

OTC DOCUMENT RENEWABLE ENERGY (ESTABLISHING WIND ENERGY UNIT)



**Small and Medium Enterprise Development Authority
Government of Pakistan**

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1 INTRODUCTION TO SMEDA

The Small and Medium Enterprises Development Authority (SMEDA) was established in October 1998 with an objective to provide fresh impetus to the economy through development of Small and Medium Enterprises (SMEs).

With a mission "to assist in employment generation and value addition to the national income, through development of the SME sector, by helping increase the number, scale and competitiveness of SMEs", SMEDA has carried out 'sectoral research' to identify policy, access to finance, business development services, strategic initiatives and institutional collaboration and networking initiatives.



2 DISCLAIMER

This information memorandum is to introduce the subject matter and provide a general idea and information on the said matter. Although, the material included in this document is based on data/information gathered from various reliable sources; however, it is based upon certain assumptions, which may differ from case to case. The information has been provided on as is where is basis without any warranties or assertions as to the correctness or soundness thereof. Although, due care and diligence has been taken to compile this document, the contained information may vary due to any change in any of the concerned factors, and the actual results may differ substantially from the presented information. SMEDA, its employees or agents do not assume any liability for any financial or other loss resulting from this memorandum in consequence of undertaking this activity. The contained information does not preclude any further professional advice. The prospective user of this memorandum is encouraged to carry out additional diligence and gather any information which is necessary for making an informed decision; including taking professional advice from a qualified consultant/technical expert before taking any decision to act upon the information.

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Objectives.

- To Elaborate Concept of Renewable Energy in Pakistan in accordance with industrial growth.
- To explain existing opportunity for investors in this sector.
- To Provide brief introduction regarding Wind Energy and its Process flow
- How wind energy works and what are its key parameters
- To provide a road map in identification of area and capacity.

3 CONCEPT AND IMPORTANCE OF RENEWABLE ENERGY.

Energy challenges are among the greatest world has to face in the coming decade. This is due to the fact that economic competitiveness fully depends on a reliable, safe, secure and sustainable energy supply that is linked with not only to the strategic economic growth but also to the improvement of the social infrastructure of the world. If the world economy expands to meet the aspirations of countries around the globe, energy demand is likely to increase even if strenuous efforts are made to increase the efficiency of energy use. Given adequate support, renewable energy technologies can meet much of the growing demand at prices lower than those usually forecast for conventional energy.

4 CONCEPT OF WIND ENERGY.

Renewable energy technologies (i.e., Solar, Wind, Bio, Hydro, Ocean and Hydrogen and Fuel) are clean sources of energy that have a much lower environmental impact than conventional energy technologies. Furthermore, renewable energy makes the world stronger and provides necessary support to get rid of our over-dependence on oil, while strengthens our economy and defense capability. Contrary to more traditional sources of energy that are finite and will someday to come be depleted, renewable energy will not run out over an indefinite period of time.

For countries like Pakistan (rich in natural resources and with a population of over 180 millions), the importance of renewable energy becomes even more critical due to the fact of limited hydro potential and conflicting mindset of our feudal elite from the point of view of water resource management. Furthermore a growing disparity between energy demands and supply in Pakistan



over a period of time, further poses threat to our long term survivability and existence as a just nation. With this in mind, it's a time to rethink and chalk out a visionary strategy (with prompt action before our national demise) defining a roadmap of energy supply for ourselves, for our next generations and for the sake of country national stability and security. A rich natural potential of renewable energy resource is already there, the question only lies how to actualize this in practice. Considering geographical and climatic conditions, Pakistan is well placed for more plausible but technological matured renewable energy source like Wind (both onshore and offshore wind energy), Photovoltaic (PV) technology and Biomass. Only wind energy source in fact has capacity to collectively produce over 150,000 MW of electricity in Pakistan (even 140,000 MW is possible in Sindh) according to recent USAID report.

5 PRODUCING WIND ENERGY.

Pre-requisite for producing and utilizing wind energy is the availability of necessary wind speed. An average acceptable wind speed in most parts of the world lies from 6.2 – 6.9 m/s (fair category) and 7.0 – 7.4 m/s (good category). Interestingly, wind speed in some parts of Pakistan (e.g., Sindh corridor, Baluchistan and some northern areas) touches even excellent category of wind speed (i.e. more than 7.4 m/s). While the first 50 MW wind project is just inaugurated (but not operational yet) in Jhimpir, several such micro projects are needed to fully exploit the true potential of our wind energy generation capacity. Due to more favorable climatic conditions in Pakistan, solar PV possesses almost infinite potential on the other hand to generate electricity in Pakistan. Leveled cost of electricity generation from different sources of energy as of today (From “US Department of Energy Estimates 2012” published in annual Energy Outlook) are 9.96 for conventional coal, 6.87 for natural gas, 11.2 for nuclear, 9.96 for geothermal, 9.0 for biomass, 9.6 for onshore wind, 15.6 for solar PV, and 8.9 for hydro in Cents/kWh.

6 POTENTIAL OF RENEWABLE ENERGY.

An ongoing current dramatic price reductions (due to overcapacity of Silicon in 2011-2012) in the Photovoltaic (PV) industry have been causing a number of other power sources to become less interesting and hence strengthening belief that PV is the fastest growing source of power in the world. Prices for solar modules (which contribute 40 % of total PV system installed cost) the part of solar panels that produce electricity will continue to fall in line with the long-term trend since



1980 thus offering far more competitiveness than it is today. The experts forecast a large expansion of the amount of installed solar power, increasing more than 10 times over the decade from 2010 to 2020, an expansion that will continue at a similar rate until 2025.

7 ESTABLISHING WIND ENERGY PLANT.

Wind energy is the good source of obtaining electricity in very cheap price and is very effective when its comes to supply electricity

Below mention are 10 steps to establish wind energy plant.

7.1 Understand Your Wind Resource

The most important factor to consider in the construction of a wind energy facility is the site's wind resource. A site must have a minimum annual average wind speed in the neighborhood of 11-13 mph to even be considered. Local weather data available from airports and meteorological stations may provide some insight as to averages. You can also check the wind maps for your state on the National Renewable Energy Laboratory Web site, at <http://rredc.nrel.gov/wind/pubs/atlas/> .In time, you will want to install your own monitoring devices to record the site's wind characteristics. A listing of consultants specializing in wind resource assessment can be found at the American Wind Energy Association Web site: see <http://www.awea.org/directory/consultcde.html>. More information on basic principles of wind resource evaluation can be found at <http://www.awea.org/faq/basicwr.html> .

7.2 Determine Proximity to Existing Transmission Lines

A critical issue in keeping costs down in building a wind farm is minimizing the amount of transmission infrastructure that has to be installed. High voltage lines can cost thousands of dollars per mile. Whenever possible, availability and access to existing lines should be considered in selecting a site.

7.3 Secure Access to Land



Landowners, both private and public, will expect to be compensated for any wind energy development that occurs on their land. Royalty or lease agreements will need to be discussed with all parties involved. Roads, transmission equipment, maintenance infrastructure, turbines, and the like all need to be considered. Moreover, the construction of a wind farm necessitates the use of heavy industrial equipment. Developers will need to invest in roads capable of accommodating significant weight. To do so will require the cooperation of landowners and, in some cases, the local community.

7.4 Establish Access to Capital

Building a wind farm is not cheap. On average, wind power development costs around \$1 million per megawatt (MW) of generating capacity installed. To take advantage of economies of scale, wind power facilities should be in excess of 20 MW. Assuming the average wind turbine is rated at 750 kilowatts (kW) in capacity, this means the installation of at least 26 turbines and an initial investment of \$20 million dollars.

7.5 Identify Reliable Power Purchaser or Market

To date, wind energy is the most cost competitive renewable energy option on the market. In fact, wind energy's cost has declined so much that it rivals many traditional power generation technologies. However, utilities will tend to purchase power from what they consider to be the cheapest and most reliable technology. In most cases today, that is natural gas. That does not mean there is not a market for wind, though. Demand for “green power” (electricity from clean sources like wind that is sold to customers at a premium price) and environmental requirements are creating buyers for wind energy and competitive rates. Before investing thousands of dollars into wind resource assessments, permitting, and pre-construction activities, a developer will secure tentative commitments from one or more buyers for the wind plants output over 10 to 30 years of its operational lifetime.



7.6 Address Siting and Project Feasibility Considerations

The fact that a site is windy does not mean it is suitable for wind power development. A developer needs to consider many factors in siting a project. Is there high raptor activity in the area? Are there endangered or protected species that could be jeopardized by the presence of the facility? Is the site's geology suitable and appropriate for industrial development? Will noise and aesthetics be issues for the local community? Will the turbines obstruct the flight path of local air traffic? There are quite a few environmental and social issues that will need to be addressed in the siting of a wind power facility. Wind farms can make great neighbors, but it is the obligation of the developer to work to ensure that a project proceeds in a fashion that is acceptable to regulators and the local community.

7.7 Understand Wind Energy's Economics

There are many factors contributing to the cost and productivity of a wind plant. For instance, the power a wind turbine can generate is a function of the cube of the average wind speed at its site, which means that small differences in wind speed mean large differences in productivity and electricity cost. Additionally, the swept area of a turbine rotor is a function of the square of the blade length (the radius of the rotor's swept area). A modest increase in blade length boosts energy capture and cost-effectiveness. Financing methods can make a major difference in project economics as well. Securing significant investment capital or joint ownership of a project can cut costs significantly. Furthermore, there are federal and state incentives for which a project may qualify and which could reduce costs and encourage more favorable investment.

7.8 Obtain Zoning and Permitting Expertise

Siting any power project can be a daunting task due to the dizzying array of social and environmental factors at play. A wind power developer would be well served to obtain the services of a professional familiar with the regulatory environment surrounding wind power development. A listing of appropriate consultants can be found at <http://www.awea.org/directory/consultsflm.html> and



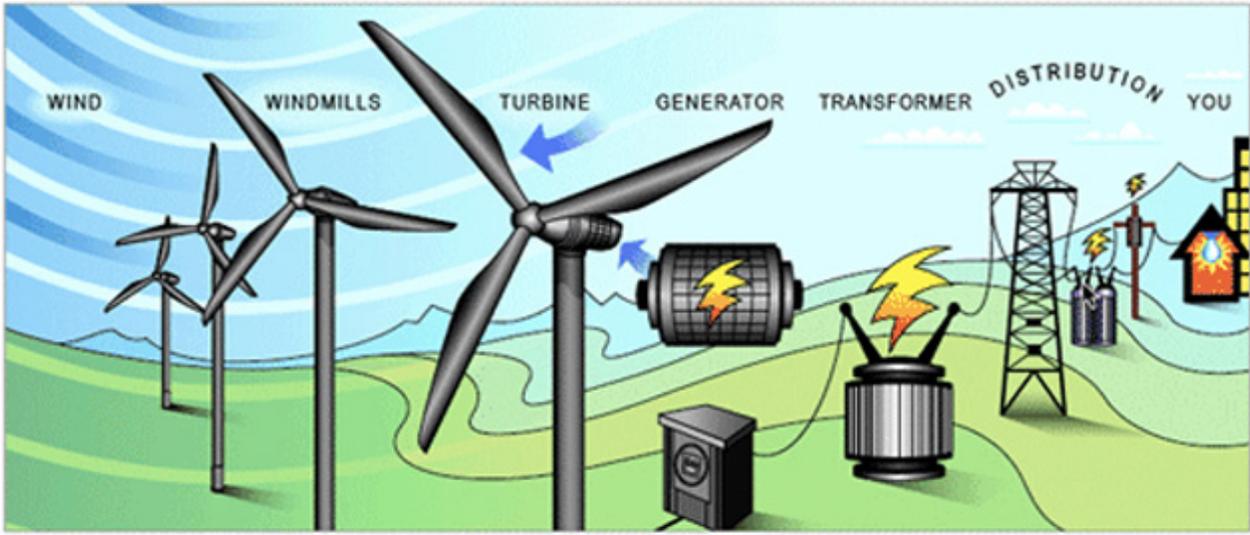
<http://www.awea.org/directory/consultcde.html> . Additionally, legal counsel familiar with the local political climate may be able to help navigate the permitting process

7.9 Establish Dialogue with Turbine Manufacturers and Project Developers

Every wind turbine is different despite seemingly similar power ratings. Some machines are designed to operate more efficiently at lower wind speeds while others are intended for more robust wind regimes. A prospective wind power developer would be wise to investigate all the various considerations and compare the performance to existing machines. Moreover, anecdotal information and even the professional services of wind power developers may prove helpful. A listing of utility-scale wind turbine manufacturers can be found at <http://www.awea.org/directory/wtgmfr.html> and a listing of developers can be found at <http://www.awea.org/directory/developers.html> .

7.10 Secure Agreement to Meet O&M Needs

Wind turbine technology has made great strides in the recent years. Today's machines are more efficient and cost-effective than ever. However, they are also more complex. Turbine availability (reliability) is a major factor in project success, and the services of professional familiar with the operation and maintenance of wind turbines can prove to be invaluable. Also, turbine manufacturers may offer more favorable product guarantees knowing that qualified project operators will be on site to maintain the equipment. A listing of project operators can be found at <http://www.awea.org/directory/developers.html> .



1. Wind blows...
2. across tall windmills...
3. to turn the blades of huge turbines...
4. which spin generators to create electricity.
5. A transformer increases the voltage to send electricity over...
6. distribution lines. Then local transformers reduce the voltage...
7. for you to use.