CENTRAL ELECTRICITY REGULATORY COMMISSION

NEW DELHI

Date: 30th March 2016

Coram: Shri Gireesh B. Pradhan, Chairperson
Shri A.K. Singhal, Member
Shri A.S. Bakshi, Member
Dr. M.K. Iyer, Member

STATEMENT OF REASONS

Central Electricity Regulatory Commission (Terms and Conditions for Tariff Determination from Renewable Energy Sources) (Fifth Amendment) Regulations, 2016

The Central Electricity Regulatory Commission ("The Commission"), exercising power under Section 178(2)(s) of the Electricity Act, 2003 ("the Act") read with Section 61 of the Act, has notified the Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2012 (referred as the "Principal Regulations" hereafter), which came into effect from 6.2.2012.

2. The Commission issued Draft Central Electricity Regulatory Commission (Terms and Conditions for Tariff determination from Renewable Energy Sources) (Fifth Amendment) Regulations, 2016 on 16th March 2016, vide public notice No. : L-1/94/CERC/2011 to amend the normative O&M expenses specified under Regulation 59 of the Principal Regulations in respect of Solar PV Power Project for the Financial Year 2016-17. The proposed amendment sought to add a proviso under Regulation 59 as under:

> "Provided that Normative O&M expenses for the last year of the Control Period (i.e. FY 2016-17) shall be Rs. 7 lakhs per MW."

3. Comments on the aforesaid draft amendment were invited from stakeholders until 28th March 2016.

4. Following stakeholders submitted their comments in writing :-

1. National Thermal Power Corporation (NTPC)
2. Hindustan Power
3. National Solar Energy Federation of India (NSEFI)

5. Subsequently, a public hearing was held on 29th March 2016 to get views of various

stakeholders. Following stakeholders attended the hearing :-

1. Welspun

2. NSEFI

6. The various issues raised by the stakeholders and Commission's analysis and decision thereof are discussed in subsequent sections below:

1. **O&M costs vis a vis Capital Cost**

Comments Received

1.1 NTPC has commented that major component of O&M expenses is the manpower cost which keeps increasing every year. Capital cost of solar PV plant experienced decline over the years mainly due to steep decline in price of solar PV modules, which constitute 60-70% of capital cost. Thus, due to decrease in capital cost, O&M cost of solar plant in percentage terms cannot be expected to remain same over years and will have an increasing tendency in percentage terms. Also, the O&M cost per MW depends upon the size of the plant. If the size of the plant is large, then because of economy of scale, O&M cost per MW corresponding to such plant would be less but for smaller size of plants, the norm for O&M cost per MW determined based on large size plants would not suffice. Since, Commission notifies only one norm for plants of all sizes, norms provided would have to be such that it takes care of plants of smaller size also. Alternatively, the Commission could consider separate norms (and consequently separate generic tariff) for small sized plants as is prevalent in case of gas turbines. It will not be possible for even bigger size plants with economies of scale to achieve such kind of O&M expenses and for smaller size plants, it may not be viable with the proposed O&M expenses. Components like inverters, SCADA, etc. are being imported and are prone to failures too. In the scenario of shortage of trained and experienced O&M manpower due to proposed lower O&M cost, solar PV plants may experience frequent failures, inefficient operation and equipment outages leading to lower generation.

1.2 Hindustan Power submitted that most of the Operations and Maintenance (O&M) Costs comprise of the expenses which are manpower related as well as administrative in nature and thus, inflationary in trend. The Commission has also observed in the Statement of Reasons to Central Electricity Regulatory Commission (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2009 that significant part of O&M expense is manpower cost. It has been submitted that had O&M Cost been directly related to Capital Cost, then O&M Cost as a percentage of capital cost would have been constant. But O& M cost is not a percentage of capital cost as it comprises of majorly of employee/administrative cost which has inherent increasing/inflationary trend.

1.3 NSEFI has commented that though the project cost has come down drastically, the O&M cost has not reduced due to the fact that it is directly proportional to manpower cost and other associative management cost to run the plant smoothly. Also, for bigger size projects, the O & M factor changes downwards. NSEFI has suggested to keep the O&M cost between 10-12 lakhs /MW/year.

Analysis & Decision

NTPC, NSEFI and Hindustan Power have noted that major component of O&M expenses is the manpower cost which has inflationary trend. They have argued that O&M cost should not be treated as a fixed percentage of capital cost, as most part of O&M cost comprises manpower cost which is independent of capital cost. NTPC has further stated that the present norm should hold for smaller plants as well, even though O&M cost per MW shall reduce with increasing size of the plant.

The Commission has taken note of these comments. The Commission feels that major component of manpower cost at the plant site is on personnel for cleaning the modules, arranging for water and its filtration, and security. The skilled personnel required are only for inspection and checking general plant performance on a daily basis, as the electrical maintenance required in solar PV plants is minimal. It is logical that manpower costs shall decrease per MW as plant size increases. However, it is also true that with advancement of technologies and economies of scale, larger size plants are becoming the norm. The Commission feels that the proposed O&M norm shall adequately compensate expenses on account of manpower employed at the plant site. The cost of manpower at control centres monitoring the data is also shared across several projects.

Additionally, it may be noted that specialized firms have been established over the last few years that provide O&M services to several solar PV projects in different locations. With increasing density of projects in particular high irradiation areas as well as more technically skilled manpower available as the industry grows, O&M contracts have in fact become cheaper. Thus, even with inflation resulting in increased cost of manpower, specialization and outsourcing has in fact reduced the financial burden of O&M on power producers.

2. Additional costs for forecasting & scheduling services and deployment of requisite personnel

Comments Received

2.1 NTPC has commented that after the introduction of day-ahead scheduling and corresponding DSM in solar plants also, deputing trained and experienced personnel round the clock has become a necessity, which will further increase O&M cost.

2.2 Hindustan Power commented that the Commission in the recent amendment to Deviation Settlement Regulations (DSM Regulations) has made forecasting and scheduling of infirm power for solar plants mandatory. This has resulted in two kinds of recurring expenses (i) the cost of engaging specialized agency for forecasting solar radiation (and hence generation) and (ii) the penalties associated with inaccurate forecasting beyond the exempted band of 15%. The first kind of cost, as indicated by the concerned agency is about 4.5 Lakh per annum for a plant capacity of 15 MW. It is to be noted that this cost will also attract service tax in addition to the quoted price. Further, there will be a requirement of additional specialized personnel at site for coordinating and on-line monitoring of forecasting and scheduling of the generation with various agencies. This will cost not less than Rs. 7.5 lakh/annum. It has been requested that this cost of forecasting of about Rs. 0.8 lakh/MW/annum may also be included in the O&M Cost. The second component of cost associated with scheduling is the penalty payable @ 10%, 20% and 30% of the tariff for deviations beyond 15%, 25% and 35% respectively. It has been shown in the studies conducted by the Commission that even after the revision in forecast allowed as per the regulations, about 6% of the forecast data is outside the exempted band. Assuming the average deviation for this 6% data to be 25% and the rate of penalty being 25%, the average penalty payable, in spite of the best forecast taken by the Commission, would be 6%x25%x20% (=0.3%) of Tariff. With current tariff of Rs. 7.04/unit, the average penalty works out to 2.1 paise/unit with an annual impact of 2.1*1.66 MU = Rs. 0.35 Lakh/MW. Thus, total impact of scheduling and forecasting on O&M Cost is to the tune of Rs. 1.15 Lakh/MW. It may kindly be noted that deviation beyond the deviation of 6 % would still be borne by the developer.

Analysis & Decision

In the order dated 23.3.2016 in Petition No. 17/SM/2015 (Suo-Motu), in the matter of 'Determination of Benchmark Capital Cost Norm for Solar PV power projects and Solar Thermal power projects applicable during FY 2016-17', it has been stated

that the cost of forecasting and scheduling services is minimal on per MW and monthly basis. The Commission maintains that. Skilled personnel required to manage this process are generally stationed at the control centre as all data are remotely monitored. This process is typically outsourced which has brought down the cost of service in the market. Most power producers do not employ full-time personnel to undertake these activities. Further, the Commission included the cost of SCADA and telemetry systems in this order. The cost of penalties due to forecasting errors cannot be included under O&M costs, and have to be borne by the developer.

3. Comparison of O&M costs with SERC orders

Comments Received

3.1 NTPC has commented that one of the reasons for proposing such steep reduction in norms is the consultative paper issued by TNERC where the O&M cost norm of 1.4% of capital cost has been proposed. NTPC has submitted that as brought out in the consultation paper of TNERC, the norms prescribed by GERC, RERC and MERC for the Solar PV projects are on the higher side. Since these states have substantial capacity of Solar PV projects, the norms prescribed by these States reflect the actual O&M expenses requirement for efficient operation of the projects. Further, O&M of the plant is very essential and any compromise on O&M cost will make it difficult for plant to run for 25 years. NTPC has requested the Commission to consider retaining the same O&M norms applicable in 2016-17 as per present CERC RE Tariff Regulations, 2012, which is Rs 13.67 L/MW.

3.2 Hindustan Power has with reference to TNERC’s draft order for determination of solar tariff in the explanatory memorandum commented that no rationale for this 1.4% of capital cost has been provided by even TNERC except that it followed this in the previous Tariff Order two years ago, in Order dated 12.09.2014. Secondly, TNERC allows insurance cost separately i.e. 0.35% of capital cost unlike the Central Commission which allows O&M Cost inclusive of insurance cost. Further, O&M contracts are outsourced and attract Service Tax, which is @15% as per latest Finance Bill. As per TNERC's order, the amount works out to Rs. 14.45 Lakh/MW for 2016-17. This doesn't include the cost incurred at Head Office. At Head Office, several manpower are required to oversee and manage day today works of O&M related activities including award of contract, human resource management, supervisory work by senior management etc. This cost is not below Rs. 1 Lakh/MW.

3.3 Further, Hindustan Power has referred to the judgment dated 17.04.2013 of Appellate Tribunal for Electricity (APTEL) in Appeal No. 75 of 2012 wherein APTEL has mandated that employees' expense is a major component of O&M expenses of solar power project and O&M cost should be in absolute value. Although, to arrive at the absolute value of O&M Cost in the matter before Hon'ble APTEL, Hon'ble APTEL expressed it through percentage of Capital Cost. The relevant extract of the said Judgment is reproduced as below;-

> *"8.8 As rightly pointed out by the Appellant and also indicated by the State Commission in the discussion paper, the employee's expense is a major component of O&M expenses of solar power project. The reduction in cost of Solar Power Projects is basically for the solar power module only. Therefore, the reduction of the capital cost should not impact the O&M cost appreciably. The intention of the State Commission in the discussion paper was also by providing O&M expenses at 0.75% of the proposed capital cost of Rs. 11 crores/MW i.e, at Rs. 8.25 lakhs/MW. However, the State Commission decided to reduce the capital cost to Rs. 10 crores/MW in the impugned order but maintained the O&M cost a Rs, 0.75% only, No explanation was given in the impugned order for effectively reducing the O&M expenses. We feel that the State Commission should have maintained 0&M expenses in absolute value at/east at the same level as approved for the FY 2010- 21 i.e. at Rs. 8. 25 lakhs/MW. Accordingly, we direct the State Commission to reconsider the O&M cost and allow atleast *0. 825% of the capital cost.*
>
> *8.9 Learned counsel for GUVNL has argued that the State Commission has also at/owed insurance cost in addition to O&M cost in the impugned order, We find that in the earlier order dated 29.1.2010 also the State Commission had allowed 0.35% of the net assets of the project, as insurance charges in addition to O&M charges. Therefore there is no force in the arguments of the Respondent no. 2 regarding insurance charges.*
>
> *8.10 Accordingly, the State Commission is directed to re-determine the O&M charges. "*

It may be pointed out here that GERC also separately allows insurance cost @0.35% of capital cost. The relevant extracts of Order dated 17.08.201 5 (for FY 2015-16) are reproduced as below:

> *"2.1.5 Operation and Maintenance Cost and its Escalation Photovoltaic power plants are characterized by their simple and low-cost operation and maintenance (O&M). The operation and maintenance of a photovoltaic power plant mainly*

involves cleaning of the photovoltaic modules at a regular interval. The cleaning frequency of the modules of a commercial plant maybe as high as once per week or as low as once per month. In addition to cleaning staff, the photovoltaic power plants typically done remotely require security staff and site supervisors, Performance monitoring of such plants are typically done remotely, and an engineer is deployed onsite only during troubleshooting of issues or preventive maintenance.

Earlier CERC and GERC tariff orders considered the operation and maintenance cost of 0.5% of the plant capital cost. However, the capital costs of the solar power plant equipment (especially the modules and inverters) have substantially reduced, while the labor cost involved in the operation and maintenance has witnessed Escalation. Hence, for the near term, the typical operation and maintenance cost of photovoltaic power plants is considered to be INR 10.75 lakh/MW/annum. This number has been arrived considering Honorable APTELs direction vide Judgment dated April 17, 2013 in Appeal No, 75 of 2012. Accordingly Honorable GERC passed Order No. I of 2012 dated July 7, 2012 where the Commission determined the O&M to be .fixed at INR 9~10 lakh/MW\annum escalating at 5.72% annually. Considering this as the cost for 2012-2013 and subsequently escalating this by 5.72% for the years 2013-14, 2014-25 and 2015-16 the Commission has arrived at the figure of INR 20.75 lakh/MW/annum. Further, as most of this cost is human resource-related, the annual escalation of the operation and maintenance cost is considered to be 5. 72% annually "

Commission's Ruling

The Commission takes into account that the service tax has been increased to 14.00% under the Finance Act 2015 and accordingly the O&M cost of a Photovoltaic power plant is working out to INR 10.90 lakh/MW/annum escalated annually at 5. 72%. "

Similar approach has been adopted by other ERCs, wherein the absolute amount has been determined by the Commission for 1st year generally based on the O&M cost considered by the Hon'ble Commission. The Central Commission in its previous regulation of 2009 adopted the Normative O&M of Rs. 9 Lakhs/MW which allowed for the escalation of 5.72% per annum and thereafter in 2012 Regulations normative O&M Cost of 11 Lakhs/MW for FY 2012-13 with annual escalation of 5.72% was fixed.

Also, it is the mandate of the Electricity Act 2003, National Electricity Policy and Tariff Policy to promote the Energy generation from Renewable Sources. By means of reducing the Normative

Operation and Maintenance Cost to 7 lakhs/MW without any credible basis, the Hon'ble Commission has proposed to act in contradiction to the clear mandate of Hon'ble APTEL and the prescribed policy measure. Also, the majority of O&M cost is independent of Capital Cost.

Analysis & Decision

NTPC has commented that O&M cost norms stated in orders by GERC, RERC, MERC etc should be considered. These O&M costs have been arrived at by escalating the O&M cost of the base year as per respective States' RE Tariff Regulations. The Commission had adopted the same methodology, but the market has changed with the nascent solar PV industry growing rapidly in the last few years. Thus, the cost components are not following a simple inflation indexed escalation as one expects to observe in a mature market.

Hindustan Power has relied upon the APTEL's Order dated 17.4.2013 in the case of GERC. APTEL has observed in the said judgment that the reduction in the capital cost should not impact the O&M cost appreciably. However, the Commission has gone through the various components of O&M cost in the light of the prevailing market conditions, availability of technology and specialized groups for providing maintenance support, and other market realities and has come to the conclusion that the O&M expenses of the Solar PV plants can be managed at the rate of Rs.7 lakhs/MW as proposed in the draft amendment.

Hindustan Power has also commented that TNERC allows for a separate insurance cost and service tax, which is not the case with CERC's norm. It is clarified here that insurance cost has been considered by the Commission as part of the 'Preliminary and Pre-operative expenses' as detailed under clause 9 of Solar capital cost benchmark order dated 23.03.2016. Secondly, Regulation 23 of CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2012, states that:

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

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

Thus, service tax is not an incorporated component in these norms and can be claimed separately.

4. Escalation rate

Comments Received

4.1 NSEFI has stated that Commission has to determine the levelised tariff which means fixed tariff for entire 25 years. Therefore, the Commission should also first amend the Regulation 39(2) of the CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2012 in the matter of specifying rate at which Normative O&M expenses are allowed to be escalated for determination of generic RE Tariff, which is presently 5.82%.

Regarding annual escalation in O&M expenses during the control period the Commission dealt with this issue in the Statement of Objects and Reasons Order issued on dated 14.03.2012 along with the notification of RE Tariff Regulations, 2012, which reads as under:

> ***"4.8.2 COMMISSION'S DECISION***
> *The Commission would like to clarify that, the escalation factor specified of 5.72% per annum is in line with the escalation factor considered for conventional power projects as per CERC (Terms and Conditions for Tariff) Regulation, 2009 for the Control period FY 2009 to FY 2014. If the provision in the said 2009 Regulations is amended, during the new Control period of the Renewable Energy Tariff, the Commission may consider extending the same prospectively to all the RE projects as well."*
>
> *The Commission has already notified new Tariff Regulations i.e. The CERC (Terms and Conditions for Tariff) Regulation, 2014. The Commission will come out separately draft amendment for public consultation in escalation rate in O&M for all RE technologies projects. Till that time the prevailing provisions in respect of annual escalation of O&M expenses for biomass based power projects shall remain unchanged. Considering the above, Clause (1) of Regulation 39 of the Principal Regulations shall be substituted as under:*
> *"39. Operation and Maintenance Expenses*
> *(1) Normative O&M expenses for the second year of the Control period (i.e. FY 2013-14 shall be ` 40 Lakh per MW."*

NSEFI has further submitted that the Commission has already notified the CERC (Terms and Conditions for Tariff) Regulation, 2014 (The Tariff Regulations, 2014) on 21.2.2014, wherein different annual escalation used while specifying Operation & Maintenance Expenses, during Control period from 2014 to 2019, for Thermal Power station (Coal, Lignite, Gas), Hydro Power Stations and for Transmission systems. Regulation 29(1)(a) of the Tariff Regulations, 2014 specify the normative Operation and Maintenance expenses for thermal generating stations.

The Compounded Annual Growth Rate (CAGR) of normative Operation and Maintenance expenses specified during the Control Period works out to 6.30%. Similarly, for Open Cycle

Gas Turbine /Combined Cycle generating Stations, CAGR works out to 6.28% for Gas Turbine/ Combined Cycle generating stations other than small gas turbine power generating stations and 6.81% for other gas based power stations.

The Commission in the Statement of Objects and Reasons dated 20.1.2009, issued along with CERC (Terms and Conditions of Tariff) Regulations, 2009 has stated that the escalation rate for the tariff period has been arrived at 5.72% after considering the inflation data for the period 2003-04 to October 2008. The CAGR for the period from 2006 to 2015 works out to 7.00%. Based on the above analysis, NSEFI requests Hon'ble commission to first initiate the Regulatory process for amendment of the Annual Escalation Rate from 5.72% to 7% and thereafter determined the Levellised Tariff for Solar PV project for FY 2016-17.

Analysis & Decision

NSEFI has presented a detailed analysis of escalation rates adopted for different categories of thermal, hydro and gas power plants. In previous sections, it has been elaborated how the solar industry is growing which is resulting in reduced prices of O&M contracts. Even including escalation based on inflation, the Commission feels that Rs. 7 lakhs/MW per year is adequate. This is also the last year of the control period, and the Commission shall revisit the escalation rate appropriately in the next control period.

5. **Miscellaneous**

5.1 NTPC commented Solar plants are normally located in remote places resulting in higher cost of repair and maintenance. This adds on to the O and M expense. NTPC has also stated that future solar plants will be located in arid zone where water availability is less, which would increase the cost of water.

5.2 Hindustan Power opines that sudden change in the fixed norms creates an environment of Regulatory uncertainty and unwelcoming investment climate. This not only creates a threat to investment in renewable sources of energy but also the security of the capital investment which is recovered over a long period of time. Also, the O&M contracts are generally outsourced and even if the same is taken as Rs. 7 Lakh/MW as proposed by Hon'ble Commission, they attract Service Tax, which is @15% as per latest Finance Bill. Moreover, these contracts are only for manpower services for maintenance only and spares and materials are provided separately by the developer. The security staff is engaged in addition to the said manpower. Further, water supply is arranged by the developer at its own cost, whether ground water or through tankers. These costs will make the O&M Cost excluding insurance almost close to Rs. 12.6 Lakh/MW as derived earlier, which works out to Rs. 14.45 Lakh/MW with insurance for 2016-17. Thus, there is no rationale for reducing the O&M Cost as proposed by the Commission. In fact, the Commission should have proposed the amendment to capture increase in change in law, e.g. increase in IT/MAT/Service Tax, in the existing norms rather than decreasing the O&M cost.

5.3 NSEFI commented it appears that the Hon'ble Commission in order to reduce the Solar PV Generic Tariff for FY 2016-17, to match with recently discovered tariff through competitive bidding, hurriedly came out with the proposed draft amendment and reduced first year Operation & Maintenance Cost. It is submitted that the Commission should avoid piecemeal amendment in the RE Tariff Regulations as the major rationale behind the reduction in tariff is due to financial engineering, fierce competition among developers, foreign funding, lower expected return on equity. There is a doubt that any of such lowest bided projects might come up on the ground. NSEFI has requested to keep this amendment in abeyance. NSEFI has also highlighted that the Commission doesn't allow annual degradation in CUF, insurance cost, auxiliary consumption, nation-wide variation in CUF, inverter replacement cost, forecasting and scheduling cost in the benchmarking of solar capital cost.

Analysis & Decision

NTPC has stated that solar plants are located in remote areas and in arid areas, resulting in higher cost of maintenance and water. Remote location is already factored into the proposed O&M cost and in several components of the capital cost benchmark such as civil works and evacuation costs. The availability of water is a location specific issue that cannot be considered in determining a generic tariff.

Hindustan Power has commented that O&M contracts are for manpower services only while spares are provided separately by the developer.

The Commission has already included cost of replacement of modules as well as inverters specifically in the capital cost benchmark. Additional contingency expenses are also provided for under Preliminary and Pre-operative expenses. Most BoS electrical components come with warranty and should not pose a significant additional cost of replacement.

NSEFI has argued that the Commission has undertaken this reduction to match

with recently discovered tariff through competitive bidding, and those are primarily through financial engineering and other financial factors. NSEFI has also quoted factors not considered in benchmarking of solar capital cost. The Commission reiterates that this amendment is to bring the O&M cost norms in line with current market reality.

Factors for solar cost benchmarking are beyond the scope of this amendment.

6. **Accordingly, the amendment as mentioned in para 2 above is approved for notification without any modification.**

Sd/	Sd/-	Sd/-	Sd/-
(M.K.Iyer) **Member**	**(A.S. Bakshi)** **Member**	**(A.K. Singhal)** **Member**	**(Gireesh B. Pradhan)** **Chairperson**