Saving Land and Reducing Visual Disturbance with Wind Repowering

Wind energy, recognized as a clean and environmentally friendly energy resource, is an important primary power source of the future. With a history of more than 120 years of electricity generation, wind power has been adopted rapidly by many countries in recent decades. Germany, USA, Denmark and Spain and now India, China and Turkey have taken significant strides in the wind power industry.

Yet aging wind farms now have to be repowered to enhance their efficiencies. Global Data identified that most wind farms set up until 1996 have the potential of being repowered. The global wind repowered market is a growing industry expanding from cumulative installed capacity of an estimated 877 MW in 2005 to an estimated 2,499.4 MW in 2011. But sadly, this is just 22% of the total repowering potential of the global wind farms. According to Global Data, 44,000 MW wind farms would be closer to their repowering deadline by 2020.[i]

Repowering Offers Multiplied Wind Power Generation Without Additional Land

When old first-generation wind turbines are replaced with modern high performance turbines, not only does the number of turbines reduce in half but the energy output is also doubled. Modern turbines also reduce the cost of wind power and provide much better integration to the power grid. Repowering replaces the smaller aged turbines with powerful wind turbines and restructures the locations, thereby providing high performance in less space. For instance, old turbines on widely dispersed sites in Denmark are now increasingly replaced by modern ones, making optimum usage of available space starting with its first repowering incentive program in April 2001.[ii]

Impact Of Repowering In Reduction In Visual Impact Of Turbines

When wind farms are set up, a number of elements are introduced in the landscape that can be visible at a great distance from the wind farm. These include wind turbines, anemometer mast, access tracks, borrow pits and a substation that can affect the landscape. The visual impact that wind farms create are often very subjective, but can foster strong feelings in those living and working in close

proximity to wind farms. Some may find wind turbines to be impressive in appearance while others might have contrasting views. 70% of people in the UK do not have any negative opinions on wind turbines while tourism officials think that tourism is being affected.[iii] That said, attitudes and individual's perception about the landscape and pristine countryside often change with the need to move to a low-carbon economy.

For both proponents and detractors of wind energy, repowering reduces the visual impact by decreasing the number of wind turbines spread out over vast areas and near residential localities. Repowering thus allows new turbines to be setup with local opinion taken into consideration.

Moreover, new high megawatt turbines are capable of running at lower speeds and generating more electricity. As compared to aged turbines that run at high speeds, modern turbines reduce the visual impact created by spinning slower. Back in the 1990s, turbines had about 40 to 60 rotations per minute, while today the newer ones only spin 10 to 20 times without much noise.[iv] This also creates a better perception of the wind industry by reducing the noise and motion associated with a large scale farm.

Nature Conservation Issues To Consider When Redesigning Wind Farms

With proper planning, any nature conservation issues can also be addressed during a wind repowering project. In the past, poorly constructed wind farms have nature conservation issues attached that can be taken care of when considering expanding wind energy capacity. By using appropriate land planning systems that take into account nature conservation concerns, rapid onshore wind development can take place.[v]

Several planning steps should be taken into consideration during any repowering project in order to appropriately address past nature conservation concerns.

- **Engaging Stakeholders:** Gathering and communicating information regarding wind power proposals to the local authorities and public is essential so that sensitive sites can be avoided and best alternatives can be considered.

- **Understand Nature Conservation Concerns:** The sensitivity and natural systems of a landscape should be explored in spatial terms so that potential locations can serve best for onshore development of wind farms.

- **Assessing Environmental Impact:** Sufficient specialist capacity is necessary and should be made accessible to local and regional planning authorities so that appropriate site are selected and clear project designs are made for onshore wind development. Assessment tools should be used which will better help in making informed decisions.

- **Maximizing Local Benefits Received From Wind Farms:** Without local support, it is difficult to roll out a successful wind development project. Make sure wind farms provide nature conservation benefits to wildlife, flora, and fauna and also to local communities.

- **Ensuring Effective Ongoing Management:** It is essential that reliable monitoring is carried out by an environmental regulator, central government or their agencies so that risks are minimized and benefits maximized.

Wind Repowering Lessons from Germany

In Germany and Denmark, spatially explicit and indicative planning processes are carried out so that clear areas are defined for wind farms, thus offering protection for nature conservation sites. For instance, in Germany, wind farms are developed once planning and analysis are done at the regional and local level. The Federal Regional Planning Act and the Federal Building Code provide a general framework for planning wind farms. The local authorities then have to define the specific criteria upon which these areas are based. They will then assess

whether a particular site is considered 'privileged' and proactively supported, excluded or restricted. This reduces any possible conflicts between nature conservation and the development of wind energy projects.

One wind farm repowering project in Germany is in Altefähr on the island of Rügen. The wind farm repowering project made use of visualizations during all consultations so that the plans are given visual substance. The visualizations helped move evaluations forward by demonstrating the height of wind turbines and how they would affect the landscape of the town of Stralsund. Although the old town of Stralsund has much history, its skyline is not protected as a landmark but has been declared as a UNESCO World Heritage Site since June 2002.

The repowering project involves replacing nine existing Nordtank wind turbines with four new high-performance turbines. The new turbines are a Vestas model V90 with a hub height of 105 meters. With the help of visualizations, the impact of repowering on the appearance and visual landscape of the historical old town of Stralsund was assessed. The photo-based simulation provided a high level of atmospheric and spatial accuracy that closely reflected the repowering in reality.[vi] The project was a great success as a result.

Replacing The World's Oldest Wind Farm

Altamont Pass, California

The world's first wind turbines in Altamont Pass, California are being repowered as well. Developed in the 1970s, the Altamont Pass wind farm covered 50,000 acres of land which was leased from cattle ranchers. The old wind turbines were in dire need of replacement since they had outlived their useful life. In strong winds, these aged turbines were not capable of functioning and would shut down, and even collapse, resulting in grass fires.

Moreover, environmental regarding avian deaths were a major consideration since the Altamont Pass lies on a major

migratory route and is an important breeding area for birds. Approximately 4,300 birds were being killed every year, one-third of which were endangered golden eagles, making the repowering project an urgent requirement. After a mutual agreement between the state, NextEra and environmental groups, the old wind farm was set for repowering in 2010. Today the first phase of the repowering project is complete.

The old Californian wind farm initially had 4,000 wind turbines which are now more than 30 years old. NextEra will replace 2,400 of these wind turbines by 2015 with just 100 huge state-of-the-art turbines that stand at 430 feet – significantly taller than the old turbines. Built by Siemens, these modern turbines have a capacity of 2.3 MW each and are capable of producing electricity for 650 homes.

Not only will the repowering reduce the number of turbines from 2,400 to 100 but will also reduce the visual impact and avian deaths.

Moreover, the new turbines spin slower as compared to the old turbines and are much quieter. Not only that, but instead of using the original 50,000 acres of land, the repowered wind farm will be significantly smaller and returned to a more natural state. About six miles of transmission lines and eight miles of road are being removed from the old wind farm, allowing much of the area to return to its natural state. The Altamont Pass wind farm is an outstanding example of saving land and reducing visual disturbance with wind repowering. [vii]

More Repowering Needed for Increased Efficiencies of Land and Energy

These are not the only old wind farms in need of repowering. As we've already seen, more than 75% of the repowering potential has yet to be tapped, with tremendous environmental and aesthetic benefits as the result. The repowering practice not only will provide more bang for the renewable energy buck, it can also solve many of the public perception problems traditionally associated with the wind industry, paving the way for a more successful wind industry of the future.

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Images via Flickr: sludgegulper and Kevin.

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