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Engineering curricula modernization in renewable energy in Albanian Universities

ENGINE

Project reference No. 619338-EPP-1-2020-1-AL-EPPKA2-CBHE-JP

(Deliverable 1.4)

Report on learning outcomes for VET and bachelor new and updated study programs

April 2021

Co-funded by the
Erasmus+ Programme
of the European Union

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Abbreviations

- ENGINE – Engineering curricula modernization in renewable energy
- MSc – Master of Science
- MP – Master Professional
- BA – Bachelor Degree
- RE – Renewable Energy
- SoSE – System of systems engineering
- VET – Vocational Education & Training

Universities & Institutions:

- EU – European Union

- HEI – Higher Education Institution
- KHAS – Kadir Has University
- PUT – Polytechnic University of Tirana
- UAMD - University Aleksander Moisiu of Durres
- UET – European University of Tirana
- KPT –Professional College of Tirana

Programs & Profiles:

- CE – Civil Engineering
- ChE – Chemical Engineering
- EE – Electrical Engineering
- EnE – Energy Engineering
- IDA – Integrated Degree in Architecture
- IE – Industrial Engineering
- IT – Information Technology
- ME – Mechanical Engineering
- MoO – Management of Organizations
- TE – Transport Engineering
- T&IE – Transport & Infrastructure Engineering
- UP – Urban Planing

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Summary

This document summarizes the results obtained from the analysis of the Albanian energy sector, as well as the results obtained from questionnaires and interviews with stakeholders.
The results help defining of the necessary knowledge, skills and competencies of engineers and specialists in this sector in terms of learning outcomes.
This report corresponds to D.1.4. "Job/domain analysis and development of guidelines for learning outcomes for VET and bachelor new and updated study programs" related to the ENGINE project.
The report is based on the following sections:

- Detailed field analysis (design and use of equipment and systems for renewable sources)
- Learning outcomes in the process of engineering education in Albanian partner HEIs
- Data analysis and development of guidelines for learning outcomes for VET and Bachelor new and updated study programs
- Conclusions

1. The analysis of energetic sector

Analysing labour market data and specifically labour power market described in Section 1.1 is important for the scope of our Project in order to identify and understand issues that affects our decisions in respect of updating the curriculas in accordance with power sector challenges and main Energy Strategy objectives.

Institute of Statistic in Albania provide a wide range of data in respect of labour market, education, etc through the surveys and natioanl census, but such data are very general and limited for the scope of the Project.

1.1Market in energy sector

The energy production system in Albania is totally based on hydro power plants. The demand for electricity, in accordance with the Albanian Market Model, is fulfilled by the production of public company Albania Power Corporation (KESH), the import of eligible suppliers to supply eligible customers, Electricity Distribution System Operator (EDSO), which is obliged to cover losses in the distribution network, and the generation of small and medium size hydro power plants (SPPs) connected direct to the transmission and distribution network. The activities of the Power System in Albania are exercised by entities licensed pursuant to Law no. 43/2015 "On Power Sector", as amended.

Under the framework of unbundling system in Albania, starting from 2004, Transmission System Operator (TSO) is established as an independent company 100% owned by state. Distribution System Operator was legally established in Albania in 2007, followed by privatization process which resulted unsuccessful ones and since 2014 the Distribution System Operator has the status of public company 100% owned by state. According to the provisions of the Power Sector Law, since January 2020 the distribution company is unbundled and the new companies are established, respectively the Universal Service Supplier and Electricity Distribution System Operator, enabling a safe, transparent and qualitative service to end use customers company.

Albanian Power Corporation (KESH sh.a) is the public company which manages the production of the Drin River cascade with a total installed capacity of 1350 MW (excluding Ashta HPP) and is charged with the public service obligation for the Electricity supply of the Universal Supplier with a regulated tariff approved by Regulatory Body. The total installed capacity managed by KESH accounts for 1448 MW including Vlora Thermo Power Plant and constitutes about 63.47% of the total installed capacity in the country.

Other electricity production companies are private generation companies, such as the priority and independent producers of electricity, as well as Lanabregas HPP, with a total installed capacity of 827 MW or about 36.53% of the total installed capacity in our country.

1.1.1 Short overview of the results in the development of generation facilities in the last decade

It is already known that Albania is a net importer country of electrical energy. The approach of satisfying the country needs with electrical energy through import it is not a feasible alternative from view of the security of power supply in the conditions of limited capacities of transmission lines, as well as from economic point of view, taking into account that the import prices are not stable and are subject of fluctuation.

Focusing and referring to the national and regional development of electrical energy market, in the frame of power sector reforms and use of incentive mechanism with the aim to increase and absorb the private investment in the field of electrical energy generation, it was considered as a high priority the exploitation of national resources in general and of hydro power potentials particularly.

The optimal use of hydropower potential resources through the massive constructions of small and medium size HPPs has other preferences and country benefits except the increase of the energy production. The geographical expansion of HPPs in country has notably improved the power quality and has positively influenced in network loss reduction and at the same time increase the efficiency use of electrical energy. These positive impacts are experienced after the commissioning and put in commercial operation of new HPPs or after the complete rehabilitation of the existing hydropower facilities.

Design, construction, implementation projects of hydro power plants and their connection to the distribution network is a process that have been growing up rapidly in the last two decades and according the studies is going to be the same trend also in the near future.

The total HPPs installed capacity is 2,214.5MW with average annual energy production of 5.8 TWh during the last decade, while the estimated potential for HPPs capacity installation is about

4,500 MW with average annual energy production of 16 TWh. So, only 42 % of hydropower potential is utilized.

As a result of the still unexploited hydro capacities, almost all plants are built as HPPs, and a large proportion of those with installed capacity less than 15 MW. These power capacities are connected to the transmission and distribution network, turning the distribution network into an active network. The implemented projects of small and medium size HPPs through private investment partnership or concessions schemes have had a very positive impact in energy production and reduction of the import in Albania.

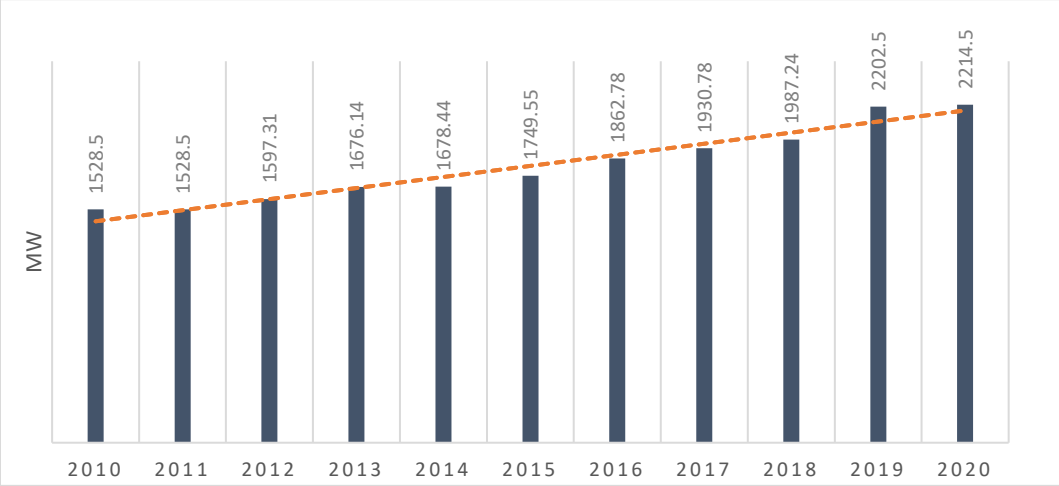


Figure 1 Total Installed capacity on the Transmission network. (Source TSO)

In the Figure Nr. 1 it is evident the development of hydro generation schemes in Albania and their contribution in the increase of the energy production in the last decade. The installed capacity of the power plants connected in the transmission system for 2020 was 2214 MW

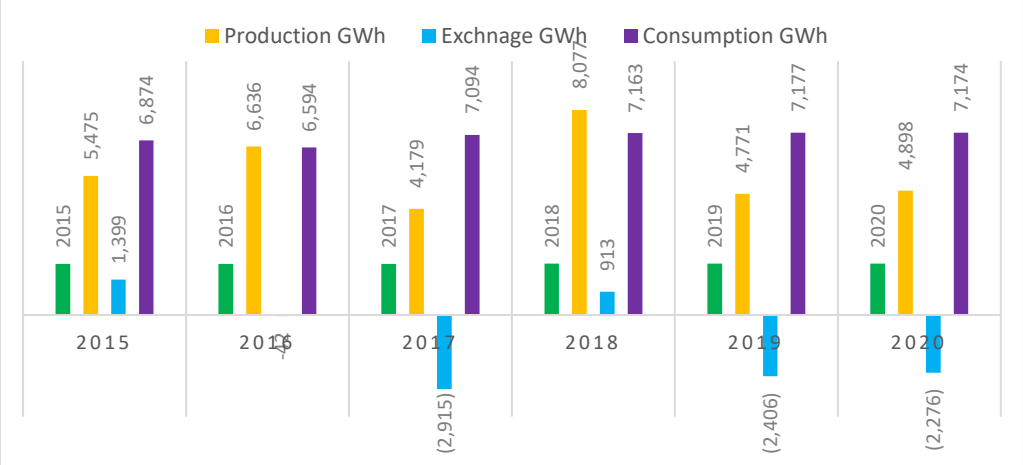


Figure 2. Energy Balance (Source: TSO)

The figure Nr.2 demonstrates the country energy balance during the period 2015-2020. As far as the country energy balance is concerned it results that during 2020 the import of energy was 2276 GWh, compared with 2406 GWh of import in 2019.

In the 220 kV network there are connected also private HPPs owned by AYEN, namely Peshqesh (28MW) and Fang (72MW). In the recent years there have been many run of river hydropower plants connected to the Albanian power system, whereas most of them have been connected into 110kV (Fig.3) and distribution system. All this exploitations of Albanian rivers and consequently increase of installed generation capacity has led to a less dependent situation from imports for country adequacy.

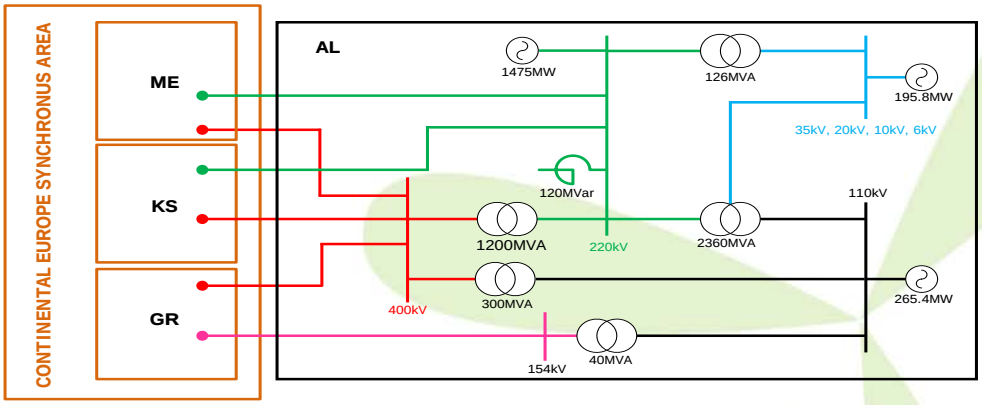


Figure.3 Hydro Generation Capacity according to the network connection point

The installed capacity of the plants connected to the distribution network is 280 MW. This installed capacity of the plants in the distribution network consists of 265 MW of the installed capacity at Hydro resources and 15 MW is the installed capacity in photovoltaic plants.The production realized by the hydropower plants connected to the distribution network during 2020 is in the amount of 646 366 MWh, while the production realized by the photovoltaic plants is in the amount of 22 190 MWh.

1.1.2 Incentive Policies

The incentive policies applied during period 2003 -2017 can be classified as follows:

Till 2008 - Calculation methodology of selling price for small and medium size HPPs named "Cost Plus" was likely the traditional approach Cost of Service/ Rate of Return i.e. calculation of selling price of energy for each HPPs was based in their respective costs (installed capacity and operation) added as well a rate of return.

2008-2014–The uniform price of all licensed producers of hydro energy from HPPs with an installed capacity up to 10 MW, constructed and in commercial operation before 2007, was calculated as follows:

$$P\_U=(P\_R \ 〖-P〗\ \_T\ )*(1-L\_D\%) \quad (1)$$

Where:

P_U – Unit price in leke/kWh

P_R – Retail average price in leke/kWh

P_T– Tariff of transmission network use

L_D– Technical losses in the distribution network

2008-2014 – The uniform price of all licensed producers of hydro energy from HPPs with an installed capacity up to 15 MW, constructed and in commercial operation before 2007, was calculated as follows:

$$P\_U=P\_I*1.1*REX \quad (2)$$

Where

P_U – Unit price in leke/kWh

P_I– Import price in euro cent/kWh

REX – exchange rate in euro/leke

2015-2016 the approach that was followed to define the fix tariff to be paid to the private producers was calculated as follows:

$$P\_U=P\_A*1.24*REX \quad (3)$$

Where

P_U – Unit price in leke/kWh

P_A– Annual Average price of Hungarian Power Exchange (HUPX) in euro cent/kWh

REX – average exchange rate in euro/leke for the last year

Year 2017under the framework of Law Nr. 7/2017 " On the promotion of the use of energy from renewable sources “the unit price of selling energy from private and concession HPPs is

going to be defined according Feed in Premium approach FIP, i.e. a bonus over the market price considering that Albanian Power Exchange (APX) should be established in July 2021

1.1.3. Transmission System Operator

Transmission System Operator (TSO) actually is responsible for the functions of Transmission Network Operator, Market Operator and Dispatch System Operator and perform it activity completely separated from the activities of generation, distribution, trade and supply of electricity, in compliance with the Power Sector Law Provisions. Transmission System Operator since March 2017 became a full member of ENTSO-Es.

The Albanian power System is a meshed network with a vertical profile. The structure of the Albanian Power System is characterized by the concentration of generating capacities in the northern part of the country while the loads are mainly concentrated in the central and southern part of the country leading to a physical flow direction from the northern part to the south.

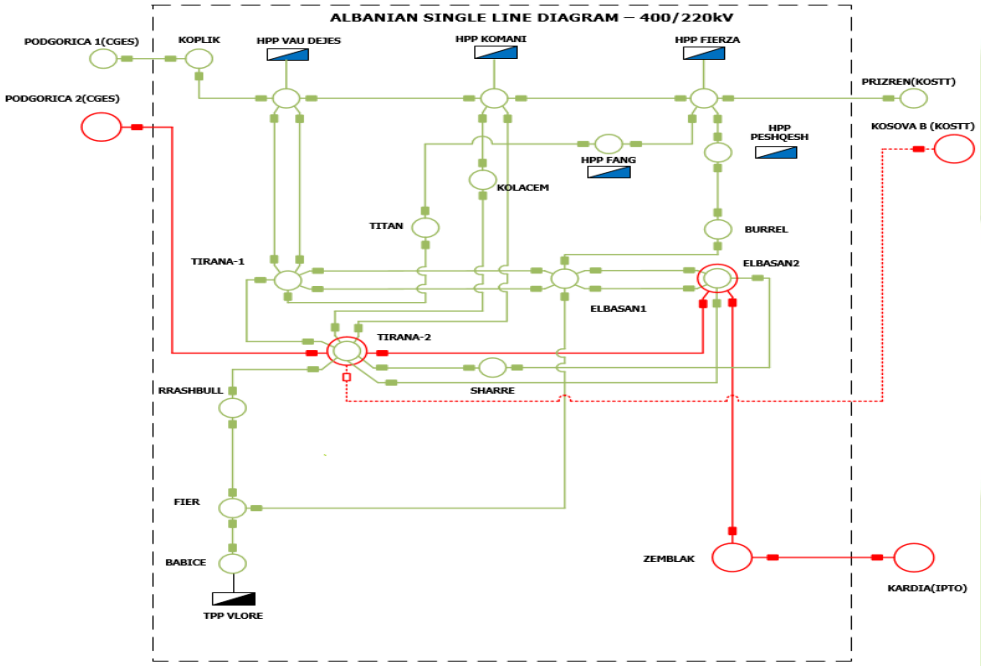


Figure 4. Singler Line Diagrame 400/220 kV

The Transmission Network has the following voltage levels: 400kV, 220kV, 154kV and 110kV and is well interconnected with other neighbors countries: 2 tie lines with Montenegro(400kV, 220kV); 2 tie line with Kosovo (400kV that was put in operation on December 14, 2020, as well as the line 220kV); 2 tie lines with Greece (400kV, 154kV).

The main generation capacities are connected with the load consumption centers through 220 kV network followed by transformation substations 220/110 kV, (110 kV network supplies all distributation substations 110 kV that mainly represent the load nodes) The network of 110 kV is developed in all urbanm areas in Albania and supplies all 110 kV substations that belong to the Electric Distribution System Operator as well as to the other clients that are directly connected to this network

The new situation for the power system with a self-sustained 110kV network from the balance point of view, has changed the physical flows in the network, consequently in certain months

of the year with high hydrology, the country has a positive balance exporting through the tie lines.

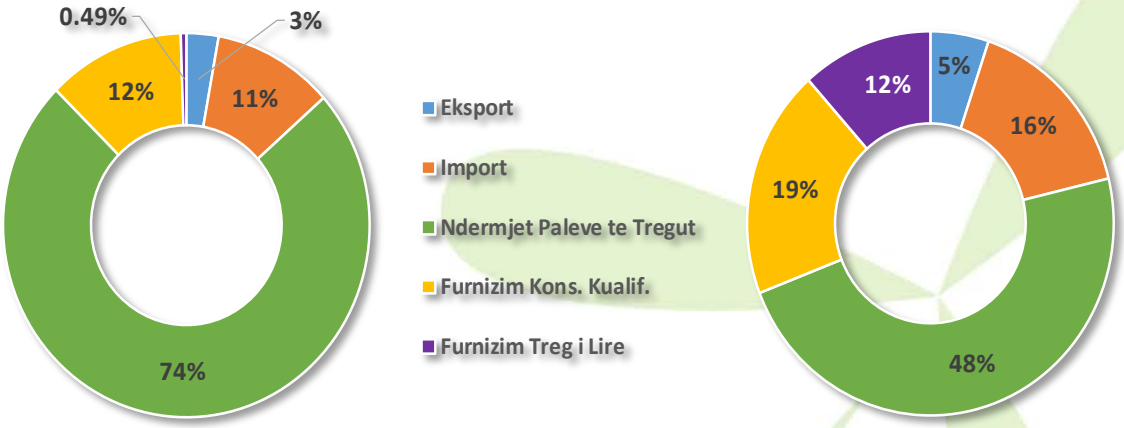
In terms of network control technology, TSO, uses SCADA/EMS systems, which enable the real time communicates also with neighbouring Transmission Companies.

Through this platform all transmission nodes are operated, monitored and commanded in real time, generators are commanded to reduce / increase the generation depending on the need of the system not to deviate from the cross-border exchange program, as well as to maintain the system frequency, in accordance with the planned values. Currently under Automatic Generation Control are 5 hydropower plants, Fierze, Koman, Vau Dejes, Banja, and Fangu.

1.1.4 Market Operator

Market Operator actually is part of Transmission System Operator and is responsible for the Register of all market players following all respective registration procedures defined in the Transmission Code System and market Rules.

During Year 2019, in the register of Market are registered and administrated the following contracts among parties:



According to the transaction value

According to the numbers of Contracts

The number of producers and consumers that will joint the liberalized market is going to be increased upon a full market liberalization and it will be fully operative. The day Ahead Market and Intraday market To enable the operation of a liberalized electricity market, it is ongoing the procedure for establishing a functional balancing market and ancillary services which will contribute to an optimal and realistic cost of such services.

The process of creation and functional operation of the Albanian Power Exchange and the procedure for the selection of stock exchange shareholders is ongoing and it is foreseen to be fully operative by June 2021. The establishment and operation of the exchange shall enable market operators, producers, suppliers, traders and customers to have a reference price which will result in long term in a decrease of the cost of energy.

1.1.5 Albanian Electric Distribution Network

Electric Distribution System Operator manages 102 substations with 35/10/6kV and about 1130km of 35kV lines that stretches across the country.

The EDSO assets like 35/10/6kV substations as well as the 35kV lines connecting these substations have a 40 - 42 years utilization period and consequently have high aging and depreciation. The overloaded work regime in which they worked has led EDSO to face difficulties in managing the network, which are reflected in the quality of customer supply: the number of outages, their duration as well as the level of losses.

1.1.6 Electricity Consumption

The new social-economic developments and the free moving of the population, change significantly the electricity consumption in Albania (Figure 5). The rapid increase of the power demand and the reduction of available capital have resulted in a need for improvement in production and use of electricity, the increasing of the international connections and exchanges, and more extensive justification of new system facilities. The first approach to overcome this challenges it was the increase of the international connections and exchanges.

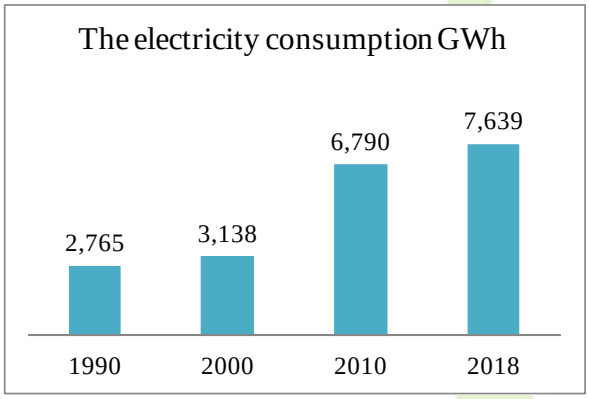


Figure 5. The electricity consumption during last decades

The electricity demand has not only been increased extremely, but the significant changes have been in its structure as well. In Figure 6 is shown the structures of electricity consumption in three different periods. The character of load is changed from industrial to residential/commercial. These kinds of loads consume small reactive power. So, the load is more active power.

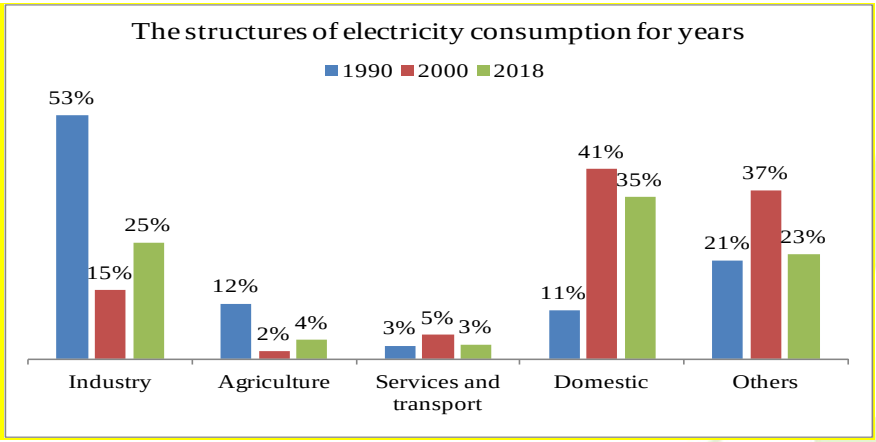


Figure 6. The structures of electricity consumption in three different periods

The electric energy consumed in the electric distribution network is concentrated in the regions of Tirana-Durres (about 50% of the total energy consumption), while the major part of the new generation capacities are installed in rural areas with low consumption of energy (about 17% of total consumption).

Most of the HPPs connected to the distribution grid are run-of-river, i.e. they do not create large water reserves and do not require the construction of large dams or reservoirs so due to the non-energy storage there is a weak correlation with grid load request, especially during night when there is low energy demand and when power generated by HPPs may be at its peak favoured by weather conditions as water flows. Under these conditions occurs the reverse power flow to Transmission System Operation (TSO).

Meantime, the major part of the new generation capacities are installed in remote rural areas, where the distribution network, despite the periodical maintenance faces an increased number of outages, deficiency in the transformer and transmission capacities to welcome the injection of generation of the new hydropower plants.

Distribution network continuously is closed to the limit of normal operation due to the fact of high penetration of energy generated from the new HPPs. Such constrains includes technical

constrains referring to the allowed limit of the level of the voltage to be maintained, level of losses of loads, specific requests of Transmission System Operator etc.

1.2 Situation of renewable energy in Albania

- **Hydropower**

Albania has tapped a great deal of its hydropower energy potential, so that nearly 50% of the full potential is already tapped. It has now reached a point where the intense exploitation of small rivers throughout Albania is creating negative environmental impacts and has raised the general popular opposition to future developments of such plants. As a result, no further hydropower capacities are expected by 2030 excluding the ones that are already under construction or under concessionary agreements.

Another important factor that has put the brakes on the hydropower generation is its variability and low reliability. This type of energy is highly dependent upon the season. The highest amounts of production occur in the winter season, when over 90% of the precipitation occurs. During this period, the country produces a surplus of electricity, which is exported. However, in June through October, hydropower production drops significantly and the country struggles to meet demand, resulting in large electricity imports.

- **Solar Energy**

Solar energy is the one with the greatest prospect and possible benefits since it is almost in phase with the increased demand during summer months and the moments during the day when the greatest demand for cooling occurs.

In the year 2018, only 10 MW of solar PV was connected to the grid (EnC, 2019), while by 2020, 88 applications were submitted for the construction of solar PV plants of up to 2 MW, and 12 of these applications have been authorized for construction, which amount to a total capacity of 24 MW. Following the first auction for solar PV, in November 2018, 50 MW of solar PV was approved for construction under a Contract for Difference (CfD) support scheme. An additional 50 MW will be built by the same developer without a support measure (MIE, 2019). In January 2020, another 140 MW solar plant will be built in Karavasta, near the city of Fier, of which 70 MW will be supported through a power purchase agreement at 24.89 Euro

per MWh, while the rest will be sold at market price. The latest auction-bidding round was launched at the end of 2020 for the construction of a 100 MW solar PV plant in Durrës with a price ceiling of 55 Euro per MWh.

Solar water heating installations have been a popular choice in residential settings. These installations are estimated to amount to 176 000 m^2 of solar water heating capacity, which is equivalent to 123 MW of nominal thermal capacity. Of this installed capacity, 90% is from flat-plate collector systems, while 10% is from evacuated tube collectors.

- **Wind power**

Up to date, Albania has no wind power plants, but according to the Ministry of Industry and Energy after the introduction of the wind Feed-in-Tariff support scheme, 70 applications have been received for the construction of wind plants up to 3 MW. Of these, three have been authorized for construction with a total capacity of 9 MW.

1.2.1 Other available incentives for renewables in Albania

In Albania, renewable energy sources are supported through the following support schemes.

Feed-in tariffs (FiTs)

FiTs are extended to eligible small-scale renewable energy power plants, including aeolic plants up to 3 MW, HPPs up to 15 MW, and photovoltaic plants up to 2 MW. The unbundled subsidiary of the distribution system operator, OSHEE is obliged to purchase the energy generated by these plants at a price set by the energy regulator

for 15 years. The tariff set by the regulator assumes a reasonable return on investment for the private investor. The energy regulator grants to these plants a license for power production and draws up a power purchase agreement.

Contract for Difference (CfD)

For renewable energy plants with capacities larger than the ones qualifying for FiT

are eligible for Contract for Difference tariff or CfD. This tariff is determined through competitive bidding/auction. The auction terms and conditions are approved by the Council of

Ministers, who may choose to limit certain technologies in the tender due to criteria such as network connection costs or resource diversification. The CfD is foreseen to have a duration of 15 years. Producers will be able to sell the electricity in the market and receive the variable difference between the auction price and the electricity market price (currently based on the Hungarian power exchange price) as a support measure. An important detail to underline is that if prices in the electricity market go up and are higher than the auction price, renewable power producers will be obliged to pay back the difference.

Net-metering scheme

Private households and small and medium-sized enterprises with wind and solar installations up to 500 kW are eligible to net-meter their renewable energy production with their electricity consumption. The net-metering calculation is done on a monthly

basis and the surplus electricity can be sold to the service provider will be credited in his electrical bill according to the price set by the energy regulator.

Customs and Value Added Tax Exemptions

Machinery and equipment used for the construction of energy power plants (both non-renewable and renewable energy technologies) are exempted from custom duties. The fuels used for producing electricity are also eligible for tax exemption. However, a tax exemption does not apply to solar thermal systems. Value-added tax (VAT) is exempted applied on all equipment, machinery and fuels, for all imported solar PV machinery and equipment valued above 50 million Albanian Lek (406,000 Euros) and for project capacities above 500 kW.

1.2.2 Institutional stakeholders in the field of renewable energy

The institutions responsible for energy development in in Albania are:

The Ministry of Infrastructure and Energy (MIE)

This is the ministry responsible for the energy sector and is designated to prepare, periodically national energy strategies and policies. MIE is also responsible for granting concessionary rights for the construction of power generation plants.

The National Agency of Natural Resources (AKBN)

This agency is under the supervision of MIE, and is designated for the development and supervision of rational use of natural resources, according to the policies of the government. The agency monitors the sustainable use and rehabilitation of natural resources in mines, hydrocarbons and energy.

The Energy Efficiency Agency (ERE)

This is an agency 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 in residential and institutional building sectors, transport, industry, and agriculture. The agency also undertakes energy audits, provides certifications for energy auditors and advises on the preparation of bylaws that promote energy efficiency.

The Ministry of Tourism and Environment

This is responsible for environmental protection, biodiversity, and climate change. The ministry is responsible for approving the environmental assessments for any future development projects including the ones in the area of energy.

The National Environmental Agency

This agency operates under the institutional framework of the Ministry of Tourism and Environment and is responsible for reviewing the environmental impact assessment

(EIA) process All power generation and transmission projects require an EIA prior to being granted a construction permit. However, small renewable power plants are only initially subjected to a preliminary EIA which, upon review, the agency may decide to further subject to an in-depth EIA.

The Energy Regulatory Authority (ERE)

This is an independent public body whose responsibilities include regulating activities in the electricity and natural gas sectors, developing and adopting electricity market rules while also monitoring all electricity market operations in Albania. The authority determines the electricity tariffs, including feed-in tariffs (FiTs), to all eligible electricity producers from renewable sources. ERE also defines the standard purchase agreements of these producers.

1.2.3 Economic outlook of renewables

Albania offers one of the lowest level cost of energy (LCOE) for hydropower generation, averaging around 35 Euros per MWh. The average LCOE for solar PV in Albania is estimated to be around 70 Euro per MWh, which is twice as much as hydropower. Consequently, the PV development has not flourished until now. To make possible greater development of PV projects it is required to extend additional incentives by the Albanian government until the expected decrease in the cost of PV technology will lower the LCOE of PV installations below that of hydropower plants. The cost-decreasing trend is already apparent, from the latest auction bidding in Albania, which reached 24.89 Euros per MWh. Similarly, the LCOE for wind generation is expected to fall below 50 Euros per MWh by 2030.

1.2.4 The rationale for Solar and Wind Energy in Albania

Albania has to think beyond hydropower energy for the following reasons:

Out of phase production in comparison to electric demand

Hydropower is generated mostly during winter months and it can cover the demand during the winter but not the demand during the summer. With increased tourism the demand for electricity during the summer is expected to increase proportionally. This demand cannot be covered by the hydropower plants and Albania will be obliged to continue to import energy during the summer at higher rates.

Unreliability

Hydropower generation is highly variable and unreliable. With variations in precipitations during different years it is hard to predict and to plan whether in a certain year the country will export or import energy and how much will export or import. Energy purchases are usually undertaken well in advance to take advantage of lower prices for such anticipated purchases, but unexpected droughts will oblige the transmission operator to purchase energy at a short notice and, consequently at a higher prices.

Global warming

Global warming is going to affect negatively the hydropower potential. A consequence of global warming in Albania is the extensive droughts and extreme precipitations within a short time span. The greatest decrease in precipitation is expected during the summer (World Bank, 2020a). A 15% decrease may be expected by the year 2050 in the average annual electricity generation from existing large HPPs, while small HPPs are expected to have a 20% decrease in generation output (Ebiger, 2010). The rise of temperatures is also expected to increase the demand for cooling, that cannot be supplied by hydropower production, since it declines significantly during summer months.

In the other end global warming is characterized also by extreme intensive precipitations within a short time span. These intense precipitations will cause quick replenishment of the hydropower reservoirs forcing the generation companies to release some of the water through discharge gates losing this commodity in the process.

Decentralized generation

One of the drawbacks of hydropower generation is its asymmetry. Most of Albania's electricity generation occurs at regions far from the areas of high demand of electricity. This causes losses in energy transmission. Therefore, a shift towards non-hydro-based renewable generation close to demand centers would be advantageous for power sector development. In fact, the Albanian Government is searching for strategies to mitigate this asymmetry by constructing new transmission lines that can improve network capacity, but these measures will still fall short of the potential for decentralized generation of the solar and wind.

Social benefits

The deployment of renewable energy leads to numerous social benefits for communities and countries, including employment, income generation, decreased air pollution, better health and increased industrial development leading to higher GDP. Although many parts of the value chain are imported or require a trained and certified workforce, much

of the workload – especially in transport and construction – can be filled by the local workforce of existing industries, which can immediately contribute to local employment and income generation.

With skilled local labor, specifically in operation and maintenance a large part of the workforce can be sourced locally, enhancing the improvement of local economy. In addition, local workforce will be needed for operation and maintenance. Even though manufacturing of solar PV and wind energy technology is concentrated in a limited number of countries, manufacturing of individual system components is already a reality in Albania, with several companies manufacturing these components locally. Furthermore, such systems can have direct economic benefits on end users since they can reduce their monthly electricity bills.

1.2.5 Challenges for implementation of renewables and their mitigation

Some of the challenges identified for the implementation of renewables in Albania are as below.

Spatial planning

Harnessing renewable energy resources yields economic, social and environmental benefits, but it also poses various challenges for their integration into a space that may be already used for other purposes. PV plants may require large areas, which are not as readily available, or can be used for agricultural purposes. Even in uncultivatable lands there are rent charges that will need to be paid to private land owners. In urban settings PV installations are constrained by the available space on top of roofs or other available structures. The same is also true for wind installations. Therefore, ingenious ways need to be found to use the available space.

One strategy is to define zones with good potential for power development and not within environmentally sensitive areas. These zones must satisfy various criteria – such as proximity

to existing or planned grid infrastructure, load centers, road networks, while avoiding environmentally protected areas or other locations that may not be acceptable for development. Such zones would inform policy makers in setting technology generation targets or auction sizing, and guide coordinated planning of generation and transmission infrastructure. Furthermore, renewable energy zones help to guide potential investors into prioritized development areas, which in turn reduces risks during project development.

Energy yield variations

Energy from renewals such as solar and wind is highly variable. The specificities of their availability need to be well understood and assessed so that they can be adequately harnessed and integrated into the system. Consequently, appropriate design is required prior to installation to allow for the continued optimal operation. This can minimize

technical disturbances to the grid and increase the quality of energy supply while ensuring economic viability for the power producer, the system operators and the final consumers. Proactive planning, based on techno-economic resource potential, thus plays a crucial role in the development of a robust energy sector.

The limited capacity of the electric network to support additional electric flux

The injection of renewable energy to the existing electrical network will pose new challenges to the distribution grid, as there is currently limited capacity of this grid to accommodate additional fluxes of electricity. Consequently, this injection will cause increased power losses in the network. The reason for these losses is the poor condition of the distribution network. Many distribution substations in this network have been in operation for more than 70 years. They have antiquated technology, are operated manually and offer very limited real-time information to allow for forecasting demand. The distribution grid is especially overloaded, in densely populated centers such as Tirana and Durres.

Consequently, the immediate priority for OSHEE is the modernization of the distribution grid especially near the main load centers such as Tirana and Durrës, which account for 50% of electricity consumption. Equally pertinent is the design of an active grid that can allow bidirectional flow. This upgrading should also include the provision of new equipment to ensure

data collection and information, and communication system controls. According to OSHEE around 40-80 million Euros are required to refurbish the distribution grid.

Legislative and regulatory issues

The Renewable Energy Law in Albania is the main legislative framework that is drafted to facilitate the wider use and deployment of renewables. It has helped somehow to initialize the deployment of various renewable energy projects, but additional support mechanisms for renewable energy is needed. The approval processes need to be streamlined, and a dedicated renewable energy agency should be established. Furthermore, additional legislative and regulatory frameworks must be reliable, transparent and credible, with changes announced in a timely manner for future projects, and without resorting to retroactive changes.

At the present, only fiscal incentives, such as tax breaks and FiT, are the supporting mechanisms for attracting renewable energy investments. However, for wider implementation of renewable energy, new support schemes should be added. For example, VAT is exempted only for imported solar PV machinery and equipment valued above 50 million Lek (406,000 Euros) and for project capacities above 500 kW, but for small scale installations and residential equipment, a full 20% VAT is applied. Therefore, it makes sense that VAT reduction should be applied on all machineries and equipment without limits and should include measurement equipment for assessing renewable energy potentials.

There is also a need for an improved methodology for FiT calculation. Currently the support tariffs are calculated based on the Hungarian power exchange (HUPEX), however, in ensuring the optimal amount of incentivization, a methodology is needed that would ensure market approach under the Albanian context and enable renewable power producers to steadily enter into the market in competitive terms at the end of the incentive scheme.

Additionally, there is a need for various streamlined permitting and approval processes for renewable power to shorten implementation timeframes, provide clarity and further incentivize investments. The private sector entities installing distributed renewable power systems in Albania indicate that improvements should be made in the standardization of application forms for grid connection approval, and that the duration for such approvals should be considerably shortened. Therefore, standardizing approval processes for interconnection is particularly

important for distributed generation, as this ensures that all systems that meet certain technical and safety requirements can connect to the distribution grid without unnecessary delay.

Infiltration of renewables in residential use

Apart from solar water heating application, the infiltration of renewables in residential settings is very disappointing. Although net-metering scheme exists in theory, in practice this net-metering is not readily offered. Therefore, individuals that invest into electricity generation from solar and wind have to scale down their installations in order to remain at levels below their lowest average consumption so that they do not waste their investment.

Unavailability of net-metering in practice contributes negatively to the payback scheme of renewable installations. Since customers are installing smaller units to the amount that they can use the generated energy without forfeiting it to the network, the unit costs of these installations are more expensive. In turn this leads to longer payback periods, which discourage residential investors going through the effort to install such installations.

Financing challenges for renewable energy installations

Presently the financing potential of renewable energy projects is extremely low. Since the local banking sector does not have experience in financing non-hydro renewable energy projects they are perceived as being risky. Private developers report that bank requirements for collaterals in approving loans are oftentimes at 150% of the loan amount, while project assets are not valued as part of the collateral. The financing sector contends that the lack of bankable renewable energy project proposals is what deters financing. Therefore, renewable energy investments can be encouraged through strengthening the quality of renewable energy project proposals as well as strengthening the capacities of local financial institutions to include renewable energy investments under existing asset lending. The increased participation of local financial institutions is needed for both the larger-scale and small-scale projects including end-use sectors.

Lack of human capabilities and skills

Human resources, adequately skilled and locally available to work on various parts of the renewable energy installations, are crucial in supporting the expansion of this energy sector. Currently, Albania lacks dedicated renewable energy training curricula at vocational, tertiary

and technical schools. This has created a lack of qualified human resources in the country to support the ongoing energy sector developments. Universities and High Education Institutions (HEIs) in particular should be at the forefront of this endeavor. They should enrich their curricula with subjects that are related to renewable energy production, and maintenance, prioritizing solar PV installers and energy auditors in the short term. Similarly, a capable workforce should be in place for the advent of electrical vehicles and their maintenance, which should be trained at the professional or better yet, university level. HEIs should be attuned to technology trends and market dynamics in the fast-evolving energy sector.

Lack of trained human resources is also a hinderance in business operation. For example, although there are many electricians, there is a shortage of qualified solar PV installers and energy auditors in the country. A lack of energy auditors is in particular stagnating the growth of solar PV net-metering systems in new buildings. According to law, before a net-metering system can be approved, an assessment of the the building's energy consumption for the past two years is needed and the energy auditor needs to estimate the building's energy consumption patterns. Since licensed installers are largely unavailable to carry out the audits, the net-metering system installations cannot be approved. As a result, HEIs, MIE and the Energy Efficiency Agency, who is the certifying body for energy auditors, should work together on expediting the licensing of accredited energy auditors.

Lack of institutional support and cooperation

Along with qualified human resources, institutional stakeholders need to provide support and ensure adequate cooperation among themselves in order to respond in a

timely manner to the dynamics of the renewable energy sector. Institutions need to have adequate capacity to fulfil their mandates and contribute to renewable energy growth. This includes, among others, having adequate capacities in energy data collection and analysis and facilitating knowledge sharing with other institutions to inform coherent information and planning.

Human resources in public institutions, can play a crucial role in supporting effective policymaking, regulation and planning of renewable energy, especially with regard to monitoring and analysis of data, since they are not integrated and not easily accessible. In many

occasions, these data are inconsistent and unreliable. INSTAT, as the central body accumulating and processing statistical data, should therefore work with AKBN (the energy data provider) and other partners that receive statistical information (such

as EUROSTAT and the World Bank) to further strengthen their institutional capacities for energy data processing and reporting.

Lack of awareness

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. Furthermore, the public is not always aware of the existing incentives, support mechanisms or plans for the deployment of renewable energy technologies. Although the private enterprises involved in installation of solar

PV net-metering or solar water heating systems do their best to advertise the benefits of renewable systems to their potential customers, the government-backed awareness campaigns can be more impactful in reaching scale and wider audiences and to sensitize the public on the direct benefits of renewable energy, both for individual citizens and the country as a whole. As part of awareness-raising campaigns, incentives and support mechanisms for renewable energy uptake need to be clearly communicated to emphasize the country's commitment. Additionally, coherent announcement the government's plans for the development of the sector can boost investors' confidence and thereby attract investment in the energy sector.

2. Learning outcomes in the process of engineering education in Albanian partner HEI

This section will highlight:

- ✓ Current programs in different branches in the field of energy offered by Albanian VET and HEI, acquired knowledge and competencies.
- ✓ Needs for improvement in current programs, which influence to the increase of knowledge and skills related to learning outcomes

- ✓ New IT tools, which influence to the increase of competencies relating of the labor market

2.1 Current Engineering Educational Programs in PUT

2.1.1 Bachelor in Electric Engineering- Electric Power System profile

Bachelor in Electric Engineering- Electric Power System profile degree will equip students with knowledge of how the industry works, as well as giving them the engineering skills and technological knowledge needed to design, assess and improve electrical equipments and electrical power systems. Study program learning outcomes are represented by knowledge, skills and competencies.

Knowledge: The study program of the first cycle in the field of Electrical Engineering, Profile Power System offers basic engineering knowledge not only of general sciences, but also of basic sciences of electric engineering, employed and maintenance of electric power system.

Skills: On the other hand, this program gives the graduate the abilities to be employed in the applying of engineering projects, maintenance and assisted control of engineering systems in electric industry, in assisted projection etc.

Competencies: In terms of training in the field of electric power system engineering, the graduate acquires competencies in: Medium and low voltage network services, maintenance and assisted control of equipments, developing electric distribution network, protection, monitoring, and safety in electric network.

For getting graduated the student has accumulated: 36 ECTS points – in general sciences, 96_ECTS points – in fundamental specific sciences, 18 ECTS points – similar or/and integrated disciplines to fundamental specific sciences, 12 ECTS points – in optional courses the institution offers, 8 ECTS points – in the area of foreign language and communication, 4 ECTS points – in practical stages, 5 ECTS points – for Final formation examination.

Course related with ENGINE project are:

1. Quality, Standards and Technical Legislation (5 ECTS points)

The program aims to give students basic knowledge on national and international standards and normative organizations, the ways of risk assessment of engineering products and systems, maintenance and quality. The quality management systems, environmental management systems, and public health workers management systems, etc. are part of the program. It also provides an assessment of technical legislation in force and the approach to technical legislation in European Community.

Technical standards and legislation, values and typology of technical normative, national and international standards, national and international normative organizations. New approach and harmonized norms, conformity, certification, accreditation, CE mark, modules. Global market and technical standards. Assessment of safety and risk, maintenance of plants and apparatus, quality and quality management systems according to ISO 9000 family. Standards of environmental management system and working environment. Systems for social administration, health protection and safety of workers. Electromagnetic compatibility and electromagnetic Pollution.

2. Renewable Energy Sources (Selected Courses) (5 ECTS points)

Environmental pollution in general and its effects in the atmosphere. International environmental conventions and concrete tasks. Types and main characteristics of renewable energy sources. Photovoltaic, wind, hydro, geothermal, biomass plants etc. Technical and economical characteristics. Different countries initiatives to promote their construction. Possibilities of their use in terms of Albania. Green card as an enabling factor for the use of renewable energy sources.

2.1.2 Master of Science in Electric Power System Engineering profile

Master of Science in Electric Power System Engineering (MS-EPSE) provides graduate students a thorough understanding of the tools, methods, and practice of electric power engineering. The program goal is to provide an education that is directly applicable to a career in industry and is suitable for a new or recent graduate, as well as experienced professionals who want to receive the necessary retraining to change careers. The program is designed to educate a new type of engineering workforce which is currently in high demand. The program consists of two years of full-time studies, giving a total of 120 ECTS credits. The plan of study

combines traditional topics in power generation, transmission, and distribution with cutting-edge topics such as energy market and the integration of renewable energy sources. Study program learning outcomes are represented by knowledge, skills and competencies.

Knowledge: The curriculum of the second cycle "Master of Science" offers advanced scientific knowledge and education for exercising initiative and decision-making skills in complex and unpredictable situations; to work in design and maintenance of the electrical power generation, transmit ion and distribution. The graduate acquires skills and intellectual tools to plan and to carry out innovative research on electric power system.

Skills: The graduate acquires skills and intellectual tools to plan and to carry out innovative processes, proper of applied research field. The knowledge of engineering skills enables the master's degree owner to use tools and methodologies to treat information and to plan solutions in the field of real systems.

Competencies: The graduate acquires skills and intellectual tools to plan and to carry out innovative processes, proper of applied research field. The knowledge of engineering skills enables the master degree owner to study, design and realize electric power system and network of different voltage, the design of the system of protection, monitoring and control of power system and networks of power supply of enterprises. The graduate combines technical, scientific and communication skills with context culture, which enables him/her to work in international high-profile positions.

For getting graduated the student has accumulated: 10 ECTS points - in general sciences, 60_ECTS points - in fundamental specific sciences, 20 ECTS points - similar or/and integrated disciplines to fundamental specific sciences, 12 ECTS points - in the internship, 18 ECTS points - for preparing and sustain the diploma.

Course related with ENGINE project is:

1. Distributed Generation and Energy Efficiency (5 ECTS points)

The course aims to provide students with comprehensive knowledge on advanced knowledge nowadays power production, mainly of renewable energy sources and to study in practice the energy efficiency. This graduate level course provides detailed explanations of the physical

mechanisms that control phenomena related to Power Quality. It addresses concepts that underlie harmonic generation and harmonic flow, and the modeling of voltage sags and swells. The effects of such disturbances on equipment (transformers, rotating machines, lamps, relays and converters) performance are studied by means of actual field cases. Others topics covered are Power Quality measurements in the era of smart grid, Power Quality problems caused by Renewable Generators.

2.1.3 Master Professional in Electric Power System

Master Professional in Electric Power System aims to provide students with in-depth professional knowledge specific in the field of Electric Power System. Graduates of the Professional Master in the field of Electric Power System gain knowledge in methodological and applied aspects of and be able to use this knowledge to interpret various problems in practice. They form the necessary skills for the design of the electricity distribution network, power supply networks of enterprises and processes, which are closely related to the field of protection and automation of the Power System and other electricity supply networks. They are able to perform experiments, analyze and interpret the data obtained from them. Study program learning outcomes are represented by knowledge, skills and competencies.

Knowledge: The second cycle curriculum offers advanced scientific education for exercising initiative and decision-making skills in complex and unpredictable situations; to work in design and maintenance of the electrical power generation, transmission and distribution.This cycle of studies in Electrical Engineering has the objective to provide students with in-depth knowledge in specific professional Power Engineering. Gain in-depth knowledge of methodological and applied aspects and be able to use this knowledge to interpret various problems in practice. Generally and in depth recognize the Electrical Engineering fields in which to be able to identify, formulate and solve problems using methods, techniques and modern equipment's.

Skills: The diploma holder combines technical, professional and communication skills with the cultural context, which gives him the opportunity to work in high-profile functions at national and international level.

Competencies: Form the necessary skills for electricity distribution network, networks of power supply enterprises and processes design, which are closely related to the protection and power

system automation and other networks power supplies. Acquire skills for organization, administration and economic aspects of enterprises.

For getting graduated the student has accumulated: 10 ECTS points – in the area of general sciences, 34 ECTS points – in the area of fundamental specific sciences, 5 ECTS points – similar or/and integrated disciplines to fundamental specific sciences, 3 ECTS points – for professional practice, 8 ECTS preparing and sustain the diploma.

Course related with ENGINE project is:

1. Energy Efficiency and Smart Grid (5 ECTS points)

The course aims to provide students with comprehensive knowledge on the energy efficiency and smart grid. The course is divided into two parts. The first part provides explanations of the physical mechanisms that control phenomena related to Power Quality. It addresses concepts that underlie harmonic generation and harmonic flow, and the modeling of voltage sags and swells. The effects of such disturbances on equipment (transformers, rotating machines, lamps, relays and converters) performance are studied by means of actual field cases.

The second part aims to provide students with knowledge about some key elements of smart grids, to understand the interaction of different disciplines in smart grids, knowing the historical, institutional and technical aspects of electricity transmission and distribution networks, existing theories and methods in the field of smart networks.

2.1.4 Needs for Improvement in the current programs

Currently, there are limited information on Renewable energy, Energy efficiency management, Smart Grids, RES integration and storage in smart grids, Intelligent grid control and telemetering, Power quality and RES, Communications & Computer networks & Smart Grid, Energy & Market & Environment Sustainability. It is considered that such courses should be included in the current curricula of BA, MSc or MP by offering them in groups of elective courses or by including them as compulsory courses. These courses should stimulate students

to think on a broader prospective in issues related alternative energy sources, technologies, processes, etc., for improving the final efficiency, solving energy problems and protecting the environment in the future. At the same time these courses should be supported with the necessary laboratory and computer equipment.

2.2 Current Engineering Educational Programs in UAMD

Table 2.1 shows the current Education Programs related with ENGINE Project in UAMD.

Table 2.1 - Programs & Profiles related with ENGINE in UAMD

Profiles	Programs	Credits
Electrical Technician	Proffesional Study Program	120
Electronic Equipment Specialist	Proffesional Study Program	120
Specialist of air conditioning systems	Proffesional Study Program	120
Energy audit in buildings	Postgraduate Study Program	30
Energy audit in transport	Postgraduate Study Program	30
Energy Manager	Postgraduate Study Program	30

2.2.1Professional Study Program "ELECTRICAL TECHNICIAN"

The 2-year Study Program, Professional Diploma in "ELECTRIC TECHNICIAN" offers an important direction for which there is a great need for skilled specialists and analysts and the purpose of this program is the training and education of professionals in the field of electricity.

Vocational Diploma provides a professional training able to meet the typical design problems in the electrical sector, understand and direct innovations in all disciplines of the electrical sector, industrial electronics and power, automation and system electro-energetic in general.

This study program forms the electrical technician with enough knowledge to cover problems such as:

- ✓ Electricity generation in power plants;
- ✓ Transmission and distribution of electricity;
- ✓ Use of electricity in industrial plants, in urban and rural systems;
- ✓ Electricity management applications in the electricity market;
- ✓ Electrical installations and their maintenance in apartments, various private and state facilities, etc.

Employment opportunities:

- ✓ In the electricity generation system;
- ✓ In the electricity transmission system;
- ✓ In the electricity distribution system;
- ✓ In companies for the design, implementation and servicing of high, medium and low voltage power systems;
- ✓ In the company for the sale and purchase of electricity;
- ✓ It can also be employed in the Manufacture of Electrical Appliances and Equipment.

Course related with ENGINE project are:

- Renewable Energy Sources
- Electrical Installations
- Electrical measurements
- Electric Machine
- Electrical Systems in Buildings (Elective)
- Distribution and use of Electricity (Elective)

2.2.2Professional Study Program "SPECIALIST OF AIR CONDITIONING SYSTEMS"

The two-year study program, Professional Diploma in "AIR CONDITIONING SYSTEM SPECIALIST" offer for the students the opportunity to develop their knowledge and professional skills in the field of air conditioning systems, HVAC. This program helps critical thinking and analysis to understand the challenges in various technical situations on these systems. 2-year study program: Professional Diploma "Air Conditioning Systems Specialist" aims to train specialists with a professional profile in the field of installation, maintenance and service of heating - ventilation - air conditioning systems (HVAC) in buildings and all air conditioning systems in various machinery or means of transport.

A) The main objectives of this professional study program are:

- ✓ Gain technical knowledge on HVAC plants and systems;
- ✓ Gain knowledge on the installation of HVAC electrical and hydraulic systems;
- ✓ Gain knowledge on the performance and energy efficiency of air conditioning systems in buildings;
- ✓ Gain knowledge about the equipment and components of these systems;
- ✓ Operation, maintenance and servicing of air conditioning equipment and plants;
- ✓ Management of HVAC systems and equipment in multifunctional buildings
- ✓ Management of HVAC systems and equipment in vehicles, etc

B) Employment opportunities:

- ✓ Installation of heating-ventilation-air conditioning (HVAC) systems;
- ✓ Hydraulic and electrical network management of HVAC systems;
- ✓ Servicing and maintenance of HVAC equipment,
- ✓ Technical services on air conditioning systems and installations, etc.
- ✓ Technical services in air conditioning technologies for navigation and any other means of transport.

Course related with ENGINE project are:

- Basics of energy efficiency
- Energy consumption

2.2.3Professional Study Program " ELECTRONIC EQUIPMENT SPECIALIST”

Evolution in the field of electronics requires professionals with deep interdisciplinary knowledge that will allow them not only to solve the problems encountered in the use of electronic devices, but also to design, build and work with them. The market study shows that in the conditions of our country have to prepare the specialists with practical knowledge for the design, simulation, construction, and implementation and maintenance of electronic circuits. The program combines courses in electronic technology with a General Education curriculum. Students will gain the necessary knowledge to face the challenges of the labor market in the field of Electronics and relevant systems. The main training objectives of the two-year study program "Electronic Device Specialist" are:

- ✓ To train students on the development of electronic products;
- ✓ To train students in the maintenance and repair of existing and new electronic and electric equipment;
- ✓ To train students in the knowledge of components of electronic devices, circuits, semiconductors and systems, photovoltaic systems, etc.
- ✓ To provide students with the necessary knowledge in order to be able to constantly adapt to the conditions of change;
- ✓ To combine theoretical and practical knowledge in the field of electrical energy and electronics to perform various tasks;

B) Employment opportunities

Students at the end of the two-year study program "Electronic Equipment Specialist" can be employed in the private and public sector, such as: as an electronic technician, electronics equipment specialist, prototype manufacturer and more for companies specializing in simple electronic design, production, service and development of electronic circuits.

Course related with ENGINE project are:

- Computer software for editing electrical circuits
- Sensors and converters

2.2.4Postgraduate Study Program "ENERGY AUDIT IN BUILDINGS" (AE)

The “Energy Audit in Buildings” (AE) program raises performance standards in energy auditing in buildings and industry and improves the practice of energy auditors through the application of national and international methodologies for calculating energy performance in buildings and innovative equipment. AEC is a 3-month training program for professionals who want to be trained in energy auditing services in buildings and industries.

This program aims to train professionals in specialization and diagnostics of energy auditors in buildings, specialization in a set of systematic surveys, collection and analysis of parameters relative to specific consumptions and operating conditions of the building and its plants.

A) Program Objectives

- ✓ To provide a theoretical training for the AE course specialist
- ✓ Determining the ENERGY balance in BUILDINGS
- ✓ Definition of technological requalification interventions
- ✓ Evaluation for each intervention of technical and economic opportunities
- ✓ Improving comfort and safety conditions
- ✓ Reduction of management costs
- ✓ Management of new energy efficiency applications

B) Employment opportunities

- ✓ Public, central or local administration
- ✓ Entrepreneurship and business companies
- ✓ Public institutions that design and implement energy projects
- ✓ Sectors of the economy
- ✓ Institute of Cultural Monuments
- ✓ Design studio

✓ Other private sectors

Course related with ENGINE project are:

- Energy efficiency legislation
- Preparation for energy audit
- Inventory and measurement of energy use
- Energy efficiency and environmental protection
- Energy management
- Energy efficiency in electrical equipment
- Design and implementation solutions for energy optimization

2.2.5Postgraduate Study Program "ENERGY MANAGER"

This program aims to train professionals in the specialization and diagnostics for "Energy Manager", specialization in a set of systematic surveys, collection and analysis of parameters relative to specific consumption and operating conditions of the building of its plants.

A) Program objectives

✓ to provide a theoretical training for the specialist of the study program
✓ determination of the energy balance
✓ determination of technological requalification interventions
✓ evaluation for each intervention of technical and economic opportunities
✓ improvement of comfort and safety conditions
✓ reduction of management costs
✓ management of new energy efficiency applications

B) Employment opportunities

✓ public, central or local administration
✓ entrepreneurship and business companies

- ✓ public institutions that design and implement energy projects
- ✓ sectors of the economy
- ✓ institute of cultural monuments
- ✓ design studio
- ✓ other private sectors

Course related with ENGINE project are:

- Energy efficiency legislation
- Energy management
- Design and implementation solutions for energy optimization
- Energy Financial Management
- Use and Integration of Renewable Energy Sources
- Energy efficiency and environmental protection

2.2.6Postgraduate Study Program "ENERGY AUDIT IN TRANSPORT"

This program aims to train professionals in the specialization and diagnostics for "Energy Audit in Transport", specialization in a set of systematic surveys, collection and analysis of parameters relative to specific consumption and operating conditions in the field of transport.

At the end of the training, participants who are positively evaluated are provided with the certificate "Energy audit in transport" in accordance with applicable law.

A) Program objectives

- ✓ to provide a theoretical training for the specialist of the study program
- ✓ determination of the energy balance in transport
- ✓ determination of technological requalification interventions
- ✓ evaluation for each intervention of technical and economic opportunities
- ✓ improvement of comfort and safety conditions
- ✓ reduction of management costs

B) Employment opportunities

- ✓ public, central or local administration
- ✓ entrepreneurship and business companies
- ✓ public institutions that design and implement energy projects
- ✓ sectors of the economy
- ✓ other private sectors

Course related with ENGINE project are:

- Energy efficiency legislation
- Analysis of energy bills
- Design and implementation solutions for energy optimization
- Energy efficiency and environmental protection
- Energy management

Needs for Improvement in the current programs

The need for Improvement of current programs comes mainly from technological changes in the field of renewable energy sources. UAMD academic staff aims to include several factors in the process of academic and professional education, which directly and indirectly affect the improvement of curricula, such as:

- Inclusion with a special course in the curriculum of the latest technologies in the field of renewable resources, the smart network and their implementations
- Study of renewable energy sources with virtual technology
- Using of the most contemporary literature for the study of new technologies
- Use of simulation programs for different courses
- Creating opportunities for the development of professional practices in energetic sector
- Students of the "Electrical Equipment Specialist" study program should get more information on energy efficiency.

Improving study programs should be in line with increasing the level of academic staff.

New IT tools to be included

UAMD focuses on the inclusion in the academic process of the most up-to-date knowledge in the field of Information Technology and Innovation. The increase of the academic and professional level of the staff in accordance with the trends of technological development helps to increase their level on the one hand and on the other hand transfers this knowledge to the students, who are preparing for the labor market. UAMD IS the Leading Institution of the project "Accelerating Western Balkan's University Modernization by Incorporating Virtual Technologies" [www.vtech-project.eu].

UAMD aims to incorporate these new technological tools:

- Capacity building of academic staff to incorporate Virtual Technologies in teaching
- Develop teaching methodologies aided by technology and/or ICT tools
- Equip students with competences to use/access tools, software and platforms
- Increase interaction between teachers and students

2.3 Current Engineering Educational Programs related with "ENGINE" in UET

When deciding to open e new program UET has in considerations the needs of potential students and labor market. Given the necessities of participants, such as high school graduates, as well as the requirements of beneficiary groups, such as potential employers for students after completing their university studies, UET University created and applied a successful policy in opening new study programs.

Thus, the opening of study programs and relevant profiles in them, has been a step preceded by genuine studies of demand and need, the current situation of the country and market needs for professionals who will emerge from this program.

In accordance with the above, in the field of the ENGINE Project, in the Department of Engineering and Architecture, at the Faculty of Engineering, Informatics and Architecture, this University has activated the following Profiles within bachelor, master of integrated studies:

Table 1 - Programs & Profiles related with ENGINE in UET

Profiles	Programs
Electrical Engineering	BA / Industrial Engineering
Mechanical Engineering	BA / Industrial Engineering
Civil Engineering	BA / Civil Engineering (Construction)
Energy Engineering	Msc. / Industrial Engineering
Mechanical Engineering	Msc. / Industrial Engineering
Transport Engineering	Msc. / Industrial Engineering
Transportation & Infrastructure Engineering	Msc. / Civil Engineering (Construction)
Urban Planning	Msc. / Civil Engineering (Construction)
Urban Planning	Integrated Degree in Architecture

Needs for Improvement in the current programs

Currently, courses in energy in UET are offered as a profile of main BA or Master Programs. There are not distinct degrees in:

- Renewable energy;
- Alternative energy technologies;
- Energy efficiency management;
- Energy and Environment Sustainability;
- etc.

It is deemed that such courses would help undergraduate students to receive more intensive education in fields of energy efficiency and RE. However, the needed human and technical resources related to energy efficiency and RE is a hot topic for the future of engineering and

sustainable development. Contents of energy still need to improve and highlight the importance and raise awareness among students on the RE.

To summarize beside preparing good technicians, courses should aim:

- Energy education courses and/or programs at the university level should aim to develop understanding and awareness among students about the nature and causes of energy crises, energy classification, and conversion processes of conventional and RE sources and technologies.
- Also, these courses should stimulate students to think on a broader prospective in issues related alternative energy sources, technologies, processes, etc., for improving the final efficiency, solving energy problems and protecting the environment in the future.

New IT tools to be included

Currently the didactic activity is articulated in classroom lectures, applied exercises, projects, practical laboratories, aiming to give the studentds the first glimpse of the professional world. The objectives of the absorption, clearly defined by the Didactic Regulation of the Course of Study, can be summarized as follows:

- Basic knowledge focused on the disciplines of mathematics, geometry, general physics and rational mechanics;
- Professional disciplines of civil engineering pertaining to the science and technique of construction, the quality of the built environment (with opportune references to thermal, acoustic, lighting), environmental impact, technological services, giving a congruent relief to economic aspects, operational, organizational, legal and those related to the more general concept of development sustainability. The purpose of these disciplines is to enable the engineer to acquire the necessary knowledge to then develop specific capacities in project development;
- Professional engineering disciplines that highlight the technical aspects as well as economic or legal aspects that allow to plan interventions on the territory, and to design works in accordance with specific requirements but also in accordance with the environment, its protection and preservation, etc.;

- Finalized linguistic and computer knowledge to improve the inclusion capacities of the engineer in the world of work and in other European countries.
- The Study Course presents in the meantime a wide and articulated offer of elective profiles, advisable for attending students, which allow the student to develop specific knowledge in the following sectors:
  a) Electrical Engineering;
  b) Mechanical Engineering;
  c) Chemical Engineering;
  d) Information Technology;
  e) Management of Organizations.

Also, in order to enable the best possible connection of students with the demands of the labor market, within the teaching process, importance has been given to practicle aspects and loboratoty activities.

Following the studies in these profiles, students develop the capacity to reflect on the arguments of the study, on their skills and on the absorption processes by combining information of different subjects.

This study programs approximates contemporary models of education and academic and professional qualification in accordance with the standards of recognized universities at the regional, European and wider level.

Anyhow, as it is mentioned at the begining of the report, the current domestic labour market, with the expected developments of the Albanian economy as an emerging economy, aims at its full integration into the single European market. In this context, there is always room for improvement to offer students more up to date technologies/tools within engineering field.

Given all the above, and considering the ever-increasing demand of the labor market, both national and international active participation in the ENGINE project will help UET to present updated curricula, modern practices and up to date technologies within their studies. The help and assistance of other EU Partners with more academic experience in these curricula will be an excellent first step toward continous improvement.

Through ENGINE, UET will update and implement relevant recommendations having in mind the following objectives:

- An increasing compliance with the objectives of the program and the different market demands;
- Closing the gap between electrical engineering and electrical engineering technology;
- To be pro-active in the innovated curricula and establishment of a platform for knowledge sharing between Albanian HEIs and program partner institutions, which is one of the ENGINE objectives.

  Taking in consideration the broader perspective, all the above will benefit not only UET as a university and its students, but all partner HEIs in Albania and consequently the job market in the country.

2.4 Current Engineering Educational Programs related with "ENGINE" in KPT

The professional study programs, altogether with their courses and curricula are projected and prepared after a detailed analysis of the labor market and demand in the country and the related local and regional studies in this regard and considering their dynamics as well. The mission of KPT is to be a bridge between academic education and vocational training, strongly supporting students to smoothly and efficiently integrate in the labor market, including the update of the curricula and training of the students with the driving trends in the industry.

KPT has faced an increasing demand from the business in terms of practice-oriented specialists for renewable energy especially in terms of photovoltaic panels etc.

One of the most important challenges the society faces, is to create an efficient education system capable of keeping up with the rapid technological change. In countries like Albania, the importance is even greater given the national goal of integration into the European family. The increased attention toward renewable energy sources which are available, the active approach of the business to this type of industry whose concerns are already shared with KPT, create an immediate need that should be addressed with practice oriented highly trained workforce. In

the context of market (business demands), government and objectives of KPT as a HEI, the update of the curricula and training of the students with the driving trends in the industry is a sensitive matter.

Needs for Improvement in the current programs

In the frame of the ENGINE project, the professional study programs of KPT deemed to be more relevant and related to the project are :

“Electro mechanics”

“Vehicle Technology”

“Airing and Conditioning Technology”

“Construction Technology”

“Technology of Electrical Installations”

The overview with regard to RES, with a special focus in the curricula of KPT provides the following conclusions:

1. The focus on renewable energy worldwide has generated rapid changes market with an increasing demand for skilled professionals in the sector.
2. EU integration process and the changes in the global market have triggered such a demand even in Albania. The number of companies operating with RES is increasing, with the photovoltaic panels, Smart Home etc. being among them.
3. Given the daily implementation of more and more of IoT family technologies used in the market there is even more need for specialists or systems integrators.
4. Vocational education is an optimal solution for entering the labor market in a short term and will practice – oriented skills, which education is able to provide the market with a skilled labor force. Although emphasize is put on the importance of vocational education, youth need to consider it as an opportunity to higher education and labor market. Women participation as students is low.
5. Technologies which are part of the IoT family (Internet of Things) such as Smart City, Industrial IOT (IIOT), Smart Farming, Smart Grid and more of Smart Home / Buildings

need to be an integral part of the curricula, as well as the integration of these technologies with renewable energy such as photovoltaic panels etc.

6. There is need to improve the current curricula, by improving the current courses and / or offering new ones with regard to RES and their use, provided that the respective well established in-house infrastructure and internship are in place.
7. There should be a stronger networking and collaboration between HEI – s and business in this regard.

To sum up:

- Engineering education has a key role to play in helping to meet the challenges associated with prosperity and sustainability. These challenges are dynamic and as such engineering curricula have to be adapted to the times and social needs.
- The utilization of renewable energy sources is growing rapidly since such sources are considered as good solutions to many problems, i.e. concerns about oil depletion and prices, climate change, etc. On other hand, not engineers and technicians are not trained to use these renewable energy technologies and some are not aware of the principles of sustainability.
- There is an urgent need to develop and implement new courses that prepare engineers, scientists and energy planners to work with energy and renewables industries to produce sustainable energy generation systems. The new needed energy education should include a study of conversion processes, technologies, resources, systems design, economics, environmental dimensions, industry structure and policies in an integrated package. Such approach would prepare the graduates to design technically, financially and environmentally sound systems from amongst available options.
- Sustainable clean energies have the potential to minimize environmental impacts, including waste production, and increase social welfare based on current and future needs.
- Education for sustainability has the purpose of preparing the students with the skills, knowledge and habits of mind to participate in the development of a sustainable and prosper future.

3. Data analysis and guidelines for learning outcomes for VET and Bachelor new and updated study programs

Questionnaires and interviews with the stakeholders are used to obtain the information needed to evaluate and improve learning outcomes.

3.1 Methodology

Both qualitative and quantitative methodologies are used. The demands in the education system, for defining of knowledge and skills, as well as competencies of specialists and electrical engineers need for ***the domain analysis*** in energy sector. This analysis carried out through the contribution of managers in the private and public sector of renewable energy, academic staff, etc. For this reason, a national report was prepared.

The evaluation of engineering curricula and the adaptation of the diploma to the labor market carried out through ***303 online questionnaires and*** 55 ***interviews*** with experts of the energy sector, graduated and ungraduated students, academic staff, representatives from private and public Institutions in this field. When choosing the sample of interviewees, it was taken in consideration their background. The sample is composed of different target groups:

- Policymakers;
- Representatives of public institutions in the area of Electrical Engineering and Energy sector;
- Academics and experts;
- Private sector representatives in area of Electrical Engineering and Energy sector.
- Others as judged by researchers.

Questions in the interview were categorized in three main types:

- General questions related to engineering profile education

In the first category of question, interviewees were asked about graduation, the function they hold within the company, years of experience within the energy sector, etc. In this category of questions, interviewees were requested to give their opinion about potential improvement in the

universities' curricula and on issues like "Engineering, Economics and Environment" and the challenges toward them.

- Questions related to the energy sector in Albania

In this group of interrogations, the participants were requested to give their opinion on topics related directly to the energy sector in Albania: technological or organizational changes of the energy market in Albania; the relation and comparison with EU countries and other Balkan countries; the management and operation of power systems; use of renewable energy sources; etc.

- The future of market needs / demands

The last group of question was focused on matters of market needs and demands in the future. In this section were enquired topics like the qualification of the workforce, collaboration with the academic institutions and the role of the universities in the energy market.

At the end of the interview, participants were given the option to include further comments they considered important.

The in-depth interviews have been carried out mostly in person and in some cases remotely using Skype/Teams. The complete in-depth interviews for engineering curricula modernization in renewable energy in Albanian Universities are attached to this report.

3.1 Data analysis of questionnaire with relevant stakeholders

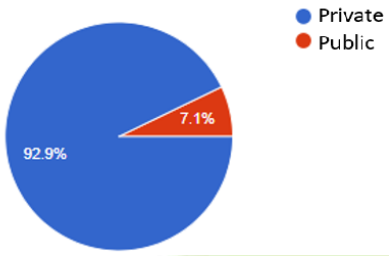
The Questionnaire include questions in respect of the employer's status in power sector (public or privat), i.e companies with 100% capital owned by state such as Transmission System Operator, Distribution System Operator, Albanian Power Corporation, private companies that operate in the generation sector where are included private hydropower plants or concessions Hydro power plants, private companies that operate in the field of inspection and verification of metering system, education institutions, traders, Regulatory Body for Energy, etc . We were seeking from the interviewers simple suggestions in respect of knowledge (new or deeper knowledge in specific disciplines) that they consider that should have been treated during the

Courses, and could have served better to their role, position and job description that they have in the company/agency that they are employed.
The feedback and suggestions received have been broken down into several groups referring to the position, function and the respective roles covered in the companies or organizations.
The most important target group are students, current and prospective willing to study Energy efficiency, renewable energy, etc. and related courses. Academic staff too will benefit from capacity building programs and activities and enrich their professional background. Business sector, ERE, foreign investors, government and the wide society too will benefit from this curriculum development project.
During the analysis made in the preparation phase (interviews with academic staff, researchers, students, professionals from the industry sector), it was realized that all institutions of partner countries face similar problems and needs that reflect the needs for creating an systematic approach in the introduction and implementation of new mechanisms in WBC HEIs.
In order to prepare individual evaluation reports, a survey was conducted on the current needs and identification of actual problems in the existing Renwable Energy programs at HEIs and connections of HEIs and Private sector. In this survey participated more than 214 different actors from different fields (lecturers, graduated students, economics, engineeriners, etc.) for feedback on existing and future cooperation between HEIs and business sectors, including knowledge transfer issues and the aspect of innovation.

3.2.1 Questonarie addresed to busineses.

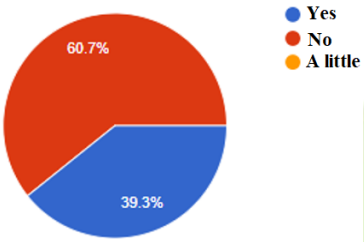
- In this survey we have 30 respondents, 92.9% of which have answered that are private companies and 7.1% of the respondents are public companies.

Figure 1: *Type of the company*



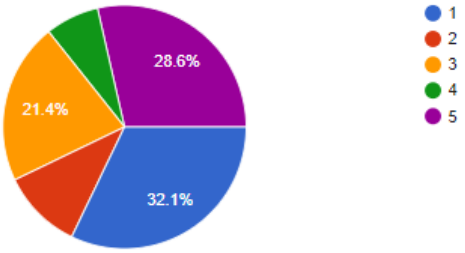
- To the question "*Is there cooperation between your company and higher education institutions*?" most respondents answered "NO" about 60.7%. 39.3% of respondents answered "YES".

Figure 2: *Cooperation between Business and HEIs*



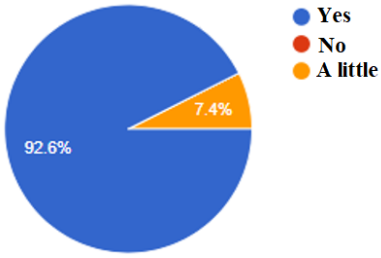
- Regarding the question "*How related is the business interviewed with the Energy Sector*?", 32.1% have checked the scale "1-not at all", followed with 28.6% of the businesses are answered "5-totally agree" and 21.4% of them are answered with “3-neutral”.

Figure 3: *Cooperatin between business with Energy Sector*



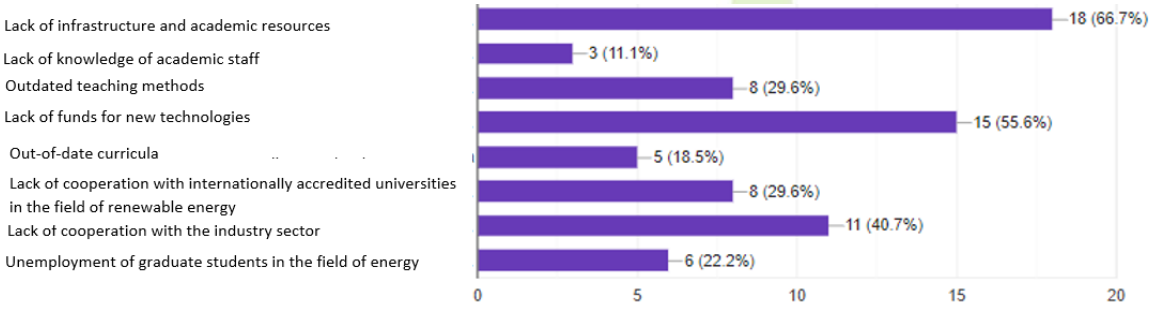
- Meanwhile, 92.6% of respondents are familiar with the term "Renewable Energy" and only 7.4% of them are less familiar with the term.

Figure 4: *Are you familiar with the term "Renewable Energy"?*



- About the question "*In your opinion, what are the main challenges that the education system in the field of Engineering in Albania is facing*?" the most choosen alternative is: "Lack of infrastructure and academic resources (eg libraries, laboratories, computers, updated teaching materials)" with 66.7%, following: "Lack of funds for new technologies" with 55.6% and the third most checked alternative is: "Lack of cooperation with the industry sector" with 40.7%.

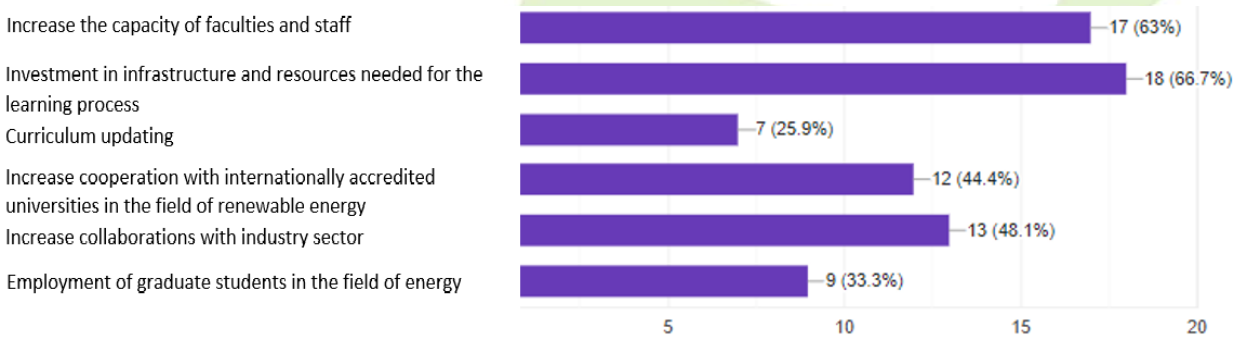
Figure 6: *In your opinion, what are the main challenges that the education system in the field of Engineering in Albania is facing?*



- Obstacles that exist can be overcome by improving: Investment in infrastructure and resources needed for the learning process (eg libraries, laboratories, computers, updating of teaching materials) 66.7%, Investment in infrastructure and resources needed for the learning process (eg

libraries, laboratories, computers, updating of teaching materials) 63% and increase cooperation with the industry sector, 48.1%.

Figure 7: *What are the positive aspects that can overcome the challenges mentioned above?*



- 92.9% of respondents think that there should be more specialists in the field of industry and 100% of respondents think that Albania should adopt renewable energy instead of non-renewable energy.

Figure 8: *Do you think there should be more specialists in the industry sector?*

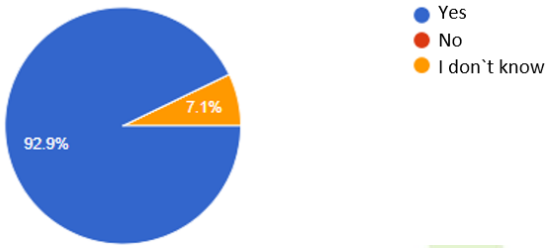
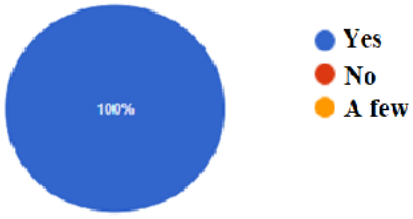


Figure 9: *Do you think that Albania should acquire renewable energy instead of non-renewable energy?*



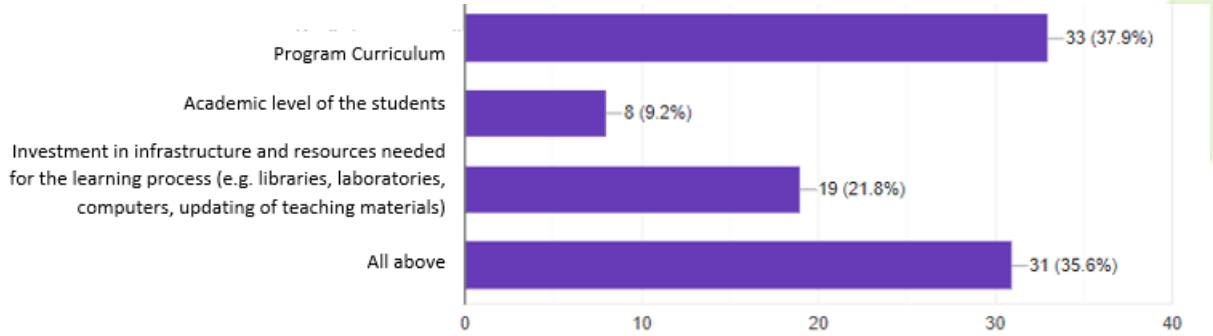
96.4% of respondents think that Albania should adopt exactly solar energy instead of wind or other energy sources.

3.2.2 Questonarie addresed to academic staff.

- In this survey we have 87 respondents. 42.5% of which give lectures at proffesional level, 40.2% of them lecture at bachelor level and 34.5% lacture at master level.

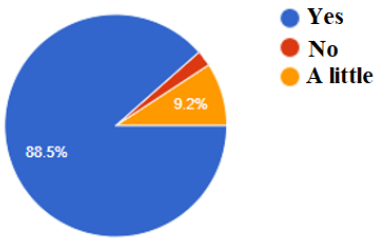
Figure 10: *Study cycle where do you lecture?*

- Regarding some of the constituent elements of the study program "program curriculum" was voted 37.9% for the best impressions, followed by the option "All of the above" with 35.6% (program curriculum, academic level of students and infrastructure where the program was implemented (buildings, laboratories, equipment, etc.), from 21.8% infrastructure where the program was implemented (buildings, laboratories, equipment, etc.) and 9.2% the academic level of students.
Figure 11: *Which of the study program elements left the best impression on you?*



- Meanwhile, 88.5% of the respondents are familiar with the term "Renewable Energy" and only 85.1% of them know the difference between renewable and non-renewable energy. 9.2% of them are less familiar with the term who are not familiar with the difference between renewable energy and non-renewable energy.

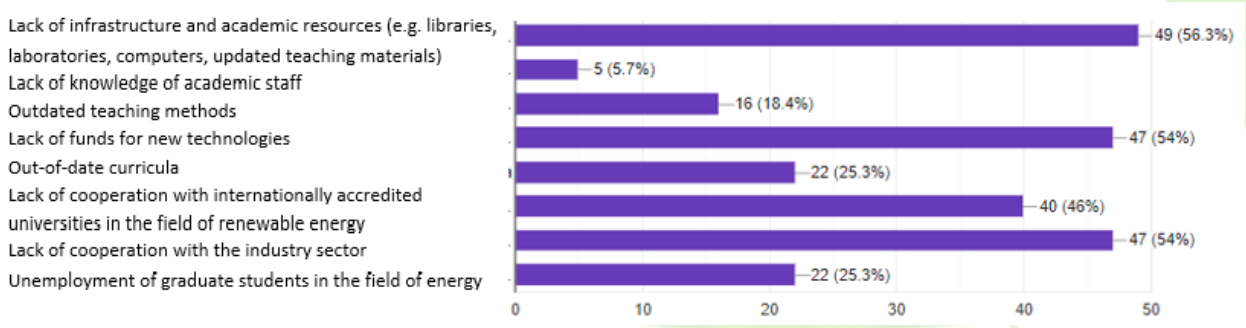
***Figure 12**: Are you familiar with the term "Renewable Energy"?*



- "In your opinion, what are the main challenges that the education system in the field of Engineering in Albania is facing?", the 3 most selected answers are:

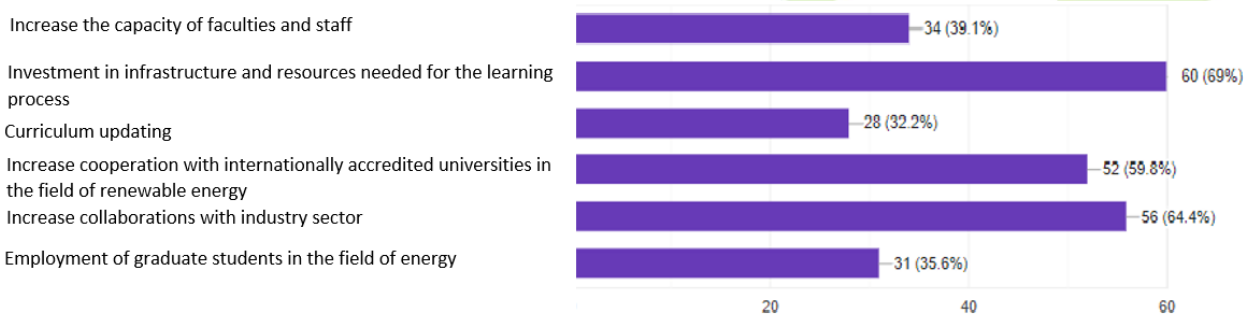
- Lack of infrastructure and academic resources (e.g. libraries, laboratories, computers, updated teaching materials), 56.3% ;
- Lack of funds for new technologies, 54%;
- Lack of cooperation with the industry sector, 54%.

***Figure13**: In your opinion, what are the main challenges that the education system in the field of Engineering in Albania is facing?*



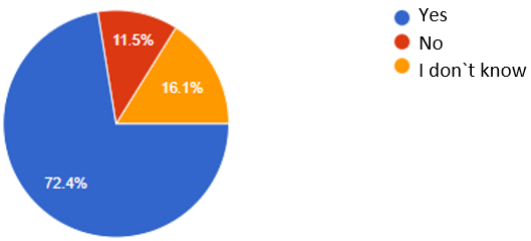
- Existing barriers can be overcome by improving: Investment in infrastructure and resources needed for the learning process (eg libraries, laboratories, computers, updating of teaching materials) 69%, Increase cooperation with internationally accredited universities in the field of renewable energy, 59.8%.

Figure 14: *What are the positive aspects that can overcome the challenges mentioned above?*



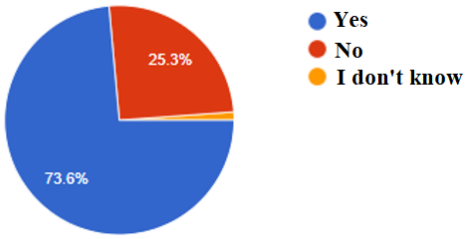
- Regarding the inclusion in the curriculum of the course "Renewable Energy", 72.4% of the staff answered positively, 16.1% are not convinced if this course should be added to the curriculum and 11.5% of them answered negatively.

Figure 15: *Do you think that the course "Renewable Energy" should be a mandatory part of the curriculum of professional study programs?*



- Regarding the opening of a new study program dedicated to "Renewable Energy", 73.6% think that a new program should be opened and 25.3% answered "NO".

***Figure 16**: Do you think that a new professional study program for renewable energy should be opened?*



Some of the suggestions on how to improve the curriculum to better serve the job position are:

- Adaptation of our curricula to European ones;
- Inclusion of as many materials related to renewable energy.
- Improving laboratories, establishing links with similar European institutions, links with industry, etc.
- More practical
- Taking the best practices from international universities and adapting them to our country.

3.2.3 Questonarie addresed to students.

- The interview of students showed that 60.8% of them are unemployed. Meanwhile, 30.9% are employed in private institutions and 8.2% are employed in public institutions.

64.9% of the interviewees are bachelor students, 20.6% of them are in the master cycle and 14.4% are enrolled in professional study programs.

Figure 17 *Are you currently employed in institutions?*

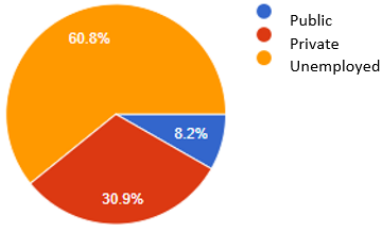
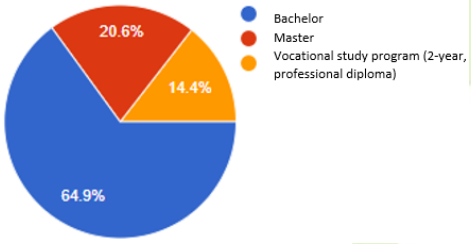
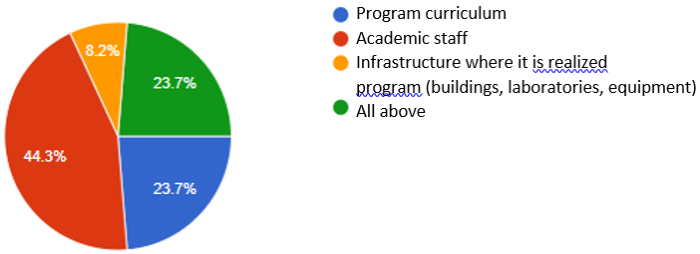


Figure 18 *Study cycle*



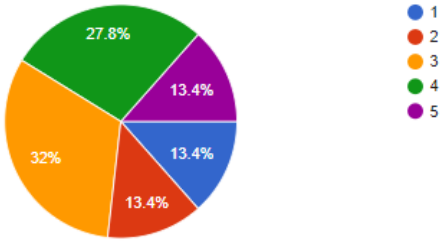
- The main elements of the study program that students have left the best impressions are:
  - Teaching staff 44.3%;
  - 23.7% Infrastructure where the program was implemented (buildings, laboratories, equipment);
  - 23.7% curriculum of the study program.

Figure 19: *Which of the study program elements left the best impression on you?*



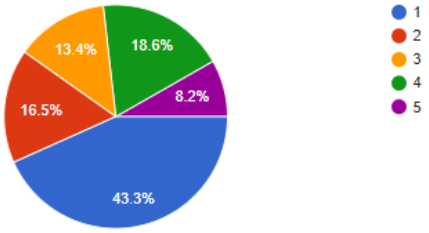
- The diploma is valued at an average of 32% in the labor market, 13.4% think that it is not valued at all and also 13.4% think that it is fully valued.

Figure 20: *How much do you think your degree is valued in the job market, from (1) not at all to (5) a lot?*



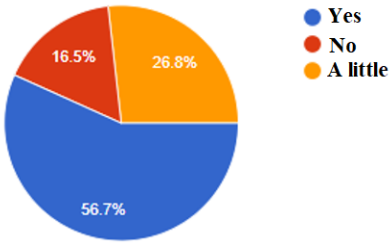
- Students think that in their stable employment the study program they attend has influenced on average 13.4%. 43.3% think that it does not affect at all and 8.2 percent of them think that it does.

Figure 21: *How much has this study program affected your stable employment, from (1) not at all to (5) a lot?*



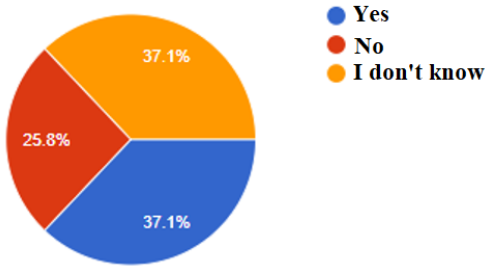
- Students are familiar with the term “Renewable Energy only 56.7% of them and 16.5% of them are not familiar with the term

Figure 22: *Are you familiar with the term "Renewable Energy"?*



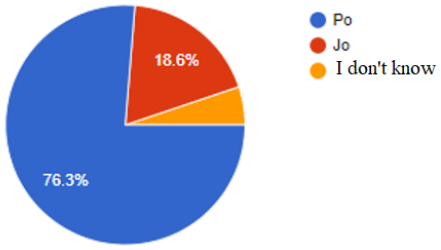
- 37.1% of students answered "I don't know" if the course "Renewable Energy" should be part of the curriculum and yes 37.1% of them answered "Yes", while 25.8% answered "No".

Figure 23: *Do you think that the course "Renewable Energy" should be a mandatory part of the curriculum of professional study programs?*



- From the answers it is noticed that the students are interested and 76.3% of them think that a new study program for Renewable Energy should be opened and 18.6% think that it should not be opened.

Figure 24: *Do you think that a new professional study program for renewable energy should be opened?*



The most common answers to how the curriculum should be improved, to better serve the job position, are:

- Practical opportunities;
- Practice and realization of these subjects in everyday life and practice in the laboratory;
- The subjects of the profession should be added more and the subjects that have general knowledge should be reduced;
- More practices should be added;

- To create more practical environments.

3.2 Data analysis of interviewers with experts from fields

3.2.1Sample composition

From 55 interviews, 38 of them or 68 % were conducted in the public sector like ministry or companies that are owned 100 % from state like OSHEE, OST,etc.

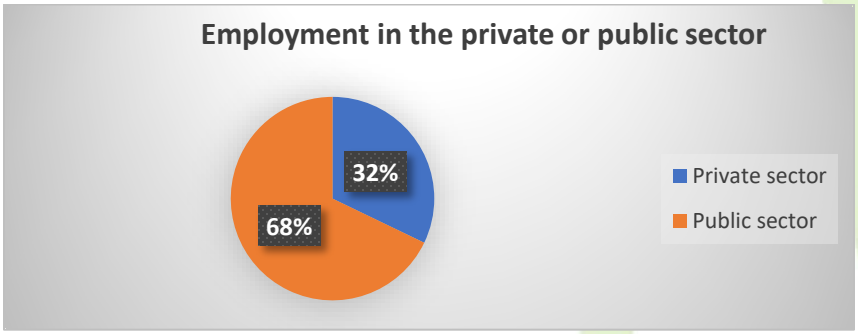


Fig.1 The employment in the private or public sector

More than 50% of the participants are in managerial positions. *(fig.2)*

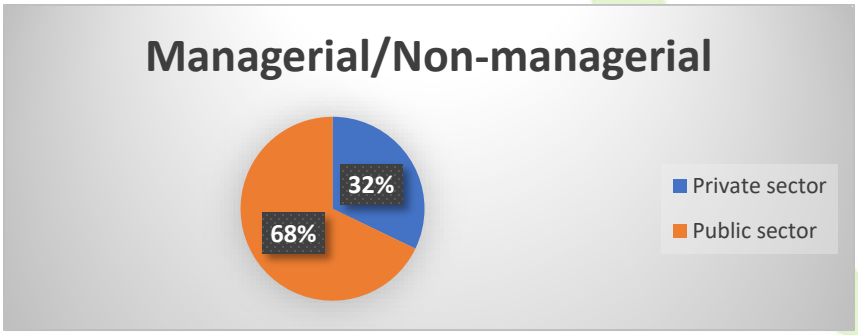


Fig. 2 Role of the Interviewees within their organizations

Regarding the years of experience in the energy industry the majority of the participants have between 5-10 years of experience, concretely 6 from 13. Four of the respondents have between 10 – 20 years of experience, and one of them is on the industry for more than 34 years. (fig 3)

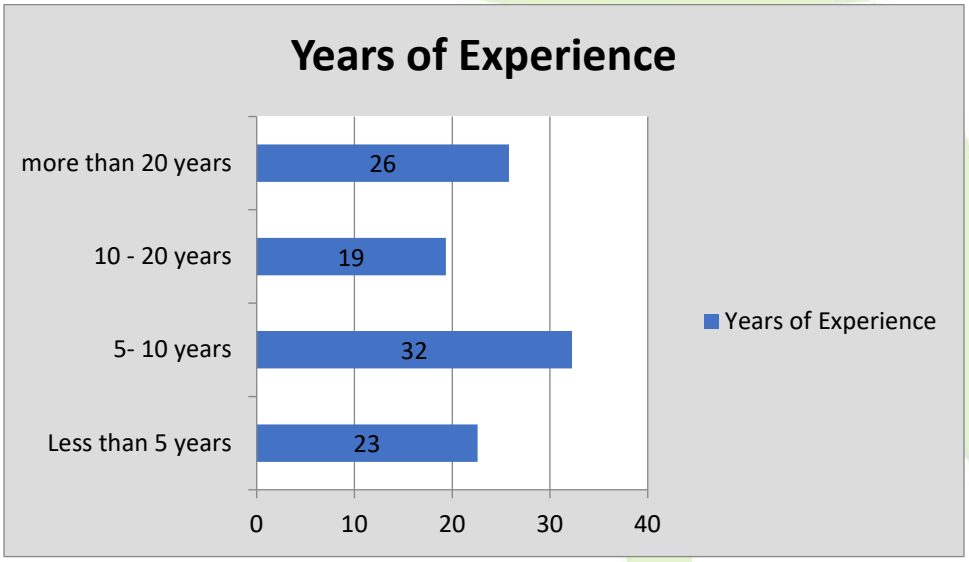


Fig. 3 Years of experience in the Energy Sector

Analyzing percentage of interviewed versus the Year of Graduation, it can be observed that around 74% of the interviewed belongs to the last decade, i.e period 2010-2020, which corresponds also with all reforms undertaken in the power sector and the recent development on this sector (Fig.4).

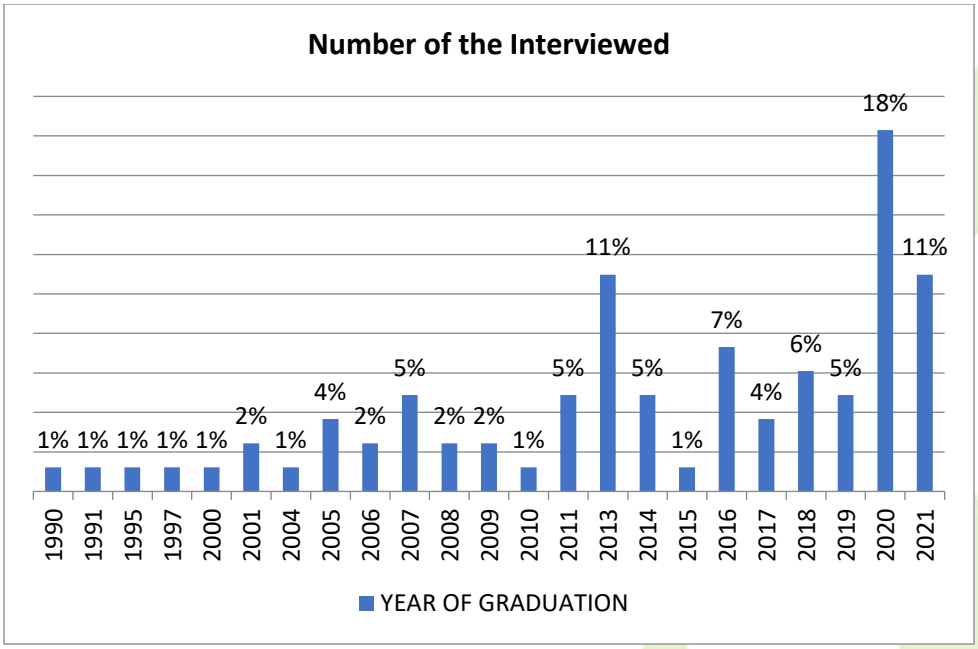


Fig.4 The interviewed versus the Year of Graduation

4. Results

Following are highlighted the main findings of the interviews:

There are 5 main topics for which respondents shared the same opinion. All respondents agreed that **university curricula have room for improvement**. Energy sector is an area that is depended on innovation; thus, university programs should follow the same strategy and steps. 97 % of the participants agreed that the key to improve university curricula and to develop further the energy market is the **collaboration of business and universities**. This can be done through sharing experiences, guest lectures from businesses at the universities, internships, workshops and trainings, etc. 70% of the respondents defined the energy market in Albania as an **"emerging market",** which has a great potential for further development and can be a focal point for the country development in general. None of the participant was able to make **a prediction of the**

energy prices, but all of them agreed that it will depend of market deregulation, energy production, beginning of full operation of the energy exchange, investment on renewable energy sources, etc. In addition, the participants agreed that the future of energy is **renewable energy** and more investments should be focused on this.

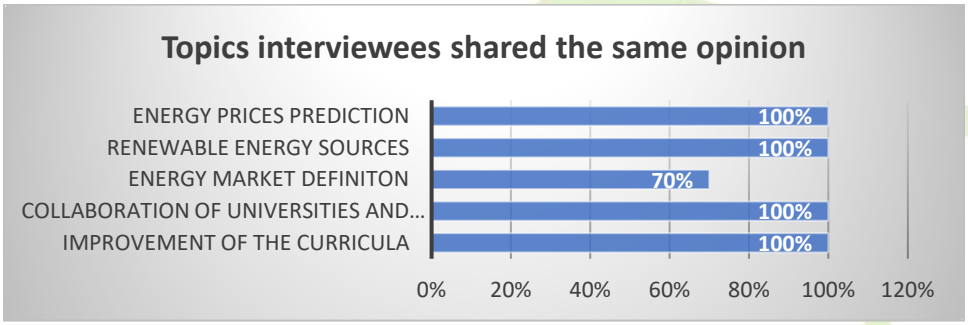


Fig.4 Topics interviewees share the same opinion

Collaboration with Academia

Surprisingly, more than 50% of the respondents declared that the institution or the business that they represent do not collaborate with academic institutions.

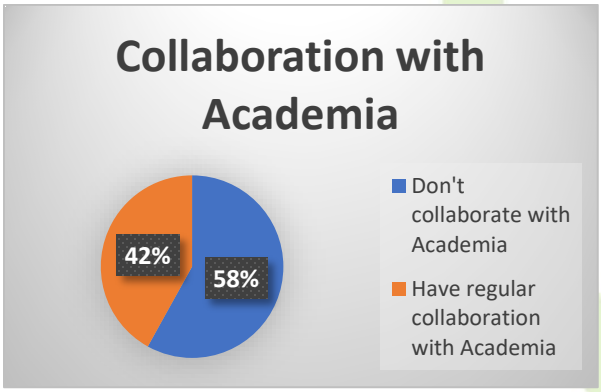


Fig. 5 Businesses and Institutions collaboration with universities

Curricula Improvement

Based on their education experience and professional practise main suggestions regarding curricula improvement are as follows:

- Including in the curricula subjects related to new technology, data transmission in the field of renewable sources, safety in industrial plants;
- Students should have more time practicing during school years: in laboratories, industrial equipment usage, internships, research performed on site, etc.
- Giving more focus to topics related to renewable energy sources and their energy;
- Continuous "cross-checking" between business, university and technology on latest development and work practice;
- Exchange with international universities;
- Lack of curricula for energy trade;

However, more than 80% of respondents declared that the job position with the degree of engineer are compatible.

Workforce Qualification

48% of respondents declared that they don't have a fully qualified workforce. Energy is a sector which requires nonstop training and investment in human capital and this is a challenge for the industry.

16.1% respondents acknowledged that in the last years one main problem in the emigration of the professional due to low level of wages compared to EU countries in this field.

Universities' role in the market

All the participants approved that universities have an important role in preparing experts in this field, thus a stronger bond and collaboration between academia and market is necessary.

Policymakers' role

All the respondents agreed that renewable energy sources should be in focus of policymakers and more investment should be concentrating on this given the potential that this sector represents for Albania.

Program accreditation process

The VET study programs, Bachelor, Professional and Scientific Masters in the field of electrical engineering in Albania are in the process of accreditation / re-accreditation by the Agency for Quality Assurance in Higher Education (acronym ASCAL).

5. Conclusions

Main discoveries of this report regarding academia and energy market are as follows:

- Curricula improvement should emphasis subjects related to new technological developments, data transmission in the field of renewable sources, safety in industrial plants; renewable energy sources; practice in laboratories and equipment usage, etc. as explained in the "results section".

- Business, Energy Sector and academia should create a stronger bond together to build the experts of the future.

- More importance should be given to energy sector on nationwide spectrum, due to the high potential it has for development. The future development will require more professionals and universities should be pro-active on this matter.

In a further analysis and an open discussion, we will identify the new courses or those that need to be updated to ensure our graduates an easier adaption with the labor market as well as to prepare them for the challenges of future developments in power sector with a high penetration of renewable energy sources.

6. Annexes

i) Interviews with stakeholders in the energy sector

1 - **General questions related to engineering profile education?**

- Name and surname / code of the respondent
- Where and when did you graduate?
- What is the function and position you hold in the company?
- What is the compatibility of the job position with the degree of engineer?
- How long have you been employed in this field?
- Do you work only in Albania or elsewhere?
- How could the curriculum be improved in the Bachelor or Master study programs at HEIs, to better serve your job position?
- How do you think the challenges in the university system can be overcome regarding the 3 main topics "Engineering, Economics and Environment"

2. Questions related to the energy sector in Albania

- Do you have cooperation relations with foreign companies?
- Have you noticed technological or organizational changes during the time you have been working in this sector? (describe somewhat longer the answer to this question)
- How would you describe the energy sector in Albania?
- Can you compare it with the countries of the region or the European ones?
- What are the challenges faced by the management and operation of power systems?
- Can you give your opinion on the following issues:
    - control and stability of power systems
    - use of renewable energy sources
    - Smart Grid implementation and intelligent energy use
    - Insulation and electrical materials
    - Electrical equipment
    - Relay equipment and power system monitoring
    - Energy price forecast
    - Energy efficiency

3. The future of market needs / demands

- Do you have a skilled workforce?
- What are the difficulties you face in relation to the workforce?
- What skills do you require from the workforce in this sector?
- Do you plan to increase investments in the implementation of Renewable Energy Sources?
- Do you cooperate with the Academy?
- Your opinion on the policies and reforms needed for the future in the energy sector.
- What is the role of Universities in this matter?
- How do you think Albania's EU Integration will affect?

4. Conclusions

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ii) QUESTIONNAIRE used by PUT

NAME SURNAME	
GRADUATED YEAR	
DO YOU ARE EMPLOYED	
DETAILED CONTACT OF THE EMPLOYER/COMPANY	
FUNCTION AND POSITION HOLD IN THE COMPANY	
PLEASE INDICATE FROM **1 TO 10,** THE COMPLIANCE OF YOUR JOB DESCRIPTION WITH THE EDUCTION AND YOUR ENGINEERING DIPLOMA	
SUGGESTIONS HOW COULD HAVE BEEN IMPROVED ENGINEERING CURRICULA IN RENEWABLE ENERGY TO THE SATISFACTION OF YOUR JOB POSITION AND FUNCTION	

Note:

The purpose of the Questionnaire is to serve to the statistic data elaboration for all graduated students with the electrical Engineering diplomas supported by the Power System Department of Faculty of Electrical Engineering

As far as the suggestion asked to you "how could have been improved the curricula of Professional Master or Scientific Master Diploma", we are seeking from you very short and simple suggestions in respect of knowledge (new or deeper knowledge in specific disciplines) that you consider that should have been treated during the Courses, and can serve better to you role, position and job description that you have in the company/agency that you are employed. Your suggestions will contribute to improve the teaching curricula in the future as well as the work of our Department.

iii) Questionnaire used by UAMD, UET, KPT

Questionnaire for academic staff in framework of ENGINE project

This questionnaire aims to analyze all the problems encountered in current professional study programs and aims to improve current curricula or open new study programs.

1. Gender
   - Female
   - Male
2. Age (in number)

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3. Where do you teach?
   - Bachelor
   - Master
   - 2-year study program (professional degree)
4. Which of the elements of the study program left the best impressions on you?
   - Program curriculum
   - Academic level of students
   - Infrastructure where the program was implemented (buildings, laboratories, equipment)
   - All of the above
5. Are you familiar with the term "Renewable Energy"?
   - Yes
   - No
   - A little
6. Do you know the difference between renewable and non-renewable energy?
   - Yes
   - No
   - A little

7. In your opinion, what are the main challenges that the education system in the field of Engineering in Albania is facing? (choose 3 alternatives)
    - Lack of infrastructure and academic resources (eg libraries, laboratories, computers, updated teaching materials)
    - Lack of knowledge of academic staff
    - Outdated teaching methods
    - Lack of funds for new technologies
    - Outdated curricula
    - Lack of cooperation with internationally accredited universities in the field of renewable energy
    - Lack of cooperation with the industry sector
    - Unemployment of graduate students in the field of energy
8. What are the positive aspects that can overcome the challenges mentioned above? (choose 3 alternatives)
    - Increase the capacity of faculties and staff (eg scholarships, teaching by foreign professors, training programs, etc.)
    - Investing in infrastructure and resources needed for the learning process (eg libraries, laboratories, computers, updating teaching materials)
    - Updating curricula
    - Increase cooperation with accredited international universities in the field of renewable energy
    - Increasing cooperation with the industry sector
    - Employment of graduate students in the field of energy
9. Do you think that the course "Renewable Energy" should be a mandatory part of the curriculum of professional study programs?
    - Yes
    - No
    - I don't know

10. Do you think that a new professional study program for renewable energy should be opened?

- Yes
- No
- I don't know

11. Suggest how the curriculum can be updated to better serve your job position?

Questionnaire for businesses in framework ENGINE project

This questionnaire aims to analyze all the problems encountered in current professional study programs and aims to improve current curricula or open new study programs.

1. Are you a private or public business?
   - Private
   - Public
2. How related is your business to the energy industry sector? ((1) not at all in (5) many)
   - 1
   - 2
   - 3
   - 4
   - 5
3. Do you have cooperation with Universities?
   - Yes
   - No
   - A little
4. Have you been supported from higher education institutions, in terms of new graduates in the field of industry?
   - Yes
   - No
   - A little
5. Are you familiar with the term "Renewable Energy"?

- Yes
- No
- A little

6. In your opinion, what are the main challenges that the education system in the field of Engineering in Albania is facing? (choose 3 alternatives)
    - Lack of infrastructure and academic resources (eg libraries, laboratories, computers, updated teaching materials)
    - Lack of knowledge of academic staff
    - Outdated teaching methods
    - Lack of funds for new technologies
    - Outdated curricula
    - Lack of cooperation with internationally accredited universities in the field of renewable energy
    - Lack of cooperation with the industry sector
    - Unemployment of graduate students in the field of energy
7. What are the positive aspects that can overcome the challenges mentioned above? (choose 3 alternatives)
    - Increase the capacity of faculties and staff (eg scholarships, teaching by foreign professors, training programs, etc.)
    - Investing in infrastructure and resources needed for the learning process (eg libraries, laboratories, computers, updating teaching materials)
    - Updating curricula
    - Increase cooperation with accredited international universities in the field of renewable energy
    - Increasing cooperation with the industry sector
    - Employment of graduate students in the field of energy
8. Do you think there should be more specialists in the industry sector?
    - Yes
    - No
    - I don’t know

9. Do you think that Albania should acquire renewable energy instead of non-renewable energy?
    - Yes
    - No
    - I don't know
10. In your opinion, in the conditions of Albania, which of the renewable sources should be implemented for the production of electricity?
    - Wind energy
    - Solar energy
    - Other energy sources

Questionnaire for students in framework of ENGINE project

This questionnaire aims to analyze all the problems encountered in current professional study programs and aims to improve current curricula or open new study programs.

1. Gender
    - Female
    - Male

1. Age (in number)

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2. Are you currently employed in institutions?
    - Public
    - Private
    - Unemployed
3. The company where you are employed?

4. Study cycle:

    - Bachelor
    - Master
    - 2-year study program (professional degree)

5. Which of the elements of the study program left the best impressions on you?
    - Program curriculum
    - Teaching staff
    - Infrastructure where the program was implemented (buildings, laboratories, equipment)
    - All above
6. How much do you think your degree is valued in the labor market, from (1) not at all to (5) a lot?
    - 1
    - 2
    - 3
    - 4
    - 5
7. How much has this study program affected your stable employment, from (1) not at all to (5) a lot?
    - 1
    - 2
    - 3
    - 4
    - 5
8. From 1 to 5, how much does your job position match your degree, from (1) not at all to (5) a lot?
    - 1

- 2
- 3
- 4
- 5

9. Are you familiar with the term "Renewable Energy"?
    - Yes
    - No
    - A little
10. Do you know the difference between renewable and non-renewable energy?
    - Yes
    - No
    - A little
11. Do you think that the course "Renewable Energy" should be a mandatory part of the curriculum of professional study programs?
    - Yes
    - No
    - I don’t know
12. Do you think that a new professional study program for renewable energy should be opened?
    - Yes
    - No
    - I don’t know
13. Suggest how the curriculum could be improved, to better serve your job position?

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