

## WIND ENERGY POTENTIALS

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### ABSTRACT

*Since the energy is very important factor for overall future developments in the world, it is necessary to point out our interests in new possibilities for energy production. In this paper we will focus on recent developments in the area of renewable energy by exploring potentials of wind energy. Since we are from Kosovo, we will present actual power production of Kosovo and the possibilities for future implementation of wind power plants. We will compare the existing power production potential and future possible potential by using wind power plants.*

**Keywords:** wind energy, renewable energy, power production, wind power plants

### 1. INTRODUCTION

Today Kosovo faces critical energy production and development choices that will impact the energy supply available to meet basic needs, and provide economic growth. These choices will also impact the health of the population, determine the job creation potential of the energy sector, and impact the wider regional role that Kosovo may play in the European Community and European Union [1].

Wind is one of the most important renewable energy sources, and mankind has been seeking various options to harness this energy for a long time. Utilizing 1% of the energy available in earth's wind spectra (per annum) could easily supply annual global energy demand. In the last 30 years, there has been an increasing will in the utilization of wind energy for electricity production, due to economic and social reasons. In the beginning of 1900's, only 10% of the energy available in the wind spectra could be converted into mechanical energy, however, today this ratio increased almost to 50%, with the help of modern energy conversion systems. Advances in wind turbine design and reduction in material costs, price of wind based electricity price decreased from 35 cent/kWh in 1980 to 5 cent/kWh in 1997. Under current conditions, wind energy is becoming a leading alternative to fossil based fuels for electricity production [2].

The renewable resources named also "green resources" are theoretically inexhaustible all over the world, free to use, and do not cause pollution. Since, they represent a great alternative to fossil fuel resources, some European countries, made the political choice to promote renewable energy and to supply electricity using a mix of traditional fossil fuels and "green resources" (such as wind, solar or biomass energy). Among these resources, wind is the cheapest on a large scale to transform into electrical energy. That is why much attention is paid nowadays to wind energy conversion systems. The use of renewable energies will continue to grow, and such plants will become cheaper and more readily accepted by the market [3].

## 2. CURRENT ELECTRICITY BALANCE IN KOSOVO

Approximately 98% of power generated within Kosovo is from two lignite coal-fired thermal power plants (TPP), ‘Kosovo A & B’. These plants are owned and operated by Korporata Energetike e Kosoves (KEK): Kosovo’s vertically integrated power utility is responsible for the mining of coal, generation, distribution and supply. TPP Kosovo A consists of five units (A1- A5), with a total installed capacity of 800 MW, although units A1 and A2 are no longer operational and considered unfit for further commissioning. TPP Kosovo B consists of two larger units (B1 and B2) with an installed capacity of 678 MW. Data on the installed and available capacities, age and remaining hours of TPP Kosovo A & B is presented in *Table 1* below [1].

*Table 1. Capacities of Existing TPP within Kosovo (2010)[1]*

Name	Installed Capacity	Available Capacity		First Year	Retirement	Remaining Lifetime
	(MW)	min (MW)	max (MW)	Years	Years	Hours
Kosova A1	65			1962	2007	
Kosova A2	125			1965	2002	
Kosova A3	200	100	130	1970	2017	61,320
Kosova A4	200	100	130	1971	2017	61,320
Kosova A5	210	100	135	1975	2017	61,320
Kosova B1	339	189	260	1983	2030	175,200
Kosova B2	339	189	280	1984	2030	175,200

The availability of TPP Kosovo A & B is low due to frequent system failures, disconnections and repairs. This has been particularly burdensome for the manufacturing and construction sectors, where in 2009, firms reported an average of 43 outages per month. These outages resulted in losses equivalent to 17% of the firms’ annual sales, compared to less than 4% for similar transition economies. The low availability of TPP A & B is also due, in part, to damages incurred during the war. Damages in low-pressure rotors of units B1 and B2, for example, have reduced the maximum available capacities to 240 MW and 280 MW, respectively [1].

## 3. MONTHLY MEAN WIND SPEED IN KOSOVO

From the available data, the mean wind speed has been calculated for each site. The mean is computed by averaging the recorded 10 minutes measurement values. Table 2 and figure 1 show the monthly mean wind speed for all sites [4].

*Table 2. Monthly mean wind speeds (in m/s) at assessed sites [4].*

	3002-ETEC	3003-EBUD	3004-BBUD	3005-SDUL	3006-WGJU	3007-EABR	3008-BBZYM	3009-SSTA	Total mean
9-Aug	2.7	2.6	4.7	5	3.6	4.5	3.5	2.6	<b>3.7</b>
9-Sep	2.8	2.6	5.9	4.7	3.6	4.5	3.2	2.7	<b>3.8</b>
9-Oct	3.3	2.9	5.8	4.3	3.4	4.6	3.2	3.6	<b>3.9</b>
9-Nov	2.8	2.7	7.4	2.9	2.4	3.6	2.5	3.4	<b>3.5</b>
9-Dec	4.2	3.9	9.5	5.1	4.6	5.3	4.3	5.8	<b>5.3</b>
10-Jan	4.9	4.1	9	5.1	4	5	3.7	5.6	<b>5.2</b>
10-Feb	4.7	4.1	9.1	4.3	3.3	4.6	3.5	6.5	<b>5.0</b>
10-Mar	4.1	3.8	8	4.8	4.7	5.5	3.5	4.7	<b>4.9</b>
10-Apr	3.8	3.6	5.9	4.4	3.9	4.7	3.2	4.6	<b>4.3</b>
10-May	3.7	3.3	7.6	4.6	5	5.3	3.8	3.9	<b>4.7</b>
10-Jun	3	2.9	5.5	3.5	3.3	3.9	3.1	3.1	<b>3.5</b>
10-Jul	3.1	3	5	4.4	3.4	4.3	3.2	3.1	<b>3.7</b>
<b>1 Year</b>	<b>3.6</b>	<b>3.3</b>	<b>7.0</b>	<b>4.4</b>	<b>3.8</b>	<b>4.7</b>	<b>3.4</b>	<b>4.1</b>	

The highest wind speed has been measured at BBUD, in Budakova. This site is located at an altitude of 1'667 m above sea level, being the highest location of all the sites. Unfortunately, the results from the two other sites at high altitudes could not be evaluated due to excessive data loss. All data show higher wind speeds during winter months and lower speeds during summer. The problems caused due to icing may have led to an underestimation of wind speeds as maybe not all icing was detected. Especially during the winter months, the data might be severely distorted [4].

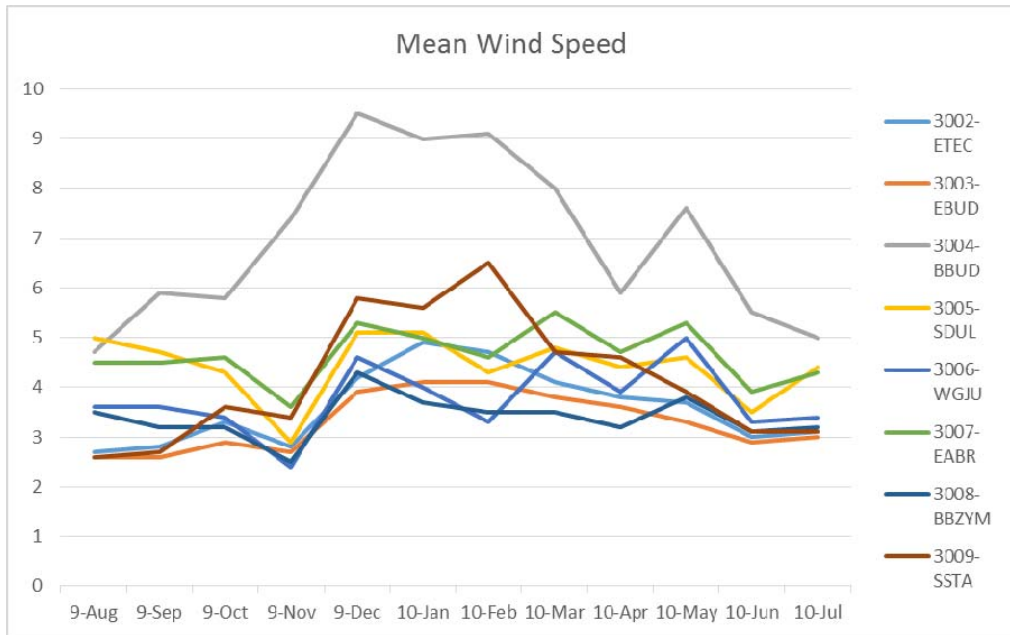


Figure 1. Monthly mean wind speed at ten sites, 01.08.2009 – 31.07.2010 [4]

#### 4. SIMULATED NET ELECTRICITY GENERATION FOR ‘BASE SCENARIO’ 2010-2020

To assess the options available, there has been examined various energy and development scenarios for Kosovo based on the initial work of the Kosovar Ministry of Energy and Mining (MEM) and those proposed by multinational development agencies and by Kosovar civil society.

In this scenario presented, by 2020 the total energy generated from renewables is 1676 GWh – which is equivalent to 22% of the Total Net Generation. Generation from hydro power plants accounts for 17% of the Total Net Generation, while Bio+Wind+Solar contribute 5%. With this high percentage of power being generated by renewables, our simulation shows that very little power is required from TPP G3 (only 376 GWh in 2020 – which represents a capacity factor of only 11%) [1].

Following assumptions were made during the scenario:

- 281MW Wind by 2020
- 140MW new hydro by 2020 (182 including existing capacity)
- HPP Zhur online in 2016 with 15% cf
- 8MW PV by 2020
- 165 MW Biomass by 2020

Table 3. Simulated Net Electricity Generation for 'Base Scenario' 2010-2020

<b>Net Electricity Generation (GWh):</b>											
<b>Base Scenario</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>
TPP Kosovo A3-A5	1740	1740	1739	1739	1739	1740	1739	1739	0	0	0
TPP Kosovo B1-B2	3271	3461	3527	3568	3595	3627	3298	3275	3975	3998	4002
TPP Kosovo G1-G2	0	0	0	0	0	0	388	693	1448	1464	1483
TPP Kosovo G3	0	0	0	0	0	0	0	0	350	370	376
<b>Total TPP</b>	<b>5011</b>	<b>5201</b>	<b>5266</b>	<b>5307</b>	<b>5334</b>	<b>5367</b>	<b>5425</b>	<b>5707</b>	<b>5773</b>	<b>5832</b>	<b>5861</b>
Small HPP	157	229	302	374	447	519	592	664	737	809	881
HPP Zhur	0	0	0	0	0	0	401	401	401	401	401
<b>Total HPP</b>	<b>157</b>	<b>229</b>	<b>302</b>	<b>374</b>	<b>447</b>	<b>519</b>	<b>993</b>	<b>1065</b>	<b>1138</b>	<b>1210</b>	<b>1282</b>
Biomass	0	8	17	25	34	42	50	59	67	75	84
Wind	0	2	32	68	99	134	169	205	240	271	311
Solar	0	0	0	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01
<b>Total Bio+Wind+Solar</b>	<b>0</b>	<b>10</b>	<b>49</b>	<b>93</b>	<b>133</b>	<b>176</b>	<b>219</b>	<b>264</b>	<b>307</b>	<b>346</b>	<b>395</b>
<b>Total Renewables</b>	<b>157</b>	<b>239</b>	<b>351</b>	<b>467</b>	<b>580</b>	<b>695</b>	<b>1212</b>	<b>1329</b>	<b>1445</b>	<b>1556</b>	<b>1677</b>
Total Net Imports	470	476	527	549	586	613	217	0	0	0	0
<b>Total Net Generation</b>	<b>5638</b>	<b>5916</b>	<b>6144</b>	<b>6323</b>	<b>6500</b>	<b>6675</b>	<b>6854</b>	<b>7036</b>	<b>7218</b>	<b>7388</b>	<b>7538</b>

## 5. CONCLUSION

Based on what is stated above we can conclude that Kosovo possess high potential of renewable energy (green resources). The possibility of energy generation up to 22% of the country needs represents a very high business potential for interested investors. What makes more interesting to the potential investors in the area of renewable energy in Kosovo is the fact that current energy provider cannot produce enough to fulfill country needs. So in this way here is a very good possibility to sale the renewable energy directly to the energy provider of Kosovo (Kosovo Energy Corporation). Except the business case, the renewable energy will make a very good contribution to environmental issues.

## 6. REFERENCES

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