampered by the general economic situation, or more likely to the fact that traditionally the country has relied on hydropower – a well-established technology – and the recent interest on solar and wind energy is mainly related to importing technologies from abroad with local firms limited to installation and maintenance.

To overcome this limitation, comparison and benchmarking with ongoing trends in Europe, where a large amount of data is available, was used. In particular, European patents (i.e. patents filed with the European Patent Office and valid in the 38 countries that have joined the European Patent Convention – including Albania) were analysed to provide a clear picture of the relevant technologies in the energy sector.

Of course, not all of those technologies may have an impact on Albania, but those related to the drivers of change that are shaping the future of the sector will sooner or later be introduced in the country. For example, any developments relating to solar panels in the EU will be adopted by Albanian companies, which are now entering the market and are keen to install the latest solutions. Moreover, the analysis of EU trends provides an input for shaping the discussion with the country's stakeholders (identifying the technologies adopted at national level and the extent to which the skills associated with these technologies are in demand by employers and are being provided by the education and training system).

Thus, the technologies shown in Chapter 4 are derived from the analysis of EU patents, but only the ones that are expected to be relevant for each sub-sector present in the country are discussed. In the same way, in the ranking of relevant professional profiles, based on the correlation with technologies in Chapter 5, only technologies that are likely to be adopted in the near future in Albania have been summarised. Weight is given to each one depending both on the relevance of the technology itself (as calculated from patent data) and the relevance of the subsector in the country's future planning (estimate obtained from a combination of data mining results, desk research and interviews).

As for the fieldwork, due to the Covid-19 pandemic, **focus group** discussions were convened online in March 2021, involving the relevant stakeholders from both the energy sector and the education and training system. Twelve representatives from government institutions, academia and research, and various associations and organisations, attended the discussions. After the focus group, face-to-face in-depth interviews, guided by a semi-structured interview schedule, were conducted between March 2021 and July 2021. A final validation event with main stakeholders took place in July 2021.

The first set of interviews was undertaken with **key stakeholders** in the energy sector. More than 20 stakeholders were identified during the planning of the fieldwork. The stakeholders represent a broad base, including sector representatives (e.g. social partners and professional associations), policymakers, government organisations, education and training providers, universities, members of the research community, intermediaries and entrepreneurs. Eight face-to-face stakeholder interviews were conducted to gain insight into how they perceive and manage the process of technological change and how they acquire the skills they need, but also to explore the incentives for skills development. A full list of these key stakeholders (as institutions, not individuals) is provided in Annex 1. The names of individuals from these institutions are not included for data privacy reasons.

The second group of interviews was conducted with **innovative companies** in the sector, to understand their perceptions of and actions taken to manage technological change in their companies and the means they employed to address their skill needs. Since patents could not be used as a proxy for innovativeness, over 40 candidate companies were selected based on desk research and the guidance of the national expert and various stakeholders. In total, 14 companies were interviewed from the sector. The questions focused on how companies deal with the process of technological change (including barriers to its implementation, such as shortages of capital and skills), and the impact on the content of jobs and the related skills needs emerging from these changes.

Collecting the views of key stakeholders and interviewing the most innovative companies was an important step, since new skills demands can be revealed only by understanding the responses of companies to the signals about emerging technologies. Arguably, by interviewing the most innovative companies, one may not be providing a fully balanced picture, but the objective of the study was to collect evidence on how technological change, if implemented, affects employment and skills demand. It was therefore important that the research covered companies in the vanguard of technological change, so to speak, so that the impact on skills demand could be identified.

2.3 Main advantages and limitations

The use of a combination of mixed methodologies provides manifold advantages:

- While each single methodology might fail to identify certain skill needs in a sector, different techniques complement one another, each compensating for the potential shortcomings of the other, thus achieving the best coverage possible.
- A forward-looking perspective is important in order to have more opportunity to influence future changes. Patents are a particularly good source of data on impending technological change, since companies file patents in order to protect the innovations that they are planning to put into production. Text mining of such documents thus allows a variety of disruptive factors to be identified, which can be then explored with key stakeholders, reflecting on how they will affect the demand for skills.
- Data mining, by extracting what is often relatively scarce data scattered across many different sources, is able to deliver information on future skill needs that would otherwise be unobserved until such time as economically damaging skill shortages were to emerge (Figure 2.1).
- While text mining provides a wealth of information, obtaining the views of key stakeholders and company representatives is still fundamental to understand how they plan to respond to the signals about emerging technologies which, in turn, will reveal much about the demands that will be made on education and training systems.

However, there are also a number of issues that need to be borne in mind, as listed below.

- The information provided by companies and other key stakeholders should be regarded as indicative rather than comprehensive given the small number of people interviewed in the study.
- Text mining was limited to searches in English, although it is highly likely that most of the scientific papers were published in English in this period.
- There has been no patent activity from the Albanian energy sector in the last five decades. Moreover, it is possible that some innovations are not patented and yet relevant for the country.

Non-technological innovations are also important; the review of scientific papers and interviews with companies and stakeholders captured other drivers of change.

- Despite the mixed-method approach used in the study, this report is not able to give an indication of the scale or volume of any change in jobs and employment (for instance, it is not able to estimate how many extra welders or installers will be required), the relative importance of particular skills, or the extent of any skills mismatches. Other methodologies are required to address these issues.
- The analysis of skills was limited to those associated with technologies and other trends identified by the text mining. If a certain technology was linked to occupations and skills in ESCO and O*NET databases, this was captured. However, certain occupations may have incomplete descriptions of skills related to recent technologies – e.g. digital competencies – in databases such as ESCO.

Despite these limitations, the data science approach brings added value. It allows the skills content of jobs in the energy sector, and the specific skill needs which arise as a consequence of technological change, to be identified. Accordingly, the focus is on actual jobs and how these will change over the short to medium term, rather than broad aggregations of jobs into occupations. Data is captured on specific skills in specific jobs rather than in relation to total demand for certain occupations. The approach is flexible, and the algorithms can be run and rerun in a relatively speedy manner. This means that if a sudden economic shock or a crisis of some kind emerges – such as Covid-19 – the analysis can be quickly rerun to capture the effects of these (so long as there is data that can be searched).

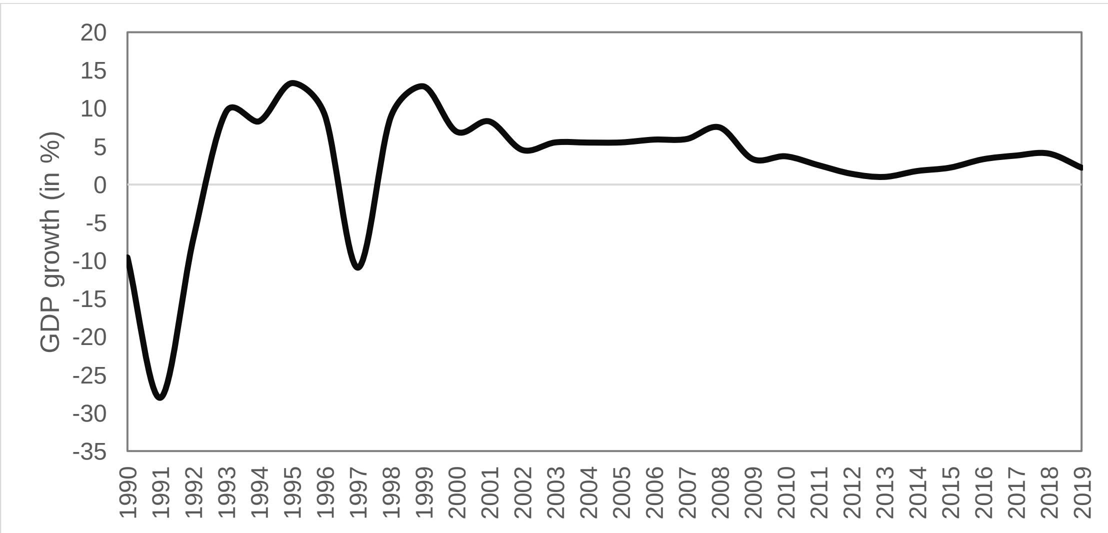
3. OVERVIEW OF THE ENERGY SECTOR

This chapter starts with a review of the main characteristics of the Albanian economy (Chapter 3.1) and of the labour market and education system (Chapter 3.2). Then, in Chapter 3.3, a snapshot of the Albanian energy sector is given in terms of current production and consumption patterns. Chapter 3.4 continues with a discussion of the main actors and policies in the sector and, lastly, Chapter 3.5 focuses on sectoral employment trends and characteristics, based on the data analysis of LFS statistics provided by INSTAT (Chapter 3.5).

3.1 The main characteristics of the Albanian economy

Since the fall of communism, an era in which Albania was the most isolated centrally planned economy in Europe, the country has undergone substantial economic and social change. With a population of 2.8 million, and a GDP of USD 15.8 billion, it has established itself as a small, upper-middle-income country after 10 years of growth averaging 2.4% a year (World Economic Forum, 2019). In the past three decades the Albanian economy has gone through deep structural reform, with partners such as the World Bank, the IMF, the European Union and the EBRD providing support to increase growth, raise productivity, create jobs and improve the performance of public institutions. Its path to the present day is marked by three distinct periods: (1) a tumultuous decade in the immediate aftermath of communism when overall growth was negative; (2) rapid but unstable growth in the 2000s, and; (3) slower, but more stable growth over the 2010s (O'Brien et al., 2017). Figure 1 shows the trend in output. Albania is committed to its candidacy for EU membership and is implementing several ongoing reforms to this end.[4]

Figure 1: Annual growth in GDP volumes for Albania, 1990-2019



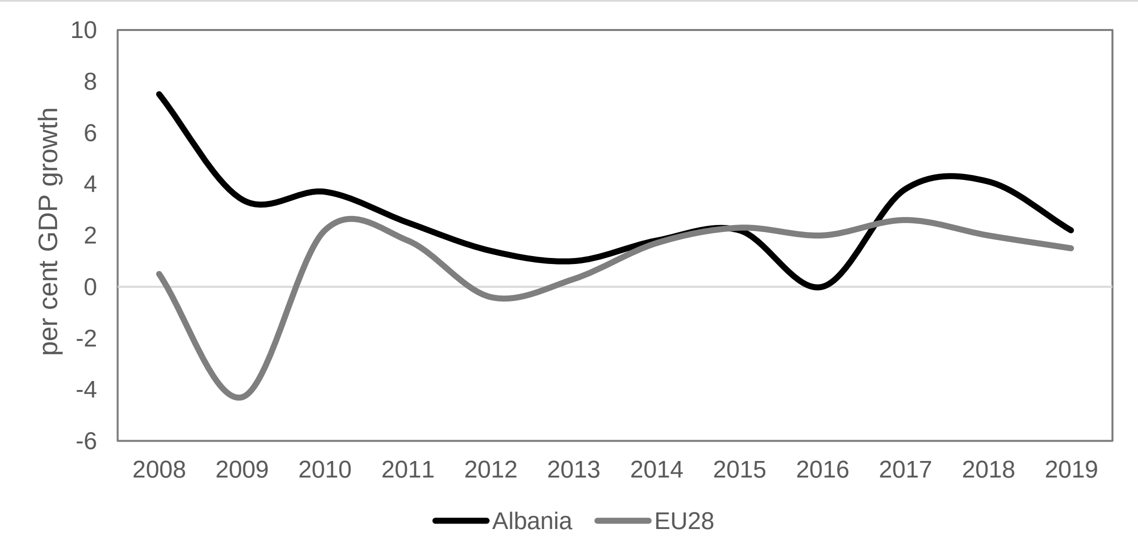
Source: World Bank.

Over the past decade, Albania's economic growth path slightly resembles that of the EU. Looking at Figure 2 below, one can observe that GDP growth in Albania and the EU follows the same pattern. This

[4] In June 2014, Albania was awarded candidate status by the European Union. In April 2018, the Commission issued an unconditional recommendation to open accession negotiations.

is explained, at least in part, by the increasing interdependence of the Albanian market and economy with that of the European Union and its members.

Figure 2: Annual growth in GDP volumes for Albania and the EU-28, 2008-2019



Source: Eurostat, World Bank.

The Albanian economy is reliant primarily on services, which account for 47.5% of its GDP, followed by industry at 29.9% (including construction and manufacturing) and agriculture at 18.4% (European Commission, 2020a). Key industries include hydropower, tourism, textiles, mining and metallurgy. Albania's main export markets are: Italy (the destination for 52.1% of all exports), Kosovo (8.7%), Germany (5%), Greece (4.2%) and North Macedonia (2.8%) (European Commission, 2019). The reliance of the country's export market on Italy is marked. Despite its openness to trade, Albania remains poorly integrated into global supply chains. Albania mainly exports manufactured goods such as textiles, construction materials and minerals. Regional trade with Western Balkan neighbours increased by 6% in 2018 but is highlighted by the European Commission as not having yet reached its full potential (European Commission, 2020a). Albania has a large trade deficit in goods, which is offset by a surplus in services driven to a large extent by tourism (see Table 1 for key economic figures).

Table 1: Economic fundamentals in Albania, selected years

Key economic figure	2011-2016 Average	2017	2018	2019
Exchange rate against EUR	139.48	134.14	127.57	123.01
Current account balance (% of GDP)	-9.9	-7.5	-6.8	-7.6
Net foreign direct investment (% of GDP)	8.0	8.6	8.0	7.6
General government balance	-3.9	-2.0	-1.6	-1.9
Government debt (% of GDP)	67.1	70.2	67.7	66.3

Source: Eurostat.

A major exogenous shock to Albania's economy came in the form of an earthquake in November 2019. The earthquake – measuring 6.3 on the Richter scale – caused damage equivalent to an estimated

7.5% of its GDP (World Bank, 2020b). The tourism and housing sectors were hit hardest as a result of the crisis. Four months later, in February 2020, international support was mobilised for a EUR 1 billion relief package to support people who had lost their homes and help the reconstruction effort. Low hydropower production in 2019 (due to low rainfall) compounded the negative impact upon the economy (European Commission, 2020b). Despite this, growth remained positive in 2019 but at a lower rate of 2.2%, compared with 4.1% in 2018, suggesting that Albania had weathered the economic storm caused by the consequences of the earthquake. In early 2020, the COVID-19 pandemic adversely affected the Albanian economy. In the second quarter of 2020, Albania had an economic contraction of 10.2% compared to 2019, followed by a contraction of 3.5% in the third quarter. Trade, transport and hospitality services, important branches of Albania's economy, were the most affected, with a 27% decrease in output. Tourism, which accounts for more than 20% of Albania's GDP, was one of the sectors most affected by the pandemic: in July 2020, the number of foreign tourists was found to have decreased by 61.5% compared with the previous year (OECD, 2021).

Compared with the 2019 level, GDP contracted by 3.8% in 2020 as tourism and services shrank abruptly (World Bank, 2021). Given the significant negative effect of the pandemic on Albania's large tourism industry, the extent of this damage was highlighted by a press release from the Albanian Tourism Union confirming that around 5 million overnight bookings had been cancelled for the summer of 2020 (EBRD, 2020). The unemployment rate rose by 0.2% and labour force participation fell from 60.4% in 2019 to 59.5% in 2020. Even remittances declined by 9.6% during the period January-September 2020 as against the same 2019 period (World Bank, 2021). Exports to Albania's main export market, Italy, fell by more than 17% in the first 7 months of 2020. The government implemented two economic support packages by the end of August 2020, worth 2.8% of GDP (EBRD, 2020). The packages consisted mainly of increased government expenditure, sovereign guarantees and one-off social transfers, and were designed to stem the emerging economic crisis by supporting businesses and employees' incomes through direct social transfers. For 2021, the World Bank estimated that GDP would grow by 4.4% as exports, consumption and investment began to rebound (World Bank, 2021).

Looking to the future, the potential growth sectors are all nature-based; coastal tourism, agriculture and mining are all cited as being promising areas of growth (European Commission, 2020a).

3.2 The Albanian labour market and skills of the workforce

Albania has a young population, of which almost half were 34 years of age or less in 2019 (ETF, 2020c). As seen in Table 2, the activity rate (aged 20-64) has improved over time, standing at 76% in 2019. The employment rate is lower than in the EU (67% in 2019 compared with 74% in the EU. In both cases, there is a clear difference between genders. In 2019, the employment rate for men stood at almost 75% in 2019, against only 60% for women. The shares of the various economic sectors in the total employment indicate the still important role of agriculture (36% employed in agriculture), followed by almost 44% in services and 20% in manufacturing and construction (ETF 2020a). Rather old data collected in 2013 research found that women were nearly twice as likely as men to be employed as family workers, mostly in informal employment or in vulnerable jobs. Women spend significantly more time than men in unpaid work (INSTAT, 2013).

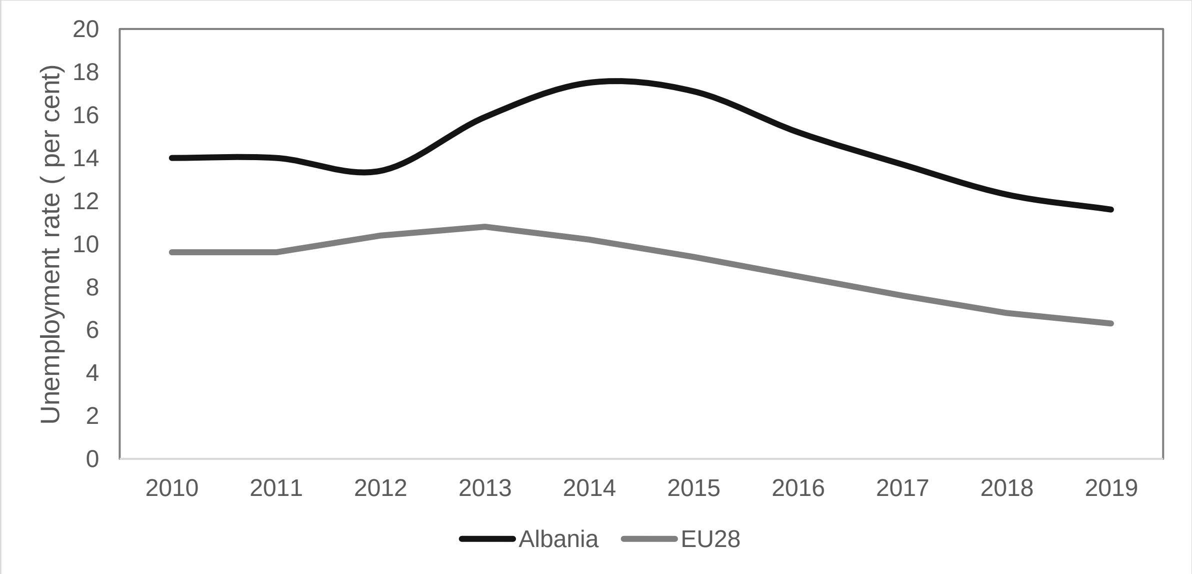
Table 2: Key employment statistics in Albania and the EU-28 (20-64 age group)

INDICATORS	Albania			EU-28		
	2010	**2019**	**Change**	**2010**	**2019**	**Change**
Population size (million and percentage change)	2.92	2.86	-0.2	503.2	513.1	+2
Population aged 34 years and under (%)	53.6	48.0	-5.6	41.2	38.8	-2.4
Activity rate (20-64) – Total	69.7	75.9	+6.2	75.5	78.7	+3.2
……Men	81.2	84.4	+3.2	82.7	84.6	+1.9
……Women	58.9	67.6	+8.7	68.4	72.9	+4.5
Employment rate (15-64) – Total	53.5	61.2	+7.7	64.1	69.3	+5.2
……Men	63.1	68.2	+5.1	70.0	74.5	+4.5
……Women	44.5	54.4	+9.9	58.2	64.1	+5.9
Unemployment rate (15+) – Total	14.0	11.5	-2.5	9.6	6.3	-3.3
……Men	12.6	11.6	-1	9.6	6.1	-3.5
……Women	15.9	11.4	-4.5	9.6	6.5	-3.1
Youth unemployment rate (15-24)	30.5	27.2	-3.3	21.2	14.3	-6.9
Employment rate of recent graduates (% aged 15-34)	**2015**	**2019**	**Change**	**2015**	**2019**	**Change**
…..Graduates of ISCED 3-8	45.7	58.6	+12.9	78.4	81.8	+3.4
…..ISCED 3-4 general programmes	35.5	46.8	+11.3	70.0	72.9	+2.9
ISCED 3-4 vocational programmes	50.3	64.5	+14.2	76.4	80.5	+4.1
Youth not in employment, education, training (NEET % aged 15-24) – Total	29.6	25.5	-4.1	12.0	10.1	-1.9
……Men	28.2	25.8	-2.4	11.8	9.9	-1.9
……Women	31.1	25.3	-5.8	12.3	10.4	-1.9

Source: Eurostat, EU LFS data, INSTAT and ETF 2020a (KIESE Database).

The unemployment rate, with little difference between men and women, stood at 11.6% in 2019, which is above the EU rate of 6.3%. The trend in unemployment among people in the 15+ age group resembles that of the EU. Despite the economic impact of the 2019 earthquake, unemployment continued to fall: from 17.6% in 2015 to 11.6% in 2019 (Figure 3). Much of the progress in reducing unemployment levels is threatened by the impact of Covid-19 (at least over the short term). However, the unemployment rate for young people (aged 15-24) remains high, at 27% in 2019, although progress has been made in bringing it down since its peak of almost 40% in 2015 (INSTAT, 2021b).

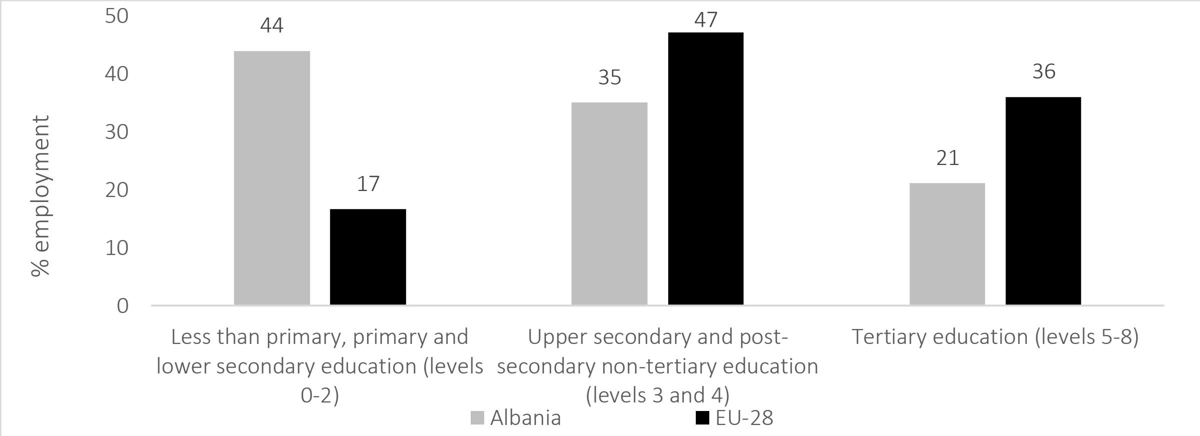
Figure 3: Unemployment rate of population aged 15+ in Albania and the EU-28, 2010-2019



Source: INSTAT, Eurostat.

With respect to the demand for skills, one can obtain an indication of this by looking at the educational attainment levels of the workforce and the occupational distribution of employment. These are imperfect indicators of current skills demand in the economy, but they are readily available and comparable across countries, and thereby provide an immediate indication of how skills demand varies over time and between countries. By way of context, Figure 4 compares the educational attainment levels of the workforce in Albania and the EU-28 average. It shows that 21% of employed people in Albania had a tertiary education (compared to 36% in the EU) in 2019, while 35% were educated to upper secondary level (compared to 47% in the EU). However, Albania has a relatively large share of employed people with a low level of education compared to the EU (44% versus 17%).

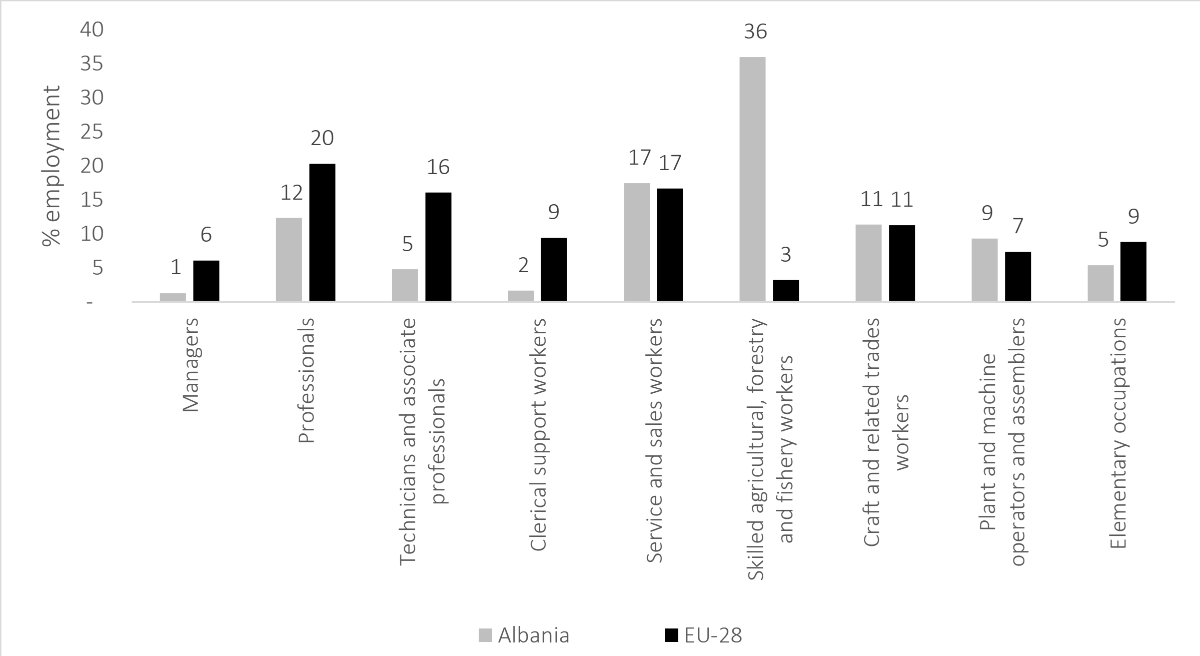
Figure 4: Educational attainment levels of employed people in Albania and the EU-28, 2019 (%)



Source: INSTAT; Eurostat.

Figure 5 compares the occupational distribution of all employment in Albania and the EU-28. The results reveal a high dependency on employment in agriculture in Albania (36% vs 3%) and less employment in high-skilled occupations (managers, professionals and associate professionals). The total share of high-skilled occupations was 18% in 2019, compared to 42% in the EU.

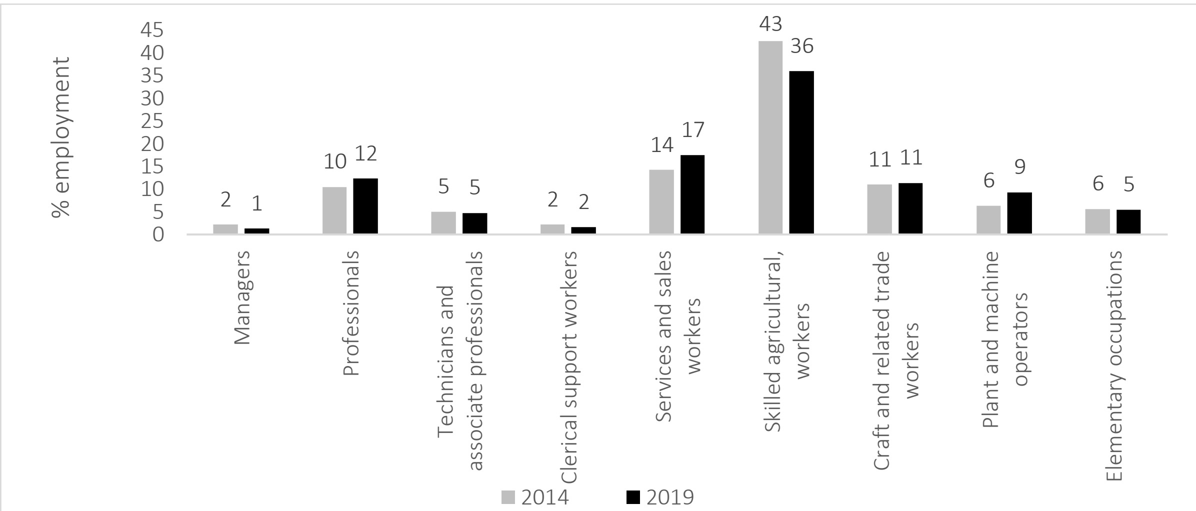
Figure 5: Occupational distribution of employment in Albania and the EU-28 in 2019 (%)



Source: INSTAT; Eurostat.

However, the evolution in the occupational distribution of employment from 2014 to 2019 shows signs of change and improvements (Figure 6). The share of employed people increased in professional jobs (12%) and services and sales jobs (17%), while it decreased in jobs related to agriculture. Over the same period, the share of people in employment with a tertiary education increased from 17 to 21%, the share with a medium level of education remained the same at 35%, and the share of people with a low level of education fell from 47 to 43%. Overall, the evidence indicates that the workforce is gradually becoming better educated and qualified, but skill levels remain much lower than those found on average across the EU-28.

Figure 6: Occupational distribution of employment in Albania, 2014 and 2019 (%)



Source: INSTAT.

Besides the considerable rise in the share of adult population achieving a tertiary education, the share of early school leavers and young people ‘not in education, employment or training’ (NEETs) has been decreasing over the last decade. Nevertheless, despite the decrease in the number of NEETs, the figure is still high, as it stood at 25.5% for the 15-24 age in 2019 (ETF 2020a), which is more than double that in the EU (10% in Eurostat, 2020). The number of NEETs with a university degree stood at almost 29%, compared with 21% of those in the same age group with a lower level of education. In the EU, the rate of people who are NEET tends to be inversely related to their level of education: the percentage of NEETs is very low for those with a tertiary education and very high for those with a low level of education (European Commission, 2020a).

Albania is working on upgrading its delivery of skills development. In March 2019 it adopted the Employment Promotion Law, which set up the National Agency for Employment and Skills (NAES). The NAES coordinates its employment services with VET providers to deliver better quality and a more strategic delivery. It is duty bound to map skills needs in the economy and develop ALMP and VET courses that meet identified skills gaps for businesses. According to the World Economic Forum (2019), the ‘skill level’ of the Albanian workforce is ranked within the first 50 of the 140 countries, but it scores relatively low under the ‘quality of vocational training’ (56th), ‘digital skills’ (81st) and ‘the ease of finding skilled employees’ (102nd).

Contrary to other Western Balkan countries, enrolment in vocational programmes is low in Albania. About 18% of all upper secondary students enrolled in VET schools in 2019 (with a very slow increase), while 82% pursued a general education. The VET system in Albania has undergone substantial changes in the last decade (ETF, 2019a-b). Two separate state-funded VET provider systems (vocational schools and vocational training centres) operated from 2014 until 2017 under the Ministry of Social Welfare and Youth, who took over VET responsibility from the Ministry of Education in 2013. Cooperation between VET and industry was weak and curriculum implementation was mostly theoretical, often lacking the relevant practice (ETF, 2020b). In 2015, the VET law allowed for the organisation of internships in companies, but this form of vocational practice was not common and was piloted largely through some donor-funded initiatives (e.g. Swiss AlbVET project) (ETF, 2014).

The National Agency for VET and Qualifications (NAVETQ) has developed a framework curriculum, consisting of vocational theory and practice, for each occupational profile. Most of the practice takes place in workshops in VET schools. No formal apprenticeship system has been in place, although informal apprenticeships have been arranged by trades and donors. Pilot dual education programmes are implemented at post-secondary level (banking, tourism, and SME management). The National Employment and Skills Strategy and Action Plan (2014–2020), revised and extended to 2022, provides for the introduction of work-based learning in the Albanian VET system and for the involvement of social partners in curriculum development. A roadmap for establishing a dual VET system was elaborated, which identified the primary need for amendments to the existing legal framework. A new VET law was adopted in February 2017 (Law No 15/2017), providing for the introduction of dual elements in VET and for recruiting school-business liaison persons in all major VET institutions (ETF, 2020b).

Primarily due to the high numbers in agricultural employment, the Albanian labour market has a large informal sector. In 2018, in total, the informal economy was estimated to account for one third of Albanian GDP (European Commission, 2020a). A part of this also involves serious organised crime, which is highlighted by the World Economic Forum as a major problem, with the country ranking 113th out of the 141 countries ranked on the measure in this area (World Economic Forum, 2019). This poses significant challenges to tax collection, labour protection and competition between firms. According to Albania’s Economic Reform Programme assessment of 2018-2020, around 40% of workers did not have a written contract and 30% did not pay social security or healthcare contributions (European Commission, 2018). The scale of low-level or non-paid labour in sectors such as agriculture has negative impacts on the quality of work and hinders the development of a functioning social welfare system.

Given the limited availability of skilled jobs, there has been also a substantial outflow of people from Albania, especially of those with high levels of education. According to INSTAT, in 2019 there were 1 680 000 Albanians living abroad, accounting for around 37% of the country's population. Many of these Albanians live in Italy (39%) and Greece (35%), constituting three-quarters of the total emigrants (INSTAT, 2020d). While less-educated and low-skilled Albanians tend to migrate mostly to Greece and Italy, more highly educated and skilled people tend to emigrate to Western Europe and North America, areas which have adopted more favourable migration policies for the highly skilled (ETF, 2021b). Moreover, in 2018 around 18 200 Albanian students were studying abroad, mainly in EU countries (Italy in particular) (UNESCO, UIS database).

A recent ETF study (2021b) points to an increasing number of highly educated Albanians leaving the country as the nature of past low-skilled migration has evolved towards emigration of skilled and high-educated professionals for better jobs abroad. Therefore, the 'brain drain' poses a substantial threat to the Albanian economy (Albanian Government, 2018a). At the same time, Albania consistently relies on foreign immigrants to meets its labour market needs: the World Economic Forum ranks Albania in position number one for the hiring of foreign labour, due to its liberal work/visa regulations which facilitate the large inflow of labour immigrants. At the end of 2019, the number of foreigners with residence permits in Albania was 13 507: overall, 66.4% of these immigrants originated from Europe (8 971 people), mainly from Italy (2 753), Turkey (1 730) and Kosovo (1 703). Over half of the migration to Albania occurs for employment reasons (55%), and around a quarter for family reunification reasons (27%) (INSTAT, 2020c).

In relation to these developments, businesses in Albania have highlighted continuing skill gaps. For example, the skills gap in IT is particularly challenging. The number of people working in the ICT sector in Albania has grown by 15% from 2012 to 2016 (ETF, 2018) with ICT & media experts in high demand and evidence indicating that demand outstrips supply (ETF, 2019a-b). Currently, ICT is the third most popular programme among VET students, followed by tourism and hospitality, and automotive mechanics (ETF, 2019a). Some innovative projects have been developed in relation to IT training on a microscale, in the S4J pilot which brought together 11 tech companies in Tirana to provide students with practical assignments. Overall, however, these remain on a very small scale (ETF, 2018).

3.3 The structure of the Albanian energy sector

Given the characteristics of the Albanian energy sector (e.g. the availability of hydroelectric power, the presence of an important gas pipeline – the Trans Adriatic Pipeline/TAP), the ideal definition of the sector is referred to according to the following NACE sub-sectors in the country:

- D 35 Electricity, gas, steam and air conditioning supply
- B 05 Mining of coal and lignite
- B 06 Extraction of crude petroleum and natural gas
- B 09 Mining support service activities
- E 36 Water collection, treatment and supply
- E 38 Waste collection, treatment and disposal activities; materials recovery
- E 39 Remediation activities and other waste management services
- F 42.9 Construction of water projects and other civil engineering projects
- H 49.5 Transport via pipeline

As already mentioned in Chapter 2.1, the list shows that not all sub-sectors of NACE B, D and E could be considered to be part of the energy sector. There are also other sub-sectors – H49.5 (Transport via pipeline) and F42.9 (Construction of water projects and other civil engineering projects) – which could be considered to be part of the energy sector in Albania.

The inclusion of the NACE sub-sector E (water collection, treatment and supply) is due to the country's dependence upon water as a source of energy. In fact, Albania belongs to a small group of countries that produce 90% or more of their electricity supply from hydropower.5 The River Drin cascade alone, in particular, accounts for the majority of electricity production in the country. While guaranteeing zero carbon-emitting energy production, this dependence on hydropower is threatened by the variation in rainfall caused by climate change. The problem worsens during the summer when hydropower plants (HPP) must compete with agricultural demand for water. Overall, according to the World Bank, electricity generation can vary from 6 000 GWh in a year to less than half that in drier years. Table 3 below provides a breakdown of the Albanian energy sector as well as a visualisation of the country's energy mix for electricity production.

Table 3: Detailed breakdown of the Albanian energy sector

Indicator	Value	Details
Estimated CO_2 emission per capita	1.94 tonnes	World average: 4.5 tonnes
Estimated oil reserves	400 million tonnes	
Estimated coal reserves	794 million tonnes	
Estimated natural gas reserves	850 million m³	
Coal production	31 ktoe	27% of 2019 yearly consumption
Oil production	1005 ktoe (note 1)	93% imported for further refining
Natural gas production	64 ktoe	Only 10% consumed locally
Wood and biomass production	160 ktoe	90% used only for heating
Average electricity consumption	7.3 TWh (note 2)	Referring to 2020 energy mix
Average electricity production	5,8 TWh	79% of the yearly demand
Imported energy	2.355 TWh	32% of the yearly demand
Exported energy	0.96 TWh	16% of national yearly production
Estimated energy losses	1.5 TWh	26% of national yearly production

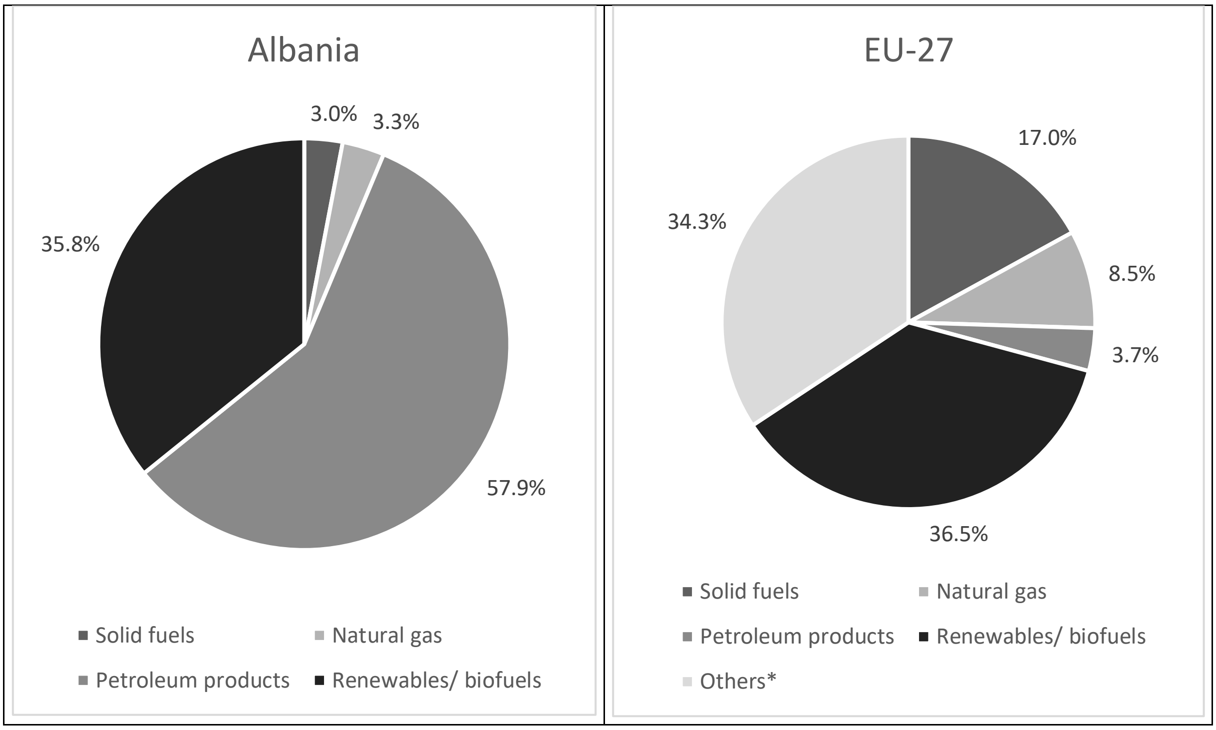
Source: INSTAT (http://www.instat.gov.al/al/temat/mjedisi-dhe-energjia/energjia/#tab2)
Notes: (1) ktoe means 'thousand ton of oil equivalent'. TOE (Tonne of Oil Equivalent) is a unit of energy defined as the amount of energy released by burning one tonne of crude oil. It is approximately 42 gigajoules or 11.630 megawatt-hours, although as different crude oils have different calorific values, the exact value is defined by convention; several slightly different definitions exist. (2) Megawatt-hours (MWh), gigawatt-hours (GWh), and terawatt-hours (TWh) are often used for metering larger amounts of electrical energy to industrial customers and in power generation. The terawatt-hour and petawatt-hour (PWh) units are large enough to conveniently express the annual electricity generation for whole countries and the world energy consumption. The watt-hour is a unit of energy equal to one watt of output for an hour, which is equal to 3,600 joules. While the watt is the SI unit of power, electrical power consumption is usually measured in Kilowatt-hours (kWh) for a household. A kilowatt-hour is a unit of energy equal to outputting one thousand watts for one hour, equalling to 3,600,000 Joules.

According to Eurostat, the total primary energy production in Albania stood at 1.7 million toe in 2019, which was 39% higher than in 2009. Out of this, petroleum products contributed to 57.9% of the total, which is the highest in the Western Balkans (Table 4). This is followed by energy production from

[5] These include: Norway, Paraguay, Democratic Republic of Congo, Nepal, Namibia, Zambia, Tajikistan, Ethiopia and Kyrgyzstan.

renewables (35.8%), which has increased its share by 17.7% since 2009. Solid fuels (e.g. wood, coal, charcoal, peat, corn, wheat, rye, dry dung) constitute 3% of Albanian energy production, while another 3.3% comes from natural gas (Figure 7). Eurostat also indicates that Albania produced 88.5% of its electricity from renewable energy sources in 2019. However, its electricity generation was more or less the same in 2019 as in 2009, with many fluctuations over time. (Eurostat, 2021). Moreover, in 2019 36.7% of Albania's energy consumption came from renewables, which is 5.2 percentage points higher compared to 2009 (Eurostat, 2021).

Figure 7: Sources of the energy mix in Albania and EU-27, 2019



Source: Eurostat, 2021.

Table 4: Primary energy production in the Western Balkans and the EU-27, 2009 and 2019

Countries	Total production (thousand toe)		Share of total production, 2019 (%)				
	2009	2019	Solid fuels	Natural gas	Petroleum products	Renewables/ biofuels	Others*
Albania	1 251	1 735	3.0	3.3	57.9	35.8	0.0
BiH	-	5 405	63.0	0.0	0.0	37.0	0.0
Kosovo	1 845	1 849	81.3	0.0	0.0	18.7	0.0
Montenegro	549	735	53.8	0.0	0.0	46.2	0.0
N. Macedonia	1 608	1 143	75.3	0.0	0.0	24.7	0.0
Serbia	10 195	10 219	66.8	3.4	9.2	20.6	0.0
EU-27	669 033	615 947	17.0	8.5	3.7	36.5	34.3

Source: Eurostat 2021. Note: (*) Nuclear energy is the main source under the column 'others'.

In 2019, Albania imported 31.5% of its total energy consumption, but its energy dependency rate has decreased by 14.8% since 2009. In 2019, the highest share of final energy consumption was recorded in transport (40.2% of total energy consumption), followed by households (24.3%) (Table 5). Compared to other countries in the region, the share of household consumption is still low. Similarly, the industry share of final energy consumption is also low (17.7%), as it is for other sectors (services and agriculture) with 17.8%. This is probably due to a lower level of industrial production, for instance compared to Serbia and North Macedonia, and to the EU-27 average.

Table 5: Analysis of final energy consumption by sector, 2019 (% of total)

Countries	Transport	Households	Industry	Others*
Albania	40.2	24.3	17.7	17.8
BiH	30.0	38.3	16.8	14.9
Kosovo	28.2	38.7	19.8	13.3
Montenegro	33.8	31.0	17.5	17.7
N. Macedonia	39.0	24.4	23.2	13.4
Serbia	25.6	31.7	24.2	18.5
EU-27	29.4	25.0	24.3	21.3

Source: Eurostat 2021. Note: (*) Others include services and agriculture.

Regarding fossil fuels, the petroleum sector in Albania is significantly dominant, and during the last half-century it has been a driving force for the local economy and a central part of the country's energy mix. Historically this sector has helped and diversified local economies especially in the central and southern regions where this industry is situated. On the other hand, the oil sector relies on often outdated infrastructure, which hampers the country's energy efficiency (European Commission, 2020a). As refining and further treatment capacities are not in place, raw materials such as petroleum coke are being used by the metal and cement industries whilst other by-products are exported mainly to Greece and Italy for further refining (Beqiraj, 2010). On the other hand, poorly refined oil is imported and marketed in Albania. More than 67% of imported oil is used by the transport sector, thus contributing to increased pollution in the most urbanised areas (National Agency of Natural Resources, 2017).

The key challenges for the energy sector in the light of the climate risk are to diversify energy supply, increase efficiency and savings, and improve management of the network. One programme for diversifying the energy network is the Trans-Adriatic pipeline project (TAP), which will transport gas from Azerbaijan to Western Europe through Northern Greece, Albania and Italy. The Albanian government aims to convert the Vlora oil-fired power plant (built in 2011 with funding from the EBRD, European Investment Bank and World Bank) into a gas-fired version when the pipeline project is complete, which ought to help stabilise energy demand in the summer months. Another pilot plan is for a gas thermal power plant (GTPP) producing 500 MWe (megawatt electric-power) to be built near Korca City[6] to provide both thermal input for households during winter and, at the same time, to produce electric energy for the south-east regions. Bearing in mind that more than 85% of households use wood for heating and cooking, mostly during wintertime, it is expected that the pollution levels and the unsustainable exploitation of the surrounding forests will be reduced by the GTPP.

In 2019, 30% of electricity output in Albania was generated by private providers. Much of this has come from fixed-price power purchase agreements (PPAs) which incentivise the installation of more

[6] The official website provides more information on this project: http://www.gppkorca.com/#secondPage

hydropower generation by offering investors 15-year contracts for the electricity produced. This progress comes after several steps were taken to liberalise and unbundle the energy market. This has not yet reached European parity, with prices remaining largely regulated and customers remaining unable to change supplier (due to the Power Sector Law). Under the Economic Reform Programme (ERP), two reform measures are currently being implemented by the government in the energy sector: firstly, the further liberalisation of the energy market; and secondly the diversification of energy sources and promotion of renewables. For the former, the market is still made up of regulated contracts between state-owned generation and private supply companies. For the latter, a target of 38% renewable energy consumption in 2020 has been achieved, and a new target of 42% renewable energy consumption by 2030 has been agreed upon in the revised National Energy Strategy (European Commission, 2020a; Albanian Government, 2018b).

Albania and Kosovo are establishing common ground as they set up their day-ahead markets, which are to be operated as two bidding zones by the Albanian Power Exchange ALPEX, established by the transmission operators of Albania and Kosovo in October 2020. Full operation is foreseen to start by the end-2021 (Energy Community, 2021). Electricity sources for Albania became more internationally diversified in the 2010s, with greater connection to Montenegro and Greece in particular. A new connection with North Macedonia is also in progress (European Commission, 2020a). Alongside the TAP, which transits gas through Greece and Albania to Italy and Western Europe, this signals an increasingly international energy integration for the Albanian market.

In terms of renewable energy sources, Albania has generous natural resources beyond its water supply, including solar radiation and consistent wind speeds (especially in mountainous areas). Hence there is strategic potential for solar photovoltaic and onshore wind electricity development. Recently market-based support schemes for renewables (including both solar and wind) have been implemented, adhering to defined mechanisms and auction practices. The government is currently working towards implementing the full legal framework and establishing the entity in charge of its implementation. The quotas and long-term auction schedules are not yet defined.

The share of energy created through renewable sources varies because of technical and non-technical losses of electricity – 12% in 2007 and 31% in 2010 (Kumar et al, 2019) – slowly but steadily growing over the past decade, reaching the 38% target in 2020. To support renewable energy's potential, the Albanian government has amended its national renewable action plan to a target of 490 MW of solar power and 150 MW of wind power by 2020. Moreover, in spite of some progress made in recent years, electricity distribution losses in 2018 remained high at 24.4%, partially hampering the investments made to increase the share of renewables in the country's energy mix (European Commission, 2020a). The constantly falling costs of renewables offer a long-term low-cost solution to Albania's energy requirements. This is important because a series of droughts as seen on the scale of 2007 will lead to serious electricity shortages. In addition, Albania has been investing in increasing energy efficiency, adopting an action plan that aims to reduce energy use by 6.8% by 2020 (European Commission, 2020a). All of these factors will help Albania reach its commitments under the 2016 Paris Agreement.

As already mentioned, hydropower is a crucial source of energy for Albania. According to estimates, annual energy production from Albania's largest hydropower plants could drop by 15% by 2050 and from smaller plants this figure could be 20%, due to the decreasing supply of water (World Bank, 2010). This lack of reliability has resulted in up to 60% of electricity supply being imported from neighbouring countries over recent years (European Commission, 2020a). Another major concern that should be taken into account is the impact of both large hydropower plants and small hydropower plants on surface waters. For the fifth consecutive year, more than 5000 hectare/ha (combined urban and agricultural areas) were flooded (Exit News, 2021). These events indicate clearly that rainfall is now more concentrated throughout the winter season and that the high waters flowing from the HPP cascades into the lowlands of north-west Albania are causing damage especially to the agriculture sector. Waters are often left in freefall to protect the dams, cascades and pipelines during the peak flow, resulting in flooding of lowland areas even after the rainfall stops.

Focusing on the electricity sector, residential housing is responsible for 49% of total electricity consumption in Albania, making it the sector with the largest electricity consumption in the country (IFC & AKBN, 2010). Overall electricity consumption per capita has quintupled since 1991 (Kumar et al, 2019). The dominant forms of thermal energy in residential consumption are electricity (54%), burning wood (37%), and oil by-products (LPG) (9%) (Albanian Government, 2017). The residential housing sector is characterised by low efficiency in both thermal comfort (insulation, heating and cooling, etc.) and the energy consumption of domestic appliances. On the other hand, natural gas is used mainly for cooking and heating. Supply of gas is manual and decentralised, since there are no national gas networks supplying communities.

The housing sector contributes up to 96 000 tons/year of CO_2 emissions, making it a key area of Albania's climate footprint.[7] These figures take into account the losses due to the low efficiency of electrical appliances, as well as the generally poor insulation of Albanian housing. Available data shows that at least 29% of the annual energy consumption of a typical 75-80 m^2 apartment is lost energy. This results in 28 800 tons of CO_2 produced because of poor insulation and outdated appliances.

3.4. Main actors and policies in the energy sector

A number of different stakeholders operate in the Albanian energy sector, both in the definition and implementation of policies and in the delivery of services to citizens. The key public authorities in the Albanian energy sector are briefly listed below.

The Ministry of Infrastructure and Energy and the dedicated directorates with responsibility for energy policies: the mission of the Ministry is to draft and implement national policy in the urban planning and development sector, in infrastructure and in the energy, use of energy resources and mining sectors, among other tasks.

The Albanian Energy Regulator Authority (ERE): the mission of the ERE is to ensure a sustainable and secure electricity supply for customers by establishing an operational and competitive electricity market, and to regulate electricity generation, transmission, distribution and supply activities. ERE discusses energy prices and tariffs with the three national energy operators: (i) Energy of Albania (KESH); (ii) Transmission System Operator (OST); and (iii) Electric Power Distribution Operator (OSHEE), the latter being the largest public electric power distribution operator in Albania.

National Gas Operator (Albgaz): the Albgaz is a publicly owned company performing the activity of transmission system operator and natural gas distribution system operator in Albania.

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7 The term 'climate footprint' refers to a measure of the full set of greenhouse gases (GHGs) controlled under the Kyoto Protocol. It is a measure of the total amount of carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6) emissions of a defined population, system or activity, considering all relevant sources, sinks and storage within the spatial and temporal boundary of the population, system or activity of interest. Calculated as carbon dioxide equivalent (CO2e) using the relevant 100-year global warming potential (GWP100).

Albanian Power Exchange (ALPEX): established by the transmission system operators OST (Albania) and KOSTT (Kosovo), the Albanian power exchange operator will operate the day-ahead market coupling between Albania and Kosovo starting from the end of 2021. ALPEX is then expected to extend its services to the intraday market segment in the future.

Energy Efficiency Agency (EFICENCA): recently established, the agency is responsible for the preparation and monitoring of the implementation of the National Action Plan for Energy Efficiency, along with monitoring the implementation of energy efficiency programmes.

National Agency of Natural Resources (AKBN): the AKBN supervises and monitors the use of natural resources in Albania, overseeing the development and rational use of natural resources.

In line with the efforts by these actors to modernise the energy sector, Albania has committed to different international agreements around climate action. For instance, in 2016 Albania signed the Paris Climate Change Agreement.[8] Under the Paris Agreement, each country commits to 'intended nationally determined contributions (INDC)' and reports developments to the United Nations (UN) within the Framework Convention on Climate Change (UNFCCC), based on enhanced transparent procedures.[9] According to its INDC, Albania is committed to reducing CO_2 emissions by 11.5% between 2016 and 2030. This should result in a 708 kT carbon-dioxide emission reduction by 2030[10] and should allow Albania to reach a longer-term target, following a smooth trend, of 2 tonnes of greenhouse gas emissions per capita by 2050 (UNFCCC, 2016).

As an EU candidate country since 2014, Albania is in the process of transposing the EU *acquis* into its legislation and received bilateral EU support under the Instrument for Pre-accession Assistance (IPA II), amounting to a total of EUR 758 million in 2014-2020 (EC, 2020b). As per Chapter 15 of the EU *acquis* on energy policies, the country is working to align its energy policies relating to supply, infrastructure and distribution, to liberalise its internal energy market, to diversify energy production sources including renewable energy, and to increase energy efficiency. With regard to energy efficiency, the EU has established a legislative framework that includes the Energy Performance of Buildings Directive 2010/31/EU (EPBD) and the Energy Efficiency Directive 2012/27/EU, which were both amended in 2018 and 2019. In particular, the Directive amending the Energy Performance of Buildings Directive (2018/844/EU) introduces new elements on the EU's commitment to modernise the building sector.

Albania's Economic Reform Programme (ERP 2020-2022) clearly recognised inefficiencies in the energy sector, including insufficient security in the energy supply. The country has adopted legislation on the liberalisation and unbundling of the gas and electricity markets in line with the EU's third energy package, and implementation is progressing (EC, 2020a). Albania must, for example, fully align its Energy Efficiency Law with the *acquis* and adopt implementing legislation related to the Energy Performance of Buildings Directive; it must also complete alignment with the EU *acquis* on minimum stocks of crude oil and/or petroleum products (Directive 2009/119/EC), and hydrocarbon licensing (Directive 94/22/EC) (EC 2020b).

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[8] As of June 2021, 197 states and the EU have signed the agreement and 190 have solidified their support with formal approval for implementing the UN Framework Convention on Climate Change. Signatory members promised to reduce their carbon output as soon as possible and to do their best to keep global warming below 2 ºC.

[9] See UN Climate Change, Secretariat, UNFCCC

[10] kT (kiloton) is the unit of measurement, often calculated and reported as elemental carbon for carbon dioxide emissions.

As per Chapter 21 of the EU *acquis*, the country is also expected to promote trans-European and trans-regional networks. Albania's electricity system has already been connected with neighbouring systems in Greece and Montenegro since 2014. The connection between Tirana and Pristina was completed in 2016 but has still not been put into operation due to an ongoing dispute between the transmission operators of Serbia and Kosovo (EC, 2020b). The construction of a connection with North Macedonia is under preparation, while work on the Trans-Adriatic Pipeline (TAP) project, a major natural gas connection between Greece and Italy through Albania, was 99% completed in June 2020 in the onshore Albanian part[11] (EC, 2020b).

In addition to this, the European Commission adopted a comprehensive Economic and Investment Plan for the Western Balkans in October 2020, which aims to spur the long-term economic recovery of the region, support green and digital transitions, and foster regional integration and convergence with the EU. Clean energy is among the six priority areas for investment (EC, 2020c). The six priority areas of investment are sustainable transport, clean energy, the digital future, the private sector, human capital, and environment and climate. The Economic and Investment Plan sets out a substantial investment package mobilising up to EUR 9 billion of funding for the region. Supported through the new instrument Guarantee for the Western Balkans, Albania can obtain up 20 billion euros in the next 10 years to this end (EC, 2020c).

Following the EU Green Deal, Albania also committed to the Sofia Declaration on the Green Agenda for the Western Balkans in November 2020 during the EU-Western Balkans summit, with the aim of supporting and accelerating changes and processes in the region under the overarching goal of addressing climate change. The Sofia Declaration on the Green Agenda for the Western Balkans builds on five pillars: (1) climate, energy, mobility (including transportation); (2) circular economy; (3) depollution; (4) sustainable agriculture and food production; (5) biodiversity. The action points from the Agreement include prioritising energy efficiency across all sectors, increasing the share of renewable energy sources, and aligning with EU Climate Law and the EU Emissions Trading Scheme. Specifically in relation to the energy sector, Albania, as one of the signatory parties, has committed to work **towards the 2050 target of a carbon-neutral continent together with the EU**[12]. In addition to a strict climate policy and a reform of the energy and transport sectors, the following actions in particular were agreed upon:

- align with the EU Climate Law once it is adopted with a view to achieving climate neutrality by 2050;
- develop and implement integrated energy and climate plans with clear measures designed to reduce greenhouse gas emissions in the Western Balkan economies by integrating climate action into all relevant sectoral policies;
- prepare and implement climate adaptation strategies to increase resilience through climate proofing of investments and to ensure greater integration of climate change adaptation with disaster risk reduction;

[11] The Trans Adriatic Pipeline is part of the Southern Gas Corridor, transporting natural gas from Azerbaijan at the Caspian Sea to Europe, starting from Greece and passing through Albania and the Adriatic Sea to Italy. Connecting with the Trans Anatolian Pipeline at the Greek-Turkish border, the TAP crosses Northern Greece, Albania and the Adriatic Sea before coming ashore in Southern Italy to connect to the Italian natural gas network. As it is designed to enhance energy security and diversify gas supplies for several European markets, the TAP project has been supported by the European institutions. Construction of the pipeline started in 2016 and it became operational in 2020. For more information, see Trans Adriatic Pipeline (TAP) (tap-ag.com).
[12] https://berlinprocess.info/wp-content/uploads/2021/02/Leaders-Declaration-on-the-Green-Agenda-for-the-WB.pdf

- continue the alignment with the EU Emissions Trading Scheme, as well as work towards introducing other carbon pricing instruments to promote decarbonisation in the region;
- increase opportunities for the deployment of nature-based solutions to mitigate and adapt to climate change;
- in view of the launch of the European Climate Pact, consider development of a similar mechanism in the region or possibilities for the region to participate in this initiative;
- review and revise, where necessary, all relevant legislation to support the progressive decarbonisation of the energy sector and secure full enforcement, notably through the Energy Community;
- cooperate in the preparation of an assessment of the socio-economic impact of decarbonisation at individual-economy and regional level with a view to a just transition;
- prioritise energy efficiency and improve it in all sectors;
- support private and public building renovation schemes, secure appropriate financing and full enforcement of the Energy Performance of Building Directive (adapted under the Energy Community framework);
- increase the share of renewable energy sources and provide the necessary investment conditions, in line with the EU and Energy Community acquis and target;
- strive to decrease and gradually phase out coal subsidies, strictly respecting state aid rules;
- actively participate in the Coal Region in Transition initiative for the Western Balkans;
- develop programmes for addressing energy poverty and financing schemes for household renovation and providing basic standards of living.

Indeed, the Ministry of Infrastructure and Energy, in cooperation with Expertise France, is currently conducting a dedicated study to extract and interpret data on energy poverty in Albania as it is one of the only West Balkans countries (along with BiH) that does not report or indicate anything on the matter (Energy Community, 2021).

Following all these commitments, Albania has adopted a framework legislation for electricity and gas in line with the National Energy Strategy 2018-2030. However, implementation lags behind in some crucial respects, such as poor infrastructure and energy efficiency, lack of transposition of the EU REMIT regulation on wholesale energy market integrity and transparency (EU/1227/2011), as well as the lingering dependence of publicly owned companies (Energy Community, 2020). It has made progress in preparing the regulatory framework for renewable energy. After achieving the target of 38% in 2020, the revised National Renewable Energy Action Plan (NREAP) set the new target of 42% for the share of renewable sources in total energy consumption by 2030. Its plans to diversify its electricity production away from hydropower and towards alternative sources of renewable energy go hand in hand with finalising the legal and functional unbundling of energy companies and removing legal obstacles to customers' rights to change their energy supplier, as well as with improving its Energy Efficiency Law and adopting legislation related to the Energy Performance of Buildings Directive.

Electricity supply and distribution are undergoing a lengthy reform process that started in 2018 and is directly supported by KfW Development Bank and ADF (Agence de Développement Française). The reform focuses on the following aspects:

- functional unbundling and restructuring of OSHEE, to be transformed into a holding company with three subsidiaries, respectively licensed as the distribution system operator (OSSH), the universal service supplier (FSHU) and the electricity market supplier (FTL). This is expected to be finalised by the end of 2021;

- enforcing market opening and price deregulation, eliminating the excessive public service obligation that impedes the development of market competition;
- legal and functional establishment of the Albanian Power Exchange Company (ALPEX) in line with approved Market Model and Market Rules. ALPEX will be operational by the end of 2021;
- implementation of market-based balancing mechanism and rules, taking place by the end of 2021;
- adoption and implementation of a support scheme for vulnerable customers;
- increasing the powers and independence of the ERE (Albanian Energy Regulator Authority) and OST (Transmission System Operator).

The gas supply and distribution sector has also been undergoing a broad reform, albeit with a slower implementation process. The main critical element is the absence of a wholesale market for natural gas. On the other hand, the retail market has well-developed supply and customer protection legislation, and all customers are eligible. Another issue is the unbundling and enhancing of the independence of operators. At present, two transmission system operators are certified in Albania: TAP and ALBGAZ. Both operators adopted the codes and standards set by the ERE, while third party access is regulated through tariffing methodology. Another critical point is the absence of infrastructure to support the direct supply of gas to households: Albania has some limited interconnectivity to the European energy market via the TAP, but the internal gas network distribution is underdeveloped.

The oil supply/distribution sector is another critical area for the Albanian energy sector, suffering from outdated infrastructure and slow reforms. The sector has burdensome stockholding obligations, as the industry is required by law to hold stocks equal to at least 90 days of average sales. The reporting system and calculation methodology, however, do not comply with Directive 2009/119/EC on the maintenance of minimum stocks of crude oil and/or petroleum products. The oil sector is also one of the key contributors to environmental pollution, and yet legislation still needs to be amended to ensure that sulphur content in gas oil for non-road mobile machinery (NRMM) is less than 10 mg/kg. There is also a lack of rigorous monitoring of oil quality during distribution, raising questions regarding the quality of fuels for end users.

Finally, the environmental impact of the energy sector should also be addressed. As already mentioned, 98% of electricity production is based on renewable sources, and is therefore carbon neutral. On the other hand, hydropower is particularly vulnerable to climate change, being subject to any variations in rainfall and surface water levels. As for nature protection, serious efforts are needed for the proper implementation and enforcement of the EU Directives on Environmental Impact Assessment (EIA Directive 2011/92/EU and SEA Directive 2001/42/EC 'Strategic Environmental Assessment'). Energy projects, in particular the numerous planned hydropower projects, must comply with national and international nature protection rules and obligations. Finally, the quality of environmental reports (in particular the assessment of effects on nature and biodiversity and the assessment of the cumulative impacts of projects) must be improved.

3.5 Employment in the Albanian energy sector

Despite the ideal definition of the sector as explained before (Chapters 2.1 and 3.3), the number of observations in each of these sub-sectors was not big enough to give us reliable results on employment characteristics in the sector. Therefore, this chapter used the overall employment statistics from the following NACE sub-sectors – thanks to Labour Force Survey data provided by INSTAT for 2014 and 2019:

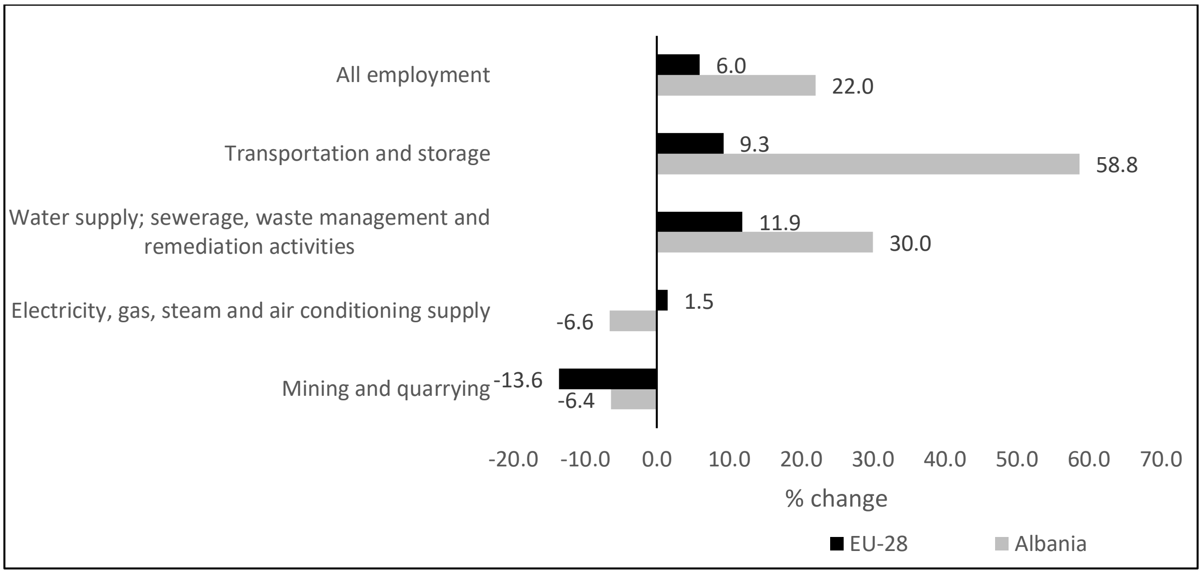
B - Mining and quarrying
D - Electricity, gas, steam and air conditioning supply

E - Water supply; sewerage, waste management and remediation activities
H - Transportation and storage.

Obviously, not all employment in these sectors is concerned with energy supply and the numbers presented below should be taken as indicative. Sector D (Electricity) is the most important one given that it is almost wholly concerned with energy production. The other sectors (B, E, H) have important roles to play too in electricity generation and distribution, but sub-sector H (Transport) is perhaps the least important, considering the fact that only H 49.5 is directly linked to the sector, while other parts are not (and this is the sector with significant employment). Nevertheless, by looking at employment changes in these sectors it is possible to gain an insight into the Albanian energy sector's shifting skill needs.

Figure 8 compares changes in employment in each of these four sectors (B, D, E, H) listed above in comparison with the EU-28. Over the 2014 to 2019 period, overall employment across all sectors in Albania increased by 22% compared with 6% in the EU-28. There is substantial variation by sector: employment increased strongly in sectors H-Transport and E-Water in Albania, while it decreased slightly in sectors D-Electricity and B-Mining (but less so than in the EU-28).

Figure 8: Employment change in the selected sectors in Albania and the EU-28, 2014-2019 (%)



Source: INSTAT; Eurostat.

To give an indication of the scale of the energy sector in Albania, Table 6 shows the percentage of employment accounted for by each of the four individual sectors (B, D, E, H). Employment in the energy sector is by no means intensive. Except for H-Transportation, each sector accounts for less than 1% of employment (around 9 000 people in D-Electricity, around 7 500 in B-Mining, and around 10 700 in E-Water) and the shares have not changed much over the period between 2014 and 2019. In total around 27 300 people were employed in the three sectors (D-Electricity, E-Water, B-Mining), 2% from the total figure for employment (1 260 000 in 2019). The employment numbers in sector H-Transport are not included in this total figure as very few jobs are directly related to energy activities (only H 49.5). Despite accounting for a relatively small share of overall employment, however, it is a strategically important sector given its role in maintaining modern living standards and providing the means to power the economy.

Table 6: Share of employment accounted for by energy and energy related sectors in Albania and the EU-28, 2014 and 2019 (%)

Energy sub-sectors (NACE)	Albania			EU-28	
	2014 (%)	2019 (%)	Employment level 2019	2014 (%)	2019 (%)
B-Mining and quarrying	0.8	0.6	7 507	0.4	0.3
D-Electricity, gas, steam and air	0.9	0.7	9 046	0.7	0.7
E-Water supply, sewerage, waste	0.8	0.8	10 738	0.8	0.8
H-Transportation and storage	2.3	3.0	38 215	5.1	5.3
Total – all NACE activities	100.0	100.0	1 265 583	100.0	100.0

Source: INSTAT; Eurostat.

As a result, very few people employed in energy production are specialised in running hydropower plants, and most employment is in the energy distribution sector. Based on national expert estimates, the public Electric Power Distribution Operator (OSHEE) registers approximately 6 000 employees, while some 470 people are employed by private companies in the electricity sector, mostly dealing with operation and maintenance of the system. The energy efficiency branch of the sector also employs an estimated 140 energy auditors and managers. As for experts in the subject, one can count around 45 people working in academia in fields related to the energy sector, both in public and private universities, as well as more than 20 freelance experts in the field. The most in-demand qualification in the energy sector is that of electrician (ETF, 2014).

Closely related to the energy sector is the extraction industry[13]. In Albania, there are around 580 licensed companies that operate in the sector, employing more than 5 870 people. 55% of these (around 3 500 employees) work in chrome extraction, while around 31% (2 000 employees) work in the limestone extraction sector. Looking more specifically at the four sectors, employment would appear to be less skilled in all of them compared with the EU-28 average (Table 7). For example, the share of high-skilled occupations (first three occupations in Table 7) is the highest in D-Electricity (35%), followed by B-Mining (26%), and E-Water and H-Transport (around 15% each) – but all are lower than in the EU-28. On the other hand, the share of low-skilled occupations (last four occupations in Table 7) is 79% in H-Transport, 69% in both B-Mining and E-Water, and 54% in D-Electricity.

Table 7: Occupational distribution of employment in energy and energy related sectors in Albania and the EU-28, 2019 (%)

Occupational groups	B-Mining		D-Electricity		E-Water supply		H-Transportation	
	ALB	EU28	ALB	EU28	ALB	EU28	ALB	EU28
1.Managers	3	6	-	7	1	5	3	5
2.Professionals	9	14	19	23	4	8	7	5
3.Associate professionals	14	12	16	29	10	18	4	9
4.Clerical support workers	0	6	8	14	5	10	6	20
5.Service & sales workers	4	2	3	2	11	2	3	5

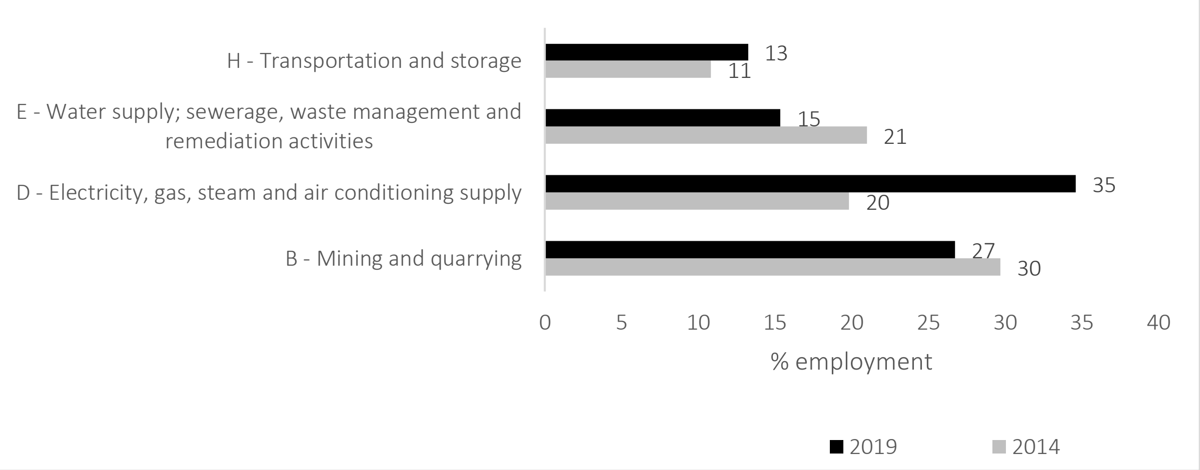
[13] National Agency of Natural Resources, Link: http://www.akbn.gov.al/wp-content/uploads/2021/03/Raport-per-tregeusit-minerar-te-realizuar-n-v2020-ne-Shqiperi-1.pdf

6.Skilled agricultural work.	0	0	0	0	1	0	0	0
7.Crafts & trades workers	12	18	42	19	34	10	2	4
8.Machine operators and assemblers	56	38	6	4	5	20	61	44
9.Elementary occupations	1	5	6	2	29	26	16	9

Source: INSTAT; Eurostat.

Figure 9 goes on to show that the share of employment accounted for by high-skilled occupations (managers, professionals, associate professionals/technicians) has increased between 2014 and 2019. The share of high-skilled occupations has almost doubled in the D-Electricity sector, while a small increase was also recorded in H-Transport. On the other hand, there is a significant decrease of higher-level occupations in the E-Water sector as well as in the B-Mining sector.

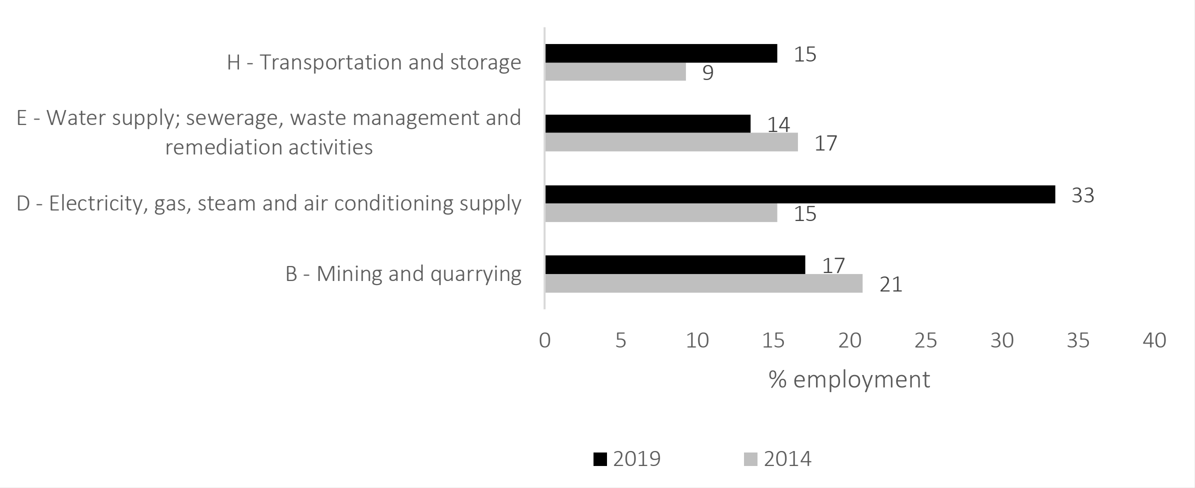
Figure 9: Share of employment in energy and energy related sectors accounted for by higher level occupations in Albania, 2014 and 2019 (%)



Source: INSTAT; Eurostat.
Note: Higher level occupations include three groups: managers; professionals; and associate professionals/technicians.

Similarly, the share of employment accounted for by people with a higher education increased significantly between 2014 and 2019, especially in the D-Electricity sector where it more than doubled (from 15% to 33%), and in the H-Transport sector where it almost doubled (see Figure 10). On the other hand, there is a decrease in higher-level qualifications in the E-Water sector as well as in the B-Mining sector.

Figure 10: Share of employed people with higher level qualifications in energy and energy related sectors in Albania, 2014 and 2019 (%)



Source: INSTAT; Eurostat.
Note: Higher level qualifications include ISCED levels 5-8.[14]

Men account for a large share of employment in the energy and energy-related sectors (almost 85% of workers). Table 8 shows the percentage of employment accounted for by women in the various sub-sectors. While women represent a relatively small share (which has grown in electricity over time), there is not much difference between Albania and the EU-28 on this measure. The relatively small share of employment occupied by women (16%) indicates that energy and energy-related sectors have failed to tap into an important source of labour and skills supply.

Table 8: Share of female employment in energy and energy related sectors in Albania and the EU-28, 2014 and 2019 (%)

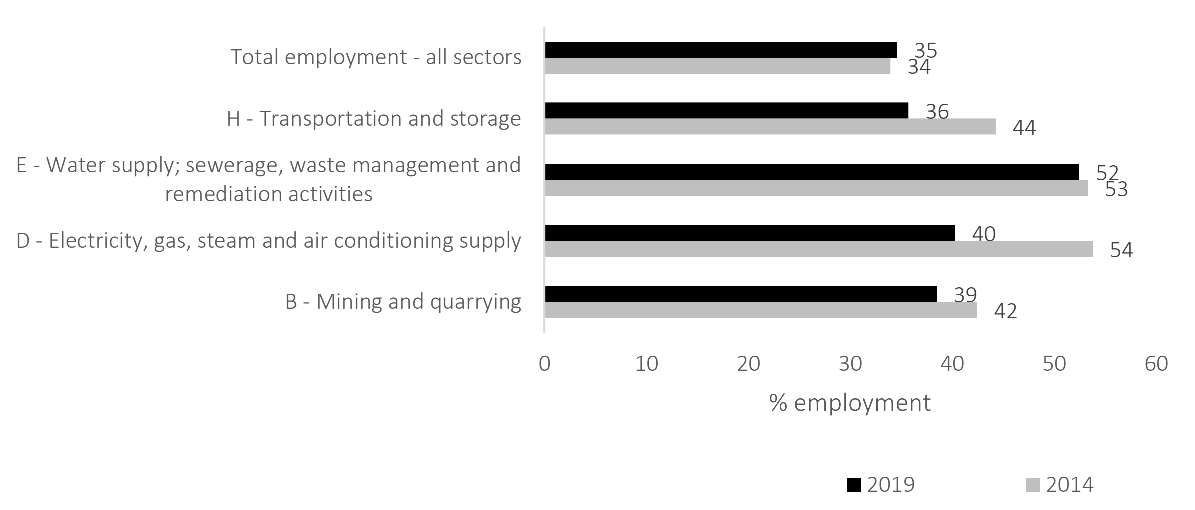
Energy sub-sectors (NACE)	Albania		EU-28	
	2014	2019	2014	2019
B-Mining and quarrying	9	7	12	14
D-Electricity, gas, steam and air conditioning	15	21	24	25
E-Water supply; sewerage, waste	25	19	20	22
H-Transportation and storage	10	11	23	22
Total employment – all sectors	**44**	**44**	**46**	**46**

Source: INSTAT; Eurostat.

Another aspect of employment in the energy sector is the relatively aged workforce. As Figure 11 shows, more than 40% of the workforce in the energy sector in Albania were aged 50 and over in 2019. Thus, there will be an increasing need to replace people who are retiring from the workforce in the energy sector in the future. From the information presented in Table 8, it is clear that there is much scope to increase female employment in the sector to meet emerging employment and skill needs.

[14] http://databaza.instat.gov.al/pxweb/en/DST/START__TP__LFS__LFSV/NewLFSY014/

Figure 11: Percentage of the workforce aged 50 and over in energy and energy-related sectors in Albania, 2014 and 2019



Source: INSTAT.

The information provided above is a *tour d'horizon* of employment and skills demand in the energy and energy-related sectors. The comparisons made over time (2014 and 2019) and with the EU show an increasing demand for skills in the energy sector, although skill levels (as proxied by occupation and educational attainment) remain below those in the EU-28. As the energy and energy-related sectors further develop in the future, it is likely that their skill demands will increase, given current trends. Considering that a substantial share of employees in the sector are aged 50 years and over, it is likely that the sector will need to satisfy an increasing demand for skills and at the same time replace a substantial tranche of its workforce. This potentially poses several challenges to the sector. As the share of employment accounted for by women is small, this suggests an important source of labour and skills which needs to be tapped into in the future.

MAIN FINDINGS OF CHAPTER 3

- The Albanian economy has suffered from two recent shocks (2019 earthquake and Covid-19) and its recovery is not yet complete. It is primarily reliant on services, which account for almost half of its GDP, followed by manufacturing, construction and agriculture. However, more than one-third of total employment is still in agriculture.
- Albania has a young population, but 44% of its employed population had a low level of education and 35% had a medium-level education in 2019. The share of the tertiary-educated workforce was 21%, while the share of high-skilled occupations (managers, professionals and associate professionals) was 18% in 2019, compared to 42% in the EU. During the last 5 years, there has been an increasing number of professionals and sales workers. Due to the limited number of skilled jobs, the country is suffering from a 'brain drain' because many citizens (particularly those with a tertiary education) want to leave Albania.
- Total energy production in Albania mainly relies on petroleum products (58%) and hydropower (36%). In 2019, almost 90% of electricity production came from hydropower. The country imports one-third of its energy consumption, with the highest levels of consumption in transportation, followed by households and industry.
- The energy sector is undergoing many challenges: climate change is affecting the levels of rainfall and therefore electricity production; the quality of infrastructure is often outdated and not evenly distributed across the country; energy efficiency, closely related to the state of the infrastructure as well as the quality of buildings (i.e. quality of insulation, efficiency of household appliances, etc.).
- Albania is part of the Paris Climate Agreement and an EU candidate country committed to transposing the EU acquis into its legal framework. Within this context, the country has adopted several policies and legislation for diversifying energy production sources, using renewable energy sources of solar and wind power, improving energy efficiency, and liberalising energy markets for customers to change their supplier.
- Analysing employment statistics from the four NACE sectors (B-Mining, D-Electricity, E-Water and H-Transport), the energy sector is not employment intensive, constituting around 2% of total employment (around 27 300 people in 2019. Over the period 2014-2019, employment in E-Water and H-Transport increased substantially, which was not the case in the other two. Men comprise the majority of the workforce with women accounting only for 16% in the sector, and more than 40% of the workforce was aged 50 and over in 2019. Thus, there will be an increasing need in the future to replace people who are retiring from the workforce.
- High-skilled occupations (managers, professionals, and associate professionals) in the energy sector are found most in the D-Electricity sector (35%), followed by the B-Mining (26%), while the figure is around 15% each in E-Water and H-Transport (all lower than in the EU-28). On the other hand, the share of low-skilled occupations is very high in the H-Transport sector (79%), B-Mining and E-Water (both 69%) and represents over half of the workforce in the D-Electricity sector. There has been a significant increase in the proportion of the workforce with a higher education from 2014 to 2019, implying an increasing skill demand in the energy sector – a more-than-twice increase in the D-Electricity sector and almost double in the H-Transport sector.

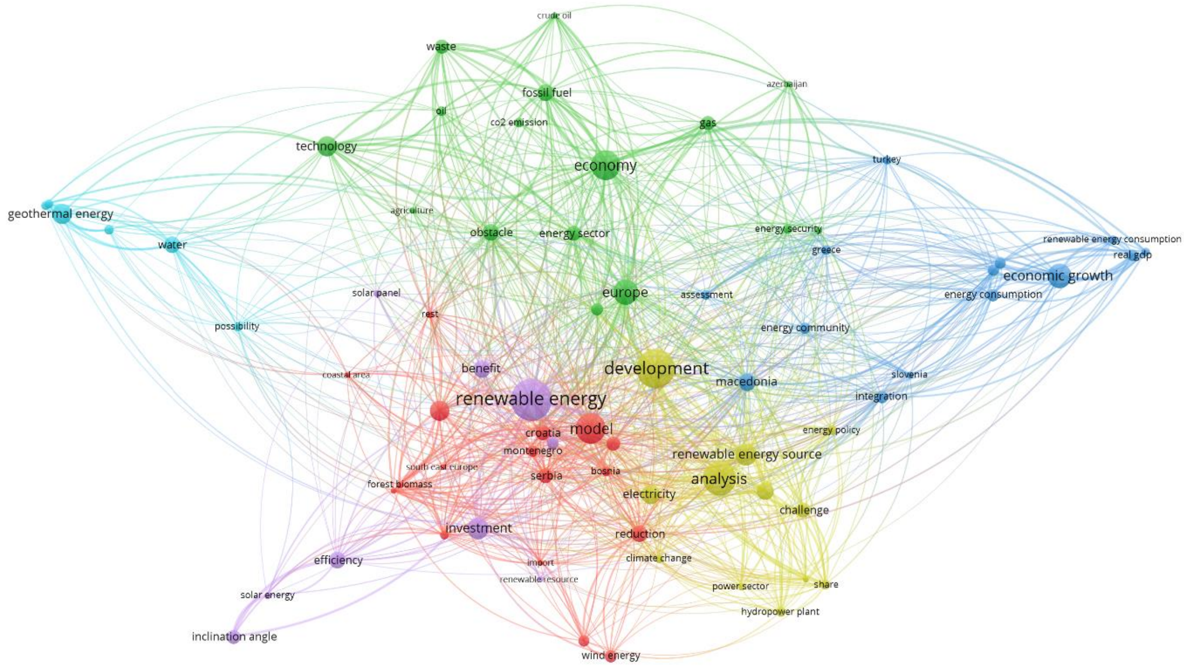
4. KEY DRIVERS OF CHANGE IN THE SECTOR

After outlining the broad contours of employment and skill demand in the energy sector, this chapter moves towards a more detailed analysis of skill needs – i.e. what are the actual skills people use in their jobs and how are they likely to change in the future? Chapter 4.1 primarily focuses on understanding the main factors that are driving the change and shaping the sector at the moment (e.g. climate change, energy efficiency, new technologies, international regulations). Chapter 4.2 gives special attention to the role of innovation by looking at the patents and scientific papers from the country. The last chapter, 4.3, reviews the evolution of new technologies in the energy sector, based on the European patent applications, under seven clusters: solar, wind, hydro, transmission and distribution, thermal, oil/gas transport, and energy efficiency.

4.1 Identifying the main drivers of demand

Fast technological development is a major factor influencing the demand for skills. But technology does not account for everything. There are many other factors, social, economic, and environmental, which shape future skill needs. In order to study all the possible drivers of change, the entire Scopus and Web of Science databases were searched to find scientific papers and conferences related to the energy sector in Albania. In addition, websites were ‘scraped’ for direct information and access to various studies. The documents gathered were scanned with text mining tools to extract the most relevant keywords, which were then clustered using network analysis. Figure 12 provides a snapshot of such a clustering process.

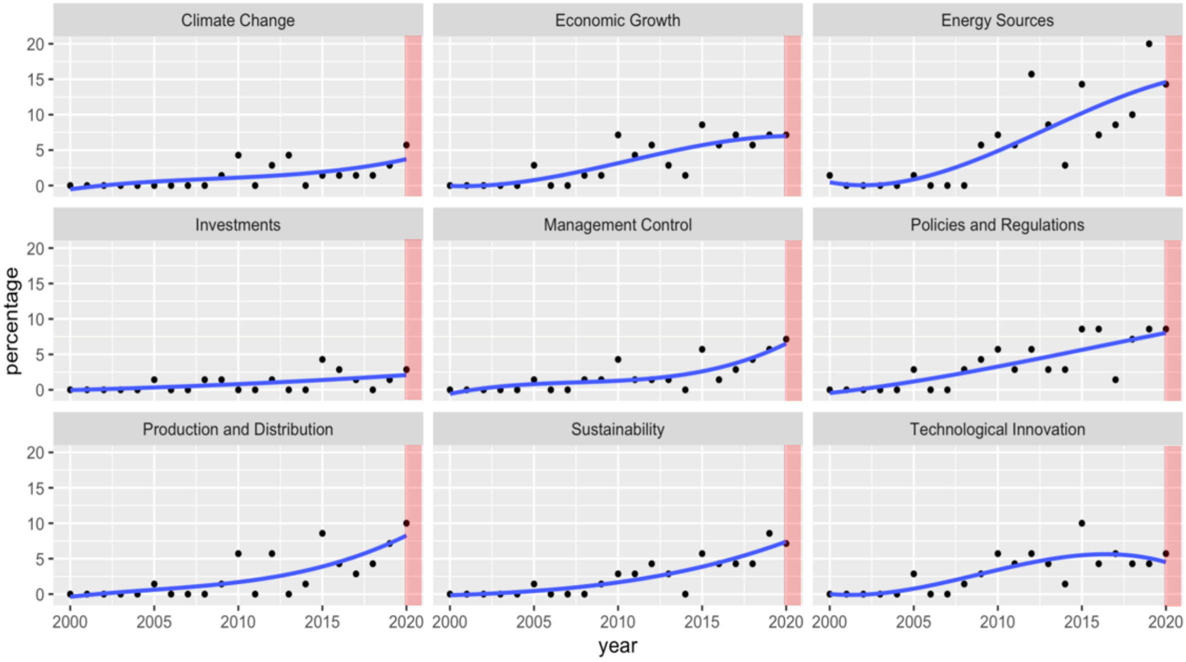
Figure 12: Network diagram of keywords related to the energy sector in Albania from the big data analysis of scientific papers on energy



Browsing the network of correlations between the topics provides an understanding of the relationships between them. For instance, the network diagram confirms the importance of renewable sources of energy for the future of the Albanian energy sector – for the development of the sector itself, and for the development of the entire country. An analysis of the links that connect nodes to each other shows that the links are not only to the main types of renewable energy sources (wind energy, solar energy, geothermal energy, etc.), but also to topics related to technology and development, such as investment or energy policies. An inspection of all the clusters provides the basis for identifying potential candidates for drivers of change.

Drivers of change are important factors that strongly influence the evolution of future scenarios. By combining the clustering with an analysis of changes over time (i.e. the number of scientific papers each year), it is possible to identify whether observed phenomena are increasing (see Figure 13 as an example) and thus whether their impact will extend in the years to come. Based on the text-mining analysis summarised in Figures 12 and 13, a series of change drivers were identified in the Albanian energy sector. Each of these is able to bring some changes to the sector and, in turn, may cause new profiles to be created within it. These drivers are classified under the 11 headings listed below.

Figure 13: Distribution over the years of key concepts identified from the big data analysis of scientific papers on energy



Availability of energy sources

The sources available to the country for producing energy at affordable prices clearly affect any possible developments. So far, the country has taken advantage of its massive water reserves to develop a large hydropower network to produce most of its electricity. There are still some new big investments taking place in this context (e.g. Devoli Hydropower and Skavica Hydropower), but some studies have emphasised that Albania will be one of the most water-stressed countries by 2040. Given this risk, it is important for Albania to diversify its sources of energy production (such as wind and solar energy). The interviews confirmed that efforts taken in this direction are to be less dependent on water, mainly through new projects for the construction of large solar power plants. In terms of wind energy, licences have been issued but no major investments have been made to date. Moreover, the TAP is making use of the affordable natural gas available to power thermal plants, and projects are underway to take advantage of this. It is the presence (or lack) of sources of energy and their abundance or scarcity that drives policymakers to adopt strategic investment plans that lead to new skills and competencies in the system.

Economic growth and increased energy consumption

The EU's Economic and Investment Plan for the Western Balkans, of which Albania is part, aims to stimulate the region's long-term recovery. In particular, it intends to promote a green and digital transition, develop regional economic cooperation, stimulate economic growth and support the reforms necessary to converge with the path of the EU. The resources that will be activated are particularly significant and include sustainable transport and energy connectivity, green and digital transformation. While the economic growth of the Balkan countries would lead to greater energy consumption by definition, issues like renewable energy and the greening of economic sectors are attracting more attention. For this reason, Albania needs investments for this type of energy (as descried by the driver 'investments'). Interviews have confirmed that from 2009 to 2016, domestic energy consumption has increased by 10%; based on this trend more energy will be needed in the future.

Adequacy of infrastructure

Infrastructure, both for power plants and for distribution pipelines or distribution grids, are necessary for the correct functioning of the energy sector. Due to its geographical position, Albania is an important link for the distribution of energy resources from the east of Europe and Central Asia to end users in the Mediterranean area. Various gas pipelines cross through Albania: the TAP has recently been inaugurated (17 October 2020) and the construction of the Eurasia gas corridor is planned. The Albanian government aims to use the TAP facilities to bring natural gas as an energy production source. From both big data analysis and interviews, it emerges that some structures and equipment are considered antiquated and are in need of an overhaul for the purposes of security and better management control. The current grid may not have enough capacity to accommodate for the future needs of the country; moreover, obsolete infrastructure creates energy waste and inefficiencies.

Environmental sustainability

Despite the preference for renewable energies, the construction of the infrastructure necessary to produce energy in the country may lead to some collateral environmental impact. A case in point is the long-term environmental impact of developing hydroelectric facilities, which may cause water quality degradation and more frequent floods, for example. The use of water for energy production leads to rising temperatures in reservoirs, with consequences for flora and fauna. The environmental impact and issues relating to sustainability are also leading to the development of new technological solutions for obtaining energy from new types of sources, such as waste-to-fuel and plastic-to-fuel solutions. Another issue is related to the presence of protected areas, which cover about 22% of the Albanian territory and are expected to increase.

Climate change

The rise in energy consumption linked to economic growth increases the exploitation of the territory, but has major consequences for the environment. According to statistical studies (Fida et al., 2009; Luo et al, 2015; Valcheva, 2018), like all the other countries on the Balkan peninsula, Albania will have to cope with warmer temperatures and significantly less precipitation in the future. Climate change is found to have a significant impact on water resources and, in turn, on Albania's power sector, which is more than 90% dependent on hydropower and, consequently, on climate conditions. The expected reduction in rainfall will intensify over Albania (around 25% in the north, 21% in the central region, 24% in the south, and 20% in the coastal area) and it could cause serious problems for hydropower. The expected irregularities in the climate will also lead to an increased risk of floods in areas with hydropower-related works.

Albania's EU accession agenda and transposition of the acquis

As mentioned in Chapter 3.4, Albania has been a candidate to join the EU since 2014 and a party to the Paris Climate Agreement since 2016. Therefore, the country is in the process of transposing the *EU acquis* into its legislation, including energy policies and greening of the sector. It is working to align its energy policies relating to supply, infrastructure and distribution, liberalise the internal energy market, diversify energy production sources including renewable energy, increase energy efficiency and promote trans-European and trans-regional networks. For example, national plans for energy production contain targets and roadmaps to improve energy efficiency in all sectors, which are requirements of the EU Directives on energy efficiency use, energy services and energy performance. The government's strategy is to maintain objectives aimed at increasing the use of renewable resources, improving energy efficiency and reducing CO_2 emissions.

State support and incentives within national policies

The energy sector is affected by the various policies and actions of state institutions. Legislation/regulations, state investments/tenders, permits/licences to build plants, controlled tariffs and investment, and tax incentives can all foster the adoption of specific innovations or means of production in a given country. To increase the use of renewable energy in the energy market in Albania, for example, the government provides incentives to promote the production of electricity from renewable sources (solar panels, wind power, plants, etc.). According to interviews, the recent introduction of net metering with price parity (i.e. the same price for the electricity given to and taken from grid) is one initiative that will bring a significant boost to the adoption of solar technologies.

Availability of foreign investments

Albania, like the whole Western Balkan area, is encouraging the injection of foreign capital into the energy sector, and this is also supported by the EU's Economic and Investment Plan for the Western Balkans, adopted by the European Commission in 2020. Given the abundance of energy sources in the country, the development of the energy sector has been a priority for the Albanian government for decades and has materialised in government facilities and subsidies to support investments. Such facilities and subsidies have attracted traditional European energy companies to invest in the country. Various ongoing or planned projects are taking advantage of EU funding and cooperation and loans from the international financial institutions such as the EBRD. The data shows, however, that to take advantage of the great potential of the country, especially the renewable energy potential, further investments are necessary. The importance of new investments for the country, from both national and international investors, was also confirmed during the workshop and the interviews.

Technological innovation

Research and innovative practices are being developed in the management of renewable sources to adapt to EU standards and to improve effectiveness and efficiency throughout all the stages of the energy production process. In Albania, new technologies are being introduced for the direct use of new sources of energy such as solar energy. The use of floating solar panels installed in water reservoirs (already being built in Banja by a Norwegian company), for instance, could be an important direction for future profitable investments.[15] New technologies can also undoubtedly provide more control over processes and plants: the adoption of technologies for monitoring, with sensors and actuators installed in the field, for example, helps to improve the control and the overall safety of the process. Digitalisation in general is one of the key technological developments that will allow smarter and more efficient production, transmission and distribution of energy.

New tools for management and control

The introduction of modern paradigms related to management control in energy production, transmission and distribution becomes one of the most important drivers for reducing inefficiencies and optimising productive performance. Solutions for maximising plant efficiency and monitoring the quality of processes are at the basis of standard modern management procedures and are regulated through energy efficiency action plans. Monitoring the performance of plants ensures process control and identifies potential drifts of production. Interviews confirmed the high level of inefficiency along the energy chain of production-transmission-distribution, at approximately 20% to 25%. Reducing big energy losses can drive the need for future skills and competences. One main game-changer is the growing importance of digital technologies (and thus of related competencies) such as those found in smart grids. Digitalisation will also impact the rapidity and effectiveness of the decision-making process.

Energy efficiency improvement

Energy efficiency simply means using less energy to perform the same task, thereby eliminating energy waste. There are enormous opportunities for efficiency improvements in every sector of the economy, from energy generation and distribution to insulating buildings, transportation modes and industrial production. Improvements in energy efficiency are generally achieved by adopting more efficient technologies (and infrastructure) or by applying commonly accepted methods to reduce energy losses. Although this goes beyond the energy sector itself, the study confirmed the high level of inefficiency along the energy production-transmission-distribution chain in Albania.

4.2 The role of innovation in the sector

This chapter is about technology as a driver of change. The focus is not on technology *per se* but rather on its potential to influence the demand for employment and skills. From a methodological point of view, the interest is in the functional use of technology rather than on its performance or actual content. All technology exists to fulfil a purpose for the user, to solve a real-life problem or provide an advantage. In engineering design theory, the purpose is referred to as the *function* of the technology.

The current literature on the future of work and skills focuses more on the potential of new technologies, but existing empirical evidence is very limited on the actual impact of technology use in companies. By looking at the functional use of the technology – i.e. the actual problem it solves or the actual benefits it offers – it is possible to study its impact on real business. Moreover, even if a specific technology is not eventually adopted, if the need expressed by its functional use is real, in the long term another substitute technology will appear. In this sense, the functional approach allows for an understanding of the

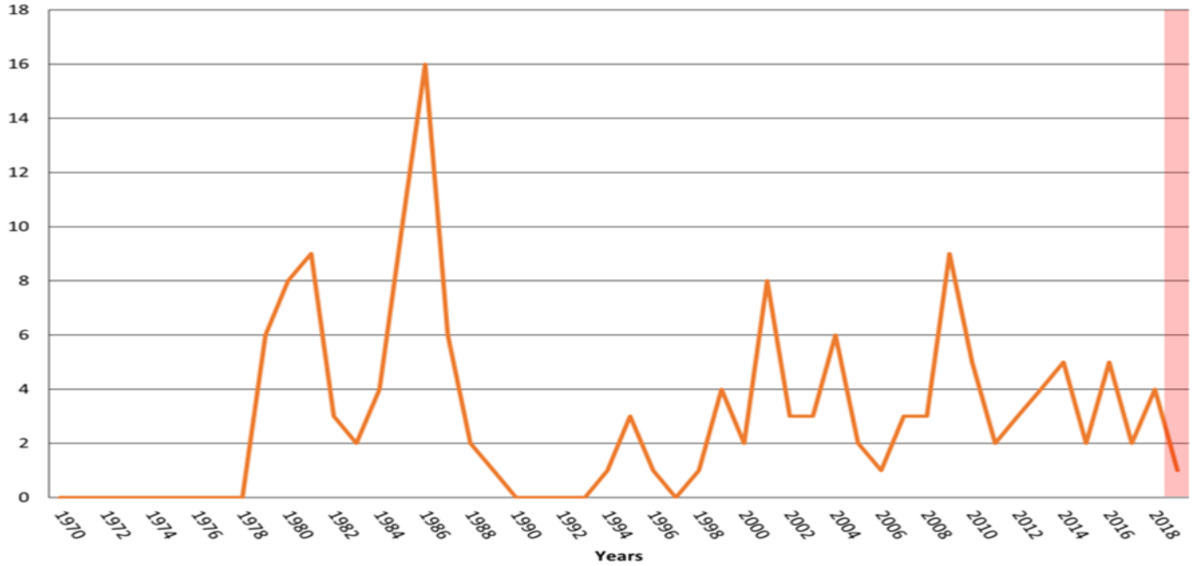
[15] The Banja Floating Solar Plant in Albania is an innovative R&D project implemented by Statkraft with an installed capacity of 2 MWp. Floating solar power involves installing solar panels on floating structures on a body of water, such as a lake, fjord or ocean, or in a hydropower reservoir. See https://www.statkraft.com/en-al/news/news/statkraft-starts-commercial-operations-at-first-floating-solar-plant-in-Albania/

obsolescence and/or resilience of certain jobs or occupations, and for forecasting or even designing the shifts occurring between jobs and the trajectory of skills from one job to another.

Trends in Albania and worldwide

An initial study was carried out on the number of patents filed in Albania without any restrictions in terms of sectors. Such information was useful at the beginning of the analysis in order to understand the tendency of a country to create innovation internally. More precisely, it makes it possible to analyse the growth in the number of Albanian patents filed over the years. Figure 14 shows the number of patents filed at (i) the Albanian National Patent Office, and (ii) issued internationally to companies located in Albania (both national companies and local branches of multinationals), over the years and in all sectors of economic activity.

Figure 14: Albanian patents in all sectors filed over the years



Note: The figures for the last year and a half are masked in red, since the number of patents filed cannot be considered as final during this period; there is an 18-month period of secrecy before a patent application is published. Counting the last 2 years as part of the analysis without keeping this in mind would lead to wrong and distorted interpretations.

The trend in patents in Figure 14 shows how 1990 represents a breaking point for innovation in the country, dividing the graphs into two different periods. The first period begins in the late seventies and shows innovation increasing overall until 1986, when it was then abruptly interrupted because of the political instability from 1989 until the mid-1990s. The second part is characterised by a non-linear trend with repeated ups and downs, and lower numbers. Taking into account the period between 1970 and 2018, there was a total of 263 patents related to the country for all economic sectors. As investment in innovation correlates highly to the growth of the economy and overall stability, the latter trend shows how the innovative capacity of the country is still not resilient or self-sustained.

Moving specifically to the energy sector, it turns out that no patents were filed by Albanian companies or research centres during this period. This does not mean that technology and innovation are not present. The number of patents filed is also linked to the size of country, the number of inhabitants, the general economic situation and the ability to invest in R&D activities, and the tendency to create innovation from within rather than import it from abroad. The last aspect is even more relevant when considering global sectors such as energy: innovative technologies adopted in one country are unlikely to be specific solutions only for the national context, but more likely solutions that are valid on a global scale. As was later confirmed by the interviews, Albania's close relationship with the EU has meant that technological solutions are mainly imported into the country by European companies.

Indeed, Albania receives significant financial/technical assistance in many energy projects from several international donors (including grants, loans and investments). A mapping of donors in the energy sector made by the EU Delegation to Albania in 2020 identified around 35 ongoing projects, mainly funded by the World Bank (seven projects, mostly loans), the EBRD (four projects, mostly loans), Switzerland (four projects with grants), Germany (10 projects with KfW, both loans and grants), USA (four projects with USAID), and the EU projects funded under the IPA and/or other programmes. For example, the EBRD has supported Albania in developing a diversified energy sector through several investment projects linked to power and energy infrastructure, transport, natural resources and environment.[16] The Bank's most recent loan was approved in 2021 to provide support for the OSHEE (the Albanian state-owned holding company of the distribution network entity and retail supplier) due to the Covid-19 crisis.[17]

Even if the energy sector is well funded, a likely explanation for the absence of Albanian patents is that it is less expensive to buy the technologies than to invest in R&D, also because developing the human capital able to generate innovation is a long and costly process. The innovation capacity of a country is not dependent only on the human capital, but the latter is the most complex capacity to achieve. Due to the absence of inventive activity in the sector at the national level, growth will have to rely solely on technologies imported from abroad.

Although not a problem *per se*, since technology is still driving change in the sector, this may become an issue in the long term due to the continued dependency of the country on contributions from outside and the need to train the workforce on imported technologies, in a scenario with an ever-increasing pace of innovation. If Albania is to take full advantage of its potential as a producer of energy from renewable sources, boosting its internal research and development capacity (and thus related occupations and competences) would be an important factor to consider. Figure 15 shows inventive activity related to the energy sector worldwide (all patent offices and all assignees' countries), and the trend is very clear: the number of patents filed worldwide has been growing exponentially over the past 20 years.

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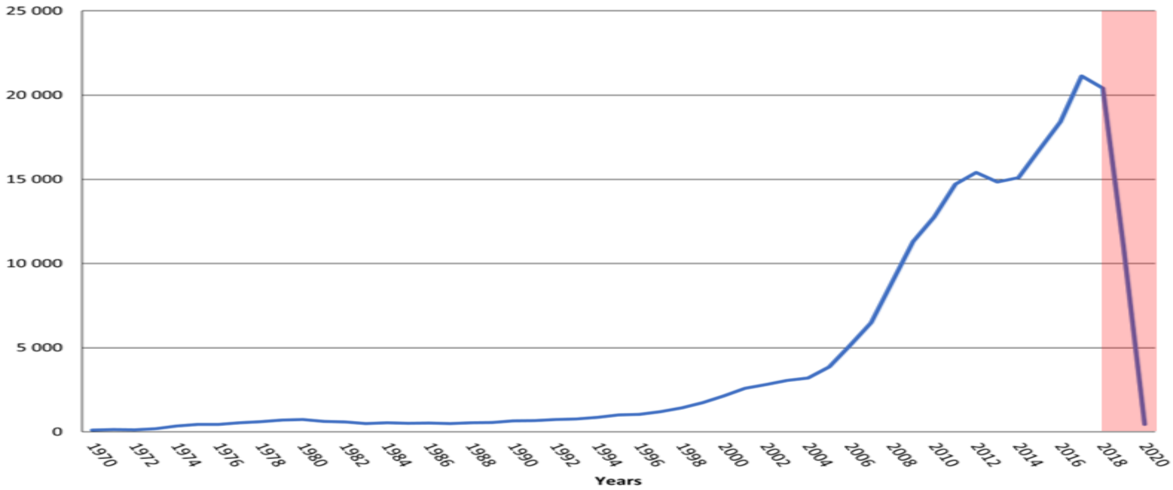
[16] See The EBRD in Albania

[17] See VISP: OSHEE COVID-19 Response (ebrd.com). The loan includes the provision of EUR 70 million to alleviate the liquidity constraints of the OSHEE caused by the continuing Covid-19 crisis and to support the construction of a distribution substation in central Tirana. Among other things, the OSHEE will establish a professional training centre to offer high quality training programmes and target young employees from underserved regions, and a new cooperation will be developed with local technical and vocational education & training institutes or technical colleges.

Figure 15: Worldwide patents filed in the energy sector over the years



4.3 Evolution of the technology landscape

As already explained, the development of technologies related to energy production is a global process that involves global players. Once a beneficial technology has been discovered, it is quickly adopted everywhere. Even if no specific solutions have been patented in Albania, it is likely that the country will refer to patented technologies in foreign countries to boost the development of the sector in the coming years. Indeed, wind farms or solar plants could be built in the country using equipment designed and manufactured abroad; as the same technologies are adopted, the skills needed to build, operate and maintain such facilities are the same as needed anywhere else in the world.

The interviews with stakeholders also confirmed the presence of many European companies working in the energy sector in Albania and that technologies are being imported from abroad. The opening of negotiations for Albania to join the EU and the EU's economic influence in terms of investments and subsidies (which has emerged as one of the change drivers) are some of the factors that support this assumption, confirmed directly in the interviews. Therefore, European patents (i.e. filed at the European Patent Office) relating to the energy sector have been analysed below based on the assumption that those technologies are most likely to be a reference point for Albania as well. Once a general overview of the energy sector has been given, we can define the possible clusters to which each energy patent belongs and the main topics that lie behind them.

Among all the possible European patent subsectors related to energy, both the desk research data and the direct interviews with stakeholders provided useful information for focusing on what is truly strategic for Albania. Direct interviews allowed us to identify not only the current use of resources but also what the government is focusing on for future investments and licenses, and helped to better identify technological clusters. Table 9 lists seven clusters of energy patents relevant for the country, ranked according to the intensity of the innovative activity in descending order.

Table 9: Families (clusters) of European energy patents tailored to Albanian energy sector

Number of patents	Clusters
8 692	Wind energy

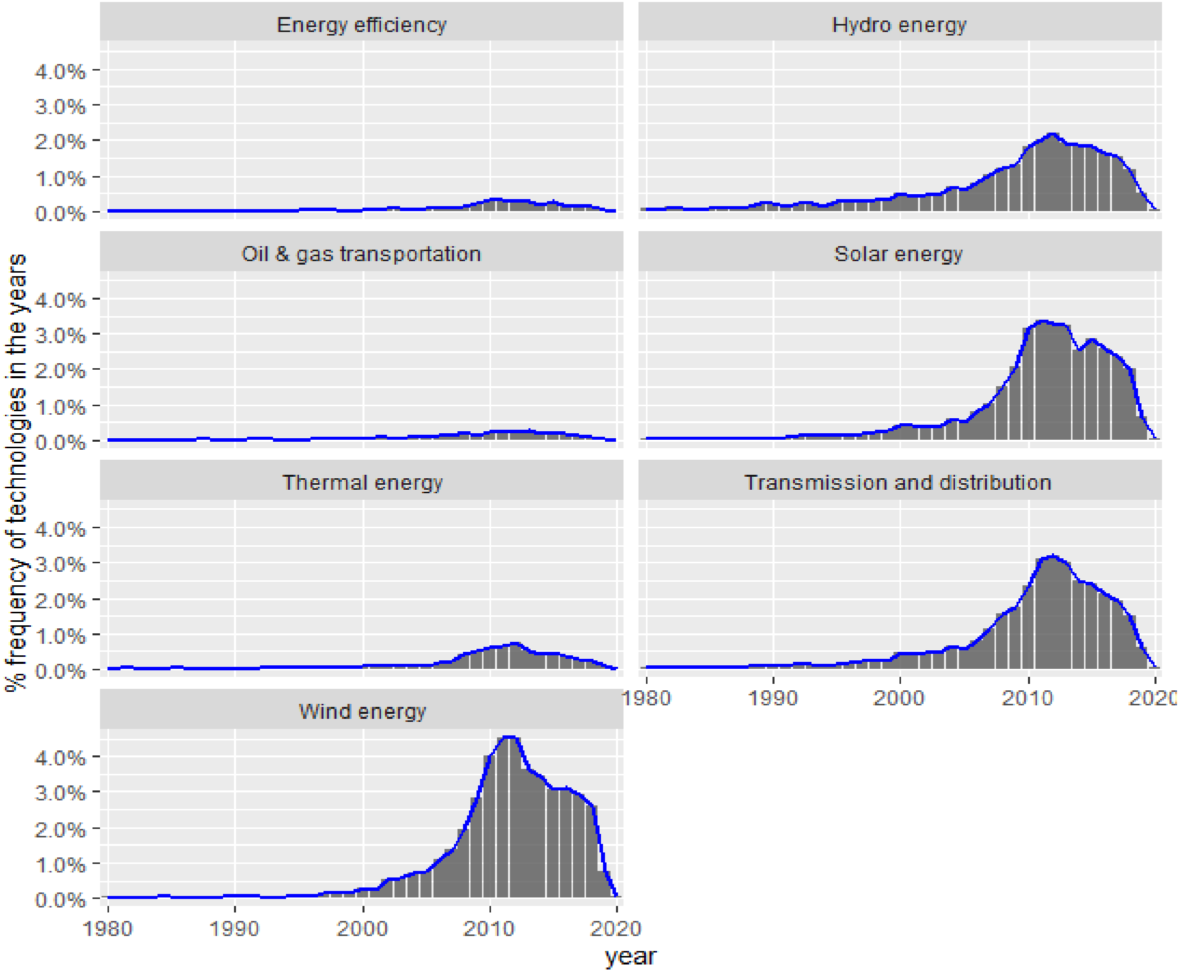
7 150	Solar energy
6 598	Transmission and distribution
5 408	Hydro energy
1 352	Thermal energy
641	Oil & gas transportation
625	Energy efficiency
30 466	TOTAL

The number of patents in Table 9 refers to European patents, with a total of 30 466 patents divided into seven clusters. The table provides an indication of the energy sub-sectors in which there is a greater level of innovative activity and therefore where, in the near future, a greater change in the set of competences needed to deal with such technologies can be expected. It is evident that the number of patents relating to wind energy or solar energy are greater in number than technologies related to energy efficiency or solutions for oil & gas transportation.

Under energy generation, wind energy is the sector with the greatest inventive activity in recent years, followed by solar and hydroelectric technology (Table 9). Ranging from wind turbines to shafts and blades, innovative technologies enhance the performance of wind power generation. In the same way, solutions such as solar receivers, solar collectors and solar cell arrays are just some of the technologies that have emerged from the research into patents. Energy distribution technology also shows a high level of innovation: the modernisation of smart grid systems, transmission systems and electric storage units are some of the elements that emerged from the analysis. Although lower in terms of the number of patents when compared with solar and wind power, the inventive activity linked to the hydroelectric sector is still relevant, and includes technologies related to pumps and hydraulic turbines. The innovation related to thermal energy is lower, as is that in the oil/gas pipeline and energy efficiency clusters. While the TAP pipeline is relevant for the future of the sector, the impact of new technologies in shaping labour demand in this sub-sector is expected to be less significant compared to renewable energies. Energy efficiency is about using resources properly by limiting losses along the value chain. In this case, the technology used by the plant and a good management approach are often combined together so that the innovations in this area may end up being fewer in number.

By showing the number of patents filed over the years, it is also possible to create temporal trends in each cluster, as shown in Figure 16. Compared with Table 9, the representation of trend clusters provides a more dynamic view. Furthermore, when trying to understand the changes occurring in the sector, trends are the key variable to analyse since they show how inventive activities evolve.

Figure 16: Trends for specific technologies from the European energy patents, 1980-2020



The bar chart shows the distribution of patents for each cluster over the years. The low number of patents in the last three clusters in Table 9 (energy efficiency, oil/gas transport, thermal energy) is also visible here, with relatively scarce investment in developing new solutions. Inventive activity in the *wind energy*, *solar energy* and *transmission & distribution* clusters has a notable peak in the period 2010-2015 and now seems to have entered into a less propulsive phase (at least in Europe); the need for related competences will likely follow a similar trend, only shifted forward by a few years due to the adoption curve of new technologies.

As for the actual technologies that have been or are being introduced, text-mining analysis has determined all the most recent and active ones within each of the above clusters. The technologies emerging from the energy sector analysis show a gradual improvement in the performance of already existing technologies rather than the introduction of completely disruptive ones, yet some technologies – such as floating solar panels – introduce new paradigms of use that will imply a stronger redefinition of the set of competences needed to adopt them.

Based on the seven patent clusters identified in Table 9 and Figure 16, the most relevant technologies under each cluster are briefly listed and described below, followed by an explanation of why such a technology is relevant for Albania and was chosen for the country analysis. In addition to the seven technology clusters (wind, solar, hydro, thermal, transmission/distribution, oil/gas transport, energy efficiency), 'transversal technologies (more disruptive ones)' were added as the eighth cluster.

Wind energy

There have been various studies (e.g. Malka et al., 2020; Serderi et al., 2019) in Albania related to wind energy development, and the government has been issuing many licenses for installations. It represents a potentially very important source of energy due to the high wind speed along the coastal area. Recently, some small projects have been launched, especially in the southwest of the country. The Albanian government has a target to generate 5% of all electricity from wind farms by 2030 but, despite its great potential, wind energy production is not taking off yet. According to the information gathered during the interviews, although some licenses have been issued, the installed capacity is still low due to a lack of investment. Although wind power and solar energy are presented by the government as parallel solutions for the country, the installed capacity so far is higher for solar. According to the patent analysis, the main technologies related to wind energy production are listed below:

▪ Wind turbine generator ▪ Rotor blades ▪ Wind turbine rotor ▪ Wind air engine ▪ Horizontal axis wind turbine ▪ Speed increasing gearbox	▪ Synchronous generator ▪ Wind turbine nacelle ▪ Rotating hub ▪ Gearbox housing, input shaft ▪ Wind turbine tower

Solar energy

The introduction of solar energy is at the foundation of the country's strategy to diversify energy production sources, also thanks to Albania's favourable weather conditions. Compared to wind energy, there are more studies and tenders for photovoltaic stations; from the production side, solar energy is expected to become more important in the near future. The country has just fallen short of the National Renewable Energy Action Plan target of hitting 490 MW of solar capacity by 2020: an ongoing project for 130 MW in photovoltaic panels is already under construction and another project for 100 MW is currently in the tendering process. Moreover, with investments in new solar power plants for a total installed capacity of around 190 MW, the country is going to have a new generation of photovoltaic stations in west Albania. In addition, there are some current investments in floating solar panels so that hydro and solar power can be generated contemporaneously, with the relevant economies of scale. If all these planned projects are realised, they could produce the imported amount of electricity in the next 10 years. On the consumption side, the introduction of bidirectional flow by the Albanian Energy Commission has allowed the introduction of a clean net metering that has incentivised the installation of photovoltaic panels and has therefore boosted the usage of solar energy in the country. The relevant technologies related to solar energy are listed below.

▪ Solar panel, collector, cell ▪ Heat exchanger ▪ Photovoltaic module, cell, panel, circuit, array ▪ Photovoltaic power generation system ▪ Light receive surface ▪ Solar receiver ▪ Heat collector ▪ Photoelectric conversion element	▪ Storage battery ▪ Heat absorption body ▪ Reflective layer ▪ Thermoelectric generator ▪ Electrical energy storage device ▪ Float energy collection device ▪ Heat exchange device ▪ Solar thermal power generation

Transmission and distribution

Regardless of the energy source adopted, in Albania, the infrastructure that allows the transmission and distribution of energy is a shared facility. Some investments in photovoltaic panels have been limited in power due to the risk of the old network infrastructure overloading. The biggest energy losses occur along the transmission and distribution chain, and are estimated at around 25%. There is an ongoing renovation of the 110 KV substation to reduce the number of voltage disconnections, but more investment in new technologies for energy distribution and transmission should be considered in the near future. Improving energy efficiency is one of the aims of the national strategy, which has a target of reducing energy losses from 25% to 11% and improving efficiency by up to 15% by the year 2030. Companies involved in energy distribution and transmission are investing heavily in the interconnection facilities. Investments are focused on extending and improving the network in the coastal area, particularly with SCADA solutions, which have become mandatory for this kind of business. Online mirroring is a technology that is also being increasingly adopted. The main technologies that came up during the analysis are listed below.

■ Smart grid network	■ Transmission and connection systems
■ Electric storage unit	■ Wireless mesh network
■ Power transmission storage unit	■ Energy transfer and storage devices
■ Smart meter	■ Communication networks and devices
■ Server for smart grids	■ Energy conversion device
■ Remote terminal unit	■ Energy lift device
■ Shift device	

Hydro energy

The biggest facilities in Albania are for the production of hydropower energy. For the sake of diversification, the government discourages investments in small and medium-sized hydropower plants and is now giving licenses only to hydropower plants that are more powerful (with at least 8/10 MW of nominal installation capacity). As a result, even if future investment is most likely to be in renewables other than water, the hydroelectric subsector still remains very important for the country. The main relevant technologies for this cluster are listed below.

■ Hydraulic pump	■ Heat pump
■ Water turbines and wheels	■ Hydroelectric turbine
■ Heat exchanger	■ Heating/cooling system
■ Hydraulic actuator	■ Pump turbine
■ Hydraulic circuit	■ Hydraulic power unit
■ Water treatment system	

Thermal energy

The use of thermal energy could represent another important strategy for energy production, not only because of the fact that there are some geothermal spots in Albania, but also because of the structures that the TAP project has brought to the country. According to some interviews, gas could become a big player in the future, representing up to 20% of the total energy consumption by 2030: its current usage is mostly for commercial use, such as heating, and there are some discussions about the installation of a thermal power plant near the city of Korçë. The final decision on the projects to implement (electricity production, heating, etc) will also depend on investments. In addition to solar and wind energies, gas could represent one of the top priorities in the coming years due to the diversification of energy production and the opportunity, for the first time, to use the TAP facilities for gas consumption. The conversion of some old hydroelectric power stations into new thermal power stations is under discussion. The main technologies related to the production of energy from thermal sources are listed below.

■ Thermal turbine	■ Gas turbine
■ Heat pipe	■ Heat pump
■ Steam turbine	■ Heat accumulator
■ Roast chamber	■ Roaster module
■ Energy accumulator	■ Steam turbine generator
■ Heat exchanger	■ Heating system
■ Heat accumulating pipe	

Oil and gas transportation

Investments in the TAP project have certainly brought infrastructure and technology from abroad. On the one hand, such facilities create the opportunity for an internal distribution of gas, and on the other hand, they are new technologies that need to be maintained and repaired. From this point of view, the transportation pipe already in the country should be considered as energy-related technology for which the country needs to develop and possess the necessary skills in the future. Some of the gas-transportation-related technologies are listed below.

■ Transmission pipeline	■ Insulation of pipelines
■ Branch pipeline	■ Subsea pipeline
■ Pipeline bundle	■ Pipeline seal system
■ Pipeline network	■ Thermal energy fluid pipeline
■ Storage tank	

Energy efficiency

For EU membership, Albanian investments must comply with the requirements, regulations and guidelines relating to energy efficiency and to the type of energy (renewable) that the country should invest in. In the framework of the new energy strategies, a new **Law on Energy Efficiency** has recently been introduced, which establishes a series of obligations to reduce energy consumption by the public and private sector. Starting from 1 September 2021, the public sector must renovate a minimum of 3% of the total stock of public buildings annually to meet the minimum energy performance requirements. Large energy consumers, after undergoing energy audits, also have to draft an action plan to save at least 4% on the electricity they consume (Spasic, 2021). In the framework of the new strategies for the energy sector in Albania, it is the first time that there is a law on energy efficiency. Another goal at national level is the certification of the energy auditors who assess the energy performance of buildings; one positive outcome is expected to be an increased awareness among the Albanian people with respect to energy usage in civilian buildings. Inefficient use of energy represents a major concern, especially with regard to losses in energy distribution (estimated at around 25% in 2018 – the target is to reduce these losses to 11% by 2030). Most of the innovative technologies related to energy efficiency are listed below.

■ Power consumption regulator ■ Power efficiency controller ■ Control units and systems ■ Display unit ■ Power storage device ■ Computer system ■ Energy controller ■ Storage unit ■ Operation mode control unit	■ Energy consumption controller ■ Measurement units and meters ■ Electronic control timepiece ■ Electric power information management apparatus ■ Control determination unit ■ Energy consumption value selection control ■ Wireless communication module

Transversal technologies (more disruptive ones)

Technologies found/used in multiple clusters with transversal applications have a higher value compared to technologies which are unique to one cluster only. Demand for job profiles with specific skills increases if a technology is found and applied in multiple clusters.

From the technologies listed for each of the seven clusters above, electrical technologies are widely used in many clusters (electric storage units, electric power tools, etc.). Besides, mechanical technologies are the basis for the development of solutions for the energy sector. Ranging from valves to transmission systems, shafts to bearings, mechanical technologies support the design and the production of innovation within the energy sector in a transversal way, including renewable sources and fossil sources. Another transversal technology is ICT innovation, digitalisation, communication and data processing applied to the energy sector: this can encompass digital communication devices and the telecommunication networks on which these devices operate, smart grids, control systems, management and decision-making tools, which are all becoming increasingly relevant for efficiency and sustainability purposes.

According to the interviews carried out, new technologies are also radically changing the scenario for energy distribution and transmission activities, in particular for monitoring, control and management activities, thanks to new digital solutions. Among these, SCADA (Supervisory Control and Data Acquisition) control systems are becoming mandatory, and investments are focused on extending and improving the network in the coastal area particularly with SCADA solutions. There have been many tech implementations over the last 5 years: besides SCADA systems, new energy management systems, the introduction of automation, forecast solutions relating to production congestion, real time communications, increased transparency on processes, etc.

As already mentioned, Albania is importing some of the most recent and interesting innovative technologies from abroad to obtain energy self-sufficiency, such as the installation and testing of floating photovoltaic solar technology (under construction by a Norwegian company in the Elbasan region). Another contract is related to the covering of the wall of a dam with photovoltaic panels in order to obtain a synergy between the use of structures dedicated to hydroelectricity and solutions for obtaining solar energy. It is a particularly winning combination due also to the proximity of the photovoltaic panels to the hydroelectric power plant: the panels are closer to the substation and therefore the energy can be transformed and feed more easily into the distribution and transmission system, exploiting part of the existing structure.

MAIN FINDINGS OF CHAPTER 4

- Several factors are influencing the evolution of the sector, from the necessity to diversify energy sources to increased energy consumption by end users. The country's sectoral policies are also affected by climate change, environmental sustainability, adequacy of infrastructure, the EU accession agenda, foreign investments, state incentives, technological incentives and the need to improve efficiency.
- The country has great potential to produce energy from renewable sources (solar and wind in particular), which makes Albania particularly favourable for the creation of new jobs in the sector. Due to the TAP project, gas could also become a big player in the country, representing up to 20% of the total energy consumption by 2030. Technologies linked to thermal energy and oil/gas pipelines could also become important in relation to the relevant job profiles and skills.
- A review of patents over the last 50 years revealed that no Albanian companies/research centres have filed a patent application in the energy sector, although this does not mean there is no innovation in the sector. Given the presence of many European companies working in the energy sector in Albania and the technologies imported from abroad, European patents relating to the sector have been analysed as those technologies are most likely to be a reference point for Albania as well.
- The evolution of new technologies in the energy sector based on the European patent applications revealed seven clusters of energy patents in descending order: solar, wind, transmission & distribution, hydro, thermal, oil/gas transport, and energy efficiency. A wide range of technologies brings new solutions for enhancing productive performance and reducing energy losses. Technologies linked to wind and solar energy in particular show a strong trend of innovation. If Albania decides to pursue a strategy of production diversification, solar and wind energy-related job profiles and skills should be considered for investments.
- According to interviewees, certain technologies, such as floating solar panels or digital control systems, have the potential to increase energy production and greatly improve efficiency. As Albania has a long way to go in terms of making energy savings and improving efficiency (including in relation to the new Law on Energy Efficiency), the assessment of energy performance in buildings will become very important and necessary.
- Transversal technologies (i.e. those required by various sub-sectors) are the basis of the development of the sector. These include electrical and mechanical technologies, SCADA systems, and all IT-related and digitalised tools for managing the production, storage, transmission and distribution of energy from all sources. However, a more diversified set of job profiles and skills is required for them to be adopted.

5. CHANGING JOB AND SKILL DEMANDS EXPERIENCED BY THE SECTOR

This chapter reviews the main occupational profiles in the sector and the evolution of the skill content of some occupations as a result of the changes occurring in the sector. Both the data mining and the interviews revealed a higher demand for three clusters of occupations as a result of the technological and policy changes introduced into the energy sector: (i) technical or technology-related occupations; (ii) business services and related occupations; (iii) expert positions for reforms in the energy sector.

Sections 5.1 and 5.2 analyse the new tasks and functions that have emerged in the three groups of occupations mentioned above, and whether such changes require higher levels of the same skills or a completely new set of skills. Then Chapter 5.3 presents other general trends in the sector's skill requirements, derived from a combination of data mining and interview results (transversal versus specialist profiles). It also discusses the new and emerging job profiles as well as the obsolescent ones, and the role of 'soft skills' in adapting to technological change.

5.1 Technology-related occupations

From technology to skills and occupations

Technology-related occupations comprise sets of tasks for managing and using a given technology. It is assumed that the growing interest in a particular technology will lead, sooner or later, to a growing need for professionals able to use that technology. The scale of demand may vary for a number of reasons, but if that technology is adopted in Albania, the occupations and competences related to that technology will be needed at least to a certain extent.

There are various possible ways to link the information on technologies derived from text mining to possible future skill needs. In this study the list of relevant technologies extracted from the literature (Chapter 4.3) has been compared – using semantic matching algorithms (i.e. algorithms able to find semantic connections between different concepts based on contextual information) – to the occupations listed by the European occupational classification system (ESCO). Each occupation in the ESCO database includes a description and a list of competences, skills and knowledge considered relevant (either essential or optional) for that occupation. The semantic algorithm looks for matches of each technology with all the concepts associated with an occupation. When a match is found, the occupation is considered to be associated with the technology. The entire procedure is automated by using ESCO's API (see glossary), which allows occupational data to be downloaded. Table 10 provides a few examples of this matching process.

Table 10: Example of the matching process from patent topics to ESCO's skills and occupations

Technological concept	ESCO knowledge or skill	Type	Correlated ESCO occupation	Relevance
Grid voltage	Transmission towers	Knowledge	Cable jointer	Essential
Grid voltage	Transmission towers	Knowledge	Power lines supervisor	Essential
Grid voltage	Transmission towers	Knowledge	Substation engineer	Optional

Grid voltage	Adjust voltage	Skill	Solar energy engineer	Essential
Grid voltage	Adjust voltage	Skill	Power distribution engineer	Optional
Grid voltage	Install inverter	Skill	Solar energy technician	Optional
Sensor node	Sensors	Knowledge	Electrical engineer	Optional
Hydraulic turbine	Hydraulic fluid	Knowledge	Fluid power engineer	Essential
Hydraulic turbine	Hydraulic fluid	Knowledge	Pump operator	Essential
Hydraulic turbine	Inspect wind turbines	Skill	Wind turbine technician	Essential
Hydraulic turbine	Inspect wind turbines	Skill	Civil engineer	Optional
Hydraulic turbine	Operate hydraulic pumps	Skill	Hydroelectric plant operator	Optional
Rotor blade	Test wind turbine blades	Skill	Wind energy engineer	Essential
Energy storage device	Electric generators	Knowledge	Electrical engineer	Optional
Energy storage device	Forecast energy prices	Skill	Energy analyst	Essential
Solar collector	Calculate solar panel orientation	Skill	Solar energy technician	Optional
Solar collector	Solar panel mounting systems	Knowledge	Electrician	Optional
Solar collector	Maintain solar energy systems	Skill	Solar energy engineer	Essential
Control system	Control systems	Knowledge	Electrical engineer	Optional

Skills required by technological professions

As well as identifying the occupations that are associated with a technological change, it is necessary to know which skills within those occupations are likely to be in demand. One can achieve this by looking at the skills listed for the occupation in ESCO. This is a straightforward exercise (for example, a sensor engineering technician must know how to assemble sensors, test sensors etc.). The process is illustrated in Table 11 below.

Table 11: Occupational skill needs related to a given technology – the example of solar cells

Starting technologies	Related occupations (ESCO match)	Related skills (ESCO match)
Solar cell	Solar energy technician	Electricity
		Use measurement instruments
		Maintain solar energy systems
		Calculate solar panel orientation
		Solar panel mounting systems
		Types of photovoltaic panels

There are limitations when using ESCO. In many cases it lists general skills (e.g. electricity), while specific competences (e.g. knowledge of different types of photovoltaic panels) that effectively provide a greater level of detail, are less well covered. Additionally, the competence level required (e.g. how deep a knowledge of or ability with photovoltaic panels is required for each of the various occupations it appears in) is another critical factor which is not specified in existing classification systems. In addition, the introduction of disruptive technologies may result in a demand for people to work in jobs or occupations that are new and not classified yet in ESCO, ISCO or O*NET job classifications (see Annex 3).

To address the limitation described above and obtain a more complete picture of the knowledge needed to master a given technology, additional information was obtained from Wikipedia (chosen for its accessibility, the comprehensive amount of information it contains, and the structured way it presents information). More precisely, for every topic (the most recurrent terms found in patents) the corresponding Wikipedia page was downloaded using 'web scraping'. By reversing the strategy, it is possible to provide a more in-depth analysis of the specific skills that will be required in various technical jobs (as shown in Table 12 below). As in the previous example, solar cell technology has been matched to the occupation of *Solar energy technician* and its associated skills (according to ESCO), but here the occupation has been further linked to more detailed information about the skills required to master the photovoltaic panels.

Table 12: Expanding occupational skills data provided in ESCO – the example of sensor nodes

Starting ESCO occupation	Skills associated by ESCO	More detailed knowledge inferred from Wikipedia
Solar energy technician	Electricity	Power optimiser
	Use measurement instruments	Thin film solar cell
	Maintain solar energy systems	Solar micro inverter
	Calculate solar panel orientation	PV junction box
	Solar panel mounting systems	Solar tracking mechanism
	Types of photovoltaic panels	Etc.

It should be noted that not all the topics/technologies that emerged from the patent analysis were matched to ESCO competencies and occupations. For example, solar array technology did not find a direct match. This is another indication that existing classifications may not yet encompass references to all new technologies. To complement the above analyses, job profiles related to technologies can also be extracted from online job postings in an automated way, i.e. through web scraping. More specifically it is possible to search for all job offers which mention, say, solar array, and extract details of the occupations where this technology is mentioned. The global employment website Monster.com was used for this task to see the possible outcomes using the example of solar array, as illustrated in Table 13. Since this approach leads to results which are not readily comparable with standard occupational classifications, it was not pursued further in this context.

Table 13: Selection of job profiles extracted from online job postings related to solar array (web scraping from monster.com, technologies from patent analysis)

Technology not matched in ESCO	Matched occupational profiles in job postings

Solar Array	Solar array and Battery Engineering Manager
	Roofing Technician
	Senior Design Engineer
	Install Tech
	PV Solar Installer
	Engineering Technician III – Solar Array Assembly
	Solar Panel Installers
	Construction Electrical Foreman
	Solar Surveyor

Ranking occupations according to potential demand

In the case of technology-related occupations or jobs, it is possible to use data mining results not only to list occupations but also to estimate their relative relevance in the future labour market based on the technological trends described in Chapter 4. To do this, an assumption is made about the relevance of an occupation depending on:

- the technological transversality of the occupation, i.e. its importance grows if it has skills related to more than one technology or topic (see discussion at the end of Chapter 4.3 and Annex 2);
- whether the associated skills are essential or optional (as defined in the ESCO classification);
- the weight of the technologies to which it has been matched, in terms of potential future use, as expressed by the normalised number of patents it appears in, further adjusted for its relevance in the country's energy planning and perspectives.

To assign an importance value to each job profile, the three conditions must be intersected as shown by the following formula:

$$\boldsymbol{Importance\ of\ job\ profile\ j(y_j) = \sum\nolimits_{i=1}^{m} T_{ij}E_{ij}W_i}$$

Where:

$$\boldsymbol{T_{ij} = \begin{cases} 1\ if\ technology/topic\ i\ is\ linked\ to\ job\ profile\ j \\ 0\ otherwise \end{cases}}$$

$$\boldsymbol{E_{ij} = \begin{cases} 1\ if\ technology/topic\ i\ is\ essential\ to\ job\ profile\ j \\ 0.5\ otherwise \end{cases}}$$

$$\boldsymbol{W_i = Importance\ of\ the\ technology/topic\ i}$$

The values of T_{ij} are based on the analysis in Table 10*;* the values of E_{ij} are based on a sensitivity analysis[18]; finally the values for W_i are a combination of two weightings: one is the intensity of the signal for the given technology derived from the patent analysis (see Chapter 4.3 and Figure 16), and the other is related to how much the subsector to which the technology belongs is considered relevant in the country's future planning. Values are estimated combining data mining, desk research and interviews - for example, all solar-related technologies receive a higher weight than fossil fuel ones since future demand for skills is expected to grow for the former and not for the latter.

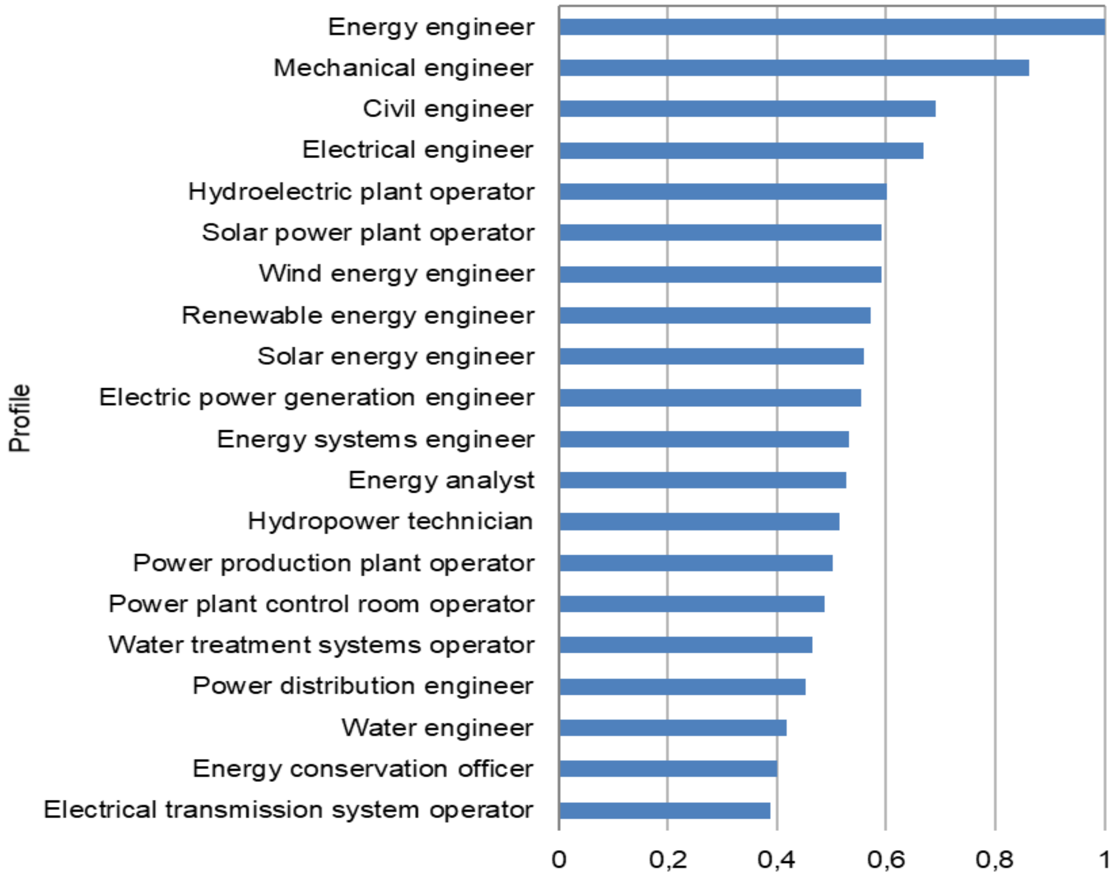
Once the scores have been calculated for all occupations it is possible to draw a bar plot that provides a visual understanding of the most relevant occupations, for both the sector as a whole and for each energy sub-sector of relevance for Albania.

Looking at the entire energy sector could, however, provide a too general, broad overview. Moreover, different categories have different needs in terms of technologies and therefore skills. The relative importance of the various technologies for the specific Albanian context was already reviewed in Chapter 4. For each of the seven technology clusters, the above-described algorithm for matching technologies with occupations and skills was repeated. Detailed and specific results for each energy sub-sector are given in Annex 2. Starting from the occupational ranking in each energy sub-sector (Annex 2), we combined the analysis in an overall ranking, as some occupations appeared in more than one chart, in order to assess which occupations will emerge as most relevant for the entire sector and therefore could be expected to be in higher demand overall.

The first of such combinations is for highly-skilled professional groups (ISCO Groups 21 – Scientific and Engineering Professionals, 31 – Associated Scientific and Engineering Professionals). Figure 17 shows the first 20 profiles of the table generated related to professionals and associate professionals (relevancy scores are normalised based on the highest score). The ranking in Figure 17 indicates which job profiles are of potential interest but not the exact order or score. A full-scale analysis of the demand for jobs would require a deeper investigation using a range of different approaches, and it is beyond the scope of the present study. Yet it provides interesting insights: it is clear from the graph that there will be a high demand for energy engineers, mechanical engineers, civil engineers, electrical engineers and all transversal occupations; then there will be a need for hydroelectric plant operators, solar power plant operators, etc., and in general a mix of more specialised profiles in the three main renewable energy industries in Albania: water, solar and wind.

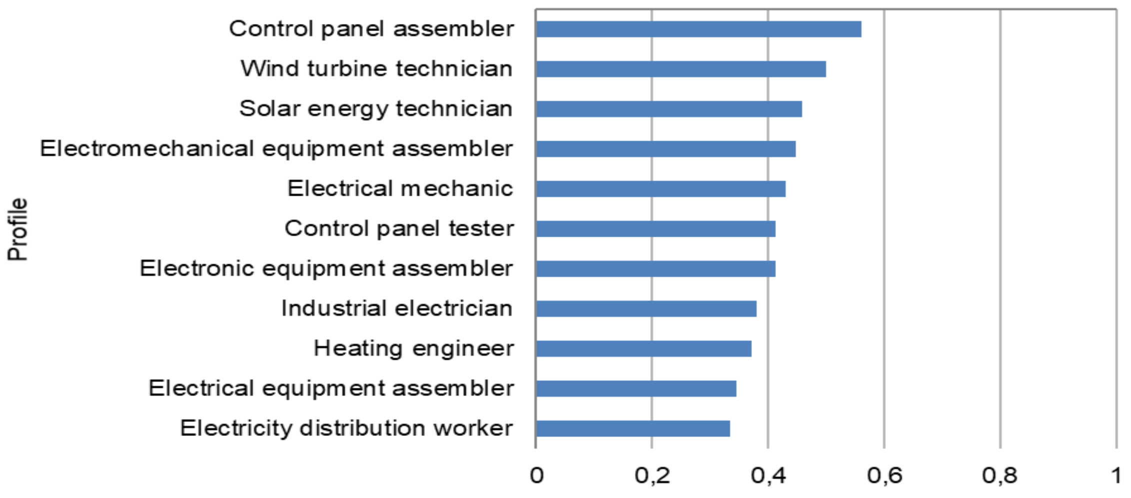
[18] A sensitivity analysis is an iterative procedure for defining the 'strength' of the link between technology/topic and job profile. In comparing the ranking obtained from the iterations the lower value is set to 0.5 in order to generate a ranking that is consistent with the association between job profiles and technologies.

Figure 17: Ranking of relevant high-skilled occupations (professionals and associate professionals) from ESCO (on the basis of the technologies they correlate with)



A similar analysis is repeated for trade workers and machine operators (ISCO 7 – Artisans and related trades, and ISCO 8 – Plant and machine operators and assemblers). A selection of the output list generated by the algorithm is shown below in Figure 18. Due to the normalisation, it is possible to note that the average score of low-skilled occupations is lower compared to high-skilled occupations. Here again there is a mix of occupations with skills that can apply to many subsectors, and more specialised profiles.

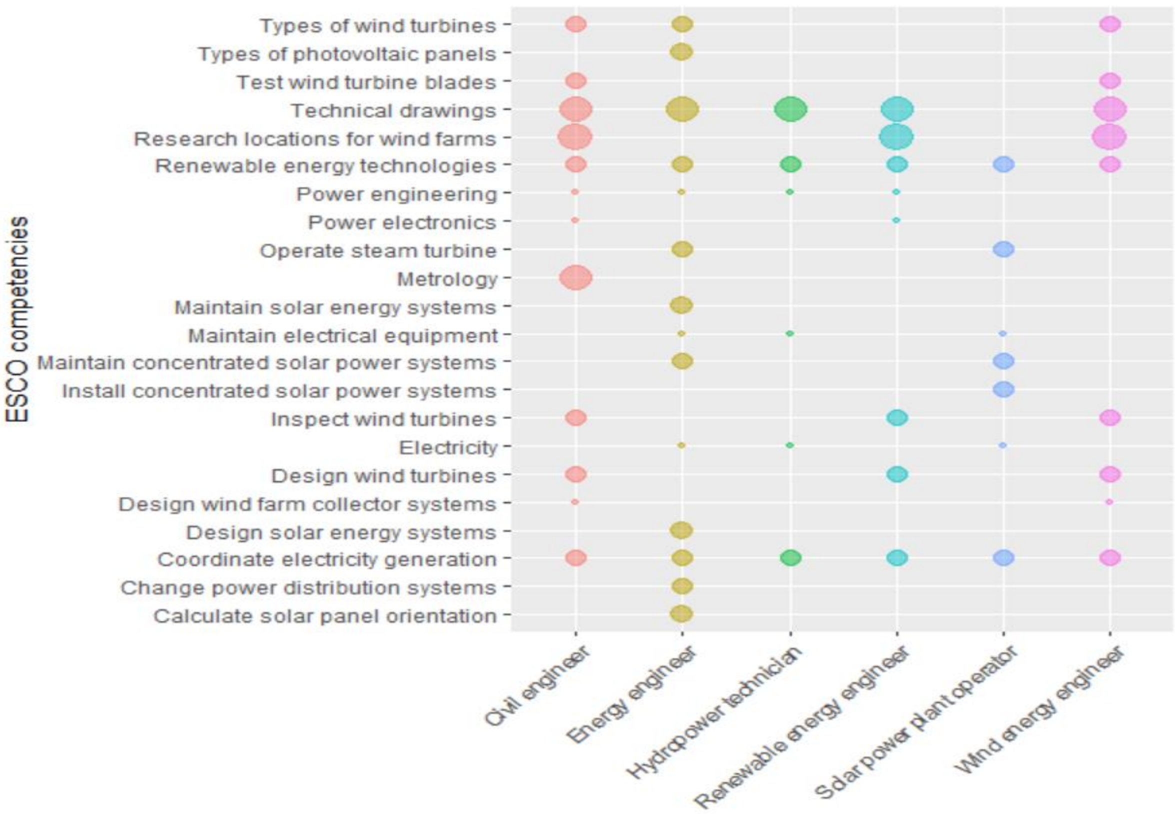
Figure 18: Ranking of relevant medium-skilled and low-skilled occupations from ESCO (on the basis of the technologies they correlate with)



In addition, it is possible to have a more detailed look at each occupation by analysing how they differ from each other based on which ESCO competences they are connected to. For example, taking six profiles (*Civil engineer*, *Energy engineer*, *Hydropower technician*, *Renewable energy engineer*, *Solar power plant operator*, *Wind energy engineer)*, a bubble chart is used to visualise which skills or sets of knowledge are associated with those six occupations based on the ESCO classification (Figure 19). The bubble chart clearly indicates how important these occupations are based on the technology/topic to which they are connected (according to the association with technologies provided by the patents analysis).

The horizontal axis of Figure 19 lists the six ESCO occupations, which are matched on the vertical axis with the competences ESCO associates to them. Each competence is associated with a technology according to the procedure described at the beginning of the chapter, and the size of the bubble at the intersection indicates the relevance of the technology as determined by its occurrence in patents.

Figure 19: Comparing six job profiles in terms of their skills, and which competences are the most relevant for each occupation



Note: Each point in the graph represents an association between a competence and an occupation; the size of the point is proportional to the weight of the technology to which the competence of interest is linked (the importance of a technology depends on the related patent filing activity).

By showing the distribution of competencies across occupations, Figure 19 provides a better understanding of why certain profiles have the rankings shown in Figures 17 and 18. For instance, the job profile of *Solar power plant operator* has a very vertical set of skills, with very specific skills and knowledge that do not go beyond their field of study. At the same time Figure 19 clarifies the reasons behind the high score obtained by engineering profiles in the ranking (e.g. *Civil Engineer, Energy Engineer*): these profiles have a large number of horizontal skills that are related to different technologies, with a high number of patents filed. Thus, they are relatively more important than the others in the innovative scenario of the energy sector.

Figure 19 also identifies some skills that cut across multiple profiles, such as knowledge of *Renewable energy technologies* or knowing how to *Coordinate electricity generation*. Other skills are more specific to certain professions, such as *Install concentrated solar power systems,* which is a specific skill for solar power plant operators only. To summarise, the bubble chart gives multiple insights into which skills and knowledge are more important for each job profile, and also a more detailed view of which skills are more transversal and therefore shared by several professional profiles.

5.2 Business services and related occupations

The analysis also identifies a second category of profiles, i.e. non-technological jobs more related to business, such as management, marketing and sales, and export and trade. Such professions, which are related to energy sub-sectors rather than technologies, are relevant to the business models that companies adopt and the way they organise production, marketing and sales (cf. work organisation). These professions have an effect on the adoption and use of technology in energy. Our analysis identified the following business service occupations.

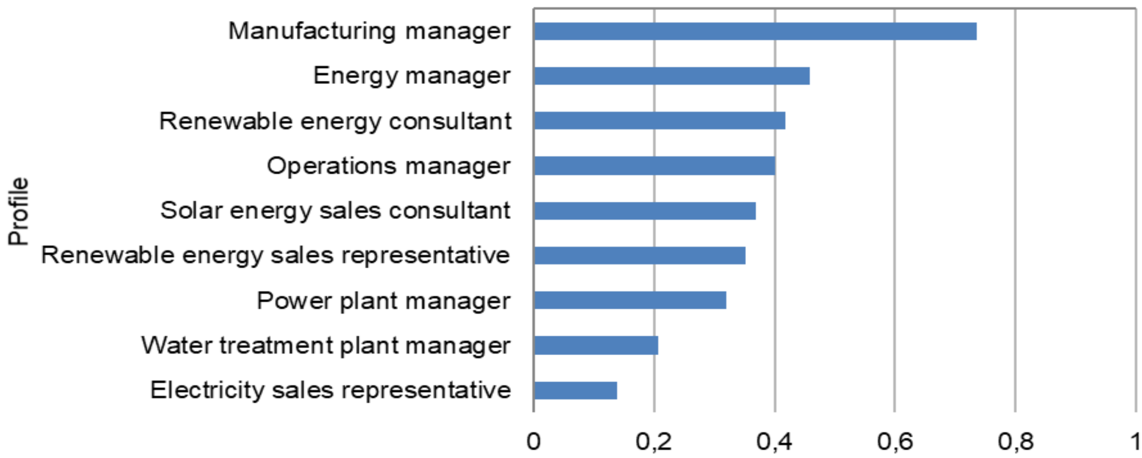
■ Manufacturing manager ■ Energy manager ■ Renewable energy consultant ■ Operations manager ■ Solar energy sales consultant	■ Renewable energy sales representative ■ Power plant manager ■ Water treatment plant manager ■ Electricity sales representative

The list spans from business professionals and associated professionals (ISCO Group 24 – Business and administration professionals, ISCO 33 – Business and administration associate professionals) to manager profiles (ISCO 12 – Administrative and commercial managers, ISCO 13 – Production and specialised services managers). From the point of view of functions performed, two main distinct groups can be specified:

- business and administration professionals related to the management of the operational aspect of the plants, such as manufacturing managers, energy managers, operations managers and power plant managers;
- market-oriented consultants and representatives, such as renewable energy consultants, solar energy consultants, renewable energy sales representatives and electricity sales representatives.

Based on the same formula used in Chapter 5.1 for the relevance ranking, the correlation of occupational groups with technologies shows the types of business professions that are most likely to be affected in the sector (Figure 20).

Figure 20: Ranking of relevant managers, salesmen and services workers from ESCO (on the basis of the technologies they correlate to)



The ranking in Figure 20 indicates which managerial or sales occupations are likely to be related to the technological changes expected over the coming years. Manufacturing manager, for example, emerges as an important position in the ranking and points to the importance of process design within electricity production. Both a systemic approach and an overall vision of the processes are required for better management of power resources, with the consequent reduction in losses and increase in energy efficiency.

A relevant category: expert profiles

As already widely discussed, the Albanian energy sector is undergoing a profound transformation. As a consequence, professional profiles that can help manage the transition to the new paradigms are also in high demand, and are profiles not found in Albania previously. While the request for energy-related consultants and managerial profiles has clearly emerged from the data mining analysis, during the interviews it was remarked how in this particular historical phase certain categories of experts are badly needed in the sector in order to contribute to strategic decision-making, the diffusion of new technologies and investment in renewable energies, if they have the right skills and expertise.

One particularly important expert profile for medium and big companies is the *Energy Manager* (see Figure 20), who monitors energy consumption, detects energy waste and losses and suggests measures and strategies for using/saving energy in a more efficient way. Due to the need to improve energy efficiency, the profile of *Energy Assessor* is also increasing in demand. With similar competencies as an energy manager, the energy assessor performs energy audits in buildings.

As expert profiles are not always already found in the country, Albania has a complex skills challenge in its energy sector. For instance, the newly established Energy Efficiency Agency has a total staff of 15, with its core function to certify the next generation of Energy Auditors and Managers. So far they have certified a total of 25 experts, who are working in the new market of energy auditing. During the last call for enrolments in this process at the aforesaid Agency, 350 applicants submitted their documents. According to the Energy Efficiency Law, the local government units must firstly employ at least two experts (which, by a simple calculation, could provide around 120 new positions), followed then by recruitment in private businesses and the construction sector to ensure all households are equipped with an energy efficiency certificate.

In addition, the national energy reform is finding it very difficult to find in-house human resources to cover the needs arising from the reform. As a result, international players such as KfW Development Bank and *Agence de Développement Française* are investing in the process and bringing mostly international expertise. The energy market could expand further if Energy Service Companies were permitted and made operative in 2022, offering a possibility for at least 10-15 start-ups to bring their expertise to the energy consultancy field. By-laws that would enable a further expansion of solar energy for households could also triple the existing market of solar panel providers (so far there are only seven registered companies in this area).

The expert profiles discussed here do not relate to business aspects only, but can be of a technical nature as well. This category may not be identified by one or more ISCO groups since it is a transversal group of occupations singled out for the role these profiles can have in the development of the Albanian energy sector. Expert profiles are dealt with here because they nonetheless have a profound impact on the management side of the energy business.

An example of a technical occupation with implications for management is the monitoring and forecasting of weather (which has been largely degraded since the 1990s – World Bank, 2009). With so much of domestic energy production reliant upon hydropower, developing a weather monitoring and forecasting programme could enable better planning for potential water shortages. This would mean trade-offs could be better planned between water users in times of drought. Digital skills in this area would also be beneficial to enable data reporting between stations and hydro-posts, currently not recorded in real time. Such a programme would also assist the delivery of wind farms, as mapping of wind speeds is essential to this process. Likewise, such a skill base could help map irradiance and cloud cover in order to better understand where to build solar farms.

5.3 Other general trends in skill demands

Transversal versus specialist profiles

Chapter 5.1 presents an overview of the technical profiles for the entire sector, while each of the seven sub-sectors is reported in detail in Annex 2. Comparing details from different sub-sectors shows the importance of a wide range of high-skilled professional occupations. While some of these occupations have vertical competences related to a specific subsector (such as hydro, solar or wind energy), others have more transversal competencies covering more or all sub-sectors. Another important finding revealed by combining the results from data mining and interviews is the continuing reliance of the sector on medium-skilled and low-skilled profiles (from assemblers to technicians), despite the increasing technical innovations that are being introduced.

Profiles that have competencies related to different fields are very important in the energy sector. For example, the *mechanical engineer* has expertise in turbines, gears and shafts that can be applied to different subsectors, from hydro to wind power. Some professional profiles are common to at least the four different technological clusters of hydropower, solar, wind and thermal energy, which are the main (actual or potential) sources of energy for Albania (see charts in Annex 2). These are *Civil Engineer, Electric Power-generation Engineer, Energy Engineer, Energy System Engineer, Mechanical Engineer, Renewable Energy Engineer, Energy Analyst* and *Manufacturing Manager*. Their relevance is also reflected in their high positions in the overall ranking (Figures A.1, A.3 and A.4).

Profiles that ranked as relevant but are related to a specific energy field are listed below. It is interesting to note that almost all the medium-skilled and low-skilled occupational profiles emerging from the analysis are present in only one cluster; in other words they are not transversal, as some high-skill profiles are.

- Wind energy engineer and wind turbine technician for the wind energy cluster;
- Solar energy engineer, solar power plant operator, solar energy technician and control panel assembler for the solar energy cluster;
- Water engineer, hydroelectric plant operator, pump operator, water treatment system operator, water plant technician for the hydro energy cluster;
- Thermal engineer and heating engineer for the thermal energy cluster.
- Power production plant operator, power plant control room operator, power distribution engineer in the power production and distribution cluster.

Among the profiles listed in Annex 2, the oil & gas transportation cluster has the largest number of exclusive profiles (13 out of 15), while the energy efficiency cluster has the largest number of profiles shared with other technology clusters (only 2 out of 15 can be found only in that cluster). Similarly, the transmission & distribution cluster gathers profiles from different fields: it spans from electrical to mechanical and energy job profiles, and its impact is related to all means of producing energy.

A comparison of the results from data mining and interviews revealed some discrepancies as well. For example, during the workshop country stakeholders confirmed the relevance of some profiles from the big data analysis, but did not mention some of the others listed above. The profiles that received the most votes in the poll held during the workshop were mainly specialised ones: solar/wind energy engineers/technicians; electrical engineers/technicians; and solar power plant operators/technicians. Interestingly, some profiles ranked highly in the text-mining exercise, such as mechanical engineers/technicians and electrical equipment assemblers, did not receive any votes.

The last paragraph relates to the perceptions of stakeholders, whereas the big data analysis depicts a different result. In fact, mechanical engineers received high relevancy scores in most of the technological clusters and the electrical equipment assembler is among the most relevant medium and low-skilled profiles. Such kind of a discrepancy could be related to the fact that certain technologies may have some overlooked aspects (in terms of skill needs) that big data analysis was able to reveal. It shows how this kind of study can help us to discover hidden aspects and develop future skill needs in a way that other approaches cannot.

The interviews with the companies, on the other hand, fully confirmed the importance of the profiles that were extracted through text-mining techniques. They confirmed that energy engineers, electrical and mechanical engineers will still be needed in the future and, along with these professional profiles, professionals linked to specific renewable sources will be more sought after as the use of new renewable energy sources increases.

Emerging skill needs and skills obsolescence

The expected growth of renewable energy subsectors will create new jobs and will obviously require the related skills, but these skills are quite specific to the respective subsectors.

On the other hand, the introduction of digital technologies in the entire energy sector will require many different profiles, both technical and business-related, and the possession of transversal skills related to the IT field. Skills related to ICT, cybersecurity, security testing and interconnection will be needed more and more in the future. Skills in IoT, data science, AI or VR, in addition to electrical or mechanical competences, will be important for future engineers and technicians, whose skillset will be expected to be more digital, in addition to the basic knowledge they will still be expected to have. More specifically, engineers specialised in IoT will allow better management solutions to be implemented and the newest technologies to be monitored.

This finding is in line with similar results in other sectors that adopt ICT solutions and are increasingly digitalised. The worker of the future needs to possess a wider set of skills, and digital technologies will be a fundamental part of the competences required. Additionally, in the context of the pandemic, some professions or jobs have appeared recently on the market. This is the case, for example, for many IT jobs, such as digital marketing or digital sales, for which the Albanian national agencies were requested to review and update their curricula this year.

Entirely new professional profiles (at least new for the sector) are also emerging due to the increasing adoption of automation within processes and the introduction of the Industry 4.0 paradigm. According to the interviews, this is the case with the mechatronics profile, which is gaining importance within the sector, and automation engineers, the demand for which is constantly increasing. Automation engineers have become necessary for enterprise project management, as home automation and data acquisition are required in any industrial applications. Data engineers are also growing in terms of demand, as are analysts.

As already mentioned in Chapter 5.2, another emerging category of new skills is expert profiles to help manage the energy transition, such as *Energy Managers, Energy Assessors*, or *Weather Forecasters*.

As far as medium-low skills are concerned, technician roles for installation, assembly and maintenance will still be required consistently in the sector. Looking at business and market-related occupations, as also shown in the interviews carried out, the technological aspect of management processes will reshape tasks and competences but will not replace the human factor. It may, however, result in the jobs becoming broader – i.e. covering a wider range of tasks – because technologies may assist with some of the tasks.

Although necessary, data analysis showed that managerial and business development profiles seem to be less required in comparison with job profiles that are more closely linked to production. As some interviews have confirmed, the trend is going to increase due both to more structured organisations and sector regulations. In other interviews it was predicted that some other profiles will also increase in demand. As back-office activities are increasing, managerial staff will be needed more in the future, including professionals involved in management, commercial and financial activities. Examples of those profiles can be brand managers and sales managers. As energy consumption in Albania increases, commercial profiles are also becoming more important for business development. Some stakeholders pointed out the difficulties in finding traders in the energy sector. According to the interviews, the 'energy trader profile' is completely missing from the curricula of the education system, while salespeople will also be needed increasingly to sell new technologies to end consumers.

Although all interviewees agreed that the energy sector is experiencing a progressive and gradual introduction of new technologies related to IT, the greater digitisation or automation of processes is not expected to cause professions to become obsolescent, and neither is there is likely to be a decrease in the workforce. It is expected that highly-skilled and medium-skilled professions will be in great demand in the future, and that upskilling and reskilling strategies will allow low-skilled profiles to keep up to date with the introduction of the latest technologies. In the coming years technicians will be advised about interventions or maintenance activities directly by applications on tablets or smartphones. Manual operational activities are slowly diminishing as activities head towards a more digital approach, with interventions that can be done remotely. Due to the increasing adoption of automation in processes, maintenance and operative jobs are expected to need to respond more to this change.

As new regulations require the introduction of managerial and administrative roles, more people are also likely to be needed. At present, activities such as management and consultancy tasks are often delegated or outsourced to external organisations, but it is possible that in the future companies will develop the skills to carry those activities out internally.

The role of 'soft' skills

'Soft skills' are not well defined or described, even in the literature. It is a general term in common usage but everyone tends to understand and interpret it differently. Moreover, these skills are in continuous evolution. Soft skills are named in the literature in different ways: transversal or soft skills, personality traits, character skills, 21st-century skills, life skills, key competences, new mindset or socio-emotional skills. This is because these skills relate to individual attributes in many instances. They refer, among other things, to teamwork, communication, initiative, sociability, empathy, collaboration, emotional control and positivity, open-mindedness, willingness to learn, discipline and determination, flexibility, curiosity, innovation, creativity, entrepreneurship, resilience, responsibility, persistence, etc.

The feedback received from interviews confirmed the importance of soft skills, which will become ever more important in the future. In this respect, in some cases soft skills are considered to be even more important than technical ones: in particular, determination, discipline and willingness to learn are considered in some cases to be important evaluation parameters when hiring a candidate, because it is easier to train someone successfully in the missing technical skills. Some Albanian stakeholders also mentioned ‘leadership and managerial skills’, which can be considered to be core competences rather than ‘soft’ skills. However, many interviewees emphasised often missing soft skills and the difficulty of developing such skills in schools or companies; they can be hard to gain on small-scale projects, and students coming from technical schools often lack the proper attitude to the working environment.

MAIN FINDINGS OF CHAPTER 5

- The three main categories of job profiles growing in demand are: technology-related occupations, business-service-related occupations and expert profiles. Among the technological occupations are transversal profiles such as mechanical, civil or energy engineers, and various technical specialisations for the subsectors that are expanding or are expected to expand. Among business-oriented occupations, the demand is for managerial roles and sales staff specialised in the energy field. Particular opportunities are open for experts that can help manage the country’s energy transition.
- One general trend is that workers will need a wider set of skills, with particular importance given to digital skills. Moreover, this general trend is valid for profiles at all skill levels, from low to medium and high-skilled occupations. Technician roles for installation, assembly and maintenance will still be required in consistent numbers in the sector.
- Stakeholders believe that increased automation and digitalisation will reduce manual operations, but the overall level of employment will not decrease in the future, due also to the technical constraints and administrative roles required by new regulations.
- Stakeholders value ‘soft’ skills highly, although there is no clear vision on the exact definition of a soft skills set. Discipline, determination and willingness to learn are particularly mentioned, so the future skill needs are not just about technical skills but the mix of technical and soft skills.

6. SECTOR INITIATIVES TO MEET CHANGING SKILL DEMANDS

This chapter looks at the impact of changes on skill utilisation in companies, their responses in addressing and meeting new skill needs, and existing initiatives and concrete actions taken in the energy sector. Chapter 6.1 starts with the main limitations experienced in the adoption of new technologies in Albania, with a special focus on skill gaps. Chapter 6.2 reviews the training and recruitment strategies used by companies to meet their skill needs. It also gives the opinions of companies on whether the education and training system is adapting to the ongoing changes and providing for companies' needs in terms of competences and skills. Finally, Chapter 6.3 makes a brief reflection on these findings in terms of skills development strategies. All the findings presented in this chapter come from the in-depth interviews and focus group discussions conducted with companies and key stakeholders in the sector in Albania.

6.1 Limiting factors for adopting new technologies

The energy sector is quite specific in terms of the ownership and structure of companies, and this affects these companies' adoption of new technologies and skills development strategies. It is estimated that 58% of the current installed capacity of 2670MW is state-owned in Albania. On the other hand, the oil companies are mostly private, producing on average 1005ktoe of electricity per year. There are seven companies operating in the extraction field and four others are socialised in testing.[19] The two biggest operators in extraction and drilling are Shell and Geo Jade/Bankers (both private). Almost 90% of the extracted oil is exported due to the poor refining capacities of the state-owned AlbPetrol refineries in Ballshi and Fier. As for natural gas, 64ktoe of electricity is produced per year on average, relying on two transmission systems: one is state-owned through ALBGAZ and the other is the privately-owned TAP.

With the key strategy of diversifying energy production towards solar and wind, solar energy has grown fast in the past few years. Three tenders were conducted for the allocation of three solar factories: Akerni (yearly production: 50MW), awarded to a Chinese-Indian consortium; Divjaka (yearly production: 75MW), awarded to the French company Voltalia; for the last one, Durres (yearly production: 100MW) the allocation process is still ongoing. In parallel, three licenses have been awarded to Albanian private companies to build three solar power plants (yearly production: 50MW each) in the region of Fier[20]. Estimates suggest that there is at least a 30MW capacity for electricity generation through the solar panels installed, mostly coming from SMEs that have invested in electricity production to cut their energy costs.

This shows that while the traditional part of the energy sector is dominated by the state-owned big companies, most renewable energy companies tend to be small and privately-owned. The latter has a negative impact on technology adoption and skills development initiatives in the sector. All interviewed companies agreed that the energy diversification policy is not proceeding at the speed initially planned by the government. However, they confirmed that there was a growing solar energy market especially after 2019, when the introduction of net metering gave users the possibility to exchange energy with the network in a bidirectional way (i.e. sell electricity produced by solar panels and fed into the grid, and purchase electricity drawn from it, at a fixed price ratio between the two operations). In addition, there

[19] https://www.altax.al/al/lajme/602-industria-e-naftes-dhe-tregquesit-e-saj-2019

[20] https://balkangreenenergynews.com/third-big-solar-power-project-without-subsidies-enters-pipeline-in-albania/

are some publicly funded incentives to install photovoltaic technologies for domestic use. The adoption of wind energy seems to be lagging behind, since many licences have been issued but not many projects have been started yet.

The diversification of energy production is a slow and long process that brings new factors for the country to deal with, which could inevitably delay the process or inhibit the adoption of new technologies. The following is a list of the possible limiting factors that emerged from the interviews.

1. **Environmental effects of investment in renewable energy sources**. Albania has a substantial presence of protected natural areas whose surface is about the 22% of the country, with that percentage expected to increase in the future. Some of the protected areas are located in spots that studies indicated as the most favourable, in terms of maximum exploitation, for installing solar/wind power plants. Along its path towards the installation of new renewable power plants, the country needs to find the right balance between protection of the environment and energy production.

2. **Awareness about costs and returns**. According to the interviewees, when it comes to new energy sources, people's first reaction is one of scepticism and distrust towards these solutions, even before knowing their benefits and the efficiency they bring. Investors are also convinced more by the payback period of the investment in solar panels than the use of green solutions for environmental reasons. A greater awareness of all their benefits (not only economic but also sustainability) is needed in the diversification strategy towards other renewable energy sources. Despite the recent introduction of energy auditors, more information campaigns are needed at national level to promote them.

3. **Missing professional occupations and skills**. Considering the entire energy sector, many professional profiles are hard to find for companies. While the Albanian labour market can provide high-skilled profiles such as engineers because these are supplied by the country's universities, some stakeholders point out that vocational schools in Albania are not sufficient in number and most of them are concentrated in the biggest cities. Thus, medium-skilled (technicians – and not only electrical technicians) and low-skilled technical profiles are far more difficult to find. Another recurrent complaint from companies is the lack of practical skills in freshly graduated students. This does not apply only to renewable energies, where installers and operators are in demand, but also to more traditional sub-sectors: for example, in pipeline construction it is difficult to find experienced welders, especially laser welders. The lack of proper skills has effects also on the optimisation of energy production and energy efficiency. Production organisation capacity is still missing in the country and leads to a substantial loss of energy.

4. **Lack of investments.** The reduction of energy losses is the goal of many innovations being introduced, especially along the energy transmission and distribution chains. However, the reduction of energy losses is also a serious issue in Albania, largely linked to a lack of renovation and investment. The 25% energy losses could be reduced with some interventions and renovations of the existing infrastructure, particularly on transmission lines where there is no dispatcher that allows all the producers to be connected with all the consumers.

More about the skill gap

The lack of people with experience and the right skills is undoubtedly a factor that is limiting the growth of the energy sector. Interviews with companies and stakeholders provided various insights into the implications of such shortages and into the possible causes. As already mentioned, medium-skilled technical profiles (not only electrical) are particularly hard to find. One consequence is that many tasks that could be managed by technicians are assigned to engineers; moreover, engineering profiles are also sought to cover activities related to business aspects, thus creating an increased demand.

According to some interviewees, graduate engineers seem to be better prepared in terms of skills than graduate technicians from vocational schools, and the motivation and desire to learn among the former is also higher. Both types of graduates, however, lack practical experience, and this is not just a matter of knowledge: professionals with medium-term or long-term experience, and people who can work directly in the plants and are able to use specific technologies, are simply in high demand and short supply.

The lack of experienced people is one of the main limiting factors that prevents new sub-sectors such as solar energy from expanding further. The most obvious profiles that are in scarce supply are people with concrete experience in the solar field regardless of their skill level: workers with a low, medium and high skill level and with some experiences are needed. While such a phenomenon can be explained by the recent growth of the solar sector, some companies believe that the education system is not aligned with the needs of the sector.

This gap is also related to the retirement of many qualified workers, with companies finding it difficult to replace them with new skilled workers from the market. Even if the sector is attractive for young people, the supply of workers with the relevant skills is not enough from a quantitative point of view to respond to company demand. In addition, the high emigration flow was pointed out as critical by most of the interviewed people, whether companies or stakeholders. Many technicians and engineers, once they have gained their qualifications, emigrate from Albania to European countries, the USA or Africa in search of higher salaries.

Relating to these missing skills, some interviewees reported the absence of a shared know-how between foreign organisations/companies and local people when the former come to invest in Albania for energy projects. These projects are developed and managed relying almost exclusively on the know-how of foreign companies, and rarely involve locals. In most cases Albanian workers are asked to deal with simple administrative tasks and are not asked to carry out high-skilled or technology-related tasks. During those projects, skills and competences should have been transferred to local actors, such as the Albanian academic sector, but this has not happened.

The disconnection between companies and public sector does not occur only with foreign investors. Albanian companies reported a gap in collaboration with universities, which are perceived as not offering up-to-date curricula. From the education and training side, agencies would like to have the capability to train people in emerging fields, but due to a lack of information (including from companies) they cannot provide appropriate training programmes.

According to some stakeholders, companies should foster a dialogue with education and training providers in order to provide input on how to update their curricula. Such an attitude is not always present in the country and the supply side also lacks understanding of skill needs from the demand side. The reasons are manifold, according to interviews: sometimes a structured framework (such as a platform or an organisation) is missing, other times companies do not take much initiative to create a fruitful collaboration. With such unstructured frameworks, identifying emerging skill needs becomes challenging for the education system.

6.2 Companies' training and recruitment strategies

Due to the innovative characteristics of the technologies emerging in the energy sector, many companies believe that the education system has not yet adapted to the needs of the sector. The absence of a structured communication between the different parties has led to a lack of good profiles on the business side, and a lack of appropriate training programmes and up-to-date curricula on the education/training system side. Given the situation, recruiting workers that are already trained is uncommon; most companies have to organise further training for new recruits or upskilling of existing employees.

As for the recruitment strategies, most interviewed companies did not have a structured HR department. They follow a fairly classic recruitment path, relying in some cases on the company's social network profiles (LinkedIn, Facebook), and in many other cases on external companies. Various companies reported that they resort to outsourcing to fill their skill gap, mainly using foreign contractors.

Regardless of the recruitment channel used, all companies provide a specific internal training course that is all the more necessary due to the lack of practical skills. In fact, internal training is seen as the most common strategy adopted by companies to deal with the lack of experience and practical skills in the sector. In this respect, in some cases soft skills are considered even more important than technical ones: in particular, determination, discipline and willingness to learn are considered in some cases to be important evaluation parameters when hiring a candidate, so that the person can be trained successfully in the missing technical skills. In addition, some companies have indicated the difference in attitude between graduates coming from technical schools and those coming from universities. Although neither of them has practical experience in the field, the latter group is more enthusiastic and has more willingness to learn. On this point, the interviewees emphasised the need to support the development of skills that are not only technical or theoretical but also motivational, that is, the ability to engage in self-directed learning within the educational system.

The government is trying to create a tighter connection between private and public sectors by supporting initiatives and pilot projects. According to the interviews, both the private and public sectors need to take one further step, building a more structured institutional collaboration that can help create a dialogue. Some bridges need to be created not just between universities or technical schools and Albanian companies but also between the education system and Western technologies, represented by Western investors or foreign companies.

Most of the companies interviewed work together with universities or schools on training, and in some cases internships are also organised. A company, for instance, has a structured period of four-weeks in which students work in the operational field. However, in general these relations are not yet well structured and regular. According to some companies, economic incentives available for apprenticeships and internships agreements are not clear; some companies even decide to suspend internships because with the increase in workload they are unable to dedicate time to untrained people, and it would entail the risk of production being slowed down.

The gap between the request for internships and other types of cooperation and the actual rate of participation and completion demonstrates the weak connection between the education system and the energy sector. Technology is continually evolving, while many education providers, public and private, are not keeping up at the same pace; as a result, not only is the practical part absent but also up-to-date technologies are not being taught.

Despite a structured connection between the public and private sector not yet being in place, there are quite a few encouraging examples and good practices. Some Albanian universities interviewed affirm that they have had contact with companies and that some new training programmes are underway. According to the education agencies and universities interviewed (see Annex 1), almost every school is set up with an internal mechanism to understand demand from the market and talk with companies. NAVETQ also confirmed that schools have an inventory of the companies with which they cooperate, and they are obliged to provide students with periods of practical learning in companies. They should be in close cooperation with the private sector about their needs, and based on the type of network they have, they are asked to give some feedback to NAVETQ to improve the standards and their curricula.

Almost every year, some universities evaluate their curricula in order to select courses to be kept and courses to be replaced. Curricula are revised more thoroughly once every 5 years and this revision is based mainly on feedback from students and companies. For example, according to the market feedback, a new doctorate programme on the implementation of technologies in Industry 4.0 is going to be established. Projects related to the alignment of curricula in the Western Balkans region (Albania included) to EU standards are underway.

According to some stakeholders, training programmes offered by the universities seem to be appreciated by the Albanian market. The faculty of electrical engineering of the Polytechnic University of Tirana is evidence of this; about 30-40% of the students there are already employed when they are still studying. To align curricula to the needs of the market, the University conducts independent analyses: to get feedback from the field, thoughts and ideas are collected from students who have already finished their education and are successfully employed. The number of students that are accepted by the University is defined according to the demands of the market.

Students at Tirana University, especially those on the Master of Science in electrical engineering, can select any internship they wish, provided that the University has checked whether what the company offers matches the content of the course. If students are not able to choose on their own, the University suggests a company, thanks to the many agreements it has signed in the production-distribution-transmission chain. Companies are usually interested in taking students for internships because the University prepares its students well.

As regards energy efficiency, licences for performing efficiency audits have been released by three universities in Albania since January 2021. New courses have been organised both for energy efficiency audits in building automation and energy efficiency audits in electric systems in industry. Another university has confirmed their intention to create a course to train Energy Managers, one of the relevant emerging professions (see Chapter 5). Yet, still more has to be done. For example, despite the climate change problems the country is facing, a Master's or Bachelor's degree in climate change is still missing. Solar energy capacities also need to be increased, according to new strategies and legislation. Some short courses about renewable energies and climate change are provided by national agencies, which organise upskilling and reskilling courses for adults as well.

According to companies, automation and digitalisation is the most important driver that will affect future change in the sector. Innovative pioneering companies are starting to look for electrical engineers with skills in IoT (internet of things), artificial intelligence and virtual reality. The courses in Industry 4.0, which some universities have included in their programmes, will be increasingly in demand in the near future. The Albanian education system is starting to prepare for this kind of change, but it is still at the beginning of the process of understanding the needs and adapting to the requirements of companies. For all the competences for which no training courses are provided, the only solution is on-the-job training. There are some initiatives where education in classrooms is combined with practice in private companies that are implementing new technologies. This could represent a short-term and highly efficient solution: giving students the possibility to go and learn technology in the field instead of bringing the theoretical technology into the classrooms.

6.3 A final word on the findings

The energy transition is taking a long time, and possibly both hydropower and oil/gas will continue to play an important role in the energy systems (WEF, 2021a; McKinsey, 2021). The Albanian government has set its path towards diversifying energy sources and increasing energy efficiency through different policies and measures, in which various good practices can be observed. The Ministry of Infrastructure and Energy has asked the International Renewable Energy Agency (IRENA) to conduct a Renewables Readiness Assessment to support Albania in its energy transition. Among several short-term to medium-term actions identified by the IRENA study (2021) to accelerate renewable energy uptake and meet Albania's National Energy Sector Strategy 2030 targets, particularly important are raising public awareness of the benefits of renewable energy, enhancing institutional capacities and local human resources, and strengthening communication and cooperation among stakeholders.

Thus, there is a need to increase overall awareness about the profitability of renewable technologies and their added value to business. From the perspective of energy consumers, high upfront investment costs in renewable energy and a lack of understanding of payback periods for such investments deter wider uptake of renewables in Albania (IRENA, 2021). As the public is not always aware of existing incentives, support mechanisms or plans for the deployment of renewable energy technologies, a wider adoption of renewable energy in Albania requires state-backed awareness-raising strategies to sensitise the public to the direct benefits of renewable energy, both for individual citizens and the country as a whole.

Cooperation and communication between all relevant actors and public-private partnerships can be further strengthened to ensure the exchange of up-to-date information on the renewable energy sector's evolution. This could ensure that challenges faced by individual stakeholders are clearly communicated and collectively addressed. To implement Albania's commitment to a higher share of renewable energy deployment, a skilled workforce is key. This requires collective work by the ministries in charge of energy, labour, training and education towards the introduction of renewable energy training curricula, prioritising solar photovoltaic systems, installers and energy auditors in the immediate term (IRENA, 2021). The Energy Efficiency Agency could work further on accelerating the licencing of accredited energy auditors, while INSTAT could work to strengthen institutional capacities for energy data processing and reporting.

According to the interviews, the main complaint in terms of skills development needs has been the missing systematic approach to skills based on needs of companies. From the educational providers' point of view, companies do not seem to be active in the training field and it is also difficult to find companies that can provide good quality 'practical' training. The representatives of the energy sector companies (and sector associations) in Albania are not directly involved in a system for defining the sector skill needs, unless they have an emergency need: a 'future-oriented approach' is generally missing. From the companies' point of view, universities and vocational schools do not include a proper practical education within their path of study.

With a more systematic approach to the skill needs analysis, national key players can translate the information into action both in the long term (vocational schools and universities) and in the short term

(VTC – Vocational Training Centres). It should be considered as a full-scale structural process, involving all relevant stakeholders, institutions, instruments and procedures. The roles of each actor within system level interventions should be defined accordingly. The Ministry of Infrastructure and Energy – together with the Ministries of Education/Labour, the NAVETQ and the NAES – should develop policies for more structural training programmes aiming at connecting the curricula with the needs of business and international companies.

The government is working to boost cooperation between the education and business sector. Its commitment to bring companies and education providers together is visible in the vocational education sector, where schools have a board composed by companies from the relevant sectors. According to the interviews, a further dedicated structure or a connection platform is also needed to overcome the disconnection. The NAVETQ is also working on the creation of sectoral committees based on the strategic relevance of the sector. The energy sector is on the list of high priority sectors, but it is not yet known when a sectoral committee for the energy sector would be created. Such a committee could represent a potential solution for obtaining information from the sector on skill requirements and new technologies. Once national training agencies receive information from the sector, it is easier to create and update the curricula and decide where those curricula will be implemented, so that they can plan the offer in vocational and higher education or in VTC.

Another recent policy development is the improvement of digital skills in the workforce (and in the general population) as a priority indicated in the new Government strategy (Prime Minister Office's, 2021). The strategy includes planning a series of actions including: the promotion of e-learning and online teaching; investment in infrastructure to guarantee connectivity and access in all parts of the country; investment to increase digital skills for jobs/the digital economy; support for e-commerce diffusion and the legal framework for the provision of online services; and the establishment of a Regional Digital Transformation Academy related to the development of digital skills for the labour force and SMEs. This is a promising direction, although it is not clear yet how and when these actions will be implemented.

In addition to government efforts to modernise and adapt education and training structures according to new developments in the sector and the creation of an energy sectoral committee, the Ministry of Infrastructure and Energy could also ask international/foreign consulting companies to provide dedicated skills development programmes for transferring occupational and technical knowledge and technology know-how whenever they invest in the energy sector. International contractors can support local business and experts by developing a system similar to solutions already successfully adopted in other countries.

While stakeholders confirm that internships and apprenticeships for developing practical skills are mandatory for students, according to the opinions of the companies interviewed, practical activities during the study period are not covered as well as they should be. Good practices that already exist in Europe could be imported, such as the adoption of a dual system, in which every student is obliged to alternate periods of study with periods of work within companies. Another suggestion emerging from the interviews is to integrate some additional disciplines in future courses: e.g. the introduction of IT skills and knowledge related to energy efficiency and the reduction of emissions in the electrical engineering curricula.

To conclude, Albania needs to have a long-term policy agenda with a clear vision to accelerate the energy transition and planning of activities in 10-20 years' time, in terms of investments, future development projects and employment and skills implications. Given the current uncertainties, a long-term strategy on anticipating precise skills will not be easy. However, particular focus and efforts are needed in the short and medium-term to strengthen interlinks between investors/companies and education and training providers (universities, VET schools); more opportunities need to be provided by companies for work-based learning (including apprenticships); training local people as part of the investment package needs to be included by foreign companies (at the moment they receive the license to operate in the country); and a more active cooperation is needed from Albanian providers (universities and VET providers) with European providers who have already developed curricula and programmes related to the energy sector. The overall idea is to strengen the training provision through a series of measures that develop skills as the restructuring of the sector proceeds.

It is hoped that these findings will raise awareness among policymakers and practitioners about the changings skill needs in the energy sector and provide food for thought especially in relation to the ability of the education and training system to respond to these needs and to prepare workers to be fit for the new jobs and occupations.

MAIN FINDINGS OF CHAPTER 6

- There are various factors that are constraining the growth of the energy sector, from missing technical profiles and skills to the limited cooperation between the demand and supply sides. A common perception is that companies are not involved in the process of skills creation and development, due also to a lack of awareness about the profitability of the process.
- According to interviews, although all profiles are in demand, the situation seems to be particularly critical for medium-skilled technicians and for experienced workers of all types. The reasons indicated for the shortage are: lack of practical skills and of up-to-date knowledge of new technological developments for people coming out of the education system; retirement of qualified personnel; emigration of experienced workers due to more attractive working conditions abroad; absent transfer of know-how from foreign companies involved in national projects to local actors. Companies react to skill shortages mainly by providing internal training to new recruits, and sometimes outsourcing some of their activities.
- Some links between the education system and companies exist and there are examples and good practices, but those links seem to be due to some direct connections rather than to a structured and systematic approach. Some recent reforms (such as net metering) and state incentives are trying to overcome the missing structural approach and creating a sectoral committee for the energy sector could help gather information from key players working in the sector. Although this is a long-term solution that does not resolve the problem in the short run (as the committees themselves need to be supported and activated), a possible suggestion is to bring in new regulations that create incentives (if not oblige) actors to work together. A possible suggestion from companies is to use this or another committee to give the education system the possibility to update curricula and forecast labour market needs according to each profile.
- The country needs to have a long-term policy agenda with a clear vision in the sector in terms of investment, future development projects and employment and skills. In the short and medium-term, particular focus is needed to: enhance links between investors/companies and education/training providers; increase opportunities for work-based learning in companies; and include the training of local people in foreign companies' investment packages. Other suggestions are to integrate curricula with teaching from different fields such as digital technologies and soft skills.

ANNEX 1. KEY STAKEHOLDERS AND COMPANIES CONSULTED

The following table lists most of the stakeholders and companies we met during the project, either during the focus group discussions or the bilateral online interviews with the Albanian representatives. The names of individuals from these institutions and some companies are not included here for data privacy reasons.

Ministry of Infrastructure and Energy
Ministry of Tourism and Environment
Ministry of Education, Sports and Youth
Ministry of Finance and Economy (labour and VET part)
NAES – National Agency of Employment and Skills
NAVETQ – National Agency of Vocational Education Training and Qualifications
INSTAT – National Statistical Office of Albania
Albanian Confindustry
Albanian Manufacturers Union
AEA – Albania Energy Association
AREA – Albanian Renewable Energy Association
ICLA – Institute for Change and Leadership in Albania
Polytechnic University of Tirana
TBU – Tirana Business University
EU Delegation to Albania
EBRD Albania office
Solares Energy Solutions
Schneider Electric, Albania branch
OST – Transmission System Operator company
Euroelektra
Alba Elettrica
Solaron
Vegasolar
ESCo Adriatic
Denas Power shpk

AMB architecture studio
SETEC Engineering, Albania branch
Strelca Energy
Global Net
Some other (anonymous) companies

ANNEX 2. RANKING OF OCCUPATIONS FOR ENERGY SUB-SECTORS

As a result of the text mining analysis of European patents, seven technology clusters were identified as the most relevant within the Albanian energy sector (See Chapter 4.3, Table 9 and Figure 16): wind, solar, hydro, thermal, transmission/distribution, oil/gas transport and energy efficiency. Using the semantic matching algorithm mentioned before in Chapter 5.1 and 5.2, each of these seven technology clusters were matched with occupations and skills in the ESCO database. As each subsector has its own specificities, this Annex gives a more detailed analysis and possible relevance ranking for the occupational profiles (at all skill levels and for both technical and business-related jobs) that are specific to the various subsectors.

The lists presented in this Annex include the following occupational groups from the ESCO classification, ranging from high-skilled to medium and low-skilled occupational profiles:

- ISCO Group 21 – Scientific and engineering professionals
- ISCO Group 31 – Associated scientific and engineering professionals
- ISCO Group 7 – Artisans and related trades
- ISCO Group 8 – Plant and machine operators and assemblers
- ISCO Group 9 – Elementary occupations

1. Wind energy

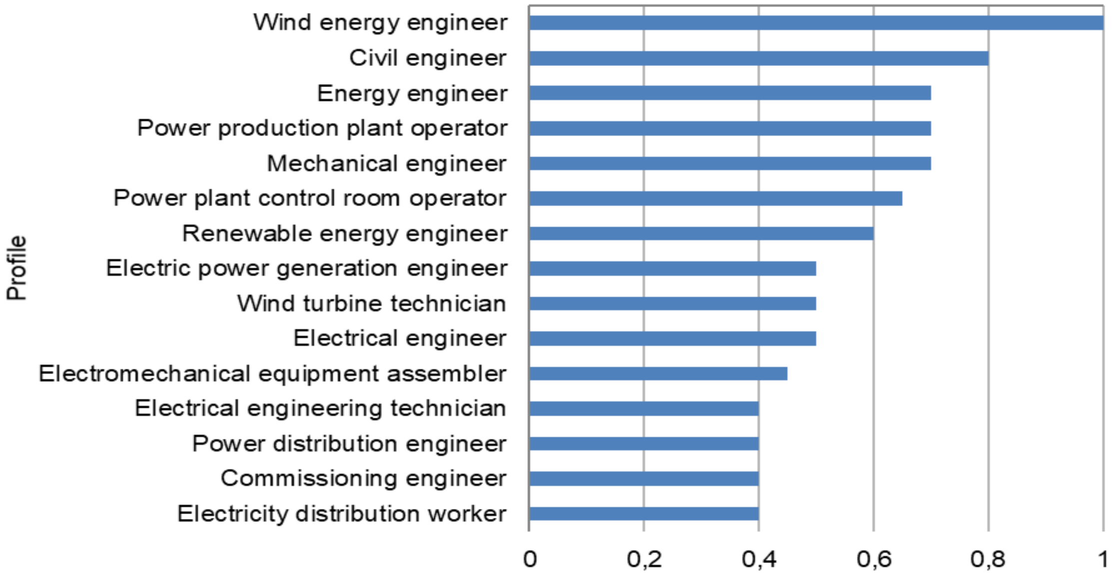
Based on the technologies extracted from the patents as being relevant for the subsector, the main ESCO occupations can be grouped according to three main branches of the occupational classification:

- science and engineering professionals: wind energy engineer, civil engineer, energy engineer, mechanical engineer, renewable energy engineer, electric power generation engineer, electrical engineer, power distribution engineer, commissioning engineer;
- science and engineering associate professionals, such as power production plant operator, power plant control room operator, electrical engineering technician;
- medium and low-skilled occupations, including wind turbine technician, electromechanical equipment assembler, electricity distribution worker.

In the wind energy generation sub-sector, the highest relevance value is obtained by 'wind energy engineer', which is a high-level profile with skills specific to the wind energy cluster (see Figure A.1). According to ESCO, these skills are necessary for the design and implementation of the wind power plant, and they are related not only to the installation of the plant but also to the search for the most suitable locations and to testing for increasingly performant solutions. If the adoption of wind energy in Albania continues to grow, the demand for wind energy engineers is expected to rise, as is the demand for the other professions that rank high in the chart below.

However, it must be noted that increasing demand is also associated with civil engineers and mechanical engineers, professions not specifically related to the wind sector: the reason is the transversality of competences possessed by the two profiles, which are needed for support work such as the construction of plants or the correct functioning of gears in wind turbines.

FIGURE A.1: Ranking of relevant job profiles for the wind energy cluster (on the basis of the technologies they correlate with)



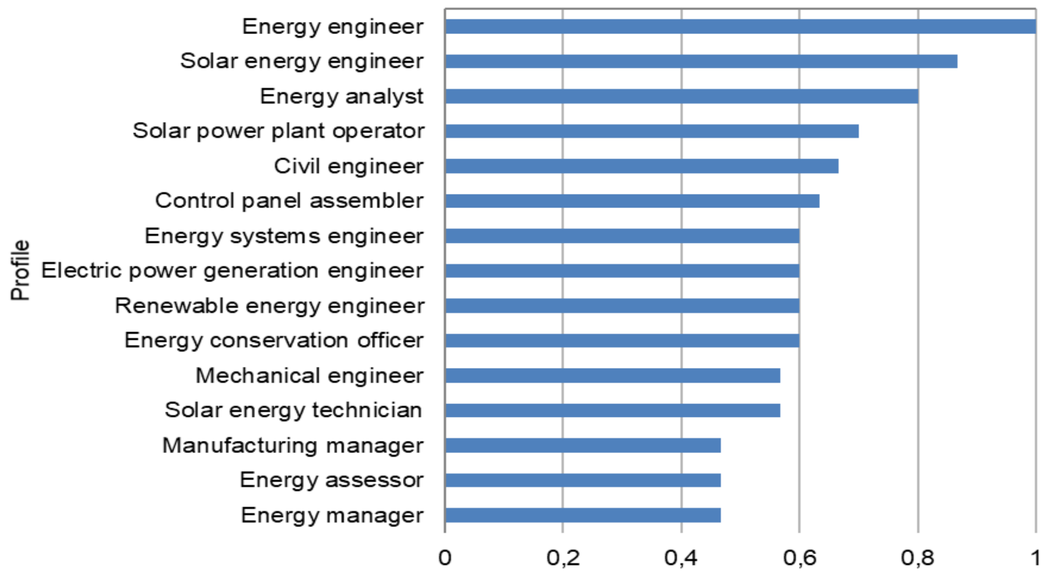
2. Solar energy

Based on the technologies extracted from the patents, the main ESCO occupations in the solar energy cluster can be grouped according to four main branches of the occupational classification:

- science and engineering professionals: energy engineer, solar energy engineer, civil engineer, energy system engineer, electric power generation engineer, renewable energy engineer, mechanical engineer;
- science and engineering associate professionals, such as energy assessor, energy analyst, energy conservation officer and solar power plant operator;
- medium and low-skilled occupations, including solar energy technician and control panel assembler;
- managers and business-related profiles, such as energy manager and manufacturing manager.

The same reasoning can be repeated for the other clusters that have been identified. In the case of the solar energy cluster, the normalisation of values was made with respect to the occupational profile of the energy engineer (see Figure A.2). Among the first positions of the ranking there are two occupations that are specific to the solar cluster and that belong respectively to the categories of professionals and associate professionals: solar energy engineer and solar power plant operator. These profiles are particularly relevant for the cluster since they have, on the one hand, the skills to design and implement systems for generating and optimising electricity obtained from solar energy and, on the other, the skills to operate and maintain the devices and equipment needed for the operation of the system itself.

FIGURE A.2: Ranking of relevant job profiles for the solar energy cluster (on the basis of the technologies they correlate with)



3. Transmission and distribution

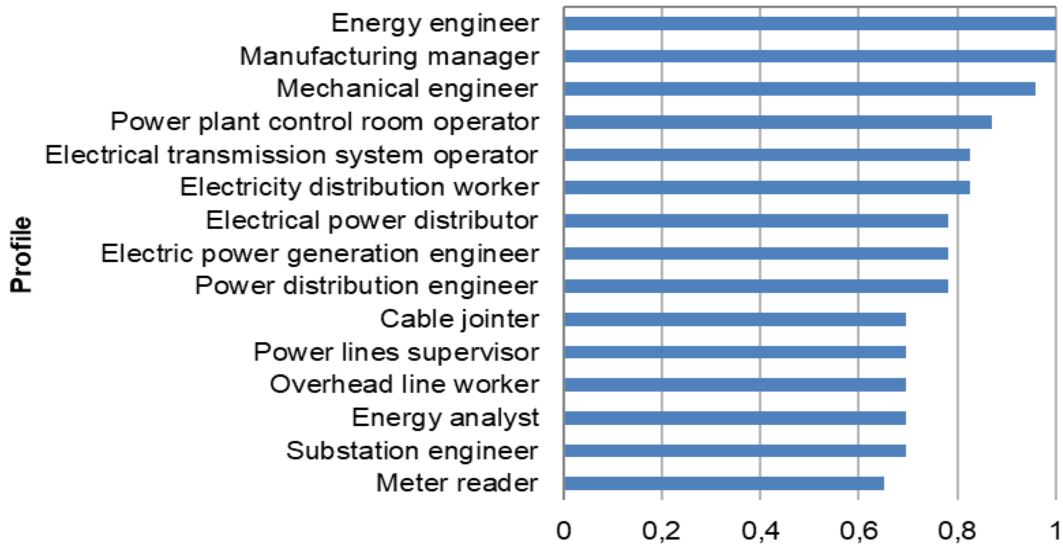
Based on the technologies extracted from the patents, the main ESCO occupations in the transmission and distribution cluster can be grouped according to four main branches of classification:

- science and engineering professionals: mechanical engineer, energy engineer, electric power generation engineer, power distribution engineer, substation engineer;
- science and engineering associate professionals, such as power plant control room operator, electrical transmission system operator, electrical power distributor, power lines supervisor, energy analyst;
- medium and low-skilled occupations, including electricity distribution worker, cable jointer, overhead line worker, meter reader;
- managers and business-related profiles, such as manufacturing manager.

In this cluster, the more transversal occupational profiles obtain greater relevance: energy engineer, manufacturing manager and mechanical engineer are in the first three positions (see Figure A.3). The profile of the energy engineer is transversal to the entire sector and has skills both in the phase of designing new solutions for the production field and also in the transformation and distribution of energy with a view to improving environmental sustainability and energy efficiency.

It is interesting to note the presence of low-skilled profiles such as cable jointer or power lines supervisor, which are profiles that are directly attributable to the electricity distribution network. At the same time, among high-medium skilled profiles the presence of power distribution engineer and substation engineer can be noted. The latter designs medium-voltage and high-voltage substations used for the transmission, distribution and generation of electricity and develops methods for the efficient operation of the energy process.

FIGURE A.3: Ranking of relevant job profiles for the transmission and distribution cluster (on the basis of the technologies they correlate with)



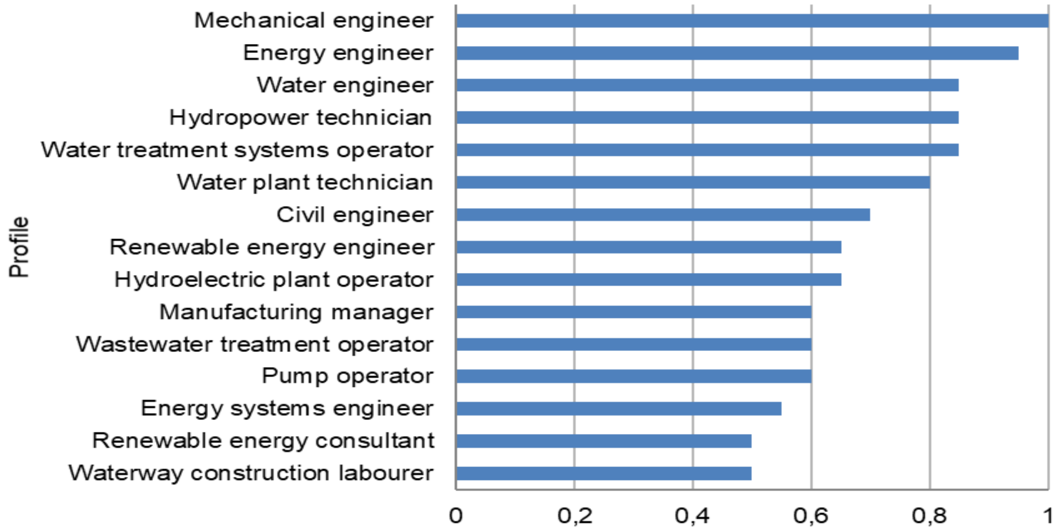
4. Hydropower

Based on the technologies extracted from the patents, the main ESCO occupations in the hydroelectric sector can be grouped according to four main branches of the occupational classification:

- engineering professionals include various branches of engineering, such as mechanical engineer, energy engineer, water engineer, civil engineer, renewable energy engineer, energy system engineer;
- associate professionals such as hydropower and water plant technicians, and some operator profiles such as wastewater treatment operator, hydroelectric plant operator, water treatment system operator;
- medium and low-skilled occupations, including service workers such as pump operators and waterway construction labourers;
- managers and business-related profiles such as manufacturing manager and renewable energy consultant.

With regard to hydroelectric power, mechanical engineer and energy engineer are in the first two positions in the relevance ranking, confirming their transversal skill profile. In the subsequent positions, it is possible to find professional profiles that are more specific to the cluster (see Figure A.4). Water engineers have skills that are related to the infrastructural aspect of water resource management; in addition to the design and development of water management projects, water engineers have the skills to maintain, repair, and build structures that control water resources, such as bridges, canals and dams. Hydroelectric technicians deal with the installation and direct maintenance of systems in hydroelectric power plants by ensuring that the turbines are operating in compliance with regulations.

FIGURE A.4: Ranking of relevant job profiles for the hydropower cluster (on the basis of the technologies they correlate with)



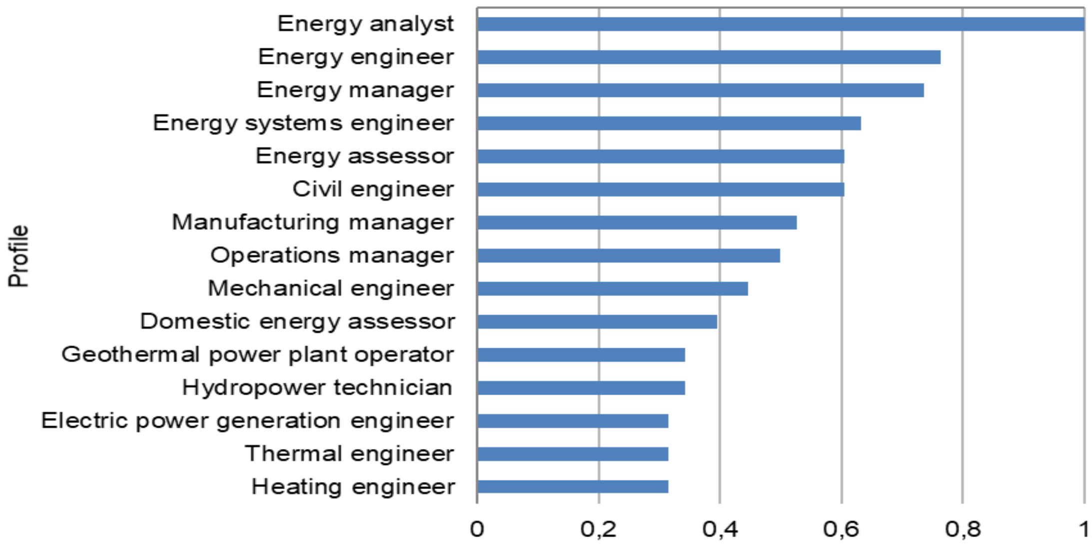
5. Thermal energy

Based on the technologies extracted from the patents, the main ESCO occupations in the thermal energy cluster can be grouped according to four main branches of the occupational classification:

- science and engineering professionals: energy engineer, energy system engineer, civil engineer, mechanical engineer, electric power generation engineer, thermal engineer;
- science and engineering associate professionals, such as energy analyst, energy assessor, domestic energy assessor, geothermal power plant operator, hydropower technician;
- medium and low-skilled occupations, including heating engineer;
- managers and business-related profiles, such as energy manager, manufacturing manager, operations manager.

In the thermal energy cluster, the professional figure that clearly emerges above the others is the energy analyst (see Figure A.5). Energy analysts are key figures in the process of improving the efficiency and modernisation of the electricity production system. Their skills are related to the analysis of existing energy systems and they participate in the development of policies regarding the use of traditional sources of energy. They work on efficiency improvements and recommend cost-effective alternatives. It is also interesting to note the presence of a managerial profile within the first three positions: energy managers are involved in implementing policies for increased sustainability and to minimise cost and environmental impact by coordinating energy use.

FIGURE A.5: Ranking of relevant job profiles for the thermal energy cluster (on the basis of the technologies they correlate with)



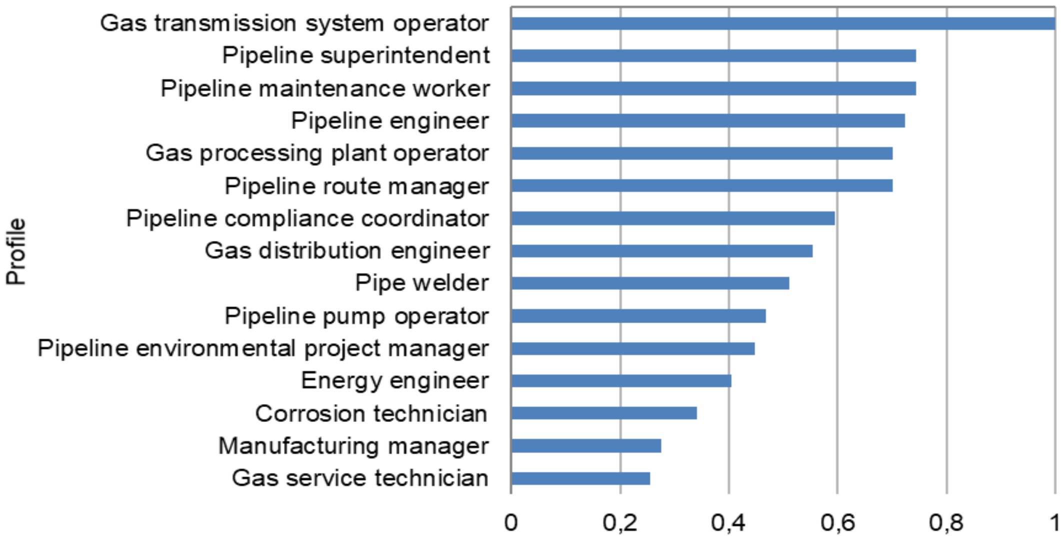
6. Oil and gas transportation

Based on the technologies extracted from the patents, the main ESCO occupations in the oil and gas transportation cluster can be grouped according to four main branches of the occupational classification:

- science and engineering professionals: pipeline engineer, gas distribution engineer, pipeline environmental project manager, energy engineer;
- science and engineering associate professionals, such as gas processing plant operator, pipeline compliance coordinator, corrosion technician;
- medium and low-skilled occupations, including pipeline maintenance worker, pipe welder, pipeline pump operator, gas service technician;
- managers and business-related profiles, such as gas transmission system operator, pipeline superintendent, pipeline route manager, manufacturing manager.

Similarly, in the oil and gas transport cluster it is the gas transmission system operator that comes out in the top position (see Figure A.6). Although generally the most relevant figures are represented by highly qualified profiles, it is interesting to note that in this case the first three positions are occupied by support staff and medium-low skilled profiles. The construction of pipelines is based on consolidated technologies and thus it is not surprising that the main demands are on operative roles. While the first profile is dedicated to the transportation of energy in the form of natural gas through pipelines, the pipeline superintendent manages the overall pipeline transportation project, and the pipeline maintenance worker maintains the overall sustainability of the facility.

FIGURE A.6: Ranking of relevant job profiles for the oil and gas transportation cluster (on the basis of the technologies they correlate with)



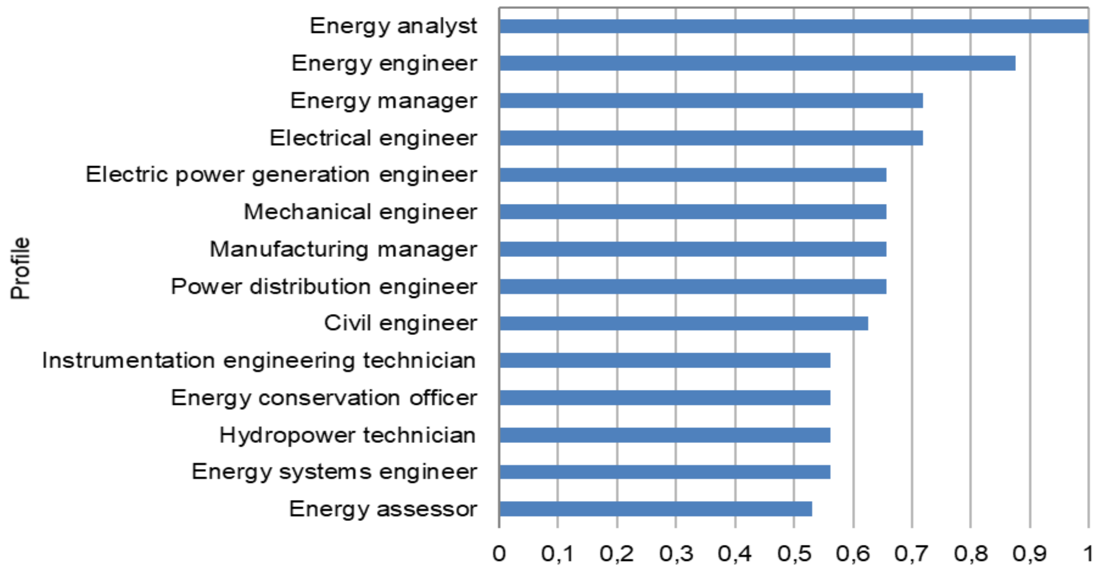
7. Energy efficiency

Based on the technologies extracted from the patents, the main ESCO occupations in the energy efficiency cluster can be grouped according to three main branches of the occupational classification:

- science and engineering professionals: energy engineer, electrical engineer, electric power generation engineer, mechanical engineer, power distribution engineer, civil engineer, energy systems engineer;
- science and engineering associate professionals, such as energy analyst, instrumentation engineering technician, energy conservation officer, hydropower technician, energy assessor;
- managers and business-related profiles, such as energy manger and manufacturing manager.

The professional figure of the energy analyst in the energy efficiency cluster acquires even greater importance (see Figure A.7). The capability of evaluating energy consumption is the first step towards putting in place an energy loss reduction strategy along the production-transmission-distribution chain. Competences related to this profile include the ability to suggest improvements in terms of energy efficiency solutions and to raise people's awareness of a more sustainable use of energy.

FIGURE A.7: Ranking of relevant job profiles for the energy efficiency cluster (on the basis of the technologies they correlate with)



ANNEX 3. GLOSSARY OF TERMS USED

API – Application Programming Interface (API), a computing interface that defines and allows interactions between multiple types of software without the need for human intervention.

Artificial Intelligence – a general term used to describe a variety of technologies and approaches that allow computers to solve complex tasks (usually associated with higher cognitive levels), for example: recognition of objects or patterns; classification of entities; simulation and modelling of situations; predictions of future behaviours; generation of constructs similar to existing ones.

Cognitive bias – a systematic pattern of deviation from norm or rationality in judgement. Cognitive biases are considered by many authors to be linked to the normal functioning of the human brain and thus can arise in any activity involving human judgement.

Competence – 'the proven ability to use knowledge, **skills** and personal, social and/or methodological abilities, in work or study situations and in professional and personal development' (European Qualifications Framework). While sometimes used as synonyms, the terms **skill** and competence can be distinguished according to their scope. The term **skill** refers typically to the use of methods or instruments in a particular setting and in relation to defined tasks. The term competence is broader and refers typically to the ability of a person – facing new situations and unforeseen challenges – to use and apply knowledge and skills in an independent and self-directed way.

Cross-sectoral (knowledge, skills or competences) – is one of the four levels of **skills** reusability identified by the **ESCO** initiative, whereby reusability it is meant how widely a knowledge, skills or competence concept can be applied in different working contexts. Cross-sector knowledge is relevant to occupations across several economic sectors, whereas sector-specific or occupation-specific knowledge is restricted to one specific sector or **occupation**. See also **Transversal knowledge**.

Cross-sectoral technology – adopting the concept of **cross-sectoral** from **ESCO**'s **skills** reusability levels, the term indicates a technology that finds application in many different economic sectors (e.g. control units or sensors).

ESCO – the **E**uropean multilingual classification of **S**kills, **C**ompetences and **O**ccupations. ESCO works as a dictionary, describing, identifying and classifying professional **occupations**, **skills**, and qualifications relevant for the EU labour market and education and training, in a format that can be understood by electronic systems. It lists over 3 000 occupations and 13 000 skills and competences). For more information, see https://ec.europa.eu/esco/portal/home.

ISCO – International Standard Classification of Occupations. This is an International Labour Organisation (ILO) classification structure for organising information on labour and jobs. It is part of the international family of economic and social classifications of the United Nations. It contains around 7 000 detailed jobs, organised in a four-level hierarchy that allows all the jobs in the world to be classified into groups, from 436 lower-level groups up to 10 major groups.

Job – a set of tasks and duties performed, or meant to be performed, by one person (ISCO-08).

Job profile – the description of a particular work function, developed by the employer or by the HR department of a company, that includes all the elements deemed necessary to perform the corresponding **job**. In particular, it includes general tasks, duties and responsibilities, and the **qualifications**, **competences** and **skills** needed by the person in the job.

Job title – the identifying label given by the employer to a specific job, usually when looking for new candidates for the position. In the absence of standardised nomenclature, it can coincide with either a description of the **job**, or the **occupation** group the job belongs too.

Labour Force Survey (LFS) – a nationally representative survey of households to understand and monitor the labour market and employment circumstances of a country's population. It is an inquiry directed to households designed to obtain information on the labour market outcomes of individuals by means of personal interviews. This comprises all persons aged 15-65 living in the households surveyed during the reference week, and those persons absent from the household for short periods due to studies, holidays, illness, business trips, etc.

NACE – abbreviated for the Statistical Classification of Economic Activities in the European Community (derived from the French ***N**omenclature statistique des **a**ctivités économiques dans la **C**ommunauté **e**uropéenne).* A four-digit classification of Eurostat, providing the framework for collecting and presenting a large range of statistical data according to economic activities. Economic activities are divided into 10 or 11 categories at high-level aggregation, while they are divided into 38 categories at intermediate aggregation.

Natural Language Processing (NLP) – an interdisciplinary field at the intersection of linguistics, computer science and information engineering. NLP deals with the interactions between computers and human (natural) languages, in particular how to program computers to process and analyse large amounts of natural language data, starting from the identification of the grammatical and logical parts of speech within a sentence, up to the complex representation of semantic relationships between words.

O*NET – Occupational Information Network, a free online database of occupational requirements and worker attributes. Currently the online database contains 1 016 occupational titles, each with standardised and occupation-specific descriptors, covering the entire US economy. It describes occupations in terms of the skills and knowledge required, how the work is performed and typical work settings. It can be used by businesses, educators, job seekers, human resources professionals, etc. It is a program that facilitates the development and maintenance of a skilled workforce, developed under the sponsorship of the US Department of Labour/Employment and Training Administration (USDOL/ETA). For more information, see https://www.onetonline.org/.

Occupation – according to ESCO, an occupation is 'a grouping of jobs involving similar tasks, and which require a similar **skill** set'. Occupations should not be confused with **jobs** or **job titles**. While a job is bound to a specific work context and executed by one person, occupations group jobs by common characteristics (for example, being the 'project manager for the development of the ventilation system of the Superfly 900 aircraft' is a job. 'Project manager', 'aircraft engine specialist' or 'heating, ventilation, air conditioning engineer' could be occupations, i.e. groups of jobs, to which this job belongs).

Occupational profile – an explanation of the **occupation** in the form of: description, scope, definition, and list of the knowledge, **skills** and **competences** considered relevant for it. Each occupation in the **ESCO** database also comes with an occupational profile that further distinguishes between essential and optional knowledge, skills and competences.

Profession – an **occupation** requiring a set of specific **skills** and dedicated training.

Qualification – is the 'formal outcome of an assessment and validation process which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards' (European Qualifications Framework).

Regulated profession – a profession is referred to as regulated if access to it, its scope of practice or its title is regulated by law.

Semantic matching – a technique used in computer science to identify information which is semantically related.

Skill – 'the ability to apply knowledge and use know-how to complete tasks and solve problems' (European Qualifications Framework). Skills can be described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments). While sometimes used as synonyms, the terms skill and **competence** can be distinguished according to their scope. The term skill refers typically to the use of methods or instruments in a particular setting and in relation to defined tasks. The term competence is broader and refers typically to the ability of a person – facing new situations and unforeseen challenges – to use and apply knowledge and skills in an independent and self-directed way.

Soft skills – usually associated with **transversal skills**, and considered to be the cornerstone for personal development, including within the context of labour and employment. To distinguish them from other knowledge-based basic skills, they are often referred to as social or emotional skills. They can be further classified into personal skills (e.g. problem-solving, adaptability) or interpersonal ones (e.g. teamwork, leadership).

Text mining – a general term indicating a variety of techniques that allow computers to extract, discover or organise relevant information from large collections of different written resources (such as websites, books, articles). The first part of any text mining process involves transforming texts into structured representations useful for subsequent analysis through the use of **natural language processing** tools. Sometimes **artificial intelligence** techniques are used to perform text mining tasks more effectively.

TOE (Tonne of Oil Equivalent) – a **unit of energy** defined as the amount of energy released by burning one tonne of crude oil. It is approximately 42 gigajoules or 11.630 megawatt-hours, although as different crude oils have different calorific values, the exact value is defined by convention; several slightly different definitions exist.

Transversal (knowledge, skills or competences) – the highest of the four levels of **skills** reusability identified by the **ESCO** initiative, whereby reusability means how widely knowledge, skills or competences can be applied in different working contexts. Transversal skills are relevant to a broad range of **occupations** and sectors. They are often referred to as *core skills*, *basic skills* or *soft skills*, the cornerstone for personal development. Transversal knowledge, skills and competences are the building blocks for the development of the 'hard' skills and competences required to succeed in the labour market.

Transversal technology – adopting the concept of **transversality** from **ESCO**'s **skills** reusability levels, a transversal technology is relevant to a broad range of **occupations** and sectors and is a building block for more specific technologies (e.g. computerised image analysis).

REFERENCES

Acclimatise. (2009). Climate change projections for Albania. Acclimatise, United Kingdom

Albanian Government, 2017. Second and Third Energy Efficiency Plan. https://www.energy-community.org/dam/jcr:8063f3a6-2759-4966-809f-7a92147389fb/AL_2_3_NEEAP_122017.pdf

Albanian Government, 2018a. Declaration of the Albanian Prime Minister at the International Conference 'Migration Challenges', 16 March 2018. https://kryeministria.al/newsroom/emigrimi-shqiptareve-si-fenomen-historik-ne-renie-2/

Albanian Government, 2018b. National Energy Strategy 2018-2030. https://administrata.al/Documents/strategjia%20doc/23.Strategjia%20Komb%C3%ABtare%20e%20Energjis%C3%AB%20p%C3%ABr%20periudh%C3%ABn%202018%20-%202030.pdf

Beqiraj, I., 2010. Production and treatment of oil and industry: environmental impact in Albania, https://www.researchgate.net/publication/294889951_Prodhimi_i_Koksit_te_Naftes_dhe_Impakti_Mjedisor_ne_Shqiperi

Energy Community, 2020. Annual Implementation Report 2020 for Albania. https://energy-community.org/news/Energy-Community-News/2020/11/23.html

Energy Community, 2021. Secretariat's WB6 Energy Transition Tracker Report, Feb 2021. https://www.energy-community.org/regionalinitiatives/WB6/Tracker.html

ETF, 2014. Skills 2020 Albania Working Document. https://www.etf.europa.eu/sites/default/files/m/27795DDCBD2353DAC1257D6400322D57_FRAME%20Skills%202020%20Albania.pdf

ETF, 2018. Digital Skills Factsheet. https://www.etf.europa.eu/sites/default/files/2019-02/digital-factsheet_albania.pdf

ETF, 2019a. Torino Process 2018-2020, Albania National report. https://openspace.etf.europa.eu/sites/default/files/2019-10/TRPreport_2019_Albania_EN.pdf

ETF, 2019b. Policies for human capital development in Albania: an ETF Torino Process assessment, POLICIES FOR HUMAN CAPITAL DEVELOPMENT IN ALBANIA | ETF (europa.eu)

ETF, 2020a. Key Indicators on Education, Skills and Employment (KIESE) 2020. https://www.etf.europa.eu/en/publications-and-resources/publications/key-indicators-education-skills-and-employment-2020

ETF, 2020b. Developments in vocational education policy in Albania: progress towards the medium-term deliverables of the Riga Conclusions in the period 2015–19. https://www.etf.europa.eu/sites/default/files/2020-05/riga_interim_report_albania.pdf

ETF, 2020c. Unlocking youth potential in South Eastern Europe and Turkey: skills development for labour market and social inclusion, https://www.etf.europa.eu/en/publications-and-resources/publications/unlocking-youth-potential-south-eastern-europe-and-turkey

ETF, 2020d. The future of skills: a case study of the agri-tech sector in Israel, https://www.etf.europa.eu/sites/default/files/2020-11/future_of_skills_agri-tech_sector_in_israel.pdf

ETF, 2021a. Case studies on the future of skills: methodological note for conducting case studies, March 2021, Turin, Skills for the future case studies, methodology | Open Space (europa.eu)

ETF, 2021b. How migration, human capital and the labour market interact in Albania:

www.etf.europa.eu/en/publications-and-resources/publications/how-migration-human-capital-and-labour-market-interact-4

ETF, 2021c. Changing skills for a changing world: understanding skills demand in EU neighbouring countries – a collection of articles, www.etf.europa.eu/en/publications-and-resources/publications/changing-skills-changing-world-understanding-skills-demand

ETF, 2021d. The future of skills: a case study of the automotive sector in Turkey, June 2021, www.etf.europa.eu/en/publications-and-resources/publications/future-skills-case-study-automotive-sector-turkey

ETF, 2021e. The future of skills: a case study of the agri-food sector in Morocco, www.etf.europa.eu/en/publications-and-resources/publications/future-skills-case-study-agri-food-sector-morocco

European Bank for Reconstruction and Development (EBRD), 2020. Transition Report 2020-21. https://2020.tr-ebrd.com/countries/#; https://www.ebrd.com/where-we-are/albania/overview.html

European Bank for Reconstruction and Development (EBRD), 2021. VISP: OSHEE COVID-19 Response (ebrd.com) and The EBRD in Albania

EC (European Commission) 2018. Staff Working Document Economic Reform Programme of Albania (2018-2020), Commission assessment, SWD(2018) 135 final. https://data.consilium.europa.eu/doc/document/ST-8117-2018-INIT/en/pdf

EC (European Commission) 2019. Directorate-General for Trade, Trade in goods with Kosovo. 3 June 2019. https://webgate.ec.europa.eu/isdb_results/factsheets/country/details_kosovo_en.pdf

EC (European Commission) 2020a. Staff Working Document: *Economic Reform Programme of Albania (2020-2022),* Commission Assessment, Brussels, 21.4.2020 SWD(2020) 70 final, https://ec.europa.eu/transparency/regdoc/rep/10102/2020/EN/SWD-2020-70-F1-EN-MAIN-PART-1.PDF

EC (European Commission) 2020b. Commission Staff Working Document: *Albania 2020 Progress Report* - 2020 Communication on EU Enlargement Policy, Brussels, 6.10.2020 SWD(2020) 354 final, https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/albania_report_2020.pdf

EC (European Commission) 2020c. Communication from the Commission on *An Economic and Investment Plan for the Western Balkans,* Brussels, 6.10.2020 COM(2020) 641 final, An Economic and Investment Plan for the Western Balkans (europa.eu)

EU-Western Balkans Summit (2020). Sofia Declaration on the Green Agenda for the Western Balkans*,* adopted on 10.11.2020 in Sofia, Regional Cooperation Council | Sofia Declaration on the Green Agenda for the Western Balkans (rcc.int)

EU Delegation to Albania, 2020. Donor mapping for the energy sector, internal note.

Eurostat, 2020. Statistics on young people neither in employment nor in education or training. https://ec.europa.eu/eurostat/statistics-explained/index.php/Statistics_on_young_people_neither_in_employment_nor_in_education_or_training#NEETs:_analysis_by_educational_attainment_level

Eurostat, 2021. Enlargement countries – Energy statistics. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Enlargement_countries_-_energy_statistics

Exit News, 2021. Synthesis of the situation during January 2021 on local media https://exit.al/en/2021/01/11/heavy-rain-results-in-flooding-throughout-albania/

Fida E. et al. (2009) Security of the energy sector in Albania in the face of climate change. In: Stec S., Baraj B. (eds) Energy and Environmental Challenges to Security. NATO Science for Peace and Security Series C: Environmental Security. Springer, Dordrecht. https://doi.org/10.1007/978-1-4020-9453-8_22

IFC & AKBN, 2010. Eficienca e energjisë në ndërtesa (Energy efficiency in buildings). [Online] Available at: http://akbn.gov.al/images/informacion/Eficenca/brochura%20final.pdf

ILOSTAT, 2020a. http://www.instat.gov.al/media/8132/atfp-t4-2020.pdf

ILOSTAT, 2020b. https://ilostat.ilo.org/data/country-profiles/

ILOSTAT, 2020c. https://www.ilo.org/gateway/faces/home/statistics?locale=EN&countryCode=ALB&_adf.ctrl-state=170zjxbzjr_4

INSTAT, 2013. Gender statistics in Albania. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/presentation/wcms_314033.pdf

INSTAT, 2017a. Adult Education Survey. http://www.instat.gov.al/media/4028/adult-education-survey-2017.pdf

INSTAT, 2017b. Table ‘Participation in education and training by sex, age and level of education completed, 2017’ http://www.instat.gov.al/en/themes/labour-market-and-education/lifelong-learning/#tab2

INSTAT, 2019. Produkti i Brendshëm Bruto. http://www.instat.gov.al/media/8278/produkti-i-brendsh%C3%ABm-bruto-final-2018-dhe-gjysm%C3%AB-final-2019.pdf

INSTAT, 2020a. Quarterly Economic Growth press release for Q2 – 2020 http://www.instat.gov.al/media/7520/gdp-q2-2020.pdf

INSTAT, 2020b. Quarterly Economic Growth press release for Q3 – 2020 http://www.instat.gov.al/media/7868/gdp-q3-2020.pdf

INSTAT, 2020c http://www.instat.gov.al/media/7362/foreigners-in-albania.pdf

INSTAT, 2020d. http://www.instat.gov.al/media/7848/diaspora-ne-shifra-2020.pdf

INSTAT, 2021a. Quarterly Economic Growth press release for Q4 – 2020 http://www.instat.gov.al/media/8172/gdp-q4-2020.pdf

INSTAT, 2021b. Yearly indicators of labour market 2010-2019, Unemployment rate by age group. http://databaza.instat.gov.al/pxweb/en/DST/START__TP__LFS__LFSV/NewLFSY014/?rxid=d914ac95-e70e-4d07-b7c0-f0f1d5b16d54

International Monetary Fund (IMF), 2020. Albania Country News, 2020. https://www.imf.org/en/Countries/ALB#whatsnew

IRENA (International Renewable Energy Agency) 2021. Renewables Readiness Assessment: the Republic of Albania, March 2021, Abu Dhabi

Kumar et al, 2019. Exploring the effect of energy consumption on the economic growth of Albania

Luo, T., Young, R., & Reig, P., 2015. Aqueduct Projected Water Stress Country Rankings.

Malka L., Konomi I, Gieta A, Drenova S., 2020, An approach to the large-scale integration of wind energy in Albania, International Journal of Energy Economics and Policy 10(5):327-343, DOI:10.32479/ijeep.9917

McKinsey 2021. Energy Insights – Global Energy Perspective 2021, January 2021.

National Agency of Natural Resources, 2017. Energy Balance Report. http://www.akbn.gov.al/wp-content/uploads/2019/02/Raporti-i-Bilancit-2017-ok3.pdf

O'Brien, T., Nedelkoska, L., & Frasheri, E., 2017. What is the binding constraint to growth in Albania. Center for International Development, Harvard University. Copy at http://www.tinyurl.com/y5ld58ot

OECD, 2021. The COVID-19 crisis in Albania, 31 January 2021. https://www.oecd.org/south-east-europe/COVID-19-Crisis-in-Albania.pdf

Prime Minister's Office, 2021. ITU Regional Forum for Europe in Digital Skills Development – Digital Skills in Albania https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Events/2021/Digital%20skills/1_Florensa_Haxhi_Albania.pdf

Serdari E., Muda V., Buzra U., Bërdufi I., Halili D., Halili M., Mitrushi D., and Berberi P., 2019, The feasibility study of a 12 MW grid-connected wind power farm in Albania using RETScreen, AIP Conference Proceedings 2075, 200021 (2019); https://doi.org/10.1063/1.5099035

Spasic V., 2021 https://balkangreenenergynews.com/albania-introduces-obligations-for-public-private-sector-to-increase-energy-efficiency/

UN Climate Change, the UNFCCC (UN Framework Convention on Climate Change) Secretariat, UNFCCC

UN Framework Convention on Climate Change (2016). Intended Nationally Determined Contribution (INDC) of the Republic of Albania following decision 1/CP.19 and decision 1/CP.20, https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Albania%20First/Albania%20First.pdf

UNFCCC, 2019. Intended Nationally Determined Contribution (INDC) of the Republic of Albania following decision 1/CP.19 and decision 1/CP.20. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Albania%20First/Albania%20First.pdf

UNICEF, 2014. Migration profiles – Albania. https://esa.un.org/miggmgprofiles/indicators/files/Albania.pdf

Valcheva, R., 2018, Temperature and precipitation projections according to RCP45 scenario for Bulgaria and Balkan Peninsula. https://www.researchgate.net/publication/325846092_Temperature_and_Precipitation_Projections_According_to_RCP45_Scenario_For_Bulgaria_and_Balkan_Peninsula

World Bank, 2009. An assessment of climate change vulnerability, risk, and adaptation in Albania's power sector. https://openknowledge.worldbank.org/handle/10986/17532

World Bank, 2010. Albania's energy sector: vulnerable to climate change, Europe and Central Asia knowledge brief, Jane Ebinger, September 2010. https://openknowledge.worldbank.org/bitstream/handle/10986/10161/622470BRI0Alba0Box0361475B00PUBLIC0.pdf?sequence=1

World Bank, World Bank Group Partnership, Program Snapshot – Albania, 2015. - http://pubdocs.worldbank.org/en/628841445980891015/Albania-Snapshot.pdf

World Bank, 2016. Albania: (Intended) Nationally Determined Contribution ((I)NDC) for Paris Agreement, Climate Policy team, Washington D.C. http://spappssecext.worldbank.org/sites/indc/PDF_Library/AL.pdf

World Bank, 2020a. 'The World Bank in Albania'. https://www.worldbank.org/en/country/albania

World Bank, 2020b. Albania Country Overview.

https://www.worldbank.org/en/country/albania/overview#1
https://www.worldbank.org/en/country/albania/overview#3

World Bank (2020c), Human Capital Index 2020 – Albania, Albania (worldbank.org)

World Bank, 2021. Western Balkans Regular Economic Report No.19. Subdued Recovery. Washington DC: The World Bank. https://openknowledge.worldbank.org/handle/10986/35509

WEF (World Economic Forum), 2019. Global Competitiveness Index. http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf

WEF (World Economic Forum), 2021a. Fostering effective energy transition, 2021 edition, Insight Report, April 2021. https://www.weforum.org/reports/1edb4488-deb4-4151-9d4f-ff355eec499a

WEF (World Economic Forum), 2021b. Harnessing artificial intelligence to accelerate the energy transition, in collaboration with Bloomberg NEF and Deutsche Energie-Agentur (dena), White Paper, September 2021.

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