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Final Report :

Feasibility Study "Wind Park Zatric"

Development of a 30 - 45 MW pilot wind park in Kosovo

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***Please note:** For a detailed and comprehensive presentation of the results from this feasibility study we refer to the publication: Detailed results from the feasibility study "Wind Park Zatric", which can be downloaded under www.nek.ch or www.repic.ch* [1]

Contents

0. Summary

The main aim of this project, which was partly financed by REPIC, was to evaluate the technical and economic feasibility of a planned pilot wind park called “Zatric” located in the west of Kosovo in the municipality of Rahovec. This is the third phase of a four phase project with the ultimate goal to realise the first wind park of any significant size in Kosovo and to enable and facilitate the development of consecutive projects. The results from this feasibility study should furthermore form a solid basis for discussions and negotiations with potential investors, which have been contacted during this project phase.
The location “Zatric”, named after a small rural village near to the planned project site, was chosen because of the promising wind conditions measured there by NEK during a previous campaign, where a wind map for the whole of Kosovo was prepared.[2]
The feasibility study for the Wind Park Zatric was planned to start in June 2011 with the installation of a 60 m met mast. Due to some delays with obtaining and organizing the permits and due to the harsh climatic conditions in winter the met mast could first be installed in May, 2012. Since then more than a year of data was collected without any data losses. Between May 2012 and July 2013 all surveys and studies, which were necessary to determine the technical and economic feasibility of the wind park project, were carried out. The results and achievements during this project phase can be summarized as follows:

- The wind measurements conducted with a 60 m met mast with heated instruments verified the results obtained from the previous measurement campaign. The extrapolated data shows an average wind speed of 7.0 m/s at a hub height of 100 m and a bi-directional wind direction pattern. This is a very promising result.

- Based on a thorough site investigation and a first land survey with GPS equipment 15 turbine locations were identified, where turbines of the 3.0 MW class can be installed.

- During a grid connection study a feed-in point to the national grid, the most suitable voltage level and the relevant costs were identified.

- An environmental impact study showed that no major environmental impacts are to be expected.

- Through a road and logistics study possible transport routes for the turbine components were evaluated. The route from Durres, Albania, over Prizren, Kosovo, is a suitable option.

- The technical planning of the wind park was concretizised, resulting in a proposed access road, platform and turbine foundation layout.

In summary, a 30 - 45 MW wind park with an estimated annual energy yield of 80’000 - 120’000 MWh is technically feasible in Zatric. However, this will be quite a challenging project to implement due to the topographical complexity of the project region. Economical calculations based on the expected energy yield, the feed-in tariffs and the costs for construction, maintenance and finance also proofed the economic feasibility of the project. Furthermore, an investor could be found for the project with whom we are in final negotiations and working together.

For this project phase, NEK tried to employ local people and companies for the tasks at hand where possible and to build up specific know-how with the people they were working with. Certain specialised equipment and know-how however had to be imported from abroad. With our involvement in Kosovo increasing and in order to keep close and personal contact with the authorities we decided to open up a branch office in Pristina in 2011. Today, we are employing three full time employees there. A further employee, who lives in Zatric, maintains contact with the local population and looks after our measurement equipment.

The Wind Park Zatric is intended as a pilot project. The aim is to transfer the knowledge gained to further wind energy projects and to facilitate the development of these. Thereby, a successful realisation of the Wind Park Zatric shall send a clear signal to developers and investors, who may still be reluctant to enter into the market of Kosovo.

A number of permits have already been applied for and obtained for the Wind Park Zatric. A good working relationship was built up with the authorities. The complex permitting procedures in Kosovo are now better understood. This will allow us to proceed faster with consecutive projects.

A recommendation to the authorities of Kosovo from our side would be to centralize the application procedure in one authority and to assist new developers with the guidelines that describe form and content of the individual applications. A recommendation to other developers entering into Kosovo would be to establish a local branch and get into regular exchange with the authorities from an early stage on. A general recommendation for the development of the wind energy sector in Kosovo would be to offer a fixed feed-in tariff that is valid for 20 years and not only for 10 years as it is at the moment.

This project phase took longer than planned, because we were first able to install the met mast in spring 2012 rather than in autumn 2011 as originally intended. However, in the meantime NEK has already been busy with the development of two further wind energy projects in Kosovo and has installed further met masts there. We hope that the results from this feasibility study will allow us to successfully move on to project phase four, the realisation and commissioning of the first wind park in Kosovo.

1. Introduction

Activities and project plan for Kosovo

NEK is a Swiss engineering company established in 1989 and focusing on the development of renewable energy projects worldwide and has branches in Spain, Brazil, Canada, England, Romania, Ghana and meanwhile also in Kosovo.

In 2009, NEK Umwelttechnik AG started to evaluate the potential for the use of wind energy in Kosovo. A four phase project was initiated starting with a comprehensive background research and ending in a concrete and feasible wind energy project to be realised.

In the first phase, a preliminary study to identify general conditions for the development of wind energy projects in Kosovo was prepared, which included a comprehensive analysis of the legal and political framework as well as geographic and infrastructural conditions.[3]

In the second phase, a wind measuring campaign was conducted including wind measurements at 10 different sites in Kosovo to calculate a wind map for the country. Sites with adequate wind potential for the construction and operation of a wind park were mainly identified in higher regions.[2]

In the third phase, a feasibility study was planned for a pilot wind park project in Kosovo. This feasibility study should form a conclusive basis for realising a concrete wind energy project and, by doing this, form a starting point for the development of consecutive projects and stimulate the wind energy sector in Kosovo as such.

All three project phases were partly financed by REPIC, the interdepartmental platform of the Swiss Government to promote renewable energies in developing countries.

For understanding the necessity of such a pilot wind park project the energy sector in Kosovo has to be understood and where renewables stand at the moment:

Conventional Energy Sources

Kosovo's main provider and producer of energy is the local operator KEDS. The two lignite power plants of KEDS produce around 98% of the electricity used in the country and have an installed capacity of around 850 - 900 MW. Kosovo A (345 MW, 40 years old) is in poor condition and is said to be the worst single-point source of pollution in Europe. It is proposed to be shut down in the years to come: Kosovo A shall be decommissioned by 2017 to comply with the EC Treaty to which Kosovo is a signatory. Kosovo B (540 MW, 27 years old) needs rehabilitation to meet EU environmental standards. Outages in generation and power shortages hurt household and economy dramatically throughout Kosovo.

Most electricity demand in Kosovo is residential (approx. 55%), followed by commercial and industry. Technical and non-technical losses in the network remain high, together representing roughly 40% of gross electricity consumption. Imports of electricity via regional interconnections have been important to Kosovo over the past years.

An analysis of the supply-demand balance shows that Kosovo needs about 950 MW of new, firm electricity capacity by 2017. This need grows to about 1'000 MW by 2019 and about 1'500 MW by 2025. There is a huge debate on-going whether a new lignite power plant (Kosovo C), having 2 x 300 MW installed power, shall be planned and implemented in Kosovo. But concerns like high costs, damage to health due to the emissions, EC Treaty, opposition of population, and so on will most likely delay or even stop these plans to construct a new lignite power plant in Kosovo.

Therefore, Kosovo needs a mix of renewables and thermal to meet its demands for peaking and base-load capacity.

Renewable Energy Sources

Hydropower: Only few smaller size hydropower plants have been installed so far, but in the last few years quite some activity in this sector can be noted with new projects being proposed and possibilities investigated for run-of-river hydro plants as well as high-pressure hydro plants with a capacity from 2.2 MW up to 57.8 MW. Currently, in the applications register

of the Energy Regulatory Office (ERO), hydropower is the pre-dominant renewable energy source applied for.

Solar energy: Solar energy usage is restricted to some solar panels on single buildings that are only intended for the own power consumption. No solar park exists so far. Due to its dry climate in summer and high number of sunshine hours in that season, Kosovo shows some limited potential for this renewable energy source. However, no major developments can be noted in that sector.

Wind energy: So far, no wind park is connected to the grid in Kosovo. In the past years, some second hand turbines were installed making up a potential capacity of roughly 2 MW, but due to different reasons, these turbines do not produce electricity. Nevertheless, the wind potential in Kosovo is given and wind energy is actively promoted by the Government of Kosovo. One important step being to set a 10 years fixed feed-in tariff of € 85 / MWh for wind energy. The Ministry of Economic Development issued earlier this year an Administrative Instruction with the firm aim that by 2020, 150 MW of wind power shall be connected to the grid. Based on the wind measurements conducted throughout the country and the available free land areas we estimate that the total potential for wind energy in Kosovo is about 300 MW. This capacity could stepwise be connected to the grid within the next 10 years, but should be combined with other measures aimed at stabilizing the grid.

For further reading we also recommend the study "Renewable energy as an Opportunity for Economic Development in Kosovo" prepared by GIZ and Evroenergie.[4]

2. Objectives

The overall objective of this project stage was to investigate the technical and economic feasibility of a concrete wind energy pilot project in Kosovo and to evaluate and assess all aspects which are necessary to develop such a project. By doing so, the development of consecutive projects should be facilitated through the knowledge gained and by the positive signal sent by a successful realisation of a pilot wind park. In the meantime, potential investors should be contacted and an interest to finance the Wind Park Zatric generated. Last but not least, NEK should actively engage in passing on practical and technical knowledge to local people, who assist them in different tasks, and to create a general awareness of the project on the local and national level. In summary all objectives have been achieved or are successfully underway.

Object "Bankable wind measurements": A 60 m met mast was installed according to IEC standards[5] and a full year of wind measurements obtained, analysed and the results presented. At the moment a bankable wind assessment is being prepared, which is required from financing institutions as a formal decision basis.

Object "Evaluation of technical (and environmental) feasibility": Various site surveys were carried out to determine the wind park layout (including access roads, platforms and turbine foundations); a road study conducted to evaluate transport routes for the wind park components; a grid connection study initiated in order to identify a feed-in point and the most

suitable voltage level; a successful environmental impact study carried out. The overall technical feasibility was found positive.

Object "Evaluation of economic feasibility": Energy yield calculations and cost-benefit analyses were conducted for various turbine types and financing scenarios. A detailed cost summary for the project realisation was prepared.[1] The economic feasibility was found positive.

Object "Build-up relationships with potential investors and promote the project": Different potential investors were contacted and informed about the project. An investor was found who is interested and prepared to finance the whole project. Final negotiations are still underway.

Object "Create a basis for further wind energy developments in Kosovo": The experiences and know-how gained, the local and national interest created and the signal sent when this project will be realised, will smoothen the path for similar projects considerably. Furthermore, our company is already in the progress of developing two further wind energy projects (with corresponding wind measurements) in Budakova and Cicavica.

Object "create local awareness and know-how": Through an open information policy participation of the local population and authorities was achieved. By hiring local workers and opening a local branch office know-how was and still is being transferred.

Although the early phase of the project was quite demanding – all local procedures had to be investigated and learned, a local company infrastructure had to be set up, support for the project had to be created and so forth – we are very happy with the goals we have achieved so far. However, lots of further tasks still await us in connection with the detailed engineering phase and the realisation of the wind park.

3. Technical Solution / Applied Method

Technical Solution

This project will make use of a well-known technical solution for energy generation and therefore this aspect isn't described here in detail. However some basic information: in Zatric we plan to employ modern wind turbines of the 2.0 - 3.0 MW class with a rotor diameter of 80 - 120 m and a hub height of 80 - 100 m. The wind park will consist of 15 wind turbines and will have an overall installed capacity of 30 - 45 MW. Suitable models for the prevailing wind conditions from Siemens, RE-Power and Gamesa were evaluated and energy yields calculated.

The amount of electricity produced is a direct function of the wind speed and the efficiency of the turbines. Thereby, the wind speed goes into the equation with a power of 3 (x^3). This means theoretically, that when the wind speed is doubled, the wind energy is multiplied by a factor of eight. This underlines, why it is so important to have precise and reliable wind measurements when developing a wind energy project.

Applied Method

For understanding the applied methods one has to keep in mind, that the feasibility study for the Wind Park Zatric represents stage three of a four stage project procedure. Phase 1 and 2 are described in chapter 1. After obtaining the necessary permits in autumn 2011, phase 3 really started with the installation of a 60 m met mast in May 2012. This project phase was concluded in September 2013 with the final analysis of the wind data and the results from various surveys (land survey, road study, grid connection study and environmental impact assessment). From the feasibility perspective, the wind measurements were the key factor. The prevailing wind conditions determine if a project site can be even taken into consideration for the development of a wind park. In the following, the different approaches for successfully completing this project phase are summarized.

Equipment: Wind measurements have to comply with IEC-standards[5] so that a bankable wind assessment can be prepared. Therefore, a standard 60 m met mast was purchased from a German manufacturer and equipped with heated first class sensors. Also quotations from companies in Kosovo were collected. However, because of the high standards demanded for a bankable wind assessment a specialised provider had to be chosen.

Working in the field: In order to obtain the necessary data for the feasibility study intensive field work and various trips to Kosovo were necessary. These consisted (next to setting up the met mast) of a field survey for the whole project perimeter, track measurements with GPS equipment for the planned access roads and turbine locations, assessments of the local site conditions (slope gradients, general geological characteristics, vegetation and wildlife) and others. On these surveys our personnel was mostly accompanied by local villagers, who have detailed knowledge of the project site.

Visiting authorities and obtaining permits: Contacts with local and national authorities were set-up early on in the project. Documentations had to be prepared in the formally correct way and consents obtained. To avoid time consuming re-adjustments a regular feedback from the authorities was sought during the permitting procedure. Regulations and formal aspects are somewhat confusing for companies coming from countries with clearer procedures like Switzerland. Visits to the authorities were mainly combined with pending field work.

Setting-up office and creating local employment: In order to maintain personal contact with the authorities and the local population a branch office was opened and staffed in Pristina in 2011. In the last years, our engineers from Switzerland instructed the local staff how to operate and maintain the measurement equipment and taught them the basic aspects of wind park development. Our aim was to build-up relevant know-how but also to reduce the number of visits from Zurich necessary. While working on the field or installing measurement systems and other installations we always employed workers from the village of Zatric to create further local employment.

Finding an investor and promoting the project: During this phase a number of Swiss energy supply companies (EWZ, Alpiq, Repower, Axpo, EGL…) were contacted and informed about the project with the aim to find in them a potential investor or partner for realising the Wind Park Zatric. Unfortunately, all Swiss energy supply companies that we contacted in the end decided, that the legal and commercial situation in Kosovo is still too unstable for an

investment or that the country doesn't fit their strategic portfolio. Therefore, we decided to concentrate our search more on the Balkan region itself and found a partner and interested investor in a company group from Kosovo, who has the intention to purchase and finance the whole project. Final negotiations are still underway.

Of course it's challenging to raise the investment volume required for this size of project. Therefore, NEK has also been in regular contact with the World Bank to find possibilities for favourable credit conditions or subsidies.

Working with local partners: Next to working together with the foreseen investor, NEK also tried to involve local companies where possible. So for example, the environmental impact assessment was carried out by a local environmental engineering company or earth works were done by a local building contractor who was repeatedly hired. Overall positive experiences with the local companies and workers were made and we used the same companies and workers again for our other sites. As already mentioned, it unfortunately wasn't possible to source the met mast locally because of the strict norms in the wind industry. However, some related installation work was offered at our two other project sites to a local company as compensation.

Analysing data and preparing documentations: The complete wind data analysis was carried out by our engineers in Zurich with the appropriate tools (Windographer, WindPro, openWind). With the drawing of plans and analysis of data from the different survey we were assisted by the team of our Romanian branch office, which has in-depth experience from the development and realisation of the 80 MW wind park "Mihai Viteazu" in the Constanta region, Romania.

4. Results

Please note: *Detailed results, calculations, figures and illustrations are available together with background information in the report "Detailed results from the feasibility study "Wind Park Zatric",*[1] *which can be downloaded from www.nek.ch or www.repic.ch. Here only the key findings are summarized.*

At project start it was agreed that the feasibility study should deliver the following results:

- Comprehensive wind measurements with energy yield calculations and wind field modelling; definition of suitable turbine models with corresponding nominal capacity, rotor diameter and hub height.
- Technical clarifications about the wind park layout (access roads, platforms and turbine foundations), logistics, grid connection (technical feasibility) as well as the assessment of environmental impacts.
- Economic calculations about yield and costs of the wind park as well as calculations of relevant economic key factors (economic feasibility).
- To use the results from the feasibility study to interest potential investors in the project.

All results were obtained and we have now moved on to phase 4 with the detailed engineering of the project.

Wind measurements

Met mast installation: The 60 m tilt-up tubular met mast with wind measuring devices on three (four) different height levels (22/41/60/(62)m) was installed at the project site in mid-May 2012 and is recording data ever since.

Figure 1: Met mast installation in Zatric.

In total, the met mast is equipped with four anemometers and two wind vanes, whereby two anemometers and one wind vane are heated to avoid icing during winter months. For the analysis one year of wind measurements (May 2012 – May 2013) was used.

Monthly wind speed: The monthly wind speed profile reveals some seasonal variation in the wind resource on-site. We observe a peak in spring (March and April) with measured mean wind speed reaching nearly 8 m/s and a low wind phase in September with average speeds below 6 m/s. This results in a mean yearly wind speed of 6.83 m/s at the top measurement level of 62 m/s.

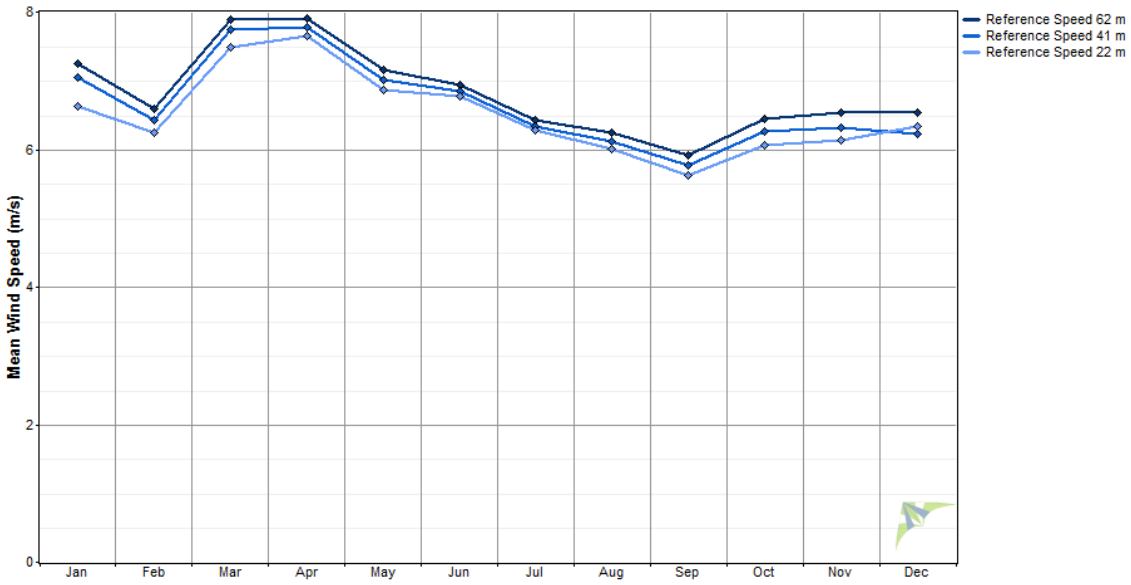

Figure 2: Mean monthly wind speed.

Diurnal wind speed: The daily on site variations in wind speed are significant. We measure low wind speeds in the morning with a minimum at around 10 am and increasing wind speeds in the evening with a peak at 8/9 pm.

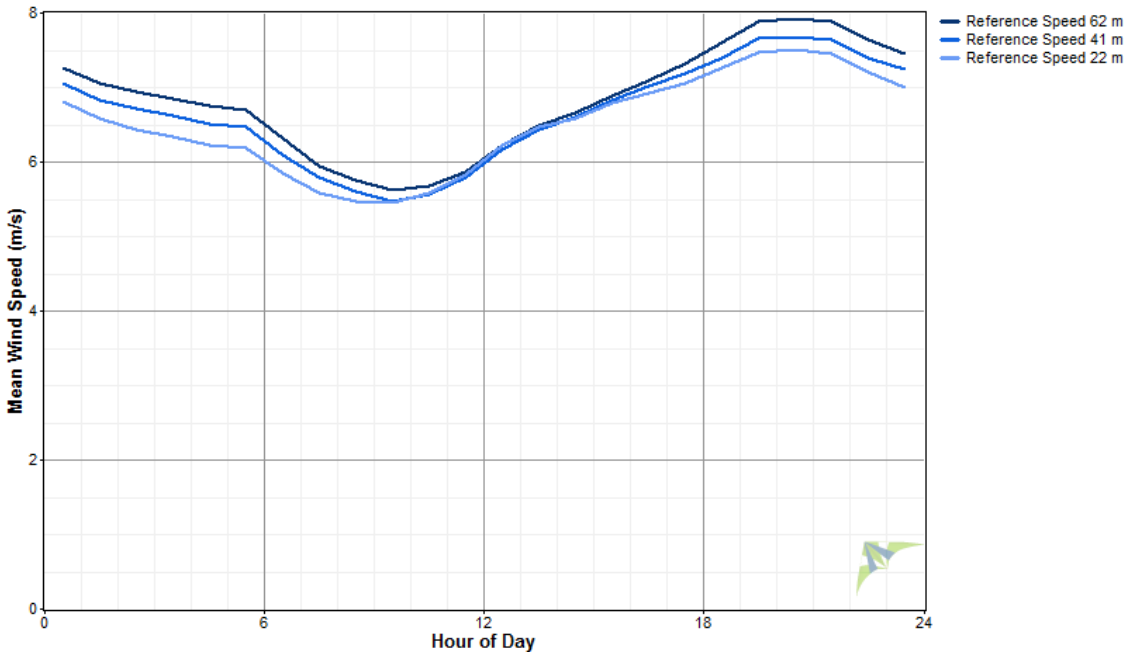

Figure 3: Diurnal wind speed profile.

Wind direction: The primary wind direction of the site is southwest and the secondary northeast. This bi-directional pattern is favourable for the design and operation of a wind park. Most wind speed measurements are in the range from 6 to 12 m/s. The energy rose reveals that the wind contains most of its energy in the southwestern sector.

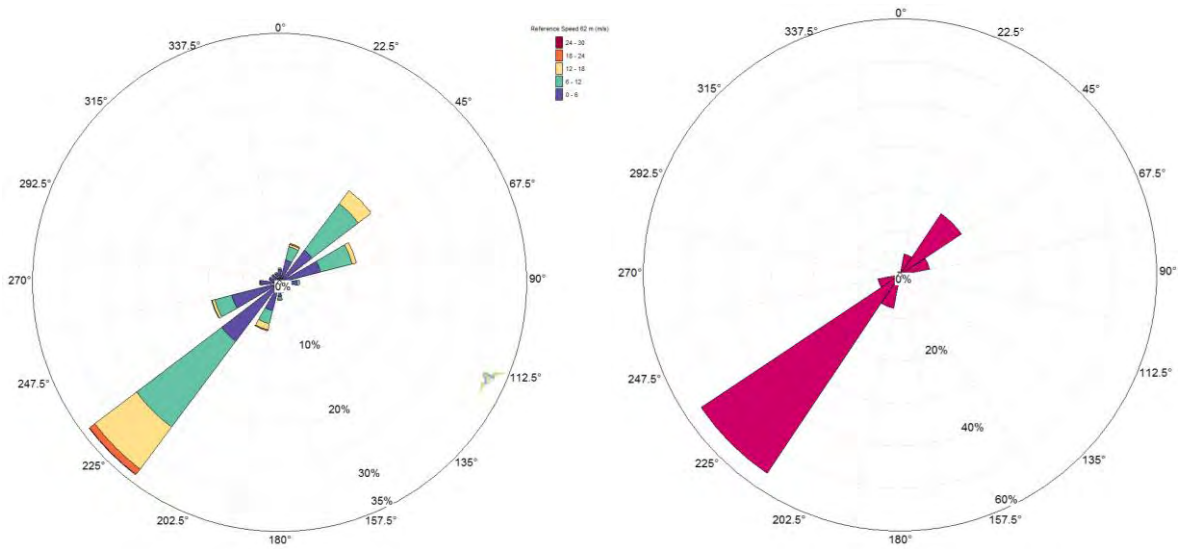

Figure 4: Frequency and energy wind rose.

Wind shear: By measuring on different levels we can calculate the wind shear. We get a power law factor of 0.05. This information can be used to extrapolate the mean wind speed to different hub heights and calculate the respective energy yield for different turbine models. For our calculations we mostly used a hub height of 80 m, where we get an annual average of 6.93 m/s, or 100 m, where the average is 7.02 m/s. It has to be considered, that while the mean wind speed gets higher with increasing hub height, also the installation and material costs get higher.

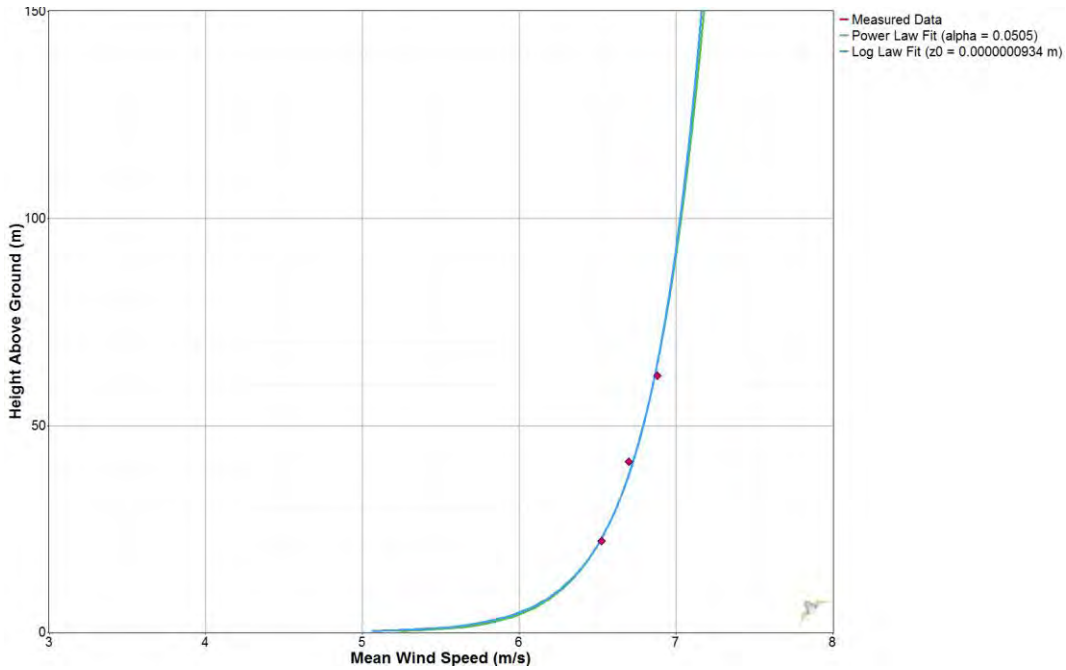

Figure 5: Vertical wind speed profile.

Wind field: The wind measurements were taken at one certain location but the turbines of the wind park Zatric will be distributed within a project area that has a north-south extension of 5.5 km and east-west extension of 2.5 km. Therefore, a wind field had to be calculated and modeled that covers the whole project perimeter. Two linear wind models were employed (Windpro with WAsP and openWind) for this purpose and we are also working on a coupled mesoscale and microscale approach.

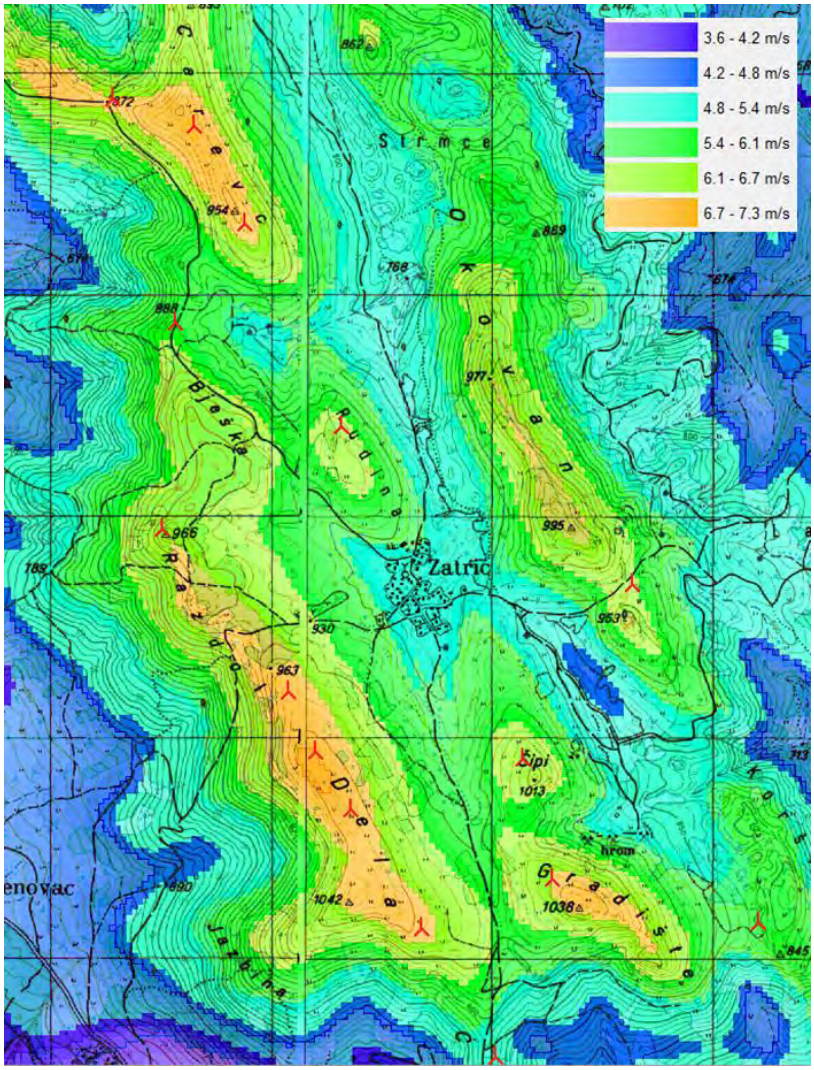

Figure 6: Wind ressource grid with 25 m resolution.

Energy yield calculation and turbine choise: With a measured wind speed of around 7 m/s at hub height, Zatric belongs to IEC class III. Different turbine models are suitable for different wind classes. Energy yields for various turbine models were calculated and a suitable selection identified. Of course, also the willingness of the turbine manufacturer to deliver into the respective country and the consentus of the investor for the chosen turbine model is required.
As an example we show an energy yield calculation with the Siemens SWT-3.0-113 (a 3 MW modell with a rotor diameter of 113 m and different available hub heights) for a hub height of 99.5 m.

Turbine Model	Wind Model	Mean Wind Speed @ Hub Height [m/s] (all turbines)	Net AEP (MWh/yr) – 10 %	Net Capacity Factor [%]	NEH [h]
Siemens SWT-3.0-113 (99.5 m)	WAsP	6.5	114’793	29.1	2’551
	openWind	6.8	123’646	31.3	2’747

Table 1: Production estimations for the Wind Park Zatric.

Technical clarification

Logistics and internal access road: Due to the huge dimensions of the individual turbine components, one important factor in analysing the feasibility of this project was to determine, if and via which route these can be transported to the project site. For this purpose, Holemann Srl., a company specialised in transportation of exceptional loads and with much experience in the wind energy sector, was hired to carry out a road study. Thereby, a suitable route was identified and evaluated starting from the harbour in Durres, Albania, and leading over Prizren in the south of Kosovo to the project site. The route mostly follows the new highway connecting the capital of Kosovo, Pristina, with the capital of Albania, Tirana. With custom relationships improving between Serbia and Kosovo a further route starting from Belgrad will be evaluated in the near future.

Holemann Srl. was also consulted for the design of the park-internal access road network, which is a challenging topic due to the complex topography of the project site. For heavy load transports a maximal gradient of 10% is tolerated and curves need to have a sufficient radius. The already existing gravel roads within the project site (with exception of the road leading up from the main valley to the village of Zatric) don't fullfil these requirements. Therefore, a new access road network was designed after the principle of keeping the length of roads as short as possible but maintaining the standards required for transportation. This approach led to one main access road that connects most of the turbines in a wide loop and some dead-end roads branching of to individual turbines.

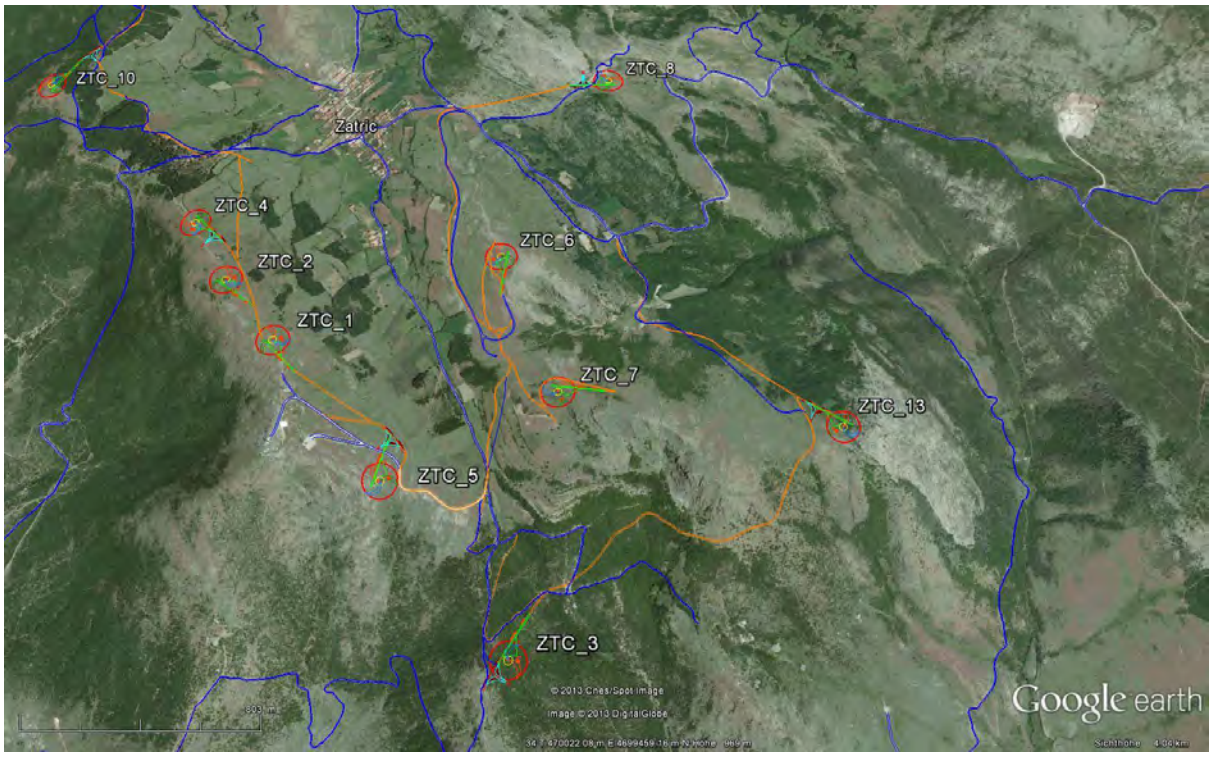

Figure 7: Planned access road network (orange) and existing tracks / roads (blue) in the southern part of the project perimeter.

Platform design and turbine layout: For the installation of a wind turbine quite an extensive leveled and cleared area is required. Once the wind park is operational, only a

permanent maintenance hardstand with a dimension of approx. 40 x 20 m is required from this initial area and the rest can be reclaimed by vegetation. For this size of turbine a concrete foundation with a diameter of 15 to 20 m and a depth of 3 to 5 m is required. With these requirements in mind a thorough site investigation was carried out and different layout possibilities evaluated. All possible turbine locations were assessed and from those 15 were chosen for the definite layout. Then a land survey of these sites was carried out with GPS equipment.

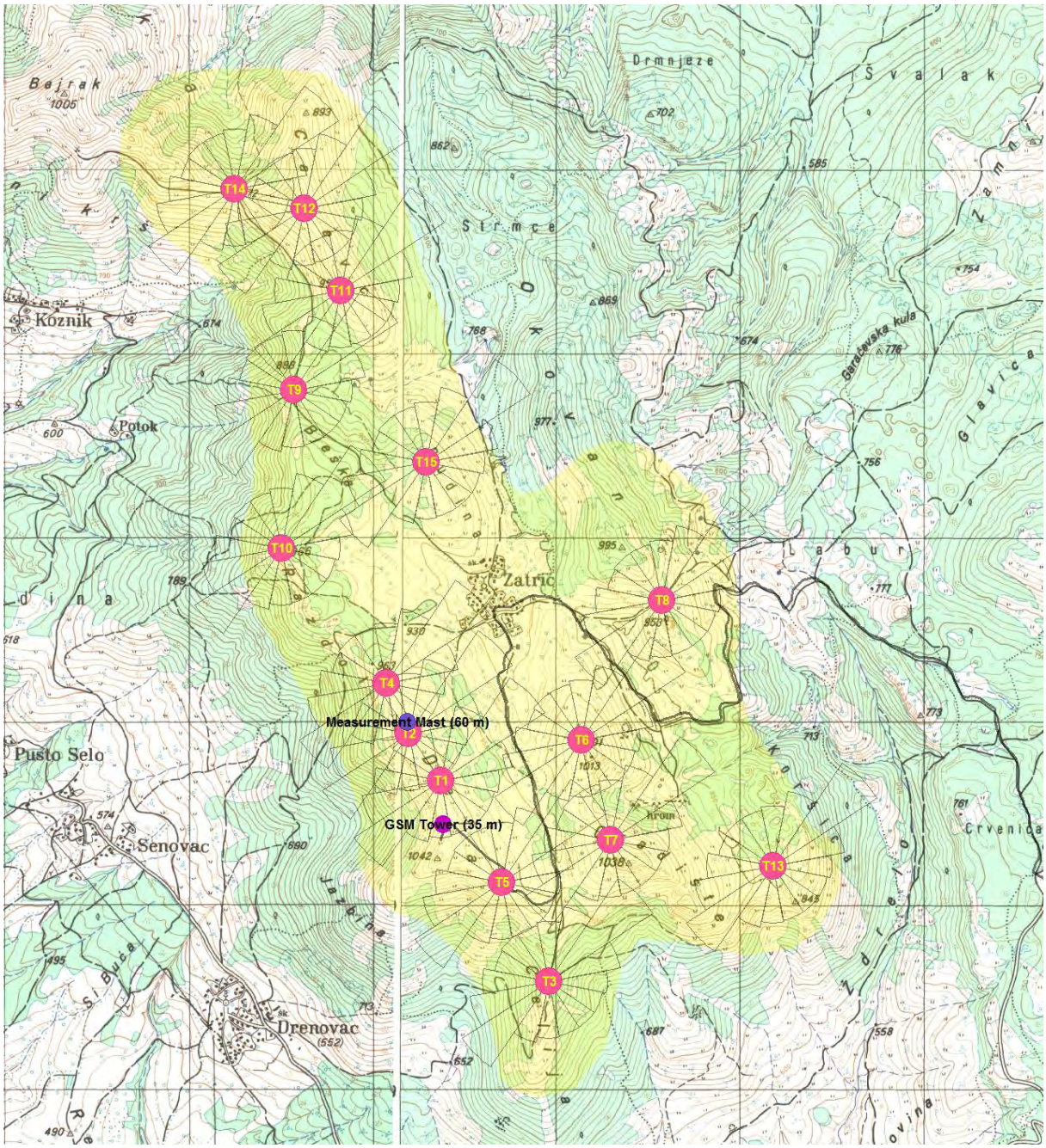

Figure 8: Turbine layout for Wind Park Zatric.

Grid access: Based on discussions with KOSTT, the national electrical grid operator, and investigations and surveys of our own, a potential grid connection point was identified. This is the existing substation near Rahovec, a mid size town approx. 8 km from Zatric. In order to assess if a grid connection there is possible, what the most suitable voltage level would be

and how much an upgrade of the existing substation would cost, NEK hired the company who originally designed and built this substation a few years ago: the Swiss electrical engineering company Pelco Srl. In a grid connection study different options where evaluated and the respective costs calculated. The conclusion is that from an economic perspective, but also in accordance with the wishes of KOSTT, the most feasible option is to collect the produced electricity at 35 kV in a park-internal collector point / connection node and then to evacuate the electricity via an overhead line to the substation Rahovec. There, the electricity will be transformed from 35 kV to 110 kV and fed into the national grid. Park-internally, the turbines will be connected by two separate loops and those cabels will be laid underground. Based on the results from this study a grid connection application was handed-in to KOSTT.

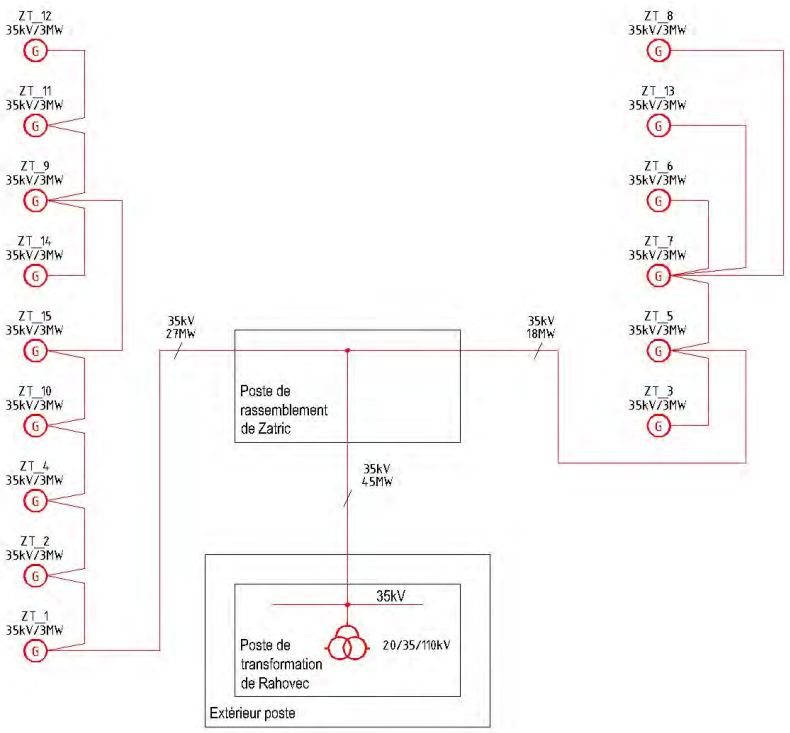

Figure 9: Schematic of grid connection for Wind Park Zatric.

Environmental clarifications

A feasibility study for a renewable energy project can't be considered complete without an assessment of possible environmental impacts. Therefore, a local environmental engineering company from Kosovo, NSH Buka, was employed to carry out an environmental impact assessment (EIA). The study showed that the impacts will not be significant due to the fact that: no rare species can be found within the project perimeter; the infrastructure of the wind park is situated in sparse grasland and most of the areas can be reclaimed by vegetation once the wind park has been constructed; a minimum distance is maintained to settlements; necessary measures and technologies will be employed to reduce negative impacts.
In addition to this study, NEK carried out their own noise and shadow flicker calculations to identify any negative impacts for the village of Zatric. In October 2012, a public hearing was held for the local population so that any complaints or reservation could be heard, and in January 2013, the environmental permit was issued.

Economic feasibility and costs

Today, a 10 years fixed feed-in tariff of € 85 / MWh for wind power is being offered in Kosovo. There are discussions about offering a fixed feed-in tariff for 20 years, because this represents the minimum lifespan of a modern wind park. But until any formal changes take place, we have been calculating with two tariff scenarios: 10 years fixed tariff and 10 years market based tariff or 20 years fixed tariff. Another important factor is the availability of capital and the interest rates for loans. Therefore, various scenarios with different interest rates were calculated. Key factors next to the feed-in tariffs are of course the construction and material costs for the wind park and the expenditures for operations and maintenance. A detailed summary of costs and the different cost-benefit-calculations can be found in the detailed report.[1]

Finding an investor

After contacting Swiss energy supply companies the search was widened to potential investors from the Balkan region. Meanwhile, a company group from Kosovo declared their interest to purchase and finance the Wind Park Zatric. At the moment the financing structure is being prepared and the process is on-going. Also the World Bank was contacted and the project shown to them on a field visit, with the aim of getting assistance for favourable loan conditions or maybe even a subsidy.

5. Impacts

Basically, the impacts can be classified into such, that are expected if and when the wind park will be realised, and those, that already have occurred because of the project development and feasibility study so far.

Expected impacts

When realised and taken into operation, Zatric will be the first wind park of any significant size in Kosovo. Apart from the additional energy production of a calculated 115’000 - 125’000 MWh (with an installed capacity of 45 MW), which will contribute to the energy supply of Kosovo, the main effect will be the signal sent to investors, developers and the public that a successful wind park development in Kosovo is possible. This will be a first very important step in giving impulses specifically to the wind energy sector and the renewable energy sector in Kosovo as a whole. Presently, there is still quite some reluctance from foreign companies and organisations to get active in the renewable energy sector in Kosovo. This pilot wind park is only a starting point and more wind or hydro energy projects are necessary if the energy supply situation shall be improved considerably with renewables.

During the realisation of the wind park an estimated 75 to 125 jobs in direct connection with the construction works will be created for the local people for about 9 months. We reckon, that a number of additional jobs will also be created indirectly through related activities. Later on, during the operation phase of the wind park, about 20 to 30 jobs will be available in maintenance and guard duties for the infrastructure of the wind park.

The feasibility study itself will have an impact by offering the possibility to promote and realise a concrete and feasible project and by being a show case for consecutive developments.

Occurred impacts

Although we have been active in Kosovo since 2009, first with this feasibility study it really became known to the public and the authorities that we are developing a concrete project and are determined to invest efforts and resources to carry it through.

While conducting the study we were able to sensitive and involve the local population through informing and showing them the planned project on site and furthermore by offering them short-term employment in connection with our field work. It pretty soon became clear, that for a successful project development it's important to gain local support from an early stage on and to point out the mutual benefit of the project.

Although not directly part of this study, but nonetheless essential, the permitting process was taken on for the wind park. This led to much involvement and contact with local and national authorities. As the permitting procedures for such a project are laid down, but not well practised in Kosovo, this was also a chance for NEK to provide feed-back to the authorities and to point out, which procedures are confusing or not clearly understandable from a developer's perspective. It's maybe not realistic to assume that because of these feed-backs amendments will be made to the procedures but a start was made. As the Energy Regulatory Office (ERO) has in the past also been confronted with a number of not very serious projects (i.e. projects without any wind measurements taken, with unrealistic layouts or proportions….) we hope that the project we have assessed in this feasibility study and handed-in to ERO gives them a signal, that also serious projects are being developed. Up to this point, the project has received a very positive feed-back and lots of support from the authorities.

Especially within Kosovo itself, and in a lesser degree in other countries, the project has received a lot of attention from the media and we have received a lot of invitation to present our work at conferences in Kosovo. We will use these opportunities to create further acceptance of the project within the country and also to promote the project in front of further potential partners.

An important impact of the study on our company was that the results strengthened us in our decision to take up the development of further wind energy projects in Kosovo. This summer we have installed professional wind measurements at two other project sites and have started the overall permitting and planning process for these projects. For this purpose, we have also increased our number of staff in Kosovo and opened further branches.

6. Future Prospects

From the project development point of view, a number of further steps are planned in the coming months in order to bring the project to a stage, where it can be given over to realisation. First of all, the bankable wind assessment will be concluded so that it can be passed on to financing institutions as is usual in the wind energy business. Then a detailed geotechnical

survey is planned in order to get precise information about the ground conditions in Zatric. This is required for designing the foundations and evaluating critical sections of the access road network. This will be part of the detailed engineering phase. Meanwhile, the overall permitting procedure will be continued, which we expect will be concluded within the next months. Further land contracts will be prepared and signed, which are necessary for the realisation of the wind park. Relationships with the investor will be strengthened and measures taken to build up the required finance and loan structure. If our planned schedule can be maintained, the project could be given over to realisation in spring 2014 and taken into operation in the first months of 2015.

Parallel to these activities, we will continue with planning and developing our other wind energy projects in Kosovo. In June, 2014, we will have a complete year of wind measurements from our two met masts in Budakova and bankable wind assessments will be prepared. In the meantime, we will also actively promote these projects and try to find interested investors.

The Government of Kosovo has issued a strategy to promote the development of the renewable energy sector in their country with pre-defined goals (expressed as MWh to be connected to the grid in the next years) for each renewable energy source. While we are concentrating on the wind energy sectors and reckon that other developers will follow, there is also a potential in hydropower that still needs further developing. As described in chapter 1, there is a considerable potential for wind and hydropower in Kosovo. Not much use of these sources has been made so far. If a promising signal is sent by successful pilot projects, there could be quite some activity and interesting developments in Kosovo in the time to come.

7. Conclusions and Recommendations

With the analysis of our wind measurements and the summary of all results from the various surveys and studies a very work intensive project phase was concluded. Valuable lessons were learned and reliable results obtained. The promising wind conditions at Zatric were confirmed with an extrapolated mean wind speed of 7.0 m/s at a hub height of 100 m.

The main conclusion from a technical perspective is that at Zatric a 30 to 45 MW wind park with a calculated annual energy yield of 80’000 MW (with an installed capacity of 30 MW) to 120’000 MW (with an installed capacity of 45 MW) can be built and connected to the electrical grid. However, construction will be challenging due to the topographical complexity of the site and the fact that no comparable project has been built in Kosovo so far. As a company we were able to gain a lot of further experience with planning a wind park in mountainous terrain.

The authorities of Kosovo lay emphasis on the environmental compatibility of wind energy projects and so an important conclusion from the respective study is that the Wind Park Zatric is environmentally compatible.

On the economic side, the feasibility study showed that the project is economically feasible and can be operated on a profitable basis. Much progress was made with finding an investor.

An important decision, which helped us a lot with our day to day work, was to open-up and staff a branch office in Pristina. Simple procedures, like the import of measurement equipment into the country, may be very complicated and time consuming if a company hasn't got local staff and structure. A local office also signals commitment to the authorities and facilitates a regular exchange with them, which is essential in moving forward with the permitting process. While the early project stage was very challenging, the work got easier the more local knowledge was obtained and once a good local team was brought together.

While dealing with the authorities, we we're pleased by the great interest of them to promote and support the development of renewable energies in their country. A good working relationship was built-up. To facilitate the process for developers, who are newly active in the country, we would like to recommend to the Government of Kosovo to set up of a coordinative office that assists and offers information to these developers. Furthermore, we recommend to the Government to offer not only a 10 years fixed feed-in tariff for renewable energies but one that is valid for 20 years. The potential for renewable energies is there, but also firm incentives have to be given to use it.

For other project developers we have the following recommendations: First, a project won't be successful or find acceptance if the local population isn't involved from the beginning. An open information policy should be adapted when on site and in contact with the local population. Furthermore, a benefit should be generated by offering employment in connection with the project realisation or by evaluating the possibilities of subsidized electricity for the nearby villages. Second, the country specific permitting process should be investigated at project start and a good relationship with the authorities cultivated.

In summary, positive experiences were made while working with the local people and authorities during this feasibility study and we are happy with the overall outcome and results. Our activities in Kosovo are far from finished. We want to see the Wind Park Zatric realised and have much confidence in the two other wind energy projects that we are developing in that country.

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Zurich, October 24, 2013 Kp/Sb/re

8. References

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[4] **GIZ and Evroenergie, 2012:** Renewable energy as an Opportunityfor Economic Development in Kosovo.

[5] **IEC** International standard 61400-12-1 for wind measurements or 61400 for more general information on wind turbines.