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RES CAPACITY INCREASE IN EU AND WIND PROJECT SUSTAINABILITY WITH CASE STUDY ON SERBIA AND MONTENEGRO MARKET

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ABSTRACT

More than 60 years ago, six countries (Belgium, France, Germany, Italy, Luxembourg and the Netherlands) have established a Coal and Steel Community and have reached an agreement that with creating a unified market for coal and steel, they will attain common prosperity, by developing national and economic interests of these countries. Today, the European policy makers are faced with the same challenge: create true European Energy Union in the era of climate change. European energy system based on fossil fuels is needed to complete the overhaul of the entire energy system. The EU has already developed a number of tools for deeper coordination of energy policies throughout the Member States.

Surely Europe can create a great momentum aimed at the increase in the number of jobs by accelerating the transformation of the energy sector with targeted and coordinated investments. Since the production of energy from fossil fuels is one of the main sources of emissions of greenhouse gases, renewable energy sources will play an increasingly important role in the production of electricity and heat with little or no CO_2 emissions.

This summary shows the expansion of the wind power industry in the last decade and draws a parallel between sustainable development and economic indicators in Europe and the market trends and the development of wind projects in the Republics of Serbia and Montenegro. This summary also provides an overview of the installed capacity of renewable energy with the focus on wind. At the same time the increase in consumption indicates production growth and the directions of further development defined by the EU Commission.

Keywords: *Renewable Energy, Investments, Wind, EU, Republic of Serbia, Republic of Montenegro*

INTRODUCTION

The United Nations Conference on Environment (Rio Summit) in 1992, an international conference, as one of the most important documents has adopted the Rio Declaration on Environment [1]. Kyoto protocol is a supplement to the international agreement on climate change with the aim of reducing emissions of CO_2 and other gases that cause the greenhouse effect. With the idea to reduce the impact

of CO_2 emissions and the global pollution [2], the European Union has adopted a directive with the reference number 2009/28 / EC [3].

This Directive defines the level of renewable energy in the EU, where 20% of the energy consumed within the EU must come from renewable energy sources [4]. Republic of Serbia and Montenegro have acknowledged this legislation and are taking an active part in reducing pollution [5].

All EU member states are obliged to make the path of achieving this goal, which path is also defined as a way of monitoring progress of the defined goals [2]. According to the latest report on progress as of 15.06.2015 in Brussels one can read that: ,,with a projected share of 15.3% in 2014 in the gross final energy consumption, the EU and an overwhelming majority of Member States are advancing well towards 2020 targets…. Already today, 26% of the EU's power comes from renewable energy sources [6]. About 10% of the total EU electricity is sourced from variable renewable electricity (such as wind and solar)'' [7].

Figure 1. shows Percentage of the average annual electricity demand covered by wind of in EU. The Euro barometer Survey from 2013 shows the trend of the European population: ``Nine in ten respondents (90%) think that it is important for their government to set targets to increase renewable energy consumption by 2030, with around half of them (49%) saying that it is "very important" for their government to do so. Only a minority (8%) does not think that it is important for their government to set such targets, with most minorities saying that it is "not very important" (6%) rather than "not at all important" (2%). A very small proportion (2%) of respondents are unable to offer an opinion`` [9].

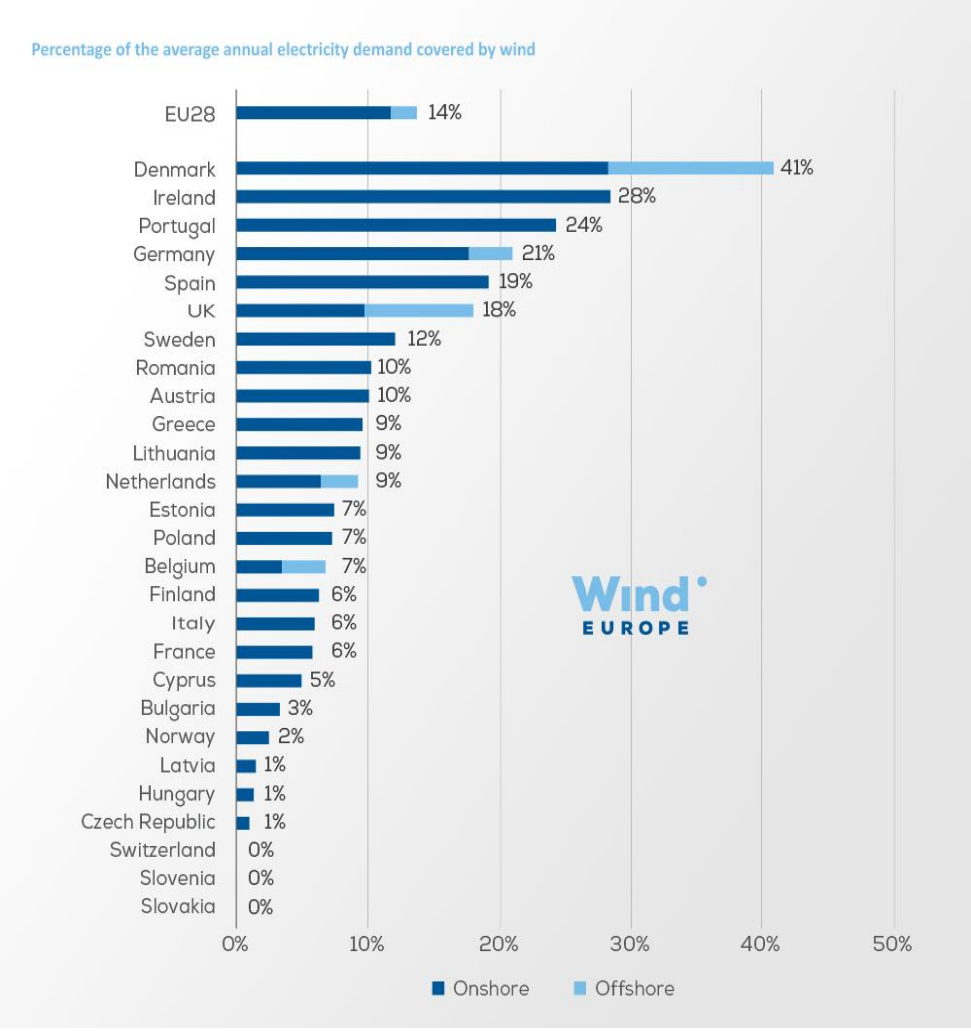

Figure 1. Percentage of the average annual electricity demand covered by wind [8]
Source: Windeurope.org

Each kW of energy derived from wind reduces CO_2 emissions by 696 g. Impact on climate changes, recorded only in the wind industry, shows a trend in the reduction of 140 million tons of CO_2 released into the atmosphere [10]. This quantity represents the CO_2 that is released by 71 million cars or 33% of the total number of cars in the EU. Projection by 2020 foresees a decrease of 342 million tons of CO_2, which represents CO_2 emissions of 174 million cars, or 80% of the EU cars [11]. This number represents 29% of the European norm of 20% reduction in CO_2 emissions. The same projection foresees a reduction in emissions by 2030 of 646 million tons of CO_2 [12], which represents CO_2 emissions of 362 million vehicles, equivalent to 152% of cars in the EU.

In 2012, wind energy has replaced 9.6 billion euro of cost for fossil fuel and it is planned that savings by 2020 will reach 22 to 27 billion whereas by 2030 they will reach the incredible figure of 47 to 51 billion Euros [13]. By comparison, oil imports in the European Union in 2012 has reached the amount of EUR 470 billion, what represents 3.4% of EU's GDP [14].

SUSTAINABLE TRENDS AND PATTERNS OF PRODUCTION AND CONSUMPTION OF ELECTRICITY IN EUROPE

In new power capacities (figure 2.) installed Power capacity per ear and renewable share in Europe 2018. The trend is that in Europe in 2014. there were 26.9 GW of new generation capacity installed: wind energy 11.8 GW (43.7% of total installed capacity), solar 8.3 GW (29.7% of total installed capacity), thermal power plants 3.3 GW (12.3% of total installed capacity), gas 2.3 GW (8.7% of total installed power), biomass 990 MW (03,7% of total installed capacity), hydro 436 MW (1.6% of total installed capacity), waste 68 MW (0.3% of total installed capacity), geothermal 45 MW, oceanic 1.3 MW. The Nuclear and oil resources power generation capacities have shown no investments during 2014 [16]. From the total amount of energy produced in Europe, 46% of energy is spent on heating and cooling, 30% is used for transport and 24% is used for power and other purposes (electricity) [17].

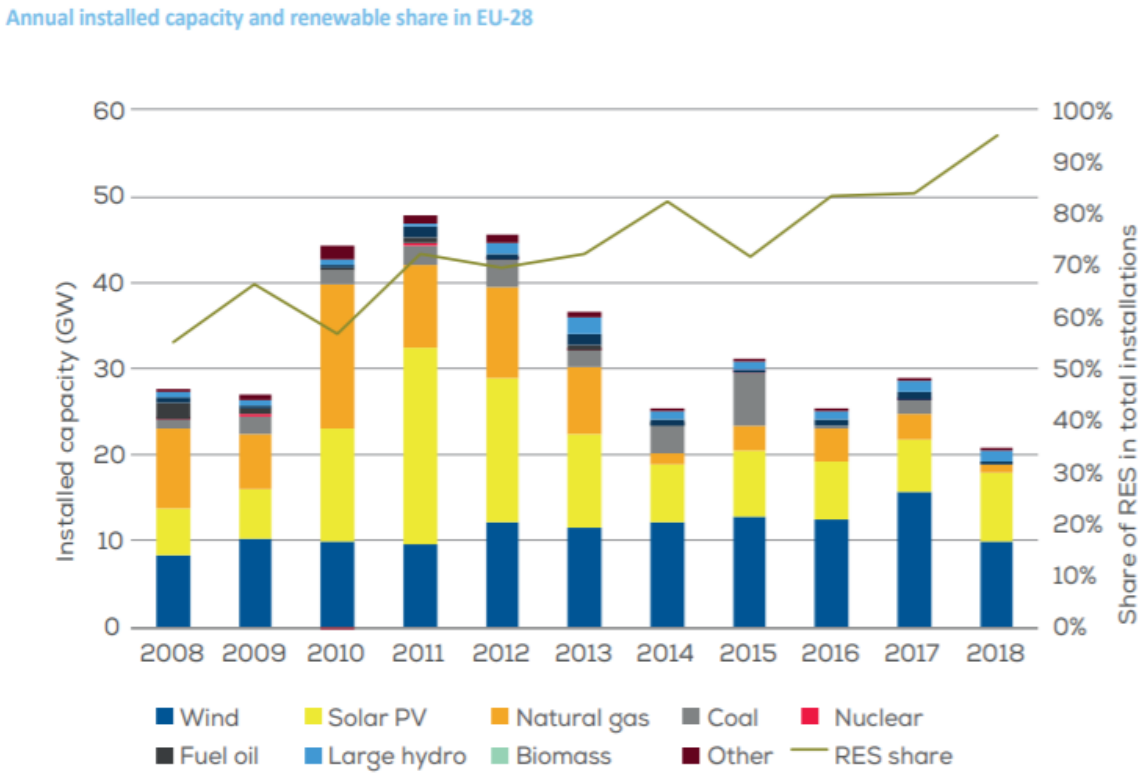

Figure 2. Installed Power capacity per Year (MW) and renewable share (%)
Source: EWEA Wind in Power 2018

The participation of renewable energy in EU from different sources in 28 EU countries in GW (figure 3.). In 2013, total production of 823 TWh of renewable energy, shows an increase of 11% compared to 2012 [18]. Hydro power plants have the largest share in the production of renewable energy from 1990 to 2013 [19]. Their share in the total renewable energy sources has reduced from 94% to 43% due to the increase of energy from wind and solar [20]. Wind power generation has tripled from 2005 to 2014 and delivered energy of 247 TWh in 2014. compared to 234 TWh in 2013. Germany, Spain and the UK are the three largest producers of electricity from wind in the EU [21]. Energy from solar panels reached 10% of renewable energy sources [20, 22]. Other renewable sources such as biomass, waste conventional thermal sources have risen from 3.5% in 1990to 9.5% in 2013. In 2018 Europe installed 11,7 GW in wind this result is a decrease of 32% compare to 2017. In 2018 wind cover 14% from 362 TWh generated in EU. Total installed power generation capacity in EU increase to 977 GW in 2018.

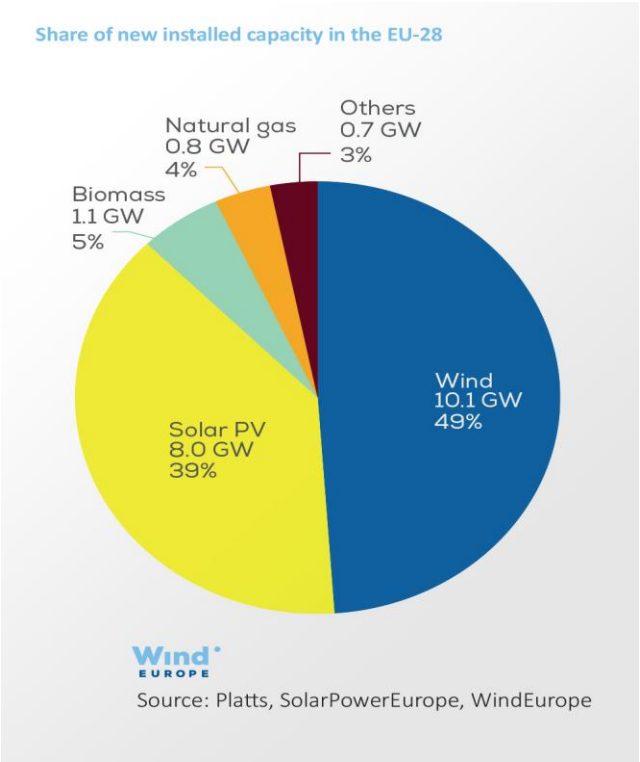

Figure. 3. Share of EU renewable market of EU (2018)

DISTRIBUTION OF THE INSTALLED WIND ENERGY IN THE WORLD AND EUROPE

In 2010, wind energy accounted for 32 billion EURO of the EU economy, which represented, from 2007 to 2010, an increase in GDP by 33% [24]. Direct and indirect employment in the wind in the EU in 2012 was 249 000, and the projection is that by 2020 that number will reach 520 000 employees [25]. In 2012 total installed energy in Europe of wind ON and OFF shore farms reached a number of 106 GW which is equivalent to the energy of 76 million tons of coal for the transport of mining which burning emit 233.1 million tones of CO_2 or 5,290 billion Euros, or 45 million cubic meters of gas for transport which emit 103.8 million tones of CO_2 at the price of 8,001 billion EUR [26, 27].

The tendency is that by 2020 230 GW are installed and by 2050. 735 GW in wind energy [28]. Figure 5 shows the division of markets between the producers of wind turbines at the end of 2016 on global level [29]. It should be noticed that the first manufacturer globally is Vestas and that the large European manufacturers (Vestas, Siemens Gamesa, Enercon,) controlled more than 30% of the world market, which provides for the creation of economic stability, and many jobs in the EU. Average in the EU is that one on shore farm turbine generates 2.2 MW, which represents an average annual production of 4,702 MWh and the cutback of CO_2 emissions from 3202 T [30]; with off-shore farm

average is 3.6 MW per turbine, which represents 12,961 MWH productions on the year to cut emissions by 8827 t of CO_2 [31].

Table 1. World indicators of installed wind energy divided by regions, Source Global Wind Statistic 2012

Region	Unit	Number
Africa and Middle East	MW	1,135
ASIA	MW	97,810
EUROPE	MW	109,237
Latin America&Caribbean	MW	3,505
North America	MW	67,576
Pacific Region	MW	3,219
World Total installed	MW	282,482

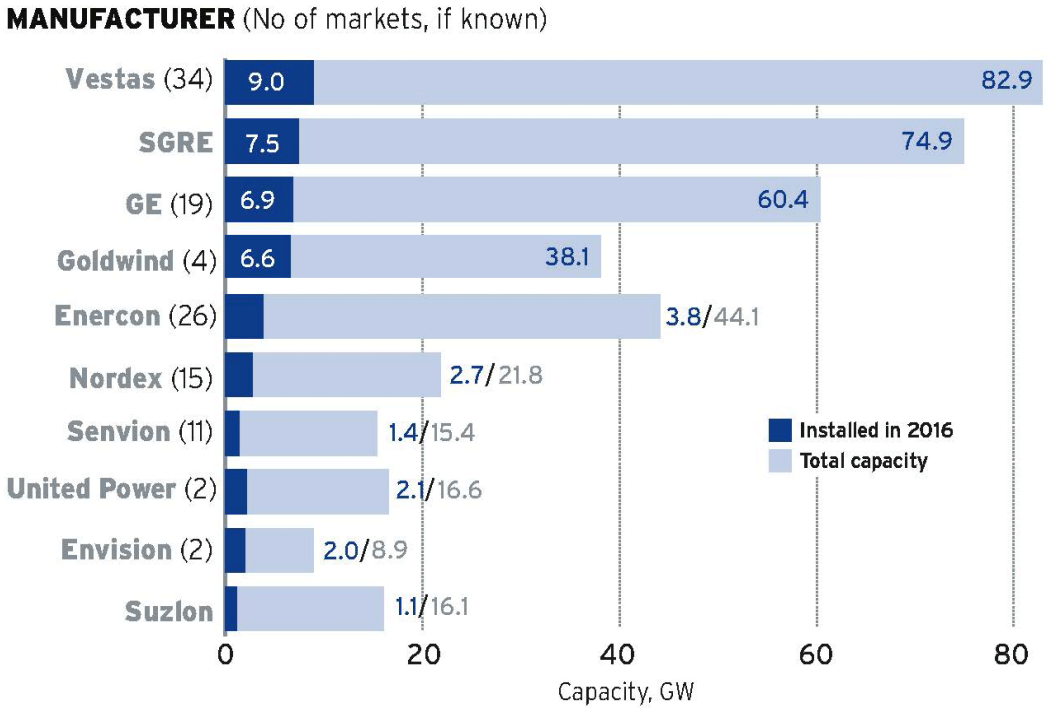

Figure. 4. Market shares of manufacturers 2016 (Source: https://thefotosgratis.eu/)
Installed power in 1996 amounted to 1,280 MW per year; in the whole world, by 2012, it reached 44,711 MW [32].

According to a study by Euro barometer Survey from 2013: Eight in ten respondents (80%) agree that fighting climate change and using energy more efficiently can boost the economy and jobs in the EU, out of which around three in ten (31%) totally agreeing and around half (49%) saying they tend to agree with the statement. Only one in seven respondents (14%) disagree that fighting climate change can help in this way, with most saying that they tend to disagree (11%). A minority (6%) are unable to provide a view [33]. These results are very similar to those in the 2011 survey. Wind energy in 2011 in Denmark covers 26% of overall energy consumption whereas in Spain and Portugal 16%, Ireland 12%, Germany 11% [34].

European Wind industry plays a very important role in the European economy, directly participating in GDP, job creation and the development of various economic sectors. In times of economic recession, a strong wind energy sector in 2010 directly and indirectly employed 238 000 people, it is planned that this number by 2020 comes to 520 000 employees and by 2030 around 794 079 employees [35]. European capacities of installed energy at the end of 2013 and 2014 show an increasing trend as well as the intention of the EU and other countries in Europe to reach their objectives and real intention and commitment to achieve the set goals.

METHODS OF PRODUCTION AND CONSUMPTION OF ELECTRIC ENERGY WITH SPECIAL EMPHASIS ON WIND ENERGY

With the entering into a more active fight against pollution and CO_2 emission, the world strives for new ways and installs new capacities in solar, wind, biomass, geothermal and hydro energy production of the electricity. The call for a strategic approach and consideration of the impact on the environment becomes even louder. At the time when a clear message is coming out of the EU, the global economy shows an increase in the segment of wind, can we predict influence of global economy wind segment on the small markets of Serbia and Montenegro. America and Germany are world powers in terms of finance and industry and those global giants, in the installed energy from renewable sources in Serbia and Montenegro, have installed 2,925 MW in Serbia and 658 MW in Montenegro, none of which has its origin in wind MW.

Comparing the installed capacity of wind parks in Europe, it is easy to conclude that there are currently only a few countries in Europe have not installed wind parks. Bearing in mind that this statement applies to Serbia and Montenegro, further some generals regarding the location, demographic and economic indicators for these countries will be explained. Both countries have great potential in solar RES, wind, bio-mass, small hydro [6, 36-38] and in case they can utilize these resources, they could cover own deficit in the of primary energy consumption. Establishing appropriate legislative frameworks one has reached the legal framework in Montenegro to launch projects in wind whilst Serbia lacks only one additional step in achieving the same goal.

RESULTS AND DISCUSSION RELATING TO THE REPUBLIC OF SERBIA

The Republic of Serbia is a landlocked country in Southern Europe on the Balkan Peninsula. Serbia has on its northern border Hungary, in the northeast Romania, to the east Bulgaria, to the south Macedonia, in the south west Albania and Montenegro and to the west Croatia and Bosnia and Herzegovina (the Entity of Rupublika Srpska). Population is of 7,243,007 people, excluding Kosovo on the surface of 88 407 km^2. GDP of US $ 6,152.9 per capita (source: World Bank). The total net installed capacity of power plants in Serbia is 8,364 MW, including plants in the territory of the Autonomous Province of Kosovo (APKM), which are under the jurisdiction of UNMIK. Total net installed capacity of power plants in Serbia, excluding those in APKM, including small independent power producers, is 7,190 MW (Table 2.). Basic data about Republic of Serbia are in table 3.

In 2014, electricity consumption was 28.1 TWh, 1.5% less than realized in 2013. The potential of renewable energy sources in Serbia can satisfy almost half of its primary energy needs [37]. Currently, used capacity reaches 18%, but almost the entire electricity production is based on hydropower resources [39]. In 2014. 2,896 GWh of energy was imported, which is 4.5 times more than the average due to the large May floods which prevented extraction of coal causing thermal power plants to operate below their usual capacity [40].

Table 2. Total installed power of power plants in Serbia, excluding APKM AERS report 2018

Technology	Installed power MW
Hydropower plant	2936
Thermal power plant- coal	4386
Thermal power plant - oil and gas	347
Gas power plant	-
Nuclear power plant	-
Other RES EPS	38
Small hydropower plant independent producers	131
Total installed power	7.838

Table 3. Basic data on the Republic of Serbia, Source: RZS, World Bank, MPE AERS report 2018

	Unit	Year		
		2014	2015	2016
Population	Thousand	7.132	7.095	7.058
GDP per capita	$	13.113	13.278	13.720
Primary energy consumption	ton of oil equivalent (toe)	13.34	14,8	15,72
Energy end consumption	ton of oil equivalent (toe)	7,67	8,08	8,67
The import dependence	%	27,9	27,7	30,3

Key data: Accession negotiations with the EU will entail renewable energy targets and adopting similar electricity market legislation as the Member States [41,42].

Legislation: Harmonized Laws on Planning and Construction adopted on 8 December 2014 also the Energy Law, which came into force on 30.12.2014 with the further directions for development of the energy sector in Serbia. From the important documents, the PPA (power purchasing agreement) is missing, which is still under construction. There are currently in the pipeline more than 2,000 MW of projects in various wind. The projects are in various stages of development, from technical documentation to projects that have resolved property issues and have a building permit. The list of projects submitted to obtain the status of a privileged producer may be found on the web at http://www.mre.gov.rs/doc/efikasnost-izvori/efikasnost-kvote/

The policy of incentivizing implies the guaranteed purchase price for all the electricity produced in small hydro power plants as well as the plants running on biomass, wind, solar, biogas, landfill or sewage gas, for the period of 12 years from the start of production. Serbia has a very attractive mechanism for feed in tariff with a price of 9.5-euro cents/kW for the next 12 years. Feed-in tariff is currently limited to 500 MW. The Serbian grid can connect 900 MW of wind energy capacity and up to 2,000 MW minor upgrades, despite the feed-in tariff limitation. (14) There are many reasons for no usage of RES in full capacity in Serbia in significant quantities (3):

- Lack of adequate legislative and technical regulations to create a simulative environment for the exploitation of RES and investment in RES plants
- Comprehensive socio-economic environment that is currently not favorable for RES investments
- The lack of experts and industry professionals from the fields of renewable energy sources

Several years after identifying these conclusions, the situation has not improved except that there is a real commitment shown in improvements of the legislation to the benefit of future projects in the wind. In Serbia, measurements and initial activities related to the construction of wind generators were done by several domestic and foreign companies. The equipment and the know-how used for energy production coming from wind is foreign origin. Currently, projects are developed by foreign companies which already possess, use and maintain certain capacities in wind, also some foreign companies have gone through complete projects to the construction phase only as a business developer.

Owners of domestic companies have entered into the wind projects only as business developers due to the reason that they profoundly know local legislation for obtaining all necessary permits and documentation. Researches that are rich in wind energy are performed by the Hydro Metereological Service in Serbia, representing area in the southeastern and eastern part of Serbia, especially in the Pannonian Basin and the southern Banat, north of the Danube. This section represents 2000 km^2 area suitable for the development of wind parks, considering the morphology necessary for the project's documentation.

RESULTS AND DISCUSSION RELATING TO THE REPUBLIC OF MONTENEGRO

The Republic of Montenegro lies on the Adriatic coast of the Balkan Peninsula. It borders with Serbia, Croatia, Albania and Bosnia and Herzegovina. It has the surface of 13,812 sqkm with 621,383 inhabitants. Montenegro's GDP in 2013 amounted to 3.327 billion euros. 7,370.9 US$ per capita (source: World Bank). The total amount of energy produced is about 3100GWh and the demand is over 3424 GWh, deficit of almost 10% offset by imports. Total nominal power of all power plants in the power system (EES) of Montenegro is 876,16MWT (table 4.), of which 657,66MW (75%) comes from hydro power plants and 218.5 MW (25%) from the TPP Pljevlja.

The average annual production is around 3.100GWh at the plants gate, but due to the high dependence on weather conditions, fluctuations in the output are evident on annual basis. Montenegro has two hydro power plants: HPP "Perucica" and "Piva", one thermal power plant TE "Pljevlja and small hydro power plants within the EPCG," Podgor", "Crnojevica Reka," Reka Musovica ","Savnik" and "Lijeva Reka", small hydro power plants within the DOO "Zeta Energy" "Head of Zeta" and "SlapZete", as well as a small hydropower plant "Jezerstica", owned by Hydroenergija LLC Berane.

The wind potential is estimated on the basis of the macroscopic three-dimensional numerical model, with calibration of results by field measurements. The result of the study is that there is a macroscopic wind potential on the entire territory of Montenegro. In order to assess the technical wind potential, limitations such as the altitude, road and railway infrastructure, electro-energetic network and national parks and protected areas are taken into consideration.

Table 4. Main power and technical characteristics of power

Power plant	Installed power MW
HPP Perućica	307
HPP Piva	342
Small HPP EPCG	2,1
SHPP Zeta Energy	6,56
SHPP Jezeraštica	0,3
Total Hydro power plant	657,96
TPP Pljevlja	218,5
Total installed power	876,46

The most interesting areas for the use of wind potential, based on the study, are:

- Coastal areas - with greater wind speeds over 6 m / s on average, and
- The northern part of the Municipality of Niksic (the plateau Krnovska) with average wind speeds in the range of 5.5- 6.5 m / s.

The analysis indicates that the majority of area that is located in the interior of Montenegro, which is typical for high wind speeds, loses their attractiveness due to high altitude of the mountain ranges that dominate in that region. On the remainder of the territory, the windiest areas are often located on the slopes of the mountains and most of them are not connected to the existing road network and infrastructure; in many cases, significant distance of these areas from the electrical grid is evident.

Key data: Accession negotiations with the EU will entail renewable energy targets and adopting similar electricity market legislation as Member States. Legislation: The Republic of Montenegro went one step further in comparison to the Republic of Serbia. In 2015 it launched the first project in wind, took a big step forward by resolving the necessary legislation and opened the door for the first project WP Krnovo. Considering only the most suitable areas for installing wind generators (with the capacity factors greater than 25%), one concludes that the Republic of Montenegro has a wind power potential

of 100 MW, considering only the windiest areas (where the wind speeds are over 7m/s). If we take into account the zones with medium potential, that value reaches almost 400 MW. By utilizing the said energy potential to produce electricity, one could provide for 20-25% of annual energy consumption in Montenegro. [16]

Montenegro has determined the Feed-in tariff for projects in the wind with a price of 9.6-euro cents / kW for the next 12 years. Under the assumption that only the high and medium productivity potential is taken into account, the study showed that the total gross capacity of wind plants that can be installed is approximately 400 MW. Consortium Aquo and Austrian holding Ivicom started construction of the project wind park of 72MW. Wind generators are of the type GE 85m, 2.8 MW, hub height of 103m and will be installed at the location Krnovo which is located between Niksic and Savnik. Project is financed by EBRD and KfW with a value of over EUR 120 million. WP Krnovo, once constructed and operational, will represent 8% of the total installed capacity and 6% of total electricity production in Montenegro.

CONCLUSION

Current global financial market is on the verge, the reason lies in the present state of the market in China. August 2015, turbulences resulted in significant changes in the markets, in particular of raw materials and depreciation of market currencies. For the real economy, the impact would directly depend on its connection with the domestic and export markets; this dictates the leading economies to, due to the demands on the domestic market, the US economy is growing but German economy is limited due the reason that its economy depends on exports to regional markets.

Obviously, case is the eastern Balkans countries and still undeveloped Wind Market and the possibility of reducing the greenhouse effect of the current production capacity (41, 42). On the European market, the economy is stabilizing considering the very turbulent period with the Greece. Negative impacts of Greece, Russia and China consequently have impact on low oil prices, weak euro, reduction of fiscal incentives and increase incentives of the European Central Bank. Based on the energy strategy of Serbia and Montenegro, in compliance with the defined directions of the EU, the sustainable development in the countries is based on studies of availability and opportunities provided by the current wind potential in each country.

Considering the clearly defined short-term and long-term goals in the development of both countries in the energy sector, certainly wind potential represents a serious factor in the further development of the same. Using the results of tests of the wind potential already existing in both countries, certain criteria are set and there are legitimate economic and sustainable criteria to utilize the opportunity provided by the wind industry in its full capacity, because surely this trend opens the door to a better economic position of both countries. The sustainability of the energy systems and reducing the energy dependence is a major advantage for countries of this size. Serbian government has in recent years made a remarkable shift in the effort to adjust the number of laws to improve the economic feasibility of producing energy from RES.

Legislation in new enterprises in the energy sector ends the era of monopoly in the Serbian energy industry. Several strategic documents that are of particular importance for RES have been adopted and as such put as medium-term target of the government and relevant agencies. Measures were adopted and action plans made which have removed barriers that have for long time prevented greater improvements in energy production from RES.

Notwithstanding positive developments and breakthroughs that are made, one misses a few more steps that will include technology, equipment, standards, rules in the design, production and management as well as connection of RES to the existing system. The highest obstacle concerning the determination of feed-in tariffs that is attractive to investors is overcome by making the block feed-in tariffs for all possible sources of energy production.

Factor affecting social and economic surrounding, that capital investments of this scale require, is overcome by the demonstrated open political will and creates the environment legislation that will protect such investments. Even despite the excessive obstacles that bureaucracy imposes to companies that develop projects, fulfilling the requirements of the legislation, distribution and transmission systems, economic recession, both countries are each on their own way fighting to overcome the barriers for producing energy. Montenegro at this time has made a big step forward by finishing the building of the wind park Krnovo. In Serbia, this breakthrough is done with big wind parks as Alibunar, Blacksmith, Cibuk and Kosava. Basically, after the first 500 MW in Serbia other developers wait for the next steps in Wind,

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LITERATURE

[1] Quental, N., Lourenço, J.M., da Silva, FN. (2011). Sustainable development policy: goals, targets and political cycles. Sustainable Development.; 19:15-29.
[2] Stević, I. (2017). Strategic orientation to solar energy productionand long term financial benefits. Arhiv za tehničke nauke/Archives for technical sciences, 1.
[3] Hall, D., Popov, V., Thomas, S., (2011). Impact of 2020 strategy on energy, water and waste sectors in eastern neighbourhood and enlargement countries. London, PSIRU;
[4] Stevovic, I, Jovanovic, J, Stevovic, S. (2017). Sustainable management of Danube renewable resources in the region of Iron Gate: Djerdap 1, 2 and 3 case study. Management of Environmental Quality: An International Journal;28:664-80
[5] Klessmann, C., Held, A., Rathmann, M., Ragwitz M. (2011). Status and perspectives of renewable energy policy and deployment in the European Union—What is needed to reach the 2020 targets? Energy policy. 39:7637-57.
[6] Haas R., Resch G., Panzer C., Busch S., Ragwitz M., Held A. (2011). Efficiency and effectiveness of promotion systems for electricity generation from renewable energy sources–Lessons from EU countries. Energy; 36:2186-93.
[7] Capros, P., Mantzos, L., Parousos, L., Tasios N., Klaassen G., Van Ierland T. (2011). Analysis of the EU policy package on climate change and renewables. Energy policy; 39:1476-85.
[8] Haas, R., Panzer, C., Resch, G., Ragwitz, M., Reece, G., Held, A. (2011). A historical review of promotion strategies for electricity from renewable energy sources in EU countries. Renewable and Sustainable Energy Reviews.; 15:1003-34.
[9] Menegaki, A.N., (2013). Growth and renewable energy in Europe: Benchmarking with data envelopment analysis. Renewable Energy.; 60:363-9.
[10] Twidell, J., Weir, T., (2015). Renewable energy resources: Routledge;
[11] Kjaer, C., (2013). Energy transition can bring lasting peace and generate wealth. Energy Strategy Reviews.; 1:140-2.
[12] Richardson J., Mazey, S., (2015). European Union: power and policy-making: Routledge;
[13] Bhutto, A.W., Bazmi, A.A., Zahedi, G., Klemeš, J.J., (2014). A review of progress in renewable energy implementation in the Gulf Cooperation Council countries. Journal of Cleaner Production.; 71:168-80.
[14] Connolly, D., Lund, H., Mathiesen, B.V., Werner, S., Möller, B., Persson, U., (2014). et al. Heat Roadmap Europe: Combining district heating with heat savings to decarbonise the EU energy system. Energy policy.; 65:475-89.
[15] Levihn, F., (2014). CO 2 emissions accounting: Whether, how, and when different allocation methods should be used. Energy. ; 68:811-8.
[16] Stevovic, S., Milovanovic, Z., Stamatovic, M. (2015). Sustainable model of hydro power development—Drina river case study. Renewable and Sustainable Energy Reviews. 50:363-71.
[17] Sener, C., Fthenakis, V., (2014). Energy policy and financing options to achieve solar energy grid penetration targets: Accounting for external costs. Renewable and Sustainable Energy Reviews. 32:854-68.
[18] Manzano-Agugliaro, F., Alcayde. A., Montoya. F., Zapata-Sierra. A., Gil. C. (2013). Scientific production of renewable energies worldwide: an overview. Renewable and Sustainable Energy Reviews. 18:134-43.
[19] Singh, G. (2013). Solar power generation by PV [photovoltaic] technology: a review. Energy. 53:1-13.

[20] González, J.S., Payán, M.B., Santos, J.M.R., González-Longatt, F. A., (2014). review and recent developments in the optimal wind-turbine micro-siting problem. Renewable and Sustainable Energy Reviews. 30:133-44.
[21] Leung, D.Y., Yang, Y., (2012).. Wind energy development and its environmental impact: A review. Renewable and Sustainable Energy Reviews. 16:1031-9.
[22] Jacobsson, S., Bergek, A., (2004). Transforming the energy sector: the evolution of technological systems in renewable energy technology. Industrial and corporate change. 13:815-49.
[23] Association, EWE. (2012). Wind energy-the facts: a guide to the technology, economics and future of wind power: Routledge.
[24] Association, EWE. (2014) The European Offshore Wind Industry–Key Trends and Statistics 2013. January.
[25] Schaeffer, G.J., (2015) Energy Sector in Transformation, Trends and Prospects. Procedia Computer Science. 52:866-75.
[26] Brouwer, A.S., van den Broek, M., Seebregts, A., Faaij A., (2015). Operational flexibility and economics of power plants in future low-carbon power systems. Applied Energy. 156:107-28.
[27] Dupont, C., Oberthür, S., (2015). Decarbonization in the European Union: Internal Policies and External Strategies: Palgrave Macmillan.
[28] Perveen, R., Kishor, N., Mohanty, S.R., (2014). Off-shore wind farm development: Present status and challenges. Renewable and Sustainable Energy Reviews. 29:780-92.
[29] Association Ewe. (2012). Green Growth-The impact of wind energy on jobs and the economy: EWEA.
[30] Bulkeley, H., Newell, P., (2015). Governing climate change: Routledge.
[31] Michalak, P., Zimny, J., (2011). Wind energy development in the world, Europe and Poland from 1995 to 2009; current status and future perspectives. Renewable and Sustainable Energy Reviews. 15:2330-41.
[32] Association EWE. (2011), Pure Power-Wind energy targets for 2020 and 2030: Ewea.
[33] Stevovic, S., Milošević, H., Stević, I., Hadrović, S., (2014). Sustainable water resources management of Prokletije region. Industrija. 42.
[34] Mikičić, D., Radičević B,., Đurišić, Ž., (2006). Wind energy potential in the world and in Serbia and Montenegro. Facta universitatis-series: Electronics and Energetics. 19:47-61.
[35] Tešić, M., Kiss, F., Zavargo, Z., (2011). Renewable energy policy in the Republic of Serbia. Renewable and Sustainable Energy Reviews. 15:752-8.
[36] PERPETUUM L. (2004), The book on renewable energy potentials of Serbia and Montenegro. OSCE Mission to Serbia and Montenegro, Economic and Environmental department, Novi Sad.
[37] Golusin, M., Tesic, Z., Ostojic, A., (2010). The analysis of the renewable energy production sector in Serbia. Renewable and Sustainable Energy Reviews. 14:1477-83.
[38] Stević, S.M., Milovanović, Z.D., Milajić, A.V. (2010). New methodological approach in techno-economic and environmental optimization of sustainable energy production. Thermal Science. 14:809-19.
[39] Wyns, T., Khatchadourian, A., (2015). Situational analysis of EU renewable energy legislation. Working paper prepared to the conference "The 2020 strategy experience: Lessons learnt for regional cooperation, EU governance and investment". Berlin: DIW.
[40] Pucar, M., Nenković-Riznić, M., (2007). Legislative and policy in energy efficient designing and renewable energy sources: Application in Serbia. Spatium. 66-71.
[41] Ren, D. (2011). Effects of global warming on wind energy availability, J. Renewable Sustainable Energy 2, 052301
[42] Ivanovic, B., Jankovic, S. and Zepinic, C., (2013). Wind power plant energy control and evacuation in Eastern Herzegovina, J. Renewable Sustainable Energy 5, 041808