National Electric Power Regulatory Authority
Islamic Republic of Pakistan

Registrar

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No. NEPRA/R/Director(Tech)/LAG-03/ 8286-90 June 05, 2024

Subject: **Order of the Authority in the matter of Nandipur Power Plant's Request for Approval of Start-up Costs for Cold, Warm and Hot Start**

Dear sir,

Enclosed please find herewith the subject Order of the Authority along with Annexure (total 07 Pages) in the matter of Nandipur Power Plant's request for approval of Start-up Costs for Cold, Warm and Hot Start.

2. The Decision is being intimated to the Federal Government for the purpose of notification in the official Gazette pursuant to Section 31(7) of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 within 30 days from the intimation of this Decision. In the event the Federal Government fails to notify the subject tariff Decision within the time period specified in Section 31(7), then the Authority shall notify the same in the official Gazette pursuant to Section 31(7) of the NEPRA Act.

Enclosure: **As above**

(Engr. Mazhar Iqbal Ranjha)

Secretary,
Ministry of Energy (Power Division),
'A' Block, Pak Secretariat,
Islamabad

Copy to:

1. Secretary, Cabinet Division, Cabinet Secretariat, Islamabad
2. Secretary, Ministry of Finance, 'Q' Block, Pak Secretariat, Islamabad
3. Chief Executive Officer, Northern Power Generation Company Limited (NPGCL), Thermal Power Station, Mahmood Kot Road, Muzaffar Garh
4. Chief Executive Officer, Central Power Purchasing Agency Guarantee Limited (CPPA-G), Shaheen Plaza, 73-West, Fazl-e-Haq Road, Islamabad

Order of the Authority in the Matter of Nandipur Power Plant's Request for Approval of Start-up Costs for Cold, Warm, and Hot Start.

Introduction & Proceedings:

1. Northern Power Generation Company Limited, (NPGCL) in its Review Motion against the decision of the Authority in the matter of its tariff determination dated January 2016 requested the Authority to allow the Start-up cost of its different units. The Authority in its decision dated October 19, 2016, decided that *"the start-up cost should be in line with the Independent Power Producers and separate invoice should be raised based on actual cost in accordance with the Power Purchase Agreement."*

2. Pursuant to the above decision of the Authority, NPGCL on October 31, 2018, filed a request for determination of Start-up cost. The Authority in November 2018 directed NPGCL to get its costs verified by CPPA-G.

3. NPGCL submitted a petition to modify its tariff for the Nandipur Combined Cycle Power Plant (CCPP) on October 16, 2020. The petitioner requested the Authority to allow start-up costs for its various units, in accordance with the Authority's decision on similar cases involving NPGCL's other units.

Grounds for and Prayer:

4. The petitioner filed the instant petition on the following grounds:

    i. *Start-up Costs (Reference) has been calculated against all three configurations of the plant. The costs will cover the consumables, fuel, and equivalent operating hours consumed for the start-up. This cost will be based on the following table and shall be indexed as per in vogue procedures set by NEPRA. The detailed working is attached:*

ABSTRACT OF REFERENCE START-UP COST AT CCPP NANDIPUR			
Cold Start-up Charges PKR	5,401,674	3,624,147	1,789,118
Warm Start-up Charges PKR	3,965,812	2,666,064	1,310,069
Hot Start-up Charges PKR	2,529,951	1,707,951	831,019

5. The petitioner has prayed for the following relief to the Authority:

    i. *To accept the modification petition.*

    ii. *To modify the costs requested by the petitioner.*

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6. It is pertinent to mention here that the Authority has already rendered its determination on the modification petition involving other parameters. The Authority in its decision regarding startup charges decided as follows:

> *The submissions of the Petitioner have been examined. Under Para 50(a) of the decision dated 27-1-2016, the determined efficiency is subject to adjustment at the time of COD tariff adjustment. Partial load adjustment, Heat Rate Degradation and Start-up Charges shall also be determined at the time of COD tariff adjustment or shall be determined through separate proceedings.*

7. Accordingly, the scope of this order is limited to the extent of startup charges in line with earlier cases of NPGCL and JPCL decided vide determination dated 21 September 2022.

8. Arguments heard, record perused.

9. The deliberation on the aforementioned issues is outlined as follows:

   a. The Authority observed that, in accordance with decisions regarding NPGCL and JPCL, CPPA-verified startup costs were separately submitted to NEPRA.

   b. Subsequently, the petitioner revised the aforementioned submissions and resubmitted them to NEPRA due to calculation errors related to Auxiliary Load calculation and Simple cycle efficiency number. The rectification of errors led to a slightly lower claim for Startup costs.

   c. The Authority examined the revised calculations submitted by the petitioner and found them to be satisfactory.

   d. The Authority noted that the petitioner requested to allow these costs retrospectively from the (COD) i.e. 2015. However, it was observed that prior to October 16, 2020, Nandipur had neither claimed startup charges nor raised the matter with NEPRA. Considering this, the Authority deemed it imprudent to allow these costs retrospectively.

   e. The revised calculations and their basis on the matter of start-up costs of different units of Nandipur CCPP (on RLNG & HSFO) as submitted by Nandipur are as follows:

ABSTRACT OF STARTUP COST ON RLNG FOR CCPP NANDIPUR

Configuration	3+1	2+1	1+1	Single GT
Cold Start-up Charges Rs.	2,810,625	1,883,300	944,326	927,325
Warm Start-up Charges Rs.	1,970,041	1,322,911	664,131	647,130
Hot Start-up Charges	1,129,457	762,521	383,937	366,936

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ABSTRACT OF STARTUP COST ON HSFO FOR CCPP NANDIPUR				
Configuration	**3+1**	**2+1**	**1+1**	**Single GT**
Cold Start-up Charges Rs.	10,547,212.03	4,732,434.96	1,214,299.50	1,194,878
Warm Start-up Charges Rs.	7,298,845.67	3,288,716.58	853,369.90	833,949
Hot Start-up Charges	4,050,487.79	1,844,998.20	492,440.31	473,019

Order:

10. The Authority after detailed deliberations and in its collective wisdom decided as under:

i. Approved the revised calculations (attached as Annexure) submitted by Northern Power Generation Co. Ltd. (NPGCL) Nandipur Plant as Startup Costs as per paragraph 5 of this Decision, with effect from October 16, 2020.

ii. Decided that all the reference values used for calculation of Start-up Charges will be applicable/adjusted as per actual.

Authority

Rafique Ahmed Shaikh
Member

Engr. Maqsood Anwar Khan
Member

Mathar Niaz Rana (nsc)
Member

Amina Ahmed
Member

Waseem Mukhtar
Chairman

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RLNG

CCPP Start-up Cost-Gas	FULL COMPLEX (3+3+1)			TWO THIRD COMPLEX (2+2+1)			ONE THIRD COMPLEX (1+1+1)		
Backfeed charges	Hot Startup	Warm Startup	Cold Startup	Hot Startup	Warm Startup	Cold Startup	Hot Startup	Warm Startup	Cold Startup
Backfeed import duration	50 min	50 min	50 min	50 min	50 min	50 min	50 min	50 min	50 min
Power import	10.59 MW	10.59 MW	10.59 MW	8.70 MW	8.70 MW	8.70 MW	4.81 MW	4.81 MW	4.81 MW
FCC	6.6636 PKR/kWh	6.6636 PKR/kWh	6.6636 PKR/kWh	6.6636 PKR/kWh	6.6636 PKR/kWh	6.6636 PKR/kWh	6.6636 PKR/kWh	6.6636 PKR/kWh	6.6636 PKR/kWh
VOM	0.3435 PKR/kWh	0.3435 PKR/kWh	0.3435 PKR/kWh	0.3435 PKR/kWh	0.3435 PKR/kWh	0.3435 PKR/kWh	0.3435 PKR/kWh	0.3435 PKR/kWh	0.3435 PKR/kWh
Power import rate (EPP Cost)	7.0071 PKR/kWh	7.0071 PKR/kWh	7.0071 PKR/kWh	7.0071 PKR/kWh	7.0071 PKR/kWh	7.0071 PKR/kWh	7.0071 PKR/kWh	7.0071 PKR/kWh	7.0071 PKR/kWh
Backfeed charges	61,857 PKR	61,857 PKR	61,857 PKR	50,788 PKR	50,788 PKR	50,788 PKR	28,070 PKR	28,070 PKR	28,070 PKR
Gas price (HHV), Reference Value	8.738 US/MMBtu	8.738 US/MMBtu	8.738 US/MMBtu	8.738 US/MMBtu	8.738 US/MMBtu	8.738 US/MMBtu	8.738 US/MMBtu	8.738 US/MMBtu	8.738 US/MMBtu
Gas HHV, Reference Value	42777.13 KJ/kg	42777.13 kJ/kg	42777.13 kJ/kg	42777.13 kJ/kg	42777.13 kJ/kg	42777.13 kJ/kg	42777.126 kJ/kg	42777.13 kJ/kg	42777.13 kJ/kg
Exchange rate (USD/PKR)	104.95	104.95	104.95	104.95	104.95	104.95	104.95	104.95	104.95
Upto GT Synchronization									
Gas consumption from start to FSNL	528 kg	528 kg	528 kg	528 kg	528 kg	528 kg	528 kg	528 kg	528 kg
Fuel gas cost for operation on FSNL	58,899 PKR	58,899 PKR	58,899 PKR	39,266 PKR	39,266 PKR	39,266 PKR	19,633 PKR	19,633 PKR	19,633 PKR
From GT Synchronization up to ST Synchronization									
Operation Time from GTs Synch to ST Synch	90 min	165 min	240 min	90 min	165 min	240 min	90 min	165 min	240 min
Load from GTs Synch to ST Synch (MW)	30 MW	30 MW	30 MW	20 MW	20 MW	20 MW	10 MW	10 MW	10 MW
Baseload GT efficiency	34.22%	34.22%	34.22%	34.22%	34.22%	34.22%	34.22%	34.22%	34.22%
Part load GT efficiency heat rate ratio	2.9052	2.9052	2.9052	2.9052	2.9052	2.9052	2.9052	2.9052	2.9052
Fuel cost from GT Synch to ST Synch	1,324,020 PKR	2,427,371 PKR	3,530,721 PKR	882,680 PKR	1,618,247 PKR	2,353,814 PKR	441,340 PKR	809,124 PKR	1,176,907 PKR
Cost of Energy Exported to Grid	315,320 PKR	578,086 PKR	840,852 PKR	210,213 PKR	385,391 PKR	560,568 PKR	105,107 PKR	192,695 PKR	280,284 PKR
Net Fuel cost from GT Synch to ST Synch	1,008,701 PKR	1,849,285 PKR	2,689,869 PKR	672,467 PKR	1,232,857 PKR	1,793,246 PKR	336,234 PKR	616,428 PKR	896,623 PKR
Total Fuel Gas Start-up Charges	1,129,457 PKR	1,970,041 PKR	2,810,625 PKR	762,521 PKR	1,322,911 PKR	1,883,300 PKR	383,937 PKR	664,131 PKR	944,326 PKR

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RLNG

GT Start-up Cost-Gas	Adding of Single GT in CCPP		
Backfeed charges	**Hot Startup**	**Warm Startup**	**Cold Startup**
Backfeed import duration	50 min	50 min	50 min
Auxiliary Power Used	1.90 MW	1.90 MW	1.90 MW
FCC	6.6636 PKR/kWh	6.6636 PKR/kWh	6.6636 PKR/kWh
VOM	0.3435 PKR/kWh	0.3435 PKR/kWh	0.3435 PKR/kWh
Power import rate (EPP Cost)	7.0071 PKR/kWh	7.0071 PKR/kWh	7.0071 PKR/kWh
Backfeed charges/Auxliary Charges	**11,069 PKR**	**11,069 PKR**	**11,069 PKR**
Gas price (HHV)	8.738 US/MMBtu	8.738 US/MMBtu	8.738 US/MMBtu
Gas HHV	42777.13 KJ/kg	42777.13 kJ/kg	42777.13 kJ/kg
Exchange rate (USD/PKR)	104.95	104.95	104.95
Upto GT Synchronization			
Gas consumption from start and on FSNL	528 Kg	528 kg	528 kg
Fuel gas cost for operation on FSNL	**19,633 PKR**	**19,633 PKR**	**19,633 PKR**
From GT Synchronization up to HRSG Latching (1+1)			
Operation from GT Synch to HRSG Latching	90 min	165 min	240 min
Load from GT Synch to HRSG Latching	10 MW	10 MW	10 MW
Baseload GT efficiency	34.2%	34.2%	34.2%
Part load GT efficiency heat rate ratio	2.9052	2.9052	2.9052
Fuel cost from GT Synch to HRSG Latching	441,340 PKR	809,124 PKR	1,176,907 PKR
Cost of Energy Exported to Grid	105,107 PKR	192,695 PKR	280,284 PKR
Net Fuel cost from GT Synch to HRSG Latching	**336,234 PKR**	**616,428 PKR**	**896,623 PKR**
Total Fuel Gas Start-up Charges	**366,936 PKR**	**647,130 PKR**	**927,325 PKR**

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HSFO

Single GT Start-up Cost in HFO		Adding of Single GT in CCPP	
Backfeed charges	**Hot Startup**	**Warm Startup**	**Cold Startup**
Backfeed import duration	50 min	50 min	50 min
Auxiliary Power Used	1.92 MW	1.92 MW	1.92 MW
FCC	7.5247 PKR/kWh	7.5247 PKR/kWh	7.5247 PKR/kWh
VOM	0.4800 PKR/kWh	0.4800 PKR/kWh	0.4800 PKR/kWh
Power import rate (EPP Cost)	8.0047 PKR/kWh	8.0047 PKR/kWh	8.0047 PKR/kWh
Backfeed charges/Auxliary Charges	**12,813 PKR**	**12,813 PKR**	**12,813 PKR**
HSFO price (HHV), Reference Value	38.265 PKR/Kg	38.265 PKR/Kg	38.265 PKR/Kg
HSFO LHV, Reference Value	38523 BTU/ Kg	38523 BTU/ Kg	38523 BTU/ Kg
Total Heat Consumption	27273671 BTU	27273671 BTU	27273671 BTU
Fuel cost for operation Upto GT Synch	**27,091 PKR**	**27,091 PKR**	**27,091 PKR**
From GT Synchronization up to ST Synchronization			
HSFO Price (HHV), Reference Value	38.265 PKR/Kg	38.265 PKR/Kg	38.265 PKR/Kg
HSFO LHV, Reference Value	38557 BTU/Kg	38557 BTU/Kg	38557 BTU/Kg
Operation from GT Synch to ST Synch	90 min	165 min	240 min
Load from GT Synch to ST Synch (MW)	20 MW	20 MW	20 MW
Baseload GT efficiency	32.14%	32.14%	32.14%
Part load GT efficiency heat rate ratio	2.13	2.13	2.13
Fuel cost from GT Synch to ST Synch	**673,257 PKR**	**1,234,304 PKR**	**1,795,351 PKR**
Cost of Energy Exported to Grid	**240,141 PKR**	**440,259 PKR**	**640,376 PKR**
Net Fuel cost from GT Synch to ST Synch	**433,116 PKR**	**794,045 PKR**	**1,154,975 PKR**
Total RFO Start-up Charges	**473,019 PKR**	**833,949 PKR**	**1,194,878 PKR**

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HSFO

CCPP Start-up Cost-RFO	FULL COMPLEX (3+3+1)			FULL COMPLEX (2+2+1)			FULL COMPLEX (1+1+1)		
	Hot Startup	Warm Startup	Cold Startup	Hot Startup	Warm Startup	Cold Startup	Hot Startup	Warm Startup	Cold Startup
Backfeed import duration	50 min	50 min	50 min	50 min	50 min	50 min	50 min	50 min	50 min
Power import	10.67 MW	10.67 MW	10.67 MW	8.75 MW	8.75 MW	8.75 MW	4.83 MW	4.83 MW	4.83 MW
FCC	7.5247 PKR/kWh	7.5247 PKR/kWh	7.5247 PKR/kWh	7.5247 PKR/kWh	7.5247 PKR/kWh	7.5247 PKR/kWh	7.5247 PKR/kWh	7.5247 PKR/kWh	7.5247 PKR/kWh
VOM	0.4800 PKR/kWh	0.4800 PKR/kWh	0.4800 PKR/kWh	0.4800 PKR/kWh	0.4800 PKR/kWh	0.4800 PKR/kWh	0.4800 PKR/kWh	0.4800 PKR/kWh	0.4800 PKR/kWh
Power import rate (EPP Cost)	8.0047 PKR/kWh	8.0047 PKR/kWh	8.0047 PKR/kWh	8.0047 PKR/kWh	8.0047 PKR/kWh	8.0047 PKR/kWh	8.0047 PKR/kWh	8.0047 PKR/kWh	8.0047 PKR/kWh
Backfeed charges	71,175 PKR	71,167 PKR	71,167 PKR	58,354 PKR	58,354 PKR	58,354 PKR	32,234 PKR	32,234 PKR	32,234 PKR
HSFO price (HHV), Reference Value	38.265 PKR/Kg	38.265 PKR/Kg	38.265 PKR/Kg	38.265 PKR/Kg	38.265 PKR/Kg	38.265 PKR/Kg	38.265 PKR/Kg	38.265 PKR/Kg	38.265 PKR/Kg
HSFO LHV, Reference Value	38523 BTU/ Kg	38523 kJ/kg	38523 kJ/kg	38523 BTU/ Kg	38523 kJ/kg	38523 kJ/kg	38523 BTU/ Kg	38523 kJ/kg	38523 kJ/kg
Total Heat Consumption	27273671 BTU	27273671 BTU	27273671 BTU	27273671 BTU	27273671 BTU	27273671 BTU	27273671 BTU	27273671 BTU	27273671 BTU
Fuel cost for operation Upto GT Synch	81,273 PKR	81,273 PKR	81,273 PKR	54,182 PKR	54,182 PKR	54,182 PKR	27,091 PKR	27,091 PKR	27,091 PKR
From GT Synchronization up to ST Synchronization									
HSFO Price (HHV), Reference Value	38.265 PKR/Kg	38.265 PKR/Kg	38.265 PKR/Kg	38.265 PKR/Kg	38.265 PKR/Kg	38.265 PKR/Kg	38.265 PKR/Kg	38.265 PKR/Kg	38.265 PKR/Kg
HSFO LHV, Reference Value	38557 BTU/Kg	38557 BTU/Kg	38557 BTU/Kg	38557 BTU/Kg	38557 BTU/Kg	38557 BTU/Kg	38557 BTU/Kg	38557 BTU/Kg	38557 BTU/Kg
Operation from GT Synch to ST Synch	90 min	165 min	240 min	90 min	165 min	240 min	90 min	165 min	240 min
Load from GT Synch to ST Synch (MW)	60 MW	60 MW	60 MW	40 MW	40 MW	40 MW	20 MW	20 MW	20 MW
Baseload GT efficiency	32.14%	32.14%	32.14%	32.14%	32.14%	32.14%	32.14%	32.14%	32.14%
Part load GT efficiency heat rate ratio	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13
Fuel cost from GT Synch to ST Synch	6,059,309 PKR	11,108,732 PKR	16,158,156 PKR	2,693,026 PKR	4,937,214 PKR	7,181,403 PKR	673,257 PKR	1,234,304 PKR	1,795,351 PKR
Cost of Energy Exported to Grid	2,161,269 PKR	3,962,327 PKR	5,763,384 PKR	960,564 PKR	1,761,034 PKR	2,561,504 PKR	240,141 PKR	440,259 PKR	640,376 PKR
Net Fuel cost from GT Synch to ST Syn	3,898,040 PKR	7,146,406 PKR	10,394,772 PKR	1,732,462 PKR	3,176,180 PKR	4,619,899 PKR	433,116 PKR	794,045 PKR	1,154,975 PKR
Total Fuel Gas Start-up Charges	4,050,488 PKR	7,298,846 PKR	10,547,212 PKR	1,844,998 PKR	3,288,717 PKR	4,732,435 PKR	492,440 PKR	853,370 PKR	1,214,299 PKR

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