1 INTRODUCTION

1.1 Geographic profile [1]
The Republic of Serbia is located in southeastern Europe, in the central part of the Balkan Peninsula, while the smaller, northern part of the country belongs to Central Europe and covers an area of 88,361 km². Plains cover the northern region, while the central parts are hilly. Further south, the hills gradually give way to mountains. A few mountain peaks rise above 2,000 m and the highest is Đeravica (2,656 m). Serbia has three major geographical areas: the Pannonian plain, hilly areas with lower mountains and lowlands and mountainous areas. The primary rivers belong to the basins of the Black, Adriatic and Aegean seas. Three rivers are navigable across the whole length of Serbia: the Danube, the Sava and the Tisa. The Danube is the longest river, which flows through Serbia for 588 km of its 2,783 km course. The total length of the artificial channels is 939.2 km. The largest canal system is located in the plains region of the country and is known as the Danube-Tisa-Danube canal, the names of the rivers that it connects. Serbia does not have large natural lakes, but it does have nine artificial lakes larger than 4 km², created by damming riverbeds to create waterpower for electricity production. The largest of these is Đerdap lake on the Danube. [1]

1.2 Climate profile
The climate of Serbia is moderately continental, with more or less pronounced local characteristics and a gradual transition between seasons. From 1960 to 2012 the mean annual temperatures rose in almost all parts of Serbia. The temperature increases were higher in the northern than in the southern parts of the country. July is the warmest month, and January is the coldest. The hottest year was 2000, with a positive anomaly of 1.86°C followed by 2008, 2007, 1994 and 2012. The most severe heat wave recorded in Serbia was in 2007. Serbia has a continental precipitation regime, with higher amounts in the warmer half of the year, apart from the southeastern areas, which have the most rainfall in autumn. June is the rainiest month. The least rainy months are February and October. Snow cover is typical from November to March and sometimes in April and October. Northwesterly and westerly winds dominate the warmer period of the year, while easterly and southeasterly winds (the Košava) blow during the coldest period of the year. The annual sums of sunshine duration range from 1,800 to 2,100 hours, with only Požega having around 1,550 hours a year.

1.3 Socio-political system
The Republic of Serbia is an independent democratic state (since 2006), with a multiparty parliamentary system. The governmental system is based on a division of power into the legislative, executive and judiciary branches. The responsibilities of the different government bodies are divided between the central government and the provincial and municipal authorities. In March 2012, Serbia was granted EU candidate status.
1.4 Population
In the period from 2000 to 2013, two Censuses were conducted, in 2002 and 2011. According to the results of the 2011 Census, the population is estimated to include 7,186,862 inhabitants. The results of the 2002 and 2011 Census have to be taken with caution because they were not conducted across the entire territory. Nevertheless, the results of the 2011 Census, when compared to the results of the previous census in 2002, indicate that the population decreased by nearly 311,139 persons because of negative natural increase and continued emigration. According to the 2011 Census, the largest cities in the Republic of Serbia are Belgrade, the capital, (1,659,440 inhabitants), Novi Sad (341,625), Niš (260,237) and Kragujevac (179,417). The average life expectancy of the male and female population in the Republic of Serbia has increased over the last ten years – from 69.9 years to 72.5 years for men, and from 75.1 to 77.7 years for women. The majority population is Serbian; however, 37 other nationalities live in Serbia.

1.5 Economy
Economic and political reforms in Serbia started at the beginning of 2001. The recession strongly affected the Serbian economy as it was heavily dependent on trade partners. The negative tendency began with the second wave of the economic crisis in the second half of 2011, and continued throughout 2012, which put the Serbian economy into recession at the end of 2012. Macroeconomic trends in 2013 were characterized by a growth of economic activity and import, with an annual GDP growth of 2.6%. The unemployment rate in 2013 was 22.1%. An increase in average salary was also recorded, from 129.1 USD in 2001 to 475.83 USD in 2012.

1.6 Energy
Energy accounts for 10% of the GDP. Production of electricity is based on burning low quality lignite in existing thermal power plants and using hydro potential. The share of renewables in gross final electricity consumption is 21.2% in 2009, and 19.1% in 2013. General consumption in households, public and communal activities sectors increased significantly comparing to the energy consumption in industry. According to data from 2013, industry accounts for 22.4% of the GDP. The average growth rate in the period from 2001 to 2012 was 0.4% and presented an above average rate of industrial growth of 3.8%. Industrial production in Serbia had an increase in 2013 compared to 2012 of 5.5%, because of growth in the mining and quarrying section, manufacturing, electricity, gas steam and air conditioning supply. The “high technological” sectors such as the manufacture of motor vehicles, manufacture of electrical and electronic equipment and information technologies have an increasing share of total production.

1.7 Agriculture
Agriculture is an important part of the Serbian economy, as the country’s larger employer and the third largest contributor to the national GDP, it accounts for 7.9% of the economy (2013). During 2000 – 2012 period, the index of physical volume of agricultural production increased twice, with an average annual growth of 9.4%, as the only sector with a positive foreign trade balance and the sector with the largest contribution to total exports. According to the Agricultural Census (2012) there are 631,522 agricultural holdings out of which 628,955 are family agricultural holdings and 2,567 are holdings of legal entities.
and unincorporated enterprises. The number of members and employees of farms is 1,442,628. Approximately 90% of arable land is privately owned and 10% belongs to the government.

### 1.8 Land-use change and forestry

In the period 2000-2013, 1.15% of total land area was subjected to a change in land use. The most significant changes occurred in urban areas, where pastures and agricultural land was converted into construction land. According to the National Forest Inventory, the Republic of Serbia can be considered an average afforested country. According to data from the National Forest Inventory, in 2009 forests covered 2,254,400 ha or 29.1% of the total territory. State forests covered 53.0% of total forest area and private owned land accounted for 47%. However, in 2011 forests covered 1,962,335 ha, out of which state forests covered 47.3%, and private forests 52.7% of the territory. State forests (in total 97.6%) are managed by state enterprises.

### 2 Current Environmental Status

Serbian Agency for Environmental Protection has prepared the Report on Environment Condition for Serbia [2] (latest edition 2014). It is the most important document in Environment Protection sector and it is intended for decision makers, but also for experts and public. It gives insight in achievements of goals that are defined by National Programme of Environment Protection and National Strategy of sustainable development. It ensures continuity and progress in monitoring and assessing the state and changes in environmental quality, as well as comparability and exchange of data with other European countries. Serbia will completely implement current legislation of the European Union by the end of 2018. There is initiative for developing sustainable financing system for funding environment protection sector, by establishing “green fund”. Investment, operational and administrative costs are estimated to be more than 10.5 billion euros in the period of 20 years, including state and private investments. The biggest investments are expected in the sectors of water and waste. It is predicted to be funded 70% from the EU funds and 30% from national sources. Brief overview of the conclusions made in Report is given:

- **Air pollution:** The most significant amounts of emitted sulfur oxides, nitrogen oxides and dust substances in 2014, come from the power plant, metal production and processing, food processing and mineral industries.
- **Air quality:** In 2014, 68.8% of the population of the Republic of Serbia had a clean or slightly polluted air. As in previous years and during the 2014 ragweed pollen was again dominant allergen at all stations.
- **Water quality:** Water quality is constantly improving in the period 2004-2013. Loss of water in the water supply network in Serbia expressed in percentages has an unfavorable (increasing) trend in the period 2005-2013, while specific water consumption in households has a favorable (decreasing) trend in the same period.
- **Water pollution:** dominant water pollution in Serbia comes from municipal and industrial sources, which discharge their untreated sewage into water recipients. Quantities of municipal wastewater in Serbia are mainly evaluated, so often there is lack of reliable data on the discharged untreated, and purified municipal wastewater quantities.
• Biodiversity: In 2014, 35,369 ha are under protection of the Republic of Serbia. There are 2,628 protected species of plants, animals and fungi, of which 1,760 species are strictly protected. In Serbia, there is 31,956 km² covered with forests, with increased intensity of damage in woods. Timber harvesting is within the limits of sustainability.

• Soil quality: Exceeding the limit values of chemical contamination are in the highest percentage recorded for Cu, Co, Ni and Hg. From a total of 398 identified potentially contaminated and contaminated sites, belonging to 200 industrial sites. Within the industry the largest share of the contamination is identified in oil industry (47.5%), the chemical industry, with 16% and the metal industry was 14%. In the local soil pollution the highest contribution has public municipal landfills with 45.48%, industrial waste landfills with 12.31% and commercial and industrial sites with 33.92%.

• Waste: The Republic of Serbia has produced about 6.12 million tons of waste (of that 5.9 million tonnes of non-hazardous waste, and 210 thousand tons of hazardous waste). The largest producers of waste are thermal power plants. Fly ash generated in coal is in an amount of 4.1 million tons, which makes 60% of the total quantity of waste produced. The amount of packaging placed on the market in the Republic of Serbia in 2014 amounted to 327,713.7 tons. The amount of used re-packaging waste amounted to 102,672.5 tons and recycled 99,496.7 tons.

• Energy: In 2014, primary energy consumption amounted to 14.63 million tons of oil equivalent. The structure of primary energy consumption is dominated by fossil fuel (share of nearly 88%). The final energy consumption in 2014 was 8.90 Mtoe, and increased compared to 2013 by 8.7%. In the structure of consumption the highest share goes to households with 34%, followed by industry with 29% and traffic by 24%, while the share of agriculture 2% and other consumers 11%. Share of renewable energy in electricity consumption in 2014 amounted to 25.48%.

• Agriculture: In 2014 there was an increase in the area under organic farming in relation to 2013 by 14% so that the share of area under organic farming in relation to Utilized agricultural area amounts to 0.27%.

2.1 Policies and Climate Change [1]
Some of the national documents that identify the problem of climate change and anticipate activities and measures that are necessary to reduce GHG emissions are: the Environmental Approximation Strategy for the Republic of Serbia for the period 2011-2019 (2011) and the Waste Management Strategy of the Republic of Serbia for the period from 2010 to 2019 (2010). Energy policy, as the key factor for GHG emission reduction, is defined in the following strategies: the Energy Development Strategy until 2025 with projections to 2030 (2015), based on the energy balances (which Government adopts on an annual basis), the Third Energy Efficiency Action Plan of the Republic of Serbia (2017), the National Renewable Energy Action Plan of the Republic of Serbia (2013), the Decree on Incentive Measures for Privileged Energy Producers – Decree on feed-in tariffs (2013). The Energy Development Strategy until 2025 with projections to 2030 is analyzing the climate change issue in a direct way. However, the National Climate Change Strategy, with an Action plan, which is in the initial phase, will provide a clear framework of activities in the fight against climate change in the period 2020 and 2030, as well as the framework for 2050. Strategy will include all relevant sectors taking into account embarrassment of the sector and possibilities of their adaptation to the climate change conditions.
Republic of Serbia (at that time a part of Federal Republic of Yugoslavia) is a Party of UNFCCC from June 2001 (although signed in 1997), while Kyoto Protocol entered into force in January 2008, making it the last country in Europe to do so [7]. The Republic of Serbia has status of non-Annex I Party to the Protocol, which means that it has no GHG emissions reduction commitments, but is obligated to contribute to global efforts on greenhouse gases emission reduction. The Republic of Serbia successfully submitted Initial (first) National Communication to the Secretariat of the UNFCCC in November 2010, in accordance with obligation which is prescribed in the Convention. Also, Republic of Serbia is actively participating in climate activities under the Regional Environmental Network for Accession (RENA), and GHG emission abatement action plan is developed until 2020 – including identifying a cluster of Nationally Appropriate Mitigation Actions (NAMA), and potential areas for carbon finance interventions. In this way, climate change is integrated into a broader development planning process of the country.

2.2 National greenhouse gas inventory [1]

The national greenhouse gas (GHG) inventory was initially conducted by the Serbian Agency for Environmental Protection (SEPA) based on its legal jurisdiction. The GHG inventory for the Republic of Serbia was prepared according to the Tier 1 approach of the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for the National GHG Inventories for 1990, as the base year, and for the years from 2010 until 2013. The calculations of the GHG emissions for the period 2010-2013 do not include data relative to the Autonomous Province Kosovo and Metohija. Total GHG emissions, excluding removals, for 1990 and the period 2010-2013 were: 83,519.50; 64,813.65; 68,027.00; 60,958.89 and 62,520.88 Gg CO$_2$eq, for each year respectively. Total GHG emissions including removals, in 1990 were 66,664.14 Gg CO$_2$eq, or 48,254.78; 51,293.83; 44,225.72 and 46,783.83 Gg CO$_2$eq for each year respectively, in the period 2010-2013. The largest share in the total GHG emissions in 1990 came from the energy sector and represented 78.70% of the total GHG emissions. In the period 2010-2013, GHG emissions decreased differently in different sectors, but the share in total emissions remained the same. Emissions from the energy sector contributed to 79.4% of the total emissions in 2013, while 10.6% of the total GHG emissions were emitted by the agriculture sector. The emission of GHG from the waste sector contributed 5.1% of the total GHG emissions, while the industrial sector contributed the least at 4.8%.

Figure 1. Share of GHG emissions in the total emissions, by sector, 1990 and the period 2010-2013 [1]
In Table 1 Comparative Indicators of Serbian and EU environmental protection service levels are shown [9]. Given the starting position shown in Table 1, the adoption of the Acquis and, especially, its implementation, will require large investments in infrastructure over an extended period of time.

Table 1. Comparative indicators of Serbian and EU environmental protection service levels [9]

<table>
<thead>
<tr>
<th>COMPARATIVE INDICATORS (Base Years for Data, 2006-2010)</th>
<th>Serbia</th>
<th>EU 27</th>
<th>Serbia compared to EU27 average</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENERAL</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Population</td>
<td>Million</td>
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<tr>
<td>GDP/Capita</td>
<td>€</td>
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<tr>
<td>Inflation</td>
<td>Dinars/E</td>
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<tr>
<td>Household Income</td>
<td>€/Household</td>
<td></td>
<td></td>
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<tr>
<td>Household Expenditure on Utilities*</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure on Environment</td>
<td>% of GDP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENVIRONMENT</td>
<td></td>
<td></td>
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<tr>
<td>Drinking Water Supply</td>
<td>% of Population Served</td>
<td></td>
<td></td>
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<tr>
<td>Purified Drinking Water Supply</td>
<td>% of Population Served</td>
<td></td>
<td></td>
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<tr>
<td>Urban Wastewater Collected</td>
<td>% of Population Served</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban Wastewater Treated</td>
<td>% of Population Served</td>
<td></td>
<td></td>
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<tr>
<td>Municipal Solid Waste Collected</td>
<td>% of MSW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliant Treatment (Life/I inc)</td>
<td>12.45%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Municipal Solid Waste Recycled</td>
<td>4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy Intensity</td>
<td>Kg Oil/€1.000 of GDP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emmissions Nox</td>
<td>Kg/Capita</td>
<td></td>
<td></td>
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<tr>
<td>Emmissions SO₂</td>
<td>Kg/Capita</td>
<td></td>
<td></td>
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<tr>
<td>Emmissions CO₂</td>
<td>Tons/Capita</td>
<td></td>
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</tr>
</tbody>
</table>

2.3 GHG emission and climate change in Serbia [6]

According to the national analyses, the period 1960-2012 is characterized by an average trend of mean annual temperature of 0.3°C per decade. It is estimated that the rise in temperature will be in range between 3.2 and 4 °C by the end of the century and precipitation deficit of up to 20%. These will be followed by the intensification of extremes, particularly in regard to temperatures. The most vulnerable sectors are agriculture, hydrology, forestry, as well as human health and biodiversity. From the mid-20th century, the river discharges in Serbia generally records a negative trend. Average annual long-term trend in river discharges, excluding large rivers, is negative and about -3% per decade. This reduction is expected in the future, particularly after 2050, ranging from a few to over 20%. These changes will cause, among other things, problems related to water availability, water quality and the intensity and frequency of floods and droughts. Droughts, insect invasions and the occurrence of forest fires have significantly influenced forest ecosystems in Serbia. In the long run, climate change may cause a transformation of entire forest ecosystems, changing the distribution and composition of Serbian forests. By the end of the 21st century, about 90% of today's beech forests will be outside the
bioclimatic niches they inhabited in the 20th century and around 50% will be found in the zone where mass mortality is likely to occur.

Climate change will affect the spatial variation in agroclimatic conditions, the conditions for plant breeding and the selection of suitable varieties. Warming will also affect the phenology of plants, leading to faster development. Certain scenarios for the period 2071-2100 indicate the expected corn yield reduction from -52 to -22% for the whole territory of the Republic Serbia, for conditions without irrigation. The impact on other crop and vegetable varieties can also be expected. Impacts of climate change on health are becoming more pronounced in recent years. During the heat wave in July 2007, increased mortality was recorded in Belgrade. Climate change will certainly lead to changes in the distribution and increase in frequency of vectorborne infectious diseases (malaria, dengue fever, West Nile virus, etc.), as well as the spread of infectious diseases through water. The two most extreme weather events that have caused significant material and financial losses as well as losses of human lives are the drought in 2012 and the floods in 2014. The drought in 2012 contributed to a decrease in yields of some crops by 50%, while the droughts in 2000, 2003, 2007 and 2012 caused over 3.5 billion Euros worth of damage and the floods in 2014 over 1.5 billion Euros. Taking into account the impacts of climate change and the need to reduce the risk thereof, and recognizing the importance of its contribution to global GHG emission reduction, the Republic of Serbia has identified GHG emissions pledges at the national level.

2.4 Carbon reduction potential in Serbia [7]

Production of electricity and district heating has an important economic role as the largest economic sector in Serbia, which makes more than 10% of GDP. At the moment, electricity makes 28% of total energy consumption, with total installed generation capacity of 7,124 MW (2011 year), excluding 1,235 MW installed in thermal power plants in Kosovo. The aggregate capacity of six thermal power plants (TPP) is 3,936 MW (55.25% of installed capacity), while 2.835MW (39.8% of installed capacity) is in nine hydroelectric power plants (HPP). A small part of 353 MW (4.95% of installed capacity) is installed in combined heat and power plants (co-generation) which use natural gas and oil as fuel. Apart from this, approximately 461 MWe is installed in industrial energy plants of more than 30 companies (significant portion is currently out of operation). The total share of generated electricity from TPP is much higher than their actual share in the installed capacities, as around 73.5% of electricity generation is obtained from local lignite-fired thermal power plants, approximately 25.5% is produced in large hydropower plants, and the rest of 1.0% is obtained from combined heat and power plants (year 2011), but this can vary depending on hydrology. Serbia's municipal district heating systems operate in 55 cities and towns and approximately 17% of Serbian households are connected to the district heating system. The district heating systems are fuelled by natural gas (65%), heavy and light fuel oil (18%), electricity (2%), and coal (15%).

The current carbon intensity (emission of greenhouse gases per unit GDP) and environmental impact of the energy sector in Serbia is relatively high, mainly as a result of the use of domestic low calorific pit-mined lignite which is burned using old equipment without abatement technology, and has low efficiency of energy production and energy use. Lignite combustion generates 90% of energy related SO₂ and NOx emissions, 65% of CO₂ emissions. Some researchers expect that the emissions of greenhouse gases will increase by about 10-13% by the year 2020 comparing to 2010, as a result of
increased demand for electricity. In 2006, Serbia used 5 times the amount of energy to produce one unit of GDP compared to the EU average; also Serbian carbon intensity per GDP is 6.8 times the world's average and 10.8 times the average of the Organisation for Economic Cooperation and Development (OECD). As energy utilization is inefficient, Serbia ranks among the 20 most energy intensive and among the 10 most carbon intensive countries in the world in terms of GDP. On the other hand, due to out-of-date energy production and distribution facilities, there is a great potential for energy efficiency and reduction of operational losses and emissions of greenhouse gases, which makes the energy sector the important sector in the future climate change regime. Mitigation potential through modernization and capacity increase of existing TPP and construction of new ones using advanced ultra super-critical technology instead of conventionally used sub-critical and closing some old TPP which operate with low efficiency is above 3Mt CO$_2$ eq.. Additional 1Mt CO$_2$ eq. can be achieved through increasing the capacity of combined heat and power plants, and 800,000 t CO$_2$ eq. through the modernization of existing district heating systems. With additional measures in building sector like thermal insulation of building walls, replacement of the existing lighting systems with more efficient ones, as well as the windows in the households and public buildings, total mitigation potential in energy and building sector is estimated at 12.5 Mt CO$_2$ eq./year.

3 National Energy Policies

All National policies described in this section can be found on official webpage of the Ministry of Mining and Energy of the Republic of Serbia [3]

  The Energy Law regulates energy policy objectives and the method of its implementation, conditions for reliable, secure and quality supply of energy and energy-generating products, conditions for safe supply to the customers, conditions for the protection of energy and energy-generating product customers, conditions and manner of performing energy-related activities, conditions for the construction of new energy facilities, the status and scope of activities of the Energy Agency of the Republic of Serbia, the use of renewable energy sources, incentive measures and guarantee of origin, the manner of organizing and functioning of the electricity, natural gas, oil and oil derivatives market, rights and obligations of market participants, establishment of ownership over system operator networks as well as monitoring of the law implementation. Energy Law also regulates the generation, distribution and supply of thermal energy as an energy-related activity.

  This Law regulates conditions and methods of efficient use of energy and energy sources in production sector, distribution, supply and consumption of energy; policies of efficient energy use; system of energy management; energy efficiency labeling of products that have impact on energy consumption; minimal requirements of energy efficiency in production, distribution and supply of electricity and thermal energy and in natural gas distribution; financing, incentive and other measures in this sector, as well as other matter relevant for rights and obligations of individuals and legal entities related to efficient energy use. The most important acts of this Law are: the obligation to introduce energy management systems for large customers in the private and public sectors; mandatory energy audits for SEM, and a system of training and certification of energy advisors who perform energy audits; energy efficiency
labeling of products which considerably affect the power consumption and the objects; eco-design requirements for products; minimum requirements of energy efficiency in the production, transmission and distribution of electrical and heat energy, and natural gas; implementation of billing based on actual (measured) energy consumption; mandatory inspection of boilers, heating and air conditioning systems; energy efficiency as a criteria in procurement; the development of markets for energy services; budget fund for energy efficiency; development programs aimed at improving the public transportation system for local governments with more than 20,000 inhabitants; incentives for rational and efficient use of energy.

- **Law on Planning and Construction (“Official Gazette of the RS, No 132/14 and 145/14”)**
  This Law regulates conditions of spatial planning, construction, renovation and use of the building land and construction. It is the basis for the adoption of law on energy efficiency and energy certification of buildings (energy passports) required in EPBD Directive. Other relevant regulations issued pursuant to this Law are: Regulation of energy efficiency of buildings (Official Gazette of the RS, No. 61/11), Regulation on conditions, content and manner of issuing certificates of energy performance of buildings (Official Gazette of RS, No. 69/12).

- **National renewable energy action plan of the Republic of Serbia, 2013**
  National Renewable Energy Action Plan is the document setting the targets of use of renewable energy sources until 2020, as well as the manner of their achievement. Among other things, its aim is to enhance investments into the field of renewable energy sources.

- **Third energy efficiency action plan of the Republic of Serbia for the period until 2018 (“Official Gazette of the RS, No. 1/17, 2017”)**
  The third energy efficiency action plan (EEAP) of Serbia was prepared for the period up to 2018. It contains a report on the results of the final energy savings so far and status of implementation of certain measures defined in the second EEAP, goals for final energy savings in 2018 and measures for their achievement. In addition 3.EEAP for the first time gives the EE measures in the sectors of energy production and distribution with estimates of reduction in primary energy consumption as well as some possibilities for the implementation of measures in the agricultural sector, and provides plans for the transposition and implementation of Directive 2012/27/EU energy efficiency.

- **Energy sector development strategy of the Republic of Serbia for the period by 2025 with projections by 2030 (“Official gazette of RS, No. 101/15”), 2016**
  Primary attention is given to the rational use of quality energy sources and increase of energy efficiency in production, distribution and energy use by end-users by 2025. It targets all sectors of production, transformation, distribution and final energy consumption.

  The goal is to provide secure energy supply through increased efficiency of the energy companies and the economy.

- **The development strategy of public procurement in the Republic of Serbia for the period 2014 to 2018 (“Official Gazette of RS, No. 122/14”)**
  „Green criterion in procurement“
• **Regulation on the requirements and procedure of acquiring the status of a privileged producer, preliminary privileged producer and producer from renewable energy sources**

This Regulation prescribes in more detail the requirements and the procedure for the acquisition, duration and termination of the status of a privileged producer, preliminary privileged producer and a producer from renewable energy sources, the contents of the application and proof of eligibility for acquiring the status of a privileged producer, payment security instruments, the minimum level of utilization of primary energy in power plants for high-efficiency electricity and thermal energy cogeneration depending on the type of primary fuel and installed power, the maximum aggregate installed capacities of all wind power plants and solar power plants that may acquire the status of a privileged producer, and/or preliminary privileged producer, the contents and the method of keeping the registry referred to in Article 75 of the Energy Law and other issues in accordance with the law.

• **Regulation of incentive measures for the production of electricity from renewable sources and from high-efficiency electricity and thermal energy cogeneration**

This Regulation prescribes in more detail the incentive measures for the production of electricity from renewable energy sources and high-efficiency combined production of electricity and thermal energy, the conditions for their realization, the duration of the incentive period, the rights and obligations arising from these measures for privileged producers and other energy entities, as well as the other issues in accordance with the law.

• **Regulation on the power purchase agreement**

This Regulation prescribes in more detail the contents and other elements of the power purchase agreement, as well as the contents and other elements of the power purchase agreement concluded between the guaranteed supplier and preliminary privileged producer, exercising the right provided under that agreement to incentives under the suspensive condition to acquire the status of privileged producer pursuant to the Energy Law and secondary legislation adopted thereunder.

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4 **National Environmental Policies**

The policies related to environmental protection can be found on official webpage of the Serbian Ministry of Agriculture and Environmental protection [4].

• **Law on environmental protection („Official gazette of the RS“, No. 135/04, 36/09, 36/09, 72/09 and 43/11, 14/2016), 2016**

This law regulates the integral environmental protection system that ensures the realization of the human right to live and develop in a healthy environment, and a balance between economic development and environmental protection in the Republic of Serbia.

• **Law on Nature Protection („Official gazette of the RS“,No. 36/09, 88/10, 91/10 and 14/2016)**

This law regulates the protection and conservation of nature, biological, geological and landscape diversity as part of the environment. This law achieves the following goals: protecting, preserving and enhancing biological and geological diversity; alignment of human activities, economic and social development plans, programs, bases and projects with sustainable use of renewable and non-renewable natural resources, and long-term maintenance of the natural ecosystems and the natural balance; the use of viable and / or management of natural resources and goods, the provision of their functions with preservation of natural resources and balance of natural ecosystems; prevention of human activities and
operations that may lead to permanent depletion of biological and geological diversity, as well as disorders with negative consequences on nature; determining and monitoring the state in nature; improving the situation of damaged parts of nature and landscapes.

- **National programme of the environmental protection** ("Official Gazette of the RS, No. 12/2010")
- **Law on environmental impact assessment** ("Official Gazette of the RS, No. 135/04 and 36/09")
- **Law on strategic environmental impact assessment** ("Official Gazette of the RS, No. 135/04 and 88/10")

This law governs the conditions, methods and procedures for assessing the impact of certain plans and programs on the environment, in order to provide environmental protection and improvement of sustainable development through integration of the fundamental principles of the environment in the process of preparation and adoption of plans and programs.

- **National sustainable development strategy** ("Official Gazette of the RS, No. 57/08")

This Strategy defines sustainable development as target-oriented, long-term, continuous, comprehensive and synergetic process which affects all aspects of life (economic, social, ecological and institutional) at all levels. Sustainable development means development of a model to a qualitative way meet socio-economic needs and interests of citizens, while eliminating or significantly reducing the impacts that threaten or damage the environment and natural resources. One of the most important goals of sustainable development is creating new jobs and reducing unemployment rates, and reducing gender and social inequalities of marginalized groups, encouraging the employment of young persons with disabilities and other groups at risk. The aim of the Strategy is to balance three key factors, i.e. the three pillars of sustainable development: sustainable development of economy, industry and technology, sustainable development of society based on social equality and environmental protection with the rational use of natural resources. At the same time, the strategy aims to bring together the three pillars of the whole, which will support the relevant institutions.

- **Roolbook on National list of environmental indicators** ("Official Gazette of the RS, No. 37/2011")
- **Law on waste management** ("Official Gazette of the RS, No. 36/2009, 88/2010 and 14/2016")

This Law regulates the types and classification of waste; waste management planning; operators of waste management; responsibilities and obligations in waste management; organizing waste management; management of specific waste streams; conditions and procedure for issuing the license; transboundary movement of waste; reporting on waste and database; financing of waste management; control, as well as other issues of importance for waste management.

- **Law on integrated prevention and control of environmental pollutants** (Official Gazette of the RS, No. 135/2004 and 25/2015)

This law regulates the conditions and procedures for issuing integrated permits for installations and activities that may have negative effects on human health, the environment or material goods, types of activities and facilities, supervision and other issues of importance for the prevention and control of environmental pollutants.

- **Waste management strategy for period 2010-2019** (Official Gazette of the RS, No.29/2010)

Waste Management Strategy is the basic document which provides conditions for the rational and sustainable waste management in the Republic of Serbia. It is supported by a large number of implementation plans for the management of specific waste streams (biodegradable, packaging, etc.).
The strategy considers the need for institutional strengthening, development of legislation, enforcement of regulations at all levels, education and raising public awareness. This strategy: determines the basic orientation of waste management for the coming period, in line with EU policy in this area and the strategic orientations of the Republic of Serbia; directs the activities of harmonizing legislation in the process of EU legislation; identifies responsibilities for waste; sets waste management goals for the short and long term period; determines measures and activities for achieving the set goals.

- **Law on water management (Official Gazette of the RS, No.30/2010 and 93/2012)**
  This law regulates the legal status of water, integrated water management, water facilities and water land, resources and funding of water activities, supervision over the implementation of this law, as well as other issues of importance to water management.

- **Law on soil protection (Official Gazette of the RS, No.112/2015)**
  This law regulates the protection of land, systematic monitoring of the quality of soil, remediation, reclamation of, inspection and other issues of importance for the protection and preservation of land as a natural resource of national importance.

- **Law on protection from noise (Official Gazette of the RS, No. 36/2009 and 88/2010)**
- **Law on Protection from Non-Ionizing Radiation (Official Gazette of the RS, No. 36/2009)**
- **Law on Agricultural land (Official Gazette of the RS, No. 62/06, 65/08, 41/09 and 112/15)**
- **Law on Forestry (Official Gazette of the RS, No. 30/10, 93/12 and 89/15)**
- **Law on Air protection (Official Gazette of the RS, No. 36/09 and 10/13)**
- **Law on Ratification of the Kyoto Protocol to the UN Framework Convention on Climate Change ("Official Gazette of the RS" - International Agreements, No. 88 / 07)**
- **Intended national determined contributions to reduce emissions of greenhouse gases globally, 2015**
- **First biennial update report of the Republic of Serbia under the United Nations framework convention on climate change, Belgrade, February 2016**
- **National strategy for approximation of environment for Republic of Serbia (Official Gazette of the RS, No. 80/2011)**
  The objectives of this Strategy are twofold: in the first place, the practice of the complexity of the challenges related to the use of EU legislation in the environmental field in Serbia and, elsewhere, providing a sound basis for negotiations on accession with respect to Chapter 27.

- **Roolbook on on detailed conditions and procedure for obtaining rights to use the ecological label, elements, form and manner of use of ecological label for products, processes and services (Official Gazette of the RS, No. 3/2009)**

5 **The Dilemma between Energy Production and Environmental Protection**

The structure of the Serbian energy sector reflects all of the flaws of global market [8]. Oil and gas remain the primary energy sources, supplying 70% of Serbian energy demand 40 years ago, and
supplying 70% today. To protect its national interests, reduce dependency on imported oil, preserve local capital, and assure the overall health and welfare of the local population, (including enhancing the standard of living), sound environmental practices and the responsible use of energy, (both carbonaceous and non-carbonaceous), are carefully considered in Serbia.

5.1 Coal
Although there is plenty of coal, there are several reasons why in the foreseeable future Serbia cannot meet its energy demand only with coal. The first is clear: environmental; even if the cleanest coal technology were adopted and all old coal fired plants were replaced, and even if Serbia added new coal-fired power plants, coal still cannot replace oil, because no oil is used for power generation and nothing but oil is used for transportation. Therefore, introducing Clean Coal Technologies, and diversifying the energy sources of the future, is the most realistic propositions. One technology that could be particularly valuable in upgrading low-rank coals (LRC), eliminating fugitive dust emissions, reducing acid gas emissions, improving transportability, and producing a low-cost alternative to oil, is the technology to convert LRC into a low-rank coal-water fuel (LRCWF). Hydrothermal treatment (HT) technology is one of the most effective ways to upgrade LRCs. It is a non-evaporative, moderate temperature and pressure process that upgrades LRC continuously in aqueous slurry to effect a permanent reduction in the inherent moisture. Following HT, LRCs can be concentrated into commercial coal-water fuels with energy contents rivaling those produced from more costly bituminous coals without the use of expensive proprietary additives.

5.2 CO₂ capture technologies
Energy independence may be jeopardized if we tend to exclude using coal. Wind and solar power plants, even at a mandated penetration of 20 percent or more, only produce electricity about 30 % of the time. At these penetration levels, they could not possibly replace the need for base load generation, such as coal-fired power. Carbon sequestration is a way to reduce greenhouse gas emissions. It complements two other major approaches for greenhouse gas reduction, namely improving energy efficiency and increasing use of non-compatible with the large energy production and delivery infrastructure now in place. All three approaches will need to make significant contributions, if Serbia is to meet the objective of the United Nations Framework Convention on Climate Change, which is the stabilization of GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. There are two primary types of carbon sequestration. First type focuses on carbon dioxide capture and storage, where carbon dioxide is captured at its source (e. g., power plants, industrial processes) and subsequently stored in non-atmospheric reservoirs (e. g., depleted oil and gas reservoirs, un-mineable coal seams, deep saline formations, deep ocean, etc.). The other type of carbon sequestration focuses on enhancing natural processes to increase the removal of carbon from the atmosphere (e. g., forestation).

5.3 Energy sector in Serbia
In the future, it is expected that mix of Serbian energy sector alternative forms of energy, such as biofuels, wind, and solar power, will play a growing role in satisfying higher demand, but so will fossil fuels, including oil, gas, and particularly clean coal technologies. Coal in the Serbian energy mix will be
mostly for electricity generation. In that respect, it will have to compete with other primary sources of electricity, mostly renewable (including biomass). Though burning coal is considered one of the most polluting ways to generate energy, the industry has already created clean technology. Emissions of sulfur dioxide, particulate matter, and nitrogen oxides have decreased dramatically since the 1970s.

Energy sector of the Republic of Serbia is comprised of the following [5]:

- Oil sector includes exploitation of domestic oil reserves; import, transport and processing of crude oil and petroleum products; distribution and sale/export of petroleum products.
- Natural gas sector includes besides gas import, exploitation of domestic reserves of natural gas their primary processing, collection, transport and distribution to end users of gas.
- Coal sector includes coal exploitation and processing. Coal exploitation is performed in the mines with surface coal exploitation, mines with underground coal exploitation and in the mine with underwater coal exploitation.
- Electric power sector includes electric power sources for electricity generation: thermal power plants, combined heat and power plants and hydro power plants, electricity transmission system used for transmission of electricity generated in the country and for the exchange with the neighboring systems, as well as the electricity distribution systems used for the supply of electricity to end customers.
- District heating systems exist in 57 cities in the Republic of Serbia. Additionally, in the industry energy system there are heating sources used for the production of technological steam and heat energy for the needs of production processes and for the heating of working space. At about 30 industrial companies in Serbia there are power plants that enable combined production of heat energy and electricity.

Total consumption of final energy in Serbia in 2010 was 9.696 million toe, with consumption structure divided according to sectors and energy products are presented in Figure 2 and 3.

![Figure 2. Structure of final energy consumption in 2010 by sectors](image)

![Figure 3. Structure of final energy consumption in 2010 by energy products](image)

Primary energy consumption in the Republic of Serbia in 2010 was 15.531 million toe with the structure presented in Figure 4. Necessary coal amounts, which participate in the primary energy consumption with 50.7%, are secured from domestic production with over 90%. Metallurgical coke and better quality coal types are being imported. Unlike coal, about 70% of crude oil and 84.5% of natural gas are secured
from import. Petroleum products (refined basic raw materials, liquefied petroleum gas, diesel) are imported, while coal and lubricants, oil fuel, kerosene and bitumen are exported.

5.4 Renewable energy sources and potentials in Serbia
Renewable energy sources sector, except hydro energy, is in its early phase of development. Estimated total renewable energy sources potential, which is technically available in the Republic of Serbia, is estimated to 5.65 million toe per year. 1.054 milion toe of biomass and 909 thousand toe of hydro energy of this potential is already in use. (Table 2) [5].

Table 2. Overview of technical usable potential of RES (from 2012) [5]

<table>
<thead>
<tr>
<th>RES type</th>
<th>Available technical potential in use (million toe/year)</th>
<th>Unused available technical potential (million toe/year)</th>
<th>Total available technical potential (million toe/ year)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biomass</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- agricultural biomass</td>
<td>0.033</td>
<td>1.637</td>
<td>1.670</td>
</tr>
<tr>
<td>- parts of agric.species</td>
<td>0.033</td>
<td>0.99</td>
<td>1.023</td>
</tr>
<tr>
<td>- fruit, wine growing and</td>
<td>-</td>
<td>0.605</td>
<td>0.605</td>
</tr>
<tr>
<td>processing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Luquid Manure</strong></td>
<td>-</td>
<td>0.042</td>
<td>0.042</td>
</tr>
<tr>
<td>- wood (forest) biomass</td>
<td>1.021</td>
<td>0.509</td>
<td>1.530</td>
</tr>
<tr>
<td>- biodegradable waste</td>
<td>0</td>
<td>0.248</td>
<td>0.248</td>
</tr>
<tr>
<td>- biodegr. municipal waste</td>
<td>0</td>
<td>0.205</td>
<td>0.205</td>
</tr>
<tr>
<td><strong>Hydro energy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- capacities up to 10 MW</td>
<td>0.004</td>
<td>0.151</td>
<td>0.155</td>
</tr>
<tr>
<td>- capacities 10-30 MW</td>
<td>0.020</td>
<td>0.102</td>
<td>0.122</td>
</tr>
<tr>
<td>- capacities over 30 MW</td>
<td>0.885</td>
<td>0.517</td>
<td>1.402</td>
</tr>
<tr>
<td><strong>Wind energy</strong></td>
<td>≈0</td>
<td>0.103</td>
<td>0.103</td>
</tr>
<tr>
<td><strong>Solar energy</strong></td>
<td>≈0</td>
<td>0.240</td>
<td>0.240</td>
</tr>
<tr>
<td>- for electricity generation</td>
<td>≈0</td>
<td>0.046</td>
<td>0.046</td>
</tr>
<tr>
<td>- for heat production</td>
<td>≈0</td>
<td>0.194</td>
<td>0.194</td>
</tr>
</tbody>
</table>
Biomass represents significant energy potential of the Republic of Serbia. Biomass potential is estimated at 3.448 million tons in the total potential of renewable energy participates with 61%. The largest part of this potential is biomass wood potential -1.53 million toe and agricultural biomass potential -1.67 million toe (parts in crop farming, cattle breeding, food growing, wine growing and primary fruit processing), while the potential of biodegradable municipal waste is estimated at 205 thousand of toe. Biodegradable waste (except municipal waste) includes also waste cooking oils and animal waste (slaughterhouse waste) in total amount of 0.043 million toe/per year. Biomass potential is available at the whole territory of the Republic of Serbia. Wood biomass is mostly located in the area of the central Serbia and agricultural biomass in the area of Vojvodina. Nevertheless, while the level of use of wood (forest) biomass potential is relatively high (66.7%), agricultural biomass potential is used very little (about 2%) while the biodegradable municipal waste potential is not used at all. Biomass (especially agricultural) potential is dynamic category and in order to increase it, it is necessary to undertake adequate activities for the use of uncultivated land, and for the use of marginal land in the biomass production for energy sector purposes (energy crops). In the Republic of Serbia it is possible to produce both bioethanol and biodiesel. Raw materials necessary for the production of bioethanol are cereals, millet, Jerusalem artichoke (topinambour) and potato. For the biodiesel production the following oilseeds can be used: sunflower, soya, and rapeseed, as well as waste cooking oils. All stated raw materials can be taken into account as the potential for the production of biofuel only after all other needs are met. It is estimated that market surpluses of the cereals are more than million tons, but using them for the production of bioethanol is economically justifiable only in the cases when it is not possible to achieve them and in the events when it is not possible to produce bioethanol from lignocellulose biomass. Also, according to the estimations there are approximately 100.000 ha of marginal land in the Republic of Serbia that can be used for cultivation of millet and Jerusalem artichoke by which about 3 million tons of ethanol per year could be produced. Growing oilseed for the production of biodiesel could be performed at 350.000 ha by which 220.000 tons of biodiesel could be produced. It is estimated that it is possible to collect about 10.000 tons of waste cooking oil per year which can be used for the production of biodiesel. It should be noted that cultivation, transportation and conversion of biomass to bio-fuel is not CO₂ neutral and it is water intensive and in most parts of the world water is a critical issue. 

**Total hydro energy potential**, gross potential of water that flows in the rivers on the territory of the Republic of Serbia is about 25.000 GWh/per year. The largest part of hydro potential (over 70%) is concentrated only at several rivers with the potential over 1000 GWh/per year: Danube, Drina, Velika Morava, Lim and Ibar. On the other hand, it will be possible to use hydro energy potential of several rivers only partially, because of the priority that water management use has (some rivers are planned as the sources of regional water supply systems). Technically usable potential in the Republic of Serbia is around 19.5 TWh/per year, out of which around 17.7 TWh/per year is at the facilities with the capacity more than 10 MW. 16 hydro power plants are built until now and average of about 10.5 TWh/ per year is produced. Total technical potential of hydro power plants with the capacity up to 10MW is estimated at around 1.800 GWh per year. Remaining part of hydro potential and the possibility to use it shall also be determined in accordance with the non-energy sector criteria which are related to multipurpose water use and based on the political agreements on the division of hydro potential with neighboring countries. Also, having in mind that the estimated potential of small HPPs is based on the Cadaster of small hydro power plants from 1987, detailed revision of the locations shall be continued in the following period in order to make more precise list of feasible locations and create better planning basis.
for the use of this renewable source. Also, for the overall hydro energy sector it is necessary to consider impact of climate changes, availability to use water flows for electricity generation. This is important both for the consideration of the expected electricity generation from the existing hydro power plants, and for the possible potential of hydro energy for the construction of new hydro power plants. By utilizing the total potentials of small hydro power plants it would be possible to produce about 4.7% of total electricity production in Serbia.

**Wind energy** in the Republic of Serbia can be used in the area of Kosava wind, south Banat, area of east Serbia, area of east side of Kopaonik, area of Zlaribor and Pester and at the location of mountain passes at the heights over 800m. For the clearer consideration of potential, in the following period it is necessary to continue with the specific measuring of the wind (at 50 m heights and higher) for the preparation of wind atlas, as one of the conditions for the investment into capacities for the electricity generation that use wind energy. In the installed capacities it is possible to have 500 MW with current size of tertiary reserves. Having in mind maximum possibilities of generation of wind power plants with such installed capacity it can be counted on their maximum technically usable potential of 1200 GWh/year, i.e. 0.103 million toe/ per year.

**Solar energy** represents energy potential of the Republic of Serbia that can be used for the generation of heating energy or electricity. On the greater part of the territory of the Republic of Serbia number of hours of the solar radiation is significantly higher than in most European countries (between 1500 and 2200 hours per year). Average intensity of solar radiation at the territory of the Republic of Serbia is from 1.1 kWh/m² per day in the north to 1.7kWh/m² per day in the south–during January and from 5.9 to 6.6 kWh/m² per day – during July. Annually, average value of radiation energy is from 1200 kWh/m² per year in the north-west Serbia to 1550 kWh/m² per year in the south-east Serbia, while in central part it is about 1400 kWh/m² per year. Technically usable energy potential for the conversion of solar energy into heating energy (for the preparation of hot water and other purposes) is estimated at 0.194 million toe per year with the assumption of application of solar thermal collectors at 50% available facilities in the country. Regarding the electricity generation basic technical limitation is the possibility of electric power system to accept this energy in months during summer due to variable generation. Based on the currently available capacities of electric power system of the Republic of Serbia for the provision of tertiary reserves it was adopted that maximum technically usable capacity of solar power plants is 450 MW, i.e. their technically usable potential is 540 GWh per year (0.046 million toe per year). Technically exploitable potential of wind and sun for electricity production is a variable and depend on the dynamics of the development of transmission and distribution network of electric power system of the Republic of Serbia. Construction of new conventional electric power capacities (coal, large HPPs) and particularly PSHPPs (Bistrica and/or Djerdap 3) could significantly increase technically available potential of intermittent RES -wind and solar energy for electricity generation. Although solar energy is significant, it is not likely that it will start to be used to a greater extent. However if one out of five households, (in 2002 there were 2.5 million households in Serbia), installs a solar collector of 4 m², it would generate about 1750 GWh of heating energy annually. This would for the most part replace the use of electrical energy and partially the energy of fossil fuels used for sanitary hot water. This would also reduce CO₂ emission for about 2.3 million tons per year.

The Republic of Serbia is within the zone of favourable geothermal potential and resources. The Republic of Serbia is significantly rich with geothermal energy which involves petrothermal and hydrogeothermal energy sources. The use of geothermal energy for heating and in other energy sector purposes in the Republic of Serbia is in the initial phase and it is very modest compared to the potential and resources. Geothermal potential of the Republic of Serbia is clearly indicated by the existence of many spas and natural springs with water temperatures higher than 30°C, and different level of natural wealth. Based on the existing measurements heat flow is above the average for Europe (60 mW/m²) i.e. from 80 to 120 mW/m². Natural and artificial springs of thermal water are identified at the territory of
more than 60 municipalities. Water temperature is usually within the range up to 40 °C and only at the territory of six municipalities water temperature is over 60°C. Average water flows from the existing springs and boreholes are at average up to 20 l/s. At several locations the water flow exceeds 50 l/s and only at one location the water flow is over 100 l/s. Total heat capacity that could be made by using all existing sources of thermal water is about 216 MWt, with generation of heat energy from 180 thousand toe. Significant but not considered geothermal potential is in the use of watered oil and gas boreholes in Vojvodina where the exploitation is completed.

6 Identification of target groups
In this section it is described which skills, competences and knowledge are required for working in energy sector for selected target professions: industrial engineer; production engineer; civil engineer; environmental engineer; mechanical engineer; chemical engineer

6.1 Mechanical Engineer
The available study programmes in Faculty of Mechanical Engineering University of Belgrade are:

![Diagram of study programmes](image)

Figure 6. Study programmes at Faculty of Mechanical Engineering University of Belgrade

Title Bachelor of Science (B.Sc.) is stated in Diploma certificate of Bachelor studies (ECTS 180). A Diploma Supplement contains a list of courses the student has attended and passed exams. Title Master of Science (M.Sc.) is stated in Diploma certificate of Master studies (ECTS 120 + 180). A Diploma Supplement contains a list of courses the student has attended and passed exams in, as well as the name of the obligatory specialization module from a certain department he/she has taken and completed. Title Doctor of Philosophy (Ph.D.) is stated in Diploma certificate of Doctoral studies. A Diploma Supplement contains date of enrollment, specialization area, a list of courses the student has attended and passed exams in, the data on student's teaching experience, papers published and
projects’ participation, and finally, the date of Ph.D. thesis defense, thesis title, name of Supervisor, and names of Ph.D. committee members.

Faculty of Mechanical Engineering University of Belgrade offers Mater academic studies in Process Engineering and Environmental Protection, Thermal Science Engineering, Aerospace Engineering, Biomedical Engineering, Control Engineering, Naval Architecture, Welding and welded structures, Design in Mechanical Engineering, Informational Technologies, Railway Mechanical Engineering, Internal Combustion Engines, Engineering in Biotechnical Systems, Motor Vehicles, Industrial Engineering, Food Industry Engineering, Production Engineering. There are other Universities in Serbia that offer studies in Mechanical Engineering: University of Niš, University of Kragujevac, Faculty of Technical Sciences University of Novi Sad,

6.1.1 Required skills for Mechanical Engineer

The required skills for Mechanical Engineer [11] are: Reading Comprehension; Active Listening (giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times); Mathematics (using mathematics to solve problems); Science (using scientific rules and methods to solve problems); Critical Thinking (using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems); Complex Problem Solving (identifying complex problems and reviewing related information to develop and evaluate options and implement solutions); Operations Analysis (analyzing needs and product requirements to create a design); Judgment and Decision Making (considering the relative costs and benefits of potential actions to choose the most appropriate one).

6.1.2 Required knowledge and competences for Mechanical Engineer

For being Mechanical Engineer, it is required to have knowledge in: Engineering and Technology (practical application of engineering science and technology, applying principles, techniques, procedures, and equipment to the design and production of various goods and services); Mathematics (arithmetic, algebra, geometry, calculus, statistics, and their applications); Design (design techniques, tools, and principles involved in production of precision technical plans, drawings, and models); Mechanical (knowledge of machines and tools, including their designs, uses, repair and maintenance); Physics (knowledge and prediction of physical principles, laws, their interrelationships, and applications to understanding fluid, material, and atmospheric dynamics, and mechanical, electrical, atomic and sub-atomic structures and processes); Computers and Electronics (circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming).

6.2 Industrial Engineer

Industrial Engineering specializes in development, design and improvement of integrated machines, people and materials, and optimal use of these systems. Students are required to have knowledge on information systems and technology in order to manage and make decisions in enterprises. The Bachelor of Industrial engineering is capable to identify, locate and solve problems in work processes in the material and immaterial production in all areas of human activity. Master of industrial engineering has the ability to optimize the production process and service delivery. In fact, they provide research, detection and resolution of problems and complex processes and tasks in the system, combining the natural, technical and socio-economic aspects of the knowledge acquired during their studies. Master in Industrial Engineering integrates human, information, material, financial and technological resources in
order to optimize the production of goods or provision of services. They design processes and systems that improve quality and productivity. Using knowledge of engineering, mathematics, business administration, and management, these engineers focus on the way products and services are made and performed. Industrial Engineers integrate combinations of people, information, materials, and equipment that produce innovative and efficient organizations. In addition to manufacturing, Industrial Engineers work and consult in every industry, including hospitals, communications, e-commerce, entertainment, government, finance, food, pharmaceuticals, semiconductors, sports, insurance, sales, accounting, banking, travel, and transportation. Industrial Engineering is the branch of Engineering most closely related to human resources in that we apply social skills to work with all types of employees, from engineers to sales people to top management.

6.2.1 Required skills for Industrial Engineer

Writing and presentation skills are very important for Industrial Engineer. Some of the most appreciated (required) skills for this profession are: active listening (Giving full attention to what other people are saying), Critical Thinking (Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems), Complex Problem Solving (Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions), Active Learning (understanding the implications of new information for both current and future problem-solving and decision-making), Mathematics, Time Management, Systems Analysis (determining how a system should work and how changes in conditions, operations, and the environment will affect outcomes), Systems Evaluation (Identifying measures or indicators of system performance and the actions needed to improve or correct performance, relative to the goals of the system), Management of Personnel Resources (motivating, developing, and directing people as they work, identifying the best people for the job).

6.2.2 Required knowledge and competences for Industrial Engineer

Industrial Engineers have broad training in many areas including people-oriented techniques, design-oriented techniques, basic engineering principles, applied math, computer techniques, communication skills, psychology and humanities. At the Faculty of Mechanical Engineering University of Belgrade, curriculum covers mainly four areas of expertise:

- Design, organization and management of the system (it includes design, management, organization and optimization production and service systems);
- Automation (emphasis is on the design, development and implementation of automation in the production and service enterprise);
- Control and communication systems (the emphasis is on the information and communication supporting the modern enterprises);
- Quality and Logistics (emphasis on processes that ensure quality production and services and adequate logistical support).

6.3 Production Engineer

The curriculum of Master studies in University in Belgrade covers three basic areas of production engineering with scientific content in the domain of techniques, technologies and cybernetics.
Production techniques relate to a wide spectrum of tool machines, robots and robotic systems, automatic assembly systems, measurement and control machines, flexible technological systems, working systems and other components and elements. Production technologies are based on a wide spectrum of different technologies, including computer technologies for process simulation and process design. Production cybernetics includes CAD, CAM, CAE systems in the engineering design area of products and production, organization, planning and numeric control. Production Engineers is entitled to design, develop, test, and evaluate integrated systems for managing industrial production processes, including human work factors, quality control, inventory control, logistics and material flow, cost analysis, and production coordination.

6.3.1 Required skills for Production Engineer
The required skills for being Production Engineer are: reading comprehension, active listening, critical thinking, complex problem solving, monitoring (Monitoring/Assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action), judgement and decision making (considering the relative costs and benefits of potential actions to choose the most appropriate one), time management, Coordination (adjusting actions in relation to others' actions).

6.3.2 Required knowledge and competences for Production Engineer
It is necessary to have knowledge of: the practical application of engineering science and technology (applying principles, techniques, procedures, and equipment to the design and production of various goods and services); Production and Processing (knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods); Mathematics (arithmetic, algebra, geometry, calculus, statistics, and their applications); Mechanical (knowledge of machines and tools, including their designs, uses, repair and maintenance); Design (design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models); Computers and Electronics (computer hardware and software, including applications and programming).

6.4 Civil Engineer
Civil Engineer performs engineering duties in planning, designing, and overseeing construction and maintenance of building structures, and facilities, such as roads, railroads, airports, bridges, harbors, channels, dams, irrigation projects, pipelines, power plants, and water and sewage systems.

Studies in Civil Engineering are available at Faculty of Civil Engineering University of Belgrade, Faculty of Civil Engineering and Architecture University of Nis, Faculty of Civil Engineering University of Novi Sad. These faculties implement (4+1+3) study programmes:
- 4 years undergraduate (B.Sc.) studies – 240 ECTS
- 1 year graduate (M.Sc.) studies – (60 + 240) ECTS
- 3 years postgraduate (Ph.D.) studies – (180 + 300) ECTS

6.4.1 Required skills for Civil Engineer
Desirable skills for Civil Engineer are: Reading Comprehension; Critical Thinking; Active Listening; Complex Problem Solving; Operations Analysis (analyzing needs and product requirements to create a
design); Systems Analysis (determining how a system should work and how changes in conditions, operations, and the environment will affect outcomes); Time Management.

6.4.2 Required knowledge and competences for Civil Engineer
Civil Engineer is required to have knowledge in Engineering and Technology (practical application of engineering science and technology, applying principles, techniques, procedures, and equipment to the design and production of various goods and services); Building and Construction (knowledge of materials, methods, and the tools involved in the construction or repair of houses, buildings, or other structures such as highways and roads); Mathematics (arithmetic, algebra, geometry, calculus, statistics, and their applications); Administration and Management (knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources), Law and Government (knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process).

6.5 Environmental Engineer
Studies related to Environmental Engineering are available at Faculty of Mechanical Engineering University of Belgrade (modul for Process Engineering and Environment Protection), Faculty of Civil Engineering University of Belgrade (modul Hydraulic and Environmental Engineering) and Faculty of Technology and Metallurgy (modul Environmental Engineering). Faculty of Technical Science University of Novi Sad offers one year Master Studies in Environmental Engineering, as well as Master in Clean Energy Technologies. Environmental Engineer is entitled to do the research, design, plan, or perform engineering duties in the prevention, control, and remediation of environmental hazards using various engineering disciplines. Work may include waste treatment, site remediation, or pollution control technology.

6.5.1 Required skills for Environmental Engineer
Some of the most favorable skills for being Environmental Engineer are: Critical Thinking (using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems), Complex Problem Solving (identifying complex problems and reviewing related information to develop and evaluate options and implement solutions), Science (using scientific rules and methods to solve problems), Learning Strategies (Selecting and using training/instructional methods and procedures appropriate for the situation when learning or teaching new things), Active Learning (Understanding the implications of new information for both current and future problem-solving and decision-making), Active Listening (Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times), Judgment and Decision Making (Considering the relative costs and benefits of potential actions to choose the most appropriate one).

6.5.2 Required knowledge and competences for Environmental Engineer
The required knowledge for Environmental Engineering is in areas of: Engineering and Technology (practical application of engineering science and technology); Mathematics (arithmetic, algebra, geometry, calculus, statistics, and their applications); Chemistry (knowledge of the chemical
composition, structure, and properties of substances and of the chemical processes and transformations that they undergo, uses of chemicals and their interactions, danger signs, production techniques, and disposal methods; Law and Government (knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process); Design (design techniques, tools, and principles involved in production of precision technical plans, drawings, and models); Public Safety and Security (knowledge of relevant equipment, policies, procedures, and strategies to promote effective local, state, or national security operations for the protection of people, data, property, and institutions); Physics (knowledge and prediction of physical principles, laws, their interrelationships, and applications to understanding fluid, material, and atmospheric dynamics, and mechanical, electrical, atomic and sub-atomic structures and processes); Biology (knowledge of plant and animal organisms, their tissues, cells, functions, interdependencies, and interactions with each other and the environment).

6.6 Chemical Engineer

Faculty of Chemistry offers four years lasting basic academic studies through the following accredited study programmes: Chemistry, Biochemistry and Environmental Chemistry. There also one year Master academic studies in Environmental Chemistry. Academic studies in Chemical Processing Engineering are available at Faculty of Technology Novi Sad. This study programme educates human resources for the performance of professional work in the field of technological engineering in the scientific field of Chemical engineering. Specialists are educated and trained to independently organize and run production processes in chemical, oil-petrochemical, food and pharmaceutical industry. Chemical Engineering programme is available at Faculty of Technology and Metallurgy University of Belgrade. They offer modules: Process Chemical Engineering, Organic Chemical Technology, Polymer Engineering, Pharmaceutical Engineering, Inorganic Chemical Technology, Quality Control, Electrochemical Engineering, Biochemical Engineering, and Food Biotechnology.

6.6.1 Required skills for Chemical Engineer

For being Chemical Engineer, it is necessary to have skills in: science (using scientific rules and methods to solve problems); Critical Thinking (using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems); Complex Problem Solving (Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions); Judgment and Decision Making; Systems Analysis (determining how a system should work and how changes in conditions, operations, and the environment will affect outcomes).

6.6.2 Required knowledge and competences for Chemical Engineer

Chemical Engineer should acquire knowledge in: Engineering and Technology; Chemistry (knowledge of the chemical composition, structure, and properties of substances and of the chemical processes and transformations that they undergo, uses of chemicals and their interactions, danger signs, production techniques, and disposal methods); Mathematics (arithmetic, algebra, geometry, calculus, statistics, and their applications); Physics (knowledge and prediction of physical principles, laws, their interrelationships, and applications to understanding fluid, material, and atmospheric dynamics, and mechanical, electrical, atomic and sub-atomic structures and processes); Computers and Electronics
(circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming).

7 Assessment of educational needs for VET
Requirements for Environment Friendly Energy Production (Implementation of EQF/NQF and ECVET)

7.1 European Qualifications Framework (EQF) and National Qualification Framework (NQF) in Serbia

The National Qualifications Framework (NQF) in Serbia represents an instrument for identification, creation and classification of qualifications in accordance with the learning requirements, in order to improve transparency, accessibility, mobility and quality of qualifications in relation to the labour market and civil society demands. NQFS determines processes and institutions responsible for setting qualifications and Qualification Standards, ways and conditions for acquisition, comparison and recognition of qualifications as well as the other mechanisms for quality assurance.

After the European Qualifications Framework (EQF) was established in 2008, this document has become the main guideline for the process of development of NQFs in all member states and in future candidate countries. The EQF is a common European reference framework which links the national systems of qualifications and acts as a translation tool, i.e. a tool for understanding and interpretation of qualifications between different countries and European education systems. The EQF represents meta-framework that should enable the establishment of links between national and sector specific qualifications frameworks in order to facilitate the transfer and the recognition of qualifications of an individual, thereby increasing transparency and mutual confidence in recognising qualifications as well as the mobility in the European labour market. The EQF has established eight different and unique levels of qualifications. The possibility of comparison, provided by the EQF, should be a substitute for bilateral agreements between countries, which would greatly facilitate international functioning when it comes to mobility in education and labour markets. The ‘Recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the EQF for lifelong learning’ has invited all member states to relate their national qualifications systems to the EQF by referencing their qualifications levels to relevant EQF levels by developing national qualifications frameworks in accordance with national legislation and practice. As a country that aspires to the EU membership, by accepting these recommendations, Serbia makes a step forward on this path. The NQF in Serbia is used by all interested parties in labour and education areas because, once established, framework contributes to the quality assurance of results of both the work processes and vocational education and training. It enables a unique statistical monitoring of education, records matching in the education and employment areas as well as the comparability to other systems in Europe. Therefore, the NQFS users are public institutions, public services, funds, etc.

7.2 Qualification levels and descriptors in NQFS

The integral National Qualifications Framework in Serbia has eight levels. In the NQFS, for each qualification level (I–V), descriptions of knowledge, skills, abilities and attitudes (the descriptors), necessary for performing a job or for further learning, have been established (see Table 3).
**Knowledge descriptors** are statements of complexity of vocational knowledge that is necessary for performing tasks, a job or an occupation. In this context, knowledge is seen as a set of acquired and related facts, principles, theories and practices (experience) in relation to the particular field of work or study. **Skills descriptors** refer to cognitive (logical, intuitive and creative opinion), psychomotor (physical abilities, the use of methods, instruments, tools and material) and/or social skills (communication and presentation, team work), whose differentiation in levels is determined by: complexity and diversity of jobs; predictability of situations/conditions; determination or standardisation of jobs; application of methods and techniques; finding new solutions; use of information (skills for collecting, selecting, processing, applying and creating information); handling utensils, tools, machines, equipment and plant; usage of material. **Attitude and ability descriptors** refer to independency, responsibility and managing and they are seen as: different levels of independency in work; assuming responsibility for own work and/or the work of others along with specifying in relation to means, actions, procedures and decisions; planning, organising and evaluation of one’s own work and/or the work of others.

Table 3. Qualification levels descriptors

<table>
<thead>
<tr>
<th>Level</th>
<th>Knowledge</th>
<th>Skills</th>
<th>Abilities and attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Possesses general practical knowledge necessary for performing tasks and/or for further learning.</td>
<td>Applies basic skills needed for performing simple and completely predictable tasks. Handles universal utensils and tools and uses basic material.</td>
<td>Performs tasks according to the simple oral and written instructions, with constant or occasional supervision, depending on the nature of the job. Performs personal preparation for a job realisation. Assumes responsibility for personal activities and entrusted means.</td>
</tr>
<tr>
<td>II</td>
<td>Possesses practical vocational knowledge necessary for performing a group of related tasks – job and/or for further learning.</td>
<td>Applies basic skills needed for performing less complicated and predetermined operative jobs. Handles tools and machines, following detailed instructions and uses basic material.</td>
<td>Performs jobs according to determined technical and technological procedures with occasional supervision. Performs personal preparation and the preparation of the means for carrying out the work. Assumes responsibility for applying determined procedures, means and for organising their own work.</td>
</tr>
<tr>
<td>III</td>
<td>Possesses practical vocational knowledge with the elements of theory necessary for performing a group of related jobs – an occupation and/or for further learning.</td>
<td>Applies skills needed for performing medium complex, diverse, occasionally non-standard operative jobs. Collects and selects information. Handles specialised equipment, machines and plant and uses different material.</td>
<td>Performs jobs according to determined technical and technological procedures with increased independence. Organises their own work and/or the work of others. Assumes responsibility for applying procedures, means and for organisation of their own work.</td>
</tr>
<tr>
<td>IV</td>
<td>Possesses vocational knowledge that includes theoretical concepts along with abstract elements necessary for performing a group of related occupations and/or for further learning.</td>
<td>Applies skills needed for performing complex, diverse, frequently non-standard jobs, using different methods and techniques. Applies and processes information. Handles different equipment, machines and plants and uses different material.</td>
<td>Performs jobs mainly independently with occasional consultations. Organises and controls own work and/or the work of others and trains them. Assumes responsibility for selecting procedures, means and for organising their own work or the work of a group.</td>
</tr>
<tr>
<td>V</td>
<td>Possesses extended theoretical and practical vocational knowledge necessary for problem solving within complex or specialized occupations and/or for further learning.</td>
<td>Applies skills needed for performing complex, specific and mostly non-standard jobs that demand participating in creating information and new solutions. Handles specialised equipment, machines and plant and uses special material.</td>
<td>Performs jobs with a lot of independence when it comes to making decisions. Organises, controls and evaluates own work and/or the work of others and trains them. Assumes responsibility for determining work methods and mode as well as for the operative work of others.</td>
</tr>
</tbody>
</table>

7.3 Acquiring qualifications in Serbia

Taking into account the concept of lifelong learning, the NQFS allows different ways and paths for acquiring qualifications of all levels at any age, so accordingly we differ:

- qualifications obtained through formal education (schooling), after which a diploma or a certificate are issued as a public document;
- qualifications gained through non-formal education (mostly through training), after which a certificate is issued as a public document;
- qualifications obtained through informal learning (by recognising the prior learning based on work or life experience) after which a certificate is issued as a public document.

The outcomes of the vocational segment of the formal and non-formal education and informal learning (recognition of prior learning) are very similar, but it is necessary to make a distinction in order to identify differences in the area of learning that refers to general knowledge.

**Formal education**

Formal education presents an organised learning process which is conducted based on teaching plans and programmes for primary and secondary education as well as the programmes for other forms of vocational education adjusted to the labour market demands. Formal education provides a wider preparation for inclusion into the world of labour, with continuous general education and with the basis for further mobility within the education system.

**Primary education** is compulsory according to the Law and lasts for eight years. Special emphasis is on functional elementary education for adults.

**Elementary education for adults** (according to the functional elementary education for adults model) is divided into three cycles. The first cycle includes the first four grades of primary education, and the second one covers the fifth and sixth grades. The third cycle, which includes seventh and eighth grades of primary education, also includes vocational training for acquiring knowledge and skills needed for performing simple occupations and qualifications at Levels I and II.

**Secondary education** can be general (gymnasia), vocational and artistic. Because the NQFS is legally focused on secondary vocational education, any further reference to formal education will be directed to the secondary vocational education except in case of FEEA.

**Secondary vocational education** can last for four or three years. However, it also includes various forms of education which allow the acquisition of qualifications at different levels through professional development and training, education for work, master and specialist education.
Through formal education it is possible to gain qualifications primarily at Levels III, IV and V. Exceptions are qualifications at Levels I and II because they can be obtained through formal education only if the qualification is structured in a way that allows exit points after the first and second years of schooling.

**Non-formal education**

Considering that the adults primarily have the need for knowledge and skills that are necessary for performing a certain job, they often acquire qualifications through the process of non-formal education or informal learning, i.e. the recognition of prior learning. Non-formal adult education is organised learning process for adults on the basis of special programmes whose aim is to provide knowledge, skills, abilities, attitudes and values, focusing on personal development of adults, work, employment and social activities. It is possible to acquire qualifications at all levels through non-formal education, except Level IV.

**Informal learning**

Informal learning of adults presents the process of self-acquisition of knowledge, skills, abilities and attitudes in everyday life, work and social environment which can be assessed through the process of recognition in relation to the Qualification Standard.

**Recognition of prior learning**

Recognition of prior learning (RPL) is a process that requires time and a specific preparation of an individual and is therefore a matter of individual choice. From the perspective of an individual, the RPL goals are to evaluate relevant values of prior learning based on experience as well as to increase self-esteem and self-confidence of an individual who has work experience and no certificate. It is possible to acquire qualifications at Levels I–V through the RPL process, but not as a general rule and will only apply to those qualifications that will be approved beforehand.

At Level IV, it is possible to access the RPL process in case of retraining (e.g. a person who has graduated from a gymnasium and has a two-year experience as a business administrator can obtain the Level IV qualification Business Administrator through the RPL process).

At Level V, it is possible to access the RPL process in case of additional training (e.g. a person who has graduated from a gymnasium and has a two-year experience as a tourist guide can obtain the Level V qualification Tourist Guide).

**Recognition of corporate qualifications**

In the conditions of globalisation and increased mobility of a modern man and in terms of qualifications obtained, the attitude towards the qualifications that have been created under the auspices and for the needs of multinational companies (e.g. Coca-Cola or McDonald’s) or propulsive sectors such as the information and communication technologies sector (e.g. Microsoft or Oracle) and refer to specific competencies is considered to be interesting. As these qualifications are supranational, the holder of these qualifications in Serbia can validate their acquired competences through the RPL process. In addition, independently of the NQFS, the employer has the autonomous right to hire a person with these qualifications.

### 7.3.1 Preconditions for acquiring within the qualifications system

Preconditions in the terms of the NQFS are minimal requirements that a person has to meet in order to start the process of acquiring a qualification at a certain level. They are an integral part of every Qualification Standard in which they are specifically defined in relation to the way of obtaining a
qualification (formal education, non-formal education or the recognition of prior learning) and person’s age (the young and adults).

**Level I** Access to the acquisition of qualifications is enabled for persons who previously have completed primary education or the second cycle of functional elementary education for adults. In the case of RPL, in addition to completing the primary education, requirements include one year of relevant work experience.

**Level II** Access to the acquisition of qualifications is enabled for persons who previously have completed primary education or the second cycle of functional elementary education for adults. In the case of RPL, in addition to completing the primary education, requirements include two years of relevant work experience.

**Level III** Access to the acquisition of qualifications is enabled for persons who previously have completed primary education or have obtained the qualification at Level I or II. In the case of RPL, in addition to completing the primary education, requirements include five years of relevant work experience.

**Level IV** Access to the acquisition of qualifications is enabled for persons who previously have completed primary education or have obtained the qualification at Level III for additional training.

**Level V** Access to the acquisition of qualifications is enabled for persons who have completed three-year of four-year secondary education and have two or five years of appropriate working experience, depending on the way of acquiring qualification. Qualification obtained at Level V is primarily intended for the labour market and does not affect the continuation of schooling within higher education.

### Table 4. Level I qualifications

<table>
<thead>
<tr>
<th>Way of acquisition</th>
<th>Formal Education (professional training)</th>
<th>Functional elementary education for adults (FEEA)</th>
<th>Non-formal education</th>
<th>Recognition of prior learning (RPL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preconditions</td>
<td>Primary education completed</td>
<td>The second cycle completed</td>
<td>Primary education completed</td>
<td>Primary education completed and a year of relevant work experience</td>
</tr>
<tr>
<td>Minimum duration of programme</td>
<td>Up to one year</td>
<td>90 hours of training</td>
<td>90 hours of training</td>
<td>-</td>
</tr>
<tr>
<td>Public document</td>
<td>Certificate of passing the exam of professional competence</td>
<td>Certificate of training completion</td>
<td>Certificate</td>
<td>Certificate</td>
</tr>
<tr>
<td>Vertical mobility</td>
<td>Acquiring a qualification at Level II or III (through non-formal education or RPL)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Example</td>
<td>Training for installers of floor coverings</td>
<td>Training for installers of floor coverings</td>
<td>Training for pasta making</td>
<td>Basket Weaver</td>
</tr>
</tbody>
</table>

### Table 5. Level II qualifications

<table>
<thead>
<tr>
<th>Way of acquisition</th>
<th>Formal Education (professional training)</th>
<th>Functional elementary education for adults (FEEA)</th>
<th>Non-formal education</th>
<th>Recognition of prior learning (RPL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preconditions</td>
<td>Primary education completed</td>
<td>The second cycle completed</td>
<td>Primary education completed</td>
<td>Primary education completed and two years of relevant work experience</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum duration of programme</td>
<td>2 years</td>
<td>240 hours of training</td>
<td>240 hours of training</td>
<td>-</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>---</td>
</tr>
<tr>
<td>Public document</td>
<td>Diploma on two-year education for work completion</td>
<td>Certificate</td>
<td>Certificate</td>
<td>Certificate</td>
</tr>
<tr>
<td>Vertical mobility</td>
<td>Acquiring a qualification at Level III (through non-formal education or RPL)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Example</td>
<td>-</td>
<td>Training for gas welding</td>
<td>Training in chimney sweeping</td>
<td>Gerontology Nurse</td>
</tr>
</tbody>
</table>

Table 6. Level III qualifications

<table>
<thead>
<tr>
<th>Way of acquisition</th>
<th>Formal Education (professional training)</th>
<th>Non-formal education</th>
<th>Recognition of prior learning (RPL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preconditions</td>
<td>Primary education completed</td>
<td>Acquired qualification at Level I or II</td>
<td>Primary education completed and five years of relevant work experience</td>
</tr>
<tr>
<td>Minimum duration of programme</td>
<td>3 years, 2 years for adults</td>
<td>1,000 hours of training</td>
<td>-</td>
</tr>
<tr>
<td>Public document</td>
<td>Diploma on secondary education completion and Certificate of having passed the exams within the educational profile programme</td>
<td>Certificate</td>
<td>Certificate</td>
</tr>
<tr>
<td>Vertical mobility</td>
<td>Acquisition of a Level IV qualification (additional qualification) or a Level V qualification (for craftsmanship/specialisation)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 7. Level IV qualifications

<table>
<thead>
<tr>
<th>Way of acquisition</th>
<th>Formal Education (professional training)</th>
<th>Non-formal education</th>
<th>Recognition of prior learning (RPL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preconditions</td>
<td>Primary education completed or three-year secondary education for additional training</td>
<td>Four-year general secondary education completed for retraining</td>
<td>Four-year general secondary education completed and two years of appropriate work experience (for retraining)</td>
</tr>
<tr>
<td>Minimum duration of programme</td>
<td>Four years, three years for adults</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Public document</td>
<td>Diploma on secondary education completion and certificate of having passed the exams within the educational profile programme</td>
<td>Certificate</td>
<td>Certificate</td>
</tr>
<tr>
<td>Vertical mobility</td>
<td>Acquiring a Level V qualification (for specialist education) or higher education</td>
<td>Acquiring a Level V qualification (through nonformal education or RPL)</td>
<td>Acquiring a Level V qualification (through nonformal education or RPL)</td>
</tr>
<tr>
<td>Example</td>
<td>Food Technician – diploma</td>
<td>Business Administrator - certificate</td>
<td>Business Administrator - certificate</td>
</tr>
</tbody>
</table>
Table 8. Level V qualifications

<table>
<thead>
<tr>
<th>Way of acquisition</th>
<th>Formal Education (professional training)</th>
<th>Non-formal education</th>
<th>Recognition of prior learning (RPL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preconditions</td>
<td>Three or four-year secondary education completed and two years of relevant work experience</td>
<td>Four-year secondary education completed and two years of relevant work experience</td>
<td>Four-year secondary education completed and five years of relevant work experience</td>
</tr>
<tr>
<td>Minimum duration of programme</td>
<td>1 to 2 years</td>
<td>6 months to 1 year</td>
<td>-</td>
</tr>
<tr>
<td>Preconditions</td>
<td>Three or four-year secondary education completed and two years of relevant work experience</td>
<td>Four-year secondary education completed and two years of relevant work experience</td>
<td>Four-year secondary education completed and five years of relevant work experience</td>
</tr>
<tr>
<td>Minimum duration of programme</td>
<td>1 to 2 years</td>
<td>6 months to 1 year</td>
<td>-</td>
</tr>
<tr>
<td>Public document</td>
<td>Certificate of having passed the specialist exam or the Craftsmanship certificate</td>
<td>Certificate</td>
<td>Certificate</td>
</tr>
<tr>
<td>Vertical mobility</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Example</td>
<td>Baker – specialist, craftsman</td>
<td>System Administrator</td>
<td>Tourist Guide</td>
</tr>
</tbody>
</table>

7.4 Specification of qualification levels

Qualification Levels I–V are shown schematically in Figure 7.

Figure 7. Qualification Levels I-V in Serbia
7.5 Qualification credit system
Credit based qualifications systems are developed in accordance with the European Credit System for Vocational Education and Training (ECVET) established on the basis of the Copenhagen Declaration. A qualification credit system implies the creation of a technical framework which classifies qualifications based on learning outcomes and ways of validating the achievement of outcomes. This system allows the transfer, accumulation and recognition of parts of qualifications, which contributes to the flexibility especially in the field of adult education.

A credit is usually a numerical value of time spent in learning – this is the time needed for a typical student, without prior relevant achievements, to complete the qualification. In a credit system, each qualification is awarded the appropriate number of credit points.

7.6 Modernisation of the Vocational Education and Training (VET) system in Serbia
The VET Reform Programme [10] has been implemented since 2003, and administrated by the Ministry of Education, in cooperation with the European Union. The aim of the reform is the development of vocational education and training based on the needs of the economy and the labour market. In other words, the reformed VET system, planned as such, will educate students who will, after graduation, find employment easily and quickly or go on to further education - higher school or university.

7.6.1 Phases of the VET Reform Programme in Serbia
During the first and second phase of the implementation of the Programme, the Project was focussed on five sectors: Agriculture, Food Production and Processing, Health, Mechanical Engineering and Metal Processing, Civil Engineering and Surveying and Electrical Engineering. New curricula were developed and old ones were refined for a total of 20 profiles, which were then implemented in 50 selected VET schools all over Serbia, with five more schools receiving support for implementation of additional activities related to training of adults. The project covered a large number of areas: the Strategy for the Development of the Vocational Education and Training was developed, and endorsed by the Government at the end of December 2006; 1000 teachers were trained for the implementation of pilot curricula through various seminars, trainings and study visits; introduction of new teaching methods, development of teaching material and modernisation of curricula (IT equipment for 55 schools). In the second phase, the Programme was realised through several key areas aiming at the development and implementation of new strategies for vocational education and training based on the partnership with the economy, professional development of employees in education, implementation of new curricula, provision of high-quality trainings for adults, continuous innovations in teaching process and modernised school infrastructure (new equipment and teaching aids). 22 pilot schools from three sectors (Wood Processing, Tourism and Catering and Mechanical and Electrical Engineering) were involved in the second phase of the Programme. Third phase of the VET Reform Programme, also referred to as 'Bridging', was aimed at providing smooth continuation of the reform, before the start IPA programmes. The Project was primarily focussed on the support to schools in which new pilot profiles exist or where schools have sectors in which classical profiles will be replaced with modernised ones in the years to come. In line with the decision of the Ministry of Education, the Project included additional
74 vocational schools. Total donations of the European Union for the VET Reform in Serbia, since commencement in 2003, have now reached almost 25 million euro.

When it comes to **National Qualifications System** – in at least two sectors, the existing educational profiles will be replaced with the modernised ones, piloted so far. Support will be given to the establishment of the National Qualifications Framework and testing proposed solutions in this area in three sectors, agreed with employers. In the component **Quality Assurance**, support will be given to the establishment of the Quality Assurance System in VET, by piloting the proposed model in selected schools, which then might be applied to the entire education system, after evaluation.


