Discussion Paper

DETERMINATION OF TARIFF FOR PROCUREMENT OF POWER BY DISTRIBUTION LICENSEES AND OTHERS FROM WIND POWER PROJECTS FOR THE STATE OF GUJARAT

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Gujarat Electricity Regulatory Commission

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Executive Summary

The Gujarat Electricity Regulatory Commission (GERC) has initiated the tariff determination process for determination of tariff for procurement of power by Distribution Licensees and others from wind power projects to be commissioned from 11 August 2012 under the powers conferred to the Commission by Sections 61 (h), 62 (1) (a), and 86 (1) (e) of The Electricity Act, 2003, and guidelines of the National Electricity Policy, 2005, and Tariff Policy, 2006. The Commission .had issued a generic tariff order for procurement of power by Distribution Licensees and others from wind power projects in Gujarat on 30 January 2010. The control period of the GERC Wind Tariff Order dated 30 January 2010 is up to 10 August 2012. Hence the Commission presents this discussion paper to initiate the regulatory process for determination of wind power procurement tariff for the next control period starting from 11 August 2012 and invite comments from stakeholders.

The state of Gujarat is blessed with excellent wind resources. As per the wind resource assessment study and Indian Wind Atlas published in April 2010 by the Centre for Wind Energy Technology (C-WET), GoI, the wind power potential of Gujarat is 35,071 MW at 80 m hub height. Whereas, the Lawrence and Berkeley National Laboratory (LBNL), under a study, "Reassessing Wind Potential Estimates for India: Economic and Policy Implications" published in March 2012 has assessed the wind power potential of Gujarat to be around 80 GW at 80 m height. The wind power density map developed by C-WET and the LBNL study reveal that most of the wind power potential area lies in 200-375 W/m^2 wind power density zone. The current installed wind power capacity of the state is around 2965 MW, in comparison to the availability of huge wind power potential. This indicates ample scope for future wind power development in the state.

The Commission, while evolving the benchmark operating and financial parameters for determination of generic wind power tariff for the next control period starting from 11 August 2012 has extensively studied the following aspects:

- In order to arrive at a benchmark capital cost for wind power projects to be commissioned in the next control period starting from August 2012, the Commission has examined the wind power capital cost trends in the national and international markets during the last control period, WTG components generally imported by the WTG manufacturers in India, currency exchange rate variation and the commodity price increases during the last control period. Along with this the Commission has also analysed the wind power capital cost data of the projects commissioned in Gujarat during the control period of the GERC Wind Tariff Order dated 30 January 2010 as well as the approach followed by the Central Electricity Regulatory Commission (CERC) while fixing benchmark wind power capital cost under RE tariff Order for FY 2012-13.
- The Commission notes that during the last control period (2009-2012), about 67% of the wind power projects (i.e. 880 MW out of 1332 MW) commissioned in the state, have used

MW-class WTGs. The Commission has also noticed that, over the period, with improvement in WTG technology, higher hub height, and larger rotor diameter, the Capacity Utilisation Factor (CUF) achieved by the commissioned wind power projects in the state has increased considerably.

- The Commission has noted that as per the wind resource assessment study conducted by C-WET and LBNL, most of the wind power potential areas in the state fall under 200-375 W/m^2 wind power density zone at 80m hub height. The Commission has further noted that the Central Electricity Regulatory Commission, under CERC RE Regulations 2012, has recommended a normative CUF in the range of 22%-30% for the 200-400 W/m^2 wind power density zone.
- The Commission has examined the actual CUF achieved by the wind power projects installed during FY 2009-10 and FY 2010-11 which have used MW-class WTGs in the state and noted that the CUF of the wind power plants commissioned during 2009-10 varies between 17.64% to 25.82% during 2010-11 and 2011-12; while the CUF of wind power plants commissioned during 2010-11 have achieved CUF between 15.29% to 31.62% during 2011-12.
- In the light of the above, and the fact that with advancement in WTG technology during the next control period (August 2012-March 2016), the CUF of future wind power projects will further increase. Therefore, the Commission is of the view that the normative CUF for the new control period needs to be set at an appropriate level.
- In case of financial parameters for tariff determination, the Commission observes that the SBI base rate has been constant at 10% since 13th August 2011. Therefore, it is proposed to fix the interest rate of term loan as the current SBI base rate plus 200 basis points. Further, based on the prevailing market practices, the tenure of term loan is proposed as 10 years. In case of the interest on the working capital, the interest on working capital is proposed as 50 basis points lower than that of interest on long-term loan. The control period of the new tariff order will commence from 11 August 2012, and it will be continued up to 31 March 2016.
- **Power evacuation System :** In case of power evacuation arrangement, the Commission envisages two options. Under Option 1, the Commission proposes to define the interconnection point at wind farm substation as specified in para 4.4 of Order No 1 of 2012 on 'Determination of tariff for Procurement by the Distribution Licensees and others from Solar Energy Projects'. Gujarat Electricity Transmission Corporation Ltd. (GETCO) will be made responsible for laying the transmission lines from the switchyard of generator to the GETCO substation. The cost for the same shall also be borne by GETCO. Under Option 2, the Commission proposes to continue the practice as followed under GERC Order No 2 of 2006, dated 11 August 2006, and Order No 1 of 2010 dated 30 January 2010, on 'Determination of Tariff for Procurement of Power by Distribution Licensees from Wind Energy Generators and other Commercial Issues'. The investors/developers will be allowed to construct the power

evacuation line from wind farm switchyard to GETCO substation. The Commission proposes to fix Rs. 41 lakh/MW towards constructing the evacuation line up to 100 km length and the same will considered in the project cost.

- Based on the above, the Commission proposes the following normative operating and financial parameters and levellized tariff for wind power projects to be commissioned during the next control period starting from 11 August 2012.

Table : Benchmark parameters for Tariff Computation

Parameters	As per Wind Tariff Order dated 30 January 2010	Proposal for new control period starting from 11th August 2012	
		Option I (Interconnection point at wind farm pooling S/S)	Option II (Interconnection point at GETCO S/S)
Project Cost			
Land + Plant & Machinery + Erection Cost (Rs. Lakh/MW)	462	568	568
Evacuation Infrastructure Cost (Rs. Lakh/MW)	38	0	41
Total Project cost (Rs. Lakh/MW)	500	568	609
Normative O&M cost for first year (Rs. Lakh/MW)	6.5	9	9
Escalation in O & M (per annum from 2nd year)	5%	5%	5%
Performance Parameters			
CUF	23%	24 %	24%
Project life in Years	25	25	25
Financial Parameters			
Debt-Equity ratio	70:30	70:30	70:30
Term of Loan in Years	10	10	10
Interest on Term Loan	10.75%	12%	12%
Interest on Working Capital	11.75%	11.5%	11.5%
Depreciation	6% (for first 10 years) 2% (from 11 to 25 years)	6% (for first 10 years) 2% (from 11 to 25 years)	6% (for first 10 years) 2% (from 11 to 25 years)
Minimum Alternate Tax for first 10 years	16.995%	20.008%	20.008%
Corporate Income Tax from 11th year onward	33.99%	32.445%	32.445%
Return on Equity	14%	14%	14%
Tariff	**Rs. 3.56 per kWh**	**Rs. 3.97 per kWh**	**Rs. 4.21 per kWh**

Other Commercial issues

Transmission and Wheeling Charges:

- Wind power projects wheeling power for own use/third party sale and opting for RECs, will have to pay normal open access charges and losses.
- Wind power projects not opting for REC benefits can avail transmission and wheeling charges/losses as per the GERC Order dated 30 January 2010.

Cross Subsidy Surcharge

- Exempted for captive use and for third party sale of wind energy.

Energy Metering

- Wind projects shall have to provide ABT compliant meters at the interface points and shall conform to the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006.
- Metering shall be done at interconnection point of the generator bus-bar with the transmission or distribution system concerned.

Pricing of Reactive Power

- 10 paise/kVARh– For the drawal of reactive energy at 10% or less of the net energy exported.
- 25 paise/kVARh– For the drawal of reactive energy at more than 10% of the net active energy exported

Sharing of Clean Development Mechanism (CDM) Benefits

- Sharing of CDM benefits on gross basis, starting from 100% to developers in the first year after commissioning, and thereafter reducing by 10% every year till the sharing becomes equal (50:50) between the developers and the consumers, in the sixth year and equal benefits thereafter.

Banking of Surplus Wind Energy

- One month banking allowed for captive wind energy projects. They are eligible to utilise the same during the month in proportion to the energy generated during peak and normal hour period.
- No banking facility offered to third party sale of wind energy.

Purchase of Surplus Power from Wind Power Projects opting for Captive use and Third Party Sale under Open Access.

- For captive wind energy projects, the surplus energy after one month's banking is considered for purchase by distribution licensee at 85% of the wind tariff.
- For third party wind energy sale, the surplus energy after 15 minutes time block is considered for purchase by distribution licensee at the rate of 85% of the tariff declared by the Commission.

Renewable Energy Certificates for Third party sale and Captive Use of Wind Energy

- Third party sale and captive use of wind energy will be eligible for availing Renewable Energy Certificates as per CERC REC Regulations.

Security Deposit

- As per the GERC Order No. 1 of 2010, dated 31.01.2010.
- In case of delay in project commissioning beyond the allowed period due to unforeseen reasons GETCO may issue extensions on case-to-case basis.

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Abbreviations

%	Percentage
ABT	Availability-Based Tariff
AC	Alternating Current
AD	Accelerated Depreciation
APPC	Average Power Purchase Cost
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emission Reductions
CERC	Central Electricity Regulatory Commission
CUF	Capacity Utilization Factor
C–WET	Centre for Wind Energy Technology
DC	Direct Current
EA	Electricity Act
FY	Financial Year
GBI	Generation-Based Incentives
GEDA	Gujarat Energy Development Agency
GERC	Gujarat Electricity Regulatory Commission
GETCO	Gujarat Energy Transmission Corporation Ltd.
GoG	Government of Gujarat
GoI	Government of India
HAWT	Horizontal Axis Wind Turbines
IEGC	Indian Electricity Grid Code
IREDA	Indian Renewable Energy Development Agency
Kg	Kilogram
kg/m^3	kilogram per cubic meter
km	Kilometre
kW	Kilo Watt
kWh	Kilo Watt hours
LBNL	Lawrence and Berkeley National Laboratory
M	Meter
m/s	meter per second
MA	Machine Availability
MAT	Minimum Alternate Tax
MNRE	Ministry of New and Renewable Energy
MW	Mega Watt
MWh	Mega Watt hour
MYT	Multi Year Tariff
NAPCC	National Action Plan for Climate Change
ND	Normal Depreciation
NEP	National Electricity Policy
NLSE	National Laboratory for Sustainable Energy , Denmark
NTP	National Tariff Policy

O&M	Operation and Maintenance
PDD	Project Design Document
PFC	Power Finance Corporation
PLF	Plant Load Factor
PLR	Prime Lending Rate
PPA	Power Purchase Agreement
PU	Per Unit
RBI	Reserve Bank of India
RE	Renewable Energy
REC	Renewable Energy Certificate
RLMM	Revised List of Models and Manufacturers
RoE	Return on Equity
RPO	Renewable Purchase Obligation
RPS	Renewable Portfolio Standards
RRF	Renewable Regulatory Fund
Rs	Rupees
RTU	Remote Terminal Units
SBI	State Bank of India
SERC	State Electricity Regulatory Commission
SLDC	State Load Dispatch Centre
STU	State Transmission Utility
UNFCCC	United Nation Framework Convention on Climate Change
V	Volt
VAWT	Vertical Axis Wind Turbines
W/m^2	Watt per square meter
WDV	written-down value
WEG	Wind Energy Generator
WPD	Wind Power Density
WPI	Wholesale Price Index
WTG	Wind Turbine Generators

1. Introduction

1.1 Background

In exercise of the powers conferred under Sections 61 (h), 62 (1) (a), and 86 (1) (e) of The Electricity Act, 2003 and guidelines of the National Electricity Policy 2005 and Tariff Policy 2006 and all other powers enabling it on this behalf, the Gujarat Electricity Regulatory Commission (GERC) presents this Discussion Paper for determination of tariff for procurement of power by Distribution Licensees and others from wind power projects to be commissioned in the control period starting from 11 August 2012. The wind power tariff proposed under this discussion paper is based on the broad principles contained in the (i) GERC (Multi Year Tariff) Regulations, 2011, (ii) GERC (Procurement of Energy from Renewable Sources) Regulations, 2010 and (iii) CERC (Terms and Conditions for Tariff Determination from Renewable Energy Sources) Regulations, 2012.

The Commission earlier had issued a generic tariff order for procurement of power by Distribution Licensees and others from wind power projects in Gujarat on 30 January 2010. The control period of GERC wind power tariff order 2010 will expire on 10 August 2012. Hence the Commission has decided to initiate the tariff determination process for determination of tariff for procurement of power by Distribution Licensees and others from wind power projects to be commissioned after 10 August 2012.

1.2 The Electricity Act, 2003

The following provisions of the Act provide the enabling legal framework for promotion of the renewable sources of energy by the State Electricity Regulatory Commissions (SERCs):

1.2.1 The Section 86 (1) (e) of the Electricity Act, 2003 mandates promotion of cogeneration and generation of electricity from renewable sources of energy which reads as under:

"Promote cogeneration and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee;"

1.2.2 The Section 61 (h) of the Act provides that, while specifying the terms and conditions of determination of tariff, the Commission shall be guided by the objective of promotion of co-generation and generation of electricity from renewable sources of energy.

Both these sections i.e. Section 86(1)(e) and section 61(h) are mandatory in nature and therefore put significant responsibility on the regulators to promote renewable sources of energy in the respective states.

1.2.3 The Section 62 (1) (a) of the Act provides for determination of tariff for supply of electricity by a generating company to a distribution licensee as under:

"Supply of electricity by a generating company to a distribution licensee: Provided that the Appropriate Commission may, in case of shortage of supply of electricity, fix the minimum and maximum ceiling of tariff for sale or purchase of electricity in pursuance of an agreement, entered into between a generating company and a licensee or between licensees, for a period not exceeding one year to ensure reasonable prices of electricity;"

1.3 National Electricity Policy (NEP)

The Clause 5.12 of the National Electricity Policy stipulates several conditions for promotion and harnessing of renewable energy sources. The salient features of the said provisions of NEP are reproduced below.

"5.12.1*: Non-conventional sources of energy being the most environment friendly, there is an urgent need to promote generation of electricity based on such sources of energy. For this purpose, efforts need to be made to reduce the capital cost of projects based on non-conventional and renewable sources of energy. Cost of energy can also be reduced by promoting competition within such projects. At the same time, adequate promotional measures would also have to be taken for development of technologies and a sustained growth of these sources.*

5.12.2*: The Electricity Act, 2003 provides that co-generation and generation of electricity from non-conventional sources would be promoted by the SERCs by providing suitable measures for connectivity with the grid and sale of electricity to any person and also by specifying, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee. Such percentage for purchase of power from non-conventional sources should be made applicable for the tariffs to be determined by the SERCs at the earliest. Progressively, the share of electricity from non-conventional sources would need to be increased as prescribed by State Electricity Regulatory Commissions. Such purchase by distribution companies shall be through competitive bidding process. Considering the fact that it will take some time before non-conventional technologies compete, in terms of cost, with conventional sources, the Commission may determine an appropriate differential in prices to promote these technologies."*

1.4 Tariff Policy (TP)

This policy further elaborates the role of regulatory commissions, the mechanism for promoting renewable energy, the time frame for implementation, etc. Clause 6.4 of the policy addresses various aspects associated with promoting and harnessing renewable energy sources. The provision stated under Clause 6.4 of TP are given below.

"(1) Pursuant to provisions of Section 86 (1) (e) of the Act, the Appropriate Commission shall fix a minimum percentage for purchase of energy from such sources taking into account availability of such resources in the region and its impact on retail tariffs. Such percentage for purchase of energy should be made applicable for the tariffs to be determined by the SERCs latest by 1 April 2006.

It will take some time before non-conventional technologies can compete with conventional sources in terms of cost of electricity. Therefore, procurement by distribution companies shall be done at preferential tariffs determined by the Appropriate Commission.

(2) Such procurement by Distribution Licensees for future requirements shall be done, as far as possible, through competitive bidding process under Section 63 of the Act among suppliers offering energy from same type of non-conventional sources. In the long term, these technologies would need to compete with other sources in terms of full costs.

(3) The Central Commission should lay down guidelines within three months for pricing non-firm power, especially from non-conventional sources, to be followed in cases where such procurement is not through competitive bidding."

1.5 Government of Gujarat Wind Power Policy 2007

The Government of Gujarat notified the 'Wind Power Policy 2007' on 13 June 2007 for development of wind power projects in the state. This policy was further amended on 7 January 2009 as 'Wind Power Policy (first amendment 2007)'. Some important provisions of this Policy are listed below:

- This policy came into force with effect from 20th June 2007 and will remain in operation up to 30 June 2012.
- Electricity generated from WEGs is exempted from payment of Electricity Duty except in the case of third party sale.
- The project developers are required to furnish Bank Guarantee of Rs.5 lakhs/MW to GETCO. In order to ensure the timely completion of wind power projects and to ensure the timely utilisation of infrastructure created by GETCO, the bank guarantee will be forfeited after the due date.

- Concessional transmission and wheeling losses in case the energy is wheeled at below 66 kV voltage level/in case of single WTG owner.
- The evacuation facility from the wind farm substation to GETCO substation within the range of 100 km shall be erected by the developer at his own cost and beyond this limit, GETCO shall erect the evacuation facility.
- The voltage level of evacuation of wind power in the grid shall be at 66 kV and above.
- The electricity generated from the WEGs shall be metered on a monthly basis, jointly by GEDA/GETCO at the sending substation of 66 kV or above located at the wind farm site.

1.6 Renewable Purchase Obligation in Gujarat

The Gujarat Electricity Regulatory Commission (Procurement of Energy from Renewable Sources) Regulations, 2010, (Notification No. 3 of 2010) dated 17 April, 2010 has specified the minimum renewable power purchase by the obligated entities for the financial year 20010-11 to 2012-13 as shown in Table No. 1.1 below.

As per this regulation, the obligated entities have the obligation to purchase electricity (in kWh) from specified RE sources. The said purchase shall be at a defined minimum percentage of the total consumption of its consumers including T&D losses during a year.

This renewable purchase obligation applies to:

- Distribution Licensees, and
- Any other Captive and Open-Access Users consuming electricity (i) generated from conventional Captive Generating Plant having capacity of 5 MW and above for his own use and/or (ii) procured from conventional generation through open access and third party sale.

Table No. 1.1 Renewable Purchase Obligation in Gujarat for FY 2010-11 to 2012-13

Year	Total RPO	Non Solar RPO		Solar RPO
		Wind	Biomass Bagasse and Other	Solar
2010-11	5%	**4.5%**	0.25%	0.25%
2011-12	6%	**5%**	0.5%	0.5%
2012-13	7%	**5.5%**	0.5%	1%

Further, this regulation recognises the Certificates issued within the scope of Central Electricity Regulatory Commission's (CERC) Notification No. L-1/12/2010-CERC dated 14 January 2010 as the valid instruments for the discharge of the mandatory obligations set out in these regulations for the obligated entities to purchase electricity from renewable energy sources termed as Renewable Energy Certificates (REC).

1.7 Wind Power Tariffs in Other States

The Central Electricity Regulatory Commission (CERC) under its RE Tariff Regulations 2012/RE Tariff Order for FY 2012-13 has adopted wind-zone-based tariff for wind power projects. Similar methodology is being adopted by the Maharashtra Electricity Regulatory Commission (MERC). In the Rajasthan Electricity Regulatory Commission (RERC) Order, the wind potential areas of the state are divided into two different zones and separate tariff for wind power projects coming under these two regions are determined. However, most of the other SERCs such as TNERC, KERC, GERC, KSERC and OERC have adopted single normative tariff for wind power projects commissioned in the respective states. CERC, MERC and RERC have adopted capital cost indexation mechanism for revision of capital cost and tariff during subsequent years of control period, whereas most other SERCs have retained the capital cost and tariff constant during control period. The comparison of wind tariff specified by different ERCs for wind power project is tabulated as below:

Table No 1.2 Comparison of Wind Power Tariff

CERC (27.03.12)	MERC (30.03.2012)	KERC (11.12.2009	RERC (draft order June 2012)	TNERC (20.03.2009)	GERC (30.01.2010)
Z1-Rs. 5.96 PU (0.60) Z2-Rs. 5.42 PU (0.55) Z3-Rs. 4.77 PU (0.48) Z4-Rs. 3.97 PU (0.40) Z5-Rs. 3.73 PU (0.38)	Z1-Rs. 5.67 PU (0.81) Z2-Rs. 4.93 PU (0.70) Z3-Rs. 4.20 PU (0.60) Z4-Rs. 3.78 PU (0.54)	Rs. 3.70 PU	Rs. 5.18-Rs. 4.90 for Jaisalmer, Jodhpur and Barmer districts Rs. 5.44-Rs..5.14 for other districts	Rs. 3.39 PU	Rs. 3.56 PU

Note: Figures in parentheses represent monetary benefit of accelerated depreciation in Rs./ PU.

1.8 GERC Wind Tariff Order 2010

The Gujarat Electricity Regulatory Commission (GERC), in its Order No. 1 of 2010 dated 30 January 2010, determined the tariff for procurement of power by the Distribution Licensees and others from wind power projects for the state of Gujarat. After due public consultation and regulatory process, GERC determined a single part levelised tariff of Rs. 3.56 per kWh for procurement of wind power by the distribution licensees in the state. This tariff order was made applicable for the wind power projects commissioned on or after 11th August 2009. The control period of this tariff order will expire on 10 August 2012. Along with the rate for sale of electricity to Distribution Licensees, the Commission in this order has also addressed other commercial issues associated with third party sale and captive use.

1.9 Wind Power Project Developments in Gujarat during the Control Period of Tariff Order dated 30 January 2010

Gujarat had added around **1,322 MW** capacity from wind power projects during the period 10 August 2009 to 31 March 2012. The annual capacity addition during the control period of previous tariff order is shown in the Table No. 1.3.

Table No. 1.3 Annual Wind Power Project Capacity Addition since 10 August 2009

Duration	Installed Capacity in MW
10.08.2009 to 31.03.2010	219
01.04.2010 to 31.03.2011	313
01.04.2011 to 31.03.2012	790
Total	**1,322**

(Source: GEDA)

Most of the above wind power plant installations are in the wind potential districts such as Kutch, Jamnagar, Rajkot, and Porbandar. The annual capacity addition in wind power project in the state of Gujarat has progressively increased during the tariff control period and has recorded the highest installation of 790 MW during the last year of the control period i.e. FY 2011-12.

:: End of Chapter 1::

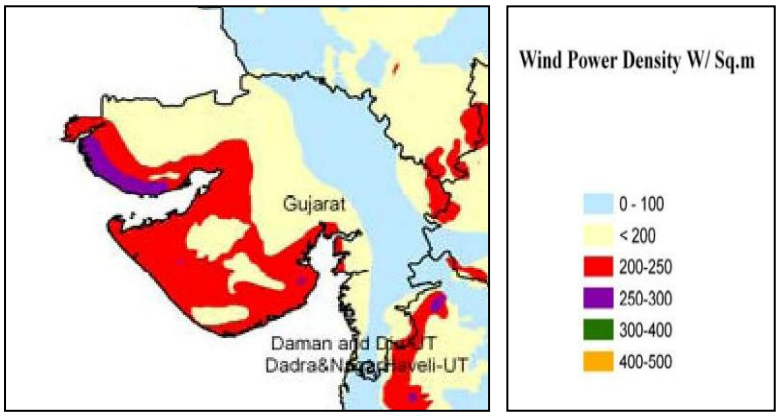
2. Wind Resource Assessment and Wind Power Technology

2.1 Wind Resource Potential Assessment for Gujarat

Wind power density which is a function of wind velocity and air density is a better indicator of wind resource availability at a particular location. The Centre for Wind Energy Technology (C-WET) under MNRE in association with Riso DTU National Laboratory for Sustainable Energy (NLSE), Denmark, developed the Indian Wind Atlas which was published in April 2010. In the wind atlas meso scale models have been used to develop the wind resource map of India for 50 m and 80 m level. The results of these meso-scale models have been correlated with the actual measured data from various wind monitoring stations to arrive at certain accuracy of the meso scale wind mapping. C-WET has installed around 64 wind monitoring stations for wind resource assessment in Gujarat.

Figure 2.1 and 2.2 below show the pattern of wind power density over the state of Gujarat at 50 m and 80 m hub height above ground as given in Indian Wind Atlas.

Figure 2.1 Wind Power Density Map at 50 m Level



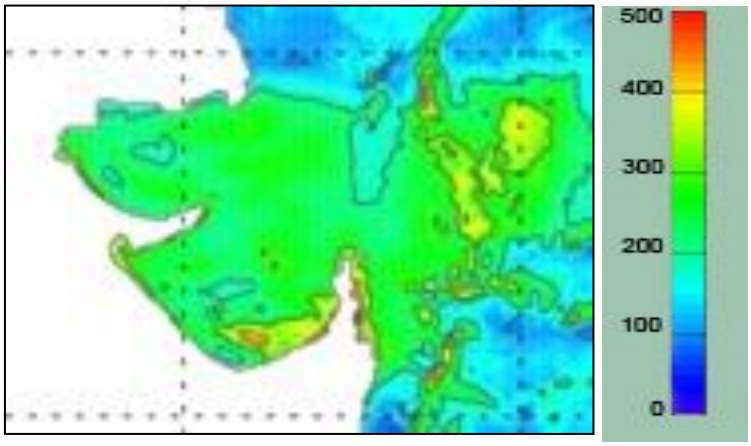
Wind Power Density Watts/Sq. m
(Source: C-WET)

As per the above assessment, the installable wind power potential of Gujarat state was pegged at 10,609 MW. This potential was assessed at 50 m level by considering 9 km^2/MW land requirement with an assumption that only 2% of available land will be brought under wind power project installation.

It may be noticed that by increasing the hub height of wind turbine, the wind power density increases and in turn the power generation capacity increases. The technological advancement in manufacturing of MW size WTG and increase in hub height lead to more swept area of wind, which can increase in the power generation from the WTG. In a recent study, C-WET has reassessed the wind power potential of India at 80 m hub height and concluded that wind

power potential of India has increased from 49,130 MW (at 50 m level) to 1,02,788 MW (at 80 m level). In the case of Gujarat, state the earlier C-WET assessed wind power potential has increased from 10,609 MW (at 50 m level) to 35,071 MW (at 80 m level).

Figure 2.2 Wind Power Density Map at 80 m level



Wind Power Density W/m^2
(Source: C-WET)

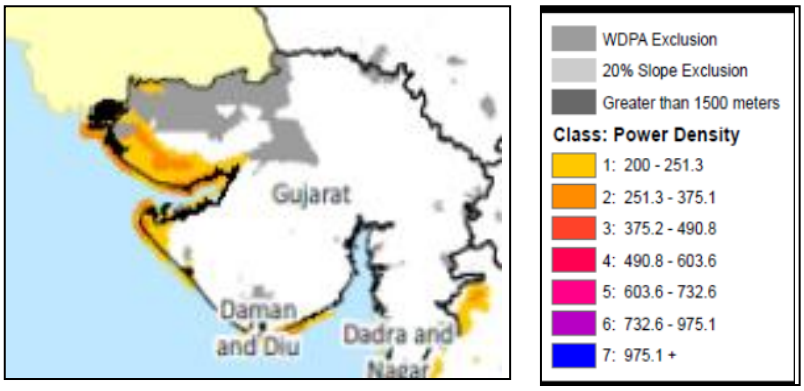
From the above map (Figure 2.2), it can be seen that most of the areas of Gujarat fall under 200 W/m^2 to 375 W/m^2 wind power density zone at 80 m above ground level, and there are a few areas with wind power density lower than 200 W/m^2. The revised C-WET assessed state wind potential of 35,071 MW (at 80 m hub height), and present installed capacity of 2,965 MW indicate ample potential for further wind power project development in the state.

2.2 LBNL Wind Power Potential Re-assessment Study for India

The Lawrence and Berkeley National Laboratory (LBNL) under a study "Reassessing Wind Potential Estimates for India: Economic and Policy Implications" published in March 2012 has reassessed the wind power potential in India.

Under the LBNL study, annual average wind power density (WPD) and wind speed data at an elevation of 80 m, 100 m, and 120 m for each 5 km by 5 km cell in India was procured from 3Tier. Publicly available GIS data on topography and land use and cover (LULC) was used to exclude areas where development of wind facilities would be technically and economically unviable. The excluded sites are low quality wind areas (WPD<200 W/m^2), areas with slopes greater than 20 degrees, elevation greater than 1,500 m, forests, snow-covered areas, water bodies, urban areas, and protected areas.

Figure 2.3 Wind Power Density Map



(Source : LBNL , "Reassessing Wind Potential Estimates for India: Economic and Policy Implications")

The LBNL study also reveals that the wind power potential locations in Gujarat lie in the wind power density zone of 200 W/m^2-375 W/m^2 at 80 m hub height. LBNL study has pegged the techno-economic wind power potential of Gujarat to be around 80 GW.

2.3 Wind Power Technology

Wind power generation is simple conversion of kinetic energy of the wind into electrical energy. The kinetic energy of the air flow provides the motive force that turns the wind turbine blades that, via a drive shaft, provide the mechanical energy to power the generator in the wind turbine. The power generation of wind turbines is determined by the capacity of the turbine (in kW or MW), wind speed, height of the turbine and diameter of the rotors.

Wind turbines are broadly categorised according to their axis of rotation as 1) Vertical axis wind turbines and 2) Horizontal axis wind turbines. The following figures show arrangement of rotor and blades in both type of WTGs .

Figure 2.4 Vertical Axis and Horizontal Axis Wind Turbines

In vertical axis WTG, wind generator is placed at the bottom of the rotating axis of wind turbine. This type of wind turbines are found to be aerodynamically inefficient and hence usually used in small wind turbines which are available in kW range. Hence such systems are used for house-hold applications which generally caters to small power requirements of individuals.

In the case of horizontal axis WTGs, wind electric generator is placed horizontally at the top of the tower which is connected to aerodynamic blades. Such systems are found to be aerodynamically efficient and hence used in commercial scale wind turbines. Three bladed upwind configuration is most commonly used.

The horizontal axis WTGs can be further categorised according to:

a) Drive-train connecting blades and the wind electric generator as geared and gearless wind electric generators.

b) Use of electric generators as Induction Generator, Synchronous Generator and Doubly-fed Induction Generator.

c) Rotor placement (upwind or downwind), number of blades, output regulation system.

d) Wind turbine capacity. (MW Class: WTG rating ≥ 1 MW and above, Sub-MW Class: WTG rating from 0 to 999 kW).

Each of the above horizontal axis WTG configurations has its own advantages and disadvantages. Apart from wind turbine generator, the balance of plant consists of wind turbine substation, metering, control and protection, Remote Transmission Unit (RTU/SCADA), high voltage evacuation line, pooling substation, etc .

The wind speed and electricity production: As wind speed increases, the amount of energy generation increases, following a cubic function. Therefore, capacity factors rise rapidly as the average mean wind speed increases. A doubling of wind speed will result in increase in power output of wind turbine by a factor of eight. In addition, wind generally blows more consistently at higher speeds at greater heights. For instance, a five-fold increase in the height of a wind turbine above the prevailing terrain can result in twice as much wind power. Air temperature, smoothness of air is also important since denser (colder) air provides more energy and turbulent air can reduce output and increase the loads on the structure and equipment.

The maximum energy that can be harnessed by a wind turbine is proportionate to the swept area of the rotor. Blade design and technology development are the key to increasing wind turbine capacity and output. By doubling the rotor diameter, the swept area and therefore power output is increased by a factor of four. This can be observed from the wind turbine technology and installations in India. In India, grid-connected wind power project installation began with wind turbines of 55 kW capacity and has reached to a capacity of 2.5 MW by 2012. Also,

the hub heights have been increased from 20 m to 100 m, and wind turbine rotor blade lengths have increased to 100 m following the global trends. The developments in wind turbine heights and rotor blade lengths in Denmark over the years (1985-2010) can be seen from the following figure.

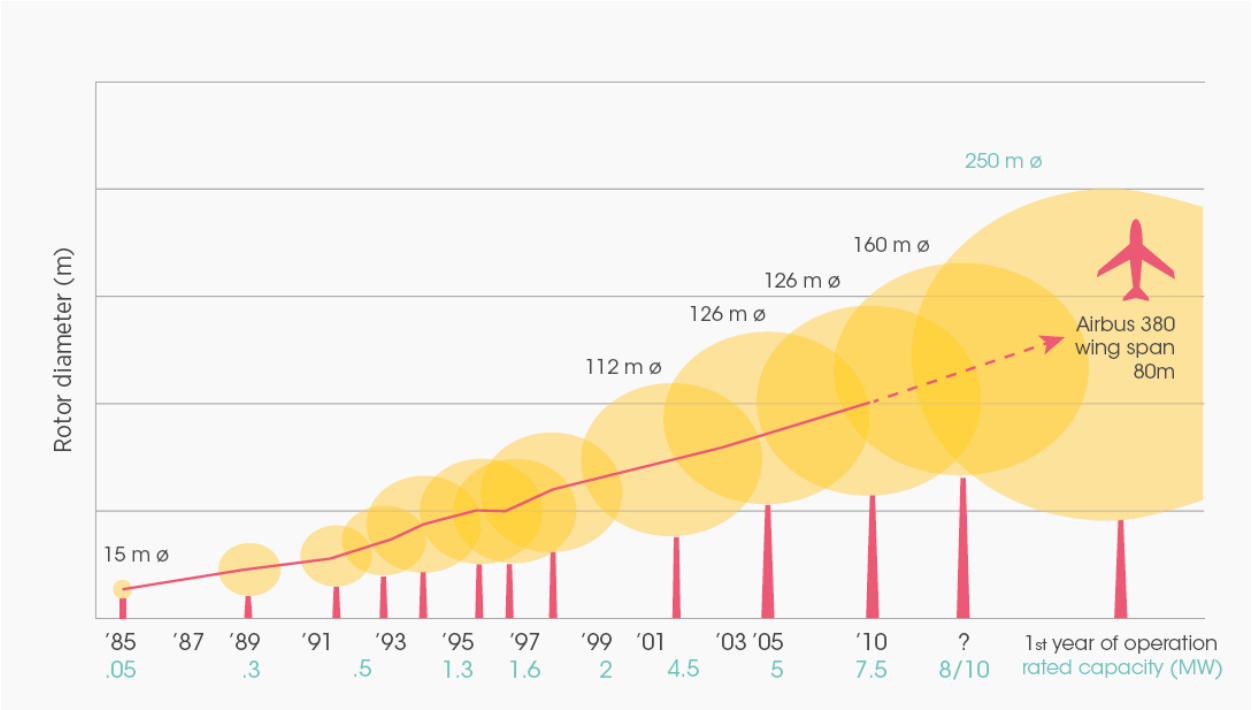


Figure 2.5: Growth in the Size of Wind Turbine Since 1985

(Source: IRENA, RE Technologies: Cost Analysis Series, Wind Power , June 2012)

2.4 C-WET Approved List of WTGs

In order to streamline the development and facilitate healthy and orderly growth of the wind power sector in the country, the Ministry of New and Renewable Energy had issued guidelines for installation of duly tested and certified quality equipment to optimise energy generation from wind power projects. The list of wind turbine manufacturers and models approved by C-WET are being published under the Revised List of Models and Manufacturers (RLMM) of Wind Turbines.

Table No.2.1 List of Wind Turbine Models Approved by C-WET as per RLMM

Name of WTG Manufacturer	Rating of WTG (in kW)	Model No	Rotor Dia. (in m)	Hub Height (in m)
Chiranjieevi Wind Energy Ltd.	250	CWEL C30/250	29.8	50
Enercon India Ltd	800	E-48	48	50/56/57/65/75/76
Enercon India Ltd	800	E-53	53	73/75
G.E India Industrial Pvt. Ltd.	1500	GE 1.5sle	77	80
G.E India Industrial Pvt.	1600	GE 1.6-82.5	82.5	80

Name of WTG Manufacturer	Rating of WTG (in kW)	Model No	Rotor Dia. (in m)	Hub Height (in m)
Ltd.				
Gamesa Wind Turbine Pvt. Ltd.	800	MADE AE59	59	60.6
Gamesa Wind Turbine Pvt. Ltd.	850	g52-850	52	44/55/65
Gamesa Wind Turbine Pvt. Ltd.	850	G52-850 IEC IIA	58	55/65
Gamesa Wind Turbine Pvt. Ltd.	850	G58-850 IEC IIIB	58	44/55/65/74
Gamesa Wind Turbine Pvt. Ltd.	2000	G90-2.0 IEC IIA	90	67/78/100
Gamesa Wind Turbine Pvt. Ltd.	2000	G90-2.0 IEC IIIA	90	67/78/100
Gamesa Wind Turbine Pvt. Ltd.	2000	G80-2.00 IEC IA	80	60/67/78
Gamesa Wind Turbine Pvt. Ltd.	2000	G80-2.0 IEC IIA	80	60/67/78/100
Gamesa Wind Turbine Pvt. Ltd.	2000	G87-2.0 IEC IIA	87	67/78/100
Global Wind Power Ltd	750	Norwind 759 kW	47	65
Global Wind Power Ltd	2500	FL 2500-100	100.2	98.2/85
Inox Wind Ltd	2000	WT2000DF	93.3	80
Kenersys India Pvt. Ltd.	2000	K82	82	80
Kenersys India Pvt. Ltd.	2500	K100	100	85/100
Leitener Shriram Manufacturing Ltd.	1350	LTW77-1.35	76.6	61/65/80
Leitener Shriram Manufacturing Ltd.	1500	LTW77-1.5	76.6	61/65/80
Leitener Shriram Manufacturing Ltd.	1500	LTW80-1.5	80.3	65/80
Leitener Shriram Manufacturing Ltd.	1800	LTW80-1.8	80.3	65/80
Pioneer Wincon Pvt. Ltd.	250	Pioneer 250/29	29.6	50
Regen Powertech Pvt. Ltd.	1500	VENSYS77	76.84	75/85
Regen Powertech Pvt. Ltd.	1500	VENSYS82	82.34	70/75/85/100
RRB Energy Ltd.	500	V 39-500	47	50
RRB Energy Ltd.	600	Pawan Shakti 600kW	47	50/65
Shriram EPC Limited	250	SEPC250T	28.5	41.2
Siva Windturbine India Pvt. Ltd.	250	SIVA 250/50	30	50
Siva Windturbine India Pvt. Ltd.	250	SIVA250/50	30	50
Southern Wind Farms Ltd	225	GWL 225	29.8	45
Suzlon Energy Ltd	600	S 52/600	52	75
Suzlon Energy Ltd	1250	S64-1.25	64	56/65/74
Suzlon Energy Ltd	1250	S66-1.25	66	65/74
Suzlon Energy Ltd	1500	S82V3-1500	82	78
Suzlon Energy Ltd	2100	S88 V3A-2100	88	80

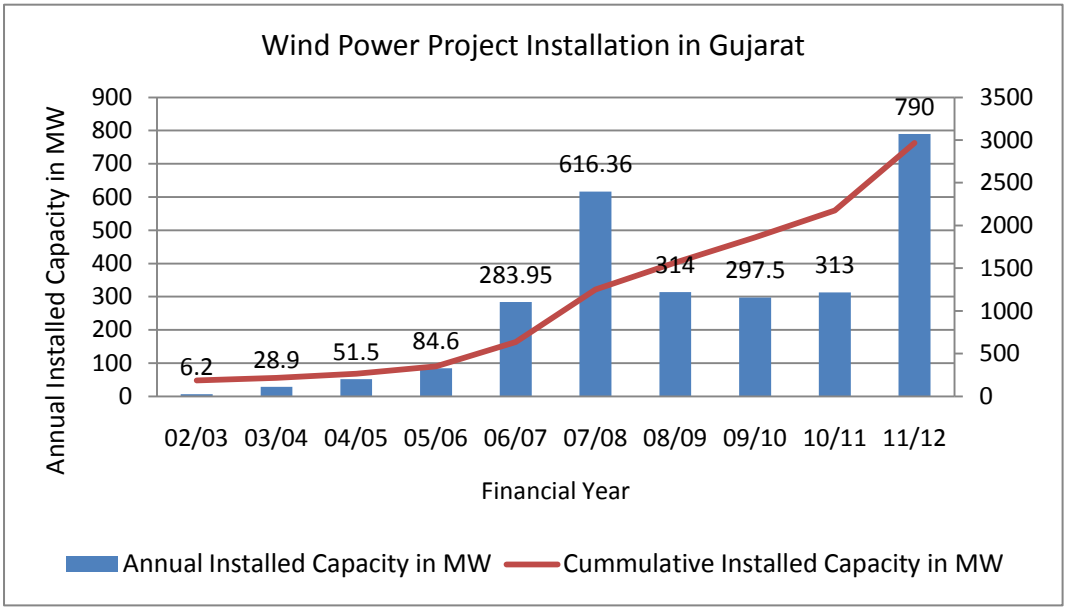
Name of WTG Manufacturer	Rating of WTG (in kW)	Model No	Rotor Dia. (in m)	Hub Height (in m)
Suzlon Energy Ltd	2100	S95 2.1	95	80/90/100
Suzlon Energy Ltd	2100	S97 2.1	97	80/90/100
Suzlon Energy Ltd	2250	S88-2.25	88	80
Vestas Wind Technology India Pvt. Ltd.	1650	V82-1.65	82	70/78/80
Vestas Wind Technology India Pvt. Ltd.	1800	V100-1.8	100	80/95
WinWinD Power Energy Pvt. Ltd.	1000	WinWinD 1	60	70

(Ref: C-WET RLMM list dated 22.6.2011, 26.09.2011, 30.11.2011 and 19.03.2012)

2.5 Wind Power Plant Installation Trend in Gujarat.

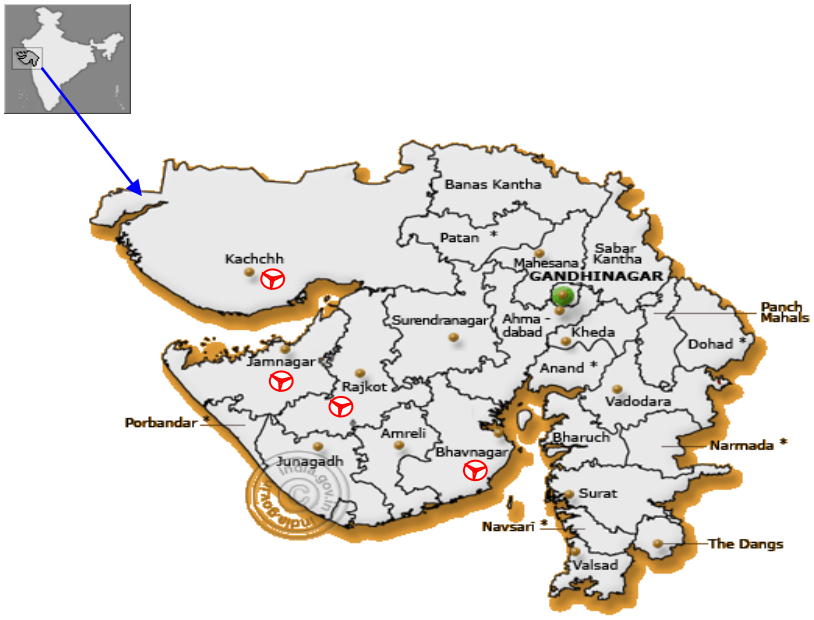
Wind power installation in Gujarat reached to 2,965 MW by 31 March 2012. Out of this, wind power capacity addition of 1322 MW (around 45%) happened during the control period of the previous wind tariff order of GERC (up to 31 March 2012). It is observed that the annual wind power installation of 790 MW witnessed during financial year 2011-12 is the highest in the state for any year. This may be attributed to the introduction of REC mechanism and availability of AD benefit. The credit for peaking of wind capacity installation in the state goes equally to the conducive policies and regulatory framework. The annual installed capacity and cumulative installed capacity of wind power projects in Gujarat are shown in Figure.2.6 and the potential regions suitable for wind power projects in Gujarat are shown in Figure 2.7.

Figure 2.6 Wind Power Project Installations in Gujarat



(Source: MNRE, GEDA)

Figure 2.7 Wind Power Potential Regions in Gujarat



A total of 1322 MW capacity wind power projects were installed in Gujarat during the last control period (11 August 2009 to 31 March2012). Most of these wind power plant installations were concentrated in the districts of Kutch, Jamnagar, Rajkot, and Porbandar.

A systematic analysis of wind power installation during the control period of previous GERC tariff order shows a clear shift towards the MW class WTG. Current market trend is towards higher hub height and higher turbine capacity machines the reason being that for a given

capacity, lower number of higher capacity WEGs are required which ultimately cut down the land and O&M cost and extract more energy from the wind due to higher hub height. The state of Gujarat is not an exception to this as can be seen from the following table:

Table No. 2.2:MW-Class and Sub-MW Class WTG Installations in Gujarat

Duration	Total Installed Wind Capacity in MW	Total Installations (in MW) with Sub-MW class WTG	Total installations (in MW) with MW-class WTG	% of Wind Installations with MW-class WTG
10.08.2009 to 31.03.2010	219	76	143	65%
01.04.2010 to 31.03.2011	313	103	210	67%
01.04.2011 to 31.03.2012	790	263	527	66%
Total	1,322	442	880	67%

(Source: GEDA)

From the above table, it can be seen that during each year of the control period of the previous tariff order, more than 65% of the machines chosen by investors were MW class machines. Out of 1,322 MW of wind power plants installed in the state during the last control period, around 880 MW of wind power plants have used MW-class wind turbines and 442 MW of wind projects have used wind turbines of ratings below 1 MW. These MW-class wind turbines were placed at a height of 70 m and above from the ground level. The wind turbine models installed after 11 August 2009 are shown in Table No 2.3 below .

Table No.2.3 Wind Turbine Models Installed during August 2009 to March 2012 in Gujarat

WTG Manufacturer	Rating (kW)	Hub Height in meter	Generator	Regulation
Suzlon	2100	80 /90/100	Asynchronous Flexi Slip	Pitch Regulated
	1500	78	Asynchronous Flexi Slip	Pitch Regulated
	1250	56/65/74	Asynchronous	Pitch Regulated
	600	75	Asynchronous	Pitch Regulated
Enercon	800	50/56/57/65/75/76	Synchronous	Pitch Regulated
ReGen	1500	70/75/85/100	Synchronous	Pitch Regulated
Vestas	1650	70/78/80	Asynchronous Optislip	Pitch Regulated
	1800	80/95	Synchronous	Pitch Regulated
Gamesa	850	44/55/65	DFIG	Pitch Regulated
SWL	225	45	Asynchronous	Stall regulation
Pioneer	250	50	Asynchronous	Stall regulation
GWL	750	65	Asynchronous	Active Stall Regulation
Kenersys	2000	80	Synchronous	Pitch Regulated
SEPC	250	41.2	Asynchronous	Pitch Regulated
Inox	2000	80	DFIG	Pitch Regulated

(Source: GEDA)

2.6 Future Wind Power Projects in Gujarat

Table 2.4 below shows the list of projects with capacity for which the evacuation estimates have been approved by GETCO, the state STU and the execution work of the evacuation lines in progress.

Table No.2.4 List of Wind Power Projects for which Evacuation work is in Progress

Name of Developer	Location	Capacity in MW
Azalea	Bojapuri	70
Suzlon	Jamanvada	300
Suzlon	Nakathrana	300
ReGen	Vejalpur	35
ReGen	Khareda	35
Veer Energy	Kundhada	30
K P Energy	Matalpur	25
Kintech	Amarpur	300
Theolia	Gala	25
Theolia	Kidi	25
Theolia	Rojmal	25
Theolia	Ratabhe	25
Suzlon	Bhanavad	100
Enercon	Thebda	50
Kintech	Parchund	200
Cape	Sultanpur	25
Jyoti Ltd	Sukhpur	25
	Total	**1595**

(Source : GETCO)

Apart from the above projects for which evacuation work is in progress, Table 2.5 below shows the list of wind power projects for which the evacuation plans have been approved by GETCO and are at various stages of planning.

Table No.2.5 List of Wind Power Projects at Various Stages of Planning

Name of Developer	Location	Capacity in MW
Enercon	Tebhda	50
Suzlon	Nani Kudal, Bhavnagar	30
Azalea	Malvan S'nagar	200
Gamesa	Sarambhada	50
Azalea	Momana	40
Suzlon	Keshav Porbandar	50
Suzlon	Dhanki, Jamnagar	100
ReGen	Kuvadva	40
ReGen	Sindhavadar	40
ReGen	Kagdadi Rajkot	40
K.P.Energy	Miyani, Porbandar	25

Name of Developer	Location	Capacity in MW
Vestas	Vandhiya Kutch	150
Games	Sadla	200
ReGen	Ishwarnagar	50
GFL	Chotila, S'nagar	100
GFL	Chotila, S'nagar	100
GFL	Savarkundla	150
GFL	Rojmal, Amreli	150
GFL	Maliya, Rajkot	200
ReGen	Shapur, Rajkot	200
Vish Wind	Dayapar, Netra	750
Kintech	Kanmer, Kutch	200
	Total	2915

(Source : GETCO)

From the above, it can be seen that about 4500 MW of wind power projects are at various stages of planning in Gujarat.

:: End of Chapter 2 ::

3. Computation of Tariff for Wind Power Projects

3.1 Approach and Methodology

3.1.1 The Commission notes that the Tariff Policy notified by the Central Government in pursuance of Section 3 of Electricity Act has stipulates that the Appropriate Commission may determine preferential tariff for procurement of power by distribution licensees from non-conventional sources of energy. The relevant extract of para 6.4 of the tariff policy is given below:

"(1) Pursuant to provisions of Section 86 (1) (e) of the Act, the Appropriate Commission shall fix a minimum percentage for purchase of energy from such sources taking into account availability of such resources in the region and its impact on retail tariffs. Such percentage for purchase of energy should be made applicable for the tariffs to be determined by the SERCs latest by 1 April 2006.

It will take some time before non-conventional technologies can compete with conventional sources in terms of cost of electricity. Therefore, procurement by distribution companies shall be done at preferential tariffs determined by the Appropriate Commission".

3.1.2 The Commission notes that the 'Report on Policies on Renewable' prepared by the Working Group constituted by the Forum of Regulators consisting of chairpersons of some State Electricity Regulatory Commissions and external experts including a representative from the MNRE has recommended preferential tariff for renewable sources at least during their loan tenure. The report urges the Ministry of Power, Government of India, to frame guidelines and standard bid documents for competitive bidding for renewables under Section 63 of the Act.

3.1.3 The Commission also notes that the Ministry of Power has constituted a committee in February 2012 to accelerate development of renewable energy through legislative changes and to evolve competitive bidding guidelines for procurement of power from renewable energy under Section 63 of the Act. The Committee at present is involved in consultation process with the stakeholders.

In view of the above, and the rising concern with regard to climate change, energy security and global warming, the Commission proposes to continue with the cost-plus methodology as adopted in the previous tariff orders issued by the Commission during year 2006 and 2010 for determination of tariff for procurement of electricity from wind power projects by the distribution licenses in the state during the next control period starting from August 2012.

3.2 General Principles

In this section, the general principles for wind power tariff determination such as control period, tariff period, tariff structure, tariff design, plant life, etc., are discussed.

3.2.1 Control Period: Since the control period of the GERC Wind Tariff Order 1 of 2010 dated 30 January 2010 is up to 10 August 2012, the Commission proposes that the control period of the tariff order under discussion will be from 11 August 2012 to 31 March 2016.

3.2.2 Useful Life of Plant: The Commission in its Order dated 30 January 2010 had considered the project life of 25 years for wind power projects. Further, the CERC in its RE Tariff Regulations 2012 dated 6 February 2012 has also considered the wind power project life of 25 years. In view of above, the Commission proposes 25 years as useful life of wind power generating station, including the evacuation line for tariff determination purpose.

3.2.3 Tariff period: The tariff period for the tariff determined by the Commission for procurement of electricity from wind power projects to be commissioned during the next control period starting from August 2012, will be of 25 years from the date of commissioning of wind power project.

3.2.4 Tariff Structure & Design: The Commission prefers to determine a single-part levelised tariff for procurement of electricity from wind power projects commissioned during the next control period starting from 11 August 2012 by the distribution licensees in the state.

3.2.5 Eligibility Criteria: The wind power projects using new wind turbine generators commissioned after 11 August 2012 and during the control period of this tariff order will be eligible to sell power to distribution licensees of Gujarat at the tariff determined by the Commission under the new tariff order.

3.2.6 Scheduling of Wind Power: As per the Indian Electricity Grid Code (IEGC), the scheduling provisions reads as *"3. ..... Hence wind generation forecasting is necessary for increased penetration. Wind generation forecasting can be done on an individual developer basis or joint basis for an aggregated generation capacity of 10 MW and above connected at a connection point of 33 kV and above. If done jointly, the wind forecasting facility shall be built and operated by wind developers in the area and sharing of the cost shall be mutually discussed and agreed."* The implementation issues of IEGC and RRF are under discussion with CERC. Once the IEGC and RRF are implemented, scheduling of wind power will be introduced in Gujarat after suitably amending the state grid code. In view of the above, the Commission has considered cost related to hardware and associated expenditure for forecasting, while fixing the capital cost and O&M benchmark for computation of tariff.

3.2.7 Applicability of Merit Order Despatch Principle: The wind power plants irrespective of plant capacity shall be treated as 'MUST RUN' power plants and shall not be subjected to merit order dispatch principles.

3.2.8 Metering Point and Interconnection point: The Commission proposes the following two options on above

Option 1: The metering point as well as interconnection point for grid connectivity will be at the 66kV pooling substation located at wind farm site.

Option 2: The metering point will be at the 66kV pooling substation located at wind farm site, whereas the interconnection point will be at nearest GETCO substation.

The interconnection point referred to above means interface point of wind generating facility with the transmission system or distribution system as the case may be.

3.3 Benchmarking of Capital Cost and Other Performance Parameters

3.3.1 Benchmark Capital Cost for Wind power Project in Gujarat

Capital cost is the most critical component while determining tariff in a regulated environment. The capital cost of wind power project comprises the cost of (i) tower and its base, (ii) turbine generators, (iii) blades, (iv) controllers, (v) power and control cabinets, (vi) distribution structure, (vii) transformer and associated equipments, (viii) land and its development cost, (ix) processing fee of Gujarat Energy Development Agency, (x) erection and commissioning charges, (xi) financing charges and IDC and (xi) creation of evacuation system up to the interconnection point .

In order to arrive at benchmark capital cost for the wind power projects to be commissioned in the next control period starting from August 2012, the Commission has examined the wind power capital cost trends in the national and International market during the last control period, WTG component generally imported by the WTG manufacturers in India, currency exchange rate variation, and the commodity price increase during the last control period. Along with this the Commission has also analysed the wind power capital cost data of the projects commissioned in Gujarat during the control period of previous tariff order as well as the approach followed by CERC while fixing benchmark wind power capital cost under FY 2012-13 tariff orders.

Component of Capital Cost and Growth Factor.

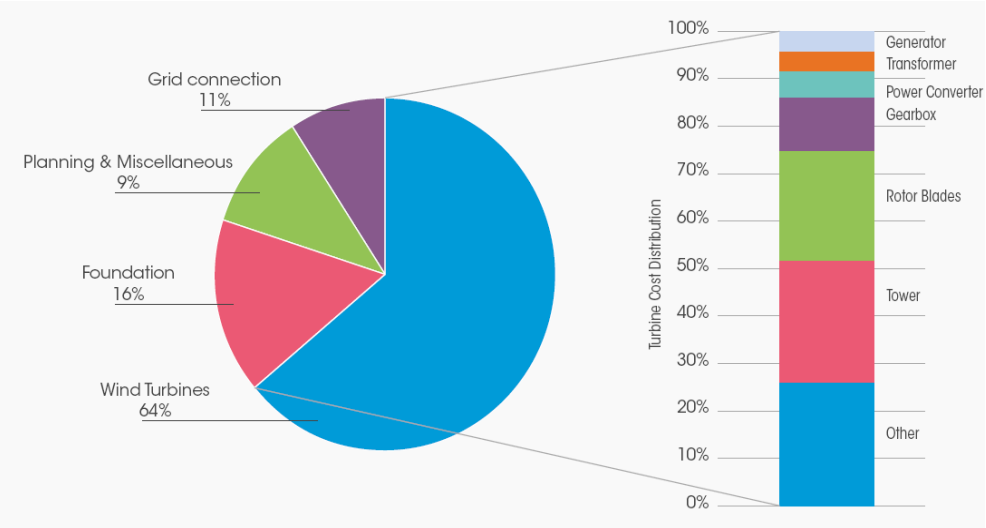
The capital costs of a wind power project can be broken down into the following major categories:

a. **The turbine cost**: including blades, tower and transformer;
b. **Civil works**: including construction costs for site preparation and the foundations for the towers;

c. **Grid-connection costs**: This can include transformers and sub-stations, as well as the connection to the local distribution or transmission network; and

d. **Other capital costs**: these can include the construction of buildings, control systems, project consultancy costs, IDC, insurance etc.

Figure 3.1: Capital Cost Break-up for a Typical On-Shore Wind Power Plant

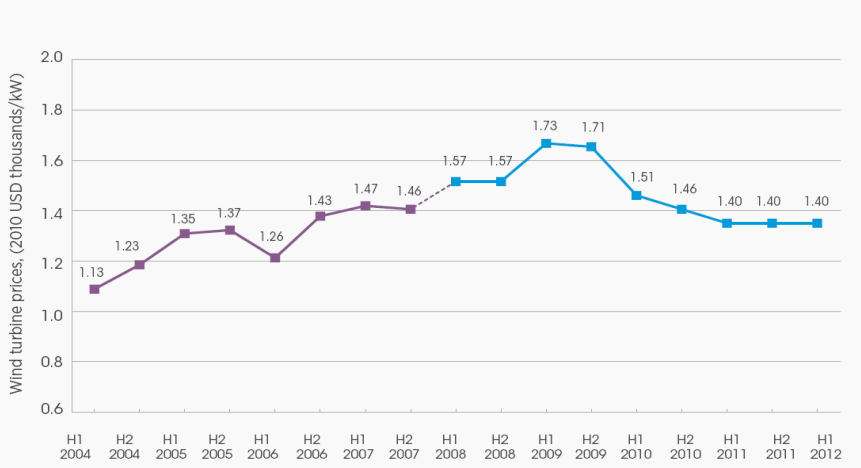


(Source: IRENA: "RE technologies cost analysis: wind power", June 2012)

It can be seen from the above figure that the capital cost of the wind power project significantly depends on the wind turbine cost followed by the foundation cost and grid connection costs. In the Indian context, the variation in Wholesale Price Index (WPI) of major commodities used in wind power plant as per the data published by Office of Economic Advisor, Ministry of Commerce and Industry, GoI, indicates that, the weighted average growth rate of steel, electrical machinery and cement was around 5% during the last control period.

3.3.1.1 Wind turbine is the single largest cost component of the total capital cost of a wind farm. Wind turbine prices increased steadily in recent years, but appear to have peaked in 2009. Between 2000 and 2002, turbine prices averaged USD 700/kW, but this had risen to USD 1500/ kW in the United States and USD 1800/kW in Europe in 2009. Since the peak of USD 1800/kW for contracts with a 2009 delivery, wind turbine prices in Europe have declined by 18% for contracts with delivery scheduled in the first half of 2010. Global turbine contracts for delivery in the second half of 2010 and the first half of 2011 have averaged USD 1470/kW, down by 15% from peak values of USD 1730/kW.

Figure 3.2: Wind Turbine Price Index by delivery date 2004 to 2012



(Source : Bloomberg New Energy Finance 2011 : levellized cost of energy update)

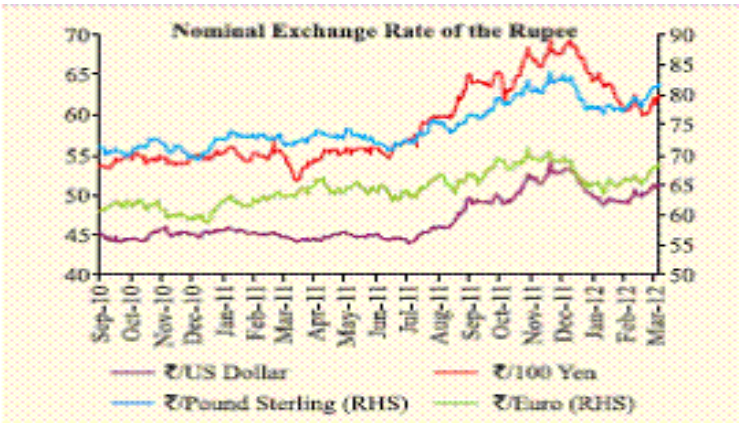
The above Figure indicates that the wind turbine prices reached the peak during 2009, steadily declined thereafter up to the first half of 2011, and is predicted to remain nearly constant up to the first half of 2012. Same trend is also predicted for USA wind turbine prices under LBNL Report titled, 'Understanding Trends in Wind Turbine Prices over the Past Decades,' (Oct 2011).

Important parameters affecting the wind power capital cost in India

- The wind power technologies employed in India (Class III and Class IV wind turbine technologies) have never been in a phase of oversupply.

- The wind power projects implemented in India need to import certain critical components (gear box, control system, yaw mechanism), which are highly volatile to Euro-Rupee and USD-Rupee exchange rates. The following figure depicts the variation in Euro-Rupee and USD-Rupee exchange rates over the period.

Figure 3.3: Exchange Rate Variation (Rupee vs other currencies)



(Source: RBI (2012), 'Macroeconomic and Monetary Developments in 2011-12' dated 16April, 2012)

Table No.3.1: Total Installed Costs (USD) per kW for On shore Wind Farms in China/India, Europe and North America

	2010	2011	2015
China/India	**1100 to 1400**	**1050 to 1350**	**950 to 1250**
Europe	**1850 to 2100**	**1800 to 2050**	**1700 to 1950**
North America	**2000 to 2200**	**1950 to 2150**	**1800 to 2050**

(Source: IRENA 'RE technologies cost analysis: wind power', June 2012)

The above table indicates that the wind power capital costs in China/India are declining from 1100-1400 USD/kW during 2010 to 1050-1350 USD/kW in 2011. The study further predicts that the wind power capital cost will further decline to the range of 950-1250 USD/kW during 2015. Based on the above study and forecast of Euro-Rupee and USD-Rupee exchange rate variation reported by the Reserve Bank of India, the benchmark wind power capital cost for next control period works out to be around Rs. 5.74Cr/MW.

3.3.1.2 The capital cost benchmark for wind power projects fixed by CERC in its RE tariff Regulations 2012 is the most recent and based on comprehensive study. The Commission noted that the capital cost formulation of CERC is based on detailed analysis of capital cost under regulatory approach, actual project cost approach and market-based approach. The CERC had proposed normative wind power capital cost of Rs. 5.25 Cr/MW (without evacuation infrastructure from pooling substation to nearest grid substation) in its discussion paper. However, the CERC has determined the capital cost as Rs. 5.75 Cr/MW for the wind power projects to be commissioned in FY 2012-13.

3.3.1.3 The Commission has also analysed the wind power capital cost data of the wind power projects commissioned in Gujarat during the last control period**.** The Commission relies on the information submitted by IREDA, and PSUs who have installed wind power projects in Gujarat. Information was also collected on wind power projects set up in Gujarat and registered with UNFCCC for availing CDM benefit,

IREDA has financed 13 projects totalling 390 MW capacity during FY 2010-11 and FY 2011-12 in Gujarat. The weighted average capital cost works out to be around Rs. 5.2 Cr/MW.

Some of the PSUs have installed wind power projects in Gujarat during the control period of the previous tariff order. PSUs have installed around 295 MW wind power projects during the this control period. The weighted average capital cost works out to be around Rs. 5.47 Cr/MW. The Commission further noted that the individual rating of WTGs in the case of PSU's installation is in the range of 1.5 MW to 2.1 MW.

Apart from the above, the Commission has also analysed the project cost declared by the wind investors in Gujarat in the Project Design Documents submitted to the UNFCCC for availing CDM benefit.

The capital cost data of 7 projects of total 145 MW capacity registered with UNFCCC and commissioned during the last control period have been analysed. The weighted average capital cost works out to be around Rs. 5.57 Cr/MW. The average capital cost arrived as per PSUs, IREDA and UNFCCC data works out to be Rs. 5.41 Cr/MW.

The wind power capital cost arrived as above does not factor in the evacuation cost from wind farm substation to GETCO substation.

After considering all the options discussed above, the Commission is of the opinion that the wind power capital cost arrived in 3.3.1.3 captures the Gujarat specific capital cost submitted by the various agencies and therefore can be considered as representative capital cost for generic tariff determination. Considering a base capital cost of Rs. 5.41 Cr/MW for FY 12-13 and growth rate of 5% during the subsequent years of the control period, the Commission proposes to fix the benchmark capital cost of Rs. 5.68 Cr/MW (excluding the power evacuation cost from wind farm substation to STU substation) for the new control period starting from 11 August 2012 for tariff determination purpose which will remain constant during the control period.

3.3.2 Power Evacuation System

Option 1

As per Section 39(2) (c) of the Act, the state transmission utility (STU) has to ensure development of economical and efficient system of intra-state transmission to bring electricity up to load centres. The Commission under Clause 4.4 of Order No 1 of 2012 on 'Determination of Tariff for Procurement by the Distribution Licensees and others from Solar Energy Projects,' dated 27 January 2012 has ruled that:

".....the transmission lines from the switchyard of generator to the GETCO substation shall be laid by GETCO. The cost for the same shall also be borne by GETCO."

The Commission further notes the CERC norms with regard to interconnection point as specified in the CERC RE Tariff Regulations 2012, which reads as under:

"Inter-connection Point shall mean interface point of renewable energy generating facility with the transmission system or distribution system, as the case may be: In relation to wind power projects inter-connection point shall be line isolator on outgoing feeder on HV side of the pooling sub-station"

Since wind power is also a renewable energy source like solar, the Commission proposes to follow the same approach for development of power evacuation line for wind power projects.

Evacuation Cost

The cost of evacuation line from generating station to interconnection point (pooling substation) has already been considered in the project capital cost.

Option 2

The Commission under Order 2 of 2006 dated 11 August 2006 and Order No 1 of 2010 dated 30 January 2010 on 'Determination of the Tariff for Procurement of Power by Distribution Licensees from Wind Energy Generators and other Commercial Issues' had allowed the investors to construct the power evacuation line from the wind farm switchyard to GETCO substation. Further, the Commission had included Rs. 38 lakhs/MW towards cost of evacuation line for constructing the evacuation line up to 100 km length, as part of capital cost in its Wind Tariff Order dated 30 January 2012.

The Commission proposes to follow the same principle for the new control period. In order to ascertain the evacuation cost for the new control period starting from August 2012, an analysis of the existing evacuation facility created for wind power evacuation has been carried out. The Commission has analysed the data of length of evacuation facility erected by wind power project developers in the past against the assumed maximum length of 100 km, for which the cost of evacuation system was approved by the Commission.

The Commission has observed that most of the wind power projects do not require to construct the 100 km length of evacuation line. Also, in cases where the evacuation line length is close to 100 km, the project capacity is comparatively high implying a lower per MW cost of evacuation facility. Table 3.2 shows the voltage level, evacuation line length constructed till 31 March 2012. It can be observed that, on an average the wind power projects commissioned till 31 March 2012 had executed the evacuation line in the range of 0.20 to 0.28 km/MW with a minimum 3 km to maximum 100 km evacuation line length for individual wind farm.

Table No. 3.2 Details of Wind Power Project Evacuation Line Commissioned till 31 March 2012

Voltage Level	MW capacity of Evacuation line	Length in km	km/MW	Maximum /Minimum Length of Line
66 kV	975.20	274.01	0.28	30km/3 km
132 kV	507.00	133.00	0.26	34km /8km
220 kV	1696.00	346.59	0.20	100km/7km
	3178.20	753.6		

(Source: GETCO)

Similar analysis was undertaken for which evacuation permissions are accorded by GETCO and the evacuation facility is under progress. The analysis of evacuation line length of projects whose execution is in progress at present is presented in Table 3.3. At present, wind evacuation facility totalling 1595 MW is under progress. It can be observed that, for wind power projects in the pipeline, the proposed evacuation line is in the range of 0.30 to 1.14 km/MW with a minimum 1 km to maximum 175 km evacuation line length for individual wind farms.

Table No. 3.3 Details of Wind Power Project Evacuation Line under Progress

Voltage Level	MW capacity of Evacuation line	Length in km	km/MW	Maximum /Minimum Length of Line
66 kV	395.00	119.75	0.30	26 km/1 km
132 kV	100.00	114.00	1.14	114 km
220 kV	1100.00	394.00	0.36	175 Km/ 68 km
	1595.00	627.75		

(Source: GETCO)

The Commission has noted that the components of evacuation line include line conductors, insulators, CT, PT, transformer, steel structures, civil works, switchgears bay for connection, ABT meters, RTU etc. The Commission is aware of the price escalation in the basic material cost and raw materials over the last control period. Considering the wind power project evacuation line constructed till 31 March 2012 and also the wind power projects evacuation line in progress, the Commission proposes to fix Rs. 41 lakhs/MW towards cost of evacuation system from wind farm substation to GETCO substation for computation of wind power tariff for the next control period.

After receiving the comments from stakeholders, the Commission will finalise its view on Option 1 and Option 2 above with scope of execution of evacuation line and the cost thereof.

3.3.3 Operations and Maintenance Cost

Operations and Maintenance (O&M) cost consists of the statutory charges, spares, employee cost, administrative and general expense, consumables, repairs and maintenance, and insurance expenses, etc. The maintenance of wind farms is carried out through a centralised maintenance system which results in a lower amount of employee expenses as well as administrative and general expenses. The Commission had, in its earlier order, considered the O&M expenses at Rs. 6.5 lakhs/MW for the year 2009-10 with escalation of 5% from the second year onward. These charges were as per the then CERC tariff order dated 3 December 2009.

The CERC RE Tariff Regulations 2012 has recognised the cost escalation in the last three years and increased the O&M cost to Rs. 9 lakhs/MW with an annual escalation of 5.72% over the

tariff period. In view of the above, the Commission proposes the O&M charges of Rs. 9 lakhs/MW with annual escalation of 5% for the control period starting August 2012.

3.3.4 Capacity Utilisation Factor

Capacity Utilisation Factor (CUF) influences the economics of a wind project at a particular wind site. The CUF at a given location would depend on (i) site-specific parameters such as wind velocity, wind density and weibull parameters, as well as (ii) machine-specific parameters like hub height, rotor diameter, micro-sitting technique used and power curve of the machine. Wind power density which is a function of wind velocity and air density presents a better indicator for determination of normative CUF.

As discussed above, the CUF at a given location predominantly depends upon (i) site-specific parameters, in a broad sense state-specific parameters and (ii) machine-specific parameters. It is imperative to analyse these two parameters in the context of the state of Gujarat before arriving at benchmark normative capacity utilisation factor for wind power tariff determination.

Analysis of machine WTG rating

The current market trend is towards higher hub height and higher turbine capacity to extract more energy from wind. The state of Gujarat is not an exception to this as can be seen from the installation trend of MW-Class and Sub-MW Class of WEGs commissioned in Gujarat during the control period of the Wind Tariff Order dated 30 January 2010.

Table No.3.4 MW-Class and Sub-MW Class WTG Installations in Gujarat

Duration	Total Installed Capacity (MW)	Total Installation (MW) with sub MW class WTG	Total installation (MW) with MW Class WTG
10.08.2009 to 31.03.2010	219	76	143**(65%)**
01.04.2010 to 31.03.2011	313	103	210**(67%)**
01.04.2011 to 31.03.2012	790	263	527**(66%)**
Total	1,322	442	880**(67%)**

The above table clearly underlines the fact that MW class machines with higher hub height are being preferred by the developers/investors in Gujarat. Therefore, it is imperative that the benchmark normative capacity utilisation factor needs to capture the wind resource at the preferred hub height of the WTG i.e. 80 m.

Analysis of Site/State specific parameters

1. C-WET in association with Riso DTU National Laboratory for Sustainable Energy (NLSE), Denmark developed the Indian Wind Atlas which has been published in April 2010. In the wind atlas meso scale models have been used to develop the wind resource map of India for

50 m and 80 m level. The results generated from the meso scale models have been correlated with the actual measured data from various wind monitoring stations to arrive at certain accuracy of the meso scale wind mapping. The C-WET map shows that most of the areas in Gujarat have wind power density of 200-375 W/m^2 at 80 m hub height and there are very less areas with wind power density lower than 200 W/m^2.

2. The Lawrence and Berkeley National Laboratory (LBNL) under a study 'Reassessing Wind Potential Estimates for India: Economic and Policy Implications' published in March 2012 has developed the wind power density map. This map shows that, at 80m hub height the wind power density in Gujarat is in the range of 200-375 W/m^2.

Determination of normative CUF

The CERC and the MERC have proposed wind power density zone based CUF for determination of wind power tariff. However, seeing the implementation issues in adopting the zone based CUF, the Commission proposes to continue the benchmarking of normative CUF for tariff determination for the next control period.

In order to determine the normative CUF for the state, the Commission has analysed the CUF from theoretical and practical point of view as given below:

1. Wind Resource Survey of India published by C-WET gives the WPD data for the wind monitoring masts installed in Gujarat under the Wind Power Programme of the GoI. C-WET has conducted the wind resource assessment studies at 69 locations in Gujarat at 20-50 m mast height. The available C-WET data at 20 m-50 m height is extrapolated at 80 m level for all the 64 potential locations as data is available for 64 locations identified in Gujarat. The 64 potential locations identified in the state are grouped into the five groups of the wind power density at 80 m hub height as adopted by CERC under CERC RE Regulations 2012. The CERC under the RE Regulations 2012 has determined the net capacity utilisation factors for the five zones of the wind power density based on the LBNL study referred in (2) above and power curves of wind turbine available in India having 80 m hub height. This exercise reveals the following results.

Table No.3.5 Wind Power Density at 80 m and Corresponding CUF

Wind Zones	Wind Power Density Watt/m^2 at 80m hub height	% CUF at 80 m hub height	No of potential Wind Sites in Gujarat
Z1	Up to 200	20%	20
Z2	201-250	22%	24
Z3	251-300	25%	10
Z4	301-400	30%	8
Z5	401 above	32%	2
		Total	**64**

(Source: C-WET, CERC, TERI)

The C-WET and LBNL studies show most of the wind power potential area in Gujarat in 200-375 W/m^2 qm wind power density zone at 80 m hub height. Therefore, the corresponding CUF for wind power density in the range of 200-375 W/m^2 of as declared by CERC in its RE Regulations 2012 is in the range of 22% to 30%.

2. The Gujarat Energy Development Agency (GEDA) and the State Load Dispatch Centre (SLDC) have provided data with regard to wind power project installation and CUF in the state during the control period of GERC wind power tariff order 2010 (i.e. from FY 2009-10 to 2011-12). The project-wise/investor-wise CUF was worked out from the data provided by the SLDC and GEDA for projects commissioned during FY 2009-10 to 2010-11.

   In order to examine the actual CUF achieved by the WTG at 80m hub height, MW class machines installed in the state are separated out from the available data. The analysis shows that 143 MW of wind power projects having MW-scale WTG commissioned in FY 2009-10 have achieved CUF in the range of 17.64% to 26.97% and 18.94% to 25.82% during 2010-11 and 2011-12 respectively. Further, 210 MW of wind power projects having MW-scale WTG commissioned in FY 2010-11 have achieved CUF in the range of 15.29% to 31.62% during 2011-12.

Considering the wind power density of the potential areas in Gujarat reported by C-WET/LBNL/the corresponding CUF recommended by CERC, the actual CUF achieved by MW class WTG during 2010-11 and 2011-12, and the fact that with advancement in technology during the next control period (11 August 2012 to 31 March 2016), it appears that the CUF of future projects will also increase. In view of the above, the Commission considers a normative CUF of 24% for the purpose of tariff determination.

3.4 Financial Parameters

3.4.1 Debt-Equity Ratio

GERC Multi Year Tariff (MYT) Regulations 2011 provide the normative debt-equity ratio of 70:30 for Generating Company/Licensees. Also, the recent CERC RE Regulations 2012 have considered the same debt-equity ratio for wind power projects. The Commission proposes to consider the debt equity ratio as 70:30 as considered in the previous wind tariff order.

3.4.2 Loan Tenure

GERC in its Wind Tariff Order dated 30 January 2010 had stipulated the loan tenure of 10 years. The CERC in RE Tariff Regulations 2012 had revised the loan tenure from 10 years to 12 years. The Commission noticed that investors did not face any problems in obtaining the loan during the last control period. Therefore the Commission prefers to keep loan tenure equal to 10 years while determining the tariff during the next control period.

3.4.3 Interest on Term Loan

The Commission in its Wind Tariff Order dated 30 January 2010 had considered the long term interest rate of 10.75%. This was worked out on the basis of the then SBI Prime Lending Rate minus 1 (one) percent. Banks are now following the base rate system after the RBI guidelines. While all banks have their own base rates, the project financing interest rates are typically indicated by the SBI base rate. A reasonably sound project usually gets funding at the rate of 150 to 300 basis points above the base rate.

Table No. 3.6. SBI Base Rates from 1 April 2011 to 15 June 2012.

Period	SBI Base Rate
1 April 2011 To 24 April 2011	8.25%
25 April 2011 to 11 May 2011	8.50%
12 May 2011 to 10 July 2011	9.25%
11 July 2011 to 12 August 2011	9.50%
13 August 2011 to 15 June 2012	10.00%

The weighted average Base Rate of SBI for the period between 16 June, 2011 to 15 June, 2012 is 9.91%. From the above table it is observed that the current SBI Base Rate of 10.00% is constant since 13 August, 2011. From the data submitted by IREDA it is also observed that the term loan sanctioned to the wind power projects in FY 2011-12 varies from 11.75% to 12.75%. In view of the above, it is proposed to use the current base rate of SBI for the tariff under discussion with a spread of 200 basis points above the current SBI base rate for tariff determination purpose.

Hence, the interest rate on term loan for tariff computation is determined as 12%.

3.4.4 Rate of Depreciation

CERC, in its (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2012 had considered the Capital Cost of the asset admitted by the Commission as value base for the purpose of determination of depreciation. Further, the salvage value of the asset considered as 10% and depreciation is allowed up to a maximum of 90% of the Capital Cost of the asset. Depreciation per annum shall be based on 'Differential Depreciation Approach'

over loan tenure and the period beyond loan tenure over useful life computed on 'Straight Line Method.'

GERC, in its Wind Tariff Order dated 30 January 2010 had considered a high rate of depreciation as a promotional measure during the loan tenure, and then the remaining depreciation is spread over the remaining useful life. In view of the above, the Commission proposes to continue the same approach for the tariff order under discussion.

Hence, depreciation of 6% per annum is considered for the first 10 years, and 2% from 11th year to 25th year.

3.4.5 Working Capital

The Commission in its Wind Tariff Order dated 30 January 2010 had considered the components of working capital as follows:

1) Receivable of one month.

2) O&M cost for one month.

The Commission proposes to continue the above components as part of the working capital for determination of tariff for the next control period.

3.4.6 Interest on Working Capital

The Commission in its Wind Tariff Order dated 30 January 2010 had considered the interest rate on working capital at 11.75% which was equivalent to the SBI PLR at that time. The Commission is of the opinion that requirement of working capital is recurring and is for a shorter time period. Hence, it is possible to get the same at a lower rate because of likely declining trend in future. Hence, the Commission proposes to consider the interest on working capital equal to 50 basis points lower than that of interest on long term loan.

Hence, the interest rate on working capital is considered as 11.50%

3.4.7 Return on Equity

The equity base for computing return will be 30% of the project capital cost considered by the Commission. If the equity employed by the project developer is more than 30%, the amount of equity for the purpose of determining the tariff will be limited to 30% only and the rest is to be treated as loan. In case the equity employed is less than 30%, the actual equity employed will be considered.

The GERC Multi Year Tariff Regulations, 2011, notified by the Commission provides norms for the Return on Equity as 14% per annum. Further the Commission has allowed MAT at

20.008% per annum for first 10 years and corporate tax at 32.445% per annum for the next 15 years.

3.4.8 Discount Rate:

The CERC in its Notification No. Eco 1/2012-CERC dated April 03, 2012 decided the discount rate of 11.08% to be considered for the Bid Evaluation for the determination of tariff for procurement of power by Distribution Licensees under the Competitive Bidding. Keeping in view the above CERC notification, the Commission proposed to consider the discount rate of 11.08% for determination of levelised tariff of WTG to be established during the control period as stated in this discussion paper.

3.5 Incentives for Wind Power Projects

The incentives available for wind power projects are as follows:

3.5.1 Accelerated Depreciation

Till 31 March 2012, the Government of India had allowed the wind power project investors to avail accelerated depreciation at the rate of 80% in the first year on a written-down value (WDV) basis as per Section 32 Rule 5 of the Income Tax Act. However, this incentive has been discontinued from 1 April 2012. Wind power projects are now allowed to avail 15% normal depreciation as per Income Tax (4th amendment) Rules 2012, Notification No. 15/2012 [F.No.149/21/2010-SO (TPL)] S.O.694(E), dated 30-3-2012.

In addition to the above 15% depreciation, the recent amendment in the Finance Act had allowed an additional depreciation of 20% to the wind power projects during the first year of commissioning. With this, wind power projects can avail 35% depreciation in the first year of commissioning. Hence, 35% depreciation is considered for calculation of depreciation benefit and is proposed to be passed on to the utility.

3.5.2 Generation Based Incentive (GBI)

On 17 December 2009, the Ministry of New and Renewable Energy issued a scheme for implementation of Generation Based Incentives (GBI) for grid interactive wind power projects. Under this scheme, a GBI was offered to wind electricity producers at Rs. 0.50 per kWh 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. 6.2 million per MW. The total disbursement in a year was limited to one-fourth of the maximum limit of the incentive i.e. Rs.1.55 million per MW during the first four years. This incentive was over and above the feed-in-tariff declared by SERCs. The GBI scheme closed on 31 March 2012. There are no further guidelines on the extension of this incentive beyond 1 April 2012.

3.6 Computation of Tariff for Wind Power Project

The parameters proposed for tariff determination during the control period starting from 11th August 2012 are compared with the parameters considered by the Commission in its Wind Tariff Order dated 30 January 2010 as presented below:

Table No. 3.7. Comparison of the Proposed Parameters with those in the Wind Tariff Order Dated 30 January 2010

Parameters	As per Wind Tariff Order dated 30 January 2010	Proposal for New Control Period starting from 11th August 2012	
		Option I (Interconnection point at wind farm pooling S/S)	Option II (Interconnection point at GETCO S/S)
Project Cost			
Land + Plant & Machinery + Erection Cost (Rs. Lakh/MW)	462	568	568
Evacuation Infrastructure Cost (Rs. Lakh/MW)	38	0	41
Total Project Cost (Rs. Lakh/MW)	500	568	609
Normative O&M Cost for First Year (Rs. Lakh/MW)	6.5	9	9
Escalation in O & M (per annum from 2nd year)	5%	5%	5%
Performance Parameters			
CUF	23%	24 %	24%
Project Life in Years	25	25	25
Financial Parameters			
Debt-Equity Ratio	70:30	70:30	70:30
Term of Loan in Years	10	10	10
Interest on Term Loan	10.75%	12%	12%
Interest on Working Capital	11.75%	11.5%	11.5%
Depreciation	6% (for first 10 years) 2% (from 11 to 25years)	6% (for first 10 years) 2% (from 11 to 25 years)	6% (for first 10 years) 2% (from 11 to 25 years)

Parameters	As per Wind Tariff Order dated 30 January 2010	Proposal for New Control Period starting from 11th August 2012	
		Option I (Interconnection point at wind farm pooling S/S)	Option II (Interconnection point at GETCO S/S)
Minimum Alternate Tax (MAT) (For first 10 years)	16.995%	20.008%	20.008%
Corporate Income Tax (From 11th year onwards)	33.99%	32.445%	32.445%
Return on Equity	14%	14%	14%
Tariff	**Rs. 3.56 per kWh**	**Rs. 3.97 per kWh**	**Rs. 4.21 per kWh**

:: End of Chapter 3 ::

4. Other Commercial Issues

4.1 Transmission and Wheeling Charges

The Commission in its Wind Tariff Order dated 30 January 2010, had specified normal transmission charges and transmission losses for wheeling of wind power at 66 kV and above voltage level. However, concessional transmission and wheeling losses @ 10% of energy fed into the grid was allowed to wind power projects wheeling wind energy below 66 kV level.

During the control period of the above wind tariff order, the Renewable Energy Certificate mechanism (REC) was introduced in India from January 2010. As per the provisions under the CERC REC Regulations, wind power projects installed for captive use are allowed to avail RECs on total generation including self-consumption provided that such projects have to forego the concessional transmission and wheeling charges/losses and other benefits offered by the state Government/SERCs. The relevant provision is reproduced as follows:

"Provided further that a Captive Power Producer (CPP) based on renewable energy sources shall be eligible for the entire energy generated from such plant including self-consumption for participating in the REC scheme subject to the condition that such CPP has not availed or does not propose to avail any benefit in the form of concessional/promotional transmission or wheeling charges, banking facility benefit and waiver of electricity duty."

Therefore, in view of the above development, the Commission propose to retain the transmission and wheeling charges as specified in the Wind Tariff Order dated 30 January 2010. However, the wind power projects wheeling power for captive use and opting for RECs, will have to pay normal open access charges.

4.2 Cross-Subsidy Surcharge

The Commission in its Wind Tariff Order dated 30 January 2010, had exempted third party sale of wind energy from the cross subsidy surcharge. In order to promote renewable energy projects, the Commission had earlier exempted from the cross-subsidy surcharge all open access transactions from wind power projects. Considering the above, the Commission proposes to continue the exemption of cross-subsidy surcharge for the next control period.

4.3 Energy Metering

Wind power projects are kept out of the purview of the intra-state ABT. However, for the purpose of energy accounting, such projects shall have to provide ABT compliant meters at the interface points. Interface metering shall conform to the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006. The electricity generated from the

wind power generator shall be metered and readings shall be taken jointly by the wind power project developer with the Gujarat Energy Development Agency (GEDA), Gujarat Energy Transmission Company Ltd. (GETCO) or Distribution Company at the interconnection point of the generator bus-bar with the transmission or distribution system concerned, as the case may be.

4.4 Pricing of Reactive Power

Some of the wind energy generators require reactive power during initial start-up and their station transformers also continuously require reactive power from the grid. Hence, in order to maintain the grid stability it is necessary to limit such reactive power consumption from the grid by installation of suitable compensation devices. In order to restrain the wind power projects from consuming more reactive power from the grid and to encourage them to install suitable devices to limit such reactive power consumption, the Commission in its earlier order had allowed Reactive Energy Charges to be recovered from Wind Power Projects. The reactive energy charges as incorporated in the Commission's Wind Tariff Order dated 30 January 2010 is reproduced as below:

"10 paise/kVARh – For the drawl of reactive energy at 10% or less of the net energy exported.

25 paise/kVARh – For the drawl of reactive energy at more than 10% of the net active energy exported".

The Commission proposes to continue the above charges for the next control period.

4.5 Sharing of Clean Development Mechanism (CDM) Benefits

In case of sharing of CDM benefit, the Commission in the its Wind Tariff Order dated 30 January 2010 has adopted the recommendations made by the Working Group on Renewable Energy Generation constituted by the Forum of Regulators. The relevant clause of the previous Wind Tariff Order is as below:

"The CDM benefits should be shared on a gross basis, starting from 100% to developers in the first year after commissioning, and thereafter reducing by 10% every year till the sharing becomes equal (50:50) between the developers and the consumers, in the sixth year. Thereafter, the sharing of CDM benefits should remain equal till the time that benefit accrues."

The Commission proposes to retain the above provision for sharing of CDM benefits for the next control period.

4.6 Banking of Surplus Wind Energy

The Commission in its Wind Tariff Order dated 30 January 2010, had allowed to set off captive consumption against the energy generated during peak and normal hours to the captive wind power projects set up after 1 July, 2009. Considering the infirm nature of wind and changing electricity rates through the year based on the ABT mechanism, the wind energy projects were allowed for only one month banking for the electricity generated during the month. However, captive wind power projects are eligible to utilise the same within one month in proportion to the energy generated during peak and normal hours. Considering the variability of wind generation and in order to encourage the use of wind power for captive use, the Commission proposes to continue the banking facility for the next control period.

4.7 Purchase of Surplus Power from Wind Power Projects Opting for Captive use and Third Party Sale under Open Access.

Considering the variability of wind generation, the captive wind power projects are allowed one month's banking as per the Commission's Wind Tariff Order dated 30 January 2010. The banked energy was allowed for captive consumption during peak and normal hours within a month. At times, when captive wind energy consumers were unable to utilise the surplus energy within a month, it was considered as sale to the distribution licensee concerned. The surplus wind energy available was allowed for purchase by the distribution licensee concerned at the rate of 85% of the tariff declared by the Commission. Also in case of open access transactions for third-party sale of wind energy, the surplus wind energy available after set off with open access consumer's consumption in the same 15 minutes time block is treated as sale to the distribution licensee concerned at the rate of 85% of the tariff declared by the Commission.

4.8 Renewable Energy Certificates for Third Party Sale and Captive Use of Wind Energy

Power generated from wind power projects if wheeled to third party or for captive use will be eligible for availing the Renewable Energy Certificates under the CERC REC mechanism. Provided further that a Captive Power Producer (CPP) based on renewable energy sources shall be eligible for the entire energy generated from such plant including self consumption for participating in the REC scheme subject to the condition that such CPP has not availed or does not propose to avail any benefit in the form of concessional/promotional transmission or wheeling charges, banking facility benefit and waiver of electricity duty. It is clarified that the energy procured/consumed from the WTG which are registered under REC scheme shall not qualify for fulfilment of RPO.

4.9 Security Deposit

In its order No. 1 of 2010, dated 30.01.2010, the Commission had decided that the project developer has to furnish Bank Guarantee of Rs. 5 lakhs/MW as a security deposit to GETCO to ensure the seriousness of the project developer. The Commission proposes to retain the same provision.

In case of delay in project commissioning beyond the allowed period due to unforeseen reasons, the Commission proposes that GETCO may issue extensions on case-to-case basis.

GERC presents this Discussion Paper to initiate the regulatory process for determination of wind power procurement tariff for the next control period starting from 11 August 2012. GERC invites comments from stakeholders for determination of wind power tariff for the new control period. The performance and financial parameters and tariff proposed in this discussion paper are indicative and will be finalised with the tariff order.

Sd/-

[Dr. Ketan Shukla]
Secretary
GERC

Place: Ahmedabad

Date: 03/07/2012

:: End of Chapter 4 ::