SCHEDULE 1

TARIFF, INDEXATION AND ADJUSTMENT

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PART I: GENERAL

1. INTRODUCTION

1.1 This Schedule 1 is attached to and constitutes an integral part of the Agreement (the "**Agreement**") dated [•] entered between Korangi Combined Cycle Power Plant (**"Power Producer"**) and Network Control Department (**"Offtaker"**).

This Schedule 1 specifies the methods for calculating the invoices to be acknowledged to the Power Producer by the Offtaker or to the Offtaker by the Power Producer, as the case maybe, including but not limited to, under sections Section 9.1 (*Capacity Invoices*), Section 9.2 (*Energy Invoices*), Section 9.3 (*Start-Up Charges*), Section 9.3 (*Pass-Through Item(s); Supplemental Tariffs*), Section 9.4 (*Liquidated Damages*), Section 9.5 (*Billing*), Article VIII (*Testing and Capacity Ratings*) and Section 15.8 (*Supplemental Tariff)* of the Agreement. It also specifies the methods for making adjustments to such invoices for changes in Exchange Rate, Interest Rates, price indices, where applicable.

(a) The methods for calculating the regular monthly invoices to be made to the Power Producer by the Offtaker or by the Power Producer to the Offtaker, as the case maybe, under Section 9.1 (*Capacity Invoices*), Section 9.2 (*Energy Invoices*) and Section 9.4 (*Liquidated Damages*) of the Agreement are set forth in Part II of Schedule 1.

(b) The method for calculating Supplemental Tariff Invoices to be made to the Power Producer by the Offtaker under Section 9.3 and Section 15.8 of the Agreement is set forth in Part III.

(c) The method for calculating additional invoices to be made to the Power Producer by the Offtaker or to the Offtaker by the Power Producer, as the case maybe, for the Pass-Through Item(s); Supplemental Tariff under Section 9.3, Invoice for Net Electrical Output during testing under Article VIII, Start-Up Charges and in case of occurrence a PPFME and CLFME that reduces the Company's ability to declare Available Capacity under section 15.6 of the Agreement are set forth in Part IV.

(d) The timelines for the submission of Indices to be used for quarterly indexations (to be used in the formulae as mentioned in the Part II to this Schedule I) against the reference values are set forth in Part V.

(e) This Schedule 1 is in accordance with the Tariff Determination by NEPRA and in case of conflict, the Tariff Determination shall prevail.

1.2 The billing and invoice procedures as set forth in Article IX of the

Agreement shall apply to all invoice obligations referred to in this Schedule 1, unless otherwise specified therein.

2. DEFINITIONS

Capitalized terms used but not defined in this Schedule 1 shall have the meaning given to them in the Agreement. Wherever the following terms appear in this Schedule 1, they shall have the meanings stated below:

"Actual Premium" Actual amount of insurance premium calculated at the start of the Year, supported by appropriate documentations.

"Adjusted Insurance Component" has the meaning which is formulated for AIC_h in Section 5.2.

"**Capacity Price**" has the meaning as formulated for Capacity $Price_h$ in Section 5.2 of this Schedule 1 as adjusted from time to time in accordance with the provisions thereof.

"**Change in Tax**" the adoption, enactment, promulgation, coming into effect, repeal, amendment, re-interpretation, change in application, change in interpretation or modification by any Public Sector Entity of any Law of Pakistan relating to any Tax or Taxes.

"**Cost of Working Capital**" has the meaning as formulated for Cost of Working $Capital_h$ in Section 5.2.

"Current Indices" means the Exchange Rate, Interest Rate, Pak-CPI (NCPI) and the US-CPI, as applicable, calculated for the Quarter as of the date immediately at the start of current Quarter, and applicable for the current Quarter.

"**Energy Price**" has meaning as formulated for Energy $Price_h$ in Section 6.3 of this Schedule 1 as adjusted from time to time in accordance with the provisions thereof.

"Exchange Rate" means the TT&OD selling rate for Dollar expressed in Rupees, as published by the National Bank of Pakistan prevailing on the last Business Day of the preceding Quarter.

"Fixed O&M Component" has the meaning as formulated for Fixed $O\&M_h$ in Section 5.2 of this Schedule-1.

"Fixed Foreign O&M Component" has the meaning as formulated for Fixed $O\&M_h$ in Section 5.2 of this Schedule-1.

"Fixed Local O&M Component" has the meaning as formulated for Fixed $O\&M_h$ in Section 5.2 of this Schedule-1.

"Free Start-Up" means the total number of Start-Ups that the Power Producer is required to perform in each Year as a result of complying with

Offtaker's Despatch Instructions before receiving any compensation for additional Start-Ups, of which amount in rupees is shown in Annex 1-B; Free Start-Ups shall not include any Start Up that follows a Forced Outage or Partial Forced Outage (unless such Forced Outage or Partial Forced Outage is account of Grid System variations or an Emergency claimed by the Offtaker), Maintenance Outage, Scheduled Outage or a Force Majeure Event affecting the Power Producer.

"Fuel Cost Component" has the meaning as formulated for FCC_h in Section 6.3.

"Indices" means the collective name for Exchange Rate, Interest Rate, Pak-CPI (NCPI) and the US-CPI used in tariff indexations as per the provisions of this Schedule-I.

"Interest Rate" means KIBOR.

"National Consumer Price Index (NCPI) - General" means the Consumer price index (General) as notified from time to time by the Federal Bureau of Statistics or any successor or replacement agency thereto.

"Pass Through Item(s)" Pass-Through Items shall be acknowledged by the Offtaker to the Power Producer on the basis of the actual costs reasonably incurred by the Power Producer to satisfy the requirements of the Agreement or to the extent the Offtaker is obligated pursuant to the Laws of Pakistan to make acknowledgement for such Pass-Through Item(s).

"Peak Period" The meaning ascribed thereto in Annex 2 of Schedule 1.

"Period Weighing Factor" or **"PWF"** means a factor set out in or otherwise determined in accordance with Section 5.2, which factor is applied in accordance with this Schedule 1 to the Capacity Price at specified times of the Day, Days of the week and seasons of the Year as an incentive to make capacity available at times when it is most valuable to the Offtaker.

"Reference Capacity Price" means the components comprised of Fixed O&M (Foreign & Local), Adjusted Insurance Component, Cost of Working Capital, Return on Equity and RoRB Cost of Debt (RoRB CoD Local) as set out in Reference Tariff Table Annex 1-A.

"Reference Cost of Debt Component" means the component, in Rs./kW/h, payable to the Power Producer in relation to the cost of debt as set forth in Annex 1-A.

"Reference Cost of Working Capital" means the component, in Rs./kW/h, payable to the Power Producer for financing the cost of working capital, as set forth in Annex 3.

"Reference Depreciation Component" means the component, in Rs./kW/h, payable to the Power Producer for depreciation, as set forth in

Annex 1-A.

"Reference Energy Price" means the components comprised of Fuel Cost Component, the Variable O&M Foreign Component and Variable O&M Local Component as set out in the Reference Tariff Table set in Annex 1-A.

"Reference Exchange Rate" With regards to Dollar means [287.10] Rupees to one (1) Dollar as notified in the Tariff Determination for K-Electric Limited Power Generation plants by NEPRA.

"Reference Fixed O&M Component" means the components comprised of Fixed O&M (Foreign) and Fixed O&M (Local), in Rs./kW/h, payable to the Power Producer for the fixed costs of operation and maintenance, as set forth in Annex 1-A.

"Reference Fixed O&M Foreign Component" means the component in Rs./kW/h, payable to the Power Producer for the foreign portion of fixed costs of operation and maintenance, as set forth in Annex 1-A.

"Reference Fixed O&M Local Component" means the component in Rs./kW/h, payable to the Power Producer for the local portion of fixed costs of operation and maintenance, as set forth in Annex 1-A.

"Reference HSD Fuel Cost Component" means the component payable in Rs./kWh to the Power Producer for the cost of HSD, that is attributable to the generation of Net Electric Output (whether or not such component compensates the Power Producer for the actual cost of such fuel) as set forth in Annex 1-A.

"Reference HSD Price" which has the meaning ascribed in Section 6.3.

"Reference Insurance Component" means the component, in Rs./kW/h, payable to the Power Producer in relation to the insurance as set forth in Annex 1-A.

"Reference NCPI" means the reference consumer price index (NCPI) (General) of 227.96 for the Month of May 2023 as per Tariff Determination.

"Reference Premium" which has the meaning ascribed in Section 5.2.

"Reference Gas Fuel Cost Component" means the component payable in Rs./kWh to the Power Producer for the cost of Gas, that is attributable to the generation of Net Electric Output (whether or not such component compensates the Power Producer for the actual cost of such fuel) as set forth in Annex 1-A.

"Reference Gas Price" which has the meaning ascribed in Section 6.3.

"Reference Return on Equity (ROE) Component" means the component,

in Rs./kW/h, payable to the Power Producer in relation to the return on investment by equity holders as set forth in Annex 1-A.

"Reference Tariff" means the sum of the Reference Capacity Price and the Reference Energy Price as set forth in Annex 1-A

"Reference Variable O&M Component" means the components comprised of Variable O&M (Foreign) and Variable O&M (Local), in Rs./kWh, payable to the Power Producer for the variable costs of operation and maintenance that are attributable to the generation of Net Electrical Output, (whether or not such component compensates the Power Producer for actual cost of providing such Net Electrical Output), as set forth in Annex 1-A.

"Reference Variable O&M Foreign Component" means the tariff component payable in Rs./kWh to the Power Producer for the foreign portion of variable costs of operation and maintenance that are attributable to the generation of Net Electrical Output, (whether or not such component compensates the Power Producer for actual cost of providing such Net Electrical Output), as set forth in Annex 1-A .

"Reference Variable O&M Local Component" means the tariff component payable in Rs./kWh to the Power Producer for the local portion of variable costs of operation and maintenance that are attributable to the generation of Net Electrical Output, which component (whether or not such component compensates the Power Producer for actual cost of providing such Net Electrical Output) as set forth in Annex 1-A .

"Reference US-CPI" means the United State consumer price index (All Urban Consumers), of 304.13 for the Month of May 2023 as per Tariff Determination.

"Return on Equity Component (ROE)" which has the meaning ascribed in Section 5.2.

"Supplemental Tariff Invoices" which has the meaning ascribed in Section 8.1.

"Tariff" means the tariff determination by NEPRA vide its letter No. NEPRA/R/ADG(Trf)/TRF-596/15878-82 dated 22 October 2024 as attached as Annex 1-C and as amended or revised from time to time.

"Test Energy Invoice" has the meaning given to it in Section 9.

"Start-Up Charge" has the meaning given to it in Section 10.

"US-CPI" means the United States Consumer Price Index (All Urban Consumers) issued by US Bureau of Labor Statistics from time to time (or any successor or replacement agency thereto).

"Variable O&M Component" has the meaning given to it in Section

6.3.

"Variable O&M Foreign Component" has the meaning given to it in Section 6.3.

"Variable O&M Local Component" has the meaning given to it in Section 6.3.

3. CONSTRUCTION

3.1 This Schedule 1 (including the Annexes) shall be read in conjunction with and to be subject to Tariff Determination, Article VIII and Article IX of the Agreement. To the extent that any provision of this Schedule 1 is inconsistent with Tariff Determination, Article VIII or Article IX or any other article or section of the Agreement, the provisions of Tariff Determination, Article VIII or Article IX or the other relevant article or section of the Agreement, as the case may be, shall prevail unless otherwise specified.

3.2 References to Parts, Articles, and Sections in this Schedule 1 are to Parts, Articles, and Sections of this Schedule 1, unless indicated otherwise. References to Tables and Annexes in this Schedule 1 are to the Tables and Annexes of this Schedule 1, unless indicated otherwise. References to Articles and Sections of the Agreement are to articles and sections contained in the main text of the Agreement.

PART II: TARIFF ACKNOWLEDGEMENT

4. TARIFF INVOICE

The Offtaker shall, for each Month of part thereof, acknowledge to the Power Producer, Capacity Invoices and Energy Invoices that shall be calculated in accordance with Sections 5 and 6, respectively.

5. CAPACITY INVOICES

5.1 The Offtaker shall acknowledge the Power Producer the Capacity Invoices, in accordance with the procedures specified in Section 9.6 of the Agreement, for the Available Capacity for each Month (or part-Month) in accordance with Section 9.1 of the Agreement.

5.1.1 In case capacity is declared on HSD, then the Available Capacity (in MW) and Tariff shall be applicable for HSD accordingly. For clarity, maximum capacity on HSD shall be 220.018 MW (i.e. the guaranteed capacity at reference site condition) along with appropriate degradation factor as per the relevant operating hour interval.

5.1.2 In case capacity is declared on both, Gas and HSD simultaneously, then the respective portion of capacity on each Fuel shall be adjusted along with appropriate degradation factor as per the relevant operating hour interval for the respective Fuel.

5.2 The Capacity Invoice for the applicable Month shall be equal to the aggregate sum (for all of the hours in such Month) of Capacity Invoice earned for each hour of the Month, and shall be equal:

$$\textbf{Capacity Invoice}_M = \sum_{h=1}^{n} \textbf{Capacity Invoice}_h$$

Where:

Capacity Invoice$_M$ = Capacity Invoice, in Rupees, payable for the relevant Month;

Capacity Invoice$_h$ = the Capacity Invoice, in Rupees, paid for hour *h* of the Month; and

n = the number of hours in the relevant Month.

$$\textbf{Capacity Invoice}_h = \textbf{Capacity Price}_h * \textbf{AvailCap}_h * \textbf{Do}_h$$

Where:

Capacity Invoice$_h$ = the Capacity Invoice, in Rupees, payable for hour *h* of the Month;

Capacity Price$_h$ = (Fixed O&M$_h$ + Cost of Working Capital$_h$ + AIC$_h$ + Return on Equity$_h$ + Depreciation$_h$ + RoRBCoD Local$_h$)* PWF$_h$

Where:

Fixed O&M$_h$ = Fixed Foreign O&M $_{(Rev)h}$ + Fixed Local O&M $_{(Rev)h}$

Where:

Fixed Foreign O&M $_{(Rev)h}$ = Fixed Foreign O&M $_{(Ref)h}$ * US CPI $_{(Rev)q}$ / US CPI $_{(Ref)}$ * ER $_{(Rev)q}$ / ER $_{(Ref)}$

Where:

Fixed Foreign O&M $_{(Ref)h}$ = Fixed Foreign O&M$_{(Ref)h}$ Rs./kW/h as per Annex 1-A;

US CPI $_{(Rev)q}$ = The revised US CPI (All Urban Consumers) at the beginning of the Quarter that includes hour h;

US CPI $_{(Ref)}$ = The Reference US CPI (All Urban Consumers) of 304.13 for May 2023;

ER $_{(Rev)q}$ = The revised TT & OD selling rate of US Dollar notified by the National Bank of Pakistan on the last day of the Quarter preceding the Quarter that includes hour; and

ER $_{(Ref)}$ = The Reference Exchange Rate of Rs. 287.10/US$.

Fixed Local O&M $_{(Rev)h}$ = Fixed Local O&M $_{(Ref)h}$ * NCPI $_{(Rev)q}$ / NCPI$_{(Ref)}$

Fixed Local O&M $_{(Ref)h}$ = Fixed Local O&M$_{(Ref)h}$ Rs./kW/h as per Annex 1-A;

NCPI $_{(Rev)}$ = The revised NCPI (General) at the beginning to the Quarter that includes hour h; and

NCPI $_{(Ref)}$ = The Reference NCPI (General) of 227.96 for May 2023.

Cost of Working Capital

Cost of Working Capital$_h$ = Cost of working capital$_{(Ref)h}$ Rs./kW/h as per Annex 3.

This cost shall be adjusted on a quarterly basis for the following variations:

- Fuel Price
- Fuel Inventory
- Load Factor
- Receivable Cycle
- SBLC Amount

• SBLC Charges
• Value of Stores & Spares
• KIBOR

The adjustment mechanism including indexation of the same for the components of the cost of working capital are set out in Annex – 3, in line with the Tariff determination.

AIC_h = Insurance $_{(Ref)h}$ / P $_{(Ref)}$ * P $_{(Act)}$

Where:

Insurance $_{(Ref)h}$ = Insurance$_{(Ref)h}$ Rs./kW/h as per Annex 1-A;

P $_{(Ref)}$ = Following Reference Premium at Rs. 287.1/US$; and

P $_{(Act)}$ = Actual Premium or USD 1.23 million at Exchange Rate prevailing on the 1st day of the insurance coverage period whichever is lower.

Return on Equity $_{(Rev)h}$ = ROE$_{(Ref)h}$ * ER$_{(Rev)q}$ / ER$_{(Ref)}$

Where:

ROE$_{(Ref)h}$ = ROE$_{(ref)h}$ Rs./kW/h as per Annex 1-A;

ER$_{(Rev)q}$ = The revised TT & OD selling rate of US Dollar notified by the National Bank of Pakistan on the last day of the Quarter preceding the Quarter that includes hour; and

ER$_{(Ref)}$ = The Reference Exchange Rate of Rs. 287.10/US$.

Depreciation = Depreciation$_{(Ref)h}$ Rs./kW/h as per Annex 1-A.

RoRBCoD Local$_{(Rev)h}$ = RoRBCoD Local$_{(Ref)}$ x CoD Local$_{(Rev)}$ / CoD Local$_{(Ref)}$

Where:

RoRBCoD Local$_{(Ref)}$ = RoRBCoD Local $_{(Ref)h}$ Rs./kW/h as per Annex 1-A;

CoD Local$_{(Rev)}$ = Revised 3 Month KIBOR notified by State Bank of Pakistan at the beginning of the Quarter + 2.25% allowed spread; and

CoD Local$_{(Ref)}$ = The Reference KIBOR of Rs. 22.91% + 2.25% allowed spread.

PWF_h = the Period Weighing Factor applicable to hour h of the Month, as set out in Annex-2;

$AvailCap_h$ = the Available Capacity, in kW, for hour *h* of the relevant Month;

h = each hour in the Month for which a Capacity Invoice is being calculated; and

Do_h = the output degradation factor as set forth in Annex 4 for the interval of operating hours immediately preceding the interval of operating hours in which hour 'h' occurs

5.3 The Period Weighing Factors ("**PWFs**") for each period are as specified in Annex-2. The Offtaker shall have the right to unilaterally revise the PWFs specified in Annex-2 in accordance with Section 5.13 of the Agreement, subject to the following provisions:

a) the Offtaker shall give notice to the Power Producer of such revision in accordance with Section 5.13 of the Agreement;

b) the value of the PWF in any hour period shall not be greater than two and one-half (2.5); and the value of the PWF during each period during the Maintenance Months shall not be greater than one (1);

c) the time-weighted average of the PWFs in a Year shall be equal to one (1); and

d) there shall be no more than three (3) periods in any one (1) Day or more than five (5) periods in any two (2) Day period.

6. MONTHLY ENERGY INVOICE

6.1 The Offtaker shall acknowledge to the Power Producer the Reference Energy Price in accordance with the procedures specified in Section 9.6 for Despatched and Delivered Net Electrical Output for the relevant Month (or part-Month) in accordance with Section 9.2.

6.2 Energy Invoice for the relevant Month shall be equal to the aggregate sum (for all of the hours in such Month) of the Energy Invoice earned for each hour of the Month, and shall equal:

$$\textbf{Energy Invoice}_M = \sum_{h=1}^{n} \textbf{Energy Invoice}_h$$

Where:

Energy Invoice_M = the Energy Invoice, in Rupees, payable for the relevant Month;

Energy Invoice_h = the Energy Invoice for hour *h;* and

n = the number of hours in the relevant Month.

6.3 The Energy Invoice earned for each hour of a Month shall be calculated as follows:

Energy Invoice$_h$ = Energy Price$_h$ * NEO$_h$

Where:

Energy Price $_h$ = FCCG$_{(Rev)h}$ or FCCHSD$_{(Rev)h}$ (as applicable) + Variable O&M$_h$

FCCG$_{(Rev)h}$ = FCCG $_{(Ref)h}$ * FPG $_{(Rev)}$ / FPG $_{(Ref)}$ * D$_{H(Gas)h}$ * K$_L$

Where:

FCCG $_{(Ref)h}$ = FCCG $_{(Ref)h}$ Rs./kWh as per Annex 1-A;

FPG $_{(Rev)}$ = the revised HHV Gas price in USD notified by the Oil and Gas Regulatory Authority (OGRA) converted to PKR at the invoiced exchange rate by the supplier, from time to time and notified by GOP, and billed by Gas Supplier, consumed during hour *h,* as applicable;

FPG $_{(Ref)}$ = The Reference HHV Gas Price for KCCPP is Rs. 3,717/MMBtu in case of RLNG and Rs. 857/MMBtu in case of indigenous gas;

D$_{H(Gas)h}$ = the heat rate degradation factor for Gas fuel as set forth in Annex 4 for the interval of operating hours immediately preceding the interval of operating hours in which hour 'h' occurs; and

K$_L$ = the load correction factor for the units in hour h, as set forth in Annex 5.

FCCHSD$_{(Rev)h}$ = FCCHSD$_{(Ref)h}$ x FPHSD$_{(Rev)}$ / FPHSD$_{(Ref)}$ x CalHSD$_{(Ref)}$ / CalHSD $_{(Rev)}$ * K$_L$ * D$_{H(HSD)h}$

Where:

FCCHSD$_{(Ref)h}$ = FCCHSD $_{(ref)h}$ Rs./kWh as per Annex 1-A;

FPHSD$_{(Ref)}$ = Reference HSD Price of Rs. 232.52 per Litre;

FPHSD$_{(Rev)}$ = The revised net HHV HSD price in PKR / liter for the month based on weighted average formula as illustrated below;

HSD	Legend	Stock in Liters	Amount - PKR	Weighted average price
		I	ii	iii = ii / i
Opening	A	4,824,108	1,061	
Purchases	B	-	-	
Available for consumption	C = A + B	4,824,108	1,061	219.94
Less: Consumption	D	(440,080)	(97)	
Closing	E = C - D	4,384,027	964	

$D_{H(HSD)h}$ = the heat rate degradation factor for HSD fuel as set forth in Annex 4 for the interval of operating hours immediately preceding the interval of operating hours in which hour 'h' occurs;

K_L = the load correction factor for the units in hour h, as set forth in Annex 5;

$CalHSD_{(Ref)}$ = reference HSD HHV Calorific Value of Rs. 36,252.364 btu per litre; and

$CalHSD_{(Rev)}$ = revised HSD HHV Calorific Value for the Month in btu per litre for the Month as illustrated below.

Description	Unit	Calculation	Amount	Source
Gross Calorific value	btu / lb	a	19,731	Actual GCV for the month as per test reports
Conversion factor	lb / kg	b	2.2046	Standard conversion factor
Gross Calorific value	btu / kg	c = a x b	43,499	Calculated
Density	kg / liter	d	0.833	Actual Density for the month as per test reports
Gross Calorific value	btu / liter	e = c x d	36,252	Calculated

GCV test is conducted at a frequency of every 10 Days by third party, subject to consumption of HSD, in case of no consumption last test certificate will prevail. The value of GCV so determined in the test is used to determine the Fuel Cost Component for the Month as formulated above. Method of sampling of HSD for every 10 Days shall be defined in the Operating Procedures.

$Variable\ O\&M_h$ = Variable Local $O\&M_{(Rev)h}$ + Variable Foreign $O\&M_{(Rev)h}$

Where:

Variable Local $O\&M_{(Rev)h}$ = Local Variable $O\&M_{(Ref)h}$ * $NCPI_{(Rev)q}$ / $NCPI_{(Ref)}$

Where:

Variable Local $O\&M_{(Ref)\ h}$ = Variable Local $O\&M_{(Ref)\ h}$ Rs./kWh as per Annex 1-A;

$NCPI_{(Rev)q}$ = The revised NCPI (General) at the beginning of the Quarter which includes hour; and

$NCPI_{(Ref)}$ = The Reference NCPI (General) of 227.96 for May 2023.

Variable Foreign O&M $_{(Rev)h}$ = Fixed Variable O&M $_{(Ref)h}$ * US CPI $_{(Rev)q}$ / US CPI $_{(Ref)}$ * ER $_{(Rev)q}$ / ER $_{(Ref)}$

Where:

Variable Foreign O&M $_{(Ref)h}$ = Variable Foreign O&M $_{(Ref)\,h}$ Rs./kWh as per Annex 1-A;

US CPI $_{(Rev)q}$ = The revised US CPI (All Urban Consumers) at the beginning of the Quarter which includes hour;

US CPI $_{(Ref)}$ = The Reference US CPI (All Urban Consumers) of304.13 for May 2023;

ER $_{(Rev)q}$ = The revised TT & OD selling rate of US Dollar notified by the National Bank of Pakistan on the last day of the Quarter preceding the Quarter that includes hour; and

ER $_{(Ref)}$ = The Reference Exchange Rate of Rs. 287.10/US$.

NEO $_h$ = Net Electrical Output of the Complex for the respective fuel (i.e. Gas or HSD as applicable), in kWh, for hour *h* of the period.

6.4 For the purpose of NEO for any hour, in case of an interval (as agreed by the Operating Committee) having both electrical energy delivered as well as power imported by the Complex, recorded under electronic data recording system on the Interconnection Point, then:

(a) If the electric energy is delivered to Offtaker on net basis during that interval, the net electrical energy shall be included in NEO during that hour; and

(b) If the electric energy is imported from Offtaker on net basis during that interval, the net electrical energy shall be considered under billing of power imported from Offtaker during that hour.

7. LIQUIDATED DAMAGES

a) Liquidated Damages

Pursuant to Section 9.4(b) of Agreement, the Power Producer shall pay liquidated damages (LDs) to the Offtaker provided that these liquidated damages shall apply and be payable by the Power Producer (only after the number of hours available to the Power Producer under Section 9.1

(c) and (d) have first been utilized) as formulated hereunder:

i) in the event, when Declared Available Capacity is revised between twelve (12) hours and four (4) hours prior to the beginning of an Operating Day.

LDs = 10% * [Declared Available Capacity or Revised Declared Available Capacity (or any Adjusted Declared Available Capacity related thereto), as applicable, prevailing twelve (12) hours before the start of the Operating Day - Revised Declared Available Capacity (or any Adjusted Declared Available Capacity related thereto), as applicable, prevailing four (4) hours before the start of the Operating Day] * Capacity Price for the relevant hour h. plus

ii) in the event, when Declared Available Capacity is revised within four (4) hours before the beginning of the Operating Day.

LDs = 20% * [Declared Available Capacity or Revised Declared Available Capacity (or any Adjusted Declared Available Capacity related thereto), as applicable, prevailing four (4) hours before the start of the Operating Day - Revised Declared Available Capacity (or any Adjusted Declared Available Capacity related thereto), as applicable, prevailing at the start of the Operating Day] * Capacity Price for the relevant hour, h. plus

iii) in the event, the Power Producer fails to Comply with Despatch Instructions:

LDs = 100% * [Declared Available Capacity or Revised Declared Available Capacity (or any Adjusted Declared Available Capacity related thereto), as applicable, at the start of the hour – the Available Capacity for that hour] * Capacity Price for the relevant hour, h.

Provided however, if the Power Producer revises its Available Capacity upwards after the Declaration Deadline, for reasons other than forecasted temperature conditions, and is eligible for Capacity Invoices for such upward revision, but after such upward revision, it fails to deliver such increased capacity when dispatched, then the liquidated damages amount calculated in this subsection (iii) above shall be multiplied by two (2) for purposes of such unavailable capacity.

Provided further, if the Power Producer revises its declaration downward of its Available Capacity on account of unavailability during an Operating Day, the liquidated damages shall not be applicable as per 9.1(d) of the Agreement, unless total outage allowance for the Agreement Year has been utilized.

PART III: SUPPLEMENTAL TARIFFS

8. Supplemental Tariff Invoice for Pakistan Political Force Majeure Event (PPFME) or Change in Law Force Majeure Event (CLFME)

8.1 If, due to a Pakistan Political Force Majeure Event (PPFME) or a Change in Law Force Majeure Event (CLFME), a invoice is due and payable to the Power Producer from the Offtaker as provided in Sections 15.8(b) and 15.8(c) of the Agreement ("**Supplemental Tariff Invoice**"), the Offtaker shall, following the completion of the Restoration, pay to the Power Producer the Supplemental Tariff Invoice, until the recoverable costs of a Restoration have been received in full by the Power Producer from the Offtaker subject to NEPRA determination (which shall be structured to allow the Power Producer to recover the reasonable and necessary costs of a Restoration net of insurance proceeds, if any, over the remainder of the Term, as provided in this Article 8) shall be calculated in accordance with Section 8.2. Each Pakistan Political Force Majeure Event or Change in Law Force Majeure Event, that may be unrelated to each other, may lead to a separate Supplemental Tariff Invoice.

8.2 The Supplemental Tariff Invoice for a Month shall be equal to the aggregate sum of the Supplemental Tariff Invoice for each hour in such Month. The Supplemental Tariff Invoice for each hour of the Month shall be calculated as follows:

$$\mathbf{STP}_m = \sum_{h=1}^{n} \mathbf{STP}_h$$

$$\mathbf{STP}_h = \mathbf{RRR}_{\mathbf{fixed/h}} * \mathbf{AvailCap}_h$$

Where:

STP_h= the Supplemental Tariff Invoice for a Restoration, in Rupees, for hour *h* of the Month; and

$RRR_{fixed/h} = R_t/(TC_t * PIT_t)$

Where:

RRR_{fixed}= the Restoration recovery rate, in Rs./kW/h, which rate shall be calculated one (1) time following the agreement by the Parties on the Restoration costs, as determined by NEPRA, or as per the resolution of a dispute over such costs pursuant to Section 15.6 of the Agreement and shall remain fixed thereafter, and which rate for all hours h shall be equal to:

R_t = the total cost of the Restoration, as determined by NERPA, or in accordance with Section 15.6 of the Agreement, as applicable;

TC_t= the then-prevailing Tested Capacity at time *t,* expressed in kW;

PIT_t = the total number of hours remaining in the Term from time *t;*

t = following the Day the Parties agree on Restoration costs, to be recovered by the Power Producer or the resolution of a dispute over such costs pursuant to Section 15.6 of the Agreement and in each case, the date that the Complex returns to operation or if the Complex did not cease operation, the date on which the Restoration, is completed;

$AvailCap_h$ = the Available Capacity, in kW, for hour, *h* of the Month provided however that it shall include the period of deemed availability for which the Power Producer shall be paid Capacity Invoices as provided for in Article 9.1 (c) and 9.1 (d) of the Agreement; and

h = an hour in the Month for which a Supplemental Tariff Invoice is calculated pursuant to this Section 8.2.

8.3 Unless NEPRA approves an alternate cost of capital (including debt and equity), the Power Producer shall be entitled to receive in accordance with Section 15.8(d) of the Agreement a return equal to KIBOR plus percent (3%) per annum on the scheduled unpaid portion of the total cost of a Restoration through the period of cost recovery. The applicable KIBOR shall be the rate prevailing on the date that the Complex returns to operation or if the Complex did not cease operation, the date on which the Restoration is completed.

8.4 At any time after the first (1^{st}) Business Day of each Month, the Power Producer may submit an invoice to the Offtaker stated in Rupees for the Supplemental Tariff Invoice, inclusive of return thereon, for the previous Month, together with supporting information as may reasonably be necessary to substantiate the amounts claimed in the invoice.

8.5 The Offtaker may seek to verify the calculation of a Supplemental Tariff Invoice for a Restoration, inclusive of return thereon, and may require the Power Producer to provide to it copies of its calculations, with reasonable supporting information, which the Power Producer shall provide within [30] Days of such request. Within one (1) Year following the commencement of such payments, the Offtaker shall have the right to engage, at its own cost, an independent auditor to audit and examine the costs claimed by the Power Producer, and the Power Producer shall make all of its relevant books and records available to the Offtaker and its auditors in connection with such audit or examination, provided however, if such Restoration cost, is submitted to and approved by NEPRA, no such audit shall be conducted.

PART IV: ADDITIONAL PAYMENTS

9. Invoices for Net Electrical Output during Testing.

9.1 The Test Energy Invoice shall be equal to the aggregate sum of the Net Electrical Output delivered during each such hour multiplied by the Fuel Cost Component applicable to each hour in such Month. The Test Energy Invoice earned for each hour shall be calculated as follows:

$$\text{Test Energy Invoice}_M = \sum_{h=1}^{n} \text{Test Energy Invoice}_h,$$

Where:

Test Energy Invoice$_h$ = FCCG$_{(Rev)h}$ or FCCHSD$_{(Rev)h}$, as applicable * **NEO$_h$**

Where:

FCCG$_{(Rev)h}$ = as ascribed in Section 6.3 to this Schedule;

FCCHSD$_{(Rev)h}$ = as ascribed in Section 6.3 to this Schedule; and

NEO$_h$ = Net Electrical Output of the Complex, in kWh, for hour *h* of the period on the respective fuel (i.e. Gas or HSD).

9.2 At any time on or after first (1st) Business Day of each Month and on the first (1st) Business Day falling after the fifteenth (15th) Day of each Month, the Power Producer may submit an invoice to the Offtaker stated in Rupees for the Net Electrical Output delivered during the tests carried out under Article VIII and the Offtaker shall acknowledge the Power Producer the Energy Price, Start up Charges or any other charges in accordance with Section 9.6 to Agreement.

9.3 The Offtaker shall acknowledge claims if there occurs a PPFME or a CLFME that reduces the Power Producer's ability to declare Available Capacity subject to and in accordance with Section 15.6 of the Agreement.

10. Start-Up Charges

10.1 For each Start-Up that (i) is required to comply with a Despatch Instruction or Revised Despatch Instruction, and (ii) does not follow a Forced or Partial Forced Outage (unless such Forced or Partial Forced Outage is on account of Grid System conditions or an Emergency claimed by the Offtaker), Maintenance Outage, Scheduled Outage, or Force Majeure Event affecting the Power Producer, the Offtaker shall pay to the Power Producer Start-Up Charges as calculated in accordance with Section 10.3 (each such charge, a "Start-Up Charge").

10.2 Start-Up Charge = MDI Charge+ Reference Start-Up Charges.

a) MDI Charge: The MDI charge shall be based on maximum demand recorded during the relevant month at startup and shall be calculated based on the then applicable MDI rate in Rs/kW, from time to time,

b) Reference Start-Up Charge: This cost will cover the consumables, fuel and equivalent operating hours consumed for the Start-Ups.

The Start-Up Charges for each Start-Up shall be indexed with relevant indices, including fuel prices and applicable degradation factors as of the start of each month as requested below:

SC_M	=	**$MDIR_x$ x N1+(($SCPI_{Ref}$ x $SCFadjust_{PI}$)+(($SCFC_{Ref}$ x $SCFadjust_{FC}$)) x N2**
Where:		
SC_M	=	The Start Up Charges during the Month M
$MDIR_x$	=	Total fixed charges for the month due to distributing segment during the relevant month (based on MDI for the month and MDI charge) divided by the total number of Start Ups performed during the month.
N1	=	The number of Start Ups to be claimed, unless any shutdowns claimed during the relevant month in which case this will be considered as zero.
N2	=	The number of Start Ups to be claimed
$SC_{(Ref)}$	=	The Reference Start-Up Charge as given below in Annex 1-B. Consists of the following two components:
$SCPI_{Ref}$	=	The Reference Start-Up Charge for the power import from transmission system during GT Startup till synchronization.
$SCFadjust_{PI}$	=	The Startup Charges Adjustment Factor for the hour h for the import of power from transmission network as per following formula: **$SCFadjust_{PI}$ = $WAVCT\text{-}C3_{(Rev)}$ / $WAVCT\text{-}B5_{(Ref)}$** where: **$WACT\text{-}C3_{(Rev)}$** = Weighted average of the latest notified variable consumer tariff for the Bulk Supply Consumer Category (C-3), or other category as notified, based on a weightage of 4:20 for Peak & Off-Peak Rates respectively. **$WACT\text{-}B5_{(Ref)}$** = Weighted average of the reference notified variable consumer tariff for the Industrial Consumer Category (B-5) based on a weightage of 4:20 for Peak & Off-Peak Rates (i.e. Rs. 30.33 per kWh & Rs. 23.55 per kWh) respectively **(i.e. Rs. 24.68 per kWh)**
$SCFC_{Ref}$	=	The Reference Start-Up Charge for the fuel consumed during GT Startup till synchronization including ST synchronization, if applicable.
$SCFadjust_{FC}$	=	The Startup Charges Adjustment Factor for the hour h for the consumption of fuel (net off revenue claimed in the hourly fuel cost) as per the following formula:
		For Gas – $SCFadjust_{FC}$ = (FPG_{Rev} / FPG_{Ref}) x D_H x D_O For HSD – $SCFadjust_{FC}$ = ($FPHSD_{Rev}$ / $FPHSD_{Ref}$) x D_H x D_O For above:

		FPG_{Ref} = The Reference HHV Gas price for RLNG is Rs. 3,300.82 based on RLNG price. In case co-mingled gas is provided by SSGC in a month then FPG_{Rev} shall be based on weighted average formula as illustrated below; **Weighted average cost = (E*D+C*F)/(E+F)** Where: C = RLNG price D = Indigenous Gas price E = Indigenous Gas actual volume billed for the month F = RLNG Gas actual volume billed for the month $FPHSD_{Ref}$ = The Reference HSD Price is Rs. 219.94 per Litre.
D_H	=	the heat rate degradation factor as set forth in Annex 4 for the relevant interval of operating hours at the start of the month in which the Startup occurs.
D_O	=	the output degradation factor as set forth in Annex 4 for the relevant interval of operating hours at the start of the month in which the Startup occurs.

Subject to Section 10 Start-Up shall be counted as payable to the Power Producer by the Offtaker even if the requested Start-Up is subsequently cancelled as a result of a change in any Despatch Instruction or Revised Despatch Instruction prior to the synchronization to the Grid System unless the Offtaker issued a Revised Despatch Instruction sufficiently prior to the Start-Up to enable the Power Producer to cancel the Start-Up.

11. Black Start Charges

Black Start is the capability to recover from a total or partial shutdown of the transmission system.

Black Start Charges shall be paid when it is necessary for the Power Producer to comply with a Dispatch Instruction or the technical requirements of the Complex.

Black start charges are based on Reference Blackstart charges indexed with relevant indices, including fuel prices and applicable degradation factors as of the start of each month as requested below

The Black-start Charges for each Start-Up shall be calculated as follows:

BSCM	=	$(BSCRef_{BSDG} \times BSCFadjusth_{BSDG} + BSCRef_{Other} \times BSCFadjusth_{Other}) \times N$
Where:		
BSCM	=	the Black-start Charges during the Month M;
BSCRef	=	the Reference Black-Start Charge as given below in Annex 1-B and consists of the following two components:
$BSCRef_{BSDG}$	=	The Reference Black-Start Charge for BSDG.

$BSCFadjust_{hBSDG}$	=	The Black-start Charges Adjustment Factor for the hour h; where: For HSD – $SHCFadjust_{hBSDG} = FCCHSD_{Rev} / FCCHSD_{Ref}$
$BSCRef_{Other}$	=	The Reference Black-Start Charge for GT including ST where applicable.
$BSCFadjust_{hOther}$	=	The Black-start Charges Adjustment Factor for the hour h; where: For HSD – $SHCFadjust_{hOther} = (FPHSD_{Rev} / FPHSD_{Ref}) \times D_H \times D_O$ $FPHSD_{Ref}$ = The Reference HSD Price of Rs. 219.94 per Litre
N	=	The number of Black Startups to be claimed
D_H	=	the heat rate degradation factor as set forth in Annex 4 for the relevant interval of operating hours at the start of the month in which the Startup occurs
D_O	=	the output degradation factor as set forth in Annex 4 for the relevant interval of operating hours at the start of the month in which the Startup occurs

Subject to Section 11 Black Start shall be counted as payable to the Power Producer by the Offtaker even if the requested Black Start is subsequently cancelled as a result of a change in any Despatch Instruction or Revised Despatch Instruction prior to the synchronization of the relevant unit to the Grid System unless the Offtaker issued a Revised Despatch Instruction sufficiently prior to the Black Start to enable the Power Producer to cancel the Black Start.

12. Pass Through Item(s)

12.1 Pass-Through Items shall be payable by the Offtaker to the Power Producer on the basis of the actual costs reasonably incurred by the Power Producer to satisfy the requirements of the Agreement or to the extent the Power Producer is obligated pursuant to the Laws of Pakistan to make acknowledgement for such Pass-Through Item(s).

12.2 The Power Producer may present invoice(s) to the Offtaker for Pass-Through Items at any time on or after the first (1st) Day of the Month following the Month in which the cost(s) was/were incurred by the Power Producer.

12.3 The following items shall be Pass-Through Items:

(a) Any unrecovered cost of outgoing MYT which may be allowed under pending end of term adjustment of the MYT.

(b) Gas Infrastructure Development Cess (GIDC) required to be paid by the Power Producer pertaining to prior periods based on court verdict, if any.

(c) In the case of any unbundling of the Company in future, one time adjustment for additional costs pursuant to unbundling.

(d) Any tax that becomes applicable to the Power Producer, including but not limited to the corporate tax.

(e) WWF/WPPF being separately levied on the Power Producer.

Any other costs reasonably incurred by the Power Producer to satisfy the requirements of Agreement, and allowed by NEPRA

For avoidance of doubt, if a particular type of Tax is stated to be a Pass Through item in this Section 12 then any Change in Tax rate for such Tax upwards or downwards shall be treated as a Pass Through Item.

12.4 The Power Producer shall invoice Offtaker in arrears for recovery of the expenditure made with the consent of Offtaker for any upgradation in the protective devices under Article VI or Metering System under Article VII of the Agreement.

PART V: INDEXATION

13.1 At the beginning of each Quarter, the Power Producer shall on the fifteenth (15th) Business Day following the end of a Quarter, deliver to the Offtaker the Current Indices and values as submitted to NEPRA for determination. Following the determination of the same by the NEPRA, the Power Producer shall provide the determined Indices and values, to the Offtaker along with the reasonable supporting information if any, within 7 Business Days of the determination by NEPRA.

13.2 If any index used herein ceases to be available, the Parties shall request NEPRA to determine an alternative index. Such determination when made available, shall be binding on the Parties for the purpose of such index hereunder. Pending the determination by NEPRA, the last available value of such index shall be used for all relevant purposes hereunder. Upon the determination of such index by NEPRA, either Party shall revise all acknowledgement made during the pendency of alternative index.

13.3 One Time Adjustments

Not Used.

ANNEX 1-A: REFERENCE TARIFF TABLE

Annex-III

K-Electric Limited
KCCP
Reference Generation Tariff (Gas)

Year	Energy Purchase Price (Rs./kWh)				Capacity Purchase Price (Rs./kW/h)								Total Tariff @ 60%		
	Fuel Cost Component	Variable O&M		Total EPP	Fixed O&M		Insurance	Working capital	RoRB		Depreciation	Total CPP	Total CPP @ 60%	Rs./kWh	Cents / kWh
		Local	Foreign		Local	Foreign			Cost of Debt	Cost of Equity					
1	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	1.6014	0.9502	0.5803	4.4600	7.4334	39.6023	13.7939
2	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	1.4992	0.8895	0.5803	4.2972	7.1620	39.3310	13.6994
3	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	1.3970	0.8289	0.5803	4.1344	6.8906	39.0596	13.6049
4	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	1.2948	0.7683	0.5803	3.9715	6.6192	38.7882	13.5103
5	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	1.1926	0.7076	0.5803	3.8087	6.3478	38.5168	13.4158
6	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	1.0904	0.6470	0.5803	3.6459	6.0764	38.2454	13.3213
7	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	0.9882	0.5864	0.5803	3.4830	5.8051	37.9740	13.2268
8	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	0.8860	0.5257	0.5803	3.3202	5.5337	37.7026	13.1322
9	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	0.7838	0.4651	0.5803	3.1574	5.2623	37.4313	13.0377
10	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	0.6816	0.4044	0.5803	2.9945	4.9909	37.1599	12.9432
11	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	0.5794	0.3438	0.5803	2.8317	4.7195	36.8885	12.8487
12	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	0.4772	0.2832	0.5803	2.6689	4.4481	36.6171	12.7541
13	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	0.3750	0.2225	0.5803	2.5060	4.1767	36.3457	12.6596
14	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	0.2728	0.1619	0.5803	2.3432	3.9054	36.0743	12.5651
15	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	0.1707	0.1013	0.5803	2.1804	3.6340	35.8029	12.4705
16	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	0.0685	0.0406	0.5803	2.0176	3.3626	35.5316	12.3760
17	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	0.0511	0.0303	0.5803	1.9899	3.3165	35.4855	12.3600
Average Tariff															
1-17	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	0.7888	0.4680	0.5803	3.1653	5.2755	37.4445	13.0423
Levelized Tariff															
1-17	30.4024	0.0795	1.6871	32.1690	0.4601	0.2641	0.0618	0.5422	1.0100	0.5993	0.5803	3.5178	5.8630	38.0319	13.2469

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Annex-IV

K-Electric Limited
KCCP
Reference Generation Tariff (HSD)

Year	Energy Purchase Price (Rs./kWh)				Capacity Purchase Price (Rs./kW/h)									Total Tariff @ 60%	
	Fuel Cost Component	Variable O&M		Total EPP	Fixed O&M		Insurance	Working capital	Cost of Debt	Cost of Equity	Depreciation	Total CPP	Total CPP @ 60%	Rs./kWh	Cents / kWh
		Local	Foreign		Local	Foreign									
1	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	1.6073	0.9537	0.5824	4.4764	7.4607	60.6400	21.1216
2	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	1.5047	0.8928	0.5824	4.3130	7.1883	60.3676	21.0267
3	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	1.4021	0.8320	0.5824	4.1496	6.9160	60.0953	20.9318
4	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	1.2996	0.7711	0.5824	3.9861	6.6436	59.8229	20.8369
5	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	1.1970	0.7102	0.5824	3.8227	6.3712	59.5505	20.7421
6	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	1.0944	0.6494	0.5824	3.6593	6.0988	59.2781	20.6472
7	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	0.9918	0.5885	0.5824	3.4959	5.8264	59.0057	20.5523
8	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	0.8893	0.5277	0.5824	3.3324	5.5540	58.7333	20.4574
9	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	0.7867	0.4668	0.5824	3.1690	5.2817	58.4609	20.3626
10	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	0.6841	0.4059	0.5824	3.0056	5.0093	58.1886	20.2677
11	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	0.5816	0.3451	0.5824	2.8421	4.7369	57.9162	20.1728
12	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	0.4790	0.2842	0.5824	2.6787	4.4645	57.6438	20.0779
13	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	0.3764	0.2233	0.5824	2.5153	4.1921	57.3714	19.9831
14	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	0.2738	0.1625	0.5824	2.3518	3.9197	57.0990	19.8882
15	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	0.1713	0.1016	0.5824	2.1884	3.6474	56.8266	19.7933
16	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	0.0687	0.0408	0.5824	2.0250	3.3750	56.5543	19.6985
17	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	0.0087	0.0052	0.5824	1.9294	3.2156	56.3949	19.6430
Average Tariff															
1-17	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	0.7892	0.4683	0.5824	3.1730	5.2883	58.4676	20.3649
Levelised Tariff															
1-17	50.7461	0.0823	2.3508	53.1793	0.4618	0.2650	0.0620	0.5442	1.0127	0.6009	0.5824	3.5291	5.8818	59.0610	20.5716

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12.3. On the basis of approved heat rates and prevailing prices, the fuel cost component for different plants and fuels have been worked out and approved as provided hereunder:

Description	Combined Cycle Operation (Rs./kWh)				Open Cycle (Rs./kWh)	
	Gas	RLNG	RFO	HSD	Gas	RLNG
BQI Unit 1	9.6249	41.7506	34.6414	-	-	-
BQI Unit 2	9.5496	41.4241	34.5148	-	-	-
BQI Unit 5	9.2542	40.1426	33.3197	-	-	-
BQI Unit 6	9.5982	41.6347	33.9404	-	-	-
BQPS-II (2 Compressors)	7.0747	30.6886	-	-	10.5506	45.7659
BQPS-II (1 Compressor)	6.9546	30.1674	-	-	10.2890	44.6312
BQPS-II (No Compressor)	6.8385	29.6637	-	-	10.0400	43.5513
BQPS-III	-	20.6731	-	43.3356	-	-
KCCP (3 Compressor)	7.0088	30.4024	-	N/A	9.0822	39.3964
KCCP (No Compressor)	6.7622	29.3328	-	50.7461	8.6674	37.5977
KGTPS	7.7456	33.5986	-	-	8.4202	36.5247
SGTPS	7.7677	33.6946	-	-	8.4750	36.7623
Fuel Prices	857	3,717/ 3,262	133,637	232.52	857	3,717

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ANNEX 1-B: REFERENCE STARTUP CHARGES

I. START-UP CHARGES:

In any Month following the Month in which Start-Ups exceed the allowable number of free Start-Ups in any Agreement Year, the Power Producer shall be entitled to invoice the Offtaker for, and receive from the Offtaker, the charges ("Start-Up Charges") as set forth in Table-I of this Section for each Start-Up in excess of the number of requests shown in Table-2 of this section as free Start-Ups in any Agreement Year. There shall be no Start-Up Charges payable to the Power Producer pursuant to this Section for any Start-Up following a Forced Outage, or Partial Forced Outage (unless such forced or partial forced outage is on account of grid conditions or an Emergency claimed by the Offtaker), Maintenance Outage, Scheduled Outage or Force Majeure Event declared by the Power Producer.

If, at any time after (a) the Power Producer has notified the Control Centre that the Power Producer will initiate the starting sequence following a Start-Up order from the Offtaker, and (b) the Power Producer has actually initiated such sequence and the sequence is subsequently abandoned at the request of the Offtaker, then the initiation of such starting sequence shall be deemed to be a Start-Up; provided however, that a Startup shall not be deemed to have occurred if the Power Producer is able to act on such order prior to the initiation of the starting sequence. Any such Start-Up, prior to the Offtaker use of the allowable number of free Start-Ups in any Agreement Year, shall be credited against such allowable number, and, after the Offtaker's use of the allowable number of free Start-Ups in any Agreement Year, Start-Up Charges for any such Start-Up shall be payable by the Offtaker.

Start-Up Charges shall be indexed and adjusted over the Term as provided in Section- 10.

"Start-Up Charge" shall consist of two components and is calculated as follows:

"Start-Up Charge = MDI Charge+ Reference Start-Up"

a) MDI Charge.

The MDI charge shall be based on actual cost charged by the distribution company to the Complex for the maximum demand recorded during the relevant month at startups and shall be calculated based on the then applicable MDI rate in Rs/kW, from time to time, applied to the actual MDI in kW for such startup.

b) Reference Start-Up Charge.

This cost will cover the consumables, fuel and equivalent operating hours consumed for the Start-Ups. This cost will be based on the following table and shall escalate as per the formulas provided for in Section 10.

Table 1: Reference Startup Charges PKR (Gas Fuel)

Description	Startup Category											
	Full Complex			3 GT CC			2 GT CC			1 GT CC		
	Hot	Warm	Cold	Hot	Warm	Cold	Hot	Warm	Cold	Hot	Warm	Cold
Reference Cost: @ Gas Fuel												
Backfeed charges ($SCPI_{Ref}$) – A	237,529	237,529	237,529	229,781	229,781	229,781	206,721	206,721	206,721	134,788	134,788	134,788
Fuel gas cost for operation on FSNL – B	195,701	195,701	195,701	146,776	146,776	146,776	97,850	97,850	97,850	48,925	48,925	48,925
Fuel cost from GT Synch to ST Synch – C	3,080,841	8,531,560	13,034,328	2,329,580	6,451,145	9,855,917	1,719,620	4,762,025	7,275,315	1,045,601	2,895,510	4,423,696
Revenue during Open Cycle Operation (For Net Revenue) – D	(2,943,681)	(8,151,732)	(12,454,036)	(2,207,761)	(6,113,799)	(9,340,527)	(1,471,841)	(4,075,866)	(6,227,018)	(735,920)	(2,037,933)	(3,113,509)
Fuel Cost Charges ($SCFC_{Ref}$) – E = B + C + D	332,861	575,529	775,993	268,595	484,122	662,166	345,629	784,009	1,146,147	358,606	906,502	1,359,112
Total Reference Startup Cost (SC_{Ref}) – E = A + E	570,390	813,058	1,013,522	498,376	713,902	891,946	552,351	990,730	1,352,869	493,393	1,041,290	1,493,900

Description	Startup Category								
	1 GT OC			2 GT CC (When 2 GTs already in CC Mode)			1 GT CC (When 2 GTs already in CC Mode)		
	Hot	Warm	Cold	Hot	Warm	Cold	Hot	Warm	Cold
Reference Cost: @ Gas Fuel									
Backfeed charges ($SCPI_{Ref}$) – A	108,623	108,623	108,623	206,721	206,721	206,721	134,788	134,788	134,788
Fuel gas cost for operation on FSNL – B	48,925	48,925	48,925	97,850	97,850	97,850	48,925	48,925	48,925
Fuel cost from GT Synch to ST Synch – C	-	-	-	1,719,620	4,762,025	7,275,315	1,045,601	2,895,510	4,423,696
Revenue during Open Cycle Operation (For Net Revenue) – D	-	-	-	(1,153,457)	(3,194,187)	(4,880,009)	(593,402)	(1,643,268)	(2,510,549)
Fuel Cost Charges ($SCFC_{Ref}$) – E = B + C + D	48,925	48,925	48,925	664,013	1,665,688	2,493,156	501,124	1,301,167	1,962,072
Total Reference Startup Cost (SC_{Ref}) – E = A + E	157,549	157,549	157,549	870,735	1,872,409	2,699,878	635,911	1,435,964	2,096,860

Table 1.1: Reference Startup Charges PKR (HSD Fuel)

Description	Startup Category											
	Full Complex			3 GT CC			2 GT CC			1 GT CC		
	Hot	Warm	Cold	Hot	Warm	Cold	Hot	Warm	Cold	Hot	Warm	Cold
Reference Cost: @ HSD Fuel												
Backfeed charges ($SCPI_{Ref}$) – A	95,929	95,929	95,929	97,204	97,204	97,204	64,892	64,892	64,892	61,754	61,754	61,754
Fuel gas cost for operation on FSNL – B	343,106	343,106	343,106	257,330	257,330	257,330	171,553	171,553	171,553	85,777	85,777	85,777
Fuel cost from GT Synch to ST Synch – C	5,441,069	15,067,576	23,019,908	4,040,279	11,188,464	17,093,487	2,846,515	7,882,658	12,042,949	1,564,884	4,333,524	6,620,662
Revenue during Open Cycle Operation (For Net Revenue) – D	(4,166,668)	(11,538,464)	(17,628,209)	(3,125,001)	(8,653,848)	(13,221,157)	(2,083,334)	(5,769,232)	(8,814,105)	(1,041,667)	(2,884,616)	(4,407,052)
Fuel Cost Charges ($SCFC_{Ref}$) – E = B + C + D	1,617,507	3,872,218	5,734,805	1,172,608	2,791,946	4,129,660	934,734	2,284,979	3,400,397	608,994	1,534,685	2,299,387
Total Reference Startup Cost (SC_{Ref}) – E = A + E	1,713,437	3,968,147	5,830,734	1,269,812	2,889,150	4,226,864	998,627	2,349,871	3,465,290	670,748	1,596,439	2,361,141

Description	Startup Category								
	1 GT OC			2 GT CC (When 2 GTs already in CC Mode)			1 GT CC (When 2 GTs already in CC Mode)		
	Hot	Warm	Cold	Hot	Warm	Cold	Hot	Warm	Cold
Reference Cost: @ HSD Fuel									
Backfeed charges ($SCPI_{Ref}$) – A	36,374	36,374	36,374	64,892	64,892	64,892	61,754	61,754	61,754
Fuel gas cost for operation on FSNL – B	85,777	85,777	85,777	171,553	171,553	171,553	85,777	85,777	85,777
Fuel cost from GT Synch to ST Synch – C	-	-	-	2,846,515	7,882,658	12,042,949	1,564,884	4,333,524	6,620,662
Revenue during Open Cycle Operation (For Net Revenue) – D	-	-	-	(2,107,881)	(5,837,208)	(8,917,957)	(1,081,861)	(2,995,924)	(4,577,106)
Fuel Cost Charges ($SCFC_{Ref}$) – E = B + C + D	85,777	85,777	85,777	910,187	2,217,003	3,296,545	568,800	1,423,377	2,129,333
Total Reference Startup Cost (SC_{Ref}) – E = A + E	122,151	122,151	122,151	975,080	2,281,895	3,361,438	630,553	1,486,131	2,191,087

Table 2: Free Startups per Agreement Year

Description	Startup Category		
	Hot	Warm	Cold
No. of Free Startups for the Complex	15	15	3

II. BLACK START-UP CHARGES:

If, at any time after (a) the Power Producer has notified the Control Centre that the Power Producer will initiate the starting sequence following a Black Start order from the Offtakers, and (b) the Power Producer has actually initiated such sequence and the sequence is subsequently abandoned at the request of the Offtaker, then the initiation of such starting sequence shall be deemed to be a Black Start-Up; provided however, that a Startup shall not be deemed to have occurred if the Power Producer is able to act on such order prior to the initiation of the starting sequence.

Black Start Charges shall be indexed and adjusted over the Term as provided in Section- 10.

"Black Start Charge" shall consist of two components and is calculated as follows:

"Black Start Charge = MDI Charge + Reference Black Start "

a) MDI Charge.

The MDI charge shall be based on actual cost charged by the distribution company to the Complex for the maximum demand recorded during the relevant month at startups and shall be calculated based on the then applicable MDI rate in Rs/kW, from time to time, applied to the actual MDI in kW for such startup. However, this cost shall be claimed unless the same has not been claimed in Start Up Charges subject to Section 10.

b) Reference Black Start Charge.

This cost will cover the consumables, fuel and equivalent operating hours consumed for the Black Start. This cost will be based on the following table and shall escalate as per the formulas provided for in Section 11.

Table 3: Reference Black Start Charges PKR

Description	Startup Category Unit Startup			
	Hot	Warm	Cold	Without ST
Reference Cost: @ HSD Fuel				
Backfeed charges ($BSC_{RefBSDG}$) – A	**29,929**	**29,929**	**29,929**	**29,929**
Fuel gas cost for operation on FSNL – B	85,777	85,777	85,777	85,777
Fuel cost from GT Synch to Dead Bus / Grid Energization – C	466,273	466,273	466,273	466,273
Fuel cost from GT Synch to ST Synch – D	1,564,884	4,333,524	6,620,662	-
Revenue during Open Cycle Operation (For Net Revenue) – E	(1,041,667)	(2,884,616)	(4,407,052)	-
Fuel Cost Charges ($BSC_{RefOther}$) – F = B + C + D + E	**1,075,266**	**2,000,958**	**2,765,659**	**552,049**
Total Reference Startup Cost (BSC_{Ref}) – G = A + F	**1,105,195**	**2,030,886**	**2,795,588**	**581,978**

ANNEX 2: PERIOD WEIGHTING FACTORS

The initial PWFs (subject to revision pursuant to Section 5.3 of the Agreement) are as follows:

Season	Day	Time	Period Weighting Factor
Summer	Weekend Days		
		Peak	1
		Off-Peak	1
	Weekdays		
		Peak	1
		Off-Peak	1
Winter	Weekend Days		
		Peak	1
		Off-Peak	1
	Weekdays		
		Peak	1
		Off-Peak	1

Periods are defined as:

Weekdays	= 0000 hrs to 2400 hrs on Monday through Saturday
Weekend Days	= 0000 hrs to 2400 hrs on Sunday
Peak Period	=1200 hrs to 1700 hrs and 2200 hrs to 0100 hrs
Off -Peak Period	= All hours that are not in the "Peak" Period

ANNEX 3: REFERENCE WORKING CAPITAL COMPONENT & INDEXATION MECHANISM

K- Electric Limited
Annexure C: Illustration for Indexation of Working Capital Component (WCC) for the Plant
For the Quarter _____

Description	Unit	Legend	FY 2024 1st Quarter (Reference) SQPS-II	SQPS-III (Unit 1)	SQPS-III (Unit 2)	KCCPP	KTGEPS	SGEPS	Indexations / Actualization
1 Cost of Borrowing									
Days applicable for the Quarter	days	A	92	92	92	92	92	92	This will be updated based on actual days for the relevant quarter
Total days in a year	days	B	366	366	366	366	366	366	Will be based on actual calendar days including impact of Leap Year where applicable
KIBOR	%	A1	22.01%	22.01%	22.01%	22.01%	22.01%	22.01%	Will be indexed as per the Latest 3 - Month KIBOR published by SBP on the last Day of the previous Quarter
Spread	%	B1	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	-
Total	%	C = A1 + B1	24.01%	24.01%	24.01%	24.01%	24.01%	24.01%	
2 Fuel cost inventory upto									
Receipt - days	days	D	26	26	26	30	30	30	Taken as 30 Days
Payment - days	days	E	7	7	7	7	7	7	Shall be updated as per W.Avg Days based on sent out of each Fuel type in the preceeding quarter and their respective Payable Days individually.
Net days	days	F = D - E	23	23	23	23	23	23	-
GLNG ME									
Net capacity	MW	G	485	450	450	221	92	92	-
Load factor	%	H	67%	90%	90%	20%	20%	20%	Shall be updated as per W.Avg Dispatch Factor based on sent out of each Fuel Type in the preceding quarter.
Units for 365 days	GWh	I = G x 365 x 8 / 10^3 x H	2,908	3,540	3,540	387	161	162	-
Allowed Heat Rate for the Quarter	btu / kWh	J	8,285	8,280	8,280	8,170	8,050	8,054	W.Avg Heat Rate based on Sent out for the Heat Rates with applicable Degradation and Part Load of the previous quarter
Fuel price	PKR / MMBtu	K	3,717	3,362	3,362	3,717	3,717	3,717	W.Avg Fuel Price based on Sent out for the Fuel Prices as used in Fuel Price Indexation for the previous quarter
Amount for 365 days	PKR / kWh	L = I x J x K / 10^6	80,274	79,357	75,987	11,762	5,428	5,474	-
Amount for outstanding days	PKR Mn	M = F x L / 365	5,036	4,629	4,849	741	341	345	
Sales tax at 18%	%	N = 18%	18%	18%	18%	18%	18%	18%	Sales Tax will be updated as per applicable Laws
Amount including Sales Tax	PKR Mn	O = M x (1+N)	5,939	5,451	5,451	875	402	407	-
Cost of working capital	PKR Mn	P = O x C x A/B	417	342	343	55	25	26	

K- Electric Limited
Annexure C: Illustration for Indexation of Working Capital Component (WCC) for the Plant
For the Quarter _____

Description	Unit	Legend	FY 2024 1st Quarter (Reference) SQPS-II	SQPS-III (Unit 1)	SQPS-III (Unit 2)	KCCPP	KTGEPS	SGEPS	Indexations / Actualization
3 Cost of SBLC									
Daily gas	MMBtu	Q = G x I x 1,000 / 10^6	97,000	86,484	86,484	43,344	19,987	20,171	-
90-days	MMBtu	R = Q x 90	8,870,767	4,184,220	4,184,220	2,000,534	1,798,834	1,710,370	
Amount of 90 days	PKR Mn	S = K x R / 10^6	27,954	13,369	13,369	9,889	4,464	4,488	
Actual SBLC given	PKR Mn	T	2,118	3,341	3,341	980	432	435	Will be updated based on actual SBLC issued at the close of previous quarter
Lower of 90 days or Actual	PKR Mn	U = Lower of S or T	2,118	3,341	3,341	980	432	435	-
SBLC cost at 1%	%	V	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	-
Maximum Allowed Cost	PKR Mn	W = U x V	5	8	8	2	1	1	
Actual cost	PKR Mn	X	3	5	5	1	1	1	Will be updated on actual cost of SBLC based on SBLC issued at close of previous quarter
Lower of Maximum allowed or actual cost of SBLs	PKR Mn	Y = Lower of W or X	3	5	5	1	1	1	-
4 Cost of HSD inventory									
HSD Price	PKR / litre	Z	233	233	233	233			Will be updated based on the Closing Fuel Price as of Last day of previous quarter
GST	%	AA	18%	18%	18%	18%			Sales Tax will be updated as per applicable Laws
HSD Price including GST	PKR / litre	AB = Z x (1 + AA)	274	274	274	274			-
Net Capacity	MW	AC	485	357	357	221			
Calorific value	btu / litre	AD	36,352	36,352	36,352	36,352			Shall be updated as per actual on quarterly basis
HSD Price	PKR / MMBTu	AE = Z / AD x 39^6	6,414	6,414	6,414	6,414	NIL		-
Allowed Heat Rate for the Quarter	btu / kWhr	AF	8,031	8,730	8,740	7,912			W.Avg Heat Rate based on Sent out for the Heat Rates with applicable Degradation and Part Load of the previous quarter
Litres for 7 days	litres	AG = AC x 1000 x 24 x 7 x AD / AF	17,340,060	15,360,720	11,386,044	8,084,046			-
Amount for 7 days of Fuel Inventory - Maximum Allowed Inventory	PKR Mn	AH = AB x AG / 10^6	4,755	3,988	3,988	2,213			
Actual Amount of Fuel Inventory	PKR Mn	AI	0	0	0	2,213			Will be updated as per actual at the close of previous quarter
Lower of Actual or Maximum Allowed Fuel Inventory Levels	PKR Mn	AJ = MIN(AH, AI)	0	0	0	2,213			-
Cost of HSD	PKR Mn	AK = AJ x C	0	0	0	100			

S- Electric Limited
Annexure G: Workings for Indexation of Working Capital Component (WCC) for the Plant
For the Quarter _____

Description	Unit	Legend	Values as per Tariff Order reference						Explanations / Assumptions
1 Cost of other inventory									
Inventory amount	PKR Mn	A	2,007	2,370	2,370	1,184	207	455	will be updated as per actual at the close of previous quarter
Cost	PKR Mn	AP = AL x C	324	140	140	49	24	27	-
Total cost of working capital	PKR Mn	AM = P + T + AE + AR	156	455	455	154	39	56	-
Max Capacity (Gen)	MW	nD	405	450	450	231	98	98	-
Units for the Quarter	GWh	AP = AD x 24 nA / 1000	1,050	900	900	450	200	200	This will be updated based on actual days for the relevant quarter
Max Capacity (DISE)	MW	AQ	405	387	707	270	N/A	N/A	-
Units for the Quarter	GWh	AS = AQ x 24 nA / 1000	1,458	780	230	648	324	324	This will be updated based on actual days for the relevant quarter
2 Working Capital Component									
Rate	PKR / KWh	AS = AM / AF	0.5041	0.4500	0.4533	0.5422	0.2400	0.3804	
WCC	PKR / kWh	AT = AM / AN	0.5376	0.4207	1.4267	0.3440	N/A	N/A	

Note:
Calculation for Cost of HSD inventory for units other than RCCPP is indicative only on the same premise as allowed by the Authority for RCCPP. However the actual number will be requested in Quarterly indexation post HSD Commissioning of the relevant Plant and approval of NEPRA regarding One Time Adjustment in the Working Capital Component for the same.

ANNEX 4-A: KCCPP HEAT RATE DEGRADATION TABLES – GAS (COMBINED & SIMPLE CYCLE)

ANNEX 4-B: KCCPP HEAT RATE DEGRADATION TABLES – HSD (COMBINED & SIMPLE CYCLE)

ANNEX 4-C: KCCPP OUTPUT DEGRADATION TABLES – GAS (COMBINED & SIMPLE CYCLE)

ANNEX 4-D: KCCPP OUTPUT DEGRADATION TABLES – HSD (COMBINED & SIMPLE CYCLE)

ANNEX 5-A: KCCPP PART LOAD TABLE – GAS (COMBINED CYCLE)

ANNEX 5-B: KCCPP PART LOAD TABLE – GAS (SIMPLE CYCLE)

ANNEX 5-C: KCCPP PART LOAD TABLE – HSD (COMBINED CYCLE)

ANNEX 5-D: KCCPP PART LOAD TABLE – HSD (SIMPLE CYCLE)

ANNEX 6-A: START UP & BLACK START COST VERIFIED BY NESPAK – GAS & HSD

Korangi Combined Cycle Power Plant (KCCPP)
Heat Rate Degradation Table - Gas Operations

Net Heat Rate Degradation Factor - HHV (Gas)						
Interval	Gas Turbine Efficiency		Correction Factor	Complex (100% LF) Efficiency		Correction Factor
	Tested	Revised		Tested	Revised	
FY-19 (Test)	32.20%	32.20%	1.0000	41.72%	41.72%	1.0000
FY-23 (end)	32.20%	31.59%	1.0193	41.72%	41.10%	1.0152
+500	32.20%	31.57%	1.0198	41.72%	41.08%	1.0156
+1000	32.20%	31.56%	1.0202	41.72%	41.06%	1.0160
+1500	32.20%	31.54%	1.0207	41.72%	41.05%	1.0164
+2000	32.20%	31.53%	1.0212	41.72%	41.03%	1.0168
+2500	32.20%	31.51%	1.0217	41.72%	41.01%	1.0173
+3000	32.20%	31.50%	1.0222	41.72%	41.00%	1.0177
+3500	32.20%	32.61%	0.9874	41.72%	41.29%	1.0105
+4000	32.20%	32.51%	0.9905	41.72%	41.28%	1.0108
+4500	32.20%	32.41%	0.9935	41.72%	41.27%	1.0111
+5000	32.20%	32.31%	0.9966	41.72%	41.25%	1.0113
+5500	32.20%	32.21%	0.9996	41.72%	41.24%	1.0116
+6000	32.20%	32.11%	1.0027	41.72%	41.23%	1.0119
+6500	32.20%	32.01%	1.0057	41.72%	41.22%	1.0122
+7000	32.20%	31.92%	1.0088	41.72%	41.21%	1.0124
+7500	32.20%	31.82%	1.0118	41.72%	41.20%	1.0127
+8000	32.20%	31.72%	1.0149	41.72%	41.19%	1.0130
+8500	32.20%	31.69%	1.0161	41.72%	41.18%	1.0133
+9000	32.20%	31.67%	1.0165	41.72%	41.16%	1.0136
+9500	32.20%	31.66%	1.0169	41.72%	41.15%	1.0139
+10000	32.20%	31.65%	1.0173	41.72%	41.14%	1.0142
+10500	32.20%	31.64%	1.0177	41.72%	41.13%	1.0145
+11000	32.20%	31.63%	1.0180	41.72%	41.11%	1.0148
+11500	32.20%	31.61%	1.0184	41.72%	41.10%	1.0151
+12000	32.20%	31.60%	1.0188	41.72%	41.09%	1.0154
+12500	32.20%	31.59%	1.0192	41.72%	41.08%	1.0157
+13000	32.20%	31.58%	1.0196	41.72%	41.07%	1.0160
+13500	32.20%	31.57%	1.0199	41.72%	41.06%	1.0162
+14000	32.20%	31.56%	1.0202	41.72%	41.05%	1.0165
+14500	32.20%	31.55%	1.0205	41.72%	41.04%	1.0167
+15000	32.20%	31.54%	1.0208	41.72%	41.03%	1.0170
+15500	32.20%	31.53%	1.0212	41.72%	41.02%	1.0172
+16000	32.20%	31.52%	1.0215	41.72%	41.01%	1.0175
+16500	32.20%	31.51%	1.0218	41.72%	41.00%	1.0177
+17000	32.20%	31.50%	1.0221	41.72%	40.98%	1.0180
+17500	32.20%	31.49%	1.0224	41.72%	40.97%	1.0182
+18000	32.20%	31.48%	1.0227	41.72%	40.96%	1.0185
+18500	32.20%	31.47%	1.0230	41.72%	40.96%	1.0187

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Korangi Combined Cycle Power Plant (KCCPP)
Heat Rate Degradation Table - Gas Operations

Net Heat Rate Degradation Factor - HHV (Gas)						
Interval	Gas Turbine Efficiency		Correction Factor	Complex (100% LF) Efficiency		Correction Factor
	Tested	Revised		Tested	Revised	
+19000	32.20%	31.47%	1.0232	41.72%	40.95%	1.0189
+19500	32.20%	31.46%	1.0234	41.72%	40.94%	1.0191
+20000	32.20%	31.45%	1.0236	41.72%	40.93%	1.0193
+20500	32.20%	31.45%	1.0239	41.72%	40.93%	1.0195
+21000	32.20%	31.44%	1.0241	41.72%	40.92%	1.0196
+21500	32.20%	31.43%	1.0243	41.72%	40.91%	1.0198
+22000	32.20%	31.43%	1.0245	41.72%	40.90%	1.0200
+22500	32.20%	31.42%	1.0248	41.72%	40.90%	1.0202
+23000	32.20%	31.41%	1.0250	41.72%	40.89%	1.0204
+23500	32.20%	31.41%	1.0252	41.72%	40.88%	1.0206
+24000	32.20%	31.40%	1.0254	41.72%	40.87%	1.0208
+24500	32.20%	31.39%	1.0256	41.72%	40.87%	1.0209
+25000	32.20%	31.39%	1.0258	41.72%	40.86%	1.0211
+25500	32.20%	31.38%	1.0261	41.72%	40.85%	1.0213
+26000	32.20%	31.37%	1.0263	41.72%	40.85%	1.0215
+26500	32.20%	31.37%	1.0265	41.72%	40.84%	1.0216
+27000	32.20%	31.36%	1.0267	41.72%	40.83%	1.0218
+27500	32.20%	31.35%	1.0269	41.72%	40.82%	1.0220
+28000	32.20%	31.35%	1.0271	41.72%	40.82%	1.0222
+28500	32.20%	32.65%	0.9861	41.72%	42.01%	0.9931
+29000	32.20%	32.62%	0.9872	41.72%	41.98%	0.9939
+29500	32.20%	32.58%	0.9882	41.72%	41.95%	0.9946
+30000	32.20%	32.54%	0.9893	41.72%	41.92%	0.9953
+30500	32.20%	32.51%	0.9904	41.72%	41.89%	0.9961
+31000	32.20%	32.47%	0.9915	41.72%	41.86%	0.9968
+31500	32.20%	32.44%	0.9925	41.72%	41.83%	0.9975
+32000	32.20%	32.40%	0.9936	41.72%	41.79%	0.9983
+32500	32.20%	32.37%	0.9947	41.72%	41.76%	0.9990
+33000	32.20%	32.33%	0.9957	41.72%	41.73%	0.9997
+33500	32.20%	32.30%	0.9967	41.72%	41.71%	1.0004
+34000	32.20%	32.28%	0.9975	41.72%	41.68%	1.0010
+34500	32.20%	32.25%	0.9984	41.72%	41.65%	1.0016
+35000	32.20%	32.22%	0.9992	41.72%	41.63%	1.0023
+35500	32.20%	32.19%	1.0001	41.72%	41.60%	1.0029
+36000	32.20%	32.17%	1.0009	41.72%	41.58%	1.0035
+36500	32.20%	32.14%	1.0018	41.72%	41.55%	1.0041
+37000	32.20%	32.11%	1.0026	41.72%	41.52%	1.0048
+37500	32.20%	32.09%	1.0035	41.72%	41.50%	1.0054
+38000	32.20%	32.06%	1.0043	41.72%	41.47%	1.0060
+38500	32.20%	32.03%	1.0051	41.72%	41.45%	1.0065

Korangi Combined Cycle Power Plant (KCCPP)
Heat Rate Degradation Table - Gas Operations

Net Heat Rate Degradation Factor - HHV (Gas)						
Interval	Gas Turbine Efficiency		Correction Factor	Complex (100% LF) Efficiency		Correction Factor
	Tested	Revised		Tested	Revised	
+39000	32.20%	32.01%	1.0058	41.72%	41.44%	1.0069
+39500	32.20%	31.99%	1.0065	41.72%	41.42%	1.0073
+40000	32.20%	31.97%	1.0072	41.72%	41.40%	1.0077
+40500	32.20%	31.94%	1.0079	41.72%	41.39%	1.0081
+41000	32.20%	31.92%	1.0086	41.72%	41.37%	1.0085
+41500	32.20%	31.90%	1.0093	41.72%	41.35%	1.0089
+42000	32.20%	31.88%	1.0100	41.72%	41.34%	1.0093
+42500	32.20%	31.86%	1.0107	41.72%	41.32%	1.0098
+43000	32.20%	31.83%	1.0114	41.72%	41.30%	1.0102
+43500	32.20%	31.81%	1.0120	41.72%	41.29%	1.0105
+44000	32.20%	31.80%	1.0126	41.72%	41.27%	1.0108
+44500	32.20%	31.78%	1.0132	41.72%	41.26%	1.0112
+45000	32.20%	31.76%	1.0138	41.72%	41.25%	1.0115
+45500	32.20%	31.74%	1.0144	41.72%	41.23%	1.0118
+46000	32.20%	31.72%	1.0149	41.72%	41.22%	1.0121
+46500	32.20%	31.70%	1.0155	41.72%	41.21%	1.0125
+47000	32.20%	31.69%	1.0161	41.72%	41.19%	1.0128
+47500	32.20%	31.67%	1.0167	41.72%	41.18%	1.0131
+48000	32.20%	31.65%	1.0173	41.72%	41.17%	1.0135
+48500	32.20%	31.63%	1.0178	41.72%	41.15%	1.0139
+49000	32.20%	31.62%	1.0183	41.72%	41.13%	1.0143
+49500	32.20%	31.60%	1.0188	41.72%	41.12%	1.0147
+50000	32.20%	31.59%	1.0193	41.72%	41.10%	1.0152
+50500	32.20%	31.57%	1.0198	41.72%	41.08%	1.0156
+51000	32.20%	31.56%	1.0202	41.72%	41.06%	1.0161
+51500	32.20%	31.54%	1.0207	41.72%	41.04%	1.0165
+52000	32.20%	31.53%	1.0212	41.72%	41.03%	1.0170
+52500	32.20%	31.51%	1.0217	41.72%	41.01%	1.0174
+53000	32.20%	31.50%	1.0222	41.72%	40.99%	1.0178
+53500	32.20%	32.61%	0.9874	41.72%	41.28%	1.0107
+54000	32.20%	32.51%	0.9905	41.72%	41.27%	1.0110
+54500	32.20%	32.41%	0.9935	41.72%	41.25%	1.0113
+55000	32.20%	32.31%	0.9966	41.72%	41.24%	1.0116
+55500	32.20%	32.21%	0.9996	41.72%	41.23%	1.0119
+56000	32.20%	32.11%	1.0027	41.72%	41.22%	1.0123
+56500	32.20%	32.01%	1.0057	41.72%	41.20%	1.0126
+57000	32.20%	31.92%	1.0088	41.72%	41.19%	1.0129
+57500	32.20%	31.82%	1.0118	41.72%	41.18%	1.0132
+58000	32.20%	31.72%	1.0149	41.72%	41.17%	1.0135
+58500	32.20%	31.69%	1.0161	41.72%	41.15%	1.0138

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LTD. VERIFIED

Korangi Combined Cycle Power Plant (KCCPP)
Heat Rate Degradation Table - Gas Operations

Net Heat Rate Degradation Factor - HHV (Gas)						
Interval	Gas Turbine Efficiency		Correction Factor	Complex (100% LF) Efficiency		Correction Factor
	Tested	Revised		Tested	Revised	
+59000	32.20%	31.67%	1.0165	41.72%	41.14%	1.0141
+59500	32.20%	31.66%	1.0169	41.72%	41.13%	1.0144
+60000	32.20%	31.65%	1.0173	41.72%	41.12%	1.0147
+60500	32.20%	31.64%	1.0177	41.72%	41.10%	1.0150
+61000	32.20%	31.63%	1.0180	41.72%	41.09%	1.0153
+61500	32.20%	31.61%	1.0184	41.72%	41.08%	1.0156
+62000	32.20%	31.60%	1.0188	41.72%	41.07%	1.0159
+62500	32.20%	31.59%	1.0192	41.72%	41.06%	1.0162
+63000	32.20%	31.58%	1.0196	41.72%	41.04%	1.0166
+63500	32.20%	31.57%	1.0199	41.72%	41.03%	1.0168
+64000	32.20%	31.56%	1.0202	41.72%	41.02%	1.0171
+64500	32.20%	31.55%	1.0205	41.72%	41.01%	1.0173
+65000	32.20%	31.54%	1.0208	41.72%	41.00%	1.0176
+65500	32.20%	31.53%	1.0212	41.72%	40.99%	1.0178
+66000	32.20%	31.52%	1.0215	41.72%	40.98%	1.0181
+66500	32.20%	31.51%	1.0218	41.72%	40.97%	1.0184
+67000	32.20%	31.50%	1.0221	41.72%	40.96%	1.0186
+67500	32.20%	31.49%	1.0224	41.72%	40.95%	1.0189
+68000	32.20%	31.48%	1.0227	41.72%	40.94%	1.0191
+68500	32.20%	31.47%	1.0230	41.72%	40.93%	1.0193
+69000	32.20%	31.47%	1.0232	41.72%	40.92%	1.0195
+69500	32.20%	31.46%	1.0234	41.72%	40.92%	1.0197
+70000	32.20%	31.45%	1.0236	41.72%	40.91%	1.0199
+70500	32.20%	31.45%	1.0239	41.72%	40.90%	1.0201
+71000	32.20%	31.44%	1.0241	41.72%	40.89%	1.0203
+71500	32.20%	31.43%	1.0243	41.72%	40.88%	1.0205
+72000	32.20%	31.43%	1.0245	41.72%	40.88%	1.0207
+72500	32.20%	31.42%	1.0248	41.72%	40.87%	1.0209
+73000	32.20%	31.41%	1.0250	41.72%	40.86%	1.0211
+73500	32.20%	31.41%	1.0252	41.72%	40.85%	1.0212
+74000	32.20%	31.40%	1.0254	41.72%	40.85%	1.0214
+74500	32.20%	31.39%	1.0256	41.72%	40.84%	1.0216
+75000	32.20%	31.39%	1.0258	41.72%	40.83%	1.0218
+75500	32.20%	31.38%	1.0261	41.72%	40.82%	1.0220
+76000	32.20%	31.37%	1.0263	41.72%	40.82%	1.0222
+76500	32.20%	31.37%	1.0265	41.72%	40.81%	1.0223
+77000	32.20%	31.36%	1.0267	41.72%	40.80%	1.0225
+77500	32.20%	31.35%	1.0269	41.72%	40.80%	1.0227
+78000	32.20%	31.35%	1.0271	41.72%	40.79%	1.0229
+78500	32.20%	32.65%	0.9861	41.72%	41.98%	0.9938

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LTD. VERIFIED

Korangi Combined Cycle Power Plant (KCCPP)
Heat Rate Degradation Table - Gas Operations

Net Heat Rate Degradation Factor - HHV (Gas)						
Interval	Gas Turbine Efficiency		Correction Factor	Complex (100% LF) Efficiency		Correction Factor
	Tested	Revised		Tested	Revised	
+79000	32.20%	32.62%	0.9872	41.72%	41.95%	0.9945
+79500	32.20%	32.58%	0.9882	41.72%	41.92%	0.9953
+80000	32.20%	32.54%	0.9893	41.72%	41.89%	0.9960
+80500	32.20%	32.51%	0.9904	41.72%	41.86%	0.9967
+81000	32.20%	32.47%	0.9915	41.72%	41.83%	0.9975
+81500	32.20%	32.44%	0.9925	41.72%	41.80%	0.9982
+82000	32.20%	32.40%	0.9936	41.72%	41.77%	0.9990
+82500	32.20%	32.37%	0.9947	41.72%	41.73%	0.9997
+83000	32.20%	32.33%	0.9957	41.72%	41.70%	1.0005
+83500	32.20%	32.30%	0.9967	41.72%	41.68%	1.0011
+84000	32.20%	32.28%	0.9975	41.72%	41.65%	1.0018
+84500	32.20%	32.25%	0.9984	41.72%	41.62%	1.0024
+85000	32.20%	32.22%	0.9992	41.72%	41.60%	1.0030
+85500	32.20%	32.19%	1.0001	41.72%	41.57%	1.0037
+86000	32.20%	32.17%	1.0009	41.72%	41.54%	1.0043
+86500	32.20%	32.14%	1.0018	41.72%	41.52%	1.0050
+87000	32.20%	32.11%	1.0026	41.72%	41.49%	1.0056
+87500	32.20%	32.09%	1.0035	41.72%	41.46%	1.0062
+88000	32.20%	32.06%	1.0043	41.72%	41.44%	1.0069
+88500	32.20%	32.03%	1.0051	41.72%	41.41%	1.0075
+89000	32.20%	32.01%	1.0058	41.72%	41.39%	1.0080
+89500	32.20%	31.99%	1.0065	41.72%	41.37%	1.0085
+90000	32.20%	31.97%	1.0072	41.72%	41.35%	1.0090
+90500	32.20%	31.94%	1.0079	41.72%	41.33%	1.0096
+91000	32.20%	31.92%	1.0086	41.72%	41.31%	1.0101
+91500	32.20%	31.90%	1.0093	41.72%	41.28%	1.0106
+92000	32.20%	31.88%	1.0100	41.72%	41.26%	1.0111
+92500	32.20%	31.86%	1.0107	41.72%	41.24%	1.0117
+93000	32.20%	31.83%	1.0114	41.72%	41.22%	1.0122
+93500	32.20%	31.81%	1.0120	41.72%	41.20%	1.0127
+94000	32.20%	31.80%	1.0126	41.72%	41.18%	1.0131
+94500	32.20%	31.78%	1.0132	41.72%	41.16%	1.0136
+95000	32.20%	31.76%	1.0138	41.72%	41.15%	1.0140
+95500	32.20%	31.74%	1.0144	41.72%	41.13%	1.0145
+96000	32.20%	31.72%	1.0149	41.72%	41.11%	1.0149
+96500	32.20%	31.70%	1.0155	41.72%	41.09%	1.0153
+97000	32.20%	31.69%	1.0161	41.72%	41.07%	1.0158
+97500	32.20%	31.67%	1.0167	41.72%	41.06%	1.0162
+98000	32.20%	31.65%	1.0173	41.72%	41.04%	1.0167
+98500	32.20%	31.63%	1.0178	41.72%	41.02%	1.0170

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LTD. VERIFIED

Korangi Combined Cycle Power Plant (KCCPP)
Heat Rate Degradation Table - Gas Operations

Net Heat Rate Degradation Factor - HHV (Gas)						
Interval	Gas Turbine Efficiency		Correction Factor	Complex (100% LF) Efficiency		Correction Factor
	Tested	Revised		Tested	Revised	
+99000	32.20%	31.62%	1.0183	41.72%	41.01%	1.0173
+99500	32.20%	31.60%	1.0188	41.72%	41.00%	1.0176
+100000	32.20%	31.59%	1.0193	41.72%	40.99%	1.0179
+100500	32.20%	31.57%	1.0198	41.72%	40.98%	1.0182
+101000	32.20%	31.56%	1.0202	41.72%	40.96%	1.0185
+101500	32.20%	31.54%	1.0207	41.72%	40.95%	1.0188
+102000	32.20%	31.53%	1.0212	41.72%	40.94%	1.0191
+102500	32.20%	31.51%	1.0217	41.72%	40.93%	1.0194
+103000	32.20%	31.50%	1.0222	41.72%	40.92%	1.0197
+103500	32.20%	32.61%	0.9874	41.72%	41.21%	1.0124
+104000	32.20%	32.51%	0.9905	41.72%	41.20%	1.0126
+104500	32.20%	32.41%	0.9935	41.72%	41.20%	1.0128
+105000	32.20%	32.31%	0.9966	41.72%	41.19%	1.0129
+105500	32.20%	32.21%	0.9996	41.72%	41.18%	1.0131
+106000	32.20%	32.11%	1.0027	41.72%	41.17%	1.0133
+106500	32.20%	32.01%	1.0057	41.72%	41.17%	1.0135
+107000	32.20%	31.92%	1.0088	41.72%	41.16%	1.0137
+107500	32.20%	31.82%	1.0118	41.72%	41.15%	1.0139
+108000	32.20%	31.72%	1.0149	41.72%	41.14%	1.0141
+108500	32.20%	31.69%	1.0161	41.72%	41.13%	1.0144
+109000	32.20%	31.67%	1.0165	41.72%	41.12%	1.0148
+109500	32.20%	31.66%	1.0169	41.72%	41.10%	1.0151
+110000	32.20%	31.65%	1.0173	41.72%	41.09%	1.0155
+110500	32.20%	31.64%	1.0177	41.72%	41.07%	1.0158
+111000	32.20%	31.63%	1.0180	41.72%	41.06%	1.0162
+111500	32.20%	31.61%	1.0184	41.72%	41.04%	1.0165
+112000	32.20%	31.60%	1.0188	41.72%	41.03%	1.0169
+112500	32.20%	31.59%	1.0192	41.72%	41.02%	1.0172
+113000	32.20%	31.58%	1.0196	41.72%	41.00%	1.0176
+113500	32.20%	31.57%	1.0199	41.72%	40.99%	1.0179
+114000	32.20%	31.56%	1.0202	41.72%	40.98%	1.0182
+114500	32.20%	31.55%	1.0205	41.72%	40.96%	1.0185
+115000	32.20%	31.54%	1.0208	41.72%	40.95%	1.0188
+115500	32.20%	31.53%	1.0212	41.72%	40.94%	1.0191
+116000	32.20%	31.52%	1.0215	41.72%	40.93%	1.0194
+116500	32.20%	31.51%	1.0218	41.72%	40.92%	1.0197
+117000	32.20%	31.50%	1.0221	41.72%	40.91%	1.0200
+117500	32.20%	31.49%	1.0224	41.72%	40.89%	1.0203
+118000	32.20%	31.48%	1.0227	41.72%	40.88%	1.0206
+118500	32.20%	31.47%	1.0230	41.72%	40.87%	1.0208

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LTD. VERIFIED

Korangi Combined Cycle Power Plant (KCCPP)
Heat Rate Degradation Table - Gas Operations

Net Heat Rate Degradation Factor - HHV (Gas)						
Interval	Gas Turbine Efficiency		Correction Factor	Complex (100% LF) Efficiency		Correction Factor
	Tested	Revised		Tested	Revised	
+119000	32.20%	31.47%	1.0232	41.72%	40.86%	1.0210
+119500	32.20%	31.46%	1.0234	41.72%	40.85%	1.0213
+120000	32.20%	31.45%	1.0236	41.72%	40.84%	1.0215
+120500	32.20%	31.45%	1.0239	41.72%	40.84%	1.0217
+121000	32.20%	31.44%	1.0241	41.72%	40.83%	1.0219
+121500	32.20%	31.43%	1.0243	41.72%	40.82%	1.0221
+122000	32.20%	31.43%	1.0245	41.72%	40.81%	1.0224
+122500	32.20%	31.42%	1.0248	41.72%	40.80%	1.0226
+123000	32.20%	31.41%	1.0250	41.72%	40.79%	1.0228
+123500	32.20%	31.41%	1.0252	41.72%	40.78%	1.0230
+124000	32.20%	31.40%	1.0254	41.72%	40.78%	1.0232
+124500	32.20%	31.39%	1.0256	41.72%	40.77%	1.0234
+125000	32.20%	31.39%	1.0258	41.72%	40.76%	1.0236
+125500	32.20%	31.38%	1.0261	41.72%	40.75%	1.0238
+126000	32.20%	31.37%	1.0263	41.72%	40.75%	1.0240
+126500	32.20%	31.37%	1.0265	41.72%	40.74%	1.0242
+127000	32.20%	31.36%	1.0267	41.72%	40.73%	1.0243
+127500	32.20%	31.35%	1.0269	41.72%	40.72%	1.0245
+128000	32.20%	31.35%	1.0271	41.72%	40.72%	1.0247
+128500	32.20%	32.65%	0.9861	41.72%	41.91%	0.9954
+129000	32.20%	32.62%	0.9872	41.72%	41.88%	0.9962
+129500	32.20%	32.58%	0.9882	41.72%	41.85%	0.9969
+130000	32.20%	32.54%	0.9893	41.72%	41.82%	0.9976
+130500	32.20%	32.51%	0.9904	41.72%	41.79%	0.9984
+131000	32.20%	32.47%	0.9915	41.72%	41.76%	0.9991
+131500	32.20%	32.44%	0.9925	41.72%	41.73%	0.9998
+132000	32.20%	32.40%	0.9936	41.72%	41.70%	1.0006
+132500	32.20%	32.37%	0.9947	41.72%	41.67%	1.0013
+133000	32.20%	32.33%	0.9957	41.72%	41.64%	1.0021
+133500	32.20%	32.30%	0.9967	41.72%	41.61%	1.0027
+134000	32.20%	32.28%	0.9975	41.72%	41.58%	1.0034
+134500	32.20%	32.25%	0.9984	41.72%	41.56%	1.0040
+135000	32.20%	32.22%	0.9992	41.72%	41.53%	1.0046
+135500	32.20%	32.19%	1.0001	41.72%	41.50%	1.0052
+136000	32.20%	32.17%	1.0009	41.72%	41.48%	1.0059
+136500	32.20%	32.14%	1.0018	41.72%	41.45%	1.0065
+137000	32.20%	32.11%	1.0026	41.72%	41.43%	1.0071
+137500	32.20%	32.09%	1.0035	41.72%	41.40%	1.0078
+138000	32.20%	32.06%	1.0043	41.72%	41.38%	1.0084
+138500	32.20%	32.03%	1.0051	41.72%	41.35%	1.0089

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LTD. VERIFIED

Korangi Combined Cycle Power Plant (KCCPP)
Heat Rate Degradation Table - Gas Operations

Net Heat Rate Degradation Factor - HHV (Gas)						
Interval	Gas Turbine Efficiency		Correction Factor	Complex (100% LF) Efficiency		Correction Factor
	Tested	Revised		Tested	Revised	
+139000	32.20%	32.01%	1.0058	41.72%	41.33%	1.0095
+139500	32.20%	31.99%	1.0065	41.72%	41.31%	1.0100
+140000	32.20%	31.97%	1.0072	41.72%	41.29%	1.0105

FY 19 : As per 3rd Party Heat Rate Test on Gas Fuel
FY 23 : As per actual operating hours. Operating hours at end of FY23 : 71,836 hours

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LTD. VERIFIED

Korangi Combined Cycle Power Plant (KCCPP)
Heat Rate Degradation Table - HSD Operations

Net Heat Rate Degradation Factor - HHV (HSD)						
Interval	Gas Turbine Efficiency		Correction Factor	Complex (100% LF) Efficiency		Correction Factor
	Calculated	Revised		Tested	Revised	
FY-21 (Test)	34.18%	34.18%	1.0000	43.13%	43.13%	1.0000
FY-23 (end)	34.18%	33.92%	1.0078	43.13%	42.93%	1.0047
+500	34.18%	33.88%	1.0088	43.13%	42.90%	1.0053
+1000	34.18%	33.85%	1.0097	43.13%	42.88%	1.0058
+1500	34.18%	33.82%	1.0107	43.13%	42.85%	1.0064
+2000	34.18%	33.79%	1.0116	43.13%	42.83%	1.0069
+2500	34.18%	33.76%	1.0125	43.13%	42.81%	1.0075
+3000	34.18%	33.73%	1.0135	43.13%	42.78%	1.0080
+3500	34.18%	35.13%	0.9729	43.13%	43.74%	0.9861
+4000	34.18%	34.97%	0.9774	43.13%	43.62%	0.9886
+4500	34.18%	34.81%	0.9819	43.13%	43.51%	0.9912
+5000	34.18%	34.65%	0.9864	43.13%	43.40%	0.9937
+5500	34.18%	34.50%	0.9909	43.13%	43.29%	0.9963
+6000	34.18%	34.40%	0.9938	43.13%	43.22%	0.9979
+6500	34.18%	34.32%	0.9959	43.13%	43.17%	0.9990
+7000	34.18%	34.25%	0.9980	43.13%	43.12%	1.0002
+7500	34.18%	34.18%	1.0001	43.13%	43.07%	1.0013
+8000	34.18%	34.11%	1.0022	43.13%	43.02%	1.0025
+8500	34.18%	34.06%	1.0037	43.13%	42.99%	1.0033
+9000	34.18%	34.02%	1.0048	43.13%	42.96%	1.0039
+9500	34.18%	33.98%	1.0060	43.13%	42.93%	1.0045
+10000	34.18%	33.94%	1.0071	43.13%	42.91%	1.0051
+10500	34.18%	33.90%	1.0083	43.13%	42.88%	1.0058
+11000	34.18%	33.86%	1.0093	43.13%	42.86%	1.0063
+11500	34.18%	33.83%	1.0103	43.13%	42.83%	1.0069
+12000	34.18%	33.80%	1.0113	43.13%	42.81%	1.0074
+12500	34.18%	33.77%	1.0123	43.13%	42.79%	1.0079
+13000	34.18%	33.73%	1.0132	43.13%	42.76%	1.0085
+13500	34.18%	33.70%	1.0143	43.13%	42.74%	1.0091
+14000	34.18%	33.66%	1.0154	43.13%	42.72%	1.0096
+14500	34.18%	33.62%	1.0165	43.13%	42.69%	1.0102
+15000	34.18%	33.59%	1.0176	43.13%	42.67%	1.0108
+15500	34.18%	33.55%	1.0187	43.13%	42.64%	1.0114
+16000	34.18%	34.98%	0.9770	43.13%	43.62%	0.9888
+16500	34.18%	34.83%	0.9815	43.13%	43.50%	0.9913
+17000	34.18%	34.67%	0.9859	43.13%	43.39%	0.9939
+17500	34.18%	34.51%	0.9904	43.13%	43.28%	0.9964
+18000	34.18%	34.36%	0.9948	43.13%	43.17%	0.9989
+18500	34.18%	34.26%	0.9976	43.13%	43.11%	1.0005
+19000	34.18%	34.20%	0.9996	43.13%	43.06%	1.0015
+19500	34.18%	34.13%	1.0015	43.13%	43.02%	1.0026
+20000	34.18%	34.06%	1.0035	43.13%	42.97%	1.0037

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LTD. ★ VERIFIED

Korangi Combined Cycle Power Plant (KCCPP)
Heat Rate Degradation Table - HSD Operations

Net Heat Rate Degradation Factor - HHV (HSD)						
Interval	Gas Turbine Efficiency		Correction Factor	Complex (100% LF) Efficiency		Correction Factor
	Calculated	Revised		Tested	Revised	
+20500	34.18%	33.99%	1.0055	43.13%	42.92%	1.0047
+21000	34.18%	33.95%	1.0069	43.13%	42.89%	1.0055
+21500	34.18%	33.91%	1.0080	43.13%	42.87%	1.0060
+22000	34.18%	33.87%	1.0092	43.13%	42.84%	1.0066
+22500	34.18%	33.83%	1.0103	43.13%	42.82%	1.0072
+23000	34.18%	33.79%	1.0114	43.13%	42.79%	1.0078
+23500	34.18%	33.76%	1.0125	43.13%	42.77%	1.0083
+24000	34.18%	33.73%	1.0135	43.13%	42.75%	1.0088
+24500	34.18%	33.69%	1.0144	43.13%	42.73%	1.0093
+25000	34.18%	33.66%	1.0154	43.13%	42.71%	1.0098
+25500	34.18%	33.63%	1.0164	43.13%	42.69%	1.0103
+26000	34.18%	33.59%	1.0176	43.13%	42.66%	1.0109
+26500	34.18%	33.55%	1.0189	43.13%	42.63%	1.0116
+27000	34.18%	33.51%	1.0201	43.13%	42.61%	1.0123
+27500	34.18%	33.46%	1.0214	43.13%	42.58%	1.0129
+28000	34.18%	33.42%	1.0227	43.13%	42.55%	1.0136
+28500	34.18%	36.32%	0.9411	43.13%	44.65%	0.9658
+29000	34.18%	36.06%	0.9479	43.13%	44.46%	0.9701
+29500	34.18%	35.81%	0.9546	43.13%	44.26%	0.9744
+30000	34.18%	35.56%	0.9613	43.13%	44.06%	0.9788
+30500	34.18%	35.31%	0.9680	43.13%	43.87%	0.9831
+31000	34.18%	35.14%	0.9726	43.13%	43.75%	0.9858
+31500	34.18%	35.02%	0.9761	43.13%	43.66%	0.9878
+32000	34.18%	34.89%	0.9796	43.13%	43.57%	0.9898
+32500	34.18%	34.77%	0.9831	43.13%	43.48%	0.9918
+33000	34.18%	34.64%	0.9866	43.13%	43.40%	0.9938
+33500	34.18%	34.56%	0.9890	43.13%	43.34%	0.9952
+34000	34.18%	34.50%	0.9908	43.13%	43.29%	0.9963
+34500	34.18%	34.43%	0.9927	43.13%	43.24%	0.9973
+35000	34.18%	34.37%	0.9945	43.13%	43.19%	0.9984
+35500	34.18%	34.31%	0.9963	43.13%	43.15%	0.9995
+36000	34.18%	34.26%	0.9977	43.13%	43.11%	1.0003
+36500	34.18%	34.22%	0.9988	43.13%	43.08%	1.0010
+37000	34.18%	34.18%	0.9999	43.13%	43.06%	1.0017
+37500	34.18%	34.14%	1.0011	43.13%	43.03%	1.0023
+38000	34.18%	34.11%	1.0022	43.13%	43.00%	1.0030
+38500	34.18%	34.07%	1.0032	43.13%	42.98%	1.0035
+39000	34.18%	34.04%	1.0042	43.13%	42.96%	1.0040
+39500	34.18%	34.00%	1.0052	43.13%	42.94%	1.0044
+40000	34.18%	33.97%	1.0062	43.13%	42.92%	1.0049
+40500	34.18%	33.94%	1.0071	43.13%	42.90%	1.0053
+41000	34.18%	35.36%	0.9666	43.13%	43.87%	0.9831
+41500	34.18%	35.20%	0.9710	43.13%	43.76%	0.9855

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LTD. VERIFIED

Korangi Combined Cycle Power Plant (KCCPP)
Heat Rate Degradation Table - HSD Operations

Net Heat Rate Degradation Factor - HHV (HSD)						
Interval	Gas Turbine Efficiency		Correction Factor	Complex (100% LF) Efficiency		Correction Factor
	Calculated	Revised		Tested	Revised	
+42000	34.18%	35.05%	0.9753	43.13%	43.66%	0.9878
+42500	34.18%	34.89%	0.9796	43.13%	43.56%	0.9901
+43000	34.18%	34.74%	0.9840	43.13%	43.46%	0.9924
+43500	34.18%	34.63%	0.9870	43.13%	43.39%	0.9940
+44000	34.18%	34.54%	0.9895	43.13%	43.33%	0.9953
+44500	34.18%	34.46%	0.9920	43.13%	43.28%	0.9965
+45000	34.18%	34.37%	0.9945	43.13%	43.22%	0.9978
+45500	34.18%	34.28%	0.9970	43.13%	43.17%	0.9991
+46000	34.18%	34.23%	0.9987	43.13%	43.13%	0.9999
+46500	34.18%	34.18%	1.0000	43.13%	43.11%	1.0005
+47000	34.18%	34.14%	1.0013	43.13%	43.08%	1.0011
+47500	34.18%	34.09%	1.0026	43.13%	43.06%	1.0017
+48000	34.18%	34.05%	1.0039	43.13%	43.03%	1.0023
+48500	34.18%	34.01%	1.0050	43.13%	43.00%	1.0029
+49000	34.18%	33.98%	1.0059	43.13%	42.98%	1.0035
+49500	34.18%	33.95%	1.0069	43.13%	42.95%	1.0041
+50000	34.18%	33.92%	1.0078	43.13%	42.93%	1.0047
+50500	34.18%	33.88%	1.0088	43.13%	42.90%	1.0053
+51000	34.18%	33.85%	1.0097	43.13%	42.88%	1.0059
+51500	34.18%	33.82%	1.0107	43.13%	42.85%	1.0065
+52000	34.18%	33.79%	1.0116	43.13%	42.83%	1.0070
+52500	34.18%	33.76%	1.0125	43.13%	42.80%	1.0076
+53000	34.18%	33.73%	1.0135	43.13%	42.78%	1.0082
+53500	34.18%	35.13%	0.9729	43.13%	43.73%	0.9862
+54000	34.18%	34.97%	0.9774	43.13%	43.61%	0.9888
+54500	34.18%	34.81%	0.9819	43.13%	43.50%	0.9914
+55000	34.18%	34.65%	0.9864	43.13%	43.39%	0.9940
+55500	34.18%	34.50%	0.9909	43.13%	43.27%	0.9966
+56000	34.18%	34.40%	0.9938	43.13%	43.20%	0.9982
+56500	34.18%	34.32%	0.9959	43.13%	43.15%	0.9994
+57000	34.18%	34.25%	0.9980	43.13%	43.10%	1.0006
+57500	34.18%	34.18%	1.0001	43.13%	43.05%	1.0018
+58000	34.18%	34.11%	1.0022	43.13%	43.00%	1.0030
+58500	34.18%	34.06%	1.0037	43.13%	42.97%	1.0038
+59000	34.18%	34.02%	1.0048	43.13%	42.94%	1.0044
+59500	34.18%	33.98%	1.0060	43.13%	42.91%	1.0050
+60000	34.18%	33.94%	1.0071	43.13%	42.88%	1.0057
+60500	34.18%	33.90%	1.0083	43.13%	42.86%	1.0063
+61000	34.18%	33.86%	1.0093	43.13%	42.83%	1.0069
+61500	34.18%	33.83%	1.0103	43.13%	42.81%	1.0074
+62000	34.18%	33.80%	1.0113	43.13%	42.79%	1.0080
+62500	34.18%	33.77%	1.0123	43.13%	42.76%	1.0085
+63000	34.18%	33.73%	1.0132	43.13%	42.74%	1.0091

Korangi Combined Cycle Power Plant (KCCPP)
Heat Rate Degradation Table - HSD Operations

Net Heat Rate Degradation Factor - HHV (HSD)						
Interval	Gas Turbine Efficiency		Correction Factor	Complex (100% LF) Efficiency		Correction Factor
	Calculated	Revised		Tested	Revised	
+63500	34.18%	33.70%	1.0143	43.13%	42.71%	1.0097
+64000	34.18%	33.66%	1.0154	43.13%	42.69%	1.0102
+64500	34.18%	33.62%	1.0165	43.13%	42.67%	1.0108
+65000	34.18%	33.59%	1.0176	43.13%	42.64%	1.0114
+65500	34.18%	33.55%	1.0187	43.13%	42.62%	1.0120
+66000	34.18%	34.98%	0.9770	43.13%	43.59%	0.9894
+66500	34.18%	34.83%	0.9815	43.13%	43.48%	0.9919
+67000	34.18%	34.67%	0.9859	43.13%	43.37%	0.9945
+67500	34.18%	34.51%	0.9904	43.13%	43.26%	0.9970
+68000	34.18%	34.36%	0.9948	43.13%	43.15%	0.9995
+68500	34.18%	34.26%	0.9976	43.13%	43.08%	1.0011
+69000	34.18%	34.20%	0.9996	43.13%	43.03%	1.0022
+69500	34.18%	34.13%	1.0015	43.13%	42.99%	1.0032
+70000	34.18%	34.06%	1.0035	43.13%	42.94%	1.0043
+70500	34.18%	33.99%	1.0055	43.13%	42.90%	1.0054
+71000	34.18%	33.95%	1.0069	43.13%	42.87%	1.0061
+71500	34.18%	33.91%	1.0080	43.13%	42.84%	1.0067
+72000	34.18%	33.87%	1.0092	43.13%	42.82%	1.0073
+72500	34.18%	33.83%	1.0103	43.13%	42.79%	1.0079
+73000	34.18%	33.79%	1.0114	43.13%	42.77%	1.0084
+73500	34.18%	33.76%	1.0125	43.13%	42.74%	1.0090
+74000	34.18%	33.73%	1.0135	43.13%	42.72%	1.0095
+74500	34.18%	33.69%	1.0144	43.13%	42.70%	1.0100
+75000	34.18%	33.66%	1.0154	43.13%	42.68%	1.0105
+75500	34.18%	33.63%	1.0164	43.13%	42.66%	1.0110
+76000	34.18%	33.59%	1.0176	43.13%	42.63%	1.0116
+76500	34.18%	33.55%	1.0189	43.13%	42.60%	1.0123
+77000	34.18%	33.51%	1.0201	43.13%	42.58%	1.0130
+77500	34.18%	33.46%	1.0214	43.13%	42.55%	1.0136
+78000	34.18%	33.42%	1.0227	43.13%	42.52%	1.0143
+78500	34.18%	36.32%	0.9411	43.13%	44.63%	0.9664
+79000	34.18%	36.06%	0.9479	43.13%	44.43%	0.9707
+79500	34.18%	35.81%	0.9546	43.13%	44.23%	0.9751
+80000	34.18%	35.56%	0.9613	43.13%	44.03%	0.9794
+80500	34.18%	35.31%	0.9680	43.13%	43.84%	0.9837
+81000	34.18%	35.14%	0.9726	43.13%	43.72%	0.9865
+81500	34.18%	35.02%	0.9761	43.13%	43.63%	0.9885
+82000	34.18%	34.89%	0.9796	43.13%	43.54%	0.9905
+82500	34.18%	34.77%	0.9831	43.13%	43.45%	0.9925
+83000	34.18%	34.64%	0.9866	43.13%	43.37%	0.9945
+83500	34.18%	34.56%	0.9890	43.13%	43.30%	0.9959
+84000	34.18%	34.50%	0.9908	43.13%	43.26%	0.9970
+84500	34.18%	34.43%	0.9927	43.13%	43.21%	0.9981

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LTD. VERIFIED

Korangi Combined Cycle Power Plant (KCCPP)
Heat Rate Degradation Table - HSD Operations

Net Heat Rate Degradation Factor - HHV (HSD)						
Interval	Gas Turbine Efficiency		Correction Factor	Complex (100% LF) Efficiency		Correction Factor
	Calculated	Revised		Tested	Revised	
+85000	34.18%	34.37%	0.9945	43.13%	43.16%	0.9992
+85500	34.18%	34.31%	0.9963	43.13%	43.11%	1.0003
+86000	34.18%	34.26%	0.9977	43.13%	43.08%	1.0011
+86500	34.18%	34.22%	0.9988	43.13%	43.05%	1.0018
+87000	34.18%	34.18%	0.9999	43.13%	43.02%	1.0025
+87500	34.18%	34.14%	1.0011	43.13%	42.99%	1.0032
+88000	34.18%	34.11%	1.0022	43.13%	42.96%	1.0039
+88500	34.18%	34.07%	1.0032	43.13%	42.93%	1.0045
+89000	34.18%	34.04%	1.0042	43.13%	42.91%	1.0051
+89500	34.18%	34.00%	1.0052	43.13%	42.88%	1.0057
+90000	34.18%	33.97%	1.0062	43.13%	42.86%	1.0062
+90500	34.18%	33.94%	1.0071	43.13%	42.84%	1.0068
+91000	34.18%	35.36%	0.9666	43.13%	43.80%	0.9846
+91500	34.18%	35.20%	0.9710	43.13%	43.69%	0.9870
+92000	34.18%	35.05%	0.9753	43.13%	43.59%	0.9895
+92500	34.18%	34.89%	0.9796	43.13%	43.48%	0.9919
+93000	34.18%	34.74%	0.9840	43.13%	43.37%	0.9944
+93500	34.18%	34.63%	0.9870	43.13%	43.30%	0.9961
+94000	34.18%	34.54%	0.9895	43.13%	43.24%	0.9975
+94500	34.18%	34.46%	0.9920	43.13%	43.18%	0.9989
+95000	34.18%	34.37%	0.9945	43.13%	43.12%	1.0003
+95500	34.18%	34.28%	0.9970	43.13%	43.06%	1.0016
+96000	34.18%	34.23%	0.9987	43.13%	43.02%	1.0026
+96500	34.18%	34.18%	1.0000	43.13%	42.99%	1.0033
+97000	34.18%	34.14%	1.0013	43.13%	42.95%	1.0040
+97500	34.18%	34.09%	1.0026	43.13%	42.92%	1.0047
+98000	34.18%	34.05%	1.0039	43.13%	42.89%	1.0055
+98500	34.18%	34.01%	1.0050	43.13%	42.87%	1.0060
+99000	34.18%	33.98%	1.0059	43.13%	42.85%	1.0065
+99500	34.18%	33.95%	1.0069	43.13%	42.83%	1.0069
+100000	34.18%	33.92%	1.0078	43.13%	42.81%	1.0074
+100500	34.18%	33.88%	1.0088	43.13%	42.79%	1.0078
+101000	34.18%	33.85%	1.0097	43.13%	42.77%	1.0083
+101500	34.18%	33.82%	1.0107	43.13%	42.75%	1.0087
+102000	34.18%	33.79%	1.0116	43.13%	42.74%	1.0092
+102500	34.18%	33.76%	1.0125	43.13%	42.72%	1.0096
+103000	34.18%	33.73%	1.0135	43.13%	42.70%	1.0100
+103500	34.18%	35.13%	0.9729	43.13%	43.66%	0.9878
+104000	34.18%	34.97%	0.9774	43.13%	43.55%	0.9903
+104500	34.18%	34.81%	0.9819	43.13%	43.44%	0.9928
+105000	34.18%	34.65%	0.9864	43.13%	43.33%	0.9953
+105500	34.18%	34.50%	0.9909	43.13%	43.22%	0.9978
+106000	34.18%	34.40%	0.9938	43.13%	43.16%	0.9993

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LTD. VERIFIED

Korangi Combined Cycle Power Plant (KCCPP)
Heat Rate Degradation Table - HSD Operations

Net Heat Rate Degradation Factor - HHV (HSD)						
Interval	Gas Turbine Efficiency		Correction Factor	Complex (100% LF) Efficiency		Correction Factor
	Calculated	Revised		Tested	Revised	
+106500	34.18%	34.32%	0.9959	43.13%	43.11%	1.0004
+107000	34.18%	34.25%	0.9980	43.13%	43.07%	1.0014
+107500	34.18%	34.18%	1.0001	43.13%	43.02%	1.0025
+108000	34.18%	34.11%	1.0022	43.13%	42.97%	1.0036
+108500	34.18%	34.06%	1.0037	43.13%	42.94%	1.0044
+109000	34.18%	34.02%	1.0048	43.13%	42.91%	1.0051
+109500	34.18%	33.98%	1.0060	43.13%	42.88%	1.0057
+110000	34.18%	33.94%	1.0071	43.13%	42.85%	1.0064
+110500	34.18%	33.90%	1.0083	43.13%	42.82%	1.0071
+111000	34.18%	33.86%	1.0093	43.13%	42.80%	1.0077
+111500	34.18%	33.83%	1.0103	43.13%	42.77%	1.0083
+112000	34.18%	33.80%	1.0113	43.13%	42.75%	1.0089
+112500	34.18%	33.77%	1.0123	43.13%	42.72%	1.0095
+113000	34.18%	33.73%	1.0132	43.13%	42.70%	1.0101
+113500	34.18%	33.70%	1.0143	43.13%	42.67%	1.0107
+114000	34.18%	33.66%	1.0154	43.13%	42.64%	1.0114
+114500	34.18%	33.62%	1.0165	43.13%	42.62%	1.0120
+115000	34.18%	33.59%	1.0176	43.13%	42.59%	1.0126
+115500	34.18%	33.55%	1.0187	43.13%	42.56%	1.0132
+116000	34.18%	34.98%	0.9770	43.13%	43.54%	0.9905
+116500	34.18%	34.83%	0.9815	43.13%	43.43%	0.9931
+117000	34.18%	34.67%	0.9859	43.13%	43.31%	0.9957
+117500	34.18%	34.51%	0.9904	43.13%	43.20%	0.9983
+118000	34.18%	34.36%	0.9948	43.13%	43.09%	1.0009
+118500	34.18%	34.26%	0.9976	43.13%	43.02%	1.0025
+119000	34.18%	34.20%	0.9996	43.13%	42.97%	1.0036
+119500	34.18%	34.13%	1.0015	43.13%	42.92%	1.0047
+120000	34.18%	34.06%	1.0035	43.13%	42.88%	1.0058
+120500	34.18%	33.99%	1.0055	43.13%	42.83%	1.0069
+121000	34.18%	33.95%	1.0069	43.13%	42.80%	1.0077
+121500	34.18%	33.91%	1.0080	43.13%	42.77%	1.0083
+122000	34.18%	33.87%	1.0092	43.13%	42.75%	1.0089
+122500	34.18%	33.83%	1.0103	43.13%	42.72%	1.0096
+123000	34.18%	33.79%	1.0114	43.13%	42.69%	1.0102
+123500	34.18%	33.76%	1.0125	43.13%	42.67%	1.0107
+124000	34.18%	33.73%	1.0135	43.13%	42.65%	1.0112
+124500	34.18%	33.69%	1.0144	43.13%	42.63%	1.0118
+125000	34.18%	33.66%	1.0154	43.13%	42.60%	1.0123
+125500	34.18%	33.63%	1.0164	43.13%	42.58%	1.0128
+126000	34.18%	33.59%	1.0176	43.13%	42.56%	1.0134
+126500	34.18%	33.55%	1.0189	43.13%	42.53%	1.0141
+127000	34.18%	33.51%	1.0201	43.13%	42.50%	1.0148
+127500	34.18%	33.46%	1.0214	43.13%	42.47%	1.0155

Korangi Combined Cycle Power Plant (KCCPP)
Heat Rate Degradation Table - HSD Operations

Net Heat Rate Degradation Factor - HHV (HSD)						
Interval	Gas Turbine Efficiency		Correction Factor	Complex (100% LF) Efficiency		Correction Factor
	Calculated	Revised		Tested	Revised	
+128000	34.18%	33.42%	1.0227	43.13%	42.44%	1.0162
+128500	34.18%	36.32%	0.9411	43.13%	44.56%	0.9679
+129000	34.18%	36.06%	0.9479	43.13%	44.36%	0.9723
+129500	34.18%	35.81%	0.9546	43.13%	44.16%	0.9766
+130000	34.18%	35.56%	0.9613	43.13%	43.96%	0.9810
+130500	34.18%	35.31%	0.9680	43.13%	43.77%	0.9853
+131000	34.18%	35.14%	0.9726	43.13%	43.65%	0.9881
+131500	34.18%	35.02%	0.9761	43.13%	43.56%	0.9901
+132000	34.18%	34.89%	0.9796	43.13%	43.47%	0.9921
+132500	34.18%	34.77%	0.9831	43.13%	43.38%	0.9941
+133000	34.18%	34.64%	0.9866	43.13%	43.30%	0.9961
+133500	34.18%	34.56%	0.9890	43.13%	43.23%	0.9975
+134000	34.18%	34.50%	0.9908	43.13%	43.19%	0.9986
+134500	34.18%	34.43%	0.9927	43.13%	43.14%	0.9997
+135000	34.18%	34.37%	0.9945	43.13%	43.09%	1.0008
+135500	34.18%	34.31%	0.9963	43.13%	43.05%	1.0019
+136000	34.18%	34.26%	0.9977	43.13%	43.01%	1.0027
+136500	34.18%	34.22%	0.9988	43.13%	42.98%	1.0034
+137000	34.18%	34.18%	0.9999	43.13%	42.95%	1.0041
+137500	34.18%	34.14%	1.0011	43.13%	42.92%	1.0047
+138000	34.18%	34.11%	1.0022	43.13%	42.90%	1.0054
+138500	34.18%	34.07%	1.0032	43.13%	42.87%	1.0060
+139000	34.18%	34.04%	1.0042	43.13%	42.84%	1.0066
+139500	34.18%	34.00%	1.0052	43.13%	42.82%	1.0072
+140000	34.18%	33.97%	1.0062	43.13%	42.80%	1.0078

FY 21 : As per 3rd Party Heat Rate Test on HSD Fuel
FY 23 : As per actual operating hours. Operating hours at end of FY23 : 71,836 hours

Note: Simple cycle output has been computed from combined cycle 3rd party test results, by removing ST

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Korangi Combined Cycle Power Plant (KCCPP)
Power Output Degradation Table - Gas Operations

Net Output Degradation Factor - CC (Gas)			
Interval	Tested Combined Cycle Output (MW)	Revised Combined Cycle Output (MW)	Correction Factor
FY-19 (Test)	220.83	220.83	1.0000
FY-23 (end)	220.83	212.32	1.0401
+500	220.83	212.14	1.0410
+1000	220.83	211.96	1.0419
+1500	220.83	211.78	1.0427
+2000	220.83	211.60	1.0436
+2500	220.83	211.41	1.0445
+3000	220.83	211.23	1.0454
+3500	220.83	218.46	1.0109
+4000	220.83	218.14	1.0123
+4500	220.83	217.82	1.0138
+5000	220.83	217.51	1.0153
+5500	220.83	217.20	1.0167
+6000	220.83	216.88	1.0182
+6500	220.83	216.57	1.0197
+7000	220.83	216.26	1.0211
+7500	220.83	215.95	1.0226
+8000	220.83	215.64	1.0241
+8500	220.83	215.40	1.0252
+9000	220.83	215.19	1.0262
+9500	220.83	214.98	1.0272
+10000	220.83	214.77	1.0282
+10500	220.83	214.56	1.0292
+11000	220.83	214.35	1.0302
+11500	220.83	214.14	1.0312
+12000	220.83	213.93	1.0322
+12500	220.83	213.72	1.0332
+13000	220.83	213.52	1.0342
+13500	220.83	213.34	1.0351
+14000	220.83	213.18	1.0359
+14500	220.83	213.02	1.0367
+15000	220.83	212.86	1.0374
+15500	220.83	212.70	1.0382
+16000	220.83	212.54	1.0390
+16500	220.83	212.38	1.0398
+17000	220.83	212.22	1.0406
+17500	220.83	212.06	1.0414
+18000	220.83	211.90	1.0421
+18500	220.83	211.77	1.0428
+19000	220.83	211.65	1.0433
+19500	220.83	211.54	1.0439
+20000	220.83	211.42	1.0445
+20500	220.83	211.31	1.0451
+21000	220.83	211.19	1.0456
+21500	220.83	211.08	1.0462
+22000	220.83	210.96	1.0468
+22500	220.83	210.85	1.0473

Net Output Degradation Factor - OC (Gas)		
Tested Simple Cycle Output (MW)	Revised Simple Cycle Output (MW)	Correction Factor
170.70	170.70	1.0000
170.70	163.56	1.0437
170.70	163.41	1.0446
170.70	163.26	1.0456
170.70	163.11	1.0465
170.70	162.96	1.0475
170.70	162.81	1.0484
170.70	162.66	1.0494
170.70	175.10	0.9749
170.70	174.10	0.9805
170.70	173.11	0.9861
170.70	172.13	0.9917
170.70	171.17	0.9973
170.70	170.21	1.0029
170.70	169.27	1.0085
170.70	168.33	1.0140
170.70	167.41	1.0196
170.70	166.49	1.0252
170.70	166.08	1.0278
170.70	165.91	1.0289
170.70	165.73	1.0299
170.70	165.56	1.0310
170.70	165.39	1.0321
170.70	165.22	1.0332
170.70	165.05	1.0342
170.70	164.88	1.0353
170.70	164.71	1.0364
170.70	164.54	1.0374
170.70	164.39	1.0384
170.70	164.26	1.0392
170.70	164.13	1.0400
170.70	164.00	1.0409
170.70	163.87	1.0417
170.70	163.73	1.0425
170.70	163.60	1.0434
170.70	163.47	1.0442
170.70	163.34	1.0450
170.70	163.21	1.0459
170.70	163.11	1.0465
170.70	163.02	1.0471
170.70	162.92	1.0477
170.70	162.83	1.0483
170.70	162.74	1.0489
170.70	162.65	1.0495
170.70	162.55	1.0501
170.70	162.46	1.0507
170.70	162.37	1.0513

Korangi Combined Cycle Power Plant (KCCPP)
Power Output Degradation Table - Gas Operations

Net Output Degradation Factor - CC (Gas)			
Interval	Tested Combined Cycle Output (MW)	Revised Combined Cycle Output (MW)	Correction Factor
+23000	220.83	210.73	1.0479
+23500	220.83	210.62	1.0485
+24000	220.83	210.51	1.0490
+24500	220.83	210.39	1.0496
+25000	220.83	210.28	1.0502
+25500	220.83	210.16	1.0507
+26000	220.83	210.05	1.0513
+26500	220.83	209.94	1.0519
+27000	220.83	209.82	1.0525
+27500	220.83	209.71	1.0530
+28000	220.83	209.59	1.0536
+28500	220.83	225.49	0.9793
+29000	220.83	225.14	0.9809
+29500	220.83	224.78	0.9824
+30000	220.83	224.42	0.9840
+30500	220.83	224.06	0.9856
+31000	220.83	223.71	0.9871
+31500	220.83	223.36	0.9887
+32000	220.83	223.00	0.9902
+32500	220.83	222.65	0.9918
+33000	220.83	222.30	0.9934
+33500	220.83	221.90	0.9952
+34000	220.83	221.47	0.9971
+34500	220.83	221.04	0.9990
+35000	220.83	220.62	1.0010
+35500	220.83	220.19	1.0029
+36000	220.83	219.77	1.0048
+36500	220.83	219.35	1.0067
+37000	220.83	218.93	1.0087
+37500	220.83	218.52	1.0106
+38000	220.83	218.10	1.0125
+38500	220.83	217.78	1.0140
+39000	220.83	217.51	1.0153
+39500	220.83	217.23	1.0165
+40000	220.83	216.96	1.0178
+40500	220.83	216.69	1.0191
+41000	220.83	216.42	1.0204
+41500	220.83	216.15	1.0216
+42000	220.83	215.88	1.0229
+42500	220.83	215.61	1.0242
+43000	220.83	215.35	1.0255
+43500	220.83	215.11	1.0266
+44000	220.83	214.88	1.0277
+44500	220.83	214.65	1.0288
+45000	220.83	214.43	1.0298
+45500	220.83	214.20	1.0309
+46000	220.83	213.98	1.0320
+46500	220.83	213.75	1.0331

Net Output Degradation Factor - OC (Gas)		
Tested Simple Cycle Output (MW)	Revised Simple Cycle Output (MW)	Correction Factor
170.70	162.28	1.0519
170.70	162.19	1.0525
170.70	162.10	1.0531
170.70	162.00	1.0537
170.70	161.91	1.0543
170.70	161.82	1.0549
170.70	161.73	1.0554
170.70	161.64	1.0560
170.70	161.55	1.0566
170.70	161.46	1.0572
170.70	161.36	1.0578
170.70	175.54	0.9724
170.70	175.20	0.9743
170.70	174.86	0.9762
170.70	174.52	0.9781
170.70	174.18	0.9800
170.70	173.84	0.9819
170.70	173.50	0.9838
170.70	173.17	0.9857
170.70	172.83	0.9876
170.70	172.50	0.9895
170.70	172.14	0.9916
170.70	171.77	0.9938
170.70	171.40	0.9959
170.70	171.03	0.9980
170.70	170.67	1.0002
170.70	170.30	1.0023
170.70	169.94	1.0045
170.70	169.58	1.0066
170.70	169.22	1.0088
170.70	168.86	1.0109
170.70	168.57	1.0126
170.70	168.31	1.0142
170.70	168.05	1.0157
170.70	167.80	1.0173
170.70	167.54	1.0188
170.70	167.29	1.0204
170.70	167.03	1.0219
170.70	166.78	1.0235
170.70	166.53	1.0250
170.70	166.28	1.0266
170.70	166.05	1.0280
170.70	165.84	1.0293
170.70	165.63	1.0306
170.70	165.42	1.0319
170.70	165.21	1.0332
170.70	165.00	1.0345
170.70	164.80	1.0358

Korangi Combined Cycle Power Plant (KCCPP)
Power Output Degradation Table - Gas Operations

Net Output Degradation Factor - CC (Gas)			
Interval	Tested Combined Cycle Output (MW)	Revised Combined Cycle Output (MW)	Correction Factor
+47000	220.83	213.53	1.0342
+47500	220.83	213.31	1.0353
+48000	220.83	213.08	1.0363
+48500	220.83	212.88	1.0373
+49000	220.83	212.70	1.0382
+49500	220.83	212.51	1.0392
+50000	220.83	212.32	1.0401
+50500	220.83	212.13	1.0410
+51000	220.83	211.95	1.0419
+51500	220.83	211.76	1.0428
+52000	220.83	211.57	1.0437
+52500	220.83	211.39	1.0447
+53000	220.83	211.20	1.0456
+53500	220.83	218.41	1.0111
+54000	220.83	218.09	1.0125
+54500	220.83	217.77	1.0140
+55000	220.83	217.45	1.0155
+55500	220.83	217.13	1.0170
+56000	220.83	216.81	1.0185
+56500	220.83	216.49	1.0200
+57000	220.83	216.18	1.0215
+57500	220.83	215.86	1.0230
+58000	220.83	215.55	1.0245
+58500	220.83	215.30	1.0257
+59000	220.83	215.09	1.0267
+59500	220.83	214.88	1.0277
+60000	220.83	214.67	1.0287
+60500	220.83	214.45	1.0297
+61000	220.83	214.24	1.0307
+61500	220.83	214.03	1.0317
+62000	220.83	213.82	1.0328
+62500	220.83	213.61	1.0338
+63000	220.83	213.41	1.0348
+63500	220.83	213.23	1.0356
+64000	220.83	213.07	1.0364
+64500	220.83	212.91	1.0372
+65000	220.83	212.74	1.0380
+65500	220.83	212.58	1.0388
+66000	220.83	212.42	1.0396
+66500	220.83	212.26	1.0404
+67000	220.83	212.10	1.0411
+67500	220.83	211.94	1.0419
+68000	220.83	211.78	1.0427
+68500	220.83	211.65	1.0434
+69000	220.83	211.54	1.0439
+69500	220.83	211.42	1.0445
+70000	220.83	211.31	1.0451
+70500	220.83	211.19	1.0456

Net Output Degradation Factor - OC (Gas)		
Tested Simple Cycle Output (MW)	Revised Simple Cycle Output (MW)	Correction Factor
170.70	164.59	1.0371
170.70	164.38	1.0384
170.70	164.17	1.0397
170.70	164.00	1.0408
170.70	163.85	1.0418
170.70	163.70	1.0427
170.70	163.56	1.0437
170.70	163.41	1.0446
170.70	163.26	1.0456
170.70	163.11	1.0465
170.70	162.96	1.0475
170.70	162.81	1.0484
170.70	162.66	1.0494
170.70	175.10	0.9749
170.70	174.10	0.9805
170.70	173.11	0.9861
170.70	172.13	0.9917
170.70	171.17	0.9973
170.70	170.21	1.0029
170.70	169.27	1.0085
170.70	168.33	1.0140
170.70	167.41	1.0196
170.70	166.49	1.0252
170.70	166.08	1.0278
170.70	165.91	1.0289
170.70	165.73	1.0299
170.70	165.56	1.0310
170.70	165.39	1.0321
170.70	165.22	1.0332
170.70	165.05	1.0342
170.70	164.88	1.0353
170.70	164.71	1.0364
170.70	164.54	1.0374
170.70	164.39	1.0384
170.70	164.26	1.0392
170.70	164.13	1.0400
170.70	164.00	1.0409
170.70	163.87	1.0417
170.70	163.73	1.0425
170.70	163.60	1.0434
170.70	163.47	1.0442
170.70	163.34	1.0450
170.70	163.21	1.0459
170.70	163.11	1.0465
170.70	163.02	1.0471
170.70	162.92	1.0477
170.70	162.83	1.0483
170.70	162.74	1.0489

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Korangi Combined Cycle Power Plant (KCCPP)
Power Output Degradation Table - Gas Operations

Net Output Degradation Factor - CC (Gas)			
Interval	Tested Combined Cycle Output (MW)	Revised Combined Cycle Output (MW)	Correction Factor
+71000	220.83	211.08	1.0462
+71500	220.83	210.96	1.0468
+72000	220.83	210.85	1.0473
+72500	220.83	210.73	1.0479
+73000	220.83	210.62	1.0485
+73500	220.83	210.50	1.0491
+74000	220.83	210.39	1.0496
+74500	220.83	210.27	1.0502
+75000	220.83	210.16	1.0508
+75500	220.83	210.04	1.0514
+76000	220.83	209.93	1.0519
+76500	220.83	209.81	1.0525
+77000	220.83	209.70	1.0531
+77500	220.83	209.58	1.0537
+78000	220.83	209.47	1.0542
+78500	220.83	225.35	0.9799
+79000	220.83	224.99	0.9815
+79500	220.83	224.63	0.9831
+80000	220.83	224.27	0.9847
+80500	220.83	223.91	0.9862
+81000	220.83	223.56	0.9878
+81500	220.83	223.20	0.9894
+82000	220.83	222.85	0.9909
+82500	220.83	222.50	0.9925
+83000	220.83	222.15	0.9941
+83500	220.83	221.74	0.9959
+84000	220.83	221.31	0.9978
+84500	220.83	220.88	0.9998
+85000	220.83	220.45	1.0017
+85500	220.83	220.03	1.0036
+86000	220.83	219.60	1.0056
+86500	220.83	219.18	1.0075
+87000	220.83	218.76	1.0094
+87500	220.83	218.34	1.0114
+88000	220.83	217.92	1.0133
+88500	220.83	217.59	1.0149
+89000	220.83	217.29	1.0163
+89500	220.83	217.00	1.0177
+90000	220.83	216.70	1.0190
+90500	220.83	216.41	1.0204
+91000	220.83	216.11	1.0218
+91500	220.83	215.82	1.0232
+92000	220.83	215.53	1.0246
+92500	220.83	215.24	1.0260
+93000	220.83	214.95	1.0273
+93500	220.83	214.69	1.0286
+94000	220.83	214.44	1.0298
+94500	220.83	214.19	1.0310

Net Output Degradation Factor - OC (Gas)		
Tested Simple Cycle Output (MW)	Revised Simple Cycle Output (MW)	Correction Factor
170.70	162.65	1.0495
170.70	162.55	1.0501
170.70	162.46	1.0507
170.70	162.37	1.0513
170.70	162.28	1.0519
170.70	162.19	1.0525
170.70	162.10	1.0531
170.70	162.00	1.0537
170.70	161.91	1.0543
170.70	161.82	1.0549
170.70	161.73	1.0554
170.70	161.64	1.0560
170.70	161.55	1.0566
170.70	161.46	1.0572
170.70	161.36	1.0578
170.70	175.54	0.9724
170.70	175.20	0.9743
170.70	174.86	0.9762
170.70	174.52	0.9781
170.70	174.18	0.9800
170.70	173.84	0.9819
170.70	173.50	0.9838
170.70	173.17	0.9857
170.70	172.83	0.9876
170.70	172.50	0.9895
170.70	172.14	0.9916
170.70	171.77	0.9938
170.70	171.40	0.9959
170.70	171.03	0.9980
170.70	170.67	1.0002
170.70	170.30	1.0023
170.70	169.94	1.0045
170.70	169.58	1.0066
170.70	169.22	1.0088
170.70	168.86	1.0109
170.70	168.57	1.0126
170.70	168.31	1.0142
170.70	168.05	1.0157
170.70	167.80	1.0173
170.70	167.54	1.0188
170.70	167.29	1.0204
170.70	167.03	1.0219
170.70	166.78	1.0235
170.70	166.53	1.0250
170.70	166.28	1.0266
170.70	166.05	1.0280
170.70	165.84	1.0293
170.70	165.63	1.0306

Korangi Combined Cycle Power Plant (KCCPP)
Power Output Degradation Table - Gas Operations

Net Output Degradation Factor - CC (Gas)			
Interval	Tested Combined Cycle Output (MW)	Revised Combined Cycle Output (MW)	Correction Factor
+95000	220.83	213.95	1.0322
+95500	220.83	213.70	1.0333
+96000	220.83	213.46	1.0345
+96500	220.83	213.21	1.0357
+97000	220.83	212.97	1.0369
+97500	220.83	212.73	1.0381
+98000	220.83	212.48	1.0393
+98500	220.83	212.30	1.0402
+99000	220.83	212.14	1.0410
+99500	220.83	211.98	1.0417
+100000	220.83	211.82	1.0425
+100500	220.83	211.66	1.0433
+101000	220.83	211.50	1.0441
+101500	220.83	211.35	1.0449
+102000	220.83	211.19	1.0456
+102500	220.83	211.03	1.0464
+103000	220.83	210.88	1.0472
+103500	220.83	218.08	1.0126
+104000	220.83	217.78	1.0140
+104500	220.83	217.49	1.0154
+105000	220.83	217.19	1.0168
+105500	220.83	216.89	1.0181
+106000	220.83	216.60	1.0195
+106500	220.83	216.30	1.0209
+107000	220.83	216.01	1.0223
+107500	220.83	215.72	1.0237
+108000	220.83	215.43	1.0251
+108500	220.83	215.18	1.0262
+109000	220.83	214.96	1.0273
+109500	220.83	214.74	1.0283
+110000	220.83	214.52	1.0294
+110500	220.83	214.30	1.0305
+111000	220.83	214.08	1.0315
+111500	220.83	213.87	1.0326
+112000	220.83	213.65	1.0336
+112500	220.83	213.43	1.0347
+113000	220.83	213.21	1.0357
+113500	220.83	213.03	1.0366
+114000	220.83	212.86	1.0374
+114500	220.83	212.69	1.0383
+115000	220.83	212.52	1.0391
+115500	220.83	212.36	1.0399
+116000	220.83	212.19	1.0407
+116500	220.83	212.02	1.0415
+117000	220.83	211.85	1.0424
+117500	220.83	211.69	1.0432
+118000	220.83	211.52	1.0440
+118500	220.83	211.38	1.0447

Net Output Degradation Factor - OC (Gas)		
Tested Simple Cycle Output (MW)	Revised Simple Cycle Output (MW)	Correction Factor
170.70	165.42	1.0319
170.70	165.21	1.0332
170.70	165.00	1.0345
170.70	164.80	1.0358
170.70	164.59	1.0371
170.70	164.38	1.0384
170.70	164.17	1.0397
170.70	164.00	1.0408
170.70	163.85	1.0418
170.70	163.70	1.0427
170.70	163.56	1.0437
170.70	163.41	1.0446
170.70	163.26	1.0456
170.70	163.11	1.0465
170.70	162.96	1.0475
170.70	167.02	1.0220
170.70	173.53	0.9837
170.70	175.10	0.9749
170.70	174.10	0.9805
170.70	173.11	0.9861
170.70	172.13	0.9917
170.70	171.17	0.9973
170.70	170.21	1.0029
170.70	169.27	1.0085
170.70	168.33	1.0140
170.70	167.41	1.0196
170.70	166.49	1.0252
170.70	166.08	1.0278
170.70	165.91	1.0289
170.70	165.73	1.0299
170.70	165.56	1.0310
170.70	165.39	1.0321
170.70	165.22	1.0332
170.70	165.05	1.0342
170.70	164.88	1.0353
170.70	164.71	1.0364
170.70	164.54	1.0374
170.70	164.39	1.0384
170.70	164.26	1.0392
170.70	164.13	1.0400
170.70	164.00	1.0409
170.70	163.87	1.0417
170.70	163.73	1.0425
170.70	163.60	1.0434
170.70	163.47	1.0442
170.70	163.34	1.0450
170.70	163.21	1.0459
170.70	163.11	1.0465

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LTD. VERIFIED

Korangi Combined Cycle Power Plant (KCCPP)
Power Output Degradation Table - Gas Operations

Net Output Degradation Factor - CC (Gas)			
Interval	Tested Combined Cycle Output (MW)	Revised Combined Cycle Output (MW)	Correction Factor
+119000	220.83	211.26	1.0453
+119500	220.83	211.14	1.0459
+120000	220.83	211.02	1.0465
+120500	220.83	210.90	1.0471
+121000	220.83	210.78	1.0477
+121500	220.83	210.66	1.0483
+122000	220.83	210.54	1.0489
+122500	220.83	210.42	1.0495
+123000	220.83	210.30	1.0501
+123500	220.83	210.19	1.0506
+124000	220.83	210.07	1.0512
+124500	220.83	209.95	1.0518
+125000	220.83	209.84	1.0524
+125500	220.83	209.72	1.0529
+126000	220.83	209.61	1.0535
+126500	220.83	209.49	1.0541
+127000	220.83	209.38	1.0547
+127500	220.83	209.26	1.0553
+128000	220.83	209.15	1.0558
+128500	220.83	224.97	0.9816
+129000	220.83	224.62	0.9831
+129500	220.83	224.26	0.9847
+130000	220.83	223.91	0.9863
+130500	220.83	223.55	0.9878
+131000	220.83	223.20	0.9894
+131500	220.83	222.85	0.9909
+132000	220.83	222.50	0.9925
+132500	220.83	222.15	0.9940
+133000	220.83	221.80	0.9956
+133500	220.83	221.40	0.9974
+134000	220.83	220.97	0.9993
+134500	220.83	220.55	1.0013
+135000	220.83	220.13	1.0032
+135500	220.83	219.71	1.0051
+136000	220.83	219.29	1.0070
+136500	220.83	218.87	1.0090
+137000	220.83	218.45	1.0109
+137500	220.83	218.03	1.0128
+138000	220.83	217.62	1.0147
+138500	220.83	217.29	1.0163
+139000	220.83	216.99	1.0177
+139500	220.83	216.70	1.0191
+140000	220.83	216.41	1.0204

Net Output Degradation Factor - OC (Gas)		
Tested Simple Cycle Output (MW)	Revised Simple Cycle Output (MW)	Correction Factor
170.70	163.02	1.0471
170.70	162.92	1.0477
170.70	162.83	1.0483
170.70	162.74	1.0489
170.70	162.65	1.0495
170.70	162.55	1.0501
170.70	162.46	1.0507
170.70	162.37	1.0513
170.70	162.28	1.0519
170.70	162.19	1.0525
170.70	162.10	1.0531
170.70	162.00	1.0537
170.70	161.91	1.0543
170.70	161.82	1.0549
170.70	161.73	1.0554
170.70	161.64	1.0560
170.70	161.55	1.0566
170.70	161.46	1.0572
170.70	161.36	1.0578
170.70	175.54	0.9724
170.70	175.20	0.9743
170.70	174.86	0.9762
170.70	174.52	0.9781
170.70	174.18	0.9800
170.70	173.84	0.9819
170.70	173.50	0.9838
170.70	173.17	0.9857
170.70	172.83	0.9876
170.70	172.50	0.9895
170.70	172.14	0.9916
170.70	171.77	0.9938
170.70	171.40	0.9959
170.70	171.03	0.9980
170.70	170.67	1.0002
170.70	170.30	1.0023
170.70	169.94	1.0045
170.70	169.58	1.0066
170.70	169.22	1.0088
170.70	168.86	1.0109
170.70	168.57	1.0126
170.70	168.31	1.0142
170.70	168.05	1.0157
170.70	167.80	1.0173

FY 19 : As per 3rd Party Heat Rate Test on Gas Fuel
FY 23 : As per actual operating hours. Operating hours at end of FY23 : 71,836 hours

Korangi Combined Cycle Power Plant (KCCPP)
Power Output Degradation Table - HSD Operations

Net Output Degradation Factor - CC (HSD)			
Interval	Tested Combined Cycle Output (MW)	Revised Combined Cycle Output (MW)	Correction Factor
FY-21 (Test)	220.02	220.02	1.0000
FY-23 (end)	220.02	217.16	1.0132
+500	220.02	216.81	1.0148
+1000	220.02	216.49	1.0163
+1500	220.02	216.17	1.0178
+2000	220.02	215.86	1.0193
+2500	220.02	215.55	1.0207
+3000	220.02	215.24	1.0222
+3500	220.02	232.93	0.9446
+4000	220.02	230.69	0.9537
+4500	220.02	228.49	0.9629
+5000	220.02	226.33	0.9721
+5500	220.02	224.22	0.9813
+6000	220.02	222.95	0.9868
+6500	220.02	222.10	0.9906
+7000	220.02	221.25	0.9944
+7500	220.02	220.42	0.9982
+8000	220.02	219.58	1.0020
+8500	220.02	219.03	1.0045
+9000	220.02	218.62	1.0064
+9500	220.02	218.21	1.0083
+10000	220.02	217.80	1.0102
+10500	220.02	217.39	1.0121
+11000	220.02	217.03	1.0138
+11500	220.02	216.70	1.0153
+12000	220.02	216.37	1.0169
+12500	220.02	216.03	1.0184
+13000	220.02	215.70	1.0200
+13500	220.02	215.35	1.0217
+14000	220.02	214.98	1.0234
+14500	220.02	214.62	1.0251
+15000	220.02	214.26	1.0269
+15500	220.02	213.90	1.0286
+16000	220.02	231.47	0.9505
+16500	220.02	229.30	0.9595
+17000	220.02	227.17	0.9685
+17500	220.02	225.08	0.9775
+18000	220.02	223.03	0.9865
+18500	220.02	221.84	0.9918
+19000	220.02	221.07	0.9953
+19500	220.02	220.29	0.9987
+20000	220.02	219.53	1.0022
+20500	220.02	218.77	1.0057
+21000	220.02	218.25	1.0081
+21500	220.02	217.84	1.0100
+22000	220.02	217.43	1.0119

Net Output Degradation Factor - OC (HSD)		
Calculated Simple Cycle Output (MW)	Revised Simple Cycle Output (MW)	Correction Factor
174.38	174.38	1.0000
174.38	171.77	1.0151
174.38	171.46	1.0170
174.38	171.16	1.0188
174.38	170.88	1.0205
174.38	170.59	1.0222
174.38	170.31	1.0239
174.38	170.03	1.0256
174.38	186.49	0.9350
174.38	184.40	0.9456
174.38	182.36	0.9562
174.38	180.36	0.9668
174.38	178.40	0.9774
174.38	177.23	0.9839
174.38	176.43	0.9883
174.38	175.64	0.9928
174.38	174.86	0.9972
174.38	174.09	1.0017
174.38	173.57	1.0046
174.38	173.19	1.0069
174.38	172.80	1.0091
174.38	172.42	1.0113
174.38	172.04	1.0136
174.38	171.70	1.0156
174.38	171.39	1.0174
174.38	171.08	1.0192
174.38	170.78	1.0211
174.38	170.47	1.0229
174.38	170.14	1.0249
174.38	169.80	1.0270
174.38	169.46	1.0290
174.38	169.12	1.0311
174.38	168.78	1.0331
174.38	185.10	0.9421
174.38	183.09	0.9524
174.38	181.11	0.9628
174.38	179.19	0.9732
174.38	177.30	0.9835
174.38	176.19	0.9897
174.38	175.47	0.9938
174.38	174.75	0.9979
174.38	174.03	1.0020
174.38	173.32	1.0061
174.38	172.83	1.0089
174.38	172.45	1.0112
174.38	172.07	1.0134

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LTD. VERIFIED

Korangi Combined Cycle Power Plant (KCCPP)
Power Output Degradation Table - HSD Operations

Net Output Degradation Factor - CC (HSD)			
Interval	Tested Combined Cycle Output (MW)	Revised Combined Cycle Output (MW)	Correction Factor
+22500	220.02	217.03	1.0138
+23000	220.02	216.63	1.0157
+23500	220.02	216.27	1.0173
+24000	220.02	215.93	1.0189
+24500	220.02	215.60	1.0205
+25000	220.02	215.27	1.0221
+25500	220.02	214.94	1.0236
+26000	220.02	214.54	1.0255
+26500	220.02	214.11	1.0276
+27000	220.02	213.69	1.0296
+27500	220.02	213.26	1.0317
+28000	220.02	212.84	1.0337
+28500	220.02	242.65	0.9067
+29000	220.02	239.86	0.9173
+29500	220.02	237.14	0.9278
+30000	220.02	234.47	0.9384
+30500	220.02	231.87	0.9489
+31000	220.02	229.96	0.9568
+31500	220.02	228.38	0.9634
+32000	220.02	226.83	0.9700
+32500	220.02	225.30	0.9766
+33000	220.02	223.79	0.9831
+33500	220.02	222.84	0.9873
+34000	220.02	222.16	0.9903
+34500	220.02	221.49	0.9934
+35000	220.02	220.82	0.9964
+35500	220.02	220.15	0.9994
+36000	220.02	219.67	1.0016
+36500	220.02	219.28	1.0034
+37000	220.02	218.89	1.0052
+37500	220.02	218.50	1.0070
+38000	220.02	218.11	1.0088
+38500	220.02	217.78	1.0103
+39000	220.02	217.48	1.0117
+39500	220.02	217.19	1.0130
+40000	220.02	216.89	1.0144
+40500	220.02	216.60	1.0158
+41000	220.02	235.00	0.9363
+41500	220.02	232.80	0.9451
+42000	220.02	230.65	0.9539
+42500	220.02	228.53	0.9628
+43000	220.02	226.45	0.9716
+43500	220.02	225.08	0.9775
+44000	220.02	224.05	0.9820
+44500	220.02	223.03	0.9865
+45000	220.02	222.02	0.9910
+45500	220.02	221.02	0.9955

Net Output Degradation Factor - OC (HSD)		
Calculated Simple Cycle Output (MW)	Revised Simple Cycle Output (MW)	Correction Factor
174.38	171.69	1.0156
174.38	171.31	1.0179
174.38	170.97	1.0199
174.38	170.66	1.0218
174.38	170.35	1.0236
174.38	170.03	1.0255
174.38	169.72	1.0274
174.38	169.35	1.0297
174.38	168.96	1.0321
174.38	168.56	1.0345
174.38	168.17	1.0369
174.38	167.78	1.0393
174.38	196.53	0.8873
174.38	193.78	0.8999
174.38	191.10	0.9125
174.38	188.50	0.9251
174.38	185.96	0.9377
174.38	184.13	0.9470
174.38	182.64	0.9547
174.38	181.18	0.9624
174.38	179.74	0.9702
174.38	178.32	0.9779
174.38	177.43	0.9828
174.38	176.80	0.9863
174.38	176.17	0.9898
174.38	175.54	0.9933
174.38	174.92	0.9969
174.38	174.48	0.9994
174.38	174.11	1.0015
174.38	173.74	1.0036
174.38	173.38	1.0057
174.38	173.02	1.0078
174.38	172.70	1.0097
174.38	172.40	1.0114
174.38	172.11	1.0132
174.38	171.81	1.0149
174.38	171.52	1.0166
174.38	188.74	0.9239
174.38	186.64	0.9343
174.38	184.58	0.9447
174.38	182.57	0.9551
174.38	180.60	0.9655
174.38	179.30	0.9725
174.38	178.32	0.9779
174.38	177.35	0.9832
174.38	176.39	0.9886
174.38	175.44	0.9940

Korangi Combined Cycle Power Plant (KCCPP)
Power Output Degradation Table - HSD Operations

Net Output Degradation Factor - CC (HSD)			
Interval	Tested Combined Cycle Output (MW)	Revised Combined Cycle Output (MW)	Correction Factor
+46000	220.02	220.39	0.9983
+46500	220.02	219.94	1.0003
+47000	220.02	219.50	1.0024
+47500	220.02	219.05	1.0044
+48000	220.02	218.61	1.0064
+48500	220.02	218.22	1.0082
+49000	220.02	217.87	1.0099
+49500	220.02	217.51	1.0115
+50000	220.02	217.16	1.0132
+50500	220.02	216.81	1.0148
+51000	220.02	216.48	1.0164
+51500	220.02	216.16	1.0179
+52000	220.02	215.84	1.0194
+52500	220.02	215.52	1.0209
+53000	220.02	215.21	1.0224
+53500	220.02	232.89	0.9447
+54000	220.02	230.64	0.9539
+54500	220.02	228.44	0.9631
+55000	220.02	226.28	0.9723
+55500	220.02	224.15	0.9815
+56000	220.02	222.89	0.9871
+56500	220.02	222.03	0.9909
+57000	220.02	221.18	0.9948
+57500	220.02	220.33	0.9986
+58000	220.02	219.49	1.0024
+58500	220.02	218.94	1.0049
+59000	220.02	218.53	1.0068
+59500	220.02	218.12	1.0087
+60000	220.02	217.71	1.0106
+60500	220.02	217.30	1.0125
+61000	220.02	216.94	1.0142
+61500	220.02	216.60	1.0158
+62000	220.02	216.27	1.0174
+62500	220.02	215.93	1.0189
+63000	220.02	215.60	1.0205
+63500	220.02	215.24	1.0222
+64000	220.02	214.88	1.0239
+64500	220.02	214.52	1.0256
+65000	220.02	214.16	1.0274
+65500	220.02	213.79	1.0291
+66000	220.02	231.34	0.9510
+66500	220.02	229.18	0.9600
+67000	220.02	227.05	0.9690
+67500	220.02	224.96	0.9780
+68000	220.02	222.92	0.9870
+68500	220.02	221.73	0.9923
+69000	220.02	220.95	0.9958

Net Output Degradation Factor - OC (HSD)		
Calculated Simple Cycle Output (MW)	Revised Simple Cycle Output (MW)	Correction Factor
174.38	174.83	0.9974
174.38	174.39	0.9999
174.38	173.95	1.0024
174.38	173.51	1.0050
174.38	173.08	1.0075
174.38	172.72	1.0096
174.38	172.41	1.0114
174.38	172.09	1.0133
174.38	171.77	1.0151
174.38	171.46	1.0170
174.38	171.16	1.0188
174.38	170.88	1.0205
174.38	170.59	1.0222
174.38	170.31	1.0239
174.38	170.03	1.0256
174.38	186.49	0.9350
174.38	184.40	0.9456
174.38	182.36	0.9562
174.38	180.36	0.9668
174.38	178.40	0.9774
174.38	177.23	0.9839
174.38	176.43	0.9883
174.38	175.64	0.9928
174.38	174.86	0.9972
174.38	174.09	1.0017
174.38	173.57	1.0046
174.38	173.19	1.0069
174.38	172.80	1.0091
174.38	172.42	1.0113
174.38	172.04	1.0136
174.38	171.70	1.0156
174.38	171.39	1.0174
174.38	171.08	1.0192
174.38	170.78	1.0211
174.38	170.47	1.0229
174.38	170.14	1.0249
174.38	169.80	1.0270
174.38	169.46	1.0290
174.38	169.12	1.0311
174.38	168.78	1.0331
174.38	185.10	0.9421
174.38	183.09	0.9524
174.38	181.11	0.9628
174.38	179.19	0.9732
174.38	177.30	0.9835
174.38	176.19	0.9897
174.38	175.47	0.9938

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Korangi Combined Cycle Power Plant (KCCPP)
Power Output Degradation Table - HSD Operations

Net Output Degradation Factor - CC (HSD)			
Interval	Tested Combined Cycle Output (MW)	Revised Combined Cycle Output (MW)	Correction Factor
+69500	220.02	220.18	0.9993
+70000	220.02	219.41	1.0028
+70500	220.02	218.65	1.0062
+71000	220.02	218.13	1.0086
+71500	220.02	217.72	1.0105
+72000	220.02	217.32	1.0124
+72500	220.02	216.91	1.0143
+73000	220.02	216.51	1.0162
+73500	220.02	216.15	1.0179
+74000	220.02	215.82	1.0195
+74500	220.02	215.48	1.0210
+75000	220.02	215.15	1.0226
+75500	220.02	214.82	1.0242
+76000	220.02	214.42	1.0261
+76500	220.02	213.99	1.0281
+77000	220.02	213.57	1.0302
+77500	220.02	213.14	1.0323
+78000	220.02	212.72	1.0343
+78500	220.02	242.49	0.9073
+79000	220.02	239.71	0.9179
+79500	220.02	236.99	0.9284
+80000	220.02	234.32	0.9389
+80500	220.02	231.72	0.9495
+81000	220.02	229.81	0.9574
+81500	220.02	228.24	0.9640
+82000	220.02	226.69	0.9706
+82500	220.02	225.16	0.9772
+83000	220.02	223.65	0.9838
+83500	220.02	222.70	0.9880
+84000	220.02	222.02	0.9910
+84500	220.02	221.34	0.9940
+85000	220.02	220.67	0.9970
+85500	220.02	220.01	1.0001
+86000	220.02	219.52	1.0023
+86500	220.02	219.13	1.0041
+87000	220.02	218.73	1.0059
+87500	220.02	218.34	1.0077
+88000	220.02	217.95	1.0095
+88500	220.02	217.61	1.0111
+89000	220.02	217.29	1.0126
+89500	220.02	216.97	1.0140
+90000	220.02	216.66	1.0155
+90500	220.02	216.34	1.0170
+91000	220.02	234.67	0.9376
+91500	220.02	232.45	0.9465
+92000	220.02	230.28	0.9554
+92500	220.02	228.15	0.9644

Net Output Degradation Factor - OC (HSD)		
Calculated Simple Cycle Output (MW)	Revised Simple Cycle Output (MW)	Correction Factor
174.38	174.75	0.9979
174.38	174.03	1.0020
174.38	173.32	1.0061
174.38	172.83	1.0089
174.38	172.45	1.0112
174.38	172.07	1.0134
174.38	171.69	1.0156
174.38	171.31	1.0179
174.38	170.97	1.0199
174.38	170.66	1.0218
174.38	170.35	1.0236
174.38	170.03	1.0255
174.38	169.72	1.0274
174.38	169.35	1.0297
174.38	168.96	1.0321
174.38	168.56	1.0345
174.38	168.17	1.0369
174.38	167.78	1.0393
174.38	196.53	0.8873
174.38	193.78	0.8999
174.38	191.10	0.9125
174.38	188.50	0.9251
174.38	185.96	0.9377
174.38	184.13	0.9470
174.38	182.64	0.9547
174.38	181.18	0.9624
174.38	179.74	0.9702
174.38	178.32	0.9779
174.38	177.43	0.9828
174.38	176.80	0.9863
174.38	176.17	0.9898
174.38	175.54	0.9933
174.38	174.92	0.9969
174.38	174.48	0.9994
174.38	174.11	1.0015
174.38	173.74	1.0036
174.38	173.38	1.0057
174.38	173.02	1.0078
174.38	172.70	1.0097
174.38	172.40	1.0114
174.38	172.11	1.0132
174.38	171.81	1.0149
174.38	171.52	1.0166
174.38	188.74	0.9239
174.38	186.64	0.9343
174.38	184.58	0.9447
174.38	182.57	0.9551

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Korangi Combined Cycle Power Plant (KCCPP)
Power Output Degradation Table - HSD Operations

Net Output Degradation Factor - CC (HSD)			
Interval	Tested Combined Cycle Output (MW)	Revised Combined Cycle Output (MW)	Correction Factor
+93000	220.02	226.05	0.9733
+93500	220.02	224.67	0.9793
+94000	220.02	223.62	0.9839
+94500	220.02	222.58	0.9885
+95000	220.02	221.55	0.9931
+95500	220.02	220.54	0.9977
+96000	220.02	219.89	1.0006
+96500	220.02	219.42	1.0027
+97000	220.02	218.96	1.0048
+97500	220.02	218.50	1.0070
+98000	220.02	218.04	1.0091
+98500	220.02	217.66	1.0108
+99000	220.02	217.34	1.0123
+99500	220.02	217.01	1.0139
+100000	220.02	216.68	1.0154
+100500	220.02	216.36	1.0169
+101000	220.02	216.06	1.0183
+101500	220.02	215.77	1.0197
+102000	220.02	215.48	1.0211
+102500	220.02	215.19	1.0225
+103000	220.02	214.90	1.0238
+103500	220.02	232.55	0.9461
+104000	220.02	230.33	0.9552
+104500	220.02	228.16	0.9643
+105000	220.02	226.02	0.9734
+105500	220.02	223.93	0.9825
+106000	220.02	222.68	0.9880
+106500	220.02	221.85	0.9917
+107000	220.02	221.02	0.9955
+107500	220.02	220.20	0.9992
+108000	220.02	219.38	1.0029
+108500	220.02	218.83	1.0054
+109000	220.02	218.41	1.0074
+109500	220.02	217.99	1.0093
+110000	220.02	217.57	1.0112
+110500	220.02	217.16	1.0132
+111000	220.02	216.79	1.0149
+111500	220.02	216.44	1.0165
+112000	220.02	216.10	1.0181
+112500	220.02	215.76	1.0197
+113000	220.02	215.42	1.0213
+113500	220.02	215.06	1.0230
+114000	220.02	214.69	1.0248
+114500	220.02	214.32	1.0266
+115000	220.02	213.95	1.0283
+115500	220.02	213.59	1.0301
+116000	220.02	231.09	0.9521

Net Output Degradation Factor - OC (HSD)		
Calculated Simple Cycle Output (MW)	Revised Simple Cycle Output (MW)	Correction Factor
174.38	180.60	0.9655
174.38	179.30	0.9725
174.38	178.32	0.9779
174.38	177.35	0.9832
174.38	176.39	0.9886
174.38	175.44	0.9940
174.38	174.83	0.9974
174.38	174.39	0.9999
174.38	173.95	1.0024
174.38	173.51	1.0050
174.38	173.08	1.0075
174.38	172.72	1.0096
174.38	172.41	1.0114
174.38	172.09	1.0133
174.38	171.77	1.0151
174.38	171.46	1.0170
174.38	171.16	1.0188
174.38	170.88	1.0205
174.38	170.59	1.0222
174.38	170.31	1.0239
174.38	170.03	1.0256
174.38	186.49	0.9350
174.38	184.40	0.9456
174.38	182.36	0.9562
174.38	180.36	0.9668
174.38	178.40	0.9774
174.38	177.23	0.9839
174.38	176.43	0.9883
174.38	175.64	0.9928
174.38	174.86	0.9972
174.38	174.09	1.0017
174.38	173.57	1.0046
174.38	173.19	1.0069
174.38	172.80	1.0091
174.38	172.42	1.0113
174.38	172.04	1.0136
174.38	171.70	1.0156
174.38	171.39	1.0174
174.38	171.08	1.0192
174.38	170.78	1.0211
174.38	170.47	1.0229
174.38	170.14	1.0249
174.38	169.80	1.0270
174.38	169.46	1.0290
174.38	169.12	1.0311
174.38	168.78	1.0331
174.38	185.10	0.9421

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Korangi Combined Cycle Power Plant (KCCPP)
Power Output Degradation Table - HSD Operations

Net Output Degradation Factor - CC (HSD)				Net Output Degradation Factor - OC (HSD)		
Interval	Tested Combined Cycle Output (MW)	Revised Combined Cycle Output (MW)	Correction Factor	Calculated Simple Cycle Output (MW)	Revised Simple Cycle Output (MW)	Correction Factor
+116500	220.02	228.92	0.9611	174.38	183.09	0.9524
+117000	220.02	226.79	0.9701	174.38	181.11	0.9628
+117500	220.02	224.70	0.9792	174.38	179.19	0.9732
+118000	220.02	222.65	0.9882	174.38	177.30	0.9835
+118500	220.02	221.46	0.9935	174.38	176.19	0.9897
+119000	220.02	220.68	0.9970	174.38	175.47	0.9938
+119500	220.02	219.90	1.0005	174.38	174.75	0.9979
+120000	220.02	219.14	1.0040	174.38	174.03	1.0020
+120500	220.02	218.37	1.0075	174.38	173.32	1.0061
+121000	220.02	217.85	1.0100	174.38	172.83	1.0089
+121500	220.02	217.44	1.0119	174.38	172.45	1.0112
+122000	220.02	217.02	1.0138	174.38	172.07	1.0134
+122500	220.02	216.62	1.0157	174.38	171.69	1.0156
+123000	220.02	216.21	1.0176	174.38	171.31	1.0179
+123500	220.02	215.85	1.0193	174.38	170.97	1.0199
+124000	220.02	215.52	1.0209	174.38	170.66	1.0218
+124500	220.02	215.18	1.0225	174.38	170.35	1.0236
+125000	220.02	214.85	1.0241	174.38	170.03	1.0255
+125500	220.02	214.52	1.0256	174.38	169.72	1.0274
+126000	220.02	214.12	1.0275	174.38	169.35	1.0297
+126500	220.02	213.69	1.0296	174.38	168.96	1.0321
+127000	220.02	213.27	1.0317	174.38	168.56	1.0345
+127500	220.02	212.84	1.0337	174.38	168.17	1.0369
+128000	220.02	212.42	1.0358	174.38	167.78	1.0393
+128500	220.02	242.10	0.9088	174.38	196.53	0.8873
+129000	220.02	239.33	0.9193	174.38	193.78	0.8999
+129500	220.02	236.62	0.9298	174.38	191.10	0.9125
+130000	220.02	233.97	0.9404	174.38	188.50	0.9251
+130500	220.02	231.38	0.9509	174.38	185.96	0.9377
+131000	220.02	229.47	0.9588	174.38	184.13	0.9470
+131500	220.02	227.91	0.9654	174.38	182.64	0.9547
+132000	220.02	226.36	0.9720	174.38	181.18	0.9624
+132500	220.02	224.84	0.9786	174.38	179.74	0.9702
+133000	220.02	223.34	0.9851	174.38	178.32	0.9779
+133500	220.02	222.39	0.9893	174.38	177.43	0.9828
+134000	220.02	221.72	0.9923	174.38	176.80	0.9863
+134500	220.02	221.04	0.9954	174.38	176.17	0.9898
+135000	220.02	220.38	0.9984	174.38	175.54	0.9933
+135500	220.02	219.72	1.0014	174.38	174.92	0.9969
+136000	220.02	219.23	1.0036	174.38	174.48	0.9994
+136500	220.02	218.84	1.0054	174.38	174.11	1.0015
+137000	220.02	218.45	1.0072	174.38	173.74	1.0036
+137500	220.02	218.06	1.0090	174.38	173.38	1.0057
+138000	220.02	217.68	1.0108	174.38	173.02	1.0078
+138500	220.02	217.34	1.0123	174.38	172.70	1.0097
+139000	220.02	217.02	1.0138	174.38	172.40	1.0114
+139500	220.02	216.70	1.0153	174.38	172.11	1.0132

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Korangi Combined Cycle Power Plant (KCCPP)
Power Output Degradation Table - HSD Operations

Net Output Degradation Factor - CC (HSD)			
Interval	Tested Combined Cycle Output (MW)	Revised Combined Cycle Output (MW)	Correction Factor
+140000	220.02	216.39	1.0168

Net Output Degradation Factor - OC (HSD)		
Calculated Simple Cycle Output (MW)	Revised Simple Cycle Output (MW)	Correction Factor
174.38	171.81	1.0149

FY 21 : As per 3rd Party Heat Rate Test on HSD Fuel
FY 23 : As per actual operating hours. Operating hours at end of FY23 : 71,836 hours

Note: Simple cycle output has been computed from combined cycle 3rd party test results, by removing ST

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Percent Load Factor	Correction Factor on Gas fuel for Combined Cycle
100.00%	1.0000
95.00%	1.0064
90.00%	1.0143
85.00%	1.0232
80.00%	1.0347
75% (Note-1)	1.0033
71.00%	1.0104
67.00%	1.0183
64.00%	1.0280
60.00%	1.0400
56.00%	1.0545
53.00%	1.0726
49% (Note-2)	1.0428
47.00%	1.0525
44.00%	1.0631
42.00%	1.0763
40.00%	1.0824
37.00%	1.1123
35.00%	1.1362
32.00%	1.1692
30.00%	1.2138
25% (Note-3)	1.0843
24.00%	1.0759
22.00%	1.0888
21.00%	1.1041
20.00%	1.1279
19.00%	1.1469
17.00%	1.1741
16.00%	1.2116
15.00%	1.2619
12.00%	1.4119
11.00%	1.5157
10.00%	1.6528
8.00%	1.8466

Note-1 Heat Rate Values from 75% to 53% assumes 03 gas turbines in operation, this assumes 01 gas turbine will be shutdown
Note-2 Heat Rate Values from 49% to 30% assumes 02 gas turbines in operation , this assumes 02 gas turbine will be shutdown
Note-3 Heat Rate Values from 25% to 8% assumes 01 gas turbine in operation , this assumes 03 gas turbine will be shutdown

Note: Use linear interpolation when the load variation values fall between the stated values

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Project	Document Name	Document Number	Revision date	Prepared by
K-Electric Limited 248 MW Combined Cycle Power Plant Korangi Creek Karachi Pakistan	Part Load Adjustment Factor Table for Net Heat Rate (Natural Gas Fuel)	01/IEI/01/2022 - PL - GEA_A_Results	21.10.2022	IEI Stroenergo International, s.r.o.

Percent Load Factor	Correction Factor on Gas fuel for Synple Cycle
100.00%	1.0000
95.00%	1.0047
92.00%	1.0112
86.00%	1.0209
81.00%	1.0333
75% (Note-1)	0.9981
77.00%	1.0023
68.00%	1.0050
64.00%	1.0185
61.00%	1.0357
57.00%	1.0468
53.00%	1.0651
50% (Note-2)	1.0781
48.00%	1.0943
45.00%	1.0426
40.00%	1.0695
35.00%	1.1126
30.00%	1.2243
25% (Note-3)	1.0448
20.00%	1.0924
15.00%	1.2630
10.00%	2.2755

Note-1 Heat Rate Values from 75% to 54% assumes 03 gas turbines in operation, this assumes 01 gas turbine will be shutdown

Note-2 Heat Rate Values from 50% to 36% assumes 02 gas turbines in operation , this assumes 02 gas turbine will be shutdown

Note-3 Heat Rate Values from 25% to 18% assumes 01 gas turbine in operation , this assumes 03 gas turbine will be shutdown

Note: Use linear interpolation when the load variation values fall between the stated values

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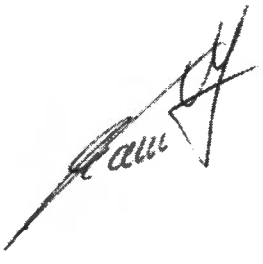

Percent load Factor	Correction Factor on NHR for Gas Turbine Combined Cycle
102.00%	1.0008
96.00%	1.0084
90.00%	1.0160
85.00%	1.0193
80.00%	1.0294
75% (Note-1)	1.007
71.00%	1.0126
67.00%	1.0197
63.00%	1.0287
60.00%	1.0368
56.00%	1.0488
52.00%	1.0598
49% (Note-2)	1.0939
47.00%	1.041
44.00%	1.0486
42.00%	1.06
39.00%	1.0727
37.00%	1.0841
34.00%	1.0942
32.00%	1.1074
30.00%	1.1196
27.00%	1.1367
25% (Note-3)	1.0507
24.00%	1.0593
22.00%	1.0697
21.00%	1.0824
20.00%	1.0977
19.00%	1.1136
17.00%	1.1251
16.00%	1.139
15.00%	1.1562
12.00%	1.3271
11.00%	1.4245
10.00%	1.5336
8.00%	1.6789

Note-1 Heat Rate Values from 75% to 52% assumes 03 gas turbines in operation, this assumes 01 gas turbine will be shutdown
Note-2 Heat Rate Values from 49% to 27% assumes 02 gas turbines in operation , this assumes 02 gas turbine will be shutdown
Note-3 Heat Rate Values from 25% to 8% assumes 01 gas turbine in operation , this assumes 03 gas turbine will be shutdown

Note: Use linear interpolation when the load variation values fall between the stated values

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Project	Document Name	Document Number	Revision date	Prepared by
K-Electric Limited 2×85 MW Combined Cycle Power Plant Bin Qasim Power Station Phase-II, Karachi, Pakistan	Part Load Adjustment Factor Table for Net Heat Rate (HSD Fuel)	10/KE/01/0023 - PL - 001_A_Remarks	11.10.2022	IEI Stroenergo International, s.r.o.

Percent Load Factor	Correction Factor on HSD fuel for Simple Cycle
100.00%	1.0000
95.00%	1.0039
90.00%	1.0080
85.00%	1.0148
80.00%	1.0228
75% (Note-1)	1.0033
71.00%	1.0074
68.00%	1.0117
64.00%	1.0188
60.00%	1.0270
56.00%	1.0394
52.00%	1.0500
50% (Note-2)	1.0093
45.00%	1.0184
40.00%	1.0347
35.00%	1.0592
30.00%	1.1014
25% (Note-3)	1.0290
20.00%	1.0604
15.00%	1.1396
10.00%	1.5381

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Note-1 Heat Rate Values from 75% to 52% assumes 03 gas turbines in operations, this assumes 01 gas turbine will be shutdown

Note-2 Heat Rate Values from 50% to 35% assumes 02 gas turbines in operations , this assumes 02 gas turbine will be shutdown

Note-3 Heat Rate Values from 25% to 10% assumes 01 gas turbine in operation , this assumes 02 gas turbines will be shutdown

Note: Use liner interpolation when the load variation values fall between the stated values

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Korangi Combined Cycle Power Plant (KCCPP) Startup Cost - Gas

										2 GT CC						2 GT CC						
	Hot Startup		Warm Startup		Cold Startup		Hot Startup		Warm Startup		Cold Startup		Hot Startup		Warm Startup		Cold Startup		Hot Startup		Warm Startup		Cold Startup	
Banked charges (Upto GT Synch)																						
Banked import duration	63	min	63	min	63	min	63	min	63	min	63	min	63	min	63	min	63	min	63	min	63	min	63	min
Power import	9.17	MW	9.17	MW	9.17	MW	8.67	MW	8.67	MW	8.67	MW	7.98	MW	7.98	MW	7.88	MW	6.38	MW	6.38	MW	6.38	MW
Power import rate	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh
Banked charges	237,529.37	PKR	237,529.37	PKR	237,529.37	PKR	229,766.51	PKR	229,766.51	PKR	229,766.51	PKR	206,721.16	PKR	206,721.16	PKR	206,721.16	PKR	164,797.26	PKR	164,797.26	PKR	164,797.26	PKR
Gas price (HHV)	1,300.02	PKR/MMBtu	1,300.02	PKR/MMBtu	1,300.02	PKR/MMBtu	1,300.02	PKR/MMBtu	1,300.02	PKR/MMBtu	1,300.02	PKR/MMBtu	1,300.02	PKR/MMBtu	1,300.02	PKR/MMBtu	1,300.02	PKR/MMBtu	1,300.02	PKR/MMBtu	1,300.02	PKR/MMBtu	1,300.02	PKR/MMBtu
GAS GCV	1,004.16	BTU/SCF	1,004.16	BTU/SCF	1,004.16	BTU/SCF	1,004.16	BTU/SCF	1,004.16	BTU/SCF	1,004.16	BTU/SCF	1,004.16	BTU/SCF	1,004.16	BTU/SCF	1,004.16	BTU/SCF	1,004.16	BTU/SCF	1,004.16	BTU/SCF	1,004.16	BTU/SCF
Fuel Cost Upto GT Synchronization																								
Gas consumption from start to Synch	99,041.75	Scf	99,041.75	Scf	99,041.75	Scf	44,281.31	Scf	44,281.31	Scf	44,281.31	Scf	29,520.87	Scf	29,520.87	Scf	29,520.87	Scf	14,760.44	Scf	14,760.44	Scf	14,760.44	Scf
Fuel cost for operation upto synch	106,700.60	PKR	106,700.60	PKR	106,700.60	PKR	146,775.60	PKR	146,775.60	PKR	146,775.60	PKR	97,850.40	PKR	97,850.40	PKR	97,850.40	PKR	48,925.20	PKR	48,925.20	PKR	48,925.20	PKR
Fuel Cost From GT Synchronization up to ST Synchronization																								
Operation from GT Synch to ST Synch	63	min	160	min	220	min	63	min	160	min	220	min	63	min	160	min	220	min	63	min	160	min	220	min
Load from GT Synch to ST Synch (MW)	97	MW	97	MW	97	MW	70	MW	70	MW	70	MW	40	MW	40	MW	40	MW	24	MW	24	MW	24	MW
Open Cycle Station base load	170.70	MW	170.70	MW	170.70	MW	170.70		170.70		170.70		170.70		170.70		170.70		170.70		170.70		170.70	
Load (Stage of base load of GT)	56.80%		56.80%		56.80%		42.00%		42.00%		42.00%		28.44%		28.44%		28.44%		14.22%		14.22%		14.22%	
Baseload GT efficiency	32.30%		32.30%		32.30%		32.30%		32.30%		32.30%		32.30%		32.30%		32.30%		32.30%		32.30%		32.30%	
Part load GT efficiency heat rate ratio	1.0468		1.0468		1.0468		1.0552		1.0552		1.0552		1.1688		1.1688		1.1688		1.4308		1.4308		1.4308	
Fuel Cost from GT Synch to ST Synch	3,880,841	PKR	8,531,580	PKR	12,894,930	PKR	2,329,580	PKR	5,481,196	PKR	8,806,917	PKR	1,735,630	PKR	4,702,025	PKR	7,235,215	PKR	1,045,681	PKR	2,895,130	PKR	4,423,696	PKR
Start-up Charges (Gas fuel)	3,344,071	PKR	8,064,790	PKR	13,457,598	PKR	2,706,196	PKR	6,837,301	PKR	10,732,473	PKR	2,054,385	PKR	5,066,884	PKR	7,579,897	PKR	1,729,514	PKR	4,079,233	PKR	6,027,489	PKR
Net Revenue																								
From GT Synchronization up to ST Synch																								
Operation from GT Synch to ST Synch	63	min	160	min	220	min	63	min	160	min	220	min	63	min	160	min	220	min	63	min	160	min	220	min
Load from GT Synch to ST Synch (MW)	97	MW	97	MW	97	MW	70	MW	70	MW	70	MW	40	MW	40	MW	40	MW	24	MW	24	MW	24	MW
Baseload Unit efficiency (HHV)	32%		32%		32%		32%		32%		32%		32%		32%		32%		32%		32%		32%	
Part load GT efficiency heat rate ratio	1		1		1		1		1		1		1		1		1		1		1		1	
Revenue from GT Synch to ST Synch	3,848,681	PKR	8,151,790	PKR	12,494,696	PKR	2,307,781	PKR	5,133,798	PKR	8,500,557	PKR	1,471,845	PKR	4,075,884	PKR	6,227,018	PKR	756,838	PKR	2,007,898	PKR	3,113,509	PKR
Net Revenue	570,599	PKR	818,896	PKR	1,019,912	PKR	484,274	PKR	713,502	PKR	891,946	PKR	583,551	PKR	990,758	PKR	1,352,880	PKR	485,599	PKR	1,091,399	PKR	1,485,980	PKR

Note 1: Formula for start up charges is given in portion which includes MDI charge and Start up charge. Calculation of start up charge is given above

Note 2: Start up charge is to be indexed due to change in fuel prices and Per unit charge for import based on latest applicable Consumer tariff rates and adjustments notified by DoP

Note 3: Efficiencies used above represent Base year efficiencies, which shall be updated based on applicable degradation as per the curve

Korangi Combined Cycle Power Plant (KCCPP) Startup Cost - Gas

KCCPP Start up Cost Gas	FUEL COMPLEX Startup						3 GT SC						2 GTCL (When 2 GTs already in CC Mode)						TGTCC (When 2 GTs already in CC Mode)					
	Hot Startup		Warm Startup		Cold Startup		Hot Startup		Warm Startup		Cold Startup		Hot Startup		Warm Startup		Cold Startup		Hot Startup		Warm Startup		Cold Startup	
Backfeed charges (Upto GT Synch)	63	min	63	min	63	min	63	min	63	min	63	min	63	min	63	min	63	min	63	min	63	min	63	min
Backfeed import duration	9.17	MW	9.17	MW	9.17	MW	4.29	MW	4.29	MW	4.29	MW	7.98	MW	7.98	MW	7.98	MW	5.30	MW	5.30	MW	5.30	MW
Power import	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh
Power import rate	257,529.57	PKR	257,529.57	PKR	257,529.57	PKR	108,433.36	PKR	108,433.36	PKR	108,433.36	PKR	206,721.16	PKR	206,721.16	PKR	206,721.16	PKR	134,787.59	PKR	134,787.59	PKR	134,787.59	PKR
Backfeed charges																								
Gas price (HHV)	1,200.52	PKR/MMBtu	1,200.52	PKR/MMBtu	1,200.52	PKR/MMBtu	1,200.52	PKR/MMBtu	1,200.52	PKR/MMBtu	1,200.52	PKR/MMBtu	1,200.52	PKR/MMBtu	1,200.52	PKR/MMBtu	1,200.52	PKR/MMBtu	1,200.52	PKR/MMBtu	1,200.52	PKR/MMBtu	1,200.52	PKR/MMBtu
GHG GCV	1,084.16	BTU/SCF	1,084.16	BTU/SCF	1,084.16	BTU/SCF	1,084.16	BTU/SCF	1,084.16	BTU/SCF	1,084.16	BTU/SCF	1,084.16	BTU/SCF	1,084.16	BTU/SCF	1,084.16	BTU/SCF	1,084.16	BTU/SCF	1,084.16	BTU/SCF	1,084.16	BTU/SCF
Fuel Cost Upto GT Synchronization																								
Gas consumption from start to Synch	59,041.75	Scf	59,041.75	Scf	59,041.75	Scf	14,760.44	Scf	14,760.44	Scf	14,760.44	Scf	29,520.87	Scf	29,520.87	Scf	29,520.87	Scf	14,760.44	Scf	14,760.44	Scf	14,760.44	Scf
Fuel cost for operation upto synch	185,700.80	PKR	185,700.80	PKR	185,700.80	PKR	46,425.20	PKR	46,425.20	PKR	46,425.20	PKR	92,850.40	PKR	92,850.40	PKR	92,850.40	PKR	46,425.20	PKR	46,425.20	PKR	46,425.20	PKR
Fuel Cost From GT Synchronization up to ST Synchronization																								
Operation from GT Synch to ST Synch	52	min	148	min	220	min							52	min	148	min	220	min	52	min	148	min	220	min
Load from GT Synch to ST Synch (MW)	57	MW	57	MW	57	MW							49	MW	49	MW	49	MW	24	MW	24	MW	24	MW
Open Cycle Station base load	120.70	MW	120.70	MW	120.70	MW							170.70		170.70		170.70		120.70		120.70		120.70	
Load (%age of base load of GT)	36.88%		36.88%		36.88%								28.44%		28.44%		28.44%		14.22%		14.22%		14.22%	
Baseload GT efficiency	32.30%		32.30%		32.30%								32.30%		32.30%		32.30%		32.30%		32.30%		32.30%	
Part load GT efficiency heat rate ratio	1.0466		1.0466		1.0466								1.1683		1.1683		1.1683		1.4208		1.4208		1.4208	
Fuel Cost from GT Synch to ST Synch	3,880,841	PKR	3,881,880	PKR	10,494,880	PKR							1,719,888	PKR	4,782,888	PKR	7,276,316	PKR	2,040,881	PKR	2,886,810	PKR	4,422,896	PKR
Start-up Charges (Gas fuel)	3,514,971	PKR	3,694,780	PKR	10,467,180	PKR	337,640	PKR	337,640	PKR	337,640	PKR	2,026,182	PKR	1,886,896	PKR	7,270,897	PKR	1,226,214	PKR	1,679,220	PKR	4,087,456	PKR
Net Revenue																								
From GT Synchronization up to ST Synch																								
Operation from GT Synch to ST Synch	52	min	148	min	220	min							52	min	148	min	220	min	52	min	148	min	220	min
Load from GT Synch to ST Synch (MW)	57	MW	57	MW	57	MW							49	MW	49	MW	49	MW	24	MW	24	MW	24	MW
Baseload Unit efficiency (HHV)	33%		33%		33%								41.72%		41.72%		41.72%		41.72%		41.72%		41.72%	
Part load GT efficiency heat rate ratio	1		1		1								1.0135		1.0135		1.0135		1.0049		1.0049		1.0049	
Revenue from GT Synch to ST Synch	3,043,881	PKR	3,181,797	PKR	22,494,886	PKR							1,132,467	PKR	3,294,197	PKR	4,880,089	PKR	893,402	PKR	1,448,384	PKR	2,336,549	PKR
Net Revenue	170,890	PKR	313,889	PKR	1,033,582	PKR	337,640	PKR	337,640	PKR	337,640	PKR	870,785	PKR	1,977,499	PKR	2,609,670	PKR	886,811	PKR	1,448,384	PKR	2,086,840	PKR

Note 1: Formula for start up charges is given in petition which includes SOC charge and Start up charge. Calculation of start up charge is given above
Note 2: Start up charge is to be trimmed due to change in fuel prices and Per unit charge for import based on latest applicable Consumer tariff rates and
Note 3: Efficiencies used above represent Base year efficiencies, which shall be updated based on applicable degradation as per the curve

Korangi Combined Cycle Power Plant (KCCPP) Startup Cost - HSD

KCCPP Start up Cost HSD	FULL COMPLEX Startup					
Backfeed charges (Upto GT Synch)	Hot Startup		Warm Startup		Cold Startup	
Backfeed import duration	63	min	63	min	63	min
Power import	3.70	MW	3.70	MW	3.70	MW
Power import rate	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh
Backfeed charges	95,928.86	PKR	95,928.86	PKR	95,928.86	PKR
HSD price (HHV)	6,066.91	PKR/MMBtu	6,066.91	PKR/MMBtu	6,066.91	PKR/MMBtu
HSD GCV	36,252.36	btu / liter	36,252.36	btu / liter	36,252.36	btu / liter
Fuel Cost Upto GT Synchronization						
HSD consumption from start to Sync	1,560.00	Liter	1,560.00	Liter	1,560.00	Liter
Fuel cost for operation upto synch	343,106.40	PKR	343,106.40	PKR	343,106.40	PKR
Fuel Cost From GT Synchronization up to ST Synchronization						
Operation from GT Synch to ST Synch	52	min	144	min	220	min
Load from GT Synch to ST Synch (MW)	100	MW	100	MW	100	MW
Open Cycle Station base load	174.38	MW	174.38	MW	174.38	MW
Load (%age of base load of GT)	57.44%		57.44%		57.44%	
Baseload GT efficiency	34.18%		34.18%		34.18%	
Part load GT efficiency heat rate ratio	1.0349		1.0349		1.0349	
Fuel cost from GT Synch to ST Synch	5,441,840	PKR	15,067,576	PKR	23,019,908	PKR
Start-up Charges (HSD fuel)	5,880,104	PKR	15,806,611	PKR	23,460,943	PKR
[illegible]						
From GT Synchronization up to ST Synch						
Operation from GT Synch to ST Synch	52	min	144	min	220	min
Load from GT Synch to ST Synch (MW)	100	MW	100	MW	100	MW
Baseload Unit efficiency (HHV)	43.13%		43.13%		43.13%	
Part load GT efficiency heat rate ratio	1		1		1	
Revenue from GT Synch to ST Synch	4,166,668	PKR	11,530,464	PKR	17,680,209	PKR
Net Revenue	1,713,437	PKR	3,908,147	PKR	5,880,734	PKR

KCCPP Start up Cost HSD	3 GT CC					
Backfeed charges (Upto GT Synch)	Hot Startup		Warm Startup		Cold Startup	
Backfeed import duration	63	min	63	min	63	min
Power import	3.75	MW	3.75	MW	3.75	MW
Power import rate	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh
Backfeed charges	97,203.98	PKR	97,203.98	PKR	97,203.98	PKR
HSD price (HHV)	6,066.91	PKR/MMBtu	6,066.91	PKR/MMBtu	6,066.91	PKR/MMBtu
HSD GCV	36,252.36	btu / liter	36,252.36	btu / liter	36,252.36	btu / liter
Fuel Cost Upto GT Synchronization						
HSD consumption from start to Sync	1,170.00	Liter	1,170.00	Liter	1,170.00	Liter
Fuel cost for operation upto synch	257,329.80	PKR	257,329.80	PKR	257,329.80	PKR
Fuel Cost From GT Synchronization up to ST Synchronization						
Operation from GT Synch to ST Synch	52	min	144	min	220	min
Load from GT Synch to ST Synch (MW)	75	MW	75	MW	75	MW
Open Cycle Station base load	174.38	MW	174.38	MW	174.38	MW
Load (%age of base load of GT)	43.08%		43.08%		43.08%	
Baseload GT efficiency	34.18%		34.18%		34.18%	
Part load GT efficiency heat rate ratio	1.0247		1.0247		1.0247	
Fuel cost from GT Synch to ST Synch	4,040,279	PKR	11,186,464	PKR	17,093,407	PKR
Start-up Charges (HSD fuel)	4,394,[illegible]	PKR	[illegible]	PKR	17,448,021	PKR
[illegible]						
From GT Synchronization up to ST Synch						
Operation from GT Synch to ST Synch	52	min	144	min	220	min
Load from GT Synch to ST Synch (MW)	75	MW	75	MW	75	MW
Baseload Unit efficiency (HHV)	43.13%		43.13%		43.13%	
Part load GT efficiency heat rate ratio	1		1		1	
Revenue from GT Synch to ST Synch	3,125,001	PKR	8,653,848	PKR	13,221,157	PKR
Net Revenue	1,268,812	PKR	2,889,150	PKR	4,226,864	PKR

KCCPP Start up Cost HSD	2 GT CC					
Backfeed charges (Upto GT Synch)	Hot Startup		Warm Startup		Cold Startup	
Backfeed import duration	63	min	63	min	63	min
Power import	2.50	MW	2.50	MW	2.50	MW
Power import rate	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh
Backfeed charges	64,882.36	PKR	64,882.36	PKR	64,882.36	PKR
HSD price (HHV)	6,066.91	PKR/MMBtu	6,066.91	PKR/MMBtu	6,066.91	PKR/MMBtu
HSD GCV	36,252.36	btu / liter	36,252.36	btu / liter	36,252.36	btu / liter
Fuel Cost Upto GT Synchronization						
HSD consumption from start to Sync	780.00	Liter	780.00	Liter	780.00	Liter
Fuel cost for operation upto synch	171,553.20	PKR	171,553.20	PKR	171,553.20	PKR
Fuel Cost From GT Synchronization up to ST Synchronization						
Operation from GT Synch to ST Synch	52	min	144	min	220	min
Load from GT Synch to ST Synch (MW)	50	MW	50	MW	50	MW
Open Cycle Station base load	174.38	MW	174.38	MW	174.38	MW
Load (%age of base load of GT)	28.72%		28.72%		28.72%	
Baseload GT efficiency	34.18%		34.18%		34.18%	
Part load GT efficiency heat rate ratio	1.0829		1.0829		1.0829	
Fuel cost from GT Synch to ST Synch	2,846,515	PKR	7,882,658	PKR	12,042,940	PKR
Start-up Charges (HSD fuel)	3,082,961	PKR	8,119,185	PKR	12,279,595	PKR
[illegible]						
From GT Synchronization up to ST Synch						
Operation from GT Synch to ST Synch	52	min	144	min	220	min
Load from GT Synch to ST Synch (MW)	50	MW	50	MW	50	MW
Baseload Unit efficiency (HHV)	43.13%		43.13%		43.13%	
Part load GT efficiency heat rate ratio	1		1		1	
Revenue from GT Synch to ST Synch	2,083,334	PKR	5,768,732	PKR	8,814,105	PKR
Net Revenue	999,627	PKR	2,349,871	PKR	3,466,296	PKR

Note 1: Formula for start up charges is given in petition which includes MDI charge and Start up charge. Calculation of start up charge is given above

Note 2. Start up charge is to be indexed due to change in fuel prices and Per unit charge for import based on latest applicable Consumer tariff rates and adjustments notified by GoP

Note 3: Efficiencies used above represent Base year efficiencies, which shall be updated based on applicable degradation as per the curve

Mujid Munir

ENGINEERING SERVICES PAKISTAN (PVT) LTD. ★ NATIONAL
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Korangi Combined Cycle Power Plant (KCCPP) Startup Cost - HSD

	1 GT CC						1 GT SC						2 GT CC (When 2 GTs already in CC Mode)						1 GT CC (When 2 GTs already in CC Mode)					
Backfeed charges (Upto GT Synch)	Hot Startup		Warm Startup		Cold Startup		Hot Startup		Warm Startup		Cold Startup		Hot Startup		Warm Startup		Cold Startup		Hot Startup		Warm Startup		Cold Startup	
Backfeed import duration	63	min	63	min	63	min	63	min	63	min	63	min	63	min	63	min	63	min	63	min	63	min	63	min
Power import	2.36	MW	2.36	MW	2.36	MW	1.40	MW	1.40	MW	1.40	MW	2.50	MW	2.50	MW	2.50	MW	2.36	MW	2.36	MW	2.36	MW
Power import rate	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh	24.68	PKR/kWh
Backfeed charges	61,754.17	PKR	61,754.17	PKR	61,754.17	PKR	36,374.06	PKR	36,374.06	PKR	36,374.06	PKR	64,892.36	PKR	64,892.36	PKR	64,892.36	PKR	61,754.17	PKR	61,754.17	PKR	61,754.17	PKR
HSD price (HHV)	6,066.91	PKR/MMBtu	6,066.91	PKR/MMBtu	6,066.91	PKR/MMBtu	6,066.91	PKR/MMBtu	6,066.91	PKR/MMBtu	6,066.91	PKR/MMBtu	6,066.91	PKR/MMBtu	6,066.91	PKR/MMBtu	6,066.91	PKR/MMBtu	6,066.91	PKR/MMBtu	6,066.91	PKR/MMBtu	6,066.91	PKR/MMB tu
HSD GCV	38,252.36	btu / liter	38,252.36	btu / liter	38,252.36	btu / liter	38,252.36	btu / liter	38,252.36	btu / liter	38,252.36	btu / liter	38,252.36	btu / liter	38,252.36	btu / liter	38,252.36	btu / liter	38,252.36	btu / liter	38,252.36	btu / liter	38,252.36	btu / liter
Fuel Cost Upto GT Synchronisation HSD consumption from start to Sync	390.00	Liter	390.00	Liter	390.00	Liter	390.00	Liter	390.00	Liter	390.00	Liter	780.00	Liter	780.00	Liter	780.00	Liter	390.00	Liter	390.00	Liter	390.00	Liter
Fuel cost for operation upto synch	86,776.60	PKR	86,776.60	PKR	86,776.60	PKR	86,776.60	PKR	86,776.60	PKR	86,776.60	PKR	173,553.20	PKR	173,553.20	PKR	173,553.20	PKR	86,776.60	PKR	86,776.60	PKR	86,776.60	PKR
Fuel Cost From GT Synchronisation up to ST Synchronisation Operation from GT Synch to ST Synch	52	min	144	min	220	min							52	min	144	min	220	min	52	min	144	min	220	min
Load from GT Synch to ST Synch (MW)	25	MW	25	MW	25	MW							50	MW	50	MW	50	MW	25	MW	25	MW	25	MW
Open Cycle Station base load	174.38	MW	174.38	MW	174.38	MW							174.38	MW	174.38	MW	174.38	MW	174.38	MW	174.38	MW	174.38	MW
Load (%age of base load of GTs)	14.36%		14.36%		14.36%								28.72%		28.72%		28.72%		14.36%		14.36%		14.36%	
Baseload GT efficiency	34.18%		34.18%		34.18%								34.18%		34.18%		34.18%		34.18%		34.18%		34.18%	
Part load GT efficiency heat rate ratio	1.1906		1.1906		1.1906								1.0829		1.0829		1.0829		1.1906		1.1906		1.1906	
Fuel cost from GT Synch to ST Synch	1,964,884	PKR	4,583,534	PKR	6,630,662	PKR							2,846,515	PKR	7,002,480	PKR	12,042,949	PKR	1,964,884	PKR	4,333,524	PKR	6,420,662	PKR
Start-up Charges (HSD fuel [redacted])	1,712,615	PKR	4,481,055	PKR	6,768,193	PKR	122,151	PKR	122,151	PKR	122,151	PKR	3,882,941	PKR	8,119,103	PKR	12,279,306	PKR	1,712,615	PKR	4,481,055	PKR	6,768,193	PKR
From GT Synchronisation up to ST Synch Operation from GT Synch to ST Synch	52	min	144	min	220	min							52	min	144	min	220	min	52	min	144	min	220	min
Load from GT Synch to ST Synch (MW)	25	MW	25	MW	25	MW							50	MW	50	MW	50	MW	25	MW	25	MW	25	MW
Baseload Unit efficiency (HHV)	43.13%		43.13%		43.13%								43.13%		43.13%		43.13%		43.13%		43.13%		43.13%	
Part load GT efficiency heat rate ratio	1		1		1								1.0118		1.0118		1.0118		1.0186		1.0186		1.0186	
Revenue from GT Synch to ST Synch	1,081,667	PKR	2,884,616	PKR	4,807,052	PKR							2,387,881	PKR	5,887,308	PKR	8,917,957	PKR	1,081,861	PKR	2,995,924	PKR	4,577,106	PKR
Net Revenue	630,948	PKR	1,596,688	PKR	2,962,141	PKR	122,151	PKR	122,151	PKR	122,151	PKR	978,880	PKR	2,231,895	PKR	3,361,488	PKR	630,953	PKR	1,486,131	PKR	2,191,087	PKR

Note 1: Formula for start up charges is given in position which includes MDI charge and Start up charge. Calculation of start up charge is given above

Note 2: Start up charge is to be indexed due to change in fuel prices and Per unit charge for import based on latest applicable Consumer tariff rates and adjustments notified by GoP

Note 3. Efficiencies used above represent Base year efficiencies, which shall be updated based on applicable degradation as per the curve

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Black Start Cost - KCCPP			
Cost For GT Startup			**Remarks / References**
EDG's Operation with Aux Till GT sync with 400V bus	45	min	
EDGS Specific Fuel Consumption (Base Load @ 1097KW)	0.24	Liter/KWh	
Aux Consumption Till GT Startup (KWh)	571.94	KWh	
Diesel Consumed By EDGs	136.08	Liters	
Rate of Diesel	219.94	PKR/Liter	Rate of Diesel @ 219.94 PKR/Liter for the month of August 2022.
Cost of Diesel Consumed by EDGs (A)	29,929	PKR	
Fuel Consumed by GT till Sync with 400V bus	390	Liter	
Cost of Fuel Consumed by GT till Sync with 400V bus (B)	85,777	PKR	
Cost of Diesel Consumed by EDGs & GT during startup C=(A+B)	115,705	PKR	
House Normalization time with GT on house Load (HV Switching)	10	Min	
GT House load operation time (EDG off - house load on GT)	30	Min	
Total Aux Load on GT for 40 Min after synchronization	1,680	KW	
GT fuel flow during 40 Min operation (while GT on house load)	53	LPM	
Fuel Consumption by GT in 40 Min. synchronization (while HV switching and GT on house load)	2,120	Liters	
Cost of Fuel Consumed by GT in 40 minuts "D"	466,273	PKR	
Cost of Diesel Consumed by GT E=(C+D)	**581,978**	**PKR**	

Fuel Cost From GT Synchronization up to ST Synchronization	Hot Startup	Warm Startup	Cold Startup
Operation from GT Synch to ST Synch (min)	52	144	220
Load from GT Synch to ST Synch (MW)	25	25	25
Open Cycle Station base load (MW)	174.375	174.375	174.375
HSD price (HHV) (Rs./MMBTU)	6067	6067	6067
Load (%age of base load of GT)	14.36%	14.36%	14.36%
Baseload GT efficiency	34.18%	34.18%	34.18%
Part load GT efficiency heat rate ratio	1.19062	1.19062	1.19062
Fuel Cost from GT Synch to ST Synch "F"	1,564,884	4,333,524	6,620,662
Cost of Diesel Consumed by GT I=(E+F)	**2,146,862**	**4,915,503**	**7,202,640**

Net Revenue:			
From GT Synchronization up to ST Synch			
Operation from GT Synch to ST Synch	52	144	220
Load from GT Synch to ST Synch (MW)	25.04	25.04	25.04
Baseload Unit efficiency (HHV)	43.13%	43.13%	43.13%
Part load GT efficiency heat rate ratio	1	1	1
Revenue from GT Synch to ST Synch	1,041,667	2,884,616	4,407,052
Net Revenue	**1,105,195**	**2,030,886**	**2,795,588**

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SCHEDULE 2

Description of the Complex:

1. General

Korangi Combined Cycle Power Plant (KCCPP) is a 247.5 MW combined cycle power Plant situated at Korangi Creek area of Karachi, commissioned in 2008. Plant comprises of 04 Gas Turbine (General Electric, LM6000 PC Sprint), 02 HRSGs (IEG & METKA) and 02 Steam Turbine (General Electric, Thermodyn). Each Heat recovery steam generator (HRSG) is connected to the exhaust of two Gas Turbines. The primary fuel of the power plant is natural gas with RLNG as alternate fuel and HSD serving as alternate / backup fuel for Gas Turbines.

The Complex is situated at Ibrahim Hyderi Road, Korangi, Karachi.

1.1 Gross Dependable Capacity of the Complex

GAS FUEL

KCCPP (4 GTs + 2 STs) GDC	= 237.078 MW
AUXILIARY CONSUMPTION (COMPLEX)	= 16.250 MW
NET CAPACITY (COMPLEX)	= 220.828 MW

HSD FUEL

KCCPP (4 GTs + 2 STs) GDC	= 228.704 MW
AUXILIARY CONSUMPTION (COMPLEX)	= 8.686 MW
NET CAPACITY (COMPLEX)	= 220.018 MW

The figures are based on NEPRA determination

2. Plant Reference Site Conditions

Reference Conditions at the Plant Site are as follows:

1. Ambient Air Temperature = 30 deg. C
2. Total Barometric Pressure = p_T = 1013.25 mbar
3. Relative Humidity = 60%
4. Sea water temperature = 25 deg C

3. Plant Characteristics

Description	Gas Fuel	HSD Fuel
Gross Dependable Capacity at mean site conditions	237.078 MW	228.704 MW
Auxiliary Consumption	16.250 MW	8.686 MW
Net Plant capacity	220.828 MW	220.018 MW
Net Heat Rate (HHV)	8178.259 Btu/kWh	7911.771 Btu/kWh
Net Efficiency (HHV)	41.722 %	43.127 %
Generation voltage (GT/ST)	11.5/11 kV	
Grid voltage	220 kV	
Frequency	50 Hz	
Power factor	Leading - 0.95 Lagging - 0.85	
Complex Cold Start Up Time upto base load	346 mints	
Complex Warm Startup upto base load	243 mints	
Complex Hot Start Up upto base load	140 mints	

4. Performance Curves

The Power Producer shall provide all performance and correction factors/curves for the units/Complex including but not limited to the following:

- Output vs. Ambient Temperature
- Output vs. Barometric Pressure
- Output vs. Ambient Relative Humidity
- Output vs. CW temperature.

5. Civil Structure Safety Design Factor

A maximum earthquake design factor of 0.24g per Uniform Building Code (UBC) utilized for the design of the plant buildings and structures.

6. Description of the Complex

Complex comprises of 02 combined cycle blocks each having 02 gas turbines, 01 HRSG

and 01 steam turbine. The EPC Contractor for Phase I: 4 GTs + ST-2 was METKA S.A and for Phase II ST-1 EPC Contractor was IEG A.S. Plant can be operated both in combined cycle and simple cycle modes, Primary fuel for the Plant operation is natural ags, supplied by Sui Southern Gas Company Ltd (SSGC) through a dedicated 24-inch pipeline, while the HSD is used backup fuel. The plant is connected to the Offtaker's system through 220 kV GIS and 132 kV new KTPS Grid.

KCCPP has 220 kV Switchyard, 11kV, 6.6kV and 0.4kV system, Water treatment plant, demin water tank, fire water tank, High Speed Diesel Storage Tanks and decanting station, Wastewater treatment plant, Central Control Room building, Office buildings, security check post, Warehouse & workshop building, Emergency Diesel Generator (for Black Start) and Firefighting pump house.

The cooling water system is based on sea water which is supplied through intake tunnels and cooling water pits where dedicated pumps are used to supply water to steam turbine, condensers, chillers condensers, heat exchangers and return to sea through outlet channel. The secondary cooling system is used for cooling gas turbine/steam turbine/gas compressors and related auxiliaries.

Generator Data of gas turbine and steam turbine is tabulated below.

Gas Turbine Generator: 64.5 MVA (at 15 degree C ambient temperature)	Steam Turbine Generator (ST-1): 35.75 MVA Steam Turbine Generator (ST-2): 33.125 MVA
Stator Current Gas Turbine: 3238 A	Stator Current Steam Turbine-1: 1876 A Stator Current Steam Turbine-2: 1739 A
Stator Voltage Gas Turbine: 11.5kV	Stator Voltage Steam Turbine: 11kV

The Complex will be capable of operation within a voltage range of ± 10% on the 220 kV voltage level.

The GT and ST Generators have brushless DC excitation (PMG) and are equipped with generator-transformer with on load tap changer. GT Generators are equipped with 115 MVA rated transformers, and ST-1 and ST-2 Generators are equipped with 40MVA and 35MVA rated transformers with OLTC and Transformer Type of Cooling is oil natural air forced (ONAF).

The Generation voltage of each Unit is at 11.5 kV (GTs) and 11.0 kV (STs) and is stepped up to 220 kV through unit step up transformers. Interconnection with the Offtaker system will be via 220 kV, indoor type GIS (Gas Insulated Switchgear) with double bus bar with single breaker scheme.

KCCPP has a central control room (CCR) to monitor and control the Complex. The power plant is controlled through a distributed control system (Honeywell) and Gas Turbine

Control System (GE Micronet Simplex). The control room operator is provided with color graphic display of the power plant equipment with sufficient detail to allow proper control and monitoring of plant fluctuations. The required control, alarm, and monitoring functions for all the necessary balance of plant equipment are also integrated into the DCS/Micronet.

7. Weather Station

KCCPP is equipped with an installed weather monitoring system which measures following weather readings on round the clock basis:

- Barometric Pressure
- Wind Speed
- Humidity
- Ambient Temperature

Sea water temperature: Reference Condenser inlet temperature (when plant is in operation). Reference from website when plant in standby.

8. Fuel Supply and Storage

The plant is designed to be operated on dual fuel; Gas and HSD. The primary fuel is natural gas with RLNG as alternate fuel and HSD as the alternate/back-up fuel.

The main function of Gas Receiving Station (GRS) is to provide gas at 46.5 bar to the Gas Turbines. The gas is supplied by Sui Southern Gas Company (SSGC). KCCPP Fuel Gas system consists of emergency shutdown (ESD) valve, Gas Receiving Station (GRS) with Cartridge Filters, Gas Metering Unit, and Gas Chromatograph.

The HSD fuel system includes the unloading system, storage system, supply system and waste recovery system. There are two storage tanks with a volume of 8000 m^3 each. The daily tank with a volume of 1500 m^3 ensures the fuel level for four Gas turbines for period of 24 hours.

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SCHEDULE 3

INTERCONNECTION FACILITIES AND TRANSMISSION FACILITIES

1. Interconnection and Transmission Facilities

1.1 The Interconnection between Power Producer and the Offtaker Grid System is stated below.

a) One 220kV transmission line CCPP - KCR Circuit-1, from CCPP to KCR Grid Station.
b) One 220kV transmission line CCPP - KCR Circuit-2, from CCPP to KCR Grid Station.
c) One 220kV interconnection CCPP - New KTPS, from CCPP to New KTPS Grid station (Terminated at BTW PTR-1).
d) One 220kV interconnection CCPP - New KTPS, from CCPP to New KTPS Grid station (Terminated at BTW PTR-2).

1.2 The transmission lines terminate in the substation of Complex and connect at bushings/cable sealing to line terminal gantries provided by the Power Producer. The boundary of responsibility between the Power Producer and the Offtaker are at the top of the bushings clamping terminal or cable sealing of the gantries (the "**Interconnection Point**").

1.3 The installed Metering System other than backup meters (including its equipment, CT / PT, remote terminal units, protection relays and electronic data recording system) which together with the transmission line referred to above within the Complex's boundary shall comprise the "Offtaker Interconnection Facilities". This equipment will remain the property of the Offtaker and shall be maintained thereafter by the Offtaker.

1.4 A carrier inter-tripping circuit for each 220kV transmission line and a Fiber Optic Cable (FOC) tripping circuit for each BTW Power Transformer, shall be provided between the line circuit breakers at the Complex owned by the Power Producer and the line circuit breakers at the adjacent 220kV and 132kV substations respectively.

2 Interconnection Works:

The Power Producer shall be responsible for maintaining all auxiliary and interconnecting equipment including Remote Terminal Unit (RTU) for SCADA, telemetry tele-protection and system of its side of the Interconnection Point, and except for the Metering System, the Power Producer shall own all such auxiliary and interconnection equipment.

The Power Producer will be responsible for the provision of an exclusive dedicated set of Current and Voltage transformers for the Main Metering system. In addition, the Main and Back-up Meter should have an accuracy of 0.2s.

3 Modification of Protective Devices

3.1 All protective devices are to be installed by the Power Producer at its own switch yard. After the Commercial Operations Date, the Offtaker may require the Power Producer to modify or expand the requirements for protective devices, subject to giving the Power Producer reasonable notice. Following approval by the Offtaker of the costs of such modification or expansion, the Power Producer shall perform such modification or expansion, and the Offtaker shall reimburse the Power Producer for the reasonable costs of such modification or expansion. Notwithstanding any provision of this Agreement to the contrary, the Power Producer shall not incur any liability to the Offtaker (including without limitation any damages or penalties for Forced Outage or Partial Forced Outage) while undertaking any modification or expansion of the protective devices at the Offtaker's request and at such time or times approved in advance by the Offtaker. Such work shall be completed within a reasonable time under the circumstances. The Offtaker shall be notified in advance of, and shall have the right to observe all work on the protective devices.

3.2 Together with an invoice for reimbursement, the Power Producer shall provide reasonable documentation of the expenses incurred in modifying or expanding the protective devices. Payments shall be due thirty (30) Days after delivery of the invoice by the Power Producer; provided, however, that in case of any Dispute, the provisions of Section 9.7 shall apply.

3.3 The Power Producer shall notify the Offtaker in advance of any changes to either the Complex and the Offtaker shall notify the Power Producer in advance of any changes to the Grid System or interconnection facilities; in each case affecting the proper co-ordination of protective devices between the two systems connected through the Offtaker Interconnection Facilities. The Power Producer shall not in the case of the Complex make any such change without the approval of the Offtaker. The. Offtaker shall not in the case of the Grid System make any such changes, without the Power Producer's approval.

4. Design Data

Below are the design data for the major component installed at the complex.

4.1 Gas Turbines

Gas Turbines	GT-1	GT-2	GT-3	GT-4
Unit Identification (Type/Model)	LM 6000 PC sprint	LM 6000 PC sprint	LM 6000 PC sprint	LM 6000 PC sprint
Manufacturer	General Electric USA	General Electric USA	General Electric USA	General Electric USA
GT rating at ISO conditions	48375 kW	48375 kW	48375 kW	48375 kW
GT rating at Reference Site conditions	30°C	30°C	30°C	30°C
GT rated Speed (rpm)	3627	3627	3627	3627
Air flow at GT inlet	45,975 m³/hr	45,975 m³/hr	45,975 m³/hr	45,975 m³/hr
GT inlet air temperature	30°C	30°C	30°C	30°C
Compression Ratio	1:30	1:30	1:30	1:30
Gas consumption/day	10.675MMCFD	10.675MMCFD	10.675MMCFD	10.675MMCFD
Gas pressure required	46.5 bar	46.5 bar	46.5 bar	46.5 bar
GT Exhaust gas flow	47,798 m³/hr	47,798 m³/hr	47,798 m³/hr	47,798 m³/hr
GT Exhaust gas temperature	450-460°C	450-460°C	450-460°C	450-460°C

4.2 Heat Recovery Steam Generator (HRSG)

Heat Recovery Steam Generator (HRSG)	HRSG-1	HRSG2
Type/Model	HRSG of vertical type, double pressure	HRSG of vertical type, double pressure
HP Steam pressure at HRSG outlet	57 barg	57 barg
HP steam temperature	408 °C	408 °C
HP Steam flow rate	92.15 t/h	91.3 t/h
LP Steam pressure at HRSG outlet	7 barg	7 barg
LP steam temperature	242 °C	242 °C
LP steam flow rate	31.14 t/h	30.6 t/h

4.3 Steam Turbine and Condenser

Steam Turbine and Condenser	ST-1	ST-2
Type/Model:	Impulse-type Multivalve Condensing GE Thermodyn 8-9MC9	Impulse-type Multivalve Condensing GE Thermodyn 8-11 MC9
Manufacturer:	GE, France	GE, France
ST Rating:	27,500 kW	26,500 kW
ST Rated Speed:	4727 rpm	4450
Number of Casings / Stages:	9 Stages	9 Stages
Output at reference conditions:	N/A	N/A
Steam pressure at Steam turbine inlet (HP/LP):	54 bara / 6 bara	54 bara / 6 bara
Steam temperature at Steam turbine inlet (HP/LP):	404.1 °C / 241.5 °C	404.7 °C / 240 °C
Steam pressure at Steam turbine outlet:	0.077 bara	0.078 bara
Steam temperature at Steam turbine outlet:	39 °C	41 °C
Steam flow rate at ST inlet (HP/LP):	91.7 / 27.96 t/hr	91.61 / 28.63 t/hr
Circulating water flow rate at condenser:	7813 m^3/hr	7873 m^3/hr
Circulating water temperature at inlet of condenser:	25 °C	25 °C
Condenser vacuum:	0.07 bara	0.07 bara
Circulating water temperature rise in condenser at base load:	8 °C	8 °C

4.4 Generators (GTG)

Generators	Gas Turbine GT1-4
Name plate Rating (At 15°C Ambient temperature)	64,500 kVA
Rated voltage at generator terminal	11.5 kV
Number of Phases/poles	3 Phase / 2 Pole
Frequency	50Hz
Rated Speed	3000rpm
Power Factor	85%
Stator Thermal Class	F
Rotor Thermal Class	F

Stator Winding Temperature Rise Limit	109°C
Rotor Winding Temperature Rise Limit	115°C
Type of cooling (Hydrogen/Air/Water Pressure PSIG)	Air
Continuous operating voltage limits per unit for continuous operation at rated kVA and power factor	+/- 5%
Apparent power base in MVA (At 15°C Ambient temperature)	64.5 MVA
Voltage base in kV	11.5 kV
Direct axis synchronous reactance unsaturated	294 %
Direct axis synchronous reactance saturated	260 %
Direct axis transient reactance unsaturated	29%
Direct axis transient reactance saturated	27%
Direct axis sub-transient unsaturated	22%
Direct axis sub-transient saturated	18%

4.5 Generators (STG)

Generators	**Steam Turbine (GT1/2) ST1**	**Steam Turbine (GT3/4) ST2**
Nameplate Rating	35,750 kVA	33,125 kVA
Rated voltage at generator terminal	11.0 kV	11.0 kV
Number of Phases/poles	3 Phase / 4 Pole	3 Phase / 4 Pole
Frequency	50hz	50hz
Rated Speed	1500rpm	1500rpm
Power Factor	80%	80%
Stator Thermal Class	F	F
Rotor Thermal Class	F	F
Stator Winding Temperature Rise Limit	125°C	130°C
Rotor Winding Temperature Rise Limit	130°C	130°C
Type of cooling (Hydrogen/Air/Water Pressure PSIG)	Water	Water
Continuous operating voltage limits per unit for continuous operation at rated KVA and power factor	+/-5%	+/-5%
Apparent power base in MVA	35.75	33.125
Voltage base in kV	11.0	11.0
Direct axis synchronous reactance unsaturated	2.243p.u.	2.84p.u.
Direct axis synchronous reactance saturated		2.38p.u.
Direct axis transient reactance unsaturated	0.276p.u.	0.39p.u.
Direct axis transient reactance saturated	0.227p.u.	0.33p.u.

Generators	Steam Turbine (GT1/2) ST1	Steam Turbine (GT3/4) ST2
Direct axis sub-transient unsaturated	0.196p.u.	0.25p.u.
Direct axis sub-transient saturated	0.155p.u.	0.23p.u.

4.6 Excitation System GTG

Excitation System	Gas Turbine GT1-4
Type/ model	Brushless (EX 2100)
Exciter model diagram	EX 2100 Regulator Control
Field current at rated load (Main Exciter)	6.9A
Field voltage at rated load (Main Exciter)	82.1 V

4.7 Excitation System STG

Excitation System	Steam Turbine (GT1/2) ST1	Steam Turbine (GT3/4) ST2
Type/ model	Brushless	Brushless
Exciter model diagram	GE, K13970	Brush, DG185ZP-04
Field current at rated load (Main Exciter)	7.4A	8.2A
Field voltage at rated load (Main Exciter)	67V	120V

4.8 Generator Characteristic Curves

Generator Capability Curves	Annexure 3.1
Generator V Curves	Annexure 3.1
Generator saturation Curves, full load and no-load	Annexure 3.1

4.9 Generator Main Transformer & Auxiliary Transformers

Generator Main Transformers	GT Transformer SUT-1 & SUT-2	ST2 Transformer (ST2) SUT-3	ST1 Transformer (ST1) SUT-4
General			
Quantity	2	1	1
Type (Single phase/ 3-phase, Shell/core)	3-Phase	3-Phase	3-Phase

Generator Main Transformers	GT Transformer SUT-1 & SUT-2	ST2 Transformer (ST2) SUT-3	ST1 Transformer (ST1) SUT-4
Applicable IEC Standards	IEC 60076	IEC 60076	IEC 60076
Design Data			
Maximum Continuous Rating (MVA)	57.5/57.5/115	35	40
Rated Voltage (HV/LV) (kV)	220/11.5/11.5	220/11	220/11
Rated temperature rise (°C)	60°C	55°C	55°C
Voltage between phases (kV)	220	220	220
Max./Min. operating voltage at rated power (kV)	242/198	242/198	242/198
Vector Group	YNd1d1	YNd1	YNd1
Tap-changer (Off-load or On-load)	On-load	On-load	On-load
Winding Taps	17	17	17
Percentage Impedance Voltage on MV A base H-L, H-T, L-T	12%	12.5%	13.5%
No-load loss at rated voltage and rated frequency (kW)	65	27	18
Copper loss at rated power and voltage at Principal tap for reference temperature of 75 °C (kW)	350	150	158
Basic Insulation Level:			
• Of HV winding (kV)	850	850	950
• Of neutral of HV winding (kV)	325	325	480
• Of LV winding (kV)	75	95	75
Type of cooling	ONAF	ONAF	ONAF
Percent Impedance	12%	12.5%	13.5%
Max Tap	12.09	12.7	14.52
Rated Tap	12.2	12.5	13.78
Min Tap	12.0	12.1	13.59
Tapping voltages at plus and minus tappings	220±8×1.25%	220±8×1.25%	220±8×1.25%
Diagram of tap changer connections	Yes	Yes	Yes

4.10 Generator Auxiliary Transformer

Generator Auxiliary Transformers	Auxiliary Unit Transformer AUT-1 & AUT-2	Auxiliary Unit Transformer AUT-3 & AUT-4
General		
Quantity	2	2
Type (Single phase/ 3-phase, Shell/core)	3-Phase	3-Phase

Generator Auxiliary Transformers	Auxiliary Unit Transformer AUT-1 & AUT-2	Auxiliary Unit Transformer AUT-3 & AUT-4
Applicable IEC Standards	IEC60076, IEC60354	IEC60076
Design Data		
Maximum Continuous Rating (MVA)	18.5	5
Rated Voltage (H.V./LV) (kV)	11.5/6.6	11.5/6.6
Rated temperature rise (°C)	65°C	65°C
Voltage between phases (kV)	11.5	11.5
Max./Min. operating voltage at rated power (kV)	12.65/10.35	12.65/10.35
Vector Group	Dyn11	Dyn11
Tap-changer (Off-load or On-load)	On-load	On-load
Winding Taps	17	17
Percentage Impedance Voltage on MV A base H-L, H-T, L-T	11.40%	7.28%
No-load loss at rated voltage and rated frequency (kW)	11	4.32
Copper loss at rated power and voltage at Principal tap for reference temperature of 75 °C (kW)	106	35.9
Basic Insulation Level:		
• Of HV winding (kV)	75 (Peak)	85 (Peak)
• Of LV winding (kV)	60 (Peak)	60 (Peak)
• Of neutral of LV winding (kV)	60 (Peak)	60 (Peak)
Type of cooling	ONAF	ONAF
Percent Impedance	11.40%	7.28%
Max Tap	12.0	7.61
Rated Tap	11.42	7.28
Min Tap	10.1	7.14
Tapping voltages at plus and minus tappings	11.5±8×1.25%	11.5±8×1.25%
Diagram of tap changer connections	Yes	Yes

4.11 Current Transformer Data

Current Transformer Data	Units	D02	D03	D05	D07
Manufacturer		SIEMENS	SIEMENS	SIEMENS	SIEMENS
Serial Number (Bay)		K 31254031	K 31254032	K 31254034	K 31266330
Rated Voltage / Operational Voltage	kV	245	245	245	245

Current Transformer Data	Units	D02	D03	D05	D07
Rated normal primary current	A				
• Core (1)		750	750	750	200
• Core (2)		750	750	750	150
• Core (3)		750	750	750	150
• Core (4)		3000	3000	3000	3000
• Core (5)		3000	3000	3000	3000
Rated secondary current	A	1	1	1	1
Rated secondary output	VA				
• Core (1)		30	30	30	10
• Core (2)		30	30	30	7.5
• Core (3)		30	30	30	7.5
• Core (4)		30	30	30	30
• Core (5)		30	30	30	30
Accuracy class:					
• Measuring core	-	0.2fs	0.2fs	0.2fs	0.2fs
• Protection core		5P20	5P20	5P20	5P20
Rated transformation ratios	-	750/1,3000/1	750/1,3000/1	750/1,3000/1	200/1,150/1,3000/1
Accuracy limit factor for protective core		20	20	20	20
Short time current rating					
• Thermal (Ith)	kA	40	40	40	50
• Dynamic (Idyn)	kA_{peak}	100	100	100	100
Impulse withstand voltage	kV_{peak}	1050	1050	1050	1050
Power frequency withstand voltage	kV_{peak}	460	460	460	460

4.12 Voltage Transformer Data

Voltage Transformer Data	Units	D04 Coupler	D07 ST1
Rated Voltage primary Voltage phase to neutral	kV	127	127
Rated normal secondary Voltage phase to neutral	V	57.7	57.7
Rated secondary output	VA		
• Measuring core		100	100
• Protection core		100	100
Accuracy class	-		
• Measuring core	-	0.2	0.2
• Protection core	-	3P	3P
Impulse withstand voltage for primary winding	kV_{peak}	1050	1050
Power frequency withstand voltage for primary winding	kV_{rms}	460	460

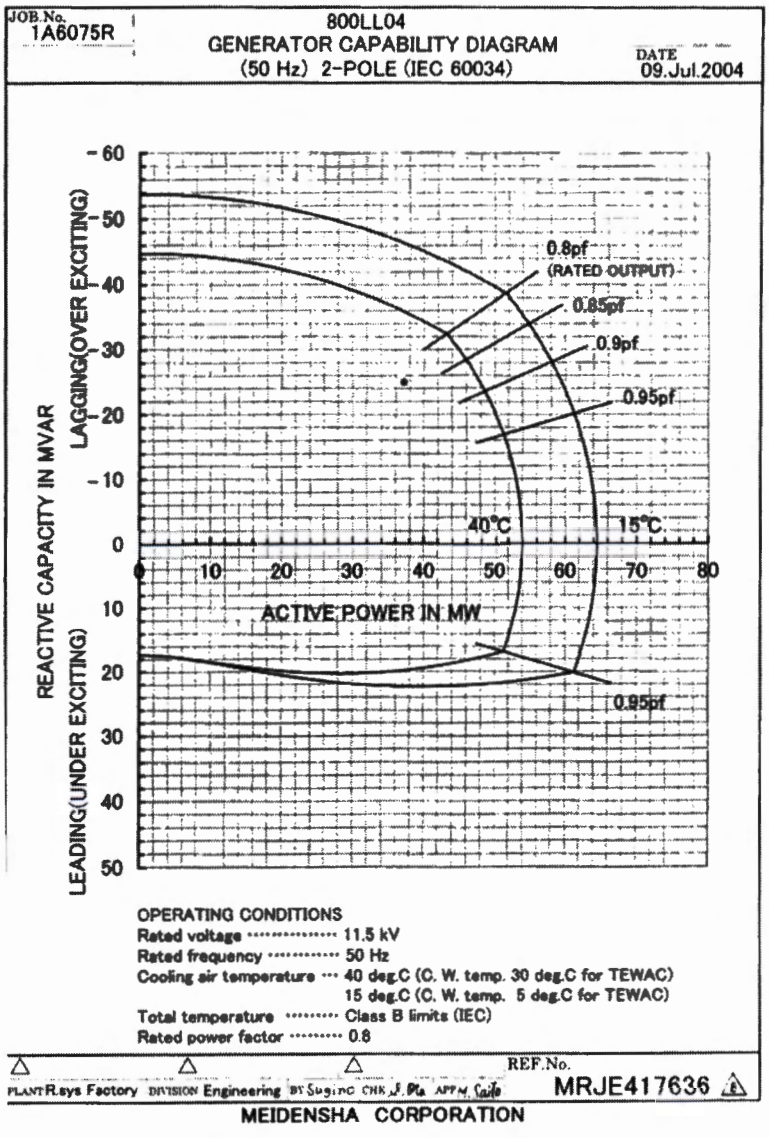
4.13 Circuit Breakers

Circuit Breakers	Units	D02	D03	D05	D07
Manufacturer		SIEMENS	SIEMENS	SIEMENS	SIEMENS
Circuit - Breaker Type - Operating years		SF6	SF6	SF6	SF6
Rated Voltage	kV_{rms}	245	245	245	245
Rated Normal Current	kA	2.5	2.5	2.5	2.5
Short - Circuit Breaking Current	kA	40	40	40	50
Rated lightning and switching impulse withstand voltage,	kV_{peak}				
• To earth		1050	1050	1050	1050
• Across open breaker		1050	1050	1050	1050
Rated one minute power frequency test withstand Voltage	KVms				
• To earth		460	460	460	460
• Across open breaker		460	460	460	460
Operating Sequence		0-0.3s-C0-3min-C0	0-0.3s-C0-3min-C0	0-0.3s-C0-3min-C0	0-0.3s-C0-3min-C0

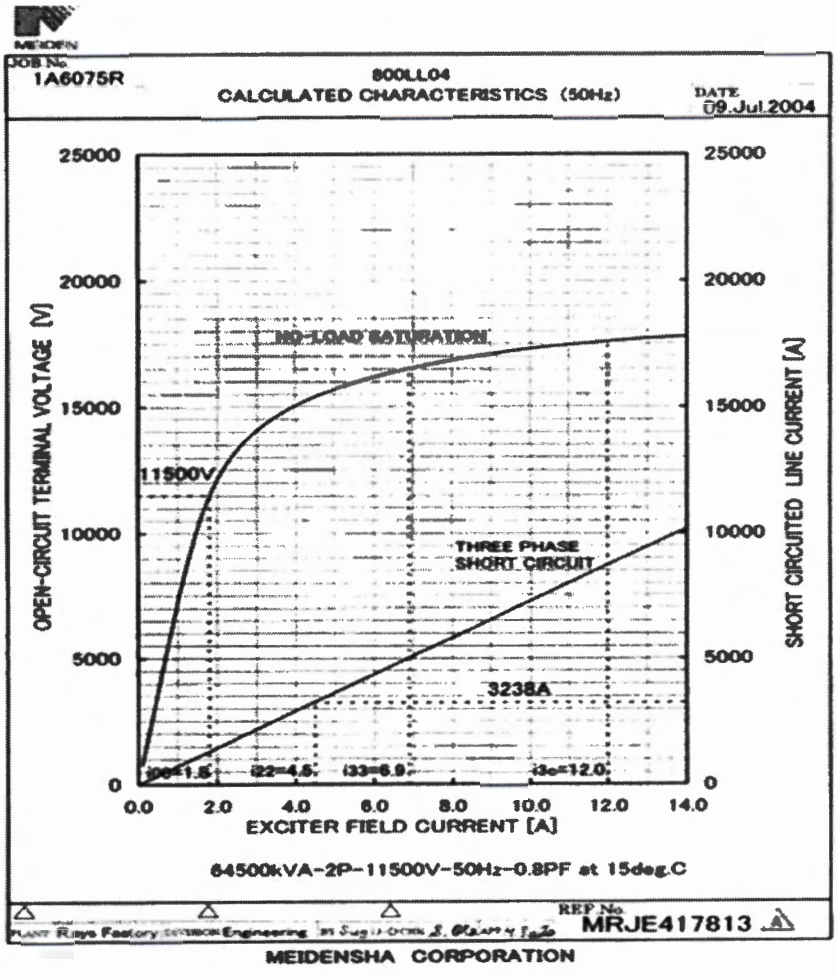
Circuit Breakers	Units	D02	D03	D05	D07
Rated normal current at 50 Hz And 50 deg.C not less than A_{rms}. Rated short – time withstand current	kA_{rms}	2.5	2.5	2.5	2.5
Rated peak withstand current	kA_{peak}	135	135	135	135
Rated duration of short circuit	Sec	3	3	3	3
Rated short circuit breaking Current at rated voltage and 50 Deg. C not less than kA_{rms}	kA_{peak}	≤50	≤50	≤50	≤50
Rated short-circuit making Current kA_{peak}	kA_{peak}	135	135	135	135
Rated out-of-phase breaking Current kA_{rms}	kA_{rms}	10kA	10kA	10kA	10kA
Rated line charging breaking Current A	A	-	-	-	-

Annexure 3.1

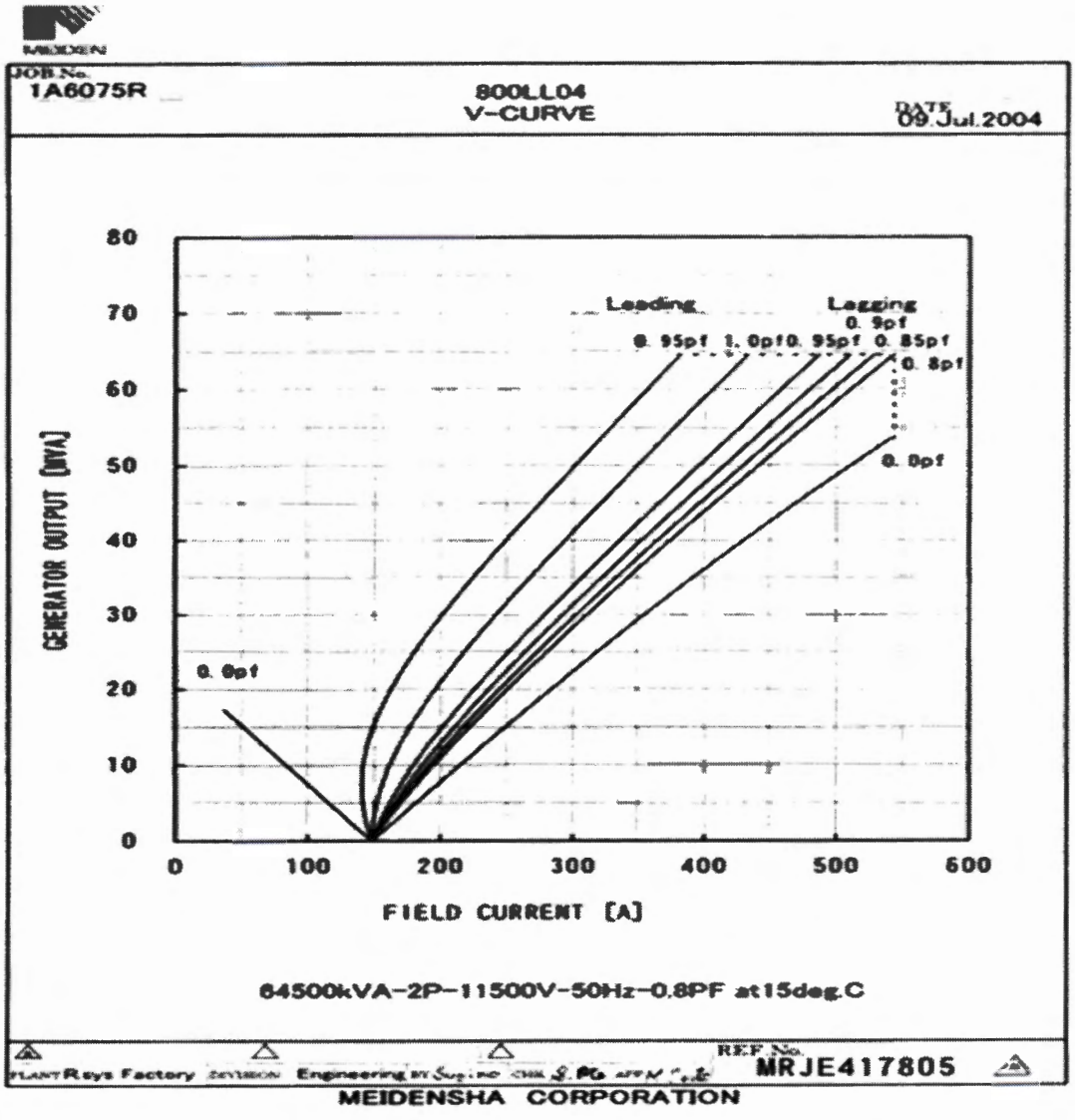
GT Generator Capability Curves



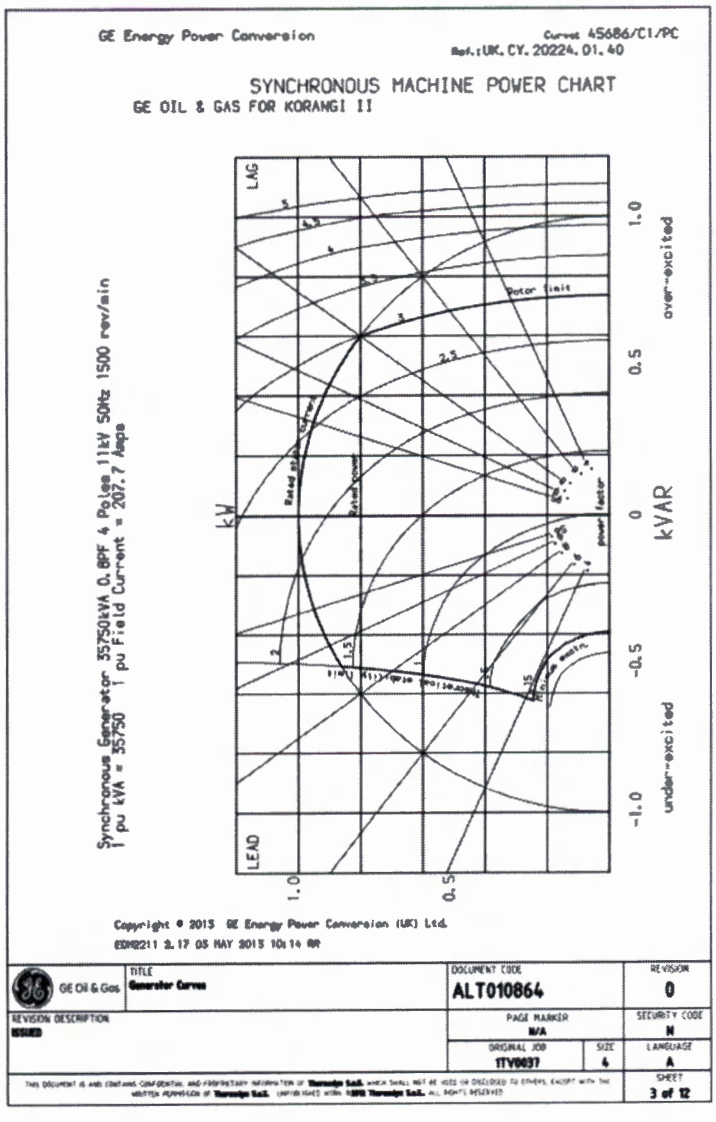
GT Generator Saturation Curve



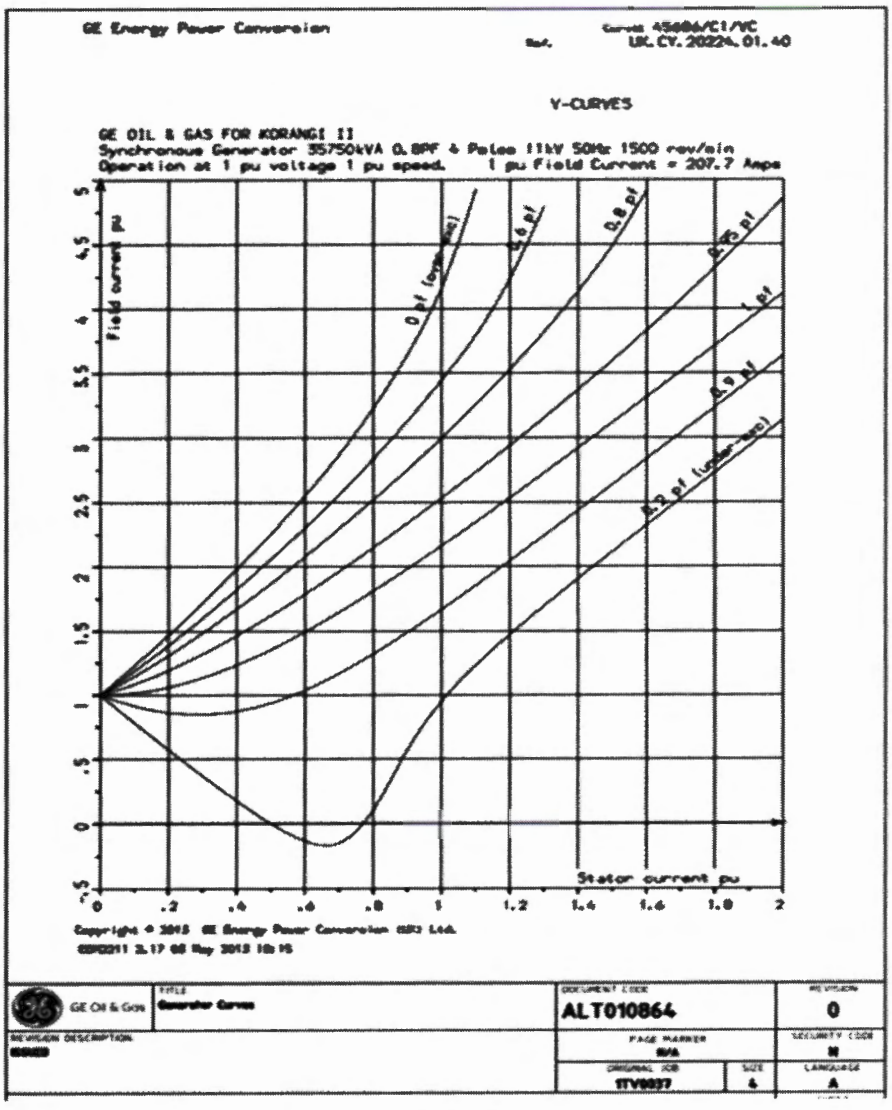
GT Generator Vee Curve



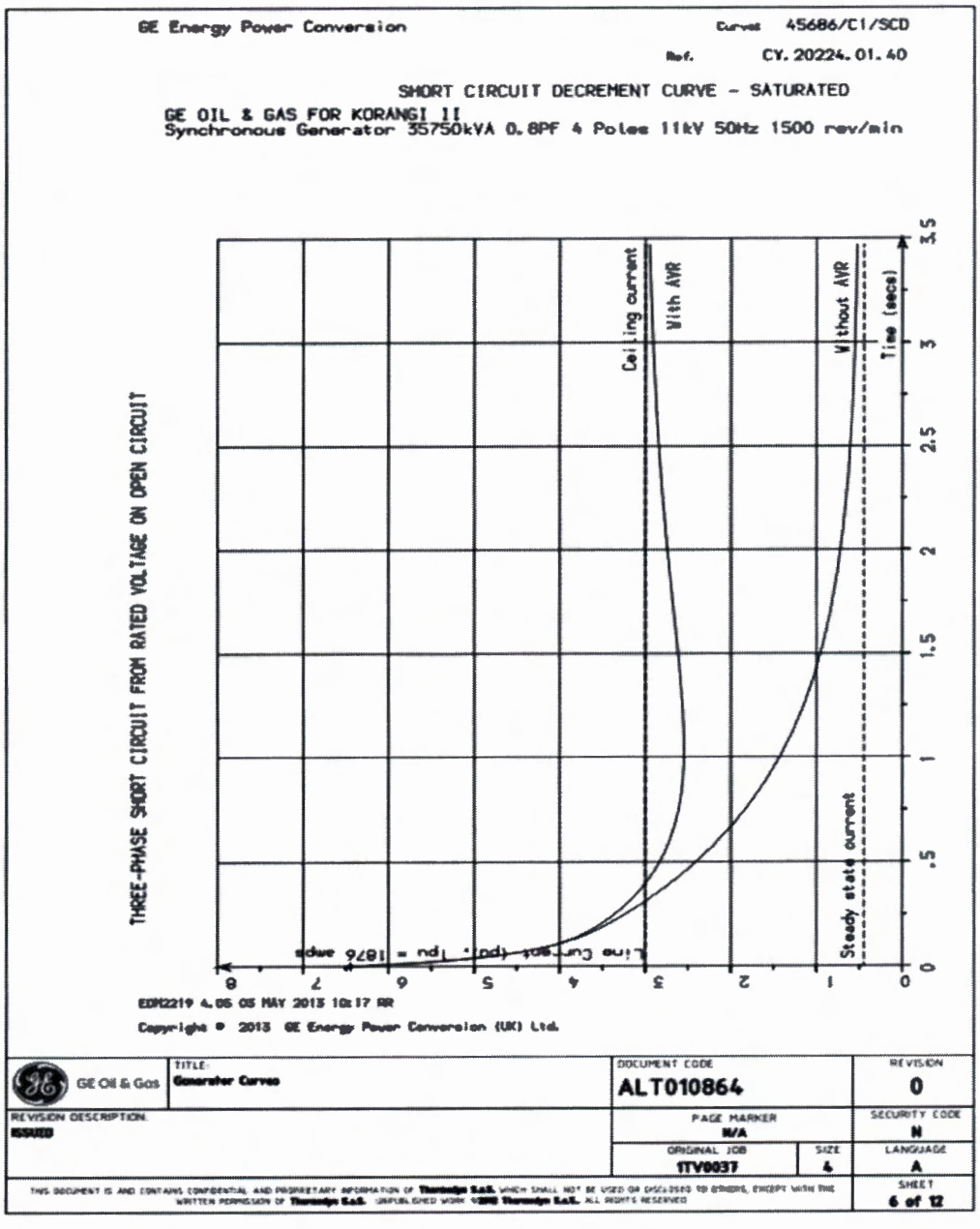
STG-1 Generator Capability Curve



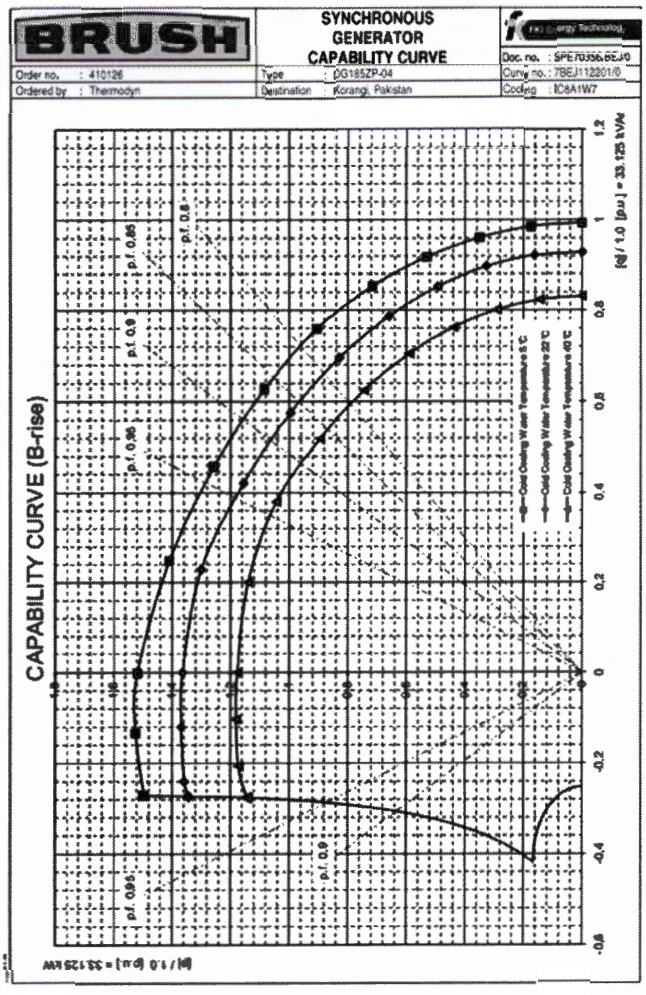
STG-1 Generator Vee Curve



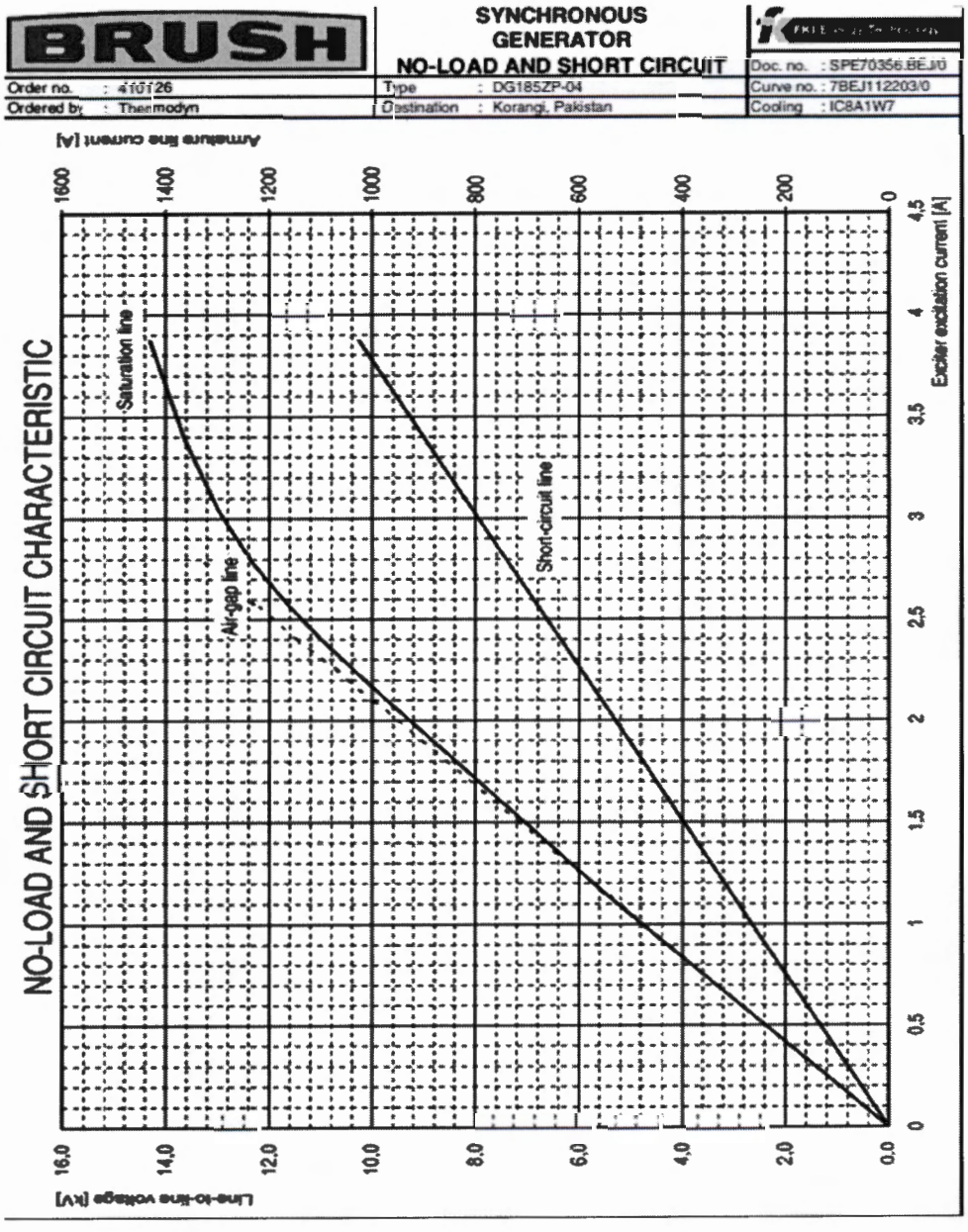
STG-1 Generator Saturation Curve



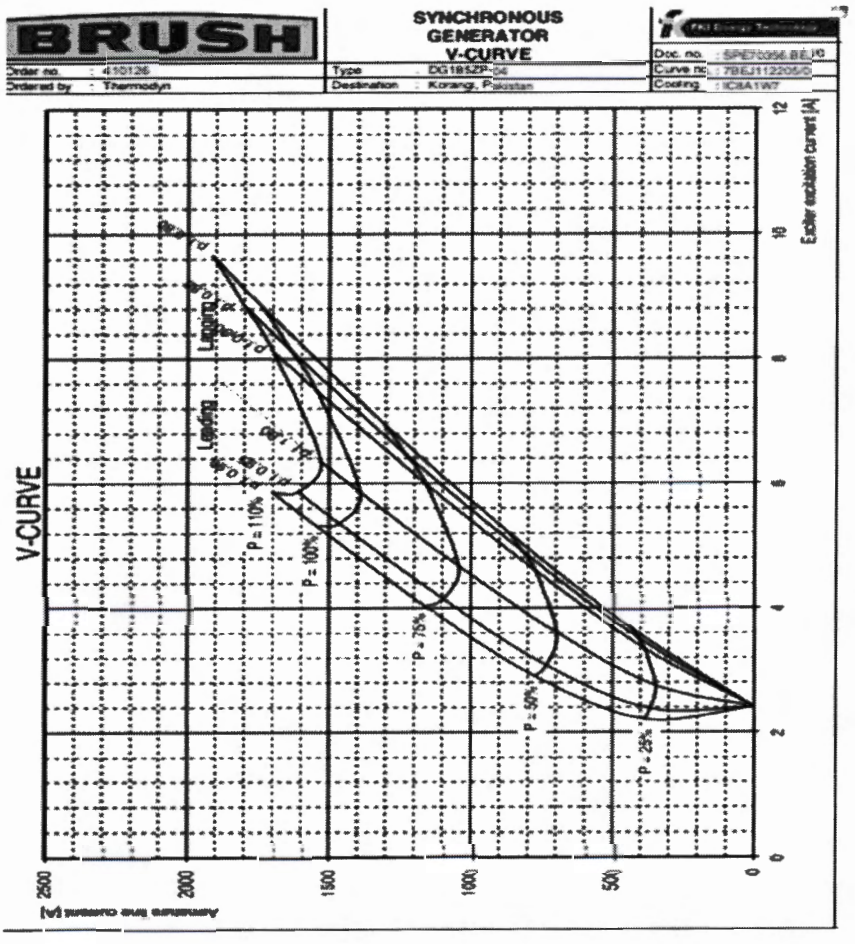
STG-2 Generator Capability Curve



STG-2 Generator Saturation Curve



STG-2 Vee Curve



SCHEDULE - 5

KCCPP TECHNICAL LIMITS:

5.1 KCCPP Technical Limits

Gas Fuel	MMSCFD / Day Approx Min per GT[3]	MMSCFD / Day Approx Max per GT[3]	Min Gross Load (MW)[2]	Installed Capacity (MW)	Leading PF	Lagging PF	Hot start[1]	Warm start[1]	Cold Start[1]
Complex	7	11	31	247.5	0.95	0.85	140	243	346

1. Time in minutes required from Offtaker demand to Base Load.
2. Against GT's 25MW, ST output is approximately 8MW in winters, and approximately 6MW in summer.
3. Fuel is approximated for reference only.
4. Above timings are maximum and units can be synchronized earlier with the permission of the Offtaker.

HSD Fuel	Liters/Hr Approx Min per GT[3]	Liters/Hr Approx Max per GT[3]	Min Gross Load (MW)[2]	Installed Capacity (MW)	Leading PF	Lagging PF	Hot start[1]	Warm start[1]	Cold Start[1]
Complex	8000	12000	31	247.5	0.95	0.85	140	243	346

1. Time in minutes required from Offtaker demand to Base Load.
2. Against GT's 25MW, ST output is approximately 8MW in winters, and approximately 6MW in summer.
3. Fuel is approximated for reference only.
4. Above timings are maximum and units can be synchronized earlier with the permission of the Offtaker.

5.2 Over Frequency / Under Frequency:

Unit	Under Frequency (Hz)	Time delay (sec)	Over Frequency (Hz)	Time delay (sec)
GTG-1	48.0	60ms (Alarm)	51.50	60ms (Alarm)
GTG-2	48.0	60ms (Alarm)	51.50	60ms (Alarm)
GTG-3	48.0	60ms (Alarm)	51.50	60ms (Alarm)
GTG-4	48.0	60ms (Alarm)	51.50	60ms (Alarm)
STG-1	48.5/47	5000 ms / 500 ms	51.5/53	10000 ms / 1000 ms
STG-2	48	5000 ms	52	5000 ms

5.3 Island Mode Operation:

Plant is capable of islanding in case of disturbance in the network, the range of the voltage and frequencies are as under.

	PROTECTION	D02 (GT1/2)		D03 (GT3/4)	
1	Over Frequency (Step-1)	51.5Hz	0.2s	51.5Hz	0.2s
2	Under Frequency (Step-1)	48.3Hz	0.4s	48.3Hz	0.4s
3	Under Frequency (Step-2)	47.8Hz	0.2s	47.8Hz	0.2s
4	Under Voltage	171.6kV	1.3s	171.6kV	1.3s

5.4 Unit Operating Limits:

Description	Unit	Limits
GT Min Gross Load (SC) Gas	MW	25
GT Min Gross Load (SC) HSD	MW	25
ST Min Gross Load	MW	06*
Complex min Gross Load (OC) Gas	MW	25
Complex min Gross Load (CC) Gas	MW	31*
Complex min Gross Load (OC) HSD	MW	25
Complex min Gross Load (CC) HSD	MW	31*
System Voltage	kV	220
Operating Frequency Range	Hz	48.5 - 51.0

*This is based on summer capacity of ST, in winters these figures shall be increased by 2 MWs approximately.

5.5 Plant Start-up Duration:

Plant Start-up Time in (Minutes)			
	Cold (>12 h)	**Warm** (<12 h, >1 h)	**Hot** (<1 h)
Startup of 2 Gas Turbines (from receipt of dispatch instruction till Synchronization)	63	63	63
HRSG (Pressurization) + remaining 2 Gas Turbines startup	175	113	35
Steam Turbines (Rolling: From Start Command to FSNL)	40	26	12
Steam Turbines Synchronization	05	05	05
Steam Turbines (Loading: From Synchronization to full load)	63	36	25
Total Time	**346**	**243**	**140**

5.6 Load Gradient:

Ramp Rate	Hot Start MW/Min	Warm Start MW/Min	Cold Start MW/Min
GT	5	5	5
ST	1	0.7	0.4

5.7 Number of Yearly Startups:

Startup of the Gas Turbine shall be subject to the following limits.

Type of Startup	Maximum Number of Starts for the term of this agreement (16 years)*		Maximum Number of Starts for each Agreement year*	
	GT	ST**	GT	ST**
HOT	2400 (per GT)	1600 (Per ST)	150 (Per GT)	100 (Per ST)
WARM		800 (Per ST)		50 (Per ST)
COLD				

*The number of startups for each type is interchangeable considering the maximum yearly/term limits with mutual consent of Offtaker and Power Producer.

**The numbers are as per prudent engineering practices.

5.8 Plant Outage Intervals & Duration:

Station	Maintenance	Outage Days
KCCPP	Gas Turbine (GT) 25K Maintenance (Hot section exchange, HSE)	9
KCCPP	GT 50K Maintenance (Major Overhaul)	6*
KCCPP	GT Reduction Gear Box (RGB) 32K Maintenance (Major Overhaul)	8
KCCPP	Gas Turbine Generator (GTG) 25K Maintenance (Minor Overhaul)	3
KCCPP	GTG 64K Maintenance (Major Overhaul)	20
KCCPP	Steam Turbine (ST) 25K Maintenance (Minor Overhaul)	15
KCCPP	ST 50K Maintenance (Major Overhaul)	30
KCCPP	ST RGB 32K Maintenance (Major Overhaul)	8

Station	Maintenance	Outage Days
KCCPP	Steam Turbine Generator (STG) 32K Maintenance (Minor Overhaul)	4
KCCPP	STG 96K Maintenance (Major Overhaul)	25
KCCPP	GT annual Maintenance Condition based	7.5
KCCPP	Balance of Plant (BOP) Maintenance System Cooling Water Pits Repair & cooling Pumps Maintenances	17
KCCPP	Complex Outage for Sea Water Cooling Water Pits Maintenance, Dredging of sea water intake channel. Dredging Operation	30

* GT 50K Maintenance time is for engine swapping.

Overhaul includes hot section exchange, Major overhaul/inspection.

Maintenance cycle shall include:
- One Major Overhaul for each GT at every 50K fired hours
- One Hot Section Exchange (HSE) for each GT at every 25K factored fired hours (One fired hour on HSD is equivalent to two fired hours on gas)
- One Minor overhaul for ST at every 25K hours
- One Major overhaul for ST at every 50K hours

Overhaul cycle shall be completed when
- Major inspections/overhaul of all GTs are completed at every 50K fired hours; and
- Major overhaul of ST is completed at every 50K hours.

5.9 Fuel Pressure Requirement:

- Inlet pressure of Gas Compressor=4.2 bar for rated flow (26335 Nm3/h).
- Decrease in inlet pressure will reduce the flow of the gas compressor.
- Minimum pressure =2.2 bar which will reduce the flow rating of gas compressor by 60% (15800 Nm3/h).

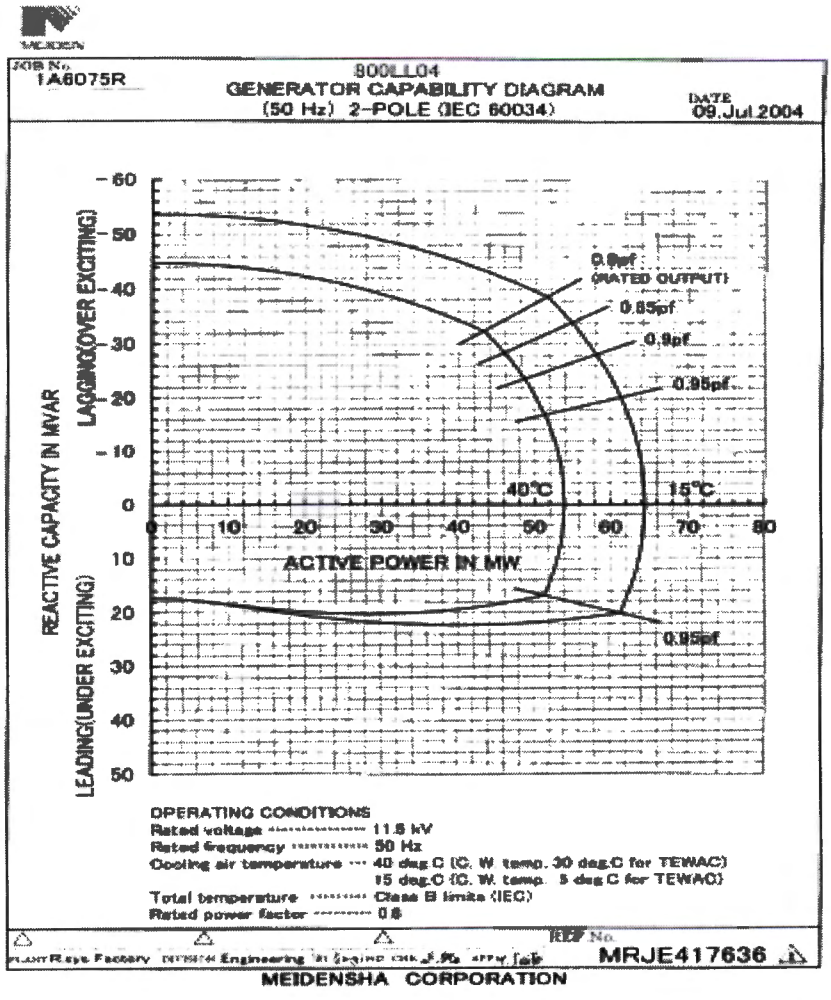
5.10 Steam Turbine Start-up Mode / Time:

Start-up category	Recommended start-up mode	Note-1 Start Up Time As per Curve (Min) From Turbine Rolling to Synchronization
Ambient start and > 12h	(Cold)	45
Shutdown time >1h and < 12h	Warm	29
Shutdown time <1h	(Hot)	17

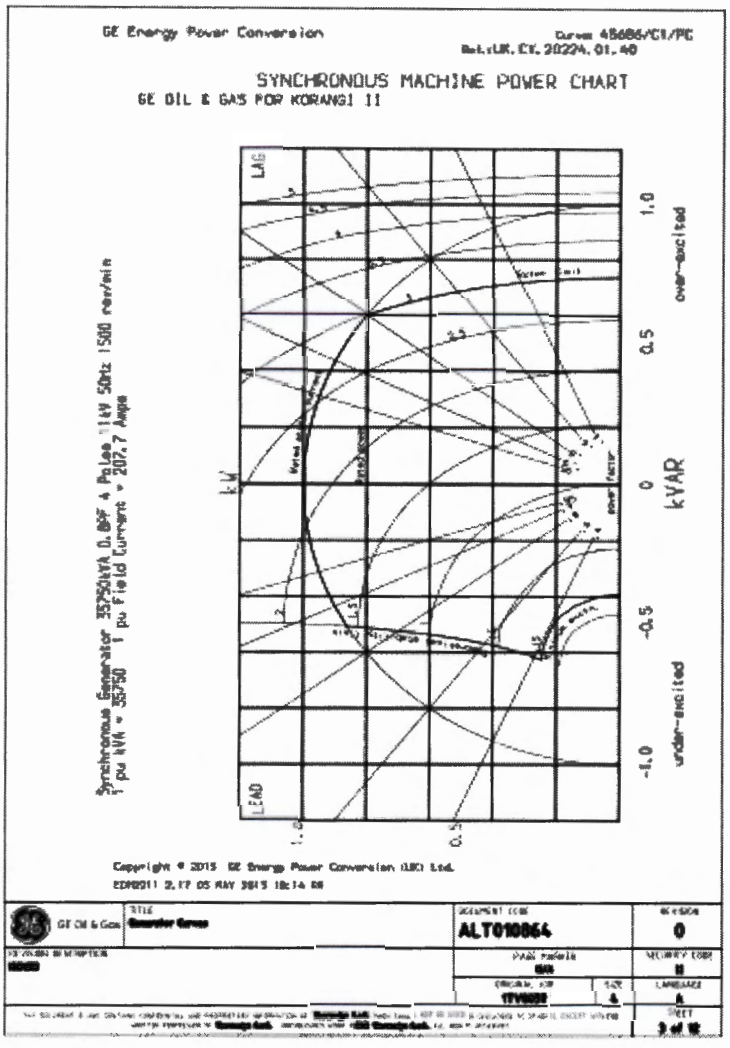
Note-1: HRSG pressurization time is separately mentioned in Section 5.5 of this Schedule.

5.11 Generator Capability Curve:

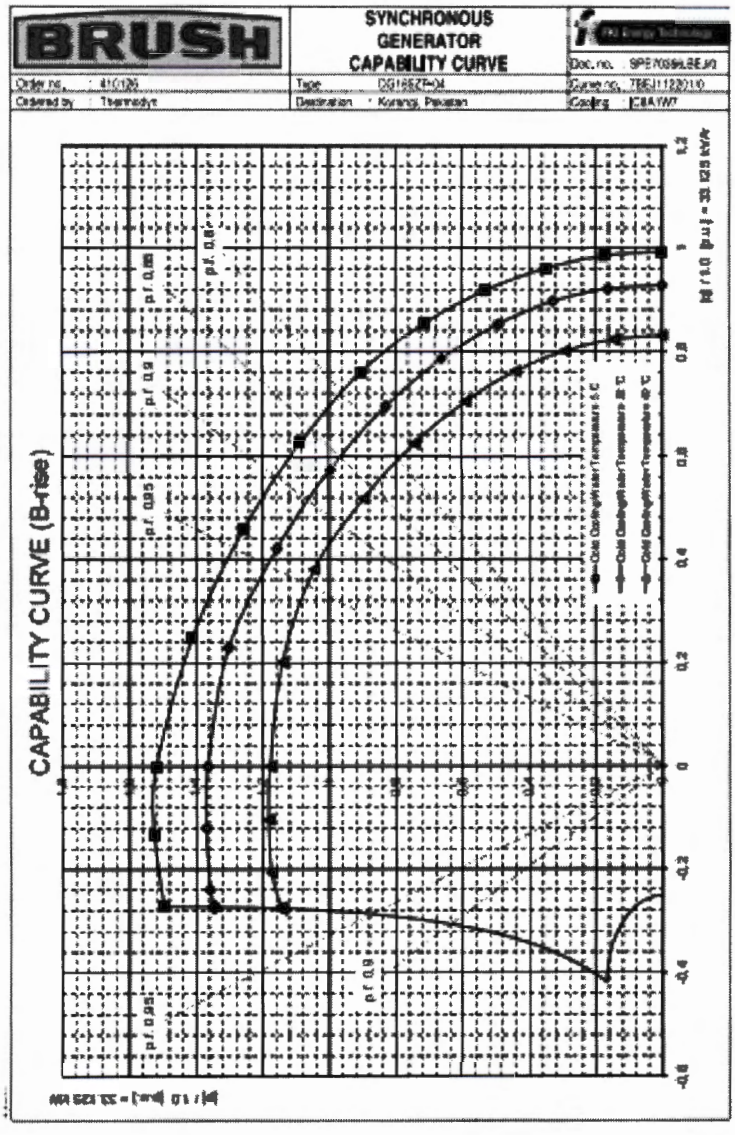
5.11.1 GT capability curve



5.11.2 ST-1 capability curve



5.11.3 ST-2 capability curve



SCHEDULE - 6

METERING STANDARDS AND TESTING

1. Provision of Tariff Metering

1.1 The metering points to record the MWh and MVARh exchange between the Complex and the Offtaker's grid system shall be on the high voltage side of the generating unit transformer as shown in an appropriate diagram to be provided by the Power Producer. The Metering System has been installed by the Power Producer. Exclusive dedicated set of current and voltage transformers is provided by the Power Producer to feed the current and voltage to the Metering System of the Complex. The meters owned by the Offtaker will be located within the GIS Relay building in a separate identified area housing all marshalling cubicles, control and metering panels and communication equipment. Photographic facilities will be provided by the Power Producer as part of the verification process for monthly meter readings.

1.2 The Metering System and the Back-up Meter system shall be in accordance with a mutually agreed international standard, having an accuracy class of 0.2s.

2. Testing

2.1 The calibration of the Metering System and the Back-up Meter system will be checked to ensure that the accuracy remains within the specified limits. The method of calibration and frequency of tests will be agreed between the Power Producer and the Offtaker based on knowledge of the performance and the design of the installed meters and the manufacturers' recommendations.

2.2 Testing and calibration of the Metering System shall be carried out by the Offtaker after giving appropriate notice to the Power Producer in line with the agreed frequency of testing or in the event of either party having reasonable cause to believe the meters are outside specified limits. During such tests and calibration, the Power Producer shall have the right to have a representative present at all times.

2.3 Testing and calibration of the Back-up Meter system shall be carried out by the Power Producer after giving appropriate notice to the Power Producer in line with the agreed frequency of testing or in the event of either party having reasonable cause to believe the meters are outside specified limits. During such tests and calibration, the Offtaker shall have the right to have a representative present at all times.

3.0 CT and PT Error Compensation

3.1 Compensation will be made for the errors of current and voltage transformers in the meter calibration or during the computation of records. Current and voltage transformers will be tested for ratio and phase angle errors following manufacture at an accredited testing station in the presence of representatives from the Power Producer and the Offtaker. Test certificates issued by the testing station will be issued independently to both parties.

SCHEDULE 8

INSURANCE

OPERATING PERIOD

Sum Insured, Deductible and Indemnity Period for All Risk, BI following All Risk including Machinery Breakdown

8.1 All Risks Insurance Including Machinery Break Down - Fixed Assets:

Cover: All Risk of Direct Physical Loss or Damage Including Machinery Break Down. All property of any nature and description which is the subject matter of the Plant or used for or in connection with the operation and maintenance of the Plant which is the property of the Insured and/ or properly under the care/ custody/ control of the Insured for which the Insured is responsible.

Sum insured: Full replacement value of the Complex.

Property All Risk = PKR 84,819,159,624

Deductible:

5% of loss amount minimum PKR 140,000,000 (equivalent to USD 500,000) each occurrence for earth quake and all ensuing damages

PKR 140,000,000 (equivalent to USD 500,000) for Machinery Breakdown with respect to Gas and Steam Turbine & associated Generator and gearboxes

PKR 98,000,000 (equivalent to USD 350,000) each occurrence for all other losses including Act of God I-e Rain, Flood, Storm, Typhoon.

Insured: Principal Insured: K-Electric Limited

Additional Insured:

Financiers
Security Trustee
Lenders
Each for their respective rights and interest.

8.2 Consequential Loss (Business Interruption (BI)) Following All Risk Including Machinery Break Down:

Cover: Loss of revenue and in addition increased costs following loss or damage which is indemnifiable or would be indemnifiable but for the application of the deductible under Section of Property Damage – All Risk Including Machinery Break down .

Sum insured: PKR 15,577,320,590/- (An amount equal to the estimated capacity payments & Take and Pay during the indemnity period.

Indemnity Period: 18 months

Deductibles:

Time Excess: 60 Days each occurrence in respect of Machinery Breakdown of Gas Turbines & Generator Sets, Steam Turbine Generator Sets & Natural Catastrophe Perils.

45 days each occurrence in respect of all other losses.

Deductible based on Average Daily Value of Loss.

Insured: Principal Insured: K-Electric Limited

Additional Insured:

Financiers
Security Trustee
Lenders
Each for their respective rights and interest

Note: *Total Limit of Liability (All Risk Including Machinery Break down and Business Interruption): PKR 100,396,480,215.*

8.3 Terrorism

Cover: All real and personal property of every kind

Sum insured:	Property Damaged	=	PKR 84,819,159,624
	Business Interruption	=	PKR 15,577,320,590
	Total	=	PKR *100,396,480,215*

Deductible:

PKR 7,000,000/-any one occurrence in respect of Property Damage,
30 days any one occurrence in respect of Business Interruption.

Limit of Liability:

PKR 35,000,000,000 any one occurrence and in the annual Aggregate in respect of Property Damage and Business Interruption only. This limit is for all generating plants of the Company, however, full amount can be claimed at the KCCP Annually.

Insured: Principal Insured: K-Electric Limited

Additional Insured:

Financiers
Security Trustee
Lenders
Each for their respective rights and interest

8.4 Public Liability Insurance

Cover: Bodily Injury including death and Property Damage to third party due to Power Generation, Transmission and Distribution of K Electric

Limit of Liability:

Bodily Injury including death and Property Damage to third party PKR 50,000,000 per occurrence and PKR 300,000,000 in Annual Aggregate. This limit is for all assets of the Company, however, full amount can be claimed at the KCCP annually.

Deductible:

PKR 500,000/- for bodily injury including death.
PKR 1,000,000 for property per accident for each and every loss.

Insured: Principal Insured: K-Electric Limited

SCHEDULE - 10
KCCPP CORRECTION CURVES

Table of Contents

10.1 Correction Curves

10.1.1 Gas Fuel Correction Curves (Combine Cycle Base Load)

10.1.1.1 Correction in Power Output and Heat Rate due to Variation in Ambient Temperature

K-Electric Limited 248 MW Combined Cycle Power Plant Korangi Creek, Karachi Pakistan	Document Name: Correction curves for Plant's base load @ 100% GTGs load Ambient air temperature correction factors for complete CCPP	Project Ref. N°: IE/KE/01/2018 File Name: I_01_a_20180905 Revision date: Sept. 5th, 2018	IEI ISTROENERGO INTERNATIONAL, s.a.

Table I.1.a: Ambient air temperature correction factors

Calculation point No.	Ambient temperature	Plant power		Plant heat rate		Power correction		Heat rate correction	
		GROSS	NET	GROSS	NET	GROSS	NET	GROSS	NET
	T	PWR_gross	PWR_net	HR_gross	HR_net	α_1_gross	α_1_net	f_1_gross	f_1_net
	[°C]	[kWe]	[kWe]	[kJ/kWh]	[kJ/kWh]	[-]	[-]	[-]	[-]
1	5.0	253 089	238 043	6 961.8	7 401.9	0.977093	0.960514	1.000429	1.017697
2	10.0	253 281	238 231	6 980.7	7 421.7	0.976353	0.959755	0.997718	1.014972
3	15.0	250 845	234 633	6 974.4	7 456.3	0.985833	0.974474	0.998629	1.010270
4	20.0	250 610	233 796	6 967.6	7 468.7	0.986758	0.977961	0.999599	1.008590
5	25.0	250 563	232 721	6 966.6	7 500.7	0.986945	0.982480	0.999746	1.004289
6	**30.0**	**247 292**	**228 644**	**6 964.8**	**7 532.9**	**1.000000**	**1.000000**	**1.000000**	**1.000000**
7	35.0	237 673	219 071	6 959.7	7 550.7	1.040470	1.043694	1.000727	0.997636
8	40.0	228 127	209 588	6 955.8	7 571.1	1.084008	1.090921	1.001292	0.994947
9	45.0	217 675	199 202	6 962.6	7 608.2	1.136060	1.147797	1.000322	0.990093

$\alpha_1 = a_5 \cdot T^5 + a_4 \cdot T^4 + a_3 \cdot T^3 + a_2 \cdot T^2 + a_1 \cdot T + a_0$

	α_1_gross	α_1_net
a_5	-2.16007906095400E-08	-2.24060113642000E-08
a_4	2.54768318464029E-06	2.67888820138547E-06
a_3	-1.04336446208434E-04	-1.12258993103667E-04
a_2	1.87652925614206E-03	2.09632123149331E-03
a_1	-1.39826518914502E-02	-1.59726208542090E-02
a_0	1.01119197580037E+00	9.99844904210947E-01

$f_1 = a_5 \cdot T^5 + a_4 \cdot T^4 + a_3 \cdot T^3 + a_2 \cdot T^2 + a_1 \cdot T + a_0$

	f_1_gross	f_1_net
a_5	0.00000000000000E+00	-1.84514971553000E-09
a_4	0.00000000000000E+00	2.15864092911300E-07
a_3	0.00000000000000E+00	-9.13787043897594E-06
a_2	1.34775237871712E-06	1.69899697685455E-04
a_1	-1.77564671749505E-05	-2.01270982199658E-03
a_0	9.99206144966699E-01	1.02465315348668E+00

10.1.1.2 Correction in Power Output and Heat Rate due to Variation in Ambient Pressure

K-Electric Limited 249 MW Combined Cycle Power Plant Korangi Creek, Karachi Pakistan	Correction curves for Plant's base load @ 100% GTGs load Document Name: Ambient air pressure correction factors for complete CCPP	Project Ref. N°	IE/KE/01/2018
		File Name	I_02_a_20180905
		Revision date	Sept. 5th, 2018
			ISTROENERGO INTERNATIONAL, a.s.

Table I.2.a: Ambient air pressure correction factors

Calculation point No.	Ambient pressure	Plant power		Plant heat rate		Power correction		Heat rate correction	
		GROSS	NET	GROSS	NET	GROSS	NET	GROSS	NET
	p	PWR_gross	PWR_net	HR_gross	HR_net	α_2_gross	α_2_net	f_2_gross	f_2_net
	[bar(a)]	[kWe]	[kWe]	[kJ/kWh]	[kJ/kWh]	[-]	[-]	[-]	[-]
1	1.001300	244 386	225 757	6 963.8	7 538.4	1.011891	1.012790	1.000146	0.999258
2	1.003690	244 978	226 341	6 963.8	7 537.3	1.009444	1.010175	1.000139	0.999415
3	1.006080	245 612	226 968	6 964.1	7 536.1	1.006840	1.007384	1.000103	0.999563
4	1.008460	246 197	227 545	6 964.4	7 535.2	1.004446	1.004828	1.000060	0.999680
5	1.010860	246 819	228 161	6 963.7	7 533.2	1.001916	1.002118	1.000152	0.999951
6	**1.013250**	**247 292**	**228 644**	**6 964.8**	**7 532.8**	**1.000000**	**1.000000**	**1.000000**	**1.000000**
7	1.015670	247 852	229 197	6 965.1	7 532.0	0.997743	0.997586	0.999956	1.000114
8	1.018070	248 440	229 778	6 965.1	7 530.8	0.995379	0.995065	0.999957	1.000272
9	1.020490	248 992	230 324	6 966.0	7 530.7	0.993173	0.992708	0.999822	1.000291
10	1.022910	249 567	230 893	6 966.5	7 530.0	0.990883	0.990260	0.999750	1.000378
11	1.025330	250 119	231 437	6 969.3	7 531.9	0.988697	0.987933	0.999351	1.000125

$\alpha_2 = a_1 * p + a_0$

	α_2_gross	α_2_net
a_1	-9.59202769707057E-01	-1.02923101915655E+00
a_0	1.97198103736369E+00	2.04297903770114E+00

$f_2 = a_3 * p^3 + a_2 * p^2 + a_1 * p + a_0$

	f_2_gross	f_2_net
a_3	-1.41642081923782E+02	-1.62488237574696E+02
a_2	4.28728884553746E+02	4.91780463845896E+02
a_1	-4.32568172868321E+02	-4.96063751380016E+02
a_0	1.46481778958076E+02	1.67770751657543E+02

10.1.1.3 Correction in Power Output and Heat Rate due to Variation in Relative Humidity

K-Electric Limited 248 MW Combined Cycle Power Plant Korangi Creek, Karachi Pakistan	Document Name: Correction curves for Plant's base load @ 100% GTGs load Ambient air RH correction factors for complete CCPP	Project Ref. N°: IEI/KE/01/2018 File Name: I_03_a_20180905 Revision date: Sept. 5th, 2018	IEI ISTROENERGO INTERNATIONAL, a.s.

Table I.3.a: Ambient air RH correction factors

Calculation point No.	Ambient air RH	Plant power		Plant heat rate		Power correction		Heat rate correction	
		GROSS	NET	GROSS	NET	GROSS	NET	GROSS	NET
	RH	PWR_gross	PWR_net	HR_gross	HR_net	α_3_gross	α_3_net	f_3_gross	f_3_net
	[%]	[kWe]	[kWe]	[kJ/kWh]	[kJ/kWh]	[-]	[-]	[-]	[-]
1	30.0	250 651	233 195	6 968.9	7 490.6	0.986597	0.980485	0.999404	1.005635
2	40.0	250 566	232 534	6 966.5	7 506.7	0.986935	0.983270	0.999756	1.003482
3	50.0	250 566	231 901	6 966.5	7 527.2	0.986935	0.985954	0.999756	1.000750
4	**60.0**	**247 292**	**228 644**	**6 964.8**	**7 532.8**	**1.000000**	**1.000000**	**1.000000**	**1.000000**
5	70.0	243 512	224 886	6 962.5	7 539.1	1.015523	1.016709	1.000332	0.999165
6	80.0	239 874	221 267	6 960.7	7 546.1	1.030923	1.033338	1.000585	0.998246
7	90.0	236 630	218 027	6 959.1	7 552.9	1.045058	1.048697	1.000818	0.997346
8	98.0	234 056	215 476	6 957.2	7 557.1	1.056551	1.061112	1.001093	0.996790

$\alpha_3 = a_5*RH^5 + a_4*RH^4 + a_3*RH^3 + a_2*RH^2 + a_1*RH + a_0$

	α_3_gross	α_3_net
a_5	5.38415633720000E-10	4.79597496180000E-10
a_4	-1.74552470369880E-07	-1.55846876102120E-07
a_3	2.14704092044691E-05	1.92124707158842E-05
a_2	-1.22706388037384E-03	-1.10015569605941E-03
a_1	3.27540470519819E-02	2.96701788928034E-02
a_0	6.57056627360132E-01	6.76461679403321E-01

$f_3 = a_3*RH^3 + a_2*RH^2 + a_1*RH + a_0$

	f_3_gross	f_3_net
a_3	4.15538962610000E-10	-3.27223342222400E-08
a_2	2.77532956234600E-08	7.77076578679014E-06
a_1	1.50330576355953E-05	-6.87219235012336E-04
a_0	9.98960574290769E-01	1.02024358035953E+00

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10.1.1.4 Correction in Power Output due to Variation in Cooling Water Temperature

K-Electric Limited 248 MW Combined Cycle Power Plant Korangi Creek, Karachi Pakistan	Document Name: Correction curves for Plant's base load @ 100% GTGs load Condenser cooling water temperature correction factors for complete CCPP	Project Ref. N°: IEI/KE/01/2018 File Name: I_09_a_20180905 Revision date: Sept. 5th, 2018	IEI ISTROENERGO INTERNATIONAL, a.s.

Table I.9.a.: Condenser cooling water temperature additive correction factor

Calculation point No.	Condenser cooling temperature	Plant power		Power correction	
		GROSS	NET	GROSS	NET
	CT	PWR_gross	PWR_net	Δ_{58}_gross	Δ_{58}_net
	[°C]	[kWe]	[kWe]	[kWe]	[kWe]
1	20.0	247 369	228 713	-73	-66
2	22.5	247 420	228 766	-124	-119
3	**25.0**	**247 295**	**228 647**	**0**	**0**
4	27.5	246 941	228 300	354	347
5	30.0	246 386	227 752	909	895
6	32.5	245 705	227 079	1 590	1 568
7	35.0	244 950	226 331	2 346	2 316
8	37.5	244 147	225 535	3 148	3 112

$\Delta_{58} = a_3*CT^3 + a_2*CT^2 + a_1*CT + a_0$

	Δ_{58}_gross	Δ_{58}_net
a_3	-4.19220277359670E-01	-4.13101708302577E-01
a_2	4.82354700435764E+01	4.76508678242492E+01
a_1	-1.51859956017598E+03	-1.50314178097538E+03
a_0	1.43718940920456E+04	1.42551958298015E+04

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10.1.2 HSD Fuel Correction Curves (Combine Cycle Base Load)

10.1.2.1 Correction in Power Output and Heat Rate due to Variation in Ambient Temperature

K-Electric Limited 248 MW Combined Cycle Power Plant Korangi Creek, Karachi Pakistan	Document Name	Correction curves for Plant's base load @ 100% GTGs load - Liquid fuel operation - Ambient air temperature correction factors for complete CCPP	Project Ref. N°	IE/KE/01/2021	IEI ISTROENERGO INTERNATIONAL, s.r.o.
			File Name	L_I_01_a_20210304	
			Revision date	March, 4th, 2021	

Table L.I.1.a: Ambient air temperature correction factors

Calculation point No.	Ambient temperature	Power correction		Heat rate correction	
		GROSS	NET	GROSS	NET
	T	α_1_gross	α_1_net	f_1_gross	f_1_net
	[°C]	[-]	[-]	[-]	[-]
1	5,0	0,976779	0,960671	1,002793	1,019607
2	10,0	0,975655	0,959545	0,999718	1,016502
3	15,0	0,986294	0,975197	0,999794	1,011171
4	20,0	0,986397	0,977856	1,000541	1,009280
5	25,0	0,990181	0,985998	0,996717	1,000946
6	**30,0**	**1,000000**	**1,000000**	**1,000000**	**1,000000**
7	35,0	1,041672	1,043506	1,000695	0,998936
8	40,0	1,085008	1,088918	1,001358	0,997763
9	45,0	1,138126	1,144846	1,000543	0,994670

$\alpha_1 = a_5 \cdot T^5 + a_4 \cdot T^4 + a_3 \cdot T^3 + a_2 \cdot T^2 + a_1 \cdot T + a_0$

	α_1_gross	α_1_net
a_5	-2,19029493602500E-08	-2,19355532167200E-08
a_4	2,61103166728266E-06	2,64983756885741E-06
a_3	-1,08569891311847E-04	-1,12671200686606E-04
a_2	1,99229124621769E-03	2,14323578042968E-03
a_1	-1,51793239517857E-02	-1,66504876824109E-02
a_0	1,01448570622865E+00	1,00232233020305E+00

$f_1 = a_5 \cdot T^5 + a_4 \cdot T^4 + a_3 \cdot T^3 + a_2 \cdot T^2 + a_1 \cdot T + a_0$

	f_1_gross	f_1_net
a_5	0,00000000000000E+00	0,00000000000000E+00
a_4	0,00000000000000E+00	-5,14327357322700E-08
a_3	-3,35492888465030E-07	5,30919215706176E-06
a_2	3,18056952820483E-05	-1,73712915403203E-04
a_1	-8,71654947965975E-04	1,26412135438847E-03
a_0	1,00628748144724E+00	1,01679435178925E+00

10.1.2.2 Correction in Power Output and Heat Rate due to Variation in Ambient Pressure

K-Electric Limited 248 MW Combined Cycle Power Plant Korangi Creek, Karachi Pakistan	Document Name	Correction curves for Plant's partial load @ 100% GTGs load - Liquid fluel operation - Ambient air pressure correction factors for complete CCPP	Project Ref. N°	IEI/KE/01/2021
			File Name	L_I_02_a_20210304
			Revision date	March, 4th, 2021
				IEI ISTROENERGO INTERNATIONAL, a.s.

Table L.I.2.a: Ambient air pressure correction factors

Calculation point No.	Ambient pressure	Power correction		Heat rate correction	
		GROSS	NET	GROSS	NET
	p	α_2_gross	α_2_net	f_2_gross	f_2_net
	[bar(a)]	[-]	[-]	[-]	[-]
1	1,001300	1,011818	1,012257	1,001081	1,000647
2	1,003690	1,009608	1,009971	1,000730	1,000370
3	1,006080	1,007326	1,007600	1,000506	1,000234
4	1,008460	1,004968	1,005153	1,000391	1,000207
5	1,010860	1,002506	1,002603	1,000329	1,000232
6	**1,013250**	**1,000000**	**1,000000**	**1,000000**	**1,000000**
7	1,015670	0,997886	0,997815	1,000140	1,000211
8	1,018070	0,996206	0,995998	1,000014	1,000223
9	1,020490	0,994086	0,993803	0,999775	1,000060
10	1,022910	0,991581	0,991207	1,000043	1,000420
11	1,025330	0,989059	0,988599	0,999892	1,000358

$\alpha_2 = a_1 \cdot p + a_0$		
	α_2_gross	α_2_net
a_1	-9,37414223132511E-01	-9,75492492468236E-01
a_0	1,95032429290931E+00	1,98890484337744E+00

$f_2 = a_3 \cdot p^3 + a_2 \cdot p^2 + a_1 \cdot p + a_0$		
	f_2_gross	f_2_net
a_3	-5,97519838884472E+01	-7,44647322595119E+01
a_2	1,84142577174387E+02	2,28981023835260E+02
a_1	-1,89166073584579E+02	-2,34675945982958E+02
a_0	6,57766955407062E+01	8,11603973856333E+01

10.1.2.3 Correction in Power Output and Heat Rate due to Variation in Relative Humidity

K-Electric Limited 248 MW Combined Cycle Power Plant Korangi Creek, Karachi Pakistan	Document Name	Correction curves for Plant's base load @ 100% GTGs load - Liquid fuel operation - Ambient air RH correction factors for complete CCPP	Project Ref. N°	IEI/KE/01/2021	IEI ISTROENERGO INTERNATIONAL, a.s.
			File Name	L_I_03_a_20210304	
			Revision date	March, 4th, 2021	

Table L.I.3.a: Ambient air RH correction factors

Calculation point No.	Ambient air RH	Power correction		Heat rate correction	
		GROSS	NET	GROSS	NET
	RH	α_3_gross	α_3_net	f_3_gross	f_3_net
	[%]	[-]	[-]	[-]	[-]
1	30,0	0,986219	0,980388	1,000322	1,006272
2	40,0	0,986397	0,983009	1,000541	1,003989
3	50,0	0,986397	0,985739	1,000541	1,001209
4	**60,0**	**1,000000**	**1,000000**	**1,000000**	**1,000000**
5	70,0	1,015958	1,016663	1,000211	0,999519
6	80,0	1,031433	1,032856	1,000558	0,999180
7	90,0	1,045979	1,048055	1,000662	0,998679
8	98,0	1,057464	1,060045	1,000866	0,998429

$\alpha_3 = a_5*RH^5 + a_4*RH^4 + a_3*RH^3 + a_2*RH^2 + a_1*RH + a_0$		
	α_3_gross	α_3_net
a_5	5,40216353080000E-10	4,68066617610000E-10
a_4	-1,74838074602610E-07	-1,51658805368810E-07
a_3	2,14490392520913E-05	1,86199979326656E-05
a_2	-1,22084964486924E-03	-1,06013108373858E-03
a_1	3,24103214464465E-02	2,83958570369210E-02
a_0	6,62175212221873E-01	6,91465933908302E-01

$f_3 = a_3*RH^3 + a_2*RH^2 + a_1*RH + a_0$		
	f_3_gross	f_3_net
a_3	8,67866330038000E-09	-3,34181558894500E-08
a_2	-1,33523184700718E-06	8,67328063769478E-06
a_1	6,20346231394271E-05	-7,78544614477918E-04
a_0	9,99514078188305E-01	1,02290459588554E+00

10.1.2.4 Correction in Power Output due to Variation in Cooling Water Temperature

K-Electric Limited 248 MW Combined Cycle Power Plant Korangi Creek, Karachi Pakistan	Document Name	Correction curves for Plant's base load @ 100% GTGs load - Liquid fuel operation - Condenser cooling water temperature correction factors for complete CCPP	Project Ref. N°	IEI/KE/01/2021	IEI ISTROENERGO INTERNATIONAL, a.s.
			File Name	L_I_09_a_20210304	
			Revision date	March, 4th, 2021	

Table L.I.9.a.: Condenser cooling water temperature additive correction factor

Calculation point No.	Condenser cooling temperature	Power correction	
		GROSS	NET
	CT	Δ_{5B}_gross	Δ_{5B}_net
	[°C]	[kWe]	[kWe]
1	20,0	-51	-52
2	22,5	-105	-105
3	**25,0**	**0**	**0**
4	27,5	299	299
5	30,0	762	760
6	32,5	1 332	1 328
7	35,0	1 951	1 944
8	37,5	2 609	2 599

$\Delta_{5B} = a_3 \cdot CT^3 + a_2 \cdot CT^2 + a_1 \cdot CT + a_0$		
	Δ_{5B}_gross	Δ_{5B}_net
a_3	-3,839169311190 18E-01	-3,82061294791100E-01
a_2	4,307616190249 74E+01	4,28698026284077E+01
a_1	-1,344175165223 83E+03	-1,33755002299643E+03
a_0	1,26836477819173E+04	1,26180484721145E+04

10.1.3 Gas Fuel Correction Curves (Simple Cycle Base Load)

10.1.3.1 Correction in Power Output and Heat Rate due to Variation in Ambient Temperature

K-Electric Limited 248 MW Combined Cycle Power Plant Korangi Creek, Karachi Pakistan	Document Name: Correction curves for Plant's base load @ 100% GTGs load Ambient air temperature correction factors for Simple Cycle Plant	Project Ref. N°: IE/KE/01/2018 File Name: I_01_c_20180905 Revision date: Sept. 5th, 2018	IE ISTROENERGO INTERNATIONAL, a.s.

Table I.1.d: Ambient air temperature correction factors

Calculation point No.	Ambient temperature	Plant power		Plant heat rate		Power correction		Heat rate correction	
		GROSS	NET	GROSS	NET	GROSS	NET	GROSS	NET
	T	PWR_gross	PWR_net	HR_gross	HR_net	α_1_gross	α_1_net	f_1_gross	f_1_net
	[°C]	[kWe]	[kWe]	[kJ/kWh]	[kJ/kWh]	[-]	[-]	[-]	[-]
1	5.0	199 244	187 472	8 854.0	9 410.0	0.971051	0.950010	1.006438	1.028729
2	10.0	199 244	187 472	8 882.0	9 439.7	0.971051	0.950010	1.003265	1.025485
3	15.0	196 884	183 947	8 894.0	9 519.5	0.982690	0.968216	1.001911	1.016890
4	20.0	196 628	183 090	8 890.0	9 547.4	0.983970	0.972748	1.002362	1.013926
5	25.0	196 628	182 062	8 890.0	9 601.3	0.983970	0.978240	1.002362	1.008233
6	**30.0**	**193 476**	**178 100**	**8 911.0**	**9 680.3**	**1.000000**	**1.000000**	**1.000000**	**1.000000**
7	35.0	184 540	169 200	8 974.0	9 787.6	1.048423	1.052601	0.992980	0.989038
8	40.0	175 808	160 519	9 037.0	9 897.8	1.100496	1.109527	0.986057	0.978031
9	45.0	166 324	151 089	9 126.0	10 046.2	1.163248	1.178771	0.976441	0.963582

$\alpha_1 = a_5*T^5 + a_4*T^4 + a_3*T^3 + a_2*T^2 + a_1*T + a_0$

	α_1_gross	α_1_net
a_5	-2.54264436771000E-08	-2.63415824847100E-08
a_4	2.99305243820256E-06	3.14663973959785E-06
a_3	-1.22031738604847E-04	-1.31483936430805E-04
a_2	2.17676912516892E-03	2.44308265230591E-03
a_1	-1.59103261334855E-02	-1.83268614117634E-02
a_0	1.00913312822551E+00	9.94437531406767E-01

$f_1 = a_5*T^5 + a_4*T^4 + a_3*T^3 + a_2*T^2 + a_1*T + a_0$

	f_1_gross	f_1_net
a_5	2.53009706003000E-09	1.26265382796000E-09
a_4	-3.03750756038540E-07	-1.09109167004440E-07
a_3	1.26390495741146E-05	1.27868134011666E-06
a_2	-2.37014770220216E-04	6.99545321816160E-05
a_1	9.29594930171786E-04	-1.79664691001207E-03
a_0	1.02886638759266E+00	1.01364735740421E+00

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10.1.3.2 Correction in Power Output and Heat Rate due to Variation in Ambient Pressure

K-Electric Limited 248 MW Combined Cycle Power Plant Korangi Creek, Karachi Pakistan	Document Name: Correcton curves for Plant's base load @ 100% GTGs load Ambient air pressure correction factors for Simple Cycle Plant	Project Ref. N°: IEI/KE/01/2018 File Name: I_02_d_20180905 Revision date: Sept. 5th, 2018	IEI ISTROENERGO INTERNATIONAL, a.s.

Table I.2.d: Ambient air pressure correction factors

Calculation point No.	Ambient pressure	Plant power		Plant heat rate		Power correction		Heat rate correction	
		GROSS	NET	GROSS	NET	GROSS	NET	GROSS	NET
	p	PWR_gross	PWR_net	HR_gross	HR_net	α_2_gross	α_2_net	f_2_gross	f_2_net
	[bar(a)]	[kWe]	[kWe]	[kJ/kWh]	[kJ/kWh]	[-]	[-]	[-]	[-]
1	1.001300	191 172	175 802	8 912.0	9 691.2	1.012052	1.013071	0.999888	0.998882
2	1.003690	191 660	176 285	8 911.0	9 688.2	1.009475	1.010298	1.000000	0.999195
3	1.006080	192 140	176 761	8 911.0	9 686.3	1.006953	1.007577	1.000000	0.999381
4	1.008460	192 620	177 235	8 910.0	9 683.4	1.004444	1.004878	1.000112	0.999680
5	1.010860	193 116	177 727	8 910.0	9 681.5	1.001864	1.002096	1.000112	0.999881
6	**1.013250**	**193 476**	**178 100**	**8 911.0**	**9 680.3**	**1.000000**	**1.000000**	**1.000000**	**1.000000**
7	1.015670	193 948	178 568	8 910.0	9 677.4	0.997566	0.997378	1.000112	1.000302
8	1.018070	194 416	179 031	8 910.0	9 675.7	0.995165	0.994801	1.000112	1.000478
9	1.020490	194 860	179 471	8 911.0	9 675.1	0.992897	0.992360	1.000000	1.000541
10	1.022910	195 324	179 931	8 911.0	9 673.3	0.990539	0.989823	1.000000	1.000724
11	1.025330	195 820	180 422	8 911.0	9 671.5	0.988030	0.987131	1.000000	1.000911

$\alpha_2 = a_1 * p + a_0$

	α_2_gross	α_2_net
a_1	-9.87055823765579E-01	-1.06745559042834E+00
a_0	2.00007443046891E+00	2.08158094545306E+00

$f_2 = a_3 * p^3 + a_2 * p^2 + a_1 * p + a_0$

	f_2_gross	f_2_net
a_3	4.77581346482038E+01	2.68567506894469E+01
a_2	-1.46200512630419E+02	-8.29221127896950E+01
a_1	1.49176329848985E+02	8.54020019597167E+01
a_0	-4.97341182806908E+01	-2.83379177725270E+01

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10.1.3.3 Correction in Power Output and Heat Rate due to Variation in Relative Humidity

K-Electric Limited 248 MW Combined Cycle Power Plant Korangi Creek, Karachi Pakistan	Document Name: Correction curves for Plant's base load @ 100% GTGs load Ambient air RH correction factors for Simple Cycle Plant	Project Ref. N°: IEI/KE/01/2018 File Name: I_03_d_20180905 Revision date: Sept. 5th, 2018	ISTROENERGO INTERNATIONAL, a.s.

Table I.3.d: Ambient air RH correction factors

Calculation point No.	Ambient air RH	Plant power		Plant heat rate		Power correction		Heat rate correction	
		GROSS	NET	GROSS	NET	GROSS	NET	GROSS	NET
	RH	PWR_gross	PWR_net	HR_gross	HR_net	α_3_gross	α_3_net	f_3_gross	f_3_net
	[%]	[kWe]	[kWe]	[kJ/kWh]	[kJ/kWh]	[-]	[-]	[-]	[-]
1	30.0	196 712	182 531	8 891.0	9 561.8	0.983550	0.975726	1.002249	1.010286
2	40.0	196 628	181 872	8 890.0	9 611.3	0.983970	0.979259	1.002362	1.007184
3	50.0	196 628	181 239	8 890.0	9 644.8	0.983970	0.982680	1.002362	1.003678
4	**60.0**	**193 476**	**178 100**	**8 911.0**	**9 680.3**	**1.000000**	**1.000000**	**1.000000**	**1.000000**
5	70.0	189 972	174 614	8 935.0	9 720.9	1.018445	1.019962	0.997314	0.995830
6	80.0	186 600	171 257	8 959.0	9 761.7	1.036849	1.039960	0.994642	0.991667
7	90.0	183 620	168 276	8 981.0	9 799.9	1.053676	1.058377	0.992206	0.987799
8	98.0	181 212	165 889	8 998.0	9 829.1	1.067678	1.073608	0.990331	0.984860

$\alpha_3 = a_5*RH^5 + a_4*RH^4 + a_3*RH^3 + a_2*RH^2 + a_1*RH + a_0$

	α_1_gross	α_1_net
a_5	6.53141323590000E-10	5.78751508620000E-10
a_4	-2.11080327651910E-07	-1.87377870225500E-07
a_3	2.58824646774 72E-05	2.30158291629829E-05
a_2	-1.47472899841465E-03	-1.31324956495791E-03
a_1	3.92506762640003E-02	3.53163401949772E-02
a_0	5.89714163614029E-01	6.14567602715647E-01

$f_3 = a_3*RH^3 + a_2*RH^2 + a_1*RH + a_0$

	f_1_gross	f_1_net
a_3	6.88485077375800E-08	2.67008184336400E-08
a_2	-1.56424015200283E-05	-5.74840628943902E-06
a_1	9.03838841910338E-04	3.19277808219585E-06
a_0	9.87237138893077E-01	1.01460675697523E+00

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