DETAILED REPORT FOR DEVELOPMENT OF WIND POWER PROJECT AND FINANCIAL MODELLING

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Declaration by the Guide

This is to certify that the Mr. Dheeraj Kumar, a student of EMBA (Power) , Roll No. 500025131 of UPES has successfully completed this dissertation report on **"Detailed Report for Development of Wind Power Project and Financial Modeling "** under my supervision.

Further, I certify that the work is based on the investigation made, data collected and analyzed by him and it has not been submitted in any other University or Institution for award of any degree. In my opinion it is fully adequate, in scope and utility, as a dissertation towards partial fulfillment for the award of degree of MBA.

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EXECUTIVE SUMMARY/ ABSTRACT

As per the data available on Ministry of Power website In June 2015, Indian power sector reached a tremendous milestone of achieving 274 GW of total installed power capacity. Commencing with a meager installed capacity of about 1360 MW in 1947, the year the country attained independence, India's power sector grew substantially over the last 68 years, and the installed capacity at the end of June 2012 stands at 2,74,818 MW.

However, contribution of renewable power is 35,777 MW, which is only 13% of the total installed capacity whereas; Renewable energy sources can make important contributions to sustainable development. Currently, their exploitation in commercial markets is low, mainly because of high cost and technological constraints. Most renewable energy technologies are still at an early stage of development. However wind power, compared to other renewable energy sources, has lower costs and improved technology. Looking at the benefits of wind energy and the energy deficit the country is facing today, development of wind power projects is a key to India's future economic growth. Nevertheless, investors' lack of interest in wind energy sector is conspicuous because of lack of procedural understanding of development of wind power projects.

To understand and defining the regulations of central and state regulatory companies this study is intended to explicate a methodology for setting up of Wind Power Project in a state of Rajasthan.

This report includes all the major steps that are required to take for putting in place a wind power project. It starts with project and financial planning procedure followed guides about feasibility study, wind resource assessment, site survey, micro-siting, land acquisition, financial planning & strategy, and power sale options. The project also includes financial modelling based on CERC/RERC guidelines for tariff planning of Wind mill plant in Rajasthan.

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Therefore this study is intended to explicate a generalized methodology for wind power project implementation. This methodology will act as a source of knowledge for wind energy power project implementation to the stakeholders of the Indian power sector.

1 INTRODUCTION

1.1. Overview

As per the data available on Ministry of Power website In June 2015, Indian power sector reached a tremendous milestone of achieving 274 GW of total installed power capacity. Commencing with a meager installed capacity of about 1360 MW in 1947, the year the country attained independence, India's power sector grew substantially over the last 68 years, and the installed capacity at the end of June 2015 stands at 2,74,818 MW.

Still, India's goal of 'energy security' is far from achieved. India has peak demand power shortage of 12% and the cost of fossil fuel is increasing day by day. Also, in National Action Plan for Climate Change (NAPCC), India has committed to increase its renewable energy share to 15% by 2020. Development of renewable energy, therefore, is necessary if Indian economy is to achieve sustainable growth at fast pace in the future.

Nevertheless, increasing the share to renewable energy in India's energy mix is a difficult task, renewable energy being far more expensive compared to the conventional energy. However, wind power is less expensive compared to all other potential sources of renewable energy like solar power. Also, India has huge unexplored wind power potential. The estimated Indian wind energy potential has been estimated by the Ministry of New and Renewable Energy to be 49130 MW. A more recent study by C-WET, India's wind energy potential is estimated to be more than 100 GW at a hub height of 80 metres. Therefore utilising wind potential seems to a one of the most credible way to achieve India's energy security.

The development of a wind power project is a complex task because of technical, managerial and regulatory hurdles. Apart from that, different procedures are followed in different states for various activities, which play its part in increasing the complexity. Hence this sector is not attracting large investments. This Report, therefore, is an attempt to guide the investors to understand the complex procedure of wind power development.

1.2. Purpose of the Study

Development of wind power project, which is a necessary task for achieving India's energy security, is a complex task. Different tariffs, policies and procedures followed in various Indian states add to this complexity. Apart from this, benefits like Accelerated Depreciation (AD) and Generation Based Incentives (GBI) are abandoned. Hence the wind power sector, compared to conventional energy sources, is less attractive to investors. Therefore there is a need of a document that can guide the investors to understand the procedure of a WPP development. This report is an attempt to elaborated the policy, procedures and regulations of the Rajasthan state.

1.3. Scope of Project

This project is an attempt to be guideline to the cumbersome procedure of setting up a wind power project in the state of Rajasthan. It deals with all the technical, economic and regulatory issues related to WPP development. The differences in policies/procedures followed in Rajasthan states in the permission of wind resource assessment, land acquisition, feed-in-tariffs etc. are also covered in this report so that it can be useful to understand the overall prospective in regard to wind power sector in Rajasthan. This report also covers financial modelling of a wind power project which can be a guideline for checking financial viability of a WPP.

1.4. Objective of the project

Wind power development is a riskier investment compared to the investments in conventional sources of energy. In India, diversities in policies/procedures in different states make it even more risky and hence unattractive. The objective of the project is to guide the investors in understanding the procedure of development of wind power project in Rajasthan. The intension is to persuade investments in the wind power sector by making the understanding of WPP development procedure simpler. By making the WPP development attractive by developing more understandable, the project is intended to contribute in India's pursuit of energy security.

1.5. Types of Wind Business Plans

There are mainly two types of business plans in the wind power project.

(1) Developed by the investor

(2) Developed by Original Equipment Manufacturer (OEM) and sold to investor (Turnkey projects)

In the first type of project the project is developed by the investor himself, which includes all the activities like site identification, wind resource assessment, land acquisition, engineering, procurement and commissioning etc.

On the other hand, in a turnkey project, the manufacturer develops the project and sells the project to the investor through bidding process. All the major activities mentioned above are performed by the manufacturer cum developer.

In a turnkey model, an investor doesn't have choice for WTG and usually the same WTG model is installed in different wind regimes leading to sub-optimal throughput. Now in India, the market is taking a turn towards developer driven scenario. In this, the investor has an inherent advantage of selection of WTG best suitable (technically and commercially) for the specific site to achieve optimum throughput. Another desirable outcome of this model is decreased reliance on the OEMs by the investor and hence it should lead to reduction in capital cost per KWh.

This report includes all the activities involved in a Green Field power project development.

2 WPP DEVELOPMENT PROCEDURE

The detailed procedure for setting up a wind power project is explained here. It consists of:

1. Project and Financial planning
2. Selection of state of preference
3. Site identification
4. Feasibility study
5. Permission for wind mast installation and capacity allocation
6. Wind mast installation, data collection and data verification
7. Site survey and wind farm layout
8. Land acquisition
9. CDM and REC related procedures
10. DPR preparation
11. Financial strategy and financial closure
12. Clearances / Agreements
13. Decision regarding power sale options
14. Physical implementation of the project

2.1 Project and Financial Planning

2.1.1 Project Planning

The key to a successful project is in the planning. Project planning is done to increase the likelihood that a project will be implemented efficiently, effectively and successfully. It involves working out what one wants to do and how is one going to do it. Creating a project plan is the first thing one should do when undertaking any kind of project.

Before setting up any project, large range of possibilities must be methodically researched and evaluated until the most promising set of actions is determined. A project plan is a useful tool to formally initiate the project and take the initial steps. A project plan typically includes the business needs that the project will address - a project description, scope definition, identification of the project manager and team, and list of constraints and assumptions. It may also include a change control process that identifies how changes will be evaluated, managed, and integrated into the project. Initially, the plan will serve as a set of objectives and guidelines to focus efforts. As information is gathered and project design aspects are solidified, attention should also be paid to regulatory compliance, minimizing environmental impacts, ease and cost of maintenance, and meeting the expectations and goals of the stakeholders. One key task while preparing a project plan is identifying which information gaps are required to be filled. Early identification and resolution of important questions reduce the project risk and facilitates project development. To assess which information is most crucial, one must consider the influence of factors such as potential project ownership and financing structures, likely technical and environmental issues, project scale, and schedule flexibility. In case of wind power projects, the overall project plan may be comprised of several points:

1) **Business goal** - Before shopping for technology, before going to the banker, before starting feasibility study, every potential WPP owner or group should pause and spend the time to answer a few key questions: What are goals in a WPP? Do you want to:
   a) Be part of the renewable energy revolution?
   b) Have the plant for captive purpose?
   c) Become energy independent and protect yourself against energy price increases?
   d) Contribute to a cleaner environment?
   e) Own the means of energy production?
   f) Make money from a rapidly expanding sector?

2) Project scope
3) Financial structure
4) Policy guidelines
   a) Central govt. policy: *MNRE*
   b) State govt. policy:
5) List of constraints & assumption
6) Professional assistance

   There are several key areas where professional expertise will likely be essential:

   a) Project management- If no one on the initial project team is experienced with wind energy project development, a project manager will be essential in moving a project through the development process.
   b) System design- Professionals with knowledge and experience to design a reliable and reasonably priced system are an essential part of the project team.
   c) Interconnection design- The connection design between a generating system and the utility grid, enabling power to be moved in either direction.
   d) Construction management
   e) Legal assistance- Power sales, project financing, land control, and various associated contracts are specialized to the independent power industry. The development process depends on these documents being up to industry standards.
7) Technical planning- All WPPs have many technical factors to consider. These include:
   a) Resource data
   b) Technology performance
   c) Grid connectivity
   d) Site access & constructability
   e) Construction design
   f) Forecast of expected production
8) Permitting planning- WPPs will require a variety of permits, ranging from building permits to grid connectivity permit. These are usually issued by the designated authorities and influenced by what kind of entity owns the site and how it is zoned.
9) Energy market analysis (who will buy the power)
10) Regulatory compliance
11) Legal aspects

12) Ease & cost of maintenance

13) Meeting the expectation & goals of stakeholders

14) Long term outlook & expansion opportunities

15) Gantt chart preparation

16) Schedule flexibility

2.1.2 Financial Planning

The work of financial management comes in three parts, each requiring undivided and well-informed attention:

- Decide how much you need (budgeting decisions)
- Decide when you will need it (cash flow)
- Decide where it will come from (financial planning)

Wind power projects, like all renewable energy projects, have a strong financial component which determines profitability or other goals, which incentives are used and how, who takes risks and earns rewards, how the development budget is controlled, and what has to be done to qualify for the intended financing.

Financial planning for WPP, like other RE power projects, comprises of following parameters:

1) General project information
   a) Rated capacity
   b) PLF or CUF
   c) Inflation
   d) Start year
   e) Project lifetime
2) Revenues - cash inflows
   a) Revenue from sale of electricity
   b) Ancillary products or benefits (like CDM, RECs etc.)
   c) Cost recovery- Depreciation
   d) Cost recovery- tax credits
   e) Grants & incentives

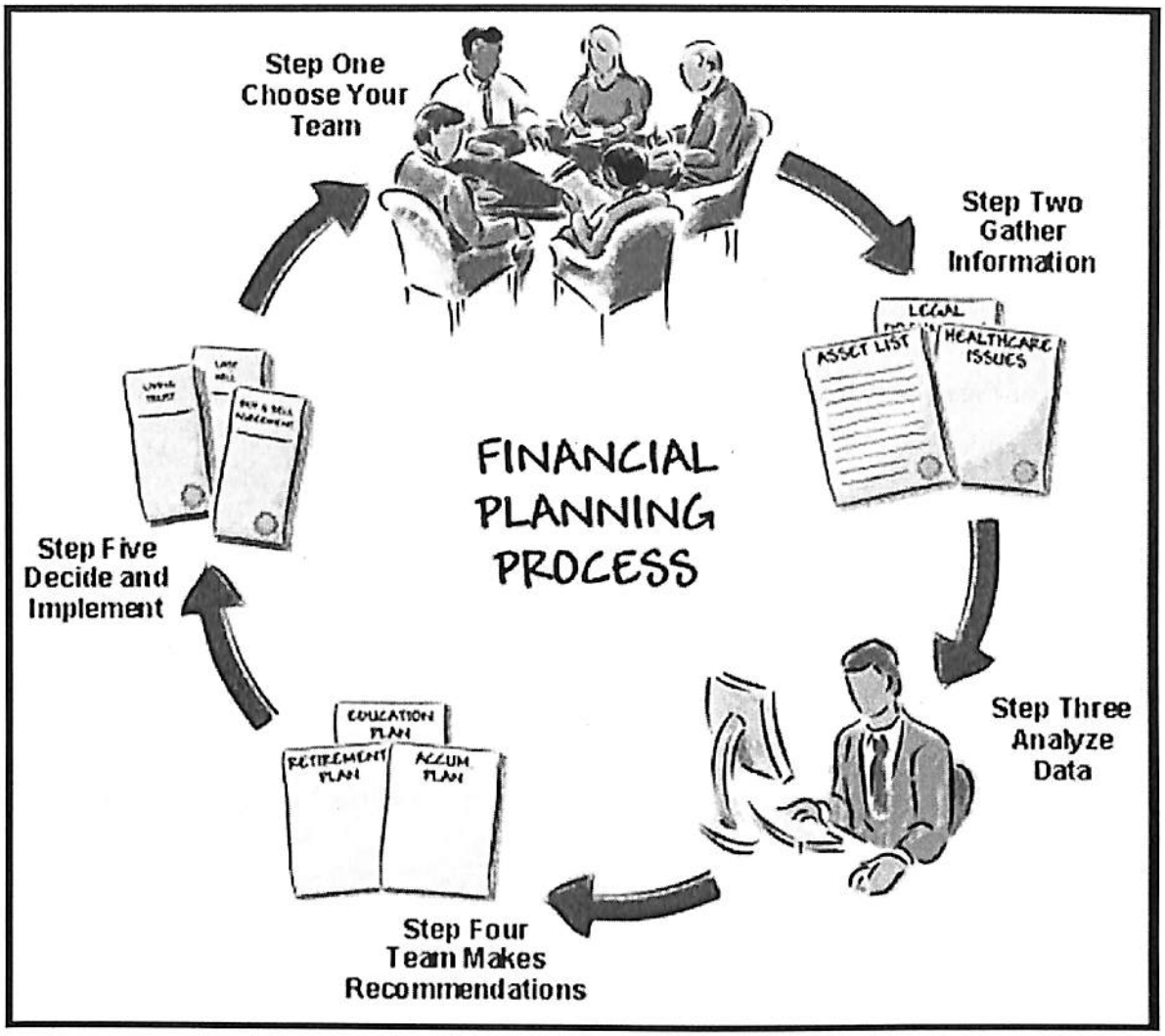

Figure 1: Financial planning process

3) Costs - cash outflow
   a) Equipment cost including installation & site preparation
   b) Balance of system(BOS) costs including all non-equipment Capital costs- such as interconnection & civil works
   c) Developer soft costs, such as developer planning, environmental studies licensing & permitting & negotiation of PPA
   d) loan interest
   e) Recurrent costs, such as equipment replacement
   f) Operation & maintenance
   g) Site owner rent or royalties
   h) Property tax
   i) Project insurance
   j) Income tax on revenue

4) Financing costs – debt & equity
   a) Loan debt
   b) Debt percentage(the percentage of capital costs being covered by a loan)
   c) Loan interest rate & term
   d) Equity
   e) Equity financing fees
   f) Initial working capital
   g) Debt financing fees
   h) Discount rate
   i) Scenario analysis

2.2 Wind Power Potential and Installed Capacity

Wind availability is the first major factor taken into consideration by the developer to select the region for developing a wind power project. Out of the total wind power potential, the unutilised part is what attracts the developer for setting up the WPP. The total wind energy potential in India has been estimated at 49130 MW at 50m hub height and 102788 at 80m out of which only around 23439 MW has been utilised by various developers as on 31.03.2015. which 3308 MW Rajasthan also have vast wind potential of 5005 MW @ 50 m hub height and 5050 MW @80 m hub height out of have already been installed by various developers

2.2.1 Feed-in-Tariffs

A feed-in tariff (FiT), also known as feed-in law, advanced renewable tariff or preferential tariff, is another important factor that affects the developers' decision of selecting a state for setting up WPPs. FiT is a policy mechanism designed to encourage the adoption of renewable energy sources.

This feed in tariff have be announced by the every years for their state by the Regulatory Commissions of that case as in Rajasthan The Rajasthan Electricity Regulatory Commission (RERC) on 20th March has proposed new tariff for wind energy sources, which will be applicable for the projects commissioned during FY 15-16. The commission has invited comments and suggestions from interested parties by 20th April 2015. The tariff will be applicable for 25 years. The details of the tariff proposed are in the table below:

Particulars	Tariff in Rs./kwh without AD benefits	Tariff in Rs./kwh with AD benefits
Wind Power Plants located in jaisalmer, Jodhpur & Barmer districts	5.74	5.44
Wind Power Plants located in districts other than Jaisalmer, Jodhpur & Barmer districts.	6.03	5.72

Figure 2: Rajasthan Feed In Tariff

The Centre Electricity Regulatory Commission (CERC) have also announce the tariff every years and Below are the some graphs on the year-wise tariff's of CERC and RERC for wind energy and the % changes in the tariff's over the years.

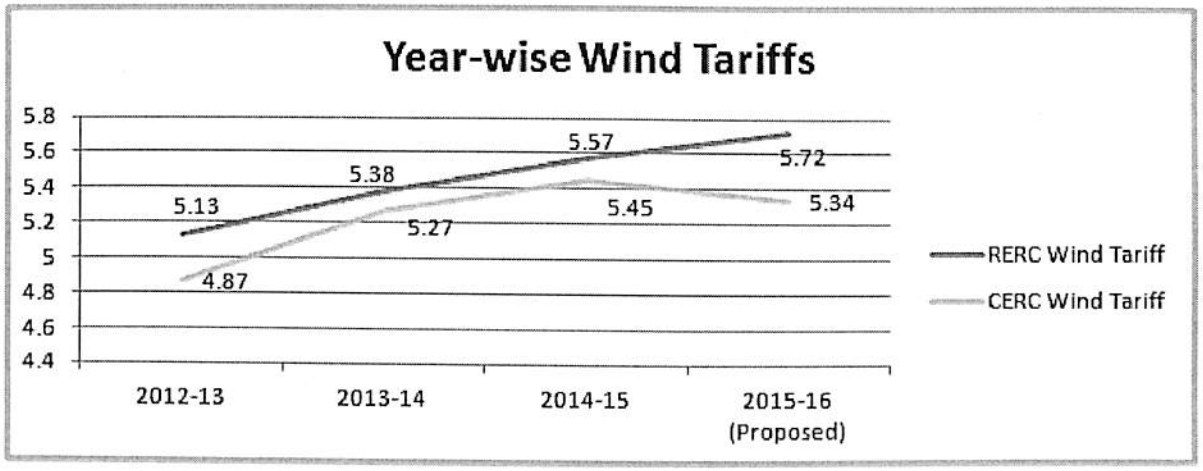

Figure 3: CERC, RERC Tariff Comparison

Note: All figures of CERC relate to wind zone-2 as defined by CERC, and all RERC tariffs relate to Wind Power Plants located in districts other than Jaisalmer, Jodhpur & Barmer districts.

It can be noticed from the graphs above that RERC has constantly increased Wind tariffs over the last three FYs, while CERC wind tariffs have risen more in terms of % whereas that proposed for FY 2015-16 has been reduced compared to previous FY.

Typically, Feed-in-Tariff includes three key provisions

- Guaranteed grid access
- Long-term Power Purchase Agreements (PPAs) for the electricity produced
- Purchase prices that are methodologically based on the actual cost of renewable energy generation. This is also known as Cost-plus approach.

Under a feed-in tariff, an obligation is imposed on regional or national grid utilities to buy renewable electricity at price determined by regulators using cost-plus approach. The cost-

based prices therefore enable the projects to be developed, and for investors to obtain a reasonable return on renewable energy investments.

Rajasthan has a wind power potential of 5050 MW's and with these tariffs proposed, it will become an attractive destination for setting up Wind projects.

2.2.2 Special incentives and facilities by Rajasthan Governments

Rajasthan Governments have declared special incentive or facilities to attract the wind / RE developers which are explained here as under

- **Exemption from Electricity Duty:** The energy consumed by the Power Producer for his own captive use will be exempted from payment of the electricity duty.

- **Grant of incentives available to industries-** Generation of electricity from Renewable Energy Sources shall be treated as eligible industry under the schemes administered by the Industries Department and incentives available to industrial units under such schemes shall also be available to the Developer/Power Producers.

- **Banking:** Rajasthan provides a facility of banking for a period of 6 months of April to September and October to March the use of banked power is not permitted in December to February.

2.2.3 Simplicity of procedures followed in the State

Proactive and simplified procedure ensures smooth and timely completion of the project. The index for attitude of the State agency gets reflected in quantum of capacity addition. Higher capacity additions obviously indicate that investor faces least problems. Though this factor is of primary consideration to the developer yet it is also relevant to IPP owners particularly after completion of the project and routine O&M.

In Rajasthan, **Rajasthan Renewable Energy Corporation** (RREC) **will act as Nodal Agency for single window clearance of the projects for following activities:**

- Registration of projects.
- Approval of capacity of projects
- Selection of projects by process of competitive bidding.
- Facilitation of loans from IREDA/PFC/REC/Financial Institutions/Commercial Banks.
- Allotment of revenue land.
- Approval of power evacuation plan and allocation of bays etc.
- Arranging other statutory clearances/approvals.
- Execution of PPA/WBA with RVPN/Discoms of Rajasthan.
- Co-ordination with MNRE/C-WET/Discoms of Rajasthan/RVPN/Central Agency/State Agency.
- Accreditation and recommending the wind power project for registration with
- Central Agency under REC mechanism.

2.2.4 Evacuation Infrastructure/ Grid Interface

The evacuation infrastructure development for wind power project is very costly and time consuming since the WPPs are generally in the remote sites where the grid connectivity is usually not readily available. Whether this infrastructure has to be developed by the grid utility or by the developer is a major factor for developer in his decision of selecting a state for WPP development. As per the Rajasthan wind policy 2012-

- Grid Interfacing: The grid interfacing arrangements for power using Wind as Renewable Energy Sources will be made by Developer/RVPN/ Discom as under:-
  - Pooling Sub-station- Interfacing arrangements such as transformers, panels, kiosks, protection, metering, HT lines from the points of generation to the Pooling Sub-station including the Pooling Sub-station shall be developed and maintained by the Developer as per the Grid Code applicable from time to time and the entire cost for this will be borne by them.
  - Receiving Sub-station- RVPN/Concerned Discom shall finalize the location of Receiving Station in consultation with RREC on which the electricity generated will be received at minimum 33 kV level.
  - Grid Connectivity- For creation of proper facility for receiving power at the Receiving Sub-station of RVPN/Discom, the Developer/Power Producer shall pay grid connectivity charges, as finalized by RERC from time to time, to RVPN/ Discom as the case may be. These charges will be paid by the Developer/Power Producer to RVPN/Discom as the case may be within 1 month of project approval by RREC. These charges include cost of complete line bay (including civil works) and its interconnection with existing electrical system. Line Bay includes breakers, CTs, CVT/PTs, isolators and protection equipments, bus bar material and other allied materials.
  - Transmission Line from Pooling Sub-station to Receiving Sub-station: The evacuation system beyond Pooling Sub-station till the nearest Receiving Sub-station shall be developed as under:
    - Grid Connected Wind Power Plants commissioned sale of power to Discom, captive use/third party sale within the State of Rajasthan RE (Non-Solar) Certificate Mechanism.
    - The power evacuation transmission line from the Pooling Sub-station to the RVPN/Discom Receiving Sub-station will be laid as per provisions of the orders of RERC.
  - The power evacuation transmission line from Pooling Sub-station to the Receiving Sub-station of RVPN/Discoms of Rajasthan will be laid as per provision of bid document and Power Purchase Agreement.

2.2.5 Grid availability

This is a major problem primarily faced by WPP developers. Obtaining sanction and/or commissioning of the project gets adversely affected due to non-availability of evacuation

facility. None of the states have so far made medium and long term plans to meet the demand of Wind Power Sector. The short term solution as offered by them is proving to be inadequate because of higher growth rate now being observed. Even after commissioning of the project, particularly in Tamil Nadu, the wind farm feeders are occasionally switched off during high generation period which badly affects the investors. Therefore the WPPs must consider the Grid availability conditions in the state in their decision of selecting a state for WPP. Though no data available but on comparatively basis the Rajasthan has a better

2.2.6 Sharing of CDM Benefits

The Clean Development Mechanism (CDM) is a project-based mechanism that allows public or private entities to invest in greenhouse gas (GHG) mitigating activities in developing countries and earn abatement credits, which can then be applied against their own GHG emissions or sold in the open market. For wind power producers, CDM benefits may become a source of revenue which can improve their project IRR by 1-1.5% and can make the project financially viable. CERC and different SERCs have declared sharing of the CDM benefits differently between the discoms and the developers. The WPP developers should examine the sharing of CDM benefits and its impact on the revenue in various states before arriving to a conclusion of finalising the state of preference.

The regulations regarding sharing of CDM benefits between the developers and the distribution licensees in Rajasthan and as per CERC are as under.

- **CERC regulation, 2009-** 100% to developers in the 1st year, reducing 10% every year till the sharing becomes 50:50 between developer and beneficiary.
- **Rajasthan State-**75% to developer, 25% to Distribution licensee. Share of the licensee shall be fully passed on to consumers.

2.2.7 Reactive Energy Charges

Reactive power consumption of wind turbine generators is high, especially during start-up. Sometimes the reactive power consumption during start up is equivalent to the kW power rating of the turbine. This reactive power has traditionally always been imported from the grid. Although Wind turbine generators now-a-days are commonly fitted with reactive compensation systems of various ratings, there is requirement of reactive power consumption from the grid during start-ups and for voltage control. In Rajasthan the reactive charges are 5.75 paisa/Kvarh escalating 25 paise per year.

2.2.8 Banking

As explained earlier, in Rajasthan power banking are allowed only for 6 months from April to September and October to March. Banked energy cannot be utilised in the month of December to February. Surplus energy is paid at 60% of large industrial tariff. Power banking is like cash banking whereby wind power producers feed in the electricity generated by their wind mills to the state grid and then draw that power for captive use within the period specified by the Rajasthan Electricity Regulatory Commission.

2.2.9 Transmission and wheeling/ open access charges

Transmission and Wheeling charges, specified by RERCs/ RVPN. The losses assumed for computation of the transmission and wheeling charges should also be taken into consideration. In Rajasthan Currently the following Open access Charges for year 2015-16 are applicable-

- Transmission Charges: **Rs. 138.10/kW/month**
- Transmission Charges (For interstate bilateral & collective power exchange transactions) : **29.23 paisa/kWh**
- Transmission Losses: **4.15%**
- Wheeling Charges: for EHV consumer 1 p/kWh
  33 kV 11 p/kWh
  11 kV 32 p/kWh
- Losses: System Voltage System losses
  33 kV 3.80%
  11 kV 12.60%

2.3 Site Identification

Selection of Site identification for erection of the wind Power Plant is the important task that needs to be taken up. Following factors should be taken into consideration for selection of site.

- There must be evidence of significant wind speed. Wind power density must be at least 200 watt/m^2. Locations like hills, ridges, plateaus, mountains etc. are preferred as these sites have more wind speeds compared to their surrounding locations.
- The available area should be taken into consideration. Generally 15-25 acre/MW of land are required, but this may vary depending upon the micro-siting.
- Wind shear – The sites with constant wind speeds and directions are more effective for wind power production and hence plants at such sites have higher CUFs.
- Land cover pattern should be studied as it affects wind speeds at various heights.

- Accessibility – The heavy transportation vehicles should be able to reach to the location of the proposed WPP at reasonable cost of road construction and transportation.
- There must be reasonable access to electrical transmission.
- Land ownership (Private/revenue/forest) also is an important factor to be considered. Additional forest/environment clearances are required for occupying a forest land. On the other hand, the developer may face problems like conflict with owners in occupation of private land.
- Prior commitments of the land – The developer needs to ensure that the proposed land is not already committed to any other WPP developer.
- Sites approved by NIWE (National Institute of Technology) Formerly known as C-WET must be given preference as the technical and regulatory work to occupy such sites reduces compared to other sites.
- The terrain must be favourable to construction.
- Apart from these several other factors need to be taken into consideration like - Cost of land, rehabilitation issues, scope for future expansion, labour and skills availability, minimum impact on labours etc.

2.4 Feasibility Study

Feasibility study is a preliminary study that is done to determine a project's viability through identifying potential return on investment as well as any fatal flow in the project if any. The results of the study are used to determine whether to proceed with the project or not. It provides a structured method that focuses on problems, identifies objectives, evaluates alternatives, and aids in the selection of the best solution. It also describes current market situations, explores outcomes, and assesses the range of costs and benefits associated with the recommended action. In short, the technical and commercial viability of the project is checked in the feasibility study. After studying the outcomes of the feasibility study the owner choses whether to proceed further with the project or not.

Figure 4: Feasibility study

Feasibility Tasks:

- Site inspection
- Wind resource review
- Investigation of interconnection opportunities
- Selection of suitable process and technology
- Capacity fixation on the basis of project
- Capital cost study
- Profitability analysis
- Fatal flaws review
- Investigation of site access

2.4.1 Generalized activities for feasibility study of Wind Power Projects:

- **Wind Resource Assessment:** The first consideration in choosing a site is the wind availability. It is the most important factor affecting the viability of the project. To determine whether to have a project or not, it is necessary to conduct a resource assessment. Professional wind resource assessment is necessary to raise debt financing, necessary approvals/ clearances before proceeding further. In some cases, technology providers may be able to help in identifying options, the best location or technology to be used.
- **Technology selection:** Various wind energy technologies are available for generating power. However each technology has its own merits & demerits. Therefore the project viability depends on the selection of appropriate technology. Various technological choices have to be made for the following:
  - Size and capacity of the turbines
  - Hub height
  - Rated and cut-in wind speeds
  - Vertical or Horizontal axes
  - Active and passive yaw
  - Type of rotor controls
  - Airfoil nomenclature
  - Tip-speed ratio
  - Pitch control and stall control
  - Rotor diameter

- Rotor solidity
- Betz limit
- Number of blades
- Blade composition
- Type of generator
- Type of hub
- Type of towers
- Type of drive trains

The selection of the technology depends on following factors:

- Wind speed and direction
- PLF or CUF
- Budget
- Land availability
- Climatic condition
- Availability of transport infrastructure
- Technology life
- Technology life cycle stage
- Ease & cost of maintenance
- Incentives linkage with technology
- Market penetration
- Agreement & clearances requirement linked with technology
- Environment & social impact assessment
- Subjective preferences
- Technical skills & abilities

- **Preliminary design**:Preliminary design includes engineering the project's details, including equipments locations, wiring, control systems, roads and foundations. *The design of the scheme should be completed at a level adequate for costing and a bill of quantities to be determined.* Hence, the design should be adequate for tendering purposes, and would include general arrangement and layout drawings. Prominent aspects of the works can be categorized into:
  - Civil works

- Generating equipment
- Grid inter-connection design
- Optimum system capacity
- Size & layout of structures & equipment

If possible, the designers will therefore need to work closely with the machinery suppliers, so that specific equipment parameters can be considered as the basis of the design.

- **Grid connectivity**

  - Check for an appropriate connection point near site
  - Conversations with those who have an understanding of the system in the area where the developer proposes to connect the project and contact local utility or discom. It provides following information:
    - Understanding the transmission & distribution system
    - Power line capacity
    - Substation capacity
    - Existing protection scheme of power system
    - Conductor size
    - Cost estimates for transmission upgrades
  - Next step is to approach transmission utility, with an application, which includes the following:
    - Feasibility study
    - System impact study
    - Facility study
    - Interconnection agreement
  - The final step is executing the agreements and constructing the additional infrastructure needed to get the energy on the grid.

- **Environmental impact Assessment: An** environmental impact assessment (EIA) is an assessment of the possible impact—positive or negative—that a proposed project may have on the environment, together consisting of the natural, social and economic aspects. The purpose of the assessment is to ensure that decision makers consider the ensuing environmental impacts when deciding whether to proceed with a project. The Ministry of Environment and Forests of India has been in a great effort in EIA in

India. The main laws in nation are Water Act (1974), The Indian Wildlife (Protection) Act (1972), The Air (Prevention and Control of Pollution) Act (1981) and The Environment (Protection) Act (1986). The responsible body for this is Central Pollution Control Board (CPCB). Wind-power generation has very low emissions on a life cycle basis, but has a number of environmental effects that may limit its potential. The following are required to check before the project implementation.

- Land use analysis - Helps in assessing the changes in land use pattern for setting up wind energy stations
- Air pollution
- Impact on flora & fauna
- Visual impact assessment
- Noise impact assessment
- Hydrological assessment
- Impact on communication signal
- On-site contamination & hazardous material issue
- Economic effects on local economy (e.g. creation of jobs)
- Mitigating measures - ways in which any adverse environmental impact may be minimized

- **Social impact assessment:** Social impact assessment includes the processes of analyzing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions. Its primary purpose is to bring about a more sustainable and equitable biophysical and human environment. SIA is often carried out as part of, or in addition to, EIA, but it has not yet been as widely adopted as EIA in formal planning systems, often playing a minor role in combined environmental and social assessments. The Social Impact Assessment is analysed taking into account the effects of the RE power project implementation on the population around the site region under various aspects such as:
  - Displacement of Habitat due to project implementation
  - Proximity to populated area
  - Worker health & safety issues

- Improved Power Availability situation for the local population
- Adequate Direct & Indirect employment opportunities to Rural Local population

- **Economic viability:** The purpose of an economic analysis is to demonstrate that the proposed project achieves optimum utilization of resources and is of sufficient economic merit to justify an investment in it. The analysis is therefore first made in the planning stage of the project, before any financial arrangements are discussed or entered into. The financing agencies will generally wish to see and approve the results of the analysis prior to making a commitment on financing the whole or part of the project. Economic analysis is always comparative. Sound economic evaluation of the proposed project during pre-feasibility and feasibility analysis is a fundamental requirement, particularly when the project requires a bank's assistance and financial commitment. The economic viability of the project is tested by financial modelling, which is explained in later chapter of this report.

2.5 Site Survey

The developer has to visit the site to conduct a site survey. Primary feasibility of the site for a wind farm development is checked at this stage.

2.5.1 Soil / Ground Conditions

Wind turbine generators require very solid foundations to secure that large structure in high wind conditions. Therefore soil conditions must be assessed to determine the stability of the ground. The location, type and cost of the foundation are largely determined by ground conditions.

Physical characteristics of the land are checked to ensure suitability for the wind farm development. For example, the located site should not be morass, a water body or a rocky surface.

The wind farm cannot be located in a tribal land, a wildlife sanctuary or a national park according to the land acquisition laws and hence the ownership of the land also has to be known. However this may have been checked by the developer while applying for the mast installation.

2.5.2 Accessibility

Accessibility to wind farm site is important for construction and for the on-going operation and maintenance of the wind farm. Construction access is usually more problematic because of the large vehicles and loads that need to be brought onto site. The turbines are brought onto site in large sections and erected using very large cranes. Local roads need to be sufficient to allow the delivery of the turbine components and construction equipment.

During the life of the wind farm the access tracks to each wind turbine, established during the initial construction, would be maintained and are sufficient for the service vehicles.

Steep gradients and unstable surfaces are generally avoided because of the added cost of cutting suitable gradients and stabilising loose surfaces.

2.5.3 Closeness to Grid

Suitable grid connection is vital for a wind farm. Because the large amount of electricity has to be transmitted from the wind farm's switchyard to the existing electricity grid, the cost of overhead transmission line increases with increase in the distance. This increases the capital cost, which ultimately affects the economic feasibility of the project. Unfortunately, the windy sites are many a time distant from the existing grid, and hence despite increase in the cost, sometimes it is better to move further away from the power line, simply because the more distant site is so much more productive.

2.6 Wind Farm Layout

Wind farm layout preparation is the next step in the project development. It means finalising the exact locations of wind turbines in the site. The objective of the layout is to maximise the Capacity Utilisation Factor (CUF) for the given site conditions.

2.6.1 Inter-turbine separation

It is determined by several factors and we need to compromise between these factors optimally. At the extremes they need far enough apart to allow the turbines to follow the wind without colliding with each other. Likewise we do not want them so far apart that the cost of the interconnecting cables is prohibitively expensive.

The main determinant of separation distance is wind speed and turbulence. A wind turbine generator necessarily removes some of the energy from the wind and causes turbulence. So downwind there is an area where it is not economic to place another wind turbine generator.

The surrounding unaffected wind will impart some of its wind energy to this slow and turbulent wind and the turbulence will be dampened and the wind speed will come back that of the surrounding wind. We normally will wait until it comes back to about 98 to 99% of the original power level before placing another machine downwind. The volume of air that is affected is determined by the diameter of rotor. So separation distances can be expressed in multiples of the rotor diameter.

The rule of thumb used for a downwind separation of wind turbine generators of between 5D and 7D (Where D stands for the rotor diameter). The influence of a wind turbine generator across the wind is nowhere near as great and could place a wind turbine as close as 1D apart across the wind. However the wind does not come from only one direction, so we cannot do this in reality.

In general wind turbine generators will be separated by 3D to 5D distances across the prevailing wind energy direction and by 5D to 7D distances with the prevailing wind energy directions.

Layout issues involve more than inter turbine separation. In most cases, the development of a wind farm layout will be much more complex. Again several factors will come into play to varying degrees according to site conditions.

2.6.2 Layout using software

Complicated three dimensional computer models help us to prepare the layout to maximise the wind turbine locations considering all the above mentioned factors. A team of developer visits the site and checks whether this optimum layout indicated by the software is feasible in reality or not. The Changes suggested by the team is done and optimum layout is re-prepared considering the constraints mentioned by the layout team.

2.7 Land acquisition

After the site for the project has been finalised and the siting is done, the developer must gain legal control over the proposed project site. This usually means acquiring interests in land, whether by purchasing the land, leasing it (which could include an option to purchase), or obtaining easements. Outright purchase normally provides the maximum amount of security and rights over the project land, but is also usually the most expensive option.

A well-executed lease is an important part of the project development process. Before the

purchase and installation of wind turbines it should be ensured that the lease provides clear, unimpeded rights for use of the land over the long term.

The most important portions of the land lease are:

- The length of the agreement
- What other uses are acceptable on the land surrounding the wind turbines
- The payment structure.

These and other major land lease provisions are described below.

A real property agreement will address major issues such as:

a) Type of land available
   1. Revenue land
   2. Private land
   3. Forest land
   4. Others

b) Nature of land
   1. Urban
   2. Rural
   3. Agricultural
   4. Industrial

c) Duration of the agreement

d) Compensation

e) The scope of the land subject to the agreement

f) Permitted uses of the land,

g) Property-related taxes

h) Assumption of liabilities

i) Assignment of contract rights by the developer

j) Termination of the agreement

k) Remediation of the land and dispute resolution

Other land issues that may be applicable:

a) Securing a right to purchase or lease land within a prescribed future timeframe through an *option to purchase if lease.*

b) Obtaining a right to match the terms of purchase or lease to a third party through *Right of*

First Refusal.

c) Ascertaining the restrictions on an owner's right to use property by means of *covenants on land.*

d) Possessing a secure legal right to develop the land by *ensuring title to the land.*

e) Conducting *land surveys* if title is uncertain, to preclude title-related questions, or if the value of the project is sufficient to justify undertaking a peremptory survey.

f) Understanding the various land-related *permits* and *approvals* that will be required (including land use permitting, conditional use permitting, environmental permitting, building and electrical codes), paying particular attention to the length of time needed to obtain the necessary permits.

g) Determining whether or not present *zoning* and *land use* permits the intended use, taking into account the difficulty of obtaining zoning exceptions.

h) Addressing *subsurface mineral rights.*

i) Addressing *water rights* (including subsurface)

As explained in the topic 2.5.1, a Land Option Agreement, which precedes the erection of the mast, gives the developer the first right to develop the land for a wind farm.

The *Land Lease Agreement* is the next step. It is much more detailed and should be carefully reviewed by a qualified lawyer or expert. The land lease includes:

(a) Length of lease

(b) Royalty percentage with minimum or floor payment (preferred over flat fee or rent)

(c) Extension options

(d) Purchase agreement or Standard Offer Contract

(e) Agreement not to conflict with normal activity on land without compensation

(f) Arrangement for the installation to be part of land deed in case of transferal

(g) Agreement by the developer to

- minimize impact
- compensate damages
- assume liability

(h) Access to land provisions

(i) Decommissioning

(j) Interconnection sites, depth of electrical wires

2.7.1 Land Acquisition Policy in Rajasthan

Allotment of land on concessional rates: The Government land required for power projects based on non-conventional sources of energy shall be allotted to Power Producer at concessional rates viz, 10% of DLC rates as per procedure prescribed below –

- The site for wind power project will be chosen by the developer after ascertaining the wind parameters.
- The land other than the government land will be procured by the Power Producer/developer at his own cost.
- While land may be allotted to the developer/power producer for the project, signing of lease agreement by the collector shall only be after deposit of the security money in RREC for at least 10% of the project capacity for which the land was allotted.

2.8 Clean Development Mechanism

The Clean Development Mechanism (CDM) is a project-based mechanism that allows public or private entities to invest in greenhouse gas (GHG) mitigating activities in developing countries and earn abatement credits, which can then be applied against their own GHG emissions or sold in the open market. The CDM has the dual objective of reducing greenhouse gas emissions and contributing to sustainable development in the host country. The CDM exploits the efficiency gap between industrialized countries and developing countries. In order to understand the potential of the CDM, one needs to consider that emission reductions through a CDM project are not assessed in absolute terms since developing countries have no reduction commitments, but in relative terms: every new energy project is compared to a forecast of future emissions, the baseline.

2.9 Renewable Energy Certificates

Renewable Energy Certificate (REC) mechanism is a market based instrument to promote renewable energy and facilitate compliance for Renewable Purchase Obligations (RPO) under inter-state transaction of RE generation. REC mechanism is aimed at addressing mismatch between availability of RE sources in state and the requirement of the obligated entities to meet the RPO.

Under this mechanism, the cost of electricity generation from renewable energy sources is classified as cost of electricity generation equivalent to conventional energy sources and the

cost of environmental attributes. These environmental attributes can be exchanged in the form of RECs. Hence, the RE generator can either sell the energy at preferential tariff specified by the ERC; or it can sell the power at normal tariff and sell the RECs on power exchanges.

In January 2010, CERC announced Regulation on Terms and Conditions for recognition and issuance of Renewable Energy Certificate for Renewable Energy Generation. According to this regulation, a generating company involved in electricity generation from renewable sources of energy will be eligible to get Renewable Energy Certificate (REC) for their each 1 MWh of generation subject to:

- It has got accreditation from State Nodal Agency
- It does not have any PPA for the capacity related to such generation with distribution licensee at preferential tariff
- It sells electricity generated to either of the following
  - ✓ The distribution licensee at price not exceeding average pooled cost of power purchase (APCPP) of the distribution licensee for last year.
  - ✓ Any other licensee or to an open access consumer at mutually agreed price, or through Power Exchange.

Captive RE Generators are also eligible for REC if such generators are:

- Not availing promotional Wheeling
- Not availing promotional Banking
- Not getting any electricity tax/duty exemption from the state.

Types of REC

According to the regulation, RECs will be issued in two categories: Solar RECs for generation through Solar PV & Solar Thermal technology, and Non-Solar RECs for generation through renewable sources other than solar. These RECs will be sold in a price band of Floor Price (minimum price) and Forbearance Price (maximum price). Floor and Forbearance prices for Solar and Non-Solar RECs are given in table below:

Table 1: Price of RECs

Type of REC	Floor Price in (Rs./REC)	Forbearance Price (Rs./REC)
Solar REC	12000	17000
Non-Solar REC	1500	3900

2.10Financing Strategy and Financial Closure

2.10.1 Financing strategy

Wind power projects are more complex and risky because they rely on the flow of wind; therefore risk management and risk allocation are extremely important. Like all other RE projects Wind power projects are very capital intensive, hence they are extremely sensitive to the structure and the conditions of capital cost financing. Due to their long time horizon, RE projects have a very long exposure period to risk. They also need long maturities and lower interest rates. There is no golden rule or a standard set funds for financing of WPPs, but adequate mix of funds and conditions are required for the WPP to be financially viable. The most common structures used to finance projects are Project Financing, Corporate Financing, and Lease Financing.

- **Project financing** : It refers to financing structures wherein the lender has recourse only or primarily to the assets of the project and depends on the cash flows of the project for repayment. It can be limited recourse financing when besides the project cash flows the lender has some recourse to the balance sheet of the promoter by way of issuance of corporate guarantees. _Non-recourse finance' is used when there is no recourse to the balance sheet of the promoter and therefore the lender takes a higher financing risk and therefore may charge higher interests and/or put stricter norms in place.
- **Corporate financing**: It involves the use of internal company capital to finance a project directly, or the use of internal company assets as collateral to obtain a loan from a bank or other lender. The main implication is that the financing of the project is based on the risk profile of the company as a whole, and not of the particular project.
- **Lease financing**: It involves the supplier of an asset financing the use and possibly also the eventual purchase of the asset, on behalf of the project sponsor. Assets which are typically leased include land, buildings, and specialized equipment. A lease may be combined with a contract for operation and maintenance of the asset.
- **Sources of finance**
    - Equity financing
    - Debt financing
    - CDM project financing

- **General eligibility criteria for RE loans**

Who can apply?

- Public, Private Ltd companies, NBFCs and registered Societies
- Individuals, Proprietary and Partnership firms (with applicable conditions)
- State Electricity Boards which are restructured or in the process of restructuring and eligible to borrow loan from REC/PFC

Eligibility

- Project demonstrating techno commercial viability
- Profit making companies with no accumulated losses.
- Debt Equity Ratio not more than 3:1 (typically 5:1 in case of NBFCs)
- No default to any government agency (IREDA/PFC/REC) and other FIs / Banks
- No erosion of paid-up capital

2.11 Clearances / Agreements Requirements

This section sketches the legal requirements for renewable energy project. Since these requirements vary from one jurisdiction to another, and also locally, the developer should make sure to verify which permits are applicable to a particular project, at the particular selected location. A local wind energy company or organization, state nodal agency, or local officials should be able to tell about the requirements that apply in particular location. This section gives a good idea as to what is generally required to get the necessary authorizations to allow construction to go ahead. However, one should be prepared to include additional requirements as one move through the permitting process and be in close dialogue with the permitting authorities to make sure all aspects of project are covered.

a) As per Electricity Act 2003, clause 7 - Any Generating Company may establish, operate and maintain a generating station without obtaining license under this act if it complies with technical standards relating to connectivity with the grid.
b) Registration of company under companies Act, 1956
c) Site approval by C-WET
d) NOC from geology and mining department
e) WTG certification from C-WET, optional
f) In-principle approval from concerned authorities
g) NOC from local Gram Panchayat / Nagar palika, if applicable

h) Final Clearance from SNA for project

i) Power evacuation/Grid connectivity clearance from STU

j) Power purchase agreement

k) Environment & Forest clearance from MOE&F/State Environment Department- Forest clearance is not applicable for a project so long as no forest land is involved. However, EIA studies even if not applicable for proposed project, NOC from the competent authorities needs to be obtained stating clearly that such kind of permissions is not applicable to the referred project.

l) Construction permit

m) Defense clearance, if applicable

n) Land conversion

o) Letter of comfort for equity/debt from promoter(s)/financial institute(s)

p) Approval from Airport Authority of India, if applicable

q) CDM agreement for CER certificates

r) Equipment Procurement(Import & Export Act)

s) Safety certificate from chief electrical inspector before plant commissioning

2.12 Power Sale options

There are two way of electricity sale for an RE generator in India, either through REC route or at preferential tariff.

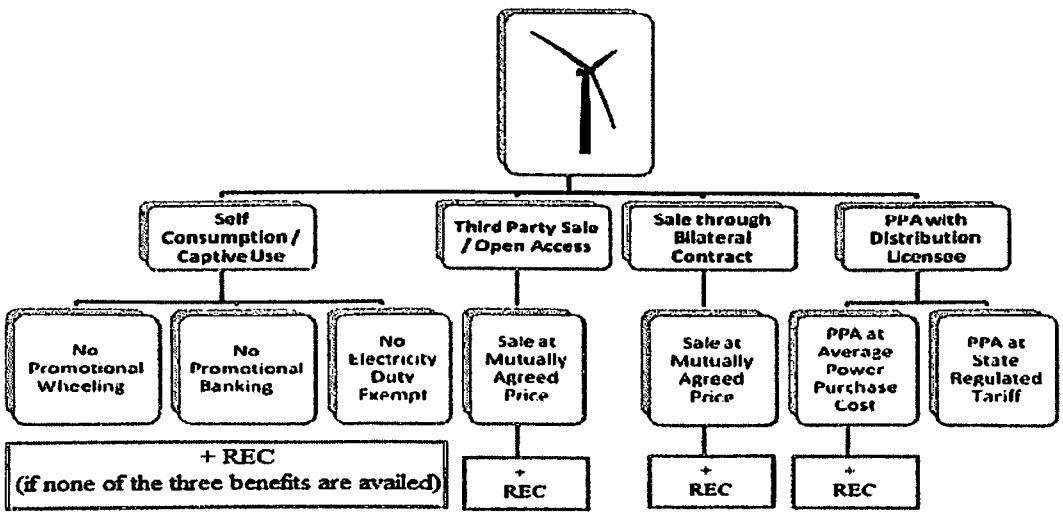

Figure 5: RE power sale options

Through non-REC route:

The RE generator can sale electricity generated to obligated entities at preferential tariff determined by CERC/SERC from time to time. 'Obligated entity' means the entity mandated under clause (e) of subsection (1) of section 86 of the Act to fulfil the renewable purchase obligation.

Hence there are following options under this route of sale of power

- Sale to any DISCOM at preferential tariff
- Sale at Open Access consumer at mutually agreed price (above APPC)

2.13 Physical implementation of the project

2.13.1 Engineering

It involves decisions regarding the following after detailed technical studies

1) Detailed plant design
2) Equipment specifications of the following major equipments
    - Rotor
    - Tower
    - Operational data
    - Generator type
    - Gearbox type
    - Control type
3) System engineering- During system analysis, systems engineering analyses and reviews the impact of operational characteristics, environmental factors, and minimum acceptable functional requirements, and develops measures suitable for ranking alternative designs in a consistent and objective manner. These measures should also consider cost and schedule. This analysis either verifies that the existing requirements are appropriate or develops new requirements which are more appropriate for the operation.
4) Civil engineering

2.13.2 Procurement

Procurement is the acquisition of goods or commodities by a company, organization, institution, or a person. This simply means the purchase of goods from suppliers at the lowest

possible cost. The best way to do this is to let the suppliers compete with each other so that the expenses of the buyer are kept at a minimum.

Procurement cycle for renewable energy power project consists of following steps:

- Information gathering: If the potential developer does not already have an established relationship with suppliers of needed products and services (P/S), it is necessary to search for suppliers who can satisfy the requirements.
- Supplier contact: When one or more suitable suppliers have been identified, requests for quotation, requests for proposals, requests for information or requests for tender may be advertised, or direct contact may be made with the suppliers.
- Background review: References for product/service quality are consulted, and any requirements for follow-up services including installation, maintenance, and warranty are investigated. Samples of the P/S being considered may be examined or trials undertaken.
- Negotiation: Negotiations are undertaken, and price, availability, and customization possibilities are established. Delivery schedules are negotiated, and a contract to acquire the P/S is completed.
- Fulfilment: Supplier preparation, expediting, shipment, delivery, and payment for the P/S are completed, based on contract terms. Installation and training may also be included.
- Consumption, maintenance, and disposal: During this phase, the company evaluates the performance of the P/S and any accompanying service support, as they are consumed.
- Renewal: When the P/S has been consumed and/or disposed of, the contract expires, or the product or service is to be re-ordered, company experience with the P/S is reviewed. If the P/S is to be re-ordered, the company determines whether to consider other suppliers or to continue with the same supplier.

2.13.3 Construction

The construction phase of a project is typically the most expensive. Therefore, it makes sense to ensure that a number of details have been finalized prior to embarking on this project component. The following is a list of issues that should have been completed prior to construction phase:

1) Finalize Costs (with fixed price agreements where possible
2) Obtaining all the necessary clearances and approvals
3) Financing

Construction Considerations

Depending on the size of the project, owner may choose to do much of the work himself or have the project done under contract. In either case, be well prepared both technically and legally to undertake the work. There are a number of factors to consider when beginning construction of a RE power project:

1) Construction Timing- The time of year for project construction can influence the pace and quality of work.
2) Materials Supply
3) Construction Permits & Inspections
4) Work Scheduling
5) Project Management

Following construction activities are involved in construction of a WPP

i. Civil work
   a) Road and drainage
   b) Wind turbine foundation
   c) Met mast foundation
   d) Building housing electrical switchgear, SCADA central equipment and possible spares and maintenance facilities

ii. Electrical works
   a) Equipment at the point of connection, whether owned by the wind farm owner or by electricity network operator
   b) Underground cable network and/or overhead lines, forming radial feeder circuits to string of wind turbine
   c) Electrical switchgear for protection and disconnection of feeder circuits
   d) Transformer and switchgear associated with individual turbine (although this is now commonly located within the turbine and is supplied by the turbine supplier)
   e) Reactive compensation equipments, if necessary
   f) Earth(grounding) electrodes and systems
   g) SCADA system
      - Central computer
      - Signal cables to each turbine and met mast
      - Wind speed and other meteorological transducer on met masts

2.13.4 Grid integration:

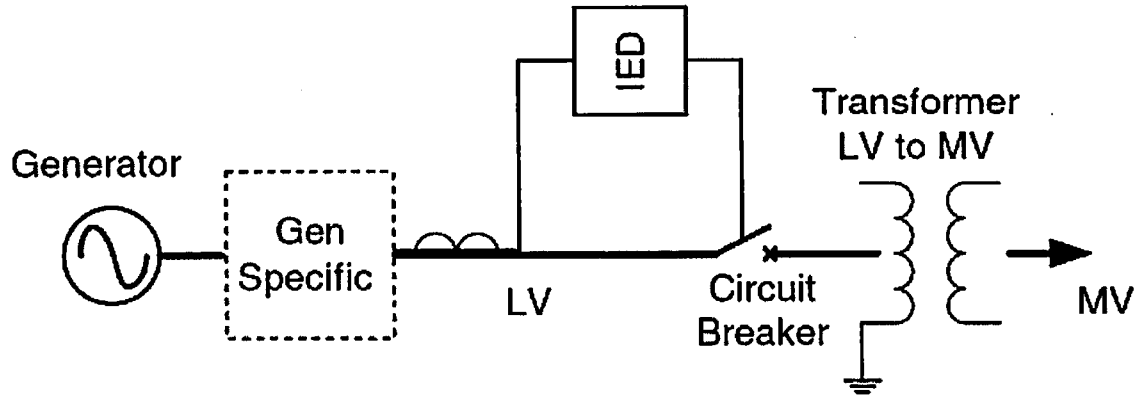

Figure 2: Single line diagram from generator to the transformer

Wind turbine has following electrical equipments connected for the purpose of grid connectivity.

- Generator
- Power electronics converter for AC to DC to AC conversion for permanent magnet and variable-speed synchronous generators.
- Current transformer, intelligent electronic device (IED), and circuit breaker
- Three-phase transformer to raise voltage from low (LV) to medium voltage (MV). Normally 420v to 33Kv step up transformer is use.

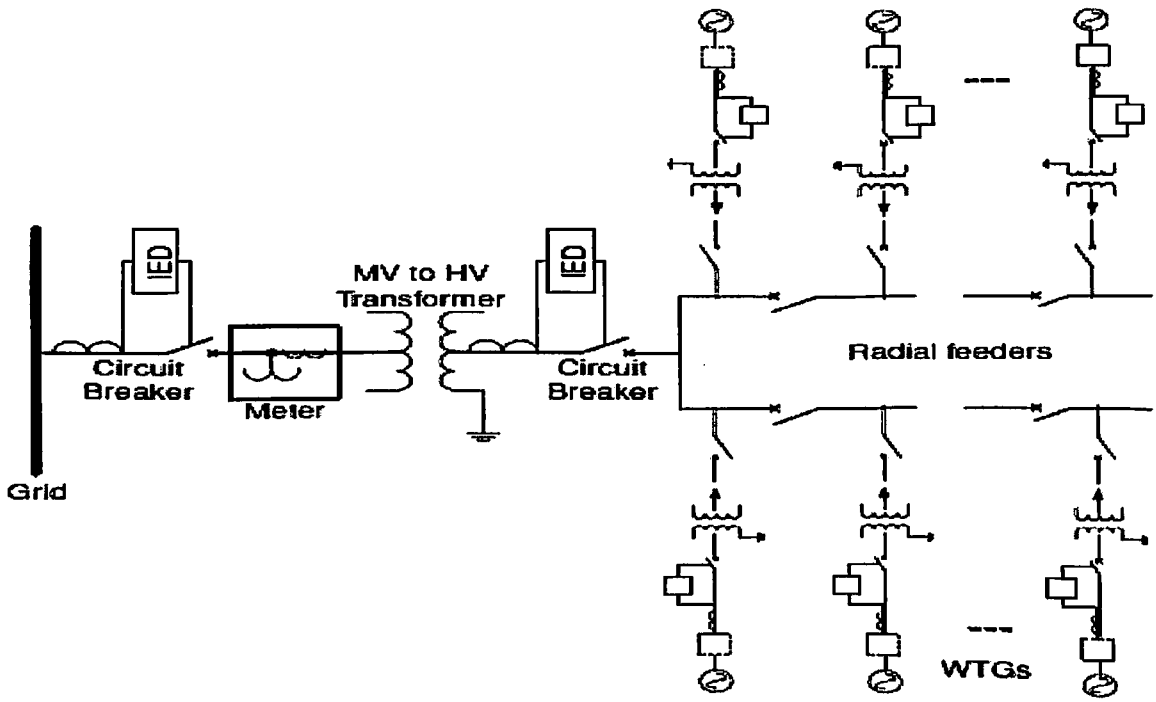

Figure 63: Single line diagram for grid connectivity from wind farm

The grid connectivity procedure is as follows:

1) Wind farm with multiple turbines is connected to feeders. Each turbine with switch gear and transformer is connected to a switch and then to the feeder. The switch is used to disconnect a single turbine whenever required.

2) The two feeders collect energy from turbines and put it on a common bar. This is then stepped up to the grid voltage using a transformer. This transformer must be rated to step up the entire power output of the wind farm.

3) A utility-grade meter is installed to measure the amount of energy that is delivered to the grid.

4) The last item is a circuit breaker that monitors grid voltage, current, frequency, phase difference, and other parameters. Depending on the data and the processing logic programmed into the relay, the circuit breaker connects/disconnects the wind farm from the grid.

5) SCADA Systems: Installation and testing of SCADA system is done before commissioning can start. This involves installation of all the telecommunications equipment, SCADA server, SCADA software, and configuration. Testing of the SCADA system involves testing if each device that is connected to the SCADA system is able to: Transmit status data when requested, Store operating data received from a device, Control of wind turbines based on stored logic, communicate with external systems like grid operator, turbine manufacturer etc., and Provide remote access Generate reports.

2.13.5 Testing and Commissioning:

Commissioning is the process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the design intent. Power plant commissioning is a critical part of the overall process of taking a power plant from construction and installation through to full operation. Testing & commissioning requirements should be clearly stated in the contracts specification. These should include parameters to be tested, test conditions, test points, values expected and acceptable tolerances.

2.13.6 Operation and Maintenance:

With proper operation and maintenance functions the production can be maximised as well as the life span of the wind turbines can be elongated. Maximizing availability and yield of each turbine is the goal of the O&M personnel. They minimize operations and maintenance costs for the remaining life of project by managing day-to-day tasks like providing day-ahead forecasts, operating the wind farm in a safe manner, protecting assets etc. There are three organizational models for O&M: Project owner manages O&M, third-party manages O&M, and turbine manufacturer manages O&M for an extended period.

3 Rajasthan Wind Policies and Regulations

3.1 Related Policies in Rajasthan- Among the non-conventional sources of energy, solar, wind, mini/small hydro and bio-mass have good potential for generation of electricity in Rajasthan. With a view to promote generation of power from non-conventional energy sources, Government of Rajasthan has issued favorable policies which have been updated time to time based on changed regulations and gaining the experience.

Government of Rajasthan promulgated a "Policy for promoting Generation of Power through Non-Conventional Energy Sources" on 11.03.1999. During the currency of this policy, a separate "Policy for Promotion of Electricity Generation from Wind" was issued on 04.02.2000. During the currency of wind policy 2000, a new policy was promulgated in April, 2003.

After gaining experience from earlier policies and identifying the impediments in the process of generation of electricity from non-conventional sources, state government issued a comprehensive policy for "Generation of Electricity through Non-Conventional Energy Sources", known as Policy-2004.

The Electricity Act 2003 has come into effect from 10.06.2003 and whereas, in exercise of the powers conferred on Rajasthan Electricity Regulatory Commission by section 42, 61 and 62 read with section 181 of the Electricity Act, 2003 (No. 36 of 2003), the Rajasthan Electricity Regulatory Commission has issued RERC MYT Tariff Regulations, 2009 vide notification dated January 23, 2009.

Now, in accordance with the provisions of Electricity act 2003 and Tariff policy, RERC has determined the tariff of wind power plant in the state to be set up in the year 2011-12 for sale to distribution companies, the state Government (RREC) has further issued a comprehensive **draft document** "Policy for promoting Generation of Electricity from Wind, 2011" which offers solution to various problems faced by Developers, Power Producers and utilities. The comments on this document have been invited from various stake holders till 05.01.2012.

3.2 Indian Electricity Act-2003-

Indian Electricity Act-2003 provides as under-

- **Section-4. (National Policy on standalone systems for rural areas and nonconventional energy systems)-**

The Central Government shall, after consultation with the State Governments prepare and notify a national policy, permitting stand alone systems (including those based on renewable sources of energy and other nonconventional sources of energy) for rural areas.

- **Section-9. (Captive generation)-**

(1) Notwithstanding anything contained in this Act, a person may construct, maintain or operate a captive generating plant and dedicated transmission lines:

Provided that the supply of electricity from the captive generating plant through the grid shall be regulated in the same manner as the generating station of a generating company.

Provided further that no license shall be required under this Act for supply of electricity generated from a captive generating plant to any licensee in accordance with the provisions of this Act and the rules and regulations made there under and to any consumer subject to the regulations made under subsection (2) of section 42.

(2) Every person, who has constructed a captive generating plant and maintains and operates such plant, shall have the right to open access for the purposes of carrying electricity from his captive generating plant to the destination of his use:

Provided that such open access shall be subject to availability of adequate transmission facility and such availability of transmission facility shall be determined by the Central Transmission Utility or the State Transmission Utility, as the case may be:

Provided further that any dispute regarding the availability of transmission facility shall be adjudicated upon by the Appropriate Commission.

3.3 Rajasthan Renewable Energy Corporation Limited (RREC)– Policy for Promoting Generation of Electricity through Non-Conventional Energy Sources-2004-

- Wind Power Plants for direct sale of power to Discom(s) of Rajasthan:
  - **Wind Power Plants for direct sale of power to Discom(s) of Rajasthan upto year 2012-13:** The State will promote setting up of wind power plants of unlimited capacity for direct sale to Discoms of Rajasthan upto year 2012-13 on the preferential tariff determined by RERC.
  - **Wind Power Plants for direct sale of power to Discom(s) of Rajasthan for the years 2013-14 onwards:** The State will promote setting up of wind power plants for direct sale to Discoms of Rajasthan on the tariff determined through competitive bidding process for the years 2013-14 onwards.
    The target under this category for the year 2013-14, 2014-15 and 2015-16 will be as follows:-

Year	2013-14	2014-15	2015-16
Wind power plants to be set up for	300 MW	400 MW	

direct sale to Discoms of Rajasthan			

- The State Government may undertake review of clause No. 4.1.1 and 4.1.2 in the light of any technological breakthrough in wind power generation industry, pricing trend of wind power, pricing trend of conventional power, energy requirement of the State and preparedness for procurement of wind power through competitive bidding process.
- Utility Grid Power Projects for captive use/third party sale within the Stateof Rajasthan: Rajasthan State will promote wind power plants of unlimited capacity for captive use or sale to third party located within the State of Rajasthan at mutually agreed rates.
- Utility grid power projects for sale through RE (Non-Solar) certificate mechanism: The Power Producers will also be allowed to set up Wind Power Plants of unlimited capacity for sale through RE (Non-Solar) Certificate Mechanism. The power generated from these power projects shall be purchased by Discoms of Rajasthan at Pooled Cost of Power Purchase determined by the Commission from time to time. The Power Producers will be required to apply for accreditation to the State Agency and thereafter to Central Agency for registration and issuance of RE (Non-Solar) Certificate under REC mechanism as per order/regulations of appropriate Commission issued in this regard. The Power Producers will sell RE (Non-Solar) Certificates as per the regulations/orders of the appropriate Commission.
- The benefit of the provision of this Policy shall be available to only those Wind Power Producers who opt for sale of power as per clause 4.1 (4.1.1 and 4.1.2), 4.2 & 4.3.
- Any Power Producer opting to sell power in contravention to the provision of clause 4.1 (4.1.1 and 4.1.2), 4.2 & 4.3 shall not be eligible for any benefits & concessions of this Policy.

- Purchase of Wind Power by Discoms:
  - The minimum Renewable Energy Purchase Obligations (RPO) for the Discoms of Rajasthan shall be governed by the relevant orders of RERC.
  - The Discoms of Rajasthan will purchase the power produced by the wind power projects sanctioned under clause 4.1 (4.1.1 and 4.1.2) and 4.3 of this Policy.
  - The Discoms of Rajasthan will purchase the wind power to the extent of the targets mentioned at clause 4.1.2 even if it exceeds Renewable Energy Purchase Obligation prescribed by RERC. In case of any shortfall in meeting the RPO after purchase of power as mentioned at clause 5.2, the Discoms of Rajasthan will purchase remaining quantity of power from the wind power plants selected through the competitive bidding process as per clause 4.1.2 or by acquiring Renewable Energy (Non-Solar) Certificate.

- Grid Interfacing: The grid interfacing arrangements for power using Wind as Renewable Energy Sources will be made by Developer/RVPN/ Discom as under:-
  - Pooling Sub-station- Interfacing arrangements such as transformers, panels, kiosks, protection, metering, HT lines from the points of generation to the

Pooling Sub-station including the Pooling Sub-station shall be developed and maintained by the Developer as per the Grid Code applicable from time to time and the entire cost for this will be borne by them.

- Receiving Sub-station- RVPN/Concerned Discom shall finalize the location of Receiving Station in consultation with RREC on which the electricity generated will be received at minimum 33 kV level.
- Grid Connectivity- For creation of proper facility for receiving power at the Receiving Sub-station of RVPN/Discom, the Developer/Power Producer shall pay grid connectivity charges, as finalized by RERC from time to time, to RVPN/ Discom as the case may be. These charges will be paid by the Developer/Power Producer to RVPN/Discom as the case may be within 1 month of project approval by RREC. These charges include cost of complete line bay (including civil works) and its interconnection with existing electrical system. Line Bay includes breakers, CTs, CVT/PTs, isolators and protection equipment's, bus bar material and other allied materials.

- Transmission and Distribution Network Augmentation-

✓ For augmentation of transmission/distribution systems to evacuate the power from receiving Sub-station, RVPN/Discom shall develop/augment the necessary transmission/ distribution network within mutually agreed timeframe.

✓ For grid connectivity/construction of line to be arranged by RVPN/Discom, the Developer/Power Producer shall submit period for construction of Wind Farm along with Bank Guarantee equivalent to the cost of bay and dedicated transmission/distribution line with an undertaking to use the system within prescribed period. In case there is any delay in utilization of system, a recovery @ 12% per annum for the period of delay on the amount of Bank Guarantee will be levied by RVPN/Discom. The Bank Guarantee shall be returned to the Developer/Power Producer after commissioning of the project on depositing amount of penalty, if any on account of delay in the utilization of the system.

✓ In case line bay and grid connectivity has been provided by RVPN/Discom at a particular voltage (say 33 kV), but later on Developer/Power Producer desires to supply the power on higher voltage (say 132 kV) then based on feasibility, RVPN may carry out requisite modification, viz addition of line bay to receive the power on higher voltage, as a deposit work of the Developer/Power Producer.

✓ In case, Developer/Power Producer first connects his feeder to Discom's sub-station, but later on desires to connect his feeder to RVPN's sub-station, then subject to feasibility, additional line shall be constructed by Developer/Power Producer and additional line bay at the grid substation shall be constructed by RVPN as deposit work of Developer/Power Producer.

✓ RVPN/DISCOM shall provide the inter-connection facility one month before scheduled COD as intimated by the Developer subject to condition that the

grid connectivity charges are deposited by the Developer/Power Producer, and sufficient time is available with RVPN/Discom for creating the interconnection facility.

- ✓ The Developer/Power Producer shall install necessary current limiting devices such as Thyristor in the generating equipment. Capacitors of sufficient rating shall also be provided to ensure that the average power factor is maintained as per requirements of State Load Dispatch Centre, measured at metering point of the Wind Farm.

- ✓ The power injection beyond the nominal voltage range of 97% - 103% may attract VAr charges as per the relevant Grid Code.

- ✓ All Wind Farms shall forecast and schedule their generation as per Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, 2010, RERC (Intra-state ABT) Regulation, 2006 and RERC (Rajasthan Electricity Grid Code) Regulation, 2008 amended from time to time. Actual generation beyond a limit as prescribed in these regulations may attract UI charges as per prevailing Grid Code and regulations.

- o Transmission Line from Pooling Sub-station to Receiving Sub-station: The evacuation system beyond Pooling Sub-station till the nearest Receiving Sub-station shall be developed as under:
  - ✓ 6.5.1 Grid Connected Wind Power Plants commissioned under Clause 4.1.1, 4.2 & 4.3: The power evacuation transmission line from the Pooling Sub-station to the RVPN/Discom Receiving Sub-station will be laid as per provisions of the orders of RERC.
  - ✓ Grid Connected Wind Power Plants commissioned under Clause 4.1.2 The power evacuation transmission line from Pooling Sub-station to the Receiving Sub-station of RVPN/Discoms of Rajasthan will be laid as per provision of bid document and Power Purchase Agreement.

- o The Developer/Power Producer shall comply with Grid Code including Load Dispatch and System Operation Code, Metering Code, Protection Code, Safety Code, relevant regulations/orders of the Commission etc. as applicable from time to time in the State of Rajasthan.

- Power Purchase Agreement: The Power Purchase Agreement between the Power Producer/Developer and Discoms of Rajasthan/RVPN will be executed in the following manner:
  - o Wind power plants for direct sale of power to Discom(s)
  - ✓ Wind power plants for direct sale of power to Discom(s) of Rajasthan upto2012-13 (clause 4.1.1): For the projects sanctioned under clause 4.1.1, the Power Purchase Agreement will be executed between Discoms of Rajasthan and Power Producer on the preferential tariff determined by RERC.
  - ✓ Wind power plants for direct sale of power to Discom(s) of Rajasthan for the years 2013-14 onwards (clause 4.1.2): For the projects sanctioned under clause 4.1.2, the Power Purchase Agreement will be executed between Discoms of

Rajasthan and successful bidders as per the provisions of bid documents on the tariff arrived at by the process of competitive bidding.

- Wind power plants for captive use/third party sale within the state of Rajasthan (clause 4.2): For the projects sanctioned under clause 4.2, the Developer/Power Producer shall execute a Wheeling and Banking Agreement with Discom(s) for such banking. In case transmission system of RVPN is also used then Power Producer and Developer will execute separate Wheeling Agreement with RVPN.

- Sale of power through RE (Non-solar) certificate mechanism (clause 4.3): In case of wind power plants established for sale of power through REC mechanism the Power Purchase Agreement will be executed between Developer/Power Producer and the Discom(s) as per the regulations/orders of appropriate commission issued from time to time in this regard. On expiry of the registration with Central Agency under REC mechanism, Power Producer will have option to sell power to Discom(s) at the tariff as determined/specified by RERC from time to time in this regard.

- PPA/WBA may be allowed to be assigned, in parts or full, to other parties after completion of the project and its connectivity to the grid, with the consent of RREC & RPVN/Discom(s) on payment of Rs. 2.00 lac per application to RREC. The taxes will be payable as applicable from time to time.

- The draft of PPA will be finalized by RREC in consultation with RVPN/Discom.

- Settlement of Accounts: The account of all transactions between the Power Producer and the Discom/RVPN regarding price of power and wheeling charges shall be settled on monthly basis.

- Incentive by the State Government:
  - Exemption from Electricity Duty- The energy consumed by the Power Producer for his own captive use under clause will be exempted from payment of the electricity duty.
  - Grant of incentives available to industries- Generation of electricity from Renewable Energy Sources shall be treated as eligible industry under the schemes administered by the Industries Department and incentives available to industrial units under such schemes shall also be available to the Developer/Power Producers.
  - Allotment of land for establishing Wind Power Generation Projects-
  - ✓ The allotment of land to the Wind Power Developers will be done as per the provisions of Rajasthan Land Revenue (Allotment of Land for setting up of Power plant based on Renewable Energy Sources) Rules, 2007 as amended from time to time.
  - ✓ The Government land required for Wind Power Projects shall be allotted to the Wind Power Developers at concessional rate of 10% of the DLC rate (agriculture land) as per the provision of rules mentioned at 9.3.1.

- ✓ For setting up of Wind Power Project, maximum allotable land to the Developer shall be 5 Hect. /MW.
- ✓ RREC will recommend the case of land allotment to concern District Collector only on submission of cash security deposit of Rs. 1 lac/MW by Demand Draft in favour of RRECL, Jaipur. The security deposit will be refunded on successful completion of the project. The security deposit will be forfeited in case allotment of land is cancelled as per provision of the rules mentioned at 9.3.1.
- ✓ The cases where recommendation for allotment of land have been made before issue of this Policy but the land allotment has not been done by the District Collector, will be governed by the provisions of clause 9.3.4. The allotment of land in such cases will be done only after submission of cash security deposit of Rs. 1 lac/MW by Demand Draft in favour of RRECL, Jaipur.
- ✓ Sub-Lease of part of land in favor of Power Producer shall be permitted as per the Rajasthan Land Revenue (Allotment of Land for setting up of Power plant based on Renewable Energy Sources) Rules, 2007 as amended from time to time. Sub-Lease can be done by the concerned District Collector on recommendation of RREC before or after commissioning of WTG. In case sub lease is done after commissioning of WTG, the stamp duty shall be levied on land cost only.

- o Procurement of private land for establishing Wind Generation Projects:
- ✓ Wind Power Developer shall be allowed to purchase private land from the Khatedar for setting up of wind power plants in excess of ceiling limit prescribed in the Ceiling Act, 1973.
- ✓ Conversion of private land to the industrial use shall be required for setting up of wind power plants before start of work. The conversion charges shall be 10% of charges levied for industrial purposes under the relevant rules.

- o Forest Lands and Protected Areas:
- ✓ If the land proposed for setting up Wind Generation Projects involves land which is categorized as forest land in light of the judgment of Hon'ble Supreme Court in Writ Petition (Civil) No. 202/95 dated 12.12.1996, the developer will be required to seek diversion of forest land under the general guidelines issued by MoEF, GoI's letter No F. No. 8-84/2002-FC dated 14.5.2004 and amendments issued from time to time. Explanation: "The word "Forest" must be understood according to its dictionary meaning. This description covers all statutorily recognized forests, whether designated as reserved, protected or otherwise for the purpose of Section 2(1) of the Forest Conservation Act. The term "forest land", occurring in Section 2, will not only include "forest" as understood in the dictionary sense, but also any area recorded as forest in the Government record irrespective of the ownership. This is how it has to be understood for the purpose of Section 2 of the Act. The provisions enacted in the forest Conservation Act, 1980 for the conservation of forests and the matters connected therewith must apply clearly to all forests so understood irrespective of the ownership or classification thereof."
- ✓ No wind generation project can be set up if the land falls in the areas like National Parks and Sanctuaries, Area of Outstanding Natural Beauty

(AONBs), Natural Heritage Site, sites of Archeological importance and sites of Special Scientific Interests and other important landscapes.

- RREC to be Nodal Agency RREC will act as Nodal Agency for single window clearance of the projects for following activities:
  - Registration of projects.
  - Approval of capacity of projects under clause 4.1.1, 4.2 & 4.3
  - Selection of projects under clause 4.1.2 by process of competitive bidding.
  - Facilitation of loans from IREDA/PFC/REC/Financial Institutions/Commercial Banks.
  - Allotment of revenue land.
  - Approval of power evacuation plan and allocation of bays etc.
  - Arranging other statutory clearances/approvals.
  - Execution of PPA/WBA with RVPN/Discoms of Rajasthan.
  - Co-ordination with MNRE/C-WET/Discoms of Rajasthan/RVPN/Central Agency/State Agency.
  - Accreditation and recommending the wind power project for registration with Central Agency under REC mechanism.

- Registration for Power Project:
  - The Developer/Power Producer will submit the application to RREC in prescribed Performa "Form-A" appended with the Policy along with following required documents, as applicable.

    ✓ A certified copy of the Memorandum & Article of Association of the Company/Certified copy of the registration certificate/Certified copy of the partnership deed.
    ✓ Certified copy of the Authority conferring powers on the person(s) who are competent to execute the MOU/the agreement with GoR/RREC/RVPN/ Discom of Rajasthan /Central Agency/State Agency.
    ✓ Detailed Feasibility/Project Report.
    ✓ Demand Draft for processing fees @ Rs. 50000 per MW + Service Tax as applicable in favor of Rajasthan Renewable Energy Corporation Ltd. payable at Jaipur.
    ✓ Annual Report of the Company/Firm for last three years.

  - The Developer/Power Producer will deposit an amount of Rs. 50000/- per MW with RREC towards processing fee, which shall be non-refundable. The service tax shall also be payable extra as applicable from time to time.
  - The processing fee for the projects registered under Policy 2004 after 31.3.2012 shall be Rs. 50000/- per MW. The service tax shall also be payable extra as applicable from time to time.
  - The Wind Power Projects, which have been registered under Policy, 2004, will be deemed to have been registered under this Policy-2012 on the same registration Number allotted earlier. These power projects will be governed by provisions of this Policy.

- For the projects under RE (Non-Solar) certificate mechanism(clause 4.3), in addition to the registration with RREC as above, the Power Producers will have to deposit accreditation/registration fee with State Agency/Central Agency as per procedure laid down by the regulations/orders of the appropriate Commission.

- Open Access for Third Party Sale: Open access will be granted to any Wind Power Producer or beneficiary. They shall have to pay the applicable open access charges and losses as approved by RERC/ CERC from time to time.

- State level Screening Committee (SLSC): The State Level Screening Committee (SLSC) consisting of the followings will be constituted for in principle clearance of the projects:-
  - Principal Secretary/Secretary, Energy, Government of Rajasthan
  - Chairman & Managing Director, RREC
  - Chairman & Managing Director, RVPN
  - Chairman Discoms
  - Director (Finance), RVPN
  - Director (Technical), RREC - Convener

- In Principle Clearance of Projects:
  - In principle clearance of Wind Power Projects under Clause 4.1.1, 4.2 & 4.3 In principle clearance of projects under clause 4.1.1, 4.2 & 4.3 will be granted by the State Level Screening Committee after evaluating/examining the project proposals on the following criteria:
    - Detailed Project Report.
    - Financial Capability of the Power Producer.
    - Technical Capability of the Power Producer.
    - Status of Power Evacuation System for proposed project and allotment of land.
    - For projects under REC mechanism, undertaking from the power producers regarding accreditation and registration with State Agency/Central Agency.
  - In principle clearance of Projects under Clause 4.1.2 In principle clearance of the projects under clause 4.1.2 will be granted by SLSC. RREC will be nodal agency for carrying out the tariff based competitive bidding process on behalf of Discoms of Rajasthan. The bid process will be conducted by RREC under guidance of SLSC. SLSC will be empowered committee for granting all necessary approvals related to bid process. Approval from RERC will be taken wherever necessary.

- Security Deposit:
  - For projects under Clause 4.1.1, 4.2 & 4.3 After in principle clearance of the projects by the State level Screening Committee as per clause 14.1, the Power Producers will be required to deposit security amount @ Rs. 5.00 Lac per MW by Demand Draft within two months from the date of issue of in principle clearance. In case Developer/Power Producer fails to deposit security money within stipulated time, the in-principle clearance shall be cancelled without any notice. The security amount deposited by the Developer/Power Producers shall not be convertible or transferable and shall only be refunded to the

Developer/Power Producer on his written request after commissioning of the Project. In case Developer/Power Producer fails to commission the Power Plant in time schedule including extension as per Clause 18.1, the security deposit shall be forfeited.

- For projects under clause 4.1.2 The security deposit will be governed by provision of bid document and power purchase agreement.

- SLEC Clearance of Power Projects: All in principle cleared projects will be submitted to the State Level Empowered Committee (SLEC) for final approval. The State Level Empowered Committee will consist of following members:-
  - Chief Secretary, GoR (Chairman).
  - Principal Secretary, Revenue, GoR (Member).
  - Principal Secretary/Secretary, Energy, GoR (Member);
  - CMD, Rajasthan Vidyut Prasaran Nigam Ltd, (Member).
  - Pr. Chief Conservator of Forest (HoFF), Forest Department, GoR (Member)
  - District Collector of concerned District- Special Invitee.
  - CMD, Rajasthan Renewable Energy Corporation Ltd., (Member-Secretary).
- Wind Resource Assessment Programme: For utilization of wind as an energy source, Wind Resource Assessment (WRA) studies had been carried out by MNRE at various locations in the State. The MNRE has also permitted independent private participation for WRA. Looking to the immense potential assessed in the limited locations, RREC has also carried out wind energy resource assessment studies for additional locations with participation of private developers.

  - Registration for establishment of wind monitoring station for wind resource assessment studies-
    - ✓ For carrying out wind resources assessment studies, Developer shall select the location for establishment of wind monitoring station and shall register the application with RREC in prescribed Performa "Form-B" appended with the Policy along with the required documents, attachments as applicable.
    - ✓ Along with application, the Developer shall deposit an amount of Rs.10000/- per site with RREC towards processing fee, which shall be non-refundable. The service tax will be payable extra as applicable from time to time. Fee, if any, payable to C-WET will be extra as applicable.

  - Allotment of land for setting up of Wind Monitoring Station- The Government land up to 150mx150m required for setting up of wind monitoring station shall be allotted on temporary basis to the Developer for maximum period of 3 years at DLC rate. The allotment for such land shall be done at the level of concerned District Collector on the recommendation of RREC. After completion of wind assessment studies, the wind monitoring station shall be dismantled at the cost of Developer and land shall revert back to the State Government free from all encumbrances.

  - Requirement of No Objection Certificate from Gram Panchayat for allotment of land for establishment of wind monitoring station - No N.O.C. will be required

from Gram Panchayat for allotment of Siwai Chak land for establishment of wind monitoring station.

- General Guidelines for Wind Resource Assessment Studies -
  - ✓ The Developer shall follow the guidelines for wind resource assessment studies issued by Ministry of New & Renewable Energy from time to time.
  - ✓ All the costs including installation of wind monitoring station with accessories and its O&M expenses shall be borne by Developer.
  - ✓ The Developer shall submit C-WET report to RREC on completion of wind resource assessment studies.
  - ✓ The Developer shall not be entitled to claim any cost/charges and expenses and incidental charges incurred by him in connection with the studies for submission of C- WET report to RREC.
  - ✓ Purchase and acquisition of private land, if any shall be sole responsibility of the Developer.
  - ✓ The Developer shall take necessary permissions of forest department, wherever required under forest conservation act before installation of wind monitoring station. The wind monitoring station would be installed by the Developer after completing various formalities with the forest department. Compliances of various orders passed by Hon'ble Court would also be ensured by the Developer.

- Time frame for completion of project: The time frame for completion of projects sanctioned under this Policy will be as follows:
  - Time frame for completion of projects sanctioned under clause 4.1.1, 4.2 & 4.3 The timeframe for completion of project, subject to force majeure conditions, would be as follow from the date of "in principle clearance

Project Capacity	Completion Time
Up to 25 MW	8 Months
Above 25 MW- 50 MW	14 Months
Above 50 MW - 75 MW	18 Months
Above 75 MW - 100 MW	22 Months
Above 100 MW	26 Months

  - The RREC may extend the completion schedule of the project given in clause 18.1.1 above, on the written request of the Developer giving convincing reasons for delay in the completion of the project beyond scheduled commissioning period. The charges for time extension shall be as under:

Time period	Amount payable for extension
Up to two-month extension in the date of scheduled commissioning	Rs.25000/MW

Two to four-month extension in the date of scheduled commissioning	Rs.50000/MW
Up to nine-month extension in the date of scheduled commissioning	Rs.100000/MW

- The Board of Directors of RREC will be empowered to determine the period of delay on account of force majeure conditions as well as on merits of the case and condonation of delay thereof as given at clause 18.1.1. Accordingly the Board shall also be empowered to relax the extension charges as mentioned at clause 18.1.2 on merits of the each case.
- In case the Project is delayed beyond nine months and is not considered by the Board of Directors for further extension, in such case the matter shall be decided by SLEC for relaxation by granting further extension afresh or for cancellation of the Project and forfeiture of Security Deposit thereof. For the purpose of calculating the time period for completion of project, the date of issue of certificate by Electric Inspector, Govt. of Rajasthan for energizing the Wind Turbine and lines from the Wind Turbine to the pooling station will be considered, provided that the Power Producer has submitted relevant PPA/WBA. In case the PPA/WBA is submitted after issue of certificate by Electrical Inspector, the date of submission of PPA/WBA will be treated as date of completion of project. However, Payment towards the energy supplied to the Discom shall be governed by the provision of PPA executed by the Developer, Power Producer and Discom(s).

3.4 RERC Tariff Regulations, 2009:

The Rajasthan Electricity Regulatory Commission (Terms and Conditions for Determination of Tariff) Regulations, 2009 are applicable for determination of tariff in all cases covered under these regulations from FY 2009-10 i.e. April 1, 2009 & onwards upto FY 2013-14 i.e. March 31, 2014. These regulations apply in respect of the supply of Electricity by generating company to a Distribution Licensee, Intra-State transmission of electricity, wheeling of electricity, retail sale of electricity & surcharges etc. Part VII of the above Terms and Conditions is applicable for determining the tariff for procurement of power by distribution licensees within Rajasthan from renewable energy based generating stations located within Rajasthan. Regulation no. 83 of above chapter deals with the various provisions and norms for wind power plants.

Various provisions of RERC's Notification dated 23.01.09 i.e. 'Terms and Conditions for Determination of Tariff) Regulations, 2009', in short, RERC Tariff Regulations, 2009 ' are applicable in general to the wind power plant in Rajasthan. The relevant Extracts of the above regulation are given below:-

Part I

- **Clause-2** These Regulations shall extend to the whole of the State of Rajasthan. These Regulations shall be applicable for determination of tariff in all cases covered under these Regulations from FY 2009-10, i.e., April 1, 2009 and onwards up to FY 2013-14 i.e. March 31, 2014. However, for all purposes including the review matters pertaining to the period till FY 2008-09, the issues related to determination of tariff shall be governed by RERC (Terms and Conditions for Determination of Tariff) Regulations, 2004, including amendments thereto.

Part VII

Tariff for Renewable Energy Generating Stations

Regulation no 83. Tariff determination for New renewable energy generating stations to be commissioned during Control Period under these Regulations

Norms for Generic Tariff determination for Wind Energy Projects

(6) The performance parameters for tariff determination of wind power plants for the base year of MYT Control Period FY 2009-10 shall be as under:-

(a) For the purpose of tariff determination for Wind Energy projects under Control Period, the financial principles as stipulated under Part III of these Regulations, such as norms for debt: equity, interest on loan capital, return on equity capital and escalation factors for O&M expenses etc. shall be applicable.

(b) Other normative parameters for generic tariff determination of wind energy projects under Control Period shall be as under:

(i) **Base Capital Cost:** Base Capital cost at the beginning of Control Period (i.e. as on 01-04-2009) shall be Rs. 525 lakh/MW towards power plant, of which Rs. 2 lakh per MW is for connectivity charges payable to Rajasthan Rajya Vidyut Prasaran Nigam Ltd. Base Capital Cost shall include Rs 15 lakh/MW towards cost of wind energy evacuation upto and including pooling station and Rs 2 lakh/MW payable to RVPN for interconnection. Wind Energy Developer shall be responsible for development of evacuation and dedicated transmission arrangement upto pooling station. RVPN/transmission licensee be responsible for development of evacuation system beyond pooling stations till the nearest Grid sub-station. Alternatively if Wind Energy Developer wants to develop the evacuation system beyond Pooling Station upto Grid Substation, the Commission separately determines the transmission tariff for the same on case-to-case basis.

Indexation formula as outlined under Regulation 85 shall be applicable for determining tariff for the plants commissioned in each subsequent year during the Control Period.

(ii) **CUF**

21% (for Jaisalmer, Jodhpur and Barmer districts) and;
20% for other districts

(iii) **De-ration in CUF** De-ration in plant load factor/capacity utilization factor shall be @1.25% of CUF from 6th, 10th, 14th & 18th year.

(iv) **O&M Expenses:**
For Power Plant: 1.25% of Base Capital Cost
For transmission lines: 3% of cost of transmission line

(v) **Project Life:** As defined under 'Useful Life'

(vi) **Depreciation:** As per Regulation 23 and Appendix-1

- **Regulation no. 89: Grid Connectivity**

(1) Capacity augmentation of a substation and backup transmission system for power evacuation to the load centre shall be planned and carried out by the State Transmission Utility (STU) as per investment plan approved by the Commission.

For this purpose, STU prepare a perspective plan for power evacuation from RE power stations proposed to be set up in the next 5 years. Such plan be revised every year and be submitted to the Commission each year by 30th September, along with estimated cost.

(2) The following grid connectivity charges be paid by the RE power producer to the STU

a) Wind & biomass power plants : Rs.2 lakh per MW

- **Regulation no 90. Other Charges**

(3) **Transmission & wheeling charges**
In case of third party sale or for captive use both within the State, the transmission & the wheeling charges be recovered in cash and in kind as follows:

(a) The transmission charges (in cash) applicable to RES power stations be half (i.e. 50%) of the transmission charges, specified by the Commission for open access consumer. However, where distribution licensee network below 132 kV level is utilized, the wheeling charges (in cash) applicable to RES power stations, be 50% of normal charges, as applicable & specified for 33 kV by the Commission, irrespective of the voltage at which electricity is supplied.

(b) These charges (in kind) i.e. transmission & wheeling losses shall be as detailed at regulation 91.

Provided, in case of Power Purchase Agreements executed and plants commissioned upto 31.03.2007, under the State Government policies specified in regulation 82, the wheeling charges as per policy shall be applicable as for transmission and wheeling charges (in cash and kind) as specified above unless RE power plant opts otherwise.

(4) **State Load Dispatch Centre-Fee & Charges:**
SLDC fee & charges shall be as specified in RERC
(Levy of fee and charges by the State Load Dispatch Centre) Regulations, 2004

- **Regulation no. 92. Banking**

1. Energy shall be allowed to be banked at consumption end within the State only.
Period of banking;

(a) In respect of third party sale and/or captive use of non firm energy, the banking and drawl shall be on six monthly basis i.e. April to September and October to March.

However, during the months of December, January & February utilization of the banked energy shall not be permitted.

3. Energy accounting and treatment of banked energy at consumption end within the State in case of Non-Firm RE power Sources be as hereunder;

(a) Available energy at the beginning of any particular month shall be the sum of banked energy carried forward from the previous month including energy banked out of generation during previous month and the delivered energy from the generating station during the previous month after accounting for sale to Discom and wheeled energy to captive or open access consumer adjusted for applicable wheeling losses, as the case may be.

(b) Non-firm RE power station shall intimate to SLDC and concerned distribution licensee on 1st of every month, out of available energy for that particular month, the quantum of energy;

(i) it wishes to bank,

(ii) it wishes to distribute amongst third party and

(iii)it wishes to captive use during that month out of available energy for that particular month. Where no such intimation is received on or before 1st of the month the intimation last received become applicable for the month. Where no such intimation is received on or before 1st of the month the intimation last received become applicable for the month.

(c) The unutilized available energy and the banked energy shall be considered as banked energy as per sub regulation 3(a) above and shall be carried forwarded for the next month.

4. In case, the energy drawl from the grid is more than the sum of energy banked wherever applicable and energy generated during any month, upon adjustment for applicable wheeling losses, the treatment of such excess energy drawl shall be in accordance with RERC (Terms and Conditions of Open Access) Regulations.

(5) Payment of unutilized banked energy adjusted for applicable wheeling losses shall be settled with RE power generation in the month of April and October of each financial year at the rate of 60% of energy charges including fuel surcharge (if any) applicable for Large Industrial Power tariff.

Extracts from Rajasthan Electricity Regulatory Commission Jaipur, Draft Order, available on WEB portal of RERC for suggestions/comments by 2nd July, 2012.

In the matter of determination of generic tariff for the sale of electricity from the wind power plant in the state to distribution Licensee for Fiscal Year 2012-13.

12 As all reasonable costs and returns are being allowed to be recovered through the tariff, therefore, any policy support by way of capital subsidy/Capital Finance Assistance (CFA), higher depreciation benefit of Generation Based Incentive (GBI), which becomes available to the developer/generator needs to be passed on the utilities.

13. Earlier, the benefit of Accelerated Depreciation of 80% was being extended to Wind power plant under Income Tax Act. However, recently, vide GOI Notification no. 15/2012 {F. No. 149/21/2010-SO (TPL)} S.O.694 dated 30.03.12; this depreciation has been restricted to 15% for wind Power Plant installed after 31.03.12. However, in addition to this, an additional depreciation of 20% has been allowed to the wind power projects during the first year in a recent Amendment in the Finance Act.

Extracts from IREDA

MNRE has announced the Generation Based Incentive (GBI) for grid Interactive Wind Power Projects commissioned after 17.12.2009

(i) Companies shall be allowed to avail either Accelerated Depreciation or GBI but not both.

- **Eligibility for availing GBI:**
- The claim for GBI would be applicable for those power producers who have Wind Turbines commissioned after 17.12.2009. The scheme is however limited to a capacity of first 4000 MW commissioned through GBI on or before 31.03.12.
- The incentive would be available for grid connected wind power projects set up for sale of electricity to grid, at a tariff notified by SERC and./or State Govt. and also for Captive Wind Power Projects including Group Captive to the extent of sale of electricity to the grid.
- Exclusion: GBI would not be available to any wind power project selling power to third party, (viz. merchant power plants) Note:- As per the latest information gathered from IRADA, GBI and AD are withdrawn after the year. 2011-12

Extracts from CERC Feb 2012

Chapter 1: General Principles

- Control Period or Review Period, The Control Period or Review Period under these regulations shall be of five years, of which the first year shall be the financial year 2012-13.

- **Tariff Period:** The Tariff Period for Renewable Energy power projects except in case of Small hydro projects below 5 MW, Solar PV, Solar thermal, Biomass Gasifies and Biogas based power projects shall be for a minimum period of thirteen (13) years.

- **Tariff Design:** The generic tariff shall be determined on levellised basis for the Tariff Period. Provided that for renewable energy technologies having single part tariff with two components, tariff shall be determined on levellised basis considering the year of commissioning of the project for fixed cost component while the fuel cost component shall be specified on year of operation basis.
- For the purpose of levellised tariff computation, the discount factor equivalent to Post Tax weighted average cost of capital shall be considered.
- Levellisation shall be carried out for the 'useful life' of the Renewable Energy project while Tariff shall be specified for the period equivalent to 'Tariff Period'.

- Dispatch principles for electricity generated from Renewable Energy Sources:

- All renewable energy power plants, except for biomass power plants with installed capacity of 10 MW and above and non-fossil fuel based cogeneration plants, shall be treated as 'MUST RUN' power plants and shall not be subjected to 'merit order dispatch' principles.

- Wind power generation plants where the sum of generation capacity of such plants connected at the connection point to the transmission or distribution system is 10 MW and above and connection point is 33 KV and above shall be subjected to scheduling and despatch code as specified under Indian Electricity Grid Code (IEGC) -2010, as amended from time to time.

Chapter-2: Financial Principle

- **Sharing of CDM Benefits**

(1) The proceeds of carbon credit from approved CDM project shall be shared between generating company and concerned beneficiaries in the following manner, namely

a) 100% of the gross proceeds on account of CDM benefit to be retained by the project developer in the first year after the date of commercial operation of the generating station;

b) In the second year, the share of the beneficiaries shall be 10% which shall be progressively increased by 10% every year till it reaches 50%, where after the proceeds shall be shared in equal proportion, by the generating company and the beneficiaries.

- **Subsidy or incentive by the Central / State Government**

The Commission shall take into consideration any incentive or subsidy offered by the Central or State Government, including accelerated depreciation benefit if availed by the generating company, for the renewable energy power plants while determining the tariff under these Regulations.

Provided that the following principles shall be considered for ascertaining income tax benefit on account of accelerated depreciation, if availed, for the purpose of tariff determination:

i) Assessment of benefit shall be based on normative capital cost, accelerated depreciation rate as per relevant provisions under Income Tax Act and corporate income tax rate.

ii) Capitalization of RE projects during second half of the fiscal year. Per unit benefit shall be derived on levellised basis at discount factor equivalent to Post Tax weighted average cost of capital.

- **Taxes and Duties**

Tariff determined under these regulations shall be exclusive of taxes and duties as may be levied by the appropriate Government:

Provided that the taxes and duties levied by the appropriate Government shall be allowed as pass through on actual incurred basis.

Chapter-3: Technological Specific Parameters for Wind Energy

- **Capacity Utilization Factor (CUF)**

(1) CUF norms for this control period shall be as follows:

Annual Mean Wind Power Density (W/m2)	**CUF**
Upto 200	20%
201-250	22%
251-300	25%
301-400	30%
> 400	32%

(2) The annual mean wind power density specified in sub-regulation (1) above shall be measured at 80 meter hub-height.

(3) For the purpose of classification of wind energy project into particular wind zone class, as per MNRE guidelines for wind measurement, wind mast either put-up by C-WET or a private developer and validated by C-WET would be normally extended 10 km from the mast-point to all directions for uniform terrain and limited to appropriate distant in complex terrain with regard to complexity of the site. Based on such validation by C-WET, State Nodal Agency should certify zoning of the proposed wind farm complex.

4 Financial Model

4.1 Introduction-

Financial models/regulations issued by various regulatory bodies like Central Electricity Regulatory Commission (CERC), state regulatory commissions Rajasthan Electricity Regulatory Commission (RERC) as well as project developers have been studied. For developing financial appraisal models, the guidelines issued by CERC and RERC have generally been followed.

While preparing the financial appraisal model for this project, guidelines issued by RERC in general and in particular, CERC & Rajasthan Renewable Energy Corporation Limited (RRECL) have been followed. The model has been devised for generic power plant and accordingly the tariff calculated is Rajasthan Feed in tariff. A brief about various parameters along with the background/basis of the values assumed in the financial model are elaborated below-

4.2 Capital Cost-

As per RERC's Renewable Energy (RE) Tariff Regulations capital cost calculated for Wind Power Plant includes evacuation infrastructure up to interconnection point. It is inclusive of -

- Wind turbine generator
- Its auxiliaries
- land cost
- Site development charges
- Civil works
- Transportation charges
- Evacuation cost up to inter-connection point(11/33 KV or 11/66 KV Substation & associated feeder for power evacuation)
- Financing charges.

CERC have proposed the normative capital cost for FY 2015-16 works out to be Rs 579.00 Lakh/MW, which is inclusive of the cost of transmission system including pooling station upto the interconnection point and also includes of Rs 2.00 Lakh/MW for grid connectivity charges payable to Transmission licensee for the FY 2015-16.

4.3 Useful Life-

Useful Life in relation to a unit of generation station including evacuation system shall mean the duration from the date of commercial operation (COD) of such generation facility.

CERC and RERC have taken the useful life of Wind Power plant as 25 yrs

4.4 Debt/Loan or Equity ratio-

CERC and RERC as per RE Regulations have considered the debt-equity ratio as 70:30.
Loan/ debt@ 70% of Capital Cost - Rs 405.30 lacs
Equity @ 30 % of Capital Cost – Rs 174 lacs

4.5 Loan Tenure and Interest rate-

Loan Tenure: - For the repayment of debt. /loan amount, tenure of 12 years has been suggested by RERC. Interest Rate as 13%.

4.6Income Tax-

As Per RERC, following assumptions are considered:-

- Income Tax (For yr 11 to 25) 30.90%
- MAT Rate (for Yr 1) - 20.39%
- MAT Rate (for yr-2 to Yr 10) 19.06%
- 80 IA Benefits- Considered

4.7Depreciation Rate-

RERC defines the value base for the purpose of depreciation to be the Capital Cost of the asset. The Salvage value of the asset shall be considered as 10% and depreciation shall be allowed up to maximum of 90% of the Capital Cost of the asset. the rate of the depreciation for the first 12 years has been considered as 5.83% of the capital cost per annum and from 13th year onwards, the remaining depreciable value has been spread over the balance useful life of the wind power plant and transmission system.

4.8Operation and Maintenance-

- Operation and maintenance expenses shall comprise repair and maintenance(R&M), establishment including employee expenses, and administrative and general expenses.
- RERC has taken for FY 2015-16 as RS 8.33 Lakh/MW. Further, the O&M Expenses have been escalated @ 5.85% over the tariff period for computation of the levellised tariff, for the plants to be commissioned in FY 2015-16.

4.9Capacity Utilization factor(CUF)-

Capacity factor is a way to measure the productivity of a wind turbine. It compares the plant's actual production over a period of time with the amount of power the plant would have produced if it runs at the full capacity for the same amount of time.

- **As per RERC CUF varies as -**

CUF: 21% (for Jaisalmer, Jodhpur and Barmer district) and;
20% for other districts

4.10 Interest on Working Capital –

Interest rate on working capital for Wind Power Plants has been taken as 250 basis points higher than the average of SBI Base rate prevalent during first six months of FY 14-15, which works out to be 12.50% (=10.00%+2.50%) Accordingly, a rate of 12.50% has been taken as interest rate on working capital requirements.

4.11 Return on Equity-

Return on Equity has been computed by grossing up the base rate of 16% with tax rate equivalent to Minimum Alternate Tax (MAT) for first 10 years from COD and normal tax rate for remaining years of the project life. In line with the practice followed during the previous control period, the MAT rate of 20.39% (= 18.5% MAT rate + 7% surcharge + 3% education cess) has been considered for first year and a MAT rate of 19.06% (= 18.5% MAT rate + 3% education cess) has been considered for remaining 9 years of the first 10 years. For remaining 15 years of plant life (also equal to useful life), the normal tax rate of 30.90% (= 30% tax rate + 3% education cess) has been applied for grossing up of the base rate of Return on Equity.

From the above parameters the levellised feed in tariff may be calculated as under-

TARIFF FOR WIND POWER PLANTS LOCATED IN JAISALMER,BARMER & JODHPUR DISTRICTS FY 2015-16

(a) Assumptions Wind Energy Project

SN	Assumption Head	Sub-Head	Sub-Head-II	Unit	
1	Power Generation				
		Capacity			
			Installesd Power generation Capacity	MW	1
			Capacity Utilisation Factor	%	21
			Deration Factor	%	1.25
			Useful Life	Years	25
2	Project Cost				
		Capital Cost	inc Land,Trans &Connectivity charges		579
			(Rs 2 Lacs)Power Plant Cost +	Rs Lakhs Per MW	577
			Transmission charges Coonectivity charges		2
3	Source of Fund				
		Debt:Equity	Debt	%	70
			Equity	%	30
			Total debt Amount	Rs Lakhs Per MW	405
			Total equity amount	Rs Lakhs Per MW	174
		Funding Option (I)			
			Loan Component	Rs lakh	405.3
			Moratorium Period	Years	0
			Repayment Period (Incl Moratorium)	Years	10
			Interest Rate	%	13.00%
			Loan Repayment Per Annum		33.77
		Funding Option (II)			
			Equity amount	Rs. Lakh	173.7
			Weighted average of ROE		16
			Discount rate		10.89%
4	Financial assumption				
		Fiscal assumptions			
			Income tax	%	30.9
			Mat Rate (for first 10 year)	%	20.39
			80 IA Benefits	Yes/No	Yes
		depreciation			
			Depreciation rate for 1st 12 years	%	5.83

			Depreciation rate for 11th year onwards	%	1.33
5	Working capital				
		For Fixed Charges			
		O&M Charges		Month	1
		Maintenance spares	% of O&M expenses		15%
		Receivable for debtor		Month	1.5
		For Variable charges			
		Interest on working Capital		%	12.5
6	Operation & Maintenance				
		Power Plant		Rs lakh/MW	8.3
		Total O&M expenses escalation		% per annum	5.85

Unit Generation	Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Deration	%	0%	0%	0%	0%	0%	1.25%	1.25%	1.25%	1.25%	1.25%	2.50%	2.50%	2.50%	2.50%	2.50%	3.75%	3.75%	3.75%	3.75%	3.75%	5%	5%	5%	5%	5%
Installed capacity	MW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gross/Net Genetaion	MU	1.84	1.84	1.84	1.84	1.84	1.82	1.82	1.82	1.82	1.82	1.79	1.79	1.79	1.79	1.79	1.77	1.77	1.77	1.77	1.77	1.75	1.75	1.75	1.75	1.75
Fixed Cost	Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
O&M expenses	Rs Lakh	8.3	8.79	9.30	9.84	10.42	11.03	11.67	12.36	13.08	13.85	14.66	15.51	16.4	17.4	18.4	19.5	20.6	21.8	23.1	24.4	25.9	27.4	29.0	30.7	32.5
Depreciation	Rs Lakh	33.77	33.77	33.77	33.77	33.77	33.77	33.77	33.77	33.77	33.77	33.77	33.77	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9
Interest on term loan	Rs Lakh	50.49	46.1	41.71	37.32	32.93	28.54	24.15	19.76	15.37	10.98	6.59	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest on working Capital	Rs Lakh	2.27	2.21	2.17	2.12	2.08	2.04	2.00	1.96	1.92	1.89	1.95	1.92	1.53	1.57	1.62	1.67	1.72	1.78	1.83	1.90	1.96	2.03	2.10	2.18	2.26
Return on Equity	Rs Lakh	34.91	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	40.22	40.22	40.22	40.22	40.22	40.22	40.22	40.22	40.22	40.22	40.22	40.22	40.22	40.22	40.22
Total fixed cost	Rs Lakh	129.74	125.20	121.28	117.39	113.53	109.71	105.93	102.18	98.47	94.82	97.19	93.62	67.08	68.08	69.15	70.27	71.46	72.73	74.05	75.48	76.97	78.55	80.22	82.00	83.87

Levelised tariff corresponding to useful life

Per unit cost of generation	Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
O&M Expenses	Rs/Kwh	0.451	0.48	0.506	0.535	0.566	0.607	0.643	0.680	0.720	0.762	0.817	0.865	0.915	0.969	1.026	1.100	1.164	1.232	1.304	1.381	1.461	1.567	1.659	1.756	1.859
Depreciation	Rs/Kwh	1.84	1.84	1.84	1.84	1.84	1.86	1.86	1.86	1.88	1.86	1.88	1.88	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.51	0.51	0.51	0.51	0.51
Interest on term loan	Rs/Kwh	2.74	2.51	2.27	2.03	1.79	1.57	1.33	1.09	0.85	0.60	0.37	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working Capital	Rs/Kwh	0.123	0.120	0.118	0.115	0.113	0.112	0.110	0.108	0.106	0.104	0.109	0.107	0.085	0.088	0.090	0.094	0.097	0.101	0.103	0.107	0.112	0.116	0.120	0.125	0.129
Return on Equity	Rs/Kwh	1.90	1.87	1.87	1.87	1.87	1.89	1.89	1.89	1.89	1.89	2.24	2.24	2.24	2.24	2.24	2.27	2.27	2.27	2.27	2.27	2.30	2.30	2.30	2.30	2.30
Total cost of Generation	Rs/Kwh	7.05	6.81	6.59	6.38	6.17	6.04	5.83	5.62	5.42	5.22	5.42	5.22	3.74	3.80	3.86	3.97	4.04	4.11	4.18	4.26	4.40	4.49	4.59	4.69	4.80

Levellised tariff	5.74

4.12 Conclusion

Wind energy is becoming very important in the energy mix of the country. This trend will accelerate in the coming years due to reasons of India's pursuit of energy security, issues related to climate change, new technologies like bigger capacity turbines, and gradual depletion of fossil fuels and their price volatility. Globally, wind energy, along with other renewable energy technologies, is the new investment destination. This sector has continued to show robust growth world over, which is evident in the acceleration in investment flows into the sector.

One of the biggest barriers in the accelerated development of the wind energy is the lack of basic understanding and knowledge about the complex procedure of project development. The discrepancies in the procedures followed in different states of India add to these difficulties. This study has tried to give an overview of project development cycle for wind power project implementation.

Initially, the report guides the investors and developers in project and financial planning. The aspects that the managers should take into consideration while project planning is indicated which can help the managers to comprehensively plan the project so as to minimise the difficulties in the later parts of the project.