Staff Paper on
"Methodology for Computing the Escalation Factors and other Parameters for the Purpose of Bid Evaluation and Payment for Procurement of Power from Renewable Energy Projects Complemented with Firm Power from any other source through Competitive Bidding" [1], Dated 23.02.2021

Ministry of Power, Government of India notified the Resolution dated 22.07.2020 on *"Guidelines for Tariff Based Competitive Bidding Process for Procurement of Round-The-Clock Power from Grid Connected Renewable Energy Power Projects, complemented with Power from Coal Based Thermal Power Projects".*

2. Subsequently, vide Resolution dated 03.11.2020, the aforesaid Guidelines was amended. The provisions of the Guidelines vide Resolution dated 22.07.2020 read with amendment to the Guidelines vide Resolution dated 03.11.2020 is henceforth referred to as "the amended 2020 MOP Guidelines". Relevant paragraphs of the amended 2020 MOP Guidelines provide as under:

a) Paragraph 2.1:

> ***"2.1 Applicability of Guidelines:*** *These Guidelines are being issued under the provisions of Section 63 of the Electricity Act, 2003 for long term procurement of electricity by the Procurers', on Round-The-Clock (RTC) basis, from Renewable (RE) Power Projects (**'RE Projects'**), complemented/balanced with firm power from any other source through competitive bidding."*

b) Paragraph 5.1:

> *"The quoted tariff shall comprise of four parts – Fixed component [RE power (fixed), non-RE power (fixed)] and Variable component [Non -RE power (escalable for fuel), and non-RE power (escalable for transportation)]. The Fixed component of tariff of the RE power and Non RE power shall be quoted for each year of the term of PPA. The variable component of the Non RE power shall be quoted as on scheduled date of commissioning. The levelised tariff shall be arrived at using the CERC escalation indices for the type of fuel quoted by the bidder and the discount factor to be specified in the bidding document. The bidder shall also quote the proportion of energy from RE sources and non-RE source that he wishes to supply. The weighted average levelised tariff shall be arrived at for the term of PPA and proportion of energy from RE sources and Non RE power source."*

c) Paragraph 5.4:

[1] **Disclaimer:** The views presented in this staff paper do not represent view of the Central Electricity Regulatory Commission, or its Chairperson, or its Members and are not binding on the Commission. The views are essentially that of the staff of the Commission and are being presented with an aim of initiating discussions and soliciting inputs from stakeholders.

"The escalable component of Non RE power, both for fuel and transportation, shall be adjusted as per the index notified by Central Electricity Regulatory Commission (CERC) for payment purposes from time to time. This shall be clearly mentioned in RfS document by the Procurer."

d) Paragraph 5.5:

"The Renewable energy supplied shall be paid at the rate of RE (fixed) tariff applicable for that year as quoted by the successful bidder.

For Non RE power, the fixed component of Non RE power shall be paid based on the monthly available capacity from Non RE sources at the rate of non RE power fixed tariff quoted by the Bidder applicable for that year.

The variable component of Non RE power shall be paid for the energy supplied from other source of energy and shall be paid at the rate of variable component of non RE power (escalable for fuel), and variable component of non-RE power (escalable for transportation)] tariff applicable for that year after adjusting as per escalation index notified by CERC for payment purposes."

e) Paragraph 6.4:

*"**Weighted Average Levelised Tariff as the Bidding Parameter**: The bidding evaluation parameter shall be the weighted average levelised tariff per unit supply of RTC power. The Procurer shall invite bids wherein the bidder shall quote the first year weighted average levelised Tariff in Rs./kWh. The quoted tariff shall comprise of four part – Fixed component [RE power (fixed), non-RE power (fixed)] and Variable component [Non -RE power (escalable for fuel), and non-RE power (escalable for transportation)]. The Fixed component of tariff of the RE power and Non RE power shall be quoted for each year of the term of PPA. The variable component of the Non RE power shall be quoted as on scheduled date of commissioning .The levelised tariff shall be arrived at using the CERC escalation indices for the type of fuel quoted by the bidder and the discount factor to be specified in the bidding document. The bidder shall also quote the proportion of energy from RE sources and non-RE source that he wishes to supply. The weighted average levelised tariff per unit supply shall be arrived at for the term of PPA and proportion of energy from RE sources and Non RE source.*

The bidder shall be selected on the basis of least quoted weighted average levelised Tariff. The bidder (called the L1 bidder) quoting the least weighted average levelised Tariff (called the L1 tariff) shall be allocated the quantum of power offered by him. If the allocated quantum of power is less than the total quantum of power to be contracted, the remaining qualified bidders will be asked to match their Tariff with the L1 tariff. The originally lowest bidder that agrees to match the L1 tariff shall be allocated the remaining quantum or the quantum offered by it, whichever is lower. If still some quantum is left, it will be allocated to the next originally lowest bidder and so on."

3. As per above-mentioned Paragraphs 2.1, 5.1, 5.4, 5.5 and 6.4 of the amended 2020 MOP Guidelines, CERC is required to notify various escalation factors and other parameters for the purpose of bid evaluation as well as payment as under:

(1) Escalation Rate for Domestic Coal

(2) Escalation Rate for Domestic Gas

(3) Escalation Rate for Inland Transportation Charges of Coal

(4) Escalation Rate for Inland Transportation Charges of Gas

(5) Escalation Rate for Imported Coal

(6) Escalation Rate for Imported Gas

(7) Escalation Rate for Transportation of Imported Coal

(8) Escalation Rate for Transportation of Imported Gas

(9) Discount rate

4. As required under the "*Guidelines for Determination of Tariff by Bidding Process for procurement of Power by Distribution Licensees"* dated 19.01.2005 (as amended from time to time) issued by the Ministry of Power, CERC has been notifying various escalation factors and other parameters for the purpose of evaluation and payment. The escalation factors and other parameters have been computed based on the methodology/ explanation published along with the notification dated 22.11.2006, 03.07.2009 and 28.12.2010; Order dated 23.12.2013 in Petition No.308/SM/2013; Order dated 18.10.2019 in Petition No.10/SM/2019; and Order dated 15.01.2020 in Petition No.11/SM/2019 (see CERC website www.cercind.gov.in).

5. The Ministry of Power, vide its Resolution dated 21.09.2013 and 09.11.2013, issued guidelines for Case-2 bidding and Case-1 bidding respectively. As per these guidelines, CERC was not required to notify the escalation factors and other parameters for the purpose of evaluation. Following these guidelines, CERC issued an Order dated 21.02.2014 in Petition No.002/SM/2014 as under:

> *"8. As mentioned in the above paras, as per the new MoP guidelines, no escalation rates are required to be notified by CERC. However, for agreements signed or actions taken prior to the date of these new guidelines, the escalation rates for payment are required to be notified by CERC (i.e. under MoP guidelines of 2005).*
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> *9. We direct that the notification of escalation rates for evaluation applicable for the six months commencing 1.4.2014 and onwards shall be discontinued in accordance with the provisions discussed in Para 3 to 7 of this order."*

Pursuant the above order, CERC has discontinued notifying the escalation rates for evaluation while it continued to notify the escalation rates for the purpose of payment.

6. CERC has been notifying the escalation rates for the purpose of payment under the Guidelines dated 19.1.2005 issued by the Ministry of Power. The same escalation rates

shall be used for meeting the requirement under Paragraphs 2.1, 5.1, 5.4, 5.5 and 6.4 of the amended 2020 MOP Guidelines.

7. For computing the escalation factors and other parameters for the purpose of evaluation to meet requirements under Paragraphs 2.1, 5.1, 5.4, 5.5 and 6.4 of the amended 2020 MOP Guidelines, the following is proposed:

a. Through its Order dated 21.2.2014, CERC has discontinued to notify the escalation rates for the purpose of evaluation. The methodology that was used till 1.4.2014 shall be used for computing the escalation rates for the purpose of evaluation after incorporating necessary changes, if any.

b. As in the previous methodology, the method of Minimum Mean Square Error and the time series data for latest twelve calendar years shall be considered for computing the escalation rates.

c. To the extent possible the data series, which were earlier being used for computing the escalation rates for payment, shall be used for computing the escalation rates for evaluation. In case of non-availability of the time series data for latest twelve calendar years, alternative data series shall be considered for computing the escalation rates.

8. **Escalation Factors for Bid Evaluation**

After consulting various experts and a study conducted by the Indian Statistical Institute (ISI), Kolkata, CERC had decided to use the method of Minimum Mean Square Error for determining the escalation factors for the purpose of evaluation of bids. Using the method of Minimum Mean Square Error on the time series data for latest twelve calendar years, the annual escalation factors for bid evaluation have been computed for the Notification dated 28.12.2010 and subsequent notifications. The formula of the method is as under:

*e: annual escalation rate in percent =g*100, where:*

g: escalation factor = $[exp\{\{(6 \times \Sigma n_t=2\ (t-1) \times \log_e(R_t)\}/\{(n-1) \times n \times (2n-1)\}\}]-1$

$R_t = (Y_t/Y_1)$

Y_t = *"t"* th *observation*

Y_1 *= initial observation*

n = number of observations

8.1 Escalation Rate for domestic coal (for Evaluation): CERC has been using its own index based on the price of non-coking coal applicable for power sector (CERC Coal Price Index, Base 2017-18=100) for computing the escalation rate for domestic coal for payment and the same is available from April 2018 onwards. However, for computing the escalation rate for evaluation, time series data for latest 12 years is required. Due to non-availability of the time series data on CERC coal price index (being available only from April 2018 onwards), it is proposed to use Wholesale Price Index (WPI) for non-coking coal to compute escalation rate of domestic coal for evaluation. In the past also CERC had used WPI of non-coking coal for computing the escalation rate for domestic coal for evaluation.

Name of the Index: WPI for non-coking coal

Source/Publisher: Ministry of Commerce and Industry, Government of India (website: www.eaindustry.nic.in)

Reasons: Use of Single index of WPI for non-coking coal is proposed for the following reasons:

- WPI is a measure of inflation at the wholesale level. It is the only general index capturing price movements of various commodities (including non-coking coal) in a comprehensive way.
- WPI for non-coking coal is published by Government of India.
- WPI for non-coking coal is available on a monthly basis with the shortest possible time lag.
- Time series data on CERC coal price index is not available for 12 years.

Description: The escalation rate for domestic coal shall be computed based on the time series data on WPI for non-coking coal for the latest 12 years.

Model computation: The escalation rate for domestic coal has been computed based on the time series data on WPI for non-coking coal for the period from 2008 to 2019. The data on WPI for non-coking coal for the period 2013-2019 has been taken from the website of Ministry of Commerce & Industry (2011-12 series) and the data for the period prior to that

has been arrived at by using conversion factor on the previous WPI series (2004-05 series). The escalation rate for domestic coal has been computed as under:

ESCALATION RATE FOR DOMESTIC COAL (FOR EVALUATION)						
Year No. (t)	**Year**	**WPI for Non-Coking Coal**	**$Y_t/Y_1 = R_t$**	**$\log_e(R_t)$**	**Year-1 (t-1)**	**Product [(t-1) x $\log_e(R_t)$]**
1	2008	62.57				
2	2009	64.70	1.03	0.03	1	0.03
3	2010	72.84	1.16	0.15	2	0.30
4	2011	89.60	1.43	0.36	3	1.08
5	2012	107.92	1.72	0.55	4	2.18
6	2013	105.40	1.68	0.52	5	2.61
7	2014	109.60	1.75	0.56	6	3.36
8	2015	109.60	1.75	0.56	7	3.92
9	2016	110.20	1.76	0.57	8	4.53
10	2017	110.70	1.77	0.57	9	5.14
11	2018	118.80	1.90	0.64	10	6.41
12	2019	119.00	1.90	0.64	11	7.07
A = Sum of "product" column						36.64
B= 6 times (6 x A)						219.83
C= (n-1) x n x (2n-1); n = No. of Years of data = 12						3036.00
D = B/C						0.07
g (Exponential Factor) = Exponential (D) -1						0.0751
e = Annual Escalation Rate (%) = g x 100						7.51

The annual escalation rate computed in the above table (7.51%) is to be notified as escalation rate for domestic coal for evaluation.

8.2. Escalation rate for domestic gas (For Evaluation): The main producers of natural gas in India are (i) Oil & Natural Gas Corporation Ltd (ONGC); (ii) Oil India Ltd (OIL); (iii) Joint Ventures (JVs) of Tapti, Panna Mukta and Ravva; and (iv) Reliance Industries Ltd. The Ministry of Petroleum & Natural Gas, Government of India (MOP&NG) has been regulating allocation and pricing of gas produced by ONGC and OIL by issuing administrative orders from time to time. Since 2006, Petroleum and Natural Gas Regulatory Board (PNGRB) has been regulating the refining, processing, storage, transportation, marketing and sale of natural gas. Petroleum and Planning Analysis Cell of MOP&NG publishes the statistics relating to consumer and producer prices of natural gas. Since the consumer price of gas for North-Eastern States is different from the consumer price for the rest of India, hybrid index of consumer price of gas (allocating the weights based on production) is proposed to be used for computing the escalation rate for domestic

gas. CERC has been using this hybrid index to compute the escalation rate for domestic gas for payment.

Name of the Index: Hybrid index of consumer price of gas (based on 10% weightage to Consumer Price of gas applicable for North-Eastern States and 90% weightage to Consumer Price of gas applicable for rest of India).

Source/Publisher: Ministry of Petroleum & Natural Gas, Government of India and GAIL (India) Ltd.

Reasons: Use of Hybrid index of consumer price of gas is proposed for following reasons:

- There is no single price available for gas.
- The weightage has been decided based on the gross production of natural gas in India. The production of natural gas in the NE Region is around 10% of the total production of natural gas in India.
- Instead of producer price of natural gas, consumer price of natural gas has been proposed to be used for computing the escalation rate for two reasons: (i) there is a subsidy component involved between the producer price and consumer price; and (ii) the consumer price is the price at which the supplier supplies the natural gas to various consumers and this is exclusive of transportation charges of gas.

Description: The escalation rate for domestic gas shall be computed based on the time series data on consumer price of gas for the latest 12 years.

8.3 Escalation rate for inland transportation charges of coal (For Evaluation): The transportation of coal to power plants takes place mainly by rail. The Ministry of Railways notifies freight rates for transportation of coal from time to time. The coal freight rates are available, in slabs, for distances from 1 km to 5000 km. The coal freight rates are sensitive to distance. Keeping in view different distances between the power plants and coal mines, the escalation rate for inland transportation charges of coal is proposed to be computed for different distances. The data on coal freight rate for 100 km, 500 km, 1000 km, 2000 km

and 3000 km is proposed to be used for computing the escalation rate for inland transportation of coal for distance upto 100 km, upto 500 km, upto 1000 km, upto 2000 km and beyond 2000 km respectively. CERC has been using this methodology and coal freight rates for computing the escalation rates for transportation charges of coal for payment.

Name of the Index: Coal freight rate.

Source/Publisher: Ministry of Railways, Government of India (website: www.indianrailways.gov.in)

Reasons: Use of Single index of coal freight rate is proposed for following reasons:

- Coal freight rates are published by Ministry of Railways, Government of India
- The rates are available in public domain.

Description: The escalation rate for inland transportation charges of coal shall be computed based on the time series data on coal freight rates for the latest 12 years.

8.4 Escalation rate for inland transportation charges of gas (For Evaluation): Domestic and imported natural gas is being transported mainly by GAIL at the rate prescribed by PNGRB. Petroleum and Planning Analysis Cell of Ministry of Petroleum & Natural Gas publishes the statistics relating to transportation charges of natural gas. HVJ pipeline is the major pipeline for transportation of gas in India. The transportation charges applicable for HVJ pipeline charged by GAIL is proposed to be considered for computing the escalation rate for transportation charges of gas. CERC has been using the transportation charges applicable for HVJ pipeline charged by GAIL for computing the escalation rate for payment.

Name of the Index: Transportation charges of gas applicable for HVJ pipeline charged by GAIL.

Source/Publisher: Ministry of Petroleum & Natural Gas, Government of India/ PNGRB (website: www.petroleum.nic.in)/ (website: www.pngrb.gov.in) and GAIL (India) Ltd (www.gailonline.com).

Reasons: Use of Single Index on Transportation charges of gas applicable for HVJ pipeline charged by GAIL is proposed for the following reasons:

- GAIL is the main transporter of gas in India
- HVJ pipeline is the major pipeline for transportation of gas.
- Transportation Charges of Gas is determined by PNGRB.

Description: The Escalation Rate for Inland Transportation Charges of Gas shall be computed based on the time series data for transportation charges of gas applicable for HVJ pipeline charged by GAIL for the latest 12 years.

8.5 Escalation Rate for Imported Coal (For Evaluation): CERC has been using composite index, assigning 25% weightage to price/ price index of Australian Coal, NEWC (Global Coal Index), 25% weightage to South African Coal (API4), 25% weightage to Indonesian Coal (ICI3 of Argus) and 25% weightage to Indonesian Coal (Platts Index), for computing the escalation rate for imported coal for payment. The same composite index for latest 12 years is proposed to be used for computing the escalation rate for imported coal for evaluation.

Name of the Index: Composite index based on Global Coal Index, API4, ICI3 of Argus and Platts index.

Source/Publisher: globalCOAL, Argu Media Ltd (API4 and ICI3) and Platts

Reasons: Use of Composite index based on Global Coal Index, API4, ICI3 of Argus and Platts index is proposed for the following reasons:

- The four indices are internationally acceptable indices.
- Coal is imported by power producers from different countries.
- A similar trend is observed in the prices/ price indices of Australian Coal, South African Coal and Indonesian coal.

Description: The Escalation Rate for imported coal shall be computed based on the time series data on composite index based on Global Coal Index, API4, ICI3 of Argus and Platts index for the latest 12 years.

8.6 Escalation Rate for Transportation of Imported Coal and Imported Gas (For Evaluation): The import of coal/ gas to India has been taking place from many countries. Keeping this in view, in place of actual freight rates of each country, CERC has been using the price of fuel used for transportation by shipping as a proxy for computing the escalation rate for transportation of imported coal for payment. Singapore 380 CST Bunker Fuel Price has been used for computing the escalation rate for payment upto December 2019. However, consequent to implementation of MARPOL Regulation with effect from 01.01.2020, CERC has started using the price of Low Sulphur Fuel Oil (LSFO) published by Clarksons Research in place of Singapore 380 CST Bunker Fuel Price for computing the escalation rate for payment applicable from January 2020 onwards (CERC order dated 15th January 2020 in Petition No.11/SM/2019). As the time series data on LSFO not being available for 12 years, it is proposed to use Singapore 380 CST Bunker Fuel Price for computing the escalation rate for evaluation.

Name of the Index: Singapore 380 CST Bunker Fuel Price.

Source/Publisher: Clarkson Research

Reasons: Use of Single index of Singapore 380 CST Bunker Fuel Price is proposed for the following reasons:

- Fuel prices form a significant component of total ocean freight costs.
- Singapore is a major fuelling point for shipping in the Asian region, and fuel prices in Singapore are seen as leading indicators.
- 380 CST bunker fuel is mainly used in shipping.
- The time series data on LSFO is not available for 12 years
- Clarkson research has historical data and credibility to provide data on shipping transportation.

Description: The escalation rate for transportation of imported coal/ gas shall be computed based on the time series data on FOB prices of Singapore 380 CST bunker fuel for the latest 12 years.

8.7 Escalation rate for Imported Gas (For Evaluation): There is no published data available on historical FOB/CIF price of imported LNG in India. A proxy can be used for computing the escalation rate for imported gas. CERC has been using Japan JCC LNG CIF

price for computing the escalation rate for imported gas for payment. Therefore, the same is proposed to be used for computing the escalation rate for imported gas for evaluation.

In February 2009, Platts has launched Asian LNG spot prices under the benchmark name Japan/ Korea Market (JKM). Once the time series data is available, JKM can be used as proxy for price of imported LNG in India in place of Japan JCC LNG CIF price.

Name of the Index: Japan JCC NLG CIF price.

Source/Publisher: Platts (website: www.platts.com)

Reasons: Use of Single index of Japan JCC NLG price is proposed for the following reasons:

- Import of LNG in Japan is similar to import of LNG in India.
- Japan JCC LNG price is the CIF price which includes transportation through shipping. Unlike transportation by pipeline in USA and in European countries, the transportation of LNG in Asian countries including India is similar.
- Platts provides services to various clients including Federal Energy Regulatory Commission (FERC, USA).

Description: The escalation rate for imported gas shall be computed based on the time series data on Japan JCC LNG price published by Platts for the latest 12 years.

9. Discount Rate for Bid Evaluation

As required under the "Tariff based Competitive-bidding Guidelines for Transmission Service" (as amended up to 10th October, 2008) issued by the Ministry of Power, CERC has been notifying the discount rate for evaluation from time to time. The methodology that has been used for computing the discount rate for the notification "escalation factors and other parameters for tariff based competitive bidding for transmission service" dated 05.10.2020 is proposed to be used for computing the discount rate for evaluation required under various paragraphs of the amended 2020 MOP Guidelines. This is mainly for the reason that the discount rate has been computed considering the parameters applicable for power sector in general. Relevant Extract from the 'Explanation for the notification on escalation factors and other parameters for tariff

based competitive bidding for transmission service, dated 5.10.2020' is reproduced below and it explains the methodology that shall be used for computing the discount rate for bid evaluation.

"*Weighted Average Cost of Capital (WACC) has been considered as discount rate and computed as under:*

WACC = Cost of Debt + Cost of Equity
Where,
Cost of Debt = 0.70 (Market Rate of Interest) X (1-Corporate Tax Rate)
Cost of Equity= 0.30 (Risk Free Rate + b (Equity Market Risk Premium))

The computation of WACC can be seen in the following table.

DISCOUNT RATE TO BE USED FOR BID EVALUATION		
Weighted Values	***Cost of Debt/Equity***	***WACC (%)***
1. Cost of Debt (after tax)		
0.70(Cost of Debt)x(1-CTR)	***6.21***	
2. Cost of Equity		
0.30((RF+b (ERP))	***2.63***	
Discount Rate (1+2)		***8.84***
Assumptions used for computing the Discount Rate		
Components of Debt/Equity		***Assumptions (%)***
Debt		*70.00*
Equity		*30.00*
Corporate Tax Rate (CTR)		*22.00*
Risk Free rate (RF)		*6.99*
Beta Value (b)		*0.72*
Equity Market Risk Premium (ERP)		*2.47*
Cost of Debt		*12.67*
Cost of Equity		*8.75*

The Debt and Equity of 70:30 has been assumed based on CERC norms on Debt and Equity in its Tariff Regulations for the 2019-24 period. The basic corporate tax rate proposed in the Union Budget for the year 2020-21 (i.e. excluding surcharge and cess) has been assumed while computing the discount rate.

While calculating the cost of debt, the market rate of interest is being linked to the marginal cost of funds based lending rate (MCLR) that refers to the minimum interest rate of a bank below which it cannot lend, except in some cases allowed by the RBI. The market rate of interest for the year 2019 shall be taken as the MCLR (9.17%, i.e., average of MCLR of five major banks) + 350 basis points. Accordingly, the market rate of interest has been taken as 12.67%.

10 year GOI securities rate for 2019 is being considered as the risk-free rate.

For the calculation of cost of equity, the market risk premium is assumed as the difference between the expected market return and the risk free rate. Accordingly, the market risk premium in this Notification has been arrived at by subtracting the average risk-free rate for the last 10 years from the average rate of return on market portfolio over the past 10 years. Sensex values for the past eleven years have been used to arrive at rate of return on the market portfolio for the past 10 years. Historical approach has been adopted for arriving at the expected market return assuming the expected future return to be the same as past returns. The beta value has been computed based on the data on Bombay Stock Exchange (BSE) Indices for Power Sector and Sensex for the year 2019.

The WACC computed in the above table (8.84%) shall be notified as discount rate for bid evaluation."

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