

**ASSESSMENT OF INVESTMENT CLIMATE**  
**FOR**  
**WIND POWER DEVELOPMENT IN INDIA**  
**FOR**  
**INDIAN RENEWABLE ENERGY DEVELOPMENT AGENCY (IREDA)**  
**NEW DELHI**



**PREPARED BY**



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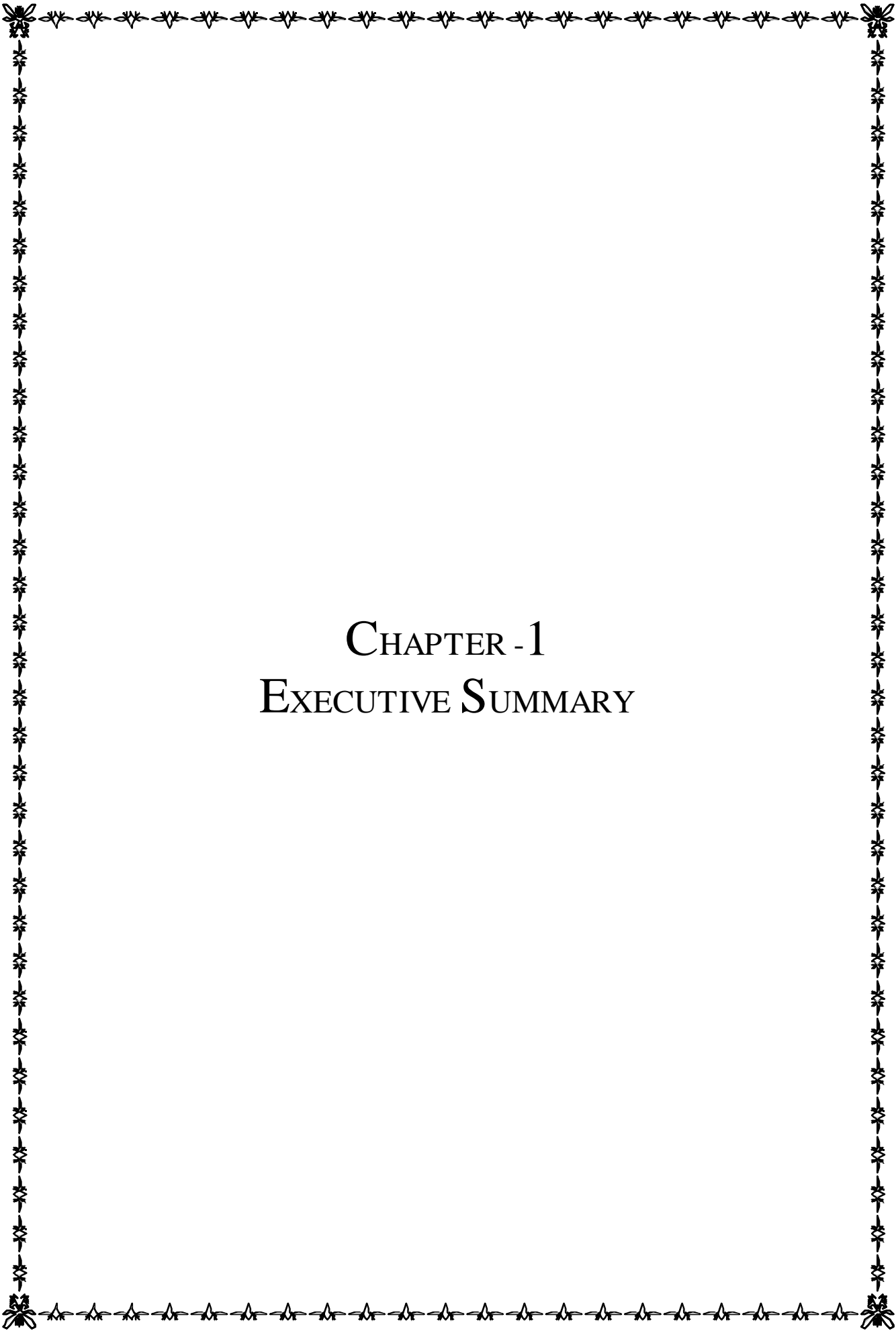
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CHAPTER -1  
EXECUTIVE SUMMARY

# CHAPTER – 1

## EXECUTIVE SUMMARY

1.1 India's Power Sector is a concurrent subject where both Central and State Governments have a role to play.

For Generation and Transmission of Electricity both Central and State Agencies active role but Distribution of Electricity is primarily a State subject.

Regarding State level issues, Govt. of India can only issue guidelines and/or declare Central assistance but cannot force a decision on the State.

1.2 The Power Sector scenario in seven major states – where Wind Power Projects are being implemented is as below.

**TABLE : T-1-1**  
**Wind Power Scenario as on 31.03.2011**

State	Total installed capacity (MW)	Shortage in terms of	
		Peak demand	Energy
Andhra Pradesh	15035.58	4.6%	3.2%
Gujarat	15722.65	7.8%	5.7%
Karnataka	11546.14	7.3%	7.6%
Madhya Pradesh	8381.34	8.7%	20.2%
Maharashtra	22645.29	18.1%	16.6%
Rajasthan	8975.10	3.7%	0.9%
Tamil Nadu	15515.43	11.0%	6.5%

The country-wide installed capacity as on 31<sup>st</sup> March'2011 is :

Thermal	:	1,12,824.48 MW
Hydro	:	37,567.40 MW
Renewable Energy	:	18,454.52 MW
Nuclear	:	4780.00 MW
<b>Total</b>		<b>1,73,626.40 MW</b>

(Source : C.E.A.)

- 1.3 In view of huge shortage – which is likely to go up further with increase in GDP growth rate, the nation has ambitious plan to increase capacity addition urgently. It is planned to add 83000 MW & 100000 MW during 12<sup>th</sup> and 13<sup>th</sup> plan period.

In immediate future – the dependence on coal based power generation would further increase.

In consideration of limited fossil fuel stock, imminent increase in cost of fossil fuel based energy and likely damage to environment, Govt. of India (GoI) has attached high importance on harnessing of Renewable Energy (RE) Sources.

The Central Govt. has an independent exclusive Ministry of New & Renewable Energy (MNRE) to promote and coordinate growth of the sector all over the country.

The GOI has also announced a National Action Plan on Climate Change (NAPCC) to produce 5% of energy requirement in year 2010-11 through RE sources and this should increase by 1% every year.

- 1.4 With continuous support and assistance, the RE sector has been growing during last two decades and out of 19974 MW installed capacity, Wind Power Projects (WPP) account for 14157 MW as on 31<sup>st</sup> March'2011. The total potential in Wind Power Sector is estimated to be more than 49130 MW.

- 1.5 To encourage RE Sector and more particularly Wind Power Sector – Regulatory measures have been introduced through enactment of Electricity Act 2003.

The Central Electricity Regulatory Commission (CERC) and a large number of State Electricity Regulatory Commissions (SERCs) have brought out regulations to determine cost plus tariff and have set down terms for generation and utilization of electricity produced by WPPs.

- 1.6 Through pro-active interventions at various levels and creation of State Nodal Agencies (SNA), the Wind Power Sector has registered continuous growth both in terms of manufacturing capability and investment – largely by private sector in generation and sale of electricity produced by Wind Electric Generators (WEGs).

- 1.7 Reasonably good wind resource has been identified in Seven major states i.e. Andhra Pradesh (AP), Gujarat, Karnataka, Madhya Pradesh (M.P.), Maharashtra, Rajasthan and Tamil Nadu – where growth is taking place continuously.

In three other states of Kerala, Orissa and West Bengal, windy sites have been identified and regulations have been introduced but because of limited potential – not much of growth has taken place.

- 1.8 The Financial Incentive Policy as declared by GoI in the form of Tax benefit through Accelerated Depreciation (AD) attracted major investment by profit earning companies.

This however created an impression that WEGs are being used more as tax saving device rather than electricity generating units.

Lately GoI has declared a modest Generation Base Incentive (GBI) in lieu of A.D. to attract Independent Power Projects (IPP). With availability of WEGs with proven technology, long term feed in Tariff declared by SERCs, benefit through Clean Development Mechanism (CDM) and now GBI, a lot of IPPs have made investment and the potential appears to be quite high.

- 1.9 Renewable Energy Certificate (REC) scheme has been launched in India. The selling option through Renewable Energy Certificate is explained in Chapter-3 para 3.1.2. The REC scheme allows another revenue model to an investor. The Central Electricity Regulatory Commission (CERC) has notified the Regulation on Renewable Energy Certificate (REC) on 14th January 2010. Trading of REC began at IEX New Delhi and IPEX Mumbai from March 2011. The price of REC is going to be dependent on how strictly the obligated entities meet their Renewable Purchase Obligation and how strictly the concerned Regulatory Commissions enforce the fulfilment of RPO in their state. The penalty mechanism for non fulfilment of RPO & quantum of RPO in various states to be declared by Regulatory Commissions from time to time is also going to play a big role in making the REC scheme a success in motivating the investors.
- 1.10 To facilitate investment by IPPs, MNRE considered it prudent to make available a comprehensive document which should provide all necessary information to IPPs and more particularly to the IPPs from foreign countries.

The Financing arm of MNRE – Indian Renewable Energy Development Agency (IREDA) took the responsibility and assigned the task of preparation of Document to M/s Consolidated Energy Consultants Limited (CECL), Bhopal – a highly reputed organization with more than two decades of experience in the Wind Power Sector.

- 1.11 CECL has rich experience on entire technical and financial aspects of Wind Power Sector and has a strong information base through publication of eleventh editions of a comprehensive Directory on Wind Power.

To conduct this study and for preparation of the Document – CECL has personally interviewed a large number of stake holders to collect and compile relevant information besides using their own information base. .

The study has covered primarily seven major Wind Power States which portrays the country wide scenario.

1.12 In the Second Chapter of this report, the role of GOI, MNRE and other Central Govt. Agencies/Department have been explained.

MNRE along with its associates – IREDA and Centre for Wind Energy Technology (C-WET) have played pioneering role.

The State agencies generally follow the guideline issued by MNRE with of course some exceptions.

Recently the Central Electricity Regulatory Commission (CERC) has played a very pro-active role in formulating vital regulations.

1.13 The role of State Electricity Regulatory Commissions (SERCs) in terms of tariff fixation and clearly defining other necessary terms and conditions relevant for healthy growth have been summarized in Chapter-3.

The comparative most critical issues as determined by SERCs are provided in Table : T-1-2 below:

**TABLE : T-1-2**  
**Critical Issues as Determined by SERCs**

State	Tariff	Period	RPO	CDM Sharing
Andhra Pradesh	Rs. 3.50	Up to 31.03.14	5%	90% to developer in first year.
Gujarat	Rs. 3.56	25 years	5% in 11-12 5.5% in 12-13 for wind	100% to developer to reduce by 10% every year from 2 <sup>nd</sup> year till the share becomes equal
Karnataka	Rs. 3.70	10 years	7 to 10% in diff. DISCOMs for non solar	-do-
Madhya Pradesh	Rs. 4.35	25 years	2.1% in 11-12 to 6% in 14-15 for non solar	-do-
Maharashtra	Varying from Rs. 3.58 to Rs. 5.37	25 Years	6.75% in 11-12 to 8.5% in 13-14 for non solar	-do-
Rajasthan	Rs.4.22 and Rs.4.44	25 years	7.5%in 11-12 for Wind	-do-
Tamil Nadu	Rs. 3.39	20 years	9%in 11-12 for non solar	-do-



- 1.14 The procedures to follow and the role of State Nodal Agency (SNA) are summarized in Chapter-4 along with mention of constraints / limitations.

Based on critical parameters the comparative matrix is provided in Table : T-1-3 below:

**TABLE : T-1-3**  
**Comparative Matrix on Critical Parameters**

State	Attitude/ Procedure	Wind Resource	Potential	Tariff	Land Issues	Grid Availability	REC + APPC
Andhra Pradesh	C	B	B	C	B	A	B
Gujarat	A	B	A	C	B	B	A
Karnataka	B	A	A	B	C	B	B
Madhya Pradesh	C	C	C	A	B	B	C
Maharashtra	B	B	B	A	C	B	B
Rajasthan	A	C	B	A	A	B	B
Tamil Nadu	A	A	B	C	A	C	A

Where - **A: Very Good      B: Good      C: Not favourable**

- 1.15 State-wise identified wind resource and quality of wind have been analyzed and indicated in Chapter-5 and produced in Table : T-1-4 below:

**TABLE : T-1-4**  
**Analyzed Wind Power Density**

(As on 31.03.2011)

State	Wind Power Density (WPD) range W/m <sup>2</sup> and no. of Stations				Estimated Potential in MW
	200-250	251 to 300	301-350	351 and above	
Andhra Pradesh	15	11	5	4	5394
Gujarat	27	8	2	3	10609
Karnataka	7	8	3	8	8591
Madhya Pradesh	3	3	-	1	920
Maharashtra	18	11	4	-	5439
Rajasthan	5	3	-	-	5005
Tamil Nadu	8	6	9	24	5374

(Source : C-WET & MNRE)

The likely capacity addition in next 3 years have been estimated on optimistic and conservative basis—based on projections indicated by major WEG manufacturers.

The State of Tamil Nadu holds a major potential of new capacity addition in the range of 1000-2000 MW through Re-powering of old windfarm projects.

- 1.16 Technical particulars of WEG Models now available have been summarized and provided in Chapter-6.

The past performance and growth of major WEG manufacturers have also been provided in Chapter-6.

The steps initiated by major manufacturers to enhance performance efficiency and cost reduction have been summarized.

The constraints/barriers faced by Manufacturers and possible remedial measures expected by them have also been indicated.

All manufacturers are quite worried about availability of Forest land and socio-political issues related to private land.

Recently at Govt. of India level serious discussions are going on regarding acquisition of private land. The issue largely considers acquisition of private land by Government where it's considered that the land owner should be paid a regular monthly/annually compensation besides one time compensation given during acquisition.

The land acquisition bill however does not consider the issue involved in sale of land by a private party to another private party.

Grid evacuation facility appears to be major hurdle and they expect Central intervention to provide financial support to State utilities.

To give a market boost and to particularly attract IPPs – all of them feel that the GBI should be substantially increased.

- 1.17 Through personal interview of a few existing IPP owners and based on CECL's own experience of providing consultancy services to some new IPP owners, their perception of risk and constraints related to project implementation and financing have been summarized and provided in Chapter-7.

They are logically quite worried about validity of energy estimation as provided by WEG manufacturers.

They are also concerned about likely availability of WEGs in near future in view of inordinate delay in getting forest land and evacuation facility.

High cost of debt is also a problem.

All of them feel that unless the GBI is increased substantially – the projects shall not be viable and bankable particularly in view of the ground reality that sites now being identified have poor wind resource.

In the draft for 12<sup>th</sup> Five year plan MNRE considers GBI at the same level of Rs. 0.50 per kWh and a total budgetary provision of Rs. 475 Crores is proposed.

They are eagerly awaiting an active REC market to ensure timely receipt of dues and better rate for selling the electricity produced.

1.18 So far the project financing on non-recourse basis was provided only by IREDA.

Now however three major banks – SBI, IDBI and ICICI are favourably considering financing of IPP with reasonable terms of slightly longer repayment period as summarized in Chapter-8.

Like the IPP owners, the Banks are also equally worried about the validity of energy estimation. Banker's other concern is regarding the financial health of Discom.

The general perceptions of Bankers are that the REC market should get developed through strict enforcement of RPO and the GBI benefit must be increased substantially.

1.19 So far all IPP Projects have been established in large Wind Power Estates being developed by Manufacturer-Cum-Developers.

Since Manufacturer-Cum-Developers are offering turnkey solutions – majority of constraints and barriers are sorted out only by them.

Even then, the IPP Project owners remain concerned about certain factors which directly affect their project viability and certain other factors which influence project commissioning and subsequent operation.

For selection of State of preference, the IPP owners would typically consider following cardinal issues:

- Wind Resource/CUF
- Tariff (either Feed-in-Tariff or APPC+REC Table : T-9-1)
- Opportunity/Potential

- Payment Regularity
- Attitude/Procedure in the State
- RPO Mandate & Compliance
- Land Issues
- Grid Availability
- Approachability of Sites

All these nine parameters have been analyzed in Chapter-9 and comparative ranking of States is provided in Table : T-1-5 below :

**TABLE : T-1-5  
COMPARATIVE RANKING OF STATES**

S. No.	Factors	Total Marks	A.P.	Gujarat	Karnataka	Maharashtra	M.P.	Rajasthan	Tamil Nadu
1	Wind Resource/CUF	25	22	17	19	16	17	15	25
2	Tariff (APPC + REC)	15	10	14	13	12	9	11	15
3	Opportunity/Potential	15	11	14	12	14	10	13	15
4	Payment Regularity	15	11	14	13	12	11	15	10
5	Attitude/Procedure	10	4	8	7	6	5	9	10
6	RPO Mandate	5	2	3	4	3	2	3	5
7	Land Issues	5	3	4	2	3	4	5	5
8	Grid Availability	5	5	4	3	3	3	4	2
9	Approachability to Site	5	4	4	3	2	4	5	5
	<b>Total Score</b>	<b>100</b>	<b>72</b>	<b>82</b>	<b>76</b>	<b>71</b>	<b>65</b>	<b>80</b>	<b>92</b>
	<b>Ranking</b>		<b>5</b>	<b>2</b>	<b>4</b>	<b>6</b>	<b>7</b>	<b>3</b>	<b>1</b>

1.20 The Barriers/constraints faced by various stake holders along with suggestions provided by them have been analyzed and furnished in Chapter-10.

The issues of major concern and possible remedial measures are provided in Table : T-1-6 as follows :

**TABLE : T-1-6**  
**Issues of Major Concern and Possible Remedial Measures**

Major issues of concern	Suggestive remedial measures
Land availability :	Uniform rate for acquisition, diversion charges and declaration of reasonable Panchayat Tax should be decided by State Govts.
- Private	MNRE may discuss and persuade MoEF to issue clarificatory notification regarding quantum of land actually used, NPV charges payable, Lease rent and Stamp duty payable etc. to bring in clarity and uniformity.
- Forest	State Govt. should create Land Bank for transfer to Forest Department.
Grid Evacuation	Soft loan may be provided to State utility to augment the evacuation facility. States may be asked to avail the fund earmarked by 13 <sup>th</sup> Finance Commission/Clean Energy Fund Development of Master Plan for Network improvement and Inter-State Transfer. Active support of CEA in developing evacuation facility and providing planned budgetary support.
Financial Issues	GBI to be at least Rs. 1.25/ kWh with maximum limit of Rs. 10 mill per MW. If CDM benefit remains available beyond 2012- the GBI can be reduced to Rs.1.00/kWh. Tax Concession Under Section 80 IA should continue beyond March 2011. If GST is introduced, the sale of electricity should be in category of "Zero-tax" and not "Exempted". REC market should be made active through strict enforcement of RPO provisions and reduction of RPO limit should be discouraged.

- 1.21 The Wind Power Sector is poised for high growth and for steady and uniform operation; creation of National Wind Power Corporation may be desirable.

In long term interest – Wind Power Projects should be coordinated with Gas based Power Plants and or Pump – Storage Plants to ensure 100% utilization of pollution free energy generated by WPPs.

- 1.21 Virtually information on all the issues which concern an IPP have been furnished in this comprehensive document and it is expected that all IPP owners shall find the document most useful.

**1.22 Plans of Transmission Companies for Grid Augmentation in Southern Region**

Proposed Work for 400 kV & above Transmission Lines in 2011-12 is provided in enclosed Map as per Plan of CEA. A list of Transmission lines 220 kV and above showing the status of construction of lines in southern Region is provided in **Appendix-B.**

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## CHAPTER -2

### GOVERNMENT POLICY / GUIDELINES

# **CHAPTER – 2**

## **GOVERNMENT POLICY / GUIDE LINES**

- 2.1 Government policy/guide lines applicable to Wind Power Projects set up for sale to Electricity Distribution Licensees and or for sale to third party purchasers, which fall under IPP category, presently prevailing are briefly considered in following paras.

Policies and guide lines of Government of India Ministry of New and Renewable Energy (MNRE) are applicable to all the States. Applicability of State Govt. policy/guide lines is limited to the concerned State. State Govt. policies & guide lines of such States, where significant development has already taken place and which still have a good wind power potential left to be harnessed only are covered.

- 2.2 **Policy & Guide lines of the Ministry of New & Renewable Energy (MNRE), Government of India**

Ministry of New & Renewable Energy (MNRE), New Delhi, has issued Guidelines to concerned Authorities in the States for setting up Wind Power Projects. No objection certificates (NOC) are to be issued to those wind power projects that meet the following requirements:

- 1) Submit Detailed Project Report (DPR), prepared by an independent consultant. The DPR should cover micorsiting for optimum capacity and most suited layout, selection of equipment, capital cost, cost of generation, energy generation, operation and maintenance. The DPR fomart will contain:
  - I) Details of applicants/promoters
  - II) Details of project indicating
    - a) Location
    - b) Wind Resource Data
    - c) Capacity
    - d) Wind Turbine that will be used
    - e) Configuration/array efficiency
    - f) Land requirement & procurement
    - g) Grid interface arrangements
    - h) Cost of the project

- i) Means of financing
  - j) Annual energy output
  - k) Cost of generation
  - l) Utilization of energy generated
  - m) Details of Central/State promotional/fiscal incentives sought to be availed.
- 2) Clearances/NOCs should be provided only for installation at locations having a proven average wind power density of more than 200 W/m<sup>2</sup> at a height of 50m above ground level.

Recently through Circular F. No. 51/55/2011-WE dated 01.08.2011 MNRE has withdrawn the minimum qualifying criteria of 200 W/m<sup>2</sup> at 50 m height.

Now the investor has to satisfy himself about the commercial viability at a particular site.

- 3) The model and manufacturer of wind turbines to be used should be drawn up from the approved list issued by Centre for Wind Energy Technology (CWET) with models of unit capacity 225 kW and above. The latest list is available at the website of CWET having the address:

[http://www.cwet.tn.nic.in/Docu/RLMM\\_Main\\_List\\_dated\\_22\\_06\\_2011.pdf](http://www.cwet.tn.nic.in/Docu/RLMM_Main_List_dated_22_06_2011.pdf) and Addendum-I dated 26.09.2011

- 4) Detailed estimates of annual energy output should be checked by State Nodal Agencies for capital cost and cost of generation.
- 5) Commissioning Certificate is to be given only after the rated capacity has been properly connected to the grid.
- 6) A minimum monthly average power factor of 0.85 has to be achieved at the metering point. All other grid parameters have to be as per duly laid down parameters.
- 7) Detailed monthly performance report submission is mandatory.

### 2.3. **Ministry of New and Renewable Energy Fiscal Incentives for Wind Power Projects**

#### **Direct Taxes:**

- i) Accelerated Depreciation Benefit under Section 32 Rule 5 @ 80% of the project cost on written down method is available from the first year.
- ii) Exemption on income Tax on earnings from the project is available for 10 years under Section 80 1A.



## 2.4 **Generation Based Incentive (GBI)**

Ministry of New and Renewable Energy (MNRE) has introduced Scheme for implementation of Generation Based Incentives (GBI) scheme for Grid Interactive Wind Power Projects to such of the investors who do not avail the benefit of accelerated Depreciation Benefit.

### **Incentive and Duration:**

Under the scheme, a GBI will be provided to wind electricity producers @Rs.0.50 per unit of electricity fed into the grid for a period not less than 4 years and a maximum period of 10 years in parallel with accelerated depreciation on a mutually exclusive manner, with a cap of Rs. 62 lakhs per MW. The total disbursement in a year will not exceed one fourth of the maximum limit of the incentive i.e. Rs.15.50 lakhs per MW during the first four years.

### **Eligibility:**

The GBI will cover grid connected generation from wind power projects set up for sale of electricity to grid at a tariff fixed by SERC and/or State Govt. and also include captive wind power projects, but exclude third party sale, (viz. merchant power plants).

### **Implementation Arrangements:**

The GBI would be implemented through Indian Renewable Energy Development Agency (IREDA).

This incentive is over and above the tariff that may be approved by the State Electricity Regulatory Commissions in various States. In other words, this incentive that is sanctioned by the Union Government to enhance the availability of power to the grid will not be taken into account while fixing tariff by State Regulators.

## 2.5 **National Action Plan for Climate Change**

### **The National Action Plan on Climate Change (NAPCC)**

The National Action Plan on Climate Change (NAPCC) was released by the Prime Minister on 30th June 2008. It outlines a national strategy that aims to enable the country adapt to climate change and enhances the ecological sustainability of India's development path. Relevant Extracts are as follows:

## **Grid Connected Systems**

The Electricity Act, 2003 and the National Tariff Policy, 2006, provide for both the Central Electricity Regulatory Commission (CERC) and the State Electricity Regulatory Commissions (SERC) to prescribe a certain percentage of total power purchased by the grid from renewable based sources. It also prescribes that a preferential tariff may be followed for renewables based power.

The following enhancements in the regulatory/tariffs regime may be considered to help mainstream renewables based sources in the national power system:

- i) A dynamic minimum renewables purchase standard (DMRPS) may be set, with escalation each year till a pre-defined level is reached, at which time the requirements may be revisited. It is suggested that starting 2009-10, the national renewables standard (excluding hydropower with storage capacity in excess of daily peaking capacity, or based on agriculture based renewable resources that are used for human food) may be set at 5% of total grids purchase, to increase by 1% each year for 10 years. SERCs may set higher percentages than this minimum at each point in time.
- ii) Central and state governments may set up a verification mechanism to ensure that the renewables based power is actually procured as per the applicable standard (DMRPS or SERC specified). Appropriate authorities may also issue certificates that procure renewables based power in excess of the national standard. Such certificates may be tradable, to enable utilities falling short to meet their renewables standard obligations. In the event of some utilities still falling short, penalties as may be allowed under the Electricity Act 2003 and rules there under may be considered.
- iii) Procurement of renewables based power by the SEBs/other power utilities should, in so far as the applicable renewables standard (DMRPS or SERC specified) is concerned, be based on competitive bidding, without regard to scheduling, or the tariffs of conventional power (however determined). Further, renewables based power may, over and above the applicable renewables standard, be enabled to compete with conventional generation on equal basis (whether bid tariffs or cost-plus tariffs), without regard to scheduling (i.e. renewables based power supply above the renewables standard should be considered as displacing the marginal conventional peaking capacity). All else being equal, in such cases, the renewables based power should be preferred to the competing conventional power.

## 2.6 Indian Renewable Energy Development Agency (IREDA)

### Financing Guidelines for Wind Energy Projects

Indian Renewable Energy Development Agency (IREDA) is a Non Banking Financial Institution under the Administrative control of Ministry of New & Renewable Energy (MNRE). IREDA's financing guidelines give general eligibility conditions.

According to these guidelines, all types of eligible applicants, who have borrowing powers and power to take as per their charter are eligible to avail financial assistance from IREDA except that:

Institutions/Societies, Individuals, Property concerns and Partnership firms, applicants with accumulated losses, loss making applicants shall be considered for financing only against Bank Guarantee.

## 2.7 Centre for Wind Energy Technology (C-WET)

It is an Autonomous Research & Development Institution established at Chennai by the Ministry of New & Renewable Energy (MNRE), Govt. of India. It has the responsibility to provide complete Scientific and Technical backing to all Stake Holders in the field of Wind Energy. Main objectives of the organisation are briefly as follows:

- To develop & support R&D programmes for reliable and cost effective technology.
- Preparation of Wind Energy density map, Wind Atlas and reference wind data.
- To accord type approval/type certification for Wind Electric Generators for installation & operation in the Country.
- Certification of wind data provided by wind monitoring studies carried out by different Agencies.
- Consultancy services for feasibility studies, due diligence, micro siting & preparation of DPRs through State of Art Software Tools.

## 2.8 Ministry of Environment & Forest Government of India

(No.8-84/2002-FC dated 14.05.2004, dated 10.06.2004, dated 06.04.2005, dated 16.12.2005, dated 22.06.2007 & 20.02.2006)

### **Guidelines for diversion of Forest Land for non-forest purposes under the Forest (Conservation) Act, 1980 – For projects utilizing Wind Energy thereof:**

- Windfarms shall be located at safe distance from areas like National Parks & Sanctuaries, areas of outstanding natural beauty, natural heritage sites, sites of archaeological importance & sites of special scientific interests & other important landscapes.
- Tips of wind turbine blades shall be painted with orange colour to avoid bird hits.
- A safe distance of 300 m shall be maintained from highways and village habitation in locating wind mills.
- Wind mills of capacity less than 500 kW shall not be allowed in forest area. However wind mills of capacity 1 MW should be promoted to ensure optimum use of forest land.
- As an exception “Stand alone” wind mills up to 10 kW off grid shall be allowed in the forest areas to enable electricity supply to remote rural areas.
- Lease period initially shall be for 30 years. Land leased to a developer, within a period of 4 years of Stage-II approval, may be transferred in the name of investor/producer with prior permission of the Central Govt.
- Proposal for forest land required shall include land required for corridors between successive wind mills, statutory buildings, earthing pits, transmission lines & roads including provisions for repose, breast walls, drains, curvature etc.
- Cost benefit analysis of the project is an essential requirement. Details of employment generation should also be given in the proposals.
- Land area of circle of 100 m dia. Shall be provided for installation of wind mast for every 500 ha. A one time payment of Rs.1.00 Lac/Wind mast shall be charged for this permission. The wind mast shall be removed within a period of maximum 2 years.
- A lease rent of Rs.30,000/MW shall be charged from the user agency by the State Govt. as lump sum one time payment for the entire period of lease. This is in addition to charges payable for compensatory afforestation, net present value etc.

- 65% to 70% of leased out area in the windfarm shall be utilised for developing medicinal plant gardens where feasible.
- Soil & moisture conservation measures like contour trenching shall be taken up on the hills supporting wind mills.
- Alignment of roads shall be done by a recognised firm and got approved by the DFO concerned.
- Wind mills to be used shall be approved for use in the Country by MNRE, Govt. of India.

## 2.9 **Government of Andhra Pradesh- Wind Power Policy 2008**

*(GOMS No.48 dated 11.04.2008 as amended vide G.O. No.99 dated 09.09.2008)*

### **Operative Period**

- 5 years from the date of policy unless superseded or modified earlier.

### **Eligible Windfarm**

- Wind Electric Generators (WEGs) to be installed shall be new & of type and specifications approved by C-WET
- Minimum capacity of WEG shall not be less than 225 kW.

### **Tariff**

- Rs.3.50/unit. for up-coming Wind Power Projects set up under this policy. Shall be applicable for a period of 10 years from Commercial Operation Date (COD) subject to approval of APERC. Tariff for the period from 11<sup>th</sup> year to 20<sup>th</sup> year shall be as fixed by APERC. Discom will have the 1<sup>st</sup> right of refusal of power purchase if plants operate after 20<sup>th</sup> year. Tariff beyond 20 years shall be as mutually agreed.

### **Land Allotment**

- To facilitate expeditious execution of project, District Collectors have been authorised to give advance possession of Govt. land subject to payment of the cost as fixed by the Collector as deposit with a written undertaking to pay additional cost if any as required subsequently.

- Govt. land adequate to set up Wind Power Project of capacity 200 MW may be allotted to a Developer. Initially land shall be provided for 100 MW capacity. On its successful completion, land for further 100 MW shall be allotted.

### **Use of Power Produced**

- Power generated and provided by Wind Power Projects may be sold to the Distribution Companies within the State or to a third party purchaser who shall be the HT consumer. In case of sale to utility, PPA will have to be signed with the concerned Discom. In case of sale to third party HT consumer, wheeling agreement has to be signed with A.P. Transco and/or Discom's concerned as per Open Access (OA) Regulations and applicable guidelines issued by APERC from time to time.

### **Duration of PPA & Wheeling Agreements**

- PPA shall be for a period of 20 years as per present norms. Wheeling agreement may be as per OA Regulations.

### **Power Evacuation Facilities**

- Cost of interconnecting the project with grid sub-station shall be borne by the Developer.

### **Wheeling & Banking**

- Wheeling of power for sale to 3<sup>rd</sup> party shall be governed by applicable OA Regulations notified by APERC.
- 3<sup>rd</sup> party purchaser shall be HT consumer.
- Concessional wheeling & transmission charges for sale to 3<sup>rd</sup> party shall be 5% of energy delivered to grid, which is inclusive of T&D loss.
- Banking of energy is not allowed.
- For 3<sup>rd</sup> party purchaser (HT consumer) minimum billing demand shall be 60% of contract demand during the months from June to September.

## **Sharing of Carbon Credits**

- Developer who opts to sell energy to the Discom may be allowed to retain 90% of CDM benefits and pass on 10% to the Discom. This is subject to orders of APERC from time to time.

### **2.10 Government of Gujarat - Wind Power Generation Policy**

*(GR No.EDA-10-2001-3054-B dated 13.06.2007. 1<sup>st</sup> Amendment vide GR No. WIND-II-2008-2321-B dated 07.01.2009 )*

#### **Operative Period**

- Effective from 20.06.2007 up to 30.06.2012. Wind Power Projects installed & commissioned during the period shall be eligible for incentives under these policies for the period of 20 years from the date of commissioning or the life span of WTG whichever is earlier.

#### **Eligible Sites**

- Sites notified by the Gujarat Energy Development Agency (GEDA) and/or any other site identified as potential site within the State by the Developer.

#### **Wheeling of Electricity**

- Wheeling to consumption sites at 66 kV and above:- Transmission charges and transmission loss charges as applicable to normal OA customer

Wheeling to consumption site at voltage below 66 kV:- Transmission charges as applicable to normal OA customer & transmission & wheeling losses @10% of energy fed to grid. Small investors with only one WEG in the State shall be allowed transmission & wheeling losses @7% and transmission charges as applicable to normal OA customer.

Where energy is required to be wheeled to more than 2 locations, the Developer shall pay 5 paise/unit on energy fed to grid to the concerned Discom in addition.

#### **Payment of Electricity Duty**

- In case of 3<sup>rd</sup> party sale, the eligible unit shall have to recover the electricity duty from the purchaser at applicable rates.

## **Sale of Energy**

- Electricity generated and provided by WTGs commissioned on or after 11.08.2009 may be sold to the Discom/GUVNL within the State @Rs.3.56/unit constant for the project life of 25 years. Developers however have to file a petition before the GERC and get the approval for the tariff payable by the Licensee.

## **Third Party Sale**

- Permissible subject to orders of GERC as amended from time to time.

## **Land**

- The Wind Power Projects may be set up on private land or revenue waste land/ GEDA land if available. Allotment of GEDA land on lease shall be done on approval of the co-ordination committee constituted by the Govt.

## **Plant & Machinery**

- Only such WTGs which are new and approved either by the MNRE Govt. of India or by recognised international test houses shall be eligible.

## **Metering of Electricity**

- The interconnection point should be the delivery point of power at the relevant GETCO Sub-station.

## **Reactive Power**

- Tariff for consumption of reactive energy shall be as per the GERC tariff order as amended from time to time.

## **Renewable Purchase Obligations (RPO)**

- 5% of total electricity consumption made in a year in 2011-12 & 5-5% in 2012-13 by the Discom to be procured from Wind based power generation.



### **Penalty for Non-fulfilling RPO**

- Penalty for the quantum of deficit to be decided by Commission will be payable in addition to the forbearance price to be deposited in a separate fund. However in case of genuine difficulty commission may order to carry forward the requirement to next year.

### **Grid Connectivity & Evacuation Facility up to GETCO Sub-station**

- Voltage level for evacuation of wind power shall be 66 kV & above.
- Evacuation facility from the project site to grid sub-station within a range of 100 Km shall be erected by the Developer at his cost. Beyond this limit, GETCO shall develop the facility at its cost.

### **Security Deposit**

- Rs.5.00 lacs/MW payable in the form of B.G. to GETCO which will be confiscated if the project is not commissioned within the specified period which is one year from the date of allotment of transmission capacity for projects up to 100 MW, 1½ years for project capacity of 101 MW to 200 MW, 2 years for projects of 201 MW to 400 MW and 3 years for projects up to 600 MW.

- 2.11 **Government of Karnataka - Karnataka Renewable Energy Policy 2009-14**  
(GO No. EN 354 NCE 2008 dated 19.01.2010 as amended vide Notification No. EN 76 EMC-2/2010 dated 06.05.2010)

### **Operative Period**

- Valid for 5 years from the date of notification up to end the year of 2014

### **Eligible Developers**

- Only such developers who have got the capacity allotment Govt. order are eligible to set up the project.
- It is obligatory to sell the generated electricity to the respective geographical Energy Supply Company (ESCOMS) in which the project is located.

## **Green Energy Fund**

- Green Energy Fund shall be established to facilitate financing for RE projects.

## **Land Policy**

- Surplus land (unused) available with Govt. bodies will be provided to Karnataka Renewable Energy Development Limited (KREDL).
- Purchase of private land by Developers shall be facilitated by suitably amending the applicable laws.
- Forest land identified for RE projects will be considered for allotment by the Karnataka Forest Deptt. under the provisions of Forest Conservation Act (1980) subject to the guidelines of the Ministry of Environment & Forest, Govt. of India.
- KREDL shall develop the land provided at its disposal to facilitate establishment of RE projects.
- KREDL will sub-lease the developed land to developers for a period of 30 years. The lease period will be renewed for 5 years at a time subject to fulfilment of specified conditions.
- Land lease rent will be as per prime lending rate over current market price as on the date of handing over the projects.
- Land allotted to developers cannot be mortgaged.
- Not more than 3 sites shall be provided to a Developer at a time.

## **Consent from Departments & Statutory Clearances**

- KREDL shall obtain consent & statutory clearances from concerned Deptts. for sites developed by them. In case of private land KREDL shall assist the developers in this regard.

## **Implementation of RE Projects**

- RE projects identified by KREDL will be offered for development on public private partnership/BOT mode on developed land ready to set up WPP.

### **Allotment Committee**

- A committee under Chaimanship of Additional Chief Secretary/Principle Secretary, Energy Deptt. will consider allotment of capacity to private entrepreneur.

### **Time Limit for Project Completion**

- 3 years from the date of statutory clearances. KREDL will endeavour to obtain all required statutory clearances within 6 months.

### **Renewable Energy Obligation**

- As per KERC Regulations dated 16<sup>th</sup> March 2011, every Distribution Licensee shall purchase a minimum of electricity ranging from 7% to 10%, specified for each ESCOM from non solar renewable energy sources, of its total procurement during a year.

### **Feed in Tariff**

- As determined by KERC. When plant completes 11 years, have to sell power to ESCOMS on tariff based on variable cost subject to KERC norms.

### **Wheeling of Electricity**

- 5% subject to KERC norms

### **Banking of Electricity**

- Permitted as per KERC norms. Energy banked beyond the prescribed time will be utilised and paid for by the Karnataka Power Transmission Co. Ltd/ Distribution Licensee concerned at tariff applicable as per KERC norms.

### **Power Purchase Agreement**

- To be signed with ESCOMS & witnessed by KERC. The Govt. will assign the PPA to the ESCOMS at the time of allotment.

## **Settlements**

- Transactions shall be settled on monthly basis. Interest at the rate of State Bank of India short term prime lending rate shall be payable for delayed payment beyond a month.

## **Exemption from Demand Cut**

- Exemption of demand cut to the extent of 50% of installed capacity assigned for captive use purpose, will be allowed.

## **Financial Incentives**

- Entry tax & other incentives shall be available to RE generation in accordance with Industrial Policy 2009-10

## **Letter of Credit**

- Facility of LOC shall be provided by the ESCOMS to developer and its cost will be reimbursed to ESCOMs from Green Energy Fund

## **Registration**

- Fees payable under relevant provisions for Karnataka Stamps & Registration Act for registration of various agreements executed by the Developer shall be considered for revision.

## **Benefits under CDM**

- KREDL has been designated as Nodal Agency to assist the Developers to claim CDM benefits

## **Award Scheme**

- RE projects successfully commissioned during the original agreement period will be awarded with a certificate with appreciation by the Govt. and a cash incentive from Green Energy Fund.

## **Local Employment**

- All unskilled/skilled personnel and other non-executives required for execution, operation & maintenance will be local people. Preference will be given to candidates conversant with language & customs in regard to technical man power.

### **2.12 Government of Madhya Pradesh**

*(Notification No.6591-F18-10-XIII-93 dated 17.10.2006 as amended vide order No. F18-10-XIII-93 dated 12.05.2008)*

#### ***Relevant Extracts applicable to Wind Energy Generation***

##### **Operative Period**

- 5 years from the date of notification subject to changes in National Policy.

##### **Eligibility for Incentives under the Policy**

- Projects set up for sale to Distribution Licensee or sale to any HT consumer under 3<sup>rd</sup> party sale scheme as well as for captive use within the State.
- Execution of project shall be commenced only after receiving the permission from the State Govt.
- Permission shall be cancelled if the project execution is not commenced within 3 months from the date of sanction and completed within 15 months.
- WEGs of type & specifications approved by the C-WET shall only be permitted.
- Land use permission will be considered only for such sites which are duly certified by MNRE/C-WET/MPUVN.
- Preferred rating of WEG to be installed in Govt. land shall be 500 kW.

##### **Facilities & Incentives**

- Purchase rate & minimum quantum to be procured by the Distribution Licensees shall be as decided by MPERC.
- Green Energy Fund will be created for facilitation of power generation through non-conventional energy sources.
- NCE based power generation shall be exempted from Open Access charges.

- Facility of wheeling will be available as per wheeling charges decided by MPERC. The Govt. would facilitate subsidy of 4% as per prevailing policy.
- Projects will be eligible for all benefits available to new industries under the Industrial Promotion Policy 2004.
- All expenses towards creation of power evacuation facility shall be borne by the developer.
- 3<sup>rd</sup> party purchaser of wind energy will be allowed the facility of reduction in contract demand.
- Metering equipments as per specification of the Distribution Licensee shall be provided at the project site by the Developers at his cost.
- Reactive energy consumption shall be payable at the rate decided by the MPERC.

### **Land Allotment**

- Govt. land, if available shall be provided for 30 years or for the project life whichever is less on a token premium of Re.1/annum. Govt. land will be allotted to the Energy Department which will grant land use permission.
- Private land shall be acquired by the Govt. and provided to the developer at acquisition cost.
- Transfer of the land use permission to a third party shall be permitted on the same terms & conditions.
- Developer shall be eligible for a rebate of 50% in stamp duty payable for procurement of private land. A BG for an amount equal to 50% of stamp duty valid for 21 months shall be provided which will be en-cashed if the project is not developed.
- Request for allotment of forest land shall be considered by the Forest Deptt. Govt. of M.P. under the guidelines & instructions issued by the Ministry of Environment & Forest, Govt. of India.
- Private parties may carry out wind monitoring studies on sites identified by them with the approval of MPUVN as per the prescribed procedure.

### **Fees payable for Sanction**

- Rs.50,000/MW to be paid with application, which is not refundable. 3 months extension of the specified period for completion may be allowed if justified on payment of a fee of Rs.1.00 Lac/MW.

- Applications in prescribed format to be submitted to MPUVN. Sanction of projects up to 5 MW shall be given by MPUVN & above 5 MW by the Govt.

### **Banking**

- Permitted for a period of a financial year. Consumption of banked energy is subject to approval of Discom. Surplus energy at the end of banking period to be procured by the Discom as per the decision of the MPERC. 2% of banked energy shall be payable as banking charges.

### **2.13 Government of Maharashtra - NCE Policy 2008**

*(GR No. APAU(NCE)-2007/Para.Kra.693/Urja-7 dated 14.10.2008)*

#### ***Relevant Extracts applicable to Wind Energy Generation***

#### **Eligibility for Sanction**

- It is obligatory to sell 50% of electricity to the Distribution Company under a long term agreement at the rate determined by MERC. Remaining 50% shall be sold within the State.
- Benefits under the policy shall be available to only such projects for which infrastructure approval is accorded by the Govt.

#### **Evacuation Arrangement**

- To be constructed with the approval of Transco/Discom by the developer at his cost. 50% of the approved expenditure to be reimbursed out of Green Energy Fund.

#### **Approach Road**

- To be constructed by MEDA out of Green Energy Fund. Repairs/ strengthening of existing roads to be done by developer at his cost.

#### **Encouragement to Co-operative Sector**

- 11% of total share capital of the project shall be paid from Green Energy Fund for projects set up by co-operative institutions.

### **Letter of Credit**

- The Discom shall provide the facility of LOC to the developer & the cost involved to be reimbursed to the Discom out of Green Energy Fund.

### **NOCs**

- NOC from Geology & Mining Deptts. shall be obtained where required.
- NOC from Development Commissioner (Industries) is required for all projects.

### **Octroi/Entry Tax**

- Taxes actually paid shall be reimbursed by MEDA out of Green Energy Fund.

### **Government Land Allotment**

- Govt. land earmarked for industrial use & Govt. barrier land may be provided on rental basis with 30 years lease agreement under usual terms & conditions.

#### **2.14 Government of Rajasthan - NCE Policy**

*(Letter No. F.20(4)Energy/2004 dated 25.10.2004 as amended vide letters dated 10.03.05, 16.07.05, 24.02.06, 30.11.06, 19.01.07 & 27.03.2008)*

#### ***Relevant Extracts applicable to Wind Energy Generation***

#### **Operative Period**

- From the date of notification until superseded or modified. Amendments are effective from the date of issue.

#### **Use of Energy**

- Sale to Distribution Companies, captive use & or sale to 3<sup>rd</sup> party purchaser.

#### **Cap on Energy Procurement by Discoms**

- As specified by Rajasthan Electricity Regulatory Commission (RERC).



### **Power Evacuation Facility**

- Power to be delivered to grid at 33 kV or above.
- A fee of Rs.2.00/MW shall be payable to RVPN/Discom for creation of proper facility to receive power.
- Transmission line from the project site to the grid sub-station to be constructed by the developer at his cost with the approval of RVPN.

### **Wheeling & Banking**

- For projects for which PPAs are signed after 31.03.2007, transmission, wheeling & other charges may be as specified by RERC.
- Banking is permitted for one calendar year. For agreement executed after 31.03.2007, terms & conditions governing banking shall be as approved by RERC.
- Wheeling & banking agreement may be allowed to be assigned on one time basis in each case to other parties after completion of project on payment of Rs.1.00 Lac/application to RREC.

### **Price of Power**

- As determined by RERC.

### **Power Purchase Agreement (PPA)**

- PPA shall be signed for a period of 20 years. On expiry fresh agreement may be signed at mutually agreed rate.
- PPA may be allowed to be assigned to others on one time basis on payment of Rs.1.00 Lacs per application to RREC.

### **Merit Order Despatch**

- Not applicable to Wind Power Project

### **Exemption from Electricity Duty**

- Energy sold to a 3<sup>rd</sup> party will be exempted from payment of ED @50% for a period of 7 years from COD.

### **Government Land for Project**

- Govt. land suitable for development of project may be allotted at concessional rates i.e. 10% of DLC rates.

### **Registration of Application for Project**

- Application to be submitted in prescribed format to RREC with a processing fee of Rs.25,000/MW (w.e.f 01.04.2007). Re-location of project, if justified shall be permitted without any additional charge.

### **Project Sanction**

- After due verification of land availability & approval for evacuation scheme, RREC which will forward the proposal to the State level empowered committee for sanction. Project shall be taken up for execution only after sanction is accorded. Liable to pay a penalty of Rs.5.00 Lacs/MW for violation.

### **Security Deposit & its Forfeiture**

- A refundable security deposit @Rs.5.00/MW (w.e.f. 01.04.2007) shall be payable which shall be forfeited if the project is not completed within the specified time frame. The specified time frame ranges from 6 months for project of 25 MW to 24 months for projects of capacity above 100 MW.
- On application 15 days before the expiry of prescribed period, with convincing reasons acceptable to authorities, the prescribed period may be considered for extension. Fees payable for grant of extension ranges from Rs.50,000/MW for one month to Rs.5,00,000/MW for a period of 3 months.

## **2.15 Government of Tamil Nadu**

Govt. of Tamil Nadu has not issued a formal policy for promotion of power generation based on NCES. Wind Power Projects are being developed as per orders of the State Govt., State Electricity Board & TNERC issued from time to time. Summary of TNERC orders is provided in the Chapter No.3.

## **Project Sanction**

- TNEB accords sanction & grid connectivity approval for wind power projects to be set up in the State.
- Application in prescribed format is to be made to the Chief Engineer (NCES) TNEB, Chennai.

## **Fees Payable**

- Registration fees (non refundable) - Rs.1000/-.
- Consultancy charges per application (irrespective of No. of WEGs) - Rs.10,000/-
- Infrastructure development charges - Rs.30.00 Lacs/MW
- O&M charges per MW/year with 5% escalation every year for the life period (These charges are payable on monthly basis) - Rs.1.60 Lacs/MW/year

## **Sale to Third Party Purchaser**

- TANGEDCO (A Company of TNEB) vide its circular No. (CMD) No.71 dated 28.12.2009 has decided to implement sale of wind energy to 3<sup>rd</sup> party permitted by TNERC in its order No.1 dated 20.03.2009 subject to following conditions.
  - 1) 3<sup>rd</sup> party sale of wind energy is permitted to all HT consumers for which necessary tripartite wheeling agreement has to be signed.
  - 2) 3<sup>rd</sup> party Open Access customers have to pay the Transmission & wheeling charges as per the TNERC orders in force.
  - 3) As like the CPP power, the unutilised wind energy by the 3<sup>rd</sup> party customer shall be treated as lapsed.

**2.16 The list of addresses of concerned officials is provided in Annexure-I.**

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# CHAPTER -3

## REGULATORY COMMISSION

# **CHAPTER – 3**

## **REGULATORY COMMISSION**

### **3.1 REGULATIONS & ORDERS OF CENTRAL & STATE ELECTRICITY REGULATORY COMMISSIONS**

#### **Governing Wind Power Project**

Central Electricity Regulatory Commission (CERC) has notified the Regulations 2009 specifying the terms & conditions for tariff determination from RE sources. Tariff orders determining generic levelised generation tariff for each type of NCE source have been issued by the CERC under these Regulations. The Regulations are applicable for the control period of 3 years from the date of notification ending with the financial year 2011-12. Capital cost of the project is linked to price index variation as per the formula specified. Due to consequent variation in project cost & related other costs like O&M etc., tariff is determined by CERC year to year, which would be applicable to projects commissioned in the period from the date of notification till a new order is issued.

Projects set up in a State & connected to the State power grid are governed by the Regulations and orders passed by the concerned State Electricity Regulatory Commission (SERC). SERCs being empowered under the Act to frame Regulations and determine the tariff for projects set up in the respective States, Regulations & orders of CERC which are not binding on them, are useful as guidelines to SERCs. SERCs which have issued regulations/tariff orders subsequently have taken note of the guidelines and adopted the same where possible.

SERCs in most of the States have specified the Renewable Purchase Obligation (RPO) as a percentage of annual energy consumption made by each Discom in the State. With a view to overcome the possible impediment in growth of wind power generation due to reluctance on the part of Distribution Licensees to procure energy beyond the specified limit, CERC has notified regulations for issue of Renewable Energy Certificate (REC) and also have specified the procedure for issue & sale of these certificates. These regulations envisage projects to be set up in potential State exclusively for obtaining RECs & selling the same through authorised Power Exchanges to the State Utilities and or Open Access consumers who are subject to RPO but not able to meet the same due to non-availability.

Regulations & tariff orders of CERC and of SERCs of such States where significant development of wind power generation has already taken place and which have good wind power potential left to be harnessed are briefly summarised below. The brief is limited to provisions applicable to sale of energy to Distribution Licensees and/or to third party purchasers.

### 3.1.1 CENTRAL ELECTRICITY REGULATORY COMMISSION

#### **Title & date of Order**

CERC Order on petition No. 256/2010 (Suo Motu) dated 09.11.2010 issued on 9<sup>th</sup> November 2010 on Determination of generic levelized generation tariff for the year 2011-12;

#### **Tariff Period**

Applicable to WEGs commissioned in 2011-12 and shall remain valid for the Tariff period of 13 years.

#### **Tariff for procurement of Energy by Utility from New Wind Power Projects**

Applicable to Wind Power Projects commissioned during 2011-12 :

Zone	CUF (%)	Levelized Tariff without considering Acc. Depn.	Levelized Tariff after adjusting for Acc. Depn.
1	20%	5.33	4.53
2	23%	4.63	3.94
3	27%	3.95	3.36
4	30%	3.55	3.02

#### **Agreement Period EPA / EWA**

13 years

#### **Sharing of CDM benefit**

100% to be retained by the developer in the 1<sup>st</sup> year. 10% share to the beneficiary in the 2<sup>nd</sup> year which will increase @10% every year till it reaches 50% after which the benefit shall be equally shared by the developer and the beneficiary (CERC Regulations 2009).

## **Special Conditions**

The Regulations and Tariff Order shall apply in all cases where tariff for generation based on RE Sources is to be determined by the CERC u/s 62 read with Section 79 of the Act. Eligibility criteria for WPP: annual mean Wind Power Density (WPD) of 200 W/m<sup>2</sup> measured at hub height of 50 m and using new WTGs.

## **Settlement Mechanism and Payment Security**

2% rebate for payment through LC; 1% rebate for payment within one month; 1.25% per month surcharge for delay in payment beyond 60 days (CERC Regulation 2009).

## **Evacuation Infrastructure**

Approved capital cost provides for evacuation infrastructure only up to the point of interconnection which is the out going terminals of the isolator on HV side of the pooling sub-station. The CERC Regulations 2009 do not mention about construction of transmission line from the pooling sub-station to the nearest grid sub-station.

## **Capacity Utilization Factor**

As per CERC Regulations 2009.

<u>Zone</u>	<u>WPD (W/m<sup>2</sup>)</u>	<u>CUF (%)</u>
1	200-250	20%
2	250-300	23%
3	300-400	27%
4	Above 400	30%

## **Capital Cost of Project/MW**

Rs.4.9252 Crores (492.52 lakhs) per MW for the FY 2011-12. Capital cost is linked to price indexation formula. Includes evacuation infrastructure cost up to point of interconnection which is the outgoing terminals of isolator on HV side in the pooling sub-station at project site.

## **Debt Equity Ratio**

70 : 30

**Interest on Term Loan**

13.39%

**Loan Repayment Period**

10 years

**Return on Equity**

As per CERC Regulations 2009.

19% Pre Tax per annum for 1<sup>st</sup> 10 years

24% Pre Tax per annum from 11<sup>th</sup> year onwards

**O&M Cost as %age of Project Cost**

Rs. 7.26 lakhs per MW for the year 2011-12.

**Interest on Working Capital**

12.75% for the year 2011-12.

**Duties & Taxes**

As per CERC Regulations 2009, tariff is exclusive of duties and taxes. Taxes and Duties to be allowed as pass through on actual basis.

**Life of the Plant**

25 years

**Depreciation Method and Rate**

As per CERC Regulations 2009, @7% per annum for the 1<sup>st</sup> 10 years; balance 20% to be spread over the remaining useful life from 11<sup>th</sup> year; salvage value 10%.



**3.1.2 Relevant Extracts of CERC (Terms & condition for recognition and issuance of Renewable Energy Certificate for Renewable Energy Generation), Regulations, 2010, Notification No. L-1/12/2010-CERC Dated: 14th January, 2010**

- These regulations shall come into force from the date of their notification in the Official Gazette. These Regulations shall apply throughout India except the State of Jammu and Kashmir.

- Categories of Certificates

There shall be two categories of certificates, viz., solar certificates issued to eligible entities for generation of electricity based on solar as renewable energy source, and non-solar certificates issued to eligible entities for generation of electricity based on renewable energy sources other than solar:

The solar certificate shall be sold to the obligated entities to enable them to meet their renewable purchase obligation for solar, and non-solar certificate shall be sold to the obligated entities to enable them to meet their obligation for purchase from renewable energy sources other than solar.

- Eligibility and Registration for Certificates

A generating company engaged in generation of electricity from renewable energy sources shall be eligible to apply for registration for issuance of and dealing in Certificates if it fulfills the following conditions:

- a. it has obtained accreditation from the State Agency;
- b. it does not have any power purchase agreement for the capacity related to such generation to sell electricity at a preferential tariff determined by the Appropriate Commission; and
- c. it sells the electricity generated either (i) to the distribution licensee of the area in which the eligible entity is located, at a price not exceeding the pooled cost of power purchase of such distribution licensee, or (ii) to any other licensee or to an open access consumer at a mutually agreed price, or through power exchange at market determined price.

Explanation for the purpose of these regulations 'Pooled Cost of Purchase' means the weighted average pooled price at which the distribution licensee has purchased the electricity including cost of self generation, if any, in the previous year from all the energy suppliers long-term and short-term, but excluding those based on renewable energy sources, as the case may be.

The generating company after fulfilling the eligibility criteria as provided in clause (1) of this regulation may apply for registration with the Central Agency in such manner as may be provided in the detailed procedure:

The Central Agency shall accord registration to such applicant within fifteen days from the date of application for such registration.

- Denomination and issuance of Certificates

The Certificates shall be issued to the eligible entity on the basis of the units of electricity generated from renewable energy sources and injected into the Grid, and duly accounted in the Energy Accounting System as per the Indian Electricity Grid Code or the State Grid Code as the case may be, and the directions of the authorities constituted under the Act to oversee scheduling and dispatch and energy accounting, or based on written communication of distribution licensee to the concerned State Load Dispatch Centre with regard to the energy input by renewable energy generators which are not covered under the existing scheduling and dispatch procedures.

The process of certifying the energy injection shall be as stipulated in the detailed procedures to be issued by the Central agency.

Each Certificate issued shall represent one Megawatt hour of electricity generated from renewable energy source and injected into the grid.

- Dealing in the certificates

Unless otherwise specifically permitted by the Commission by order, the Certificates shall be dealt only through the Power Exchange and not in any other manner.

- Pricing of Certificate

The price of Certificate shall be as discovered in the Power Exchange:

Provided that the Commission may, in consultation with the Central Agency and Forum of Regulators from time to time provide for the floor price and forbearance price separately for solar and non-solar Certificates.

- **A write up on Renewable Energy Certificate (REC) and trend observed in trading of REC in Indian Power Trading Exchanges is given hereunder :**

### **Introduction**

Keeping in mind the disproportionate availability of renewable energy resources in various states and the fact that every State electricity Regulatory Commission (SERC) is mandated to promote renewable energy in its respective state, Renewable Energy Certificate (REC) scheme has been launched in India. The REC scheme allows another revenue model to an investor and enables obligated entities like distribution licensees to fulfil the shortfall in their targets by buying RECs from renewable energy project developers registered under the REC scheme. The REC scheme is also likely to meet the objectives identified in National Action Plan on Climate Change (NAPCC) which has set 5% of Power purchase from renewable in the year 2009-10 and an increase of 1% each year to reach 15% by the year 2020.

The Central Electricity Regulatory Commission (CERC) has notified the Regulation on Renewable Energy Certificate (REC) on 14th January 2010. Under this arrangement, each State Electricity Regulatory commission (SERC) has to develop Renewable Purchase Obligation (RPO) framework for its respective state. Obligated entities (Distribution companies, Open access users and Captive power consumers) who cannot fulfil their RPO, can purchase RECs to discharge their RPOs. The RECs are tradable instruments through Energy Exchange. Renewable Energy Certificate (REC) means that 1 megawatt-hour (MWh) of electricity i.e. 1000 kWh or 1000 Units was generated from an eligible renewable energy resource (renewable electricity). These certificates can be traded, and the owner of the REC who purchases the same can claim to have met the requirement of RPO. The owner thus gets remunerated for his power( electricity component) through sale of power at the rate of average procurement price of that utility benefiting from the injected power and the price of REC traded (environmental attributes). Instead of sale of energy to the Discom at pooled price of power purchase, the electrical component can also be used for captive purposes or sold to third party at a mutually negotiated rate provided no other concession available to an investor of renewable energy is drawn. As per CERC order, the trading price of REC has to be between floor price and forbearance price. Currently the Floor price declared by CERC is Rupees 1500 per REC and Forbearance price is Rupees 3900 per REC. In India the Trading of RECs is through Energy Exchange and the same is presently done on every last Wednesday of every month.

## **Salient Features of the REC Framework**

- The RE generators have four options for the utilization of the energy produced by it –
  - 1) Sell the RE at preferential tariff fixed by the concerned State Electricity Regulatory Commission
  - 2) Use the RE for own or Captive use
  - 3) Sell the RE to a third party
  - 4) Sell the electricity generation and environmental attributes associated with RE generation separately.
- On choosing the fourth option, the environmental attributes can be exchanged in the form of REC. Price of electricity component would be equivalent to weighted average power purchase cost of the distribution company pertaining to previous year. Weighted average cost includes short-term power purchase but excludes renewable power purchase cost.
- The Central Agency (NLDC) will issue the REC to RE generators on verification from State Load Dispatch Centre (SLDC). Central Agency will also function as Repository of transactions of Certificates and will maintain & settle accounts in respect of Certificates.
- The value of REC will be equivalent to 1 MWh (1000 kWh) of electricity injected into the grid from renewable energy sources.
- The REC will be exchanged only in the Power Exchanges approved by CERC within the band of a floor price and a forbearance (ceiling) price. Presently the Floor price has been declared as Rupees 1500 per 1000kWh and forbearance price as Rupees 3900 per 1000kWh by CERC Vide order dated June 1<sup>st</sup>, 2010.
- The distribution companies, Open Access consumer, Captive Power Plants (CPPs) will have option of purchasing the REC to meet their Renewable Purchase Obligations (RPO). Pertinently, RPO is the obligation mandated by the State Electricity Regulatory Commission (SERC) under the Act, to purchase minimum level of renewable energy out of the total consumption in the area of a distribution licensee.
- National Load Dispatch Centre has been designated as central level agency by the Central Electricity Regulatory Commission (CERC) for registration of Renewable Electricity (RE) generators participating in the scheme.

- State Regulatory Commissions have to designate the state agency for their state. (Generally State Nodal agencies have been designated by the SERCs as the State agency).
- There will also be compliance auditors to ensure compliance of the requirement of the REC by the participants of the scheme.

**Price of REC to be discovered in Trading Session held on last Wednesday of every month :**

The price of REC has to remain between Floor & Forbearance price dedared by CERC. As per order of CERC dated 1<sup>st</sup> June 2010 the prices valid up to 31<sup>st</sup> March 2012 are :

	Non solar REC	Solar REC
Forbearance Price	3,900	17,000
Floor Price	1,500	12,000

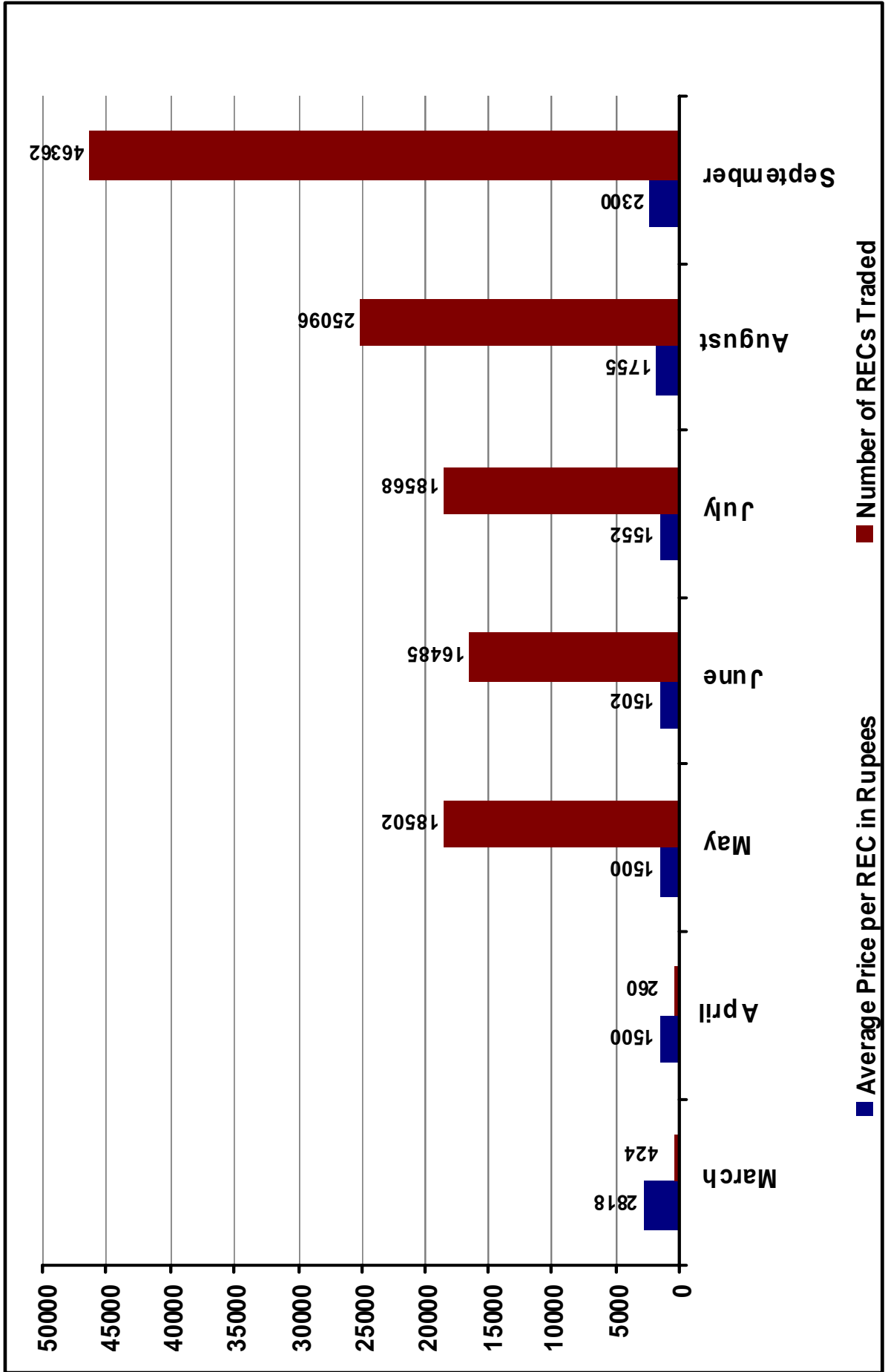
As per CERC order dated 23<sup>rd</sup> Aug 2011 the prices for next control period, from 01.04.2012 to 31<sup>st</sup> March 2017, have been slightly lowered to:

	Non solar REC	Solar REC
Forbearance Price	3,300	13,400
Floor Price	1,500	9,300

**Status of REC as on 30<sup>th</sup> Sep 2011**

Trading of REC began at IEX New Delhi and IPEX Mumbai from March 2011. The trend indicates that both volume and price has been on rise month after month. The volume and price both are expected to show improvement as the financial year approaches the close. Till the trading sessions up to Aug 2011, the volume and the price has been as follows :

Month	Average Price per REC in Rupees	Number of RECs Traded
March	2818	424
April	1500	260
May	1500	18502
June	1502	16485
July	1552	18568
August	1755	25096
September	2300	46362



**3.1.3 Relevant Extract in the matter of Determination of Forbearance and Floor Price for the REC framework. Order date of order: 23rd August, 2011 [Petition No. 142/2011 (Suo Motu)]**

The Commission has, for computing floor price, used the target RE generation based on the average of renewable energy target as per NAPCC and MNRE for non solar technology which is around 70000 MUs. As regards the reference RE tariff for computation of floor and forbearance prices, the Commission has considered, as in the past CERC RE tariff for the sake of uniformity.

- **Forbearance Price:**

The forbearance price has been derived based on the highest difference between cost of generation of RE technologies / RE tariff and the average power purchase cost of 2011-12 for the respective states.

- **Floor Price:**

The floor price has been determined keeping in view the basic minimum requirements for ensuring the viability of RE projects set up to meet the RE targets. This viability requirement shall cover loan repayment & interest charges, O&M expenses and fuel expenses in case of Biomass and Cogeneration.

Based on the above principles, the following forbearance price and floor price are prescribed for dealing in Certificates under the REC Regulations:

Price	Non Solar REC (Rs/MWh)	Solar REC (Rs/MWh)
Forbearance Price	3,300	13,400
Floor Price	1,500	9,300

The above stated forbearance and floor prices shall be valid for 5 years beginning 01.04.2012 that is up to 2016-17 (Control Period coincides with 12<sup>th</sup> five year plan).

- Average Power Purchase Cost (APPC) for the year 2011-12

		(Rs./kWh)
Andhra Pradesh	-	2.50
Karnataka	-	2.66
Madhya Pradesh	-	2.09
Maharashtra	-	2.62
Gujarat	-	2.98
Rajasthan	-	2.60
Tamil Nadu	-	3.38

### 3.1.4 CERC (Grant of connectivity, long term access and medium term Open Access in inter-State transmission & related matters) Regulations 2009 dated 07.08.2009 as amended vide CERC Notification dated 03.09.2010

- Regulation 2 sub-d. (b)(i) of Clause (1) as per amendment dated 03.09.2010 provides that applicant for grid connectivity under these Regulations shall include power generating stations using renewable sources of energy of installed capacity between 50 MW & 250 MW.
- Regulation 8 Cl.(1) as per amendment notification dated 03.09.2010 provides that a generating station using renewable sources of energy of capacity of 250 MW and above other than a captive generating plant shall not be required to construct a dedicated transmission line to the point of connection and such station shall be taken into account for co-ordinated transmission planning by the Central Transmission Utility (CTU) & the Central Electricity Authority (CEA).

### 3.2 Andhra Pradesh Electricity Regulatory Commission (APERC)

#### **Title & date of Order**

APERC order dated 31.03.2009 in case O.P. No. 5/2009; APERC order dated 31.03.2009 in case No.16/2008; APERC (Procurement of Energy from RE sources) Order dated 01.05.2009 in case of O.P. No. 6 & 7/2009; Govt. of A.P. Policy dated 11.04.2008 as amended vide Order dated 09.09.08.

#### **Date from which Order is effective**

From the date of notification of Order/Regulations.



### **Tariff Period**

Applicable to PPA signed from 01.05.2009 to 31.03.2014 and shall remain valid for the Tariff period of 10 years from the COD.

### **Tariff Review/ Control Period**

5 years from the date of Order to 31.03.2014.

### **Tariff for procurement of Energy by Utility from New Wind Power Projects**

Rs.3.37per kWh for Projects for which PPAs are signed on or after 01.04.2009; Rs.3.50 per kWh for a period of 10 years for Projects for which PPA are signed during the period from 01.05.2009 to 31.03.2014; from 11<sup>th</sup> year to 20<sup>th</sup> year Tariff for these Projects shall be as determined by the APERC. After 20 years from COD, Tariff shall be as mutually settled between the two.

### **Renewable Purchase Obligations (RPO)**

5% of consumption of energy from RP Sources during each of the years 2009-10 to 2013-2014 as per APERC Order dated 31.03.2009. To be procured from sources within the State.

### **Banking**

Banking not permitted. However, energy delivered, if not used, will be deemed to be sold to DISCOM at 85% of Tariff as amended (as per Govt. Policy G.O.Ms 99 dated 09.09.2008).

### **Transmission Charges & Wheeling Charges**

5% of energy wheeled which is inclusive of transmission and wheeling losses also.

### **Transmission Loss and Wheeling Loss**

Included in transmission and wheeling charges.

### **Agreement Period EPA / EWA**

13 years

**Sharing of CDM benefit**

10% to DISCOM and 90% to Developer.

**Special Conditions**

WEGs to be installed shall be brand new and strictly as per the specifications issued by C-WET from time to time. Unit rating shall not be less than 225 kW.

**Evacuation Infrastructure**

Cost to be borne by Developer.

**Capacity Utilization Factor**

24.50%

**Capital Cost of Project/MW**

Rs.4.70 Crores per MW including power evacuation cost.

**Debt Equity Ratio**

70 : 30

**Interest on Term Loan**

12.00%

**Loan Repayment Period**

10 years

**Return on Equity**

15.5% pre Tax per annum

**O&M Cost as %age of Project Cost**

1.25% of Project cost with 5% annual escalation.

**Duties & Taxes**

Tariff is inclusive of Taxes and Duties.

**Life of the Plant**

20 years

**Depreciation Method and Rate**

SLM @ 4.5% per annum over 20 years of useful life.

**3.3 Gujarat Electricity Regulatory Commission (GERC)****Title & date of Order**

GERC Regulations 2009 dated 17.04.2010; GERC Wind Power Tariff Order dated 30.01.2010; Govt. Wind Power Policy 2007 amended up to 07.01.2009.

**Date from which Order is effective**

From the date of notification of Order/Regulations. (Excluding Regulation 8)

**Tariff Period**

Tariff period 25 years.

**Tariff Review/ Control Period**

3 years from 11.08.2009.

**Tariff for procurement of Energy by Utility from New Wind Power Projects**

Levelized Tariff Rs.3.56 per kWh; constant for project life of 25 years. Applicable to projects commissioned on or after 11.08.2009.

**Renewable Purchase Obligations (RPO)**

Percentage annual consumption of each Discom from RE Sources as per GERC Regulations 2009 dated 17.04.2010 :

FY	Wind	Others	Total
2010-11	4.5%	0.5%	5%
2011-12	5%	1%	6%
2012-13	5.5%	1.5%	7%

## **Banking**

Banking shall be allowed for one month and surplus energy is payable at 85% of applicable Tariff.

## **Transmission Charges & Wheeling Charges**

Wheeling of energy for consumption 66 kV or above Transmission charge and Transmission loss as applicable to normal OA consumer. Wheeling of energy for consumption at voltage below 66 kV Transmission charge at the rate applicable to normal OA consumer along with transmission and wheeling losses @10%. For small investors with only one WEG. Transmission and wheeling losses payable shall be only 7%. If energy is to be wheeled to more than two locations for consumption Charges at the rate 5 paise per kWh shall be payable extra. Transmission charges for long term OA consumer determined by the Commission for the year 2009-10 is Rs.2410 per MW per day.

## **Transmission Loss and Wheeling Loss**

For consumption at 66 kV and above: Transmission loss 4.09% and wheeling loss Nil

For consumption below 66kV: Transmission and wheeling losses @10%.

For small investor with only one WEG: Transmission and wheeling losses shall be only 7%.

## **Agreement Period EPA / EWA**

25 years.

## **Reactive Energy**

10 paise/kVArh for reactive energy consumption for 10% or less of net energy export. 25 paise per kWh if reactive energy consumption is more than 10%.

## **Sharing of CDM benefit**

As per CERC Regulation 2009.

## **Special Conditions**

Wind Power Projects are exempted from settlement mechanism based on U.I. Rate.

Security Deposit :- Developer to provide a BG of Rs.5.00 Lakhs as security to GETCO which shall be forfeited if the project is not commissioned within the specified time period.

Cross Subsidy :- RE Sources based Power Generation consumed for captive use/third party sale shall be exempted from payment of Cross Subsidy Surcharge.

## **Evacuation Infrastructure**

Voltage level for evacuation shall be 66 kV and above.

Govt. Policy (Amendment-1) 2007 dated 07.01.2009 provides that owner will bear the entire cost up to 100 km; beyond this limit GETCO will construct at its cost. Approved capital cost includes 38 lakhs per MW towards cost of transmission line from project site to grid sub-station.

## **Capacity Utilization Factor**

23.0%

## **Capital Cost of Project/MW**

Rs.4.62 Crores per MW for the project and 0.38 Crores per MW towards power evacuation cost making a total 5.00 Crores per MW as total project cost.

## **Debt Equity Ratio**

70 : 30

## **Interest on Term Loan**

10.75%

## **Loan Repayment Period**

10 years

**Return on Equity**

14% per annum

**O&M Cost as %age of Project Cost**

Rs. 6.50 lakhs per MW for the 1<sup>st</sup> year with 5% escalation every year from 2<sup>nd</sup> year onwards.

**Interest on Working Capital**

11.75%

**Duties & Taxes**

Tariff is inclusive of Taxes and Duties.

**Life of the Plant**

25 years

**Depreciation Method and Rate**

@6% per annum for 1<sup>st</sup> 10 years and @2% per annum for remaining 15 years.

**3.4 Karnataka Electricity Regulatory Commission (KERC)****Title & date of Order**

KERC's Order dated 11.12.2009 in the matter of determination of tariff in respect of RE sources of Energy; Renewable Energy Policy. KERC (Power Procurement from RE sources by Distn. Licensee) Regulation 2009 dated 23.01.2008.

**Date from which Order is effective**

Effective from the date of notification and applicable to new projects entering into agreement on or after 01.01.2010 for a period of 10 years from the date of agreement. Also applicable to old projects which have completed 10 years agreement period but tariff for which was not determined.

**Tariff Period**

Tariff period 10 years.

**Tariff Review/ Control Period**

5 years from the date of Order

**Tariff for procurement of Energy by Utility from New Wind Power Projects**

Rs.3.70 per kWh without any escalation. Applicable for 10 years from the date of signing of PPA on or after 01.01.2010.

**Renewable Purchase Obligations (RPO)**

BESCOM 10%, MESCOM 10%, CESC 10%, HESCOM 7%, GESCOM 7%, Hukeri Society 7% as per KERC Notification No. S/03/1 dated 16.03.2011.

Non compliance of RPO by Distribution Licensees:

Commission may direct the Distribution Licensee or such other consumer to deposit such amount as the commission may determine into a separate fund, to be created and maintained as directed by the Commission.

**Banking**

Banking is allowed subject to the conditions as per KERC Order dated 11.07.2008. Banking charges @2% of input energy.

**Transmission Charges & Wheeling Charges**

5% of energy fed to grid as per KERC Order No. Q/01/1 dated 09.06.2005.

**Transmission Loss and Wheeling Loss**

Included in transmission and wheeling charges.

**Agreement Period EPA / EWA**

10 years.

**Sharing of CDM benefit**

As per CERC Regulation 2009.

**Special Conditions**

Cross subsidy surcharge @Rs.1.15 per unit is payable for wheeling for other than own use.

**Evacuation Infrastructure**

Cost to be borne by Developer.

**Capacity Utilization Factor**

26.5%

**Capital Cost of Project/MW**

Rs.4.70 Crores per MW inclusive of cost of power evacuation infrastructure.

**Debt Equity Ratio**

70 : 30

**Interest on Term Loan**

11.75%

**Loan Repayment Period**

10 years

**Return on Equity**

16% per annum

**O&M Cost as %age of Project Cost**

1.25% of project cost with 5% escalation per year.



**Interest on Working Capital**

13.25%

**Duties & Taxes**

Taxes and Duties to be allowed as pass through on actual basis.

**Life of the Plant**

Not mentioned.

**Depreciation Method and Rate**

7% by SLM

**Auxiliary Consumption**

0.5%

**3.5 Madhya Pradesh Electricity Regulatory Commission (MPERC)****Title & date of Order**

MPERC order May 2010 dated 14.05.2010 in the matter of procurement of wind energy; MPERC (Co-gen. and generation of electricity from RE sources) Regulations 2010 dated 09.11.2010; Govt. Policy dated 17.10.2006 amended up to 12.05.2008.

**Date from which Order is effective**

From the date of notification of Order/Regulations. Applicable to new projects commissioned on or after the date of notification during the control period.

**Tariff Period**

Tariff period 25 years.

**Tariff Review/ Control Period**

3 years ending with 31.03.2013.

## **Tariff for procurement of Energy by Utility from New Wind Power Projects**

Levelized tariff Rs.4.35 per kWh. Applicable to projects commissioned on or after the date of issue during the control period and shall remain constant for the project life of 25 years.

## **Renewable Purchase Obligations (RPO)**

As per Order Dated Nov 9th, 2010 Renewable Purchase Obligation is to be 2.1% Non Solar 0.4% Solar for 2011-12, 3.4% Non solar 0.6% Solar for 2012-13, 4.7% Non Solar 0.8% Solar for 2013-14, 6.0% Non Solar 1.0% Solar for 2014-15.

If the Distribution Licensees fulfil the minimum purchase requirements and still have offers from energy generators including Co-generators from Renewable Sources, then either the Distribution Licensee or the Investor/Developer can approach the Commission for approval of such additional procurement offers.

### Effect of Default :

In the event the Obligated Entities do not fulfil the mandate of the obligation to purchase energy from Renewable Energy Sources as provided in these Regulations during any Financial Year and also do not purchase the certificates from the Power Exchange, the Commission may direct the Obligated Entity to deposit into a separate Fund, to be maintained by such Obligated Entity, such amount as the Commission may determine as required for purchase of Certificates to the extent of the estimated obligation on the basis of the shortfall in units of RPO and the Forbearance Price of the Certificates which shall be utilized, as may be directed by the Commission, partly for purchase of the certificates and partly for development of Transmission infrastructure for evacuation of power from Generating Stations based on Renewable Energy Source.

## **Banking**

The banked power may normally be returned from 15th July to 15th October from 2300 hours to 2400 hours and 0000 hours to 1700 hours by deducting 2% in terms of units (kWh) towards Wheeling Charges. The banked power may also be returned during November to February keeping in view the availability of power and demand in the Rabi Season and at the time of Peak Demand as decided by the MP Power Trading Co. Ltd. /Distribution Licensees. Surplus energy if any at the end of the financial year is to be paid @Rs.2.95 per kWh.

## **Transmission Charges & Wheeling Charges**

Wheeling charges, cross subsidy charges & applicable surcharge on wheeling charges shall be as decided by the Commission from time to time. Captive consumers & sale to third party availing open access shall be exempted from payment of OA charges in respect of energy provided by RE sources. Wheeling charges presently is 2% for self-use as well as for sale to third party.

## **Scheduling and Merit Order Despatch**

Generation from co-gen & RE sources are excluded from the ambit of merit order despatch principles.

## **Reactive Energy**

27 paise per kWh prevailing as at present which may be revised from time to time.

## **Sharing of CDM benefit**

As per CERC Regulation 2009.

## **Special Conditions**

Old projects if not connected to sub-station are required to pay monthly line rent @0.5% of cost of line used for evacuation at current Schedule of Rates after renewal of agreement on or after 21.11.2007.

## **Settlement Mechanism and Payment Security**

2% rebate for payment through LC; 1% rebate for payment within 15 days; Interest @2% per annum over and above short term PLR of SBI for delay in payment beyond 30 days;

## **Evacuation Infrastructure**

Cost to be borne by Developer.

## **Capacity Utilization Factor**

20%

**Derating**

Not considered.

**Capital Cost of Project/MW**

Rs.5.00 Crores per MW inclusive of cost of power evacuation infrastructure.

**Debt Equity Ratio**

70:30

**Interest on Term Loan**

12.00%

**Loan Repayment Period**

10 years

**Return on Equity**

16% Pre Tax per annum

**O&M Cost as %age of Project Cost**

1% of project cost for the 1<sup>st</sup> year with 5.72% escalation per year from 2<sup>nd</sup> year onwards.

**Interest on Working Capital**

12.75%

**Duties & Taxes**

Tariff is inclusive of Taxes and Duties.

**Life of the Plant**

25 years

## Depreciation Method and Rate

As per CERC Regulations 2009.

### 3.6 Maharashtra Electricity Regulatory Commission (MERC)

#### Title & date of Order

MERC (RPO, its compliance and implementation REC Framework) Regulation 2010 Notification No.MERC/Legal/2010/483 dated 07.06.2010; MERC (terms and conditions for determination of RE Tariff) Regulations 2010 Notification No.MERC/Legal/2010/482 dated 07.06.10; MERC (Renewable Energy) Tariff Order on case No. 20 of 2010 dated 14.07.2010.

#### Date from which Order is effective

From the date of notification of Order/Regulations.

#### Tariff Period

Tariff period 13 years.

#### Tariff Review/ Control Period

5 years ending with 2014-2015. Tariff will be determined for each year of the control period commencing from 2010-11.

#### Tariff for procurement of Energy by Utility from New Wind Power Projects

As per Tariff Order dated 14.07.2010. Applicable to projects commissioned on or after the date of issue during the year 2010-11 :

Zone	CUF (%)	Levelized Tariff without considering Acc. Depn.	Net Levelized Tariff after adjusting for Acc. Depn.
1	20%	5.07	4.29
2	23%	4.41	3.73
3	27%	3.75	3.18
4	30%	3.38	2.86

## **Renewable Purchase Obligations (RPO)**

Renewable Purchase Obligation as per MERC's RPO Regulations 2010, Dt. 07.06.2010. Purchase of REC shall meet the RPO. Entities, which fail to comply, may have to pay an amount to be specified by MERC as a deposit in special fund.

FY	Solar	Non-Solar (Other RE)	Total
2010-11	0.25%	5.75%	6%
2011-12	0.25%	6.75%	7%
2012-13	0.25%	7.75%	8%
2013-14	0.50%	8.50%	9%
2014-15	0.50%	8.50%	9%
2015-16	0.50%	8.50%	9%

## **Banking**

There is no mention in the Government Policy, MERC Regulations and MERC Draft Order 2010 about banking.

## **Transmission Charges & Wheeling Charges**

As applicable for normal OA consumers. Rates determined by the Commission applicable for the year 2009-10 are: Transmission Tariff Rs.918.25 per MW/day (for short term OA). Wheeling charges range from 0 to 43 paise per kWh depending upon the voltages at which power is injected and consumed.

## **Transmission Loss and Wheeling Loss**

Transmission loss @4.85%; wheeling loss ranging from 0% to 14% depending upon the voltage at which power is injected and consumed.

## **Agreement Period EPA / EWA**

13 years

## **Reactive Energy**

25 paise per kWh prevailing as at present which may be revised from time to time. Subject to the condition that escalation in rate shall not be more than 5% per year for kVAh consumption up to 10% of kWh export to grid. Consumption in excess of 10% to be paid at prevailing rates as per Tariff Order 24.11.2003 validity of which has been extended till issue of fresh order for the new control period.

There is no mention in the Government Policy, MERC Regulations and MERC Tariff Order 2010 about reactive energy.

## **Sharing of CDM benefit**

As per CERC Regulation 2009.

## **Special Conditions**

WPP setup at sites having a minimum annual average WPD of 200W/m<sup>2</sup> using new WEGs are eligible for preferential tariff.

## **Settlement Mechanism and Payment Security**

As per CERC Regulation 2009.

## **Evacuation Infrastructure**

Cost to be borne by Developer.

## **Capacity Utilization Factor**

As per CERC Regulations 2009.

## **Capital Cost of Project/MW**

Rs.4.6713 Crores (467.13 lakhs) per MW for the year 2010-11 inclusive of cost of power evacuation infrastructure up to interconnection point. Capital cost is linked to price indexation formula.

**Debt Equity Ratio**

70 : 30

**Interest on Term Loan**

11.87%

**Loan Repayment Period**

10 years

**Return on Equity**

As per CERC Regulations 2009.

**O&M Cost as %age of Project Cost**

Rs.6.87 lakhs per MW for the year 2010-11 to be escalated @5.72% per annum over tariff period.

**Interest on Working Capital**

12.87%

**Duties & Taxes**

As per CERC Regulations 2009.

**Life of the Plant**

25 years

**Depreciation Method and Rate**

As per CERC Regulations 2009.

**3.7 Rajashtan Electricity Regulatory Commission (RERC)****Title & date of Order**

RERC (Renewable Energy Obligations) Regulations 2007 dated 23.03.2007; RERC Tariff Regulations 2009 dated 23.01.2009; RERC Tariff Order dated 16.07.2009; RERC Tariff Order dated 31.03.2010; Govt. Policy dated 25.10.2004 as amended up to 27.03.2008.



### **Date from which Order is effective**

RPO Notification dated 23rd December, 2010 effective from the date of publication in official gazette, tariff regulations 2009 dated 23 01 2009 w.e.f. financial year 2009-10 to 2013-14 with indexation mechanism for tariff every year & tariff order dated 31 03 2010 for FY 2010-11 effective from the date of notification of order.

### **Tariff Period**

Tariff determined every financial year within the control period shall be applicable for the projects commissioned in that year for the project life of 25 years.

### **Tariff Review/ Control Period**

5 years ending with 31.03.2014. Tariff shall however be determined year to year as capital cost is linked to price index.

### **Tariff for procurement of Energy by Utility from New Wind Power Projects**

FY	Tariff for projects in Jaisalmer,	Projects in other Districts
2010-11	Rs.3.83/kWh	Rs.4.03/kWh
2011-12	Rs.4.22/kWh	Rs.4.44/kWh

Tariff determined is on ex-bus basis at generator premises which is the interface point for metering. If by mutual agreement, meter is installed at licensee's premises, losses over the interconnecting line shall be added to the net energy export @1% for metering at 33 kV and @4% for metering at 132/220 kV.

### **Renewable Purchase Obligations (RPO)**

For Distribution licensees:

Obligation in respect of Wind, Biomass and Solar energy as per RERC Regulation No.85 & 86 – 2011 dated 24.05.2011 on Power Purchase and Procurement Process of Distribution Licensee – 2<sup>nd</sup> amendment and Renewable Energy Obligation – 1<sup>st</sup> amendment.

The Renewable Purchase Obligation in respect of various sources expressed as percentage of energy consumption shall be as under :

Sl. No.	Year	Obligation Expressed as Percentage of Energy Consumption (%)			
		Wind	Biomass	Solar	Total
1.	2011-12	4.50	1.00	0.50	6.00
2.	2012-13	5.10	1.25	0.75	7.10
3.	2013-14	5.70	1.50	1.00	8.20

### **Banking**

As per RERC (terms and conditions for determination of Tariff) Regulation 2009 dated 23<sup>rd</sup> January, 2009, banking and drawal shall be on 6 monthly basis from April to September and October to March. Utilization of banked energy shall not be permitted in December to February. Payment for unutilized banked energy will be settled @60% of energy charges including fuel charges applicable to large industrial power tariff.

### **Transmission Charges & Wheeling Charges**

Transmission charges and wheeling charges for RE Power shall be 50% of charges specified for normal OA consumers payable in cash.

### **Transmission Loss and Wheeling Loss**

Ranges from 4.4% to 8% depending upon the voltage at which power is injected and consumed.

### **Agreement Period EPA / EWA**

25 years (Project life)

### **Reactive Energy**

5.75 paise per kVAh w.e.f. 01.04.2009 escalated @0.25 paise per kWh every year.

### **Special Conditions**

If metering is done at grid sub-station, losses over interconnecting transmission line @1% for metering at 33 kV and @4% for metering at 132/220 kV shall be considered. Cross subsidy charges are nil for RE based power.

### **Evacuation Infrastructure**

A sum of Rs.2.00 Lakhs per MW is payable to RVPN as connectivity charges. RVPN to develop evacuation system from Pooling Sub-station to Grid Sub-station. If evacuation system is constructed by developer beyond pooling sub-station, Commission may determine transmission tariff on case to case basis.

### **Capacity Utilization Factor**

21.0% in Bamer, Jaisalmer and Jodhpur, 20% in other districts.

### **Derating**

1.25% of CUF from 6<sup>th</sup> year, 10<sup>th</sup> year, 14<sup>th</sup> year & 18<sup>th</sup> year.

### **Capital Cost of Project/MW**

Rs.5.25 Crores per MW which includes 2 lakhs/MW payable to RVPN as connectivity charge and Rs.15 lakhs/MW towards evacuation up to pooling sub-station. RVPN to develop evacuation system from pooling s/s to grid s/s. Transmission tariff for such developer to be decided on case to case basis, who construct the interconnecting line from pooling sub-station to grid sub-station at his cost.

### **Debt Equity Ratio**

70 : 30

### **Interest on Term Loan**

100 basis point higher than SBI long term PLR as on 31.01.2009.

### **Loan Repayment Period**

10 years

### **Return on Equity**

16% Pre Tax per annum

### **O&M Cost as %age of Project Cost**

For power plants 1.25% of base capital cost and 3% on cost of transmission line per year.

### **Interest on Working Capital**

Equivalent to Short Term PLR of SBI as on 31.01.2009.

### **Duties & Taxes**

Tariff is inclusive of Taxes and Duties.

### **Life of the Plant**

25 years

### **Depreciation Method and Rate**

10% salvage value; 90% cost to be depreciated over life of plant.

## **3.8 Tamil Nadu Electricity Regulatory Commission (TNERC)**

### **Title & date of Order**

Comprehensive Tariff Order for Wind Energy TNERC Order No. 1 of 2009 dated 20<sup>th</sup> March, 2009; TNERC (Power procurement from New and RE Sources of Energy) Regulations 2008 dated 08.02.2008 as amended vide Tamil Nadu Electricity Regulatory Commission (Renewable Energy Purchase Obligation) (Amendment) Regulations, 2011 notified vide Notification No. TNERC/RPO/19/2, dated 29-07-2011.

### **Date from which Order is effective**

Applicable to WEGs commissioned on or after 19.09.2008. Monetary benefit will accrue from the date of this order i.e. w.e.f. 20<sup>th</sup> March, 2009.

### **Tariff Period**

Tariff period 20 years.

## Tariff Review/ Control Period

2 years ending with 31.03.2011.

## Tariff for procurement of Energy by Utility from New Wind Power Projects

### Sale to Utility:- For WEGs commissioned

Before 15.05.2006	-	Rs.2.75 per kWh
From 15.05.2006 to 18.09.2008	-	Rs.2.90 per kWh
From 19.09.2008 to 19.03.2009	-	Rs.2.90 per kWh
From 20.03.2009 to 31.03.2009	-	Rs.3.24 per kWh
From 1.04.2009 onwards	-	Rs.3.39 per kWh

**For Captive use/Sale to Third Party :-** Net energy consumption made from the Utility is payable on TOD slot basis. In addition 80.39% of the applicable demand charges for the deemed demand supplied by the Generator plus 100% of applicable demand charges for the balance demand supplied by the licensee is payable.

Deemed demand :- A

$$= \frac{\text{Total generated units consumed by user on OA}}{30 \times 24 \times \text{Actual power factor recorded during the month}}$$

Demand actually availed :- B

Recorded MD or 90% of sanctioned MD whichever is higher.

Demand supplied by the Licensee :- (B-A) = C

Demand charges payable :-

A X 80.39% of applicable demand charges + C X Applicable Demand Charges.

Existing contracts signed prior to the date of issue of this order will continue to remain in force.

## **Renewable Purchase Obligations (RPO)**

For 2011-12 9% for Wind.

If the RPO for any of the year is not specified by the Commission, the RPO specified for the previous year shall be continued beyond the period till any revision is effected by the Commission in this regard.

- a) In the first phase, RPO compliance shall be implemented for captive and open access consumers whose sanctioned demand is 2 MVA and above from the date of commencement of these regulations.
- b) In the second phase, RPO compliance shall be implemented for captive and open access consumers whose sanctioned demand is 1 MVA and above from 01-04-2012.
- c) In the third and final phase, RPO compliance shall be implemented for all captive and open access consumers irrespective of the sanctioned demand from 01-04-2013.

## **Banking**

One year (April-March); Banking charges @5%. Un-utilized energy at the end of the year to be paid by the Utility @75% of the relevant purchase tariff.

## **Transmission Charges & Wheeling Charges**

5% of energy in case of consumption at HV/EHV level. For LT service it shall be 7.5%.

## **Transmission Loss and Wheeling Loss**

Included in transmission and wheeling charges.

## **Agreement Period EPA / EWA**

EPA 20 years; EWA minimum period of 5 years.

## **Scheduling and Merit Order Despatch**

Scheduling and system operation charges @ Rs.300/- per day per 1.65 MW per service connection. No increase in charges if connected load per service is more. Charges on pro-rata basis if connected load per service is less.

## **Reactive Energy**

25 paise per kWh for consumption up to 10% of net energy generated.

For drawal in excess of 10%, entire consumption is payable at 50 paise per kWh.

## **Sharing of CDM benefit**

As per CERC Regulation 2009.

## **Special Conditions**

Application fees and Agreement fees payable shall be as follows :

Wheeling Agreement :- Application fees Rs.200/- per MW subject to a maximum of Rs.5,000/-.

Agreement Fees :- Rs.2000/- per MW subject to a maximum of Rs.50,000/-

Energy Purchase Agreement :- Agreement Fees Rs.2,000/- per MW which is to be recovered & paid to the Commission.

Cross Subsidy Surcharge :- 50% of the rate specified for other consumers. Third party purchasers shall have a minimum contract demand or connected load of 1 MW.

## **Settlement Mechanism and Payment Security**

Payment within 30 days of receipt of bill. Interest @1% per month is payable for delay in payment beyond 30 days.

## **Evacuation Infrastructure**

To be borne by the Licensee if entire energy is sold to the Distribution Licensee. For captive consumption and third party sale, cost will have to be borne by the Developer but the work will be executed by the Licensee.

## **Capacity Utilization Factor**

27.15%

## **Derating**

1% every year after 10 years.

## **Capital Cost of Project/MW**

Rs.5.35 Crores per MW; 85% towards plant & machinery, 10% civil works & 5% land cost.

## **Debt Equity Ratio**

10 years

## **Interest on Term Loan**

17.63% Pre Tax up to 31.03.2009

19.85% Pre Tax after 31.03.2009

## **O&M Cost as %age of Project Cost**

1% per annum with 5% annual escalation on 85% of project cost (plant & machinery cost), 0.22% per annum on 15% of project cost (land & civil work). In addition, insurance charges @0.75% of plant & machinery cost (85% of project cost) in the 1<sup>st</sup> year to be reduced by half a percent of previous year insurance cost every year thereafter.

## **Duties & Taxes**

Tariff is inclusive of Taxes and Duties.

## **Life of the Plant**

20 years

## **Depreciation Method and Rate**

4.5% by SLM on 85% of capital cost over 20 years leaving a balance of 10% as salvage value.



### 3.9 Summary of Tariff Order

ERCs	(1) Tariff Period
<b>CERC</b>	Tariff Order is effective from 02-04-2011 and shall remain valid for the Tariff period of 13 years.
<b>Andhra Pradesh</b>	Applicable to PPA signed from 01.05.2009 to 31.03.2014 and shall remain valid for the Tariff period of 10 years from the COD.
<b>Gujarat</b>	Tariff period 25 years.
<b>Karnataka</b>	Tariff period 10 years.
<b>Madhya Pradesh</b>	Tariff period 25 years.
<b>Maharashtra</b>	Tariff period 13 years.
<b>Rajasthan</b>	Tariff period 25 years.
<b>Tamil Nadu</b>	Tariff period 20 years.

ERCs	(2) Tariff for procurement of Energy by Utility from New Wind Power Projects																				
<b>CERC</b>	<p>Applicable to Wind Power Projects commissioned during 2010-11 :</p> <table border="1"> <thead> <tr> <th>Zone</th> <th>CUF (%)</th> <th>Levelized Tariff without considering Acc. Deprn.</th> <th>Levelized Tariff after adjusting for Acc. Deprn.</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>20%</td> <td>5.33</td> <td>4.53</td> </tr> <tr> <td>2</td> <td>23%</td> <td>4.63</td> <td>3.94</td> </tr> <tr> <td>3</td> <td>27%</td> <td>3.95</td> <td>3.36</td> </tr> <tr> <td>4</td> <td>30%</td> <td>3.55</td> <td>3.02</td> </tr> </tbody> </table>	Zone	CUF (%)	Levelized Tariff without considering Acc. Deprn.	Levelized Tariff after adjusting for Acc. Deprn.	1	20%	5.33	4.53	2	23%	4.63	3.94	3	27%	3.95	3.36	4	30%	3.55	3.02
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<b>Andhra Pradesh</b>	Rs.3.37per kWh for Projects for which PPAs are signed on or after 01.04.2009; Rs.3.50 per kWh for a period of 10 years for Projects for which PPA are signed during the period from 01.05.2009 to 31.03.2014; from 11 <sup>th</sup> year to 20 <sup>th</sup> year Tariff for these Projects shall be as determined by the APERC. After 20 years from COD, Tariff shall be as mutually settled between the two.																				
<b>Gujarat</b>	Levelized Tariff Rs.3.56 per kWh; constant for project life of 25 years. Applicable to projects commissioned on or after 11.08.2009.																				
<b>Karnataka</b>	Rs.3.70 per kWh without any escalation. Applicable for 10 years from the date of signing of PPA.																				
<b>Madhya Pradesh</b>	Levelized tariff Rs.4.35 per kWh. Applicable to projects commissioned on or after the date of issue during the control period and shall remain constant for the project life of 25 years.																				

<b>Maharashtra</b>	<p>As per Tariff Order dated 29.04.2011, Applicable to projects commissioned on or after the date of issue during the year 2011-12 :</p> <table border="1"> <thead> <tr> <th>Zone</th> <th>CUF (%)</th> <th>Levelized Tariff without considering Acc. Deprn.</th> <th>Net Levelized Tariff after adjusting for Acc. Deprn.</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>20%</td> <td>5.37</td> <td>4.56</td> </tr> <tr> <td>2</td> <td>23%</td> <td>4.67</td> <td>3.96</td> </tr> <tr> <td>3</td> <td>27%</td> <td>3.97</td> <td>3.38</td> </tr> <tr> <td>4</td> <td>30%</td> <td>3.58</td> <td>3.04</td> </tr> </tbody> </table>	Zone	CUF (%)	Levelized Tariff without considering Acc. Deprn.	Net Levelized Tariff after adjusting for Acc. Deprn.	1	20%	5.37	4.56	2	23%	4.67	3.96	3	27%	3.97	3.38	4	30%	3.58	3.04
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<b>Tamil Nadu</b>	<p><b>Sale to Utility:-</b> For WEGs commissioned</p> <p>Before 15.05.2006 - Rs.2.75 per kWh</p> <p>From 15.05.2006 to 18.09.2008 - Rs.2.90 per kWh</p> <p>From 19.09.2008 to 19.03.2009 - Rs.2.90 per kWh</p> <p>From 20.03.2009 to 31.03.2009 - Rs.3.24 per kWh</p> <p>From 1.04.2009 onwards - Rs.3.39 per kWh</p> <p><b>For Captive use/Sale to Third Party :-</b> Net energy consumption made from the Utility is payable on TOD slot basis. In addition 80.39% of the applicable demand charges for the deemed demand supplied by the Generator plus 100% of applicable demand charges for the balance demand supplied by the licensee is payable.</p> <p>Deemed demand :- A</p> $= \frac{\text{Total generated units consumed by user on OA}}{30 \times 24 \times \text{Actual power factor recorded during the month}}$ <p>Demand actually availed :- B</p> <p>Recorded MD or 90% of sanctioned MD whichever is higher.</p> <p>Demand supplied by the Licensee :- (B-A) = C</p> <p>Demand charges payable :-</p> <p>A X 80.39% of applicable demand charges + C X Applicable Demand Charges.</p> <p>Existing contracts signed prior to the date of issue of this order will continue to remain in force.</p>																				

ERCs	(3) Renewable Purchase Obligations (RPO)																												
<b>CERC</b>	-																												
<b>Andhra Pradesh</b>	5% of consumption of energy from RP Sources during each of the years 2009-10 to 2013-2014 as per APERC Order dated 31.03.2009. To be procured from sources within the State.																												
<b>Gujarat</b>	Percentage annual consumption of each Discom from RE Sources as per GERC Regulations 2009 dated 17.04.2010 : <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>FY</th> <th>Wind</th> <th>Others</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>2010-11</td> <td>4.5%</td> <td>0.5%</td> <td>5.0%</td> </tr> <tr> <td>2011-12</td> <td>5.0%</td> <td>1.0%</td> <td>6.0%</td> </tr> <tr> <td>2012-13</td> <td>5.5%</td> <td>1.5%</td> <td>7.0%</td> </tr> </tbody> </table>	FY	Wind	Others	Total	2010-11	4.5%	0.5%	5.0%	2011-12	5.0%	1.0%	6.0%	2012-13	5.5%	1.5%	7.0%												
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<b>Karnataka</b>	BESCOM 10%, MESCOM 10%, CESC 10%, HESCOM 7%, GESCOM 7%, Hukeri Society 7% as per KERC Notification No. S/03/1 dated 23.01.2008.																												
<b>Madhya Pradesh</b>	(Order Dated Nov 9 <sup>th</sup> , 2010) 2.1% Non Solar 0.4% Solar for 2011-12, 3.4% Non solar 0.6% Solar for 2012-13, 4.7% Non Solar 0.8% Solar for 2013-14, 6.0% Non Solar 1.0% Solar for 2014-15.																												
<b>Maharashtra</b>	Renewable Purchase Obligation as per MERC's RPO Regulations 2010, Dt. 07.06.2010 : <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>FY</th> <th>Solar</th> <th>Non-Solar (Other RE)</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>2010-11</td> <td>0.25%</td> <td>5.75%</td> <td>6%</td> </tr> <tr> <td>2011-12</td> <td>0.25%</td> <td>6.75%</td> <td>7%</td> </tr> <tr> <td>2012-13</td> <td>0.5%</td> <td>7.5%</td> <td>8%</td> </tr> <tr> <td>2013-14</td> <td>0.50%</td> <td>8.50%</td> <td>9%</td> </tr> <tr> <td>2014-15</td> <td>0.50%</td> <td>8.50%</td> <td>9%</td> </tr> <tr> <td>2015-16</td> <td>0.50%</td> <td>8.50%</td> <td>9%</td> </tr> </tbody> </table>	FY	Solar	Non-Solar (Other RE)	Total	2010-11	0.25%	5.75%	6%	2011-12	0.25%	6.75%	7%	2012-13	0.5%	7.5%	8%	2013-14	0.50%	8.50%	9%	2014-15	0.50%	8.50%	9%	2015-16	0.50%	8.50%	9%
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<b>Rajasthan</b>	As per order Dated Dec 23 <sup>rd</sup> , 2010 For Distribution Licensee: <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Sl.No.</th> <th>Year</th> <th>Wind</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>2010-11</td> <td>6.75%</td> </tr> <tr> <td>2.</td> <td>2011-12</td> <td>7.50%</td> </tr> </tbody> </table> <p>For Captive Consumers and OA users :</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Sl.No.</th> <th>Year</th> <th>Obligation expressed as percentage of total energy drawn other than from distribution licensee</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>2010-11</td> <td>8.50%</td> </tr> <tr> <td>2.</td> <td>2011-12</td> <td>9.50%</td> </tr> </tbody> </table>	Sl.No.	Year	Wind	1.	2010-11	6.75%	2.	2011-12	7.50%	Sl.No.	Year	Obligation expressed as percentage of total energy drawn other than from distribution licensee	1.	2010-11	8.50%	2.	2011-12	9.50%										
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<b>Tamil Nadu</b>	(Order dated 29 07 2011) 9% from all Non Solar 0.05% from Solar for 2011-12																												

ERCs	(4) Sharing of CDM benefit
<b>CERC</b>	100% to be retained by the developer in the 1 <sup>st</sup> year. 10% share to the beneficiary in the 2 <sup>nd</sup> year which will increase @10% every year till it reaches 50% after which the benefit shall be equally shared by the developer and the beneficiary (CERC Regulations 2009).
<b>Andhra Pradesh</b>	10% to DISCOM and 90% to Developer.
<b>Gujarat</b>	As per CERC Regulation 2009.
<b>Karnataka</b>	As per CERC Regulation 2009.
<b>Madhya Pradesh</b>	As per CERC Regulation 2009.
<b>Maharashtra</b>	As per CERC Regulation 2009.
<b>Rajasthan</b>	-
<b>Tamil Nadu</b>	As per CERC Regulation 2009.

ERCs	(5) Cross Subsidy
<b>CERC</b>	-
<b>Andhra Pradesh</b>	Not mentioned in TO
<b>Gujarat</b>	RE Sources based Power Generation consumed for captive use/third party sale shall be exempted from payment of Cross Subsidy Surcharge.
<b>Karnataka</b>	Cross subsidy surcharge @Rs.1.15 per unit is payable for wheeling for other than own use.
<b>Madhya Pradesh</b>	Not mentioned in TO. Presently not being levied on captive use/3 <sup>rd</sup> party sale
<b>Maharashtra</b>	Not mentioned in TO
<b>Rajasthan</b>	Cross subsidy charges are nil for RE based power consumption.
<b>Tamil Nadu</b>	50% of the rate specified for other consumers. Cross subsidy payable by other consumers varies from 97 paisa/unit to Rs.3.02/unit depending upon category of consumer & voltage of supply.

3.10 The list of addresses of concerned officials is provided in Annexure – II.

A decorative border consisting of repeating floral motifs, including small flowers and leaves, arranged in a rectangular frame around the page content.

# CHAPTER -4

## STATE NODAL AGENCY GUIDELINES

# CHAPTER-4

## STATE NODAL AGENCY GUIDELINES

### PROCEDURES AND RELEVANT ISSUES

- 4.1 Though generally all the State Nodal Agencies (SNAs) follow MNRE guideline yet procedures followed are different.

The simplicity of procedure makes a significant difference in making Investment decisions.

The wind resource and the tariff are however the prime factors for decision making.

Different types of constraints and limitations are being observed – primarily related to land, grid evacuation, timely payment and procedural delays.

State-wise information have been provided in subsequent sections for seven major states considered in this study.

### 4.2 Past Performance

The performance of the states in terms of capacity addition is provided in Table : T-4-1 below.

**TABLE : T-4-1**  
**Growth of Wind Power Installed Capacity in India**  
**during last 5 years**

*(As on 31.03.2011)*

Sl. No.	State	Year-wise Installed Capacity Addition (MW)						Total Capacity (MW)
		Up to March'06	2006-07	2007-08	2008-09	2009-10	2010-11	
1	Andhra Pradesh	126.040	0.800	-	-	13.600	63.400	203.840
2	Gujarat	345.755	328.950	580.130	313.605	296.150	312.175	2176.765
3	Karnataka	578.370	264.750	187.000	322.350	154.400	257.050	1763.920
4	Kerala	2.350	-	8.700	18.600	1.500	4.800	35.950
5	Madhya Pradesh	39.140	17.450	69.250	25.100	16.600	46.500	214.040
6	Maharashtra	996.705	483.600	276.075	181.075	134.100	232.800	2304.355
7	Rajasthan	359.895	111.750	70.450	199.600	350.000	436.700	1528.395
8	Tamil Nadu	2890.855	570.460	392.650	423.675	598.300	991.225	5867.165
9	West Bengal	1.250	0.500	-	-	-	-	1.750
10	Others	1.300	-	-	-	-	-	1.300
TOTAL (MW)		5341.660	1778.260	1584.255	1484.005	1564.650	2344.650	14097.480

*(Source: Directory Indian Windpower 2011)*

The performance during the financial year 2010-2011 is provided in Table : T-4-2 below :

**TABLE : T- 4-2**  
**State & Make-wise Installation of Wind Power Projects in India**  
**During April 2010 to March 2011**

Sl. No.	Make	Andhra Pradesh	Gujarat	Karnataka	Kerala	Madhya Pradesh	Maharashtra	Rajasthan	Tamil Nadu	Total
		MW	MW	MW	MW	MW	MW	MW	MW	MW
1	2	3	4	5	6	7	8	9	10	11
1	Suzlon	-	183.100	93.950	4.800	40.500	107.200	333.500	191.550	954.600
2	Enercon	62.400	78.400	116.000	-	-	31.200	103.200	112.000	503.200
3	Gamesa Wind	-	15.300	-	-	-	-	-	216.750	232.050
4	Vestas Wind	-	20.400	39.600	-	-	41.250	-	115.500	216.750
5	Regen Powertech	-	7.500	7.500	-	-	7.500	-	96.000	118.500
6	RRB Energy	-	-	-	-	-	-	-	99.000	99.000
7	Leitner Shriram	-	-	-	-	-	9.000	-	40.500	49.500
8	Kenersys India	-	-	-	-	-	32.000	-	2.000	34.000
9	Pioneer Wincon	-	2.000	-	-	-	2.250	-	27.750	32.000
10	WinwinD	-	-	-	-	-	-	-	28.000	28.000
11	Southern Windfarms *	-	0.225	-	-	-	-	-	20.925	21.150
12	Global Wind Power	-	3.000	-	-	6.000	-	-	12.000	21.000
13	Shriram EPC	1.000	2.250	-	-	-	0.750	-	11.500	15.500
14	CWEL	-	-	-	-	-	-	-	14.250	14.250
15	Inox	-	-	-	-	-	-	-	2.000	2.000
16	Ghodawat	-	-	-	-	-	1.650	-	-	1.650
17	SIVA *	-	-	-	-	-	-	-	1.500	1.500
	<b>TOTAL</b>	<b>63.400</b>	<b>312.175</b>	<b>257.050</b>	<b>4.800</b>	<b>46.500</b>	<b>232.800</b>	<b>436.700</b>	<b>991.225</b>	<b>2344.650</b>

\* Unconfirmed

(Source: WEG Manufacturers)

### 4.3 Andhra Pradesh

#### 4.3.1 Guidelines

##### 1) Availability of Clear Guide Line

Andhra Pradesh is having a clear Guideline for allocation of Wind Power Project. In the Guidelines issued by Andhra Pradesh, following points have been covered:-

- i) Procedure for setting up of Windfarms.
- ii) Services offered by State Nodal Agency i.e. NRDCAP.

- iii) Incentives offered to NCES based Power Projects.
- iv) Details of Documents required, while submitting the application for sanction of Wind Power Project.

**2) Documents needed for sanction:**

- i) Company details indicating the type of organization, present activity/business, turn over of the company during last three years. Net profit of the company in last three years etc.
- ii) Electrical Details  
Present consumption of electricity, connected load and consumer details HT/LT connection.
- iii) Proposed wind farm details:
  - i. Site(s) proposed for setting up Wind Power Project with order of preference.
  - ii. Proposed for captive use or for commercial basis.
  - iii. Capacity of Wind Power Project and number of Wind Electric Generators to be installed.
  - iv. Nearest sub station of A.P. Transco/Discom and Voltage ratio of sub-station.
  - v. Estimated Project cost.
  - vi. Source of finance
  - vii. Planned duration for project completion
- iv) The WEG proposed should find place in the latest list published by C-WET.
- v) Declaration.
- vi) Submission of project profile (as per format).

**3) Clearances Needed:**

- i) Detailed project report covering all relevant aspects like selection of WEGs, capital cost, energy estimation, cost of generation, operation and maintenance etc.
- ii) No objection certificate from SEB/SNA after analyzing the wind data to ensure adequate availability of wind at the specific site.
- iii) The applicant has to obtain all the statutory clearances prior to commissioning of the project including obtaining project land.
- iv) Obtain NOC for sanctioned capacity from NRDCAP.



**4) Evacuation system required:**

- i) Eligible developer shall bear the entire cost of power evacuation facility for inter-connecting the wind farm with grid and delivery of power.
- ii) Tariff period– Applicable to PPA signed between 01/05/2009 & 31/03/2014 and shall remain valid for the period of 10 years.
- iii) Tariff for procurement of Energy by utility from new wind power project is Rs.3.50 per kWh for a period of 10 years for projects for which PPA are signed during the period from 01/05/2009 to 31/03/2014. From 11<sup>th</sup> year to 20<sup>th</sup> year Tariff for these projects shall be as determined by the APERC.
- iv) Banking is allowed. However, energy delivered, if not used, will be deemed to be sold to DISCOM at 85% of tariff. (As per Government Policy G.O. Ms 99 dated 09/09/2008).
- v) Transmission and wheeling charges are 5% of Energy wheeled which is inclusive of transmission and wheeling losses also.

**5) Fees Payable:**

NRDCAP extends the service to the wind farm developer to set up projects:-

The fee payable to NRDCAP towards sanction of project is 0.25% of the project cost subject to a minimum Rs.1.50 Lacs per MW.

This fee is to be paid to NRDCAP at the time of signing the agreement, through Demand Draft, drawn in favour of NRDCAP Ltd., Hyderabad.

Further, an amount of Rs.25,000/- per MW shall be paid as security deposit, towards performance guarantee for timely completion of the project.

**6) Time needed for sanction / Approval:**

NRDCAP, is acting as the Nodal Agency as per orders of Government of Andhra Pradesh.

The application form in the prescribed format, has to be addressed to the Managing Director, NRDCAP Ltd., 5-8-207/2, Pishgah Complex, Nampally, Hyderabad – 500001.

On obtaining sanction from NRDCAP the developer will approach the district administration for land.

In case of forest land, the developer shall approach Forest department for land allotment.

#### **4.3.2 Relevant Issues**

Though not of very good quality yet A.P. has good wind resource in large area.

In past few years there has been hardly any growth primarily due to low tariff and rather negative attitude of State utility.

Vast potential is in Forest area and it may take time to actually make such land available.

Even the procedure for allotment of Revenue land is cumbersome.

Though project sites have been allotted to large number of Investors/Developers not much growth is actually taking place, since the tariff is rather low.

Efforts are being made to convince APERC to increase the tariff and wind zone wise differential tariff may be considered.

#### **4.4 Gujarat**

##### **4.4.1 Guidelines**

###### **1) Availability of Clear Guide Lines**

Gujarat Energy Development Agency is having a clear Guideline for setting up Wind farms in Gujarat State.

In the Guidelines issued by Gujarat State, following points have been covered:-

- i) Dates for filing of application.
- ii) Validity of permission.
- iii) Suitability of sites.
- iv) Land related responsibilities.

- v) Power Evacuation arrangements .
- vi) Metering arrangement.
- vii) Micrositing of the WTGs.
- viii) Bar chart of Activities for project completion.
- ix) Commissioning of the sub station.
- x) Transfer and commissioning of the windfarm.
- xi) Declaration /undertakings.

**2) Documents needed for sanction:**

- i) Developer is required to submit the declaration that they have ascertained the potentiality and suitability of the site, for setting up of the windfarm, in terms of annual average wind speed, wind power density etc.
- ii) The developer to ensure that all the statutory permissions/conditions, pertaining to the use of revenue land and /or private land for setting up of windfarm are obtained /fulfilled, from with the concerned authority.
- iii) Developer shall furnish a copy of the approval granted by GETCO, for construction of sub station, Transmission line between the windfarm and GETCO's sub station, the quantum of power allowed for transmission and receipt of supervision fee paid to GETCO.
- iv) The developer shall provide metering arrangement of all the WTGs as well as at the sending end of the Windfarm as per GETCO specifications and provisions of the GERC orders
- v) Four copies of drawings shall be submitted with following details:-  
Name of Developer, village, Taluka, District, Land Survey No., Plot No., Land area in Hectares, wind farm capacity, number of WTGs, rating of WTGs, make of WTG, Rotor diameter and Hub height.
- vi) The Developer shall submit a Bar Chart of the activities, with dates/deadlines of each of the activity for project completion.
- vii) The authorized person of the Developer shall sign a declaration/undertaking, as per the contents and format specified on a Rs.100/- non-judicial stamp paper.

**3) Clearances Needed:**

- i) The WTG proposed for installation shall new and have type test approval of the C-WET.

**4) Evacuation system required:**

- i) The developer shall construct the sub station and the transmission line at their own cost.
- ii) Levelized tariff Rs.3.56 per kWh constant for project life of 25 years, applicable to projects commissioned on or after 11/08/2009.
- iii) Banking shall be allowed for one month and surplus energy shall be payable at 85% of applicable tariff.
- iv) Transmission charges and wheeling charges:-

1. Wheeling of energy for consumption at 66 kV or above.
2. Transmission charges and transmission loss as applicable to normal Open Access consumer.
3. Wheeling of energy for consumption at voltage below 66 kW.
4. Transmission charge at the rate applicable to normal Open Access consumer along with transmission and wheeling losses @ 10%. For small investors having only one WEG, transmission and wheeling losses payable shall be only 7%.
5. If energy is to be wheeled to more than two locations for consumption charges at the rate 5 paise per kWh shall be payable extra.

Transmission charges for long term Open Access consumer determined by the commission for the year 2009-10 is Rs.2410 per MW per day.

**5) Fees Payable:**

Application processing fee inclusive of the windfarm commissioning charges, along with the application form shall be paid as given below, in the form of Demand Draft drawn in a nationalized bank in favour of Gujarat Energy Development Agency, payable at Gandhinagar.

Up to 25 MW	-	Rs.2.50 Lacs
26 MW – 50 MW	-	Rs.5.00 Lacs
51 MW – 75 MW	-	Rs.7.50 Lacs
76 MW and above	-	Rs.10.00 Lacs

In the event of the Developer, requiring to change the location/s of the WTG/s, their configuration etc. after having been granted the permission, a reprocessing fee of Rs.25000/- per Developer application shall have to be paid.

The Developer permission shall be valid for a period of Twenty four months from the date of grant of permission or up to the period that the present wind power policy is in force, whichever is earlier. If the developer requests for extension of validity period with genuine reasons, the reprocessing charge is Rs.25000/- per Developer.

#### **6) Time needed for sanction / Approval:**

The application complete in all respect, by the Developer for obtaining Developer Permission for setting up of windfam, shall not be filed later than:-

15<sup>th</sup> August - For part/full commissioning of the proposed windfam capacity by 30<sup>th</sup> September.

15<sup>th</sup> February- For part/full commissioning of the proposed windfam capacity by 31st March.

In case of transfer of the developed windfam to the client of the developer the application shall be filed, minimum fifteen days prior to the date of commissioning.

#### **4.4.2 Relevant Issues**

Though the wind regime is of medium order and tariff is on lower side yet high growth has taken place in Gujarat primarily because of pro-active and simplified procedure followed by State Agency.

The consumer tariff being quite high large growth has taken place through captive consumption route. There is no cross-subsidy charges in Gujarat.

Lately third party sale is also taking place as no cross subsidy charges are imposed. Most simplified procedure and least interference has prompted Manufacturers and Developers to explore new potential sites in unexplored regions.

The terms and cost for allotment of Revenue land is well established but slightly time consuming. Right of Way is also available.

Electricity Board is simultaneously expanding 400 kV network and in next 3/5 years Gujarat shall logically achieve high capacity addition.

Too much capacity addition may mean high financial burden on Discom and Gujarat is anxiously waiting for REC Market to develop.

## **4.5 Karnataka**

### **4.5.1 Guidelines**

#### **1) Availability of Clear Guide Line**

Karnataka Renewable Energy Development limited have issued a clear Guideline for allocation of Wind Power Capacity/Projects in Karnataka State.

In the Guidelines issued by Karnataka State, following points have been covered:-

- i) Instructions to the applicant.
- ii) Role and responsibilities of KREDL.
- iii) Responsibilities of Energy Department.
- iv) Responsibilities of Allotment Committee.

#### **2) Documents needed for sanction:**

- i) Pre-Feasibility Report containing all General, Technical & Financial aspects of the proposed Project.
- ii) Audited Balance sheet for previous three years/Income tax return statements/Profit & Loss Account Statements, Company Incorporation Certificate, PAN card copy, Passport size Photo of the applicant, and details about Individual Directors.

- iii) Net worth details of Company Directors. The company should have minimum Net worth of 30% of the total project cost.
- iv) Attested copies of the documents by a Gazetted Officer or Public Notary.
- v) Project Area marked on Survey of India Map of scale 1:50,000
- vi) Land ownership details and extent of land required.
- vii) The Technical potential (WPD) of candidate site (As per MNRE)
- viii) The WTG proposed should find place in the latest RLMM list published by C-WET.
- ix) The Government Capacity Sanction Order contains certain Terms and Conditions such as permitting the Applicant to sign an agreement with Government within 45 days from the date of Government order.

**3) Clearances Needed:**

- i) The applicant has to obtain all the statutory clearances prior to commissioning of the project including obtaining the Project Land.
- ii) Obtain NOC for the sanctioned Capacity from KREDL and commission the project thereafter.
- iii) The proposal do not overlap with any of the existing or proposed projects and other developers.

**4) Evacuation system required:**

- i) For Evacuation Infrastructure, cost to be borne by Developer.
- ii) Tariff period is applicable for a period of 10 years from the date of signing of PPA.
- iii) Tariff for procurement of Energy by utility from New wind Power Projects is Rs.3.70 per kWh without any escalation.
- iv) Banking is allowed as per laid down conditions.  
Banking charges @ 2% of input energy.
- v) Transmission charges and wheeling charges are 5% of Energy fed to the Grid.
- vi) Transmission loss and wheeling loss are included in Transmission and wheeling charges.
- vii) Reactive Power charges are 40 paise per kVAh.

**5) Fees Payable:**

Application fee	: Rs.10,000/- per MW
DPR Processing fee	: Rs.1,00,000/- per MW
Transfer fee	: Rs.1,50,000/-per MW
Security Deposit	: Rs.1,00,000/-per MW

**6) Time needed for sanction / Approval:**

i) Statutory Clearances:

Various statutory clearances that are essential for the development and commissioning of Project, Karnataka Renewable Energy Development Limited will pursue with the Departments and co-ordinate for speedy approvals and clearances within 90 days for all Departments/Agencies and 120 days in case of forest clearance.

ii) Clearance of Renewable Energy Projects

Clearance of Renewable Energy Projects involves sanctions /clearances from a number of Government Agencies/Departments. The concerned Department will give necessary approvals and clearance within 90 days of the applications submitted. KREDL will monitor with the concerned Departments.

**4.5.2 Relevant Issues**

Next to Tamil Nadu, Karnataka has the best wind regime and a very large potential is available.

To ensure faster growth and achieve capacity addition of 500 MW of WPPs per year the state authorities have created single window facility and are contemplating creation of a single agency for signing of PPA's and making payments.

Due to high cross subsidy and Transmission charges, sale to Third Party is not attractive. There are however several constraints related to:



**Land – Private -** The system of diversion of agricultural land is time consuming and costs Rs. 45000/- per Ha, besides payment of yearly Panchayat tax in the range of Rs.5000-Rs.10000 per MW. There is some public criticism regarding use of agricultural land.

**Land – Forest -** Vast windy area is in Forest Land.

Karnataka was the first state where windfarm was developed in Forest land.

Lately however there are several problems since the Forest Department is charging :

- Soil Moisture Conservation (SMC) charges over and above the NPV cost under CAMPA.
- Yearly lease rent of Rs. 1000/- per Ha. over and above Rs. 30000/- lease rent paid per MW.

The total cost of Forest land works out to be Rs. 1.5 Mill/MW.

The Forest Department is also refusing to accept some alternate land out of Govt. land Bank which appears to be green and considered as “Deemed Forest”.

**Grid -** The high growth area is in a closely region of Gadag, Devangre and Bellari Districts. Very large evacuation facility is not available in the area. The State utility is constructing a 220 kV substation at Chitradurga and a 400 kV substation at Gadag but for transferring the power to consumption centres around Bangaluru, shall be a problem since the lines are overloaded.

There is a provision that Developer may deposit 50% of grid evacuation cost on reimbursable basis to Karnataka Power Transmission Co. Ltd. (KPTCL).

30 new Anemometry Stations have been established to explore new sites and prospective Developers are being asked to establish one mast per 5 MW Project in virgin area.

## 4.6 Madhya Pradesh

### 4.6.1 Guidelines

#### 1) Availability of Clear Guide Lines

Government of Madhya Pradesh is having a clear Guideline for development of Wind Power Projects in the Madhya Pradesh.

In the Guidelines issued by Madhya Pradesh, following points have been covered:-

- i) Eligible Developers.
- ii) Land allotment.
- iii) Facilities and Incentives.
  - a) Purchase rate of Energy.
  - b) Green Energy Fund
  - c) Open Access
  - d) Third Party sale
  - e) Wheeling
  - f) Status of Industry
  - g) Power Evacuation facility
  - h) Contract demand reduction
  - i) Banking

#### 2) Documents needed for sanction:

The developer to submit the application in the prescribed proforma along with fixed fee to the Managing Director, M.P. Urja Vikas Nigam Ltd.

The M.P. Urja Vikas Nigam Ltd., would accord sanction of projects up to five Mega Watt Capacity to private sector.

The cases of over five Mega Watt Capacity projects would be forwarded to the State Government for approval.

**3) Clearances Needed:**

- i) For according permission to set up Wind Energy Project in Madhya Pradesh WEGs which are included in the latest list of C-WET only are permitted.
- ii) Land use permission for those sites only would be considered, which are declared as potential sites by C-WET/MPUVN.
- iii) The promoter shall submit a list of investors along with other necessary documents two months before the completion of project to MPUVN.
- iv) For forest land, the guidelines issued by ministry of Environment and Forest, Government of India from time to time shall be applicable. State Government also would hold the right to impose other additional terms and conditions.
- v) All statutory clearances and necessary approvals, if any, are to be obtained by the developer.

**4) Evacuation System required:**

- i) The control period is from the date of issue of order i.e. 14/05/2010 and will end on 31/03/2013.
- ii) Tariff period is 25 years.
- iii) Levelized tariff Rs.4.35 per kWh, applicable to projects commissioned on or after the date of issue of order during the control period and shall remain constant for the project life of 25 years.
- iv) All expenses for evacuation facility shall be borne by the developer. These lines and equipments will be maintained by MPSEB/successor company at the cost of party.
- v) Banking is allowed, but yet to be implemented. Surplus energy shall be paid @ Rs.2.95 per kWh.
- vi) Transmission and wheeling charges are 2% for self use as well as for sale to third party of energy fed to grid.
- vii) The reactive power charges for kVArh consumption from the grid are 27 paise per kWh.

**5) Fees Payable:**

Developer shall have to pay @ Rs.50,000/- per MW as non refundable processing fee along with the application.

If the developer applies 15 days prior to the specified date of completion for extension of time with proper justification, then in such condition extension for 3 months to the developer can be granted, for which the developer shall have to pay an additional fee of Rs.1,00,000/- per MW.

**6) Time needed for sanction / Approval:**

Time needed for Sanction / Approval not defined. However, developer will have to commence and commission the project only after receiving the permission from the State Government for setting them up the project in the prescribed time limit.

The developer will have to follow the time limit as given below, only they would be eligible for availing the incentives under the policy.

Commencement of project	- 3 months from the date of sanction.
Commissioning of project	- 15 months from the date of sanction.

**4.6.2 Relevant Issues**

M.P. has low wind regime and limited resource. Anemometric study has been conducted in few locations and there are large virgin area where potential sites could be identified.

The procedures followed in M.P. is cumbersome and time consuming. The guidelines of MNRE is not followed in totality.

Though only limited number of projects have been implemented – regular payment is not received from Discom. Even signing of PPA takes unduly long time.

So far there has been hardly any demand on the grid due to limited capacity addition. The cost of grid extension up to Windfarm site is borne by Investor and cost involved would be much higher in view of sites being in far-flung area.

A vast potential could have been identified in certain locations but since the land would probably belong to Tribals, the same shall not be available for windfarm projects under the existing law.

In spite of comparatively better tariff – not much of growth can be expected due to other constraint.

## **4.7 Maharashtra**

### **4.7.1 Guidelines**

#### **1) Availability of Clear Guide Lines**

Maharashtra Energy Development Agency (MEDA) has issued a procedure for setting up wind power projects in Maharashtra.

#### **2) Documents needed for sanction:**

- i) Land details of project.
- ii) No objection certificate from Geology and Mining Department.
- iii) No objection certificate from Development Commissioner (Industry) for Industrial use of land.
- iv) Detailed Project Report.
- v) Micrositing plan.
- vi) Technical details of WEGs, power curve, type test certificates.
- vii) Copy of the application made to MSEB for Grid connectivity.
- viii) No objection certificate from Forest Department, if applicable.

#### **3) Clearances Needed:**

- i) All legal and statutory clearances shall be complied by project.
- ii) owner/developer only.

It is also binding on project owner/developer to obtain no objection certificate from public local body, Revenue Department, Geology and Mining Department, Pollution Control Board, Forest Department, Civil Aviation, Seaport, and Defence Authorities.

Infrastructure consent for the project from Maharashtra Energy Development Agency (MEDA) :

- Projects up to and including 10 MW capacity – Approval by Director General, MEDA
- Projects above 10 MW capacity – Approval by Chairman, MEDA.

**4) Evacuation system required:**

- i) The developer will have to develop evacuation infrastructure from generation facility up to the inter connection point at his own expense.

The evacuation infrastructure cost beyond the inter-connection points shall be borne by the licensees and shall be recovered from the consumers as per pricing frame developed by the State Commission.

- ii) Tariff period is for 13 years.
- iii) Tariff review/control period is 5 years ending with 2014-15. Tariff will be determined for each year of the control period commencing from 2010-11.
- iv) Transmission and wheeling charges are as applicable for normal Open Access Consumers.

Rate defined by the commission applicable for the year 2009-10 are:

- Transmission tariff Rs.918.25 per MW/day (for short term open access)
  - Wheeling charges range from 0 to 43 paise per kWh depending upon the Voltage at which power is connected and injected.
- v) Reactive energy charges are 25 paise per kWh prevailing at present, subject to the condition that escalation in rate shall not be more than 5% per year for kVArh consumption up to 10% of kWh export to grid.

**5) Fees Payable:**

The application form in prescribed format shall be submitted with application fee @ Rs.3000/- per MW.

Every developer /investor shall pay a security deposit @ Rs.15,00,000/- per MW with his proposal.

The project of applied capacity subject to applicable target shall be commissioned within nine months from the date of infrastructure clearance.

After commissioning of the project in the scheduled time of Nine Months, the security deposit will be refunded otherwise this security deposit will be forfeited.

**6) Time needed for sanction / Approval:**

Not defined.

**4.7.2 Relevant issues**

Though wind regime is of medium order the high growth has taken place in Maharashtra primarily because of relatively better tariff.

Lately progress slowed down due to land issues, political interference, theft and sabotage, Right of way problems, non-cooperative attitude of Village/local bodies.

As per the tariff regulation 2010, tariff for wind energy projects to be determined for each of the year for the control period of 5 years for 31.03.2011, for projects to be commissioned during the year separate for different Wind Zones (i.e. Zone-I WPD 200-250 W/m<sup>2</sup> CUF:20%, Zone-2: WPD: 250-300 W/m<sup>2</sup> CUF:23%, Zone-3 WPD:300-400 W/m<sup>2</sup> CUF:27%, Zone-4 WPD 400 W/m<sup>2</sup> CUF 30%). The methodology of declaring a site for the particular wind zone has not been finalized yet, due to which developers have to execute PPA for the lowest tariff until methodology is finalized.

Separate tariff for different wind zone has increased the complications.

Further PPA period is only for 13 years.

**4.8 Rajasthan**

**4.8.1 Guidelines**

**1) Availability of Clear Guide Lines**

Rajasthan Renewable Energy Corporation Limited has issued a policy for promoting Generation of Electricity through non-conventional Energy Sources for Rajasthan State.

In the guideline following points have been covered:-

- 1) Title and information.
- 2) Use of power for Captive purchase/sale.
- 3) Grid interfacing.
- 4) Wheeling and Banking.
- 5) Price of Power.
- 6) Power Purchase Agreement.
- 7) Settlement of Accounts.
- 8) Merit order Dispatch.
- 9) Incentive by the State Government.
- 10) RREC to be Nodal Agency.
- 11) Registration for Power Project.
- 12) Approval of Power Project.
- 13) Security Deposit and its forfeiture.
- 14) Savings.

**2) Documents needed for sanction:**

- i) The Power Producer shall register the application with RREC in prescribed proforma with the following Documents :
  - a) Project Report for establishing the Wind Power Project.
  - b) The power Producer shall select the site for establishing the Power Project and shall also submit the application to RREC for allotment of land.
  - c) The Power Producer shall submit the interfacing scheme.
  - d) The Power Producer shall submit the Documents and Attachments as per prescribed proforma.

**3) Clearances Needed:**

- i) For the identified Government land, clearance from District Collector is needed. The site proposed by the Power Producer should be for which wind parameters are certified by C-WET.



- ii) Clearance in principle for the project will be issued by RREC for:-
  - a) The plan/layout of the project, strictly in accordance with standard guidelines of MNRE/C-WET.
  - b) The suggested grid interfacing arrangement as submitted by the applicant is accepted and approved by RVPN/DISCOM.

The project proposal shall be cleared "in principle" by RREC initially and thereafter final approval for projects meeting the above requirements, shall be issued by the State level Empowered Committee.

**4) Evacuation system required:**

- i) Interfacing arrangements such as Transformers, Panels, Kiosks, Protection, metering, H.T. lines, from the points of generation to the pooling station, including the pooling station shall be developed and maintained by the power producer as per the specifications and requirements of the RVPN /DISCOM, and the entire cost for this will be borne by the power producer.
- ii) Tariff period is 20 years.
- iii) Tariff review/control period is 5 years ending on 31/03/2014. Tariff shall however be determined year to year.
- iv) The tariff for projects in Jaisalmer, Barmer and Jodhpur Districts:-

Year 2010-11	-	Rs.3.87 kWh
Year 2011-12	-	Rs.4.22 kWh

The tariff for projects in other Districts:-

Year 2010-11	-	Rs.4.08 kWh
Year 2011-12	-	Rs.4.44 kWh

If by mutual agreement, meter is installed at licensees premises, losses over the interconnecting line shall be added to the Net Energy export @ 1% for metering at 33 kV and @ 4% for metering at 132/220 kV.

- v) Banking and drawal shall be on 6 monthly basis from April to September and October to March.

Utilization of banked energy shall not be permitted in December to February. Payment for unutilized banked energy will be settled @ 60% of energy charges including fuel charges applicable to large industrial power tariff.

- vi) Transmission and wheeling charges for RE Power shall be 50% of charges specified by normal open access consumers.
- vii) Reactive Energy charges is Rs.5.75 per kVArh w.e.f. 01/04/2009 escalated @0.25 paise per kWh every year.

**5) Fees Payable:**

- i) Non refundable processing fee payable to RREC along with application is Rs.50,000/- per MW.
- ii) Refundable security Deposit payable to RREC towards timely completion of project-  
For Jaisalmer District - Rs.10 Lacs per MW  
For other Districts - Rs.5 Lac per MW  
Security deposit for projects of capacity up to 25 MW shall be paid in cash only, and for projects of capacity above 25 MW in the form of Bank Guarantee.
- iii) Fees payable to RVPN/DISCOM for creation of proper facility for receiving power is Rs.2.00 Lac per MW.

**6) Time needed for sanction / Approval:**

The Approval of Project will be accorded by the State level Empowered Committee within one month.

**4.8.2 Relevant Issues**

Rajasthan has comparatively lower wind regime but significant growth has taken place because of better tariff and pro-active approach of state authorities.

Procedure for project approval is simple and prompt.

The state utility also make regular payment.

There has been growth only in a concentrated area in Jaisalmer district.

Vast virgin area is available in southern part of the state.

The tariff declared in Rajasthan is quite attractive but it is related to price variation clause in terms of cost for cement, steel etc.

If the cost of Cement, steel etc. goes down the tariff is reduced but in reality the manufacturers do not offer any cost reduction.

There has been recently certain difficulties in grid evacuation since growth has taken place in a concentrated area.

However 400 kV network is being augmented and they have plans for 750 kV network in future.

Rajasthan has high potential for growth and they have plans to add 300 MW of WPPs per year. This would put high financial burden on state and they may have to reduce the RPO limit if REC trading does not pick up.

There are no cross-subsidy charges in Rajasthan.

Rajasthan has provided for land bank to offer to Forest Deptt as alternate land.

## **4.9 Tamil Nadu**

### **4.9.1 Guidelines**

#### **1) Availability of Clear Guide Line**

Procedure for registration and obtaining approval for Wind Power Project is available.

#### **2) Documents needed for sanction:**

The application to be submitted to the Chief Engineer/Non-Conventional Energy Sources (NCES) Chennai along with following documents.

- i) Request Application.
- ii) Specified profoma duly filled along with required enclosures.

- iii) Land sale deed documents along with originals for verification.
- iv) Technical particulars of WEG with power curve.
- v) Copy of partnership deed/Company, copy of Memorandum & Articles of Association with Registration of Firm/Company certificate.
- vi) Indemnity Bond on Non-Judicial Stamp Paper.
- vii) Undertaking in Non-Judicial Stamp Paper.
- viii) Copy of Purchase order of WEG with order acceptance by the Manufacturer.
- ix) Electrical schematic single line diagram.
- x) Copy of Type Test Certificate of WEG issued by C-WET.

**3) Clearances Needed:**

After verifying the above mentioned documents and on receipt of the payments the application is forwarded to the concern Superintending Engineer.

The concerned Superintending Engineer shall submit the Field Feasibility Report with recommendation.

**4) Evacuation system required:**

- i) The cost of interfacing line up to the interconnection point shall have to be borne by the State Transmission Utility/Distribution licensee, in case of sale of power to distribution licensee by WEGs.

For captive use or sale of such power to third parties or to distribution licensee other than the distribution licensee of that area, the entire cost of interfacing line up to interconnection point shall have to be borne by the developers and work will be executed by the distribution licensee under deposit work basis.

The State Transmission Utility/Distribution licensee shall have to maintain the standards as per CEA norms and Tamil Nadu Electricity Grid Code.

- ii) Tariff period is 20 years.
- iii) Tariff review /control period is 2 years ending on 31/03/2011.

- iv) Sale to Utility.
  - a) From 01/04/2009 onwards is Rs.3.39 per kWh.
  - b) For captive use/sale to third party.

Net Energy consumption made from the utility is payable on TOD (Time of the Day) slot basis.

In addition 80.39% of the applicable demand charges for the deemed demand supplied by the Generator Plus 100% of applicable demand charges for the balance demand supplied by the licensee is payable.

- v) Banking is allowed for one year (April to March)
 

Banking charges @5% of unutilized energy at the end of the year, to be paid by the utility @75% of the relevant purchase tariff.
- vi) Transmission and wheeling charges are 5% of energy, in case of consumption of HV/EHV level.
 

For LT service it will be 7.5%.
- vii) Reactive energy charges are 25 paise per kWh for consumption up to 10% of Net energy generated.
 

For drawal in excess of 10%, entire consumption is payable at 50 paise per kWh.

## 5) **Fees Payable:**

Fees payable to TNEB for registration of application	- Rs.1000/-per WEG.
Consultancy charges to be paid to TNEB	- Rs.10000/-per application Irrespective of number of WEGs (non refundable)
Infrastructure development charges	- Rs.30.00 Lac per MW
Fees payable for execution of agreement	- Rs.2000/-per MW or part thereof.
Annual O&M charges	- Rs. 1.60 Lacs per MW.
Fees payable for name transfer	- Rs.6000/-per WEG
After six months from the date of initial registration fees payable for name transfer shall be	- Rs.1,00,000/- per WEG.

**6) Time needed for sanction / Approval:**

Not defined. However, the application registration, is valid for a period of six months from the date of Registration.

**4.9.2 Relevant Issues**

Maximum growth has so far taken place in Tamil Nadu primarily because it has the best wind regime. The installed capacity is already almost equal to estimated potential.

In future, installations would take place in such areas where the generation potential would be lower.

Presently problems are being faced in Tamil Nadu both on count of grid evacuation and receipt of payment.

TNEB has plans to construct 5 Nos. of 400 kV and 4 Nos. of 230 kV substations but that would provide only short term relief.

An elaborate master plan needs to be developed for major network improvement along with inter-state linkage.

Even for creation of short term grid evacuation facility, TNEB is facing financial problem though it collects Rs. 3.0 Mill /MW for evacuation facilities.

Though sale to Third party is permitted, the terms and conditions are not very favourable.

TNEB already has a huge accumulated loss of more than Rs. 36000 Mill and with higher burden due to very high wind power penetration; the financial crisis would get aggravated unless REC trading takes place immediately.

So far high growth has been taking place due to pro-active attitude and well-established norms follow by TNEB which is in fact acting as the state nodal agency for wind power. It is now reported that TNEB may be unbundled.

The transmission company, Tamil Nadu Transmission Corporation Limited (TaATRANSCO), has started functioning, the registration of the Distribution and Generation Company, Tamil Nadu Generation and Distribution Corporation (TANGEDCO), and that of the holding company TNEB Ltd. are over but transfer of assets and employees is yet to be completed.

Unless immediate financial support/assistance is provided, TNEB may not be able to cope up with the situation and large number of WPPs may even be disconnected from the system during high wind season.

4.10 The comparative State-wise features is provided in Table : T-4-3 below:

**TABLE : T-4-3**

**State-Wise Comparative Features**

States	Approach of			Land Issues	Grid related issues	Opportunity for IPP
	SNA	Utility	SERC			
Andhra Pradesh	B	C	C	B	A	A
Gujarat	A	A	A	A	B	B
Karnataka	B	B	B	C	B	B
M.P.	C	C	B	B	B	A
Maharashtra	B	C	A	C	B	A
Rajasthan	A	A	A	A	B	A
Tamil Nadu	A	B	A	A	C	B

A : Very Good  
 B : Good  
 C : Not favourable

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# CHAPTER -5

## WIND RESOURCE ASSESSMENT



# CHAPTER-5

## WIND RESOURCE ASSESSMENT

### 5.1 Qualified Sites

5.1.1 Under funding of Govt. of India about 616 Anemometry Masts (AM) have been installed all over the country.

However, only 233 Masts have recorded the qualifying criteria of Wind Power Density (WPD) being above 200 Watts per Sq. Mtr. at 50 mtr. height.

State-wise gross potential is given in Table :T-5-1.

State wise list of qualified masts is provided in Table : T-5-3.

The WPD Map of the Country is provided in Figure F-5-1.

5.1.2 State-wise list of Masts and Locational Map is provided in Appendix-A.

Few new masts have been installed by C-WET and the list is provided in Table : T-5-4.

### 5.2 Gross Potential

5.2.1 Estimated gross potential of total country is provided in Table : T-5-1 below:

**TABLE : T-5-1**  
**Estimated Gross Potential**

Sl. No.	State	Potential (MW)	Achievement as on 31.03.2011 (MW)
1	Andhra Pradesh	5394	203.840
2	Gujarat	10609	2176.765
3	Karnataka	8591	1763.920
4	Kerala	790	35.950
5	Madhya Pradesh	920	214.040
6	Maharashtra	5439	2304.355
7	Rajasthan	5005	1528.395
8	Tamil Nadu	5374	5867.165
9	Others	7008	3.050
<b>Total</b>		<b>49130</b>	<b>14097.480</b>

*(Source: MNRE & Directory Indian Windpower 2011)*

5.2.2 Quality-wise state resource is provided in Table : T-5-5.

5.2.3 As against potential of 49000 MW estimated by MNRE, some other agencies have indicated the gross potential to be much higher and varying between 4 Lac MW to 8 Lac MW (Lawrence Berkley National Laboratory, USA).

### **5.3 Large Failures – reason thereof**

Out of total 616 Anemometry Masts (AM) installed under Govt. sponsored scheme only 233 Masts have recorded the qualifying criteria of Wind Power Density (WPD) being 200 Watts per Sq. Mtr. at 50 mtr. height as already indicated in Table : T-5-3.

The main reasons for such huge failure are:

- a) The Anemometry Masts (AM) were not located at the ideal spot. Shifting the AM by few hundred meters would have indicated better results.
- b) The recording period was probably in a lean-wind period as can now be verified through 30-year wind data recording by NASA.

### **5.4 Private Masts**

MNRE through order dated 20.06.08 has provided detailed guideline for Wind measurement by Private Sector.

The summary / cardinal features of the guideline are:

- i) Installation of Anemometry mast under intimation to SNA and C-WET at minimum height of 50 mtr.
- ii) In non-complex area – an area with 10 km radius shall be the qualified area under the mast.
- iii) On completion of minimum one year wind data collection – the data should be validated by C-WET.
- iv) On recommendation of C-WET, SNA shall provide clearance for setting up of Windfarm.
- v) A period of 3 to 5 years shall be available to set up the windfarm project.
- vi) After 3/5 years C-WET can make the wind data publicly available.

- vii) Regarding land availability for project the procedure shall be :
- Private land - Entirely responsibility of Investor/Developer
  - Revenue land - SNA shall keep the land reserved for 3/5 years.
  - Forest land - Investor/Developer shall reserve the suitable land area compartments) with the Forest Department for 3 years as per guideline of MoEF

## 5.5 New Techniques

With Wind Data being available for 30 years at fixed grid points and with availability of advanced computer soft-wares, it is now possible to develop MESO and MICRO scale wind resource maps with higher degree of accuracy.

Such exercise must necessarily be carried out with use of high quality Contour Maps.

To be on the safer side, the output from MESO/MICRO Scale maps must be validated through AM data already recorded at nearby locations.

Besides wind Atlas published by C-WET, there are several other options available in the markets – which are now being used widely to ascertain the ideal mast location and avoid high rate of failure.

The Indian Wind Atlas is a result of combined effort of Centre for Wind Energy Technology (C-WET), Chennai, India and Riso DTU National Laboratory for Sustainable Energy, Roskilde, Denmark on the investigation of Indian Wind Climatology with a specific focus on wind resource assessment for harnessing wind energy in India.

The project involved the use of Meso-Scale Wind Model Map of Karlsruhe Atmospheric Meso Scale Model (KAMM) and Micro-Scale Model WA<sup>S</sup>P.

Meso Scale Modelling was carried out for 12 domains of about 600x600 km at a resolution of 5 km covering entire India.

To validate this Meso-scale map, Micro-scale mapping was carried out at 52 locations only for a domain size of 20 km x 20 km at 1 km resolution. The results of the selected 52 micro-scale models were used to fine tune the Meso-scale map to produce the final wind atlas.

Wind speed and wind power density maps at height of 50 and 80 mgl were prepared.

The final Atlas is presently available only in a hard copy for reference.

The Meso-scale map at 5 km resolution provides only indicative information of wind potential. The Micro-scale map with high resolution terrain data is more useful for actual identification of site and establishment of windfarms.

Uncertainty would however still prevail in terms of year to year variation particularly for marginal sites.

## **5.6 Modification of Qualifying Criteria**

WPD is only an indicative feature. The actual generation would depend on the frequency distribution, height of Wind Electric Generator (WEG) and Power Curve Characteristic of WEG.

The guideline issued by Central Electricity Regulatory Commission (CERC) has rightly considered the Capacity Utilization Factor (CUF) at the site for determination of tariff.

There are large number of sites where the WPD is lower than 200 Watts per Sq. mtr but the CUF is much above 20% with use of WEG at higher height and having better characteristic Power Curve.

With revision of qualifying criteria in terms of CUF – large number of sites are likely to be available for setting up of commercially viable projects.

## **5.7 Likely State-wise Potential**

Only the State of Tamil Nadu rigidly follows the separating distance criteria of 5D x 7D.

All other States permit much lower separating distance corresponding to Wind-rose recorded at the site. This is surely a more Scientific approach – provided Array efficiency of 90% is ensured.

With use of more optimum Layout design, the potential in terms of MW would largely increase in already identified windy sites.

Possibilities of identifying new potential sites and capacity additions appear to be as below:

#### **5.7.1 Andhra Pradesh (A.P.)**

For various reasons there has been hardly any capacity addition in AP.

The estimated potential is 5394 MW and installed capacity till 31.03.2011 is only 203.840 MW. There is strong indication that the present tariff of Rs. 3.50/kWh is likely to be increased and should this happen, there shall be large investment since large number of sites have already been identified.

#### **5.7.2 Gujarat**

As against the estimated potential of 10609 MW, the installed capacity as on 31.03.2011 is 2176.765 MW.

Large number of Anemometry Masts have been installed by Private Investors / Developers in virgin area of Porbandar, Amreli and Bhavnagar Districts where potential is expected to be 2000 MW.

The influence area per mast is considered as 25 km radius.

Quite a few of new 400 kV Sub-stations are proposed to be constructed at new potential Districts in near future along with construction of 400 kV lines.

Further, 400 kV line and substation is also being constructed in Kutch area.

In view of this, the capacity addition in next 3-5 years is likely to be quite substantial.

The main constraint shall be higher financial burden on Discom and remedy shall be enforcement of Renewable Energy Certificates (REC).

#### **5.7.3 Karnataka**

The estimated potential is 8591 MW and installed capacity as on 31.03.2011 is 1763.920 MW.

Large number of sites have been identified in a concentrated area in Gadag, Chitradurga, Devangere and Bellari District.

There is strong possibility of identifying more sites in virgin area of Shimoga, Chikmagalur and Hassan District in South Karnataka.

Though the state has substantially large potential, the main constraints for growth are:

- a) Inadequate grid evacuation facility around concentrated growth area of Gadag, Chitradurga, Devangere and Bellari.
- b) Extreme difficulties being faced in acquisition of Forest Area both due to high cost and long time taken.

#### **5.7.4 Madhya Pradesh**

The estimated potential is 920 MW and installed capacity as on 31.03.2011 is only 214.040 MW.

Anemometric study has been carried out at limited number of locations in Western MP.

There are virgin potential area in the Districts of Khargone, Khandwa, Chindwara and Mandsaur which needs to be explored.

The main constraint is non-availability of land at high potential sites in Tribal area and high cost of grid evacuation at far-flung locations.

#### **5.7.5 Maharashtra**

The estimated potential is 5439 MW and installed capacity as on 31.03.2011 is 2304.355 MW.

A very large number of Anemometry Masts have been installed in Kolhapur, Aurangabad, Pune and Nasik Districts.

The main constraint is role of political and social activists on instigating the Private Land Owners and Panchayats.

However, in view of attractive tariff, the growth is likely to be substantial provided of course, grid evacuation facility is augmented in concentrated area of development and timely payment is made by Discom.

#### **5.7.6 Rajasthan**

The estimated potential is 5005 MW and installed capacity as on 31.03.2011 is 1528.375 MW.

So far the growth has primarily taken place in Jaisalmer District and partly in nearby Jodhpur and Bamer District. This area still holds large potential subject to augmentation of 400 kV grid network.

Large potential sites are likely to be available in virgin area at Southern part of the State around Udaipur.

With reasonably good tariff, the installed capacity is likely to increase substantially subject to grid augmentation around Jaisalmer and availability of Forest land in Udaipur and nearby Districts.

At one stage this may mean high financial burden on Discom unless REC route becomes functional.

#### **5.7.7 Tamil Nadu**

Maximum growth has taken place in the State of Tamil Nadu.

The estimated potential is 5374 MW and installed capacity as on 31.03.2011 is 5867.165 MW.

There has been high growth in high wind area around Tirunelveli and Coimbatore – where hardly any land would now be available.

The new growth area is likely to be in Theni and Dindigul Districts.

Due to large demand, the growth is likely to be also in peripheral area of Tirunelveli and Coimbatore District where probably the CUF would come down to 20% from present level of 25 to 30% CUF.

The main constraint for growth shall be non-availability of massive 400 kV grid network and inter-state linking involving huge investment.

The State has far exceeded its RPO obligation and further capacity addition would mean prohibitive burden on Discom unless REC route is made available.

Delayed payment by Discom is already a matter of concern.

5.7.8 In view of the facts stated above, the likely capacity addition in major States in next 5 years would be as per Table : T-5-2 below:

**TABLE : T-5-2**  
**Likely Capacity Addition in Major States in next 5 years**

State	Estimated Potential (MW)	Installed up to 31.03.2011 (MW)	Likely installation in next 5 years (MW)	
			Optimistic	Conservative
Andhra Pradesh	5394	204	3000	2000
Gujarat	10609	2177	3000	2000
Karnataka	8591	1764	2500	2000
Madhya Pradesh	920	214	750	500
Maharashtra	5439	2304	2000	1500
Rajasthan	5005	1528	2000	1500
Tamil Nadu	5374	5867	3000	2500
<b>Total</b>	<b>41332</b>	<b>14058</b>	<b>16250</b>	<b>12000</b>

## 5.8 Repowering of old Windfarms

Initially in early 90's when Private Sector Investment started, the WEGs installed were of rating 225/250 kW with hub height of 30 mtr and vast majority of them had stall regulation.

These WEGs of Orthodox design are now operating at CUF ranging from 15% to 20%. Some of them-installed in extremely high wind zones are operating at CUF of above 20%.



Incidentally these machines were located at prime locations – where a new generation WEG would have CUF of 40% and above with advanced technology, Larger rotor diameter and higher hub-height.

The installed capacity till 31.03.1996 in India was about 700 MW out of which about 550 MW is in Tamil Nadu and some are in Gujarat.

Initially in Tamil Nadu, the Investors purchased Large continuous land area and installed WEGs with separating distance of 5Dx7D – as insisted by Tamil Nadu Electricity Board (TNEB). Subsequently the trend was to only acquire the foot-print area for installation of individual WEG.

These old machines with Orthodox design feature and lower hub-height have completed more than 15 years of Operation and have residual life of 4-5 years.

These old machines producing much lower quantum of energy at prime locations should be logically replaced with new generation machines which would surely increase the generation by 300 to 400 percent.

If TNEB continues to insist for 5D x 7D separating distance, the increase in installed capacity in terms of MW shall not increase much but the generation would increase by 350 to 400 %.

If however, the separating distance is allowed at 3D x 5D – the installed capacity in terms of MW would increase by 300 to 350%.

The critical factor for consideration should be to avoid negative impact (due to shadow effect) between other WEGs around the new WEG.

Even after consideration of cost for augmentation of evacuation facility, the new investment would provide better financial results.

While working out the financial return, it would be logical to take into consideration the loss of revenue out of the old WEG for the residual life.

## **5.9 New Initiatives**

Though apparently there is not much of potential available yet Govt. of India has initiated step to assess and – if viable – harness the off-shore potential.

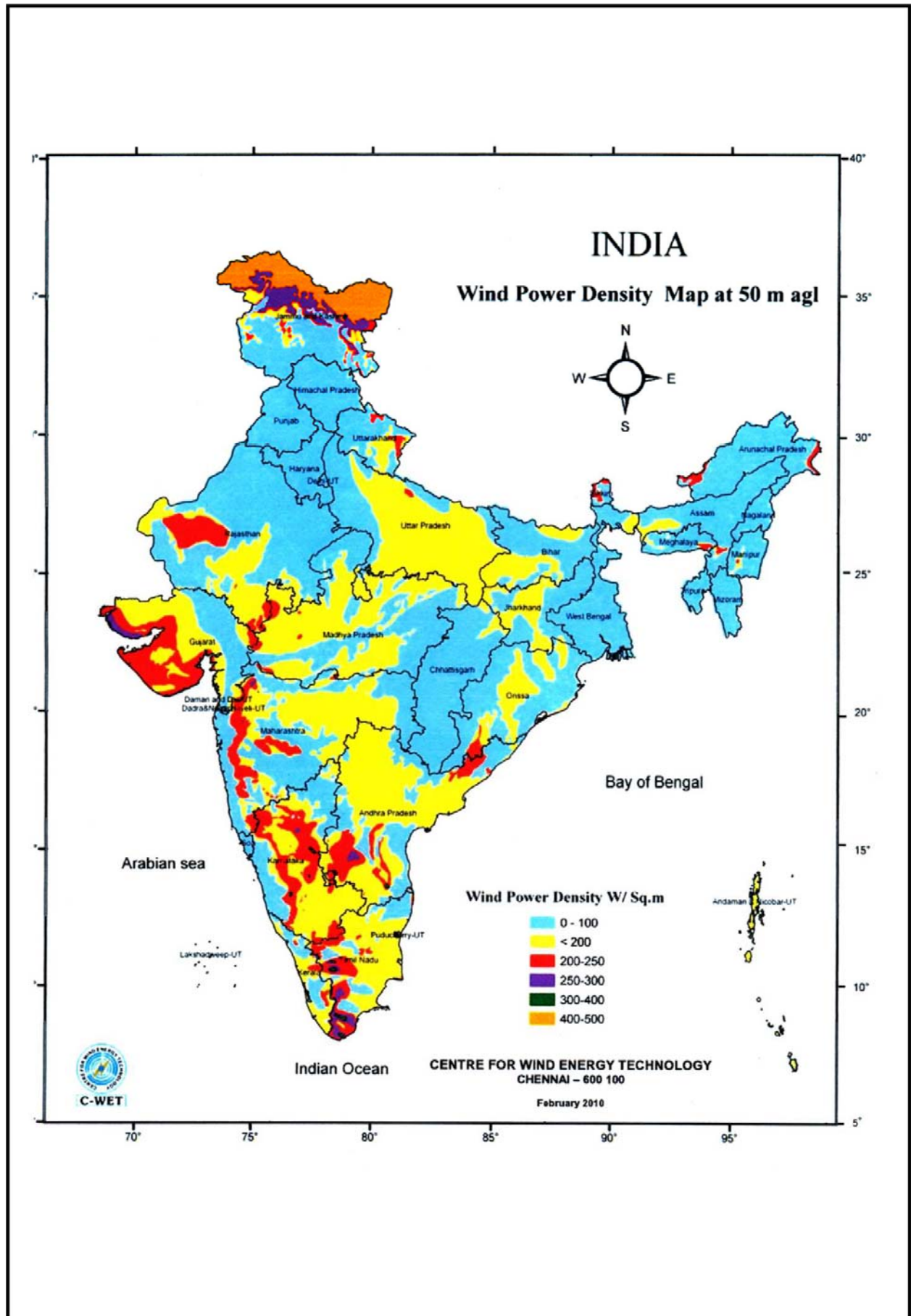
It is quite well known that capital cost for off-shore project 2.5 to 3 times higher than on-shore projects to be substantially higher in a large area.

**TABLE : T-5-3****List of Approved Wind Farmable Sites  
(as on 31-03-2011)**

<b>Sl. No.</b>	<b>State / Union Territory</b>	<b>Stations with Annual Average WPD &gt; 200 W/m<sup>2</sup> at 50 m height</b>
1	Andaman & Nicobar	2
2	Andhra Pradesh	35
3	Arunachal Pradesh	-
4	Assam	-
5	Gujarat	40
6	Haryana	-
7	Himachal Pradesh	-
8	Jammu & Kashmir	1
9	Karnataka	26
10	Kerala	17
11	Lakshadweep	9
12	Madhya Pradesh	7
13	Chattisgarh	-
14	Maharashtra	33
15	Orissa	6
16	Punjab	-
17	Pondicherry	-
18	Rajasthan	8
19	Tamil Nadu	47
20	Uttarakhand	1
21	West Bengal	1
<b>Total</b>		<b>233</b>

(Source : C-WET)

FIG : F-5-1



**TABLE : T-5-4**  
**C-WET Wind Monitoring Masts in Operation**  
**(as on 31.03.2011)**

<b>S. No.</b>	<b>Name of the Station</b>	<b>District</b>	<b>Remarks</b>
<b>1</b>	<b>Andaman &amp; Nicobar Islands</b>		
1	Chouldari	Andaman	
2	Collinpur	Andaman	
3	Corbins Pahar	Andaman	
4	Hog Point	Nicobars	
5	IRBN Complex	South Andaman	
6	Vikas Nagar	Nicobars	
7	Wandoor	Andaman	
<b>2</b>	<b>Andhra Pradesh</b>		
1	Chinnapalasa	Adilabad	
<b>3</b>	<b>Bihar</b>		
1	Adhaura	Kaimur	
<b>4</b>	<b>Chattisgarh</b>		
1	Ghatgaon	Raigarh	
2	Nawapara	Jashpur	
<b>5</b>	<b>Goa</b>		
1	Betul	South Goa	
2	Pernam	North Goa	
3	Sirigao	North Goa	
<b>6</b>	<b>Gujarat</b>		
1	Balava	Jamnagar	
2	Jegawada	Surendranagar	
3	Jikiali	Amreli	
4	Lamba	Jamnagar	
5	Sarva	Bhavnagar	
6.	Virewadi	Bhavnagar	
<b>7</b>	<b>Jammu &amp; Kashmir</b>		
1	Bidda	Reasi	
2	Patnitop	Udhampur	
3	Pir Ki Gali	Poonch	
<b>8</b>	<b>Jharkhand</b>		
1	Metrameta	Simdega	

S. No.	Name of the Station	District	Remarks
<b>9</b>	<b>Karnataka</b>		
1	Doni Mines (KPCL)	Dharwad	
2	Hulkotti	Gadag	
3	Jogimatti	Chitradurga	
<b>10</b>	<b>Madhya Pradesh</b>		
1	Ghat Pipariya	Betul	
2	Pahari	Satna	
3	Seamau	Raisen	
4	Ubhariya	Betul	
<b>11</b>	<b>Maharashtra</b>		
1	Bahaduri	Nasik	
2	Chincholi	Aurangabad	
3	Dhundi	Yavatmal	
4	Dolasane	Ahmadnagar	
5	Garpit	Wardha	
6	Girda	Washim	
7	Gondhalwadi	Akola	
8	Harni	Buldhana	
9	Jagmin	Satara	
10	Janori	Washim	
11	Jawla	Ya vatmal	
12	Kesarkarwadi	Kolhapur	
13	Kolasa	Akola	
14	Kolura	Ya vatmal	
15	Methepathar	Nagpur	
16	Portgavan	Ya vatmal	
17	Rasulpura	Aurangabad	
18	Sarati	Aurangabad	
19	Shewga	Aurangabad	
20	Songirpada	Nandurbar	
21	Umri	Nagpur	
22	Virgavahan	Amravati	

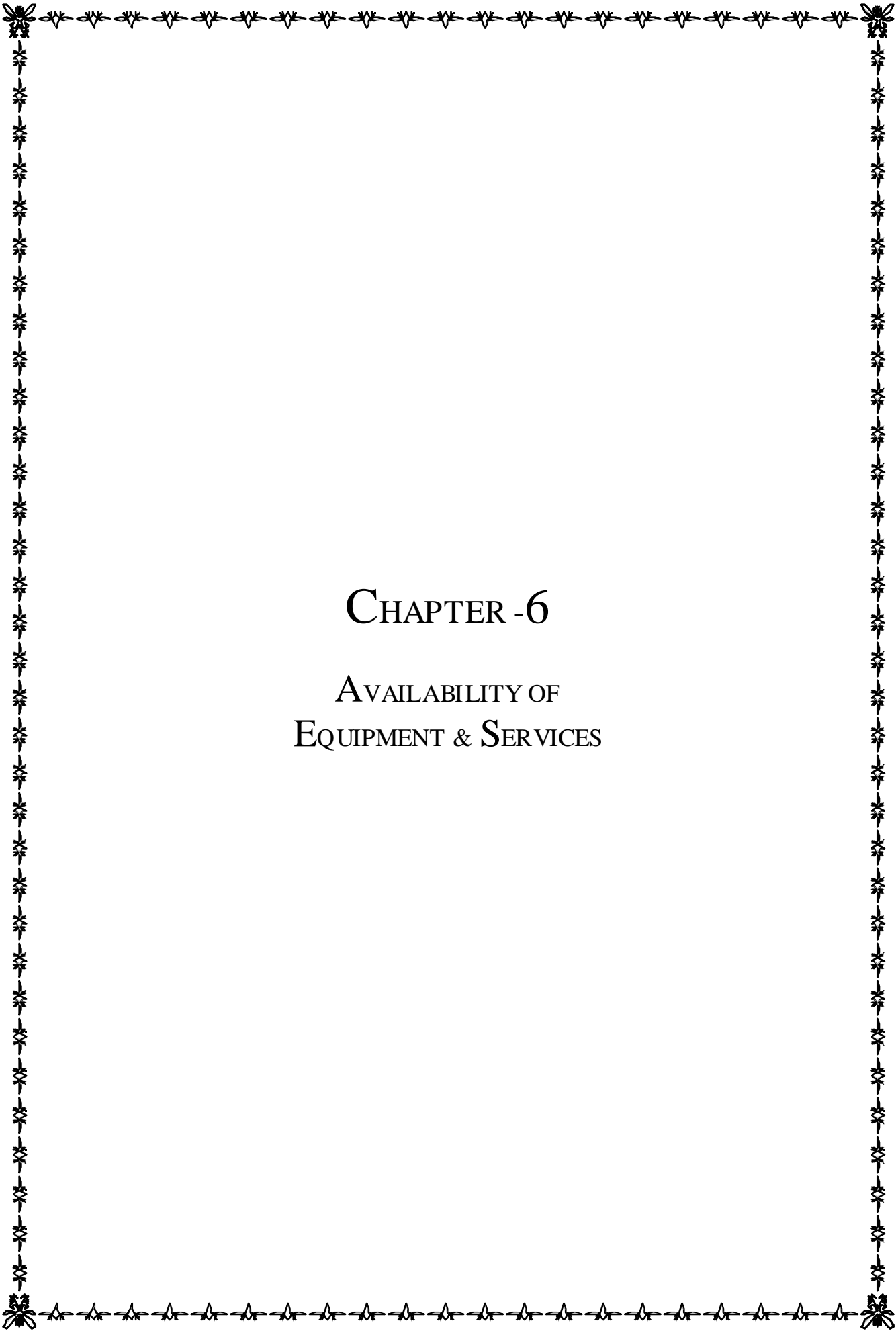
<b>S. No.</b>	<b>Name of the Station</b>	<b>District</b>	<b>Remarks</b>
<b>12</b>	<b>Manipur</b>		
1	Kamnong	Ukhrul	
2	Mao	Senapathi	
<b>13</b>	<b>Meghalaya</b>		
1	Laitdiengsai	East Khasi Hills	
2	Mawiwete	West Khasi Hills	
<b>14</b>	<b>Nagaland</b>		
1	Kekrima	Phek	
2	Pfutsero	Pfutsero	
3	Thizama	Kohima	
<b>15</b>	<b>Rajasthan</b>		
1	Akal	Jaisalmer	
<b>16</b>	<b>Tripura</b>		
1	Barjola	West Tripura	
<b>17</b>	<b>Uttar Pradesh</b>		
1	Bhagawanpur	Gorakhpur	
2	Garaura	Robartsganj	
3	Mamna	Mahoba	
4	Manikpur	Chitrkoodam	
<b>Total No. of stations in operation as on 31.03.2011</b>			<b>66</b>

(Source : C-WET)

**TABLE : T-5-5**  
**Details of Approved Wind Farmable Sites**  
**in various States as on 31.03.2011**  
**(indicating WPD Ranges)**

Sl. No.	State / Union Territory	No. of Stations				Total Stations having WPD more than 200 W/m <sup>2</sup> at 50 m height
		WPD 200 to 250 W/m <sup>2</sup>	WPD 251 to 300 W/m <sup>2</sup>	WPD 301 to 350 W/m <sup>2</sup>	WPD Above 350 W/m <sup>2</sup>	
1	Andaman & Nicobar	2	-	-	-	2
2	Andhra Pradesh	15	11	5	4	35
3	Gujarat	27	8	2	3	40
4	Jammu & Kashmir	-	-	1	-	1
5	Karnataka	7	8	3	8	26
6	Kerala	7	2	3	5	17
7	Lakshadweep	4	5	-	-	9
8	Madhya Pradesh	3	3	-	1	7
9	Maharashtra	18	11	4	-	33
10	Orissa	4	2	-	-	6
11	Rajasthan	5	3	-	-	8
12	Tamil Nadu	8	6	9	24	47
13	Uttarakhand	1	-	-	-	1
14	West Bengal	1	-	-	-	1
	<b>Total</b>	<b>102</b>	<b>59</b>	<b>27</b>	<b>45</b>	<b>233</b>

(Source : C-WET)

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CHAPTER -6

AVAILABILITY OF  
EQUIPMENT & SERVICES



# CHAPTER-6

## AVAILABILITY OF EQUIPMENTS

### 6.1 Manufacturers & Models

There are now about 18 Manufacturers of WEG and as per approved list of C-WET there are more than 40 models available.

The list of models and relevant Technical particulars are provided in Table : T-6-3 (4 Pages).

There appear to be quite a few interested in manufacturing WEG with Chinese technology.

### 6.2 Past Performance of Manufacturers

The capacity addition by all Manufacturers during past 5 years is provided in Table : T-6-4 (1-Page).

It is observed that there are four major manufactures – Suzlon, Enercon, Vestas and RRB Energy – who have the market share of 92%.

Besides the four well established manufacturers, there are two manufacturers- Gamesa and Regen – who are likely to have a major share in next 3/5 years.

All these established manufacturers are offering Turnkey project as also long term O&M Services.

There are two other manufacturer of International repute – GE and Siemens who have ventured in Indian market but their strategy to capture the market is not yet known.

Quite a few new entrants are contemplating to introduce WEG with Chinese Technology but their testing, certification, capability to offer turnkey solution and O&M services would be a mater of concern.

### 6.3 New initiatives

Virtually all the established manufacturers are concerned about availability of good windy sites and financial viability of projects in future.

They have initiated several measures to encounter the problem.

#### **a) Energy Generation capability**

All of them have introduced or are in the process of introducing new generation models with:

- higher rating
- higher rotor diameter
- higher Hub-height

#### **b) Wind Resource Assessment**

Enercon and Suzlon have installed large number of Anemometry Stations at so far unexplored locations to identify new potential sites.

Enercon is installing Anemometry Masts at higher height.

The new entrants – Gamesa and Regen have also initiated activities in this field.

#### **c) Forecasting**

Forecasting of WPPs of 10 MW and above shall be mandatory beyond January 2012.

Enercon has been continuously exploring the possibilities to achieve acceptable level of accuracy without of course, much success in Tamil Nadu and Gujarat.

The communication link appears to be inadequate.

Suzlon is actively trying to establish such systems and fine tuning the mechanism.

Gamesa and Vestas are using internally developed software.

Manufacturers feel that no penalty should be imposed in near future for default.

## **Forecasting Methods:**

Wind Power Forecasting (WPF) is quite a complex job since it deals with two major variables:

- The wind speed varies corresponding to weather conditions – which is again dependent on few variable factors.
- The generation from a Wind Power Projects varies in cubic proportion of wind speed – which again is dependent on site features.

In general, forecast models deals with three steps:

- Numerical Weather Prediction (NWP)
- Wind to Power model
- Regional Up-scaling

The input data by meteorology needs to be accurate to forecast short and long term variation.

For utility grid, the forecasting should be on day ahead and hourly basis for proper planning.

For Wind Power Project the forecasting is necessary at three different scales.

- In seconds for Turbine Control
- In hours for grid management
- In days for maintenance planning

Forecasting process involves four steps:

- Forecast of meteorological parameters obtained from Numerical Weather Prediction (NWP) model.
- Weather input refined for exact location of wind power project.
- Detailed generation characteristic of the windfarm.
- Prediction of generation on hourly and days-ahead basis.

The usual procedures to reduce error are:

- Use of several NWP
- Use of several forecasting models
- Aggregate forecast predictions

Forecasting of generation is not only useful for the utility to do advance planning but it would be useful also for the power traders.

Some of the popular WPF systems available are -

<b>Model</b>	<b>Developer</b>
PREDIKTOR	RISO, Denmark
WPPT	IMM.DTU/ENFOR, Denmark
Zephyr	RISO and IMM.DTU, Denmark
GH Forecaster	Garrad Hassan, UK
ewind	AWS Truewind, USA
Power Sight	3 TIER, USA

The main constrain for forecasting at higher accuracy level is non-availability of large number of ground metrological station to facilitate necessary correction for local wind conditions.

None of the manufacturers with foreign collaboration who are using the software developed in their parent country are able to forecast with reasonable accuracy in view of the above mentioned constrain.

The cost for the forecasting software varies from Rs. 5.00 Lacs to Rs. 10.00 Lacs which does not include installation of reference Anemometry mast.

In the 12<sup>th</sup> plan draft report it is envisaged that C-WET shall acquire the expertise and provide services on forecasting.

#### **d) Guarantee of Generation**

Except Regen no one else is offering any absolute guarantee of generation.

#### **e) Cost Reduction**

Indigenization, expanding vendor base and entering into long term contract with the suppliers are some of the measures initiated by Manufacturers.

## 6.4 Immediate Future Plan

Immediate future plan of major players based on Infrastructure Development work already initiated is indicated in Table : T-6-1 below:

**TABLE : T-6-1**  
**YEAR 2011-12**

Make	Andhra Pradesh	Gujarat	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan	Tamil Nadu	Total
Enercon	100	100	100	50	150	150	100	750
Gamesa		100	30	20	50	25	300	525
Regen		65		30	230	60	240	625
RRB					75	25	85	185
Suzlon	150	300	200	50	150	350	300	1500
Vestas								
Others								100

(Source : WEG Manufacturers)

**YEAR 2012-13**

Make	Andhra Pradesh	Gujarat	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan	Tamil Nadu	Total
Enercon	100	150	100	50	100	200	100	800
Gamesa	100	200	186	50	100	100	200	936
Regen	50	200	50	150	200	100	300	1050
RRB		25	84	12	50	45	25	241
Suzlon								2000
Vestas								
Others								150

(Source : WEG Manufacturers)

**YEAR 2013-14**

Make	Andhra Pradesh	Gujarat	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan	Tamil Nadu	Total
Enercon	100	150	150	50	150	200	100	900
Gamesa	50	200	150	50	200	150	200	1000
Regen	250	400	100	200	350	300	400	2000
RRB		25	25	25	160	25	75	335
Suzlon								2500
Vestas								
Others								

(Source : WEG Manufacturers)



- Grid - Central Funding to State Utilities to augment the grid network.
- Financial - GBI benefit should be increased and REC market should be developed through strict enforcement of RPO obligation.
- Reduction of RPO limit by some states should be discouraged.
- Benefit through A.D. should continue for some more time.

## 6.8 Future Scenario

The Manufacturers have indicated the future capacity addition primarily in consideration of their manufacturing capacity.

The actual capacity addition shall largely depend on availability of land and evacuation facility.

If sufficient land and adequate evacuation facility is not available – there shall be a higher market demand and that may lead to increase in capital cost.

## 6.9 Future Cost Implementation

Based on personal discussion and indicative figures provided by Manufacturers, the cost break up appears to be -

Complete WEG	- 74 to 76 % of total cost
Tower foundation, unit substation for each WEG, Transportation, Erection and commissioning	- 8 to 10% of total cost
Balance all infrastructure, land and charges for Permission / clearance	- 14 to 16% of total cost

The cost of land is usually considered as 3 to 4% of project cost.

It is obvious that cost of land shall substantially increase in near future and Manufacturers have to bring down the cost of WEG by 2-3%.

**TABLE : T-6-3**

**MAJOR TECHNICAL PARTICULARS OF WEGS BEING INSTALLED IN INDIA**

(In the ascending order of rating from 225 kW to 2500 kW)

Sl. No.	Item	225 kW	250 kW					500 kW	600 kW
		1	2	3	4	5	6	7	
1.	Make	Southern W/F (NEPC India)	CWEL	Pioneer Wincon	Shri ram EPC (TTG)	Siva Windturbine	RRB Energy	RRB Energy	
2.	Model No.	GWL	C30/250	P250/29	250T	SIVA 250/50	V39	Pawan Shakti 600	
3.	Rating (kW)	225/40	250	250	250/80	250/50	500	600	
4.	Rotor Diameter (m)	29.8	29.8	29.6	28.5	30	47	47	
5.	Highest hub height (m)	45	50	50	41.2	50	50	50/65	
6.	Type of tower (Tubular/Lattice)	Tubular	Lattice	Lattice	Lattice	Lattice	Tubular/Lattice	Lattice	
7.	No. of blades	3	3	3	3	3	3	3	
8.	Power regulation Pitch/Stall	Stall	Stall	Stall	Stall	Stall	Pitch	Pitch	
9.	Type of generator (Synchronous/Asynchronous)	Asyn.	Asyn.	Asyn.	Asyn.	Asyn.	Asyn.	Asyn.	
10.	Single speed/Dual speed/Variable speed (Generator)	Dual speed	Dual Speed	Dual Speed	Dual Speed	Dual Speed	Single Speed	Single Speed	
11.	AC/DC/AC system (Yes/No)	No	No	No	No	No	No	No	
12.	Rated Voltage	400 V	415 V	415 V	400 V	415 V	690 V	690 V	
13.	Geared/Gearless	Geared	Geared	Geared	Geared	Geared	Geared	Geared	
14.	Cut-in wind speed (m/s)	4.0	3.5	3	4	4	4.0	4.0	
15.	Cut-out wind speed (m/s)	25	25	25	23	25	25	25	
16.	Rated wind speed (m/s)	15	15	16	14	14	15	16	
17.	Survival wind speed (m/s)	60	70	>52	58	-	70	70	
18.	Weight								
	a. Tower (kg)		25000	24000	20000	52500	32000	41000	
	b. Nacelle (kg)		7250	12500	11500	10500	20400	20400	
	c. Rotor (kg)		4250	3900	2100	3900	7200	7200	
	d. Total (kg)		36500	40400	33600	66900	59600	68600	

**Note :** The above information has been collected from various sources. For exact and more information, respective WEG manufacture may be contacted.

Contd....



Sl. No.	Item	600 kW	750 kW		800 kW		850 kW	1000 kW
		8	9	10	11	12	13	14
1.	Make	Suzlon	Global Wind-Norwin	Pioneer Wincon	Enercon	Enercon	Gamesa Wind Turbine	Winwind Power
2.	Model No.	S-52	Norwin 750	P750/49	E-48	E-53	G52-850/ G58-850	Winwind-1 MW
3.	Rating (kW)	600	750/180	750	800	800	850	1000
4.	Rotor Diameter (m)	52	47	49	48	53	52/58	60
5.	Highest hub height (m)	75	65	61.1	75	75	65	70
6.	Type of tower (Tubular/Lattice)	Lattice	Tubular	Lattice	Tubular/ Concrete	Tubular/ Concrete	Tubular	Tubular
7.	No. of blades	3	3	3	3	3	3	3
8.	Power regulation Pitch/Stall	Pitch	Active Stall	Semi-Pitch	Pitch	Pitch	Pitch	Pitch
9.	Type of generator (Synchronous/Asynchronous)	Asyn.	Asyn.	Asyn.	Syn.	Syn.	DFM	Permanent Magnet SG
10.	Single speed/Dual speed/Variable speed (Generator)	Single Speed	Dual Speed	Dual Speed	Variable Speed	Variable Speed	Variable Speed	Variable speed
11.	AC/DC/AC system (Yes/No)	No	No	No	Yes	Yes	Yes	Yes
12.	Rated Voltage	690 V	690 V	690 V	400 V	400 V	690 V	690 V
13.	Geared/Gearless	Geared	Geared	Geared	Gearless	Gearless	Geared	Geared
14.	Cut-in wind speed (m/s)	4.0	3-4	4.0	2.0	3.0	3.0	4
15.	Cut-out wind speed (m/s)	25	25	25	25	25	21	20
16.	Rated wind speed (m/s)	13		14	14	12	17	11.5
17.	Survival wind speed (m/s)	59.5	60	52.5		57		
18.	Weight							
	a. Tower (kg)	78340					73000	
	b. Nacelle (kg)	25087					23000	
	c. Rotor (kg)	10379						
	d. Total (kg)	113806						

**Note :** The above information has been collected from various sources. For exact and more information, respective WEG manufacture may be contacted.

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		1350 kW	1500 kW				1650 kW
No.		15	16	17	18	19	20
1.	Make	Leitner Shiriram	GE Wind Energy	Leitner Shiriram	Suzlon	Regen-Vensys	Vestas Wind
2.	Model No.	LTW77	1.5 sle	LTW 77	S-82	V-77	V82/1650
3.	Rating (kW)	1350	1500	1500	1500	1500	1650
4.	Rotor Diameter (m)	77	77	76.6	82.0	77	82.0
5.	Highest hub height (m)	65	80/85	61/65/80	78.5	85	78/80
6.	Type of tower (Tubular/Lattice)	Tubular	Tubular	Tubular	Tubular	Tubular	Tubular
7.	No. of blades	3	3	3	3	3	3
8.	Power regulation Pitch/Stall	Pitch	Active Pitch	Pitch	Pitch	Pitch	Active Stall
9.	Type of generator (Synchronous/Asynchronous)	Permanent Magnet	DFM	P.M.	Asyn.	Permanent Magnet SG	Asyn.
10.	Single speed/Dual speed/Variable speed (Generator)	Variable speed	Variable speed	Variable speed	Single Speed	Variable Speed	Single Speed
11.	AC/DC/AC system (Yes/No)	Yes	Yes	Yes	No	Yes	No
12.	Rated Voltage	690 V		690 V	690 V	690 V	690 V
13.	Geared/Gearless	Gearless	Geared	Gearless	Geared	Gearless	Geared
14.	Cut-in wind speed (m/s)	3	3.5	3	4	3	3.5
15.	Cut-out wind speed (m/s)	25	25	25	20	22	20
16.	Rated wind speed (m/s)	10.6	12	10.6	14	11.8	14
17.	Survival wind speed (m/s)	-			52.5	52.5	52.5
18.	Weight						
	a. Tower (kg)				145424	162000	130000
	b. Nacelle (kg)				59900	57500	52000
	c. Rotor (kg)		19230		11691	31000	43000
	d. Total (kg)				217015	250500	225000

**Note :** The above information has been collected from various sources. For exact and more information, respective WEG manufacture may be contacted.

Contd....

Sl. No.	Item	1800 kW	2000 kW			2100 kW	2500 kW
		22	23	24	25	26	27
1.	Make	Vestas	Gamesa	Inox Wind	Kenersys	Suzlon	Global
2.	Model No.	V-100	G-90	WT2000DF	K82	S88	FL 2500
3.	Rating (kW)	1800	2000	2000	2000	2100	2500
4.	Rotor Diameter (m)	100	90	93	82	88	100.2
5.	Highest hub height (m)	95	100	80	80	80	98.2
6.	Type of tower (Tubular/Lattice)	Tubular	Tubular	Tubular	Tubular	Tubular	Tubular
7.	No. of blades	3	3	3	3	3	3
8.	Power regulation Pitch/Stall	Pitch	Pitch	Pitch	Pitch	Pitch	Pitch
9.	Type of generator (Synchronous/Asynchronous)	Asyn.	Doubly Fed.	DFIG	Syn.	Asyn.	DFIG
10.	Single speed/Dual speed/Variable speed (Generator)	Variable Speed	Variable Speed	Variable Speed	Variable Speed	Single Speed	Variable Speed
11.	AC/DC/AC system (Yes/No)	Yes	Yes	Yes		No	Yes
12.	Rated Voltage	690 V	690 V	690 V	600 V	690 V	690 V
13.	Geared/Gearless	Geared		Geared	Geared	Geared	Geared
14.	Cut-in wind speed (m/s)	3	3	3	3.5	4	3.5
15.	Cut-out wind speed (m/s)	20	25	20	25	25	25
16.	Rated wind speed (m/s)	12	15	11		12	13
17.	Survival wind speed (m/s)	12		52.5		59.5	59.5/52.5
18.	Weight						
	a. Tower (kg)				135000	161000	
	b. Nacelle (kg)				65000	73000	96000
	c. Rotor (kg)				38000	45000	52000
	d. Total (kg)				238000	281000	

(Source : Directory Indian Windpower 2011)

**Note :** The above information has been collected from various sources. For exact and more information, respective WEG manufacture may be contacted.

**TABLE : T-6-4****WIND ELECTRIC GENERATORS INSTALLED DURING LAST 5 YEARS IN INDIA**

(31.03.2011)

Sl. No.	Make	During 2006-2007	During 2007-2008	During 2008-2009	During 2009-2010	During 2010-2011	Total during last 5 years
		MW	MW	MW	MW	MW	MW
1	Chettinad			2.400			2.400
2	C-WEL	10.750	4.750	7.750	10.500	14.250	48.000
3	Elecon		4.200	4.800	0.600		9.600
4	Enercon	474.260	313.430	348.230	348.800	503.200	1987.920
5	Gamesa Wind				13.600	232.050	245.650
6	G.E. Energy	3.000					3.000
7	Ghodawat Energy				3.300	1.650	4.950
8	Global Wind Power				16.500	21.000	37.500
9	India Wind Power	0.750	1.250	1.000	0.250		3.250
10	Inox					2.000	2.000
11	Kenersys India				4.000	34.000	38.000
12	Leitner Shriram				22.350	49.500	71.850
13	NAL				0.500		0.500
14	NEPC-India	2.625					2.625
15	Pioneer Asia	12.750	1.700				14.450
16	Pioneer Wincon	27.000	23.250	26.000	27.000	32.000	135.250
17	Regen			24.000	55.500	118.500	198.000
18	RRB Energy	173.600	112.025	85.350	119.250	99.000	589.225
19	Shriram EPC (TTG)	20.500	9.750	19.000	14.250	15.500	79.000
20	Sinovel Wind				15.000		15.000
21	SIVA		0.250	0.500	2.000	1.500	4.250
22	Southern Windfarm	33.075	45.450	20.475	18.000	21.150	138.150
23	Suzlon	827.700	929.350	781.700	762.650	954.600	4256.000
24	Vestas Wind	192.950	137.500	160.800	121.950	216.750	829.950
25	Winwind			2.000	10.000	28.000	40.000
	<b>TOTAL NOS.</b>	<b>1778.960</b>	<b>1582.905</b>	<b>1484.005</b>	<b>1566.000</b>	<b>2344.650</b>	<b>8756.520</b>

(Source : Directory Indian Windpower 2007, 2008, 2009, 2010 &amp; 2011)

**Note** : Total Installed Capacity as on 31.03.2011 is 14,097.480 MW.

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# CHAPTER -7

## PERCEPTION OF INVESTORS

# CHAPTER-7

## PERCEPTION OF EXISTING IPP OWNERS

### 7.1 Methodology for Project Implementation

Presently all most all Wind Power Projects (WPPs) are implemented in Large Wind Power Estates developed by Manufacturers of Wind Electric Generators (WEG).

Major WEG Manufacturers have acquired large land area in most of the good Wind States. They develop the complete infrastructure and obtain necessary clearance/permissions to install large number of WEGs.

On completion of basic infrastructure, the manufacturer offer one or more WEGs to prospective investors.

On receipt of firm order from Investor, the foundation is constructed; WEGs are dispatched to site, erected and commissioned within 2/3 months.

The responsibility of the Investor is limited to arranging fund, selecting the sale option and signing of PPA. They are also responsible to avail incentives and benefits.

After commissioning, the Manufacturer ensures Operation and Maintenance based on long term contract.

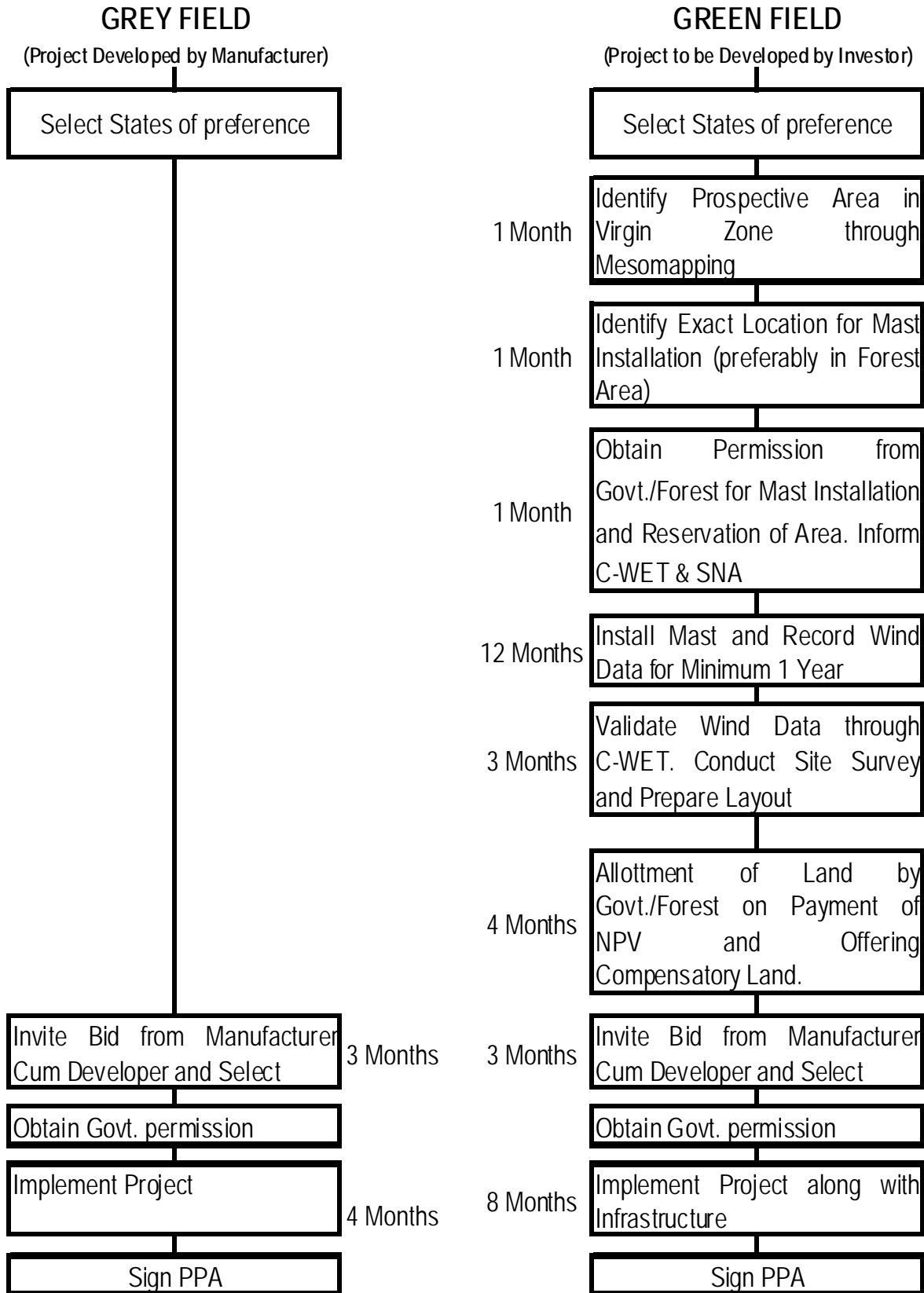
This is a Land-bank oriented route where truly speaking no competitive bidding is possible.

Hardly a project is implemented where the Investor offers the land and asks for competitive bidding from Manufacturers.

The advantages of the existing arrangement are that the Manufacturer offers Turn-key solutions, obtains all permission and clearances and usually in such short term contract – there is hardly any scope for cost escalation and time over-run.

Presently all IPPs have invested in such estates.

# PROJECT ACTIVITY SCHEDULE



**Note :** If the land belongs to Private Owner, the time needed for acquisition of land shall be much less.

## 7.2 Strategy for Investment

The Investor/IPP owners obtain offers from various manufacturers for WEGs at various locations and in different States.

The investment decision is taken primarily based on two factors:

- a) The energy generation figures quoted by manufacturers at different sites is critically analyzed and at times validated by Independent Agency.
- b) Two selling options are being examined –

- i) Sale to utility – as per rate declared by State Electricity Regulatory Commission (SERC).

Financial health of the State Utility and their track record in terms of timely payment is examined.

- ii) Sale to Third party buyer – as per terms and conditions declared by SERC. The net selling rate is examined keeping in view the transmission charges, cross subsidy charges, implication of TOD Metering, Surplus and Inadvertent sale, Electricity Duty exemption, benefit out of reduction in contract demand etc etc.

Under this route, GBI shall be available only of the quantum sold to State Utility.

Unless the purchaser is a group company and or cross-subsidy charges are lower, the option for sale to Third Party buyer may not be quite attractive.

The selling rate is higher through commercial consumers but usually their consumption is low.

The cash flow is prepared and financial analysis is carried out based on the quoted price, estimated generation and selling rate and on consideration of O&M charges as offered by WEG Manufacturers.

## 7.3 REC Route

Trading of REC takes place on last Wednesday of every month. The trading started from March 2011 has shown an increasing trend. The details of monthwise trading are available in Chapter-3 para 3.1.2.



With the increase in the REC price, most of the IPP owners may opt for this to minimize risk of delayed payment by Discoms.

Opting for REC should not debar them from availing CDM benefit.

#### **7.4 Risk Perception /Apprehensions**

The main risk factors – as envisaged by IPP owners are :

##### **7.4.1 Generation Estimation**

Except one WEG Manufacturer – no one else is offering any absolute generation guarantee. Estimation done based on one year data may widely vary on year to year basis.

No reasonable Insurance cover is also available against short fall in energy generation.

There is potential risk of switching off the grid by state utility in the event of over-feeding.

##### **7.4.2 Forecasting**

Though the time limit for forecasting has been extended up to January 2012 yet there is strong apprehension about capability of forecasting with 70% accuracy through available technologies and existing meteorological setup and communication link.

Unless these issues are resolved, selling shall be problematic.

##### **7.4.3 CDM Benefit**

The fate of this benefit beyond 2012 is quite uncertain.

Further, sharing of this benefit with State Utilities as recommended by SERCs would substantially reduce the actual net gain.

#### 7.4.4 80IA/MAT

As per finance bill 2011, for FY 2011-12, AY 2012-13, the availability of tax benefit U/s 80 IA is available for 10 years if the Undertaking begins the operation at any Time during April 1, 1993 and March 31, 2012.

MAT Rate for AY 2012-13, FY 2011-12.

MAT – 18%, SC-7.5% if Book Profit exceeding Rs. 01 Crore

SHE Cess – 3% on tax & surcharge

Direct Tax Code (DTC) Bill 2010 (Bill No 110 of 2010) has been proposed by the Govt of India in Parliament during August 2010. Though yet it has not approved but it is proposed to be effective w.e.f. 01.04.2012.

Salient features / proposals in DTC which would effect Wind Power Projects are as below.

1. Income tax Rate – as per Schedule-1 of DTC. For domestic Companies – 30%
2. MAT – as per Schedule-2 of DTC. Tax @ 20% on Book Profits.
3. Depreciation—as per Schedule-13 of DTC. @ 80% WDV method for Wind mills.
4. Repeals & Savings – as per clause 318 of DTC, The deduction U/s 80IA of the repealed Income tax act shall continue to be allowed under this code if the assessee is eligible for such deduction for the assessment year beginning on the 1<sup>st</sup> day of April 2012.

**Conclusion – For Income tax. Situation will remain same for WPPs under DTC Provisions.**

#### 7.4.5 GST

Though Goods & Service Tax (GST) has not yet been introduced, yet it would be highly risky if sale of electricity is termed as “Exempted”. This would drastically increase the Capital Cost to turn all WPPs totally unviable.

#### **7.4.6 Financial Health of State Utility**

The gradually and continuously deteriorating financial health of State Utilities is a matter of serious concern which would result in :

- a) Non –payment of Bills
- b) Non-augmentation of grid infrastructure corresponding to increase in capacity addition of WPPs.

#### **7.4.7 Increase in Capital Cost**

Recent increase in Market Price – obviously due to high demand – raises doubt about viability of future Projects.

Likely increase in cost of Cement and Steel would also adversely effect the viability and future investment.

Even when cost of Cement and Steel gets reduced, the Manufacturers are not likely to reduce their price.

#### **7.4.8 Socio-Political Issues**

The recent demand for payment of Panchayat Tax for land already purchased/acquired – particularly in the States of Maharashtra and Kamataka is a matter of grave concern with risk of total stoppage of operation by villagers.

Govt. of India is considering amendment under land acquisition act whereby the land owner shall be entitled for regular compensation over and above the one time compensation. This however is applicable only on land acquired by Government agency and there is no mention about private sale of land.

#### **7.4.9 Expectation of IPP Owners**

The most important expectation of all IPPs are immediate upward revision of GBI benefit without which the growth may come to a grinding halt.

In recent past – the capital cost has been increased by quite a few manufacturers and a number of IPP owners have deferred their investment decision.

It is a ground reality that all good windy sites are over crowded and now the sites which shall be available will mean lower CUF in the range of 20-22% even with larger rotor diameter and higher Hub-height.

Under such situation, the project viability and bankability can only be established if:

- GBI is increased to Rs. 1.25 / kWh
- Maximum limit is increased to Rs. 10 Mill per MW
- Period to avail is 10 years

It is however felt that GBI rate may be increased to Rs. 1.00 / kWh provided:

- CDM benefit is available beyond 2012
- 80IA benefit continues beyond March 2011
- MAT rate is not increased

With increase in GBI rate minimum capacity addition of 1500-2000 MW per year can be expected through IPPs.

A decorative border with a repeating floral motif surrounds the page. The top and bottom edges feature larger, more complex floral designs at the corners, while the sides consist of smaller, simpler floral elements.

# CHAPTER -8

## FINANCING / PROFITABILITY

# CHAPTER-8

## FINANCING/PROFITABILITY

### 8.1 **Financing of Independent Power Projects (IPP)**

So far not many projects in IPP mode have been established.

It is a comparatively new trend and financing terms are not yet well-established. Virtually all WPPs have been established by existing business establishments as an add-on activity to avail benefit of Accelerated Depreciation (AD) and the projects were mainly financed based on Balance Sheet with resource facility readily available.

#### 8.1.1.1 **Risk Perception of Financiers**

To provide non-resource project financing to Wind Power Projects, the Banks and Financial Institutions anticipate two major risks:

- a) Accuracy of energy estimation as done by WEG supplier is seriously doubted as:
  - It is based on one-year data
  - The terrain features at Anemometry mast location and WEG location is quite different in complex terrain.
  - Correction factors applied are not realistic
- b) Timely receipt of payment from State Utility against Sale of electricity is quite doubtful particularly in view of experience faced in Tamil Nadu and Maharashtra.

In years to come, with higher capacity addition, this particular problem of delayed payment is likely to get aggravated.

The financiers are eagerly awaiting REC market to develop and come to a maturity level so that with reasonable accuracy the final rate of selling electricity can be estimated.

Financiers would prefer this option in view of timely payment likely to be available through this route.

The methodology for REC has been explained in the write up given in 3.1.2.

#### 8.1.1.2 **Risk Mitigation**

The financiers are considering engagement of Independent Agencies to validate the energy estimation done by WEG supplier. Validation should preferably be done on long term perspective at P-75 level.

Besides obtaining an undertaking from Promoter/Investor to meet shortfall in debt servicing, the financiers are eagerly expecting an active trading of REC as an alternate route for sale.

#### 8.1.2 **Terms for availing Debt**

IREDA has been the pioneer in this field and have largely set the trend.

IREDA has however limitations regarding limit of exposure.

The general feeling in the market about IREDA however are:

- it takes lot of time to sanction
- lot of paper work is involved
- Repayment period is low

Power Finance Corporation has also provided debt to a large Wind Power Project with terms quite similar to IREDA and with quite a few personal guarantees and undertakings from promoters.

Lately however some banks are showing interest and prominent among them are:

- State Bank of India
- IDBI Bank
- ICICI Bank

SBI Capitals is taking keen interest in syndicating the loan.

These Bankers appear to be quite reasonable in their approach with main deciding factor being D.S.C.R (Debt Service Cover Ratio) which as envisaged by them are:

- SBI Caps - 1.3
- SBI - 1.4 (up to 1.75)
- IDBI - 1.5
- ICICI - Minimum 1.25

The other terms as considered by them are:

	SBI Caps	SBI	IDBI	ICICI
Debt Equity	Related to DSCR	Related to DSCR (Maximum 75:25)	May be even 80:20 but generally 60:40	May be 70:30 but preferably 60:40
Interest Rate	14 to 14.5%	14% to 14.5% and more as per credit rating	-	14% to 14.5%
Repayment period	10 to 12 years	12-14 Years	3+7 Years	10 to 12 Years
Security	-	Pledge of 51% Shares. Paripasu charge in syndication	First charge on project. Corporate Guarantee and Escrow A/c	Pledge of shares up to 30% NDU/POA for 21%
Undertaking	Against cost escalation	Non-disposal Undertaking	Security Trustee	-
Preference	-	Long term PPA	Long term PPA	Long term PPA

In view of high interest rate, quite a few IPPs particularly the foreigners are considering External Commercial Borrowing (ECB).

Due to variation in currency rate, the net cost of ECB after consideration of hedging is likely to be around 10.5%. This may be 2% lower than the cost through Indian Banks but the repayment period is usually lower.

IFC (The Private Sector Financing wing of World Bank) has also provided loan under syndication to few WPPs up to maximum 35% of project cost. Repayment period may be 14 years and DSCR between 1.3 to 1.4.

### 8.1.3. Equity Funding

Few International Private Equity (P.E.) Fund Operators are getting active through their Indian outfit.



Some recent IPP Promoters have tied up with P.E. Fund Providers.

Usually PE Fund is made available on short or at the most medium term of 5-7 years.

P.E. fund providers are typically looking for 15 to 20% return.

They ideally look for a high growth projection with strong possibility of Initial Public Offering (IPO) as an exist option.

Though IDFC has a mandate to provide equity support for infrastructure projects-yet in reality it has not supported any Wind Power Project except their own outfit. They have however provided debt funding for some projects.

## **8.2 Incentives**

So far the main driving force for investment in Wind Power Projects (WPP) has been the Accelerated Depreciation Benefit.

An IPP does not have any other profit earning business where the accelerated depreciation benefit can be availed to reduce tax liability and the tax thus saved is used as promoter's equity.

On consideration of cost of project, generation potential, tariff declared by SERC, a WPP in IPP mode is not a viable and or bankable project.

As on date – two incentives are available to IPPs – as mentioned below:

### a) Generation Based Incentive (GBI)

Govt. of India has declared GBI in lieu of Accelerated Depreciation. The terms and conditions are as below:

Rate	:	@Rs. 0.50 per kWh united generated
Maximum limit	:	Rs. 1.55 Mill per year per MW with ceiling of total Rs. 6.2 Mill per MW.
Period	:	To be availed in maximum 10 years
Size of Project	:	Minimum 5 MW

This benefit is disbursed by IREDA. So far 30 projects with installed capacity of 260.9 MW have been registered with IREDA.

b) Clean Development Mechanism (CDM)

CDM benefit under Kyoto Protocol has been availed by many WPPs in India.

Ministry of Environment and Forest (MoEF) is the Nodal Agency and a National CDM Authority (NCDMA) has been established.

There are quite a few agencies with foreign tie-up available to assist in –

- Registration and Certification by MoEF and UNFCCC
- Trading of CER's in market

Under the present conditions the net benefit available under long term contract is about Rs. 0.50 per kWh after meeting all expenses at several stages.

IPP Owners with foreign tie-up are likely to do trading at higher rate.

There is however some reservation regarding availability of this benefit beyond 2012.

### **8.3 Tax Liabilities**

#### **INCOME TAX LIABILITY FOR WPP (As per provisions applicable for Assessment year 2011-12)**

##### **I. Rate of income tax for domestic company**

Rate of income tax as per finance bill 2011, for FY 2011-12, AY 2012-13 for Domestic Companies are as follows :

Income tax	@30%
SC	7.5% if Net Income exceeding Rs. 01 Crores,
SHE Cess	3%.

##### **II. Deduction from total Income u/s 80-IA of IT Act, in respect of profits and gains from Power Generation / Distribution (as per finance bill 2011, for FY 2011-12, AY 2012-13)**

Deduction – 100% of the profits is deductible for 10 years commencing from the initial AY.

### **Conditions to be satisfied:**

- 1. Commencement** – The undertaking must be setup in any part of India for the generation or generation & distribution of power and it begins the operation at any time during April 1, 1993 and March 31, 2012.
- 2. New Undertaking** – Not to be formed by old plant and machinery and not to be formed by splitting up, or the reconstruction of a business already in existence.
- 3. Amount of deduction and period** – 100% of the profit is deductible for 10 years commencing from the initial assessment year. The deduction is available only for 10 consecutive assessment years falling within a period of 15 assessment years beginning from the year in which the undertaking begins generation or generation and distribution of power.
- 4. Profits eligible for deduction** – Only profits from generation of power or profits from generation and distribution of power.
- 5. Return of income and claim for deduction** – Deduction u/s 80-IA is not available unless it is claimed in the return of income and / or the return of income is submitted belatedly.

### **III. Minimum Alternate Tax (MAT) and credit for MAT paid u/s 115JB & 115JAA of IT act.**

#### **Rate of MAT on book profit**

<b>MAT</b>	@ 18% on book profit
<b>Surcharge</b>	@ 7.5% if book profit exceeds Rs. 1 crore.
<b>Education &amp; SHE cess</b>	@ 3% on MAT and surcharge.

**Applicability** – MAT would be payable, if tax liability of a company under normal provisions is lower than the MAT on book profits.

**Credit for MAT paid** – As per applicable IT provisions the Credit for MAT paid shall be allowed in subsequent 10 assessment years to the extent of excess of tax liability as per normal provisions over the tax liability as per MAT in the subsequent year.

## 8.4 Foreign Direct Investment (FDI)

FDI is permitted in Wind Power Sector and the policy/norms are as below:-

India has among the most liberal and transparent policies on FDI among the emerging economies. FDI up to 100% is allowed under the automatic route in all activities/sectors except the following, which require prior approval of the Government.

1. Sectors prohibited for FDI
2. Activities/items that require an industrial license
3. Proposal in which the foreign collaborator has an existing financial/technical collaboration in India in the same field.
4. Proposal for acquisitions of shares in an existing Indian company in financial service sector and where Securities and Exchange Board of India (substantial acquisition of shares and takeovers) regulations, 1997 is attracted.
5. All proposals falling outside notified sectoral policy/CAPS under sectors in which FDI is not permitted.

Most of the sectors fall under the automatic route for FDI. In these sectors, investment could be made without approval of the central government. The sectors that are not in the automatic route, investment requires prior approval of the Central Government. The approval is granted by Foreign Investment Promotion Board (FIPB). In few sectors, FDI is not allowed.

After the grant of approval for FDI by FIPB or for the sectors falling under automatic route, FDI could take place after taking necessary regulatory approvals from the state governments and local authorities for construction of building, water, environmental clearance etc.

Manual for FDI brought out by the Department of Industrial Policy and promotion provides details about FDI policy and Procedures and is available at <http://www.dipp.nic.in/manual/FDI Manual Latest.pdf>

All press Notes of Department of Industrial Policy and Promotion that provides details about FDI policy are available at their website <http://siadipp.nic.in/policy/changes.htm>.

FDI Policy is also notified by Reserve Bank of India (RBI) under Foreign Exchange Management Act (FEMA) and could be seen at [www.rbi.org.in](http://www.rbi.org.in)

### **Procedure under automatic route**

FDI in sectors/activities to the extent permitted under automatic route does not require any prior approval either by the Government or RBI. The Investors are only required to notify the Regional Office concerned of RBI within 30 days of receipt of inward remittance and file the required documents with that office within 30 days of issue of shares of foreign investors.

### **Procedure under Government Approval**

FDI in activities not covered under the automatic route require prior government approval. Approvals of all such proposals including composite proposals involving foreign Investment/foreign technical collaboration are granted on the recommendations of Foreign Investment Promotion Board (FIPB).

Application for all FDI cases, except Non-Resident Indian (NRI) investments and 100% Export Oriented Units (EOUs), should be submitted to the FIPB Unit, Department of Economic Affairs (DEA) Ministry of Finance.

Application for NRI and 100% EOU cases should be presented to SIA in Department of Industrial Policy and Promotion.

Application can be made in Form FC-IL. Plain paper applications carrying all relevant details are also accepted. No fee is payable. The guidelines for consideration of FDI proposals by FIPB are at Annexure-III of the Manual for FDI.

Form FC-IL-COMPOSITE FORM FOR FOREIGN COLLABORATION AND INDUSTRIAL LICENSE

<http://siadipp.nic.in/policy/policy/ip202.htm>

Manual for FDI <http://www.dipp.nic.in/manual/FDI Manual Latest.pdf>

### **Prohibited Sectors**

The extant policy does not permit FDI in the following cases:

- i. Gambling and betting
- ii. Lottery Business

- iii. Atomic Energy
- iv. Retail Trading
- v. Agricultural or Plantation activities of Agriculture (excluding Floriculture, Horticulture, Development of Seeds, Animal Husbandry, Pisciculture and Cultivation of Vegetables, Mushrooms etc. under controlled conditions and services related to agro and allied sectors) and plantations (other than Tea Plantations).

### **General permission of RBI under FEMA**

Indian companies having foreign investment approval through FIPB route do not require any further clearance from RBI for receiving inward remittance and issue of shares to the foreign investors.

The companies are required to notify the concerned Regional Office of the RBI of receipt of inward remittances within 30 days of such receipt and within 30 days of issue of shares to the foreign investors or NRI's.

## **8.5 Profitability**

On consideration of present cost of project, energy estimation, tariff for sale to state utility, Wind Power Projects are really not viable without consideration of incentives.

With Debt-Equity ratio of 70:30, the projects are just not bankable.

For working out the profitability following parameters can be considered:

Project cost	-	Rs. 55 Mill/MW
Generation	-	Rs. 1.75 Mill kWh per MW
Debt Equity	-	60:40
Interest Rate	-	12.5%
Loan repayment Period	-	10 years
Life of Project	-	20 Years
Tariff	-	Rs. 4.35 / kWh (as available in M.P.)

The comparative financial results as per above mentioned parameters are indicated in Table below:

	<b>Project IRR</b> %	<b>Equity IRR</b> %	<b>DSCR</b>
Without any incentive	11.13	8.45	1.19
With GBI Benefit	12.47	10.14	1.28
With GBI+CDM (@Rs.0.50) Benefit	14.69	13.34	1.41

## 8.6 Sensitivity Analysis

### **ASSUMPTIONS**

The bases of financial analysis are as below:

- 1) A typical 1500 kW WEG has been considered.
- 2) Cost of the WEGs per WEG has been considered as Rs.650 Lacs/WEG as base price.
- 3) Generation of WEGs has been considered as 25% CUF. 5% derating has been considered after 10 years due to aging of WEGs.
- 4) Debt Equity ratio has been taken as 70:30.
- 5) Interest on debt has been considered as 12.00% on declining balance.
- 6) Loan repayment out of available surplus cash after deducting O&M charges, Interest payments, Reactive charges and tax liabilities. No moratorium period has been considered, loan is repaid from the first year itself.
- 7) The cash-flows have been designed considering sale of energy to Discom as per rate declared by KERC of Rs.3.70/kWh for 10 years. The same rate has been assumed to be continued from 11<sup>th</sup> to 20<sup>th</sup> year.
- 8) CDM benefit has been considered @ Re. 0.50 per unit for 10 years after all expenses and sharing.

- 9) Reactive power charges have been considered as Re.0.25 per unit for 20 years.
- 10) 5% reactive power consumption has been considered.
- 11) No O&M charges have been considered for the first year as the manufacturer provides free O&M during warranty period of one year.  
  
O&M charge has been considered @1.50% of project cost in the second year. 5% annual compounded escalation has been considered for 20 years.
- 12) Insurance has been considered at the rate of 0.10% on capital cost of project for burglary, theft and fire Insurance.
- 13) Cash flows have been prepared on the basis of availing GBI benefit @ 50 Paise per Unit up to ceiling of Rs.62 Lacs per MW as per MNRE Guidelines.

Tax benefits of the Project have been calculated based on Project accounts.

The benefits have been availed as below:

- a) Income Tax payable has been considered as outflow.
- b) Income Tax exemption benefit (u/sec 80IA) has been considered on Profits after the benefit from Normal Depreciation (@15%) is exhausted.
- c) Total Income Tax benefit period availed is 15 years.
- d) Depreciation has been considered @ 15% for general Plant & Machinery items.
- e) Benefit u/sec 80 IA is available for 10 years. During this period Minimum Alternate Tax is applicable. This benefit has been cumulated.
- f) Full Income Tax rate: @ 30%+ 7.5% surcharge + 3% cess= 33.218% has been considered on Profits.
- g) Minimum Alternate Tax (MAT) rate: @ 18.5%+ 7.5% surcharge + 3% cess= 20.480% has been considered on Profits.



- h) The cumulated payment of MAT during the period of benefit u/sec 80IA has been adjusted from the Full Income Tax payable immediately on completion of period of 80IA benefit as per present Income Tax adjustment Rules. During this adjustment period again MAT is applicable.
- i) After full adjustment of cumulated MAT for 10 years during 80IA period – Full tax rate is applicable.
- j) MAT paid during the initial few years has not been adjusted as the adjustment period of MAT is only applicable within a period of 10 years.

14) Salvage value has been taken as 10% of the project cost at the end of 20<sup>th</sup> year.

## **SENSITIVITY ANALYSIS**

Sensitivity Analysis has been carried out for the following variables:

WEG Cost Rs.600 Lacs – lower by Rs.50 Lacs/WEG from base case

WEG Cost Rs.700 Lacs – higher by Rs.50 Lacs/WEG from base case

CUF 24% - lower by 1% from base case

CUF 26% - higher by 1% from base case

Interest Rate 11% - lower by 1% from base case

Interest Rate 13% - higher by 1% from base case

Tariff of Tamil Nadu @Rs.3.29/kWh with CUF of 28%

Tariff of Rajasthan @Rs.4.22/kWh with CUF of 24%

REC/RPO tariff – Base tariff has been assumed as Rs.2.00/kWh for sale to EB plus Rs.2.45/kWh (the average of Floor price of Rs.1.50/kWh and Forbearance price of Rs.3.40/kWh).

The table below shows the variation in Project IRR for 20 years :

SENSITIVITY ANALYSIS		
Sl. No.	DETAILS	Project IRR 20 years
1	BASE CASE- KARNATAKA TARIFF; 25% CUF; Rs.650 Lacs/WEG; 12% INTEREST	22.73%
2	LOW COST-KARNATAKA TARIFF; 25% CUF; Rs.600 Lacs/WEG; 12% INTEREST	25.52%
3	HIGH COST-KARNATAKA TARIFF; 25% CUF; Rs.700 Lacs/WEG; 12% INTEREST	20.38%
4	LOW CUF- KARNATAKA TARIFF; 24% CUF; Rs.650 Lacs/WEG; 12% INTEREST	21.48%
5	HIGH CUF- KARNATAKA TARIFF; 26% CUF; Rs.650 Lacs/WEG; 12% INTEREST	24.00%
6	LOW INTEREST- KARNATAKA TARIFF; 25% CUF; Rs.650 Lacs/WEG; 11% INTEREST	22.57%
7	HIGH INTEREST- KARNATAKA TARIFF; 25% CUF; Rs.650 Lacs/WEG; 13% INTEREST	22.90%
8	LOW-TAMIL NADU TARIFF; 28% CUF; Rs.650 Lacs/WEG; 12% INTEREST	23.98%
9	HIGH-RAJASTHAN TARIFF; 22% CUF; Rs.650 Lacs/WEG; 12% INTEREST	22.30%
10	REC - TARIFF; 25% CUF; Rs.650 Lacs/WEG; 12% INTEREST	28.35%

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## CHAPTER -9

### CARDINAL FACTORS & RANKING OF STATES

# CHAPTER-9

## CARDINAL FACTORS FOR DECISION MAKING AND COMPARATIVE RANKING OF STATES

There are several issues which are being considered by IPP to make an investment in a particular State.

There are however, 9 (Nine) major factors with varying degree of importance which influence their decision making.

State wise status and comparative ranking of states – based on these 9 factors is explained below:-

### 1) **Wind Resource/CUF:-**

The generation potential at a particular site is the most important factor for decision making.

The overall Wind Resource in a State does not truly reflect the generation potential that shall be actually available for the project.

The more pertinent factor is the likely generation at specific site as indicated by various Manufacturers in different States.

The generation potential as indicated by different manufacturers for their future projects have been summarized in Table : T-6-2 and based on that the comparative ranking of States has been carried out.

### 2) **Tariff :-**

The tariff as declared by the State Electricity Regulatory Commission and as is prevailing today has been considered for comparative ranking of State.

Though the tariff dedared by Maharashtra Regulatory Commission is best yet there shall be some confusion regarding differential CUF assumed at different locations.

REC price will vary between floor price & forbearance price. Based on the trading that has taken place from March 2011 to August 2011, it will be appropriate to assume an average price of Rs.2/- per unit to assess the receivable of an investor through REC and APPC route. A Table : T-9-1 given hereunder details state-wise position of REC+APPC :

**TABLE : T-9-1**  
**REC + APPC Price in different States**

States	APPC for 2011-12 (Rs/kWh)	Average rate of REC/Unit (Assumed) (Rs/kWh)	REC+APPC (Rs/kWh)
Andhra Pradesh	2.50	2.00	4.50
Gujarat	2.98	2.00	4.98
Karnataka	2.66	2.00	4.66
Madhya Pradesh	2.09	2.00	4.09
Maharashtra	2.62	2.00	4.62
Rajasthan	2.60	2.00	4.60
Tamil Nadu	3.38	2.00	5.58

\* CERC Order dated 23.08.2011

3) **Opportunity/Potential:-**

Almost all the IPP investors are opting for readymade project site as offered by various manufacturers.

None of the IPPs have so far opted for identification of virgin site where competitive bidding from manufacturers can be opted.

The sites offered by major manufacturers for capacity addition in next three years have been summarized in Table : T-6-1 and based on that comparative ranking of States have been carried out.

The State where maximum growth is planned by the manufacturers is considered to be most potential.

4) **Regularity in receipt of payment:-**

This is an important factor that IPP owners and Bankers would consider to ensure financial viability of the project.

The financial health of almost all State utilities is in bad shape.

Comparative ranking of the states has been carried out based on the general experience of IPP owners regarding timely receipt of payment and according to the market report Rajasthan is the best.

5) **Attitude/Procedure 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 problem. Though this factor is of primary consideration to the Manufacturer Cum Developer yet it is also relevant to IPP owners particularly after completion of the project and routine O&M.

In Tamil Nadu the procedure is most simplified for establishment of the project but the attitude of the SEB in accepting in-firm power is not quite healthy.

6) **RPO Mandate and compliance:-**

Most of the State Regulatory Commissions have declared the quantum of RPO which varies from State to State.

Some States have exceeded the RPO mandate and are not willing to accept higher liability.

In consideration of higher financial liability, some States are already considering reduction in RPO target.

Except Maharashtra, no other SERC have declared the penalty for non-compliance but even in Maharashtra it is not strictly followed.

Option available for Renewable Energy Certificate (REC) trading can be availed only if RPO obligation is strictly enforced.

Basis of ranking is related to the quantum of RPO obligation.

7) **Land Issues:-**

This is primarily a matter of serious concern for Manufacturer cum Developer who faces maximum problem in acquisition of land. When Manufacturer-Cum-Developer offers turnkey solution, the IPP owner does not get adversely affected. However, in few States the project owners are facing difficulties due to public criticism after commissioning of the project and in some of the States the functioning of the windfarm is adversely affected.

The basis of ranking is based on experience of Manufacturers and market report.

8) **Grid availability:-**

This is a major problem primarily faced by Manufacturer-Cum-Developer. 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 plan to meet the demand of Wind Power Sector. The short term solution as offered by them is proving to be in-adequate because of higher growth rate now being observed.

Even after commissioning of the project particularly in Tamil Nadu, the windfarm feeders are occasionally switched off during high generation period which badly affects the investors.

The basis of ranking is based on experience of Manufacturers and market report.

9) **Approachability to site:-**

This issue is a matter of concern primarily for Manufacturer-Cum-Developer. Buying out the land for approach road is a costly proposition.

Right of Way (ROW) as arranged initially by the Manufacturer-Cum-Developer is some times not honoured by land owners subsequently and the project owner faces hardship.

The initial cost of the construction of the approach road even in difficult terrain is usually included in the project cost as offered by Manufacturer-Cum-Developer through turnkey solution.

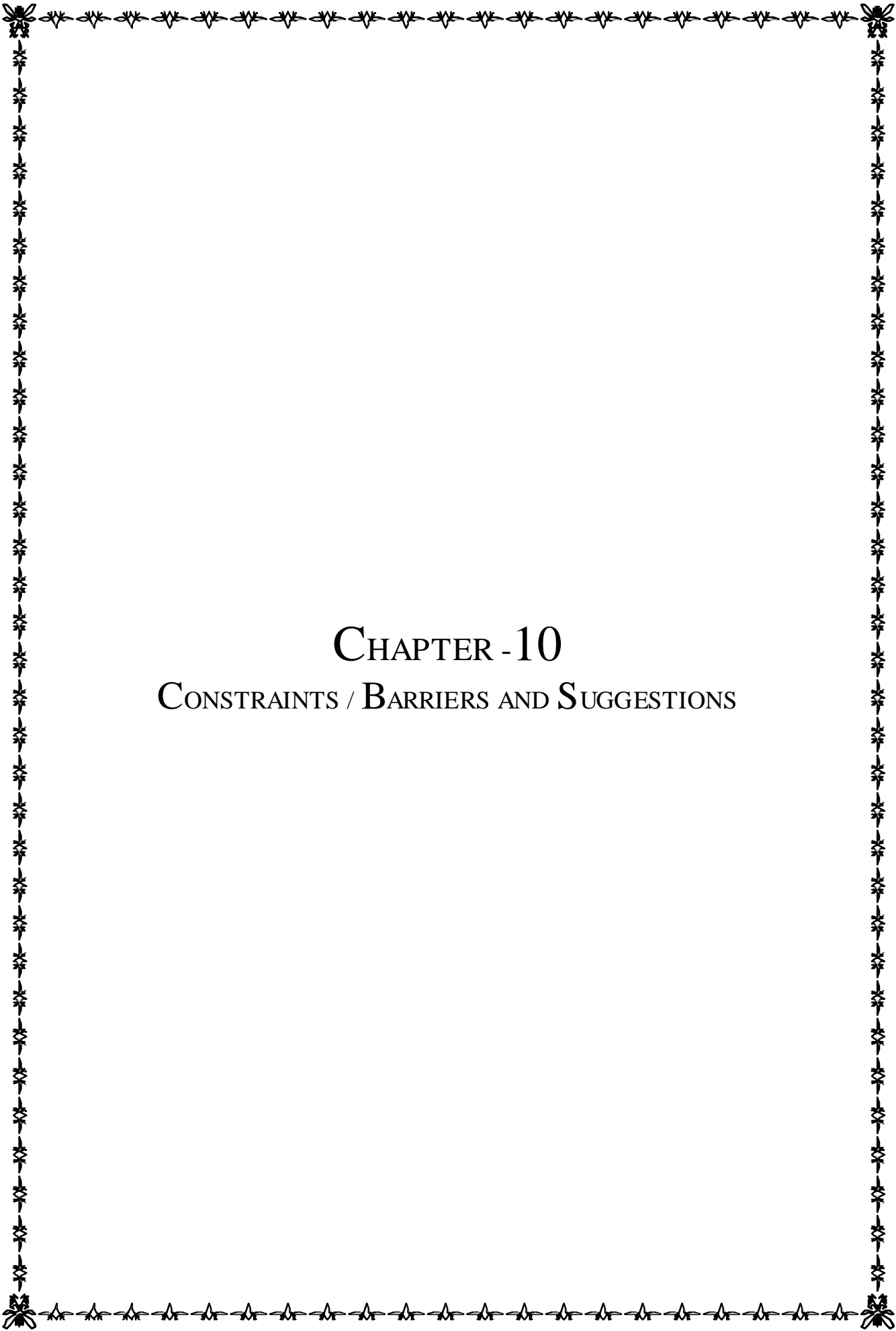
The basis of ranking is based on experience of Manufacturers and market report.

Based on the above mentioned considerations the comparative ranking of the States have been carried out and is provided in Table : T-9-2 below :-

**TABLE : T – 9-2**  
**COMPARATIVE RANKING OF STATES**

S. No.	Factors	Total Marks	A.P.	Gujarat	Karnataka	Maharashtra	M.P.	Rajasthan	Tamil Nadu
1	Wind Resource/CUF	25	22	17	19	16	17	15	25
2	Tariff (APPC + REC)	15	10	14	13	12	9	11	15
3	Opportunity/Potential	15	11	14	12	14	10	13	15
4	Payment Regularity	15	11	14	13	12	11	15	10
5	Attitude/Procedure	10	4	8	7	6	5	9	10
6	RPO Mandate	5	2	3	4	3	2	3	5
7	Land Issues	5	3	4	2	3	4	5	5
8	Grid Availability	5	5	4	3	3	3	4	2
9	Approachability to Site	5	4	4	3	2	4	5	5
	<b>Total Score</b>	<b>100</b>	<b>72</b>	<b>82</b>	<b>76</b>	<b>71</b>	<b>65</b>	<b>80</b>	<b>92</b>
	<b>Ranking</b>		<b>5</b>	<b>2</b>	<b>4</b>	<b>6</b>	<b>7</b>	<b>3</b>	<b>1</b>



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CHAPTER -10  
CONSTRAINTS / BARRIERS AND SUGGESTIONS

# CHAPTER-10

## CONSTRAINTS / BARRIERS AND SUGGESTIONS

### 10.1 Issues Related to all WPPs

The major issues related to growth of Wind Power Sector are :

- Land related
- Evacuation related
- Financial viability related

#### 10.1.1 Land related Issue

For Windfarm Projects, land is usually available from three routes:

##### a) Govt. revenue land

*There is hardly much of problem except slight delay except in A.P. where it is quite complicated. Gujarat should also introduce a uniform policy.*

*The actual quantum of suitable land is however quite limited.*

##### b) Private Land

In majority of the States this has been the main source

Initially a large continuous land area used to be purchased by Investor/Developers but in recent past only the land for foot print area (for Tower Foundation and Unit sub-station) and approach road is being purchased.

The constraints now being faced are :

- i) Diversion of agricultural land charges thereof particularly in Karnataka.
- ii) Public opinion against one time compensation paid to land owner and ill feeling about subsequent high rate for transfer of land to Investor.

- iii) Right of way is not readily available and consent of nearby land owner is needed in Maharashtra.
- iv) In Karnataka, Panchayat Tax varies between Rs. 5000 – Rs. 10000/- per MW.

***These are basically State issues where SNA and State Govt. may finally settle and declare:***

- ***Procedure for diversion***
- ***Stamp duty payable***
- ***One time cost payable to land owner per Ha.***
- ***Panchayat or Gram Sabha Tax Payable yearly on the basis of per Hectare of land actually used for Wind Power Project (instead of per MW basis). This is being already proposed in Maharashtra & Karnataka.***

***This shall avoid the ill feeling, public criticism and it shall have a very positive social impact.***

***This tax should not be imposed on Forest Land.***

- v) Govt. of India is considering amendment under land acquisition act whereby the land owner shall be entitled for regular compensation over and above the one time compensation. This however is applicable only on land acquired by Government agency and there is no mention about private sale of land.

### **c) Forest Land**

An elaborate guideline has been issued by Ministry of Environment & Forest (MoEF) for use of Forest land for Wind Power Projects (WPPs).

A large number of WPPs have been installed in Forest Land in the States of Karnataka, Maharashtra and even in Madhya Pradesh.

In Tamil Nadu – there is no such requirement.

Forest land requirement will now be there in the States of Andhra Pradesh, Gujarat and Rajasthan.

Though generally the guideline of MoEF is being referred, yet at local – level different interpretations are made and dispute arises in terms of:

**i) actual land area used for –**

- foot - print
- path-way-width
- electricity line – width

**ii) Charges payable for use of land**

Compensatory Application Management and Planning Agency (CAMPA) charges are being recovered from Windfarm Developers as per NPV of land varying from Rs. 0.6 to Rs. 0.9 mill per Ha.

Beyond this charge, some States Departments are asking for charges to develop medicinal plant.

**iii) Transfer of land in lieu of Forest land**

- So far most of the Developers offered Govt. revenue land in lieu of forest land. Now since such revenue land is not available in plenty and forest department insists for -

- good quality of land and
- proximity to forest area

- The issue is getting critical and Developers are forced to buy Private Land and permanently transfer it to Forest Department.

In Karnataka, the State Govt. created Land Bank for transfer to Forest Department but now a days any green land is termed as “Deemed Forest” and is not acceptable to Forest Department.

**iv) MoEF guideline provides for one time lease rent of Rs. 30000/- per MW.**

At local level however even a yearly lease rent is demanded.

Further, there is confusion regarding registration of Lease agreement and the value to be considered for payment of Stamp-Duty.

***The issue related to Forest-land is gradually getting complex and critical and this shall seriously retard the growth rate.***

***This issue should primarily get resolved at Central level through interaction between MNRE and MoEF.***

***MoEF need not necessarily issue a fresh guideline. They can only issue a clarificatory Notification on the above mentioned four issues.***

***Similar notification was earlier issued by MoEF for land needed to establish Anemometry Mast.***

***This is not only a critical issue but also an urgent one – as otherwise growth may come down substantially particularly in the States of Karnataka, Maharashtra and Madhya Pradesh.***

***The concerned State Govts. should create Land Bank for transfer to Forest Department.***

10.1.2 Other than the three above mentioned routes for land – availability, there is a strong possibility to have very large capacity addition in land belonging to Tribals particularly in States of Madhya Pradesh & Maharashtra.

As per constitution Amendment, land belonging to Tribals can neither be purchased nor taken on long lease by a non-tribal.

The tribal land can be taken on rent which is usually for 11 months period and such arrangement is neither safe nor acceptable to Bankers for creation of charge.

For large Hydro Projects, Mining or National Highway – tribal land is however frequently acquired by Govt. on the basis of one time compensation and the tribals are displaced.

For Windfarm project however the situation is quite different since –

- he need not be displaced
- only a small foot-print area and land for approach road is required with balance land area remaining with the tribal for his usual/traditional cultivation.

***A comprehensive strategy therefore needs to be evolved so that***

- ***Tribal gets one time compensation***

***and - entire village population gets a regular monthly income through collection of Panchayat/Gram Sabha Tax based on total land area used by Windfarm Project.***

***This would be a highly innovative concept to ensure –***

- ***inclusive growth with some regular non-agriculture income for extremely poor families living below poverty line.***

## **10.2 Evacuation related issues**

This issue involves both Technical and Financial aspects

### **10.2.1 Main Technical Aspects**

10.2.1.1 As the capacity addition in WPPs were increasing, the State utilities sequentially resorted to :-

- a) Increasing Transformer capacity in nearby 110/132/33 kV Sub-Station.
- b) Constructing 2<sup>nd</sup> EHV Line of 110/132/220 kV and connecting it to upstream 220/400 kV Sub-station.
- c) Increasing Transformer capacity in up-stream 220/400 kV Sub-station.

10.2.1.2 Up to a limit the above mentioned activities met the requirement – at times at the cost of shutting off the windfarm feeder.

But now the situation is gradually getting beyond control.

The State Utilities are now proposing to construct few more 400/220/132 kV sub-stations to meet the immediate demand.

This would however be a short term measure and problem shall resurface after 3/5 years.

10.2.1.3 Number of 400 kV Sub-Stations cannot be increased arbitrarily unless the entire upstream Net-work is augmented along with inter-state connectivity.

This would involve serious and elaborate load-flow study and the entire system capacity has to be taken into consideration both in terms of load and short-circuit capacity.

***For long term solution following activities need to be taken up sequentially:***

- a) Wind Turbine Manufacturers Association in collaboration with C-WET Mast prepare State-wise Master-plan for likely future growth.***
- b) State Transmission Utility should prepare a Master – Plan along with Central Transmission Utility ( Power Grid) to meet the future demand.***
- c) Central Electricity Authority (CEA) should examine the proposal and include the Augmentation Scheme in future planning.***

***It is worth while to consider the merit of reversing the power flow direction from North to South and East to West to South to North and West to East as WPPs would all be in South and Western part of the country.***

#### **10.2.2 Other Technical Issues**

All State Utilities are reluctant to use and encourage WPPs which deliver in-firm power.

As per CERC guideline – Forecasting of Wind Power Generation would be mandatory beyond January, 2012.

The available Tools and Techniques have so far not be able to forecast with accuracy level as desired.

Even if forecasting is done – the question would still remain – regarding 100% utilization of such intermittent power generation.

***Ultimate solution lies in co-relating WPPs with –***

***either Gas Based Generating Station  
or Hydel Projects with pump – storage facility***

***Such measures would not only ensure usage of variable Wind Power but would also vastly improve the power system stability.***

***CEA should be requested to prepare a comprehensive integration plan and recommend to Regional and Central Load Despatch Centre.***

***For adequate forecasting – a centralized agency may be considered.***

### 10.2.3 **Financial Aspects**

As per CERC guidelines, the metering point for WPPs should be at Windfarm location meaning thereby that the cost of grid connectivity should be borne by State utility particularly since this cost is not included in project cost for determination of tariff.

Though SERCs do not include this cost while determining the tariff, the state utilities are insisting the Developers to bear the cost – at times with consent of State Govt.

The Developers are helplessly incurring such expenditures of grid extension from nearby EHV sub-station to Windfarm but asking them to invest for upstream augmentation of the net-work is quite absurd (unreasonable).

The State Transmission utilities neither have long term planning nor have the financial resource.

TNEB collects Rs. 3.0 Mill per MW for Grid connectivity but collection of this charge on case-to-case basis does not provide a lump sum fund to meet the requirement.

As per CERC guideline, Central Transmission utility should provide grid connectivity to WPPs of capacity above 50 MW.

Even under this route, there would be constraints in terms of –

- location of nearby Central Utility network
- Capital expenditure requirement
- Transfer of energy to buyer (in all probability State Discom)
- Signing of PPA etc.



***To resolve this issue following suggestions may be considered –***

- a) 13<sup>th</sup> Finance Commission has provided an outlay of Rs. 50000 Mill. for States to develop such infrastructures and windy states should access this fund for short and medium term need.***

**Funds are likely to be available from the corpus collected out of imposition of cess on coal. This clean energy fund can be utilized for upgrading transmission net work.**

- b) Once the CEA accepts and includes the Master Plan – budgetary support should be provided in 12<sup>th</sup> Five-year plan.***

### **10.3 Financial Viability related issues**

There is a general apathy of conventional power sector people towards Renewable Energy Sources and more particularly the Wind Power Sector – delivering in-firm power. They hardly have any concern towards –

- limited stock of fossil fuel
- imminent increase in cost of fossil fuel based generation due to ever increasing demand.
- dangerous consequence on climate due to coal based power generation.

Their narrow and myopic vision prohibits them to extend fair treatment to WPP inspite of several govt. policies and regulations.

Consequently WPP owners are facing financial difficulties on many counts. The major issues are listed below:

#### **10.3.1 Lower Tariff**

CERC has declared Tariff for procurement by Central Sector Agencies. This is quite an elaborate and rational exercise which could provide clear guidelines to SERCs.

Unfortunately none of SERCs-except MERC has followed the guidelines of CERC in totality.

The main controversial issue is related to assumption of capital cost and factorizing the cost of grid evacuation.

Though theoretically the SERC Tariff orders project an attractive return on promoter's equity, yet it is far from being even a Bankable proposition.

***The remedy lies in providing a liberal GBI by Central Govt. so that the financial burden on account of climate change issue is mainly shared by Govt. of India.***

***This is more relevant in view of the cess collected by GOI on sale of Coal.***

***In view of uncertainty in availability of CDM benefit, the GBI should be @Rs.1.25/kWh with a limit of Rs. 10 mill per MW.***

***If however CDM benefit is available beyond 2012, the GBI may be reduced to Rs. 1.00 / kWh with maximum limit of Rs. 10 mill per MW.***

***There is a general feeling that AD benefit should continue for some more time.***

### 10.3.2 Delay in receipt of payments

In spite of many SERCs providing for payment of interest on delayed payment, none of the Discoms are following the orders of SERCs resulting in several appeals.

The payment situation is abnormally bad in Tamil Nadu. It is also unsatisfactory in Karnataka and Maharashtra. Gujarat and Rajasthan are comparatively better.

Karnataka is considering a separate window to make timely payment.

As financial health of Discoms is likely to get worse, the concern would continue.

***The escape route appears to be bright with introduction of REC options.***

***Availing REC option should not however deny availability of CDM benefit.***

***REC market – however – can develop only if RPO obligation is strictly enforced by all SERC. Some of the States are already considering reduction of RPO limit.***

***Discoms being mostly under Govt. control, it is quite unlikely that SERC would take strong action. A national level intervention would therefore be needed to comply with NAPCC.***

### **10.3.3 Long Term Solution**

***Wind Power Sector has grown sufficiently big with huge potential of future growth. To sustain the growth rate and to encourage the sector, it is now probably necessary to create a National Wind Power Corporation which should procure and trade wind power besides making initial investments for development of infrastructure.***



APPENDIX-A

**List of Potential Sites for Wind Power Projects in Andaman & Nicobar Islands**  
**(WPD $\geq$ 200 W/m<sup>2</sup> at 50magl)**

Sl. No.	Station	District	Mast Height (m)	Latitude (N)			Longitude (E)			Elevation (masl)	Mean Annual Wind Speed (m/s)			Mean Annual Wind Power Density (W/m <sup>2</sup> )			
				Deg	Min	Sec	Deg	Min	Sec		measured at 20/25/30/50 m			measured at 20/25/30/50 m			Extrapolated/Measured 50 m
1	Keating Point	Nicobar	20	9	15	21	92	46	34	10	4.9			1.14		2.03	
2	Mount Harriet	Andaman	30	11	43	12	92	44	1	353	5.6			1.65		2.04	

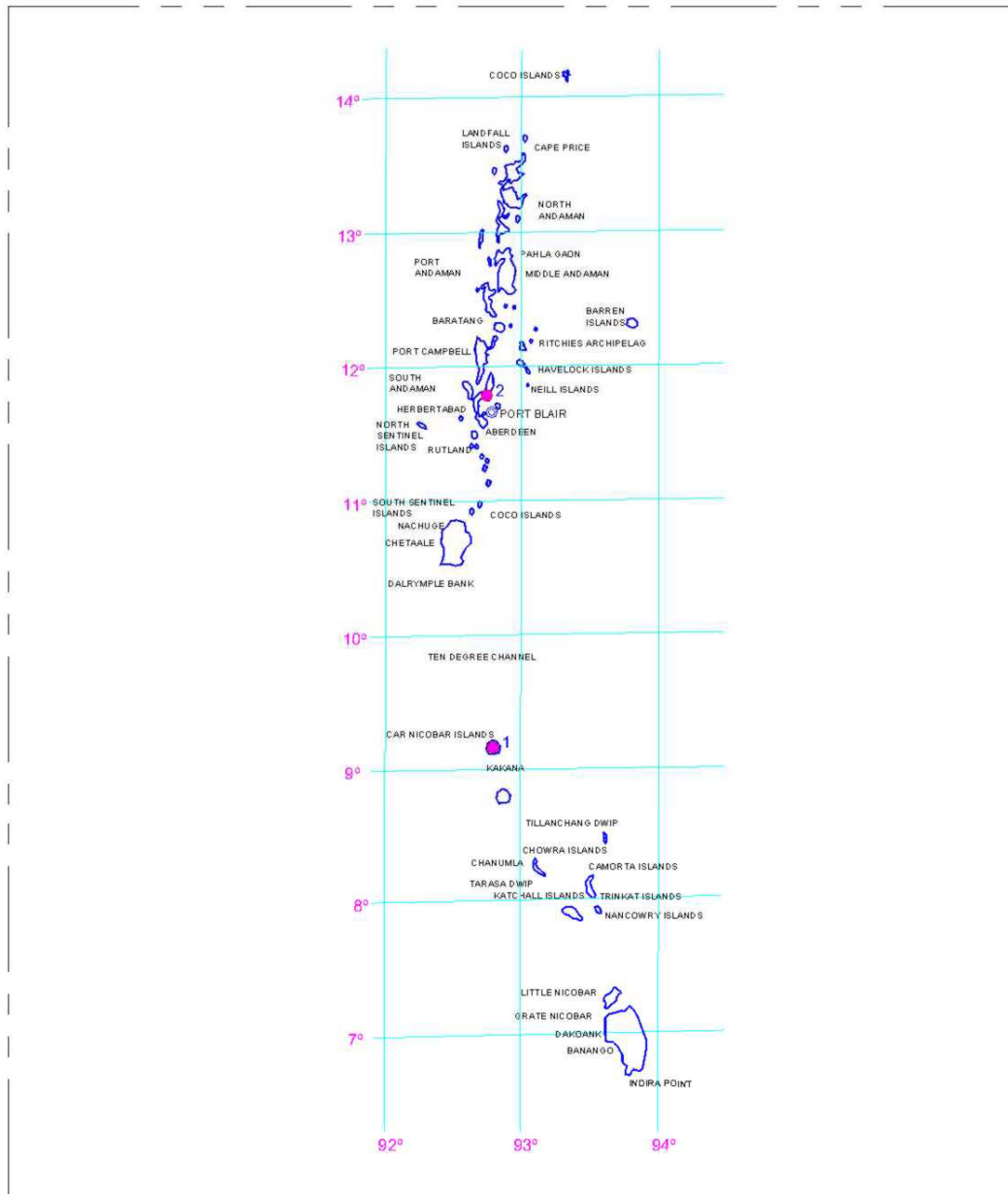
*(Source : C-WET)*

FIG : F-5-2

# MAP OF ANDAMAN & NICOBAR



Showing Wind Monitoring Stations having  $WPD \geq 200W/m^2$



Map not to Scale

**List of Potential Sites for Wind Power Projects in Andhra Pradesh**  
(WPD $\geq$ 200 W/m<sup>2</sup> at 50 magl)

Sl. No.	Station	District	Mast Height (m)	Latitude (N)			Longitude (E)			Elevation (masl)	Mean Annual Wind Speed (m/s)	Mean Annual Wind Power Density (W/m <sup>2</sup> )		
				Deg	Min	Sec	Deg	Min	Sec			measured at 20/25/30/50 m	measured at 20/25/30/50 m	Extrapolated/ Measured 50 m
1	Alangarapeta	Anantapur	25	14	50	55	77	48	01	360	5.77	244	272	
2	Badhrampalli Kottala	Kurnool	25	14	55	30	77	23	39	433	5.92	248	277	
3	Banderlapalli	Kurnool	25	15	00	43	78	03	40	438	5.78	240	320	
4	Bhimunipatnam*	Visakapatnam	20	17	49	3.7	83	24	27.1	115	5.31	195	282	
5	Borampalli	Anantapur	25	14	35	15	77	09	07	550	5.38	163	219	
6	Burugula	Kurnool	25	15	07	47	77	57	23	540	5.11	147	216	
7	Chinnababayapalli	Anantapur	25	13	57	43	77	37	33.5	762	5.14	132	206	
8	Jamalamadugu - 2	Cuddapah	25	14	43	56	78	22	31	380	5.17	165	248	
9	Jamalamadugu* - 1	Cuddapah	25	14	43	57.2	78	22	4.2	390	4.86	161	265	
10	Kadavakallu* - 1	Anantapur	25	14	51	17	77	55	17	368	6.14	303	325	
11	Kadavakallu-2(Ref.Stn.)	Anantapur	25	14	47	26	77	57	09	386	6.47	274	437	
12	Kakula Konda	Chittoor	20	13	41	24.7	79	21	39.1	972	6.42	332	488	
13	Kodumuru	Kurnool	25	15	41	25.3	77	46	03	406	5.79	225	270	
14	Kondamitlipalli*	Kurnool	25	15	03	15	78	02	31	439	5.89	252	349	
15	Korakodu	Anantapur	25	14	47	09	77	19	33	460	5.19	146	220	
16	M.P.R. Dam*	Anantapur	20	14	49	6.8	77	27	56.33	404	5.53	228	269	
17	Madugupalli	Anantapur	25	14	42	30	77	51	07	440	5.19	152	266	
18	Mustikovala	Anantapur	20	14	15	07	77	30	51	570	5.61	201	237	
19	Nallakonda*	Anantapur	25	14	07	43.87	77	33	44.36	735	6.33	276	324	
20	Narasimha Konda	Nellore	20	14	27	34.1	79	52	42.6	138	5.58	186	273	
21	Nazeerabad*	Rangareddy	25	17	11	2.97	77	54	54.96	663	5.83	176	232	
22	Pampanoor Thanda*	Anantapur	25	14	38	27	77	24	13	490	5.44	182	232	
23	Payalakuntla	Cuddapah	20	14	52	29.5	79	01	46.5	355	5.58	230	257	
24	Ramagiri -II (Ref.Stn.)	Anantapur	25	14	17	03	77	30	55	567	5.88	197	226	
25	Ramagiri -III	Anantapur	20	14	20	43	77	31	18	550	5.39	190	246	
26	Ramagiri* -I	Anantapur	20	14	16	12.89	77	30	55.54	573	5.42	205	308	
27	Siddanagatta	Kurnool	25	15	34	14.5	78	03	7.1	499	4.97	126	203	
28	Singanamala	Anantapur	20	14	46	33	77	43	17	425	6.61	366	392	
29	Talaricheruvu	Anantapur	25	14	56	40	78	03	11	360	5.03	144	205	
30	Tallimadugula	Anantapur	25	14	22	27	77	32	19	555	6.17	260	288	
31	Tirumala	Chittoor	20	13	40	23.5	79	21	17.5	946	5.67	226	374	
32	Tirumalayapalli*	Cuddapah	20	14	53	40.5	78	11	1.9	453	5.28	154	285	
33	Ullindakonda	Kurnool	25	15	38	34.28	77	59	6.69	418	4.87	130	225	
34	Vajrakurur -II	Anantapur	50	14	58	29.7	77	19	10.8	511	5.40	154	202	
35	Vajrakurur*-I	Anantapur	20	14	58	30.8	77	19	9.7	512	5.41	173	243	

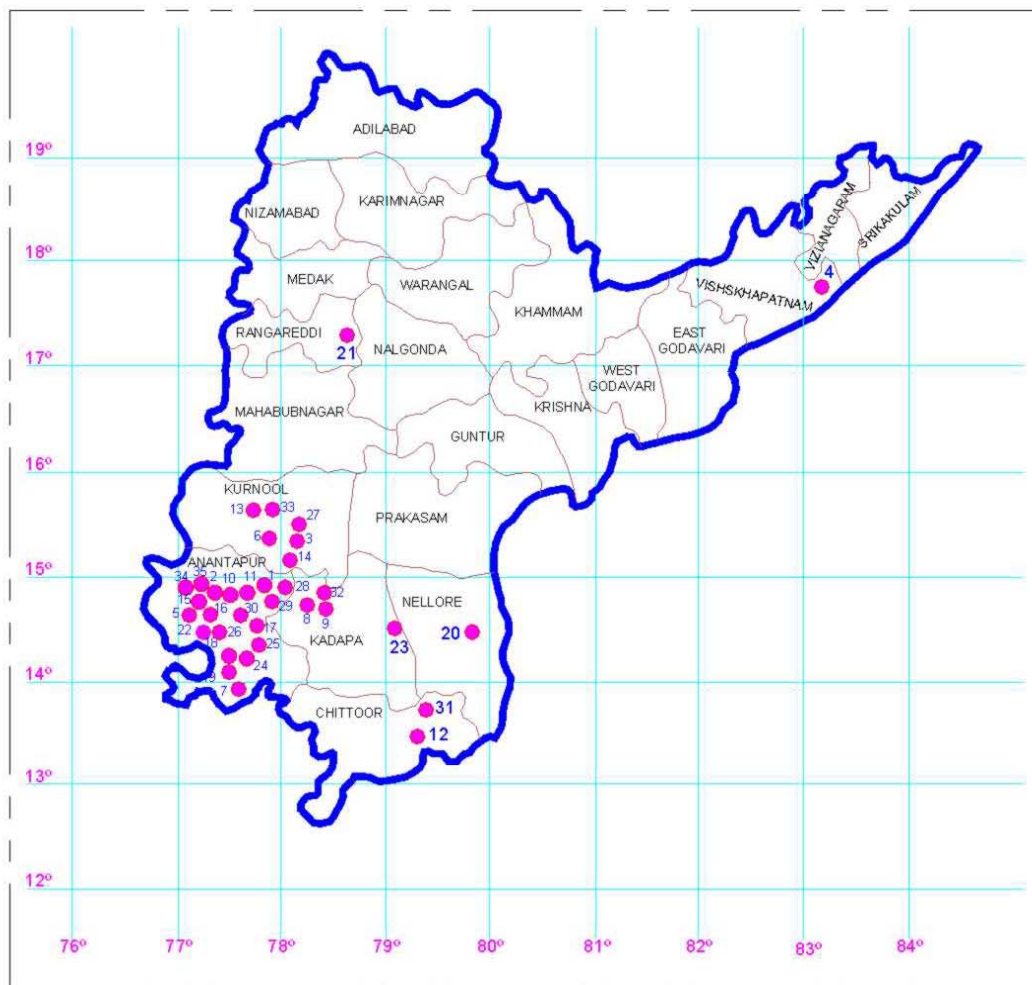
(Source : C-WET)

FIG : F-5-3

# MAP OF ANDHRA PRADESH



Showing Wind Monitoring Stations having  $WPD \geq 200W/m^2$



Map not to Scale

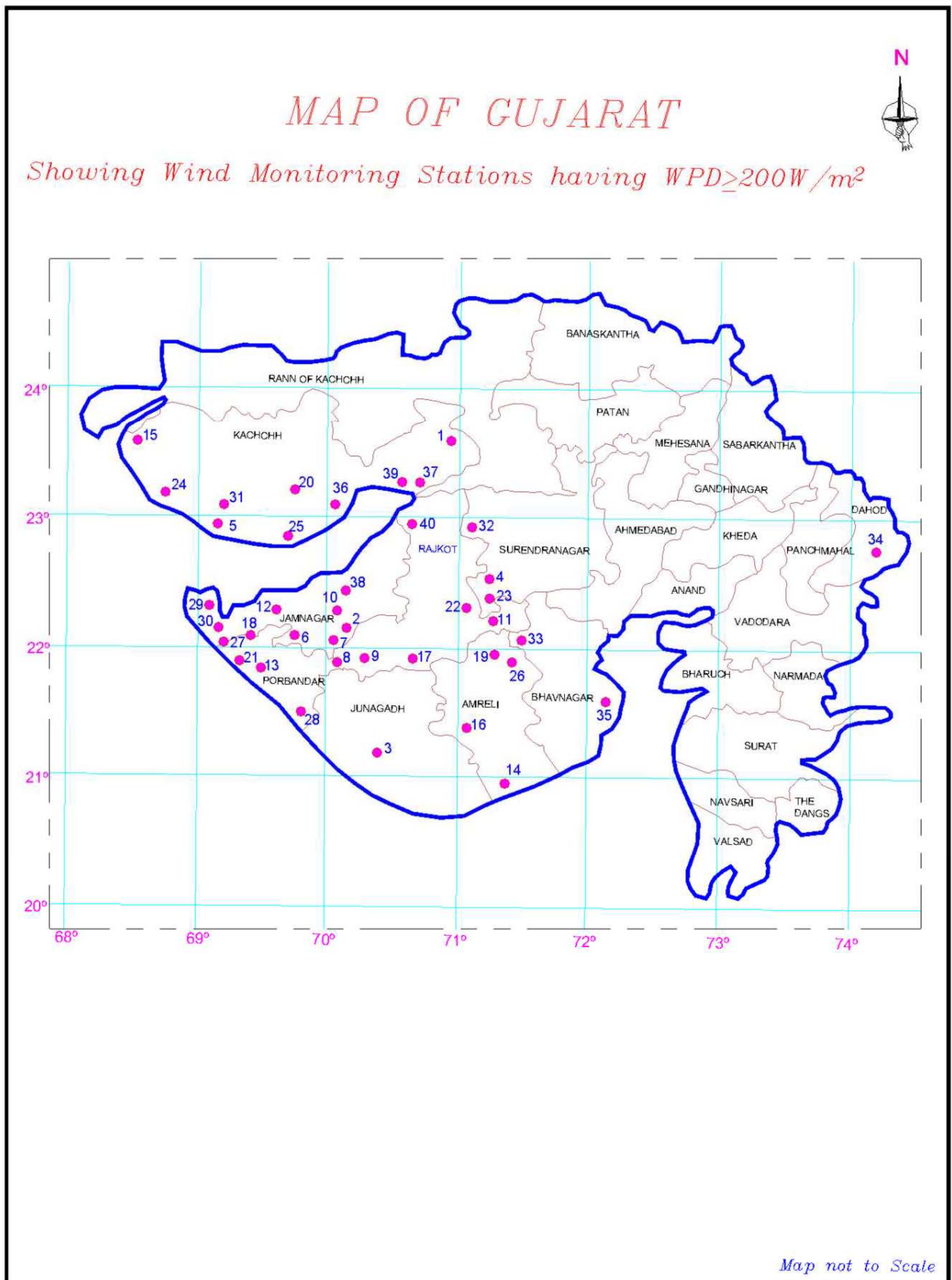


**List of Potential Sites for Wind Power Projects in Gujarat**  
(WPD $\geq$ 200 W/m<sup>2</sup> at 50magl)

Sl. No.	Station	District	Mast Height (m)	Latitude			Longitude			Elevation (masl)	Mean Annual Wind Speed (m/s)	Mean Annual Wind Power Density (W/m <sup>2</sup> )		
				(N)			(E)					measured at 20/25/30/50 m	measured at 20/25/30/50 m	Extrapolated/ Measured 50 m
				Deg	Min	Sec	Deg	Min	Sec					
1	Adesar	Kachchh	20	23	33	27	70	58	45	30	4.33	093	201	
2	Amrapar (Seth)	Jamnagar	20	21	43	48.7	70	01	37.8	102	5.33	151	221	
3	Amrapar* (Gir)	Junagarh	20	21	10	46.9	70	25	5.2	146	5.47	147	241	
4	Bamanbore* - 2	Suren dranagar	20	22	25	49.6	71	03	24.5	227	5.64	171	243	
5	Baya th	Kachchh	20	22	56	26	69	10	17	20	5.00	118	204	
6	Bhandariya*	Jamnagar	20	22	05	21	69	40	57	97	5.42	162	208	
7	Butava dar	Jamnagar	20	21	56	58.6	70	12	8.3	119	4.56	098	200	
8	Dhank -2	Rajkot	20	21	47	24.47	70	07	2.9	187	6.97	327	367	
9	Dhank* - 1-1 (Ref.Stn.)	Rajkot	20	21	47	14.2	70	07	18.9	154	6.78	312	414	
10	Gala*	Jamnagar	20	22	14	51.6	70	06	51.2	111	5.49	175	254	
11	Godladhar*	Rajkot	20	22	03	15.4	71	18	48.5	240	5.52	144	212	
12	Hari par*	Jamnagar	20	22	15	56.5	69	38	21.5	51	5.46	160	210	
13	Harshad	Jamnagar	20	21	50	14.6	69	21	50.2	15	5.56	164	239	
14	Jafrabad*	Amreli	20	20	53	49.87	71	23	33.09	25	4.86	137	242	
15	Jamanvada*	Kachchh	20	23	34	42	68	35	53	60	5.17	149	299	
16	Jasapar	Amreli	20	21	21	25.4	71	05	30	224	4.78	104	201	
17	Kagavad	Rajkot	20	21	47	31	70	41	50	132	5.13	141	212	
18	Kalyanpur*	Jamnagar	20	22	03	24.2	69	24	5.8	92	6.14	208	327	
19	Khambada	Rajkot	20	21	58	20.7	71	21	39.1	169	4.86	126	204	
20	Kukma*	Kachchh	20	23	10	20.78	69	46	42.32	224	5.33	150	239	
21	Lamba	Jamnagar	20	21	53	25.4	69	17	28.4	8	5.56	164	232	
22	Limbara	Suren dranagar	20	22	33	15.6	70	59	9.4	165	5.31	166	227	
23	Mahida d*	Suren dranagar	25	22	16	49.6	71	11	31.7	326	5.97	178	231	
24	Moti Sindholi*	Kachchh	20	23	09	24	68	47	00	10	4.87	118	204	
25	Mundra*	Kachchh	20	22	47	29	69	43	18	02	5.42	168	303	
26	Nani Kundal	Bhavnagar	20	21	54	38.6	71	27	3.5	166	5.74	163	278	
27	Navadra-1 (Ref.Stn.)	Jamnagar	20	21	56	49.5	69	14	26.5	24	5.78	183	297	
28	Navvi Bander*	Junagarh	20	21	26	53.5	69	47	19.3	12	5.42	153	213	
29	Okha*	Jamnagar	20	22	27	26.2	69	02	29.4	3	5.39	150	260	
30	Okham adhi	Jamnagar	20	22	05	05	69	06	19.7	20	5.28	129	209	
31	Poladiya*	Kachchh	20	23	03	30	69	13	14	138	5.72	177	278	
32	Ralabhe	Suren dranagar	20	22	50	58.8	70	59	22.3	88	4.86	123	212	
33	Rojmal - 2	Bhavnagar	20	22	00	46.8	71	28	38.6	137	5.12	129	200	
34	Sangasar	Dahod	50	22	41	40.8	74	10	6.9	481	6.00	207	207	
35	Sanodar*	Bhavnagar	20	21	33	25.6	72	06	30.9	195	6.24	197	373	
36	Sinai*	Kachchh	20	23	02	45	70	03	44	57	5.77	183	244	
37	Surajbari*	Kachchh	20	23	13	0.63	70	42	19.49	11	5.42	184	270	
38	Suwarda	Jamnagar	20	22	24	6.9	70	09	50.8	80	5.61	166	243	
39	Vandhya (Surajbari)	Kachchh	45	23	13	06	70	36	04	14	5.76	196	203	
40	Warshamedi	Rajkot	20	22	58	16.1	70	33	59.5	9	5.67	192	282	

(Source : C-WET)

FIG : F-5-4



**List of Potential Sites for Wind Power Projects in Jammu & Kashmir**  
**(WPD $\geq$ 200 W/m<sup>2</sup> at 50magl)**

Sl. No.	Station	District	Mast Height (m)	Latitude (N)			Longitude (E)			Elevation (masl)	Mean Annual Wind Speed (m/s)			Mean Annual Wind Power Density (W/m <sup>2</sup> )			
				Deg	Min	Sec	Deg	Min	Sec		measured at 20/25/30/50 m			measured at 20/25/30/50 m			Extrapolated/Measured 50 m
1	Bidda	Reasi	50	33	7	12.76	74	49	16.07	754	6.89	336	336				

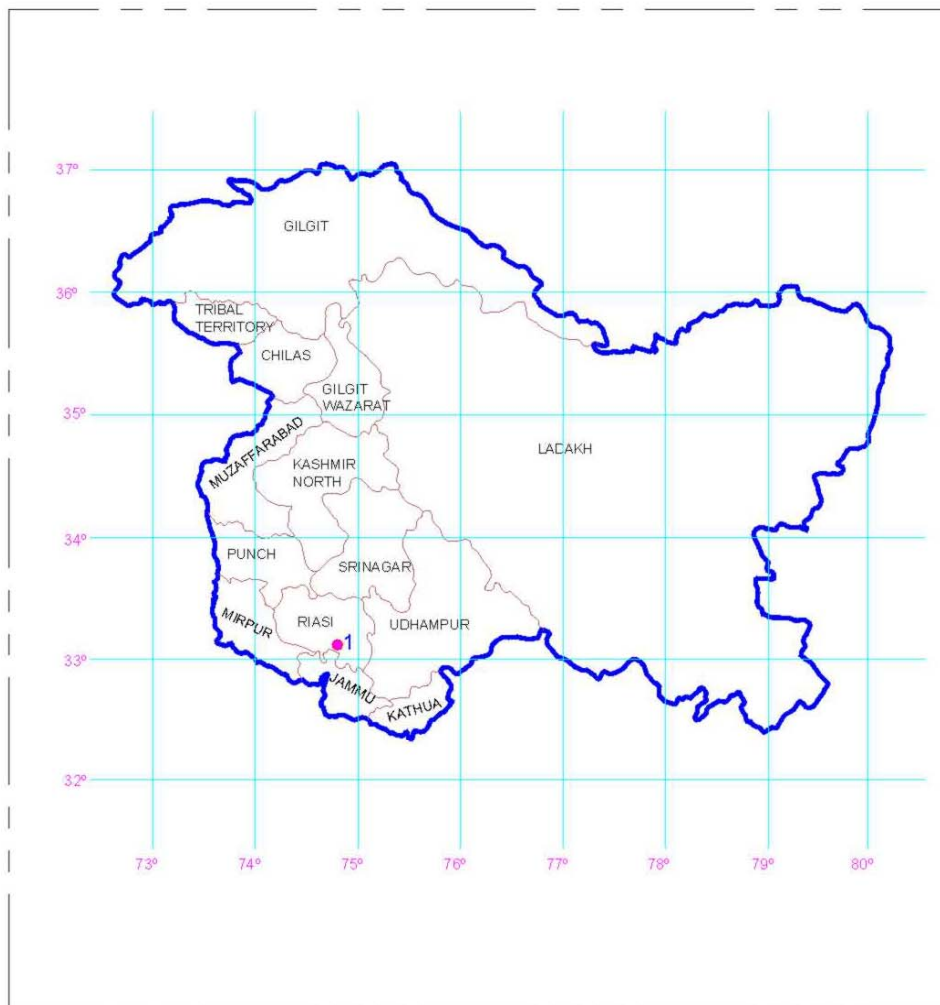
*(Source : C-WET)*

FIG : F-5-5

# MAP OF JAMMU & KASHMIR



Showing Wind Monitoring Stations having  $WPD \geq 200W/m^2$



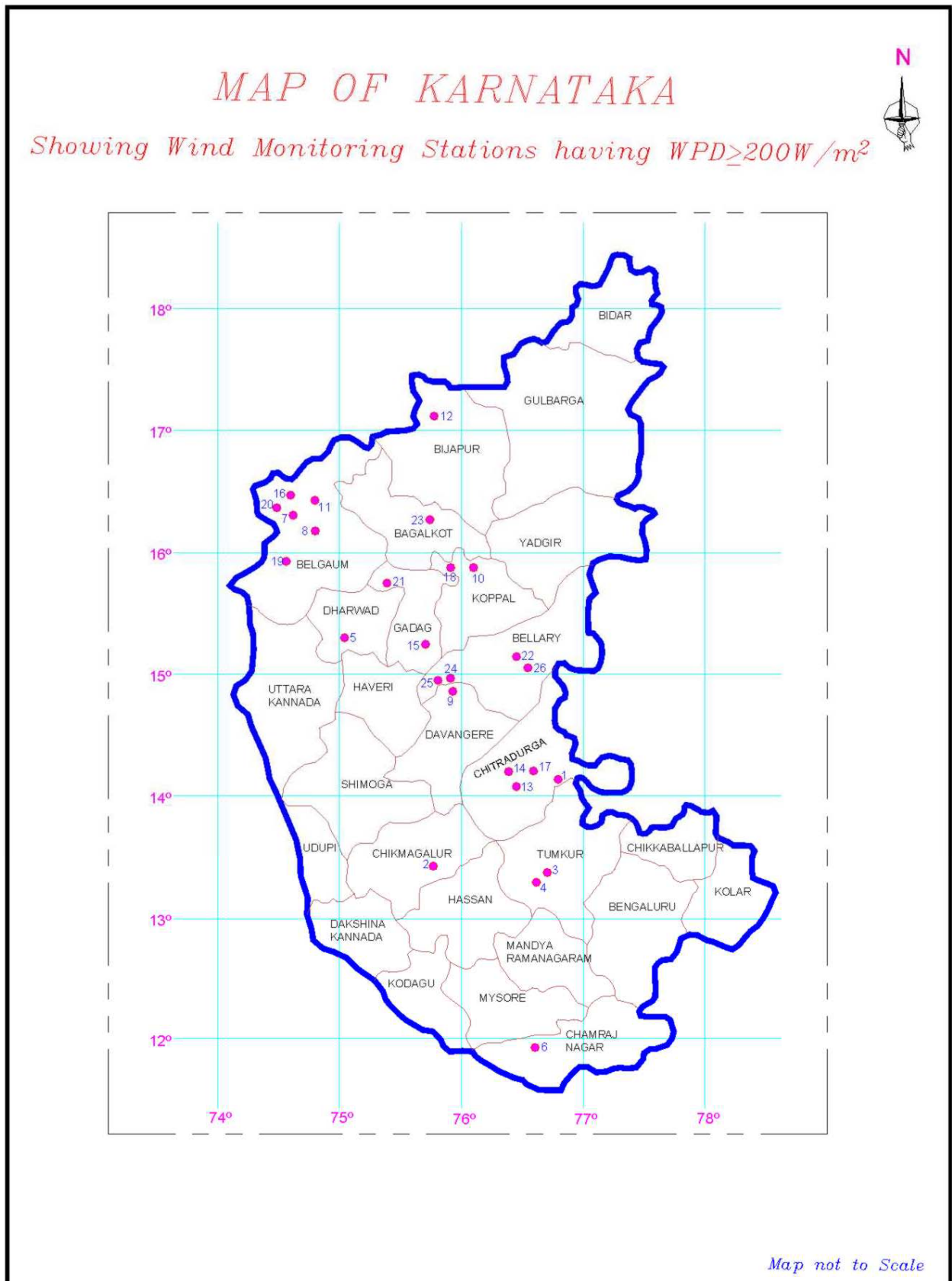
Map not to Scale

**List of Potential Sites for Wind Power Projects in Karnataka**  
(WPD $\geq$ 200 W/m<sup>2</sup> at 50magl)

Sl. No.	Station	District	Mast Height (m)	Latitude (N)			Longitude (E)			Elevation (masl)	Mean Annual Wind Speed (m/s)		Mean Annual Wind Power Density (W/m <sup>2</sup> )	
				Deg	Min	Sec	Deg	Min	Sec		measured at 20/25/30/50 m		measured at 20/25/30/50 m	Extrapolated/Measured 50 m
1	Arasinagundi (KPCL)	Chitradurga	30	14	29		76	21		780	7.50	392	>392	
2	B.B. Hills*	Chikmangalur	20	13	25	34	75	46	04	1830	7.52	498	581	
3	Bullenahalli - I (KPCL)	Tumkur	30	13	25		76	40		1060	5.89	168	>200	
4	Bullenahalli - II (KPCL)	Tumkur	30	13	24		76	41		1060	5.65	195	>200	
5	Chalamaatti*	Dharwar	20	15	17	42	75	02	59	705	5.79	189	268	
6	Channavadayanpura	Chamaraja Naga	25	11	57	21.3	76	36	26.2	938	5.66	154	243	
7	Chikkodi* (Ref.Stn.)	Belgaum	25	16	25	07	74	34	40	760	6.44	264	298	
8	Gokak*	Belgaum	20	16	10	20.76	74	47	37.36	730	5.33	168	336	
9	Gujannur (KPCL)	Bellary	30	14	58		75	54		684	6.49	240	>240	
10	Hanamsagar*	Kopai	20	15	52	57.38	76	02	30.24	722	5.62	173	270	
11	Hanumanhatti*	Belgaum	20	15	53	28	74	42	31	895	5.64	165	294	
12	Horti*	Bijapur	25	17	07	10	75	43	27	633	5.50	173	202	
13	Jogimatti (KPCL)	Chitradurga	30	14	12		76	25		1040	8.62	582	>582	
14	Jogimatti* (Ref.Stn.)	Chitradurga	20	14	09	49	76	23	56	1132	8.33	498	632	
15	Kappatagudda*	Gadag	25	15	14	45.71	75	42	53.59	976	6.92	311	423	
16	Khamkarhatti*	Belgaum	25	15	47	18.66	74	36	26.54	846	5.78	159	217	
17	Madekeripura (KPCL)	Chitradurga	30	14	13		76	27		800	7.54	365	>365	
18	Malgatti	Kopai	20	15	48	48.8	75	53	49.2	709	5.37	156	335	
19	Mannikere*	Belgaum	20	15	58	20	74	28	21	923	6.75	252	315	
20	Mavinhunda*	Belgaum	25	16	25	11	74	47	34	780	6.00	212	283	
21	Nargund	Gadag	25	15	44	8.7	75	22	31.3	786	8.37	530	652	
22	Ramgad	Bellary	25	15	07	54.3	76	27	25.3	963	5.27	134	204	
23	Sangundi*	Bagalkot	20	16	14	52.3	75	44	2.77	619	5.19	153	259	
24	Sogi - A (KPCL)	Bellary	30	14	55		75	59		845	7.38	415	>415	
25	Sogi-B	Bellary	25	14	54	56.9	75	58	34.5	849	6.61	246	284	
26	Subramanyahalli*	Bellary	25	15	00	38	76	33	11	1026	6.02	214	286	

(Source : C-WET)

FIG : F-5-6



**List of Potential Sites for Wind Power Projects in Kerala**  
(WPD $\geq$ 200 W/m<sup>2</sup> at 50magl)

Sl. No.	Station	District	Mast Height (m)	Latitude			Longitude			Elevation (masl)	Mean Annual Wind Speed (m/s)	Mean Annual Wind Power Density (W/m <sup>2</sup> )		
				(N)			(E)					measured at 20/25/30/50 m	measured at 20/25/30/50 m	Extrapolated/ Measured 50 m
				Deg	Min	Sec	Deg	Min	Sec					
1	Kailasammedu	Idukki	20	09	51	05	77	09	53	1160	6.30	251	375	
2	Kanjikode*	Palakkad	20	10	47	16	76	46	39	120	6.20	218	296	
3	Kolahalamedu	Idukki	20	09	40	14.70	76	55	12.5	1060	4.69	146	222	
4	Kotamala	Palakkad	20	10	47	13.57	76	35	35	106	5.12	154	239	
5	Kottathara	Palakkad	20	11	07	24	76	40	02	529	5.39	207	297	
6	Kulathummedu*	Idukki	20	09	44	42.15	77	10	16.4	1121	5.61	181	349	
7	Kuttikanam	Idukki	20	09	35	54	76	58	17	1065	4.51	140	243	
8	Nallasingam*	Palakkad	20	11	04	57	76	42	52	840	6.36	324	456	
9	Panchalmedu	Idukki	20	09	31	37	76	58	24	973	5.56	258	327	
10	Parampukettimedu	Idukki	20	09	53	29	77	13	08	1128	7.58	470	691	
11	Ponmudi	Trivandrum	20	08	45	53	77	07	51	995	5.10	216	226	
12	Pullikanam	Idukki	20	09	44	5.82	76	52	4.87	960	5.06	178	200	
13	Pushpagiri	Idukki	50	09	50	35	77	03	53	1085	6.02	223	223	
14	Ramakalmedu	Idukki	20	09	48	33	77	14	44	997	8.82	532	535	
15	Sakkulathummedu	Idukki	20	09	52	26	77	12	42	1127	8.12	531	561	
16	Senapathi	Idukki	20	09	56	43	77	10	23	1212	5.39	189	339	
17	Tolanur	Palakkad	20	10	43	02	76	29	56	114	4.41	115	231	

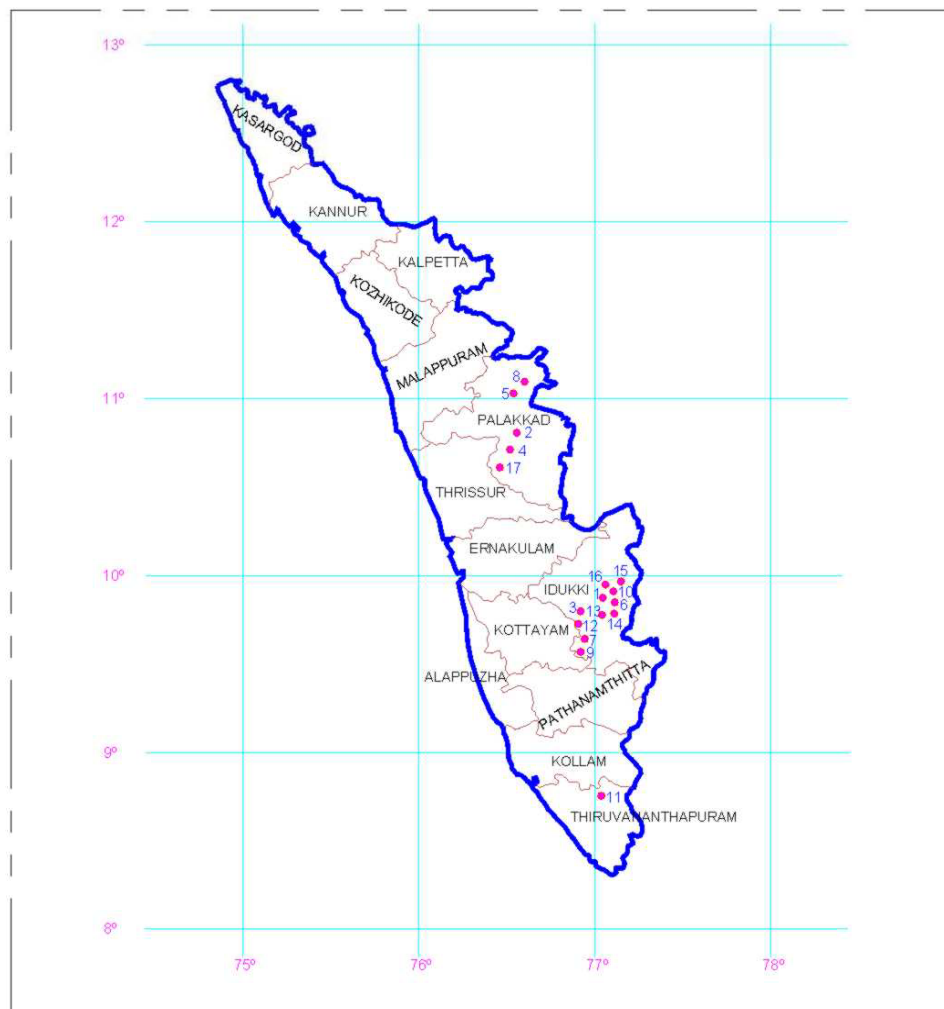
(Source : C-WET)

FIG : F-5-7

# MAP OF KERALA



Showing Wind Monitoring Stations having  $WPD \geq 200W/m^2$



Map not to Scale



**List of Potential Sites for Wind Power Projects in Lakshadweep**  
(WPD $\geq$ 200 W/m<sup>2</sup> at 50magl)

Sl. No.	Station	District	Mast Height (m)	Latitude			Longitude			Elevation (masl)	Mean Annual Wind Speed (m/s)	Mean Annual Wind Power Density (W/m <sup>2</sup> )	
				(N)			(E)				measured at 20/25/30/50 m	measured at 20/25/30/50 m	Extrapolated/ Measured 50 m
				Deg	Min	Sec	Deg	Min	Sec				
1	Agathi	Lakshadweep	20	10	50	06	72	10	55	3	5.07	179	253
2	Agatti	Kavarathi	50								5.46	202	202
3	Amini	Lakshadweep	20	11	07	51	72	43	23	4	4.75	140	205
4	Bitra	Lakshadweep	20	11	35	59.42	72	11	10.72	6	4.67	173	254
5	Chellat	Lakshadweep	20	11	40	56	72	42	16	1	5.13	172	267
6	Kadmat	Lakshadweep	20	11	10	58	72	45	45	5	4.90	169	282
7	Kalpeni	Lakshadweep	20	10	05	04	73	38	50	8	4.43	125	205
8	Kavarathi	Lakshadweep	20	10	32	54	72	37	27	01	4.92	161	283
9	Minicoy	Lakshadweep	20	08	18	09	73	03	58	01	4.73	162	238

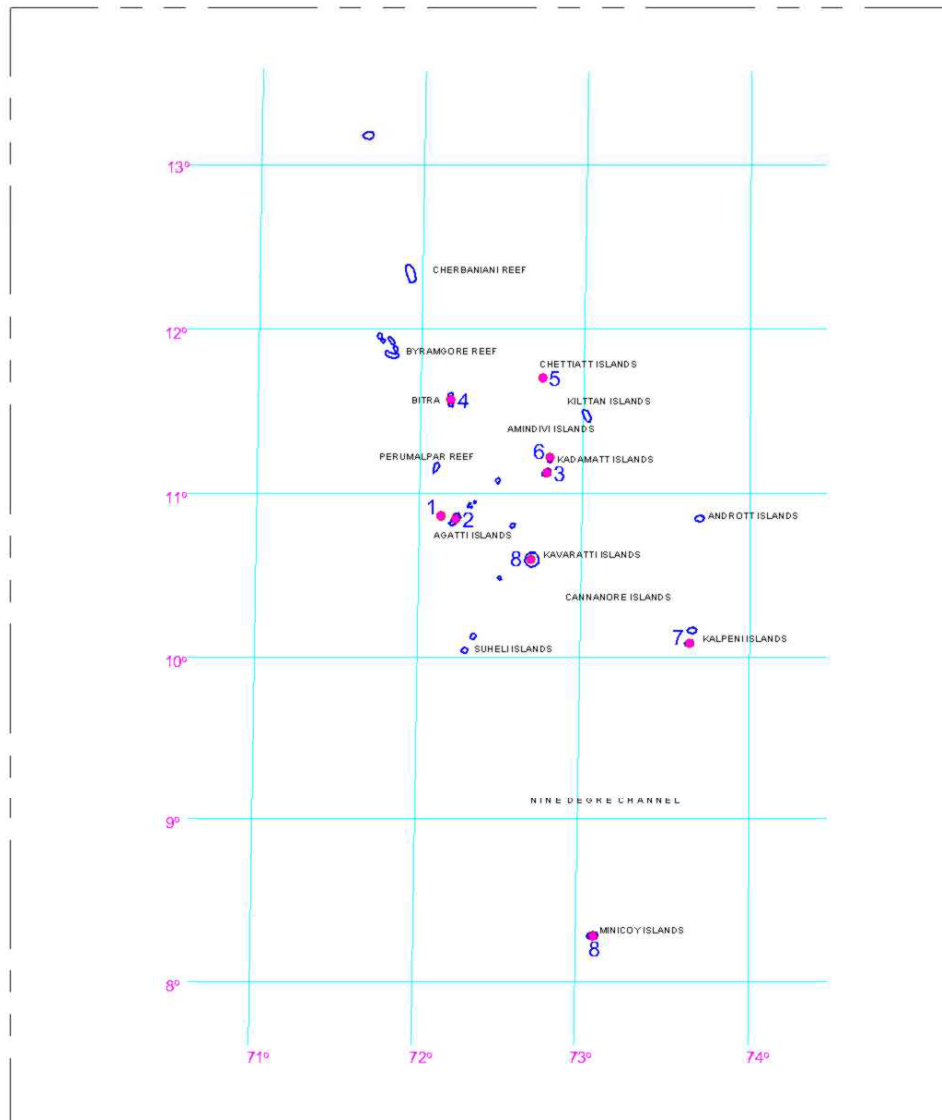
*(Source : C-WET)*

FIG : F-5-8

# MAP OF LAKSHADWEEP



Showing Wind Monitoring Stations having  $WPD \geq 200W/m^2$



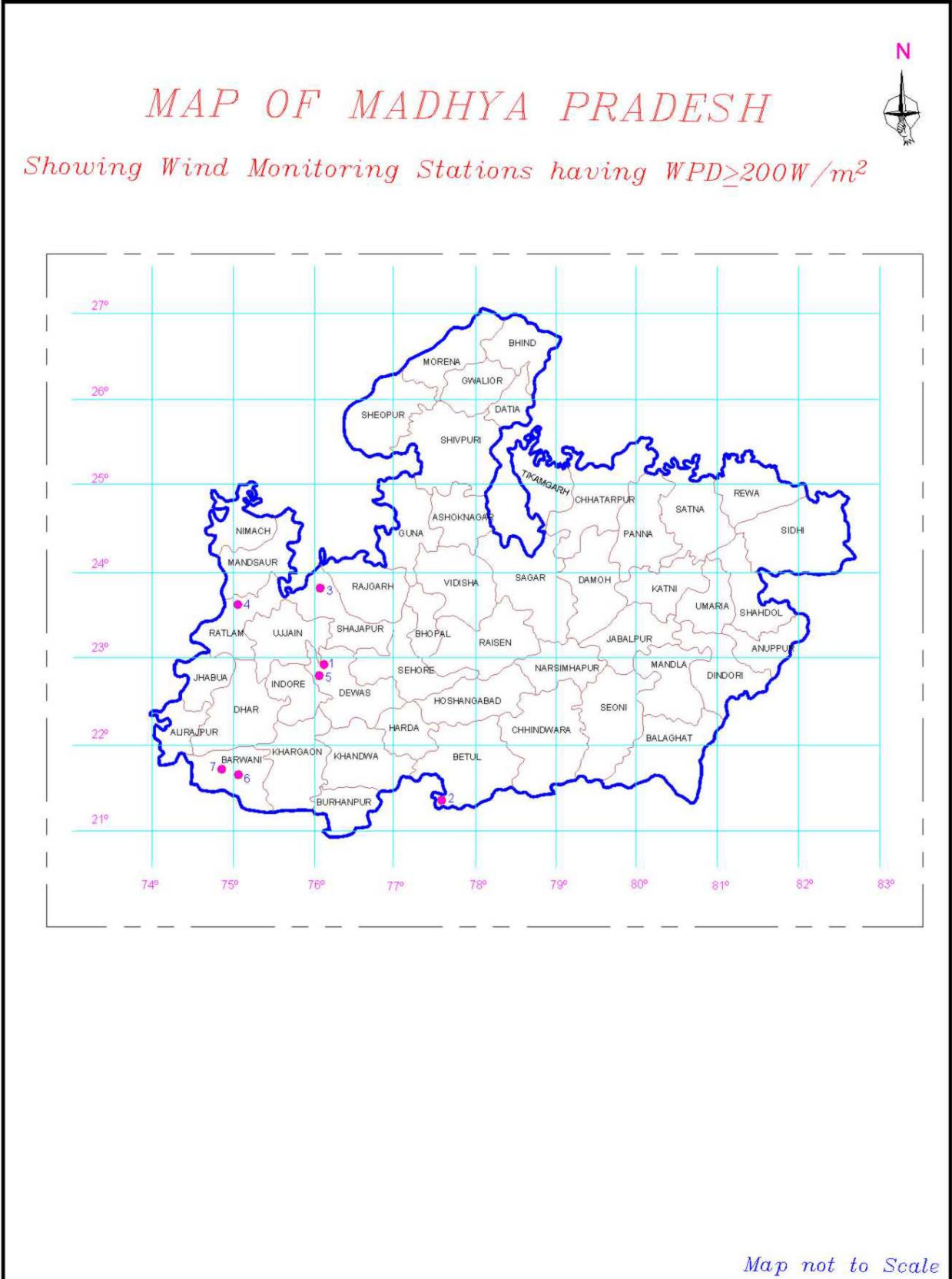
Map not to Scale

**List of Potential Sites for Wind Power Projects in Madhya Pradesh**  
(WPD $\geq$ 200 W/m<sup>2</sup> at 50magl)

Sl. No.	Station	District	Mast Height (m)	Latitude			Longitude			Elevation (masl)	Mean Annual Wind Speed (m/s)	Mean Annual Wind Power Density (W/m <sup>2</sup> )		
				(N)			(E)					measured at 20/25/30/50 m	measured at 20/25/30/50 m	Extrapolated/ Measured 50 m
				Deg	Min	Sec	Deg	Min	Sec					
1	Jamgodrani	Dewas	20	22	59	09	76	09	56.5	580	5.00	130	222	
2	Kukru*	Betul	20	21	29	35.4	77	28	38.7	1133	5.28	157	255	
3	Mahuriya*	Shajapur	25	23	50	0.3	76	05	26.8	508	5.28	171	217	
4	Mamatkheda	Ratlam	20	23	40	44.7	75	03	29.5	543	5.57	169	255	
5	Nagda* (Ref.Stn.)	Dewas	25	22	53	51	76	02	31	656	6.25	219	371	
6	Sendhva*	Khargon	20	21	37	51	75	02	35	540	5.03	163	215	
7	Valiyarpani*	Barwani	20	21	39	37.4	74	57	13.7	510	5.25	191	287	

*(Source : C-WET)*

FIG : F-5-9



**List of Potential Sites for Wind Power Projects in Maharashtra**  
(WPD $\geq$ 200 W/m<sup>2</sup> at 50magl)

Sl. No.	Station	District	Mast Height (m)	Latitude			Longitude			Elevation (masl)	Mean Annual Wind Speed (m/s)	Mean Annual Wind Power Density (W/m <sup>2</sup> )		
				(N)			(E)					measured at 20/25/30/50 m	measured at 20/25/30/50 m	Extrapolated/ Measured 50 m
				Deg	Min	Sec	Deg	Min	Sec					
1	Alamprabhu Patthar*	Kolhapur	25	16	45	56	74	22	26	790	5.58	164	224	
2	Amberi*	Satara	25	17	35	6.78	74	17	56.56	980	6.39	237	275	
3	Aundhewadi	Nasik	25	19	45	53.3	73	52	55.8	858	6.58	294	324	
4	Bhud	Sangli	25	17	20	33.5	74	42	6.8	809	5.48	160	224	
5	Brahmanvel*	Dhule	25	21	09	24.83	74	12	19.19	596	6.42	278	324	
6	Chakla	Nandurbar	25	21	19	0.14	74	18	59.9	352	6.02	242	323	
7	Chalkewadi	Satara	20	17	37	25	73	48	41	1185	5.61	206	218	
8	Dhalgaon*	Sangli	20	17	08	11	74	58	51	805	5.89	216	260	
9	Dongewadi*	Sangli	25	16	53	58.53	74	50	18.30	830	5.94	179	284	
10	Gawalwadi	Nasik	20	20	06	5.4	73	45	3.9	750	5.28	140	278	
11	Gude Panchagani*	Sangli	20	17	06	50	73	58	48	903	5.50	178	296	
12	Jagmin	Satara	120	17	37	26	73	48	54.5	1185	7.42	410	288	
13	Kankora	Aurangabad	25	19	58	20	75	26	16	920	5.56	127	204	
14	Kas	Satara	25	17	44	22.2	73	48	32.4	1232	5.69	194	277	
15	Kavya Donger*	Ahmadnagar	25	19	00	24.9	74	32	2.0	900	6.44	224	277	
16	Khandke*	Ahmadnagar	20	19	08	00	74	52	31	920	5.44	146	250	
17	Kolgaon*	Ahmadnagar	25	18	50	02	74	42	32	800	5.69	177	238	
18	Lonavla*	Pune	20	18	46	40	73	22	39	580	4.31	122	200	
19	Mandhardeo	Satara	25	18	01	34.3	73	53	9.4	1286	5.64	153	206	
20	Matrewadi*	Satara	25	17	11	25	73	55	58	898	5.67	211	253	
21	Palsi	Satara	25	17	17	8.99	73	51	34.02	970	5.24	137	203	
22	Panchgani	Satara	20	17	55	39	73	48	45	1318	5.11	133	205	
23	Panchpatla	Ahmadnagar	25	19	43	40	73	53	04	1049	5.70	201	236	
24	Rajpur	Dhule	25	21	02	59	74	22	21	500	5.25	162	214	
25	Rohina	Latur	25	18	28	59.95	76	56	16.88	662	5.57	149	226	
26	Sautada*	Bid	25	18	47	52	75	20	14	800	5.68	167	223	
27	Takarmauli*	Dhule	25	21	04	40	74	02	48	624	5.78	186	224	
28	Thoseghar* (Ref.Stn.)	Satara	20	17	35	33.8	73	53	15	1140	6.03	229	336	
29	Vankusa wade - II	Satara	50	17	27		73	50		1100	5.68	188	249	
30	Vankusa wade* - I	Satara	25	17	27	14	73	49	58	1100	5.89	231	293	
31	Varekarwadi	Sangli	20	17	12	27.9	73	59	3.8	920	5.46	204	216	
32	Vaspet	Sangli	50	17	06	10.3	75	21	24.4	680	5.62	220	220	
33	Vijayadurg*	Sindhudurg	20	16	30	02	73	19	59	100	5.44	207	253	

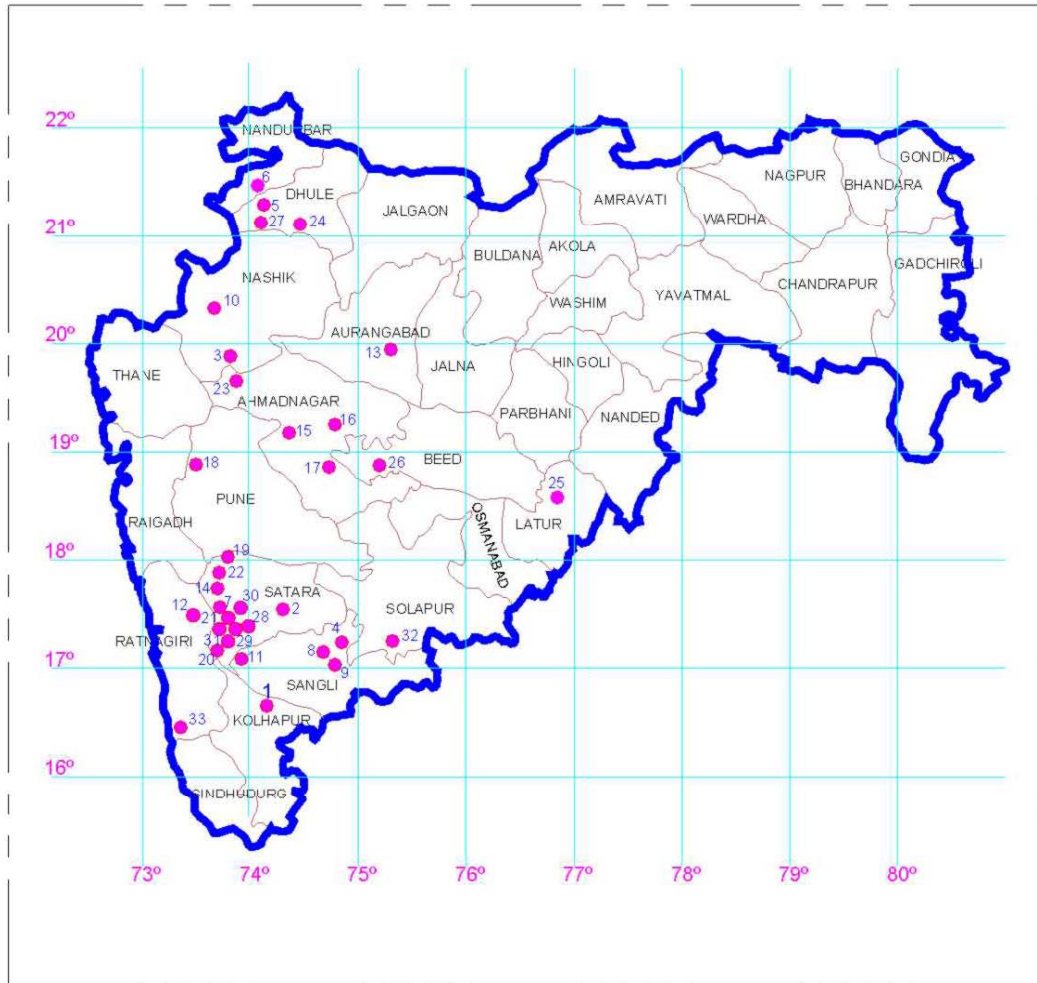
(Source : C-WET)

FIG : F-5-10

# MAP OF MAHARASHTRA



Showing Wind Monitoring Stations having  $WPD \geq 200W/m^2$



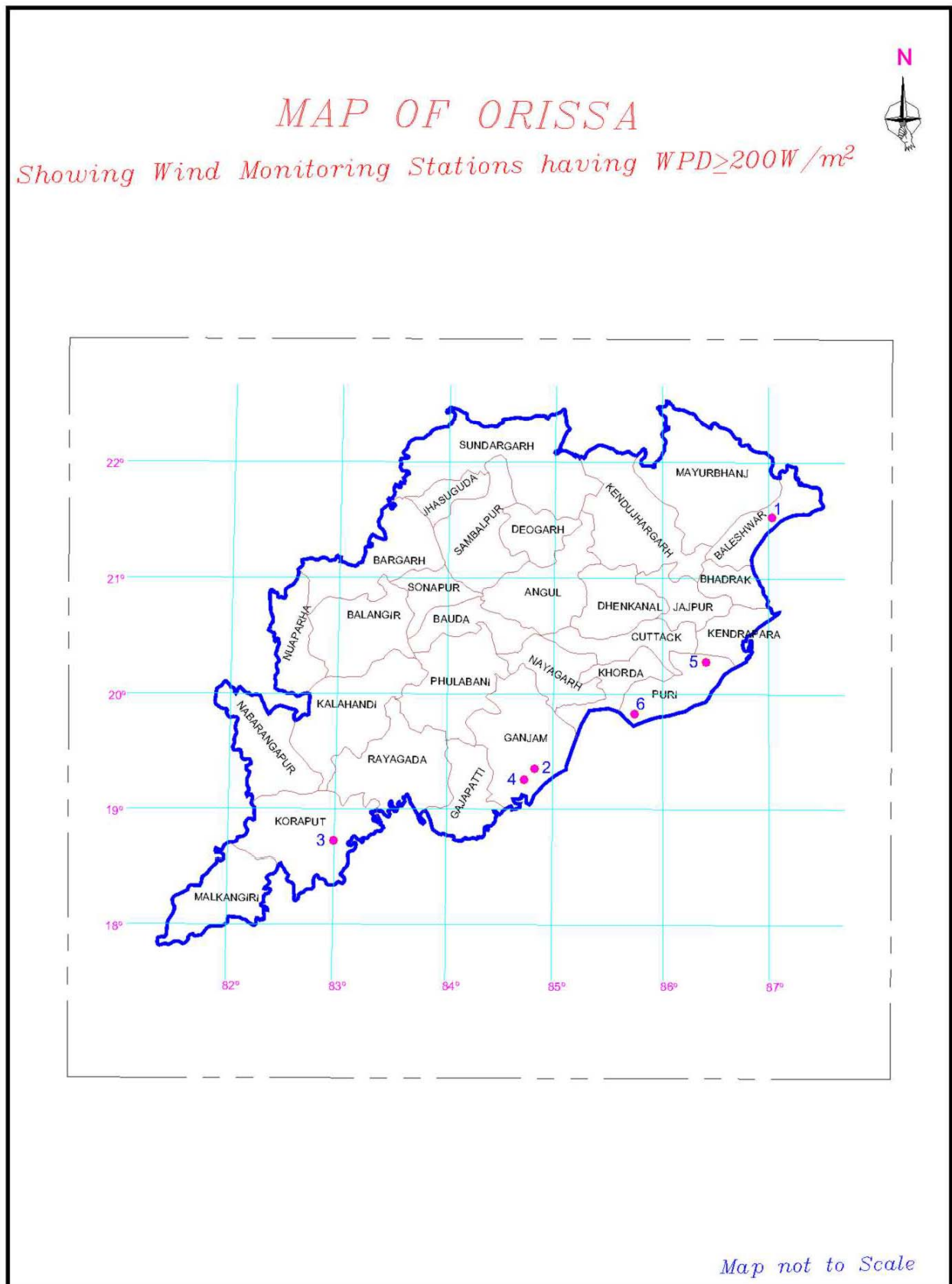
Map not to Scale

**List of Potential Sites for Wind Power Projects in Orissa**  
(WPD $\geq$ 200 W/m<sup>2</sup> at 50magl)

Sl. No.	Station	District	Mast Height (m)	Latitude (N)			Longitude (E)			Elevation (masl)	Mean Annual Wind Speed (m/s) measured at 20/25/30/50 m	Mean Annual Wind Power Density (W/m <sup>2</sup> )	
				Deg	Min	Sec	Deg	Min	Sec			measured at 20/25/30/50 m	Extrapolated/ Measured 50 m
1	Chandipur	Balasore	20	21	26	26	87	1	31	5	4.21	120	202
2	Chatrapur	Ganjam	20	19	19	1	84	57	57	12	4	101	200
3	Damanjodi 2	Koraput	20	18	49	42	83	0	26	1340	5.18	150	250
4	Gopalpur	Ganjam	20	19	15	21	84	54	23	15	3.97	124	265
5	Paradwip	Jagatsinghpur	20	20	15	6	86	39	9	2	4.95	153	289
6	Puri	Puri	20	19	47	14.35	85	48	2.19	7	4.83	137	214

*(Source : C-WET)*

FIG. : F-5-11



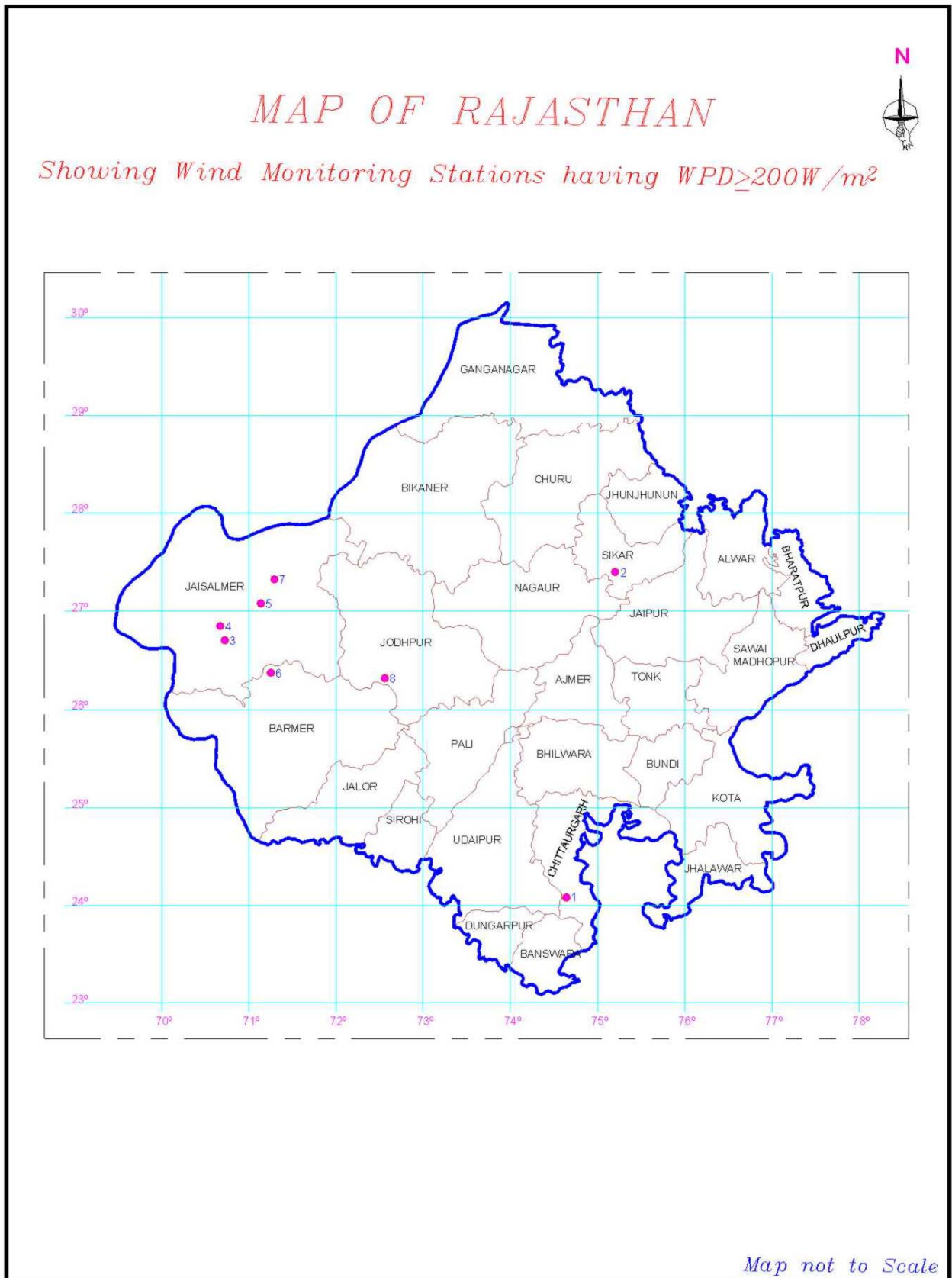


**List of Potential Sites for Wind Power Projects in Rajasthan**  
(WPD $\geq$ 200 W/m<sup>2</sup> at 50magl)

Sl. No.	Station	District	Mast Height (m)	Latitude			Longitude			Elevation (masl)	Mean Annual Wind Speed (m/s)	Mean Annual Wind Power Density (W/m <sup>2</sup> )		
				(N)			(E)					measured at 20/25/30/50 m	measured at 20/25/30/50 m	Extrapolated/ Measured 50 m
				Deg	Min	Sec	Deg	Min	Sec					
1	Devgarh*	Pratapgarh	25	24	02	35	74	39	10	520	5.62	151	202	
2	Harshnath	Sikar	25	27	29	59	75	10	24	891	5.73	206	276	
3	Jaisalmer* - 1	Jaisalmer	20	26	56	33	70	53	38	241	4.83	159	274	
4	Jaisalmer-2 (Ref.Stn.)	Jaisalmer	25	26	56	24	70	53	16	255	5.50	182	244	
5	Kanod	Jaisalmer	20	27	07	03	71	05	33	157	5.23	153	220	
6	Khodal	Barmer	20	26	21	53	71	12	59	269	4.68	135	229	
7	Mohanagarh	Jaisalmer	20	27	17	36	71	13	19	155	4.02	117	243	
8	Phalodi*	Jodhpur	20	27	06	17	72	19	17	250	4.83	142	261	

*(Source : C-WET)*

FIG. : F-5-12

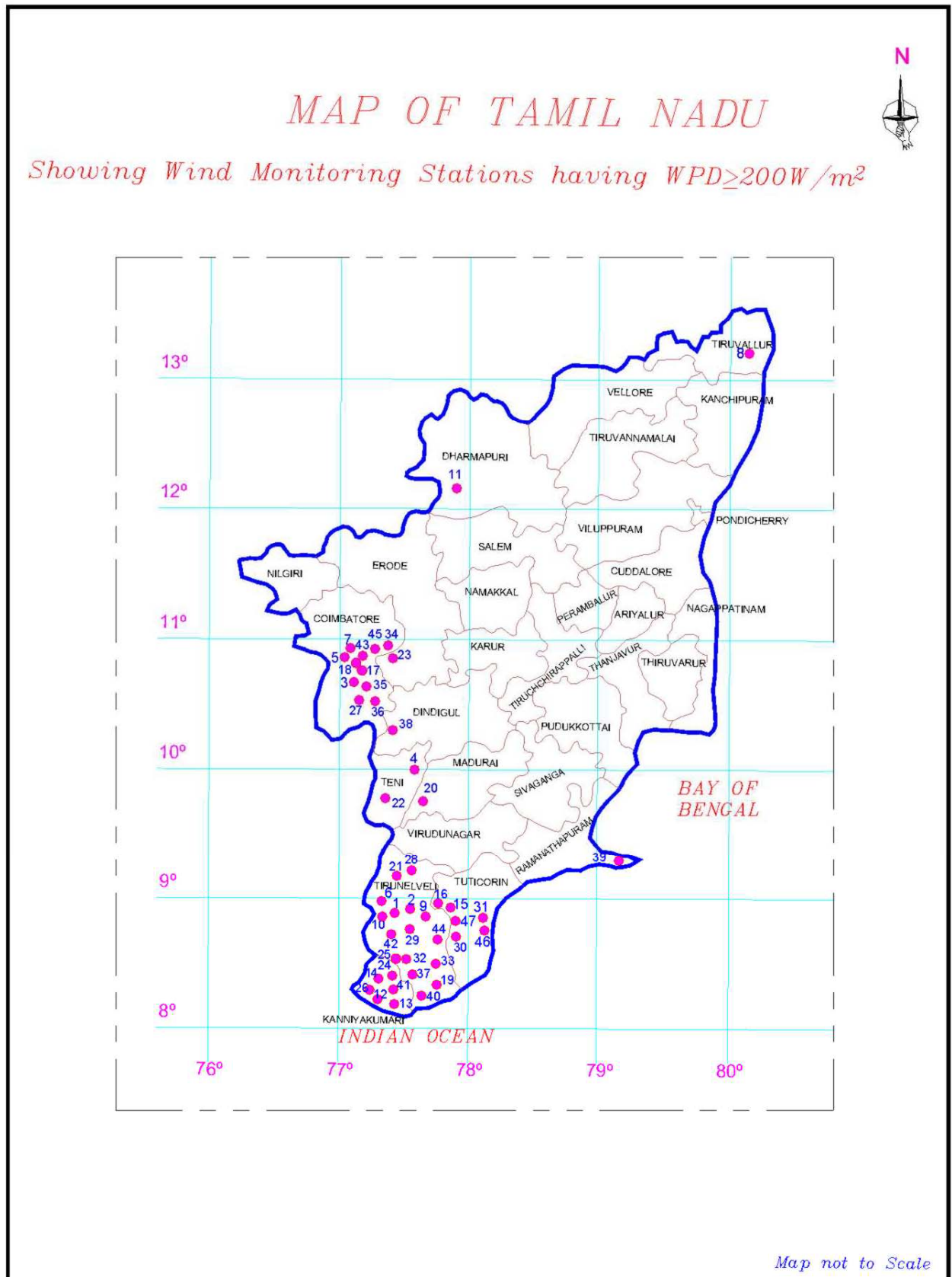


**List of Potential Sites for Wind Power Projects in Tamil Nadu**  
(WPD $\geq$ 200 W/m<sup>2</sup> at 50magl)

Sl. No.	Station	District	Mast Height (m)	Latitude			Longitude			Elevation (masl)	Mean Annual Wind Speed (m/s)		Mean Annual Wind Power Density (W/m <sup>2</sup> )	
				(N)			(E)				measured at 20/25/30/50 m	measured at 20/25/30/50 m	Extra polated/ Measured 50 m	
				Deg	Min	Sec	Deg	Min	Sec					
1	Achankuttam*	Tirunelveli	20	08	57	08	77	28	38	139	5.17	270	397	
2	Alagiyapandiapuram*	Nellai katta bom	20	08	56	14	77	39	04	106	5.81	301	442	
3	Andhiyur	Coimbatore	20	10	36	38	77	10	21	380	5.31	177	271	
4	Andipatti*	Madurai	20	10	00	15	77	34	04	298	5.28	266	346	
5	Arasampalayam	Coimbatore	20	10	50	44	77	02	21	370	5.69	195	291	
6	Ayikudy*	Nellai katta bom	20	08	59	46	77	21	08	179	5.94	305	448	
7	Edayarpalayam*	Coimbatore	20	10	55	15	77	06	59	444	6.22	273	398	
8	Ennore*	Chengalpattu	20	13	14	13.73	80	19	56.62	01	5.36	139	243	
9	Gangakondan	Tirunelveli	25	08	50	59.8	77	45	58.9	40	5.11	246	338	
10	Kalunir Kulam	Tirunelveli	50	08	54	40.3	77	27	27.4	119	6.60	390	390	
11	Kamagiri*	Dharmapuri	50	12	21	38.5	77	53	08	1178	6.25	212	212	
12	Kannakulam	Kanyakumari	25	08	09	49	77	34	55	20	5.92	238	375	
13	Kanyakumari	Kanyakumari	30	08	04	38.98	77	33	19.08	5	7.32	352	436	
14	Kattimalai	Kanyakumari	20	08	14	26	77	32	29	90	6.58	312	458	
15	Kayattar-I	Chidambaram	20	08	58	08	77	43	59.7	94	5.64	294	413	
16	Kayattar-II (Ref.Stn.)	Chidambaram	25	08	56	59.2	77	42	57.5	105	5.37	285	356	
17	Kethanur-1	Coimbatore	20	10	55	26	77	16	07	439	5.86	259	376	
18	Kethanur-2 (Ref.Stn.)	Coimbatore	25	10	55		77	15		403	5.47	189	345	
19	Kumarapuram*	Tirunelveli	25	08	15	45.76	77	34	27.12	80	6.11	288	385	
20	M.S.Puram*	Madurai	50	09	48	39	77	39	06	253	5.57	343	343	
21	Mangalapuram*	Tirunelveli	20	09	02	44	77	22	12	182	6.19	312	423	
22	Meenakshipuram	Madurai	20	09	52	55	77	15	38	464	4.56	224	334	
23	Mettukadai*	Periyar	20	10	52	30	77	23	20	350	5.00	184	281	
24	Muppandal-1 (Ref.Stn.)	Kanyakumari	20	08	15	30	77	33	20	105	7.08	406	597	
25	Muppandal-2	Kanyakumari	25	08	15		77	33		103	6.19	243	410	
26	Muttom	Kanyakumari	25	08	07	26	77	18	58	70	4.75	116	203	
27	Myvadi*	Coimbatore	20	10	36	29	77	19	27	341	5.44	251	376	
28	Naduvakkurichi*	Nellai katta bom	20	09	07	03	77	29	35	163	4.67	157	244	
29	Nettur	Nellai katta bom	25	08	54	14.1	77	32	58.1	100	5.53	338	419	
30	Onakkulam*	Chidambaram	25	08	56	56.6	77	50	55.7	100	5.53	247	292	
31	Ottapidaram*	Chidambaram	20	08	54	08	78	01	16	57	5.14	221	378	
32	Ovari*	Tirunelveli	20	08	17	13	77	52	10	21	5.08	160	221	
33	Panaku di	Tirunelveli	20	08	19	19	77	32	16	140	6.36	366	469	
34	Pongalur*	Coimbatore	20	10	58	25	77	21	06	388	5.31	213	309	
35	Pola vadi*	Coimbatore	20	10	43	54	77	16	42	321	5.89	283	416	
36	Poosari patti*	Coimbatore	25	10	40	21	77	07	21	380	5.36	168	254	
37	Puliyankulam*	Nellai katta bom	20	08	18	53.49	77	44	22.76	35	5.26	188	343	
38	Pushpapur	Dindigul	25	10	33	55	77	25	09	363	4.47	128	201	
39	Rameswaram	Ramanathapuram	20	09	13	40	79	20	35	04	6.64	290	426	
40	Sankaneri*	Tirunelveli	25	08	11	55	77	39	53	30	6.28	258	388	
41	Sembagaramanpudur	Kanyakumari	20	08	15	16	77	29	30	40	6.03	300	441	
42	Servallar Hills	Nellai katta bom	20	08	41	07	77	18	23	312	4.78	207	313	
43	Sultanpet	Coimbatore	20	10	52	00	77	11	09	380	5.28	203	206	
44	Talayathu	Nellai katta bom	20	08	47	44	77	39	29	105	5.69	324	422	
45	Thannirpandal	Coimbatore	20	10	56	58	77	18	48.9	400	5.06	216	317	
46	Tuticorin	Tuticorin	20	08	43	33	78	07	57	3	4.89	148	245	
47	Vaikaikulam*	Tuticorin	20	08	44	47	77	59	41	32	4.61	167	256	

(Source : C-WET)

FIG. : F-5-13

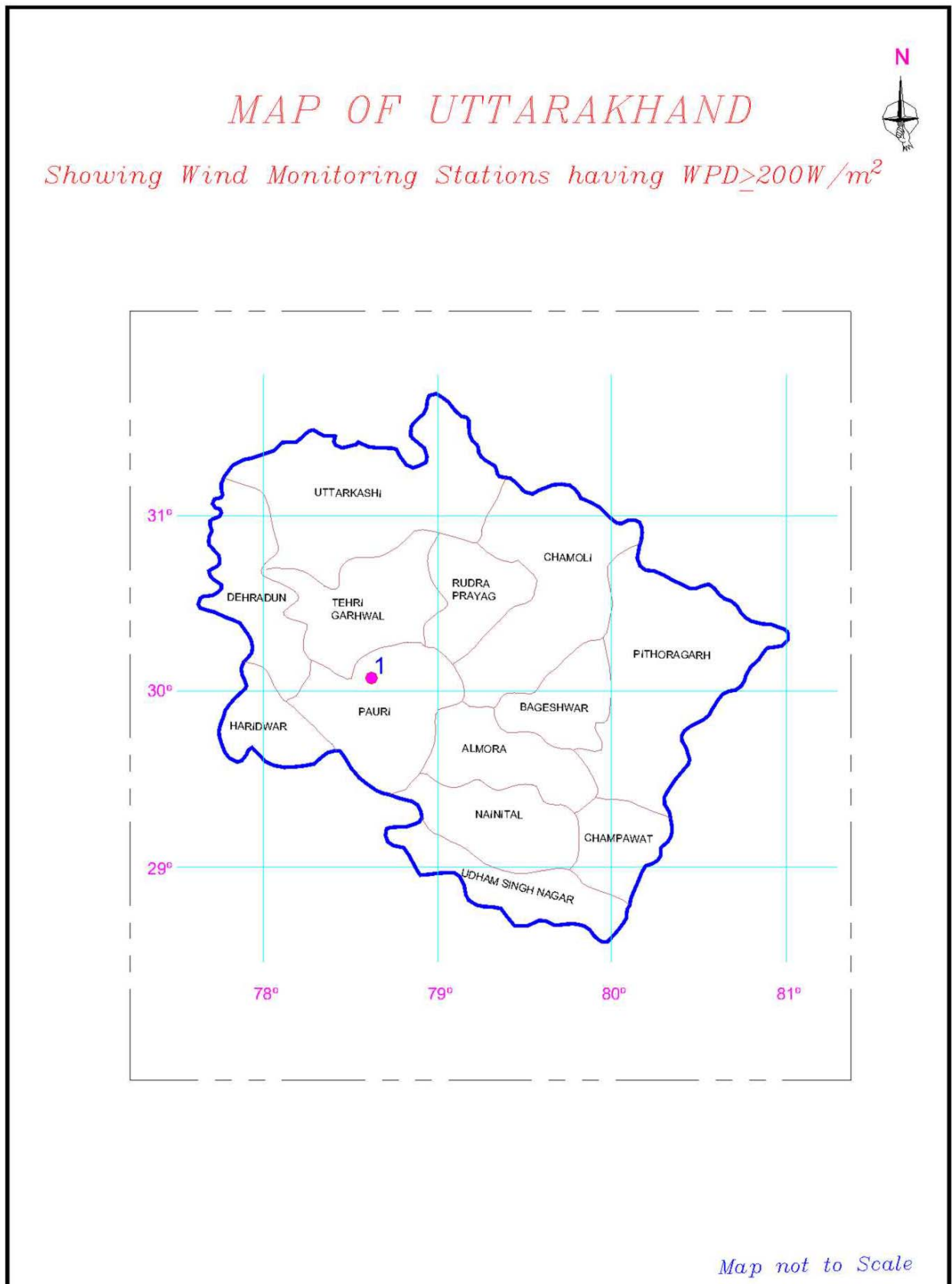


**List of Potential Sites for Wind Power Projects in Uttarakhand**  
**(WPD $\geq$ 200 W/m<sup>2</sup> at 50magl)**

Sl. No.	Station	District	Mast Height (m)	Latitude (N)			Longitude (E)			Elevation (masl)	Mean Annual Wind Speed (m/s)		Mean Annual Wind Power Density (W/m <sup>2</sup> )	
				Deg	Min	Sec	Deg	Min	Sec		measured at		Extrapolated/ Measured 50 m	
											20/25/30/50 m	20/25/30/50 m		
1	Bachelkhal	Narendra Nagar	20	30	4	29	78	34	11.1	981	5.19	144	244	

*(Source : C-WET)*

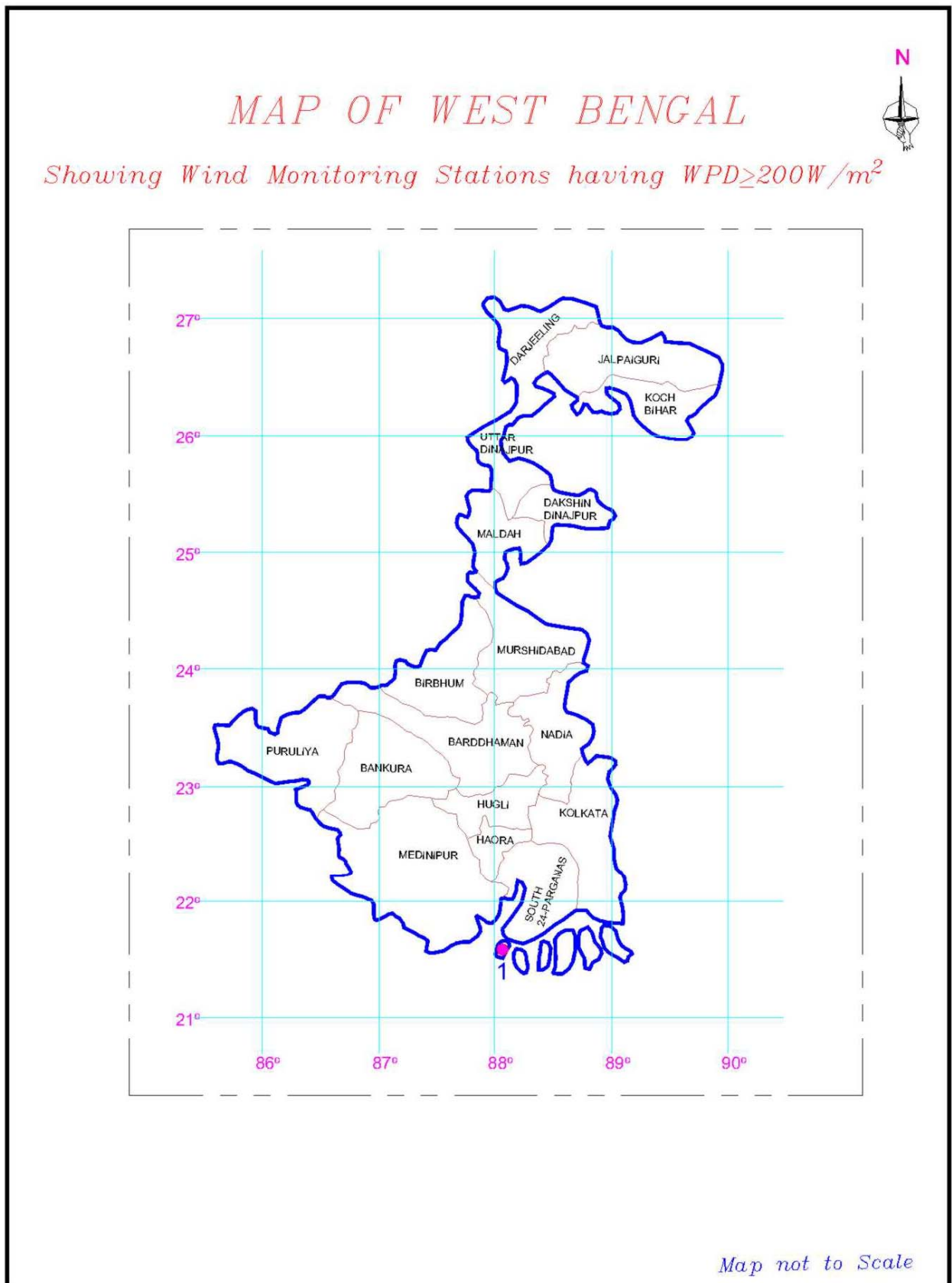
FIG. : F-5-14



**List of Potential Sites for Wind Power Projects in West Bengal**  
**(WPD $\geq$ 200 W/m<sup>2</sup> at 50magl)**

Sl. No.	Station	District	Mast Height (m)	Latitude (N)			Longitude (E)			Elevation (masl)	Mean Annual Wind Speed (m/s)		Mean Annual Wind Power Density (W/m <sup>2</sup> )	
				Deg	Min	Sec	Deg	Min	Sec		measured at		measured at	Extra polated/ Measured 50 m
											20/25/30/50 m	20/25/30/50 m		
1	Ganga Sagar	South 24 Parganas	25	21	38	16.4	88	4	26.7	3	4.77	142	225	

*(Source : C-WET)*

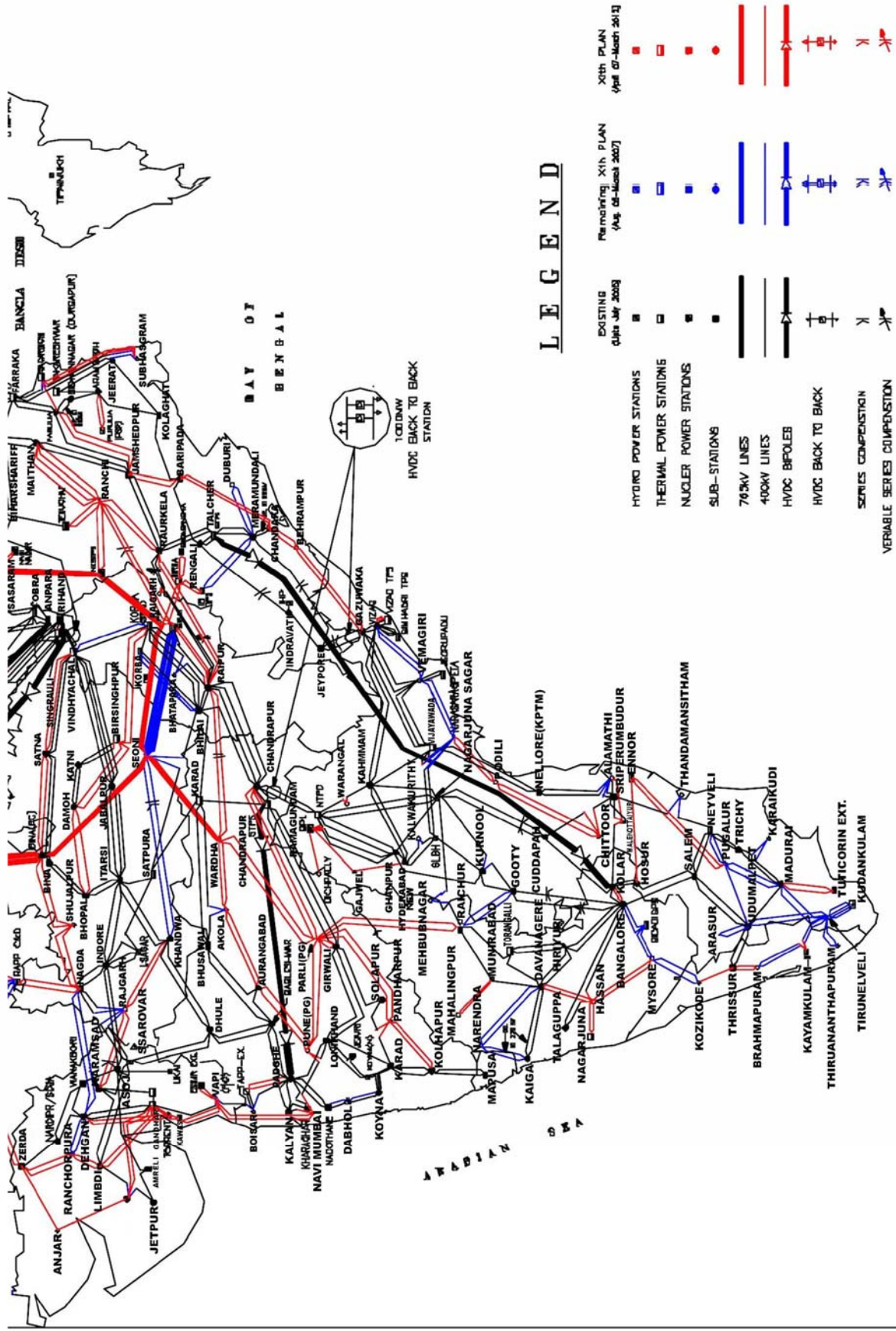






APPENDIX-B

# MAJOR TRANSMISSION NETWORK OF SOUTHERN AREA 400 KV AND ABOVE (EXISTING, APPROVED AND PLANNED - UPTO 2011-12)



**STATUS OF CONSTRUCTION OF ONGOING TRANSMISSION LINES (220 KV & ABOVE)**

As on 31.05.2011

Sl. No.	Name of Transmission Lines	No. of Circuits	Total Length (CKm)	Date of Award	Stringing upto March 2011 (CKM)	Stringing from April 2011 onwards (CKM)	Cumulative progress till date			Commissioning Original Target	Commissioning Actual/Anticipated	Remarks	
							TL (Nos.)	Stubs (Nos.)	TE (Nos.)				
1	2 400 KV TRANSMISSION System (PGCIL) SOUTHERN REGION	3	4	5	6	7	8	9	10	11	12	13	14
1	Kalga 3 & 4 Trans. System a Mysore - Kozhikode	D/C	418	Mar-05	302	0	609	446	446	302	Dec-07	Mar-13	* Completion uncertain as work completely held-up in stretch of 50 Kms since more than 02 year due to severe ROW problem in Kerala portion of line by Coffee planter & forest clearance in Kerala & Kamalaka. Matter taken up with Karnataka Govt. at the highest level and further being followed up through intervention from MOP.
2	Kundankulam - APP Trans. System a Edamon (KSEB) - Muvattupuzha (PG) b Muvattupuzha (PG)-North Trichur (PG)	D/C D/C	296 150	May-05	12 83	5 11	438 223	153 223	80 219	17 94	Nov-08 Nov-08	Mar-12 Sep-11	*Completion uncertain due to severe ROW problem Sever ROW problem being faced.
3	Trans. System Associated with CHENNAI NTPC - a LIL O of Alamythi - Siperumbalur at North Chennai TPS Sw. Yd.	M/C D/C	131	May-08	61	18	129	129	118	79	Jul-10	Jul-11	
4	Trans. System Associated with Tuticorin a Tulicorin JV - Madurai	D/C	316	Feb-09	231	12	428	418	409	243	12-Feb	Feb-12	
5	System Strengthening - IX of SR a Mysore - Hassan	D/C	192	Feb-09	129	29	262	261	259	158	12-Feb	Feb-12	
6	System Strengthening - X of SR a LIL O of Nelimgangla -Somanhalli at Bidadi	D/C	60	Dec-09	0	10	150	25	15	10		Mar-12	
7	System Strengthening - XI of SR a LIL O of both ckt of Udiurmalpet - Madakathara at Chulliar	2XD/C	208	Mar-09	0	0	144	102	38	0	Jul-11	Feb-12	
8	Sirhadri TPS St-II (NTPC) 2x500 MW a LIL O of both ckt of Gazuwaka - Vemagiri at Sirhadri-II TPS	D/C	24	Jan-10	16	2	23	23	21	18		Jul-11	All efforts shall be made to complete the line earlier.
9	System Strengthening - XII of SR a LIL O of Neelamangla -Hoddy 400KV S/C line at Yelahanka	S/C	9	Feb-10		0						Jul-12	Award under progress.
	b LIL O of Somanthally-Hoddy line at Yelahanka	D/C	8			0						Jul-12	Award under progress.
10	Supplementary Transmission System a Vallure TPS-Melakottaiyur line Truvellam (PG) -Chittoor line	D/C D/C	72 42	Aug-10	0	0						Apr-13 Apr-13	Award placed in Mar'11. Engg. in progress. Award placed in Mar'11. Engg. in progress.
11	Transmission System Associated with a Krishnapatham UMPP - Nallore line (Quad) b Krishnapatham UMPP -Gooty line (Quad)	D/C D/C	70 620	Dec-10	0	0						Nov-12 Nov-12	Award placed in Jan'11. Engg. in progress. Award placed in Mar'11. Engg. in progress.
	SOUTHERN REGION (SR) : (STATE SECTOR) ANDHRA PRADESH (APTRANSCO) :												
	Vijayawada TPS(500 MW)	D/C	226		0	0	315	162	71	0	Jun-11	Oct-11	Work awarded on 19.12.2009;WIP.
1	Vijayawada TPS-Suryapeta	D/C	149		0	0	195	101	15	0	May-11	Oct-11	Work awarded on 21.05.2010;Work in progress..
2	Suryapeta-Narsapur	D/C	147		0	0	200	122	73	0	May-11	Oct-11	Work awarded on 21.05.2010;Work in progress..
3	Narsapur-Malkaram	D/C	147		0	0	200	122	73	0	May-11	Oct-11	Work awarded on 21.05.2010;Work in progress..

Sl. No.	Name of Transmission Lines	No. of Circuits	Total Length (CKm)	Date of Award	Stringing Completed upto March 2011 (CKM)	Stringing from April 2011 onwards (CKM)	TL (Nos.)	Stubs (Nos.)	TE (Nos.)	Cumulative String Completed (CKm)	Original Target	Actual/Anticipated	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Bhoopalapally(Kakatiya) TPS	D/C	262		0	0	361	100	35	0	Apr-11	Aug-12	Purchase order issued on 20.08.10. Check survey under
1	Bhoopalapally -Gajwel												
1	Krishnapatham TPP	D/C	72		0	0	11	3	0	0	Feb-12	Feb-12	Tender under finalization
2	Krishnapatham TPP - Nellore(Quad) D/C	D/C	182		0	0					Jun-12		Tender under finalization
2	Krishnapatham TPP - Bonapally (Quad)	D/C											
3	Bonapally -Chittoor (Quad)	D/C	194		0	0					Jun-12		Tender under finalization
1	Ringmani Transmission Scheme	D/C	210		0	0	287	100	42	0	Feb-12	Feb-12	
1	Yeddumairam -Gajwel	D/C	1442		0	0				0			
	TOTAL (APTRANSCO) 400 KV KARNATAKA (KPTCL)												
	Jindal TPC(Thorangalli-Bellary)												
1	BTPS-Hiriyur	D/C	313		238	36	440	432	430	274	Dec-08	Oct-11	Work under progress. Constraint: Forest Clearance required for 14.34 hectares. Stage I clearance received on 11.05.2011. Railway Clearance. B/w loc. 326-327 -Joint inspection done. Intimation to be received. Dismantling work: 15/15 Nos. of towers completed.
1	Lanco Nagarjuna(Udupi) TPS												
1	UTPS -Hassan(Shantigram)	D/C	358		77	10	529	405	370	87	Jul-10	Mar-12	Work under progress. Constraint: ROW problems in 9 locations. Case filed in DC court for 8 locations. Forest Clearance required for 172.53 Hectares (Line length of 33.39 km comprising of 91 locations). Stage 1 approval received. NPV & afforestation charges paid. Net present value (i) B/w loc 5/0-6/0 -revised estimate submitted. Intimation to be received. (ii) B/w 44/0-45/0 intimation received, amount paid, work commencement approval to be received. (iii) 15/0-6/0 intimation to be received.
	TAMILNADU (Tantransco) :		671		315	46				361			
	North Chennai TPS SLII												
1	NCTPS SLII-Alamathy 400 KV S/S	M/C	168		0	3	113	100	56	3	Jun-11	Sep-11	14 foundation gangs . 14 erection gangs are currently deployed.
2	Alamathy -Sunguvarchattram	M/C	94		0	0	158	94	41	0	10-Jun	Mar-12	WIP
1	Vallur JV Project	D/C	8		0	0	12	1	0	0	11-Mar	Aug-11	WIP
1	Vallur JV Project-NCTPS SLII	D/C	280		0	33	324	311	246	33	12-Mar	Jul-11	
2	MTPS SL III -Arasur	D/C	200		0	0						Mar-12	Tender will be floated. On acquiring the land for ss
1	MTPS SL III -Singarpal	D/C	14		5	0	23	21	18	5	Jun-10	Jun-11	WIP(Route diverted , line length reduced ) . Court case.
	System Strengthening												
	LLO of Srperumbudur-Neyveli	D/C											
	at Sunguvarchattram 400KV S/S												
	TOTAL (Tantransco) 400 KV		764		5	36				41			
	TOTAL (SR) 400 KV		2877		320	82				402			

Sl. No.	Name of Transmission Lines	No. of Circuits	Total Length (CKm)	Date of Award	Stringing upto March 2011 (CKM)	Stringing from April 2011 onwards (CKM)	TL (Nos.)	Stubs (Nos.)	TE (Nos.)	Cumulative progress till date String. Completed (CKM)	Commissioning Original Target	Commissioning Actual/ Anticipated	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	<b>SOUTHERN REGION (SR):(STATE SECTOR 220 KV)</b>												
	<b>ANDHRA PRADESH (APTRANSCO) :</b>												
	Evacuation From PGCIL Sub-Stations												
	Rayalseema Stage-III												
1	Pulivendula-Hindupur	D/C	250		0	0	383	178	116	0	Jun-11	Dec-11	Works are under progress.
1	Warrangal ( Oglapur) 400/220 KV S/S	D/C	142		0	0	248	153	43	0	Jun-10	Dec-11	W/P
	<b>System Strengthening</b>												
1	Palamaneru -Chittoor	S/C on D/C	60		32	18	194	173	173	50	Apr-10	Jul-11	
2	LIL of Tadikanda-Ongoliat at Poddili	D/C	144		0	0	229	166	73	0	Oct-11	Oct-11	Work are under progress.
3	LIL of Renigunta Chittoor at Nagari	D/C	75		0	5	120	98	91	5	Dec-11	Dec-11	
4	Malakaram -Guntur SS	DC UG Cable	34		0	22	Cable		22		Sep-11	Sep-11	
5	Chandrayanagutta SS-Ittibani (GIS) SS cable	DC UG Cable	22		0	13	Cable		13		Sep-11	Sep-11	
6	Moulali -Osmani University (Chilakalaguda) SS	DC UG Cable	18		0	10	Cable		10		Oct-11	Oct-11	
7	LIL of Shapur Nagar -Gachilbowli feeder at GIS Erragadda SS	DC UG Cable	19		0	6	Cable		6		Oct-11	Oct-11	
8	Vijayawada TPS-Talipally	D/C	266		256	10	411	411	411	266		Jun-11	All work completed except Earthing for 239 Locations and 8 KM earth wire stringing is pending.
9	Ramagundam-Bellampalli	S/C on D/C	37		33	0	134	131	130	33	Mar-08	Jun-11	W/P
10	Dhone -Krishnagiri	S/C on D/C	12		11	0	37	37	37	11	Mar-09	Jun-11	W/P
11	LIL of both ckt's of Gooly Somayajulapally at Dhone sw. stn.	-2 x D/C	114		108	2	178	178	176	110	Dec-09	Jun-11	
12	Kondapuram-Thimmapuram	D/C	10		9	1	33	33	33	10	Sep-10	Jun-11	Almost complete.
13	Lakkasagarlam -Nansuralla	D/C	7		7	0	21	21	21	7	Nov-10	Jun-11	Ready for charging.
14	Thimmapuram-Yellanur	D/C	8		8	0	27	27	27	8	Nov-10	Jun-11	Almost complete.
15	Yellanur-Gaddamvaripalli	D/C	5		4	1	16	16	16	5	Dec-10	Jun-11	
16	Gaddamvaripalli-Goddumari	D/C	9		0	0	31	13	5	0	Dec-10	Jun-11	
17	Kalpaka S/S -M/s Brandix	D/C	39		22	9	74	65	58	31	Jun-08	Jun-11	Works completed for 11 KM line & commissioned .For balance work severe ROW/ problem arised .
18	LIL of Manubolu-Renigunta at Ranchagumteri S/S	D/C	3		0	6	1	0	0	0	Mar-12	Mar-12	Excavation works are in progress.
19	Yedditumalaram-Sadasivpet	D/C	80		0	118	8	0	0	0		Dec-11	
20	Marnipally S/S -M/s K.S.K. Photo Voltaic near Fabcoty Ravirala(V)	D/C	11		0	37	17	13	0	0		Dec-11	
	<b>TOTAL (APTRANSCO) 220 KV</b>		<b>1365</b>		<b>490</b>	<b>97</b>			<b>587</b>				
	<b>KARNATAKA (KPTCL) :</b>												
	<b>Raichur Unit &amp; TPS</b>												
1	RTPS -Raichur	D/C	35		15	0	72	72	67	15	Dec-07	Jun-11	Line work short closed for incorporating the Jurala project 220 KV line & formation of multi ckt in the same corridor.
	<b>Varahi HEP</b>												
1	Varahi-Khemar in the existing 110 KV corridor	D/C	226		201	10	422	403	391	211	Dec-08		Work under progress. Constraint: Railway Clearance required B/w loc 14/9-15/0 -Supervision charges paid, work commencement approval to be received. ROW/ problem: For location No. 48 case filed in Hon'ble High court of Kamalaka.At loc no. 2, 20 & 21 case filed in the Court of Civil Judge (Jr.Divn), Mangalore.

Sl. No.	Name of Transmission Lines	No. of Circuits	Total Length (CKm)	Date of Award	String. Compl upto March 2011 (CKM)	Stringing from April 2011 onwards (CKM)	TL (Nos.)	Stubs (Nos.)	TE (Nos.)	Cumulative progress till date	Commissioning Actual/ Anticipated	Remarks	
										String. Completed (CKM)	Original Target		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	<b>System Strengthening</b> Somanahalli Matur I & II lines - Jigani	D/C	14		0	0	34	6	0	0		Oct-11	ROW problem at loc. No 6. Case filed in JMFC Court, Anekal. Approached KIADB for issue of permission to erect 220 kv Double circuit line along the KIADB roads of Jigani Industrial Area, approval awaited. Revised route 'check survey under progress.
2	Hurrinabad-Halbarga	D/C	80		0	56	138	137	135	56	Jul-11	Jul-11	WIP
3	Narendra 400KV S/S-Mahalingapur	D/C	246		177	30	422	418	415	207	Jun-09	Oct-11	All foundation work completed.Erection work in progress.
4	L/O of Hoody-Kolar at Hoskote	D/C	26		0	0	55	34	31	0	Sep-07	Dec-11	ROW Problem. at locations 53,54, 1-5, 14-18, 23,27-33, 36,51 pending in DC Court Bangalore Rural.
5	HSR Layout -Nimhans	S/S	11		6	0		cable		6	Jun-10	Jul-11	WIP. Awaiting approval from BBMP for deviation of route at Madivala Junction due to construction of under pass.
6	Chikkodi-Kudachi	D/C	70		0	0	120	120	90	0	Sep-06	Dec-11	Tendered on 18.02.2011
7	Hiriyur 400KV S/S-Gowribidanur	D/C	242		184	2	431	371	336	186	Mar-08	Jun-11	ROW problem at 92 locs in Hiriyur Taluk. Cases pending in DC Court chitradurga which is being pursued.
8	Tubinakere-Kothipura	D/C	137		0	0	277	227	123	0	Jun-09	Sep-11	ROW Problem. at 27 locations. Court cases in the line which is being pursued.
	<b>TOTAL (KPTCL) 220 KV</b>		<b>1087</b>		<b>583</b>	<b>98</b>				<b>681</b>			
	<b>KERALA (KSEB) :</b>												
	<b>Evacuation From PGCIL Sub-Stations</b>												
	<b>Muvattupuzha (Kochi East) 400/220 KV S/S</b>												
1	(a) Kochin (East)-Marakkala line	M/C	8				12	12	9	0	Dec-07 *		Substation at palikkara being constructed by PGCIL
(b) Marakkala-Brahmapuramline	M/C	17					14	7	3	0	Dec-07 *		
<b>System Strengthening</b>													
1	L/O of New Pallom-Kayamkulam at Punnappara	D/C	40		0	0	67	6	0	0	Mar-08	Oct-11	Overall 15% progress
2	Mannukkad(Chulliar) 400 KV S/S -Kanjikode	M/C	12		0	0	16					Sep-11	Yet to start
3	Polhencode-Kattakkada	D/C	54		0	0	107	44	0	0		Jan-12	
	<b>TOTAL (KSEB) 230 KV</b>		<b>131</b>		<b>0</b>	<b>0</b>				<b>0</b>			
	<b>TAMILNADU (Tantransco) :</b>												
	<b>Mettur TPS Stage -III</b>												
1	L/O of MTPS -Malco at MTPS Stage-III	D/C	8		6	0	17	17	17	6		Jun-11	MTPS Stage III -Malco S/C line energised 2/11
2	MTPS Stage III -Pallakkapalayam	S/C	8		8	0	20	20	20	8		Jun-11	Stringing completed.
	<b>System Strengthening</b>												
1	L/O of Arasur-Ingur at Karamadai	D/C	6		0	0	13	13	0	0		Jun-11	Work awarded for lower erection and line stringing
2	Sunguvachattam-Oregadam	S/C on D/C	10		3	4	47	47	43	7	Dec-10	Jun-11	Railway crossing involved.
3	L/O of Chekkurani - Amathapuram at Nallanackkenpalayam	D/C	30		0	10	42	42	38	10		Sep-11	
4	L/O of Supurambur-Arni at Sunguvachattam	D/C	12		0	0	28	10	3	0	Dec-10	Jun-11	
5	Othakkalmandapam (Malurichampatty)-Palladam	S/C	53		46	7	189	189	189	53	Mar-11	May-11	Ready for commissioning 5/11.
6	Kavanur -Karaiyudi	S/C on D/C	82		63	0	320	311	309	63	Mar-11	Aug-11	Held up due to cultivation
7	Stiperumbalur -Korattur (Changing of conductor)	S/C	20		12	0	70	Existing		12	Sep-06	Sep-11	Shut down required for stringing
8	(a)Alamathy S/S -Avadi	S/C	18		18	0	45	45	45	18	Sep-07	Jun-11	Stringing completed.
(b) Avadi-Ayappakkam line	S/C	3					Cable					Jun-11	To be taken up.
(c) Ayappakkam -Koladi line	D/C	5		5	0	0	11	11	11	5		Jun-11	Stringing completed.

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	
11*	Devakkurichi-Pudhanchandai	S/C on D/C	84		70	14	299	299	299	84	Dec-07	May-11	Ready for commissioning 5/11.	
12*	LILO of Thiruvapur-Karaikudi at Karambayam (Nimmell Thippalakudi)	D/C	17		17	0	33	33	33	17	Nov-10	May-11	Ready for commissioning 5/11.	
13	Arasur-Palladam	D/C	66		0	8	232	163	107	8		Mar-12		
14	Karaikudi-Sembhalty	D/C	140		0	0	581	289	164	0		Mar-12		
	<b>TOTAL (Tantransco) 220 kV</b>		<b>562</b>		<b>248</b>	<b>43</b>				<b>291</b>				
	<b>PUDUCHERRY</b>													
1	Rammathpuram - Thondamanatham	D/C	8		0	0	35	14	4	0	Jun-10	Jun-11	ROW to be resolved (executed by PGCIL)	
	<b>TOTAL (Puducherry) 220 kV</b>		<b>8</b>		<b>0</b>	<b>0</b>				<b>0</b>				
	<b>TOTAL (SR) 220 kV</b>		<b>3153</b>		<b>1321</b>	<b>238</b>				<b>1559</b>				

LEGEND: →

\* Outside programme  
 S/C Single circuit  
 D/C Double circuit  
 M/C Multi circuit  
 S/C on KV Single circuit on Double circuit  
 CKM Circuit Kilometer  
 LILO Loop in Loop out  
 WIP Work in progress

A decorative border consisting of repeating floral motifs, including small flowers and leaves, arranged in a rectangular frame around the page.

# ANNEXURES



## ANNEXURE-I

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(Source : MNRE)

## ANNEXURE-II

### Indian Renewable Energy Development Agency

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<p>Indian Renewable Energy Development Agency Ltd. (IREDA) Corporate Office : 3<sup>rd</sup> Floor, August Kranti Bhawan, Bhikaiji Cama Place, New Delhi – 110 066 T : 011-26717400-26717413 F : 011-26717416 E : cmd@ireda.in W: www.iredaltd.com</p> <p>Indian Renewable Energy Development Agency Ltd. Core-4A, East Court, 1st Floor India Habitat Centre Complex, Lodhi Road, New Delhi - 110 003 T : 011 – 24682214-21 F : 011 – 24682202 E : mdireda@rediffmail.com W : www.iredaltd.com</p> <p><u>Branch Offices</u> IREDA Camp office : C/o. M/s. Industrial and Technical Organization of Tamil Nadu Limited (ITCOT) 50-A, Greams Road, Chennai – 600 006 (Tamil Nadu) Cont : Mr. Ishwar N. Madival, Manager (F&amp;A) In-Charge Branch Office T : 044-28294365/28290324 M : 08754497457</p> <p>C/o. The Federation of Andhra Pradesh Chambers of Commerce and Industry (FAPCCI) II Floor, Federation House, 11-6-841 Red Hills, P.B.No.14, Hyderabad – 500 004 (A.P.) T : 040-23397885 F : 040-23395083 Cont : Shri A. Chandrasekhar, Sr. Manager (TS) E : achandrashekar@ireda.in</p>	<p>Mr. Debashish Majumdar Chairman cum Managing Director T : 011-26717414, 26717415 F : 011-26717416 Extn. 113 E : cmd@ireda.in</p> <p>Mr. S.P. Reddi Director (Finance &amp; Admn.) T : 011- 26717417 F : 011- 26717418 Extn. 136</p> <p>Mr. K.S. Popli Director (Technical) T : 011- 26717419 F : 011- 26717420 Extn. 130</p> <p>Mr. Satish Kumar Bhargava General Manager (F&amp;A) &amp; Company Secretary T : 011- 26717425 Extn. 115</p> <p>Mr. Abdul Aziz Khatana Chief General Manager (Technical Services) T : 011- 26717421</p> <p>Smt. Debjani Bhatia Asstt. General Manager (Technical Services) T : 011- 26717400</p>

(Source : IREDA)

## Centre for Wind Energy Technology

Address :

Chennai	Kayathar
<b>Centre for Wind Energy Technology (C-WET)</b> Velachery – Tambaram Main Road, Pallikaranai Chennai – 600 100 Tel : +91 – 44 – 22463982-84, 29001162, 67, 95 Fax: +91 – 44 – 22463980 Email: info@cwet.res.in Web Site : www.cwet.tn.nic.in	<b>Wind Turbine Test Station (WTTS)</b> <b>Wind Turbine Research Station (WTRS)</b> TNEB Windfarm, Ayyanaruthu –Substation Kayathar- Devarkulam Road, Koilpatti Taluk, Kayathar-628952, Tuticorin Dist. (T.N.) Tel : +91 – 04632 – 261751-52/261931 Fax: +91 – 04632 – 261751

Contact Persons :

Name & Designation	Telephone	Email
Dr. S. Gomathinayagam Executive Director	2246 3981 Fax 22463991	ed@cwet.res.in
<b>Administration</b>		
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G. Rajan, Admn. & Accounts Officer	22463982-84	rajang@cwet.res.in
<b>Research &amp; Development</b>		
Rajesh Katyal, Scientist & Unit Chief	65714240	katyal@cwet.res.in
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Deepa Kurup, Scientist	EPABX : 442	deepa@cwet.res.in
<b>Wind Resource Assessment</b>		
Dr. E. Sreevalsan, Scientist & Unit Chief	22463993	esree@cwet.res.in
R. Sasikumar, Scientist	EPABX : 662	sasikumar@cwet.res.in
K. Boopathi, Scientist	EPABX : 663	boopathi@cwet.res.in
<b>Wind Turbine Testing</b>		
S.A. Mathew, Scientist & Unit Chief In-Charge	22463992	mathew@cwet.res.in
M. Anvar Ali, Scientist	EPABX : 772	anvar@cwet.res.in
M. Saravanan, Scientist	EPABX : 774	Saravanan@cwet.res.in
<b>Standards &amp; Certification</b>		
A. Senthil Kumar, Scientist & Unit Chief In-Charge	22463988	asenthilkumar@cwet.res.in
N. Raj Kumar, Scientist	EPABX : 334	rajkumar@cwet.res.in
A.G. Rangaraj	EPABX : 336	rangaraj@cwet.res.in
<b>Information, Training &amp; Commercial Services</b>		
P. Kanagavel, Scientist & Unit Chief In-Charge	22463994	pkanagavel@cwet.res.in
<b>Wind Turbine Research Station (WTRS), Kayathar</b>		
A. Mohamed Hussain, Scientist	4632-261751/931	hussain@cwet.res.in
<b>Wind Turbine Test Station (WTTS), Kayathar</b>		
A.R. Hasan Ali, Jr. Engineer	4632-261751/931	hasanali@cwet.res.in

(Source : C-WET)

**Electricity Regulatory Commissions**

**CENTRAL ELECTRICITY REGULATORY COMMISSION**

3rd & 4th Floor, Chanderlok Building,  
36, Janpath,

New Delhi – 110 001

T : 011-23353503

F : 011-23753923

E : info@cercind.gov.in

W : www.cercind.gov.in.

**ANDHRA PRADESH**

**Andhra Pradesh Electricity Regulatory Commission**

4th&5th Floor,11-4-660,

Singareni Bhavan, Red Hills,

Hyderabad – 500 004

T : 040-23397381, 399, 556, 656

F : 040-23397489, 23397378

E : aperc@ercap.org

W : www.aperc.gov.in

**GUJARAT**

**Gujarat Electricity Regulatory Commission**

1st Floor, Neptune Tower,

Opp. Nehru Bridge, Ashram Road,

Ahmedabad – 380 009

T : 079-26580350, 26580359

F : 079-26584542

E : gerc@gercin.org

W : www.gercin.org

**KARNATAKA**

**Karnataka Electricity Regulatory Commission**

9/2, 6th & 7th Floor, Mahalakshmi Chamber,

M.G. Road, Bangalore – 560 001

T : 080-25320213, 25320214

F : 080-25320338

E : kerc35@bsnl.in

W : www.kerc.org

## **KERALA**

### **Kerala State Regulatory Commission**

KPFC Bhavan,  
C.V. Raman Pillai Road,  
Vellayambalam,  
Thiruvananthapuram-695 010  
E : [kserc@erckerala.org](mailto:kserc@erckerala.org)  
W : [www.erckerala.org](http://www.erckerala.org)

## **MADHYA PRADESH**

### **Madhya Pradesh Electricity Regulatory Commission**

“Metro Plaza” 4th & 5th Floor,  
Bittan Market,  
E-5, Arera Colony  
Bhopal – 462 016  
T : 0755-2430154, 2463585  
F : 0755-2430158  
E : [secmperc@sanchamet.in](mailto:secmperc@sanchamet.in)  
W : [www.mperc.org](http://www.mperc.org)

## **MAHARASHTRA**

### **Maharashtra Electricity Regulatory Commission**

World Trade Centre, Centre No.1,  
13th Floor, Cuffe Parade, Colaba,  
Mumbai – 400 005  
T : 022-22163964, 65, 69  
F : 022-22163976  
E : [mercindia@mercindia.com](mailto:mercindia@mercindia.com)  
W : [www.mercindia.com](http://www.mercindia.com)

## **ORISSA**

### **Orissa Electricity Regulatory Commission**

Bidyut Niyamak Bhavan,  
Unit - VIII  
Bhubhaneshwar - 751 012.  
T : 0674-2413097, 2414117, 2418299  
F : 0674-2413306/2419781  
E : [info@orierc.org](mailto:info@orierc.org)  
W : [www.orierc.org](http://www.orierc.org)

## **RAJASTHAN**

### **Rajasthan Electricity Regulatory Commission**

Vidhyut Viniyamak Bhawan,  
Sahakar Marg, Near State Motor Garage  
Jaipur

T : 0141-2741181, 2741016

F : 0141-2741018

E : rercjpr@yahoo.co.in

W : www.erc.gov.in

## **TAMIL NADU**

### **Tamil Nadu Electricity Regulatory Commission**

No.19A, Rukmani Lakshmipathi Salai,  
Egmore, Chennai – 600 008

T : 044-28411376, 28411378

F : 044-28411377

E : tnerc@nic.in

W : www.tnerc.tn.nic.in

## **WEST BENGAL**

### **West Bengal Electricity Regulatory Commission**

Poura Bhawan (3rd Floor),  
Block-FD, 415-A, Sector-III  
Bidhannagar,  
Kolkata – 700 106

T : 033-23592189, 23593397

F : 033-23593397

E : wberc@cal3.vsnl.net.in

W : www.wberc.net

*(Source : Web Sites)*

## State Nodal Agencies

### ANDHRA PRADESH

#### New and Renewable Energy Development Corpn. of Andhra Pradesh (NRDCAP)

5-8-207/2, Pisingah Complex,

Nampally,

Hyderabad-500001

T : 040-23202391 / 3692 / 3376

F : 040-23201666

E : nedcap@ap.nic.in

W : www.nedcap.gob.in

Cont : Mr. Chandan Mitra , Vice Chairman & M.D.

### Windfarm Site Office

NRDCAP Ltd.

Near Clock Tower,

1st Floor, Agro Bhawan,

Anantapur-515 001

T : 08554-241060

Cont : Mr. M.K. Murthy, EE (RENDG)

### GUJARAT

#### Gujarat Energy Development Agency (GEDA)

Block No.11&12, 4<sup>th</sup> Floor, Sector-II,

Udyog Bhawan,

Gandhi Nagar-382 017

T : 079-23257251-54

F : 079-23247097

E : info@geda.org.in, W: www.geda.org.in

Cont : Mr. Ishwarbhai M. Bhavsar, Chairman

Mr. V.H. Buch, Director

### Windfarm Project Office

'White Villa',

5, Bhojeshwar Plot

Porbandar – 360575 (Gujarat)

T : 0286-2242544,

F : 0286-2241663



## **KARNATAKA**

### **Karnataka Renewable Energy Development Ltd.**

(KREDL)

No.-39, "Shanthigruha"

Bharat Scots & Guides Building, Place Road, Bangalore – 560 001

T : 080-22282221, 22207851,

F : 080-22257399

E : kredlnc@yahoo.co.in

W : www.kredl.kar.nic.in

Cont : Mr. P. Manivanna, MD

Mr. N.K. Payannavar, DGM

## **KERALA**

### **Agency for Non-conventional Energy and Rural Technology (ANERT)**

Thycaud,

Thiruvananthapuram-695014, Kerala

T : 0471-2330124, 2330122

F : 0471-2339853, 2338077

E : anert@vsnl.com

W : www.anert.gov.in

## **MADHYA PRADESH**

### **Madhya Pradesh Urja Vikas Nigam Ltd. (MPUVN)**

Urja Bhawan, Link Road No.2.

Shivaji Nagar, Bhopal - 462 016

T : 0755-2556566

F : 0755-2553584

E : cmpuvn@bsnl.in

W : www.mprenewable.nic.in

Cont : Mr. Neeraj Mandloi, M.D.

mdurjanigam@rediffmail.com

## **MAHARASHTRA**

### **Maharashtra Energy Development Agency (MEDA)**

MHADA Commercial Complex, 2<sup>nd</sup> Floor

S.No.191-A, Phase-I, Opp. Tridal Nagar,

Yerawada, Pune - 411006

T : 020-26614393, 26614403

F : 020-26615031

E : meda@vsnl.com, dg@mahaurja.com

W : www.mahaurja.com

Cont : Mr. Anand Limaye, IAS, D.G.

Mr. M. A. Pise, Manager (P.G.I)

**Division office**

Chinar Plaza, Old RTO Road  
Satara – 415 001  
T : 02162-236658,  
F : 02162-226526  
E : str\_medawind@sancharnet.in,

**ORISSA****Orissa Renewable Energy Development Agency (OREDA)**

S-3/59, Mancheshwar Industrial .Estate,  
Bhubaneswar – 751 010,  
T : 0674-2580258, 2580558  
F : 0674-2586368  
E : partha\_1969@hotmail.com  
W : www.oredaorissa.com  
Cont : Mr. Joginder Batra, Chief Executive

**RAJASTHAN****Rajasthan Renewable Energy Corpn. Ltd. (RRECL)**

E-166, Yudhishtir Marg, `C` Scheme,  
Jaipur – 302 005  
T : 0141-2225859, 2221650  
F : 0141-2226028  
E : rrec\_jai@yahoo.co.in  
W : www.rrecl.com  
Cont : Mr. Nareshpal Gangwar, MD  
Mr. M.M. Vijayvargia, Director Technical

**Windfarm Site Office**

Devgarh Near Pratapgarh,  
T : 01478-223131  
Phalodi/Village – Beethadi  
T : 02925-223612(PP)

**TAMIL NADU****Tamil Nadu Energy Dev. Agency (TEDA),**

EVK Sampath Maaligai, V-Floor,  
66/67, College Road,  
Chennai - 600006  
T : 044-28224830, 28212249  
F : 044-28222971  
E : teda@dataone.in,  
W : teda.gov.in  
Cont : Mr. R. Christodas Gandhi, IAS, Chairman & Managing Director

**Tamil Nadu Electricity Board (TNEB)**

5<sup>th</sup> Floor, (East) NPKRR Maaligai,  
144, Anna Salai,  
Chennai - 600002,  
T : 044-28520131 to 133 & 135  
F : 044-28521944  
E : cences@tnebnet.org  
W : www.tneb.org  
Cont : Mr. Amolarpanthan, Chief Engineer (NCES)

**Other Offices - Wind Energy**

Superintending Engineer  
Wind Energy Development Cell (WEDC),  
TNEB, Maharaja Nagar, Tirunelveli-11  
T : 0462-2530622,  
F : 042-2534101

Executive Engineer  
Windfam Project,  
Tirunelveli Distribution Circle  
T : 0462-2531982

Executive Engineer  
Windfam Project,  
Udumalpet Distribution Circle, TNEB,  
Tirupur Main Road  
Udumalpet-642126,  
T : 04252-224152

**WEST BENGAL****West Bengal Renewable Energy Development Agency (WBREDA),**

Bikalpa Shakti Bhawan,  
Plot No.J-1/10, EP&GP Block,  
Salt Lake Electronics Complex,  
Sector-V, Kolkata – 700091,  
T : 033-23575038, 23575348  
F : 033-23575037, 23575347  
E : wbreda@cal.vsnl.net.in  
W : www.wbreda.org  
Cont : Mr. S.P. Gon Chaudhuri, Director

*(Source : State Nodal Agencies)*

**WEG Manufacturers**

**M/s. Chiranjeevi Wind Energy Limited,**

26-A, Kamaraj Road,  
Mahalingapuram  
Pollachi-642 002  
Coimbatore - District  
P : 04259- 224438  
F : 04259-224437

**M/s. Enercon (India) Ltd.**

“Enercon Tower”  
A-9, Veera Industrial Estate  
Veera Desai Road  
Andheri (West)  
Mumbai - 400 053  
P : 022-66924848  
F : 022- 67040473

**M/s. Gamesa Wind Turbines Private Limited**

No.489, G.N.T Road,  
Thandal Kazhani village,  
Vadagarai (Post), Red Hills,  
Chennai– 600 052  
P : 044-30989898

**M/s. Garuda Vaayu Shakthi Ltd.**

New No.56, Old No.44  
Thirumalai Pillai Road,  
T. Nagar,  
Chennai-600 017  
T : 044-28345377  
F : 044-28345376

**M/s. GE India Industrial Private Limited**

A-1, 2nd Floor,  
Golden Endave,  
Corporate Towers Old Airport Road,  
Bangalore – 560 017  
P : 080- 40183802  
F : 080 – 25203860

**M/s. Global Wind Power Limited**

301, Satellite Silver,  
3 rd Floor,  
Andheri Kurla Road,  
Marol, Andheri (East)  
Mumbai- 400 059  
P : 022-39918500  
F : 022- 39918521

**Ms. Inox Wind Limited,**

Inox Towers  
Plot No.17, Sector 16 A,  
Noida, Uttar Pradesh- 201 301  
P : 0120 – 3063708  
F : 0120- 3063610

**M/s. Kenersys India Private Limited**

Industry House,  
Survey No.49, Mundhwa,  
Pune- 411 036  
P : 020- 30462851  
F : 020 – 30462888

**M/s. Leitner Shriram Manufacturing Ltd**

No.5, T.V.Street  
Off. Spurtank Road, Chetpet,  
Chennai – 600 031  
P : 044-27926000  
F : 044-27924944

**M/s. Pioneer Wincon Private Ltd.**

30/1A, Harrington Chambers,  
2nd Floor, “B” Block,  
Abdul Razaq 1st Street,  
Saidapet,  
Chennai- 600 015  
P : 044- 24314790  
F : 044- 24314789

**M/s. Regen Powertech Pvt. Ltd**

No.28/11, College Road,  
Chennai- 600 006  
P : 044 – 30280200  
F : 044 – 30280199

**M/s. RRB Energy Limited**

No.17 , Vembuliamman Koil Street,  
K.K. Nagar (West), Chennai- 600 078  
P : 044-23641111  
F : 044-23642222

**M/s. Shriram EPC Limited**

No.9, Vanagaram Road,  
Ayanambakkam, Chennai – 600095  
P : 044-26533313  
F : 044-26532780

**M/s. Siva Windturbine India Private Limited**

12A, Kandampalayam, Perundurai,  
Erode- (DIS) Pin : 638052  
P : 04294 – 220017  
F : 04294 – 220137

**M/s. Southern Wind Farms Limited**

No.15, Soundarapandian  
Salai, Ashok nagar,  
Chennai – 600 083  
P : 044 – 39182600  
F : 044 – 39182636

**M/s. Suzlon Energy Ltd.**

Tree Lounge, Level 0  
One Earth,  
Opp. Magarpatta City,  
Hadapsar,  
Pune – 411028  
P : 020- 40122000  
F : 020- 40122200

**M/s. Vestas Wind Technology India Private Limited**

298, Old Mahabalipuram Road, Sholinganallur,  
Chennai- 600 119  
P : 044- 24505100  
F : 044- 24505101

**M/s. Winwind Power Energy Private Limited**

STERLING TOWER  
327, Anna Salai Teynampet,  
Chennai – 600 006  
P : 044 – 24313001  
F : 044 – 24313066

(Source : WEG Manufacturers)

## Service Providers

### ➤ Windfarm Developers

M.P. Windfarms Limited  
Theolia Wind Power Pvt. Ltd.

### ➤ Operation & Maintenance Agencies

Batlilboi enXco Pvt. Ltd.  
Divine Wind Technik  
Golden Non Conventional Energy Systems Pvt.Ltd. (Splst of Bonus WEGs)  
Henel Engineers Pvt. Ltd  
Hitech Wind Solutions  
India WindPower Ltd.  
Kalani Industries Limited  
Kintech Synergy (P) Ltd  
M.P.Windfarms Limited  
Powerzen Technologies  
Rajee Wind Energy Services  
RPP Windtech Services  
R.S.Windtech Engineers (P) Ltd.  
SANA Engineering Company  
Sastha Engineers & Consultants  
Simms Wind Power Services  
Sri Ganesh Windpower Engineers Pvt. Ltd.  
Star Energy Systems  
Subhash Projects & Marketing Ltd.  
Suzlon Windfam Services Pvt. Ltd.  
Utility Powertech Ltd.  
Vasanth Energy Consultants  
Victory Windfarm Services Pvt. Ltd.  
Wescare (India) Ltd.  
WINCO (Wind Mill Division)  
Windcare India Pvt. Ltd.  
Windengineering India  
Greenweiz Projects Ltd.

➤ **WEG Erection Contractors**

Continental Transport Organisation Pvt. Ltd.  
Divine Wind Technik  
India Wind Power Ltd.  
Kintech Synergy (P) Ltd  
Mesuka Engineering Company P. Ltd.  
Rameez Engineering Construction Corporation  
Royal Engineering Works  
RPP Windtech Services  
R.S.Windtech Engineers (P) Ltd.  
SANA Engineering Company  
Sastha Engineers & Consultants  
Sri Ganesh Windpower Engrs .Pvt. Ltd.  
Victory Windfarm Services Pvt. Ltd.  
Vitaa Zeus Energy Pvt. Ltd.  
Weltech Engineers  
Windcare India Pvt. Ltd.  
Windengineering India

➤ **Crane Hiring Agencies**

Aban Energies Ltd.  
ABG Heavy Industries Ltd.  
Crane Hiring Co.  
Divine Wind Technik  
Essar Investments Ltd.  
Express Crane Services  
Express Transport Pvt. Ltd.  
Gopalji and Bros  
Hasan Brothers  
Kumar Crane & Transport Pvt. Ltd.  
Laxmichand Dharshi  
Malik Crane Service  
Mesuka Engineering Company P. Ltd.  
Modern Hiring Co.  
Navin Heavy Lifters  
Pankaj Transport Pvt. Ltd.  
Parson Equipments  
Penosh Transport Pvt. Ltd.  
PSTS Heavy Equipments Ltd.  
R.S.Windtech Engineers (P) Ltd.  
Reshamsingh & Co. Pvt. Ltd.  
Revia Cranes & Hoists



S. Crane Engineering Works  
Safex Engineers  
Saico Engineers & Fabricators  
Sanghvi Movers Ltd.  
Sri Ganesh Windpower Engrs.Pvt. Ltd.  
Technocraft Cranes Pvt. Ltd.  
Tulsa crane  
Tungabhadra Steel Products  
Visco Handlings  
Voltas Ltd.  
Wescare (India) Ltd  
Windcare India Pvt. Ltd.

➤ **Civil Contractors**

A.G. Immanuel Construction  
Bardai Pvt.Ltd  
Dear Constructions (Engineers & Contractors)  
D. H. Pawar  
Divine Wind Technik  
Kamla Electricals & Engineering Co.  
Kintech Synergy (P) Ltd  
Krishna Pillai & Co.  
Lars Enviro Pvt. Ltd.  
Mesuka Engineering Company Pvt. Ltd.  
Namada Infrastructure (P) Ltd.  
N.D. Shetty  
Nashtel Optronics  
Petron Civil Engg. Ltd.  
PGP Engineers & Consultants  
Ponkumari Wind Fam  
S.Ponnaiyan Associates  
Ramawat Construction Company  
SANA Engineering Company  
Sastha Engineers & Consultants  
Sharvari Construction  
Sri Ganesh Windpower Engrs.Pvt. Ltd.  
Sri Satya Sai Constructions  
T.R.Trehan Constructions Pvt. Ltd.  
Victory Windfarm Services Pvt. Ltd.  
Windcare India Pvt. Ltd.  
Windfab  
Yeses Infrastructure Pvt. Ltd

➤ **Civil Engineering Surveyors**

Geo Test House  
Goodland Surveys  
Hindustan Topomappers  
Primentor Consultancy & Services P. Ltd  
Top View Consultants  
Transwat

➤ **Electrical Contractors**

ABLETECH Electro Engineers Pvt. Ltd.  
Aditya Engineers  
Akash Switchgears  
Bharat Electrical Contractor & Manufacturers  
Deepak Panchaity & Co.  
Divine Wind Technik  
En-En Electrical Engineers  
Everest Electricals & Engg. Services  
Kintech Synergy (P) Ltd  
Mega Electricals (P) Ltd.  
Mega Power Transmission Pvt. Ltd  
Mehta Electric Corporation  
M.M. Engineers  
Natraj Filters  
PGP Engineers & Consultants  
P.R.V. Constructions  
Paragon Erectors Pvt. Ltd.  
Power Best Electricals Pvt. Ltd.  
R.S.Windtech Engineers (P) Ltd.  
SANA Engineering Company  
Sastha Engineers & Consultants  
S.G. Associates  
Shanthy Electricals  
Simms Engineering  
Space Age Associates  
Spectrum Electrical Engineers  
Sri Ganesh Windpower Engrs. Pvt. Ltd.  
Victory Windfarm Services Pvt. Ltd.  
Windcare India Pvt. Ltd.  
Windfab

➤ **Components Repairers (other than OEMs)**

**Blade**

Divine Wind Technik  
Gandhi & Associates  
Hitech Wind Solutions  
Mikel Polymers  
Motwane Manufacturing Co. P.Ltd.  
Nu-Tech Industrial Spares & Services (P) Ltd  
Parag Fans  
Sastha Engineers & Consultants  
Satyam Industries  
TTL Technology Pvt. Ltd  
Windcare India Pvt. Ltd.  
Weltech Engineers  
Windengineering India

**Electronic Cards, Anemometer and Windvane**

Aravindar Electronix  
Cotton City Electronics  
Divine Wind Technik  
Gold Stone Tele services Ltd.  
Lac System Pvt. Ltd.  
Nruthya Ganpathi Engineers  
R.S.Windtech Engineers (P) Ltd.  
Sastha Engineers & Consultants  
Sri Amman Services  
Victory Windfarm Services Pvt. Ltd.  
Weltech Engineers  
Windcare India Pvt. Ltd.  
Winn Tek Power Systems Pvt. Ltd.

**Gear Box**

Batliboi enXco Pvt. Ltd.  
Divine Wind Technik  
Fluidmech Equipment  
Greaves Limited  
Hitech Wind Solutions  
Nu-Tech Industrial Spares & Services (P) Ltd  
P.V. Gear Designer  
R.S.Windtech Engineers (P) Ltd.

Sakthi Drives  
Sastha Engineers & Consultants  
Shanthi Gears Ltd.  
Windcare India Pvt. Ltd.  
Windengineering India

### **Generator**

ABB Limited  
Appllo Electrical Services  
Avant-Garde Engineers & Consultants (P) Ltd  
Coral Rewinding Industries  
Divine Wind Technik  
Everest Electricals & Engg. Services  
Hitech Components  
Hitech Wind Solutions  
Indian Heavy Electricals  
Paramount Conductors Ltd.  
Premier Electrical Services  
Ramakrishna Electrical Winding Works  
Re-union Engg. Co. Ltd.  
R.S.Windtech Engineers (P) Ltd.  
Sankaranarayana Electricals  
Sri Sanari Electrical & Engg. Works  
Universal Electric Engg. Works  
Venus Engineering Services  
Victory Windfarm Services Pvt. Ltd.  
Windcare India Pvt. Ltd.

### **Refurnishing of whole WEG**

Batliboi enXco Pvt. Ltd.  
R.S.Windtech Engineers (P) Ltd.  
Sastha Engineers & Consultants  
Sri Ganesh Windpower Engrs. Pvt.Ltd.  
Windcare India Pvt. Ltd.  
Windengineering India

### **Yaw System**

Batliboi enXco Pvt. Ltd.  
R.S.Windtech Engineers (P) Ltd.  
Sastha Engineers & Consultants  
Windcare India Pvt. Ltd.  
Windengineering India

## ➤ Insurance Companies, Valuers / Surveyors

### **Insurance Companies**

Bajaj Allianz General Insurance Co. Ltd  
ICICI Lombard General Insurance Co. Ltd  
IFFCO Tokio General Insurance Co. Ltd  
National Insurance Company Ltd.  
Oriental Insurance Company Ltd.  
The New India Assurance Company Ltd.  
Reliance General Insurance Co. Ltd  
Royal Sundaram Alliance Insurance Co. Ltd  
TATA AIG General Insurance Co. Ltd.  
United India Insurance Company Ltd.

### **Valuers / Surveyors**

Adarsh Associates  
Anmol Sekhri & Associates  
Armour Consultants Pvt. Ltd.  
Bhatawadakar & Co.  
Bhaskar G. Bhatt  
Bhatt & Associates  
D. Shrinivas  
Elcimech Engineers & Enterprises  
J.B. Boda & Co. Pvt. Ltd.  
R.B.Davar  
R.K.Patel & Co.  
S I B & Associates  
S.R. Chire & Co.  
S. Sundararaman & Associates  
Thomas Jacob & Co.  
Unison Risk Services (P) Ltd.

## ➤ Consultants

### **Wind Energy Consultants**

3TIER India Private Limited  
Centre for Wind Energy Technology (C-WET)  
Consolidated Energy Consultants Ltd.  
Det Norske Veritas AS (DNV)  
Garrad Hassan India Pvt. Ltd.  
Industrial & Technical Consultancy Organisation of Tamil Nadu Ltd. (ITCOT)

National Aerospace Laboratories (NAL)  
Tata Consultancy Services  
The Energy Resource Institute (TERI)  
Hitech Wind Solutions  
MITCON Consultancy Services Ltd  
Power & Energy Consultants  
Resurge Energy Pvt. Ltd.  
Septett Advisory Services Pvt. Ltd.  
Shah Energy Inc.  
Sri Ganesh Windpower Engrs. Pvt. Ltd.  
Victory Windfarm Services Pvt. Ltd.

### **Agricultural Consultants for Windfarm Projects**

Consolidated Energy Consultants Ltd  
Innovative Agro - Tech  
Jain Irrigation Systems Ltd.  
Thungam Agricultural Consultants  
CDM/Carbon Trading Consultants  
Emergent Ventures India Pvt. Ltd.  
Enking International  
General Carbon Advisory Services P.Ltd  
Zenith Energy Services (P) Limited

### **Condition Monitoring Consultants**

Bently Nevada India Sales & Service Pvt. Ltd.  
Dantech Engineers Pvt. Ltd.  
Predictive Maintenance and Designs (P) Ltd

### **Electricity Regulatory Measures**

Consolidated Energy Consultants Ltd

### **Land Brokers**

Krishna Pillai & Co.  
Shri Maruti Wind Park Developers  
S. Rajendran  
Sri Saanthini Enterprises  
Redefine Energy Pvt. Ltd.

## **Power Quality Study Consultants**

Balaji Engineers

Electrical Research & Development Association (ERDA)

### **➤ Certifying Agencies**

Centre for Wind Energy Technology (C-WET)

Det Norske Veritas AS (DNV)

Germanischer Lloyd (GL)

### **➤ Training Providers**

Centre for Wind Energy Technology (C-WET)

Consolidated Energy Consultants Ltd.

Crompton Greaves Ltd.

Indian Wind Power Association (WINDPRO)

National Power Training Institute (NPTI)

World Institute of Sustainable Energy (WISE)

### **➤ Sellers/Purchasers of old WEGs**

Sastha Engineers & Consultants

Windcare India Pvt. Ltd.

Sri Ganesh Windpower Engrs. Pvt. Ltd.

*(Source : Directory Indian Windpower 2011)*

**Financial Institution & Banks**

**ICICI Bank Limited**

ICICI Bank Tower,  
5th Floor (West Way)  
ICICI Bank Building,  
Bandra-Kurla Complex,  
Bandra (East),  
Mumbai-400051  
T : 022-26536635,  
F : 022-26531369

**Indian Renewable Energy Development Agency Limited (IREDA)**

Corporate Office :  
3<sup>rd</sup> Floor, August Kranti Bhawan,  
Bhikaiji Cama Place,  
New Delhi – 110 066  
T : 011-26717400-26717413  
F : 011-26717416  
E : cmd@ireda.in  
W: www.iredaltd.com

**Indian Renewable Energy Development Agency Limited**

Core-4A, East Court, 1st Floor  
India Habitat Centre Complex,  
Lodhi Road, New Delhi - 110 003  
T : 011 – 24682214-21  
F : 011 – 24682202  
E : mdireda@rediffmail.com  
W : www.iredaltd.com

**Industrial Credit & Investment Corp. of India Ltd.**

ICICI Building ,  
163, Backbay Reclamation,  
Churchgate,  
Mumbai - 400 020  
T : 022-2022535, 22022594  
F : 022-22846025



**Industrial Development Bank of India**

Venture Capital Department  
IDBI Tower, WTC Complex, Cuffe Parade,  
Mumbai - 400 005  
T : 022-22189111,66553355  
F : 022-22181294, 22185179  
W : www.idbi.com

**Industrial Finance Corporation of India**

IFCI Tower, 61, Nehru Place,  
New Delhi – 110 019  
T : 011-41792800, 41732000  
F : 011- 26488471, 26230201  
E : helpdesk@ifcilt.com  
W : www.ifcilt.com

**Infrastructure Development Finance Company Ltd**

KRM Tower, 8th Floor,  
No.-1, Harington Road, Chetpet,  
Chennai-600 031  
T : 044-45644000  
F : 044-28547597  
E : mail@idfc.com  
W: www.idfc.com

**Power Finance Corporation**

“Urjanidhi”,  
1, Barakhamba Lane, Connaught Place,  
New Delhi - 110 001  
T : 011- 23456000  
F : 011- 23412545  
W : www.pfcindia.com

**Project Finance SBI**

State Bank of India,  
Voltas House, 1st Floor,  
23, J.N. Heredia Marg, Ballard Estate,  
Mumbai - 400001  
T : 022-22633369  
F : 022-22686911  
E : srinivasa.j@sbi.co.in  
W : www.sbi.co.in

**Rabo India Finance**

Forbes Building, IInd Floor,  
Charanjit Rai Marg, Fort,  
Mumbai – 400 001  
T : 022-22034567  
F : 022-22035544  
W : [www.rabobank.com](http://www.rabobank.com)  
Cont : Mr. Ashutosh Mahesvari, Director

**Rural Electrification Corporation**

Core-4, Scope Complex,  
7, Lodhi Road,  
New Delhi - 110 003  
T : 011-24365161  
F : 011-24360644  
E : [reccorp@recl.nic.in](mailto:reccorp@recl.nic.in),  
W : [www.recindia.nic.in](http://www.recindia.nic.in)

**SBI Capital Markets Limited**

202, Maker Tower, “E”  
Cuffe Parade,  
Mumbai-400005  
T : 022-22718437/904495534  
F : 022-22180198  
E : [yashpal.singh@sbicaps.com](mailto:yashpal.singh@sbicaps.com)  
W : [www.sbicaps.com](http://www.sbicaps.com)

**Small Industries Development Bank of India**

SME Development Centre,  
Plot No. C-11, ‘G’ Block,  
Bandra-Kurla Complex, Bandra (east),  
Mumbai - 400 051  
T : 022-67531202  
F : 022-67531354  
W : [www.sidbi.com](http://www.sidbi.com)  
Cont : Mr. S.V.G. Nandagopal

*(Source : Directory Indian Windpower 2011, Financial Institutions and Banks)*

### Questionnaire for State Nodal Agency (SNA)

- 1) Has there been any change in your State Policy?
- 2) Have you provided any clear guideline for Application and obtaining permission?
- 3) In how many days – the permission is issued?
- 4) Have you fixed any target for capacity addition?
- 5) Where are the likely growth areas?
- 6) What are the constraints and remedies regarding :

#### Constraints

#### Remedy

- a) Land :

Private  
Revenue  
Forest

- b) Grid Evacuation

- 7) Are you identifying new sites/locations:

#### No. of Masts

- a) Your Own
- b) Private
- c) C-WET

- 8) What is your opinion on :

- a) R.P.O.
- b) R.E.C.
- c) Forecasting

- 9) Is there any possibility of Tariff-re vision
- 10) How is the payment schedule/ record DISCOM
- 11) What are the factors – restricting growth – Land/ Grid/Supplier/Administrative
- 12) Do you have plans to acquire land and allot?
- 13) What kind of support/incentives are needed to accelerate growth?
- 14) Are you preparing any Master Plan for future Growth and Grid Evacuation?

### Questionnaire for Manufacturers

- 1) What is your plan/target for installation in near future : State wise and year-wise

**TABLE - A**

State	2011-12		2012-13		2013-14	
	MW	CUF	MW	CUF	MW	CUF

- 2) What are the constraints faced and remedies suggested : (State-wise)

**Constraints**

**Remedy**

- a) Land :  
     Private  
     Revenue  
     Forest
- b) Grid Evacuation  
 c) Administrative

- 3) What initiatives are you taking to identify/acquire new sites?

- 4) What is your state-wise preference?

- 5) What initiatives are you taking in terms of :

- a) Increasing CUF  
 b) Cost Reduction  
 c) Forecasting

- 6) What is your expectations on

- a) Incentive  
 b) Support/Policy

- 7) What is the percentage break up of cost of Installations : Equipment /Civil Electrical Works/Grid/Land/Erection & Commissioning (Table-B)

**TABLE-B**

S.No.	Description	% of cost
a)	Complete WEG	
b)	Transportation	
c)	Civil Foundation	
d)	Unit Substation for WEG	
e)	Grid Evacuation (Line +Substation)	
f)	Approach Road	
g)	Internal Road	
h)	Internal Electrical Distribution	
i)	Land	
j)	Erection & Commissioning	
k)	Permission/Sanction	
	Total	100%

- 8) Do you have plan for export?

- 9) Your opinion on :

- a) R.P.O.
- b) R.E.C.
- c) Forecasting

**Questionnaire for Investors (IPP)**

1) What is your installed capacity :

Existing                                      In pipe-line                                      Future  
State – MW                                      State – MW                                      State-MW-Year

2) What is your objective: IPP/CDM benefit

3) What is your preferred option for sale of electricity:

- Discom
- Third Party
- ERC

4) What has been your experience: (Good √ ) (Bad – X )

a)

State	Attitude	Land			Grid Evacuation	Permission/ Sanction	Pay ment
		Private	Revenue	Forest			

b) Your State of Preference –

c) Your suggestions or remedies

5) What has been your experience on supply : (Good √ ) (Bad – X )

a)

Manufacturer	Cost	Timely performance	Commercial Dealing	Attitude

b) Your preferred Supplier –

c) Your suggestions on supply –

6) What has been your experience on Funding : (Good ✓) (Bad – X)

a)

Bank/Institution	D/E Ratio	Interest Rate	Repayment Period	Collateral Security	Attitude

b) Your preferred Funding Agency -

c) Your suggestions on funding -

7) Your opinion on Incentives

a)

Item	Opinion on existing system	Suggestions for improvement
GBI		
ERC		
CDM		

b) Your views/efforts on Forecasting

c) Your expectation :

- Project IRR :
- Equity IRR :

9) Your views on availability/benefit on Private Equity Fund

10) Your preferred options of funding in through :

- Indian Bank/Institution
- Foreign Bank/Institution
- P.E. Funds

11) What is biggest hurdle/barrier?

12) What you feel is most needed to accelerate growth?

**Questionnaire for Bank/Financial Institution**

- 1) What are your security requirements (co-lateral) to provide Term Loan/ Hypothecation limit for Wind Power Project?
  
- 2) What are your usual terms of Lending :
  - Debt equity
  - DSCR
  - Interest Rate
  - Loan Repayment period
  - Project IRR
  
- 3) Your views on risk factors

**Perception**

**Mitigation adopted/  
proposed**

Energy Generation

Timely Payment .

Due-Diligence

- 4) The terms of lending and security what you would expect from Foreign Investors:
  
- 5) Have any special cell and target for funding Wind Power Projects.



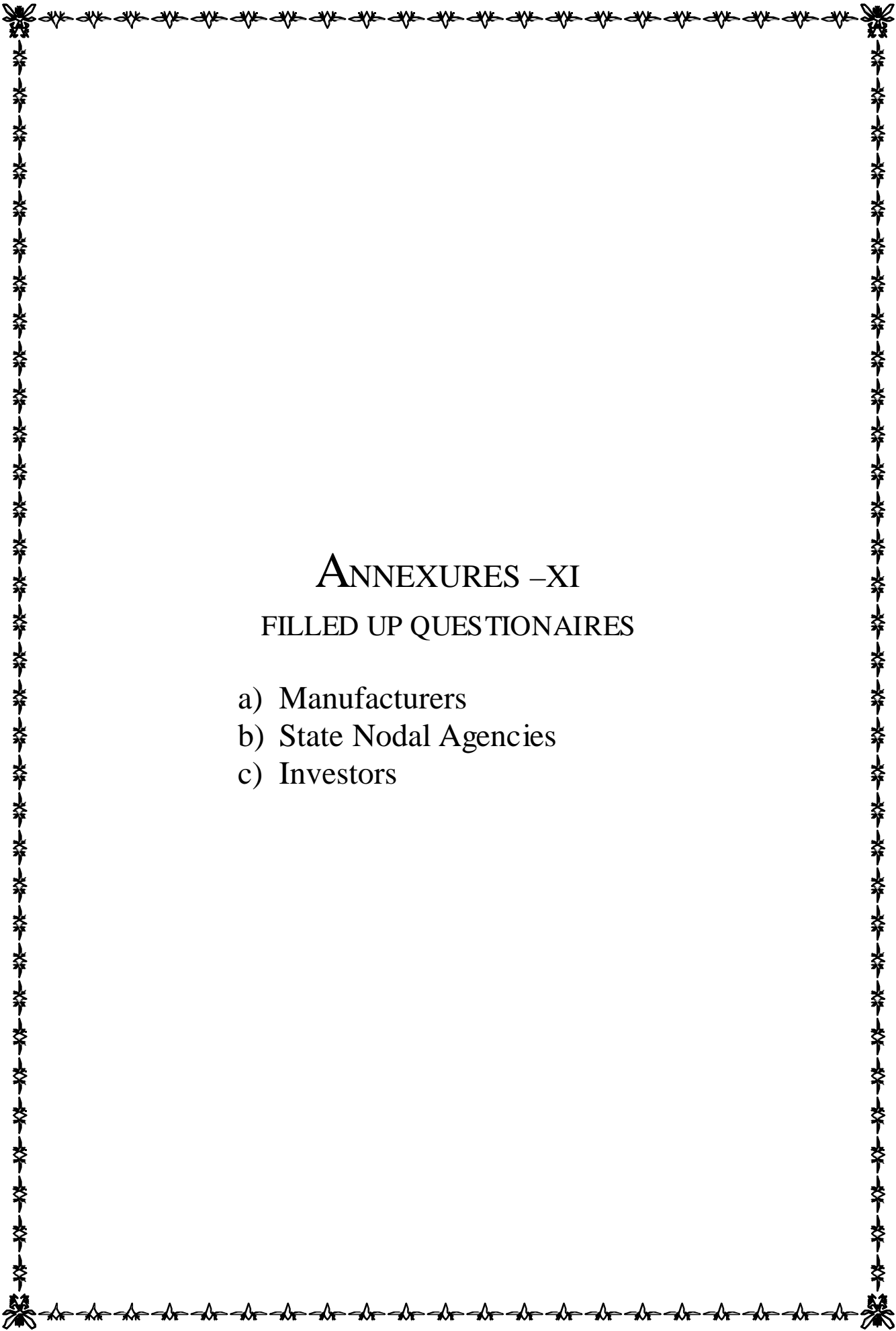
## ANNEXURE-X

**PERSONS INTERVIEWED**

Sl. No.	Organization	Person Met	Contact No.	Date
1	M/s Gamesa Wind Turbines Pvt. Ltd., No. 489, GNT Road, Thandal Kazhani, Vadagarai Post, Red Hills, Chennai – 600 052	Mr. Ramesh Kymal, Chairman & Managing Director,	098407-30510	08/12/2010
2	M/s Regen PowerTech Pvt Ltd., 28/11, College Road, Chennai.	Mr. Madhusudan Khemka, CEO & President	09952011777	08/12/2010
3	M/s Rattha Holding Company Pvt. Ltd., No. 37, TTK Road, Alwarpet, Chennai – 600 018	Mr. H.S. Rattha, Chairman	09791177771	09/12/2010
4	M/s Suzion Energy Ltd., Raheja Towers, Delta Wing, 1 <sup>st</sup> Floor, No. 177, Anna Salai, Chennai – 600 002	Dr. V. Bapeshwar Rao, Vice President – Business Development	099406-63687 098410-27795	09/12/2010
5	M/s Pioneer Wincon Pvt Ltd., 30/1A, Harrington Chambers, 2 <sup>nd</sup> Floor, “A&B” Block, Abdul Razaq, 1st Floor, Saidapet, Chennai-600 015	Mr. D.V. Giri, President & CEO	09444392245 09840063289	10/12/2010
6	M/s Leitner Shriram Mfg. Limited, No. 9, Vanagaram Road, Ayanambakkam, Chennai-600 095	Mr. V.K. Krishnan, Executive Director	099625-51947	10/12/2010
7	M/s Enercon (India) Ltd., Enercon Tower, A-9 Veera Industrial Estate, Veera Desai Road, Andheri (West) Mumbai – 400 053	Mr. D.G. Kamath, Vice President – Sales & Marketing,	09004022049	18/01/2011
8	SBI Capital Markets Limited, 202, Maker Tower ‘E’, Cuffe Parade, Mumbai – 400 005	Mr. Shray Shikhar, Manager – Project Advisory & Structured Finance	090044-95545	19/01/2011
9	M/s IDBI Bank Limited, 5 <sup>th</sup> Floor, IDBI Bank Tower, World Trade Centre Complex, Cuffe Parade, Colaba, Mumbai – 400 005	Mr. Ravi Kumar, General Manager	09892003248	19/01/2011
10	M/s ICICI Bank Limited, ICICI Bank Tower, North Tower, 5 <sup>th</sup> Floor (West Way), ICICI Bank Building, Bandra-Kurla Complex, Bandra (East), Mumbai – 400 051	Mr. Manish Wadhia, Dy. General Manager	09004419418	19/01/2011
11	M/s State Bank of India, Project Finance SBU, Voltas House, 1 <sup>st</sup> Floor,	Mr. S. Ramesh, Asst. General Manager	09619483790	20/01/2011

Sl. No.	Organization	Person Met	Contact No.	Date
	23, J.N. Heredia Marg, Ballard Estate, Fort, Mumbai – 400 001			
12	Karnataka Renewable Energy Development Limited (KREDL), #19, Maj. Gen. Logandan INA Cross, Queen's Road, Bangalore-560 052	Mr. Nagappa K. Payannavar, Dy. General Manager	09448053549	21/01/2011
13	M/s Enercon Wind Farms (India) Ltd., No.10, Casa Birgitta, 3 <sup>rd</sup> Floor, Brunton Road (Off. M.G. Road), Bangalore – 560 025	Mr. U.B. Reddy, Vice President	09620899999	21/01/2011
14	M/s Skyzen Infrabuild Pvt. Ltd. , D - 301, Kailas Complex, Park Site, Veer Savarkar Marg, Vikhroli West Mumbai - 400 079	Mr. Arvind Bansal, Director	09920101305	22/01/2011
15	Gujarat Energy Development Agency (GEDA), Block No. 11&12, 4 <sup>th</sup> Floor, Sector-11, Udyog Bhawan, Gandhi Nagar	Mr. S.B. Patil, Dy. Director	09909900652	28/01/2011
16	Central Electricity Regulatory Commission, 3 <sup>rd</sup> Floor, Chandralok, 36, Janpath, New Delhi	Dr. Pradmod Deo	011-23753911 (Office)	15/02/2011
17	M/s Green Infra Limited, NBCC Plaza, Tower II, 2 <sup>nd</sup> Floor, Puhsp Vihar, Sector-V, Saket, New Delhi.	Mr. Sunil Jain, Chief Operating Officer	09810518308	15/02/2011
18	M/s RRB Energy Limited, GA-1/B-1, Extension, Mohan Co-operative Industrial Estate, Mathura Road, <u>New Delhi</u>	Mr. Sarvesh Kumar, Dy. Managing Director (DMD)	09810091100	15/02/2011
19	M/s Indian Energy, 528, Laxmi Mall, Building No. 5, Laxmi Industrial Estate, Link Road, Andhrei West, Mumbai.	Mr. Ashish Tiwari, Vice President	09833750676	16/02/2011
20	M/s MCap Fund Advisors, 1A, Ground Floor, Building 10B, DLF Cyber City, Gurgaon, Haryana-122 002	Mr. Subbu Subramaniam. N., Managing Partner	0124-4816100	17/02/2011

Sl. No.	Organization	Person Met	Contact No.	Date
21	M/s Rajasthan Renewable Energy Corporation Limited, (Government of Rajasthan Undertaking), E-166, Yudhisthir Marg, C-Scheme, Jaipur.	Mr. M.M. Vijayvargiya, Director (Technical)	0141-2229341 09982044488	18/02/2011
22	M/s Maharashtra Energy Development Agency (MEDA). MHADA Commercial Complex, 2 <sup>nd</sup> Floor, S.No. 191-A, Phase-1, Opp. Tridal Nagar, Yerawada, Pune – 411 006	Mr. M.A. Pise, GM I/C & Manager PGI	09422319093	25/02/2011
23	M/s Kenersys India Private Ltd., (Kalyani Group Company) E.C.C. Training Center, 2 <sup>nd</sup> Floor, S No.15, Keshav Nagar, Mundhwa, Pune – 411036	Mr. C.P. Vishwanathan, Manager – Mktg.	09011004638	25/02/2011

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ANNEXURES –XI  
FILLED UP QUESTIONAIRES

- a) Manufacturers
- b) State Nodal Agencies
- c) Investors