

Repowering – New Chances for Wind Power Implementation?

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The successful implementation of wind energy in Europe during the past decade and the continuing economical support by national legislations has led to an upcoming market for second hand wind turbines. Repowering of plant after 5 to 15 years of operation releases a large number of turbines into the market. These plant in the range of 30 to 1000 kW often represent state-of-the-art technology enabling 10 to 20 years of remaining life expectancy and are available at relative low initial costs. For some countries these plant could facilitate project implementation during the market opening period. However, when re-erecting used plant certain precautions have to be taken to ensure high availability of operation. Service and maintenance become more serious issues to be considered at an early stage of project.

Origin of second-hand wind energy converters

The second booming development of wind energy technology particularly affects countries like Denmark and Germany that are running short on productive sites. Therefore, it can be more efficient for investors to replace smaller and middle sized Wind Energy Converters (WECs) on highly productive sites with a smaller number of new larger ones instead of just building the new WECs on less productive sites. In addition, this “Repowering” process is often applied to restore landscape and scenery since the increase of installed power is accompanied by slowing down of rotor speed and the reduction of numbers of turbines. A large number of these second-hand WECs are already available on the international market.

Launching of wind power technology becomes easier utilizing tough plant of the second WEC generation due to less demands concerning installation and maintenance in comparison with newer WECs of larger capacity that require a sophisticated infrastructure. By now, it is the first time since technology and size of plant have been advanced that used WECs are appropriate for re-erection. In past Repowering activities in the USA and Denmark plant of the first WEC generation were scrapped due to their expired life expectancy.

Trading business with used turbines of manufacturers that are successfully established on the wind power market has already been started by several companies specialized in this business.

Countries eligible for second hand WEC application

Successful implementation of wind energy converters in general is always dependent on sufficient wind energy potential. This is the basis for both new and second-hand wind turbines. Electrical stability in weak grids with stochastic feeders limits the permissible load of wind turbines. That is why only small generators in the class of 100 to 600 kW are suitable for uncomplicated grid connection. Turbines of this size are not being manufactured any more but only available on the second-hand market. This option allows lower costs for the initial expenditure resulting in a shorter project duration that can be favourable for countries without long-term planning reliability in the initial implementation period.

Additionally, the stability of the electrical grid has to comply with standards concerning voltage, frequency, drop-outs, etc...; a certain technical infrastructure is required (cranes, roads, companies for basic maintenance ...) and access to the national grid should be supported by a sufficient buyback price.

Currently, second hand wind turbines are mainly being demanded in Poland, Russia, Romania, Bulgaria and Turkey. In most of these countries renewable energy laws have recently passed the legislation to initiate project planning.

General overhaul and adaptation

In some cases the time of Repowering coincides with major repairs of the wind turbine – but even if the plant is in good condition it may be advisable to tackle repairs to prevent downtimes that will become costly after re-erection.

Gearbox tooth flanks can be reshaped if the inspection yields pitting damage. Exceeding acceptable tolerances in this process would necessitate the costly replacement of the gearwheels. Usually, the main bearings are replaced as wearing parts. Minor damages of the rotor blades have to be repaired and sealed against environmental impacts. New balancing of the rotor and new alignment of the shafts are essential to reduce dynamic loads for a long remaining life expectancy. The generator insulation has to be checked. Additionally, oil change and replacement of rubber components and several small parts needs to be carried out.

Wind turbines are microcontroller or plc operated and thus the passwords to the software become important for the commissioning on the new site and service afterwards. Often, missing or incomplete documentation as well as technical errors in the control system cause long down times if no expert of the manufacturer can be consulted.

A good maintenance concept in the first operating period with regular vibration monitoring of gearbox shafts can give indication of the status of wear to deduce the remaining life expectancy with better certainty. Alternatively, a one or two day monitoring campaign can certify the condition before the plant is dismantled. In most cases this report (e.g. provided by German Lloyd) is the only possibility to obtain dynamic data since condition monitoring data is hardly available.

Some adaptations to the local requirements of the new site could easily be included in the general overhaul. This may concern additional cooling of generator and adapted oil viscosity for the gearbox if operated in a warmer climate, leading edge protection for the rotor blades against erosion from sand and corrosion protection against salt water.

Most of the available wind turbines from Europe are for grids with a frequency of 50 Hz which makes them unsuitable for Central or South American countries operating 60 Hz grids. Only converter driven plant can be adjusted to 60 Hz at relatively low additional cost. The replacement of gearbox or an additional frequency converter for a small wind farm is often too expensive.

Normally, the general overhaul can be carried out by the manufacturer or a general contractor that is specialized in certain types of wind turbines. A basic warranty is included for the overhauled components if the commissioning will be conducted by experts from Europe. Extending the warranty to 24 month is also possible with a good maintenance concept but at relative high additional costs.

Service and maintenance

Often, projects with second-hand wind turbines represent the first contact with large scale wind energy for the respective country. To provide sustainability for a demonstration project and initiate further WEC installations, awareness creation of utility operators, service technicians, politicians and public towards the entire wind energy background is advisable. The subsequent step will be the realization of capacity building for the turbine operators,

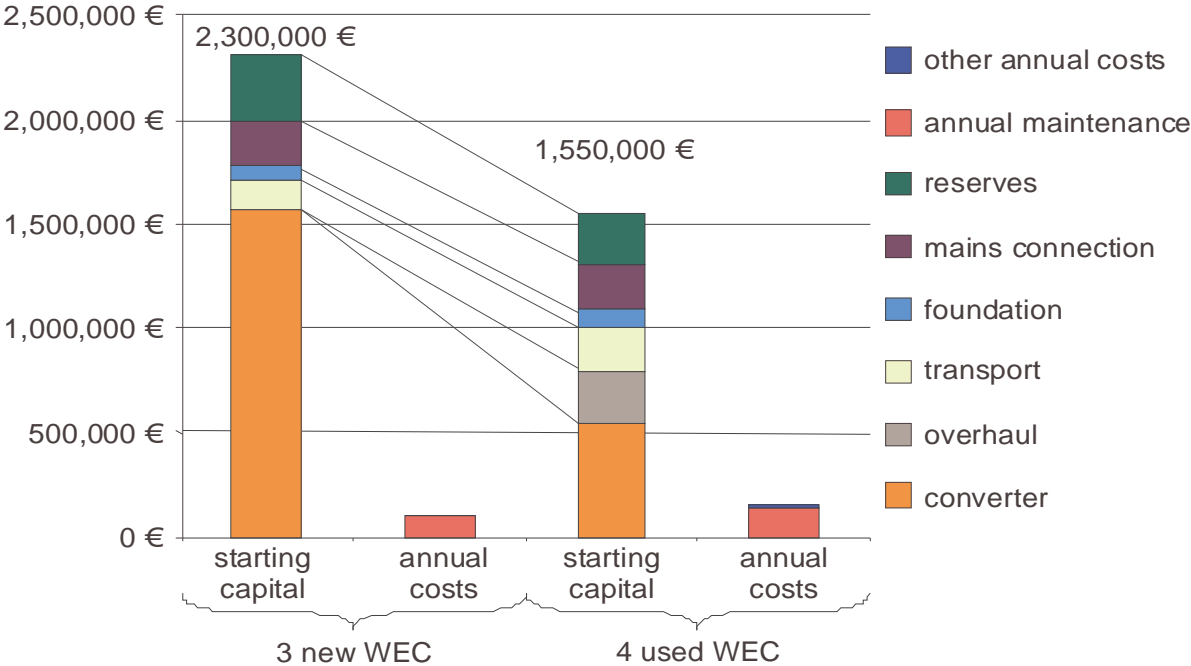
service technicians and grid operators. Proper local expertise should be built up in co-operation with local universities or permanent training and research centres.

A comprehensive service concept includes spare part availability (most of these wind turbines use standard components). It could be advisable and has already been put into practice to acquire more plant of the same type than actually planned to install in order to put gearboxes, generators, rotor blades and control systems of the operated turbine type on local stock.

The infrastructure in the respective country concerning transportation and availability of large cranes should be thoroughly matched with the site where the wind turbines are reinstalled. To decrease the financial risk the WEC should be small enough to be erected with cranes available locally reducing costs in case of any repairs that crop up.

Cost of project

Projects with second-hand WECs have a similar cost structure to projects using new plant; life expectancy is 10 to 15 years respective 20 years. Comparison of two small wind farms (one with new and the other one with second-hand wind turbines) shows that the main reason for cost reduction is explained by the lower turbine costs for the used one. To compare initial project costs the projects displayed below are designed to have the same energy output:



Conclusion

Projects with second-hand wind turbines that have already been realized in several countries represented the initial step for the long-term alteration of these countries’ energy sectors concerning the introduction of wind power technology.

These projects differ from projects with new equipment regarding certain aspects that need to be taken into consideration and evaluated in the process of project planning.

In summary, any project with either new or used WECs can only be profitably carried out if a number of different crucial basic requirements are met regarding the existence of sufficient wind speeds, a stable grid, minimum buyback prices, technically qualified personal, spare parts and reliable economical and political conditions. The option of reusing second-hand

turbines mainly makes a difference concerning the simplification of financing due to lower initial expenditure.

References

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