EXPLANATION TO
THE NOTIFICATION DATED 18.4.2022
ON
ESCALATION RATES AND OTHER PARAMETERS

In pursuance of paragraph 5.1 and paragraph 6.4 of the Resolution 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" dated 22.07.2020 read with amendment dated 03.11.2020 issued by the Ministry of Power (MOP), the Central Electricity Regulatory Commission (CERC) is required to notify various escalation rates/factors and other parameters, for the purpose of bid evaluation. The escalation rates and other parameters are 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 ofGas

(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

2.   The escalation factors and other parameters have been computed based on the methodology defined in the CERC Order dated 29-5-2021 and its Addendum dated 6.4.2022 in Petition No.7/SM/2021 (see CERC website www.cercind.gov.in).

3.   **Escalation Factors for Bid Evaluation**

The method of Minimum Mean Square Error has been used for determining the escalation rates for the purpose of evaluation of bids. Using the Minimum Mean Square Error method on the time series data for the latest twelve calendar years, the annual escalation rates for bid evaluation have been computed with the formula given 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*

3.1 Escalation Rate for Domestic Coal (for Evaluation): The escalation rate for domestic coal has been computed based on the time series data onWPI for non-coking coal (G7 to G14) for the period from 2012 to 2021. The data on WPI for non-coking coal has been taken from the website of Ministry of Commerce & Industry. The escalation rate for domestic coal has been computed as under:

Table-1: ESCALATION RATE FOR DOMESTIC COAL (For Evaluation)						
Year Number (t)	Year	WPI for Non-Coking Coal	Yt/Y1 = Rt	Ln Rt	Year -1 (t-1)	Product [(t-1) x (Ln Rt)]
1	2012	101.5				
2	2013	106.3	1.05	0.05	1	0.05
3	2014	113.3	1.12	0.11	2	0.22
4	2015	113.3	1.12	0.11	3	0.33
5	2016	118.8	1.17	0.16	4	0.63
6	2017	122.8	1.21	0.19	5	0.95
7	2018	136.4	1.34	0.30	6	1.77
8	2019	136.7	1.35	0.30	7	2.08
9	2020	136.8	1.35	0.30	8	2.38
10	2021	137.8	1.36	0.31	9	2.75
A = Sum of "product" column						11.16
B = 6 times (6 x A)						66.96
C = (n-1) x n x (2n-1); n = No. of Years of data = 10						1710.00
D = B/C						0.04
g (Exponential Factor) = Exponential (D) -1						0.04
e = Annual Escalation Rate (%) = g x 100						3.99

The annual escalation rate computed in the above table (3.99%) is notified as escalation rate for domestic coal for evaluation.

3.2. Escalation Rate for Domestic Gas (For Evaluation): The escalation rate for domestic gas has been computed based on the time series data on consumer price of gas for the period from 2010 to 2021. The data has been collected from Ministry of Petroleum & Natural Gas (MoPNG) and GAIL (India) Ltd. Composite series (Average consumer price

of Gas), based on 90% weight to Consumer Price-Off-shore (Landfall point and On-shore) and 10% weight to Consumer Price (North-Eastern States) has first been developed, which then has been used for computing the escalation rate as under:

Composite series: Average Consumer Price of Gas					
Year	Consumer Price Off-shore (Landfall point and On-shore) (₹/'000 cubic metre)	Consumer Price (North-Eastern States) (₹/'000 cubic metre)	Proportion of off-shore Gas in total Gas Production	Proportion of North-East Gas in total Gas Production	Average Consumer Price of Gas (₹/'000 cubic metre) (Yi)
2010	5373	3224	90%	10%	5158
2011	7057	4234	90%	10%	6775
2012	8080	4848	90%	10%	7757
2013	8860	5316	90%	10%	8506
2014	9754	5854	90%	10%	9364
2015	10482	6293	90%	10%	10063
2016	8359	5014	90%	10%	8024
2017	6396	3834	90%	10%	6140
2018	7630	4583	90%	10%	7325
2019	8851	5310	90%	10%	8497
2020	6524	3908	90%	10%	6263
2021	5512	3299	90%	10%	5291

Table-2: ESCALATION RATE FOR DOMESTIC GAS (For Evaluation)						
Year Number (t)	Year	Average Consumer Price of Gas (₹/'000 cubic metre) (Yi)	Yt/Y1 =Rt	Ln Rt	Year -1 (t-1)	Product [(t-1) x (Ln Rt)]
1	2010	5158				
2	2011	6775	1.31	0.27	1	0.27
3	2012	7757	1.50	0.41	2	0.82
4	2013	8506	1.65	0.50	3	1.50
5	2014	9364	1.82	0.60	4	2.39
6	2015	10063	1.95	0.67	5	3.34
7	2016	8024	1.56	0.44	6	2.65
8	2017	6140	1.19	0.17	7	1.22
9	2018	7325	1.42	0.35	8	2.81
10	2019	8497	1.65	0.50	9	4.49
11	2020	6263	1.21	0.19	10	1.94
12	2021	5291	1.03	0.03	11	0.28
A = Sum of "product" column						21.71
B = 6 times (6 x A)						130.23
C = (n-1) x n x (2n-1); n = No. of Years of data = 12						3036.00
D = B/C						0.04
g (Exponential Factor) = Exponential (D) -1						0.04
e = Annual Escalation Rate (%) = g x 100						4.38

The annual escalation rate computed in the above table (4.38%) is notified as escalation rate for domestic gas for evaluation.

3.3 Escalation Rate for Inland Transportation Charges of Coal (For Evaluation):

The escalation rate for inland transportation charges for coal has been computed based on the time series data on coal freight rates for the period from 2010 to 2021. The data has been collected from the Ministry of Railways. Based on the availability of data from the Ministry of Railways and in terms of their Circular dated 30.06.2020 and 29.06.2021 regarding long lead concession @ 20% for coal transportation of distance more than 1400 kms w.e.f. 01-07-2020, the data on coal freight rate for 125 km, 500 km, 1000 km, 2000 km and 3000 km has been used for computing the escalation rate for inland transportation of coal for distance up to 125 km, up to 500 km, up to 1000 km, up to 2000 km and beyond 2000 km respectively. The escalation rate for inland transportation charges for coal has been computed as under:

Year Number (t)	Year	Coal Freight Rate (₹/Tonne) for 125 km	Yt/Y1 =Rt	Ln Rt	Year -1 (t-1)	Product [(t-1) x (Ln Rt)]
1	2010	125.10				
2	2011	125.10	1.000	0.000	1	0.000
3	2012	145.67	1.164	0.152	2	0.304
4	2013	157.33	1.258	0.229	3	0.688
5	2014	192.10	1.536	0.429	4	1.716
6	2015	202.55	1.619	0.482	5	2.409
7	2016	205.60	1.643	0.497	6	2.981
8	2017	247.68	1.980	0.683	7	4.781
9	2018	361.20	2.887	1.060	8	8.483
10	2019	389.60	3.114	1.136	9	10.224
11	2020	389.60	3.114	1.136	10	11.360
12	2021	389.60	3.114	1.136	11	12.496
A = Sum of "product" column						55.44
B = 6 times (6 x A)						332.65
C = (n-1) x n x (2n-1); n = Number of Years of data = 12						3036.00
D = B/C						0.11
g (Exponential Factor) = Exponential (D) -1						0.12
e = Annual Escalation Rate (%) = g x 100						11.58

Table-3.1: ESCALATION RATE FOR INLAND TRANSPORTATION CHARGES FOR COAL (UP TO 125 KM) (For Evaluation)

Table-3.2: ESCALATION RATE FOR INLAND TRANSPORTATION CHARGES FOR COAL (UP TO 500 KM) (For Evaluation)						
Year Number (t)	Year	Coal Freight Rate (₹/Tonne) for 500 km	Yt/Y1 =Rt	Ln Rt	Year -1 (t-1)	Product [(t-1) x (Ln Rt)]
1	2010	462.55				
2	2011	480.60	1.04	0.04	1	0.04
3	2012	559.43	1.21	0.19	2	0.38
4	2013	604.12	1.31	0.27	3	0.80
5	2014	641.17	1.39	0.33	4	1.31
6	2015	691.95	1.50	0.40	5	2.01
7	2016	705.86	1.53	0.42	6	2.54
8	2017	754.08	1.63	0.49	7	3.42
9	2018	977.68	2.11	0.75	8	5.99
10	2019	1054.70	2.28	0.82	9	7.42
11	2020	1054.70	2.28	0.82	10	8.24
12	2021	1054.70	2.28	0.82	11	9.07
A = Sum of "product" column						41.21
B = 6 times (6 x A)						247.27
C = (n-1) x n x (2n-1); n = Number of Years of data = 12						3036.00
D = B/C						0.08
g (Exponential Factor) = Exponential (D) -1						0.08
e = Annual Escalation Rate (%) = g x 100						8.49

Table-3.3: ESCALATION RATE FOR INLAND TRANSPORTATION CHARGES FOR COAL (UP TO 1000 KM) (For Evaluation)						
Year Number (t)	Year	Coal Freight Rate (₹/Tonne) for 1000 km	Yt/Y1 =Rt	Ln Rt	Year -1 (t-1)	Product [(t-1) x (Ln Rt)]
1	2010	888.38				
2	2011	923.40	1.04	0.04	1	0.04
3	2012	1074.75	1.21	0.19	2	0.38
4	2013	1160.70	1.31	0.27	3	0.80
5	2014	1231.94	1.39	0.33	4	1.31
6	2015	1329.43	1.50	0.40	5	2.02
7	2016	1349.50	1.52	0.42	6	2.51
8	2017	1391.58	1.57	0.45	7	3.14
9	2018	1753.71	1.97	0.68	8	5.44
10	2019	1891.80	2.13	0.76	9	6.80
11	2020	1891.80	2.13	0.76	10	7.56
12	2021	1891.80	2.13	0.76	11	8.31
A = Sum of "product" column						38.31
B = 6 times (6 x A)						229.87
C = (n-1) x n x (2n-1); n = Number of Years of data = 12						3036.00
D = B/C						0.08
g (Exponential Factor) = Exponential (D) -1						0.08
e = Annual Escalation Rate (%) = g x 100						7.87

Table-3.4: ESCALATION RATE FOR INLAND TRANSPORTATION CHARGES FOR COAL (UP TO 2000 KM) (For Evaluation)						
Year Number (t)	Year	Coal Freight Rate (₹/Tonne) for 2000 km	Yt/Y1 =Rt	Ln Rt	Year -1 (t-1)	Product [(t-1) x (Ln Rt)]
1	2010	1645.49				
2	2011	1710.50	1.04	0.04	1	0.04
3	2012	1990.83	1.21	0.19	2	0.38
4	2013	2149.99	1.31	0.27	3	0.80
5	2014	2281.78	1.39	0.33	4	1.31
6	2015	2462.48	1.50	0.40	5	2.02
7	2016	2407.42	1.46	0.38	6	2.28
8	2017	2285.48	1.39	0.33	7	2.30
9	2018	2841.88	1.73	0.55	8	4.37
10	2019	3065.70	1.86	0.62	9	5.60
11	2020	2816.65	1.71	0.54	10	5.38
12	2021	2567.60	1.56	0.44	11	4.89
A = Sum of "product" column						29.37
B = 6 times (6 x A)						176.21
C = (n-1) x n x (2n-1); n = Number of Years of data = 12						3036.00
D = B/C						0.06
g (Exponential Factor) = Exponential (D) -1						0.06
e = Annual Escalation Rate (%) = g x 100						5.98

Table-3.5: ESCALATION RATE FOR INLAND TRANSPORTATION CHARGES FOR COAL (BEYOND 2000 KM) (For Evaluation)						
Year Number (t)	Year	Coal Freight Rate (₹/Tonne) for 3000 km	Yt/Y1 =Rt	Ln Rt	Year -1 (t-1)	Product [(t-1) x (Ln Rt)]
1	2010	2105.03				
2	2011	2188.10	1.04	0.04	1	0.04
3	2012	2546.61	1.21	0.19	2	0.38
4	2013	2750.41	1.31	0.27	3	0.80
5	2014	2918.80	1.39	0.33	4	1.31
6	2015	3149.90	1.50	0.40	5	2.02
7	2016	3051.93	1.45	0.37	6	2.23
8	2017	2835.48	1.35	0.30	7	2.09
9	2018	3511.37	1.67	0.51	8	4.09
10	2019	3787.90	1.80	0.59	9	5.29
11	2020	3409.11	1.62	0.48	10	4.82
12	2021	3030.32	1.44	0.36	11	4.01
A = Sum of "product" column						27.07
B = 6 times (6 x A)						162.41
C = (n-1) x n x (2n-1); n = Number of Years of data = 12						3036.00
D = B/C						0.05
g (Exponential Factor) = Exponential (D) -1						0.05
e = Annual Escalation Rate (%) = g x 100						5.50

The annual escalation rates computed in the above tables (11.58%, 8.49%, 7.87%, 5.98% and 5.50% respectively, applicable for transportation of coal up to 125 km, up to 500 km, up to 1000 km, up to 2000 km and beyond 2000 km) are notified as annual escalation rates for inland transportation charges of coal for evaluation.

3.4   Escalation Rate for Inland Transportation Charges of Gas (For Evaluation):
The escalation rate for inland transportation charges for gas has been computed based on the time series data on transportation charges of gas along HVJ pipeline charged by GAIL for the period from 2010 to 2021. The data has been collected from the Ministry of Petroleum & Natural Gas, PNGRB and GAIL (India) Ltd. The escalation rate for inland transportation charges of gas for evaluation has been computed as under:

Year Number (t)	Year	Transportation charges along HVJ pipeline (₹/'000 cubic metre)	$Y_t/Y_1 = R_t$	Ln R_t	Year -1 (t-1)	Product [(t-1) x (Ln R_t)]
1	2010	982				
2	2011	856	0.87	-0.14	1	-0.14
3	2012	856	0.87	-0.14	2	-0.27
4	2013	856	0.87	-0.14	3	-0.41
5	2014	856	0.87	-0.14	4	-0.55
6	2015	856	0.87	-0.14	5	-0.69
7	2016	856	0.87	-0.14	6	-0.82
8	2017	856	0.87	-0.14	7	-0.96
9	2018	856	0.87	-0.14	8	-1.10
10	2019	1111	1.13	0.12	9	1.11
11	2020	1365	1.39	0.33	10	3.30
12	2021	1365	1.39	0.33	11	3.63
A = Sum of "product" column						3.09
B = 6 times (6 x A)						18.52
C = (n-1) x n x (2n-1); n = No. of Years of data = 12						3036.00
D = B/C						0.01
g (Exponential Factor) = Exponential (D) -1						0.01
e = Annual Escalation Rate (%) = g x 100						0.61

Table-4: ESCALATION RATE FOR INLAND TRANSPORTATION CHARGES OF GAS

The annual escalation rate computed in the above table (0.61%) is notified as escalation rate for inland transportation charges of gas for evaluation.

3.5   Escalation Rate for Imported Coal (For Evaluation): The escalation rate for imported coal has been computed based on the time series data on composite index,

assigning 25% weightage to price/price index of Australian Coal (NEWC Global Coal Index), 25% weightageto price/price index South African Coal (API4), 25% weightageto price/price index of Indonesian Coal (ICI3 of Argus) and 25% weightage to price/price index of Indonesian Coal (Platts Index). The composite index for latest 12 years for the period from 2010 to 2021 has been considered for computing the escalation rate for imported coal for evaluation.

Table-5: ESCALATION RATE FOR IMPORTED COAL (For Evaluation)		
Component Index	Data Series	Annual Escalation Rate
Composite index based on Global Coal Index, API4, ICI3 of Argus and Platts index	12 years (Jan 2010 to Dec 2021)	(-)1.59%

The annual escalation rate computed in the above table (-) 1.59% is notified as escalation rate for imported coal for evaluation.

3.6   Escalation rate for Imported Gas (For Evaluation): The escalation rate for imported gas has been computed based on the time series data on Japan/Korea Marker (JKM) published by Platts for the period from 2010 to 2021 as under:

Table-6: ESCALATION RATE FOR IMPORTED GAS (For Evaluation)		
Component Index	Data Series	Annual Escalation Rate
LNG Japan/Korea DES Spot Crg. ($/MMBTU)	12 years (Jan 2010 to Dec 2021)	1.37%

The annual escalation rate computed in the above table (1.37%) is notified as escalation rate for imported gas for evaluation.

3.7   Escalation Rate for Transportation of Imported Coal (For Evaluation): The escalation rate for transportation of imported coal has been computed based on the time series data on Singapore 380 CST Bunker Fuel Price for the latest 12 yearsfor the period from 2010 to 2021 as under:

Table-7: ESCALATION RATE FOR TRANSPORTATION OF IMPORTED COAL (For Evaluation)		
Component Index	Data Series	Annual Escalation Rate
Singapore 380 CST Bunker Price Index	12 years (Jan 2010 to Dec 2021)	(-)2.86%

The annual escalation rate computed in the above table (-)2.86% is notified as escalation rate for transportation of imported coal for evaluation.

3.8   Escalation Rate for Transportation of Imported Gas (For Evaluation): The escalation rate for transportation of imported gas has been computed based on the time series data on Singapore 380 CST Bunker Fuel Price for the latest 12 yearsfor the period from 2010 to 2021 as under:

Table-8: ESCALATION RATE FOR TRANSPORTATION OF IMPORTED GAS (For Evaluation)		
Component Index	**Data Series**	**Annual Escalation Rate**
Singapore 380 CST Bunker Price Index	12 years (Jan 2010 to Dec 2021)	(-)2.86%

The annual escalation rate computed in the above table (-)2.86% is notified as escalation rate for transportation of imported gas for evaluation.

4.   Discount Rate for Bid Evaluation

The discount rate has been computed as under:

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)

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		
[0.70(Cost of Debt)x(1-CTR)]	**5.28**	
2. Cost of Equity		
[0.30{(RF+b(ERP)}]	**2.82**	
Discount Rate (1+2)		**8.09**
Assumptions used for computing the Discount Rate		
Components of Debt/Equity		**Assumptions (%)**
Debt		70.00
Equity		30.00
Corporate tax rate for the assessment year 2022-23 (Effective tax rate, i.e., inclusive of cess and surcharge)		25.17
Risk Free Rate (RF)		6.26
Beta Value (b)		0.76
Equity Market Risk Premium (ERP)		4.15
Cost of Debt		10.07
Cost of Equity		9.39

The Debt and Equity of 70:30 has been assumed based on CERC norms on Debt and Equity in its Tariff Regulations 2019-24. The effective corporate tax rate (i.e. inclusive of surcharge and cess) proposed in the GOI Budget for the year 2022-23 has been used as corporate tax rate while computing the cost of debt.

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 2021 is taken as the MCLR (8.07%, i.e., average of MCLR of five major banks) + 200 basis points. The 200 basis points have been considered as per the methodology used in the Order dated 29-5-2021 in Petition No.7/SM/2021. Accordingly, the market rate of interest has been taken as 10.07%.

10-year GOI securities rate for 2021 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 12 years from the average rate of return on market portfolio

overthe past 12 years. Sensex values for the past thirteen years have been used to arrive at the rate of return on the market portfolio for the past 12 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 2021.

The WACC computed in the above table (8.09%) is notified as discount rate for bid evaluation.

5.   The data series for API-4, Global Coal Index, Argus ICI3, Platts CI, JKM, and Singapore 380 CST Bunker Fuel Price Index has been analysed by CERC. The data is not made available for public dissemination since it is paid for and is sourced on a single user subscription.

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