



National Electric Power Regulatory Authority
Islamic Republic of Pakistan

Registrar

2nd Floor, OPF Building, G-5/2, Islamabad.
Ph : 9207200 Ext : 330 — Fax : 9210215
E-mail : office@nepra.isb.sdnpk.org
Direct Phone : (051) 9206500

LAG 01 / 3587-88

01 July 2002

Chief Executive Officer,
M/s. Central Power Generation Company Ltd.
(GENCO - II),
Guddu Thermal Power Station,
Guddu
Tehsil Kashmir
District Jacobabad
Tele: 071 – 614019

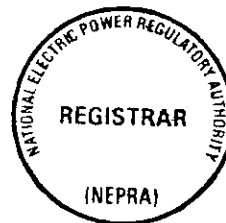
Subject: **Grant of Generation Licence GL/02/2002**
Licence Application No. LAG 01
M/s. Central Power Generation Company Ltd.

Please refer to your application No. CEO/TD-Genco-II/2k1, dated 23 August 2001, for a Generation Licence.

2. Enclosed here is Generation Licence No. GL/02/2002 granted by the Authority to M/s. Central Power Generation Co. Ltd. The Licence is granted to you pursuant to Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act (XL of 1997).

3. Please quote above mentioned Generation Licence No. in your future correspondence with the Authority.

DA/As above.



(Signature)
01.07.2002
(Mahjoob Ahmad Mirza)

Copy for information to Director General, Pakistan Environmental Protection Agency, 44-E, Office Tower, Blue Area, Islamabad.

GENERATION LICENCE

**CENTRAL POWER GENERATION
COMPANY LIMITED
GUDDU**

TERM OF THE LICENCE

TERM OF THE LICENCE

(Article 4 of the Licence)

CENTRAL POWER GENERATION COMPANY LIMITED

The Rule 5 of the Licensing (Generation) Rules – 2000 stipulates that the Term of the Licence shall be commensurate with the maximum expected useful life of the units comprised in a generation facility demonstrated to the satisfaction of the Authority unless the applicant consents to a shorter period.

Central Power Generation Company Limited has shown in its application Ref. No CEO/TD-Genco-II/2k1/____ dated August 23, 2001 to NEPRA for grant of Generation Licence, expected remaining life of the units in its generating facility. The maximum expected life is claimed as 22 years for units 11, 12 & 13.

The Licensing Group considers that Steam Power Generating Units normally have a useful life of around 30 years; and the Gas Turbines Generating Units around 20-25 years. The units of Central Power Generation Company Limited were commissioned during 1974 to 1994. The Steam Power generating unit 13 commissioned in 1994 is based on the exhaust of Gas Turbines units 11 & 12 commissioned in 1992. The Group is of the opinion that maximum useful life should depend on these Gas Turbine units.

In view of all the details provided with the application including the date of commissioning of generating units and normal expected life for the plants of same type and technology, the group does not agree with the expected life claimed by the applicant. The Group recommends that the licence be issued to Central Power Generation Company Limited by the Authority for **(Fifteen) 15 years** from the date of grant of Licence by the Authority.

AUTHORITY DECISION

The Authority agrees with the Licensing Group recommendations about the Term of the Licence. The Licence is granted for a term of **(Fifteen)15 years**.

AUTHORITY

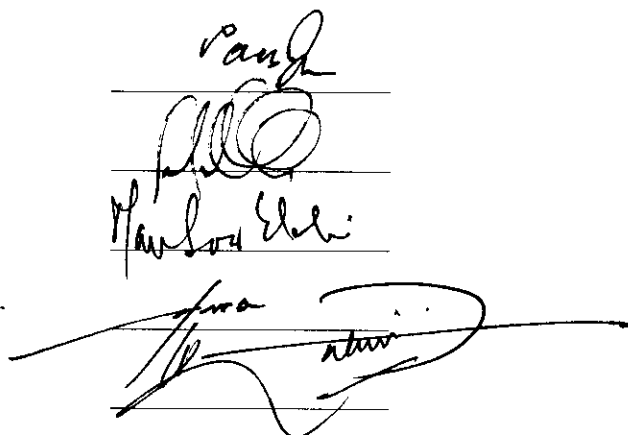
Justice (R) Saad Saood Jan, Chairman

Mr. Fazlullah Qureshi Vice Chairman

Mr. Mansoor Elahi, Member

Sardar Muhammad Sharif Khan T. St., Member

Mr. Abdul Rahim Khan, Member



The image shows four handwritten signatures in black ink, each written over a horizontal line. The signatures are: 1. A cursive signature that appears to be 'Saad Saood Jan'. 2. A signature that appears to be 'Fazlullah Qureshi'. 3. A signature that appears to be 'Mansoor Elahi'. 4. A signature that appears to be 'Sardar Muhammad Sharif Khan T. St.'. The signatures are written in a fluid, cursive style.

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(Article 4 of the Licence)

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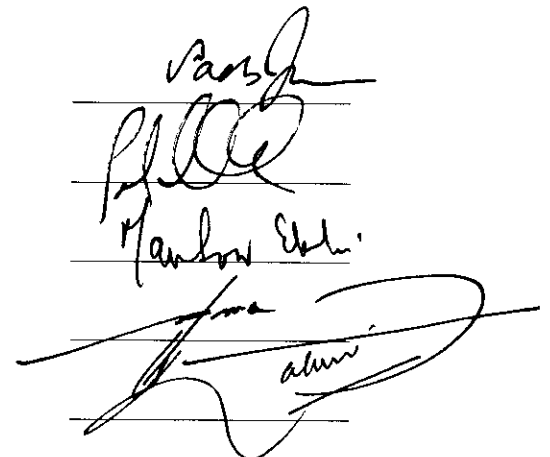
Justice (R) Saad Saood Jan, Chairman

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Sardar Muhammad Sharif Khan T. St., Member

Mr. Abdul Rahim Khan, Member



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**National Electric Power Regulatory Authority
(NEPRA)**

Islamabad - Pakistan

GENERATION LICENCE

NO. GL/02/2002

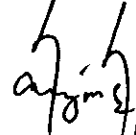
In exercise of the Powers conferred upon the National Electric Power Regulatory Authority (NEPRA) under Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (XL of 1997), the Authority hereby grants a Generation Licence to: -

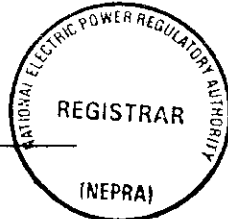
CENTRAL POWER GENERATION
COMPANY LIMITED
TPS - GUDDU

Incorporated under the Companies Ordinance, 1984
under Certificate of Incorporation
No. L 09677 of 1998-99 dated 26th October, 1998

to engage in generation business subject to and in accordance with the Articles of this Licence.

Given under my hand this 1st day of July, Two Thousand & Two, and expires on 30th day of June, Two Thousand & Seventeen.


1.07.02
Signed



Article 1
Definitions

In this Licence:

“Act” means the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (XL of 1997);

“Authority” means the National Electric Power Regulatory Authority constituted under Section 3 of the Act;

“Licensee” means Central Power Generation Company Limited; and

“Rules” means the National Electric Power Regulatory Authority Licensing (Generation) Rules, 2000.

Words and expressions used but not defined herein bear the meaning given thereto in the Act or in the Rules.

Article 2
Application of Rules

This Licence is issued subject to the provisions of the Rules, as amended from time to time.

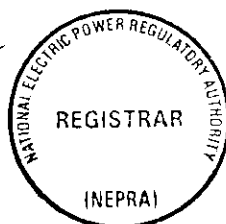
Article 3
Generation Facilities

The location, size, technology, interconnection arrangements, technical limits, technical functional specifications and other details specific to the generation facilities of the Licensee are set out in Schedule I to this Licence.

The net capacity of the generation facilities is set out in Schedule II hereto.

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Article 4

Term

This Licence is granted for a term of **Fifteen (15) years**.

Article 5

Licence Fee

The Licensee shall pay to the Authority the licence fee in the amount and manner and at the time specified in the National Electric Power Regulatory Authority (Fees) Rules, 2002.

Article 6

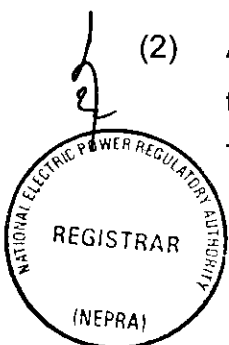
Competitive Trading Arrangement

- (1) The Licensee shall participate in such measures as may be directed by the Authority from time to time for development of a Competitive Trading Arrangement. The Licensee shall in good faith work towards implementation and operation of the aforesaid Competitive Trading Arrangement in the manner and time period specified by the Authority:

Provided that, any such participation shall be subject to:

- (a) any contract entered into by and between the Licensee and another party prior to the enactment of the Act and for the due performance of which a sovereign guarantee has been provided by the Government of Pakistan; or
- (b) any contract entered into subsequent to the enactment of the Act between the Licensee and another party with the approval of the Authority.

- (2) Any variation or modification in the above-mentioned contracts for allowing the parties thereto to participate wholly or partially in the Competitive Trading Arrangement shall be subject to mutual agreement of the parties



thereto and such terms and conditions as may be approved by the Authority.

Article 7

Maintenance of Records

For the purpose of sub-rule (1) of Rule 19, copies of records and data shall also be retained in electronic form and all such records and data shall, subject to just claims of confidentiality, be accessible by authorized officers of the Authority.

Article 8

Compliance with Performance Standards

The Licensee shall conform to the relevant rules on performance standards as may be prescribed by the Authority from time to time.

Article 9

Compliance with Environmental Standards

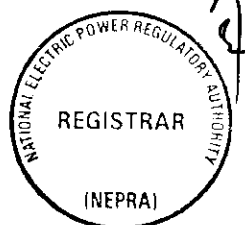
The Licensee shall conform to the environmental standards as may be prescribed by the relevant competent authority from time to time.

Article 10

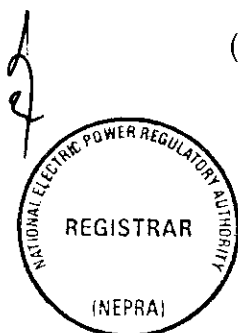
Provision of Information

Without prejudice to the obligation of the Licensee to comply with any call for information made by the Authority from time to time under section 44 of the Act, the Licensee shall submit to the Authority the following statements of availability of the generation facilities:

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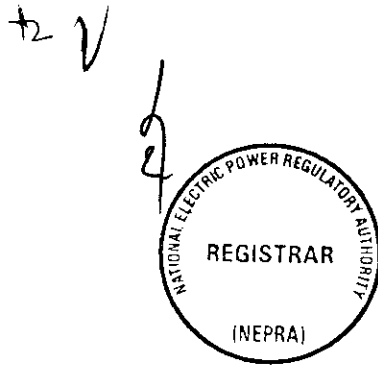


- (1) Within three (3) months of the beginning of a financial year, the licensee shall prepare and submit before the Authority for its approval, the criteria upon which the licensee will:
- (a) determine the duration and timing of planned outages of generation units;
 - (b) determine which hours of the day and days of the week a generation unit which is not subject to a planned outage will be sufficiently manned to be capable of being made available;
 - (c) determine its policy for making available generation units which are not subject to planned outages; and
 - (d) determine its policy for the temporary or permanent closure of generation units.
- (2) No later than one (1) month before the end of a financial year, the licensee shall submit to the Authority a written forecast for each generation unit expected to operate in the following financial year stating:
- (a) the net capacity of the unit;
 - (b) the planned outage schedule of each unit;
 - (c) best estimates of unplanned outages for each unit;
 - (d) the means by which the unit will be fuelled or expected to be primarily fuelled in the case of dual firing units;
 - (e) best expectation of any unplanned outages; and
 - (f) the factors known to the licensee likely to affect the number of outages.



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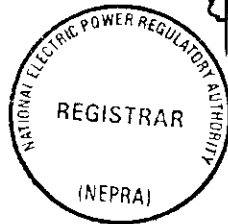
- (3) No later than six (6) months into each financial year, the licensee shall submit to the Authority any changes to the best estimates submitted to the Authority under Article 10(2) above with respect to the remainder of the financial year.
- (4) Within three (3) months of the beginning of each financial year, the licensee shall submit to the Authority a statement of actual availability of each generation unit during the previous financial year. The said statement shall compare forecasts and plans made for the previous financial year against outturns.



SCHEDULE - I

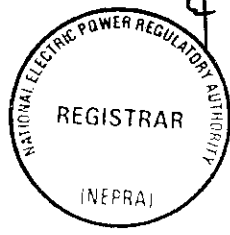
- The location, size (capacity in MW), technology, interconnection arrangements, technical limits, technical functional specifications and other details specific to the generation facilities of the licensee

✓ to



LOCATION MAP AND SITE MAP

✓ 2



INTRODCUTION

Central Genco consist of Three Power Stations

1. Guddu Thermal Power Station
2. Sukkur Thermal Power Station (Retired)
3. Quetta Thermal Power Station (Retired).

1. Guddu Power Station.

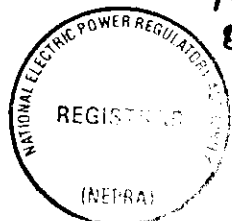
It is the biggest Thermal Power Station and comprises 13 Generators of total capacity 1655MW. Geographically it is situated on right bank of River Indus at Guddu Barrage junction of three provinces i-e Sindh, Balouchistan, and Punjab.

2. Sukkur Power Station (Retired).

This station based on 04 Generators of total capacity of 50 MW. It is situated at right bank of River Indus at Sukkur Barrage.

3. Quetta Power Station (Retired).

The Capacity of Quetta Power Station is 85MW with 06 Generators and situated at Shaikh Mandha, Quetta.



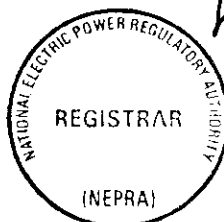
L O C A T I O N

WAPDA in 1963 carried out Power market-survey and power system analysis to prepare integrated plan for 10 years developments. It is established the need of construction of a big Thermal Power Station (800-1000MW) in Upper Sindh. Many sites were considered. Guddu being a MID COUNTRY place was one of the most under developed parts of our country, found to be ideally situated on the junction of Sindh, Balouchistan and Punjab, flanked by Sui and Mari Gas fields. Presence of Guddu Barrage with an additional facility of 1200 built in Residence vacated by irrigation department on completion of Guddu Barrage, made it A LOGICAL CHOICE for construction of the proposed Power Station which was finally selected by the planners.

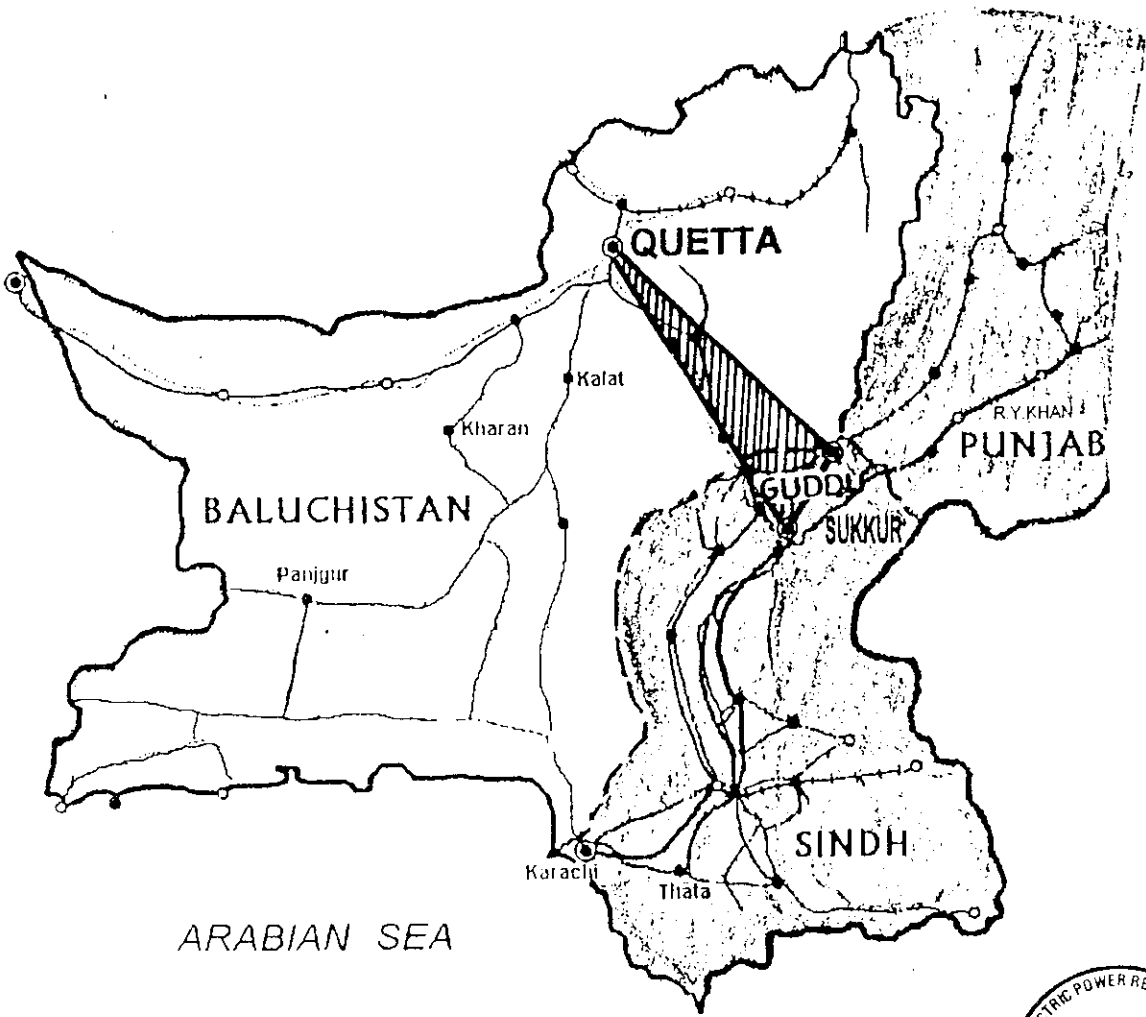
Guddu, the largest Thermal Power Generation Complex of Pakistan is situated on the right bank of River Indus near Guddu Barrage, 10 Km from Kashmore in District Jacobabad (Sindh). It is about 60 Km away from Sadiqabad and about 160 Km from Sukkur. Guddu has Air Link with Karachi and Lahore. The nearest Air Port is Rahim Yar Khan at 85 Km. Rail link nearest at Kashmore is also available besides Sadiqabad and Daharki Railway Stations on main line each 60 Km from Guddu. It is a confluence of three provinces, i.e., Sindh, Punjab and Baluchistan.


Guddu is connected with rest of the Country both by Road and Rail. Telex, Telefax and Telephonic facilities have connected Guddu with rest of the world. A small metaled air strip is also available for operation of small aircrafts for VIP visitors and in emergencies.

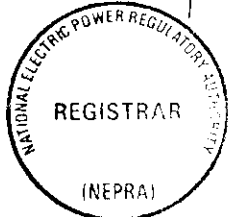
V-12



LOCATION MAP

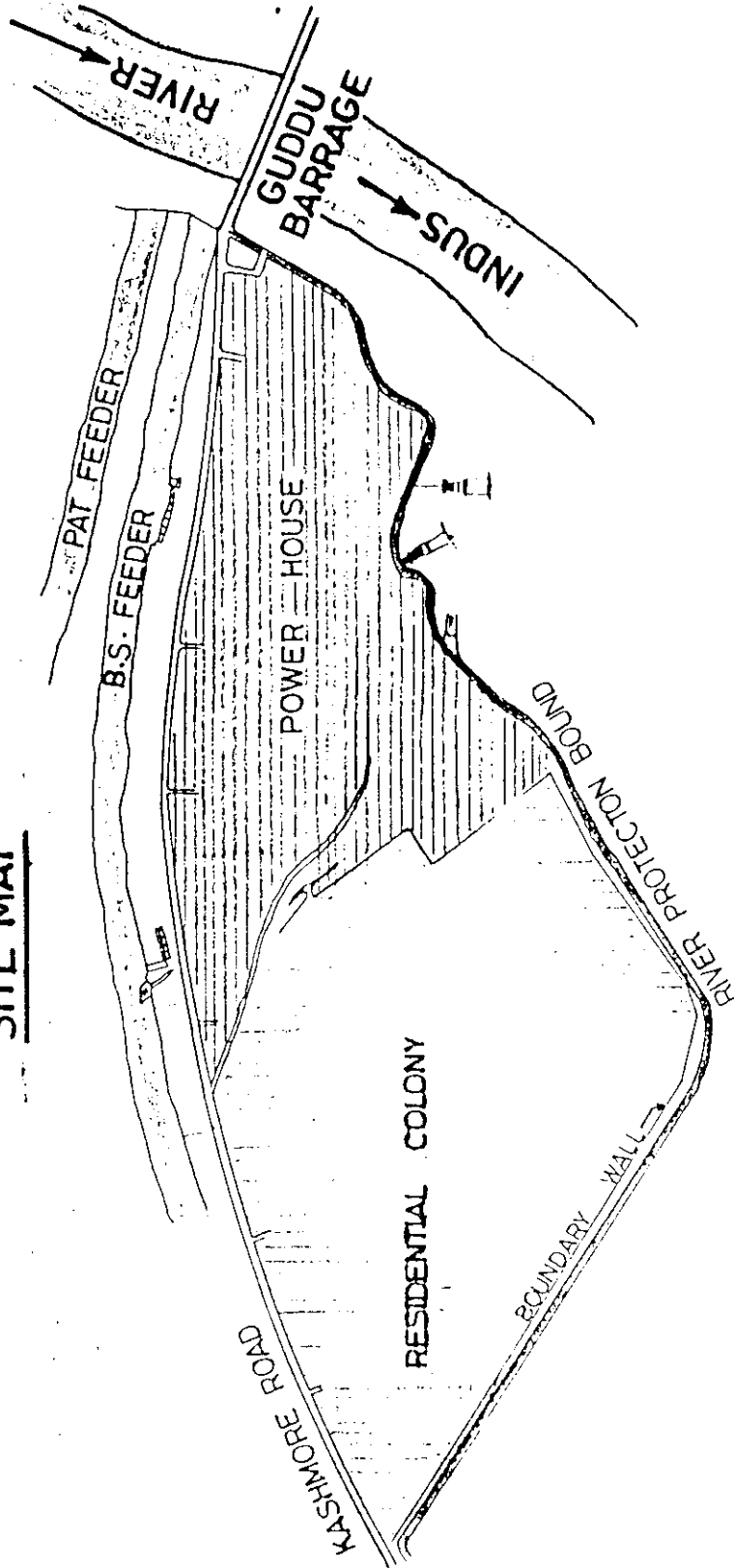


 CENTRAL GENCO

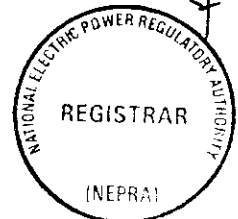


V. H.

SITE MAP



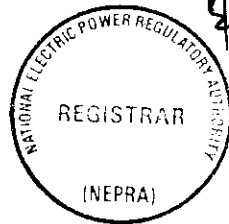
COLONY AREA	= 454 ACRES
POWER HOUSE AREA	= 250 ACRES
GROUND LEVEL AT COLONY	= 250 TO 252
GROUND LEVEL AT POWER HOUSE	= 263
ELEVATION OF RIVER PROTECTION BOUND	= 264
WORST FLOOD LEVEL IN 1976 - 77 U/S	= 259.3
WORST FLOOD LEVEL IN 1976 - 77 D/S	= 258.4
BARRAGE ROAD LEVEL	= 271.16



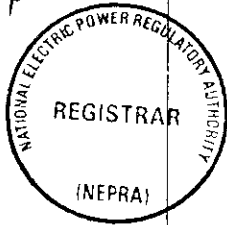
PLANT CHARACTERISTICS

12

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PLANT CHARACTERISTICS

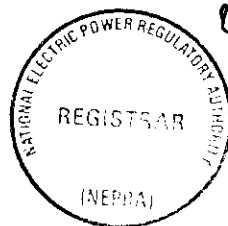


Sr. No.	Description	Phase No. I			Phase No. II			Phase No. III						Phase No. IV					
		Units			Units			Units									Units		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
1	Date of Commissioning	30.03.74	06.10.74	07.11.80	29.12.85	18.12.87	22.03.88	20.12.85	01.04.86	06.03.86	12.04.86	27.09.92	07.12.92	17.03.94					
2	Installed Capacity (MW)	110	110	210	210	100	100	100	100	100	100	136	136	143					
3	Derated Capacity (MW)	85	85	180	180	85	85	95	95	95	95	130	130	140					
4	Generation Voltage (KV)	10.5	10.5	15.75	15.75	11	11	11	11	11	11	11	11	15.75					
5	Frequency (Hz)	50	50	50	50	50	50	50	50	50	50	50	50	50					
6	Ramping rate MW/Min	2	2	2	2	10	10	15	15	15	15	20	20	8					
7	Type of Fuel	Gas	Gas	Gas + F.Oil	Gas + F.Oil	No Fuel Used	No Fuel Used	Gas	Gas	Gas	Gas	Gas	Gas	No Fuel	Gas	No Fuel			
8	Aux. Consumption (%)	8%	8%	8.5%	6%	3.5%	3.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	3.5%	1.5%	3.5%			
9	Synchronizing Time (Hrs)	2.5	2.5	2.5	2.5	4	4	20 min	20 min	20 min	20 min	4 min	4 min	3.5	4 min	3.5			

GENERATION PERFORMANCE INDICATORS

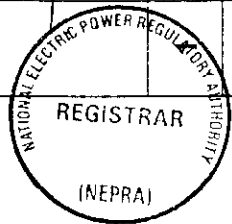
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PERFORMANCE INDICATORS FOR THE YEAR 1999-2000.

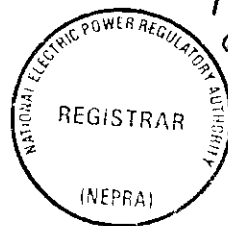
S.No.	Months	Total Installed Capacity MW	Derated Capacity MW	Max: Load MW	Load Factor %	Plant Utilization Factor %	Plant Availability Factor %	Plant Capacity Factor %	Gross Heat Rate Btu/KWh	Thermal Efficiency %
	Jul-99	1655	1480	1157	84.90	59.35	91.89	74.81	9891	34.51
2	Aug-99	1655	1480	1137	81.49	55.99	80.00	68.50	9863	34.60
3	Sep-99	1655	1480	1027	73.10	43.90	75.37	62.41	10173	33.55
4	Oct-99	1655	1480	1144	83.32	57.59	84.59	64.73	9395	36.33
5	Nov-99	1655	1480	1216	86.00	61.15	81.67	78.39	9367	36.44
6	Dec-99	1655	1480	1315	86.98	69.11	88.00	77.93	9532	35.81
7	Jan-2k	1655	1480	1319	85.55	65.98	86.47	77.83	9611	35.51
8	Feb-2k	1655	1480	1295	77.25	60.45	86.00	75.00	9633	35.43
9	Mar-2k	1655	1480	1297	86.66	65.72	91.00	78.50	9685	35.24
10	Apr-2k	1655	1480	1311	76.42	60.53	92.99	76.85	9937	34.35
11	May-2k	1655	1480	1290	86.42	65.19	95.00	75.50	9982	34.19
12	June-2k	1655	1480	1259	80.95	61.58	88.50	71.50	9942	34.33



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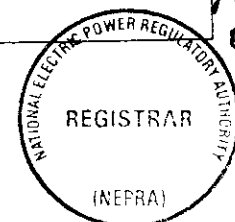
TECHNOLOGY AND DETAIL OF UNITS

1/12



TYPE, SIZE & MAKE OF UNITS

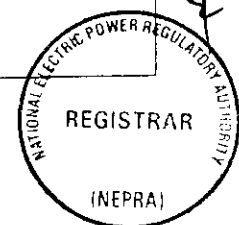
Unit No.	Capacity (MW)	Type of Unit	Make	Date of Commissioning
1	110	Steam	Czechoslovakia	30.03.1974
2	110	Steam	Czechoslovakia	06.10.1974
3	210	Steam	Russia	07.12.1980
4	210	Steam	China	29.12.1985
5	100	CC (Steam)	U.S.A	18.12.1987
6	100	CC (Steam)	U.S.A	22.03.1988
7	100	G.T	U.S.A	20.12.1985
8	100	G.T	U.S.A	01.04.1986
9	100	G.T	U.S.A	06.03.1986
10	100	G.T	U.S.A	12.04.1986
11	136	G.T	Germany	27.09.1992
12	136	G.T	Germany	07.12.1992
13	143	C.C (Steam)	Germany	17.03.1994



GENERATION CAPACITY

(As Per PC-1 Life of Units Declared 30 Years)

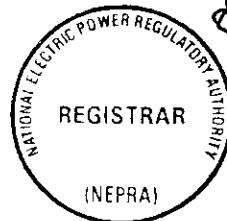
Unit No.	Date of Comm.	Installed Capacity (MW)	Derated Capacity (MW)	Expected Life (Years)
1	30.03.1974	110	85	6
2	06.10.1974	110	85	6
3	07.11.1980	210	180	10
4	29.12.1985	210	180	15
5	18.12.1987	100	85	15
6	22.03.1988	100	85	15
7	20.12.1985	100	95	15
8	01.04.1986	100	95	15
9	06.03.1986	100	95	15
10	12.04.1986	100	95	15
11	27.09.1992	136	130	22
12	07.12.1992	136	130	22
13	17.03.1994	143	140	22
Total		1,655	1,480	



✓ 12

TECHNICAL DATA

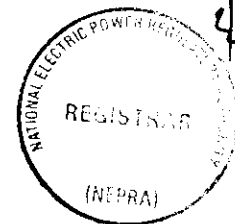
1/12



UNIT NO. 1 & 2

T U R B I N E

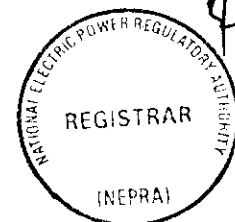
Type of Steam Turbine	Tendom Compound Turbine
High Pressure Turbine	Curits wheels + 8 action stages
Medium Pressure Turbine	12 action stages.
Low Pressure Turbine	4 action stages in double flow arrangements (i.e 8 action stages)
Rated output of the Steam Turbine	110 MW
Rated Speed of the Steam Turbine	3000 RPM
Rated pressure of the Super Heated Steam before HP stop valve	130 ata.
Rated temp. of the superheated steam before HP stop valve	535 °C
Rated pressure of the reheatd steam before M.P Turbine	32.5 ata.
Rated temp. of the reheated steam before MP Turbine	535 °C
Rated temp. of the primary cooling water	33 °C
Max. temp. of the primary cooling water	36 °C
Number of steam Extractions from turbine	8
Number of HP Turbine regulating valves	4
Number of MP Turbine regulating valves	2



1/2

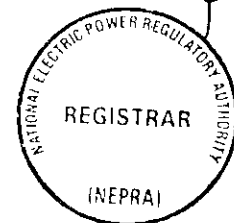
GENERATOR

Type of turbo alternator	3 Phase, Hydrogen Cooled
Rated Output	110MW, 137.5 MVA
Rated P.F Voltage at Terminals	10.5 KV +5%, -10%
Frequency Speed	3000 RPM
Hydrogen Pressure	2KP/cm ²
Hydrogen Temp.	40 °C
Temp. of Secondary Cooling Water	33 °C
Numbers of Hydrogen Coolers	3 x 2
Rated Out put of Exciter	700 KW
Exciter Speed	1000 RPM



BOILER

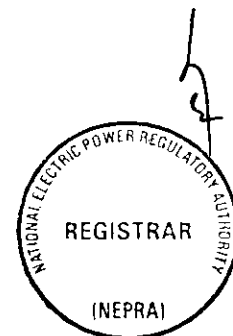
Max. Continuous rating of Boiler	375 tons/hour
Economical rating of Boiler	330 t/hr
Rated outlet steam pressure	139 kp/cm ²
Drum Operating Pressure	168 kp/cm ²
Boiler Design Pressure	177 kp/cm ²
Rated Steam Temp. at super heater outlet	540 °C + 5 °C, -10 °C
Rated feed water Temp.	240 °C
Rated quantity of reheated steam	323 tons/hr
Temp. of steam at the inlet of reheater	360 °C
Rated temp. of the reheated steam at the outlet of reheater	540 °C + 5 °C, -10 °C
Steam Pressure at the inlet of reheater	33.5 atg
Steam Pressure at the outlet of reheater	32.5 atg
Total area of evaporation	9047 sq.m
Total surface of superheaters	26912 sq.m



UNIT NO. 3

GENERATOR

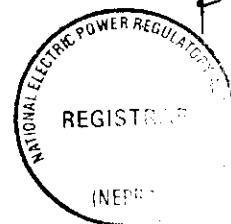
Year of Manufacturing	1975
Make	ELECTROSILA, USSR
Class of Insulation	'B'
Full Power-MVA	2335
Active Power-MW	210
Voltage-V	15750
Stator Current-A	8550
Power Factor	0.9
Efficiency %	98.6
Static Overloading	1.5
Stator winding Phase interconnection	Double Star
Number of Stator winding out-going loads	9
Frequency HZ	50
Speed RPM	3000
Fly wheel moment tm^2	21.1
Critical Speeds RPM	1370/3400
Hydrogen Pressure	3.5 kgf/cm^2
Rated temp. of cold gas	+ 50 °C
Rated gauge pressure of distillate in the stator winding	3.0 kgf/cm



1/2

TURBINE

Type of Turbine	K-200-130-3 Single shaft-three cylinders
Rated Output	210MW
Superheated steam absolute pressure before H.P	130 kgf/cm ²
Superheated steam temp. before H.P	540 °C
Absolute steam pressure at HPC exhaust at rated output	29.3 kgf/cm ²
Steam Temp at HPC exhaust at rated output	339 °C
Absolute steam pressure after reheater & before MP	25.6 kgf/cm ²
Steam temp. after reheater & before MP	450 °C
Absolute pressure in Turbine condenser at rated output	0.078 kh/cm ²
Cooling water temp.	27 °C
Cooling water quantity	27500 m ³ /hr
Max. Steam flow	670 t/hr
Turbine rotor speed	3000 RPM

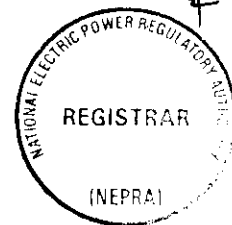


V 12

BOILER

Boiler plant TIM 104 is designed for producing steam of High pressure in burning natural Gas & Oil and operating in block with turbine K-200-130.

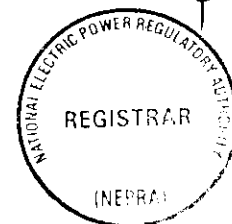
Normal Rating	670 t/hr
Working pressure in drum	155 ata
Working pressure of primary steam at boiler outlet	140 ata
Temp. of superheated primary steam	545 °C
Consumption of secondary steam	590 t/hr
Pressure of Secondary steam at boiler outlet	25 ata
Pressure of secondary steam at boiler inlet	27 ata
Temp. of secondary steam at inlet	333 °C
Temp. of secondary steam at outlet	545 °C
Feed water temp.	243 °C



UNIT NO. 4

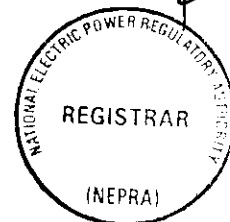
TURBINE

Model	N210-130-535/535
Manufacturer	Harbin Turbine Works China
Rated Speed	3000 RPM
Rated Power	210 MW
Rotary direction of the rotor	Clockwise (Viewed from the turbine head).
Live Steam Pressure	130 ata
Live steam temp.	535 °C
Exhaust steam pressure of HP cylinder	25.5 ata
Exhaust steam temp. of HP casing	312.5 °C
Reheat steam pressure	22.5 ata
Reheat steam temp.	535 °C
Exhaust back pressure	0.0729 ata
Cooling water temp.	27 °C
Cooling water volume	27500m ³ /Hr
Feed water temp.	245 °C
Steam pressure after curtis stage	102.5 ata
Main steam flow at the rated power	630 t/hr
Steam temp. after curtis stage	506 °C



BOILER

Type	DG-680/140
Manufacturer	Dongfang works China
Date of manufacture	1984
Installation date	1985
Rating	680 t/hr
Drum pressure	157 kg/cm ²
Super heat steam pressure	140 kg/cm ²
Super heat steam temp.	540 °C
Reheat steam flow	589 t/hr
Reheat steam temp.	540 °C
Reheat steam inlet temp.	315 °C
Reheat steam inlet pressure	26.2 kg/cm ²
Reheat steam outlet pressure	24.2 kg/cm ²
Exit flow Gas Temp.	130 °C
Feed water temp.	250 °C
Hot air temp.	243 °C
Air temp. at preheater inlet	60 °C
Fuel consumption (Gas)	63239 nm ³ /H
Efficiency	93.17%



GENERATOR

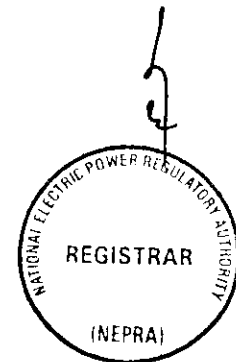
Type	QN-210-2
Active Power	210 MW
Rated Capacity	247 MVA
Rated Voltage	15750 V
Rated Current	9056A
Power Factor	0.85
Phase	3
Frequency	50 HZ
Rated Hydrogen pressure	3 kg/cm ²
Cooling mode	Water-Hydrogen-Hydrogn

MAIN EXCITOR

Type	JL-1165-4
Rated Capacity	1650 kva
Rated Voltage	431/249v
Rated current	1562A
Frequency	100 HZ
Power Factor	0.91
Phase	3

PERMANENT MAGNETIC EXCITOR

Type	TFY-46-500
Rated Capacity	46 KVA
Rated Voltage	161/93 V
Rated Current	165 A
Phase	3

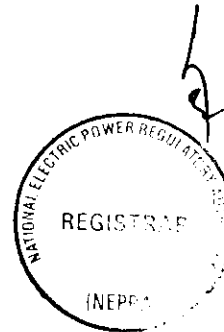


V 2

UNIT NO. 7 to 10

G A S T U R B I N E

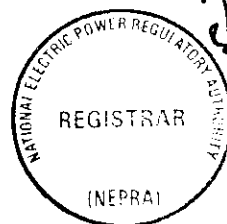
Manufacturer	GENERAL ELECTRIC CO. USA
Type of Gas Turbine	Heavy Duty
Model No.	PG9151E
Net Out Put	85.64/81.7MW base at 50 °C
Heat Rate	11950/12350 (Kj/kwh)
Speed	3000 RPM
Exhaust Temperature	549/578 °C
Type of Fuel	Natural Gas/distillate
Number of Compressor Stages	17
Compressor Ratio	1:11.5
Number of Turbine Stages	3
Starting System	Electric Motor



✓ 12

GENERATOR

Manufacturer	GENERAL ELECTRIC CO. USA
Rating	MVA 125.88 at 0.85 power factor 128.89 at 0.90 PF
Rated Voltage	11.5 Kv
Rated ampres	6320, Peak capability 6471A
Subtransient reactance	0.162 per unit
Transient reactance	0.227 per unit
Synchronous reactance	1.794 per unit
Poles	2
RPM	3000
Excitation Volts	500 V
Field Current	1103 A



V 12

UNIT NO. 5 & 6

H R S G s

Type Forced circulation with economizer evaporator, superheater and exhaust gas by-pass dampers.

Number of units Four

Performance with Base Load

TURBINE

Inlet Air Temp. (°F) 80 , 80.4 , 104 , 122

Maximum steam flow (Lbs) 6302 , 5982 , 5868 , 5717

Steam temp. at superheater outlet, (PSIG) 936 , 942 , 930 , 909

Steam pressure, at superheater outlet, (°F) 936 , 965 , 977 , 991

Feedwater temp. at Economizer inlet. (°F) 167 , 171 , 172 , 172

HRSG Exist Gas Temp. (°F) 361 , 361 , 360 , 356

HRSG DESIGN

Outlet dimensions (Length x Width x ht) 67.6 x 16.4 x 69.9 feet

Design Maximum pressure 1166 psi

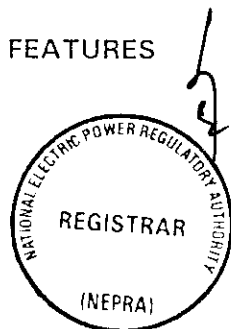
Approximate Empty Weight 971, 303 lbs

Super Heater heating surface 61, 215 ft²

STEAM TURBINE DESIGN FEATURES

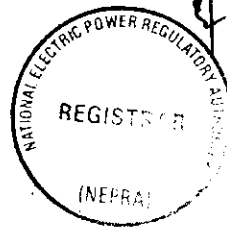
Turbine Type Straight Condensing - Double Flow

Driving Performance 118, 306 KVA, 11, 500 V, Hydrogen Cooled Generator, 500V static Exciter



V →

Rating	95,700 KW
Design Steam conditions	
Initial pressure	850 PSIG
Initial Temperature	949.5 °F
Back Pressure	2.5 inches Hg Abs.
Speed	
Rated	3000 RPM
Primary trip	3360 RPM
Emergency trip	3420 RPM



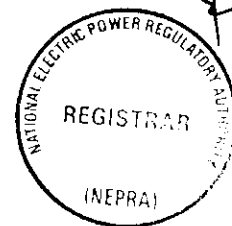
✓ 12

GENERATOR

Rating	118,306 KVA
Armature Current	5,939 A
Field Current	11,500 A
Exciter Voltage	942 V
Power Factor	0.85

Design Data

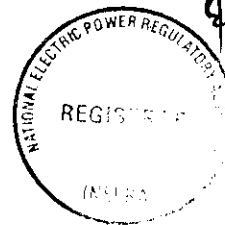
Gas 98% purity (PSIG)	30
Maximum KVA One Cooler out of service	94,645
No. Load Field current	348 A
Three phase Armature winding capacitance	0.947 μ f
Armature winding DC Resistance (per phase)	0.00258 Ω at 100 $^{\circ}$ C
Field winding DC Resistance	0.555 Ω at 125 $^{\circ}$ C



UNIT NO. 11 & 12

G A S T U R B I N E

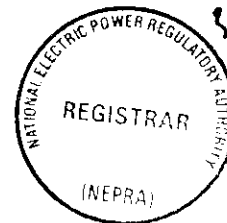
Manufacturer	SIEMENS Germany
Type of Gas Turbine	Single Shaft Heavy Duty
Model	V.94.2
Net Output	136.07 MW at 30 °C (Ambient)
Heat Rate	11193 Kj/Kwh
Speed	3000 RPM
Exhaust Temp.	531 °C
Type of Fuel	Natural Gas/Distillate
Fuel Gas Consumption	15 Cft/Kwh
Fuel Oil Consumption	0.28 Litre/Kwh
Number of Stages	16
Compressor Ratio	1:10
Number of Turbine Stages	4
Starting System	S.F.C (Static Frequency Converter)



V 12

GENERATOR

Generator Type	TLRI 108/36
Rated apparent Power	154.6 MVA
Rated active Power	136 MW
Rated Stator Voltage	11 KV \pm 1.1 KV
Rated Stator Current	8.114 KA
Rated Frequency	50HZ
Power Factor	0.85
Speed	3000 RPM
Cold Air Temp.	40 °C
Rated Field Current	876 A
Rated Field Voltage	415 V



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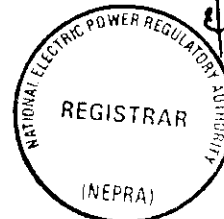
UNIT NO. 13

H R S G

Manufacturer	CMI Belgium
Type	HRSG
Design Pressure	75 Bar
Working Pressure	61.5 Bar
Steam Flow	65 Kg/Sec

STEAM TURBINE

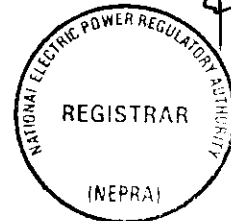
Manufacturer	SIEMENS Germany
Type	2 Cylinder condensing Turbine
Net Output	143 MW at 27 °C
Speed	3000 RPM
Heat Rate	7335 Kj/Kwh
Number of Stages	H.P/L.P 26 / 8
Design Steam Pressure	54 Bar
Steam Flow	130 Kg/Sec
Design Temp.	528 °C



V-12

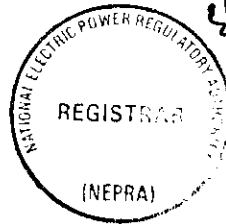
GENERATOR

Type	TLRI 108/46
Apparent Power	180 MVA
Active Power	153 MW
Stator Current	6598 A
Stator Voltage	15.75 KV \pm 1.575KV
Speed	3000 RPM
Frequency	50 HZ
Power Factor	0.85
Rated Field Current	770 A
Rated Field Voltage	429 A
Cold Air Temp.	40 °C



✓ 2

FUEL SOURCES



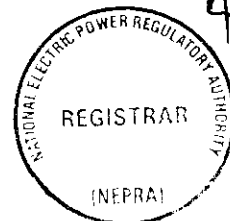
FUELS

NATURAL GAS

1. Kandh Kot	Supply through pipe Lines
2. Mari	
3. Tullow	

FURNACE OIL

Supply by Road
From P.S.O Karachi



✓ 12

DECANTING FACILITIES OF FURNACE OIL

There are complete decanting facilities by lorries and trains are available at fuel oil station. A big underground tank alongwith decanting channel is provided for this purpose. Four No. transfer pumps are used to shift the oil from under ground tank to (09) storage tanks. At the site there are (09) fuel oil storage tanks of total capacity of 53400 M.Tons. are available

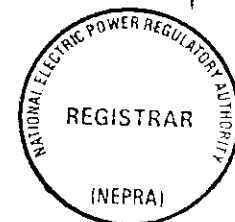
At fuel oil station , five low pressure fuel oil pumps and five high pressure fuel oil pumps are installed. These pumps are in good condition. Brief descriptions of low and high pressure fuel oil pumps are as under

Low Pressure Fuel Oil Pump.

Q	=	120 m ³ /Hrs
P	=	6.5 Kg/Cm ²
Stage	=	Single
Type	=	Centrifugal

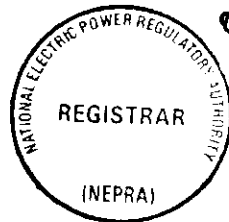
High Pressure Fuel Oil Pump.

Q	=	90 m ³ /Hrs
P	=	30 Kg/Cm ²
Stage	=	04 stage
Type	=	Centrifugal

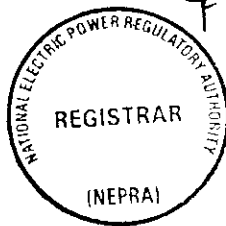


EMISSION VALUES

✓



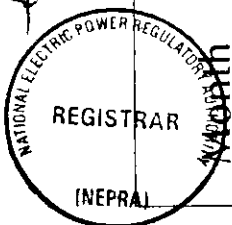
Environmental Improvement Monitoring Emissions / Effluents



Emissions / Effluents	PAK Standard (NEQS)	Measured Values				
		1995-96	1996-97	1997-98	1998-99	1999-2000
CO	0.8 ppm	Nil	Nil	Nil	Nil	Nil
SOX	0.4 ppm	0.15 - 0.35	0.1 - 0.41	0.2 - 0.3	0.1 - 0.35	0.2 - 0.4
NOX	0.4 ppm	Nil	Nil	Nil	Nil	Nil
Effluents	6-9 pH	6.0 - 8.0	6.2 - 8.0	6.5 - 8.5	6.5 - 0.8	7 - 8.5

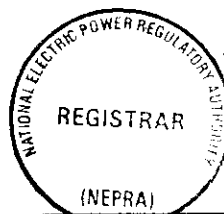
EMISSIONS DATA

	Fuel Consump.		Emission on Fuel Gas & Oil (Tons)					Emission Tons/Day			
	Fuel Oil (Tons)	Gas (MCF)	SOx	NOx	PM	CO ₂	SOx	NOx	PM	CO ₂	
July 99	13924	8073406	22	219	14	87675	0.71	7.06	0.45	2828.2	
Aug 99	9658	7727948	28	186	10	76525	0.90	6.00	0.32	2468.5	
Sep 99	Nil	6806496	15	53	Nil	40774	0.50	1.77	Nil	1359.1	
Oct 99	3483	7823133	14	98	4	57850	0.45	3.16	0.13	1866.1	
Nov 99	Nil	8533636	15	64	Nil	51258	0.50	2.13	Nil	1708.6	
Dec 99	14033	9108675	17	228	14	74338	0.59	7.35	0.45	2398.0	
Jan 2000	16365	8626301	15	221	16	102842	0.48	7.13	0.52	3317.5	
Feb 2000	12021	8077151	15	180	12	50343	0.52	6.21	0.41	1736.0	
Mar 2000	15230	8795312	16	220	15	86693	0.52	7.10	0.48	2796.5	
Apr 2000	17423	8204694	19	246	17	99874	0.63	8.20	0.57	3329.1	
May 2000	23570	8614028	25	280	23	129243	0.81	9.03	0.74	4169.1	
June 2000	16447	8312612	18	268	16	101195	0.6	8.93	0.53	3373.2	



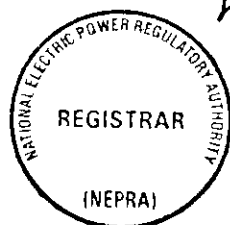
WASTE WATER ANALYSIS DATA

Month	Water	P.H	C.O.D	Chloride	Sulphate	T.D.S
July 99	46838	8.20	0.95	11.36	14.00	158.80
Aug 99	42311	8.13	0.81	12.00	14.10	160.60
Sep 99	41874	8.14	1.33	8.00	20.00	144.25
Oct 99	29445	8.14	0.32	14.91	23.00	173.60
Nov 99	39986	8.30	0.47	14.20	18.20	199.14
Dec 99	41772	8.35	0.78	14.20	34.80	240.83
Jan 2000	53125	8.30	1.19	41.89	33.50	316.78
Feb 2000	42189	8.42	0.88	25.00	34.00	243.43
Mar 2000	31295	8.00	0.30	14.00	32.20	227.14
Apr 2000	48802	8.29	0.89	14.20	34.00	238.00
May 2000	50727	7.95	0.69	9.90	25.10	159.75
June 2000	40734	8.34	0.65	11.20	12.00	167.20



COOLING WATER SOURCES

1/2



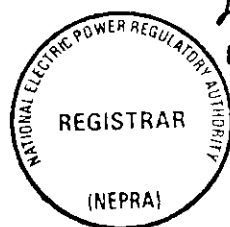
COOLING WATER SOURCES

Primary Source (Open Cycle)

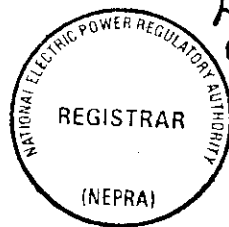
Canal Water supply from Begari Sind
(B.S) Feeder emitting from Right Bank
of River Indus at Guddu Barrage.

Secondary Source (Close Cycle)

Water Supply through Tube Wells and
Floating Pump House from Guddu
Barrage.



INTER CONNECTION WITH NATIONAL GRID



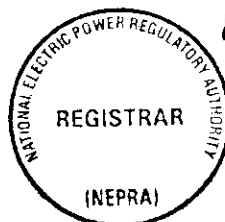
POWER EVACUATION FROM TPS GUDDU

1. TRANSMISSION LINES EMANATING FROM TPS GUDDU

Sr. No.	Voltage (Kv)	Circuit	Controlling Breakers	Capacity
01.	500	Multan-1	B3Q3&B3Q3	1000 MW/1200A
02.	500	Multan-2 (Muzaffargarh)	B4Q3&B4Q3	1000 MW/1200A
03.	500	Multan-3	B1Q3&B1Q3	1000 MW/1200A
04.	500	Dadu-1	B3Q1&B3Q3	1000 MW/1200A
05.	500	Dadu-2	B2Q1&B2Q3	1000 MW/1200A
06.	220	Sibbi	D13Q1&B2Q3	1000 MW/1200A
07.	220	Uch-1	D14Q2&D14Q3	300 MW/750A
08.	220	Uch-2	D15Q2&D15Q3	300 MW/750A
09.	132	Multan-1 (Sadiqabad)	E1Q2&E1Q3	300 MW/750A
10.	132	Multan-2 (Sadiqabad)	E2Q2&E2Q3	100 MW/600A
11.	132	Hyderabad-1 (Daharki)	E3Q2&E3Q3	100 MW/600A
12.	132	Hyderabad-2 (Ghotki)	E4Q2&E4Q3	100 MW/600A
13.	132	Kandh Kot (Kashmore)	E5Q2&E5Q3	100 MW/600A
14.	132	D.G Khan-1 (Rojhan)	E7Q2&E7Q3	100 MW/600A
15.	132	D.G Khan -2 (Rojhan)	E8Q2&E8Q3	100 MW/600A

2. AUTO TRANSFORMERS AT TPS GUDDU

Sr. No.	Voltage (kV)	Transformer	Controlling Breakers	Capacity (MVA)
01.	500 / 220	T-1	B1Q1&B1Q3/D16Q1&D16Q3	3 x 150 = 450
02.	500 / 220	T-2	B2Q2&B2Q3/D17Q2&D17Q3	3 x 150 = 450
03.	500 / 220	T-3	B4Q1&B4Q3/D18Q1&D18Q3	3 x 150 = 450
04.	220 / 132	T-4	D9Q1&D9Q3/E8Q1&E8Q3	3 x 75 = 225



TRANSMISSIONS

System connected through NTDC with

132Kv Lines

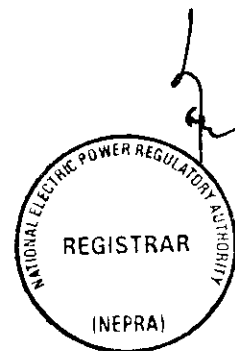
Sadiq Abad - I	GRID
Sadiq Abad - II	GRID
Daharki	GRID
Ghotki	GRID
Kandh Kot	GRID
Rojhan - I	GRID
Rojhan - II	GRID

220Kv Lines

Sibbi	GRID
Uch - I	GRID
Uch - II	GRID

500Kv Lines

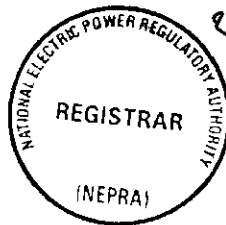
Dadu - I	GRID
Dadu - II	GRID
Multan - I	GRID
Multan - II	GRID
Multan - III	GRID



12

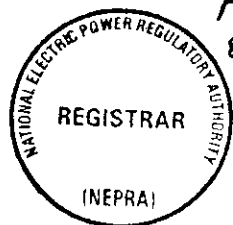
INFORMATION ABOUT PROJECT COST

✓ 2



PROJECT COST

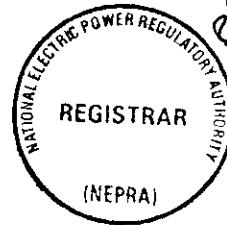
Phase	Units	Capacity & Type	Final PC-1 Cost Rs. in Millions	Credits	Consultants
I	1,2	2x110 MW Steam	631	Czech. Italian	M/s Electro Consultant Italy
		9 MW Gas Turbine			
II	3	210MW Steam	1,690	USSR	M/s Noon Qayum WAPDA
	4	210MW Steam	1,631	Chinese	M/s Lhameyer, Germany Nespak.
III	5&6	2x100MW Steam	1,791	ADB US Grant	Gibbs & Hill, USA
	7 to 10	4x100MW Gas Turbines	2,438	US Aid	Gibbs & Hill, USA
IV	11&1 2	2x136MW Gas Turbines	7,324	ADB KFW Loan Belgium Loan US Aid GOP	Gibbs & Hill, USA Mirza Associates.
	13	143 MW Steam			



SCHEDULE - II

- The net capacity of the licensee's generation facilities

V 12



GENERATION CAPACITY

Unit No.	Date of Comm.	Installed Capacity (MW)	Derated Capacity (MW)	Net Capacity* after Aux. Consumption (MW)
1.	30.03.1974	110	85	78.20
2.	06.10.1974	110	85	78.20
3.	07.11.1980	210	180	164.70
4.	29.12.1985	210	180	169.20
5.	18.12.1987	100	85	82.02
6.	22.03.1988	100	85	82.02
7.	20.12.1985	100	95	93.57
8.	01.04.1986	100	95	93.57
9.	06.03.1986	100	95	93.57
10.	12.04.1986	100	95	93.57
11.	27.09.1992	136	130	128.05
12.	07.12.1992	136	130	128.05
13.	17.03.1994	143	140	135.10
TOTAL		1,655	1,480	1419.82

* Indicative Figures only: These figures have been based on historic average auxiliary consumption provided by the licensee. The net capacity available to NGC Licensee for dispatch and other purchasers will be determined through procedures contained in the Grid Code, applicable documents or the bilateral contracts.

