



# HALMORE POWER GENERATION COMPANY LIMITED

Mian Salahuddin Road, Along Q. B. Link Canal, 16km Sheikhpura-Faisalabad Road, Bhikki, District Sheikhpura  
Tel: +92-56-367 9231-8, +92-56-367 9351-5 Fax: +92-56-367 9239, +92-56-367 9390 Email: info@halmore.com

F/A

HPGCL/EXE-0043-2012  
July 11, 2012

**Registrar**  
National Electric Power Regulatory Authority  
OPF Building, 2<sup>nd</sup> Floor  
Shahrah-e-Jamhuriyat  
G-5/2, Islamabad

For m/f to  
- AD (MR) + R  
- M/F

Registrar 5/168-A  
Dy. No. ....  
Dated 11-07-12

**SUBJECT: APPLICATION FOR THE REVISION/MODIFICATION OF THE GENERATION TARIFF – APPROXIMATELY 225 MW DUAL-FUEL COMBINED CYCLE THERMAL POWER PROJECT AT BHIKKI, PUNJAB**

Dear Sir

Halmore Power Generation Company Limited (the “Company”), on November 21, 2011, submitted to the Authority its petition seeking one-time adjustments to certain tariff components in addition to the allowance of various indexations (the “True-up Petition”). Thereafter, the Company has submitted further information and evidence in respect of several issues raised by NEPRA.

It must be noted by the learned Authority that (i) at present the True-up Petition is pending determination by NEPRA; and (ii) the appended application for the revision/modification of the generation tariff is being made pursuant to the NEPRA Act 1997, applicable provisions of the NEPRA Tariff Standards and Procedures Rules 1998 and the ECC decision dated 30 June 2011 (communicated to the Company by PPIB through its letter dated 15 July 2011 – attached herewith as Annex A (1)).

In light hereof, the learned Authority would appreciate that the appended application for the revision/modification of the generation tariff is entirely distinct from the True-up Petition dated November 21, 2011 submitted by the Company; and thereby ought to be treated separately.

Please note that the Company submitted the petition for revision/modification of the generation tariff on June 28, 2012 and subsequently withdrawn on July 09, 2012. This is a re-submission of the same petition.



## **HALMORE POWER GENERATION COMPANY LIMITED**

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The required fee for the petition amounting to PKR 1,179,760/- has already been deposited with NEPRA vide Bank Draft Number 0496858 dated 27 June 2012 issued by MCB.

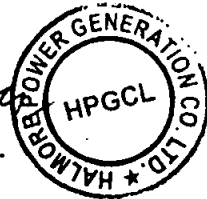
We look forward to working with you to expeditiously complete the regulatory process in relation to both of the aforementioned matters.

Yours sincerely,

For and on behalf of

**HALMORE POWER GENERATION COMPANY LIMITED**

  
Ahmed Zia Haider  
Chief Financial Officer



**Enclosures:**

- 1- Board Resolution
- 2- Affidavit
- 3- Petition with Annexure



# HALMORE POWER GENERATION COMPANY LIMITED

Head Office/Site Office: Mian Salahuddin Road, Along Q. B. Link Canal, 16km Sheikhpura-Faisalabad Road, Bhikki, District Sheikhpura. Tel: +92-56-367 9231-8 Fax: +92-56-367 9239 & +92-56-367 9390 Email: info@halmore.com

## TRUE EXTRACT OF THE RESOLUTIONS

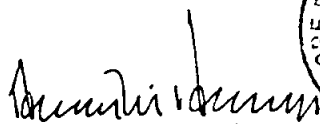
PASSED IN THE MEETING OF THE BOARD OF DIRECTORS OF THE COMPANY

HELD ON 05<sup>th</sup> July 2012, 2012

"RESOLVED THAT the Halmore Power Generation Company Limited (HPGCL) ("the Company") file its Tariff Petitions with the National Electric Power Regulatory Authority (NEPRA)."

"FURTHER RESOLVED THAT Mr. Zafar Iqbal, the Chief Executive Officer, Mr. Zaheer Ahmed, Managing Director, Mr. Arshad Ameen, Chief Operating Officer, Mr. Ahmed Zia Haider, Chief Financial Officer, Mr. Shahid Saud ul Hassan, Senior Manager Finance and Mr. Majid Naseer, Manager Finance of the Company is hereby authorized for and on behalf of the Company to sign and submit all the necessary documentation, pay the necessary fees, appear before NEPRA as needed and to do all such acts necessary for processing and completion of the Petition."

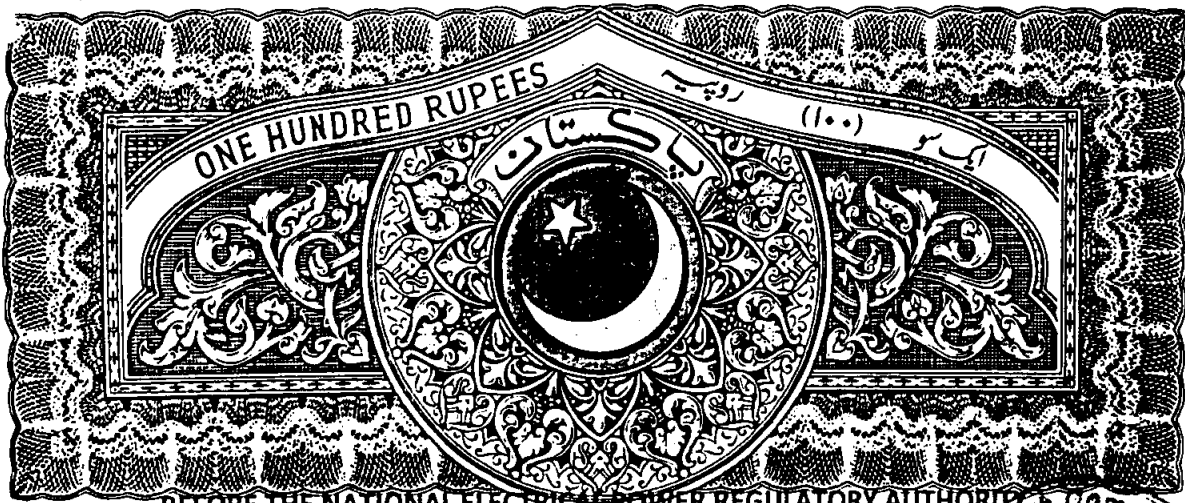
CERTIFIED TRUE COPY

  
Ahmed Zia Haider

(Company Secretary)

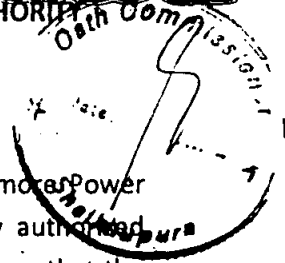


Dated: 05<sup>th</sup> July 2012



BEFORE THE NATIONAL ELECTRICAL POWER REGULATORY AUTHORITY

**AFFIDAVIT**



I, Ahmed Zia Haider, S/o Ahmed Iqbal, Chief Financial Officer, Halmora Power Generation Company Limited (HPGCL) ("the Company") being duly authorized representative / attorney of HPGCL, hereby solemnly affirm and declare that the contents of the accompanying Tariff Petition No. HPGCL/EXE-0043-2012 dated July 10, 2012 including all supporting documents are true and correct to the best of my knowledge and belief and that nothing has been concealed.

I also affirm that all further documentation and information to be provided by me in connection with the accompanying petition shall be true to the best of my knowledge and belief.

*Ahmed Zia Haider*



**DEPONENT**  
**AHMED ZIA HAIDER**  
 Chief Financial Officer, HPGCL  
 CNIC # 35200-1501078-7

**ATTESTED**

*Shahidullah Khan*  
 Oath Commissioner  
 Shahdulpur



## HALMORE POWER GENERATION COMPANY LIMITED

### Rule 3 PETITIONS

Petition under Sections 31 of the National Electric Power Regulatory Authority Act, 1997 read with Rule 3 of the NEPRA Tariff Standards and Procedures Rules, 1998 (the "Rules") for Revision/Modification of the Generation Tariff Determination dated 26<sup>th</sup> December 2007 of Halmore Power Generation Company Limited (the Company/Petitioner")

Rules 3(2) (a)            PETITIONER'S NAME AND ADDRESS

Halmore Power Generation Company Limited, through  
Mr. Ahmed Zia Haider  
Chief Financial Officer

Mian Salah ud din Road along Q-B Link Canal, 16km Sheikhpura  
Faisalabad Road, Bhikki, Sheikhpura.  
Tel: +92-56-3679231-8  
Fax: +92-56-3679239

Rules 3(2) (a)            Generation License No. IGSP/07/2006 dated 04<sup>th</sup> Sep, 2006

Rules 3(2) (b)            GROUNDS

Amended Operating Regime as authorized by the Economic  
Coordination committee of GOP requiring changes in tariff  
component of Energy

Rules 3(2) (c)            RELIEF SOUGHT

Relief sought is mentioned in Section 6 of this Revised Tariff  
Petition

Rules 3(2)(f)            SUMMARY OF EVIDENCE

Attached herewith as Annexures of the Tariff Petition

REGISTRY  
NEPRA



## i. BASIC FACTS

This particular petition to the Authority is being submitted in the wake of the situation beyond June 30, 2011 which is affecting Company's financial operations.

At the very onset, we would like to highlight certain relevant basic facts which have a direct link to this Petition and which constitute the platform from which this petition moves forward. The Authority is of course already aware of these facts; Company is highlighting them only to invite the focus of the Authority;

1. Company's operations, its rights and its obligations are governed by the following core documents;
  - (a) Implementation Agreement
  - (b) Power Purchaser Agreement
  - (c) Gas Supply Agreement
  - (d) Fuel Supply Agreement
2. These documents were derived and were subsequently executed based upon the Guidelines of the Power Generation policy of Government of Pakistan 2002 (the "2002 Policy")
3. The Tariff determination for the Company from the Authority is also derived from the 2002 Policy and such Tariff determination also takes into account the provisions of the above core agreements

*ndrew*



## ii. PROVISIONS OF THE AGREEMENT

Section 5.7 of the Implementation Agreement states;

"High Speed Diesel Cost Recovery after 30<sup>th</sup> June 2011

(a) If prior to June 30, 2011 (which date upon any extension(s) of the present Gas Allocation, as provided in (i) below, shall be deemed to be a date that is three hundred and sixty five (365) days prior to the end of such extended date the Gas Allocation for the firm delivery of Gas (as defined in the Gas Supply Agreement) during nine (9) Months of each Year will expire or shall materially reduce in duration within the following twelve (12) Months so that the Company will be able to continue to operate the Complex on Gas in a manner that will allow the Company to operate the Complex on Gas in a manner consistent with its Tariff Approval or (ii) the Power Purchase Agreement has not been modified or amended in a matter that will allow the Company to operate the Complex using high speed diesel beyond ninety (90) Days in a Year, consistent with the Tariff Approval (for high speed diesel), the GOP and the Company shall meet within (10) Business Days of the beginning of the Pre-Expiry Period and continue to meet at reasonable intervals until the Parties have agreed a mechanism reasonably acceptable to the Parties that will compensate the Company for the continued operation of the Complex.

(b) One of the three (3) options under Section 5.7(a) providing for either an extension in the Gas Allocation or an amendment or modification in the Power Purchase Agreement or a mechanism which will compensate the Company for the continued operation of the Complex shall be agreed upon between the Company and the GOP prior to the end of the Pre-Expiry Period.

(c) If by the date that is five (5) Business Days prior to the end of the Pre-Expiry Period, the Parties have not agreed on the mechanism which will compensate the Company for the continued operation of the Complex or the Gas Allocation has not been extended or the Power Purchase Agreement has not been modified or amended as provided for in Section 5.7(a), either Party may terminate this Agreement by giving thirty (30) days prior notice to the other Party. Upon termination of this Agreement following the delivery of such notice, the Power Purchase Agreement shall immediately terminate and the provisions of Section 14.5 and Section 14.6 and the Article XV shall apply."

Point (b) above is one of the important links to this Petition.



iii. **DECISION OF THE ECONOMIC COORDINATION COMMITTEE OF THE CABINET**

In the backdrop of Section 5.7 of the IA, various communications were exchanged between GOP and the IPPs. Eventually, a summary was moved to the ECC for a decision on this subject. The ECC gave its decision on June 30, 2011 which was communicated to the Company by PPIB through its letter no.1 (102) PPIB-1028/11/PR dated July 14, 2011 attached as Annex-A (I). ECC decision is given as under:

- i. *Firm gas allocation of 76 MMCFD to IPPs namely Saif, Sapphire, Orient and Halmore, till 30<sup>th</sup> November 2011;*
- ii. *Cost differential on account of use of alternate fuel-(HSD) by the four IPPs should be equally shared by the SNGPL and the Government; and*
- iii. *Modification of Tariff by NEPRA allowing operation of gas based IPPs on backup fuel (HSD), with full cost recovery, for whatever period gas was not made available to them."*

What this ECC decision means is that;

(a) Gas allocation to IPPs has been cut by half so that instead of 152 MMCFD, the IPPs will now get only 76 MMCFD and, as such, they will run partly on Gas and partly on HSD till November 30, 2011.

(b) ECC also decided to continue with the existing terms of the GSA wherein if the Gas Supplier was not able to provide even 76 MMCFD for any reason, then the cost of using HSD will be shared evenly between GOP and SNGPL.

(c) ECC also emphasized that this situation requires a modification of the Tariff from NEPRA and that the IPPs should be able to operate in HSD regime with **full cost recovery** beyond June 2011 for whatever indefinite period gas is not made available to the IPPs.

Thus ECC upheld Section 5.7 of the IA which makes the same statement and emphasizes that IPPs be allowed full compensation to run under this regime beyond June 2011.

In other words, what this means is that current tariff structure where Complex is supposed to run on nine months on Gas and three months on HSD is being amended/changed so that Complex may run on HSD for unlimited periods when full Gas supply is not made available. Therefore, Tariff modification is required to ensure that Company recovers its full cost in this new regime.





#### iv. 2002 POLICY GUIDELINES

Under the 2002 Policy Guidelines and with special reference to Guidelines for Tariff Determination, Section 1.4 9a) states;

*"Tariff should be determined allowing reasonable Internal Rate of Returns (IRR) on equity investment"*

This basically means that IPPs tariff is structured on a cost + IRR model

Section 1.13 continues to say;

*"As fuel cost is a pass through, prices of different fuels e.g. gas, oil, coal, etc., tend to distort the evaluation. Therefore, levelized tariff be evaluated on the basis of capacity purchase price, efficiency (taking into account fuel cost) and O&M costs."*

Therefore, as Authority has already determined the IRR for the Company, any additional operations cost for the Company in current operation regime that is imposed by an external situation (relating to GOP) and is beyond Company's control and is not covered under the existing tariff determination for the Company is a pass through item and needs to be treated as such to ensure that Company's determined IRR is not diluted.

*rdm*



#### V. ADJUSTMENTS/COSTS INVOLVED

In the light of above situation (which would now be very much clear to the Authority), the Company had discussions with GOP and Power Purchaser with specific reference to; (a) Section 5.7(b) of the IA which requires that Company and GOP may agree on the amendment/compensation to the Company, and; (b) ECC decision of June 30, 2011 which allows full cost recovery to the IPPs. The conclusion of these discussions is:

- Company will file a petition with NEPRA on following grounds;
  - (i) O&M cost component may be revised
  - (ii) A Heat Rate Test on HSD will be conducted after each major maintenance and results of such Test will be used as a bench mark for establishing the HSD heat rate/HSD fuel efficiency till the next major maintenance and so on. The average period for a major maintenance is around 5-6 years depending on actual running hours of the GTs. Related benchmarks of HSD specifications during summers may also be revisited.
  - (iii) All cost adjustments determined by NEPRA would be allowed to the Company from retrospective effect i.e. starting from July 1, 2011 so that Company's losses for this interim period are absorbed through a new determination.

*[Handwritten signature]*



vi. APPEAL TO THE AUTHORITY

Based on above presentation, we request the Authority for;

- i. Adjustment on HSD O&M variable component to make it 1.79 times the cost of O&M Gas component as against existing cost factor of 1.44 times.
- ii. Conduct of HSD Heat rate test after each major maintenance.
- iii. Adjustment of Specific gravity of HSD fuel to reflect the actual position during Gas months.
- iv. Adjustments for item no. i and iii may be made effective from July 1, 2011

Detailed explanations of the items are given hereunder;

A handwritten signature in dark ink, appearing to be "J. W. ...", located at the bottom left of the page.



i. O&M VARIABLE COST COMPONENT

1. Current Tariff determined by NEPRA for the Company for April -June Quarter is as follows;

Component on Gas	=	Rs. 0.3011
Component on HSD	=	Rs. 0.4345

As per this determination, HSD cost component is 1.44 times the cost of the Gas component while in reality and on actual basis the HSD component needs to be 1.79 times the cost component of Gas.

2. To explain this matter in detail, we request you to refer to Section 5.3 and Appendix G of our O&M Agreement which is already available with your office;

As per section 5.3, the base price (un-indexed) of O&M variable component on Gas is \$ 179.49 USD per FFH (Factored fired hours) per GT while the base price of O&M variable component on HSD (after 1450 actual hours) is \$ 214.2 per FFH per GT which means that the base price of HSD component is 1.193 times the base price of Gas component.

Now we request you to kindly have a look under Appendix G wherein the Agreement prescribes the 2 different calculation methods of arriving at FFH on Gas and on HSD. Under the formula, whereas on Gas the Annual Base Load Operating Hours on Gas fuel (referred to as G) are multiplied by a factor of one (1) only, in the case of HSD (referred to as D), these operating hours are multiplied by a factor of 1.5. This means that apart from the rate difference, there is a difference in the factors as well which lead to a much increased cost in the case of O&M variable cost component on HSD.

3. This means the cost to the Company on HSD is  $1.193$  (as in 2 above)  $\times 1.5 = 1.79$  times the cost of Gas component as against the existing factor of 1.44 times allowed by NEPRA.
4. Company, therefore, appeals to the Authority to adjust the HSD O&M Variable cost to 1.79 times the cost of the Gas O&M variable component.

*[Handwritten signature]*



**ii. HSD HEAT RATE TEST AFTER EACH MAJOR MAINTENANCE**

As the HSD fuel component initially determined for all the 4 similar IPPs was discrepant. The Power Purchaser, GOP and the Company/ies agreed that a heat rate test would be conducted after the major maintenance (when the turbines would be brought back to the near brand new position). In this way, the heat rate benchmark would be reestablished again to allow a more true representation. The results of such heat rate test would become the benchmark for the HSD fuel cost component in the tariff till next major maintenance which has a cycle of around 5-6 years. Other Related Provision and annexures would remain the same.



### iii. SPECIFIC GRAVITY

In its earlier Decisions relating to Halmore Power Generation Company Limited Limited, this learned Authority incorporated a specific gravity value of 0.84 at 15° C in HSD Fuel Cost Component calculations. On the other hand, the actual average HSD supply on site is collected at much higher temperatures, *i.e.*, approximately 25° C — resulting in the much lower specific gravity of less than 0.84. This translates to significant annual losses for the Company. By way of pertinent documentary evidence hereof, appended herewith at Annexure "A" hereof is the HSD specific gravity chart derived from API 54 B Standard Since the average ambient site temperature of 25° C, is the standard temperature for all other project tariff and billing calculations, it can be assumed to be a reasonable approximation for average collection temperature on site.

**This learned Authority is therefore respectfully requested to: allow adjustment in HSD fuel component on account of change in reference specific gravity value from 0.84 to 0.833, in accordance with the actual average ambient site temperature of 25° C.**

*[Handwritten signature]*  
A circular stamp with the text "HALMORE POWER GENERATION COMPANY LIMITED" around the perimeter and "HPGCL" in the center.



GOVERNMENT OF PAKISTAN  
MINISTRY OF WATER AND POWER  
(PRIVATE POWER & INFRASTRUCTURE BOARD)

"Annex-A (I) "

No. 1(102)PPIB/11/PRJ

15<sup>th</sup> July 2011

SUBJECT: CONTINUED OPERATION OF FOUR (04) IPPS OF 842 MW CUMULATIVE CAPACITY, WHICH ARE BASED ON PIPELINE QUALITY GAS FROM SNGPL SYSTEM

Pursuant to Power Policy 2002, four (04) SNGPL gas based IPP projects namely Saif, Sapphire Orient and Halmore, have been set up. The aggregate (pipeline quality) gas requirement of 152 MMCFD for these projects was earlier allocated through the SNGPL system by the Economic Coordination Committee (ECC) of the Cabinet in year 2004 on nine (9) months firm basis, which ended on 30<sup>th</sup> June 2011. In order to ensure continued operation of the four (04) IPPs beyond 30<sup>th</sup> June 2011, PPIB / Ministry of Water & Power (MoW&P) earlier initiated a Summary for the ECC, on which the following decision was taken by the ECC in its meeting held on 30<sup>th</sup> June 2011:

- i. Firm gas allocation of 76 MMCFD to IPPs, namely Saif, Sapphire, Orient and Halmore, till 30<sup>th</sup> November 2011;
- ii. Cost differential on account of use of alternate fuel-(HSD) by the four IPPs should be equally shared by the SNGPL and the Government; and
- iii. Modification of tariff by NEPRA allowing operation of gas based IPPs on backup fuel (HSD), with full cost recovery, for whatever period gas was not made available to them.

2. In order to deliberate on the modalities of compliance of the above mentioned ECC decision, a meeting has been scheduled to be held on Wednesday, 20<sup>th</sup> July 2011 at 1300 hrs in Board Room of PPIB Islamabad.

3. You are requested to kindly make it convenient to attend the above meeting.

Best regards,

Yours sincerely,

(N. A. Zuberi)

Managing Director

- |   |   |
|---|---|
| 1. Mr. Muhammad Zargham Eshaq Khan<br>Joint Secretary (Power)<br>Ministry of Water & Power<br>Islamabad | 2. Mr. Saeed Ullah Shah<br>Director General (Gas)<br>Ministry of Petroleum & Natural Resources<br>Islamabad |
| 3. Rana Muhammad Amjad<br>General Manager (Sales)<br>SNGPL House<br>Lahore                              | 4. Mr. Masood Ahmad<br>General Manager (Sales)<br>SNGPL<br>Lahore   |

5. ✓ Mr. Javed Saifullah Khan,  
Chief Executive  
Saif Power Limited  
3<sup>rd</sup> Floor, Kulsum Plaza, 2020 Blue Area  
Islamabad  
Fax: 051-2201110

7. Mr. Nadeem Babar  
Chief Executive  
Orient Power Company (Pvt) Ltd.  
10-Ali Block, New Garden Town  
Lahore  
Fax: 042-35911168

9. Mr. Shah Jahan Mirza  
Director Finance & Policy  
PPIB  
Islamabad

6. Mr. Shahid Abdullah  
Chief Executive  
Sapphire Electric Company Ltd  
7- A/K, Main Boulevard, Gulberg II,  
Lahore  
Fax: (042) 5758783, 5713753

8. Mr. Arshad Ameen  
Chief Executive  
Halmore Power Generation Company  
(Private) Limited  
Halmore House 234-B, Street 13,  
Sector E-7, Islamabad  
Fax: 051-2655291

10. Mr. Abdul Majid Khan  
Director Legal  
PPIB  
Islamabad

Copy for information:

Mr. Sami Rafi Siddiqui, Director Admin./IT, PPIB, Islamabad.





NATIONAL TRANSMISSION & DESPATCH COMPANY

Tel # 042-99202229  
Fax # 042-99201179

Office of the  
Chief Executive Officer  
National Transmission & Despatch Company  
414-WAPDA House, Lahore

No. 48-55/COO(CPPA)/CE-ITPPs

Dated: 29/06/2011

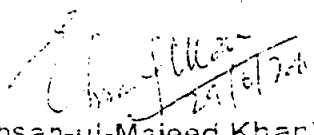
The Registrar,  
National Electric Power Regulatory Authority,  
Islamic Republic of Pakistan,  
2<sup>nd</sup> Floor, OPF Building, G-5/2,  
Shahrah-e-Jamhuriat,  
Islamabad.

**Subject: Continued Operation of four (4) IPPs of 842 MW Cumulative Capacity, which are based on Pipeline Quality Gas from SNGPL system – GOP Policy guideline**

In pursuance to the GoP Policy Guideline as mentioned in the Ministry of Water & Power, Government of Pakistan, Islamabad letter P-II 7(166)/08 dated 28<sup>th</sup> June 2011 (copy enclosed) with respect to the four (4) IPPs, i.e Saif, Sapphire, Orient and Halmore for operation on HSD beyond 30<sup>th</sup> June 2011 till such time gas is made available for these projects or some other policy decision is taken by the GoP to address gas requirement of these four gas based IPPs.

NEPRA is requested to allow NTDC / General Manager (System Operation) NPCC to allow dispatch for the above mentioned four (4) Power Plants on HSD beyond 30<sup>th</sup> June 2011 due to non-availability of gas this may help to some extent the menace of load shedding in the country.

Matter may please be treated on priority basis.

  
(Ehsan-ul-Majeed Khan)  
General Manager (CPPA)

D.A./ As above.

CC to:

- Managing Director (PEPCO) WAPDA House, Lahore
- Managing Director (PIB), 50-Nizami-uddin Road Islamabad
- Joint Secretary Power, Ministry of Water & Power Islamabad.
- General Manager (System Operation) NPCC Islamabad.
- M/s Saif Power Limited Islamabad.
- M/s Sapphire Electric Power Company, Lahore.
- M/s Halmore Power Project Islamabad.
- M/s Orient Power Company Lahore.

TABLE 3: API TABLE 54B, VOLUME CORRECTION TO 15°C		DENSITY AT 15°C = 840 kg/m <sup>3</sup>								
Temp.	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90
-40.00	1.0458									
-39.00	1.0450	1.0451	1.0452	1.0452	1.0453	1.0454	1.0455	1.0456	1.0456	1.0457
-38.00	1.0441	1.0442	1.0443	1.0444	1.0445	1.0446	1.0446	1.0447	1.0448	1.0449
-37.00	1.0433	1.0434	1.0435	1.0435	1.0436	1.0437	1.0438	1.0439	1.0439	1.0440
-36.00	1.0425	1.0426	1.0427	1.0427	1.0428	1.0429	1.0430	1.0431	1.0431	1.0432
-35.00	1.0417	1.0418	1.0419	1.0419	1.0420	1.0421	1.0422	1.0423	1.0423	1.0424
-34.00	1.0408	1.0409	1.0410	1.0411	1.0412	1.0413	1.0413	1.0414	1.0415	1.0416
-33.00	1.0400	1.0401	1.0402	1.0402	1.0403	1.0404	1.0405	1.0406	1.0406	1.0407
-32.00	1.0392	1.0393	1.0394	1.0394	1.0395	1.0396	1.0397	1.0398	1.0398	1.0399
-31.00	1.0384	1.0385	1.0386	1.0386	1.0387	1.0388	1.0389	1.0390	1.0390	1.0391
-30.00	1.0375	1.0376	1.0377	1.0378	1.0379	1.0380	1.0380	1.0381	1.0382	1.0383
-29.00	1.0367	1.0368	1.0369	1.0369	1.0370	1.0371	1.0372	1.0373	1.0373	1.0374
-28.00	1.0359	1.0360	1.0361	1.0361	1.0362	1.0363	1.0364	1.0365	1.0365	1.0366
-27.00	1.0351	1.0352	1.0353	1.0353	1.0354	1.0355	1.0356	1.0357	1.0357	1.0358
-26.00	1.0342	1.0343	1.0344	1.0345	1.0346	1.0347	1.0347	1.0348	1.0349	1.0350
-25.00	1.0334	1.0335	1.0336	1.0336	1.0337	1.0338	1.0339	1.0340	1.0340	1.0341
-24.00	1.0326	1.0327	1.0328	1.0328	1.0329	1.0330	1.0331	1.0332	1.0332	1.0333
-23.00	1.0317	1.0318	1.0319	1.0320	1.0321	1.0322	1.0322	1.0323	1.0324	1.0325
-22.00	1.0309	1.0310	1.0311	1.0311	1.0312	1.0313	1.0314	1.0315	1.0315	1.0316
-21.00	1.0301	1.0302	1.0303	1.0303	1.0304	1.0305	1.0306	1.0307	1.0307	1.0308
-20.00	1.0293	1.0294	1.0295	1.0295	1.0296	1.0297	1.0298	1.0299	1.0299	1.0300
-19.00	1.0284	1.0285	1.0286	1.0287	1.0288	1.0289	1.0289	1.0290	1.0291	1.0292
-18.00	1.0276	1.0277	1.0278	1.0278	1.0279	1.0280	1.0281	1.0282	1.0282	1.0283
-17.00	1.0268	1.0269	1.0270	1.0270	1.0271	1.0272	1.0273	1.0274	1.0274	1.0275
-16.00	1.0259	1.0260	1.0261	1.0262	1.0263	1.0264	1.0265	1.0266	1.0266	1.0267
-15.00	1.0251	1.0252	1.0253	1.0253	1.0254	1.0255	1.0256	1.0257	1.0257	1.0258
-14.00	1.0243	1.0244	1.0245	1.0245	1.0246	1.0247	1.0248	1.0249	1.0249	1.0250
-13.00	1.0235	1.0236	1.0237	1.0237	1.0238	1.0239	1.0240	1.0241	1.0241	1.0242
-12.00	1.0226	1.0227	1.0228	1.0228	1.0229	1.0230	1.0231	1.0232	1.0233	1.0234
-11.00	1.0218	1.0219	1.0220	1.0220	1.0221	1.0222	1.0223	1.0224	1.0224	1.0225

TABLE 3: API TABLE 54B, VOLUME CORRECTION TO 15°C		DENSITY AT 15°C = 840 kg/m <sup>3</sup>								
Temp.	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90
-10.00	1.0210	1.0211	1.0212	1.0212	1.0213	1.0214	1.0215	1.0216	1.0216	1.0217
-9.00	1.0201	1.0202	1.0203	1.0203	1.0204	1.0205	1.0206	1.0207	1.0208	1.0209
-8.00	1.0193	1.0194	1.0195	1.0195	1.0196	1.0197	1.0198	1.0199	1.0199	1.0200
-7.00	1.0185	1.0186	1.0187	1.0187	1.0188	1.0189	1.0190	1.0191	1.0191	1.0192
-6.00	1.0176	1.0177	1.0178	1.0178	1.0179	1.0180	1.0181	1.0182	1.0183	1.0184
-5.00	1.0168	1.0169	1.0170	1.0170	1.0171	1.0172	1.0173	1.0174	1.0174	1.0175
-4.00	1.0160	1.0161	1.0162	1.0162	1.0163	1.0164	1.0165	1.0166	1.0166	1.0167
-3.00	1.0151	1.0152	1.0153	1.0153	1.0154	1.0155	1.0156	1.0157	1.0158	1.0159
-2.00	1.0143	1.0144	1.0145	1.0145	1.0146	1.0147	1.0148	1.0149	1.0149	1.0150
-1.00	1.0134	1.0135	1.0136	1.0137	1.0138	1.0139	1.0140	1.0141	1.0141	1.0142
-0.00	1.0126	1.0127	1.0128	1.0128	1.0129	1.0130	1.0131	1.0132	1.0132	1.0133
+0.00	1.0126	1.0125	1.0124	1.0124	1.0123	1.0122	1.0121	1.0120	1.0120	1.0119
1.00	1.0118	1.0117	1.0116	1.0116	1.0115	1.0114	1.0113	1.0112	1.0111	1.0110
2.00	1.0109	1.0108	1.0107	1.0107	1.0106	1.0105	1.0104	1.0103	1.0103	1.0102
3.00	1.0101	1.0100	1.0099	1.0099	1.0098	1.0097	1.0096	1.0095	1.0095	1.0094
4.00	1.0093	1.0092	1.0091	1.0090	1.0089	1.0088	1.0087	1.0086	1.0086	1.0085
5.00	1.0084	1.0083	1.0082	1.0082	1.0081	1.0080	1.0079	1.0078	1.0078	1.0077
6.00	1.0076	1.0075	1.0074	1.0074	1.0073	1.0072	1.0071	1.0070	1.0069	1.0068
7.00	1.0067	1.0066	1.0065	1.0065	1.0064	1.0063	1.0062	1.0061	1.0061	1.0060
8.00	1.0059	1.0058	1.0057	1.0057	1.0056	1.0055	1.0054	1.0053	1.0053	1.0052
9.00	1.0051	1.0050	1.0049	1.0048	1.0047	1.0046	1.0045	1.0044	1.0044	1.0043
10.00	1.0042	1.0041	1.0040	1.0040	1.0039	1.0038	1.0037	1.0036	1.0036	1.0035
11.00	1.0034	1.0033	1.0032	1.0032	1.0031	1.0030	1.0029	1.0028	1.0027	1.0026
12.00	1.0025	1.0024	1.0023	1.0023	1.0022	1.0021	1.0020	1.0019	1.0019	1.0018
13.00	1.0017	1.0016	1.0015	1.0015	1.0014	1.0013	1.0012	1.0011	1.0010	1.0009
14.00	1.0008	1.0007	1.0006	1.0006	1.0005	1.0004	1.0003	1.0002	1.0002	1.0001
15.00	1.0000	0.9999	0.9998	0.9998	0.9997	0.9996	0.9995	0.9994	0.9994	0.9993
16.00	0.9992	0.9991	0.9990	0.9989	0.9988	0.9987	0.9986	0.9985	0.9985	0.9984
17.00	0.9983	0.9982	0.9981	0.9981	0.9980	0.9979	0.9978	0.9977	0.9977	0.9976
18.00	0.9975	0.9974	0.9973	0.9972	0.9971	0.9970	0.9969	0.9968	0.9968	0.9967
19.00	0.9966	0.9965	0.9964	0.9964	0.9963	0.9962	0.9961	0.9960	0.9960	0.9959

TABLE 3: API TABLE 54B, VOLUME CORRECTION TO 15°C		DENSITY AT 15°C = 840 kg/m <sup>3</sup>								
Temp.	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90
20.00	0.9958	0.9957	0.9956	0.9956	0.9955	0.9954	0.9953	0.9952	0.9951	0.9950
21.00	0.9949	0.9948	0.9947	0.9947	0.9946	0.9945	0.9944	0.9943	0.9943	0.9942
22.00	0.9941	0.9940	0.9939	0.9939	0.9938	0.9937	0.9936	0.9935	0.9934	0.9933
23.00	0.9932	0.9931	0.9930	0.9930	0.9929	0.9928	0.9927	0.9926	0.9926	0.9925
24.00	0.9924	0.9923	0.9922	0.9922	0.9921	0.9920	0.9919	0.9918	0.9917	0.9916
25.00	0.9915	0.9914	0.9913	0.9913	0.9912	0.9911	0.9910	0.9909	0.9909	0.9908
26.00	0.9907	0.9906	0.9905	0.9905	0.9904	0.9903	0.9902	0.9901	0.9900	0.9899
27.00	0.9898	0.9897	0.9896	0.9896	0.9895	0.9894	0.9893	0.9892	0.9892	0.9891
28.00	0.9890	0.9889	0.9888	0.9888	0.9887	0.9886	0.9885	0.9884	0.9883	0.9882
29.00	0.9881	0.9880	0.9879	0.9879	0.9878	0.9877	0.9876	0.9875	0.9875	0.9874
30.00	0.9873									