WIND POWER TARIFF POLICY – INDIAN SCENARIO

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Abstract:
India was the first country in the world to set up a ministry of non-conventional energy resources. With the wind policy support for wind power, India now has the fifth largest installed wind power capacity in the world. Although, renewable energy inherently seems to be a cheapest option as its fuel - the source of energy- is free & abundantly available, nonetheless, it isn't so. A proper tariff design is a mechanism to incentivise and accelerate investments in renewable energy. This paper presents an overview of different aspects of the tariff policies adopted in India for wind energy systems.

1. Introduction

"To truly transform the economy, protect our energy security, and save our planet from the ravages of climate change, we need to ultimately make clean, renewable energy the profitable kind of energy."

Barack Obama, President (USA)

World over serious concerns are being raised to make renewable energy a "profitable kind of energy". Although, renewable energy inherently seems to be a cheapest option as its fuel - the source of energy - is free & abundantly available. Nonetheless, it isn't so. To make it happen, the prevailing technology needs to be revolutionised to bring down the initial capital costs and enhance efficiency to a level to make it really competitive with conventional sources of energy. Colossal R&D is being done across the globe, both by Governments and Industry as well, to achieve this target of making renewable energy a viable solution[2].

There are some innovative policy measures adopted by Governments which makes Renewable Energy a viable proposition and encourage further proliferation of the renewable energy. The most popular measures like tax breaks, preferential tariffs, incentives, etc. are oriented towards provision of direct or indirect subsidies and thus have their own pros & cons on the economics of a Nation.

Climate change and diminishing supplies of fossil fuels are creating greater interest in renewable energy and therefore, wind energy is growing across the globe. The quantum of energy associated with wind is huge. With modern day technology, wind is an environment friendly and economically viable source of energy, which can be tapped in a commercial scale.

Economic issues of wind energy systems are multidimensional[3]. Economic merit of a wind generation plant depends on the local conditions. For a wind turbine, the fuel is free, but the capital investment is high. The cost of wind generation depends on the cost of the wind turbine, other essential requirements like land, transmission lines, power conditioning systems etc.

2. Feed-in Tariff

A feed-in tariff (FIT) is a *policy mechanism* designed to incentivise and accelerate

investments in renewable energy by offering long term contracts to renewable energy generators, usually based on the cost of generation of the technology used.

FIT is also known by the names, Advanced Renewable Tariffs (a system of feed-in tariffs for different technologies), Renewable Energy Payments (the 'tariffs' are a payment per kilowatt-hour of electricity generated), Standard Offer Contracts (Feed-in tariffs use 'standard contracts' and 'standard offers' and 'offers' may differ by technology (one price for solar, another for wind and so on) Fixed-Price Policies, Minimum Price Policies, Feed laws, Feed-in laws etc.

A good feed-in law can overcome many barriers to market entry for RE producers[4] by:

a. Giving RE priority access to the grid (connectivity)
b. Giving first priority as Must Run status
c. Obliging grid operators to purchase electricity from renewable sources
d. Setting the price for RE electricity for long, fixed periods
    - Longer contracts with lower initial tariff while Shorter contracts with higher initial tariff
e. Standardized contract (model Power Purchase Agreement)
f. Setting no limit to amount of RE feeding into the grid

In this way FIT provides long-term certainty about receiving financial support, which is considered to lower investment risks.

Well designed and implemented FITs can also[4]:

a. Support installations of different sizes and technologies: in addition to large RE projects for wind, solar, biomass etc. and house-holds can now get a guaranteed pay-back on a solar roof in just a few years, rather than 20–30 years.
b. Promote innovation: annual reduction of tariffs for new installations drives technological efficiency.
c. Drive economies of scale: investment and demand are rising, and manufacturing expansion is taking place globally in response, lowering costs further.

3. Design elements of Tariff

The tariff is differentiated by Technology (wind, solar, biomass, hydro, etc.), Project size (higher prices for small projects while lower prices for large projects), Resources qualities, Application (higher prices for rooftop solar, BIPV), Project location. The other elements are Pre determined and Responsive tariff degression, Annual inflation adjustment, Front-end loading (i.e., higher tariffs initially, lower tariffs later on, which can help to reduce financing cost without increasing the total sum of financial support), Time of delivery (coincidence with demand to encourage peak shaving).

Since first introduced in Germany in 1991, FIT has gained greater popularity worldwide. As of early 2012, at least 65 countries have enacted FIT policies[6]. FIT has been considered as successful in terms of deployment, by some estimates they are responsible for approximately 75% of global solar photovoltaic and 45% of global wind capacity.

Feed-in tariffs have become the most widely used policy instrument to promote renewable energy deployment around the world. In the *Policy Research Working Paper 6376*, "How Fit are Feed-in Tariff Policies? Evidence from the European Wind Market", Fan Zhang[6] examines the relation between tariff setting and policy outcome based on wind capacity expansion in 35 European countries over the 1991–2010 period. Using a dynamic panel data model, they have estimated the long-run elasticity of wind deployment with respect to the level of feed-in support and have found that higher subsidies do not necessarily yield greater levels of wind installation. Non-economic barriers and rent-

seeking may have contributed to the weak correlation. On the other hand, the length of feed in contract and guaranteed grid access are important determinants of policy effectiveness. A one-year extension of an original 5-year agreement on average increases wind investment by 6% annually, while providing an interconnection guarantee almost doubles wind investment in one year.

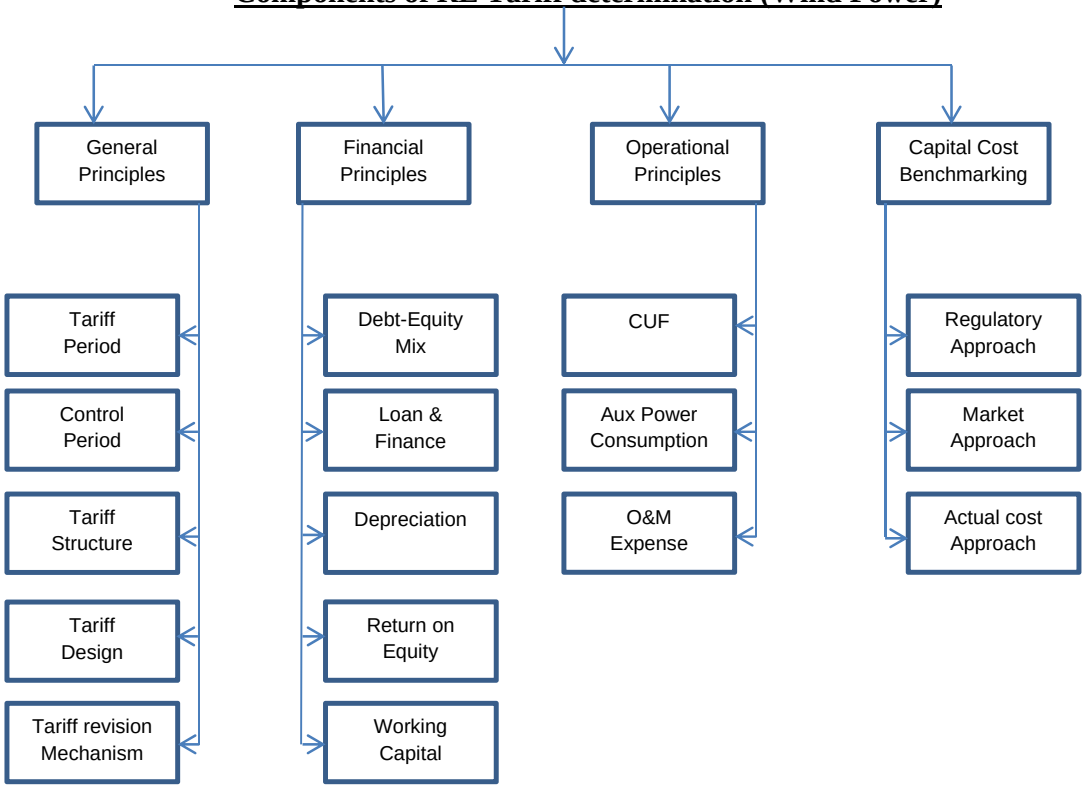
4. Over view of Tariff determination of Wind Power in India

Power is a concurrent subject in India, i.e. both the central government and state governments are empowered to enact policies and regulations. The institutions of Electricity Regulators were established in 1998, with a Central Regulator (Central Electricity Regulatory Commission) and State-level Regulators (State Electricity Regulatory Commission) in each state. The Regulators are autonomous and are legally empowered. The policy and regulatory framework in India is therefore a mix of Federal Government policies, Central Electricity Regulator's guidelines, directives of State Electricity Regulators and policy prescriptions of State Governments.

CERC has issued RE tariff guidelines in 2009. In 2012, CERC notified the "Central Electricity Regulatory Commission (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2012" which came into force with effect from 01.04.2012. These regulations contain the procedure for determination of tariff of various category of RE sources. Subsequently, CERC has determined generic tariff of the RE projects for each year of control period. Salient features of the generic levellised generation tariff of wind power for the third year of the control period (i.e. 2014-15) are brought out below. The CERC has suggested wind power tariff ranging from INR 3.96/kWh to INR 6.34 kWh, on the basis of zoning.

State-specific feed-in tariffs began to be prescribed from 2003 onwards with Maharashtra Electricity Regulatory Commission being the first state to do so.

Components of RE Tariff determination (Wind Power)



Following are the components of RE Tariff determination (Wind Power):

a) Eligibility Criteria: Using new WTG
b) Useful Life: 25 years
c) Control Period: 5 years (first year 2012-13)
d) Tariff Period: 13 years
e) Tariff Structure: The tariff for RE projects is single part tariff consisting of the following fixed cost components:
   i. Return on equity
   ii. Interest on loan capital
   iii. Depreciation
   iv. Interest on working capital
   v. Operation and maintenance expenses
f) Tariff Design:
   i. The generic tariff is determined on levellised basis for the Tariff Period.
   ii. For the purpose of levellised tariff computation, the discount factor equivalent to Post Tax weighted average cost of capital is considered.
   iii. Levellisation is carried out for the 'useful life' of the Renewable Energy project while Tariff is specified for the period equivalent to 'Tariff Period.
g) Levellised Tariff: Levellised Tariff is calculated by carrying out levellisation for 'useful life' of each technology considering the discount factor for time value of money.
h) Discount Factor: The discount factor is equal to the Post Tax weighted average cost of the capital on the basis of normative debt: equity ratio (70:30). Considering the normative debt equity ratio and weighted average of the post-tax rates for interest and equity component, the discount factor is calculated. Interest Rate considered for the loan component (i.e.70%) of Capital Cost is 12.70%. For equity component (i.e. 30%) rate of Return on Equity (ROE) considered at Post Tax ROE of 16% considered. The discount factor derived by this method for all technology is 10.67% ((12.70% × 0.70 × (1 – 33.99%)) + (16.0% × 0.30)).
i) Capital Cost: The capital cost is inclusive of all capital works like plant and machinery, civil works, erection and commissioning, financing and interest during construction, and evacuation infrastructure up to inter-connection point. The Commission has specified the normative capital cost, applicable for the first year of control period i.e. FY 2012-13 for Wind Energy based power projects.

The normative capital cost for the remaining years of the control period is determined based on indexation mechanism which takes into account adjustments in capital cost with the changes in Wholesale Price Index of Steel and Wholesale Price Index of Electrical Machinery as per the following formulation:

$$CC_{(n)} = P\&M_{(n)} * (1+F_1+F_2+F_3)$$

$$P\&M_{(n)} = P\&M_{(0)} * (1+d_{(n)})$$

$$d_{(n)} = [a*\{(SI_{(n-1)}/SI_{(0)}) - 1\} + b*\{(EI_{(n-1)}/EI_{(0)}) - 1\}]/(a+b)$$

Where, $CC_{(n)}$ = Capital Cost for n^{th} year

$P\&M_{(n)}$ = Plant and Machinery Cost for n^{th} year

$P\&M_{(0)}$ = Plant and Machinery Cost for the base year

$P\&M_{(0)}$ is computed by dividing the base capital cost (for the first year of the control period) by $(1+F_1+F_2+F_3)$. Factors F_1, F_2, F_3 is as below

$d_{(n)}$ = Capital Cost escalation factor for year (n) of Control Period

$SI_{(n-1)}$ = Average WPI Steel Index prevalent for calendar year (n-1) of the Control Period

$SI_{(0)}$ = Average WPI Steel Index prevalent for calendar year (0) at the beginning of the Control Period

$EI_{(n-1)}$ = Average WPI Electrical Machinery Index prevalent for calendar year (n-1) of the Control Period

$EI_{(0)}$ = Average WPI Electrical Machinery Index prevalent for calendar year (0) at the beginning of the Control Period

a = Constant to be determined by Commission from time to time,

(for weightage to Steel Index), default value = 0.6

b = Constant to be determined by Commission from time to time,

(for weightage to Electrical Machinery Index), default value = 0.4

F_1 = Factor for Land and Civil Works, default value = 0.08

F_2 = Factor for Erection and Commissioning, default value = 0.07

F_3 = Factor for IDC and Financing Cost, default value = 0.10

Source for WPI (electrical & machinery and iron and steel), WPI (all commodities), WPI (Price of HSD): Office of Economic Advisor, Ministry of Commerce & Industry (www.eaindustry.nic.in)

Source for IRC (Average Annual Inflation rate for indexed energy charge component in case of captive coal mine source): CERC (www.cercind.gov.in)

Capital cost of Wind Energy Project: Normative cost for 2012-13 is INR 575 Lakh/MW. For 2014-15, based on indexation, it is INR 603.929 Lakh/MW.

j) Debt-Equity Ratio: 70:30, based on which Debt is INR 422.75 Lakh/MW and Equity is INR 181.17 Lakh/MW.

k) Return on Equity: Value base is 30% of capital cost. Normative ROE is:
   a. 20% per annum for the first 10 years, and
   b. 24% per annum from the 11th year onwards

l) Interest on Loan: The normative loan outstanding as on April 1st of every year is worked out by deducting the cumulative repayment up to March 31st of previous year from the gross normative loan. The normative interest rate is average State Bank of India (SBI) Base rate prevalent during the first six months of the previous year plus 300 basis points. Repayment of loan is considered from the first year of commercial operation of the project and is equal to the annual depreciation allowed. Average Base rate for first six months of FY 13-14 is 9.70%, applicable rate of interest on value base of loan as 70% of capital cost is 12.70%.

m) Depreciation: The value base for the purpose of depreciation is the Capital Cost of the asset. The Salvage value of the asset is considered as 10% and depreciation is allowed up to maximum of 90% of the Capital Cost of the asset. Depreciation per annum is based on 'Differential Depreciation Approach' over loan period beyond loan tenure over useful life computed on 'Straight Line Method'. The depreciation rate for the first 12 years of the Tariff Period is 5.83% per annum and the remaining depreciation is spread over the remaining useful life of the project from 13th year onwards @ 1.54% per annum. Depreciation is chargeable from the first year of commercial operation.

n) Interest on Working Capital: The working capital requirement is computed as below:
   i. Operation & Maintenance expenses for one month
   ii. Receivables equivalent to 2 (Two) months of energy charges for sale of electricity calculated on the normative CUF
   iii. Maintenance spare @ 15% of operation and maintenance expenses

   Interest rate on working capital is considered as weighted average of State Bank of India Base Rate prevalent during the first six months of the previous year plus 350 basis points (equivalent to interest rate of 13.20%).

o) Operation & Maintenance Expenses: Operation and Maintenance or O&M expenses' comprises of repair and maintenance (R&M), establishment including employee expenses and administrative & general expenses. Operation & maintenance expenses are determined for the Tariff Period based on normative O&M expenses. Normative O&M expenses allowed during first year of the Control Period (i.e. FY 2012-13) are escalated at the rate of 5.72% per annum over the Tariff Period. For 2014-15 normative O&M expenses are INR 10.05 Lakh/MW.

p) Capacity Utilization Factor (CUF):Annual Mean Wind Power Density (W/m^2) CUF

Wind zone - 1 (Up to 200) 20%
Wind zone - 2 (201 - 250) 22%
Wind zone - 3 (251 - 300) 25%
Wind zone - 4 (301 - 400) 30%
Wind zone - 5 (Above 400) 32%

q) Subsidy or incentive by the Central / State Government

Any incentive or subsidy offered by the Central or State Government, including accelerated depreciation benefit if availed by the generating company, for the renewable energy power plants is taken into consideration while determining the tariff.

5. Summary

Based on the aforesaid provisions in the Regulations, the generic tariffs of wind power projects for the financial year 2014-15 are worked out as under:

Particular	Levellised Total Tariff (FY 2014-15)	Benefit of Accelerated Depreciation (if availed)	Net Levellised Tariff (upon adjusting for Accelerated Depreciation benefit) (if availed)
	INR/Kwh	INR/Kwh	INR/Kwh
Wind Zone -1 (CUF 20%)	6.34	0.34	6.00
Wind Zone -2 (CUF 22%)	5.76	0.31	5.45
Wind Zone -3 (CUF 25%)	5.07	0.28	4.79
Wind Zone -4 (CUF 30%)	4.23	0.23	4.00
Wind Zone -5 (CUF 32%)	3.96	0.22	3.74

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