



Registrar

National Electric Power Regulatory Authority

Islamic Republic of Pakistan

NEPRA Tower, Attaturk Avenue (East), G-5/1, Islamabad
Ph: +92-51-9206500, Fax: +92-51-2600026
Web: www.nepra.org.pk, E-mail: registrar@nepra.org.pk

No. NEPRA/Consultant(RE/Tech)/TRF-362/K-ELECTRIC-2016/5552-5554

April 21, 2022

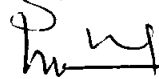
Subject: **Order of the Authority in the matter of Approval of Heat Rate for Bin Qasim Power Station-I of K-Electric Ltd. (Case No. NEPRA/TRF-362/K-ELECTRIC-2016)**

Dear Sir,

Enclosed please find herewith the subject Order/Decision of the Authority (07 Pages) in the matter of Approval of Heat Rate for Bin Qasim Power Station-I of K-Electric Ltd.

2. The Order/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 Order/Decision. In the event the Federal Government fails to notify the subject Order/Decision or refer the matter to the Authority for reconsideration, 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 NEPRA Act.

Enclosure: As above


21 04 22
(Syed Safer Hussain)

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

CC:

1. Secretary, Cabinet Division, Cabinet Secretariat, Islamabad.
2. Secretary, Ministry of Finance, 'Q' Block, Pak Secretariat, Islamabad.

ORDER
APPROVAL OF HEAT RATE FOR BQPS-I OF K-ELECTRIC (KE)

Introduction:

Bin Qasim Power Station-I is a power plant of K-Electric located in Port Qasim area of Karachi. The Plant comprises 6 units of gross installed capacity of 210MW each. The gross installed capacity of plant is 1260MW. The plant is a part of the overall fleet of generating stations owned by K-Electric. The detail of the plant is as hereunder¹:

Units	Fuel	Technology	COD	Installed Capacity
Unit 1	RFO/Gas	Steam Turbine	1983	210MW
Unit 2	RFO/Gas	Steam Turbine	1984	210MW
Unit 3	RFO/Gas	Steam Turbine	1989	210MW
Unit 4	RFO/Gas	Steam Turbine	1990	210MW
Unit 5	RFO/Gas	Steam Turbine	1991	210MW
Unit 6	RFO/Gas	Steam Turbine	1997	210MW

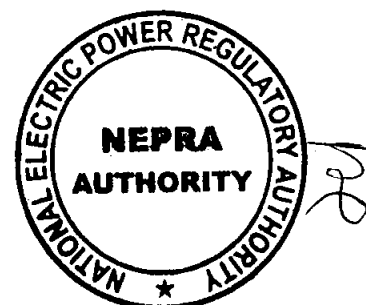
Multi-Year Tariff (MYT) Determination of K-Electric Ltd:

2. The Authority in the matter of reconsideration request filed by the Federal Government regarding Multi-Year Tariff (MYT) petition of KE for the period commencing from July 1, 2016 to June 30, 2023 directed KE to conduct performance test of BQPS-I plant. (Ref: Case # NEPRA/TRF-362/K-Electric-2016/10232-10234 dated July 5, 2018 paragraph IX of ORDER)

Regarding BQPS-I, the parameters allowed by the Authority are provisional and the Authority directs K-Electric to arrange performance test (Heat Rate test) by an Independent Engineer within a period of six months from the date of notification of the instant tariff determination. For the selection of independent engineer, KE shall broadly follow the procedure specified in NEPRA (Selection of Engineering, Procurement and Construction Contractor by IPPs) Guidelines, 2017. The tests shall be conducted in the presence of NEPRA professionals as observers. The adjustment in Heat Rates will be made based on the results of the performance (Heat Rate) test.

3. In order to test and evaluate the thermal performance of BQPS-I, NEPRA directed KE to undertake a bidding process to procure the services of an Independent Engineer (IE) for conducting the performance test (Heat Rate and Capacity).

¹ Ref: Authority determination of KE dated March 20, 2017



Case
J

4. Pursuant to the above mentioned Authority's directions, KE procured the services of KEPCO for conducting the performance test (Heat Rate and Capacity) of BQPS-I.

Objective of Performance (Capacity and Heat Rate) Test:

5. The objective of the performance test was to verify the gross & net capacity and gross & net Heat Rate of units of BQPS-1. The Heat Rate test was required to be conducted as per international codes and standards. The test procedure was based on ASME PTC-46 and was approved by NEPRA.

Codes and Standards:

6. IE used the following codes and standards in conduct of performance test (Ref: IE report)

- Manufacture's Technical Design Data**
- ASME PTC 46-1996 : Overall Plant Performance**
- ASME PTC 19.1-2013 : Measurement Uncertainty**
- ASME Steam Table 1997, based on the "1997 IFC Formulation for industrial Use"**

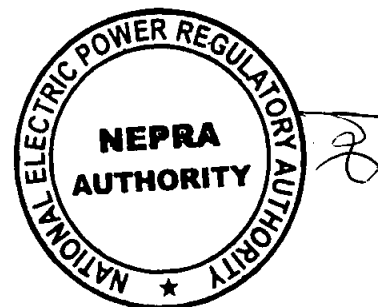
- GPA-2166 : Obtaining Natural Gas Samples for Analysis by Gas Chromatography**
- ASTM D-4057 : Standard Practice for Manual Sampling of Petroleum and Petroleum Products**

Performance (Capacity and Heat Rate) Tests (November 2019):

7. Pursuant to the performance test procedures the performance tests for BQPS-I was conducted in November 2019 in following configurations:

Unit	Load	Fuel
1	Maximum Load and 110 MW	HFO & NG
2	Maximum Load and 110 MW	HFO & NG
3	Maximum Load and 110 MW	HFO
4	Maximum Load and 110 MW	HFO
5	Maximum Load and 110 MW	HFO & NG
6	Maximum Load and 110 MW	HFO & NG

8. All test instrumentation used in calculation of test results were calibrated by recognized international standard organization and the recognized physical constants were used in calculations. The measured values for capacity and Heat Rate were corrected to site reference conditions by using correction factors curves and formulae as per PTC 46 guidelines.



9. For the purpose of fuel sampling one sample of HFO and three samples of NG (Natural Gas) were taken (where applicable) for determining the calorific value and composition of HFO/NG.

Test Results:

10. Following are the test results for Net Power Output (capacity) and Heat Rate as evaluated by IE in its Performance report (corresponding to Test day):

Unit	Corrected Net Power Output	
	HFO (MW)	NG (MW)
1	168.32	161.83
2	170.22	171.62
3	118.01	-
4	126.51	-
5	175.90	176.24
6	176.38	177.24

Unit	Corrected Net Heat Rate HHV – (efficiency %)*	
	HFO Btu/kWh – (%)	NG (Btu/kWh) – (%)
1	10566.01 (32.29%)	11230.95 (30.38%)
2	10527.41 (32.41%)	11143.11 (30.62%)
3	12184.82 (28.0%)	-
4	12115.86 (28.16%)	-
5	10162.88 (33.57%)	10798.40 (31.60%)
6	10352.22 (32.96%)	10391.27 (32.84%)

* Numbers correspond to maximum loading.

11. Further, based on the test results, IE in its report has also estimated Heat Rate number for every unit of BQPS-I for every year of the MYT period incorporating degradation adjustment and impact of part load operations. IE has taken average loading of the unit based on historical data of 3.5 years and has taken part load ratio based on commissioning data.

Request of K-Electric:

12. Through its letters dated March 2020 KE has requested following Heat Rates for approval. KE has included impact of degradation and part load operation in its request.

Unit	Corrected Net Heat Rate HHV – (efficiency %)	
	HFO Btu/kWh – (%)	NG (Btu/kWh) – (%)
1	10849 (31.45%)	11531 (29.59%)
2	10658 (32.01%)	11283 (30.24%)
3	12827 (26.60%)	-
4	13018 (26.21%)	-
5	10618 (32.13%)	11282 (30.24%)
6	10797 (31.60%)	11680 (29.21%)



Kate J

Analysis:

13. The Authority noted that the Independent Engineer (IE) has carried out the performance (capacity and Heat Rate) tests of BQPS-I of KE as per ASME PTC 46 standard and code. These tests were also observed by the NEPRA representatives.

14. The Authority considered that the original decision of the MYT 2017~23 it had determined a unit wise Heat Rate for BQPS-I. This Heat Rate was evaluated based on design efficiency, useful life and comparison with similar technology plants. The Heat Rate numbers as given in determination are given hereunder:

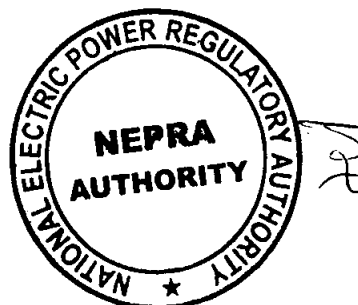
BQPS 1	Fuel	Net HHV Flat Thermal Efficiency % at RSC	Net HHV Flat Heat Rate at RSC (Btu/kWh)
Unit 1	RFO/Gas	31.59	10802.14
Unit 2	RFO/Gas	32.04	10650.00
Unit 3	RFO/Gas	31.03	10995.78
Unit 4	RFO/Gas	31.31	10898.96
Unit 5	RFO/Gas	33.11	10304.22
Unit 6	RFO/Gas	33.29	10248.90

15. However, KE had filed a review ^{against us} to the decision of the Authority seeking review of the Heat Rate numbers. KE in its review, had proposed its own Heat Rate numbers based on the commissioning data – KE also substantiated its proposed numbers with detailed analysis. In its analysis, KE had considered the impact of part load, degradation over life of plant and other miscellaneous considerations such as planned maintenance and re-starts, forced trips and re-starts, standby operations, etc. KE had included 4% degradation over life of plant.

16. The Authority after considering the justification as provided by KE, had provisionally maintained the earlier allowed Heat Rate numbers and had further required KE to conduct Heat Rate test. Similarly, the Authority in its Determination on the Reconsideration Request by the GOP had decided that adjustment in Heat Rate will be made based on the result of Performance (Heat Rate) test

17. Accordingly the Heat Rate numbers as requested by KE through its letter dated March 2020 were analysed. The Authority has noted that KE has worked out an average number for the seven year control period (FY 2017-2023) for every unit of BQPS-I based on IE's numbers and has requested the same. Analysis shows that the requested numbers represent Heat Rates incorporating part load and degradation adjustment.

18. The Authority has seen that some of the units of BQPS-I have already been decommissioned and would not be operated going forward. Therefore the Authority does not concur with KE's request of average Heat Rate of 7-year period for the respective units.



Handwritten signature/initials

Effect of Part Load:

19. It is highlighted that IE has included the impact of Part Load operations in its evaluation of Heat Rate numbers. IE has taken average loading of the respective units based on historical data of 3.5 years and has taken part load ratio based on commissioning data. The Authority deems the same as practicable.

Effect of Degradation:

20. The Heat Rate test of BQPS-I was conducted in November 2019. On the basis of test numbers IE has evaluated Heat Rate numbers for the seven year control period (MYT 2017-23) using degradation based on commission data.

21. The Authority noted that IE was required to estimate degradation based on industry reference. However, IE has not provided the same, rather IE has assumed degradation on the basis of comparison between the test result and commissioning data. Further IE has also assumed degradation in future years i.e. after the conduct of test.

22. The Authority during analysis has also obtained operational and fuel data of BQPS-I plant. The Authority notes that the units of BQPS-I have immensely and exorbitantly degraded, despite the fact that it is the responsibility of KE to maintain the plants in optimum conditions, and KE has also been allowed O&M cost for this purpose. Therefore, the Authority does not agree that in-efficiency of KE be passed on to the consumers. It is considered that in its Determination on the Reconsideration Request by the GOP had decided that the adjustment in Heat Rate will be made based on the result of Performance (Heat Rate) test. Therefore, the Authority has decided to accept the Heat Rate numbers as evaluated by the IE till the conduct of test.

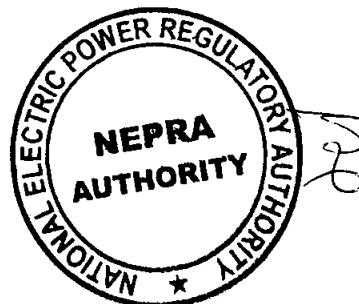
23. Accordingly, the Authority has decided not to allow KE to recover impact of further degradation of its plant from the end consumers i.e. FY 2020 onwards.

Heat Rate numbers to be allowed for the Control Period July 2016-June 2023:

24. The Authority has reviewed the record provided by KE, current conditions of gas supply conditions at KE's plants and the response of KE to the observations of the Authority on the IE's report, etc. The Authority principally agrees that KE be allowed part-load operations and that heat rate numbers be allowed to reflect such scenario.

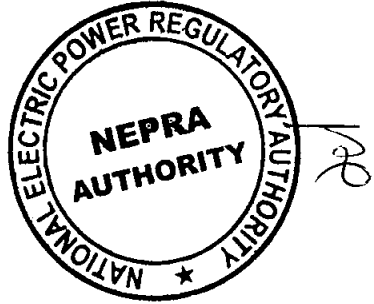
25. The Authority further agrees to allow recovery of impact of degradation of BQPS-I, however, does not allow adjustment on account of further degradation of BQPS-I, as the plant has already been massively degraded and it would not be prudent to pass KE's inefficiency on to


Kass
Jr



Unit	FY 17		FY 18		FY 19		FY 20		FY 21		FY 22		FY 23	
	HFO	Gas	HFO	Gas	HFO	Gas	HFO	Gas	HFO	Gas	HFO	Gas	HFO	Gas
1	10776	11454	10807	11486	10831	11511	10844	11525	10844	11525	10844	11525	10844	11525
2	10600	11222	10611	11233	10640	11264	10653	11277	10653	11277	10653	11277	10653	11277
3	12686		12740		12792		12818		12818		12818		12818	
4	12849		12915		12978		13006		13006		13006		13006	
5	10565	11226	10582	11243	10605	11268	10614	11277	10614	11277	10614	11277	10614	11277
6	10689	11563	10738	11615	10768	11648	10785	11667	10785	11667	10785	11667	10785	11667

Summary Table : Net Heat Rate for BQPS-I (HHV-Btu/kWh)



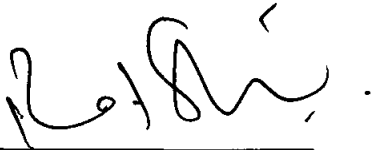
Kats


Decision of the Authority:

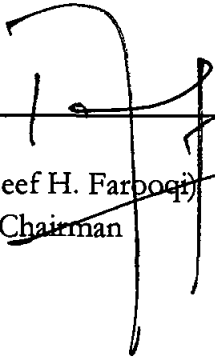
The Authority approves the net Heat Rate numbers for BQPS-I for MYT 2017-2023 as given in the Summary Table.



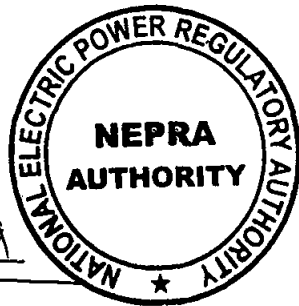
(Engr. Maqsood Anwar Khan)
Member



(Rafique Ahmed Shaikh)
Member



(Tauseef H. Farooqi)
Chairman



21 04 22