Copy - II

DHA Cogen Ltd

September 13, 2012

Mr. Syed Safeer Hussain
Registrar,
National Electric Power Regulatory Authority,
OPF Building, 2nd Floor, Shahrah-e-Jamhooriyat, G-5/2,
Islamabad, Pakistan

Sub: **Petition for Approval/Determination of Tariff for DHA Cogen Ltd (the "Company") Combined Cycle Power Plant at DHA Phase VIII, Karachi, Sindh**

Dear Sir,

The Company is submitting this Tariff Petition, pursuant to its ongoing efforts for the rehabilitation and startup of its Combined Cycle Power Plant, under Rule 3(1) of Tariff Standard and Procedure Rules, 1998 for the kind consideration and favorable approval by the Authority for the determination of Tariff as follows:

a. The reference generation tariff (the Reference Generation Tariff);
b. The Indexations and Adjustments;
c. Adjustments (if needed to debt and equity in PKR terms) at achievement of COD;
d. Other matters set out in this Tariff Petition, in each case, for DHA Cogen Limited's 94 MW power generation facility located at Phase VIII, Karachi, Sindh.

DCL was incorporated on 29th, January 2003 in Pakistan to put up the country's first integrated power generation and desalination unit. The Company was awarded a generation license, IGSPL/01/2005, on January 1st, 2005 and construction started in May 2005. The plant started commercial operations during April 2008.

Since achievement of COD in April 2008, the plant has only operated for nine (09) months due to rotor-vibration and compressor surge problems. Intermittent rotor-vibration problems in the Gas Turbine resulted in plant shutdown for rehabilitation from October 2008, to July 2009. Then starting late August 2009 the plant experienced four compressor surges within a period of 2 to 3 months with a fifth surge event in May 2010, resulting in compressor damage. The plant has been shut since then.

International Electric Power, LLC (IEP) has come to an agreement with AEI Asia, LTD., for the acquisition of the plant and intends to rehabilitate it. IEP leadership has substantial expertise and a combined experience of over 70 years in the development and management of all types of power generation, transmission and distribution systems and utilization of diverse power generation sources such as natural gas, oil, coal, uranium, wind, sun, water, waste and biomass within and outside the United States. It has devised and already started implementing the rehabilitation plan. The Sponsors have already negotiated a restructuring plan with existing lenders including a haircut in equity along with bringing in foreign financing for the project's revival.

In this regard, NEPRA is approached by DCL for the favorable approval by the Authority of the attached tariff petition for the rehabilitated DCL power plant. The Authority is kindly requested to process the Tariff Petition at the earliest, thereby enabling DCL to swiftly proceed towards plant start-up and dispatch of electricity.

Thanking you.

Yours sincerely,

Nazoor Baig

Chief Executive Officer

DHA Cogen Limited

BEFORE
THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY (NEPRA)

TARIFF PETITION

PURSUANT TO
NEPRA (TARIFF STANDARDS AND PROCEDURE) RULES, 1998
READ WITH THE PROVISIONS OF
THE REGULATION FOR GENERATION, TRANSMISSION AND DISTRIBUTION OF ELECTRIC POWER ACT (XL OF) 1997 & THE RULES AND REGULATIONS MADE THERE UNDER

ON BEHALF OF

DHA COGEN LIMITED

FOR NEPRA'S APPROVAL OF REFERENCE GENERATION TARIFF FOR
DHA COGEN LIMITED

DATED: September 13th, 2012

DHA COGEN LIMITED
ADDRESS: *DSL-1, COASTAL AVENUE, PHASE VIII, DHA, KARACHI*
PHONE #: *+92-21-5869787-8*
FAX #: *+92-21-5860895*

COPY OF
DHA COGEN LIMITED
BOARD RESOLUTION

DHA Cogen Ltd

EXTRACTS OF RESOLUTION PASSED BY CIRCULATION BY THE BOARD OF DIRECTORS OF DHA COGEN LIMITED

The following resolutions were passed by circulation by the Board of Directors of DHA Cogen Limited ("**Company**"):

RESOLVED THAT:

(a) The Company be and is hereby authorized to file a revised Tariff Petition under Rule 3(1) of the Tariff Standard and Procedure Rules, 1998 with the National Electric Power Regulatory Authority in such form as has been presented before the Board; and

(b) The Chief Executive Officer and the Company Secretary be and are hereby jointly or severally authorized to act on behalf of the Company in respect of the Tariff Petition and to file such documents, make such filings, pay fees, make such amendments as may be required for the purposes of obtaining the revised Tariff from the National Electric Power Regulatory Authority and generally take all such actions as may be necessary or advisable in respect of the same;

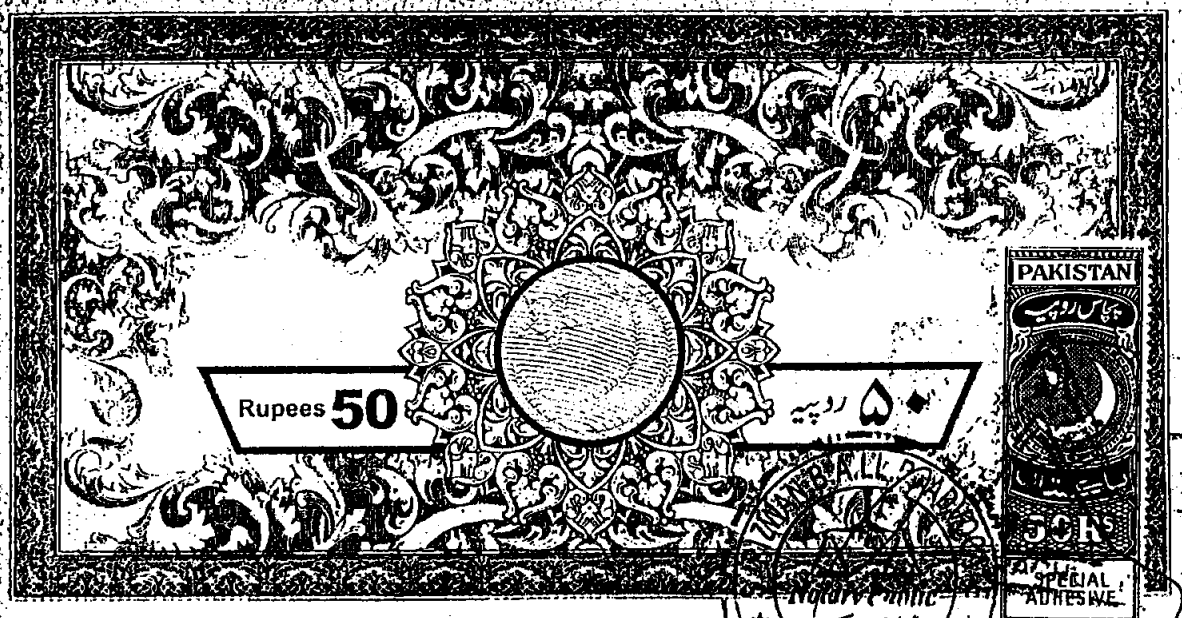
(c) The Company Secretary be and is hereby authorized to prepare an extract of this resolution for the purposes of submitting the same with the National Electric Power Regulatory Authority along with the Tariff Petition.

CERTIFIED TO BE TRUE COPY

Muhammad Hashim Khan
Company Secretary

DHA COGEN LTD. KARACHI

COPY OF AFFIDAVIT



ASGHAR ALI STAMP VENDOR
Licence No. 3 Stall No. 38, City Court Karachi
S. No. 2650 Date
Issued to Mr. ZAFAR ALAM
Through ADVOCATE
Purpose
Paid Rs. Signature
Stamp Vendor's Signature

13 SEP 2012

ATTENDENT OF STA
STAMP OFFICE, CITY COURT
KARACHI

BEFORE

THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

12 SEP 2012

AFFIDAVIT

AFFIDAVIT of MR. NAZDOR BAIG, 60, authorized representative of M/S DHA COGEN LIMITED, DSL-1, Coastal Avenue, Phase VIII, DHA, Karachi, Pakistan.

I, the above-named Deponent, do hereby solemnly affirm and declare that:-

1. I am the Chief Executive Officer of M/S DHA COGEN LIMITED, DSL-1, Coastal Avenue, Phase VIII, DHA, Karachi, Pakistan.

2. I am the authorized representative of M/S DHA COGEN LIMITED, DSL-1, Coastal Avenue, Phase VIII, DHA, Karachi, Pakistan.

3. The contents of the accompanying Tariff Petition dated 13 September, 2012, including all supporting documents are true and correct to the best of my knowledge and belief, and nothing material or relevant thereto has been concealed or withheld there from.

4. I also affirm that all further documentation and information to be provided by me in connection with the aforesaid Tariff Petition shall be true and correct to the best of my knowledge and belief.

DEPONENT

VERIFICATION

It is hereby verified on solemn affirmation at Karachi, Pakistan on this 13th day of September, 2012, that the contents of the above Affidavit are true and correct to the best of my knowledge and belief, and that nothing material or relevant thereto has been concealed or withheld there from.

15 Sep 2012

ATTESTED
SHAHZAD RIZWAN
ADVOCATE HIGH COURT
and Notary Public
CITY COURT KARACHI

DEPONENT

COPY OF BANK DRAFT

faysal

Payee's Account Only

Pay Order No.: 0127586
Date: 16-SEP-12

0106-F-7 J.SUPER MKT BR. ISLAMABAD

Not Over: PKR 712,704.00

PAY TO THE ORDER OF

PAKISTANI RUPEE SEVEN HUNDRED TWELVE THOUSAND SEVEN HUNDRED FOUR ONLY**

PKR 712,704.00

PURPOSE

1157615

Payable at any branch of Faysal Bank Limited in Pakistan.

Authorised Signature

Authorised Signature

⑈1157615⑈ 060016⑆0000000000⑈020⑈

TABLE OF CONTENTS

1. DETAILS OF THE PETITIONER

NAME AND ADDRESS

M/s DHA Cogen Limited
ADDRESS: DSL-1, Coastal Avenue, Phase VIII, DHA, Karachi
Phone #: +92-21-5869787 - 8
Fax #: +92-21-5860895

REPRESENTATIVES OF M/S DHA COGEN LIMITED

- **Mr. Nazoor Baig**
  Authorized Representative, DHA Cogen Limited

2. REGULATORY FRAMEWORK LEADING TO TARIFF PETITION

2.1. NATIONAL ELECTRIC POWER REGULATORY AUTHORITY – THE COMPETENT AUTHORITY FOR DETERMINATION OF TARIFF

2.1.1. NEPRA Act & NEPRA Rules

Under the Regulation for Generation, Transmission and Distribution of Electric Power Act (XL of) 1997 (the **NEPRA Act**), the National Electric Power Regulatory Authority (**NEPRA**) is responsible, inter alia, for determining tariffs and other terms and conditions for the supply of electricity through generation, transmission and distribution. NEPRA is also responsible for determining the process and procedures for reviewing tariffs and recommending tariff adjustments. Further, pursuant to the provisions of the NEPRA Act, the procedure for filing a tariff petition and award of tariff determination have been prescribed in the NEPRA (Tariff Standards and Procedure) Rules, 1998 (the **NEPRA Rules**) .

2.2. BASIS FOR SUBMISSION

DHA Cogen Limited **(DCL)** a 94MW (gross) gas-fueled power plant located at DSL-1, Coastal Avenue, Phase VIII, DHA, Karachi (the **Project**), has executed a memorandum of understanding with Karachi Electric Supply Company (**KESC**) for sale of electricity generated by the Project (the **MoU**).

Pursuant to the relevant provisions of the NEPRA Rules, read with the provisions of the NEPRA Act and the rules and regulations made there under: **DHA Cogen Limited submits herewith** (under Section 3(1) of NEPRA Rules) before NEPRA, the competent regulatory authority lawfully authorized to determine tariff for power generation companies, a tariff petition (the **Tariff Petition**) for approval of the following:

i. Reference generation tariff (the **Reference Generation Tariff**);
ii. Indexations and escalations;
iii. Onetime adjustments upon achievement of Commercial Operations Date (**COD**): and
iv. Other matters set out in this Tariff Petition, in each case, for DHA Cogen Limited's 94 MW power generation facility located at Phase VIII, Karachi.

3. EXECUTIVE SUMMARY

Subject to the assumptions contained in this Tariff Petition, please find below a summary of the Project for NEPRA's perusal:

Project Company	DHA Cogen Limited (**DCL** or the **Company**)
Major Sponsors	Sacoden Investments (Pte) Limited Singapore. Defence Housing Authority (**DHA**), Faysal Bank Limited and Optima Trading
Project Capacity	94MW (gross) 80.3MW (net)
Interconnectivity	132 KVA – evacuation of power from DCL sub-station located on DCL site is the responsibility of KESC
Project Location	DSL-1, Coastal Avenue, Phase VIII, DHA, Karachi
Plant Type	Combined cycle natural gas fired power plant with an associated seawater desalination plant
Technology	Siemens Combustion Gas Turbine (**GT**) type (SGT 1000F) (former V64.3A ECONOPAC) with Hitachi Babcock Heat Recovery Steam Generator (**HRSG**), Steam Turbine (**ST**) type NK 40/56, and Two Units of Desalination
Concession Period	25 years from execution of the Power Purchase Agreement
Power Purchaser	Karachi Electric Supply Company Limited (**KESC**)
Fuel Type	Natural Gas
Plant Factor	65%
Energy Production	457,228 MWh per annum
Rehabilitation Provider	Tenaga Nasional Berhad (**TNB**) Remaco

<table>
<tr><td>Funds Utilization</td><td>
<table>
<tr><th>Cost Heads</th><th>USD</th></tr>
<tr><td>Repayment of Existing Debt</td><td>32,623,556</td></tr>
<tr><td>Mezzanine Loan Purchase and Settlement of Trade Payable</td><td>3,936,954</td></tr>
<tr><td>Startup Costs</td><td>3,171,795</td></tr>
<tr><td>Rehab Cost</td><td>9,767,695</td></tr>
<tr><td>Fee and Expenses</td><td>500,000</td></tr>
<tr><td>Total (excluding IDC)</td><td>50,000,000</td></tr>
<tr><td>Interest During Rehabilitation Period</td><td>1,500,000</td></tr>
<tr><td>Total (including IDC)</td><td>51,500,000</td></tr>
</table>
</td></tr>
<tr><td>Funding Plan</td><td>DCL will borrow an amount of US$50,000,000 from the Overseas Private Investment Corporation in the form of senior secured debt for extinguishing existing debt, rehabilitation and plant startup.</td></tr>
<tr><td>Lenders</td><td>Overseas Private Investment Corporation (OPIC)</td></tr>
<tr><td>Key terms of Long Term Loan</td><td>
<table>
<tr><td>Currency</td><td>US Dollars</td></tr>
<tr><td>Interest Rate</td><td>6% per annum (fixed)</td></tr>
<tr><td>Repayment Term</td><td>15 years</td></tr>
<tr><td>Grace Period</td><td>1 year</td></tr>
<tr><td>Debt Repayment</td><td>Equal quarterly installments</td></tr>
</table>
</td></tr>
<tr><td>Long Term Service Agreement (LTSA) Contractor</td><td>TNB Remaco</td></tr>
</table>

Operation Costs	**Energy Purchase Price (PKR per annum)** Fuel: 1,707,353,793 Variable O&M: 80,164,550 **Capacity Purchase Price (PKR per annum)** Fixed O&M: 315,681,833 LTSA: 409,500,000 Insurance: 90,000,000 Return on Equity: 178,502,651 Debt Service: 439,843,903 WC Fee: 24,909,200 DSRA: 2,199,220 **Total Cost: 2,629,808,595**
Levelized Tariff	PKR 6.9284 / kWh
Concession Documents	• Power Purchase Agreement • Gas Supply Agreement • Water Purchase Agreement
Technical Advisors	TNB Remaco, Fichtner, PF Engineers
Financial Advisors	Bridge Factor
Legal Counsel	Mohsin Tayebaly & Co.
Commercial Operations Date (COD)	8 months after financial close, whereas financial close is expected to be within 90 days after NEPRA decision.

4. PROJECT BACKGROUND & WAY FORWARD

4.1 BACKGROUND

Incorporation of DCL

DCL is a specific purpose company incorporated in Pakistan to put up the country's first integrated power generation and desalination unit. DCL was initially sponsored by Defence Housing Authority and Sacoden Investments (Pte.) Limited, Singapore. DCL was incorporated with an envisaged ownership structure whereby the principal sponsors (M/s. Sacoden Investments and M/s DHA) took up 51% equity of the company while the balance 49% equity had been privately placed amongst leading financial institutions/investment banks.

The Company was incorporated on 29th January, 2003 with the objective to design, finance, insure, build, own, operate and maintain facilities for both, generation and supply of electricity to KESC and supply of potable water to Defence Housing Authority (**DHA**) / Cantonment Board Clifton (**CBC**).

Siemens was appointed as the EPC and O&M Contractor for the Project. Due to Siemens' involvement and strong project fundamentals, investors from Singapore took up a majority stake in the Company. Subsequently, DHA also participated in the equity of the Project. The power plant and desalination facilities were constructed during May, 2005 to April, 2008 and commenced commercial operations in April, 2008.

Technical Summary and Project Contractors

The power generation unit consists of a combined cycle power block comprising of a Gas Turbine and a Steam Turbine with installed capacities of 67 MW and 27 MW, respectively (combined capacity of 94MW at ISO conditions), and a Heat Recovery Steam Generator.

The Project has a net generation output of 80.3MW. The excess heat (unutilized) from the power plant will be used to run the desalination plant. The water desalination unit consists of two Multi Effect Desalination Plants (**MED**) having a capacity of 1.5 million gallons per day (**MGD**) each.

For initial development of the power generation facility, the Company entered into an equipment supply contract with Siemens A.G. for the supply of GT, ST and HRSG. The balance of plant works were carried out under a separate agreement executed between the Company and LINCAS (a subsidiary of Siemens A.G.). Similarly, the desalination equipment was procured through a contract with Alfa Laval (Denmark).

The Company also entered into an Engineering Design and Construction Contract with Siemens A.G. and Siemens Pakistan for detailed engineering design and construction supervision. Further, DCL entered into an O&M contract with Siemens Pakistan to appoint the latter as the plant operator post commercial operations.

Project's Original Cost and Financial Structure

The estimated cost of the Project was USD 99.91 million and was envisaged on a capital structure of 75:25 (debt: equity). The entire debt amounting to approximately USD 74.42 million was raised from local financial institutions in the form of a local currency long-term loan having a 2 year grace period and 10 year stepped up principal repayment structure payable on quarterly basis.

Generation License and Reference to Previous Tariff Petition

DCL was awarded a generation license for production of electricity through utilization of natural gas in 2005. Subsequent to filing an application for award of a generation license DCL submitted its application for award of tariff to NEPRA on September 4, 2004. The tariff requested under the petition was based on the rate agreed between KESC and the Company. The petition was formally admitted on September 15, 2004 and assigned case number NEPRA/TRF-33/DCL.

Based on the aforementioned agreement on tariff between KESC and the Company, NEPRA granted DCL the tariff requested in its petition, as is.

Operational History

The Project was successfully commissioned at the start of 2008 and achieved commercial operations in April, 2008. Since COD, the Gas Turbine suffered problems related to rotor-vibration and compressor surge.

During May, 2008, increasing vibrations in the GT bearings had been detected; this reached alarming levels i.e. beyond 9.5 mm / sec in June, 2008. In July, 2008, Siemens suggested balancing of the rotor to fix the vibration problem. Several attempts were made by Siemens AG during August, 2008. As a result of rotor balancing the vibrations were reduced to just below alarm limits, however, these remained above the acceptable range.

In September, 2008, the Company was intimated by Siemens that the vibrations could not be brought down to within the normal acceptable range due to deformation of the central hollow shaft connecting the compressor to the GT section. Siemens, therefore, decided on September 12th, 2008, to shut down the plant for replacement of the entire hollow shaft.

Siemens AG, at its own cost, changed the entire central hollow GT shaft and replaced all bearings, tilting pads, bearing supports, gas lines and manifolds, burner fittings, first stage burner blades and stage 2 vanes & blades. Additionally, four Inlet Guide Vanes (**IGV**) were also repaired. The rehabilitation of GT took place from October 13th, 2008, to July 23rd, 2009; DCL successfully resumed base load operation from August 14th, 2009.

Subsequent to recommencement of operation, the plant experienced a series of compressor surge problems starting from August 24th, 2009. The chronology of surge events is provided below:

First Surge (24-08-2009)

Grid Frequency reduced to a remarkably low figure (49.1 Hz). Although it was well within the designed operational limit of 49-51 Hz, still the GT tripped due to surge protection. As per Siemens AG advice several preventive measures were performed on the IGV position sensor to bring the Project back online on August 28th, 2009.

Second Surge (29-08-2009)

Grid Frequency decreased to 49.2 Hz. As a result, GT tripped for the second time due to surge protection. Boroscopic turbine inspections were conducted that showed damages to the GT. The IGV position sensor was replaced again and the Project was synchronized to the grid on September 16th, 2009.

Third Surge (17-09-2009)

GT tripped for the third time on surge protection under frequency drop. Boroscopic turbine inspections showed further damage to the GT. Following Siemens AG recommendations several settings related to the air valve, Over Temperature Control (**OTC**) and closing ratio of IGV were modified. These modifications seemed to be successful but reduced the base load output of the plant. The plant went back to commercial operation on October 17th, 2009.

Fourth Surge (02-11-2009)

Heavy grid disturbances due to short circuit and tripping of 132 kV parallel lines caused the GT to trip for the fourth time on surge protection. The actual grid frequency drop rate of 6.7 Hz/s exceeded the maximum design drop rate of 1 Hz/s. In order to avoid reoccurrence of surge and take further risks of damages M/S Siemens decided to open the machine for thorough checking and fact finding. Hence the plant was shut down on November 2nd, 2009. Siemens (in collaboration with their head office in Germany) in association with DCL plant engineers dismantled the GT to carry out a fact finding exercise.

The fact finding exercise revealed the following damages:

- Cracks in stator blades of compressor
- Damage to rotor blades and stator casing
- Damage to turbine bearings
- Damage to compressor casing

As a result, all rotor blades and vanes were polished and additional equipment was installed. Furthermore, a modified GT washing schedule to avoid the accumulation of

deposits (which was the main cause of the surge in Siemens AG's opinion) was introduced. The plant went back to base load operations on 01st February, 2010.

Fifth Surge (May, 2010)

A fifth surge event resulted in compressor damage and a subsequent forced outage of the power & desalination plant. The power & desalination plant only operated for nine (09) months after achievement of COD and has not been restarted to date. A detailed technical evaluation study conducted by Fichtner is attached as **Annex A** *(Technical Project Evaluation Report)*.

Impact on Power Purchase Agreement

The Power Purchase Agreement (**PPA**) is currently being renegotiated with KESC as the previously executed PPA between KESC and DCL stands terminated due to the non-operational status of DCL.

Status of Gas Supply Agreement

The Project was, as per the decision of the Economic Coordination Committee (**ECC**), allocated 17.5 mmcfd of gas with a minimum gross calorific value of 920 Btu per Standard Cubic Feet under the Gas Supply Agreement (**GSA**) executed between DCL and Sui Southern Gas Company Limited (**SSGCL**) on May 31st, 2005. It is pertinent to mention that the GSA remains valid & effective thereby ensuring firm supply of gas to DCL till 2015. Furthermore, an amendment to the GSA to ensure firm supply of gas until 2030 has been negotiated between DCL and SSGCL. A letter of comfort, issued by SSGCL, to this effect is attached herewith as **Annex B** along with a copy of GSA.

Water Purchase Agreement

As one of the key reasons for the development of the Project in DHA was supply of potable water to CBC, the Company entered into a Water Purchase Agreement (**WPA**) with CBC pursuant to which DCL is responsible for the supply of 3.0 MGD of potable water to CBC for a period of 30 years.

4.2 WAY FORWARD

Acquisition of Sacoden Investments by International Electric Power

International Electric Power, LLC (IEP), a US-based Independent Power Producer, has come to an agreement with AEI Asia, LTD., for the acquisition of Sacoden Investments PTE. LTD., a Singapore-based entity, which owns 60.22% of the shareholding of DCL The remaining shares of DCL are held by DHA, Faysal Bank Limited, Optima Trading and several smaller investors.

Based on their extensive experience as an IPP developer and operator, and in collaboration with world renowned technical consultants, IEP has developed a

comprehensive rehabilitation plan along with details of the technical and financial resources to be involved for the revival of DHA Cogen power project. A basic overview of the rehabilitation plan is provided below; details of the same are provided under Section 6 (*Project Cost*).

Arrangement of Debt for Rehabilitation & Restructuring of Existing Loans

In order to revive the Project the Company would, in addition to the rehabilitation plan detailed above, need to restructure the long term debt obtained in 2005 from local financial institutions for the development of the Project. To this effect IEP has secured a mandate letter with OPIC for arrangement of USD 50 million for DCL project.

The utilization of funds to be obtained from OPIC is briefly set out below (further details provided under Section 6 (*Project Cost*)):

Utilization of Funds	USD
Repayment of Existing Debt	32,623,556
Mezzanine Loan Purchase and Settlement of Trade Payable	3,936,954
Startup Costs	3,171,795
Rehab Cost	9,767,695
Fee and Expenses	500,000
Total	**50,000,000**

Further to write-off on the existing long term debt, the Project sponsors have agreed to a haircut on the original equity – PKR 1,755 million (USD 29.25 million, exchange rate PKR 60 / USD as per the time of actual equity injection) of 55% bringing the original base equity of the Project down to PKR 1,190 million (USD 13.22 million, exchange rate PKR 90 / USD).

The equity and debt write-offs have after thorough deliberation been accepted by all parties in order to revive the Project and make the tariff workable for KESC.

5. RATIONALE FOR REHABILITATION OF DCL

5.1 REHABILITATION PHILOSOPHY & MOTIVATION FOR IEP

IEP has a strong and experienced technical team that specializes in developing energy and power assets worldwide. It has built and/or operated over 25,000 MW of wind, solar, combined cycle gas, coal, diesel and hydro generation plants.

As owner-operators, IEP understands the complexities of developing power solutions in remote and challenging environments. This experience puts IEP in a position to realize the true value of DCL as an asset that is currently not utilized. With IEP's experience, a "good" asset like DCL can be rehabilitated to provide electricity and water to the city of Karachi.

For rehabilitating the Project, IEP has engaged TNB Remaco, a world class service provider that itself operates generation assets of 20,000 MW, to implement and conduct the rehabilitation. With IEP's oversight, the Project can be rehabilitated to achieve sustained generation to provide electricity to the city of Karachi.

Furthermore, IEP has larger investment plans for Pakistan and rehabilitation of this Project will lay the foundations for IEP's entrance into Pakistan and it intends to expand the existing DCL project into Phase II to further increase the generation capacity of the plant and clean water supply to the city of Karachi.

5.2 PAKISTAN'S CURRENT ELECTRIC POWER SHORTAGE

Pakistan currently has 21.593 GW of installed capacity for electricity generation. Conventional thermal plants (oil, natural gas, coal) account for 67.5% of Pakistan's capacity, with hydroelectricity making up 30.36% and nuclear 2.14%.

GOP estimates that by 2014, Pakistan will have to increase its generating capacity by more than 50% to meet the increasing demand. Pakistan's chronic energy crisis is jeopardizing its economic progress and social development. One of the major reasons for the energy crises are the lack of investment in power sector. It is imperative for Pakistan to look for energy resources for sustainable growth through self-reliance. Rehabilitation of the Project would help reduce energy shortages by ensuring supply of 80.3 MW of electricity to KESC, thereby displacing KESC's import from Water and Power Development Authority (**WAPDA**).

5.3 MEMORANDUM OF UNDERSTANDING EXECUTED WITH KESC

For the revival of the Project, the Sponsors have been in discussions with KESC for the past year in pursuit of a renegotiated PPA. Significant progress has been made in this regard – a MoU for purchase of net electrical output of DCL has been executed with KESC. The MoU also stipulates the tariff at which KESC has agreed to procure power from DCL – this tariff has been used as the basis for the filing of this Tariff Petition. Copy of the executed MoU is attached as **Annex C**. However, this Tariff

Petition is filed to NEPRA requesting for review and approval of the said tariff as per this Tariff Petition.

5.4 DEFENCE HOUSING AUTHORITY'S WATER SHORTAGE

As highlighted above, the Project is responsible for supplying 3.0 MGD of potable water to CBC for onward supply of water to DHA. One of the main issues faced by CBC in respect of water management has been the gap in supply and demand of potable water.

Currently, DHA's water demand is fulfilled by only one source namely Karachi Water & Sewerage Board (**KW&SB**). The total water demand experienced by CBC for DHA alone is 11.52 MGD, whereas, the total current supply from KW&SB is only 7 MGD leading to a deficit of 4.52 MGD. Rehabilitation of DCL would ensure operations of its water desalination unit (which has the capacity to supply 3 MGD) thereby assisting CBC in addressing the acute water shortage being faced in DHA and adjoining areas. Rehabilitation of DCL would also enable the development of phase II of the project, which would enable additional electric power and potable water production beginning as early as 2015.

5.5 EXPERIENCED SPONSORS WITH EXPERTISE IN POWER SECTOR

International Electric Power

IEP is a privately held U.S. firm, headquartered in Pittsburgh, Pennsylvania, that specializes in developing energy and power assets worldwide. IEP builds, owns and operates power generation and energy assets in emerging markets and developing countries, with a focus on reducing the energy dependence of host nations on expensive imported fuel and mitigating energy shortages to fuel economic growth. IEP engages in transactions that have significant positive social, as well as economic impact on host nations.

IEP's management team has a proven track record in large transactions along with extensive experience in hedging, financing, structuring, operating and monetizing power assets. The management of IEP consists of well recognized experts in utility management, power generation and international project development. The Sponsors have built and/or operated over 25,000 MW of wind, solar, combined cycle gas, coal, diesel and hydro generation plants. As owner-operators, IEP understands the idiosyncrasies of developing power solutions in remote and challenging environments. In close cooperation with local partners, IEP routinely works with world class engineers, technology providers and contractors to derive energy solutions which are deemed to be "technology agnostic", stressing the right solution for the unique requirements of individual countries. IEP understands how to conduct feasibility assessments and develop commercially viable power projects that meet the expectations of financial stakeholders.

Team Details

Peter Dailey

Peter Dailey, Chairman and CEO at IEP, has over 20 years of experience in the power and energy industry and has closed transactions with a combined worth of over $2.5 billion. Mr. Dailey received the "Deal of the Year" award in 2007 in London from Project Finance & Risk for negotiating and executing the La Paloma equity structure. Mr. Dailey has carved a reputation on Wall Street as honest and smart. Through his experiences in the industry, Mr. Dailey has acquired knowledge and experience about various types of generation technologies and associated fuels such as renewables, oil, natural gas, coal and uranium as well as operations and maintenance. Mr. Dailey received his J.D. in Law from the University of Pittsburgh and Bachelors of Science from the University of Pennsylvania.

Enzo M. Zoratto

Enzo Zoratto, President and COO of IEP, is a registered professional engineer with over 25 years of successful P&L performance in the infrastructure, environmental and logistics fields. He has successfully built, led and managed several multi-national companies and is recognized for his ability to conceptualize and implement successful growth strategies.

Steven Adelkoff

Steven Adelkoff, CFO and Executive Vice President at IEP, has worked in all aspects of the power, alternative energy and commodities industries for over two decades. He has led teams negotiating domestic and international transactions involving commodities, power generation development, renewable energy development, and commodity exploration. Mr. Adelkoff's diverse skill set has allowed him to meld legal, regulatory, tax and accounting aspects of transactions to achieve world-class results. Mr. Adelkoff received his J.D. in Law from the University in Pittsburgh and an undergraduate degree from Rutgers University. In addition, Mr. Adelkoff holds an MBA degree from Cornell University.

James ("Jim") Crisanti

Jim Crisanti, Senior Vice President at IEP, has over 10 years of working experience on Wall Street as a power and utility investment banker. He has led or participated in over $10 billion worth of transactions for the development and/or acquisition financing of power generating projects. At IEP, Mr. Crisanti is responsible for leading teams involved in the economic analysis and execution of material agreements necessary to achieve financial close for a variety of domestic and international energy-related projects. Mr. Crisanti received his MBA from Massachusetts Institute of Technology (MIT) and a BS in Electrical Engineering from Washington University in St. Louis.

Nazoor Baig

Nazoor Baig, Senior Vice President of Operations at IEP, is an accomplished power sector engineer with over 30 years of work experience. As an Executive Director of Engineering and a Director of Operations at DTE Energy in Michigan, Mr. Baig was responsible for operations and maintenance of over 10,000MW of generating assets with annual budget totaling in excess of US$1 Billion. Mr. Baig has been a recipient of the Alex Dow Award, Sarah Sheridan Award and Asian American Achievement Award and has patents awarded in his name in the energy sector. Mr. Baig received his BS in Electrical Engineering from Detroit Institute of Technology.

Fahad Qureshi

Fahad Qureshi, Vice President at IEP, is responsible for conducting financial and legal due diligence and execution of material agreements in connection with IEP's development and/or acquisition financing of power generation and energy assets. Prior to IEP, Mr. Qureshi worked in the M&A group of a leading industrial corporation and provided advisory services to several clean tech firms. Mr. Qureshi received his MBA from Carnegie Mellon University and BS in Computer Science from the University of Virginia.

Bryan Tamburro

Bryan Tamburro, Vice President Pakistan Development at IEP, has over 14 years of international relations and program management experience and is a recognized knowledge leader on South Asia. He started work in university development at the Massachusetts Institute of Technology in Cambridge, MA and then came to Carnegie Mellon University to develop and implement an international relations program and serve as CMU's Heinz College Senior Director for Strategic Initiatives. Mr. Tamburro received his BA from Clark University in International Relations.

5.6 ESTIMATED OUTPUT

GAS TURBINE	Siemens Combustion Gas Turbine type (SGT 1000F) (former V64.3A ECONOPAC)
STEAM TURBINE	Steam Turbine type NK 40/56
HEAT RECOVERY STEAM GENERATOR	Hitachi Babcock Heat Recovery Steam Generator
TOTAL INSTALLED CAPACITY	80.3 MW (net)
PLANT FACTOR	65%
HEAT RATE [1]	7,700 BTU/kWh
ANNUAL ENERGY PRODUCTION (NET)	457,228 MWh per annum

[1] Source: Heat Rate/Efficiency review for DHA DCL-Karachi – issued by PF Engineers attached as **Annex D**

6. PROJECT COST

6.1 SUMMARY OF COSTS

For the purposes of this tariff petition an exchange rate of PKR 90 per USD has been assumed.

Cost Heads	USD
Repayment of Existing Debt	32,623,556
Mezzanine Loan Purchase and Settlement of Trade Payable	3,936,954
Startup Costs	3,171,795
Rehab Cost	9,767,695
Fee and Expenses	500,000
Total (excluding IDC)	**50,000,000**
Interest During Rehabilitation Period	1,500,000
Total (including IDC)	**51,500,000**

6.2 REPAYMENT OF EXISTING DEBT

The total debt payable by the Company to various local financial institutions amounts to PKR 6,673 million. As per the restructuring plan, local financial institutions have agreed to write off 56% of the outstanding debt against a bullet payment of PKR 2,936.12 million (USD 32.623 million) to be made by the Project at the time of achievement of financial close.

6.3 MEZZANINE LOAN PURCHASE AND SETTLEMENT OF TRADE PAYABLE

IEP will be paying an amount of US$ 3,936,954 at financial closing to AEI Asia and SSGCL for settlement of outstanding trade payables and buyout of a US$6,037,573 loan obligation to Sacoden under which DCL is currently in default. DCL had defaulted in its payment obligations to SSGCL for consumption of gas and has agreed to a negotiated settlement of certain past dues at financial closing with the rest paid over a period of 15 years from the shareholder's profit cash flows.

6.4 STARTUP COSTS

Scope of work and associated costs related to Start-Up activities has been identified by plant personnel and not covered under the rehabilitation agreement with TNB Remaco.

Start-Up costs amount to US$3,171,795 and comprise of the following components:

1. Work identified by plant personnel = US$1,813,968.

    - Steam turbine – Inspection and perform necessary routines on valves, controls and instrumentation calibration, complete back log of work
    - Gas Compressor – Over haul, routines and start up activities, cleaning out of the supply system
    - Sea water intake – Cleaning and back flush intakes, perform routines and repairs on filtration systems
    - Boilers – removing the boiler and feed water system from lay-up status, repair insulation, hydro static testing, perform routines for certifications
    - Main generator – Inspections and perform required electrical testing before start up
    - Other – De-mothball the plant, inspection and repairs of pumps, breakers, instrumentation, chemicals and lubrications for all other systems.

2. Contingency for additional scope of work 30% = US$544,190

    - Most of the work identified above is based on known problems and is routine work. We expect the scope of work to increase once we are in the rehabilitation outage, as is the case in all-major outages.
    - Our concern is with the lay-up of the plant, where there have been problems with humidity control due to power outages.

3. Total Operating and Maintenance Costs during rehabilitation period = US$813,637

    - All activities associated with plant operating and maintenance personnel for a period of 6 months

6.5 REHABILITATION COST

Under the Rehabilitation plan, TNB Remaco will focus on Gas Turbine and associated equipment with an estimated cost of US$9,767,695.

The scope of works and cost estimates covers (but not limited to):

- Labor, parts, tools, technical advisors, consumables, taxes, etc.

- Replacement of Compressor blades and vanes with coated blades and vanes to prevent corrosion build-up to maintain efficiency and avoid surge problems due to grid frequency drop
- Rebuilding of Inlet guide vanes and drive mechanism overhaul.
- Control system redundancy, calibration of relays and trip string check-out for asset protection.
- Air inlet modifications to eliminate by-passing, addition of moisture separator, upgraded filters and online filter replacement capabilities.
- Permanent repairs to dehumidification system to prevent corrosion and build up while the GT is not in operation.

Summarized cost estimates for the rehabilitation plan are presented in the table below - A copy of the initialed rehabilitation term sheet is attached as **Annex E.**

All Figures in US$

Item	Cost	Duty, Taxes and Insurance	Total
Labor & Tools	1,951,953.35	390,390.67	2,342,344.02
GT Parts	2,651,939.60	609,946.11	3,261,885.71
Technical Advisors	820,720.38	123,108.06	943,828.44
Cone & Consumables	607,887.44	139,814.11	747,701.55
Specialty Tools	599,076.00	227,648.88	826,724.88
Air Intake Modifications	397,896.00	59,684.40	457,580.40
Filters	67,000.00	15,410.00	82,410.00
Control & Instruments	556,602.00	83,490.30	640,092.30
Total	**7,653,074.77**	**1,649,492.53**	**9,302,567.30**
Contingency	5%		465,128.36
Total Rehabilitation Cost			**9,767,695.66**

6.6 FEES & EXPENSES

This represents the cost of local and foreign legal counsel engaged by DCL for:

- Negotiating PPA with KESC;
- Negotiating GSA with SSGC;
- Preparation of Tariff Petition;
- Negotiating the LTSA with TNB Remaco;
- Negotiating rehabilitation contract with TNB Remaco;
- Debt restructuring with local financial institutions; and
- Engagement with OPIC for arrangement of financing.

6.7 INTEREST DURING REHABILITATION PERIOD

The interest during the rehabilitation period has been estimated on the basis of draft term sheet currently under negotiations with OPIC. A fixed interest rate of 6% has been assumed for the purposes of this Tariff Petition (kindly refer to note provided in Section 7.3 (*Debt Servicing*)). The Project does not expect any variations in this cost and would therefore request that the same be allowed as a fixed charge i.e. not subject to adjustment upon achievement of COD.

7. PROJECT FUNDING STRUCTURE (DEBT &EQUITY)

7.1 CAPITAL STRUCTURE

The capital structure of the Project based on the OPIC loan of USD 50 million to be obtained for revival of the Project and using the original base equity of PKR 1,755 million (USD 29.25 million, exchange rate PKR 60 / USD as per the time of actual equity injection) comes to 63:37 (debt: equity). However, keeping in view the distressed status of the Project the owners of DCL have agreed to a haircut in equity of 55% bringing the original base equity of the Project down to PKR 1,190 million (USD 13.22 million, exchange rate PKR 90 / USD) resulting in a debt: equity of 79:21.

	AMOUNT IN US$
DEBT	50,000,000
EQUITY	13,222,419
TOTAL PROJECT COST	**63,222,419**

7.2 RETURN ON EQUITY

Based on past-precedents DCL is aware that NEPRA has allowed a maximum return on equity of 15% (net of withholding tax) to similar thermal power projects.

Keeping in view the precedents set by NEPRA with regard to return on equity (net of withholding tax) and as agreed with KESC under the terms of the MoU, DCL would request NEPRA to allow PKR 0.3904 / kWh as ROE component to the Project.

In addition to the aforementioned ROE component, as part of discussions held with KESC, the DCL shareholders have agreed to an additional haircut of PKR 0.05 / kWh from year 16 onwards (once the debt and trade payables are paid off). This results in a levelized ROE component of PKR 0.3823 / kWh.

It is imperative to highlight at this point that while debt of USD 50 million in debt is to be arranged from OPIC for the revival of the Project, as agreed with KESC, USD 47.465 million has been used to determine the debt component payable to the Project. The onus for making payments to OPIC against the differential in debt servicing, which amounts to USD 409,823 per year and consequently reduces the debt component of the tariff by PKR 0.0807 / kWh, is to be managed by DCL through its internal cash flows. This effectively lowers the Sponsor's IRR, based on a levelized ROE of PKR 0.3823, from 14.15% to 10.95%.

Furthermore, trade payables close to PKR 0.85 billion due to various creditors of DCL shall also be settled by DCL through its internal cash flows over the tenor of the loan. The payments to the SSGC translate into PKR 0.1239 / kWh and reduce the Sponsor's IRR by an additional 4.93%.

Keeping in view the differential in debt servicing and the payments to the SSGC, the Sponsor's net realizable IRR, based on the levelized ROE component of PKR 0.3823 / kWh, is 6.02%.

7.3 DEBT SERVICING

Given the fact that the Project had originally obtained 100% financing (of the debt amount) through local financial institutions for the development of the Project in 2005, and the fact that local financial institutions have not since been repaid any part of the principal amount, no local financiers were willing to provide additional financing for revival of the Project (including restructuring of loans or working capital facilities).

IEP, being a US-based firm, has been able to obtain interest from US multilateral bank, namely Overseas Private Investment Corporation (OPIC), for arrangement of the requisite debt funding for revival of the Project. A draft of the term sheet currently under negotiation with OPIC is attached as **Annex F**. Key terms of financing have been reproduced below for ready reference:

PRINCIPAL AMOUNT	USD 50,000,000
DRAWDOWN PERMITTED	One – at achievement of financial close
INTEREST RATE	6% per annum
TERM	15 years
REPAYMENTS	Equal quarterly payments
INTEREST ONLY PERIOD	1 year

Kindly note, *since the term sheet is still under negotiation with OPIC, DCL hereby requests NEPRA to allow a reopener with regards to the interest rate finalized with OPIC at the time of achievement of financial close. Notwithstanding the immediately preceding sentence, the sponsors are hopeful that no change in the financing terms would be required by OPIC subsequent to the submission of this Tariff Petition.*

As mentioned in the immediately preceding Section even though a debt of USD 50 million is to be obtained from OPIC the debt component agreed with KESC and forming part of the Reference Generation Tariff requested in this Tariff Petition is based on a total debt amount of USD 47.465 million.

8. OPERATION COST

8.1 SUMMARY O&M COST

The structure of the reference tariff comprises of the Energy Purchase Price and Capacity Purchase Price as per the local power sector norms. Summarized break-up of costs expected to be incurred under each of these categories is provided below:

Cost Heads	PKR per Annum
Energy Purchase Price	
Fuel	1,707,353,793
Variable O&M	80,164,550
Capacity Purchase Price	
Fixed O&M	315,681,833
LTSA	409,500,000
Insurance	90,000,000
Return on Equity	178,502,651
Debt Service	439,843,903
WC Fee	24,909,200
DSRA	2,199,220
Total Cost	**2,629,808,595**

8.2 ENERGY PURCHASE PRICE

As per local power sector norms, the Energy Purchase Price (**EPP**) component of DCL tariff comprises of:

- Fuel Cost; and
- Variable O&M

8.2.1 FUEL COST

The fuel cost estimate used for the purposes of this tariff petition is based on the following assumption: an.

Cost of Gas (PKR / MMBTU)	437.86
Heat Rate (BTU / kWh)	7,700
HHV / LHV Ratio	1.107553
Total Cost of Fuel (PKR / annum)	**1,707,353,793**

As explained under Section 5.6 (*Estimated Outputs*) the heat rate used for determining the fuel cost was negotiated between KESC and IEP and is within the range based on

the heat rate efficiency evaluation carried out by PF Engineers (USA). The report issued by PF Engineers is attached as **Annex D.**

8.2.2 VARIABLE O&M

Variable O&M costs are expenses related to the ongoing upkeep of the power block and amount to PKR 80,164,550 per annum.

A breakup of the costs is provided in the table below:

Cost Heads	PKR per Annum
Chemicals and Lubricants	20,620,000
Consumables	25,380,000
Preventive and corrective maintenance	7,136,000
Routine spares	8,400,000
Contractor's Cost for services to be contracted	11,220,000
Training - Local and abroad	5,408,550
Lube Oil change for GT/ST	2,000,000
Total Variable O&M Cost	**80,164,550**

8.3 CAPACITY PURCHASE PRICE

The Capacity Purchase Price of DCL tariff comprises of the following components:

- *Escalable Component*
  - Fixed O&M
  - Long Term Service & Supply Agreement
  - Insurance
  - Return on Equity
- *Non-Escalable Component*
  - Debt Servicing
  - Working Capital Fee & Interest
  - Debt Service Reserve Account

8.3.1 ESCALABLE COMPONENT: FIXED O&M

Break-up of the Fixed O&M cost is provided below:

Cost Heads	PKR per Annum
Payroll	*158,981,321*
Salaries and other allowances	108,171,000
Medical and LFA	10,817,100
Bonus	10,817,100
Vehicle maintenance	9,789,115
Vehicle Lease	7,488,196

Cost Heads	PKR per Annum
Mobile facility	1,081,710
Employee Group Life Insurance	540,855
EOBI	540,855
Food expenses	8,653,680
Staff Uniform (twice a year for 100 employees)	1,081,710
Advisor's Fee	*90,000,000*
Annual CAPEX	***157,793,948***
Administrative & Other Expenses	*27,993,710*
Sewerage Water Tanker	252,000
General supplies	960,000
Water	100,000
General repair and maintenance	600,000
Security services	12,000,000
Electricity line rent and usage for startups	10,000,000
Land Lease	3,000,000
Entertainment fund	1,081,710
EHS Department	*5,110,000*
Personnel Protective Equipments	400,000
Refilling of Portable Fire Extinguishers	200,000
First Aid Items	100,000
Printing of Work Permit Books	50,000
Printing of JSA Books	50,000
Printing of Tags	20,000
Safety Training once in two months	250,000
Environmental Monitoring on Quarterly Basis	1,000,000
Spill Kits	150,000
Fumigation Services once in two months	100,000
Waste Management	700,000
EHS Audit costs	1,000,000
Medical Examination & Vaccinations	500,000
Misc. Items	500,000
Safety Videos	90,000
IT Equipment	*900,000*
Network and general accessories	700,000
Trainings	100,000
Telephone accessories	100,000
Additional O&M	*15,087,500*
Total Fixed O&M	**455,866,479**
Reduced by Cost of Desal	***(140,184,646)***
Net Fixed O&M	**315,681,833**

Fixed O&M – Payroll Expense

Payroll expense for the Plant is PKR 158,981,321 per annum and constitutes approximately 35% of total fixed O&M cost. This cost includes salary and associated human resource expenses for seven (7) management level personnel, sixty six (66) professional/skilled employees and thirty two (32) unskilled positions.

This payroll expense is crucial to engage the human resource necessary to run and maintain the plant.

The following points highlight the salient features for which the payroll expense is to be incurred:

a. This power plant was constructed with practically no redundancies and very little automation, requiring manpower to operate a number of systems manually, which requires a higher level of staffing

b. Over a period of 2 years, since its last shutdown, approximately 50% of the staff has left the plant for better opportunities. This along with the lower expertise level of some of the newer staff will require considerable training, and we expect higher turn-over

c. These estimates include salaries, medical coverage, bonuses, vehicles, insurance, uniforms, etc.

d. Due to the location of the facility, i.e. on reclaimed land immediately adjacent to the Arabian Sea, the humidity level is high and very corrosive requiring a full time crew to continually paint the assets for external preservation.

e. Also due to the high silting problem and potentially marginal design of the micro giant and fine filter, this plant has a crew that repairs these filters 24 hours a day and every day the plant is in operation.

f. Due to the high moisture levels, and high dust loading from property development around the site, this plant has had to replace air intake filters every two to three weeks, requiring shutdown and associated human resource expense for these replacements.

For items (d), (e) and (f) above, the plant has engaged 24 people to maintain these areas

Fixed O&M – Annual CAPEX

Annual CAPEX expense for the Plant is PKR 157,793,948 per annum and also constitutes approximately 35% of total fixed O&M cost.

The annual CAPEX expense figure is the average of the total cost to be incurred each year over a period of six (6) years and has been calculated keeping in view the cyclical nature of the outages and corresponding plant improvement projects.
The following points highlight the salient features and activities covered under the Annual CAPEX expense:

a. Along with virtually zero redundancies, there are no repair shops, and there are no spare parts at this facility. We are addressing these issues to ensure reliable plant operations

b. To ensure high availability, by reducing Mean Time To Repair (MTTR), we have added strategic spares for all the systems critical to the operations of the facility

c. Some of the key areas of focus (but not limited to) over the next 6 years are;

- HRSG
- Generator brushes/CTs/PTs
- Desalination: as it is also a condenser for the steam turbine
- Sea water intake screens and filters
- Air intake filters
- Debris filter for the dump condenser
- Batteries and transformers
- Security systems Sea wall repairs and dredging

Fixed O&M – Reduction by Cost of Desal

As shown in the Fixed O&M cost break down table, the total Fixed O&M cost is reduced by PKR 140,184,646 which represents the costs associated with the Desalination plant. This reduces the overall fixed O&M cost component and brings it down from PKR 0.997/kWh to PKR 0.690/kWh.

The design of the plant does not allow complete separation of the power and desalination systems. To separate the costs associated with desalination, we looked at two approaches:

- One approach was to look at the total cost of the plant as installed and calculate a percentage allocated to desalination system, which is 17.84% of the total installed capital costs.

- The second approach in which we applied a line-by-line evaluation of the forecasted budget and applied engineering judgment on percentage usage by each system. By this method we allocated from 20% up to 100% to the desalination system on various line items.

We chose the allocation methodology, and have made appropriate arrangements in the water tariff and the associated agreement.
Items included (but not limited to) in this estimate include:

- The two trains of desalination equipment
- Chemicals
- Legal
- Land lease
- Electrical & valves
- Re-mineralization, sea water treatment, potable water system and fine filtration

8.3.2 ESCALABLE COMPONENT: LONG TERM SUPPLY AGREEMENT

The Company has entered into an LTSA with TNB Remaco at a cost of USD 4.55 million (PKR 409.5 million) per annum, for a period of 10 years. For the purposes of determining the tariff, the LTSA component has been included for a period of 25 years as DCL is expected to either extend the contract with TNB Remaco at the end of year 10 or carryout the maintenance work by itself, incurring similar costs.

A summary of the components covered under the LTSA is provided below – an initialed copy of the LTSA term sheet is attached as **Annex G:**

- Power Block
    - GT – inspections and over hauls based on OEM recommended intervals
    - ST – all scheduled outages at 4 to 5 years intervals
    - Generator – all scheduled major and minor outages every 4 years alternating
    - HRSG – yearly scheduled outages and certifications
    - Auxiliaries – yearly inspections or per maintenance regime developed based on site conditions and industry standards
- Balance of Plant – Complete overhauls every 4th year covering equipment not covered under GT, ST, Generator, and HRSG
- Personnel training along with providing for performance guaranteed and site support

8.3.3 ESCALABLE COMPONENT: INSURANCE

The Insurance Cost component consists of all-risk insurance/reinsurance for the Project. As machinery breakdown, natural calamities (such as earthquakes), sabotage and consequential business interruption are the biggest threat to the Facility and the Project Company, it is imperative that all aspects of the risk are covered adequately and no compromise is made in this respect. As is the common practice in project financing lending throughout the world, a comprehensive operational insurance and reinsurance arrangement is fundamental to the bankability of the Project.

The Company, in view of the practices set by other IPPs in Pakistan and in accordance with the requirements set out by OPIC, proposes to procure the insurances that will meet the requirements of its various stakeholders (including OPIC and the power purchaser) during the operational phase of the Project.

The Sponsor's insurance company estimates the Plant Insurance cost at PKR 90 million based on the performance track record of the Plant & previous insurance history of the Plant (Summary attached as **Annex H**) and covers (but not limited to):

a. Property Damage Insurance;
b. Comprehensive Machinery Insurance;
c. Business Interruption Insurance;
d. Terrorism; and
e. Motor Insurance.

8.3.4 ESCALABLE COMPONENT: RETURN ON EQUITY

Details of ROE component and the basis for the same have been provided under Section 7.2 (**RETURN ON EQUITY**); the component has only been mentioned here as it forms part of the Escalable Component of the Reference Generation Tariff.

8.3.5 NON-ESCALABLE COMPONENT: DEBT SERVICING

Details of the debt component and the basis for the same have been provided under Section 7.3 (**DEBT SERVICING**); the component has only been mentioned here as it forms part of the Non-Escalable Component of the Reference Generation Tariff.

8.3.6 NON-ESCALABLE COMPONENT: WORKING CAPITAL

The Working Capital component of the tariff comprises;

- Working Capital Line
- Working Capital for Fuel
- L/C to SSGC
- L/C to KESC

A breakdown of the costs and fees associated with the above is presented below:

All amounts in PKR

WC Facility	*RF Line*	*Fuel*	*L/C to SSGC*	*LC to KESC*
Amount	450,000,000	140,000,000	397,000,000	225,000,000
Interest - 15.50%	-	10,850,000	-	-
Commission - 1%	4,500,000	1,400,000	3,970,000	2,250,000
FED - 16%	720,000	224,000	635,200	360,000
Total Cost of Facility	**5,220,000**	**12,474,000**	**4,605,200**	**2,610,000**
Total WC Fees				**24,909,200**

8.3.7 NON-ESCALABLE COMPONENT: DEBT SERVICE RESERVE ACCOUNT

Internationally as well as locally, infrastructure projects such as this Project are typically financed through an arrangement termed as "Project Financing." The lenders for such projects determine the viability of such projects based upon the projected cash flows of the project rather than the balance sheets of the project sponsors. Usually, a Project Financing structure involves a number of equity investors, as well as a syndicate of banks and financial institutions that provide loans for the project. Such loans are most commonly non-recourse loans, which are secured by the project assets and paid entirely from project cash flow, rather than from the general assets or creditworthiness of the project sponsors - a decision in part supported by financial modeling. The financing is typically secured by all of the project assets, including the revenue-producing contracts. Project lenders are given a lien on all of these assets and contracts, and are able to assume control of a project if the project company has difficulties complying with the loan terms.

Generally, a special purpose entity (the Project Company) is created for each project, thereby shielding other assets owned by a project sponsor from the detrimental effects of a project failure. As a special purpose entity, the project company has no assets other than the project. Capital contribution commitments by the owners of the project company are sometimes necessary to ensure that the project is financially sound.

The mechanism of arrangement of Project Financing, described above, is the theme behind which the GOP has invited investors from private sector investment in power generation. Arrangement of conventional financing would expose the sponsors to unnecessary risks, as it would provide the lenders an opportunity to obtain recourse towards other assets of the sponsors.

The debt to be arranged by the Sponsors of the Project is to be structured as a project financing transaction, under which the cash flows of the Project during the debt repayment period shall be appropriated based on a waterfall which is usually applied by lenders i.e. the monthly or quarterly revenues earned by the Project shall be applied in the order of precedence specified below:

- Payment of interest and principal due for the month or quarter shall be secured by the lenders in a Debt Payment Account;
- Payment of maintenance reserve in accordance with the PPA shall be secured by the lenders in a Maintenance Reserve Account;
- Payments to be made for operating expenditure shall flow through the Project – the same shall be immediately paid to the relevant creditors i.e. O&M contractor, staff salaries, etc; and
- The payment against ROE shall be utilized by the Lenders to fund the Debt Service Reserve Account (**DSRA**).

DSRA is maintained by lenders in Project Financing transactions as a means to secure the debt service due immediately after the next debt repayment date. The DSRA provides the lenders with adequate time to take over the Project in case of default by the Project Company. IEP expects that OPIC will require a DSRA in the amount of six months' debt service on its loan (including interest and principal).

The two options available for funding the DSRA are provided below:

- through cash – there are two further sub-options in case this method of funding is chosen by the lenders (i) Upfront funding – funding through equity injection by the sponsors at the time of COD, or (ii) funding through diversion of ROE cash flows into a DSRA account. In either scenario, the sponsors of the Project are unable to avail any return on the amount retained by the lenders to fulfil the DSRA requirement; or
- through L/C – the Project Company provides an L/C equivalent to the amount required for funding the DSRA requirement; L/C charges are borne by the Project Company.

The sponsors are of the view that the lenders may be willing to accept securing the DSRA through an L/C. The cost associated with the L/C to be provided to the lenders for securing the DSRA has been catered for under this account.

If the cost of such L/C is not allowed to the Project Company, the same would result in a further reduction of the sponsor's return (which has already been impacted severely due to delays in achievement of COD and haircut on equity).

In this regard, the Tariff Standards and Procedures, 1998 (NEPRA Rules), clearly state that the:

"tariffs should allow licensees a rate of return which promotes continued reasonable investment..."

and

"tariffs should generally be calculated by including a depreciation charge and a rate of return on the capital investment of each licensee commensurate to that earned by other investments of comparable risk"

Furthermore, NEPRA Rules clearly stipulate that the:

"tariffs should, to the extent feasible, reflect the full cost of service to consumer groups with similar service requirements"

It is therefore, respectfully submitted that the Project Company be allowed to claim the said L/C charges for fulfilling the DSRA funding requirement of the lenders along with the working capital facility. It is pertinent to mention that NEPRA has in the past allowed projects to recoup thru the electricity tariff the interest charged on working capital facility and DSRA L/C where US multilateral (OPIC) was involved. The decision of NEPRA in the case of AES Pakistan (Pvt.) Ltd. with regards to the request by AES for arrangement of working capital facility and DSRA L/C is reproduced below:

"...The Authority has, however, in the cases of other IPPs who obtained funds from accredited IFIs and not from commercial banks allowed other financial charges such as DSRA L/C charges and agency fees, etc. The Authority, in the instant case, keeping in view the size of the project and funding required, understands that the Petitioner will have to obtain funding from IFIs such as US Exim Bank and IFC, etc. In view thereof, the Authority has decided to accept the Petitioner's request, subject to provision of verifiable documentary evidence."

A similar view was taken by NEPRA in the case of tariff determination of Uch-II Power (Private) Limited. Taking into account the decision taken by NEPRA in the determination awarded to AES and Uch-II, and the similarity between the AES and Uch-II projects and the Project with regards to the sources of debt funding it is reasonable for the Project Company to request for the working capital facility and interest cost on DSRA L/C to be allowed to the Project Company against provision of actual documentary evidence.

9. REFERENCE GENERATION TARIFF & DEBT SCHEDULE

9.1 REFERENCE GENERATION TARIFF

Years	Energy Purchase Price (PKR / kWh)			Capacity Purchase Price (PKR / kWh)								Total Tariff (PKR / kWh)
	Fuel Cost	Variable O&M	Total EPP	Fixed O&M	LTSA	ROE	LT Debt	Local Insurance	WC Fee & Int	Debt Service Reserve	Total CPP	
1	3.734	0.175	3.909	0.690	0.896	0.390	0.949	0.197	0.054	0.005	3.18	7.09
2	3.734	0.175	3.909	0.690	0.896	0.390	0.949	0.197	0.054	0.005	3.18	7.09
3	3.734	0.175	3.909	0.690	0.896	0.390	0.949	0.197	0.054	0.005	3.18	7.09
4	3.734	0.175	3.909	0.690	0.896	0.390	0.949	0.197	0.054	0.005	3.18	7.09
5	3.734	0.175	3.909	0.690	0.896	0.390	0.949	0.197	0.054	0.005	3.18	7.09
6	3.734	0.175	3.909	0.690	0.896	0.390	0.949	0.197	0.054	0.005	3.18	7.09
7	3.734	0.175	3.909	0.690	0.896	0.390	0.949	0.197	0.054	0.005	3.18	7.09
8	3.734	0.175	3.909	0.690	0.896	0.390	0.949	0.197	0.054	0.005	3.18	7.09
9	3.734	0.175	3.909	0.690	0.896	0.390	0.949	0.197	0.054	0.005	3.18	7.09
10	3.734	0.175	3.909	0.690	0.896	0.390	0.949	0.197	0.054	0.005	3.18	7.09
11	3.734	0.175	3.909	0.690	0.896	0.390	0.949	0.197	0.054	0.005	3.18	7.09
12	3.734	0.175	3.909	0.690	0.896	0.390	0.949	0.197	0.054	0.005	3.18	7.09
13	3.734	0.175	3.909	0.690	0.896	0.390	0.949	0.197	0.054	0.005	3.18	7.09
14	3.734	0.175	3.909	0.690	0.896	0.390	0.949	0.197	0.054	0.005	3.18	7.09
15	3.734	0.175	3.909	0.690	0.896	0.390	0.949	0.197	0.054	0.005	3.18	7.09
16	3.734	0.175	3.909	0.690	0.896	0.340	-	0.197	0.054	-	2.18	6.09
17	3.734	0.175	3.909	0.690	0.896	0.340	-	0.197	0.054	-	2.18	6.09
18	3.734	0.175	3.909	0.690	0.896	0.340	-	0.197	0.054	-	2.18	6.09
19	3.734	0.175	3.909	0.690	0.896	0.340	-	0.197	0.054	-	2.18	6.09
20	3.734	0.175	3.909	0.690	0.896	0.340	-	0.197	0.054	-	2.18	6.09
21	3.734	0.175	3.909	0.690	0.896	0.340	-	0.197	0.054	-	2.18	6.09
22	3.734	0.175	3.909	0.690	0.896	0.340	-	0.197	0.054	-	2.18	6.09
23	3.734	0.175	3.909	0.690	0.896	0.340	-	0.197	0.054	-	2.18	6.09
24	3.734	0.175	3.909	0.690	0.896	0.340	-	0.197	0.054	-	2.18	6.09
25	3.734	0.175	3.909	0.690	0.896	0.340	-	0.197	0.054	-	2.18	6.09

9.2 DEBT REPAYMENT SCHEDULE

Repayment Period	Principal Repayment (PKR)	*Principal Tariff Component (PKR / kWh)*	Interest on Outstanding Debt (PKR)	*Interest Tariff Component (PKR / kWh)*	Total Installment (PKR)	*Debt Servicing Component of Tariff / Qtr (PKR / kWh)*	*Debt Servicing Component of Tariff / Yr (PKR / kWh)*
1	44,399,407	0.0971	64,078,103	0.1401	108,477,510	0.2373	
2	45,065,398	0.0986	63,412,111	0.1387	108,477,510	0.2373	0.9490
3	45,741,379	0.1000	62,736,130	0.1372	108,477,510	0.2373	
4	46,427,500	0.1015	62,050,010	0.1357	108,477,510	0.2373	
5	47,123,912	0.1031	61,353,597	0.1342	108,477,510	0.2373	
6	47,830,771	0.1046	60,646,739	0.1326	108,477,510	0.2373	0.9490
7	48,548,233	0.1062	59,929,277	0.1311	108,477,510	0.2373	
8	49,276,456	0.1078	59,201,053	0.1295	108,477,510	0.2373	
9	50,015,603	0.1094	58,461,907	0.1279	108,477,510	0.2373	
10	50,765,837	0.1110	57,711,673	0.1262	108,477,510	0.2373	0.9490
11	51,527,325	0.1127	56,950,185	0.1246	108,477,510	0.2373	
12	52,300,235	0.1144	56,177,275	0.1229	108,477,510	0.2373	
13	53,084,738	0.1161	55,392,772	0.1211	108,477,510	0.2373	
14	53,881,009	0.1178	54,596,501	0.1194	108,477,510	0.2373	0.9490
15	54,689,224	0.1196	53,788,285	0.1176	108,477,510	0.2373	
16	55,509,563	0.1214	52,967,947	0.1158	108,477,510	0.2373	
17	56,342,206	0.1232	52,135,304	0.1140	108,477,510	0.2373	
18	57,187,339	0.1251	51,290,171	0.1122	108,477,510	0.2373	0.9490
19	58,045,149	0.1270	50,432,360	0.1103	108,477,510	0.2373	
20	58,915,826	0.1289	49,561,683	0.1084	108,477,510	0.2373	
21	59,799,564	0.1308	48,677,946	0.1065	108,477,510	0.2373	
22	60,696,557	0.1327	47,780,952	0.1045	108,477,510	0.2373	0.9490
23	61,607,006	0.1347	46,870,504	0.1025	108,477,510	0.2373	
24	62,531,111	0.1368	45,946,399	0.1005	108,477,510	0.2373	
25	63,469,077	0.1388	45,008,432	0.0984	108,477,510	0.2373	
26	64,421,114	0.1409	44,056,396	0.0964	108,477,510	0.2373	0.9490
27	65,387,430	0.1430	43,090,079	0.0942	108,477,510	0.2373	
28	66,368,242	0.1452	42,109,268	0.0921	108,477,510	0.2373	
29	67,363,765	0.1473	41,113,744	0.0899	108,477,510	0.2373	
30	68,374,222	0.1495	40,103,288	0.0877	108,477,510	0.2373	0.9490
31	69,399,835	0.1518	39,077,675	0.0855	108,477,510	0.2373	
32	70,440,833	0.1541	38,036,677	0.0832	108,477,510	0.2373	
33	71,497,445	0.1564	36,980,064	0.0809	108,477,510	0.2373	
34	72,569,907	0.1587	35,907,603	0.0785	108,477,510	0.2373	0.9490
35	73,658,455	0.1611	34,819,054	0.0762	108,477,510	0.2373	
36	74,763,332	0.1635	33,714,177	0.0737	108,477,510	0.2373	
37	75,884,782	0.1660	32,592,727	0.0713	108,477,510	0.2373	
38	77,023,054	0.1685	31,454,456	0.0688	108,477,510	0.2373	0.9490
39	78,178,400	0.1710	30,299,110	0.0663	108,477,510	0.2373	
40	79,351,076	0.1735	29,126,434	0.0637	108,477,510	0.2373	

Repayment Period	Principal Repayment (PKR)	*Principal Tariff Component (PKR / kWh)*	Interest on Outstanding Debt (PKR)	*Interest Tariff Component (PKR / kWh)*	Total Installment (PKR)	*Debt Servicing Component of Tariff / Qtr (PKR / kWh)*	*Debt Servicing Component of Tariff / Yr (PKR / kWh)*
41	80,541,342	0.1762	27,936,168	0.0611	108,477,510	0.2373	
42	81,749,462	0.1788	26,728,048	0.0585	108,477,510	0.2373	0.9490
43	82,975,704	0.1815	25,501,806	0.0558	108,477,510	0.2373	
44	84,220,340	0.1842	24,257,170	0.0531	108,477,510	0.2373	
45	85,483,645	0.1870	22,993,865	0.0503	108,477,510	0.2373	
46	86,765,899	0.1898	21,711,610	0.0475	108,477,510	0.2373	0.9490
47	88,067,388	0.1926	20,410,122	0.0446	108,477,510	0.2373	
48	89,388,399	0.1955	19,089,111	0.0417	108,477,510	0.2373	
49	90,729,225	0.1984	17,748,285	0.0388	108,477,510	0.2373	
50	92,090,163	0.2014	16,387,347	0.0358	108,477,510	0.2373	0.9490
51	93,471,515	0.2044	15,005,994	0.0328	108,477,510	0.2373	
52	94,873,588	0.2075	13,603,921	0.0298	108,477,510	0.2373	
53	96,296,692	0.2106	12,180,818	0.0266	108,477,510	0.2373	
54	97,741,142	0.2138	10,736,367	0.0235	108,477,510	0.2373	0.9490
55	99,207,260	0.2170	9,270,250	0.0203	108,477,510	0.2373	
56	100,695,368	0.2202	7,782,141	0.0170	108,477,510	0.2373	
57	102,205,799	0.2235	6,271,711	0.0137	108,477,510	0.2373	
58	103,738,886	0.2269	4,738,624	0.0104	108,477,510	0.2373	0.9490
59	105,294,969	0.2303	3,182,540	0.0070	108,477,510	0.2373	
60	106,874,394	0.2337	1,603,116	0.0035	108,477,510	0.2373	

10. COST ADJUSTMENT & INDEXATIONS

10.1 INDEXATIONS & ESCALATIONS

NEPRA is requested to allow indexation for the various Reference Generation Tariff components in the following manner.

10.1.1 Fuel Cost

The Fuel Cost component shall be adjusted on account of Fuel Price variation of fuel consumed during operation period. Fuel consumed during testing period shall be recovered from the Power Purchaser at actual.

The Fuel Cost component shall be indexed based on the following formula:

$$FC_{(Rev)} = \text{Relevant Reference Generation Tariff Component} * (FP_{(Rev)} / FP_{(Ref.)})$$

Where:

$FC_{(Rev)}$ = Revised Fuel Cost Component

$FP_{(Ref.)}$ = PKR 437.86 / MMBTU (based on DCL Tariff Assumptions)

$FP_{(Rev)}$ = The new Price of Fuel

10.1.2 Variable O&M Cost

The Variable O&M Cost of the Project exclusively comprises of local component. Therefore it shall be quarterly indexed to the WPI of manufacturing in Pakistan, as notified by the Federal Bureau of Statistics, based on the following formula.

$$VO\&M_{(Rev)} = \text{Relevant Reference Generation Tariff Component} * (WPI_{(Rev)}/WPI_{(Ref.)})$$

Where:

$VO\&M_{(Rev)}$ = the revised Variable O&M Cost Component applicable for the relevant quarter.

$WPI_{(Rev)}$ = the revised WPI of manufacturing in Pakistan for the month prior to the month in which indexation is applicable, as notified by the Federal Bureau of statistics.

$WPI_{(Ref.)}$ = the WPI of manufacturing in Pakistan for the month in which tariff is determined, as notified by the Federal Bureau of statistics.

10.1.3 Fixed O&M Cost

The Fixed O&M Cost of the Project also comprises of local component only. Therefore it shall also be quarterly indexed to the WPI of manufacturing in Pakistan, as notified by the Federal Bureau of Statistics based on the following formula.

$$FO\&M_{(Rev)} = \text{Relevant Reference Generation Tariff Component} * (WPI_{(Rev)}/WPI_{(Ref)})$$

Where:

$FO\&M_{(Rev)}$ = the revised Fixed O&M Cost Component applicable for the relevant quarter.

$WPI_{(Rev)}$ = the revised WPI of manufacturing in Pakistan for the month prior to the month in which indexation is applicable, as notified by the Federal Bureau of statistics.

$WPI_{(Ref)}$ = the WPI of manufacturing in Pakistan for the month in which tariff is determined, as notified by the Federal Bureau of statistics.

10.1.4 LTSA Cost

The LTSA Cost exclusively comprises of foreign component and, therefore, shall be quarterly indexed to both:

i. The USD/PKR exchange rate, based on the revised TT & OD selling rate of USD notified by the National Bank of Pakistan; and
ii. the US CPI (for all Urban Consumers), issued by US bureau of Labor Statistics.

The applicable formula shall be as follows:

$$LTSA_{(Rev)} = \text{Relevant Reference Generation Tariff Component} * (US\ CPI_{(Rev)}/US\ CPI_{(Ref)}) * (FX\ USD_{(Rev)}/90.00)$$

Where:

$LTSA_{(Rev)}$ = the revised LTSA Cost Component, applicable for the relevant quarter.

$US\ CPI_{(Rev)}$ = the revised US CPI (for all Urban Consumers) for the month prior to the month in which indexation is applicable, issued by US Bureau of Labour Statistics.

$US\ CPI_{(Ref)}$ = the US CPI (for all Urban Consumers) for the month in which tariff is determined, as issued by US Bureau of Labour Statistics.

$FX\ USD_{(Rev)}$ = the revised TT & OD selling rate of PKR/USD as on the date on which indexation is applicable, as notified by the National Bank of Pakistan.

10.1.5 Insurance Cost

The Reference Insurance Cost Component shall be quarterly indexed to USD/PKR exchange rate, based on the revised TT & OD selling rate of USD notified by the National Bank of Pakistan.

The Insurance cost component shall be indexed based on the following formula:

$$Insurance_{(Rev)} = \text{Relevant Reference Generation Tariff Component} * (FX\ USD_{(Rev)} / 90.00)$$

Where:

$Insurance_{(Rev)}$ = the revised Insurance Cost Component applicable for the relevant quarter

$FX\ USD_{(Rev)}$ = the revised TT & OD selling rate of PKR/USD as on the date on which indexation is applicable, as notified by the National Bank of Pakistan.

10.1.6 Return On Equity

In line with NEPRA's previous determinations for thermal IPPs, the ROE Component of the Reference Generation Tariff shall be quarterly indexed to the USD/PKR exchange rate, based on the revised TT & OD selling rate of USD notified by the National Bank of Pakistan.

The applicable formula shall be as follows:

$$ROE_{(Rev)} = \text{Relevant Reference Generation Tariff Component} * (FX\ USD_{(Rev)} / 90.00)$$

Where:

$ROE_{(Rev)}$ = the revised ROE Component applicable for the relevant quarter

$FX\ USD_{(Rev)}$ = the revised TT & OD selling rate of PKR/USD as on the date on which indexation is applicable, as notified by the National Bank of Pakistan.

10.1.7 Debt Servicing – Principal Component

As the Project is financed 100% Foreign debt financing, the outstanding principal portion of the Debt Service Component shall be quarterly indexed to PKR/USD variation using the following formula:

$$PRIN_{(Rev)} = \text{Relevant Reference Generation Tariff Component} * \frac{FX\ USD_{(Rev)}}{(90.00)}$$

Where:

$PRIN_{(Rev)}$ = the revised Principal Component applicable for the relevant quarter.

$FX\ USD_{(Rev)}$ = the revised TT & OD selling rate of PKR/USD as on the date on which indexation is applicable, as notified by the National Bank of Pakistan.

10.1.8 Debt Servicing – Interest Component

Similarly, the Interest Charges part of the Reference Debt Service Component shall be quarterly indexed to foreign exchange fluctuations in the PKR/USD exchange rate.

The Interest Charges of the Debt Service Component shall be indexed based on the following formula:

$$I_{(Rev)} = \text{Relevant Reference Generation Tariff Component} * \frac{FX\ USD_{(Rev)}}{(90.00)}$$

Where:

$I_{(Rev)}$ = the revised Interest Component applicable for the relevant quarter

$FX\ USD_{(Rev)}$ = the revised TT & OD selling rate of PKR/USD as on the date on which indexation is applicable, as notified by the National Bank of Pakistan.

10.1.9 Debt Service Reserve Account – DSRA Component

The Debt Service Reserve Account Component under Reference Generation Tariff Component is required to be quarterly indexed to foreign exchange fluctuations in the PKR/USD exchange rate.

The DSRA Component shall be indexed based on the following formula:

$$DSRA_{(Rev)} = \text{Relevant Reference Generation Tariff Component} * \frac{FX\ USD_{(Rev)}}{(90.00)}$$

Where:

$DSRA_{(Rev)}$ = the revised DSRA Component applicable for the relevant quarter

$FX\ USD_{(Rev.)}$ = the revised TT & OD selling rate of PKR/USD as on the date on which indexation is applicable, as notified by the National Bank of Pakistan.

10.1.10 WC Facility

The cost of working capital facility shall be indexed to quarterly changes in the 1-month KIBOR, using the following formula:

$$CWC_{(Rev.)} = \text{Relevant Reference Generation Tariff Component} * (Kibor_{(Rev.)} / Kibor_{(Ref.)})$$

Where:

$CWC_{(Rev.)}$ = Revised Cost of Working Capital component

$Kibor_{(Rev.)}$ = the revised 1-month KIBOR rate at the end of each quarter.

$Kibor_{(Ref.)}$ = 15.50% p.a., as per DCL Tariff Assumptions

10.2 ADJUSTMENTS AT FINANCIAL CLOSE

NEPRA is requested to allow the adjustments to the Reference Generation Tariff at the time of Financial Close.

10.2.1 Adjustments To Interest Component

It is submitted that the Project Cost be adjusted at Financial Close for the Interest Component of the Project Cost based on the signed Financing Agreement with OPIC. The adjusted interest rate component will be fixed at Financial Close and will remain fixed for the duration of the loan. The adjustment to the Project Cost is required to be reflected in the Reference Generation Tariff.

11. GENERAL ASSUMPTIONS

The following have been assumed while calculating the Reference Generation Tariff and changes in any of these assumptions will result in changes in the Reference Generation Tariff.

1. Interest rate of 6% per annum for the duration of the loan. The interest rate is assumed to be fixed for the duration of the loan.

2. The debt repayment is assumed to be 15 years with a grace period of 1 year.

3. Indexation against PKR / USD variations will be permitted for debt servicing payments to be made for settlement of foreign source debt.

4. A constant ROE of 15% (IRR based) is assumed (net of 7.5% withholding tax on dividends) over 25 years.

5. Exchange rate has been assumed to be: PKR 90 /USD.

6. 7.5% withholding tax on dividend is assumed. Any changes in the aforesaid withholding tax regime will be "pass through" to the Power Purchaser. General Sales Tax and all other taxes will also be treated as a "pass through"

7. The Zakat deduction on dividends (currently @ 2.5%), as required to be deducted under Zakat Ordinance, is to be considered as "pass through".

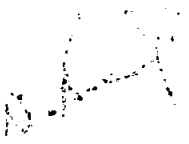
8. Financing Terms including interest rate are as yet based on the initial discussion with the financial institutions and hence are subject to final agreement.

9. No hedging cost is assumed for exchange rate fluctuations during construction and all cost overruns resulting from variations in the exchange rate during construction shall be included in the Project Cost.

10. Project contingency and maintenance reserves are not included in Reference Generation Tariff calculations. If required by Lenders, these will be adjusted accordingly in the Reference Generation Tariff.

11. Any other assumptions that are not expressly stated herein but are based on the EPA draft negotiated by the Project Company with the KESC. Consequently any change in any such assumptions may lead to change in the Reference Generation Tariff,

12. The payments to Workers Welfare Fund and Workers Profit Participation Fund have not been accounted for in the Project budget and have been assumed to be reimbursed at actual by KESC.



12. RELIEF SOUGHT UNDER THIS TARIFF PETITION

In summation, the Project Company herewith most respectfully submits before NEPRA for its approval the matters set out in this Tariff Petition and further prays for NEPRA to kindly approve the following:

1. The Project Costs and related arrangements (including IDC) amounting to USD 51,500,000 as detailed in Section 6 (**Project Cost**);
2. O&M Costs (excluding ROE and Debt Servicing) amounting to PKR 2,629,808,595, as detailed in Section 8 (**Operation Cost**);
3. Energy production estimate of 457.2 GWh per annum for calculation of the tariff and a heat rate of 7,700 BTU/kWh, basis for which has been provided under Section 5.6 (**Estimated Output**);
4. Debt: Equity ratio of 79:21 – 100% foreign financing through OPIC at a fixed interest rate of 6% per annum, detailed basis for which is provided under Section 7.3 (**Debt Servicing**);
5. A Return on Equity of 15% which reduces to 13.08% from Year 16 onwards, details for the same have been provided in Section 7.2 (**Return on Equity**);
6. Indexations and Escalations for the individual tariff components along with one-time adjustments at COD, as detailed in Section 10 (**Cost Adjustment & Indexations**);
7. The Reference Generation Tariff provided under Section 9.1 (**Reference Generation Tariff**) along with individual tariff components and debt schedule provided under Section 9.2 (**Debt Repayment Schedule**); and
8. The General Assumptions, as provided in Section 11 (**General Assumptions**).

Furthermore, NEPRA is kindly requested to, upon issuance of a tariff determination in response to this Petition, nullify the earlier tariff determination of the Project (*Case No. NEPRA/TRF-31/DCL-2004*) thereby enabling the Project Company to move forward with the rehabilitation of the plant.

For and on behalf of DHA Cogen Limited

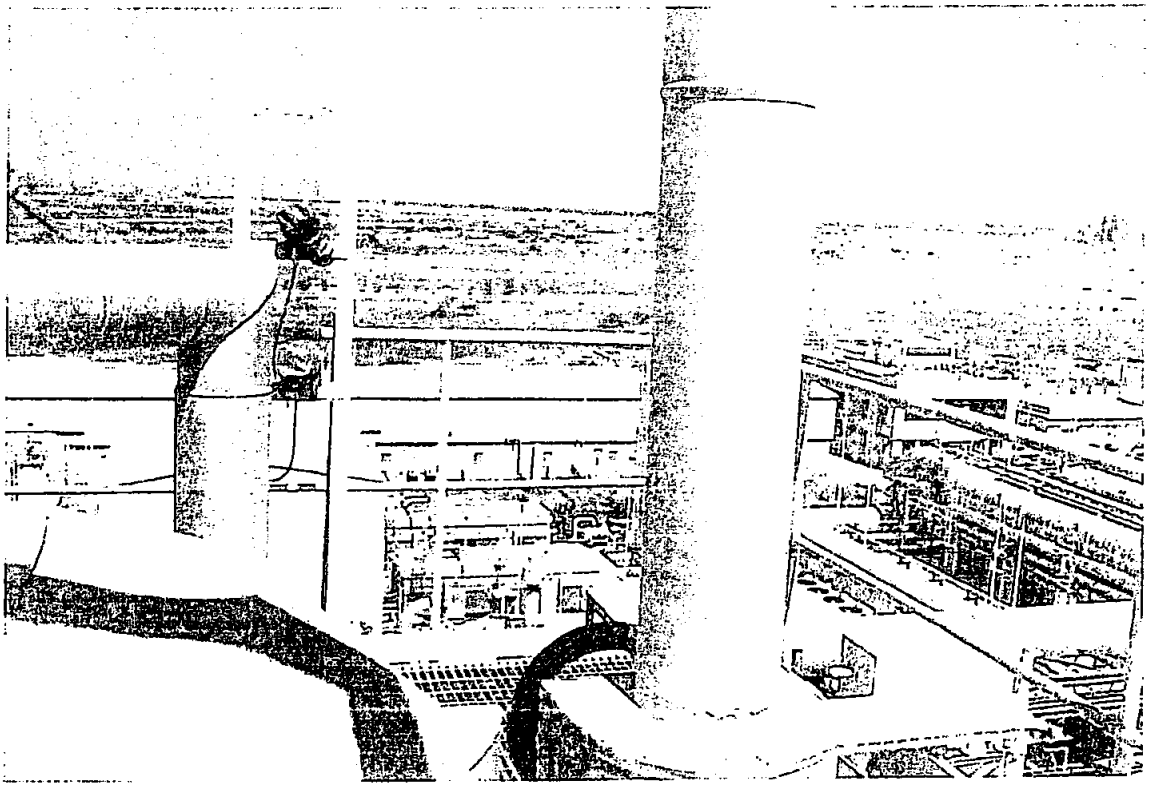
Nazoor Baig
Chief Executive Officer
DHA Cogen Limited

ANNEX – A

TECHNICAL PROJECT EVALUATION REPORT

DHA Cogen Ltd. (DCL)

Karachi, Pakistan



Technical Project Evaluation (TPE) Report
Rev 2

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Rev No.	Rev-Date	Contents /amendments	Prepared/revised	Checked/released
0	Dec 2011	Technical Project Evaluation (TPE) Report	J. Dammann / P. Roth / Dr. V. Silbermann / T. Spanier B.-D. Tydecks	H.-D. Binder
1	Jan 2012	DCL Comments dated Dec 21,2011 incorporated	B.-D. Tydecks	H.-D. Binder
2	Feb 2012	Comments on SIEMENS RCA Report incorporated	B.-D. Tydecks	H.-D. Binder

Table of Contents

1. Summary, Conclusions and Recommendations

The current overall mechanical design of the Power & Desalination Plant - though very basic - permits a safe and reliable long-term-operation.

The expression 'very basic 'refers in particular to the limited possible operation modes (refer to Clause 3.1) and the lack of redundancies.
Within the desalination trains there are no redundancies provided at all.
within the BoP the provided redundancies are limited to the feed water pumps and the fuel gas compressors.
Recommendations and options for upgrades have been addressed within Clause 3.5.
Recommendations for design adoptions of the primary and secondary electrical equipment have been given also.
For design details refer to Clause 3.6.

The final results and recommendations of the root cause analyze (RCA) on the gas turbine (GT) will be presented later (refer to Clause 4).

The present overall mechanical conditions of the power & desalination plant reveal a reasonable shape considering the exposure time to the severe ambient conditions.
Only minor additional measures in the area of the desalination plant are recommended (see Clause 5).

Referring to the review of DCL Managements' Improvement Plan it has been found reasonable and the application is recommended except the

- Sea water blending of potable water in order to save dosing chemical costs (see Clause 6.1.2.2)

For details refer to Clause 6.

The power & desalination plant maintenance currently performed by DCL staff is reasonable planned and well executed.
The review of the DCL managements' Maintenance Proposal showed no gaps worth to mention.
However, the maintenance work shop is insufficient referring to size and features (see Clause 7).

The operation of the power & desalination plant has been performed according to the reviewed DCL Standard Operation Procedures reflecting the state-of-the art content commonly applied in facilities of comparable design and size.
No additions or corrections are required (see Clause 8).

As far as the preservation of the power & desalination plant is concerned, the DCL concepts reflect the state-of-the- art and are well maintained.
Only minor modifications are recommended, in particular the dry air flow concept of the gas turbine preservation has to be adjusted accordingly.

For details refer to Clause 9.

The on-site spare part inventory and spare part storage both are insufficient.
The inventory seems to be based rather on random erection-/ commissioning left-overs than on planned and scheduled spare parts supply.
The storage facility is too small for the O&M spare part demand and the ambient storage conditions are poor (see Clause 10).

The DCL staff and staff training proposal is suitable and should be implemented.
The current staff gap shall be closed immediately in order to gain the necessary time for training execution.
I&C training should be focused in particular due to the current staff situation (see Clause 11).

For gross / net power output of the combined cycle refer to Clause 12.1 and Annex 12.1-1.
In order to provide a solid and reliable base for further proceedings it is recommended to perform a third-party performance test of the entire Power and Desalination Plant after re-start covering all realized operation modes.
The necessary temporary measurement devices should be installed prior to the re-start to avoid a second shut down.

For availability of the power and desalination plant refer to Clause 12.2 and Table 12.2-1.

For net heat rate of the combined cycle refer to Clause 12.3 and Annex 12.3-1.

The DCL CAPEX and OPEX proposals have been reviewed and found reasonable.
Minor adjustments have been made in the CAPEX distributions and amounts.
(see Clause 13 and Annex 13.1-1)

The O&M of the power & desalination plant can be performed without a LTSA with the exception of the gas turbine.
As far as the gas turbine is concerned the award of a LTSA is recommended.
Alternative LTSA providers have been identified and investigated (see Clause 14).

2. Project History

AEI Energy (AEI), a Cayman Island-based private investment company through a Special Purpose Vehicle (SPV) named Sacoden located in Singapore holds the majority ownership (60%) of the Defense officers Housing Authority (DHA) Cogen Limited (DCL) Power & Desalination Plant.
The remaining ownership of 40 % is distributed between the Pakistan Defense Officers Housing Authority (DHA), the Faysal Bank, Optima Trading and several smaller investors.

Procurement and erection of the Power and Desalination Plant was executed under three separate contracts.

Contractual parties to DCL are:

- Siemens AG – Power Generation, Germany
- Siemens Pakistan Engineering Co. Ltd.
- Alfa Laval Copenhagen A/S, Denmark.

Siemens AG – Power Generation, Germany was responsible for supply and commissioning of all equipment material and systems listed below:

- gas turbine (GT)
- heat recovery steam generator(HRSG)
- steam turbine (ST)
- generator
- balance of plant (BoP)
- electrical systems
- control and instrumentation (I&C)

Siemens Pakistan Engineering Co. Ltd. was responsible for the following scope of services:

- complete erection of the Power & Desalination Plant
- providing commissioning Support
  design and engineering of fuel gas supply and the seawater inlet/outlet
- design and engineering of 132 kV DCL substation
- civil works

Alfa Laval Copenhagen A/S, Denmark was responsible for supply and commissioning of all equipment material and systems listed below:

- two multi effects desalination (MED) units with all necessary equipment
- filter for filtration of evaporator feed flow
- dump condenser
- complete assortment of pumps for distillate, brine, seawater and condensate

- all valves and piping systems for seawater, brine, distillate, condensate and steam discharge
- complete vacuum system
- all electrical units (LCP, MCC, PLC, VDU) and instruments with cables, cable trays and junction boxes for plant instrumentation and power distribution
- chemical dosing stations
- distillate coolers
- remineralisation system

Initially DCL's revenue was primarily gained from selling the net power output of the CC to the Karachi Electric Supply Company (KESC), a private power supply company, under a Power Purchase Agreement (PPA) which terms were scheduled to end in 2038.
However, KESC terminated this PPA on April 23, 2009 and the parties agreed on an interim PPA which was terminated in May 2010.
Currently a new PPA is under discussion between DCL and KESC based on the supply of 71 MW electric power.

It shall be noted that in old PPA as well as in new PPA the long parallel work of combined cycle gas turbine (CCGT) with frequency 49 Hz is not mentioned. As consequence the behavior of different equipment which have the essential influence on the stable work of CCGT (e.g. gas compressors or water pumps) were not analyzed by the frequency ~ 49 Hz. Additionally the test of AVR of generator was carried out by minimum frequency only 49.6Hz and the protocol of testing of turbine governor with the value of tested turbine protection device is generally not given in the Imtech Karachi Report "Witnessing of Commissioning and Capacity Tests" (April 2008).
By the testing of protection relays described in the same Report there are no references on the Project with corresponding calculations which hiders to estimate the coordination of these protections. Except that only the designations of tested relay instead of their types are given in all relay protocols.

In addition to power DCL sold approximately three million gallons per day of potable water produced by the Desalination Plant to Cantonment Board Clifton (CBC), under a Water Purchase Agreement (WPA).

All the above mentioned information has been gathered by the review of the following documents submitted in Folders 1 (see Annex 2-1):

Contract Documents

The Plant was commissioned in 2007/2008 and started commercial operation on April 17, 2008.
Since commercial operation date the gas turbine (GT) suffered from rotor and compressor surge problems.

During May 2008 increasing vibrations at the GT bearings have been detected reaching alarm levels (> 9.5 mm/s) in June 2008.

After several fruitless rotor re-balancing approaches SIEMENS AG changed the whole central hollow GT shaft and replaced all bearings, tilting pads, bearing supports, gas lines and manifolds, burner fittings, first stage burner blades and stage 2 vanes & blades. Four inlet guide vanes (IGV) have been repaired.

The power island achieved base load operation Aug 14, 2009 again.

On Aug 24, 2009 GT tripped first time on surge protection. Grid frequency at this time was remarkable low (49.1 HZ) however, well within the design operation limit of 49 - 51 Hz.
Following the SIEMENS AG advice besides several checks the preventive exchange of the IGV position sensor was performed and the power island was back on base load on Aug 28, 2009.
On Aug 29, 2009 the GT tripped second time on surge protection. Grid frequency again was low (49.2 Hz).
Boroscopic turbine inspections showed now damages.
The fact finding mission performed by SIEMENS identified a compressor degration raising the surge line closer to the actual operation speed of 2952 rpm at 49.2 Hz.
The compressor ratio limit switch was activated which a start closing the IGV's when the GT speed starts to decrease subsequently to frequency decrease.
The IGV position sensor was replaced again and the power island was synchronized to the grid on Sept 16, 2009.

On Sept 17, 2009 the GT tripped for the third time on surge protection under frequency drop.
Baroscopic turbine inspections again showed now damages.

Following the SIEMENS AG recommendations I&C several settings have been modified:

- cooling air valve started opening when frequency starts to decrease
- the flue gas over temperature control (OTC) setting was reduced
- the polygon governing the reasonable IGV closing ratio was re - calculated

These modifications seemed to be successful, however, the base load output of the power island dropped from net 80 MW_{el} to net 71 MW_{el}.

The Plant went back to commercial operation on Oct 17, 2009.

On Nov 02, 2009 the fourth GT trip on surge protection occurred caused by heavy grid disturbances (occurrence of short circuit and tripping of one of 132 kV parallel lines by off operation of second line).
The actual grid frequency drop rate of 6.7 Hz/s exceeded the max. design drop rate of 1Hz/s significantly.
As it follows from the data submitted by DCL the stepwise increase of power at the common shaft of both turbines and generator (at single shaft)

from 76.5 MW to 92.5 MW within 130 ms after this disturbance in the grid led to trip of the whole unit by surge protection of gas turbine. As the result of this increase the turbine governor began to reduce the turbine speed but in reality it made this reduction to the value 47.75 Hz only in idle mode after tripping of generator circuit breaker. Unfortunately the reason of additionally tripping of transformer circuit breaker was not investigated, what causes the necessity to check the coordination of relay protection settings in the 132 kV network of DCL power plant as well as to necessity to win over the recording in the electrical relays by investigation of such tripping in future.

The GT was opened and the rotor was pulled for further investigations by SIEMENS AG.
In contradiction to the results of the boroscopic inspections prior performed the inspection of the GT revealed extended numbers of damages on the 3rd row stage vanes of the compressor.
The complete diaphragm 3 was replaced as well as in totals 16 stationary blade vanes all over the compressor and the turbine end bearing.

All rotor blades and vanes have been polished and additional I&C equipment has been installed:

- a thyristor-controlled plug & play module for the IGV actuator providing faster IGV closing to avoid compressor overload.
- a SIPROTEC 7VE6 multifunction paralleling device providing quicker isolation of the power island from grid in case of frequency disturbances exceeding the design range

In addition a modified GT washing schedule to avoid the accumulation of deposits - which was the main cause of the surge in SIEMENS AG opinion - was introduced.

The power island went back to base load on Feb 01. 2010.
However, in order to recover at least some of the power output losses caused by the modifications in connection with the 3rd surge effect the I&C performed settings have been set partially back to the initial figures.

In May 2010 a fifth surge event resulted in compressor damage and subsequently to another forced outage of the Power & Desalination Plant.

The Power & Desalination Plant wasn't re-started up to the date of this report.

DCL and SIEMENS commenced on an initial Root Cause Analysis (RCA) in order to identify finally the gas turbines' (GTs') weak point(s) and to recommend rehabilitation measures.

This Root Cause Analysis (RCA) will be executed as part of a complete Technical Project Evaluation (TPE) covering besides the Root Cause Analyses (RCA) all operational, design-, maintenance- and cost-related

aspects of a future commercial operation of the Power and Desalination Plant.
FICHTNER awarded a Consultancy Service Agreement in order to assist DCL staff in the execution of this Technical Project Evaluation (TPE).

3. Plant Description and Design Data

3.1 General

DCL is a Combined Cycle (CC) natural gas (NG) fired power plant with an associated seawater desalination plant.
The gross power generation of the CC is 94 MW_{el} based on ISO conditions and 87 MW_{el} based on Reference Site Conditions (RSC) at 50 Hz.

The gross water generation of the sea water desalination plant is appr. 14 x 10^3 m^3/day (3 MIGD).

The Power and Desalination Plant consists of:

- one SIEMENS combustion gas turbine (GT) type SGT 1000F (former V64.3A ECONOPAC)
- one SIEMENS steam turbine (ST) type STS 600 (former NK 56/60)
- one Hitachi Babcock heat recovery steam generator (HRSG)
- one SIEMENS turbo generator type TLRI 10/30 with ABB SF6 generator circuit breaker type HECS-808
- one SIEMENS generator transformer 11 kV/138 kV type TLSM 8152
- two Alfa Laval multi effect sea water desalination units (MED) type MEP-7-6840
- one seawater inlet and outlet facility
- one 132 kV GIS substation type 8DN8-2 which consists of 3 bays (one for unit G-T and two for the lines "Defence" and "Creek City").
- one 6.3 kV/0.4 kV auxiliary switchgear which is supplied from SIEMENS 11 kV/6.9 kV auxiliary transformer type TSUN 7241 and
- all necessary balance- of- plant (BoP) facilities

3.2 Combined Cycle (CC)

The Combined Cycle (CC) is designed in a single shaft configuration with the gas turbine (GT), a gearbox, a generator another gearbox and the steam turbine (ST) on the common shaft.
The steam turbine ST can be coupled / decoupled to / from the generator by a flexible clutch.

The gas turbine (GT) is equipped with an annular combustion chamber and 24 low-NO_x hybrid burners.
Gas turbine inlet temperature reaches 1190°C at base load, which typically results in a turbine outlet temperature of approx. 570°C and an outlet flue gas flow of 15.9 t/h.
Rated output at ISO conditions is 67 MW_{el}. Rated speed of the GT is 5400 rpm. Transmission to 3000 rpm is performed by a gearbox.

The exhaust gas from the gas turbine (GT) is fed to an unfired heat recovery steam generator (HRSG), which is designed as a double pressure, natural circulation boiler, generating live steam of 520 0C at 84 bar(g) in an amount of 29 kg/s at base load.

A by-pass stack for simple cycle operation is not available e.g. with HRSG out-of-operation the entire plant has to be shut down.

The circulation in the evaporators' is maintained by natural circulation due to vertical tube arrangement and horizontal flue gas flow. The stack is located at the back of HRSG.

The live steam is fed to the ST which is a condensing turbine with radial exhaust steam flow.
Rated speed is 7692 rpm; the transmission is performed by a gearbox to 3000 rpm.
The steam turbine (ST) exhaust (31, 5 kg/s at 0.42 bar/76°C at base load) is condensed within the inlet sections of the two multiple effect desalination (MED) units of the Desalination Plant for heating.
If the multiple effect desalination (MED) units are not able to accept the expanded steam supplied either from the steam turbine (ST) exhaust or the steam turbine (ST) bypass stations completely, a dump condenser will take over the steam for condensation.
However, dump condenser condensing capacity is limited to max. 60% of the steam generation at base load, e.g. with one desalination train in full operation power train may kept on base load. With both desalination units out of service the power train load has to be decreased accordingly.

The dump condenser is evacuated by water ring pumps and cooled by sea water.

The turbo generator is rated 121 MVA / 11 KV power with an indirectly air-cooled stator winding and a radial direct air-cooled rotor winding.
The rated speed is rpm 3000 at 50Hz.
Turbo generator can be driven either by the GT or by GT and ST.

Within the combined cycle several different control systems of Siemens are used, partly interconnected for limited signal exchange.

The gas turbine is as per standard controlled via Siemens Teleperm XP control system. On the automation level it is equipped with redundancies such as redundant automation stations in hot-stand-by configuration and redundant field instruments for protection purposes. On the operator level one combined engineering and operator station is installed in the central control room of the power and desalination plant.

A Siemens WIN TS system is installed for remote monitoring of the GT. This system enables that Siemens GT experts can log in remotely to the machine and perform analyses and diagnosis from their home office.

Additionally a flight recorder is installed for monitoring and archiving of measured data.

The HRSG, steam turbine as well as the water and steam cycle are realized in a Siemens PCS7 control system. On the automation level this system was not designed with redundancies, i.e. there are no redundant CPU's or field bus systems connecting the remote I/Os though redundant field instruments for protection purposes have been used. On the HMI level there is a single operator station installed and as back-up a combined engineering / operator station. After commissioning the O&M crew has added a large screen display for visualization of important process data.
The PCS7 system is interconnected to the GT control system via a redundant serial link on the plant bus level, to the desalination plant via a single Profibus connection and with the fuel gas compressor (proprietary Murphy Millennium Controller) via hardwired signal exchange.

The design of the primary electrical equipment 0.4 - 132 kV is generally satisfactory.

Nevertheless some weak spots in the operation/design of this primary equipment as listed below have to be considered:

a) some existing entries to cable way are open (see Annex 15, Picture 187). Such exposure of active sea environment as well as of active rains in the period of monsoon on the control cable can lead to their damages and to failure of protection equipment.

b) the single line diagram of HV part of DCL in the relay room doesn't correspond to reality (e.g. the isolator between current and voltage transformers doesn't exist) and has to be updated.

Currently operators use the mimic diagram in the GIS control panel and the related 132 kV page in the Teleperm XP to operate the switchgear, which both reflect the as-built status.

The design of the secondary equipment 0.4 - 132 kV is generally satisfactory as well.

Nevertheless some weak spots in the operation/design of this secondary equipment as listed below have to be considered:

a) there was not submitted the Relay Protection Study of DCL node (the submitted Relay Settings Study calculates the protection settings only in 6.6 kV and 0.4 kV auxiliary networks and submitted 132 kV GIS Relay Settings Calculation doesn't contain the settings of other line protections in this node). It makes impossible to estimate the coordination of protections in the power plant and in the network.

b) the settings of current and voltage protections proposed in 132 kV GIS Relay Settings Calculation were not checked on the sensitivity to corresponding short circuits and the values of these short circuit currents were not submitted (it is applied only SLD of some lines in the DCL node with their positive and zero sequences parameters.

c) except that by reading of existing protection settings from microprocessor relays at the 132 kV side of DCL it was found that many settings in many relays don't correspond to settings proposed in GIS Relay Settings Calculation above and cannot be explained absolutely. E.g. the stage I> of relay 7SJ602 of 132 kV feeder "Creek City" has pick-up value 1.1*I/In although the line can be normally overloaded about 15%, the stage I>> is disabled, i.e. remains without any current setting. but it has to act without time delay by manual closing etc.

According to the power plant staff the settings incorporated at the time of commissioning has been a mutual consensus between KESC and SIEMENS. KESC electrical reviewed the settings in recent past and suggested a few alterations due to revised grid parameters.

d) the fibre optic cable at 132 kV lines outgoing from DCL was damaged and is now off operation. Despite the teleprotections of both lines were in operation because SIEMENS has not left DCL the passwords necessary to change these settings. However. Siemens submitted the password on request and the protection settings have been put into compliance with the state of fibre optic cable.

e) the designations of MCBs supplying the secondary equipment in the building of GIS are missing.

f) remote DC signaling is missing.

g) the event and disturbance recorders within all microprocessor protection relays are off operation.

h) the DTL over current protections of two-winding auxiliary transformers have unnecessary time delay between 6.6 kV side and 0.4 kV side. It might lead to an increased damage risk of the transformer.

i) the settings of frequency protections in the generator relay 7UM622 don't correspond to analogous settings in the network and to corresponding settings of turbine governors.

3.3 Desalination Plant

The Desalination Plant is based on multiple effect technology, in which pre-treated (chemical dosed and fine filtered) seawater supplied from the seawater intake is partly evaporated in effects utilizing the condensing energy of condensing steam or vapor on the other side of the heat transfer surface.
It consists of 2 desalination units with a rated output of 3 Million Imperial Gallons / Day (MIGD).
Auxiliary steam is extracted from the Combined Cycle (CC) and provided to the Desalination Plant in order to accomplish vacuum conditions in the desalination units.

The condensate of the low pressure steam, excluding internal losses, is discharged from the desalination units and returned to the Combined Cycle (CC).

The desalinated water is directed to the remineralization treatment facilities adding appropriate mineral solutions and leaves the facility as potable water.

A side flow of the desalinated water, approximately equal to the internal steam losses and an additional amount of power plant makeup water, is supplied separately from the desalination units and piped to the power plant. The mixture of brine and seawater return is discharged to the sea.

The desalination plant is controlled by a Siemens S7-300 PLC with WinCC visualization. There are two local control panels installed in the local control container (one for each desalination train) and one touch panel is installed in the central control room for remote operation and control.

The demineralization plant has its own and independent S7-300 PLC control system which is not monitored from the central control room.

In addition one Siemens S7-200 PLC is used for the chemical dosing system which is operated stand-alone with local control panel only.

3.4 Sea Water Intake

The Seawater Inlet is located in the southeast of the Power & Desalination Plant site.

Seawater (5724 t/h) is extracted around 30 m offshore through GRP pipes via concrete inlet channels, equipped with 2 x 100 % bar screens and 2 x 100 % travel screens to a concrete basin serving as the reservoir for the 3 x 60% seawater pumps.

The seawater is pre-filtered in the seawater inlet to remove suspended solids larger than 0.5 mm and treated with chlorine in the range of 2 -3 mg/l to prevent marine growth prior to the supply to the Desalination Plant and to various cooling systems.

For the seawater intake and potabilization plant an additional Siemens S7-300 PLC is used for control and monitoring. These systems are controlled from the central control room via a separate operator station. The chemical dosing of the potabilization plant is controlled by a S7-200 PLC without any signal exchange.
The above mentioned design information have been gained by the review of the following documents submitted within Folders 1, 3 and 22 (see Annex 2-1):

System Specifications (Folder 1)
Plant Data Main Equipment (Folder 1)
Plant Layout (Folder 1)
Plant Familiarization (Folder 1)
GT Parameter List (Folder 3)
GT Data (Folder 3)
ST Data (Folder 3)
HRSG Data (Folder 3)
Plant Overview, Control Structure and Heat Balance (Folder 22)

3.5 Plant Operation Modes

Considering the available equipment and design the following operation modes are foreseen or could be achieved by several upgrades.
It has to be noted that the dump condenser was not included in the initial Contract but added later. Operation modes requiring dump condenser however, don't work proper due to frequent clogging. Therefore the installation of a debris filter prior to the dump condenser is recommended (see also clause 6.1.3.1).

A Operation Mode I (Base Load)

- Gas turbine(GT) 100%
- Steam turbine (ST) 100%
- Heat recovery steam generator (HRSG) 100%
- 2 Desalination trains (100%)
- Steam Bypass 0%
- Dump condenser 0%

B Operation Mode II (One Desalination Train out-of-Service)

- Gas turbine(GT) 100%
- Steam turbine (ST) 100%
- Heat recovery steam generator (HRSG) 100%
- 1 Desalination train 100%
- 1 Desalination train 0%
- Steam Bypass 0%
- LP Dump condenser 100%

Base load operation CC is possible with the existing dump condenser on-off valve.

C Operation Mode III (ST out-of-Service)

- Gas turbine(GT) 100 %
- Steam turbine (ST) 0%
- Heat recovery steam generator (HRSG) 100 %
- 2 Desalination trains 100%
- Steam Bypass 100%
- LP Dump condenser 0%

D Operation Mode IV (ST and one desalination train out-of-Service)

- Gas turbine(GT) 100 %
- Steam turbine (ST) 0%
- Heat recovery steam generator (HRSG) 100 %
- 1 Desalination train 100%
- 1 Desalination train 0%
- Steam Bypass 100 %
- LP Dump condenser 100%

E Operation Mode V (ST and two desalination trains out-of-Service)

- Gas turbine(GT) app.50%
- Steam turbine (ST) 0%
- Heat recovery steam generator (HRSG) app.50%
- 2 Desalination trains 0%
- LP Steam Bypass 50%
- LP Dump condenser 100%

Base load for GT and HRSG is not possible because there is no steam consumer at all in this operation mode.
However, an option to keep the GT in base load is the installation of a diverter damper and a second stack.

F Operation Mode VI (HRSG out-of-Service)

- Gas turbine(GT) 0%
- Steam turbine (ST) 0%
- Heat recovery steam generator (HRSG) 0%
- 2 Desalination trains 0%
- LP Steam Bypass 0%
- LP Dump condenser 0%

In case HRSG is out-of-service the present plant design requires a complete shut-down.

Installing the aforementioned diverter damper and a second stack, however, will provide the ability to run the GT in a simple cycle mode on base load.

E Operation Mode VII (Generator out of service)

- Gas turbine (GT) 0%
- Steam turbine (ST) 0%
- Heat recovery steam generator (HRSG) 0%
- 2 Desalination trains 0%
- LP Steam Bypass 0%
- LP Dump condenser 0%

With the generator out-of-service the entire plant has to be shut down. There is no upgrade option.

3.6 Recommendations

To prevent possible breakdowns in the work of CC GT it is recommended to perform the following works on the primary equipment:

a) close a.s.a.p. the existing entries to cable way with special covers (their construction shall be approved by LCD General Designer - Siemens).

b) the single line diagram of HV part of DCL in the relay room shall be brought into compliance with real state of primary equipment.

To prevent possible breakdowns in the work of CC GT it is recommended to perform the following works on the secondary equipment:

c) perform a.s.a.p. the Relay Protection Study of whole 132 kV DCL node inclusive the checking of all protections on sensitivity to all kinds of short circuits and on full selectivity. This Study shall be carried out on a competitive basis and their recommendations (new calculated relay settings) set into operation both by DCL and KESC immediately.
After analysis of the documents collected by site visit as well as documents sent additionally by Mr. Seraj-ul-Haq (see exchange of E-Mails from 09.01.12 and 10.01.12) it can be made the following conclusions:
All line parameters are given only for one 132 kV DCL - Creek City and two consecutive 132 kV lines Creek City - DHA SS and DHA SS - Qayyumabad SS. And performed calculations of settings of the 2nd and 3rd zones of distance protections can be accepted only for simple transit which consists of some consecutive lines. But in reality there is one additional 132 kV line DCL - Defence SS, which via 132 kV transit Defence SS - K. West SS -Qayyumabad SS forms 132 kV loop, which is supplied additionally from 220 kV SS K.C.R. (via autotransformer 220 kV/132 kV 250 MVA and 132 kV transit K.C.R. SS - K. West SS - Qayyumabad SS) as well as from 220 kV SS Lalazar (via two autotransformers 220 kV/132 kV 250 MVA and 132 kV transit Lalazar SS - Q/Road SS - Clifton SS - Gizri SS - Defence SS). Conversely both 220 kV SSs above are incorporated in the big 220 kV ring of Karachi. In

this case the settings for 2nd and 3rd zones of distance protections shall be calculated taking into account the corresponding in-feed coefficients which consider the distribution of short circuit currents flowing to the fault place from different directions and which have very essential influence on the values of these settings. But complex configuration of primary network above excludes the simple calculation of these in-feed coefficients. Their right selection is very complex task especially for 1-pole faults which can be solved only with help of special computer programs in the frame of required Relay Protection Study.
This means that even by assuming that given line parameters are correct FICHTNER can confirm for the line protections only the correctness of selection of 1st zones of submitted line distance protections as well as for their SOFT and power swing detection settings.
FICHTNER can also confirm the protection settings in the auxiliary network 6.6 kV - 0.4 kV (with exception of time settings of I> stages at the 6.6 kV side of 6.6 kV/0.4 kV transformers - see point 'f' below).

d) perform a.s.a.p. the Static and Dynamic Stability Study of DCL node. This Study shall be carried out on a competitive basis and it shall include all necessary recommendation for characteristics of all turbine and generator regulators as well as for coordinated settings of frequency protections at DCL and at corresponding KESC objects.
Independent from collaboration with KESC the both Studies shall be absolutely performed (only the results of Dynamic Stability Study can define the permissible trip times by 3-pole and 1-pole short circuits in the complex node of DCL as well as the right coordination of generator frequency protections.

e) perform by DCL one additional TC/IP station bus with corresponding gateway and protocol IEC 61850-8. To this bus shall be connected all microprocessor relays at DCL to receive from their built-in event and disturbance recorders the information by possible disturbances in 132 kV - 0.4 kV networks of DCL. This new station bus shall be designed a.s.a.p. by LCD General Designer - SIEMENS.
This measure will not only facilitate the operator to see the information about electrical faults in 0.4 kV - 132 kV networks, but has to increase the reliability of the storing of all disturbance data in the central computer. These disturbance data will be available in any time, independent on the following data storing in these relays. It has to remind that by last investigation all these data were already erased by the next data.

f) restore a.s.a.p. the fibre optic cable at all lines outgoing from DCL a.s.a.p. and to put into operation the line differential protections which have big influence on dynamic stability of DCL operation.

g) install remote DC signaling in control room for status information in the control room of 132 KV breakers and presence of 132 KV voltage from KESC and observing DC power supply voltage (especially about the deviation of "plus" and "minus" voltages from standard values by earth contact in DC network).

h) change the time settings of over current protections at the 6.6 kV side of all two-winding auxiliary transformers. There is one additional time-delay between O/C protections of 6.6 kV and 0.4 kV. The S-protections of 0.4 kV incomes have the time-delay 0.3 sec and corresponding I> stages at the 6.6 kV side - time-delay 0.55 sec. Taking into account that there is no any object which is connected to these transformers before their 0.4 kV incomes the time settings of O/C protections at the 6.6 kV side can be carried out with the same time-delay as time-delay of O/C protection at the 0.4 kV side, i.e. 0.3 sec. The possible non-selective tripping of 6.6 kV CB by fault at the 0.4 kV bus has no meaning under these conditions, but such reduction can minimize the damages in the transformer by fault in its low voltage windings.

i) bring into compliance the settings of frequency protection of generator and the settings of turbine governors. The available information do not allow coordination of turbine governor and generator frequency protections. The settings of turbine governor represent only the low (and last) limit for the settings of 2nd stage of low frequency protection of generator - broadly this setting shall be 1.2 higger than turbine governor setting. But exact settings for both stages of generator low frequency protections as well as exact settings for both stages of generator high frequency protection (especially their time settings) can be defined only after performance of Dynamic Stability Study of the DCL node, which will show the influence of all transient processes in the 132 kV network on the DCL generator. After performance of this study its results shall be compared with the curve in the submitted file "Generator_Protection.pdf" and so the right settings will be selected.

4. Evaluation 5th Surge Event GT Compressor

4.1 General

In order to evaluate the 5th surge event a Route Cause Analyses (RCA) was performed under participation SIEMENS (OEM), FICHTNER (Consultant to DCL) and DCL (Owner).

In preparation prior to the start of the RCA on-site on the Oct 05th, 2011 FICHTNER review the following documents submitted under Folders 2 and 6 (see Annex 2-1):

Surge Reports and Data (Folder 2)
Tables A & B (Major Shut downs)/ Changes made by SIEMENS (Folder 6)

After analysis of all documents submitted by DCL (it should be noted here that the recordings in the electrical relays were also not won over investigation of this tripping) as well as of observation of existing state of primary and secondary electrical equipment 0.4 - 132 kV it can be taken in, that this equipment had no influence and had not participate in the 5th surge event GT compressor.
The entire electrical equipment has worked by the frequency about 49 Hz in the range of their own possibilities as it is foreseen by its technical conditions without any failure.

The findings, conclusions and rehabilitation recommendations arising from this RCA are lined out in a separate SIEMENS RCA Report dated 18 January, 2012, attached as Annex 4.

4.2 SIEMENS RCA Report Review

After review of the SIEMENS RCA report the following remarks arise:

4.2.1 Scope of Work Not Covered

SIEMENS recommendation on the air intake filtration system in the RCA report doesn't meet the requirement of the RCA Scope of Work. Rev-3 which reads:

Quote
SIEMENS will review the previous findings and recommend a solution / mitigation plan latest with submission of the RCA report"

Unquote
SIEMENS recommendation in the RCA Report Clause 14 iii), however, just reads:

Quote
"Possibilities to improve the air intake filtration system according to the site specific conditions should be checked (type of filters, etc.), including maintenance requirements and maintenance practices."

Unquote
The requested solution / mitigation plan is missing.

SIEMENS should be requested to perform accordingly.

4.2.2 Points Requested to be Incorporated / Corrected / Clarified in the RCA Report

On page 5 the first line of the first paragraph indicates that plant was commissioned in October, 2007 whereas the correct commissioning/COD date is April 17th, 2008.

The applied surface treatment (polishing by grade 6 emery paper) could be a possible cause of extraordinary corrosion noted between Feb to May, 2011 period.
This should be mentioned in the RCA report as one of the reasons for corrosion found on the compressor.

The Munter's dryer was in operation during the standstill period as can be seen from trends retrieved from TXP for shutdowns periods on 12.3.2010, 27.3.2010 and 18.4.2010 (see clause 6.3 RCA Report). Munter's dryer started 2 hours after each shutdown.
Further, with reference to SIEMENS I&C Fact Finding Report dated Jul 23rd, 2010 under clauses 2.2 and 2.3 the operational status of Munter's dryer and air inlet flap was OK during the shutdowns. As per GT logic the flap will close when GT speed is less than 3 Hz. for more than 130 min. This was verified by SIEMENS I&C Engineer in his a/m Fact Finding Report. Munter's dryer would start automatically (in auto mode) after the closure of flap.
Hence, the operation of dryer and flap during standstill was as per logic and specification.
Moreover, it is to be noted that there is no flap on GT exhaust duct. The exhaust stack on the boiler was covered with thick tarpaulin during standstill.

Furthermore, the drop in temperatures for TV1, TV2 and OTC (see clause 6.4, page 20 of the RCA Report) is most probably due to ineffectiveness of the installed Munter Dryer's System. SIEMENS was informed about this ineffectiveness of the dryer system in previous correspondences and modified after the last outage in October, 2011 the piping arrangement for Munter's Dryer for end to end connection to allow the air to circulate inside GT. The modified system however, is still not effective as the humidity inside GT is not maintained to less than 48% as initially recommended by SIEMENS.

This was notified to SIEMENS. As a reaction SIEMENS is now recommending a humidity limit of 60 %.
Nevertheless, the present design of the Munter's Dryer system seems to be insufficient and it should be proper red-designed prior to the re-commissioning of the GT.
After installation of the re-designed system SIEMENS should carry out a performance test in order to verify the effectiveness.
The ineffective design of dehumidification system installed during site construction stage certainly contributed to the excessive corrosion on compressor and therefore, deserves to be mentioned as one of the causes of corrosion on compressor parts in RCA Report.

SIEMENS recommended a particular washing regime for Feb – May 2010 operation in which off-line washing was performed very much more frequently as requested in the SIEMENS O&M Manual.
Washing regime as provided by SIEMENS and listed below was applied very strictly operation:

- On line washing with demineralized water every day
- On line washing with detergent every 3rd day
- Off line washing with detergent every two weeks.

Certainly also this increased washing frequency contributed at least to a certain extend to the corrosion compressor and should be verified by SIEMENS prior to further application after GT rehabilitation.

Within clause 14 of the RCA Report the installation of new vane rings with an improved design is recommended.
While in general this recommendation is supported, some open questions as listed below should be answered by SIEMENS prior to the final acceptance:

a) Lead time for availability, highlighting in particular the availability for the upcoming rehabilitation
b) Taking into account that V64.3A GT is cancelled from SIEMENS production line, will this vane rings be available for further purchase?

Referring to clause 7 of the RCA Report showing the pictures of the heavy corroded IVG equipment and the related recommendation to exchange this parts -which is supported - a statement is missing in the RCA Report whether this IVG corrosion was involved in the surge events or not.

Furthermore with regard to the IVG's SIEMENS should clarify the following:

SIEMENS Report PI12 / 2010 / 078, C. Geerling, Fact Finder June 2010. reports IVG angles of -33 degree (closed position) and - 1degree (open position) and recommends to check the entire IGV actuation system.
SIEMENS Report PI PW2 / 2011 / 094 CUST, Moritz Kunkel, Fact Finder Sept 2011 reports IVG angles of -41degree(closed position) and - 1degree(open position) and declares proper function and correct settings for the actuation system.

Referring to clause 9.1 of the RCA air intake coalescer filters were replaced every 25~30 days which certainly will meet the requested short time frequency. While on-line replacement of these filters is not available in the existing SIEMENS standard design, more frequent replacement causes increased down times e.g. decreased availability, which certainly is not an option.

Referring to clause 11 of the RCA Report the SIEMENS conclusion salts identified on the wipe tests are released from the desalination plant cannot be supported.
No salts of the identified compositions are stored for desalination plant or produced as its by-product. Anti-sealants stored are in liquid form kept in sealed drums covered with tarpaulin.
With regard to the presence of the radio-active element Thorium in wipe samples, no source or contributing factor available at the plant can be identified.
Quoting the 'Agency for Toxic Substances and Diseases' registry, small amounts of Thorium are present in all rocks, soil plants and animals. Soil contains an average of 6 parts per million (6ppm) Thorium. Thorium is a relatively abundant element in earth's crust
The most common ores of Thorium are Thorite and Monazite. Monazite is a common form of beach sand. It can be found, among other places, on sea beaches such as in Florida. Such sand may contain up to 10 % Throium.
The environment impact assessment for this site however, does not indicate any Thorium in the soil or water. Likewise, the environment impact assessment of a barge mounted rental power plant in nearby Korangi Creek does not indicate any Thorium.

4.2.3 Review Summary

The SIEMENS RCA Report covers almost all aspects of a state-of-the art root cause investigation. Nevertheless, some missing items / clarifications as mentioned in clauses 4.2.1 and 4. 2.2 have to be delivered by SIEMENS.

The conclusions and recommendations given in clause 14 of the report can be supported in general.
The installation of a chiller, however, might be a future option after rehabilitation and the achievement of a reliable plant operation, based on calculations of the actual operation data.

5. Overall Mechanical Conditions of the Power & Desalination Plant

5.1 Present Conditions

5.1.1 Combined Cycle (CC)

In general the entire power train (Gas Turbine, Generator, Steam Turbine) as well as its "housing" has shown proper conditions. The interior of the corresponding enclosure areas was found clean and tidy (rather better than expected for this type of industrial equipment).

5.1.1.1 Gas Turbine (GT)

The GT is under preservation (see Clause 9.1.2.1).

The dismantling activities on the GT by Siemens team have started on 22nd Sept. 2011 and progressing according to the time schedule as planned. The step by step witnessing of those by Fichtner engineers has enabled to record the current conditions of the GT-internal area and its components.

Combustor Chamber & Burners

- the entire combustion chamber appearing generally in good shape, no signs of any overheating, spallation of the thermal barrier coating etc.
- burners removed from upper part appear in good conditions
- bore scope inspection of the fuel gas path for the premix flame shows deposits by the gas contaminants

Turbine Blading

- the entire turbine blading generally in good conditions
- the tips of the TLa 1and 2 show negligible traces of rubbing
- TLa 1 and 2 cooling air discharge at the TE coloured rusty
- shaft and TLe labyrinth seal strips in good condition
  (see Annex 15, Pictures 01-10/12-19/23-29/31-48/61-70)

5.1.1.2 GT Air Intake System

The Air Intake System as supplied by OEM appears generally in good conditions. It has been found adequately preserved for the standstill / out of operation period. All areas are clean and equipped with bags containing hygroscopic materials. Some places / surfaces re-painted to prevent further oxidation.

The coalescer mats (AMPC75; grade G3) found "discolored", i.e. surfaced by the dust particles from the passing ambient air, this mat is rather thin and

shows on many places open section which reduce and eliminate the functionality of this stage.

Area between coalescer and pre-filter sections found clean.

The pre-filter (Novatex; gradeG4) found visually clean. slight discoloration by dust visible, installation correct. no gaps or damaged cartridges found.

Fine filter (Compatex TMPC; grade F8) appearing at the accessible back side clean, no particularities evident hence functionality ensured.

Area downstream the fine filter equipped with bags containing hygroscopic material, clean and proper (see Annex 15, Pictures 71 to 80).

5.1.1.3 Steam Turbine (ST)

The ST is under preservation (see Clause 9.1.2.2) and was inspected by boroscope during the site investigations.
The blade / vane surfaces show the expected slightly surface corrosion as well as erosion corrosion particular in the low pressure section.

Slight surface corrosion is wildly common phenomena built up in the time between shut down - where the turbine is wet- till the turbine is dried out by the air blower installed for preservation.

Erosion corrosion in the low pressure sector mainly is caused by water drops developed within the turbine due to the necessary enthalpy decrease of the steam passing through.

5.1.1.4 Heat Recovery Steam Generator (HRSG)

The HRSG was under extended repair works during Mar 2010. All necessary measures in order to restore the operability of the HRSG have been performed.
The HRSG was successfully pressure-tested (hydro-test) prior to re-start and worked without obstacles till the forced plant shut-down in May 2011 (5th Surge Event).

During the entire operation time the HRSG didn't achieve the design steam pressure of 84 bar (g) but was limited to 75 bar (g). The reason for this sub-performance was never investigated.
At the present time the HRSG is under preservation (see Clause 9.1.2.3) and was visually inspected during the site investigations (see Annex 15, Pictures 152-176).
In addition spot checks of the tube wall thickness have been performed (see Annex 5.1.1.4-1).

5.1.2 Desalination Plant

The desalination plant is in a reasonably shape considering the exposure time to such an environment close to the shore.

However, the inspection revealed some minor corrosion spots on the inside of the stainless steel vessel of the desalination (see Annex 15, Pictures 90-111).
As can be seen on these pictures the corrosion spots are of minor nature and can be addressed by some remedial action. Some of these corrosion spots appear to have been addressed earlier by grinding and as such removal of the corrosion. However this remedial work left some rough surfaces that can easily lead to further corrosion.
One preheater of desalination unit 11 between stage 3 & 4 has been inspected (see Annex 15, Pictures 188-195).
The inspected preheater tube ends do show similar signs of damage although of significant lesser amount as observed on earlier inspections at the final condenser (see Annex 15, Pictures 112-114 of earlier final condenser inspections handed over by DHA operation staff).

The material used for the sacrificial anodes inside the desalination plant e.g. within the waterboxes of the preheater/final condenser appears to release flakes. Such release of corrosion flakes easily leads to blocked tubes of the final condenser, the preheater tubes or of the heat exchangers within the desalination units. It is unknown whether the installed sacrificial anodes are still of the original/supplied material delivered and / or specified by the equipment manufacturer (Alfa Laval). The equipment manufacturer (Alfa Laval) confirmed verbally that usually soft iron sacrificial anode material is normally in use to prevent such flaking of the sacrificial anodes.
It has further been noted that external piping made of GRP and plastics are not coated/painted.

The main materials of construction for valves in contact with seawater and brine are stainless steel (SS 316 and similar).
One of these valves has been inspected. The inspection revealed reasonable conditions of the valves despite the work environment and the materials of construction. Please refer to Annex 15, Picture 178 of inspected brine valve.
Another inspection of a valve in a similar environment but constructed of different materials revealed some further corrosion due to ingress of seawater underneath the rubber liner protecting the valve body. Please refer to Annex 15, Picture 179, valve fine filtration.

Given the close vicinity of the plant to the sea shore and the low level difference between high tide sea level and the plant level the structural steel and other support elements (e.g. cable trays, grating, etc.) are exhibiting a degree of oxidation of the protective zinc coating that should be prevented from further degradation to achieve reasonable durability.

5.1.3 Seawater Inlet

No closer inspection of the seawater intake system has been possible at the time of the site inspection as the intake bay was flooded. As such the review of the present conditions has been limited to the equipment mounted above the deck level of the concrete cover of the seawater intake bay.
No assessment of the intake pipes, the intake bay or any of the equipment mounted below the deck level has been possible (see Annex 15, Pictures 115-121).

5.1.4 Balance of Plant (BoP)

The BoP equipment is in suitable mechanical overall conditions, however due to the local ambient conditions under constant de-rusting and painting activities.

Inspections of the internals of significant equipment like fuel gas compressors and tanks showed no signs of corrosion attacks or other surface deteriorations (see Annex 15, Pictures 123-151).

The state of the primary and secondary equipment 0.4 - 132 kV and the I&C equipment also is generally satisfactory.

5.2 Conclusions and Recommended Additional Measures

5.2.1 Combined Cycle (CC)

5.2.1.1 Gas Turbine (GT)

Refer to Clause 4

5.2.1.2 Steam Turbine (ST)

None of the corrosion poses a major threat to the turbine.

During re-commissioning the ST should be washed by saturated steam for app. 8 h in order to remove the surface corrosion products.

5.2.1.3 Heat Recovery Steam Generator (HRSG)

The finned tubes and the headers of the HRSG show the ordinary uniform mid- brown protection layer built up by low alloyed iron based materials under the design operation conditions.
The spot check tube thickness measurements performed on the revealed wall thicknesses almost matching the design figures, e.g. no remarkable surface abrasion triggered by corrosion have been detected (see Annex 5.1.1.4-1).

The DCL proposal to test the HRSG safety valves prior to re-start (see Start up Activities, Folder 9) is strongly supported.

Investigations clarifying the reason of the HRSG sub-performance referring to the achievable max. steam pressure is recommended.

5.2.2 Desalination Plant

It is recommended to consider limiting grinding of stainless steel to those areas affected by corrosion and to polish the stainless steel surfaces thereafter to prevent rough surfaces that are more easily attacked by corrosion.

Furthermore it is critical that all works inside the desalination vessel are carried out such that carbon steel contamination of the stainless steel surfaces is prevented. All tools should he dedicated for stainless steel and should not be used on other material such as carbon steel, cupper, graphite. etc.
It is also recommended to verify the material in use for sacrificial anodes and to consider alternative materials like high permeability low carbon refined iron (soft iron) anodes compared to the installed sacrificial anode material to prevent such flaking from occurring.

Referring to the uncoated GRP-plastic piping it is recommended to paint/coat these materials of construction to prevent further bleaching which indicates some degradation of the material already present.
Furthermore such paint/coat would not only prevent future damage e.g. due to embrittlement but also reduce sunlight educed biological growth in the seawater. Such might affect the amount of hypochlorite dosing or at least allow the hypochlorite dosing to be more effective.

Referring to the valves it is recommend to inspect more valves to get a better understanding of the extent of corrosion. The design of the valves at the fine filtration exhibits a good list of materials of construction suited for the environment but requires supervision to prevent ingress of seawater underneath the rubber lining protecting the valve body. The main valves at the desalination unit are of a lesser corrosion resistant material but the inspected valve nevertheless revealed no significant corrosion. Further inspections should be performed to confirm this being the case for other valves. Future operation should consider flushing with low salinity water prior to standby conditions to preserve this state of condition.

Referring to the structural steel supports it is recommended to apply painting in-situ after removal of salt and loose debris/oxide layer.

5.2.3 Sea Water Intake

As per the site investigations the materials of construction of equipment installed at the seawater intake such as the seawater pumps (1.4462 and similar), the travelling band screens and the bar screens (SS316, protection by sacrificial anode) are of durable nature and commonly used in the industry.

The state of some equipment indicates the need of further investigation of the present conditions, particular of equipment mounted submerged and being idle in stagnant seawater for at least a couple of month. It is highly recommended to drain/pump-out the seawater intake basin to prevent further corrosion as it is very likely that some corrosive damage already occurred.

5.2.4 Balance of Plant (BoP)

The de-rusting and painting activities shall be also furthermore performed continuously.

6. Review of DCL Managements' Improvement Plan

6.1 Review of DCL Managements' Improvement Plan

Referring to the DCL Managements' Improvement Plan the below listed documents submitted under Folders 8, 15, 16 and 17 (see Annex 2-1) have been reviewed:

Debris Filter for DC (Folder 8)
HRSG Bypass Diverter (Folder 8)
Redundancy Equipment (Folder 8)
Sea Water Inlet Bypass Header (Folder 8)
Potable Water Storage Tank Roof Strength Evaluation & Enhancement Report (Folder 8)
Potabilization Unit (Folder 15)
DCL PH 1 Blending (Folder 15)
Potabilization Overview (Folder 15)
Remineralization System (Folder 15)
Sea Water Blending (Folder 16)
Sea Water Intake (Folder 17)
Assessment of Desalination System (Folder 17)

6.1.1 Combined Cycle

6.1.1.1 Heat Recovery Steam Generator (HRSG) Bypass

The additional installation of a diverter damper and stack in order to add the possibility of a simple cycle operation of the power train (see HRSG Bypass Diverter, Folder 8) is recommended, however only after the plant has proven its sound operability.

6.1.1.2 Potable Water Storage Tank Roof Strength Evaluation & Enhancement

The improvement of the Potable Water Storage Tank (PWST) Roof as described in the reviewed report is recommended in order to provide the precondition for the necessary extension of the maintenance work shop (see Clause 7.3) and the spare part storage building (see Clause 10.2.2).

6.1.2 Desalination Plant

6.1.2.1 Redundancy Equipment

Missing redundancy of major pumps such as condensate, brine, feed water and vertical pump downstream of 53µm fine filtration
As visible from the P&ID's of the desalination plant no redundancy of the major pumps is available. Therefore the desalination plant availability is dependent on reliability of any of these pumps and failure of any of them immediately reduces the desalination plant output by at least 50% of the installed capacity. As reported the situation in regard to the fine filtration (53µm drum screen) export to the desalination units has been somewhat remedied by procuring a spare pump that is available as a spare. As further reported this is not the case for the condensate, brine, distillate and feed water pump of the desalination plant. The design as such with no spare pump is inconsistent with the seawater intake pumping that includes an installed standby pump.
It appears advisable to remedy this vulnerability to failure of significant capacity of the desalination plant by procuring spare pumps for the condensate, brine, distillate and feed water in order to allow for reasonably quick removal of a failure as it has been considered for the pumps downstream of the fine filtration. At the very least critical spares for all of these pumps should be available.

6.1.2.2 Sea Water Blending/ DCL PH 1 Blending

As per the provided documentation it is considered to change the potabilisation process from the present design to distillate of the desalination units and mixing with seawater in order to lower the operation costs of the system.
Key chemical analysis data of Seawater Jan 2008 - Jan 2009 Values provided by DHA are listed below:

pH	8.0 - 8.2
Conductivity	52 - 54 mS/cm
Turbidity	5 - 175 NTU
TDS	42 000 mg/l
Total Hardness	6500 - 7500 mg/l
Calcium Hardness as CaCO3	850 - 1000 mg/l
Magnesium Hardness as CaCO3	5950 - 6000 mg/l
Chloride	20 000 - 22 000 mg/l
Sodium	12 950 - 14250 mg/l
Sulphate	3254 mg/l
Silica as SiO2	5 - 20 mg/l
Total Alkalinity as CaCO3	130 mg/l
Bicarbonate Alkalinity HCO3as CaCO3	158 mg/l
BOD	22 - 25 mg/l
COD	120 - 150 mg/l

The provided seawater analysis is of significant concern as it indicates a significant pollution that might be present at least partially at the site location. Water of that kind of quality should not be mixed with water intended for human consumption. Even if some of the pollution is due to the particle load present in the samples there remains a high risk of pollution of the drinking water making it unfit for human consumption of seawater is bypassing all treatment and mixed with distillate for supply as drinking water. Presently seawater mixing with distillate is phased out in most facilities due to such concern of the drinking water quality. Even if seawater would be treated with several treatment steps such as e.g. disinfection and activated carbon filtration it remains a high risk on quality as some chemicals might not necessarily be treated or removed by the selected treatment process.

It is suggested to review alternative potabilisation processes such as limestone filtration or lime slurry/water dosing, if alternatives of the present potabilisation process are to be considered to reduce operation costs. In the meantime it might be considered seeking clarification with the end customer in regard to required water quality. As per all information available it appears that the only requirements for water quality are the WHO regulations that would allow for a significant variation of the drinking water supplied. Depending on the conditions required in regard to corrosion protection of the drinking water distribution system of the end customer there might be potential for operational savings even with the present potabilisation process.

6.1.2.3 Demineralization

6.1.3 Sea Water Intake

6.1.3.1 Debris Filter for Dump Condenser

The seawater feed to the dump condenser downstream of the bar screen and the 500µm band screen at the seawater intake shall be additionally filtered by a 200µm filter. The parallel seawater feed to the desalination units has been modified in the same way and the installed Taprogge PR-BW100-FC 200µm self cleaning filter are reportedly operating satisfactory. The observed clogging of the final condenser of the desalination units has been significantly reduced. Furthermore it has been suggested to cross connect these additional filters (the existing two and one additional) to allow back-up function of any of the filter units for any of the desalination units or the dump condenser.

6.1.3.2 Sea Water Intake Modification

A more substantial modification of the seawater intake has been suggested by Taprogge to deal with the high content of suspended solids presently contained in the seawater. The concept in principal is based on cutting the submerged, open intake pipes, adding a sedimentation basin from which the intake pipe would draw the seawater and installing Taprogge TAPIS filter upstream of the sedimentation basin as the new intake mouth. The sedimentation basin would be constructed of concrete filled double sheet piling constructed around a certain area in front of the present shore line seawater intake. The proposal of Taprogge has already been tested in a physical model test.

We acknowledge that the addition of a similar filter than the type installed at the desalination units (Taprogge PR-BW100-FC 200µm, self cleaning) will improve operational reliability of the dump condenser as the present design is fully relying on the seawater intake filtration.

As such the present design and dump condenser operation is significantly vulnerable to clogging due to the seawater quality present at the intake.

A failure of the dump condenser is directly affecting the power plant operation and power plant output.

However it should be considered that the analysis data available for the period February - April 2010 still show a suspended solid content of up to 120 ppm. Furthermore the inspection of the seawater preheater in desalination unit 11 downstream of the filtration at the seawater intake (Bar screens & 500µm travelling band screens) and downstream of the three filtration steps at the desalination unit itself (Taprogge PR-BW100-FC 200µm. Passavant drum screen 53µm, Alfa Laval ALF 50R 200 µm) still revealed some sediment in the heat exchanger tubes and the desalination stages.

It is noted that the addition of a sedimentation basin is significantly more costly than the additional 200 µm filter for the dump condenser.

Nevertheless it has to be considered that previous analysis of the sediment found inside the desalination units revealed particle sizes down to 3 µm which is well below the filtration size of the installed filtration systems. This load of suspended solids is significantly affecting the consumption of anti scalant or the effectiveness of the anti scalene. This suspended solid load also might contribute to the problems observed on the final condenser / preheater tubes.

Due to the above it is feasible to implement the modification of the seawater intake by installing a sedimentation basin in order to reduce the load of suspended solid in the seawater feed of the plant.

However, prior further proceedings an off-shore geotechnical survey should be carried out.

6.2 Recommended Additional Improvement Measures

6.2.1 Desalination Plant

6.2.1.1 Alternative Dosing Chemicals

The DHA operation team reported their concern about the high operation costs due to required anti scalant dosing at the desalination units. The DHA operation team provided some information on alternative chemicals reviewed earlier internally.
The antiscalant dosing rates which can be calculated from the submitted information does not appear to be highly excessive (approx. 4.6 ppm according to the information available) although detailed operational data is not available to allow for a detailed review. However it has to be noted that the desalination units already had to be acid-cleaned to remove excessive scaling as reported by the operation team. Given the limited operation time (less than 10 month) these desalination units have experienced till date such would appear to indicate that the antiscalant dosing rates might not have been sufficient to prevent scaling of the heat exchange surfaces to the degree one normally would expect. The reason for such is most likely to be found in the excessive suspended solid load found the seawater feed. The effectiveness of the antiscalant chemical will be significantly reduced y this high load of suspended solids as the chemical acts in a similar fashion on those particles as on the scaling it is supposed to be acting. As such the recommended actions on the suspended solid load of the seawater due to the observed operational problems should allow for a much higher effectiveness of the antiscalant and potentially even lower dose rates without excessive scaling. Tests with alternative antiscalant chemicals might be performed after reducing the suspended solid load in the seawater feed. However it is recommended to use only products of experienced, proven manufacturers in the thermal desalination industry (e.g. Sokulan PM 15 i). Such test should be conducted under close supervision of the heat rates and from an excessive start dose rate downwards to prevent excessive scaling of the desalination units going unnoticed. The same procedure should be followed when testing lower antiscalant dose rates of the present chemical after reducing the suspended solid load.
The new antiscalant could be tested in one of the desalination trains to compare and monitor its performance with the present used antiscalant being dosed into the second train at the same time.

6.2.1.2 Filter Basket

The filter basket of the 200µm filter at the desalination units which are acting as a police filter downstream of the fine filtration drum screens have been repeatingly failed (broken). In normal operation these filters (Alfa Laval ALF 50R 200 µm) should not be exposed to high loads of suspended solids as the two filters installed in series upstream of these are of the same or smaller filtration size (Taprogge PR-BW100-FC 200µm, self cleaning and Passavant drum screen 53µm). However due to the high load of weeds

and silt the upstream baskets of the seawater travelling band screen (500µm at seawater intake) and of drum screen (53µm at the desalination. downstream of final condenser) have reportedly failed and therefore might have overloaded these filters. Furthermore the review of the installation of these filters at site revealed that a part of the filter vessel is not automatically de-aerated. This could lead to water hammer at automatic backwash of the filter. Please refer to Annex 15, Picture 177 of Alfa Laval ALF 50R installation and attachment xx drawing of Alfa Laval ALF 50R. Is can be seen from the drawing and site installation the backwash drain section of the filter is not de-aerated, neither automatic nor manually, and should air enter this section of the filter it might lead to significant water hammer in operation. Such could explain the repeated failure of the filter basket even at the relatively low feed pressure of the feed water pump of the desalination unit. It is therefore proposed to modify the Alfa Laval ALF 50R installation to allow for automatic de-aeration. Such design change could be done either by re-arrangement of the backwash drain piping or by installation of automatic de-aeration valves onto this part of the filter vessel.

6.2.1.3 CuNi-90/10 Tube Ends in Final Condenser and Preheaters

At the time of site inspection one preheater on one of desalination units (unit 11, preheater between stage 3 & 4) has been inspected. The inspected preheater tube ends do show similar signs of damage although of significant lesser amount as observed on earlier inspections at the final condenser. Please refer to Annex 15, Pictures 188-195 of preheater inspection on unit 11, between stage 3 & 4 and Annex 15, Pictures 112-114 of earlier final condenser inspections handed over by DHA operations team.
As can be seen from either inspection photos the CuNi 90/10 tube ends exhibit some damage that is of irregular nature and limited to certain tubes. In contact with the equipment supplier, Alfa Laval an earlier report in regard to these tube damages has been brought to our attention. Please refer to attachment xx Alfa Laval inspection report January 2009.
Unfortunately Fichtner has been unable to obtain design information of the materials of construction for the tube end plates and the tubes itself (although the contract lists them as CuNi 90/10) and the number of tubes and tube dimensions in the final condenser and preheaters of the desalination unit from the DHA operation or even the equipment manufacturer, Alfa Laval. As such we are unable to calculate the design flow velocities in these tubes. The design velocities are of importance for CuNi tubes due to lower material strength, particularly for CuNi 90/10 which is prone to erosion at higher flow velocities.
The report of Alfa Laval as of January 2009 lists flotsam and jetsam, in particular plastic material as the reason for the observed damage on the tube ends (please refer in particular to Annex 6.2.2.3-1, Alfa Laval Report). The suggested remedial action has been the installation of plastic inserts at the tube inlet of damaged tube ends.
While it is certainly possible that the plastic material found in the preheater and the final condenser tubes contributed to erosion and might be remedied at the tube inlet ends by the addition of plastic inserts Fichtner is of the believe that this modification does not fully address the problem observed.

As it can be seen in Annex 15 Pictures 112-114 of earlier final condenser inspections handed over by DHA operations team also the tube outlet ends of the final condenser have been attacked in a similar manner than the tube inlet ends, which have been remedied by plastic inserts as shown on the photos. This remedial action of inserting protective plastic inserts cannot be performed for the tube outlet ends as there is no method of fixing these inserts to the tubes and the plastic inserts would be prone of being flushed out of the tubes. Furthermore would plastic inserts increase the head loss at the final condenser and the preheaters and such might not be within the design limits of the system.
Fichtner reviewed all available information and is of the believe that the flotsam and jetsam, in particular the plastic found wedged into the tube ends might have contributed to the problem observed on the in-/outlet of tube ends in the final condenser and the preheaters. However it appears unlikely that the observed irregular nature of the damage of the tubes that has only affected certain tubes and left other tubes undamaged in the immediate surroundings can only be explained by erosion. It appears much more likely that the tube velocities which have been locally increased due to partial blockage of tubes lead to galvanic corrosion between the tube material (believed to be CuNi 90/10) and the tube end plate made of stainless steel (believed to be SS316 as the desalination vessel is made of SS316 material as well). At higher velocities SS316 material can be nobler than CuNi 90/10 which would lead to local galvanic corrosion between the two materials. Such local galvanic elements would then not be fully protected by the sacrificial anode installed in the waterbox of the final condenser/preheater. This would appear to explain the irregular nature of the damage observed on the tube ends as the galvanic corrosion would continue along an initial damage e.g. by erosion. Erosion by itself on tube ends has been observed on other desalination condensers and is usually of much more regular pattern on the tubes itself. It also usually affects not only single tubes as observed on the inspected DHA desalination unit but also tubes in vicinity of them. Given the limited information at this stage and that the observed damage as per the DHA operation team has not noticingly been progressing since the last inspection in 2009 it is suggested to observe and monitor the tube conditions of all preheaters and final condensers closely by e.g. photographic mapping of either tube endplates when inspecting the sacrificial anodes mounted in the water box. Given that the preheater tubes appear to be significantly less affected it also appears that the load of flotsam and jetsam and suspended solid load might contribute significantly in enabling galvanic corrosion by exposing CuNi material that has not the required oxide layer. As such a reduction of the suspended solid load in the seawater feed might prevent further/future damage of the CuNi tubes in the preheater/final condenser of the desalination tubes.
Fichtner asked Alfa Laval to provide certain design information for further investigation, however, such design data are considered as proprietary items.

6.2.1.4 Demineralization

The demineralization plant is reportedly operating without problems apart from issues with the chemical dosing system. These problems are also believed to be related to problems in achieving full regeneration of the mixed bed ion exchange resins that requires extended / repeated regeneration cycles that further cause issues of running out on volume of the neutralization tank prior to achieving full neutralization. The review of the design documents available and the site arrangement, in particular the pipe arrangement, revealed that the chemicals for regeneration of the ion exchange resins are controlled but not fitted with feed-back control in dosing. In contrary to the chemical dosing for neutralization of the regeneration waste water which is equipped with chemical dosing pumps the chemical dosing for regeneration of the ion exchange resins is simply drawn in the system by an ejector system fitted a local flow meter, a non-return valve and an on/off-valve on the chemical injection line. Investigation with the equipment manufacturer confirmed this arrangement. However the system was likely functioning prior to the observed problems due to excess chemicals drawn into the system. The ejectors propelling the chemicals are constructed of plastic material and as such are to be considered as a regular wear & tear item. Such is not unusual in the industry for such applications, but the control concept should take this into account. In order to remedy the observed problems it is recommended to replace the plastic ejectors in charge of the chemical injection at the mixed bed ion exchangers.
Furthermore should the chemical injection be equipped with feed-back control to ensure full regeneration of the ion exchange resins and to prevent excessive chemical use. At the very least the chemical injection should be equipped with manual control valves (presently no control valves at all) and a minimum flow alarm connected back into the control system at the existing local flow meter of the chemical injection lines. Either action should solve the observed problems, but a manual flow control would require regular verification of the correct flow rates to prevent alarms raised due to ejector performance degradation.

6.2.1.5 Remineralization

As per the site inspection the acid dosing is downstream of all other chemical dosing and no hypochlorite dosing of the drinking water is performed.
It is recommended to reverse the order of acid dosing, if dosed, in order to allow for dissolving of any precipitation that might occur. It is further suggested to add hypochlorite dosing, if not present, to allow for disinfection of the drinking water as it otherwise might not comply with mandatory health regulations in regard to bacteriological aspects.

6.2.2 Seawater Intake

The site inspection of the seawater intake and the hypochlorite dosing indicated the following issues that might be considered to improve the future reliability/durability of the plant.

6.2.2.1 Flooding Relief

At the time of site inspection it has been observed that the seawater intake basin is flooded and has not been kept dry. As reported by the operation team the leakage of the penstocks at the front of the seawater intake increased beyond the means available for pumping out the installation and keeping the intake bay dry. It is highly recommendable to remedy this situation to allow for inspection of all installed equipment within the seawater intake bay e.g. the seawater pumps as this equipment is likely to suffer from corrosive attacks under such idle conditions.

6.2.2.2 Cathodic Protection

Some corrosion of the seawater pumps might be observed, particularly if no cathodic protection has been installed as suggested by the review of design. Should no cathodic protection be installed it is recommend to do so for future operation.

6.2.2.3 Hypochlorite Dosing

The hypochlorite dosing system is presently installed in a shed and does not necessarily comply with safety regulations for handling of such chemicals. A review of such might be in order. In regard to the operability of the system it should be considered to change the design such that the dosing of hypochlorite is performed with diluted chemical instead of neat hypochlorite at delivery concentration to increase control of dosing and improve mixing of the hypochlorite with the intake water. Further flushing of the dosing pumps and the dosing lines with low salinity water might prevent scaling of the dosing equipment.
The DCL plan for the sea water hypochlorite dosing system should be applied.

6.2.2.4 Filter Baskets Travelling Band Screen

The sea water intake modification described in Clause 6.1.3.2 should certainly be capable to reduce the load of weed and silt observed at the travelling band screens and significantly reduces the number of failures of the filter baskets if not stop the failures observed. Due to the very high load of suspended solids at the seawater intake and high feed water quality requirement of the desalination plant itself the proposed modification of the seawater intake would help to significantly reduce or even stop the problems observed at the travelling band screen other seawater filtration systems and potentially even at the desalination heat exchanger systems. As such this

modification of the seawater intake to install a sedimentation basin and upstream intake filters is recommended for the future operation of the plant.

7. Power & Desalination Plant Maintenance

7.1 Present Conditions

Referring to the present maintenance the below listed documents submitted under Folder 10 (see Annex 2-1) have been reviewed:

Maintenance Procedure (Write-Up)
Permit-JSA Samples
Planning Database
PM-Calendars
Issues Gas Compressor

7.1.1 Combined Cycle (CC)

The presented maintenance plan is reasonably detailed and appears to contain the main works one would usually expect for such kind of equipment.

7.1.2 Desalination Plant

The presented maintenance plan is reasonably detailed and appears to contain the main works one would usually expect for such kind of equipment. However some works in between operation and maintenance of the desalination plan might need closer review in future operation of the system. General checks such as conductivity verification of the brine flow or observation of the heat rate development should be part of normal operation to prevent maintenance being required in the long-run. Presented maintenance documents and operation documents do not appear to include such requirements.

7.1.3 Seawater Intake

The presented maintenance plan is reasonably detailed and appears to contain the main works one would usually expect for such kind of equipment.

7.1.4 Balance of Plant (BoP)

The presented maintenance plan is reasonably detailed and appears to contain the main works one would usually expect for such kind of equipment.

7.1.5 Maintenance Facilities

The present work shop building on-site is located on the concrete top (roof) of the Potable Water Storage Tank (PWST).

Also additional containers temporarily used as workshops are placed on this roof.
The available workshop space is not sufficient to host the necessary maintenance tool/machinery inventory.
The maintenance tools inventory (except GT) is more than poor and far away from even the basic needs of any sufficient plant maintenance.

Essential machinery like drilling , grinding/welding/cutting machinery is not available.
Suitable lifting devices like overhead cranes, travel cranes etc. are not available.
Necessary heating, ventilation, air conditioning (HVAC) equipment to protect maintenance tools from local corrosive environment is not available

Though space for workshop building extension or additional containers is available, the max. static load of the concrete roof is reached.

Power supply to the work shop facilities is insufficient for the operation of the necessary basic maintenance tool inventory/the necessary HVAC equipment (see Annex 15, Pictures 149-151).

7.2 Review of DCL Managements' Maintenance Proposal

Referring to the DCL's maintenance proposal the below listed documents submitted under Folder 10 (see Annex 2-1) have been reviewed:

Maintenance Procedure

7.2.1 Combined Cycle (CC)

The presented maintenance proposal is reasonably and covers the demand of the equipment concerned.

7.2.2 Desalination Plant

The presented maintenance proposal is reasonably and covers the demand of the equipment concerned.

7.2.3 Sea Water Intake

The presented maintenance proposal is reasonably and covers the demand of the equipment concerned.

7.2.4 Balance of Plant (BoP)

The presented maintenance proposal is reasonably and covers the demand of the equipment concerned.

7.3 Recommended Additional Maintenance Measures

7.3.1 Combined Cycle (CC)

No additional maintenance measures have to be considered.

7.3.2 Desalination Plant

No additional maintenance measures have to be considered.

7.3.3 Sea Water Intake

No additional maintenance measures have to be considered.

7.3.4 Balance of Plant (BoP)

No additional maintenance measures have to be considered.

7.3.5 Maintenance Workshop

7.3.5.1 Recommendations Maintenance Workshop

In order to provide the necessary pre-conditions for adequate maintenance execution the enlargement of the work shop, the provision of tools, machinery, lifting devices and HVAC is recommended.
Civil re-enforcement measures shall apply on the concrete top (roof) of the Potable Water Storage Tank (PWST) to gain necessary space for extension (see also Clauses 7.3.5 and 10.1.6).

The power supply requirements have to be considered and adopted accordingly.

8. Power & Desalination Plant Operation

8.1 Review DCL's Standard Operation Procedures (SOPs)

8.1.1 Plant/ Unit

Referring to the overall plant / unit the below listed Standard Operation Procedures (SOPs) named 'SOP' submitted under Folder 18 (see Annex 2-1) have been reviewed:

Document No.	Title
	Overall Plant Start-up
	Overall Plant Shut-down
	Unit Start-up Check List
	Unit Warm Start-up Procedure
	Unit Hot Start -up Procedure
SOP-DCL/SHUTDOWN/18	Unit Shut-down Procedure

8.1.2 Combined Cycle

8.1.2.1 Gas Turbine (GT)

Referring to the GT the below listed Standard Operation Procedures (SOPs) named 'SOP 'submitted under Folder 18 (see Annex 2-1) have been reviewed:

Document No.	Title
SCP-DCL/GT/01	Standard Operating Procedure
SCP-DCL/GT	Standard Operating Procedure Comp-Washing
SOP-DCL/FGCS/01	Standard Operating Procedure Fuel Gas Compression
	Standard Operating Procedure Lube & Lifting Oil System

8.1.2.2 Steam Turbine (ST)

Referring to the ST the below listed Standard Operation Procedures (SOPs) named 'SOP' submitted under Folder 18 (see Annex 2-1) have been reviewed:

No KKS	Title
SOP-DCL/STEAM-TURBINE/03	Standard Operation Procedure
SOP-DCL/DUMP-SYS/01	Standard Operation Procedure Dump Condenser/Vacuum System

8.1.2.3 Heat Recovery Steam Generator (HRSG)

Referring to the HRSG the below listed Standard Operation Procedures (SOPs) named 'SOP' submitted under Folder 18 (see Annex 2-1) have been reviewed:

Document No.	Title
SOP-DCL/HRSG/01	Standard Operating Procedure
SOP-DCL/SUSS/01	Standard Operating Procedure Steam System

8.1.2.4 Generator

Referring to the generator the below listed Standard Operation Procedures (SOPs) named 'SOP' submitted under Folder 18 (see Annex 2-1) have been reviewed:

Document No.	Title
	Standard Operating Procedure Main Generator System

8.1.3 Desalination Plant

Referring to the Desalination the below listed Standard Operation Procedures (SOPs) named 'SOP 'submitted under Folder 18 (see Annex 2-1) have been reviewed:

Document No.	Title
SOP-DCL/Fine Filt-SYS/01	Standard Operating Procedure Fine Filtration
SOP-DCL/DESAL-SYS/11	Micro Giant Operating Procedure Standard Operation Procedure Desalination Remineralization Start-up Check List

8.1.4 Sea Water Intake System

Referring to the Sea Water Intake System the below listed Standard Operation Procedures (SOPs) named 'SOP 'submitted under Folder 18 (see Annex 2-1) have been reviewed:

Document No.	Title
SOP-DCL/SEA-WATER/19	Standard Operating Procedure Sea Water Start-up Check list

8.1.5 Balance of Plant (BoP)

Referring to the BoP the below listed Standard Operation Procedures (SOPs) named 'SOP' submitted under Folder 18 (see Annex 2-1) have been reviewed:

No KKS	Title
SOP-DCL/INST-SYS/01	Standard Operating Procedure Instrument Air
SOP-DCL/DEMIN-SYS/18	Standard Operation Proc. Demineralization
SOP-DCL/CCWS/02	Standard Operation Procedure CCW System
SOP-DCL/AUX-STEAM/07	Standard Operation Proc. Auxiliary Steam
SOP-DCL/Demin Water-SYS/01	Standard Operation Proc. Demin System

Standard Operating Procedure 0.4 KV Bus Bar from EDG
Standard Operation Procedure Auxiliary Boiler and Auxiliary Steam System

8.2 Conclusions and Recommended Additional Operation Measures

All above mentioned SOG documents reflect a state-of-the art content enabling a skilled operation crew facilitated with the necessary personal protection equipment to operate the entire plant without restrictions in accordance with its intended use within the designed range.

Necessary operational correction measures are described appropriate and start-/ shut down check-lists are provided to the required extend.

Assuming the compliance of the plant operation with this SOGs the integrity of humans, environment and plant equipment is granted to the extend the state-of-the-art, the general duty of care and the mandatory requirements ask for.

In so far no additional operation measures have to be recommended.

However, one has to take into consideration the comment above refer to the present design, configuration, settings and operation mode of the plant.

Any change in these conditions, in particular after applying rehabilitation upgrade measures to the plant require a customization of the SOG's concerned.

9. Power & Desalination Plant Preservation

9.1 Present Conditions

9.1.1 General

Starting from May 2010 when the plant was forced down by the 5th GT compressor surge event on the entire plant long-term preservation measures have been applied and are maintained up to present.

Referring to the preservation concepts the below listed documents submitted under Folder 20 (see Annex 2-1) have been reviewed:

Plant Preservation Plan/Procedures
Calendars (Zones 1-4) and status.
Preservation Report-July 2011 (actual: Aug 2011)
ST Preservation Report
Additional Preservation Plan

The proper application of the preservation concepts to the components and facilities was cross-checked by visual on-site inspections and the review of the related measurement log sheets.

9.1.2 Combined Cycle (CC)

9.1.2.1 Gas Turbine (GT)

On the GT a dry preservation concept is realized using air blown by a Munters® Dryer into the GT casing.

In general this is the most economic method out of the appropriate and proven methods for long time preservation of already installed turbines of all kind.

However, the successful application of this method depends on the strict compliance to the following conditions:

- A continuous air flow over the entire cross section of the turbine casting has to be maintained
- Relative humidity of air should not exceed 43 %
- Sufficient air inlet flow (f.e. 150 feet/min in a 10 inch round duct at turbine inlet) has to be maintained
- IGV fully open to allow max. airflow
- Daily control measurements of humidity and flow

At the time of on-site visual cross-checking, however, in particular the essential continuous air flow over the entire cross section of the turbine casting was not maintained.

Thus air inlet and outlet have been connected to the same plenum, a short-cut was created providing only a very insufficient air flow through the GT.

In order to avoid slagging (bending) the GT was hand-turned 180° once a week and put on turning gear once a month for several hours prior to the opening of the GT.

Related to the opening the turning activities have been stopped.

Resuming this turning activity after reassembling of the GT was intensively discussed between DCL/SIEMENS/FICHTNER.

9.1.2.2 Steam Turbine (ST)

On the ST also a dry preservation concept is realized using air blown by a locally purchased de-humidifier and additional heater / blower arrangement into the ST casing (see Annex 15, Pictures 180-184).

Subsequently the general remarks and conditions mentioned under Clause 9.1.2.1 apply without restrictions.

With closed SSS clutch turning to avoid slagging was achieved with the GT (see Clause 9.1.2.1).

In opposite to the GT the dry conservation concept is well maintained.

9.1.2.3 Heat Recovery Steam Generator (HRSG)

On the HRSG two different preservation concepts are realized using an alkaline/oxygen scavenging wet preservation with Nitrogen (N_2) capping on the water-/steam side and dry air preservation maintained by the application of hydroscopic silica gel on the flue gas side.
The stack outlet is covered by a tar rag.

The concepts reflect the state-of-the-art and are well maintained.

However, the oxygen scavenger 'Hydrazine' (N_2H_4) used within the water-/steam side is under suspicion causing cancer and is subsequently banned from such a use in most of the countries all over the world.
In addition the applied dosing concentration of 1000 ppm (mg/l) seems extremely high. Proven dosing levels obtained prior to the ban was 300 ppm (mg/l).

9.1.2.4 Generator

On the generator a dry preservation concept as on the GT/ST is realized using air blown by a Munters® Dryer into the generator casing (see Annex 15, Pictures 185-186).

Also the 4 generator coolers watersides are air-dried.

Turning to avoid slagging was achieved with the GT (see Clause 9.1.2.1).

The concept reflects the state-of-the-art and is well maintained.

9.1.3 Desalination Plant

Within the desalination plant the following preservation concepts according to the specific demands of the various components' facilities are realized:

- **Desalination units** are drained, dried out and kept under dry preservation with hydroscopic silica gel.
- **Valves** are covered by plastic bags with hydroscopic silica gel inside continuously removing humidity to maintain necessary dry air conditions. The valves are stroked on a frequent base and greased accordingly.
- **Instrumentation devices** (switches, Actuators, control valves, positioners, thermocouples, etc.) also are covered by plastic bags with hydroscopic silica gel inside continuously removing humidity to maintain necessary dry air conditions. The stainless steel (SS) instrument lines are drained.
- **Tanks/Condenser** are flushed and kept under dry with hydroscopic silica gel.

Basically the concepts reflect the state-of-the-art.

As per the submitted documentation the desalination units have been flushed with low salinity water prior to preservation. At the time of the site inspection the desalination units have been found in a reasonably good state of preservation. However ongoing work at the time of the site inspection might suggest that a number of these preservation preparations have been performed not necessarily from the date of shutdown or within the time shortly thereafter. Nevertheless appears the desalination plant to be in good condition. Further inspection is recommended in regard to the state of conditions of the valves.
Please refer also to Annex 15, Pictures 188-195 of preheater inspection on unit 11 and Annex 15, Pictures 90-111 of the desalination vessel unit 11.

There have been a number of spots showing salt crystals with the desalination vessels. It is unclear whether this salt is present due to insufficient flushing after shutdown of the units or due to airborne salt or contamination by equipment or manpower although it is more likely due to salty water remaining after flushing. It has been noticed that attempts have been made to reduce the humidity levels with the desalination vessels by pans filled with lime or silica gel or similar chemicals. These attempts are one way of addressing the humidity problem at the plant site, but only useful if the vessels have been dried prior to the application and are kept closed thereafter to prevent further ingress of humidity due the ambient air. At the time of the site inspection the color of the silica gel appeared to

indicate exhaustion of the drying potential, but this might be due to the open desalination stages at that time.

9.1.4 Sea Water Intake

Refer to Clause 5.2.3.

9.1.5 Balance of Plant (BoP)

Within the BoP several preservation concepts according to the specific demands of the various components/ facilities are realized:

- **Valves** are covered by plastic bags with hydroscopic silica gel inside continuously removing humidity to maintain necessary dry air conditions. The valves are stroked on a frequent base and greased accordingly.
- **Piping** is either under dry Nitrogen (N_2) or dry air with hydroscopic silica gel preservation.
- **Instrumentation devices** (switches, Actuators, control valves, positioners, thermocouples, etc.) also are covered by plastic bags with hydroscopic silica gel inside continuously removing humidity to maintain necessary dry air conditions. The stainless steel (SS) instrument lines are drained.
- **Motors** also are covered by plastic bags with hydroscopic silica gel inside suggested to remove humidity to maintain necessary dry air conditions. The motors are rotated on a frequent base.
  The installed space heaters, however, are switched off.
- **Auxiliary boiler** is dried out by air and sealed completely with silica gel inside continuously removing humidity to maintain necessary dry air.
- **Dump condenser** condensing and cooling side are both under forced dry air preservation.
- **Demineralization System** plastic ion exchanger vessels and filter vessels are left under stand-by conditions and rinsed frequently with demineralized water.
- **Tanks are emptied** and kept under dry preservation
- **Air compressors** are under no preservation concept, but operated twice a week.
- **Fuel gas compressors** are under a dry preservation concept filled with Nitrogen (N_2). Compressor shaft is rotated by hand 450^0 once a week.
- **Closed Cooling Water Coolers** are under dry preservation on sea water side and wet preservation on the demin water side.
- **Electrical Panels** are sealed with hydroscopic silica gel inside.

The concepts basically reflect the state-of-the-art and are well maintained. Exception is made for HP feed water pumps (see Clause 9.2.4)

9.2 Recommended Modifications/Additional Preservation Measures

9.2.1 Combined Cycle (CC)

9.2.1.1 Gas Turbine (GT)

Although the dry air concept applied is undisputed, at least one of the essential conditions for a successful application is not fulfilled (see Clause 9.1.2.1).
Since this air-in / air-out configuration is based on the recommendation of the Original Equipment Manufacturer (OEM) of the GT (SIEMENS). DCL/FICHTNER approached SIEMENS immediately urging for mitigation.

A revised air connection sketch was submitted by SIEMENS, which was reviewed and commented by DCL/FICHTNER and finally accepted and applied.
This concept was considered to avoid the prior inadequacies and was under close DCL surveillance.
However, the records of the humidity readings inside the GT also after modification showed improper high humidity. The detailed records have been submitted to SIEMENS for further investigations.

9.2.1.2 Heat Recovery Steam Generator (HRSG)

The 'Hydrazine' (N_2H_4) should either be replaced by carbohydrazide or Vapor Phase Inhibitors (VCI) - whatever is available on-site under the most economical conditions - or a dry preservation concept shall be applied.
If this is deemed not feasible for whatever reason, at least the 'Hydrazine' (N_2H_4) dosing concentration should be limited to 300 ppm (mg/L) (see Clause 8.1.2.3).

9.2.2 Desalination Plant

During the site inspection of the desalination units salt crystals have been found in either unit.
Full flushing of the desalination vessels and subsequent drying is highly recommended. Measures such as the observed attempts to reduce the level of humidity within the vessels are to be appreciated and should be continued, if humidity measurements show their effectiveness. Alternatively flushing with low humidity air or gases (e.g. nitrogen) might be considered.

9.2.3 Sea Water Intake

Refer to Clause 5.2.3.

9.2.4 Balance of Plant (BoP)

In addition to application of plastic covers and silica gel installed space heaters should always be kept energized.

10. Spare Parts

10.1 Status on-Site Available Spare Parts

10.1.1 General

The on-site available spare part inventory according to the submitted document named 'DHA Cogen Ltd. Store Positions from Aug 01 - Aug 15 2011', pages 1-113, dated August 16th, 2011 (see Annex 2-1, Folder 14) simply lists all available tools, spare parts, wear & tear parts, consumables and personal protection equipment.

Though a kind of coding/classification as well as an in-out balance and a valuation of the inventory are provided, the inventory seems to be based rather on random erection - / commissioning left over's than on a planned and scheduled spare part supply.

10.1.2 On-Site Spare Part Inventory Combined Cycle (CC)

10.1.2.1 Gas Turbine (GT)

The on-site available spare parts for the GT are listed under the coding/classification 030001 within the spare part inventory list representing a total value of 4,598,926.58 PKR.

Kind, type and amount of this parts show very little significance to any kind of planning / scheduling but seems to be the result of the random excess amount remaining from prior erection / commissioning/ maintenance activities.

Specific tools for GT maintenance are available on -Site as listed below:

- Standard Tool Set
- Tool Set for Initial Assembly and Inspection
- Major Overhaul Tools (partial)

However, tools for minor overhauls, hot gas path inspection and parts for major overhauls are not on-Site.
Consumables for hot gas path inspection and major overhauls are also lacking on-Site.

10.1.2.2 Steam Turbine (ST) / Generator

The only on-site available spare part for the ST is listed under the coding/classification 030003 within the spare part inventory list representing a total value of 275,500.00 PKR.

Furthermore under coding / classification 080006 Commissioning Spares Consumables for the ST and under 080008 Special Maintenance Spare Parts are listed.

The only on-site available spare part for the generator is listed under the coding/classification 030017 within the spare part inventory list representing a total value of 0.01 PKR.

So, basically no spare part stock for the ST and the generator are available on site.

10.1.2.3 Heat Recovery Steam Generator (HRSG)

The on-site available spare parts for the HRSG are listed under the coding/classification 030019 within the spare part inventory list representing a total value of 390,570.92 PKR.

Comparable to the situation on GT spare parts also kind, type and amount of this parts show very little significance to any kind of planning / scheduling but seems to be the result of the random excess amount remaining from prior erection / commissioning/ maintenance activities.

10.1.3 On-Site Inventory Spare Parts Desalination Plant

The on-site available spare parts for the desalination are listed under the coding/classification 030002 within the spare part inventory list representing a total value of 491,264 PKR.

However, comparable to the situation on the CC kind, type and amount of this parts show very little significance to any kind of planning / scheduling but seems to be the result of the random excess amount remaining from prior erection / commissioning/ maintenance activities.

10.1.4 On-Site Inventory Spare Parts Seawater Intake

The on-site available spare parts for the seawater intake are listed under the coding/clarification 030004 within the spare part inventory list representing a total value of 928,136 PKR.
Also in this case type and amount of this parts show very little significance to any kind of planning / scheduling but seems to be the result of the random excess amount remaining from prior erection / commissioning/ maintenance activities.

10.1.5 On-Site Inventory Spare Parts Balance of Plant (BoP)

The on-site available spare parts for the BoP are listed under several codings/classifications within the spare part inventory list.

With the exception of the fuel gas compressor spare part stock covering one complete overhaul of one fuel gas compressor out of two no sufficient spare part availability is given.

10.1.6 On-Site Spare Part Storage Facility

The present spare part storage on-site is located besides the work shop on the concrete top (roof) of the Potable Water Storage Tank (PWST).

The inspection of the on-site storage facilities for spare parts showed insufficient ambient storage conditions.
The total available space for a sufficient spare part inventory is ways to small.

10.2 Findings and Recommendations

10.2.1 Findings

- A state-of-the-art spare part management system is not developed /implemented / in-force.
- The on-site spare part inventory is insufficient considering plant operation on the maximum achievable level.
- Storage facility space on-site is too small.
- Ambient storage conditions are insufficient.
- Though space for building extension or additional containers is available: the max. static load of the concrete roof is reached.

10.2.2 Recommendations

10.2.2.1 Spare Part Management

It is recommended to develop and implement a state-of-the art spare part management system.
This spare part management system shall be computerized and integrated with other systems.
Computerization will bring in all round improvement by stream lining the process as well as reducing the total cost of stock holding, ordering and stock-out costs.

The systematic approach to develop such a system is described in brief below:

a) Identification of spare parts
b) Forecast of spare parts requirement
c) Inventory analyses
d) Formulation of selective control policies for various categories
e) Development of inventory control systems

f) Stocking policies for capital & insurance spares
g) Stocking policies for rotable spares or sub-assemblies
h) Replacement policies for spare parts
i) Spare part inspection
j) Indigenization of spares
k) Reconditioning of spare parts
l) Computer applications for spare parts management

Identification means the classifying and codifying all the spare parts in order to maintain easy accounting and computerization in addition to easier communication between concerned parties.

Commonly used **inventory analyses** are:

(1) FSN Analysis (Classification based on frequency of issues/use)
(2) ABC Analysis (Classification based on consumption)
(3) VED Analysis (Classification based on criticality)
(4) SDE Analysis (Classification based on the lead time)
(5) HML Analysis (Classification based on unit price)

F S N stands for Fast moving, Slow moving and Non moving items. This form of classification identifies the items frequently issued, less frequently issued for use and the items which are not issued for longer period, say, 2 years.

ABC
CLASS A: 10% of total spares contributing towards 70% of total consumption value.
CLASS B: 20% of total spares which account for about 20% of total consumption value.
CLASS C: 70% of total spares which account for only 10% of total consumption value.

VDE stands for Vital Essential and Desirable items.
VITAL (V): A spare part will be termed vital, if on account of its non-availability there will be very high loss due to production downtime and/or a very high cost will be involved if the part is procured on emergency basis. In a process industry, most spare parts for the bottleneck machine or process will be of vital nature. For example, bearings for a kiln in a cement plant will be considered vital.
ESSENTIAL (E): A spare part will be considered essential if, due to its non-availability, moderate loss is incurred. For example, bearings for motors of auxiliary pumps will be classified as essential.
DESIRABLE (D): A spare part will be desirable if the production loss is not.

SDE stands for Scare, Difficult, Easily available items.
Scarce (S): Items which are imported and those items which require more than 6 months' lead time.

Difficult (D): Items which require more than a fortnight but less than 6 months' lead time.
Easily available (E): Items which are easily available i.e., less than a fortnights' lead time.

HML stands for High, Low, Medium cost of items.
High Cost (H): Item whose unit value is very high, say, PKR.**100, 000/-** and above.
Medium Cost (M): Item whose unit value is of medium value, e.g. less than PKR.**100, 000/-.**
Low Cost (L): Item whose unit value is low, e.g. less than PKR **10,000/-.**

This type of analysis helps in exercising control at the shop floor level

Some other Classifications based on other characteristics may also be considered.

A) Capital Spares

These are vital spares for critical equipment. The stock-out cost for such spares is very high and the unit cost also is very high. The number of items consumed during the life time of the equipment may be 1 or 2 or 3. Hence, the decision has to be made as to the number of items to be stored.

B) Insurance Spares

An insurance item is a spare part that will be used to replace a failed identical part in operating equipment whose penalty cost for downtime is very high. Hence, by definition, it is an insurance against such failures for which the down time costs are very high. They do not become obsolete until the parent equipment is retired from service no matter if they do not move for many years.

C) Overhaul Spares

Spare parts which must be replaced every time the equipment is dissembled and re-assembled.

D) Wear and Tear Spares

Spare parts which have regular wear and tear in the course of operation of the equipment and need to be replaced after definite number of hours of equipment operation.

E) **Consumable Spares**

These are regularly used items such as fasteners, seals, bearings, etc.

To ensure smooth functionality of the implemented spare part management system it is essential to develop a suitable **inventory control** by which optimization of spare parts cost is achieved in a systematic way. As regards the fast moving and slow moving items are concerned, the following procedure can be followed taking into consideration various cost elements.

While managing the spare-parts inventory, basically there are four cost elements to be considered:

1. Cost of the spare part
2. Cost of ordering
3. Cost of storage
4. Cost of stock-out.

Also essential is a **periodic review system.** In general a purchase order has to be placed when the stock level reaches the reorder level, e.g. a continuous watch on the stock level is required.
There will be orders released almost daily as there is large number of items. The possibility of combining more number of items in the same order for a supplier is very much reduced. A periodic review system aims at eliminating such disadvantages. In this system, the stock level of all or a group of items are reviewed periodically. The review period and the replenishment level are fixed and order is placed while the stock level is less than the replenishment level. Ordering quantity is equal to replenishment level minus stock level.
Replenishment level = Safety stock + Consumption Rate x (Review period + Lead Time).

10.2.2.2 On-Site Spare Part Inventory

The necessary spare pare part availability just on demand for the entire plant is one of the top priority items in order to ensure the maximum possible plant availability.

Availability on demand, however, requires a sufficient spare part inventory considering OEM recommendations as well as the findings recovered from the spare part management system as soon as it is implemented.

Considering the matter of fact that the spare part inventory basically has to be built-up from scratch (refer to Clause 9.1), OEM recommendations shall be followed so far.

Referring to the GT this means as a minimum requirement all wear parts and all parts for the minor overhaul out of the GT V64.3A initial spare parts package shall be available on-Site.

These spare parts are required for the performance of the scheduled minor inspections or day-to- day maintenance according to the maintenance check list and should be available in terms of availability commitments to ensure disassembly and reassembly of the GT in case of an unscheduled event.

Also the strategic spare parts package offered for the GT is recommended to be available on -Site.
This package is required to overcome unexpected failures or damages during normal operation and during Minor- and Major-Inspections.

Program and spare parts used within the scheduled major overhaul and hot gas path inspections as well as the related tools and consumables might not be available on-Site and shall be included in the related services contract for the GT.

10.2.2.3 Spare Part Storage Facility on-Site

In order to provide sufficient ambient and adequate special storage conditions the existing spare part storage facility has to be extended and equipped with heating, ventilation and air conditioning (HVAC).

Civil re-enforcement measures shall apply on the concrete top (roof) of the Potable Water Storage Tank (PWST) to gain necessary space for extension.

11. Power & Desalination Plant Operation and Maintenance Management

11.1 Staff Plan

Referring to the staff plan the below listed documents submitted under Folder 27 (see Annex 2-1) have been reviewed:

Employees Experience Matrix
Staff Management Plan Updated Aug 26, 2011

Furthermore the job descriptions submitted by DCL e-mail dated Oct 07, 2011, Plant Manager Mr. Seraj-ul-Haq (see Annex 10.1-1), the Operations staff training plan and the organization chart both, made available on -Site have been considered.

11.1.1 Current Situation

The current situation shows an insufficient staffing with just 64 out of 95 total staff required for plant operation available.
Within this staff shortfall maintenance department (-13) and operation department (- 10) are effected most.
While the present staffing might be in a position to maintain the necessary preservation activities during plant shut down, a reliable plant operation cannot been considered.
The submitted job descriptions are suitable and comprehensive.

11.1.2 Review DCL's Staffing Proposal

The staffing proposal laid down under Clause A of the DCL Staff Management Plan is based on state-of-the art requirements for plants of the given design and size without any restriction.
Staff recruiting procedure described is appropriate and the invitation of a competitive remuneration package is essential to minimize the expensive fluctuation of trained staff.
The proposed organization chart and the distribution of responsibilities (chain of command) are capable to ensure a smooth and adequate course of business.

11.2 Staff Training

11.2.1 Current Situation

The Operation Staff Training Plan currently effective for the available plant staff covers the present day-to-day business of the plant, however not the demand of the plant under operation conditions in particular with view to the necessary recruiting activities.

11.2.2 Review DCL's Training Proposal

The staff training proposal laid down under Clause B of the DCL Staff Management Plan including the internship training program and the outside training for specialized jobs is suitable to provide the necessary knowledge and skills for plant operation.
Special attention has to be drawn to the provision of an extended training (in-house and abroad) for the I&C Engineer to be recruited/promoted from the existing staff.

11.3 Findings and Recommendations

11.3.1 Findings

11.3.1.1 Findings Staff Plan

- the current staffing (64) is insufficient for reliable plant operation
- the existing job descriptions cover the demand
- the proposed recruiting procedure, the organization chart and the distribution of responsibilities are appropriate

11.3.1.2 Findings Staff Training

- the proposed staff training schedule is suitable to provide the necessary knowledge and skills for plant operation
- in particular the training of the I&C engineer needs extended efforts

11.3.2 Recommendations

11.3.2.1 Recommendations Staff Plan

- full implementation of the DCL proposal

11.3.2.2 Recommendations' Training

- full implementation of the DCL proposal
- special, extensive training in-house and abroad referring to the plant control system for the I&C engineer

12. Power & Desalination Plant Performance Forecast

12.1 Combined Cycle (CC) Net Power Output

Referring to CC net power output forecast the below listed documents submitted under Folder 22 (see Annex 2-1) have been acknowledged:

Daily Data Average Values 2008
Daily Data Average Values 2010

In order to provide the CC net power output forecast the gross power output of the CC cycle considering base load operation of the desalination plant covering a temperature range from 8°C - 40°C was calculated using Consultants 'KAPRO' program.

The Summary Curve considering

- Steam turbine (ST) gross output
- Gas turbine (GT) gross output
- Generator gross output

is attached as Annex 12.1-1.

The in-house demand of the power & desalination plant estimated to has to be deducted from the generator gross output respectively.

12.2 Plant Availability

Referring to the plant availability forecast the below listed document submitted under Folders 23 (see Annex 2-1) have been reviewed:

DCL Generation Statistics

In the time between April 2008 (COD) and March 2010 (last operation up to date) due to several forced outages (see Clause 2.) the plant showed a poor performance reaching just 14 - 53 % availability.

Taking into consideration the below listed assumptions the availability forecast according to table 12.2-1 are calculated:

- 8.600 base operation hours / year are defined as 100 % availability
- The measures as identified in Annex 13.1-1, Priority 1 to 4 are implemented.
- The inspection and overhaul schedule according to Annex 14.1-1 are applied.
- An additional 14 days (336 h) / year (8600 h) unscheduled outage period is considered.
- No shut down periods resulting out of fuel restrictions (f.e. fuel shortage, fuel quality) are considered.

- No shut down periods resulting out of sea water supply restrictions (f.e. bad weather conditions like storm. flooding) are considered.
- No shut down periods resulting out of consumables shortage are considered.
- No shut down periods resulting from grid disturbances are considered.

Table 12.2-1 Availability Forecast

Year	2012	2013/19	2014/20	2015/21	2016/22	2017/23	2018/24
Scheduled Outage/ year Annex 14.1-1	Re-Start	(14 d) 336 h	(14 d) 336 h	39 d 936 h	(14 d) 336 h	(14 d) 336 h	58 d 1,392 h
Un-scheduled Outage/ year		(14 d) 336 h	(14 d) 336 h	(14 d) 336 h	(14 d) 336 h	(14 d) 336 h	(14 d) 336 h
Avai-lability/ year		7,928 h	7,928 h	7,328 h	7,928 h	7,928 h	6,872 h
Avai-lability/ year		92.2 %	92.2 %	85.2 %	92.2 %	92.2 %	79.9 %

12.3 Combined Cycle Net Heat Rate

Referring to the CC net heat rate forecast the below listed document submitted under Folder 22 (see Annex 2-1) have been reviewed:

Heat Rates Weekly Reports 2008 to 2010

In order to provide the CC net heat forecast considering base load operation of the combined cycle Consultants 'KAPRO' program was used again. The Summary Curve considering is attached as Annex 12.3-1.

13. Expenditures

13.1 Capital Expenditures

Referring to CAPEX the below listed documents submitted under Folder 25 (see Annex 2-1) have been reviewed:

CAPEX for Plant Improvement Work Priority List
Plant CAPEX Sheets

The estimated costs in the documents expressed in PKR seem reasonable according to the local conditions and Consultants' experience.

For conversion in USD the following rates have been applied:

100 PKR = 1, 00 Euro= 1, 4 USD

The scope of work addressed in the documents is considered appropriate.

Some minor adjustments in the amounts and distribution have been performed according to the Summary Table CAPEX (refer to Annex 13.1-1).

Costs for the rehabilitation of the GT according to the RCA results are included neither in the submitted DCL documents nor in Consultants' Summary Annex 13.1-1.

While the total CAPEX in this Annex adds up to 17.294.000 USD, the total CAPEX in the DCL document 'CAPEX for Plant Improvement Work Priority List' adds up to just 15.183.000 USD (1.084.486.715 PKR).

This difference results mainly out of the following different approaches:

- DCL CAPEX for Plant Improvement Work Priority List' doesn't contain any CAPEX related to Plant Start up Work estimated to 760.000 USD 8 (see Annex 13.1-1, Priority 1)
- In DCL CAPEX for Plant Improvement Work Priority List' the spare part demand considers just 2012 with a total amount of 276.000 USD (19.700.000 PKR), while Annex 13.1-1, Priority 2 considers 1.170.000 USD.

The submitted DCL 'Plant CAPEX Sheets' adds up to 8.413.539 USD (600,967,091 PKR), not considering however the measures

- HRSG Bypass 3,015.700 USD (215.407.000 PKR)
- Improvement Sea Water Intake 7,000,000 USD (500.000.000 PKR)

which are considered in the DCL 'CAPEX for Plant Improvement Work Priority List' as well as in Annex 13.1-1.

In addition to DCL 'CAPEX for Plant Improvement Work Priority List' and Annex 13.1-1 the DCL 'Plant CAPEX Sheets', however, contains increased costs for repeated

- Tube replacement for Desal. H/Es
- Purchase of additional Test Equipment
- Purchase of non Sparkings and other tools

etc., which might be tenable but not imperative.

Summarized it has to be noted that the CAPEX estimations provided by DCL and performed by Consultant match and adds up to 17,500,000 USD (± 10 %) without the costs resulting from the implementations of the GT RCA rehabilitation recommendations.

13.2 Operational Expenditures

Referring to OPEX the below listed document submitted by DCL e-mail dated Oct 19, 2011 (see Annex 13.2-1) has been reviewed:

OPEX Budgets Spread Sheet AEI Format V1 covering the period from 2010 to 2015.

The estimated costs and the allocation in the documents expressed in PKR seem in general reasonable according to Consultants' experience.

However, it has to be noted that the Spread Sheets

- 1.3 Working Capital Costs
- 1.4 Vehicle Budget
- 1 Clause 2, Human Resources Costs
- 1 Clause 3, Administrative Costs
- 1 Clause 6, Plant Insurance

just have been accepted instead of verified. In this cases Consultant is forced to rely on the DCL information.

14. Long Time Service Agreement (LTSA)

Referring to the LTSA the below listed documents submitted under Folders 12 (see Annex 2-1) have been reviewed:

LTMP offer Aug 24- Best Proposal (Folder 12)
LTMP offer for Maint on GT 800371_Dec 7, 2010 (Folder 12)
LTMP offer Sept 3 (Folder 12)
LTMP Whole Package (Folder 12)

14.1 Power & Desalination Plant O&M without LTSA

The O&M of the plant without LTSA is possible and recommended for the entire plant except the gas turbine (GT), provided the recommendations and findings of the DCL proposals / this report are realized and applied in particular referring to Clause 10, 'Spare Parts' and Clause 11 'Operation & Maintenance Management'.
The accordingly adopted DCL resources should be certainly in a position to provide the necessary day-to-day O&M capabilities.

However, taking into consideration the Inspection and Overhaul Schedule Annex 14.1-1 it might be appropriate to contract either an OEM or a local independent service provider on a Purchase Order basis for inspections /overhauls.

For the gas turbine (GT) it is recommended to award a LTSA for the execution of the inspections / overhauls according to Annex 14.1-1.
Here neither the necessary DCL resources neither are available nor could be provided on an economical appropriate scenario.
Certainly also the execution of the GT inspections and overhauls could be provided on a Purchase Order basis as well, which is, however, not recommended.

A LTSA provides besides the sole execution of the works like a Purchase Order among other things a certain risk sharing like warranties and availability, frequent up-grade activities and a certain long time price security.

14.2 Alternative LTSA Provider

While there are in general hundreds of none-OEM (alternative) LTSA providers on the market offering a wide selection of services starting from just repair services up to full scaled O&M contracts, none of this companies awarded the requested min. of 5 LTSAs on a type V 64.3A GT. (see ToR, Bullet 14 of the Consultancy Contract).

In absence of this contractual precondition alternative none-OEM providers have been justified based on the following criteria:

- prior experience in SIEMENS GT fleet maintenance, preferably including the GT V 64.3A
- financial resources
- staff resources
- ability of GT V 64.3A spare part (OEM and high quality non-OEM) supply
- organization structure
- reputation

Applying this screening the below listed providers can be taken into consideration:

- Ansaldo Thomassen, The Netherlands
- Sulzer Turbo Services, Switzerland
- Wood Group, UK
- ESBI Energy Innovation, Ireland
- Vasavi Power Service Ltd., India

All these providers offer in general the full scope of GT service agreements, starting with simple purchase orders for a certain service on a certain component (f.e. GT minor overhaul etc.), followed by LTSAs for specific components (f.e. GT) and ending up with Operation & Maintenance Contracts for the entire plant.

However, regarding to LTSA service providers the following observations have been provided by DCL:

- Ansaldo Thomassen will not be able to work on V 64.3A GT's until Dec 2013 due to the existence of an agreement between Ansaldo and SIEMENS.
- Sulzer Turbo Services declined to work at DCL site in Pakistan due to security reasons when contacted in early 2011.
- Wood Group declined to provide a proposal to DCL when contacted in 2009 without giving specific reasons.

When and whether other service providers are willing and able to work in Pakistan certainly is based on an internal decision process and cannot be predicted by FICHTNER.

15. Annexes

Annex 2-1	Folder List Documents submitted by DCL
Annex 4	SIEMENS RCA Report
Annex 5.1.1.4-1	HRSG Wall Thickness Measurement Results
Annex 6.2.2.3-1	Alfa Laval Inspection Report
Annex 10.1-1	DCL e-mail Job Descriptions
Annex 12.1-1	Summary Curve Gross Power Output CC
Annex 12.3-1	Summary Curve Net Heat CC
Annex 13.1-1	Summary Table CAPEX
Annex 13.2-1	DCL e-mail OPEX
Annex 14.1-1	Inspection & Overhaul Schedule
Annex 15	Pictures

ANNEX – B

SSGC COMFORT LETTER

&

GAS SUPPLY AGREEMENT

SSGC

Sui Southern Gas Company Limited

11 September 2012

Mr. Peter J. Dailey
Chief Executive Officer
International Electric Power
603 Stanwix Street
Gateway Two, Suite 1825
Pittsburgh, PA 15222
U.S.A.

LETTER OF COMFORT – FIRM GAS SUPPLY FOR DHA COGEN LIMITED (DCL)

This is with reference to our discussion on the captioned subject. We are pleased to confirm that SSGC's Board has approved the continuation of gas supply to DHA Cogen Limited (DCL) until 2030. The Board has accordingly directed certain amendments in the GSA; which we will shortly share with DCL.

With Kind Regards

Yours Sincerely,

Yusuf J. Ansari
Company Secretary / SGM (MS)

DHA Cogen Ltd

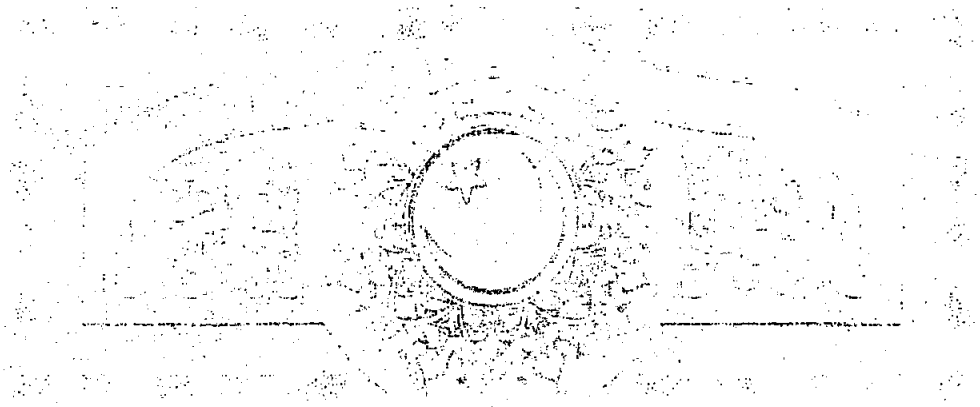
GAS SALE AGREEMENT

BETWEEN

SUI SOUTHERN GAS COMPANY LIMITED

AND

DHA COGEN LIMITED



GAS SALE AGREEMENT

THIS GAS SALE AGREEMENT (the "Agreement") [illegible] between [illegible] (the "Seller") and [illegible] (the "Buyer") [illegible] under the [illegible] Companies Ordinance, 1984, and having its principal [illegible] (the "Seller") and [illegible] Limited, [illegible] registered under the Companies Ordinance, 1984, and having its principal [illegible] (the "Buyer").

[illegible] (the "Borough").

WHEREAS, the [illegible]

WHEREAS, the Buyer plans to construct, own, operate and maintain a [illegible] and desalination facility, with the power plant [illegible] and water desalination plant of 5 MIGD capacity in [illegible], Pakistan;

WHEREAS, the Seller is willing to supply [illegible] through a [illegible] pipeline to the Buyer's power and water desalination plant [illegible] (the "Delivery Point");

NOW, THEREFORE, in consideration of the mutual [illegible] representations and warranties, conditions and promises herein contained and intending to be legally bound hereby the Parties hereto agree as follows:

GAS SALE AGREEMENT

THIS GAS SALE AGREEMENT (this "Agreement") is made at _____this _____ day of _____ 2005 by and between Sui Southern Gas Company Limited, a public limited company incorporated under the laws of Pakistan and registered under the Companies Ordinance, 1984, and having its registered office at SSGC House, Sir Shah Suleman Road Bl-14, Gulshan-e-Iqbal, Karachi, 75300, Pakistan (hereinafter referred to as the ("Seller"), and DHA Cogen Limited, a company incorporated under the laws of Pakistan and registered under the Companies Ordinance, 1984, and having its principal place of business at D-35, Block 5, Clifton, Karachi, Pakistan (hereinafter referred to as the "Buyer").

Both the Seller and the Buyer are hereinafter referred to individually as a "Party" and collectively as the "Parties".

WHEREAS, the Seller is the authorized and licensed distributor of natural gas in the Provinces of Sindh and Baluchistan; and

WHEREAS, the Buyer plans to construct, own, operate and maintain a combine power and desalination facility with the power plant of approximately 94.0 Megawatts and water desalination plant of 3 MIGD capacity in Defence Housing Authority, Karachi in the Province of Sindh, Pakistan.

WHEREAS, the Seller is willing to supply Gas though a 14 kilometer pipeline from the 24 inch Dia high pressure Korangi Landhi main on Korangi Industrial Area Road, Karachi up to the Buyer's power and water desalination Plant in Phase VIII of Defence Housing Authority, Karachi.

NOW, THEREFORE, in consideration of the mutual benefits to be derived and the representation and warranties, conditions and promises herein contained, and intending to be legally bound hereby the Parties hereby agree as follows:

DHA COGEN LTD KARACHI

SUI SOUTHERN GAS CO. LTD. Karachi

ARTICLE I

DEFINITIONS AND RULES OF INTERPRETATION

1.1 Definitions

In this Agreement, unless the context otherwise requires:

"Agreement" means this instrument (including the recitals, articles and schedules hereto) as originally executed or as from time to time supplemented, amended, novated or replaced.

"Annexure" mean those annexures which are attached and form an integral/binding part of this Agreement.

"Annual Contract Quantity" or ACQ shall have the meaning set out in Article 5 means the quantity of gas to be supplied by Seller to the Buyer during a 330 day calendar year; and

"Article" means an article in this Agreement (including paragraphs within that article; a paragraph within the same article unless otherwise specified).

"Atmospheric Pressure" means an absolute pressure of fourteen decimal point sixty-five pounds (14.65) force per square inch.

"Authority" means the Oil and Gas Regulatory Authority established pursuant to Section 3 of the OGRA Ordinance 2002.

"British Thermal Unit" or its abbreviation "Btu" means the amount of heat required to raise the temperature of one pound of pure water from fifty-nine degrees Fahrenheit (59° F) to sixty degrees Fahrenheit (60° F) at a constant pressure of fourteen and sixty fifth hundredths (14.65) psia;

"Business Day" means a day (other than Sunday or a public holiday) on which banks in Karachi are open for business;

"Buyer" means DHA Cogen Limited, a company incorporated under the laws of Pakistan and registered under the Companies Ordinance, 1984, and having its principal place of business at D-35, Block 5, Clifton, Karachi, Pakistan and its permitted successors and assigns.

"Buyer's Facilities" means all of the gas pipeline, valves and fittings, approved by the Seller prior to installation and compatible with the Seller's Facilities, to be installed by or on behalf of the Buyer and to be owned by the Buyer, which pipeline, valves and equipment are necessary to interconnect the Complex with the Seller's Facilities at Delivery Point and which are identified in Schedule 2.

"Commiercial Delivery Period" means the period of time that begins on the Commercial Operations Date and ends on the Expiry Date. In case the Commercial Operations Date does not occur within a period of sixty (60) Days of the Commissioning Period Start Date or the Revised Commissioning Period Start Date, whichever is later, the Commercial Delivery Period shall commence after the expiry of the aforesaid period of sixty (60) Days;

"Commercial Operations Date" means the date on which the Buyer confirms in writing to the Seller that the Complex has been commissioned and is ready for commercial operations for the intended purpose and the Buyer has issued a notice to the Seller to that effect in a timely manner;

"Commissioning Period" means the period of time, if any, that begins on the Commissioning Period Start Date and ends at 08:00 a.m. PST on the Commercial Operations Date;

"Complex" – A cogeneration plant for generating electrical power of approximately 94.0 MW and producing approximately 3.0 MIGD of desalinated water to be constructed and owned by the Company at Phase-VIII, Defence Housing Authority, Karachi, Province of Sindh, including land, engineering and design documents, all energy producing equipment and its auxiliary equipment, Gas handling facilities, a switchyard and interconnection facilities;

"Commissioning Period Start Date" means the date on which the Buyer declares that the Complex is substantially complete and the Complex or any Gas consuming part thereof is ready for testing and initial Gas deliveries hereunder may commence;

"Gas Security" means an irrevocable, transferable, divisible and revolving stand-by letter of credit or a continuing bank guarantee in favor of the Seller having a term not less than 365 Days and containing appropriate renewal or extension provisions in form attached as Schedule 1;

"Consents" means all such approvals, consents, authorizations, notifications, concessions, acknowledgments, agreements, licenses, permits, decisions or similar items required to be obtained from any Public Sector Entity by the Buyer for the construction of the Buyer's Facilities, or for the construction, financing, ownership, operation, and maintenance of the Complex;

"Contract Period" means the period of this Agreement as specified in Article 2;

"Contract Year" means each period of twelve (12) consecutive months beginning at 08:00 a.m. PST on the Commercial Operations Date and each anniversary thereafter, and ending at 08.00 a.m. PST of each anniversary of the Commercial Operations Date;

"Disclosing Party" shall have the meaning set out in Article 17;

"Daily Contract Quantity" means 17.5 MMSCF of Gas per Day;

"**Day**" means a period beginning at 08:00) a.m. PST on a calendar day and ending at 08:00 a.m. PST on the next succeeding calendar day and "Daily" shall be construed accordingly;

"**Delivery Point**" means the point where the flanges (or welds or other agreed marks) downstream of the valves of the Seller's Facilities connect to the inlet of the Buyer's Facilities at the Complex which is identified in Schedule 3;

"**Dispute**" means any dispute or disagreement or difference arising under, out of, in connection with or arising out of this Agreement, including, without limitation, any dispute or difference concerning the existence, legality, validity or enforceability of this Agreement or any provision hereof or the delegations or performance of a Party or under any provision hereof;

"**Due Date**" is defined in Article 9.3;

"**Emergency**" – A condition or situation that, in the reasonable opinion of either Party, does materially and adversely, or is likely materially and adversely to (i) affect the ability of the Party to maintain safe, adequate and continuous operations, or (ii) present a physical threat to persons or property or the security, integrity or reliability of the Buyer's or Seller's Facilities, or a major system break-down;

"**Expiry Date**" means the last day of the Term;

"**Firm Notice**" shall have the meaning set out in Article 5;

"**Flow Rate**" means the maximum rate of flow of Gas, which shall be 0.730 MMSCF per hour;

"**Force Majeure Event**" as defined in Article 15;

"**Gas Price**" as defined in Article 8;

"**Gas Quality Specification**" means specifications provided in Article 7;

"**Gas Security Deposit**" as defined in Article 8.2;

"**Government**" means the Government of the Islamic Republic of Pakistan;

"**Gross Calorific Value**" shall mean that number of British Thermal Units produced by the complete combustion at Atmospheric Pressure of one (1) Standard Cubic Foot of Gas at sixty (60°F) degrees Fahrenheit with excess air at the same temperature and pressure as the Gas when the products of combustion are cooled to sixty (60°F) degrees Fahrenheit and when the water formed by combustion is condensed to the liquid state and when the products of combustion contain the same

total mass of water vapor as the Gas and air before combustion;

"Kibor" means the six month Karachi Inter Bank Offered Rate as published on the Reuters page "KIBOR" at 11:30 PST by the Financial Markets Association.

"Lapse of Consent" means any Consent (a) ceasing to remain in full force and effect, (b) not being issued or renewed upon application having been timely made in the Prescribed Form together with the Prescribed Fee, and diligently pursued, or (c) being made subject, subsequent to its grant, upon renewal or otherwise, to any terms or conditions that, in case of each or (a), (b) or (c) above, materially and adversely affects the Buyer's ability to perform its obligations under this Agreement despite the Buyer's compliance in all respects with the procedural and substantive requirements under the Laws of Pakistan related thereto;

"Laws of Pakistan" means the federal, provincial and local laws of Pakistan, and all orders, rules, regulations, statutory rules & orders, executive order, decrees, judicial decisions, notifications, or other similar directives issued by any Public Sector Entity pursuant thereto, as any of them may be amended from time to time;

"Loss" means any loss, damage, liability, payment and obligation (excluding any indirect or consequential loss), damage, liability, payment or obligation;

"Maximum Daily Quantity" or "MDQ" means the maximum quantity of gas to be supplied by the Seller to the Buyer during a calendar day as set out in Article 5;

"MSCF or Mscf" means one thousand (1,000) Standard Cubic Feet of Gas;

"Measuring Equipment" means one or more gas chromatographs, flow computers, and other appurtenances necessary to accurately measure the Gross Calorific Value of Gas delivered and sold to the Buyer under this Agreement;

"Meter Reading" as defined in Schedule 11;

"MMBtu" means one million (1,000,000) Btu;

"MMSCFD or mmscfd" means one million (1,000,000) Standard Cubic Feet per day;

"Monthly TOP Quantity" or "TOP" means the guaranteed amount of gas m be taken by Buyer during a calendar month or to be paid in lieu thereof and shall have the meaning set out in Article 6;

"Month" shall mean a period beginning at 08:00 a.m. PST on the first (1st) day of a calendar month and ending at 08:00 a.m. PST on the first (1st) day of the next calendar month and "Monthly" shall be construed accordingly;

"Monthly Invoice" shall have the meaning as ascribed thereto in Article 9;

"**Measuring Station**" means a properly equipped station including the Metering System, installed, maintained and owned by the Seller, located adjacent to or on the Site immediately upstream of the Delivery Point for measuring the volume and controlling the pressure of Gas delivered to the Buyer hereunder;

"**Metering System**" means the orifice meter runs, straightening vanes, valves, gauges, pressure and temperature records, and other appurtenances necessary to accurately measure the volumetric quantities of Gas delivered and sold to the Buyer under this Agreement, all to be installed in the Measuring Station as described in Schedule 5;

"**No Flow Period**" shall have the meaning ascribed thereto in Article 14.3;

"**Notice of Intent to Terminate**" is defined in Article 19.2;

"**Natural Gas**" means hydrocarbons or mixture of hydrocarbons and other gases which at sixty (60°F) degrees Fahrenheit and atmospheric pressure are in the gaseous state (including gas from gas wells, gas produced with crude oil and residue gas and products resulting from the processing of gas) consisting primarily of methane, together with any other substance produced with such hydrocarbons;

"**Notice**" means a notice issued in accordance with Article 22.1;

"**Operating Procedures**" shall mean such procedure as developed to deal with all operational interfaces between the Seller and the Buyer, including, but not limited to, the method of day-to-day communication, identification and contact of key personnel, clearances and switching practices, reporting, operations logs and support;

"**Party**" means the Seller, the Buyer and "Parties" shall be construed to mean the same;

"**Pakistan**" means the Islamic Republic of Pakistan;

"**Person**" means any person, firm, company, corporation, society, government, state or agency of a state, or any association or partnership (whether or not having separate legal personality) of two or more of the foregoing;

"**Prescribed Fee**" means with respect to any Consent, the charge or fee, if any, prescribed by the Laws of Pakistan;

"**Prescribed Form**" means with respect to any Consent, the form, if any, (including all information and details) prescribed by the Laws of Pakistan for the application for or renewal of such Consent;

"**Pressure Specifications**" means the delivery pressure specifications for Gas

. delivered to the Buyer by the Seller at the Delivery Point as specified in Article 7;

"Project" means the DHA Cogen Power and Desalination Plant in Phase VIII, Defence Housing Authority, Karachi;

"psia" means pounds per square inch absolute;

"psig" means pounds per square inch gauge;

"PST" means Pakistan Standard Time;

"Public Sector Entity" means the department, authority, instrumentality, agency or other relevant entity from which a Consent is to be obtained from time to time and any authority, body or other person having jurisdiction under the Laws of Pakistan with respect to the Buyer, the Seller, the Project or this Agreement, as the case may be;

"Reasonable and Prudent Operator" means a person exercising that degree of skill, diligence, prudence and foresight which would reasonably and ordinarily be expected from a skilled and experienced operator engaged in the same type of undertaking employing good oil and gas field/pipeline operating practices (and not incurring costs which would be so disproportionate to the benefit which would be achieved by the incurring of such costs that no skilled operator acting reasonably and ordinarily would be expected to incur them). Any reference to "acting as a Reasonable and Prudent Operator" means taking such steps as a Reasonable and Prudent Operator would take under the same or similar circumstances or conditions;

"Revised Commissioning Period Start Date" shall have the meaning set out in Article 4;

"Rupee" means the legal tender of the Islamic Republic of Pakistan;

"Rules" mean the Natural Gas Regulatory Authority (Licensing) Rules, 2002;

"Schedule" means a schedule attached and made part of this Agreement for all purposes;

"Scheduled Commissioning Period Start Date" means the date advised to the Seller by the Buyer pursuant to Article 4.2, as may be revised from time to time pursuant to Article 4.3, for the commencement of Commissioning Period;

"Scheduled Outage" means an interruption or reduction in the Gas to be supplied by the Seller as set out in Article 14.2;

"Seller" means Sui Southern Gas Limited, a public limited company incorporated under the laws of Pakistan and registered under the Companies Ordinance, 1984,

and having its registered office at SSGC House, Sir Shah Suleman Road Bl-14, Gulshan-e-Iqbal, Karachi,-75300, and its permitted successors and assigns;

"Seller's Facilities" means that portion of the pipeline capacity and related equipment and facilities of the Seller, as described in Schedule 4 and Measuring Station, that are required to provide gas to the Complex from the Seller's existing Gas transmission and distribution network up to the Delivery Point;

"Seller's Representatives" means persons appointed by the Seller to act on its behalf;

"Site" as further described in Schedule 6;

"Specification Gas" means Gas delivered at the Delivery Point that conforms to the Gas Quality Specification as defined above and as has been set out in this Agreement;

"Standard Cubic Foot "SCF" or " Scf " shall mean, when applied to the Specification Gas that quantity of Specification Gas, which at sixty (60°F) degrees Fahrenheit and Atmospheric Pressure and the Specification Gas being saturated with water vapor at the same temperature and pressure occupies one (1) cubic foot;

"Standards" means the environmental guidelines and occupational health and safety and environmental standards applicable under the Laws of Pakistan;

"Term" shall have the meaning ascribed thereto in Article 2;

"Termination Notice" means a written notice of termination of this Agreement issued by the Seller or the Buyer, as the case may be pursuant to Article 25.1(a);

"Winter Months" shall mean the months of December and January;

1.2 Interpretation.

In this Agreement:

(a) the headings are for convenience only and shall be ignored in construing or interpreting this Agreement;

(b) the singular includes the plural and vice versa;

(c) references to Articles, Annexures, Recitals, and Schedules are, unless the context otherwise requires, Articles, Annexures, Recitals and Schedules to this Agreement.

(d) unless otherwise provided herein, whenever a consent or approval is required by one Party from the other Party, such consent or approval shall not be unreasonably withheld or delayed; and

(e) in carrying out its obligations and duties under this Agreement, each Party shall have an implied obligation of good faith.

ARTICLE II
TERM OF AGREEMENT

2.1 Initial Term. This Agreement shall come into full force on the date of its execution and subject to Article 5.2 and any specific rights of termination set out herein shall, after the Commercial Operations Date or 60 Days from the Commissioning Period Start Date or the Revised Commissioning Period Start Date, as the case may be, continue in force until the end of the thirtieth Contract Year or, such other period as may be agreed in writing by the Buyer and the Seller.

2.2 Extension of Term. Following the end of the twenty eighth Contract Year, at the request of either Party, the Buyer and the Seller agree to enter into good faith negotiations for a renewal of this Agreement for any additional term on the terms and conditions mutually agreed to by the Parties. If the Parties fail to agree on the terms and conditions on which this Agreement will be extended, this Agreement will terminate on the Expiry Date. Upon such termination Article 19 shall apply. Any failure to agree on the terms and conditions for the extension of this Agreement shall not be a Dispute hereunder.

ARTICLE III
AGREEMENT FOR PURCHASE AND SUPPLY

3.1 Purchase and Supply. Subject to the provisions of this Agreement, the Buyer shall purchase from the Seller, and the Seller shall sell to the Buyer, all of the Complex's requirements for Gas, to the extent of the Maximum Daily Contract Quantity adjusted as expressly set forth in Article 5.

ARTICLE IV
CONSTRUCTION SCHEDULE AND FACILITIES

4.1 Construction Schedule. The Buyer undertakes no later than nineteen (19) months from the date of the notice pursuant to Article 4.2, it shall complete the construction of the Complex.

4.2 Notice of the Commissioning Period Start Date. Within three (3) Months of the signing of this Agreement, the Buyer shall deliver construction schedule and notice in writing of the Scheduled Commissioning Period Start Date, which shall not be earlier than fifteen (15) months from the date of signing of this Agreement.

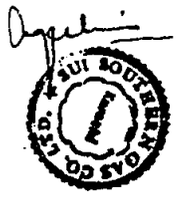
4.3 Revised Commissioning Period Start Date. The Scheduled Commissioning Period Start Date may be delayed by either Party for a period not exceeding four (4) months without penalty, provided that a notice of such delay is given to the other Party at least six (6) months prior to the then Scheduled Commissioning Period Start Date provided however that the Commissioning Period Start Date does not fall during the Winter Months in which case it will be deemed to be first day of February of the following year.

4.4 Construction of the Seller's Facilities. Upon receipt of notice of the Scheduled Commissioning Period Start Date, the Seller shall complete the design, construction and installation of the Seller's Facilities necessary to supply Gas to the Complex up to the Delivery Point on or before the Scheduled Commissioning Period Start Date. The Seller shall be responsible for connecting the Seller's Facilities to Buyer's Facilities at the Delivery Point.

4.5 Commissioning and Testing of the Seller's Facilities. At least sixty (60) Days prior to the commissioning and testing of the Seller's Facilities, the Seller shall give the Buyer notice of such commissioning and testing, and the Buyer and/or its representative shall have the right to observe such commissioning and testing.

4.6 Commissioning Period. Both Parties agree that there shall be a sixty (60) day period for the commissioning and testing of the Complex, starting from the Scheduled Commissioning Period Start Date or the Revised Commissioning Period Start Date, as the case may be.

4.7 Compliance with Instructions. Each Party shall abide by, and cause its representatives to abide by, the reasonable instructions of the other Party when observing the commissioning and testing of the other Party's facilities.



Article V
SUPPLY AND PURCHASE OF GAS

5.1 Supply of Gas. From and after the Scheduled Commissioning Period Start Date and until the Expiry Date, the Seller shall have available and deliver at the Delivery Point the Maximum Daily Quantity in accordance with the terms and subject to the condition set out in this Agreement Further, the Seller shall use reasonable efforts available to it under the circumstances to deliver at the Delivery Point the quantity of Gas in excess of the Daily Contract Quantity if requested by the Buyer.

5.2 The quantities of Specification Gas to be supplied by the Seller to the Buyer during the Term of this Agreement shall be as follows:

The Maximum Daily Quantity or MDQ shall be 17.5 MMCFD;
The Annual Contract Quantity or ACQ shall be 5775 MMCF; and
The Monthly Take or Pay Quantity or TOP shall be 394 MMCF.

The Maximum Daily Quantity of 17.5 MMCFD will remain constant up to the year 2015 and after 2015; Gas will be supplied for the remaining period of the Initial Term, subject to availability of Gas supplies in the Seller's overall network as solely determined by the Seller.

5.3 Commissioning Period Deliveries. The Buyer will provide the Seller with a Firm Notice at least thirty (30) Days prior to the Commissioning Period Start Date that a Gas consuming part of the Complex is ready for testing. On each Day during the Commissioning Period, the Seller shall use all reasonable efforts to deliver to the Buyer at the Delivery Point the quantity of Gas requested by the Buyer in accordance with the Operating Procedures, provided, however, the Buyer shall exercise its best efforts to receive and purchase Gas tendered for delivery at the Delivery Point.

5.4 Supply during Emergency. Notwithstanding the provisions of this Article 5 to the contrary, in the event of, and during, an Emergency, neither the Seller nor the Buyer shall be obligated under this Agreement to respectively deliver or receive Gas; provided, however, that the existence of an Emergency shall not, unless such Emergency is also a Force Majeure Event, relieve either Party of any liability it may have to the other Party under this Agreement and that are attributable to such emergency or the failure to deliver or receive Gas pursuant to the terms of this Agreement.

5.5 Volume Adjustment. The quantities specified in this Article are based on the Gas having a minimum BTU content of 920 BTUs per Standard Cubic Foot. If the BTU content of the Gas delivered to Buyer is less than 920 BTUs per Standard Cubic Foot, the Seller undertakes that the Daily Contract Quantity shall be adjusted to offset the difference between the actual BTU content of the Gas delivered and the minimum BTU content of 920 BTU per Standard Cubic Foot. However, in case the Btu content of the Gas being delivered by the Seller to the Buyer is less than 900 BTUs per Standard Cubic Foot, the Buyer reserves the right to reject the delivery of such Gas.

ARTICLE VI
TAKE OR PAY

6.1 During the Commercial Delivery Period the Buyer shall purchase each Month the Monthly Take or Pay Quantity. If the Buyer has consumed in any Month during the Commercial Delivery Period, such quantity of Gas which is less than the Monthly Take or Pay Quantity of Gas ("Actual Consumption"), the Buyer shall pay for the Monthly Take or Pay Quantity.

6.2 The Buyer shall be entitled to consume the difference of Monthly Take or Pay Quantity of Gas and Actual Consumption, as defined in Article 6.1 above ("Differential Quantity") during the six (6) months period immediately following the Month in which the Differential Quantity exists and if the Differential Quantity is consumed during the said six (6) months period over and above the Monthly Take or Pay Quantity of Gas, the Buyer shall not be liable to pay again for the Differential Quantity.

6.3 Provided however that in case of (i) No Flow Period (ii) Every sixth year Scheduled Outage Period as provided under Article 14.4 (iii) Emergency and (iv) Force Majeure Event, the Monthly Take or Pay Quantity shall be adjusted pro rata on a Day for Day basis.

ARTICLE VII
QUALITY AND DELIVERY PRESSURE

7.1 The Gas supplied at the Delivery Point shall have a minimum Gross Calorific Value of 920 Btu per Standard Cubic Foot.

7.2 The pressure of Gas supplied at the Delivery Point will not be less than 45 psig at the Complex. However, should the pressure in the main supply ring decrease on its own account no penalty will be imposed on either Party.

7.3 The Seller shall install pressure control/relief devices to prevent the Gas supply pressure exceeding 120 Psig (or as may be otherwise agreed between the Buyer and the Seller) in the event of sudden closure of the valves within the Buyer's Facility.

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ARTICLE VIII
GAS PRICE

8.1 Gas Price.

(a) Subject to Article 8.1(c) and the other terms and conditions of this Agreement, the Buyer shall pay to the Seller the Gas Price notified by OGRA under the OGRA Ordinance 2002 as it relates to the Buyer's ("Gas Price") is and based on the Daily Contract Quantity of Gas available to the Buyer and for Gas actually delivered to, and received by, the Buyer at the Delivery Point.

(b) The Buyer shall be considered an independent power producer for the purpose of identifying the applicable Gas Price for this Agreement.

(c) The Buyer shall also pay to the Seller the rent of meter at the rates prescribed by the Authority from time to time from the date when such meter is installed up to the date that such meter is removed provided that in case the quantity of Gas is increased and such an increase necessitates replacement of the meter by a meter of larger size, the Buyer shall pay for the rent at the rates prescribed by the Authority.

(d) The amount to be paid by the Buyer for all Gas delivered to the Delivery Point under this Agreement shall be based upon the Monthly Invoice.

(e) All payments to be made by the Buyer to the Seller shall be inclusive of taxes, levies, charges, and duties of whatsoever nature.

8.2 Gas Security Deposit.

(a) On or before the Commercial Operations Date the Buyer shall provide to the Seller a Gas Security Deposit in the form of a continuing bank guarantee equivalent to ninety (90) Days of MDQ. The Seller shall be entitled to draw on the Gas Security Deposit at any time if any amount becomes due and payable by the Buyer to the Seller under this Agreement and remains unpaid for five (5) Business Days following the due date for such amount. The Buyer shall maintain the Gas Security Deposit continuously during the Term and shall replenish the Gas Security Deposit to the full required amount, as the case may be, within fifteen (15) Days following any draw thereon by the Seller. All costs or charges in connection with any draw on the Gas Security Deposit shall be from the account of the Buyer. If a replacement Gas Security Deposit is not provided to the Seller at least ten (10) Business Days prior to the Expiry of the existing Gas Security Deposit the Seller shall be entitled to encash the Gas Security in full. The Seller will return the Gas Security Deposit to the Buyer within ninety (90) Days after expiration or termination of this Agreement. The bank guarantee shall be substantially in

the form attached as Schedule 1.

(b) Subsequent to the execution of this Agreement, in case the Gas Price or the rent of meter is increased or decreased, or any applicable tax or charge is increased, decreased or revoked or any new tax or charges is imposed on the sale of Gas, the Gas Security Deposit shall be accordingly adjusted within fifteen (15) Days following such change.

8.3 Gas Pipeline Cost.

(a) The Gas pipeline for the Complex, as described in Schedule 4 to this Agreement, shall be constructed by the Seller. The cost of this pipeline, however, shall be borne by the Buyer and the maximum cost of this pipeline has been agreed at Rs. 137,590,000 (Rupees one hundred and thirty seven million, five hundred and ninety thousand only) between the Seller and the Buyer.

(b) Out of the maximum cost mentioned in Article 8.3(a) above, the Buyer agrees to pay a sum of Rs. 60,000,000 (Rupees sixty million only) upfront ("First Installment").

(c) The remaining cost of Rs. 77,590,000 (Rupees seventy seven million, five hundred and ninety thousand only) shall be paid by the Buyer in forty eight equal monthly installments (each a "Monthly Installment"). The first Monthly Installment shall be paid on the Day the second Monthly Invoice of the first Contract Year becomes due.

(d) Monthly Installments payable under Article 8.3(c) shall be paid by the Buyer along with mark-up to cover the financing cost of the Seller. For this purpose, the mark-up rate to be used shall be the average effective cost of borrowing of the Seller.

(e) In case the Seller is unable to complete the construction of the pipeline till the expiry of 30 Days from the Scheduled Commissioning Period Start Date or the Revised Commissioning Period Start Date, as the case may be, the Seller shall reimburse to the Buyer the cost of diesel consumed by the Complex during the Commissioning Period.

(f) This Agreement shall become effective upon signing; provided that the Buyer has deposited the First Installment within 30 Days from the date of signing this Agreement.

ARTICLE IX
BILLING AND PAYMENT

9.1 Monthly Billing. The Seller's invoices for the supply of Gas hereunder shall be furnished to the Buyer on a Monthly basis (the "Monthly Invoice").

9.2 Delivery of Bills. All Monthly Invoices duly sent by the Seller in accordance with the notice provision hereof shall be considered prima facie evidence of delivery of Monthly Invoices to the Buyer by the Seller.

9.3 Posting and Payment. All Monthly Invoices pertaining to Gas consumption, may be sent at any time on or after the fifth (5th) Day of the following applicable Month of Gas delivery and shall be payable within fifteen (15) Days of receipt of the Monthly Invoice by the Buyer of the applicable invoices (the "Due Date").

9.4 Method of Payment. Payment shall be made to the Seller in Rupees on or before the Due Date either by cheque or wire transfer, bank draft or pay order in immediately available funds in favor of the Seller. Payment will not be considered to have been made unless and until proceeds are in fact received in the designated account of the Seller.

9.5 Late Payment; Disputed Amounts. If payment of the amount shown in the Monthly Invoice rendered by the Seller is not made by Buyer on the Due Date, any such late payments shall bear penal charges at a rate equal to 1.5 percent per Month or a part thereof for the first twelve (12) Months in which such amount remains unpaid, and thereafter at a rate equal to 2 percent per Month or part thereof for the period exceeding the first twelve (12) Months. In the event that the Buyer disputes any part of any Monthly Invoice, then the Buyer shall deliver written notice to the Seller setting forth details of the dispute. Any disputed payment that is agreed or determined through the dispute resolution procedure provided in this Agreement to be owing to shall be paid or, if not paid within five (5) Business Days of such agreement or determination, withdrawn from the Gas Security Deposit along with penal charges thereon at a rate equal to 1.5 percent per Month or a part thereof for the first twelve (12) Months in which such amount remains unpaid, and thereafter at a rate equal to 2 percent per Month or part thereof for the period exceeding the first twelve (12) Months and shall be computed from the Due Date of the original invoice until paid by the Buyer or deducted by the Seller from the Gas Security Deposit.

9.6 Suspension of Deliveries. Notwithstanding the late payment surcharge and Gas Security Deposit or any other provisions in this Agreement, if the Buyer fails to make payment after five (5) Days from the Due Date of any bill, which is not timely disputed in accordance with Article 9.5, the Seller shall be entitled to suspend deliveries of Gas by giving five business (5) Days written notice to the Buyer. Upon payment of the full outstanding amounts by the Buyer the Gas supply shall be resumed.

9.7 Estimated Billing. In case a meter cannot be read due to any reason, the Seller shall submit provisional invoices based on the available information pursuant to Article 5.5. The Seller shall adjust provisional invoices based on estimated consumption against actual meter reading obtained subsequently, but in no event later than the next scheduled Monthly invoicing, and invoice or give credit to the Buyer of the difference, if any. The Buyer shall pay such invoices not later than the Due Date and the Seller shall adjust any refund if there is any refund against future charges for Gas supplied.

9.8 Billing Errors. After the invoices have been furnished and or paid, if the Seller or the Buyer discovers any error, omissions, or discrepancies in any such invoices due to any reason whatsoever, the Seller or the Buyer shall bring such discrepancies to the notice of the other and the Parties shall agree to adjust the invoices accordingly. Any mistake in the Monthly invoice or meter reading shall not entitle the Buyer to withhold payment of the Monthly Invoice by the Due Date to the extent of undisputed amounts. The Buyer shall not make any arbitrary deduction from the Monthly Invoice unless the dispute is settled.

9.9 Compensation.

(a) In case the Gas delivered by the Seller is lesser than the quantity of Gas ordered by the Buyer ("Short Supply"), the Seller shall compensate the Buyer for such Short Supply in an amount equal to the differential in the Gas Price and the diesel price existing on the date of calculation for the Short Supply quantity of Gas.

(b) The compensation shall not be payable (i) for the first 458 Equivalent Hours of the Short Supply during any Contract Year (ii) if KESC has not imposed any liquidated damages or other charges upon Buyer for the short supply of gas.

(c) For the purpose of Article 9.9 (b), the Equivalent Hours in the period of Short Supply shall be the summation of the product of A) the time in hours during which such Short Supply existed and B) the Weighting Factor applicable for the Month of Short Supply.

(d) The Weighting Factors for the purpose of Article 9.9 (c) above shall be:

Months	Weighting Factor
January	0.25
February	0.25
March	0.50
April	1.50
May	2.00

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June	2.00
July	1.50
August	1.25
September	0.75
October	1.50
November	0.25
December	0.25

(e) The differential under Article 9.9(a) shall be determined on the basis of the diesel price recommended by the Director General (Oil) (or any successor competent authority) for supply of diesel to KESC.

(f) Provided however that in case of (i) No Flow Period (ii) Every sixth year Scheduled Outage Period as provided under Article 14.4 (iii) Emergency and (iv) Force Majeure Event, the Compensation payable under Article 9.9 shall not apply.

9.10 Compensation Limit. The Buyer's right for Compensation under Article 9.9 is limited to 60 Days of compensation in each Contract Year. In case the aggregate Short Supply in any Contract Year exceeds this limit the Seller shall reimburse the cost of diesel actually consumed by the Buyer on monthly basis for the hours of Short Supply.

9.11 Offset. The compensation in accordance with Articles 9.9 and 9.10 above shall be offset by the Seller against the Monthly Invoice for the Month following the month during which the Short Supply occurs.

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ARTICLE X
DUTIES AND TAXES

10.1 All taxes, charges, fees, octroi and any other surcharge, duty or penalties relating thereto levied in respect of the Gas now or in future shall be paid by the Seller if such levies are imposed on the Gas before the Delivery Point and from the Delivery Point by the Buyer.

10.2 Payments to the Seller may be subject to such withholding tax as may be applicable in accordance with the law.

10.3 Excise duty, sales tax and any similar tax, levy or duty levied now or in the future on Gas sales of whatever description, which the Seller is obliged by applicable law to collect from the Buyer, levied now or in the future, shall be determined, invoiced and remitted by the Seller on behalf of the Buyer, in Rupees, to the concerned government agency in accordance with the prevailing laws and/or rules.

ARTICLE XI
GAS MEASUREMENT AND RECORDING

11.1. · Measuring Station.

(a) To determine the quantities, quality and pressure of Gas delivered under this Agreement, the Seller shall, at its expense, procure and install a properly tested and operational Measuring Station on or before the beginning of the Scheduled Commissioning Period Start Date. The gas delivered by the Seller to the Buyer will be measured according to the standard methods prevalent in the industry.

(b) The Measuring Station shall be located immediately upstream of the Delivery Point. The Metering System contained in the Measuring Station shall be capable of recording the quantity of Gas delivered on a daily basis. The Metering System shall operate at an accuracy of measurement of plus or minus (+/-) one percent. No meter shall be connected to or disconnected (at the Measuring Station) from the Gas pipeline except by the authorized personnel of the Seller. The Metering System shall be inspected periodically by the Seller.

11.2 Meter Readings. Meter readings for normal billing purposes (whether recorded from visual readings at the Measuring Station, telemeter, or computed from measurement charts and records) shall be recorded at the end of each Month. Gas quantities sold hereunder shall be determined from such readings or records in accordance with the provisions of this Article 11. Should any Dispute arise between the Parties as to quantities of Gas delivered hereunder, the Parties shall in good faith reconcile their differences in accordance with the mechanism set forth in this Article 11.

11.3 Measurement. The unit of volumetric measurement for Gas delivered shall be SCF; however the Monthly Invoice shall be prepared on BTU basis. Whether determined by the flow meters, manually, or by other means, the unit of volumetric measurement shall he a cubic foot of Gas and the term "cubic foot of Gas" shall mean a cubic foot of Gas at an absolute pressure of 14.65 pounds per square inch and a temperature of 60 degrees Fahrenheit, without adjustment of water vapor content, but correction factors for pressure, temperature, specific gravity, deviations from Boyle's Law and Charles' Law, expansion and Reynolds's number, manometer, Orifice Thermal Expansion, and Gauge Location Factors specified in the relevant American Gas Association report, shall be applied. The value of atmospheric pressure for calculating the pressure factor shall be 14.65 pounds per square inch and value of acceleration due to gravity shall be 32.174 feet per second. The Gas delivered hereunder shall be measured in accordance with the methods in use in the industry generally and recommended by the Gas Measurement Committee of the Gas Department of the American Gas Association, or other internationally recognized standard as the Parties may agree, applied in a practical manner or in accordance with the Laws of Pakistan.

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11.4 Accuracy of Equipment. The accuracy of the Measuring Station shall be verified when requested by either Party, but not more often than quarterly and not less often than annually. In case of any doubt regarding the accuracy of the Measuring Equipment all such tests conducted to determine the accuracy of the equipment shall be made at the Buyer's expense.

(a) by less than one percent, the previous reading thereof shall be considered correct, but such meter shall be calibrated at once to read correctly;

(b) by more than one percent, the registration of such meter shall be corrected at the rate of such inaccuracy for any period which is definitely known or agreed upon, failing which for a period extending back one-half of the time elapsed from the date of the last calibration and then a corresponding adjustment shall be made with respect to any payment made hereunder during such period. Following any test, Measuring Station equipment found inaccurate shall be immediately corrected by the Seller or the Seller's representative to a condition of accuracy.

11.5 Alternate Measurement Determination. If, for any reason, the Measuring Station is (i) out of adjustment, (ii) out of service, or (iii) out of repair and the total calculated hourly Flow Rate through each meter run is found to be in error by an amount of the magnitude described in Article 11.4, the total quantity of Gas delivered shall be re-determined in accordance with the first of the following methods which is feasible:

(a) by using the registration of any mutually agreeable check metering facility, if installed and accurately registering (subject to testing as described herein);

(b) where parallel multiple meter runs exist, by calculation using the registration of such parallel meter runs; provided, however, that they are measuring gas from upstream and downstream headers in common with the faulty metering equipment, are not controlled by separate regulators, and accurately registering;

(c) by correcting the error by re-reading of the official charges, or by straight forward application of a correction factor to the quantities recorded for the period (if the net percentage of error is ascertainable by calibration, tests or mathematical calculations); or

(d) By estimating the quantity, based upon deliveries made during period of similar conditions when the meter was registering accurately.

11.6 Equipment Testing. For testing the accuracy of measuring and testing equipment as provided under this Article 15 either Party may give reasonable notice, but in no event less than seven (7) days Business Days notice, to the other Party of tests so that each Party may conveniently, at its own expense, have its representative present at such tests.

11.7. Inspection. The Seller shall after having been given proper notice of the inspection by the Buyer, at any time during business hours, allows the Buyer to inspect the Measuring Station. Any reading, calibration, or adjustment of any such equipment and the changing of charts shall be done only by a responsible representative of the Seller.

11.8 Buyer's Check Meters. The Buyer may install, maintain and operate, at its sole cost and expense, check measuring equipment; provided, however, that such equipment shall be installed in a manner that will not interfere with the operation of the Measuring Station and that such check measuring equipment shall be on Buyer's property; provided, further, that the Buyer's check measuring equipment shall not be used for billing purposes hereunder except as expressly provided in Article 11.5.

ARTICLE XII
RISK OF LOSS, TITLE

12.1 Risk of Loss and Title. The Seller shall be responsible for all of the Seller's Facilities upstream of the Delivery Point. The Buyer shall be responsible for all of Buyer's Facilities downstream of the Delivery Point. Unless the Parties agree otherwise in writing risk of loss and title to all Gas delivered to the Buyer pursuant to the terms and conditions of this Agreement shall pass from the Seller to the Buyer at the Delivery Point.

12.2 The gas meter, regulator, service pipe, valves and other fittings forming part of Meter Station or meter point shall be installed and kept in repair by the Seller. The Buyer shall be responsible for the safety and protection of the meter station and all installations / equipments described hereinbefore and shall be liable for any damage caused thereto by fire or other accidents or due to carelessness of any one whomsoever, not in the Seller's employment. The Buyer shall be responsible for keeping Meter Station easily accessible and free from all sorts of encroachments/obstructions in all weather conditions.

ARTICLE XIII
RERESENTATIONS, WARRANTIES AND INDEMNITIES

13.1 By the Seller

(a) The Seller hereby represents and warrants that

(i) the Seller warrants title to all Gas delivered under this Agreement and that such Gas is and will be free from all liens and adverse claims of any and every kind at the delivery point. The Seller will indemnify and hold harmless the Buyer from and against any damages or losses of whatever nature arising out of any lien or adverse claim of any kind before or on delivery of or relating to title to the Gas delivered by the Seller to the Buyer under this Agreement.

(ii) the Seller warrants that it has the right to sell the Gas to the Buyer to be delivered hereunder.

(iii). the Seller represents that it has obtained and covenants that will maintain throughout the term hereof of all and any necessary governmental, statutory and third party license, consent or approval, which it requires to enter into and perform its obligations hereunder.

(b) The Seller hereby covenants as follows:

(i) The Seller shall (A) at all times maintain its corporate existence in compliance with the Laws of Pakistan, (B) at all times, so far as it is material to the Buyer hereunder, comply with all Laws of Pakistan applicable to the Seller, (C) procure, and (D) give all required notice and allow all required inspections under all approvals, permits, decisions and similar items obtained, or applied for, by the Seller in connection with the Seller's Facilities and the Measuring Station as may be applicable;

(ii) The Seller shall render reasonable assistance to the Buyer at Buyer's request to enable the Buyer to obtain and maintain all approvals, consents, authorizations, grants or certificates of registration, notifications, licenses, concessions, acknowledgments, agreements, rights-of-way, permits decisions and similar items that are required by the Buyer to perform its obligations under this Agreement;

(iii) The Seller shall develop, design, construct, complete, operate and maintain (either by itself or through the use of experienced third-party, reputable and recognized contractors) the Seller's Facilities and any and all additionally required facilities (A) in accordance with the Operating Procedures which are ultimately established pursuant to Article 4 of this Agreement, (B) in accordance with the Laws of Pakistan, (C) in accordance with all approvals,

consents, authorizations, grants or certificates of registration, notifications, licenses, concessions, acknowledgments, agreements, rights-of-way, permits, decisions and similar items, (D) in a good workmanlike manner (only with materials and equipment that are new, petroleum industry grade and suitable for their intended use), and (E) in such a manner as to provide that the useful life of the Seller's Facilities and the Measuring Station, with proper operation and maintenance, will last at least until the Expiry Date.

13.2 By the Buyer.

(a) The Buyer hereby represents and warrants that:

(i) the entering into, and performance of, this Agreement by the Buyer have been duly authorized by the Buyer and are in conformity with the existing Laws of Pakistan;

(ii) it is duly incorporated, existing and in good standing under the Laws of Pakistan and has, so far as it is material to the Seller, complied fully with all applicable Laws of Pakistan as of the date hereof;

(iii) there are no proceedings pending or, to the best of its knowledge, threatened, for the liquidation of the Buyer or that would materially adversely affect the performance by the Buyer of its obligations under this Agreement;

(iv) this Agreement has been duly authorized, executed and delivered by the Buyer and constitutes the legal, valid and binding obligation of the Buyer; and

(v) to the best of its knowledge, the execution and delivery of, and, performance of its obligations under, this Agreement by the Buyer, subject to the granting and maintenance of the requisite Consents, does not violate the existing laws of Pakistan.

(b) The Buyer hereby covenants as follows:

(i) It will (A) at all times maintain its corporate existence in compliance with the Laws of Pakistan, (B) at all times, so far as it is material to the Seller hereunder, comply with all Laws of Pakistan applicable to the Buyer, (C) procure and maintain in full force and effect as and when necessary all consents required for its performance under this Agreement, and (D) give all required notices and allow all required inspections under all Consents obtained, or applied for, by the Buyer in connection with the Complex;

(ii) It will render reasonable assistance to the Seller to enable the Seller to obtain and maintain all approvals, consents, authorizations, grants or certificates of registrations, notifications, licenses, concessions, acknowledgments, agreements, rights-of-way, permits, decisions and similar items that are required by the Seller to perform its obligations under this Agreement;

(iii) The Buyer undertakes that it will construct and complete the Complex and the Buyer's Facilities, operate and maintain the Complex and the Buyer's Facilities (A) in accordance with the Operating Procedures as may be developed by the parties, (B) in accordance with the Laws of Pakistan and (if not inconsistent therewith) the Standards, (C) in accordance with all applicable consents and rights-of-way and similar items, (D) in good workmanlike manner (only with materials and equipment that are new and suitable for their intended use) and (E) in such a manner as to provide that the useful life of the Complex and the Buyer's Facilities with proper operation and maintenance, will last at least until the Expiry Date;

(iv) If at any time during the financing, development, design, insuring, construction and completion of the Complex, the Buyer determines that any material delay, the Buyer will notify the Seller of such expected delay; and

(v) The Buyer shall indemnify and hold harmless the Seller from and against any and all claims by either the Buyer or any third party for damages and losses of whatsoever nature which may occur downstream of the delivery point which arise out of or which are in any way connected with the design, engineering, construction operation of the Buyer's Facilities.

13.3 No Party shall be liable to the other party in respect of any consequential loss or damage suffered by the other party however caused, whether or not due to the negligence nf a Party including loss or profit, product, contract or revenue.

13.4 The Parties warrant to each other that:

(i) They have all requisite power and authority, including all consents to conduct their respective business, to own their properties and to execute and perform their respective obligations under this Agreement.

(ii) This Agreement has been duly authorized, executed and delivered by them and constitutes legal, valid and binding obligation as per the terms hereof.

(iii) They shall maintain and operate their respective facilities to the extent it is material vis-à-vis their obligations hereunder in accordance with all applicable Laws of Pakistan, consents and prudent utility practices.

ARTICLE XIV
CURTAILMENT, INTERRUPTION AND SHUTDOWN

14.1 Permitted Interruption by Seller. After giving at least 24 hours notice in advance for carrying out necessary extensions, maintenance, repair and or alterations work on the Seller's pipelines, equipment and devices, the Seller shall have the right, without any liability, damages or other compensation to the Buyer hereunder, to reduce or interrupt Gas supply to the Complex for periods not to exceed 30 hours during any one period of interruption and 458 Equivalent Hours in the aggregate in any Contract Year. This period is not in addition to the period provided in Article 9.9 (b).

14.2 Scheduled Outages by the Buyer. The Buyer shall give the Seller not less than three (3) months advance notice of the annual Scheduled Outage of the Complex. The Buyer shall advise the Seller not less than 24 hours in advance of any shutdown of the Complex resulting from any reason other than an annual Scheduled Outage or an Emergency which Shutdown may adversely impact Buyer's ability to purchase Gas from the Seller.

14.3 No Flow Period. In each Contract Year between the month of March and October, Seller shall inform the Buyer about the "No Flow Period", which shall be during the Winter Months. In the No flow Period, the Seller shall have the right to reduce or interrupt Gas supply to the Complex for a period which shall not be less than thirty (30) consecutive Days and not more than thirty five (35) consecutive Days. The Seller agrees, to the extent possible, to designate the No Flow Period during the Schedule Outage Periods of the Complex provided in Article 14.2.

14.4 Within forty-five (45) Days following receipt by the Buyer of the notification of the No Flow Period from the Seller pursuant to Section 14.3, the Buyer shall submit to Seller its proposed schedule of Scheduled Outage for the Year to which such notification applies. Such Scheduled Outage Periods shall not exceed thirty (30) Days in each Year except every sixth (6th) Year, wherein up to sixty (60) Days Scheduled Outage shall be provided.

14.5 Coordination. The Seller and the Buyer shall make every effort to coordinate their respective shutdown times for purposes of respective maintenance and repair. Non-delivery or a reduction in the delivery of Gas by the Seller during any such mutually agreed shutdown period shall not constitute a breach or default of the performance obligations of the Seller under this Agreement and, notwithstanding anything to the contrary contained in this Agreement, shall not give rise to any claim by the Buyer for any compensation or damages hereunder. The Buyer and the Seller also agree that to enable the Seller to complete any maintenance or repair of the Seller's facilities which have been scheduled during such a shutdown period, the Seller may reduce or interrupt the supply of Gas.

ARTICLE XV
FORCE MAJEURE EVENT

15.1 In the event of Force Majeure, the obligations of the Parties (other than the obligations to pay money as provided by this Agreement) under this Agreement shall be excused during the time and to the extent that performance thereof is prevented wholly or in part by the Force Majeure.

15.2 "Force Majeure" shall mean an event or circumstance which is not within the control of the Party affected and which causes or results in default or delay in the performance by such affected Party of any of its obligations hereunder and then only to the extent to which such Party, acting as a Reasonable and Prudent Operator is not able to prevent or overcome that event or circumstance and shall include but not be limited to:

(a) Natural disaster, including but not limited to cyclones, epidemics, landslides, earthquakes, floods and washouts;

(b) Strikes or other industrial disturbances which prevent the delivery or acceptance of Specification Gas at the Delivery Point;

(c) Governmental or semi-governmental law, regulation, order, decree, restriction, restraint, prohibition, intervention or expropriation, or the failure of any governmental or semi-governmental entity to act;

(d) Explosion, collision, radiation, act of a public enemy, act of war (declared or undeclared), blockade, riot, civil commotion or disturbance, sabotage, insurrection or national emergency (whether in fact or law);

(e) Unavoidable accident or emergency shut down to prevent an accident;

(f) Freezing of well or leakage, partial or entire failure of natural gas reserves;

(g) Any other relevant event or circumstances outside the reasonable control of the Party affected thereby, provided that lack of funds shall not constitute Force Majeure;

15.3 A Party claiming to be affected by Force Majeure shall:

(i) promptly but not later than forty eighty (48) hours, notify the other Parties of the occurrence and details of any event or circumstance said to give rise thereto and the estimated nature and extent of the delay in performance of its obligations under this Agreement resulting there from; and

(ii) if the Force Majeure has caused damage to or destruction of any facilities submit a plan for the repair or reinstatement thereof provided that no Party shall be obliged to take such action by the provisions of this Article if in the reasonable opinion of such Party it would not be economical to do so.

15.4. The Party affected shall use all reasonable diligence to overcome or control the effect of the Force Majeure as quickly as possible provided that the settlement of strikes, labor disputes, matters relating to kidnapping, extortion or the like shall be at the sole discretion of a Party affected thereby and provided further that the Party affected shall not be obliged to incur expenditure to overcome the events or circumstances which caused the Force Majeure which would make it uneconomical for that Party to continue to be a Party to this Agreement. Where a Party is prevented from performing an obligation under this Agreement as a result of a Force Majeure and such obligation is to be performed within a given time period, such time period shall be extended by the duration of the Force Majeure.

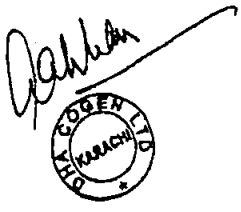
15.5 Subject to Article 15.2 and so long as the affected Party has at all times since the occurrence of an event of Force Majeure complied with the obligations of Article 15.3 and continues to so comply, then (a) the affected Party shall not be liable for any failure or delay in performing its obligations (other than an obligation to make a payment) under or pursuant to this Agreement, including, without limitation, in the case of the Seller, Seller's obligation to deliver Gas up to the Maximum Daily Quantity; (b) any performance deadline that the affected Party is obligated to meet under this Agreement, including the Commercial Operations Date, and (c) the Expiry Date shall be extended on a day for day basis upon the occurrence of an Event of Force Majeure provided that such extension shall not exceed any corresponding extension of the Power Purchase Agreement. No relief including without limitation the extension of any performance or other deadlines, shall be granted to the affected Party pursuant to this Section to the extent that such failure or delay would have nevertheless been experienced by the affected Party had such event of Force Majeure not occurred; and provided further, notwithstanding anything to the contrary herein, and consistent with the Article 7, when an event of Force Majeure prevents the Seller from delivering the quantity of Gas requested by the Buyer or the Buyer from receiving and using, the Gas up to the Maximum Daily Quantity, the Buyer's obligation to pay for the Monthly Take or Pay Quantity of Gas shall be reduced proportionately. Other than for breaches of this Agreement by the other Party, and without prejudice to the affected Party's right to indemnification pursuant to this Agreement, the other Party shall not bear any liability for any loss or expense suffered by the affected Party as a result of an event of Force Majeure.

15.6 In the event that a Party affected by Force Majeure could only overcome the Force Majeure by incurring expenditure which would make it uneconomical for that Party to continue to be a Party to this Agreement or circumstances or events caused by the Force Majeure are incapable of remedy, and in either case the delivery or acceptance of Specification Gas at the Delivery Point is prevented, either the Seller or the Buyer shall have the right to terminate this Agreement upon giving six (6) Months' Notice to the other Parties.

ARTICLE XVI
ASSIGNMENT

16.1 (a) This agreement cannot be assigned to any third party by either of the parties hereto without the consent of the other first having been obtained in writing and such consent will not be unreasonably withheld.

(b) The cost of assignment shall be borne by the grantee i.e., the party to whom the rights have been assigned to the entire exclusion of the other Party.



ARTICLE XVII
CONFIDENTIALITY

17.1 The terms and conditions of this Agreement and all information disclosed pursuant to this Agreement shall be treated as confidential during the Contract Period and for five (5) years thereafter and shall not be disclosed, in whole or in part, by Parties receiving the same hereunder without the prior written consent of the Party or Parties provided the relevant information or without prior written consent of all the other Parties in the case of disclosure, of the terms and conditions of this Agreement. Notwithstanding the foregoing, any Party (the "Disclosing Party") may, without obtaining such prior written consent, disclose all or any of such terms and conditions and/or information to the following persons:

(i) to the legal or financial advisers of the Disclosing Party;

(ii) to any Affiliate of the Disclosing Party;

(iii) to any bona fide intended transferee or assignee of the whole, or a significant part, of the issued share capital of the Disclosing Party or of the whole or part of the Disclosing Party's interest under, or related to, this Agreement (including, without prejudice to the generality of the foregoing, an interest in the Gas Field);

(iv) to any bank or financial institution, including international lending agencies (such as the Asian Development Bank, the World Bank and International Finance Corporation), from whom the Disclosing Party is seeking or obtaining finance;

(v) to the extent required by the law applicable to a Party or the regulations of a recognized stock exchange;

(vi) to the extent required by the order of any Court having competent jurisdiction over the Disclosing Party;

(vii) to any person appointed as arbitrators pursuant to this Agreement to the extent reasonably necessary for the performance of his duties; and

(viii) to any contractors (including professional consultants) engaged by the Disclosing Party;

Provided that it is a condition precedent to such disclosure to persons listed in:

i. paragraphs (i) and (ii) above, that Disclosing Party procures that such persons keep the information disclosed strictly confidential; and

ii. paragraphs (iii), (iv), (vii) and (viii) above that such persons enter into an agreement with the Disclosing Party that the information disclosed will be kept strictly confidential. The Disclosing Party shall take all reasonable

endeavors to enforce all such agreements, failing which the Disclosing Party shall be liable for the loss suffered by the other Parties for wrongful disclosure by such persons.

ARTICLE -XVIII
EVENTS OF DEFAULT

18.1 Any one or more of the following shall constitute an Event of Default.

a) Any representation or warranty made by either party herein proves incorrect in a material respect when made.

b) Any material breach by either party of this Agreement which is not remedied within thirty (30) days of notice from the affected party to the other, which notice states that a material breach has occurred that could result in the termination of the Agreement, identifies the breach in question and demands remedy thereof.

c) If, by the order of a court of competent jurisdiction a receiver or liquidator or custodian or trustee of either party is appointed and not discharged within fifty (50) days or if, by decree of such a court, either party is adjudicated insolvent and such decree has continued un-discharged and un-stayed for sixty (60) days after the entry thereof, or if a petition to reorganize either party pursuant to any statute applicable to them, as is now or hereinafter in effect, filed against either party and is not dismissed within sixty (60) days after such filing.

d) Failure to make due payment to the Seller under the Agreement.

e) any assignment or transfer of this Agreement or of either Party's rights or obligations hereunder in violation of Article 16.

f) except for the purpose of amalgamation or reconstruction that does not affect the ability of the amalgamated or reconstructed entity to perform its obligations under this Agreement and provided that the entity in question has unconditionally assumed such obligations, the occurrence of any of the following events: (i) the passing of a resolution by the shareholders of a Party for the winding up of such Party, (ii) the appointment of a provisional liquidator in case of bankruptcy adjudged by a court of competent jurisdiction, which appointment has not been set aside or stayed within ninety (90) Days of such appointment, or (iii) the making of any order winding up of Party by a court of competent jurisdiction.

18.2 Within fifteen (15) days of the events of the default specified in Article 18.1(a), (d) and (e) and the expiry of the periods specified in Article 18.1(a), (c) and (f) and unless the Parties shall have otherwise agreed, the non-defaulting party may terminate this Agreement by delivering a notice of termination to the defaulting party in accordance with Article 19.

ARTICLE XIX
TERMINATION

19.1 This Agreement may be terminated by either Party in accordance with the following provisions:

(a) In the event that a Party facing Force Majeure could only overcome the Force Majeure by incurring expenditure which would make it uneconomic for such Party acting as a reasonable and prudent operator to continue with it obligations hereunder or circumstances or events caused by Force Majeure are incapable of remedy and in either case the delivery or acceptance of Specification Gas is prevented, the Party affected thereby shall have the right to terminate this Agreement upon giving sixty (60) days advance notice to the other Party.

(b) In the event of a material breach of the terms of this Agreement by a Party, the Party affected shall have the right to terminate this Agreement upon giving sixty (60) days advance notice to the other Party, provided that the material breach is not remedied within sixty (60) days.

(c) On termination of this Agreement, the rights and obligations of the Parties shall cease but the termination shall not affect any right of action existing or liabilities incurred by a Party before the date of termination and any arbitration proceedings which might have been commenced against a Party may continue against it.

19.2 Notice to the Lenders of the Buyer's Default.

The Seller shall not seek to terminate this Agreement as a result of any default of the Buyer without first giving a copy of any notices required to be given to the Buyer under Article 18 and this Article 19 to the Lender's Agent without any further liability / obligation. The address and facsimile number for the Agent shall be provided to Seller by the Buyer within five (5) Business Days of the execution and delivery of this Agreement, and thereafter may be changed by the Lenders or the Agent by subsequent delivery of a Notice to Seller at the address or facsimile number for the Seller provided in Article 21.1 (or at such other address or facsimile number subsequently delivered to the Lenders or the Agent in accordance with this Section) and otherwise in accordance with the requirements of Article 21.1.

19.3 Remedies

The exercise of the right of a Party to terminate this Agreement, as provided herein does not preclude such Party from exercising other remedies that are provided

herein or are available at law. Remedies are cumulative, and, except as otherwise provided herein, the exercise of, or failure to exercise, one or more remedy by a Party shall not impair, limit or preclude the exercise of, or failure to exercise, one or more remedy by a Party shall not impair, limit or preclude the exercise of, or constitute a waiver of, other remedies by that Party that are available to it at law or in equity.

19.4 Obligations Upon Termination.

Upon expiration or termination of this Agreement, the Parties shall have no further obligations or liabilities hereunder except for those obligations and liabilities that (i) arose prior to such expiration or termination, and (ii) obligations and liabilities that arose upon termination and expressly survive such termination.

ARTICLE XX
DISPUTE RESOLUTION

20.1 Both Parties will attempt to resolve all disputes arising hereunder amicably. If no such amicable resolution is possible, the dispute shall be resolved in accordance with the OGRA Ordinance 2002 and the rules made there under.

ARTICLE XXI
MISCELLANEOUS

21.1 Notices.

(a) Except as otherwise expressly provided in this Agreement, all notices or other communications to be given or made hereunder shall be in writing, shall be addressed for the attention of the persons indicated below and shall either be delivered personally or sent by courier registered or certified mail or facsimile. The addresses for service of the Parties and their respective numbers shall be:

If to the Seller:

Attention:	Company Secretary
Address :	SSGC House Sir Shah Suleman Road,
	Bl-14, Gulshan-e-Iqbal, Karachi-75300 Pakistan.
Telephone No:	021 - 9321582
Facsimile No:	021 - 9231702

If to the Buyer:

Attention:	Managing Director
Address:	DHA Cogen Limited
	D-35, Block 5, Clifton, Karachi
Telephone No:	021 - 5869787
Facsimile No:	021 - 5869789

All notices shall be deemed delivered (i) when presented personally (ii) if received on a Business Day for the receiving Party, when transmitted by facsimile to the receiving Party's facsimile number specified above and, if received on a Day that this is not a Business Day, on the first Business Day following the date transmitted by facsimile to the receiving Party's facsimile number specified above,(iii) two Days after being delivered to a courier for overnight delivery, addressed to the receiving Party, at the address indicated above or, (iv) five Days after being deposited in a regularly maintained receptacle for the postal service in Pakistan, postage prepaid , registered or certified, return receipt requested or , addressed to the receiving Party, at the address specified above. Any notice given by facsimile shall be confirmed in writing delivered personally or sent by registered or certified mail, but the failure to so confirm shall not void or invalidate the original notice if it is in fact received by the Party to which it is addressed.

(b) Any Party may by notice change the addressee and/or address to which such notices and communications to it are to be delivered or mailed.

DHA COGEN LTD. KARACHI

SUI SOUTHERN GAS CO. LTD.

21.2. Third Parties. This Agreement is intended solely for the benefit of the Parties, and nothing in this Agreement shall be construed to create any rights in duty to, standard of, or any liability to, any person not a Party.

21.3. No Waiver.

(a) No waiver by either Party of any default or defaults by the other Party in the performance of any of the provisions of this Agreement:

(i) shall operate or be construed as a waiver of any other or further default whether of a like or different character; or

(ii) shall be effective unless in writing duly executed by a duly authorized representative of such Party.

(b) Neither the failure by either Party to insist on any occasion upon the performance of the terms, conditions and provisions of this Agreement nor time or other indulgence granted by one Party to the other shall act as a waiver of such breach or acceptance of any variation or the relinquishment of any such right or any other right hereunder, which shall remain in full force and effect.

21.4 Relationship of the Parties. This Agreement shall not be interpreted or create an association joint venture or partnership between the Parties or to impose any partnership obligation or liability upon either Party. Neither Party shall have any right, power or authority to enter into any agreement or undertaking for, or act on behalf of, or to act as or be an agent or representative of or to otherwise bind, the other Party.

21.5. Survival. The cancellation, expiration or earlier termination of this Agreement shall not relieve the Parties of obligation that by their nature should survive such cancellation, expiration or termination, including, without limitation, warranties, remedies, promises confidentiality.

21.6. Severability

(a) Each of the rights and obligations contained in this Agreement shall be deemed to be distinct and severable terms to the intent that if one or more of such rights and obligation shall be or be declared or become illegal, void or unenforceable then the remaining rights and obligations shall (unless the effect is to frustrate the fundamental basis of this Agreement) continue in force and effect.

(b) Where a right or obligation is or has been declared or becomes illegal, void or unenforceable and the effect thereof is not to frustrate the fundamental basis of the Agreement, the Parties agree to meet as soon as possible with a view to agree on alternative arrangements, if possible, which will most closely

conform to the right or obligation which has become or has been declared illegal, void or unenforceable.

(c) Any applicable stamp duty will be paid by the Buyer to the complete exclusion of the Seller.

21.7 Language. The language for the purpose of administering this Agreement shall be English.

21.8 Entire Agreement. This Agreement (as may be amended in writing, signed by all Parties) represents the entire agreement of all the Parties with respect to the matters covered herein and supersedes any previous understandings, commitments, agreement or representations whatsoever, oral or written.

For the avoidance of doubt, the Buyer hereby agrees and accepts that the Seller is bound by, *inter alia*, the provisions of the OGRA Ordinance 2002 and the Natural Gas Regulatory Authority (Licensing) Rules 2002.

21.7 Successors and assigns. This Agreement shall be binding upon, and inure to the benefit of, the Parties and their respective successors and permitted assigns.

21.8. Affirmation. The Buyer declares and affirms that it has not paid nor has it undertaken to pay and that it shall in the future not pay any bribes, pay-offs, "kick backs" or unlawful commission and that it has not in any other way or manner paid any sums, whether in Pakistan currency or foreign currency and whether in Pakistan abroad or in any other manner given or offered to give any gifts and presents in Pakistan or abroad to any person or Buyer to procure this Agreement and the Buyer undertakes not to engage in any of similar act during the term in relation to this Agreement.

21.9. Counterparts. This Agreement may be executed in two or more original copies and each such copy may be executed by each of the Parties in separate counterparts, each of which copies when executed and delivered by the Parties shall constitute an original, but all of which shall together constitute one and the same instrument.

21.10 Governing Law and Jurisdiction. This Agreement will be subject to and construed in accordance with the substantive and procedural laws of the Islamic Republic of Pakistan and will be subject to the jurisdiction of the Courts of Karachi.

DHA COGEN LTD. KARACHI

SUI SOUTHERN GAS CO. LTD.

IN WITNESS WHEREOF, this Agreement has been executed by the Parties on the day and year first above written.

FOR AND ON BEHALF OF
SUI SOUTHERN GAS COMPANY LIMITED

WITNESSES:

1. Signatures:		1. Signatures:	
Name:	MUNAWAR BASEER AHMAD	Name:	AZAM IQBAL SIDDIQUI
CNIC:		CNIC:	
Address:		Address:	

FOR AND ON BEHALF OF
DHA COGEN LIMITED

WITNESSES:

1. Signatures:		1. Signatures:	
Name:	BRIG. MASOOD HUSSAIN	Name:	HASEEB KHAN
CNIC:		CNIC:	
Address:		Address:	

SCHEDULE 2

BUYER'S FACILITIES

SCHEDULE 3

DELIVERY POINT

SCHEDULE 4

SELLER'S FACILITIES

The pipeline expansion project to supply Natural Gas for the Complex and to the residents of Phase VIII Defence, Karachi is a part of SSGC's pipeline system which will cater the full requirement of Gas for the operation of Complex.

Seller's Transportation Facilities will consist of the following:

- Approximately 14 km of 20-inch diameter pipeline loops on the existing 24-inch diameter pipeline system.
- Measuring Station: A Gas Measurement facility installed at or near the Point of Delivery on or adjacent to the Buyer's Complex

SCHEDULE 5

METERING SYSTEM

SCHEDULE 6
SITE DESCRIPTION

The site is located in Phase VIII Defence, Karachi, the largest residential area managed under Pakistan Defence Officers Housing Authority, Karachi. Based on the survey of site the coordinates for the Complex is Latitude N= 29969.74, Longitude E= 1271.46. Site elevation is 1.0 meter (m) above sea level. The selected site plot is bounded by sea front on the western side and the residential area on the southern side.

Ambient conditions for the site as follows:

1. Average rainfall: 160 mm per year, but this amount falls in short durations

2. Ambient Temperature

a)	Mean air temperature	24.5°C
b)	Maximum air temperature	43 °C
c)	Minimum air temperature	8 °C

3. Relative Humidity

a)	Minimum relative humidity	60%
b)	Maximum relative humidity	8[illegible]%

4. Wind Speed: Minimum design wind speed will be 144 km/hr

5. Mean site Barometric Pressure. 1013 mbara

This exhibit is provided for general informational purpose and does not impact upon the rights and obligations of the Parties under this Agreement.

ANNEXURE "A"

BUYER'S CONSTRUCTION SCHEDULE

ANNEX – C

MOU EXECUTED WITH KESC

MEMORANDUM OF UNDERSTANDING

[illegible]

[illegible]

INTERNATIONAL [illegible] POWER, [illegible] registered office at [illegible] Street [illegible] Town, [illegible] (hereinafter referred to as "IIP" or "SELLER" [illegible] administrators, permitted transferees [illegible] FIRST PART

AND

KARACHI ELECTRIC SUPPLY COMPANY LIMITED [illegible] Islamic Republic of Pakistan [illegible] "KESC" which term shall, wherever the context so permits, mean and include [illegible] administrators, successors [illegible] SECOND PART

[illegible] "Party" [illegible]

WHEREAS:

[illegible]

A. [illegible] generation and water [illegible] Pakistan [illegible]

B. [illegible] KESC is exploring the option of purchasing from IIP/DCL, the estimated [illegible] capacity [illegible] MW net and all of the net electrical output of DCL (the "Purchase") [illegible]

C. The parties [illegible] the present understanding [illegible] the Purchase [illegible] within [illegible]

[illegible], in consideration of the mutual benefits to be derived and in accordance with the terms and conditions contained herein, the parties hereby agree and bind themselves as follows:

1. [illegible]

1.1 [illegible]

1.2 [illegible]

1.3 [illegible]

2. [illegible]

2.1 [illegible]

a. [illegible]

b. [illegible]

3. [illegible]

3.1 Neither party shall make any claim against the other party for [illegible] under this MOU [illegible] whatsoever [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

SCHEDULE A (PPA TARIFF STRUCTURE - PKR)

2011	1	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	7.10
2012	2	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	7.10
2013	3	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	7.10
2014	4	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	7.10
2015	5	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	7.10
2016	6	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	7.10
2017	7	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	7.10
2018	8	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	7.10
2019	9	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	7.10
2020	10	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	7.10
2021	11	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	7.10
2022	12	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	7.10
2023	13	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	7.10
2024	14	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	7.10
2025	15	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	7.10
2026	16	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	7.10
2027	17	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	6.09
2028	18	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	6.09
2029	19	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	6.09
2030	20	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	6.09
2031	21	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	6.09
2032	22	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	6.09
2033	23	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	6.09
2034	24	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	6.09
2035	25	3.736	0.175	3.909	0.600	0.578	0.330	0.961		0.197	0.054	0.005	3.19	6.09

Capacity sold at factor	85%
MW's	64.26

Levelized Tariff PKR	5.57
Discount Rate	12%

ANNEX – D

HEAT RATE/ EFFICIENCY REVIEW REPORT

PF Engineers

Mr. Peter Dailey
Chairman & CEO
International Electric Power
603 Stanwix St.
Gateway Two, Suite 1825
Pittsburgh, PA 15222

E-mail: pdailey@iepwr.com

Subject: Heat Rate/Efficiency review for DHA DCL-Karachi

Dear Mr. Dailey:

PF Engineers is pleased to provide this letter report detailing our independent engineering assessment of the heat rate/efficiency of Defense officers Housing Authority ("DHA") Cogen Limited ("DCL") Power and Desalination Facility (the "Project") located in Karachi, Pakistan. The Project entered Commercial Operation in April 2008, and is an 87 Megawatt ("MW") cogeneration facility providing steam and energy to a desalination plant to produce approximately 3.0 million gallons of potable water per day.

Introduction

Our approach is drawn from years of experience with power plant design, operations, and performance. During our review, we have taken three separate approaches to provide an opinion on the estimated heat rate and efficiency for the Project. The three approaches are:

- Review of the as designed heat balances, including the guaranteed case;
- Review of the historical operations of the Project, and
- Evaluation of typical Performance Factors that will impact the heat rate/efficiency of the Project.

The results from these three approaches were then combined to develop an estimated heat rate for the Project based on an assumed operational profile.

Heat Balances

Siemens, the Original Equipment Manufacturer ("OEM"), developed heat balances shown in Table 1. These heat balances are dated September 23, 2003. These seven heat balance cases provide the expected design conditions for a new and clean facility based on a given ambient temperature, fuel flow, and percentage of boiler blowdown.

TABLE 1
Heat Balance Cases

Heat Balance Case	Output (MW)	Natural Gas Use (kJ/s)[1]	Calculated Heat Rate (kJ/kWh) LHV	Calculated Heat Rate (Btu/kWh) LHV
Guarantee 30°C (No Blowdown)	87.157	179.799	7.427	7.039
Design 30°C (1.5% Blowdown)	87.064	179.799	7.434	7.047
ISO 15°C (1.5% Blowdown)	93.537	192.063	7.392	7.007
ISO 15°C (No Blowdown)	93.622	192.063	7.385	7.000
Winter 8°C (1.5% Blowdown)	96.589	198.011	7.380	6.995
Summer 40°C (1.5% Blowdown)	82.940	172.302	7.479	7.089
50% Load 30°C (1.5% Blowdown)	46.299	111.392	8.661	8.210

Notes:
1 Natural gas use is based off of a natural gas heat content of 938.7 Btu/cubic foot (LHV).

Some of the key attributes to consider from the heat balances noted in Table 1 are:

- New and Clean conditions, so degradation has not been applied;
- Output is based off of the Power Island and does not fully contemplate the auxiliary load or any additional load that may be attributable to the desalination plant;
- The average annual high temperature in Karachi is approximately 30 degrees Centigrade ("°C") with a relative humidity generally above 60-percent;
- Some level of boiler blowdown is required for proper operation, so the "No Blowdown" cases are only for testing;
- Heat rates are shown on a Lower Heating Value ("LHV") basis; and
- The Project is operating at a continuous load, which in most of the heat balances is at 100-percent load.

Historical Operations

The Project attained Commercial Operation on April 17, 2008. Since attaining Commercial Operation the Project has had several operational issues, which have impacted the ability of the Project to produce power. The Project has been operational for three periods since Commercial Operation. 1.) April 17th to September 12th, 2008; 2.) August 14th to November 2nd, 2009; and 3.) February 22nd to May 1st, 2010. For the purposes of our heat rate/efficiency review we have utilized the raw data from the most recent operation. Table 2 below contains the results from our consolidation of the operating data for 2010.

TABLE 2
Operational Data for February 22nd to May 1st, 2010

Month	Output (MWh)	Heat Rate (Btu/kWh) LHV(1)	Capacity Factor(2)	Water Produced (MM gallons)	Notes
Feb	7,135	8,333	68.3%	9.6	February 21st-25th
Mar	19,707	7,811	67.4%	27.3	March 16th-31st (down 28th-29th)
Apr	47,772	7,846	76.3%	68.9	Full month
May	677	7,899	32.4%	1.0	May 1st

Notes:
1. Natural gas heat content assumed to be 815 Btu/cubic foot LHV based on historical gas analysis results
2. Uses a nominal plant output of 87MW to calculate Capacity Factor

Some of the key attributes to consider from the operational data noted in Table 2 are:

- The data provided for our review comes from the plant control system in different time scales (i.e. output was provided hourly and natural gas use was daily);
- Instrumentation tolerance has not been contemplated for the values provided;
- The ambient temperatures varied from a low of 22°C to a high of 37°C with a relative humidity in the range of 40 to 85 percent; and
- The grid voltage varied from 49 to 50 Hertz ("Hz").

Performance Factors

After a combined cycle power plant reaches Commercial Operation, it is common practice that the initial heat balances are no longer reviewed. The plant may have testing requirements, but the results are generally corrected back to a theoretical value based on performance curves.

These performance curves are to compensate for a number of Performance Factors that will impact the operation of the Project. The major Performance Factors are noted below along with the potential impact on performance.

Temperature

The power output and the efficiency of a Combustion Turbine ("CT") are driven primarily by firing temperature and the air mass flow going through the machine. The firing temperature is fixed per the design, but the air mass flow will vary depending on the temperature and relative humidity. Cold air is denser than warm air, so a CT will be able to produce more power and be more efficient on days where the ambient temperature is low.

The average annual temperature for the Karachi area is approximately 30°C. The performance deterioration from ISO Conditions (15°C, 60% relative humidity, at sea level) to the average annual temperature in Karachi can be significant. This performance deterioration continues to get worse as the ambient temperature increases. Therefore, we would expect significant performance deterioration when the Project is operating at 30°C and higher.

In addition, the higher ambient temperature further impacts performance by increasing the temperature of the cooling water. The higher cooling water temperature impacts the effectiveness of the condenser and the generation capabilities of the Steam Turbine ("ST").

Relative Humidity

The relative humidity in the air will add mass to the air going into the CT. A higher relative humidity will help performance, but it can also have other consequences as equipment is more prone to rust and accelerated degradation in high humidity environments.

Based on the operating data that we have reviewed, it appears that the average relative humidity level is around 70 to 80 percent. This should be beneficial for the performance of the unit without being too high to warrant corrosion concerns.

Power Factor, Voltage control

The Project has historically had issues with the stability of the grid. Based on the operational data that we reviewed, it is not uncommon for the grid voltage to go from 49 Hz to 50Hz within an hour. These swings in voltage can make it difficult to control the CT, thus taking the CT out of the optimal

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performance curve. These voltage swings will adversely affect the equipment, which will impact the performance of the Project.

Load

CTs and STs are designed to be the most efficient at a certain load point. Typically, this most efficient load point is near full load. Therefore, as the plant is starting up or reducing load, the heat rate-efficiency will be adversely impacted, which means that depending on the load point, number of starts and stops, the annual average heat rate will be affected.

Degradation

The performance of a CT will degrade over time due to fouling, wearing of seals, minor damage to parts, corrosion, etc. Degradation also applies to the Heat Recovery Steam Generator ("HRSG") and the ST, but to a much lesser extent. The industry standard for combined cycle plant degradation is 4.5 percent on output and 2.5 percent on heat rate. Major maintenance repairs will restore the CT performance to within approximately 1.0 to 2.0 percent of the initial guarantees, but this is for a limited time period. In the industry, this is commonly referred to a "saw tooth" performance curve.

Most turbine suppliers will start to apply degradation losses after as few as 500 hours of operation.

Availability

If a combined cycle project is operated and maintained properly, then we would expect the annual average availability to be approximately 90 to 92 percent. This means that during the un-available period, the plant is down for maintenance, either preventative or corrective.

This impacts the efficiency in that more downtime means that there are more starts and stops for the project (see Load). In addition, a lower availability could also lead to additional environmental impacts and corrosion, which accelerates the degradation losses.

Analysis

Our review of the heat rate-efficiency of the Project has combined the review of the design heat balances and the operational history. For both of these cases, we have considered the impact of the Performance Factors noted above.

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Heat Balances

The heat balances are the performance basis provided by the OEM to set expectations on how the Project should perform under given parameters. During performance testing, the Project will be operated and then the parameters from this operation will be "corrected" back to the given parameters used in the heat balance.

For example, the Guarantee Case assumes that the Project is operating with an ambient temperature of 30°C, but if the actual temperature is 35°C, then the output and heat rate will be lower than expected. Therefore, correction curves are used to "recalibrate" the results of the performance test.

The reason that we note these performance test corrections is that the heat balances are valid for specific parameters and the output and heat rate will vary depending on these parameters.

The heat balances are also focused on the Power Island (consisting of the CT, HRSG, and ST). Therefore the heat balances do not take the full auxiliary load into consideration. With the addition of the auxiliary load to the heat balance, the output will decrease and the heat rate will increase. Based on historical operations, the auxiliary load for the Project is approximately 6 percent, which we have used in our evaluation of the heat balances.

The heat balances assume that the Project is in a "New and Clean" condition. Once the Project is in operation this will no longer be the case. Per the Degradation section above, we have assumed that a 2.5 percent degradation rate on heat rate should be applied to convert the heat balances to the expected operational values.

Table 3 below shows the progression of the heat rates per the heat balance from a Base Case or "New and Clean" condition to more realistic operating parameters by accounting for the full auxiliary load of the Project (including the desalination plant) and performance degradation.

While the Project is operating at full load, the Design 30°C most accurately represents the expected performance of the Project based on the annual average ambient conditions in Karachi. The heat rate for this case, including the auxiliary load and degradation is: 7,686 Btu/kWh (LHV), which equates to an overall plant efficiency of 44.4 percent.

The Design 30°C case does most provide a good estimate for the heat rate/efficiency at full load operation, but the Project will operate at various load levels and various temperature ranges. Therefore, it is our opinion that the actual annual average heat rate of the Project would be higher than 7,686 Btu/kWh (LHV) by approximately 1.5 to 3.0 percent equating to a range of 7,801 Btu/kWh (LHV) to 7,917 Btu/kWh (LHV).

TABLE 3
Heat Balance- Heat Rate Adjustments

Heat Balance Case	Base Case	Base Case – Aux.Load[2]	Base Case – Aux Load + Degradation
	Heat Rate[1]	Heat Rate[1]	Heat Rate[1]
Guarantee 30°C (No Blowdown)	7,039	7,489	7,676
Design 30°C (1.5% Blowdown)	7,047	7,497	7,684
ISO 15°C (1.5% Blowdown)	7,007	7,454	7,640
ISO 15°C (No Blowdown)	7,000	7,447	7,633
Winter 8°C (1.5% Blowdown)	6,995	7,442	7,628
Summer 40°C (1.5% Blowdown)	7,089	7,541	7,730
50% Load 30°C (1.5% Blowdown)	8,210	8,734	8,952

Notes
1 Heat rate units are in Btu/kWh (LHV).
2 Auxiliary load includes equipment such as but not limited to the cooking water pump, circulating water pump, desalination, etc. for an overall Auxiliary Load of approximately 6% of output

Historical Operations

The data shown previously in Table 2, represents the historical operations data for February 21st 2010 through May 1st, 2010. In compiling this data, we have assumed:

1. The instrumentation is calibrated and providing the correct values.
2. The heat content of the natural gas averaged 815 Btu/cu. ft. (LHV)

In reviewing the historical operations data, we noticed some anomalies where it was obvious that the instrument reading was incorrect or there was a time discrepancy in the data readings. For those instances, we removed that data from our assessment of the heat rate. For example, the natural gas meter readings from February 25th to March 15th were not available.

After the Project was restarted in February, the operation was more consistent. The Project averaged a heat rate of 7,852 Btu/kWh (LHV) from March to May 1st. Since the Project was recently repaired, it is our opinion that degradation of the performance had not significantly impacted the heat rate of the Project.

PF Engineers

The performance noted in March and April had the Project operating at a capacity factor just over 70 percent. With the varying load demands, voltage changes, and downtime, it is our opinion that this operational level is a valid representation of how the Project will operate on an annual basis.

Conclusions

Based on our review of the heat balance and operational information provided, it is our opinion that the average annual heat rate for the Project should be in the range of 7,900 Btu/kWh (LHV) to 7,800 Btu/kwh (LHV), which equates to an efficiency range of approximately 43.20 percent to 43.75 percent.

If you have any questions on this analysis, please feel free to contact me at trent.markell@pfengineers or at 303-513-8796. Thank you.

Sincerely,

Trent J. Markell, Principal
PF Engineers

cc Nazeer Baig, EP

ANNEX – E

INITIALED COPY OF REHABILITATION TERM SHEET

TNB REMACO

DHA CO-GENERATION LIMITED
94MW CO-GENERATION COMPLEX
AT
KARACHI, PROVINCE OF SINDH
PAKISTAN

PLANT REHABILITATION SCOPE AND PRICING

Revision 5

August 3, 2012

A. **Overhaul of Siemens V64.3A gas turbine including replacement of compressor blades with coated blades**

No	Description	Price (USD)
1.	Manpower cost for the entire scopes and tools (excluding special tools). Please see **Attachment 1** for work program.	1,951,953.35
2.	Supply of compressor rotor and stator inclusive of locking hard wares. Please see **Attachment 2** for detail pricing and **Attachment 3** for description of the locking hard wares. Note: The cost is inclusive of transportation and insurance but exclude Pakistan duties & tax.	2,651,939.60
3.	Technical Assistances (TA) –(Mechanical 1, Commissioning. 1, Balancing 1 and Fact Finder 1)	820,720.38
4.	Damping cone and consumables Note: The cost is inclusive of transportation and insurance but exclude Pakistan duties & tax.	607,887.44
5.	Supply of 5 types of special tools set for gas turbine and compressor. Note: The cost is inclusive of transportation and insurance but exclude Pakistan duties & tax. The detail list is as per **Attachment 4.**	599,076.00
	Sub-total for Part A	6,631,576.77

B. Scope of work for the gas turbine air intake system modification

No	Description	Price (USD)
1.	Extend the platform of the Intake.	Lump Sum
2.	Modify Pre-filter housing for ease of maintenance	
3.	Installation of the Equalizing Chambers for on line filters replacement.	
4.	Modification of the Delta-pressure measuring system. Price inclusive installation of Pressure Gauges, lighting system and onsite electrical connection.	
5.	*Additional Scopes* Supply and installation of one unit drift eliminator. The scope of works includes removing and reinstallation of the bird screen and fabricating of new additional steel support for the eliminator.	inclusive in the lump sum
	Sub-total for Part B	**397,896.00**

Detail description of the modification is as per **Attachment 5** attached.

Excluded work scope:

a) Major modification that involve replacement of hardware of the distributed control system (DCS) and gas turbine control system (e.g. alarm setting), major programming to the control and sequence logic, replacement of electrical cable connection from Intake System to Control Room which related to the modification of the GT Intake System.

C. Supply of a new improved air filters after the modification works.

No	Description	Price (USD)
1.	150 nos. of EMW pre-filter cell VZ00239 ***plus additional of 150 nos. This is for the purpose of replacement online using roll in roll out concept.***	Lump sum
2.	150 nos. of EMW TF00339 ***plus additional of 150 nos. This is for the purpose of replacement online using roll in roll out concept.***	
3.	MW minipleat compact Cassette F9	
	Sub-total for Part C	67,000.00

D. Control & Instrumentation (C & I) Improvement works.

Detail description on the revised scopes is as per Attachment 6.

The total rehabilitation works for C & I portion is **USD556,602.00.**

The grand total for the complete rehabilitation works (Item A + Item B + Item C + Item D) is USD 7,653,074.77

E. Payment Term

Our payment terms are as follows:

1. Upon signing of contract TNB REMACO will require a bank guarantee from owner for purchase of long lead parts, especially compressor parts. The amount of the bank guarantee will be determined later based on risks we need to bear in case the owner cancelled the order/works. The bank guarantee shall be valid until owner made first payment after achieving financial close.
2. Upon owner achieving financial close, owner to pay 40% of total price for compressor parts (Item A, no.2), damping cone (Item A, no. 4) and new special tools (Item A, no. 5) or the amount we need to pay our supplier, whichever is higher. The balance of sixty percent (60%) to be paid upon delivery.
3. Mobilization Fee amounting to ten percent (10%) of contract price and to be paid two (2) months prior the start of works.
4. The payment for the remainder for Item A, Item B, Item C and Item D to be paid in equal monthly payment with final payment upon commissioning of the plant.
5. All payment shall be made in US Dollar and to our Malaysian bank account.

F. Performance Warranty

Please note that the pricing above does not take into consideration of performance guarantee since we only works on the gas turbine of the co-generation plant. If owner require TNB REMACO to provide performance guarantee, we reserve our right to revise the price accordingly to cover our risks. The price above is inclusive of standard warranty for parts, which is eighteen (18) after delivery or twelve (12) months after installation or 8,000 EOH.

We also guarantee the works listed above will be completed in 60 days from the start date (which will be agreed later) excluding the delivery of parts. The guarantee for works completion is void for event beyond our control such as not getting permission from grid controller to start the commission of the plant. We will hand over the plant to owner after completion of the reliability run (RR), which from our experience is around five (5) days. The parameters to conduct and determine status of the RR shall be agreed by both parties.

G. Additional Works

If during the rehabilitation works there arise requirement for an additional works, TNB REMACO will prepare a proposal for the additional work together with the associated costs for owner review and approval. The additional work will only be performed after TNB REMACO received an official confirmation from owner.

Notes:

1. The overhaul duration for Siemens gas turbine is sixty (60) days and our works is only at the gas turbine. We will not perform any works to the rest of the plant such as the steam turbine, generator, heat recovery steam generator (HRSG) and balance of plant (BOP).
2. Supply of part and services excludes withholding tax and duties. These items will be chargeable to owner.
3. We require a lead time of two (2) months to commence works.
4. The prices and scope of works are based on available information and visit by our technical team to the plant. The technical team did not perform root caused analysis to the problems encountered by the plant, especially the compressor surge incidents nor they identified all the parts required for the rehabilitation works. During the actual rehabilitation works, we may require certain parts to complete the works. These parts shall be procured by Owner and at Owner's cost
5. The price is valid until **30th September 2012** and can be extended subject to our agreement. Both parties will conclude the terms and conditions prior to signing of contract.

ANNEX – F

INDICATIVE TERM SHEET WITH OPIC

Overseas Private Investment Corporation
International Electric Power LLC
Draft Term Sheet for Senior Loan
January 31, 2012

Project:	The DHA Cogen Project is a 94 MW gross rated combined-cycle gas-fired electric power generating facility which also converts up to three (3) million gallons per day of seawater to potable water, was constructed by Siemens AG and Siemens Pakistan, achieved initial commercial operation in 2008, and is located in Karachi, Pakistan (the "Project"). The Project is currently owned by AEI Energy (60.2%); The Pakistani Defence Housing Authority ("DHA") (8.1%), Faysal Bank (9.75%) and others (21.95%).
Project Capitalization:	US$50,000,000 will be required by the Borrower (as defined below).
Instrument:	A senior first-mortgage note
Borrower:	DHA Cogen Ltd. a Pakistani entity ("DCL"), which at Closing will be majority-owned by a subsidiary of International Electric Power, LLC ("IEP"), a Delaware limited liability company. The equity will be owned approximately as follows: IEP – 65.2% DHA - 13% Faysal Bank: – 9.75% Others – 12%
Lender:	Overseas Private Investment Corporation ("OPIC")
Note Facility:	Lender shall issue to Borrower a Note (the "Note") in the principal amount of US$50,000,000.
Term:	Fifteen (15) years, beginning after Commercial Operation of the Power Plant, pending rehabilitation. The period prior to Commercial Operation is referred to herein as the "Rehabilitation Period." The Rehabilitation Period is anticipated to take approximately 6 months after Closing.
Commercial Operation	Shall be the date upon which Borrower and Lender's engineer agree that the Project has achieved its minimum, maximum, and average output at an agreed heat rate, etc.

Funding Date:	A single funding on the Closing Date. No additional draws shall be permitted.
Use of Proceeds:	Purchase of existing senior and subordinated debt issued by United Bank Limited, Faysal Bank, Habib Bank, Askari bank, among others with face value of Pakistan Rupees ("PKR") 6,673,000,000 at a discount of approximately 56%; the purchase of AEL equity and certain second lien debt issued by AEL with a face amount of $6 million (for $1.3 million), with the balance being used for plant rehabilitation and costs.
Material Project Documents	The following shall be reasonably acceptable to Lender and shall include: 1. that certain power purchase agreement between DCL and Karachi Electric Supply Company (KESC) for a term of twenty-five (25) years (the "PPA"); 2. that certain gas supply agreement between DCL and Sui Southern Gas Company (SSGC) dated May 2005 which provides for the daily gas needs of the Project for the term of the agreement, which expires May 2040, it being expressly understood that the gas supply for the Project is guaranteed thru 2030 (the "GSA"); 3. that certain long term services agreements between DCL and Tenaga National Berhad Remaco ("TNB Remaco") which shall provide for rehabilitation, spare parts and provision of long-term maintenance services for the Project for a period of ten (10) years ("LTSA"); 4. that certain water supply agreement between the Cantonment Board Clifton and DCL providing for delivery of up to 3,000,000 gallons per day of potable water (the "WSA"). Agreements 1 through 4 above constitute the Material Project Documents.
Maturity Date:	Fifteen (15) years from date of Commercial Operation
Base Interest:	Base Interest shall be a fixed rate of approximately 6% per annum (depending upon market conditions and U.S. Treasury rates at financial closing), payable quarterly in arrears on the last day of each calendar quarter (the "Quarterly Dates"). Interest shall be calculated on the basis of a 360 day year for actual days elapsed.
Base Principal Scheduled Amortization:	During the Rehabilitation Period, interest will accrue on amounts drawn and shall be added to the balance of the note. After the Rehabilitation Period ends, mortgage-style payments shall be made, with equal quarterly installments of principal and interest payable in arrears.

Payment Dates:	Beginning on the last day of the first month following the three month anniversary of the date of Commercial Operation (as defined in the PPA), quarterly level installments of principal and interest will be payable.
Grace Period:	Fifteen (15) days from the end of each Quarterly Date
Default Interest:	Two percent (2%) per annum in excess of the rate otherwise chargeable on the Note
Distributions:	No distributions shall be allowed unless: (a) No Event of Default shall have occurred and be continuing or shall result from such distribution; (b) the Debt Service Coverage Ratio test shall be satisfied, such that the Debt Service Coverage Ratio for the prior quarter shall equal or exceed 1.25x.
Ranking:	The Note will be senior secured debt of Borrower, will rank *pari passu* in right of payment with – and will share equally and ratably in the collateral with – any other senior secured debt permitted by Lender, and will rank senior to any subordinated debt incurred by Borrower. Borrower will have the right to obtain working capital, letter of credit, and trade financing for operations.
Priority of Revenue Application:	Not less frequently than quarterly, the Project shall distribute to a restricted collateral account at Borrower level (the "Collateral Account") all cash then available for distribution to Borrower under applicable law and the terms of any existing debt arrangements at the Project level. All cash in the Collateral Account shall be applied on Quarterly Dates in the following order of priority to pay (the "Waterfall"): (1) Payment of operating and administrative expenses of the Project as incurred; (2) Deposits into the senior Note payment reserve account until the amount of the next payment of senior Note principal and interest is obtained; (3) Deposits into reserve accounts in favor of any working capital lender, letter of credit lender or gas supply provider until the necessary balance(s) of such reserve accounts is are achieved; (4) Deposits into accounts in respect of any major maintenance reserve or debt service reserve requirements, and then (5) Deposits into a distribution reserve account, which may be distributed to the owners of the Project at their election.
Debt Service	A debt service reserve (the "Debt Service Reserve Account") shall be

Reserve Account:	established on the Closing Date. The Debt Service Reserve Account shall be used to meet shortfalls in debt service of the Note. The Debt Service Reserve Account shall initially be funded with a letter of credit, and over time, with cash, until it reaches a balance equal to two quarters' debt service. Any draws on the Debt Service Reserve Account shall be replenished in accordance with the Priority of Revenue Application until the required balance is achieved. Interest and earnings on permitted investments shall accrue to the balance of the Debt Service Reserve Account. Borrower may fund the Debt Service Reserve Account with a letter of credit acceptable to Lender.
Voluntary Prepayment:	The Note may be prepaid by Borrower in whole or in part on any Payment Date, with no prepayment penalty.
Mandatory Prepayment:	Principal on the Note shall be subject to mandatory prepayment upon any major casualty or major condemnation events, any sale of assets and certain other extraordinary transactions.
Security/Collateral:	Collateral shall include (i) all cash flows of the Project and (ii) a first lien on all tangible and intangible property of the Project. Lender shall have a first priority perfected security interest in all assets of Borrower. All restricted accounts, including the Collateral Account, shall be maintained for the benefit, and subject to the security interest, of Lender.
Recourse:	Borrower and the Project will have sole responsibility to pay the principal of, and interest on, the Note.
Force Majeure	Borrower shall be excused from paying interest or principal to Lender in the event of and for the duration of a Force Majeure event. Force Majeure events shall include, *inter alia*, (i) natural disasters, (ii) government actions negatively affecting the Project, and (iii) failure of the KESC system to maintain adequate voltage.
Incurrence of Additional Debt:	Borrower will not incur any additional debt *pari passu* with the Note without the written consent of Lender (except as otherwise stated in this term sheet) provided, however, if required by the gas supplier, Lender will agree to permit such supplier to secure a reserve account for gas supply payments that is funded ahead of the Lender's debt service account with regard to the Waterfall.
Documentation:	A Note Purchase Agreement, Note, Mortgage and related agreements, which shall contain appropriate conditions precedent, representations and warranties, covenants, and events of default prepared by and satisfactory in all respects to Lender and its counsel.
Affirmative Covenants:	The Note Purchase Agreement shall contain usual and customary affirmative covenants for facilities and transactions of this type, including,

	but not limited to, those set forth below (such covenants to be applicable to Borrower): (i) maintenance of corporate existence and rights; (ii) performance of contractual obligations; (iii) periodic reporting, including delivery of financial statements, projections, engineering reports, and operating/technical reports; (iv) timely provision of information, notices and financial reports; (v) maintenance of insurance; (vi) maintenance of properties; (vii) compliance with all rules, laws, contracts and authorizations/approvals; (viii) inspection of books and properties; (ix) compliance with other legal and regulatory matters; (x) maintenance of licenses and authorizations; (xi) maintenance of liens; (xii) maintenance of books and records; (xiii) compliance with customary environmental requirements; (xiv) payment of taxes and other claims when due; (xv) maintenance of security interests and security accounts; and (xvi) compliance with budgeting process and annual budgets.
Negative Covenants:	The Note Purchase Agreement shall contain usual and customary negative covenants for facilities and transactions of this type, including, but not limited to, those set forth below (such covenants to be applicable to Borrower): (i) prohibition on liens and encumbrances other than "permitted liens" to be negotiated; (ii) prohibition on sale-leaseback transactions; (iii) prohibition on loans, capital contributions, and other investments;

	(iv) prohibition on incurrence of additional liens; (v) restrictions on use of proceeds of the Note Facility; (vi) prohibitions on additional debt and contingent obligations; (vii) limitations on capital expenditures (to be negotiated); (viii) limitations on leases; (ix) prohibition on the acquisition of the stock of or the assets of another business; (x) prohibition on transactions with affiliates, subject to existing affiliate transactions which shall be scheduled and future affiliate transactions which are entered into in the ordinary course, on an arm's-length basis and in an annual amount not to exceed an amount to be determined; (xi) limitations on scope of, and changes in, business/activities conducted; and (xii) prohibition on amendment, waiver or other changes of material contracts, permits or authorizations.
Representations and Warranties:	The Note Purchase Agreement shall contain usual and customary representations and warranties for transactions of this type applicable to Borrower.
Conditions to Closing and Funding:	The Note shall contain those conditions to funding and closing usual and customary for transactions of this type, including, but not limited to, those set forth below: (i) accuracy of representations and warranties; (ii) absence of default or potential default; (iii) no material adverse effect; (iv) no violation of law or any applicable orders or injunctions; (v) delivery of customary legal opinions in form and substance satisfactory to OPIC; (vi) receipt of a report satisfactory to OPIC from an Independent Engineer regarding the technical aspects of the Project; (vii) completion of due diligence review by OPIC with results

	satisfactory to OPIC; (viii) execution of Material Project Documents satisfactory to Lender; (ix) all required consents, permits and approvals have been obtained; and (x) closing of acquisition.
Events of Default:	The Note Purchase Agreement shall include usual and customary default provisions, for transactions of this type, including but not limited to, the following: (i) failure to make timely payments of principal, interest or fees when due; (ii) breach of covenants, representations or warranties (with cure periods for certain covenants to be negotiated); (iii) cross default to other material debt (if any); (iv) breach of Material Project Documents; (v) failure to comply with any material law, permit, rule concession or approval; (vi) failure of the Note Purchase Agreement or any related document to remain in full force and effect; (vii) loss or impairment of priority of any lien or security interest of Lender; (viii) failure to make timely payments on any other Project debt; (ix) bankruptcy, insolvency or dissolution; (x) judgments in excess of specified amounts; and (xi) abandonment of the Project Industry standard cure periods will be afforded to the Borrower.
Expenses:	Borrower hereby agrees to reimburse Lender for all reasonable out-of-pocket fees and expenses of Lender and its reasonable legal counsel and independent consultants at Closing.
Proposed Closing Date:	November 30, 2012

Governing Law:	State of New York.
Waiver of Jury Trial:	Borrower and Lender and their respective affiliates hereby each waive any right to trial by jury in any action arising in connection with the transactions contemplated hereby or by any of the documents relating to the facility.
Not a Commitment:	This term sheet is not binding on Borrower or Lender or any of their affiliates and is submitted for discussion purposes only. No binding agreement shall be considered reached on the subject matter of this term sheet unless and until definitive and final documentation has been signed and delivered by all parties containing such terms and conditions as are satisfactory to Lender and Borrower.

ANNEX – G

INITIALED COPY OF LTSA TERM SHEET

TNB REMACO

DHA CO-GENERATION LIMITED
94MW CO-GENERATION COMPLEX
AT
KARACHI, PROVINCE OF SINDH
PAKISTAN

TERM SHEET FOR THE PROVISION OF LONG TERM SERVICE AGREEMENT (LTSA)

Revision 3

August 2, 2012

A. **Scope and Term**

TNB REMACO will supply spare parts ("Program Parts") for the gas turbine and also repair or refurbish the Program Parts at a suitable repair facilities ("Repair Center") during the term of the LTSA. TNB REMACO will also provide services to perform scheduled maintenance and unscheduled maintenance to the gas turbine, waste heat boiler, steam turbine and its generator during the term. The Balance of Plant (BOP) routine maintenance shall be performed by the plant operator. TNB REMACO will perform inspection to the BOP during HGPI and MI of the respective main plant. The BOP inspection cost is included below (to be submitted on 27th June 2012). The unscheduled maintenance will be considered as extra works and will be provided by TNB REMACO at the Time and Material Rates in effect at the time the work is performed. Our manpower rates are per **Attachment 1**.

The scheduled maintenance outage will be based on the following conditions:

1. The gas turbine shall be operated at base load with around 7,000-8,000 equivalent operating hours (EOH) /year.
2. The main fuel for the gas turbine is gas and running hours on distillate shall be limited to a minimum.
3. The gas turbine, waste heat boiler, steam turbine and associated generator shall be operated as per OEM recommendations.

The term of the LTSA shall commence from the effective date and unless terminated earlier, the term shall end ten (10) years from the effective date, whichever come earlier.

A proposed complete cost of one cycle maintenance of the power plant is detailed in **Attachment 2**. Please note that the portion quoted by Sulzer on new parts supply, parts refurbishment and inspection consumables will be directly taken from Sulzer's quotation whereby the handling charges percentage added for TNB REMACO is to be discussed and agreed. Owner should also observe and adhere to terms and conditions outlined in the Sulzer's quotation. The revised quotation by Sulzer (dated 10th July 2012) is attached in **Attachment 3**.

B. **Technical Expert and Site Support**

TNB REMACO will provide four (4) technical experts inclusive of one Contract Performance Manager (CPM) to be residents at the power plant and these experts will act as technical advisors to the plant management team. These experts will be the residents at the power plant for a period of two (2) years except for CPM, which will stay throughout the period of the LTSA. The experts will be as follows:

1) Maintenance Expert – The Maintenance Expert will advice technically on any maintenance issue. Among the scope of works is:
   - To develop a maintenance regime for the various equipment with the assistance of the power plant personnel

- To develop a Work Management Process for the power plant for day to day operation and work schedule
- To establish a metric for performance management

2) Operation Expert - The Operation Expert will advice on any operational issue. Among the scope of works is:
   - Provide On Job Training (OJT) for power plant personnel
   - To develop a Standard Operating Procedure (SOP) and troubleshooting technique
   - To develop metrics for operation for performance management
   - To develop operations routine

3) Control and Instrumentation Expert - The Control and Instrumentation Expert will advice technically on any Control and Instrumentation issue. Among the scope of works is:
   - To provide On Job Training to the I & C team
   - To develop tools for monitoring the power plant performance
   - To develop a long term plan for I & C

4) Contract Performance Manager - The Contract Performance Manager will be responsible for matters regarding the LTSA. Among others, the Contract Performance Manager will be responsible to:
   - Advise the Owner in outage scheduling for the power block
   - Ordering the Capital Parts
   - Follow-up on the progress of delivery of Capital Parts
   - Arranging and follow-up on the parts repair works at Repair Center
   - Participate in pre-outage planning and post-outage meeting
   - Arranging for the manpower for scheduled and unscheduled maintenance

Estimated cost for deployment of one (1) expert is USD 22,000 per month. The cost covers the followings:

- Flight ticket for mobilization and demobilization to site
- Accommodations at site

The owner shall provide and bear the costs for the followings:

- Official travel, accommodation and associated allowances related to work outside or inside Pakistan.
- Office facilities at site.
- Transportation at site.

Total cost for two (2) years of four (4) technical experts inclusive of a Contract Performance Manager is **USD 2,112,000.00.** Please note that yearly escalation will be applied as stated in Item K.

C. **Supply of Siemens V64.3A gas turbine Capital Parts**

Based on Sulzer quotation and agreed percentage adder TNB REMACO will supply the following Capital Parts listed below during the term of the LTSA. The numbers of Capital Parts required during the term of the LTSA are estimated based on records gathered by our technical team during the site visit only. Please refer to **Attachment 2.**

The total cost for one cycle of maintenance is **USD 8,026,402.00** and total for inspection consumable is **USD3, 377, 860.51.**

These cost already taken into account 10% percentage adder for TNB REMACO, transportation cost, insurance, Pakistan duties and taxes.

Please note that we assume a complete set of Inner and Outer Heat shield and Turbine Heat shield (all shield also known as tiles) to be purchased during 1st HGPI to cover for any shortfall.. However we anticipate a partial refurbishment of these shields at the next MI. Costing as shown in the costing sheet (**Attachment 2**).

Note:

1. Since the cost from our parts supplier i.e. Sulzer are passed directly to the owner, the terms and conditions for parts will be as per outlined in Sulzer's quotation.

D. **Repair/refurbishment services**

We will implement the concept of roll-in roll-out maintenance concept to optimize the procurement of Capital Parts. However, one (1) set of spares need to be purchased or refurbished prior to upcoming Schedule Inspection. List of spares and cost for ten (10) years is included in **Attachment 2.** The price for repair services is subject to price escalation. The estimated price for parts repair is listed in table below.

The prices listed below are based on the followings:

1. The terms and conditions are as per outlined in Sulzer's quotation.
2. The price for repair is based on medium repair.

The total refurbishment cost based on Sulzer quotation is **USD 1,682,171.68.**

These cost already taken into account 10% percentage added for TNB REMACO, transportation cost, insurance, Pakistan duties and taxes.

E. **Services for scheduled maintenance**

Listed in table below is the estimated price for services to perform scheduled maintenance. The price is inclusive the cost of TNB REMACO manpower, consumables, technical adviser and site works.

(i) Gas Turbine V64.3A/SGT 1000F

Type of Maintenance	Estimated Duration (Days)	Estimated Cost (US$)	Note
Minor Inspection	7	93,000.00	1. Cost is per event. 2. Cost of new spare and parts refurbishment is not included - to be borne by owner. 3. These prices are inclusive of Technical Advisor's and inspections consumables. 4. Commissioning activities for Combustion Inspection will be by owner's.
HGP Inspection	42	1,800,000.00	
Major Inspection	52	2,500,000.00	

(ii) Steam Turbine Siemens NK40

Type of Maintenance	Estimated Duration (Days)	Estimated Cost (US$)	Note
Minor	21	191,000.00	1. Cost is per event. 2. Cost of new spare and parts refurbishment is not included - to be borne by owner. 3. These prices are inclusive of Technical Advisor's and inspections consumables.
Major	52	1,072,000.00	

(iii) Generator

Type of Maintenance	Estimated Duration (Days)	Estimated Cost (US$)	Note
Minor Inspection	42	115,000.00	1. Works is inclusive of diagnostic services 2. Cost is per event. 3. Cost of new spare and parts refurbishment is not included - to be borne by owner. 4. These prices are inclusive of Technical Advisor's and inspections consumables.
Major Inspection	52	440,000.00	

(iv) Waste Heat Boiler (WHB)

Type of Maintenance	Estimated Duration (Days)	Estimated Cost (US$)	Note
Yearly Inspection	14	74,000.00	1. Cost is per event. 2. Cost of new spare and parts refurbishment is not included - to be borne by owner. 3. These prices are inclusive of Technical Advisor's and inspections consumables.

Notes:

- Supply of parts and manpower to perform unscheduled maintenance will be treated as extra works and the scopes and prices to be mutually agreed at the time of event.
- Repair (parts and manpower) for inspect only items is considered as Extra Works. Inspect only items are items that fail prematurely or items not meant to be replaced during the life of the gas turbine, such as the turbine rotor.

Please refer to **Attachment 2** for detail. The total cost for services based on ten (10) years of schedule maintenance is **USD 6,282,000.00.**

F. We will provide training for C & I staff which is for 15 people for a period of one (1) week. The training will be provided by the C & I expert. The training will be on plant control system, covering theory and may also include practical training. We will finalize training syllabus with power plant management before the training. The total training cost will be **USD 60,000.00.** The venue and accommodation if required for the participants will be provided by owner. The time for the training shall be agreed by both parties.

G. We estimating that the total spare parts requirement for steam turbine, generator and HRSG for ten (10) years period to be **USD18,818,185.00.** If owner require TNB REMACO to manage the purchase of these parts on its behalf, TNB REMACO will charge management fee, the amount of the fee will be agreed by both parties. The owner need to agree on the parts list prior to purchase by TNB REMACO.

H. TNB REMACO will supply and install a complete unit of Compressor Cleaning System as describe in **Attachment 4**. The cost is **USD 373,833.00.**

I. Contingency – To cater for unforeseen additional works that might be encountered during ten (10) years operation and maintenance of the power plant, 10% contingency amount has been added as per Attachment 2. The total contingency amount is **USD 4,073,245.00.**

J. The total estimated cost for the Long Term Service Agreement for a period of ten (10) years for the above scope of works and as detailed in **Attachment 2** is **USD 44,805,697.15. Inclusive of estimated 10% as TNB REMACO percentage adder for new parts, refurbish parts and consumable and also 10% contingency to cover for any additional works.** This price is not inclusive of yearly escalation based on indexation. We also do not include any cost for the inspection of the water desalination equipment.

K. **Price Escalation**

Prices above is based on February 2012 price ("Based Year Price" or BYP) and will be escalated to cover, among others, inflation and currency fluctuation. The mechanism to calculate the price escalation is divided into two (2) portions:

1. Services by TNB REMACO

The escalation will be as follows;

$$\text{Service Cost}_{LREV} = \text{Service Cost}_{LREF} \times \text{CPIadjust}_{YY}$$

Where:

$\text{Service Cost}_{LREV}$	=	The service cost at the year the service to be rendered
$\text{Service Cost}_{LREF}$	=	Reference Service Cost as per stated in this proposal as Based Year Priced (BYP)
CPIadjust_{YY}	=	the CPI adjustment factor as calculated below for the Year.

$$\text{CPIadjust}_{YY} = \text{WPakistanCPI}_{YY} / \text{WPakistan CPI}_{YY-0}$$

where:

$CPIadjust_{YY}$	=	the Inflation Adjustment Factor applicable for the adjusted year;
$WPakistan\ CPI_{YY}$	=	the WPakistan CPI applicable for the adjusted Year
$WPakistan\ CPI_{YY-0}$	=	the WPakistan CPI for the Base Year

[Note : The Pakistan CPI used as issued by Pakistan Federal Bureau of Statistics from time to time (or any successor or replacement agency thereto).

"Yearly WPakistan CPI" means the average of each of the end of Month values for the Wholesale Pakistan Consumer Price Index (WPakistan CPI) in the Year immediately preceding the relevant Year, which shall equal the sum of all the Month-end WPakistan CPI values in the Year immediately preceding the Year divided by the number of such values; provided, that if any such values for any of such Year are not available, then the average of the end of Month values for the most recent available three (3) Months shall be used.

i. All intermediate calculations in relation to the indexation of the Fixed O&M Fee shall be made to five (5) places of decimal without rounding and the final product shall be rounded to the second (2^{nd}) decimal place and a figure of five (5) or more in the third (3^{rd}) decimal place shall result in a rounding up of the second (2^{nd}) decimal.

ii. In the event the specified indices are discontinued, or the basis of the calculation is modified, equivalent indices shall be substituted by mutual agreement of the Parties.

The price escalation will become effective one (1) year after the BYP.

2. The escalation prices for Sulzer parts are as per Sulzer proposal **(Attachment 3).**

L. Terms and Conditions

We will finalize the terms and conditions at our soonest. We reserve the right to change the price for the works provided by us as stated in this term sheet pending finalization of the LTSA.

This Term Sheet shall be executed by the LTSA upon its execution.

M. Warranty and Guarantee

TNB REMACO will provide warranty for parts and repair services. Warranty for parts and services are twelve (12) months after installation or eighteen (18) months after delivery or 8,000 EOH.

TNB REMACO will not provide guarantees for plant performance such as plant output (MW) or heat rate/efficiency since we are not the operator of the plant.

TNB REMACO will provide a separate quote to the Owner for our team to do a performance test of the power plant after the COD.

N. Exchange Rate

Please note that the prevailing exchange rate used to convert from EURO to USD is 1 EURO to 1.26166 as per XE Exchange Rate (www.xe.com) on 15th June 2012.

ANNEX – H

SUMMARY OF INSURANCE HISTORY OF DCL

13 September, 2012

The Chief Executive Officer,
DHA Cogen Ltd
DSL-1, Coastal Avenue, DHA Phase -8
Karachi.

Insurance Covers of 90 MW DHA Cogen Power Plant

Dear Sir,

We at Aon in our capacity as appointed insurance brokers of DHA Cogen Ltd have been working for DCL since 2009 when the plant first started its commercial operations. We arranged Comprehensive Machinery insurance (CMI), Terrorism & Sabotage and Third Party Liability insurance covers for DCL. All three covers remained in place for two years in 2009 and 2010. A brief summary of the insurance cover is appearing in the following lines.

31 Jan, 2009 to 30 Jan, 2010

Insurance Type	Sum Insured (PKR)	Deductible (PKR)	Premium Rate(%)	Gross Premium (PKR)	Net Premium (PKR)
Comprehensive Machinery Insurance (CMI)	PD: 6,926,746,000 BI: 1,600,000,000	GT: 80,000,000 ST, HRSG, Transformer, Boiler: 40,000,000 Act of God: 40,000,000 All Other losses:8,000,000 BI: 60 Days	0.34% 0.42%	30,709,864	34,093,520
Terrorism	PD: 3,200,000,000 BI: 800,000,000	PD: 40,000,000 BI: 30 Days	0.27%	11,059,000	12,233,330
Third Party Liability (Bodily injury to or Property damage of third parties)	800,000,000 EEO and AGG	800,000	0.19%	1,520,000	1,689,440
Total				**43,288,864**	**48,016,290**

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Aon Insurance Brokers (Private) Limited | R. No. 42144

31 Jan 2010 to 30 Jan, 2011

Comprehensive Machinery Insurance (CMI)	PD: 7,966,620,149 BI: 2,401,987,615	GT: 126,600,000 ST, HRSG, Transformer, Boiler: 42,200,000 Act of God: 42,200,000 All Other losses:21,100,000 BI: 75 Days	0.50% 0.80%	59,934,737	70,129,512
Terrorism	PD: 3,376,000,000 BI: 844,000,000	PD: 42,200,000 BI: 30 Days	0.27%	11,816,000	14,103,574
Third Party Liability (Bodily injury to or Property damage of third parties)	840,000,000 EEO and AGG	840,000 each and every occurrence	0.19%	1,596,000	1,776,314
Motor Insurance	15,765,000	NIL	2.60%	409,890.00	481,931.30
Total				**73,756,627.00**	**86,491,331.30**

However, following repeated Gas Turbine losses, plant could not continue its operations and is shutdown till to date. As the plant is not operating markets treat the risk as silent and only allowed a limited perils cover called FLEXA (Fire, Lightning, Explosion and Aircraft Damage) and Terrorism insurance cover whereas DCL decided not to renew Third Party Liability insurance cover.

At your advice we approached London and Singapore markets to have their advice for any operational cover after plant resumes operations (anticipated by May, 2013) and were told that without a full underwriting submission to assess they cannot even comment (at this stage) on the coverage to be offered. They also need information about the current plant status including GT, ST and detailed breakdown of values. However for terrorism insurance markets are prepared for flat renewal as per expiry provided security situation in Pakistan does not worsen.

Therefore, at this point in time it would not be appropriate for Aon to provide DCL with any indicative premium for All Risk / Comprehensive Machinery insurance until such time the plant attains a better status and both GT and ST and other ancillary equipments become functional.

However, when assessing the premium for operational plant, DCL must factor in the future behavior of markets (which is currently considered as hard market) and loss history over the last five years.

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AON

We intend to carry out a Risk Engineering Survey in coming months to capture the current status and future plans to bring improvement to the plant which will be shared with the insurance market allowing them to gain interest and provide us a quotation.

Hope the above explanation is of assistance.

Very Best Regards,

Abdul Basit Jhaplawala
General Manager

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