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OED SPECIAL STUDIES
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Power-Singapore-Pub.

1967-1976



30248803

A1994-141 Other #: 12

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Power - Singapore - Public Utilities Board - 1966 - 1970

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PUBLIC UTILITIES BOARD, SINGAPORE
ELECTRICITY DEPARTMENT

I. The World Bank has granted the following loans to the Electricity Department:

Generation

Pasir Panjang Power Station 'B'	44,081,632
Pasir Panjang Power Station 'B' - Extension	29,214,665
	<hr/>
	S\$ 73,296,297 US\$23,943,493

Distribution

Loan 503 SI (Transmission & Distribution Projects)	43,775,510
Loan 595 SI (Transmission & Distribution Projects)	62,755,010
	<hr/>
	S\$106,530,520 US\$34,800,020
Total Generation & Distribution Loans	S\$179,826,817 US\$58,743,513
	<hr/>

II. Actual costs and commissioning dates of the main components included in the projects which were partly financed by the World Bank:-

(i) Generation

The two loans for Generation projects amounting to S\$73 million were for the construction of Pasir Panjang Power Station 'B' and extension which cost S\$101 million. The first two units of 60 MW each of this power station were commissioned in 1965, whilst the 3rd and 4th units of similar capacity were commissioned in 1966 and 1967 respectively. Pasir Panjang Power Station 'B' contributed 52% of the total installed generating capacity until the commissioning of the first 60 MW unit at Jurong Power Station in late 1969. In terms of units generated Pasir Panjang Power Station 'B' is still the Board's largest contributor. In 1970 Pasir Panjang Power Station 'B' generated 53% of the Republic's requirements of electricity.

(ii) (a) Distribution First Loan 503 SI granted in 1967

The loan was granted for the expansion of the Electric Power Distribution System through:

- (i) the expansion of the 66kV, 22kV and 6.6kV systems and the installation of associated substation equipment.
- (ii) the expansion of 400/230 Volt secondary distribution system and the installation of associated ancillary equipment and meters.
- (iii) tariff study.
- (iv) network study.

Messrs Montreal Engineering Co. were appointed as consultants for the network study in 1968 and the preliminary report was submitted in February 1969 prior to negotiation to loan 595 SI. The final report was completed in late 1970. The cost of the net work study is S\$371,429. Messrs Electro-watt were appointed for the Tariff study and a final report was submitted earlier this year. It has, however, been necessary to review the final report in the light of the recent increases in oil prices. The Tariff' study cost amounted to S\$110,866.

The actual costs and commissioning dates of the main components are shown in the attached schedule combining the two loans granted for the expansion of the distribution network.

(b) Distribution Second Loan 595 SI granted in 1969

The loan was granted for the expansion of the Electric Power Distribution System through:

- (a) the expansion of the 66kV system and the installation of associated substation equipment;
- (b) the expansion of the 22kV primary distribution system and the installation of associated primary distribution substation equipment;
- (c) the expansion of the 6.6kV primary distribution system and the installation of primary distribution substation equipment; and
- (d) the expansion of the low voltage secondary distribution system and the installation of associated ancillary equipment.

The actual costs and commissioning dates of the main components are shown in the attached schedule combining the two loans granted for the expansion of the distribution network.

The expansion of the 66kV system included the installation of high powered 66kV oil-filled submarine cables capable of providing a firm supply of 120 MVA of power from Jurong Power Station to meet the load requirements of the oil refineries in the Southern Islands of Pulau Ayer Chawan, Pulau Merlimau and Pulau Bukom.

The project which commenced in December 1969 was completed in September 1970.

The whole project which comprised the laying of 17 miles of land and 82 miles of submarine cables together with the construction of two major 66/22kV substations at Pulau Ayer Chawan and Merlimau cost approximately \$18 million.

**MAJOR COMPONENTS OF CAPITAL EXPENDITURE FOR
THE EXTENSION TO THE TRANSMISSION & DISTRIBUTION NETWORK**

Year	No. of Substations	66kV Network Extension			22kV Network Extension			6.6kV Network Extension		
		Cables in Miles	Transformer Capacity	Project Cost	Cables in Miles	Transformer Capacity	Project Cost	Cables in Miles	Transformer Capacity	Project Cost
1967	79	122	500 MVA	\$5,411,410	421	579 MVA	\$4,710,095	760	497 MVA	\$8,855,004
1968	109	149	531 MVA	\$5,115,123	445	663 MVA	\$8,517,041	821	571 MVA	\$10,161,216
1969	84	160	594 MVA	\$7,587,910	465	766 MVA	\$10,829,114	874	650 MVA	\$8,199,805
1970	107	322	781 MVA	\$27,728,996	491	916 MVA	\$10,971,464	946	785 MVA	\$13,588,458

GENERATION

- (I) INSTALLED CAPACITY AND PEAK DEMAND
- (II) PRODUCTION AND SALES
- (III) REVENUE AND OPERATING COSTS
- (IV) TRANSMISSION & DISTRIBUTION OPERATING COSTS

	1963	1964	1965	1966	1967	1968	1969	1970
I <u>Installed Capacity (MW)</u>								
St. James	48	58	49	49	49	49	49	49
Pasir Panjang 'A'	175	175	175	175	175	175	175	175
Pasir Panjang 'B'	-	-	120	180	240	240	240	240
Jurong Stage I	-	-	-	-	-	-	60	120
Total	223	233	344	404	464	464	524	584
Maximum Demand (MW)	151.5	168	192.5	223	248	283	320	375
II <u>GWH Generated</u>								
St. James)	823	20	58	33	16	4	6
Pasir Panjang 'A')	894	854	713	609	617	650	575
Pasir Panjang 'B'	-	-	136	490	799	1,018	1,144	1,165
Jurong Stage I	-	-	-	-	-	-	76	464
LESS: WORK UNITS	823 (4.6%)	914 39	1,048 44	1,236 55	1,424 (5.7%)	1,639 78	1,876 (5.2%)	2,206 102
LESS: DIST. LOSSES	784 (6.6%)	870 54	993 42	1,166 81	1,346 (7.5%)	1,553 91	1,774 (6.5%)	2,077 121
Total units sold	730	828	912	1,075	1,238	1,447	1,653	1,942
III Revenue from Sale	S\$53,735,681	S\$59,842,283	S\$64,689,747	S\$75,155,097	S\$88,822,385	S\$101,299,829	S\$113,645,672	S\$130,384,352
<u>Operating Costs - Fuel</u>								
St. James	135,069*	569,895	1,583,159	956,965	477,797	135,734	207,822	77,369
Pasir Panjang 'A'	7,008,230*	11,507,406	14,332,333	12,102,672	6,919,228	7,273,736	7,545,007	5,565,515
Pasir Panjang 'B'	-	-	2,057,092	4,921,854	7,362,144	9,651,968	10,951,569	9,375,624
Jurong Stage I	-	-	-	-	-	-	820,852	3,655,042
	S\$ 7,143,299	S\$12,077,301	S\$17,972,584	S\$17,981,491	S\$14,759,169	S\$ 17,061,438	S\$ 19,525,250	S\$ 18,673,550
<u>Operating Costs - Others</u>								
St. James	455,281*	873,600	1,144,675	1,078,019	961,406	772,558	595,553	546,916
Pasir Panjang 'A'	2,443,889*	4,051,877	4,366,820	5,056,548	4,157,181	3,764,507	3,560,173	3,612,755
Pasir Panjang 'B'	-	-	-	656,196	2,097,323	2,678,252	2,750,108	2,794,461
Jurong Stage I	-	-	-	-	-	165,327	769,521	1,868,253
	S\$ 2,899,170	S\$ 4,925,477	S\$ 5,511,495	S\$ 6,790,763	S\$ 7,215,910	S\$ 7,380,644	S\$ 7,675,355	S\$ 8,822,385
Total Generation Operating Costs	S\$10,042,469	S\$17,002,778	S\$23,484,079	S\$24,772,254	S\$21,975,079	S\$ 24,442,082	S\$ 27,200,605	S\$ 27,495,935
IV Total Transmission & Distribution Operating Costs	S\$ 2,858,926*	S\$ 5,143,547	S\$ 5,613,206	S\$ 5,986,578	S\$ 6,553,417	S\$ 6,507,441	S\$ 6,327,254	S\$ 8,070,116

* 8 months figure from inception of 'Board' (May 1963 - December 1963)

Attached are the major electrical and mechanical outages
in 'B' Station.

Turbine Incidences requiring immediate Unit shut downs for repair purposes

Duration
of outage

UNIT ONE

6. 8.66 to 8. 8.66	Exciter hunting. Machine taken off to check bearings of exciter. Exciter Inboard Bearing thrust edge found severely worn and was renewed. Machine recommissioned on 8.8.66.	2 days
3.10.67 to 10.10.67	High Shaft Voltage. This resulted from the failure of the shaft Grounding Device. Machine was taken off to install a new set of grounding device. Recommissioned on 10.10.67.	7 days
25. 7.67	Barring Gear Failure on 25. 7.67. Machine was taken off immediately for repair. Recommissioned after 12 hours approximately.	12 hours

UNIT TWO

18. 5.66 to 20. 5.66	Condensate Extraction Pump 'B' seizure on 18.5.66 as a result of faulty impeller locking device. Machine was taken off for the repair. Recommissioned on 20.5.66.	2 days
24.10.69 to 25.10.69	Erratic operation of Governor Valves on 24.10.69. Machine taken off. It was discovered that No.5 Governor Valve Spindle locking pin had been sheared. This was rectified. Machine recommissioned on 25.10.69.	1 day

UNIT FOUR

19. 1.67 to 21. 1.67	Violent vibration experienced on 19.1.67. Bearings were opened up for inspection. No damage was found. Turbine Coupling realigned and machine was recommissioned on 21.1.67.	2 days
3. 5.67 to 9. 7.67	Thrust Failure Incident occurred on 28.4.67. Machine taken off for investigation on 3.5.67. Extensive damage found on rotor wheels and thrust bearings. Rotor sent to Japan for repair. Spare rotor was used and machine was recommissioned on 9.7.67.	73 days
20. 6.70 to 25. 6.70	'F' Boiler Feed Pump seized on 20.6.70. Taken off for repair. Extensive mag damage to rotating element found . Reinstalled with new rotating element. Machine recommissioned on 25.6.70.	5 days

FORCED OUTAGE DUE TO MAJOR DEFECTS ON
BOILER UNITS

<u>DATE</u>	<u>UNIT NO.</u>	<u>REASONS</u>	<u>DURATION OF OUTAGES</u>
18.10.65 to 16.11.65	Boiler No.1	Explosion in furnace causing damage to the left hand side wall tube No.2 (counting from rear). A section of the damaged tube was replaced.	28 days
2. 7.69 to 17. 7.69	Boiler No.1	Tube leakage - leakage from the left hand side economiser outlet wall tubes No. 14 & 15 (counting from the rear) led to serious erosion and failure of 6 tubes at the primary superheater.	15 days
2. 8.70 to 4. 8.70	Boiler No.4	<p>Severe leakage of feedwater was detected on the downstream side of the 'B' feed controller. Erosion on the piping by the feedwater was probably the cause of the thinning down of the pipe wall and ultimately puncture the pipe.</p> <p>The valve body and a short length of piping were renewed. All welds were subjected to radiographic examinations.</p>	2 days
19. 8.70 to 22. 8.70	Boiler No.3	<p>A pin-hole puncture on the piping immediately after the 'B' feed controller was detected. The defect was similar to that on Boiler No.4.</p> <p>The valve body was still in serviceable condition and only a short length of piping was renewed.</p>	3 days

'B' STATION MAJOR ELECTRICAL OUTAGE

<u>Date</u>	<u>Unit</u>	<u>Cause</u>	<u>Duration of Outage</u>
8. 4.71	Blr.3	I.D. Fan A winding fault.	Blr. limited to $\frac{1}{2}$ load for 17 hrs.
23.11.70	T.G.2	66kV switchgear failed, loss of oil or OP2C	Tripped at 17 MW. C.B. had to be changed. 24 hrs. outage.
*69	4	Feed Pump F seized.	Off load 3 weeks.
1.68	2	Feed Pump C windings damaged, bracing shifted.	Off load, 20 days.
8.68	1	Feed Pump A windings damaged, bracing shifted.	Off load, 14 days.
11.68	3	Feed Pump D winding damaged, bracing shifted.	Off load, 12 days.
26. 9.67	3	Feed Pump C starter failure (F.P. being shut down).	Off load, 30 days.
27.10.67	3	Feed Pump C starter failure (F.P. being started).	3.3kV cubicle badly damaged. 30 days.
5.66	3	ID 3A winding fault. Rewound.	Off load, 2 months.
12.65	2	ID Fan winding fault. Changed motor from No.3.	Off load, 1 week.
16. 8.65	1 or 2	Feed Pump B 3.3kV starter flashed over. (Standby Feed Pump).	1 machine unavailable. 5 days.

PASIR PANJANG 'A' POWER STATION

AVERAGE CAPACITY OUT OF SERVICE IN MW

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Yearly
1958	21.45	16.77	16.62	16.46	16.20	16.26	16.94	14.86	*31.59	*32.72	*33.78	*34.97	21.36 22.39 (135.4)
1959	22.53	23.37	*34.02	*33.75	*35.40	23.06	29.10	23.27	29.19	22.25	22.28	21.56	24.15 26.65 (150)
1960	22.71	22.29	22.16	20.87	20.55	21.55	19.68	20.29	22.29	19.24	19.40	19.44	20.77 20.87 (159)
1961	19.27	19.24	19.27	19.22	17.77	16.74	16.39	16.38	16.13	13.61	12.08	14.84	16.73 (177)
1962	14.63	16.49	17.18	15.22	12.92	11.00	21.22	21.81	*32.76	*30.77	19.69	20.79	14.47 19.54 (129.5)
1963	22.52	23.68	23.14	22.54	22.16	22.40	21.65	23.01	23.03	27.03	*32.52	*33.27	22.94 24.74 (222.9)
1964	18.70	19.87	*28.28	*28.28	17.20	16.01	17.36	16.11	16.54	15.64	16.72	15.89	17.15 18.88 (224)

*T.G. 4 under overhaul 1958

*T.G. 1 -do- 1959

*T.G. 3 -do- 1962

*T.G. 5 -do- 1963

*T.G. 2 -do- 1964

295
310
7200
700
750
1200
1100

MAJOR MAINTENANCE & OVERHAUL IN HOURS

PASIR PANJANG 'A' POWER STATION

<u>'A' Station</u>	<u>Routine Maintenance Hours</u>	<u>Break-Down Hours</u>	<u>% Routine Maintenance</u>	<u>% Break-down</u>
Mar. 1965	680	-	100%	Nil ?
Sept. 1965				
Mar. 1966	147	190	43.62%	56.38%
Sept. 1966				
Mar. 1967	207	122	62.92%	37.08%
Sept. 1967	552	157	77.85%	22.15%
Mar. 1968	205	64	77.86%	22.14%
Sept. 1968	329	160	67.28%	32.72%
Mar. 1969				
Sept. 1969				
Mar. 1970	17	-	100%	Nil ?
Sept. 1970	372	120	78.81%	21.19%

PUBLIC UTILITIES BOARD

		1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	
06	MW Installed Capacity in the Country (Total)	152	152	178.05	180.93	205.96	216.98	227.98	348.23	468.23	468.23	468.23	528.5	588.5	
07	MW of which: "captive" plants			1.05	3.93	3.96	3.98	3.98	4.23	4.23	4.23	4.23	4.5	4.5	
12/23	Gwh Total Energy supplied/billed P.U.B.	492.5	524.7	577.6	636.6	689.5	729.9	828.0	912.4	1,074.8	1,238.6	1,446.8	1,652.9	1,941.6	
13	Gwh of which: Lighting and Fans	81.3	89.4	104.2	120.5	133.2	148.1	168.0	174.2	196.7	217.9	241.6	261.1	297.3	
14	Gwh Domestic Power	147.8	162.2	178.1	197.8	212.2	234.5	268.0	250.4	273.7	278.3	276.1	305.8	341.3	
15	Gwh Commercial and Small Industrial Power	253.5	262.7	284.4	306.3	331.2	327.9	295.3	373.8	418.0	467.7	557.6	626.3	717.3	
19/20	Gwh Large Industrial Power	-	-	-	-	-	5.7	81.5	96.2	165.5	251.5	345.8	431.6	554.8	
16	Gwh Public Lighting and Traffic Signals	9.9	10.5	11.0	12.0	12.9	13.7	15.1	17.8	20.9	23.2	25.7	28.1	31.0	
21	Gwh Selected consumers: Oil Refineries	-	-	-	-	NOT AVAILABLE	-	-	-	-	-	92.8	94.0	128.4	
22	Gwh British Forces	-	-	-	-	NOT AVAILABLE	-	-	-	-	-	198.3	199.6	155.4	
26A	No. Number of Consumers of P.U.B. Electricity	86,621	93,108	98,191	106,530	118,664	133,069	146,474	169,260	186,022	202,278	218,812	244,418	267,645	
B	No. Number of Meters of P.U.B.	148,761	163,702	174,934	189,642	212,322	241,116	271,620	314,216	349,544	382,735	417,796	464,630	509,037	
28	No. Estimated number of Households in Singapore	300,600	304,500	308,200	312,100	315,900	319,900	323,800	327,800	331,900	343,400	355,100	367,400	380,000	
42A	No. Number of Employees of P.U.B. <i>including General Services</i>					5,098 4,470 + 324	5,326 4,669 + 346	5,635 4,992 + 383	5,863 5,075 + 424	6,229 5,237 + 505	6,648 5,593 + 579	6,955 5,866 + 591	7,212 6,265 + 589	7,840 6,612 + 647	8,611 + 670 *
B	No. of which Number of Employees of Electricity Department	1,954	1,925	2,152		2,309 2,375 2,733	2,580 2,695 2,913	2,695 2,799 3,119	3,069 3,069 3,304	3,159 3,159 3,648	3,284 3,284 3,750	3,590 3,590 3,855	3,980 3,590 4,237	4,650 *	
44	Mth Average delay on making new connections	Scheduled time required for major projects is 1.5 - 2.0 months while for other connections it is 0.1 - 1.0 months. For rural areas depends on rural electrification scheme.												12.0	16.8
45	S\$ Sales Revenue of P.U.B. <i>(including indirect taxes)</i>					14	14.6	14.8	15.7	19.0	19.9	18.7	18.4	157,814	177,768
45A	S\$ Electricity Sales Revenue (\$ 000's) <i>(excluding indirect taxes)</i>													113,646	130,384
46	S\$ Indirect Taxes <i>(power consumption)</i> (\$ 000's) <i>(all utilities)</i>													+ 12,600	15,162
47	S\$ Indirect taxes on power (\$ 000's) <i>(Estimate)</i>													= 9,073	11,120
47'	S\$ Electricity Sales Revenue (\$ 000's) <i>(including indirect taxes)</i>													= (122,72	141,504) =
48	S\$ Depreciation and Retirement Provision of P.U.B. (\$ 000's)													- 27,828	28,839
49	S\$ Net Fixed Assets in Service of P.U.B. (\$ 000's)													- 570,072	631,871

$$\begin{aligned}
 x &= \text{nb of residential consumers} \\
 y &= \text{nb of other consumers} \\
 x+y &= 98.191 \\
 x+y &= 174.934 \\
 x &= 76.743
 \end{aligned}$$

$$\begin{aligned}
 x+y &= 267.615 \\
 2x+y &= 509.037 \\
 x &= 241.992
 \end{aligned}$$

P U B L I C U T I L I T I E S B O A R D

		1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	
06	MW Installed Capacity in the Country (Total)	152	152	178.05	180.93	205.96	216.98	227.98	348.23	468.23	468.23	468.23	528.5	588.5	
07	MW of which: "captive" plants			1.05	3.93	3.96	3.98	3.98	4.23	4.23	4.23	4.23	4.5	4.5	
12/23	Gwh Total Energy supplies/billed P.U.B.	492.5	524.7	577.6	636.6	689.5	729.9	828.0	912.4	1,074.8	1,238.6	1,446.8	1,652.9	1,941.6	
13	Gwh of which: Lighting and Fans	81.3	89.4	104.2	120.5	133.2	148.1	168.0	174.2	196.7	217.9	241.6	261.1	297.3	
14	Gwh Domestic Power	147.8	162.2	178.1	197.8	212.2	234.5	268.0	250.4	273.7	278.3	276.1	305.8	341.3	
15	Gwh Commercial and Small Industrial Power	253.5	262.7	284.4	306.3	331.2	327.9	295.3	373.8	418.0	467.7	557.6	626.3	717.3	
19/20	Gwh Large Industrial Power	-	-	-	-	-	5.7	81.5	96.2	165.5	251.5	345.8	431.6	554.8	
16	Gwh Public Lighting and Traffic Signals	9.9	10.5	11.0	12.0	12.9	13.7	15.1	17.8	20.9	23.2	25.7	28.1	31.0	
21	Gwh Selected consumers: Oil Refineries	-	-	-	-	NOT AVAILABLE			-	-	-	-	92.8	94.0	128.4
22	Gwh British Forces	-	-	-	-	NOT AVAILABLE			-	-	-	-	198.3	199.6	155.4
26A	No. Number of Consumers of P.U.B. Electricity	86,621	93,108	98,191	106,530	118,664	133,069	146,474	169,260	186,022	202,278	218,812	244,418	267,645	
B	No. Number of Meters of P.U.B.	148,761	163,702	174,934	189,642	212,322	241,116	271,620	314,216	349,544	382,735	417,796	464,630	509,037	
28	No. Estimated number of Households in Singapore	300,600	304,500	308,200	312,100	315,900	319,900	323,800	327,800	331,900	343,400	355,100	367,400	380,000	
42A	No. Number of Employees of P.U.B.				5,098	5,326	5,635	5,863	6,229	6,648	6,955	7,212	7,840	8,611	
B	No. of which Number of Employees of Electricity Department	1,954	1,925	2,152	2,309	2,375	2,580	2,695	2,799	3,069	3,159	3,284	3,590	3,980	
44	Mth Average delay on making new connections	Scheduled time required for major projects is 1.5 - 2.0 months while for other connections it is 0.1 - 1.0 months. For rural areas depends on rural electrification scheme.													
45	S\$ Sales Revenue of P.U.B. (including indirect taxes)												157,814	177,768	
45A	S\$ Electricity Sales Revenue (\$ 000's)												113,646	130,384	
46	S\$ Indirect Taxes (power consumption) (\$ 000's)												12,600	15,162	
48	S\$ Depreciation and Retirement Provision of P.U.B. (\$ 000's)												27,828	28,839	
49	S\$ Net Fixed Assets in Service of P.U.B. (\$ 000's)												570,072	631,871	

ELECTRICITY DEPARTMENT

TOTAL DEBT SERVICE

	1967 \$000's	1968 \$000's	1969 \$000's	1970 \$000's	1971 \$000's	1972 \$000's	1973 \$000's	1974 \$000's	1975 \$000's
Interest Payable									
Debenture Stocks	6,982	6,982	6,982	6,982	6,827	6,102	5,213	4,125	4,125
Government Loans 1963-1967	3,266	3,511	3,247	2,982	2,717	2,474	2,296	2,118	1,940
Government Loan 1968	-	120	449	427	404	381	358	336	313
<u>Government Loan 1973</u>	-	-	-	-	-	-	-	-	-
Government Loan 1974	-	-	-	-	-	-	-	1,645	3,249
Government Loan 1975	-	-	-	-	-	-	-	-	1,890
I.B.R.D. Loan I	2,211	2,130	2,051	2,015	1,903	1,785	1,661	1,529	1,391
I.B.R.D. Loan II	1,428	1,473	1,466	1,605	1,544	1,480	1,415	1,346	1,273
I.B.R.D. Loan III	24	271	1,697	2,235	2,638	2,538	2,432	2,320	2,201
I.B.R.D. Loan IV	-	-	245	1,148	3,335	4,052	3,969	3,825	3,671
Proposed I.B.R.D. Loan V	-	-	-	47	299	676	1,702	2,015	2,219
C.O.F.A.C.E. Loan)	461	1,088	1,713	(a) 3,442	3,733	4,438	9,599	6,632	5,592
Other Deferred Payments)									
Less Interest Receivable	14,372	15,575	17,850	20,883	23,400	23,926	28,645	25,896	27,864
Architect's Dept. - P.U.B. Building	-	-	-	104	659	1,212	1,149	1,089	1,028
	14,372	15,575	17,850	20,779	22,741	22,714	27,496	24,807	26,836
Principal Repayments									
Government Loans 1963-1967	3,980	4,480	4,480	4,420	4,420	3,100	3,100	3,100	3,100
Government Loans 1968	-	-	350	350	350	350	350	350	350
<u>Government Loans 1973</u>	-	-	-	-	-	-	-	-	-
Government Loans 1974	-	-	-	-	-	-	-	-	2,350
I.B.R.D. Loan I	1,813	1,760	1,708	1,959	2,066	2,173	2,311	2,433	2,556
I.B.R.D. Loan II	-	812	827	964	1,026	1,087	1,087	1,160	1,233
I.B.R.D. Loan III	-	-	-	1,546	1,638	1,741	1,838	1,954	2,071
I.B.R.D. Loan IV	-	-	-	-	-	1,040	2,173	2,326	2,479
Proposed I.B.R.D. Loan V	-	-	-	-	-	-	-	-	550
C.O.F.A.C.E. Loan)	1,205	2,247	3,937	6,663	9,180	9,557	12,317	13,257	12,136
Other Deferred Payments)									
Less Principal Repayment Recoverable	6,998	9,299	11,302	15,962	18,740	19,048	23,176	24,580	26,825
Architect's Dept. - P.U.B. Building	-	-	-	-	-	-	930	930	930
	6,998	9,299	11,302	15,962	18,740	19,048	22,246	23,650	25,895
Total Debt Service									
Interest Payable	14,372	15,575	17,850	20,779	22,741	22,714	27,496	24,807	26,836
Principal Repayments	6,998	9,299	11,302	15,962	18,740	19,048	22,246	23,650	25,895
Sinking Fund Contributions	3,442	4,526	4,304	4,303	4,228	3,703	3,185	2,296	2,296
	24,812	29,400	33,456	41,044	45,709	45,465	52,927	50,753	55,027

(a) include financing charge of \$298,000/-.

ELECTRICITY DEPARTMENT - FORECAST OF CAPITAL EXPENDITURE

Page: El

	A C T U A L						F O R E C A S T						Total 1970-1975 \$000's 86
	1965 \$000's 25	1966 \$000's 5	1967 \$000's 33	1968 \$000's 33	1969 \$000's 24	1970 \$000's 11	1971 \$000's 15	1972 \$000's 15	1973 \$000's 15	1974 \$000's 15	1975 \$000's 15		
1. ADMINISTRATION													
2. GENERATION:-													
Pasir Panjang Power Station 'A'	10	18	22	12	34	72	25	25	25	25	25	25	197
Pasir Panjang Power Station 'B' -	101	-	-	-	-	-	-	-	-	-	-	-	-
Land	-	-	8	16	10	34	50	50	50	50	50	50	284
Others	-	-	-	-	3	-	-	-	-	-	-	-	-
St. James Power Station	653	1	-	-	-	-	-	-	-	-	-	-	-
Additional Gas Turbine Sets	5	-	-	-	-	-	-	-	-	-	-	-	-
Jurong Power Station -	-	-	2,893	-	2,089	-	-	-	-	-	-	-	-
Land	-	-	7,110	48,125	17,813	6,845	-	-	-	-	-	-	6,845
1st Phase (2x60 MW) Total Cost (\$85,457)	185	1,226	-	1,217	4,312	23,442	5,738	1,338	-	-	-	-	30,518
2nd Phase (2x60 MW) Total Cost (\$36,047)	-	-	-	-	-	-	-	-	-	-	-	-	-
New Power Station (3x120MW and 2x200MW)	-	-	-	-	-	-	-	237	(a)10,347	29,857	(a)62,062	102,503	
Total Cost (\$380,666)	-	-	-	-	-	-	-	-	-	-	-	-	-
	954	1,245	10,033	49,370	24,261	30,393	5,813	1,650	10,422	29,932	62,137	140,347	
3. COMMERCIAL AND HIRING													
Hiring Section:-													
Appliances	700	894	1,065	936	521	1,367	1,000	1,000	1,000	1,000	1,000	1,000	6,367
Other	-	-	-	5	2	9	13	14	15	16	17	18	84
Installation Section	19	60	21	11	7	14	13	14	15	16	17	18	89
Inspectorate Section	-	-	-	17	3	39	20	20	20	20	20	20	139
4. QUARTERS	397	1,282	98	Cr. 21	341	1,310	-	-	500	1,000	-	-	2,810
5. STORES DEPOTS	4	10	-	-	94	433	1,000	50	100	50	50	50	1,683
	1,120	2,246	1,184	948	968	3,172	2,046	1,098	1,650	2,102	1,104	1,104	
6. DISTRIBUTION													
Programme of Works	29,139	19,691	-	-	-	-	-	44,112	45,987	94,434	67,552	252,085	
Others	1,222	767	208	-	-	-	-	2,066	1,958	1,900	1,900	1,900	7,824
	30,361	20,458	208	-	-	-	-	46,178	47,945	96,334	69,452	259,909	
Sub-Total	32,460	23,954	11,458	50,351	25,253	33,576	7,874	48,941	60,032	128,383	132,708	411,514	
Projects financed by I.B.R.D.													
7. GENERATION													
Pasir Panjang Power Station 'B'													
1st Phase (Total Cost \$61,734,000)	9,535	5,592	2,881	325	7	-	-	-	-	-	-	-	-
2nd Phase (Total Cost \$39,253,000)	11,224	19,533	5,356	2,251	3	-	-	-	-	-	-	-	-
Jurong Power Station -	-	-	-	-	-	1,630	18,475	56,995	14,929	4,368	-	-	96,397
Stage II (2x120MW)(Total Cost \$96,397,000)	-	-	-	-	-	-	200	5,500	27,000	6,400	1,600	1,600	40,700
Stage II(Another 1x120MW)(Total Cost \$40,700,000)	-	-	-	-	-	-	-	-	-	-	-	-	-
8. DISTRIBUTION													
Tariff Survey	-	-	-	38	18	25	-	-	-	-	-	-	25
Inspection Services	-	-	-	-	8	67	50	-	-	-	-	-	117
Network Analysis	-	-	-	37	108	156	-	-	-	-	-	-	156
Programme of Works	-	-	21,183	26,132	29,707	65,237	42,125	-	-	-	-	-	107,362
Transportable Sub-Station	-	-	-	-	-	-	2,800	-	-	-	-	-	2,800
Others	-	-	-	1,429	1,293	2,128	1,576	-	-	-	-	-	3,704
Sub-Total	20,759	25,125	29,420	30,212	31,144	69,243	65,226	62,495	41,929	10,768	1,600	1,600	251,261
TOTAL - CAPITAL EXPENDITURE	53,219	49,079	40,878	80,563	56,397	102,819	73,100	111,436	101,961	139,151	134,308	662,775	

(a) Include cost of land acquisition - \$5 m. in 1973 and \$5 m. in 1975.

PUBLIC UTILITIES BOARD, SINGAPORE
ELECTRICITY DEPARTMENT - FORECAST OF DISTRIBUTION CAPITAL EXPENDITURE - DETAILS

	A C T U A L					F O R E C A S T						
	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1970-1975
	\$000's	\$000's	\$000's	\$000's	\$000's	\$000's	\$000's	\$000's	\$000's	\$000's	\$000's	\$000's
(i) 6.6 KV NETWORK -												
Land and Buildings	132	37	9	Cr. 43	23	139	190	190	190	407	231	1,347
Transformers and Switchgears				3,272	1,385	2,739	2,356	2,493	2,727	2,850	2,827	15,992
Erection, Ancillaries,				406	347	540	348	367	421	550	550	2,776
Engineering & Supervision				6,525	6,445	7,738	4,418	4,648	5,497	4,290	4,622	31,213
Mains	6,650	6,196	5,970				696	733	841	653	610	3,533
Contingency												
	10,753	9,873	8,855	10,160	8,199	11,156	8,008	8,431	9,676	8,750	8,840	54,861
(ii) 22 KV NETWORK -												
Land and Buildings	55	68	47	151	63	173	155	125	190	210	250	1,103
Transformers and Switchgears				5,017	7,475	6,992	2,628	1,522	3,258	3,582	3,867	21,849
Erection, Ancillaries,				3,479								
Engineering & Supervision				261	326	587	458	403	537	583	700	3,268
Mains	2,038	1,391	1,184	3,108	2,965	5,565	1,515	3,465	2,065	2,215	2,720	17,545
Contingency							453	525	576	610	663	2,827
Sub-Total	6,582	5,602	4,710	8,517	10,829	13,317	5,209	6,040	6,626	7,200	8,200	46,592
22 KV MAJOR CONSUMERS' PROJECTS -												
Transformers and Switchgears	-	-	-	-	-	-	1,989	2,624	2,559	3,265	2,725	13,162
Erection, Ancillaries,	-	-	-	-	-	-	85	325	279	530	450	1,669
Engineering & Supervision	-	-	-	-	-	-	2,807	2,569	3,658	3,103	2,851	14,988
Mains	-	-	-	-	-	-	488	552	649	702	611	3,002
Contingency	-	-	-	-	-	-	5,369	6,070	7,145	7,600	6,637	32,821
Sub-Total	-	-	-	-	-	-						
22 KV POTENTIAL CONSUMERS' PROJECTS -												
Transformers and Switchgears	-	-	-	-	-	-	1,930	1,798	2,122	2,800	3,020	11,670
Erection, Ancillaries, Engi-	-	-	-	-	-	-	745	258	304	543	443	2,293
neering & Supervision	-	-	-	-	-	-	2,470	2,443	2,883	2,153	2,525	12,474
Mains	-	-	-	-	-	-	490	428	506	504	412	2,340
Contingency	-	-	-	-	-	-	5,635	4,927	5,815	6,000	6,400	28,777
(iii) 66 KV NETWORK -												
Land and Buildings	427	302	115	131	279	702	320	160	-	300	600	2,082
Transformers and Switchgears				1,419	4,534	7,631	2,555	1,020	-	600	4,100	15,906
Erection, Ancillaries,				1,686								
Engineering & Supervision				49	216	568	623	635	-	-	-	1,826
Mains	4,412	1,322	3,610	3,520	2,560	28,501	5,920	7,529	3,310	22,700	18,600	86,560
Contingency							897	890	-	-	-	1,787
Sub-Total	10,478	2,788	5,411	5,119	7,589	37,402	10,315	10,234	3,310	23,600	23,300	108,161
(i) 220 KV NETWORK (proposed)												
(i) L.V. MAINS	-	-	-	-	-	-	-	-	4,142	33,884	6,325	44,351
(i) Transportable Sub-station	1,326	1,428	1,440	1,821	2,054	2,010	5,734	6,515	7,288	5,400	5,800	32,747
(vi) Reactive Power Metering Equipment	-	-	-	-	-	-	2,800	-	-	-	-	2,800
(vii) METERS	1,095	668	767	515	825	1,816	1,855	1,895	1,985	2,000	2,050	11,601
x) OTHERS	127	99	208	1,429	1,293	1,167	1,576	2,066	1,958	1,900	1,900	10,563
TOTAL - DISTRIBUTION CAPITAL EXPENDITURE	30,361	20,458	21,391	27,561	31,000	67,365	46,501	46,178	47,945	96,334	69,452	373,775

PUBLIC UTILITIES BOARD, SINGAPORE
ELECTRICITY DEPARTMENT - FORECAST OF ELECTRICITY SALES

9.10.1970.

Page E3

		Lighting & Fans			Domestic Power			Commercial & Other Industrial Power (i)		Large Industrial Power (b)			Public Lighting			Total		
		Kwh	Percentage Increase	Percentage of Total	Kwh	Percentage Increase	Percentage of Total	Kwh	Percentage Increase	Percentage of Total	Kwh	Percentage Increase	Percentage of Total	Kwh	Percentage Increase	Percentage of Total	Kwh	Percentage Increase
1965	A	174.2	3.7	19.1	250.4(a)	(6.6)	27.4	373.8	(a) 36.6	41.0	96.2	18.0	10.5	17.8	17.1	2.0	912.4	10.2
1966	C	196.7	12.9	18.3	273.7	9.3	25.5	418.0	11.8	38.9	165.5	72.0	15.4	20.9	17.4	1.9	1,074.8	17.8
1967	T	217.9	10.7	17.6	278.3	1.7	22.5	467.7	11.9	37.7	251.5	52.0	20.3	23.2	11.0	1.9	1,238.6	15.2
1968	U	241.6	10.9	16.7	276.1(b)	(0.8)	19.1	557.6	19.2	38.5	345.8	37.5	23.9	25.7	10.8	1.8	1,446.8	16.8
1969	A	261.1	8.1	15.8	305.8	10.8	18.5	626.3	12.3	37.9	431.6	24.8	26.1	28.1	9.3	1.7	1,652.9	14.2
	L																	
1970	F																	
1970	O	290.0	11.0	14.8	335.0	9.5	17.0	690.0	10.2	35.1	620.7	43.8	31.6	30.0	7.1	1.5	1,965.7	18.9
1971	R	310.0	6.9	13.8	370.0	10.4	16.4	765.0	10.9	33.9	777.5	25.3	34.5	32.0	6.7	1.4	2,254.5	14.7
1972	E	340.0	9.7	13.2	410.0	10.8	15.9	835.0	9.2	32.3	960.8	23.6	37.2	35.0	9.4	1.4	2,580.8	14.5
1973	C	375.0	10.3	12.1	455.0	11.0	14.7	950.0	13.8	30.8	1,270.8	32.3	41.2	37.0	5.7	1.2	3,087.8	19.6
1974	A	413.0	10.1	11.9	500.0	9.9	14.3	1,080.0	13.7	31.0	1,454.2	14.3	41.7	39.0	5.4	1.1	3,486.2	12.9
1975	S	455.0	10.2	11.9	555.0	11.0	14.5	1,225.0	13.4	32.0	1,547.2	6.4	40.5	41.0	5.1	1.1	3,823.2	9.7
	T																	

NOTE:

(a) Transfer of consumers to different categories.

(b) (i) Due to transfer of 7,520 accounts (3.5 million units per month) to Industrial Power w.e.f. 1.11.67. After adjustment of the 10 months' consumption of the 7,520 accounts, the 1967 figure will amount to 243.3 million units. Therefore, the real rate of increase for 1968 (i.e. 276.1 million units over 243.3 million units) is 13.5%.

(ii) The rapid rate of growth in the large industrial power sector as forecast for the period 1973/75 is mainly to meet anticipated demand by a proposed petrol-chemical complex, and expansion of a steel mill and oil refineries.

(c) The above forecast of Electricity Sales is based on the following forecast:-

	1969	1970	1971	1972	1973	1974	1975
Station maximum demand (M.W.)	328	375	457	524	647	712	780
Annual Load Factor (%)	65	68	64	64	62	64	64
Units generated (Kwh)	1876	2234	2562	2933	3509	3962	4345
Losses (% of units generated)	12	12	12	12	12	12	12

Total Commercial and Industrial Power

Year	Kwh	Percentage Increase	Percentage of Total
1965	470.0	24.7	51.5
1966	583.5	24.1	54.3
1967	719.2	23.3	58.0
1968	903.4	25.6	62.4
1969	1,057.9	17.1	64.0
1970	1,310.7	23.9	66.7
1971	1,542.5	17.7	68.4
1972	1,795.8	16.4	69.6
1973	2,220.8	23.7	71.9
1974	2,534.2	14.1	72.3
1975	2,772.2	9.6	72.5

PUBLIC UTILITIES BOARD, SINGAPORE
ELECTRICITY DEPARTMENT - FORECAST OF ELECTRICITY REVENUE FROM SALES

	Lighting and Fans			Domestic Power			Commercial & Other Industrial Power		Large Industrial Power (above 400,000 units per mth.)			Public Lighting			Total				
	A	Million Units	Average cts per unit	Revenue \$000's	Million Units	Average cts per unit	Revenue \$000's	Million Units	Average cts per unit	Revenue \$000's	Million Units	Average cts per unit	Revenue \$000's	Million Units	Average cts per unit	Revenue \$000's			
		C	T	U	A	L													
1965		174.228	14.89	25,938	250.391	6.06	15,179	373.849	5.04	18,834	96.209	3.54	3,406	17.778	7.50	1,333	912.455	7.09	64,690
1966		196.746	14.69	28,903	273.723	6.22	17,020	417.987	5.23	21,860	165.536	3.51	5,807	20.864	7.50	1,565	1,074.856	6.99	75,155
1967		217.942	14.69	32,016	278.339	7.06	19,649	467.495	5.66	26,439	251.505	3.57	8,921	23.298	7.50	1,747	1,238.579	7.17	88,822
1968		241.600	14.66	35,416	276.114	7.06	19,488	557.569	5.79	32,275	345.826	3.53	12,193	25.699	7.50	1,927	1,446.808	7.00	101,299
1969		261.107	14.65	38,243	305.760	7.06	21,575	626.320	5.74	35,944	431.579	3.65	15,774	28.135	7.50	2,110	1,652.901	6.88	113,646
1970	F O	290.000	14.66	42,514	335.000	7.00	23,450	690.000	5.75	39,675	620.700	3.30	20,483	30.000	7.50	2,250	1,965.700	6.53	128,372
1971	R	310.000	14.65	45,415	370.000	7.00	25,900	765.000	5.75	43,988	777.500	3.25	25,269	32.000	7.50	2,400	2,254.500	6.34	142,972
1972	E	340.000	14.64	49,776	410.000	7.00	28,700	835.000	5.70	47,595	960.800	3.20	30,746	35.000	7.50	2,625	2,580.800	6.18	159,442
1973	C	375.000	14.63	54,863	455.000	7.00	31,850	950.000	5.70	54,150	1,270.800	3.15	40,030	37.000	7.50	2,775	3,087.800	5.95	183,668
1974	A	413.000	14.62	60,381	500.000	7.00	35,000	1,080.000	5.70	61,560	1,454.200	3.10	45,080	39.000	7.50	2,925	3,486.200	5.88	204,946
1975	S T	455.000	14.61	66,476	555.000	7.00	38,850	1,225.000	5.70	69,825	1,547.200	3.05	47,190	41.000	7.50	3,075	3,823.200	5.89	225,416

PUBLIC UTILITIES BOARD - SINGAPORE
ELECTRICITY DEPARTMENT - FORECAST OF OPERATING COSTS

	A C T U A L					F O R E C A S T					
	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
	\$'000's	\$'000's	\$'000's	\$'000's	\$'000's	\$'000's	\$'000's	\$'000's	\$'000's	\$'000's	\$'000's
Administration	1,257	1,372	1,439	1,616	2,620	2,985 2,242	2,278	2,367	2,639	2,749	2,868
Generation - Fuel Oil:											
Pasir Panjang Power Station 'A'	16,389	12,103	6,919	7,274	7,545	5,265	6,017	7,203	7,859	2,074	3,039
Pasir Panjang Power Station 'B'	-	4,922	7,362	9,652	10,952	8,637	8,783	8,637	8,637	8,637	8,637
St. James	1,583	957	478	136	208	100	100	-	-	-	-
Jurong	-	-	-	-	821	3,861	6,878	8,896	12,782	20,575	21,112
New Power Station	-	-	-	-	-	-	-	-	-	-	1,638
Generation - Others:											
Pasir Panjang Power Station 'A'	4,367	5,056	4,157	3,764	3,560	4,626	4,775	4,944	5,041	5,190	5,337
Pasir Panjang Power Station 'B'	-	656	2,098	2,678	2,750	3,132	3,136	3,236	3,312	3,412	3,428
St James	1,145	1,078	961	772	595	680	-	-	-	-	-
Jurong	-	-	-	165	769	3,594	3,486	3,620	4,674	4,991	5,212
New Power Station	-	-	-	-	-	-	-	-	-	318	1,786
Distribution	5,613	5,988	6,190	5,249	5,004	6,159	7,428	7,677	7,867	8,075	8,283
Commercial and Hiring:											
Installation	-	-	-	428	486	538	609	630	652	675	698
Inspectorate	-	-	-	145	168	204	212	221	229	236	243
Hiring	1,642	-	-	-	35,428 2,615	36,261 24,904,111	-	-	-	-	-
Service Department's Costs	3,343	3,845	3,459	2,415	2,615	43,149 40,310	5,614	6,713	7,149	8,584	9,014
Property Tax	35,339	35,977	33,063	34,294	38,093	49,316	54,144	60,841	65,516	71,295	
	6,151	2,898	6,204	6,974	7,783	8,903 8,977	9,875	10,885	12,438	13,515	14,867
	41,490	38,875	39,267	41,268	45,876	52,126	59,191	65,029	73,279	79,031	86,162
						61,042					

PUBLIC UTILITIES BOARD, SINGAPORE
ELECTRICITY DEPARTMENT - INCOME STATEMENT

9.10.1970

Page E6

	ACTUAL (pre-conversion)	ACTUAL (commercial basis)					FORECAST					TOTAL 1970-1975
		1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	
1. Electricity Generated (Million Units)	1,047	1,236	1,424	1,639	1,876	2,234	2,562	2,933	3,509	3,962	4,344	
Less: Systems Loss	135	161	186	192	223	268	307	352	421	476	521	
Percentage Loss to Generation	12.9	13.0	13.0	11.8	12.0	12.0	12.0	12.0	12.0	12.0	12.0	
Electricity Sold	912	1,075	1,238	1,447	1,653	1,966	2,255	2,581	3,088	3,486	3,823	
2. Average Price (cents per unit sold)	7.09	6.99	7.17	7.00	6.88	6.53	6.34	6.18	5.95	5.88	5.89	
	\$000's	\$000's	\$000's	\$000's	\$000's	\$000's	\$000's	\$000's	\$000's	\$000's	\$000's	
3. Revenue from Sales	64,690	75,155	88,822	101,300	113,646	128,372	142,972	159,442	183,668	204,946	225,416	1,044,816
4. Other Revenue	2,900	920	(c) 340	325	435	420	360	360	365	365	370	2,175
5. Total	67,590	76,075	89,162	101,655	114,081	128,727	143,332	159,802	184,033	205,311	225,786	1,046,991
6. Total Cost of Operations	41,490	38,875	39,267	41,267	45,876	52,126	59,191	65,029	73,279	79,031	86,162	414,818
7. (i) Net Revenue from Operations	26,100	37,200	49,895	60,388	68,205	76,601	84,141	94,773	110,754	126,280	139,624	632,173
(ii) Net Revenue from Hire of Appliances	-	565	451	946	992	1,122	1,321	1,429	1,526	1,632	1,738	8,864
(iii) Net Revenue (Total)	26,100	37,765	50,346	61,334	69,197	77,819	85,462	96,202	112,280	127,912	141,362	641,037
8. Less Depreciation - Fixed Assets(b)	12,219	14,521	20,737	20,696	21,432	21,805	25,472	28,845	30,716	37,519	38,014	182,371
- Appliances	-	492	307	325	406	520	628	721	822	921	997	4,609
- Total	12,219	15,013	21,044	21,021	21,838	22,325	26,100	29,566	31,538	38,440	39,011	186,980
9. Return from Operations	13,881	22,752	29,302	40,313	47,359	55,494	59,362	66,636	80,742	89,472	102,351	454,057
10. Less - (i) Interest Payable	10,480	12,178	14,372	15,575	17,850	20,779	22,741	22,714	27,496	24,807	26,836	145,373
(ii) Discount Amortised	370	343	264	264	56	55	-	-	-	-	-	55
11. Total	10,850	12,521	14,636	15,839	17,906	20,834	22,741	22,714	27,496	24,807	26,836	145,428
12. Net Profit from Operations	3,031	10,231	14,666	24,474	29,453	34,660	36,621	43,922	53,246	64,665	75,515	308,629
13. Less: Sinking Fund Contributions	(a) 1,868	3,507	3,442	4,526	4,304	4,303	4,228	3,703	3,185	2,296	2,296	20,011
Insurance Fund Contributions	-	-	-	-	27	27	-	-	-	-	-	27
Add/(Less): Profit/(Loss) on Devaluations/Revaluation	-	-	4,014	-	(964)	-	-	-	-	-	-	-
14. Net Profit carried to Surplus	1,163	6,724	15,238	19,948	24,158	30,330	32,393	40,219	50,061	62,369	73,219	288,591
15. Interest Coverage - 9/10 (i)	1.3	1.9	2.0	2.6	2.7	2.7	2.6	2.9	2.9	3.6	3.8	
STATISTICS												
16. Revenue per unit Sold (Cents)												
(i) Sale of Electricity	7.09	6.99	7.17	7.00	6.88	6.53	6.34	6.18	5.95	5.88	5.89	
(ii) Other Revenue	0.32	0.08	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	
(iii) Net Profit on Hire of Appliances	-	0.05	0.04	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	
	7.41	7.12	7.24	7.09	6.97	6.61	6.42	6.25	6.01	5.94	5.95	
17. Cost per unit Sold (Cents)												
(i) Cost of Operation	4.55	3.61	3.17	2.85	2.78	2.65	2.63	2.52	2.37	2.27	2.25	
(ii) Depreciation - Fixed Assets	1.34	1.35	1.68	1.43	1.30	1.14	1.16	1.15	1.02	1.10	1.02	
(iii) Interest and Discount Amortised	1.19	1.16	1.18	1.10	1.08	1.06	1.01	0.88	0.89	0.71	0.70	
	7.08	6.12	6.03	5.38	5.16	4.85	4.80	4.55	4.28	4.08	3.97	
(iv) Sinking Fund and Principal Repayment	0.45	0.61	0.84	0.96	0.94	1.03	1.02	0.88	0.82	0.74	0.74	

(a) Sinking Fund Contributions deferred (\$1,736).

(b) 1967, 1968 and 1969 includes accelerated depreciation for St. James Power Station - plant and machinery.

(c) Excluding cost recovered.

Net Internal Cash Generation =
 [20 i] — [18 iv]

PUBLIC UTILITIES BOARD, SINGAPORE
 ELECTRICITY DEPARTMENT - CASH FLOW

9.10.1970
 Page 57

	ACTUAL (Pre-Conversion)		ACTUAL (Commercial Basis)		FORECAST							Total 1970-1975 \$000's	
	1965 \$000's	1966 \$000's	1967 \$000's	1968 \$000's	1969 \$000's	1970 \$000's	1971 \$000's	1972 \$000's	1973 \$000's	1974 \$000's	1975 \$000's		
18. Requirements of Funds													
(i) Capital Expenditure (40)	53,219	49,079	40,878	80,563 ✓	56,397 ✓	102,819	73,100	111,436	101,961	139,151	134,308	662,775	
(ii) Repayment of Refundable Deposits	(-329)	(-6,732)	(-550)	(-1,624)	(-1,201)	817	790	537	-	-	-	2,144	
(iii) Increase in Stocks (b) (41)	3,890	-	560	3,752 ✓	-	6,417	-	1,079	143	230	4,345	12,214	
(iv) Total Debt Service	(d) 12,908	18,718	24,812	29,400	33,456	41,044	45,709	45,465	52,927	50,753	55,027	290,925	
(v) Other Requirements (42)	-	(c) 1,634	-	-	1,027 ✓	(a) 1,627	(a) 8,500	(a) 8,500	-	-	-	18,627	
19. Total Requirements	70,346	76,163	66,800	115,339	91,081	152,724	128,099	167,017	155,031	190,134	193,680	986,685	
20. Sources of Funds													
(i) Cash Generated from Operations (21)	26,100	37,764	50,346	61,334	69,197	77,819	85,462	96,202	112,280	127,912	141,362	641,037	
(ii) Depreciation of Operating A/cs (22)	14	37	37	35	34	30	30	30	30	30	30	180	
(iii) Capital Receipts (1)	1,559	1,548	1,727	2,535	1,722	2,500	2,500	2,500	2,500	2,500	2,500	15,000	
(iv) Refundable Deposits (6)	630	2,139	966	1,260	715	-	-	-	-	-	-	4,138	
(v) Decrease in Stocks (11)	-	(-1,216)	-	-	(-697) ✓	-	4,138	-	-	-	-	-	
(vi) I.B.R.D. LOAN I (\$44,178)	6,732	8,222	4,203	-	-	-	-	-	-	-	-	-	
I.B.R.D. LOAN II (\$29,269)	-	22,150	4,647	2,472	-	-	-	-	-	-	-	10,292	
I.B.R.D. LOAN III (\$45,918)	-	-	42	17,694	17,890	10,292	-	-	-	-	-	62,275	
I.B.R.D. LOAN IV (\$62,730)	-	-	-	-	.455	45,334	16,113	828	-	-	-	30,600	
PROPOSED I.B.R.D. LOAN V (\$30,600)	-	-	-	-	-	745	1,267	19,395	5,014	4,179	-	101,000	
(vii) Government Loans	24,000	15,000	10,000	7,000	-	-	-	-	47,000	47,000	54,000	104,817	
(viii) Deferred Payment (e) ?	-	67	9,258	28,715	6,352	23,676	20,273	47,960	10,880	2,028	-	-	
(ix) Other Receipts	10	-	-	-	104	-	-	-	-	-	-	-	
21. Total Sources of Funds	59,045	88,143	81,226	121,045	97,066	160,396	129,783	166,915	130,704	183,649	197,892	969,339	
22. Surplus (+)/Deficit (-)	-11,301	11,980	14,426	5,706 ✓	5,985 ✓	7,672	1,684	-102	-24,327	-6,485	4,212	-17,346	
23. Cash at beginning of year	-7,002	-18,303	-6,323	8,103	13,809	19,794	27,466	29,150	29,048	4,721	-1,764	19,794	
24. Cash at end of year	-18,303	-6,323	8,103	13,809	19,794	27,466	29,150	29,048	4,721	-1,764	2,448	2,448	
Debt Service Coverage													
25. Total Cash Generated (20(i)+20(ii))	26,114	37,801	50,383	61,369	69,231	77,849	85,492	96,232	112,310	127,942	141,392	641,217	
26. Total Debt Service	(b) 14,644	18,718	24,812	29,400	33,456	41,044	45,709	45,465	52,927	50,753	55,027	290,925	
27. No. of Times Debt Service Covered	1.9	2.0	2.0	2.1	2.1	1.9	1.9	2.1	2.1	2.5	2.6	2.2	
Capital Expenditure Financing													
28. Capital Expenditure	53,219	49,079	40,878	80,563	56,397	102,819	73,100	111,436	101,961	139,151	134,308	662,775	
29. Financed from:													
(i) Internal Sources	11,186	15,620	27,154	30,388	37,685	30,444	37,131	43,151	61,740	79,459	84,520	336,445	
(ii) I.B.R.D. LOAN I (\$44,178)	6,732	8,222	4,203	-	-	-	-	-	-	-	-	-	
I.B.R.D. LOAN II (\$29,269)	-	22,150	4,647	2,472	-	-	-	-	-	-	-	10,292	
I.B.R.D. LOAN III (\$45,918)	-	-	42	17,694	17,890	10,292	-	-	-	-	-	62,275	
I.B.R.D. LOAN IV (\$62,730)	-	-	-	-	455	45,334	16,113	828	-	-	-	-	
PROPOSED I.B.R.D. LOAN V (\$30,600,000)	-	-	-	-	-	745	1,267	19,395	5,014	4,179	-	30,600	
(iii) Government Loans	24,000	15,000	10,000	7,000	-	-	-	-	-	47,000	54,000	101,000	
(iv) COFACE Loan)	-	67	9,258	28,715	725)	23,676	20,273	47,960	10,880	2,028	-	104,817	
(v) Deferred Payments)	11,301	-11,980	-14,426	-5,706	-5,985	-7,672	-1,684	102	24,327	6,485	-4,212	17,346	
(vi) Other Sources	53,219	49,079	40,878	80,563	56,397	102,819	73,100	111,436	101,961	139,151	134,308	662,775	
Note:-		1970	1970	1971	Total								
(a) For new P.U.B. Building		1,600	8,500	8,500	18,600	(e) Deferred payments							
(b) As from 1.1.70 purchases of transformers and switchgear will be charged to Capital Stock in the first instance. The values of new transformers and switchgears (\$13,893) shown under works-in-progress as at 31.12.69 has been transferred to Capital Stock.						Jurong Power Station - Stage I	18,579	1,133	.530	-	-	20,242	
(c) Inter-departmental cash adjustment on conversion.						Jurong Power Station - Stage II	-	9,796	29,167	7,236	1,328	-	47,527
(d) Sinking Fund Contributions deferred \$1,736.						Proposed Extension(Third 120mw) Distribution	-	4,700	13,700	3,500	700	-	22,600
						5,097	4,644	4,563	144	-	-	14,448	
							23,676	20,273	47,960	10,880	2,028	-	104,817

ELECTRICITY DEPARTMENT - STATEMENT OF ASSETS AND LIABILITIES

	ACTUAL (Pre-Conversion)					ACTUAL (Commercial Basis)					FORECAST			
	1965 \$000's	1966 \$000's	1967 \$000's	1968 \$000's	1969 \$000's	1970 \$000's	1971 \$000's	1972 \$000's	1973 \$000's	1974 \$000's	1975 \$000's			
ASSETS														
1. Cash/Departmental Current Account	-18,303	- 6,323	8,103	13,809	19,794	27,466	29,150	29,048	4,721	- 1,764	2,448			
2. Inventories - Stores, Capital Stock, etc.	15,288	14,072	14,632	18,384	(b) 31,580	37,997	33,859	34,938	35,081	35,311	39,656			
3. Deferred Charges	836	639	375	111	55	-	-	-	-	-	-			
4. Architect's Department - P.U.B. Building Loan (Contra)	-	-	-	-	-	1,600	10,100	18,600	17,670	16,740	15,810			
5. TOTAL CURRENT ASSETS AND DEFERRED CHARGES	- 2,179	8,388	23,110	32,304	51,429	67,063	73,109	82,586	57,472	50,287	57,914			
6. Gross Fixed Assets in Operation	388,939	437,682	458,337	494,447	599,893	679,766	764,276	812,762	953,813	1,081,164	1,266,352			
7. Less: Accumulated Depreciation	109,620	121,867	142,184	162,258	182,807	205,162	231,292	260,888	292,456	330,926	369,967			
8. Net Fixed Assets in Operation	279,319	315,815	316,153	332,189	417,086	474,604	532,984	551,874	661,357	750,238	896,385			
9. Works in progress	18,736	18,529	37,988	81,459	17,194	40,140	28,730	91,680	52,590	64,390	13,510			
10. TOTAL FIXED ASSETS	298,055	334,344	354,141	413,648	434,280	514,744	561,714	643,554	713,947	814,628	909,895			
11. TOTAL ASSETS	295,876	342,732	377,251	445,952	485,709	581,807	634,823	726,140	771,419	864,915	967,809			
LIABILITIES														
1. Refundable Deposits	7,171	2,578	2,994	2,630	2,144	1,327	537	-	-	-	-			
2. Debenture Stocks	158,059	158,059	158,059	158,059	158,059	158,059	141,629	125,659	91,299	91,299	91,299			
3. Less: Sinking Fund Investment and Cash	74,675	81,687	85,722	94,323	103,118	109,207	101,822	94,049	67,029	72,310	77,818			
4. I.B.R.D. Loans:-	83,384	76,372	72,337	63,736	54,941	48,852	39,807	31,610	24,270	18,989	13,481			
(i) Existing Loans	31,752	61,286	64,352	81,945	98,939	150,096	161,479	156,266	148,857	140,984	132,645			
(ii) Proposed Loans	-	-	-	-	-	745	2,012	21,407	26,421	30,600	30,050			
5. Government Loans	43,279	56,083	62,102	64,623	59,793	54,963	50,133	46,683	43,233	86,783	134,983			
6. Deferred Creditors	-	67	8,120	34,588	36,787	53,800	64,893	103,296	101,859	90,630	78,494			
7. NET LOANS OUTSTANDING	158,415	193,808	206,911	244,892	250,460	308,456	318,324	359,262	344,640	367,986	389,653			
8. General Reserve	42,055	49,551	64,789	84,737	108,896	139,226	188,049	244,238	328,659	391,028	464,247			
9. Sinking Fund Reserve	74,675	81,687	85,722	94,323	103,118	109,207	101,822	94,049	67,029	72,310	77,818			
10. Capital Contribution towards cost of mains, etc.	13,560	15,108	16,835	19,370	21,091	23,591	26,091	28,591	31,091	33,591	36,091			
11. TOTAL EQUITY	130,290	146,346	167,346	198,430	233,105	272,024	315,962	366,878	426,779	496,929	578,156			
12. TOTAL LIABILITIES (1+7+11)	295,876	342,732	377,251	445,952	485,709	581,807	634,823	726,140	771,419	864,915	967,809			
Average Net Fixed Assets in Operation	246,095	293,957	315,984	324,171	374,637	445,845	503,794	542,429	606,615	705,797	823,311			
Return from Operations	13,881	(a) 22,752	29,302	40,312	47,359	55,494	59,362	66,636	80,742	89,472	102,351			
Rate of Return on Average Net Fixed Assets in Operation (%)	5.60	(a) 7.70	9.30	12.44	12.64	12.45	11.78	12.28	13.31	12.68	12.43			
Debt/Equity Ratio	55/45	57/43	55/45	55/45	52/48	53/47	50/50	49/51	45/55	42/58	40/60			

(a) Actual Return for 1966 = \$18,959 (6.4%) and 1965 = \$17,674 (7.2%)
viz. over-provision for property tax \$1,133 and Depreciation \$2,660.

(b) Stocks of new transformers and switchgears totalling \$13,893 transferred
to Capital Stock as at 31.12.69.

*Prepared by Mr Philip Low
Finance*

DEFERRED CREDITS FROM 1966 TO 1970

	1966	1967	1968	1969	1970
	\$ cts	\$ cts	\$ cts	\$ cts	\$ cts
Deferred Credits:-					
Electricity Department - Jurong Power Station	-	-	26,921,729.08	2,259,994.68	18,553,547.00
- Distribution	66,899.20	10,618,117.64	1,793,491.90	3,876,211.02	4,006,757.00
Water Department				418,176.00	-
Gas Department					
Architect's Department					
	66,899.20	10,618,117.64	28,715,210.98	6,554,381.70	22,560,304.00
Less Principal Repayment:-					
Electricity Department	-	1,205,018.21	2,247,205.40	3,936,906.31	6,663,846.70
Water Department	-	-	88,637.60	88,637.60	88,637.60
Gas Department	-	91,691.58	183,383.16	183,383.16	183,383.16
Architect's Department	-	-	-	-	139,392.00
	66,899.20	1,296,709.79	2,519,226.16	4,208,927.07	7,075,259.46
BALANCE	66,899.20	9,321,407.85	26,195,984.82	2,345,454.63	15,485,044.54
Interest Charges:-					
Electricity Department	-	461,143.89	1,088,011.56	1,713,067.66	2,029,716.53
Water Department	-	4,808.28	23,990.42	18,599.31	13,281.04
Architect's Department	-	-	-	8,386.43	22,295.09
Gas Department	-	32,421.14	45,097.18	33,958.54	22,955.56
	-	498,373.31	1,157,099.16	1,774,011.94	2,088,248.22

CONTRACT NO.	NAME OF CONTRACTOR	COUNTRY OF ORIGIN	NATURE OF CONTRACT	PERIOD	RATE OF INTEREST	DEFERRED SUM	1966						
							YEARS	%	\$ cts	1966	1967	1968	
DISTRIBUTION													
PUB - 357/66	Calor Emag	Germany	30" Isocompact Ring Mains s/s	3	6	1,233,658.00	66,899		1,166,759	-	-	-	
358/66	-do-	-do-	22 kv Isocompact Switchgear	3	6	731,482.00	-	731,482	-	-	-	-	
170/185/67(2nd)	Marubeni Iida Co. Ltd.	Japan	Hitachi Transformers	5	6	513,738.00	-	513,738	-	-	-	-	
170/185/67(1st)	-do-	Japan	-do-	5	6	1,172,232.00	-	1,172,232	-	-	-	-	
169/67	-do-	-do-	Various Transformers	5	6	786,600.00	-	-	786,600	-	-	-	
Variation 70/65	Sim Lim Co. Ltd.	Singapore	66 kv Oil-filled Cables & Accessories	3	6	200,604.00	-	200,604	-	-	-	-	
198/67	-do-	-do-	-do-	3	6	2,468,799.00	-	2,468,799	-	-	-	-	
12/67	Sandilands Buttery Co.Ltd.	Jurong Town Corporation	Volts Transformers	3	6	110,976.00	-	110,976	-	-	-	333,234	
		-do-	Land for Qrs. (Daily-Rated)			333,234.00	-	-	-	-	-	-	
		-do-	Land for J.P.S.			2,893,424.00	-	2,893,424	-	-	-	-	
		-do-	Land for Qrs. (Snr. & Jnr.)			418,176.00	-	-	-	-	-	418,176	
		-do-	Land for Oil Fuel Tank			2,088,789.00	-	-	-	-	-	2,088,789	
		-do-	66 kv Metal-Glad Switchgear	5	6	1,454,276.00	-	-	-	-	1,006,892	447,384	
200/67	Calor-Emag	Germany	22 kv Supervisory Control Equipment	7	6	672,353.00	-	-	-	-	-	556,182	104,941
418/69	Cogalex	France	-do-	Extensions & 66 kv Sup. Control Equipment	7	6	833,011.00	-	-	-	-	-	444,798
360/70	-do-	-do-	Extensions to 22 kv Supervisory Control Equipment	7	6	921,812.00	-	-	-	-	-	-	242,711
361/70	-do-	-do-	-do-	Spares for 66kv Switchgear and other spares	7	6	1,245,856.00	-	-	-	-	169,022	270,352
205/70	-do-	-do-	-do-	Equipment for upgrading of 66 kv Switchgear	7	5½	935,120.00	-	-	-	-	-	1,740
93/70(A)	-do-	-do-	-do-	66 kv Sulphur Hexafluoride	7	5½	2,891,837.00	-	-	-	-	-	-
93/70(B)	-do-	-do-	-do-	Spare parts for existing 66 kv Switchgear	7	5½	398,736.00	-	-	-	-	-	-
93/70(C)	-do-	-do-	-do-	66 kv Sulphur Hexafluoride Equipment	7	5½	2,916,801.00	-	-	-	-	-	-
93/70(D)	-do-	-do-	-do-	Supervisory Control Equipment	7	5½	1,648,360.00	-	-	-	-	-	-
362/70	-do-	-do-	-do-	Equipment for uprating of 66 kv s/gear at P.P.'B'P.S.	7	5½	295,360.00	-	-	-	-	-	-
	-do-	-do-	-do-	66 kv Sulphur Hexafluoride s/gear (GUL-Channel)	7	5½	2,474,332.00	-	-	-	-	-	-
	-do-	-do-	-do-	Supervisory Control Equipment for 66 kv & 22 kv s/s	7	5½	1,119,813.00	-	-	-	-	-	-
Coface IV	-do-	-do-	-do-	66 kv Sulphur Hexafluoride Switchgear	7	5½	6,867,623.00	-	-	-	-	-	-
	-do-	-do-	-do-	Mod. Equipment for 66kv Sulphur Hexafluoride s/gear	7	5½	1,053,400.00	-	-	-	-	-	-
	-do-	-do-	-do-	Supervisory Control Equipment for 66 kv & 22kv s/s	7	5½	989,400.00	-	-	-	-	-	-
	-do-	-do-	-do-	Current Transformers Isolator Components	7	5½	186,300.00	-	-	-	-	-	-
61/70	Dainichi-Nippon	Japan				1,745,616.00	-	-	-	-	-	281,600	1,196,600
830/70	E.C. Pauwels	Belgium				1,478,200.00	-	-	-	-	-	-	1,745,616
							66,899	9,258,014	1,793,492	4,294,337	4,006,752		

CONTRACT NO.	NAME OF CONTRACTOR	COUNTRY OF ORIGIN	NATURE OF CONTRACT	PERIOD	RATE OF INTEREST	DEFERRED SUM \$ cts	1966				
							1967	1968	1969	1970	
P.S.J. 5	Ishikawajima Harima Heavy Industries Ltd.	Japan	Structural Steelworks for buildings	15	5½	2,416,051.90			2,416,052	-	-
P.S.J. 10	Hitachi Co. Ltd.		60,000 kw CMR Turbo-Alternat Condensing Plant & Auxiliary Apparatus	15	5½	8,433,340.44		333,837	40,911	-	-
P.S.J. 11	Ishikawajima Harima Heavy Industries Ltd.	Japan	Boiler Units, Oil firing Equipment and other associated plants.	15	5½	740,699.42		8,322,337	111,003	-	22,500
P.S.J. 12	Hitachi Co. Ltd.		High and Low Pressure Piping Equipment and valves	12½	5½	1,939,125.80		500,485	217,715	-	-
P.S.J. 13	Harland Engineering Co. Ltd.	England Japan	Boiler Feed Pumps	4½	6	462,790.60		5,634,900	250,504	-	-
P.S.J. 14	Hitachi Co. Ltd.		Circulating Water Pumps and Pumphouse Equipment	7	5½	371,434.20		1,621,800	270,575	-	-
P.S.J. 16	Marubeni-Iida Co. Ltd.	Japan	Boiler Make-up Water Treatment Plant and Condensate Chemical Treatment Plant	12½	5½	979,011.00		1,896,745	42,381	-	-
P.S.J. 19	C. Itoh Co. Ltd.		66 kv Generator Transformers	4	6	146,636.10		317,881	135,910	8,999	-
P.S.J. 21	Compagnie Generale D'Enterprises Elect. Brown, Boveri & Co. Ltd.	France Switzerland	66 kv Indoor Switchgear	10	5½	414,137.96		371,434	-	-	-
P.S.J. 22			3.3 Auxiliary Switchgear	7	6	609,197.70		926,046	52,965	-	-
P.S.J. 23	Compagnie Generale D'Enterprises Electriques (Cogelex)	France	415 Volt Switchgear	5	5½	42,543.50		109,079	37,557	-	-
P.S.J. 24	Compagnie Generale D'Enterprises Electriques		66 kv Supervisory Control Equipment	5	5½	2,060,210.00		414,138	-	-	-
P.S.J. 35	Mitsui & Co. Ltd.	Japan	66 kv and Lower Voltage Cables and Accessories	13	6	588,587.93		-	-	-	-
P.S.J. 36	Mitsubishi-Shoji Kaishi Ltd.		2 x 12.5 NVA 66/33 kv Station Transformers	5	5½	16,828.23		609,197	1	42,064	480
P.S.J. 41	Hitachi & Co. Ltd.	Japan	Turbo Alternators Condensing Plant and Auxiliary Apparatus	7	6	255,239.25		1,923,600	131,652	4,958	-
P.S.J. 42	Ishikawajima Harima Heavy Industries		Boiler Units, Oil Firing Equipment and other plants	15	5½	9,843.22		476,123	112,465	-	-
P.S.J. 43	Hitachi & Co. Ltd.	Japan	Piping Equipment	7	6	443,585.47		-	16,828	-	-
P.S.J. 44	Harland Engineering Co. Ltd.		Boiler Feed Pumps	15	5½	-		91,896	163,443	4,021	5,822
P.S.J. 49	C. Itoh & Co. Ltd.	Japan France	General Transformers	5	6	-		-	-	-	203,910
P.S.J. 51	Compagnie Generale D'Enterprises Elect.		66 kv Indoor Switchgear	5	6	545,728.68		540,000	1,794	3,989	-
P.S.J. 53	Compagnie Generale D'Enterprises Elect.	France	Auxiliary Switchgear	5	5½	235,950.40		191,852	(-546)	816	-
P.S.J. 60	Mitsui Co. Ltd.		66 kv and Lower Voltage	2	6	8,473,166.68		-	123,905	8,340,712	-
P.S.J. 52	Brown, Boveri & Co. Ltd.		Auxiliary Switchgear	3½	5½	739,468.22		-	652,500	-	-
						5,299,448.00		-	5,299,448	-	-
						1,871,783.10		-	1,710,000	-	-
						1,465,084.80		-	1,452,942	-	-
						391,170.00		-	20,114	-	-
						505,286.40		-	316,707	-	-
						412,465.67		-	493,543	-	-
						447,058.59		-	-	-	-
						80,529.89		224,327	188,138	97,524	-
						210,318.30		-	79,465	-	-
						264,742.59		-	149,703	-	-
						49,026,849.79		26,921,729	2,269,993	18,553,547	6,112