

National Electric Power Regulatory Authority

Islamic Republic of Pakistan

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No. NEPRA/R/LAG-20/10180-81

11-5-2004

Chief Executive Officer, Southern Electric Power Co. Ltd. 6th Floor, Razia Sharif Plaza, 90-West, Jinnah Avenue, Islamabad

Subject:

Grant of Generation Licence IPGL/018/2004

Licence Application No. LAG - 20 M/s. Southern Electric Power Co. Ltd.

Please refer to your application No. ISL/18/2003 dated 15.04.2003 for a Generation Licence.

- 2. Enclosed here is Generation Licence No. IPGL/018/2004 granted by the Authority to M/s. Southern Electric Power 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.

(Mahjoob Ahmad Mirza)

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

National Electric Power Regulatory Authority (NEPRA) Islamabad – Pakistan

GENERATION LICENCE

NO. IPGL/018/2004

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: -

Southern Electric Power Company Limited

Incorporated under the Companies Ordinance, 1984 Under Certificate of Incorporation

No. I<u>-01592</u> Dated <u>20th December 1994</u>

to engage in generation business subject to and	d in accorda	nce with the	Articles
of this Licence.			
Given under my hand this	day of	May	, Two
Thousand & four and expires on10 ¹¹	day of _	May	, Two
Thousand & Nineteen.		O	
Registrar (NEPRA)			



Article 1 Definitions

(1) In this Licence:

- a. "Act" means the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (XL of 1997);
- b. "Agreements" means any or both of the Implementation Agreement and the Power Purchase Agreement,
- c. "Authority" means the National Electric Power Regulatory Authority constituted under Section 3 of the Act, or any successor thereof;
- d. "Implementation Agreement" means the Implementation Agreement dated 23 November 1994 as amended between the Licensee and the President of Pakistan;
- e. "Licensee" means Southern Electric Power Company Limited;
- f. "Power Purchase Agreement" means the Power Purchase Agreement dated 17 November 1994 as amended between the Licensee and the power purchaser thereof and for the due performance of which a sovereign guarantee has been executed by the Government of Pakistan;
- g. "Rules" means the National Electric Power Regulatory Authority Licensing (Generation) Rules, 2000, as amended from time to time;
- (2) 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

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

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During the subsistence of the Agreements entered into by the Licensee prior to the enactment of the Act, nothing contained in the Rules or this Licence shall be applied in a manner which is inconsistent with the Agreements and materially increases the obligations or impairs the rights of the Licensee under the Agreements.

Article 3

Generation Facilities

- (1) 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.
- (2) The net capacity of the generation facilities is set out in Schedule II hereto.

Article 4

Term

- (1) Pursuant to Rule 5 of the Rules, this Licence is granted for a term of fifteen (15) years.
- (2) Unless revoked earlier, the Licensee may, ninety (90) days prior to the expiry of the term of the licence, apply for renewal of the Licence under the Licensing (Application and Modification Procedure) Regulations, 1999.

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 (Fee) Rules, 2002.

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Article 6 Competitive Trading Arrangement

- (1) During the subsistence of the Agreements entered into by the Licensee prior to the enactment of the Act, the Licensee shall have the option to participate in such measures as may be directed by the Authority from time to time for development of a Competitive Trading Arrangement.
- (2) Any variation or modification in the Agreements under the foregoing subarticle (1), for allowing the Licensee 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.
- (3) In the event that the Licensee exercises its option to participate wholly or partially in development of the Competitive Trading Arrangement under the fore-going sub-article (1), 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 and in doing so, the Licensee shall not by any act or omission impede the development, implementation or operation of the Competitive Trading Arrangement.

Article 7 Maintenance of Records

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

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officers of the Authority.

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Article 8

Compliance with Performance Standards

Subject to the provisions of Article 2(2), the Licensee shall comply with 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, to the full satisfaction of the relevant competent authority, comply with the environmental standards as may be prescribed by the aforesaid relevant competent authority from time to time.

Article 10

Provision of Information

Subject to the provisions of Article 2(2), the Licensee shall provide to the Authority all such information as the Authority may require.

Article 11

Revocation and Suspension

- (1) In exercising its powers to suspend or revoke the Licence under Section 28 of the Act, the Authority shall issue a show cause notice of a period not less than 30 days.
- Pursuant to the powers under Rule 8(4), the obligations of the Licensee under Rule 8(3) stand modified to the extent of inconsistencies with the Agreements and in the event of termination of the Agreements, the Authority may revoke or suspend this Licence.

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Article 12 Approvals and Authorisations

Notwithstanding the provisions of Article 11(2), the Licensee shall apply to the Authority, where required, for approvals and authorizations under the Rules, including without limitation, the approvals and authorisations under Rule 8, Rule 10 and Rule 14.

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SCHEDULE 1

MINIMUM FUNCTIONAL SPECIFICATIONS

The Complex consists of RFO (Residual Furnace Oil) fired five (5) units of diesel generating set with the following design ratings:

1. Gross Capacity under ISO 3046 (Latest Version)

A. Diesel Generating Unit at Alternator Terminal

: 23.4 MW per unit x 5 units = 117.00 MW

for the Complex

B. Auxiliary Consumption

: 4,500 kW

of the Complex

2.

Estimated Dependable Capacity : 112.5 MW

of the Complex at 132kV Busbar under Mean Site Conditions

The Site is located approximately 4.5 km north of the Raiwind railway station adjucent to east side of the railway line to Lahore.

The Site area is characterized by tropical climate. Average rainfall is 600mm per year, but this amount falls in short durations. Mean Site conditions are as follows:

AMBIENT AIR TEMPERATURE = 30 deg. C

CHARGE AIR COOLANT TEMPERATURE = 30 deg. C

RELATIVE HUMIDITY = 40 %

A maximum earthquake design factor of 0.15 g will be utilized for the design of the plant buildings and structures and the design wind speed will be 177 km/hr.

The Site will be at elevation 214 meters with respect to mean sea level (MSL). All structures will have a ground floor elevation of at least 215.5 meters above MSL. Access to the Site will be provided by Public Road.

The main power block consists of five (5) units of diesel generating sets. The diesel generating units are arranged inside power house.

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The cooling system will be closed, with forced liquid to liquid heat exchanger, coupled with an evaporative cooling circuit (cooling tower).

Each diesel generator will be nominally rated at 29,200 kVA (40 deg. C), 0.8 lagging and 0.9 leading power factor, 15,000 V, 3 phase, 50 cycle, not less than 0.66 short circuit ratio

The Complex will be capable of operation within a voltage range of \pm 10 % on the 132 kV system.

The Complex will have four main transformers 50 MVA, 132/15 kV, ONAN.

Interconnection with the WAPDA Grid System will be via a 132kV, outdoor SF6 type substation with interrupting capacity of 31.5 kA at 132kV.

A common control room is provided to monitor and control the Complex. Operator interfaces for control of the Complex will be via control panel and PC operating stations and each, generating unit can be started and stopped locally. The Complex control system will include a data acquisition system.

Fuel supply to the Complex will be via rail. The Site will have sufficient RFO & HSD storage capacity to support operation of the Complex for the equivalent of 100 % of full load for 60 Days.

All material, plant, equipment and machinery incorporated in the construction of the Complex shall be new and unused.

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				SCHEDULE 2 Page 1 of 4	
		SC	HEDULE 2		_
		TECH	NICAL LIMITS		
1.	Design Limit	2			
	1.1 Design	n Conditions]
V*	MINI MAX MINI MAX	IMUM AMBIENT AI MUM AMBIENT AIR IMUM CHARGE AIR MUM CHARGE AIR IMUM RELATIVE H MUM RELATIVE HU	R TEMPERATURE R COOLANT TEMP. COOLANT TEMP. UMIDITY	= 45 deg. C = 0 deg. C = 45 deg. C = 0 deg. C = 90 % = 0 %	
	1.2 Unit S	Starts			
	(a)	Complex and synchr according to the leng	by the Company to start-up onize to the WAPDA Grid 3th of time the unit has been gth of notice required again	System will vary 1 shutdown. Table I	-
			Table 1		_
	Length of Sh	nutdown	Notice required upto full l	<u>oad</u>	_
			for the Complex	for each diesel generating unit	_
(i)	Hot Start		30 minutes	17.5 minutes	-
(ii)	Cold Start		60 minutes	47.5 minutes	-
4	(b)	as follows:	this Schedule start up of th		-
- ·	REGISTRAR	Hot Start" - A sta	rting of the Complex where erature is 60 deg. C or high erature is 40 deg. C or high		-

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"Cold Start"- A starting of the Complex in case of total shutdown where the cooling water temperature is lower than 60 deg. C or lubricating oil temperature is lower than 40 deg. C.

1.3 Complex loading

(a) The Complex minimum continuous loading shall be 8.19 MW at Mean Site Conditions, and the Complex maximum continuous loading shall not exceed 112.5 MW at Mean Site Conditions. The maximum load ramping rates are shown below in Table 2.

Table 2-

Unit Load Range Hot Start % per minutes (i) 0 - 75% of MCR 10 % (ii) 75 - 100% of MCR 5 %

- (b) Step changes in Despatched load of up to 30 % per minute/diesel generating set are allowable provided that Complex load is greater than 35 %. After such step change the new Complex load must be held constant for 5 minutes for stabilization purposes, or for a pro rata period for lesser step changes.
- (c) The Complex can withstand a full load rejection and remain in a safe condition. Provided the Complex auxiliaries are operated continuously, the Complex can be re-synchronized within one hour provided that the reason for the load rejection has been removed.
- (d) The unit minimum loading shall be 35% of MCR.

1.4 Frequency, Power Factor, Voltage Limits and Droop Settings

- (a) The unit will operate at 100% load with a power factor in the range 0.8 lagging to 0.9 leading which range shall not be exceeded. At 0% load the unit has a Reactive Power capability at leading side of 13.1 MVAR and lagging side of 20 MVAR. At full load, at leading side of 12.77 MVAR and 17.58 MVAR on lagging side multiplied by number of units.
- (b) The Complex can operate within the range \pm 10% on the 132 kV high



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voltage system which range shall not be exceeded.

- (c) The Complex can operate within the frequency range 47.5 Hertz to 52.5 Hertz which range shall not be exceeded.
- (d) The Complex will be subject to tripping if frequency and/or voltage fluctuations outside the ranges stated in 1.4(b) and 1.4(c) occur.
- (e) The Unit governor droop is adjustable in the range 0% to 10%. The automatic voltage regulator droop setting is adjustable in the range 0 15% of rated voltage.

1.5 General

(a) The Company shall advise WAPDA of any temporary operating constraints and limits which may from time to time apply to the Complex.

2. Design Maintenance Limits

The cycle of Scheduled Outages is set out in Table 3 below together with a manufacturer's recommended durations for such inspections.

Table 3

a) Each year except every fourth year

Type of maintenance: Duration:

Inspection and minor overhaul.

Inspection and overhaul.

25 days.

b) Every fourth year

Type of maintenance:

Duration: 50 days.

Required time per unit

600 hours

Scheduled Outages thereafter continue on a one-year cycle which must be maintained.

The scheduling of maintenance inspections will be compatible with regulatory requirements. All regularoty inspections will be carried out during Scheduled Outages.



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In addition to the above yearly Scheduled Outage, 600 hours Scheduled Outage for Overhaul shall be allowed at every fourth (4th) year.

3. Prudent Utility Practice

Notwithstanding anything to the contrary, the Company shall operate and maintain the Complex in accordance with Prudent Utility Practices.

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SCHEDULE 3

INTERCONNECTION FACILITIES AND TRANSMISSION FACILITIES

1. Interconnection and Transmission Facilities

- The connection between the Complex (three line bays) and WAPDA's (a) 132 kV substation at Raiwind, Lahore shall be provided. The transmission line will terminate in the substation of the Complex, the location of which will be shown on the Site plans Figures 1 and 2, which shall be submitted later. The circuits of the transmission line will connect at terminal of line gantries provided by the Company and will be shown on the single line diagram of the substation in Figure 3, which shall be be submitted later. The boundary of responsibility between the Company and WAPDA will be at the top of the terminal of line gantries (the "Interconnection Point"). The Company will provide WAPDA with an earth connection from the earthing system of the Complex. WAPDA will install the Metering System which together with the transmission line referred to above within the Site boundary shall comprise the "Interconnection Facilities." This equipment will remain the property of WAPDA and shall be commissioned and maintained thereafter by WAPDA.
- (b) Protection. A carrier intertripping circuit for each transmission line shall be provided between the line circuit breakers at the Complex owned by the Company and the line circuit breakers at 132 kV Pattoki Grid Station owned by WAPDA.

2. Design Data

The following design data has been provided by the Company to WAPDA to enable completion of WAPDA of the design of the Interconnection Facilities and the Transmission Facilities.

2.1. Generator Design Data (for diesel engine)

(a)

<u>Rating</u>

Rating

Nominal Rated Capacity

Power factor



29,200 kVA (40 deg. C)

29,200 kVA (40 deg. C)

0.8 lagging

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			1450 7 01 3
			0.9 leading
		Rated hydrogen pressure	N.A (Air Cooled).
		Number of phases	3
		Number of poles	14
	73	Frequency -	50 Hz
		Rated speed	428 rpm
		Terminal voltage	15 kV
		Short circuit ratio at rated MVA	0.66
		Excitation system	Brushless Static
(p)) <u>Generato</u> i	Reactances (at the rated MVA & kV base) (for d	iesel engine)
		Unsaturated direct axis synchronous reactance	182 %
		Saturated direct axis sub-transient reactance	16.0 %
		Saturated direct axis transient reactance	31.0 %
		Negative phases sequence reactance	18.0 %
		Zero phase sequence reactance	9.0 %
		Leakage reactance	17.0 %
(c)	Generator	time constants (for diesel engine)	7 13 seconds
		Direct axis open circuit time TDO' constant	7.13 seconds (NEPRA)
		Direct axis open circuit sub- "TDO" transient time constant	0.06 seconds

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Direct axis short circuit trans- TD"

1.35 seconds

transient time constant

Direct axis short circuit sub- T

0.04 seconds

transient time constant

(d) Inertia constant

diesel engine + its generator

J= 29,499 kgm2 H= 1.45 kWs/kVA

Note: (1) The above design values will have tolerances as specified in the relevant IEC standards.

2.2 Excitation System

Excitation of the engine generator is provided by a brushless system using rotating rectifiers and a pilot exciter. The excitation control system has one (1) automatic voltage regulator (AVR) and a manual excitation control (MEC). During normal operation, the whole excitation system is subject to automatic control by means of AVR.

Technical Characteristics

- (i) Voltage setting range for AVR operation: \pm 10 %
- (ii) Voltage adjusting range for MEC operation: ± 10 %
- (iii) Generator terminal voltage is held within ± 10 % from no load to full load at rated frequency
- (iv) Under the maximum direct current supplied from the excitation system for a specified time, the ceiling voltage to the generator field voltage is 2.0 p.u.
- (v) The transfer function diagram of excitation system as shown in attachment 3.



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2.3	Generator Transformer	
	Rated Power	50 MVA (ONAN)
	Rated voltage	132 kV <u>+</u> 10% /15 kV (<u>+</u> 13 Taps)
	Current prim./sec.	/ A
	Frequency	50 Hz
	Connection Group	YNdII
	Insulation Level Impulse AC withstand	[() / ()] kV [() / ()] kV
	Type of Cooling	ONAN
	Temp. rise wdg. / oil	[/] deg. C
	Max. AC withstand overvoltage	[] kV for I minute according to relevant IEC Standard
	Max. system short circuit power	[_] GVA
	Impedance and losses Impedance No load losses Load losses Aux. losses	at reference power 50 MVA [] % HV to LV [] kW [] kW [] kW
	Positive Reactance	Ux = [_] %
	Zero Sequence Reactance at 132kV and 63MVA base	Zo = 10 %
	X Air Core (HV-Terminal)	89 Ohm REGISTRAR
	X Air Core (LV-Terminal)	1.0 Ohm
	Saturation Curve at no load	see attachment 4.

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- 2.4 The governor droop will be adjustable from 0 % to 10 % and is designed to operate over the frequency range 47.5 to 52.5 Hz.
- The AVR droop setting is $0 \sim 10\%$ of rated voltage, to control voltage within $\pm 0.5\%$.

Note: The Company undertakes that the missing technical data and formula for adjustment of capacity for variations in temperature shall be supplied later and will be subject to approval by WAPDA.

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SCHEDULE 4

COMMISSIONING AND TESTING

I. <u>Delivered Capacity</u>

During Commissioning the delivered capacity of the Complex will be demonstrated to be 112.5 MW measured at 132kV busbar through the Metering System under Mean Site Conditions. The tested capacity shall be calculated according to ISO standard (3046/1) under site conditions according to Table-I of Schedule 4 subject to the technical design limit described in Schedule 2. In the event of a shortfall in calculated capacity exceeding ten (10) percent of Estimated Dependable Capacity, WAPDA shall have the right to reject the Complex.

II. Other Tests

In addition to the demonstration of delivered capacity set forth above, the following tests will be conducted during Commissioning.

a). Reliability Run

A reliability run will be carried out as part of the Commissioning tests and must be satisfied prior to the Complex being certified Commissioned by the Engineer. The run will be for a period of 7 days (168 hours) and will include seventy-two (72) continuous hours at maximum continuous rating. The output during the remaining 96 hours of the test will be as requested by WAPDA. The test shall have been satisfactorily completed only if it continues without interruption for not less than 168 hours.

b) Automatic Voltage Regulator (AVR) Droop

The AVR will be demonstrated to control the generator voltage over the range of \pm 10 percent of rated voltage with a droop characteristic of 0 - 10 percent.

c) Engine Governor Operation

The operation of the speed governor will be demonstrated over its range, the droop being adjusted from 0% to 10%.

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Leading

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d) Reactive Capacity

Tests will demonstrate the capability of the Unit to operate at rated voltage and frequency at power factors and under reactive conditions as follows:

<u>unganis</u>	
 	12.77 MVAR 13.10 MVAR

Lagging

e) Response of Complex to Step Load Changes

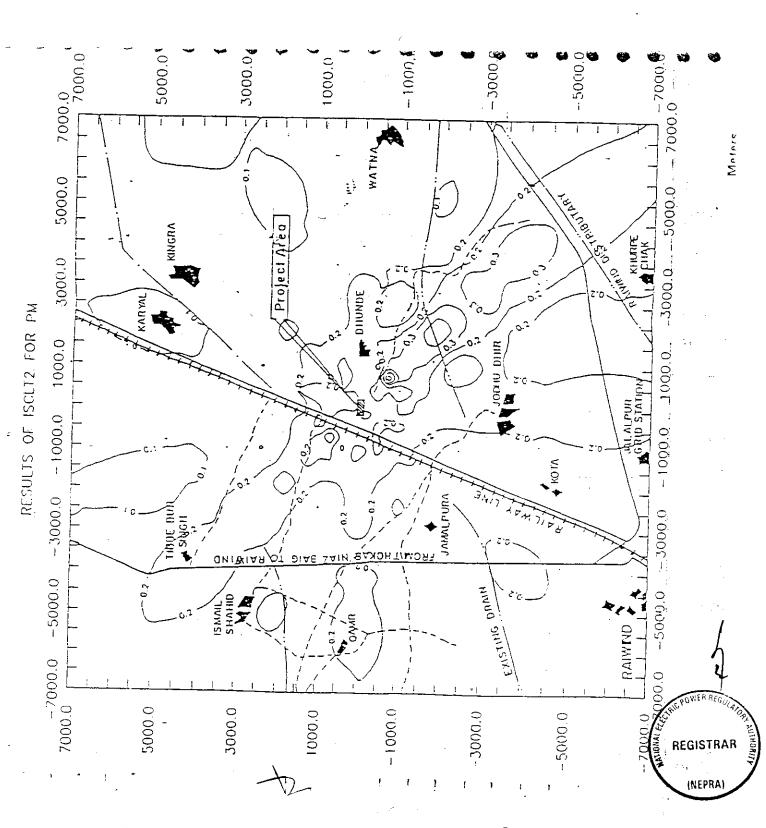
The unit shall be demonstrated to be capable of a step increase in load of thirty percent (30%) per minute of gross rated output provided the unit load is greater than thirty-five percent (35%). It shall also be demonstrated to be capable of withstanding a sudden loss of demand of ten percent (10%) of gross rated output from any load in the range thirty-five percent (35%) to one hundred percent (100%). The unit must not trip and must otherwise remain in a safe condition.

f) Full Load Rejection

Tests shall demonstrate the ability of the unit and its auxiliaries to withstand full and part load rejection and remain in a safe condition.

The Company's obligation to conduct such test is subject to the provision by WAPDA of the required load.





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INSTALLED CAPACITY (GROSS) & NET CAPACITY

Installed ISO (Gross) Capacity

117MW

Net Capacity

112.5MW

Note: Net Capacity – These are indicative figures only as provided by the Licensee. The net capacity available to NTDC for dispatch and other purchasers will be determined through procedures contained in the Agreements or Grid Code.





DETERMINATION FOR GRANT OF GENERATION LICENCE

TO

Japan Power Company Ltd.

Southern Electric Power Company Ltd.

- 1. Pursuant to Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act (XL of 1997), (hereinafter referred to as the 'Act'), no person shall construct, own, or operate a generation facility without a licence issued by the Authority under the Act. Accordingly, Japan Power company Ltd. (hereinafter referred to as 'JPCL') and Southern Electric Power Company Ltd. (hereinafter referred to as 'SEPCOL') which, entered into contracts backed by sovereign guarantees prior to the commencement of the Act, are therefore required to obtain individual licences from the Authority for operating their generation facilities.
- 2. SEPCOL and JPCL applied for generation licences on 14.4.2003 and 9.5.2003 respectively. However, the applications could not be processed because complete information required under the Application and Modification Procedure Regulations, 1999 was not provided. The Authority admitted the application of JPCL on 8.10.2033 and of SEPCOL on 28.10.2003 after obtaining all requisite information from them.
- 3. A draft generation licence, similar to the one granted to other IPPs in August 2003 was circulated amongst the two applicants and all other

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stakeholders. The Authority solicited comments on the draft generation licence. Comments were received in writing on the said draft. A Hearing was conducted on 13.1.2004, in order to provide an opportunity to the applicants and other stakeholders to assist the Authority in arriving at an informed decision.

- 4. During the Hearing the Authority discussed inter alia issues relating to the compliance of applicable environmental standards by the applicants, the term of their individual licences and the application of rules as amended from time to time to the Licensees.
- 5. Earlier the Authority has granted generation licences to 12 other IPPs vide its determination dated 26 August 2003 (hereinafter referred to as the 'determination'). SEPCOL did not raise any objection to the draft generation licence. On the other hand, the objections raised to the draft generation licence by JPCL have already been adequately addressed in the Authority's determination of 26 August 2003.
- 6. In view of the above, The Authority hereby grants generation licences to JPCL and SEPCOL in terms of and for reasons stated in the determination dated 26 August 2003.

WITH THIS, the Authority hereby grants generation licences to the generation companies listed below:

- 1. M/s Japan Power Generation Limited
- 2. M/s Southern Electric Power Company Limited

(Fazlullah Qureshi) Member (Mansoor Elahi) Member

(Sardar Muhammad Shairf Khan 'T.St.')

Member

(Abdul Rahim Khan) Vice Chairman

(Lt. Gen. (R) Saeed uz Zafar, HI (M) Chairman