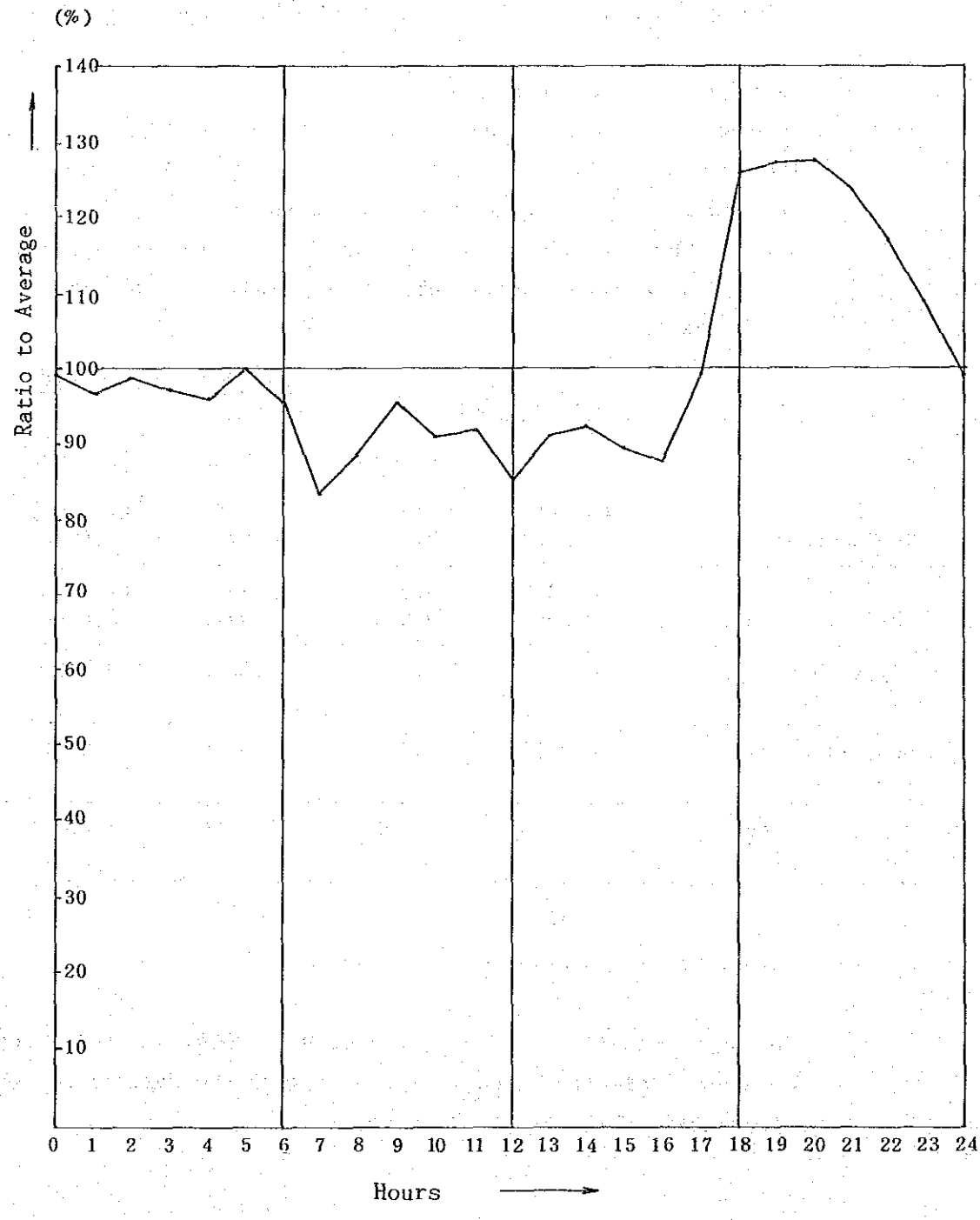
Fig. A-3 Standard Weekday Load Curve in East Java System



iv) to compare this load curve with the given system load curve and revise every assumed curves in order to decrease the differences at each hour under the condition that each daily sold energy should be fixed.

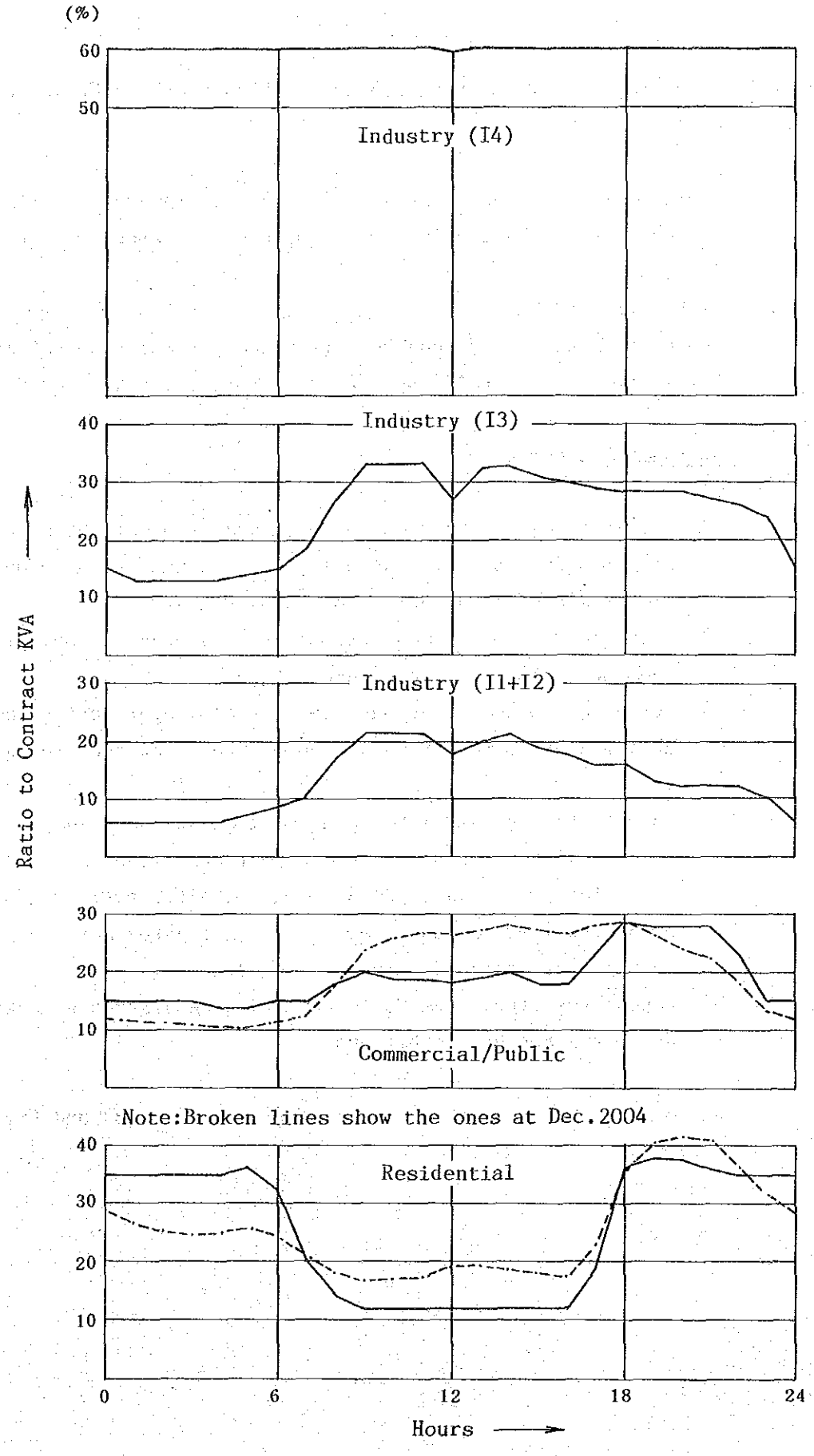
is required as the next procedure.
An example of this procedure is illustrated on Supplement B. The results of this approach are shown on Fig. A-4; and the final result is highly precise as shown on Fig. A-5(3). Hereby, the following demand conversion factors which contain no losses should be applicable at the middle of 1983/84 (September).

	for Contract kVA		for Weekday Average Demand	
	14 hours	19 hours	14 hours	19 hours
Residential	(0.1819) 0.1200	(0.4010) 0.3800	(0.7153) 0.4720	(1.5768) 1.4940
Commercial/Public	(0.2806) 0.2000	(0.2639) 0.2800	(1.3915) 1.0410	(1.3096) 1.4580
Light Industry (I1 + I2)	0.2100	0.1300	1.5650	0.9690
Heavy Industry (I3)	0.3250	0.2850	1.3340	1.1700
Heavy Industry (I4)	0.6000	0.6000	1.0000	1.0000

(3) Future Transfiguration of Load Curves

In the remote future, for instance, Dec. 2004, the following changes of electric uses will transfigure the residential or commercial/public use load curves.

Fig. A-4 Standard Load Curves by Use



Supplement B Illustration for Decision Process of Standard Load Curves by Use

Table A-3(1)~(3) and Fig. A-5(1)~(3) are prepared for illustration ; they show the iterative approaching aspect over three (3) stages.
After prepared Table A-2 , the ratios of weekday average demand to contract kVA can be determined for each use category. Hereafter, we will call them "Load factor to contract capacity"

Approach Procedure

1) Assume trial load curves for each use category, so as to each one has the daily quantity which equals twenty-four (24) times of load factor to contract kVA.
2) Convert this load curves into MW base by means of multplying contract capacity of each use category.
3) Obtain a tentative weekday load curve by aggregating those MW for every categories, and normalize it on the average value.
4) Compare this curve with the normalized standard weekday load curve which are obtained in a manner described in the foregoing paragraph and shown on Fig.A-3; alter every tentatively estimated load curves so as to the aggregated curve approaches to the standard curve mentioned.
5) Repeat the steps from 2) to 4) until the diference mentioned above reaches negligible one.

As for the concrete method, refer Table A-3(1)~(3) and Fig. A-5(1)~(3).

Table. A-3(1) Approach to Standard Load Curves by Use

	Residential % per contract/MW	Comm/Pub % per contract/MW	I1+I2 % per contract/MW	I3 % per contract/MW	I4 % per contract/MW	Total MW / % per ave.	System L.C.(% per ave.)
1	30 / 95.84	15 / 26.01	8 / 7.69	15 / 30.83	49 / 46.16	206.53/ 88.2	97
2	〃 / 〃	〃 / 〃	6 / 5.77	11 / 22.61	〃 / 〃	196.39/ 83.9	97
3	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	196.39/ 83.9	97
4	〃 / 〃	14 / 24.28	〃 / 〃	〃 / 〃	〃 / 〃	194.66/ 83.2	96
5	〃 / 〃	15 / 26.01	〃 / 〃	〃 / 〃	〃 / 〃	196.39/ 83.9	99
6	25 / 79.87	14 / 24.28	〃 / 〃	〃 / 〃	〃 / 〃	178.69/ 76.4	95
7	21 / 67.09	15 / 26.01	12 / 11.53	19 / 39.05	〃 / 〃	189.84/ 81.1	83
8	18.4 / 58.78	19 / 32.95	17 / 16.34	29 / 59.61	59 / 55.58	223.26/ 95.4	88
9	19.0 / 60.70	18 / 31.21	19 / 18.26	32 / 65.78	70 / 65.94	241.89/103.4	93
10	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	92
11	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	92
12	〃 / 〃	〃 / 〃	18 / 17.30	30 / 61.67	68.7 / 64.72	235.60/100.6	85
13	〃 / 〃	〃 / 〃	19 / 18.26	32 / 65.78	64 / 60.29	236.24/100.9	91
14	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	70 / 65.94	241.89/103.4	92
15	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	69 / 65.00	240.95/103.0	89
16	〃 / 〃	〃 / 〃	18 / 17.30	31 / 63.72	〃 / 〃	237.93/101.7	88
17	23 / 73.48	23 / 39.88	17 / 16.34	30 / 61.67	〃 / 〃	256.37/109.5	99
18	32 /102.23	29 / 50.29	16 / 15.38	29.6 / 60.84	64 / 60.29	289.03/123.5	126
19	33 /105.42	28 / 48.55	12 / 11.53	29 / 59.61	59 / 55.58	280.69/119.9	127
20	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	280.69/119.9	127
21	32 /102.23	〃 / 〃	〃 / 〃	28 / 57.55	〃 / 〃	275.44/117.7	123
22	31 / 99.03	23 / 39.88	〃 / 〃	26 / 53.44	〃 / 〃	259.46/110.9	117
23	30 / 95.84	20 / 34.68	〃 / 〃	23 / 47.28	〃 / 〃	244.91/104.6	108
24	〃 / 〃	16 / 27.75	〃 / 〃	19 / 39.05	〃 / 〃	229.75/ 98.2	99
total	610.4/1,950.03	461.0 /799.37	322.0 /309.47	584.6/1,201.66	1,499.7/1,336.24	5,616.77/2,400.0 (234.032)	2,400
contract MVA	(319.46)	(173.41)	(96.10)	(205.55)	(94.20)		

Fig. A-5(1) Approach to Standard Load Curves by Use

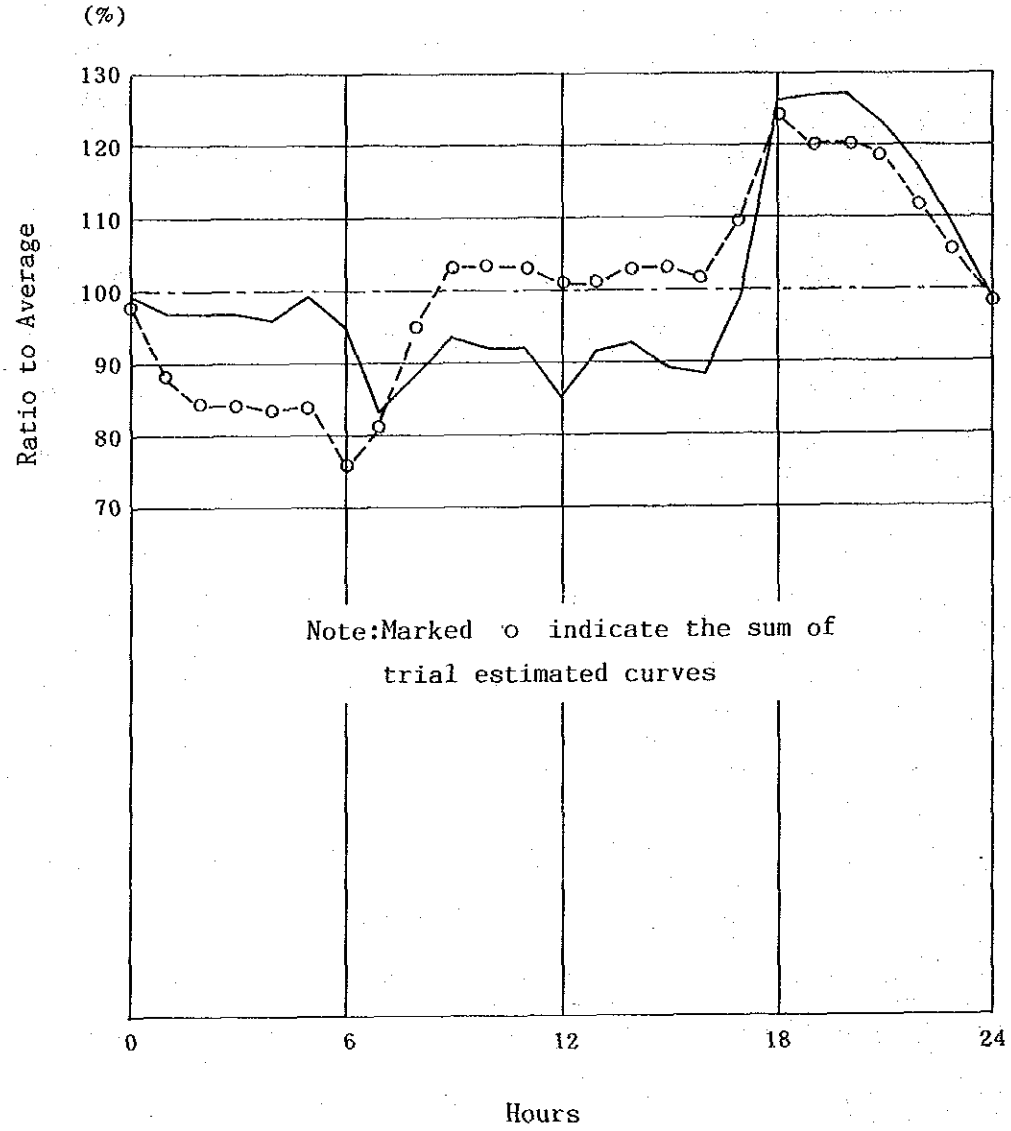


Table. A-3(2) Approach to Standard Load Curves by Use

	Residential % per contract/MW	Comm/Pub % per contract/MW	I1+I2 % per contract/MW	I3 % per contract/MW	I4 % per contract/MW	Total MW / % per ave.	System L.C.(% per ave.)
1	35 /111.8	15 / 26.01	8 / 7.69	16 / 32.89	60 / 56.52	234.91/100.4	97
2	〃 / 〃	〃 / 〃	6 / 5.77	13.4 / 27.54	〃 / 〃	227.64/ 97.3	97
3	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	227.64/ 97.3	97
4	〃 / 〃	14 / 24.28	〃 / 〃	〃 / 〃	〃 / 〃	225.91/ 96.5	96
5	〃 / 〃	15 / 26.01	〃 / 〃	〃 / 〃	〃 / 〃	227.64/ 97.3	99
6	28 / 89.45	14 / 24.28	〃 / 〃	〃 / 〃	〃 / 〃	203.56/ 87.0	95
7	21 / 67.09	15 / 26.01	12 / 11.53	19 / 39.05	〃 / 〃	200.2 / 85.5	83
8	17.4 / 55.59	19 / 32.95	17 / 16.34	28 / 57.55	〃 / 〃	219.0 / 93.6	88
9	12 / 38.34	18 / 31.21	19 / 18.26	31 / 63.72	〃 / 〃	208.1 / 88.9	93
10	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	92
11	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	92
12	〃 / 〃	〃 / 〃	18 / 1730	29 / 59.61	59.7 / 56.24	202.7 / 86.6	85
13	〃 / 〃	〃 / 〃	19 / 18.26	31 / 63.72	60 / 56.52	208.1 / 88.9	91
14	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	92
15	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	89
16	〃 / 〃	〃 / 〃	18 / 17.30	30 / 61.67	〃 / 〃	205.0 / 87.6	88
17	23 / 73.45	23 / 39.88	17 / 16.34	29.6 / 60.84	〃 / 〃	247.0 /105.6	99
18	35 /111.80	29 / 50.29	16 / 15.38	28 / 57.55	〃 / 〃	291.5 /124.6	126
19	37 /118.2	28 / 48.55	12 / 11.53	〃 / 〃	〃 / 〃	292.4 /124.9	127
20	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	127
21	36 /115.0	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	289.2 /123.6	123
22	35 /111.82	23 / 39.88	〃 / 〃	26 / 5344	〃 / 〃	273.2 /116.7	117
23	〃 / 〃	20 / 34.68	〃 / 〃	23 / 47.28	〃 / 〃	261.8 /111.9	108
24	〃 / 〃	16 / 27.75	〃 / 〃	19 / 39.05	〃 / 〃	246.7 /105.4	99
total	610.4/1,949.9	461.0 /799.37	322.0 /309.47	584.6/1,201.6	1,439.7/1,366.20	5,617.00/2,400.1 (234,032)	2,400
contract MVA	(319.46)	(173.41)	(96.10)	(205.55)	(94.20)		

Fig. A-5(2) Approach to Standard Load Curves by Use

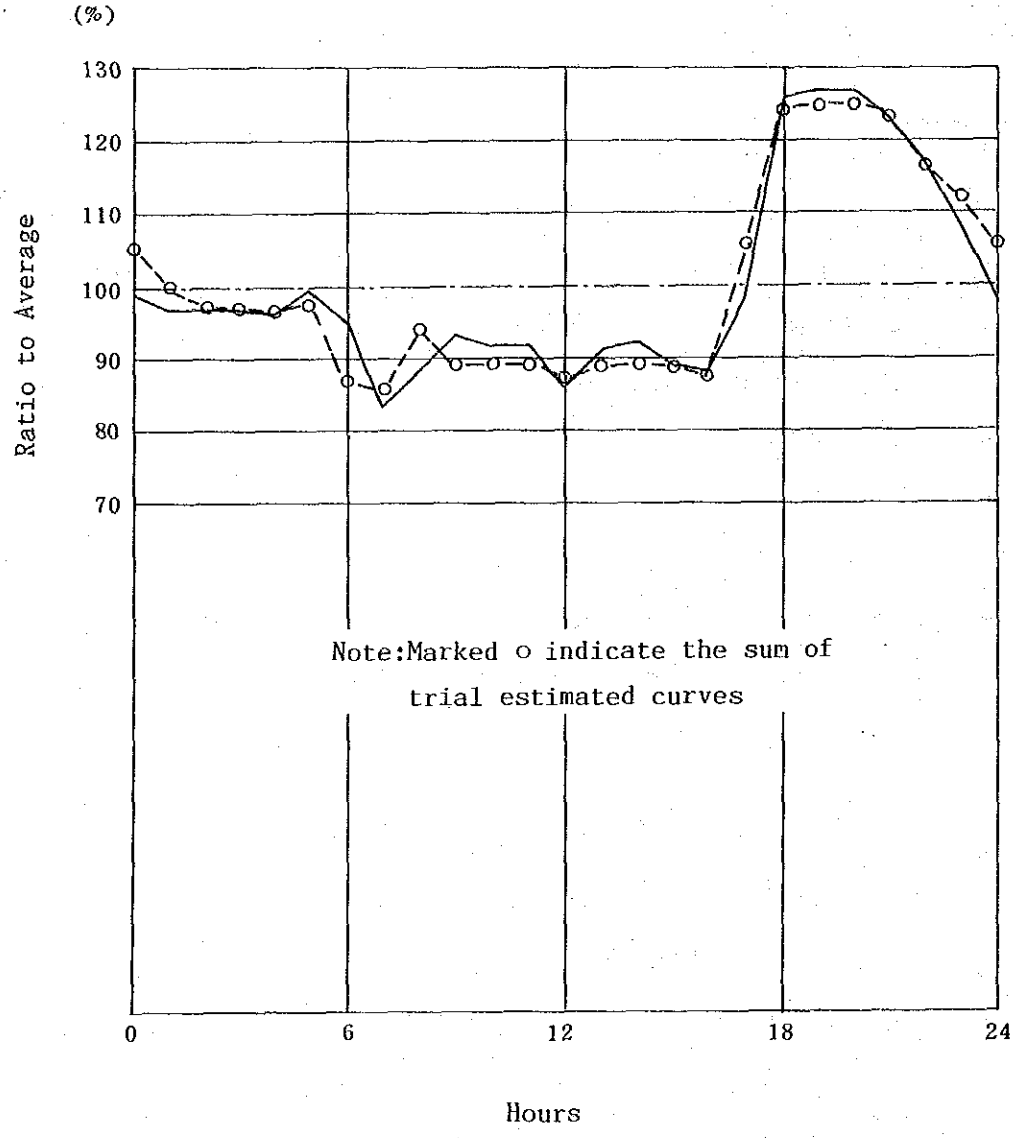


Table. A-3(3) Approach to Standard Load Curves by Use

	Residential % per contract/MW	Comm/Pub % per contract/MW	I 1 + I 2 % per contract/MW	I 3 % per contract/MW	I 4 % per contract/MW	Total MW / % per ave.	System L.C.(% per ave.)
1	35 /111.81	15 / 26.01	6 / 5.77	13 / 26.72	60 / 56.52	226.83/ 96.9	97
2	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	97
3	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	97
4	〃 / 〃	14 / 24.28	〃 / 〃	〃 / 〃	〃 / 〃	225.10/ 96.2	96
5	36 /115.01	〃 / 〃	7 / 6.73	14 / 28.78	〃 / 〃	231.32/ 98.8	99
6	32 /102.23	15 / 26.01	8 / 7.69	15 / 30.83	〃 / 〃	223.28/ 95.41	95
7	20 / 63.89	〃 / 〃	10 / 9.61	19 / 39.05	〃 / 〃	195.08/ 83.36	83
8	14.4 / 46.00	18 / 31.21	17 / 16.34	27 / 55.50	〃 / 〃	205.57/ 87.8	88
9	12 / 38.34	20 / 34.68	21 / 20.18	33 / 67.83	〃 / 〃	217.35/ 93.0	93
10	〃 / 〃	19 / 32.95	〃 / 〃	〃 / 〃	〃 / 〃	215.82/ 92.2	92
11	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	〃 / 〃	92
12	〃 / 〃	18 / 31.21	18 / 17.30	27 / 55.50	59.7 / 56.24	198.59/ 84.9	85
13	〃 / 〃	19 / 32.95	20 / 19.22	32 / 65.78	60 / 56.52	212.81/ 90.9	91
14	〃 / 〃	20 / 34.68	21 / 20.18	32.5 / 66.80	〃 / 〃	216.52/ 92.5	92
15	〃 / 〃	18 / 31.21	19 / 18.26	31 / 63.72	〃 / 〃	208.05/ 88.9	89
16	〃 / 〃	〃 / 〃	18 / 17.30	30 / 61.67	〃 / 〃	205.04/ 87.6	88
17	19 / 60.70	23 / 39.88	16 / 15.38	28.6 / 58.79	〃 / 〃	231.27/ 98.8	99
18	36 /115.01	29 / 50.29	〃 / 〃	28.5 / 58.58	〃 / 〃	295.78/126.4	126
19	38 /121.39	28 / 48.55	13 / 12.49	〃 / 〃	〃 / 〃	297.53/127.1	127
20	〃 / 〃	〃 / 〃	12 / 11.53	〃 / 〃	〃 / 〃	296.57/126.7	127
21	36 /115.01	〃 / 〃	〃 / 〃	27 / 55.50	〃 / 〃	287.11/122.7	123
22	35 /111.82	23 / 39.88	〃 / 〃	26 / 53.44	〃 / 〃	237.19/116.7	117
23	〃 / 〃	15 / 26.01	10 / 9.61	24 / 49.33	〃 / 〃	253.29/108.2	108
24	〃 / 〃	〃 / 〃	6 / 5.77	15 / 30.83	〃 / 〃	230.95/ 98.7	99
total	610.4 /1,950.05	461.0 /799.38	322.0 /309.47	584.6 /1,201.63	1,439.7/1,356.20	5,616,73/2,399.8 (234,032)	2,400
contract KVA	(31946)	(173.41)	(96.10)	(205.55)	(94.20)		

Fig. A-5(3) Approach to Standard Load Curves by Use

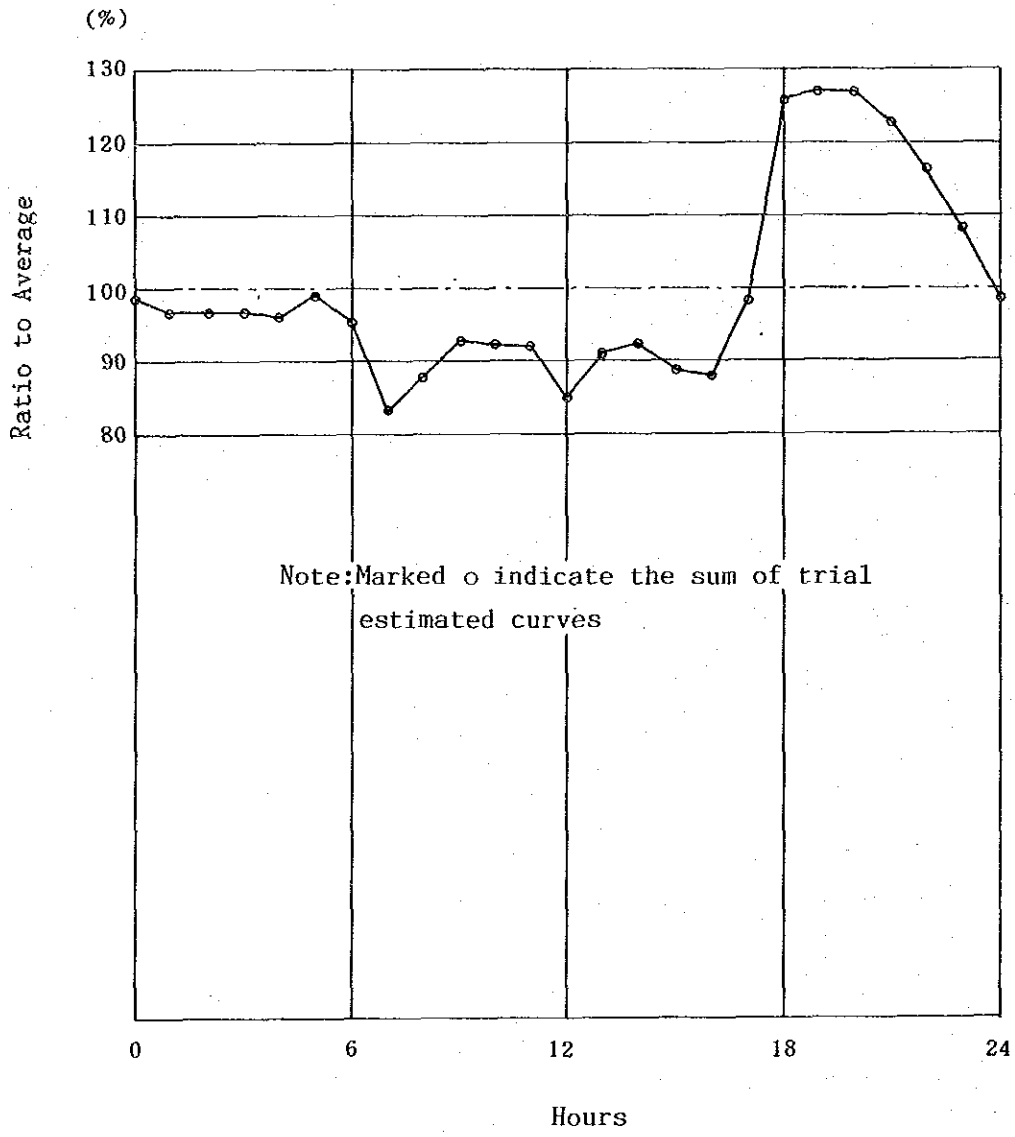


Table. A-4(1) Residential Load Curve in Summer

〔Present Status in a Developed Country for Reference to Forecast Future Status in East Java〕

time	Developed Country		East Java 1983/84	Halving of East Java & Developed Country	
	% to ave. (integrated)	% to ave. (indicated)	% to ave. (do)	% to ave. (do)	% to contract (do)
1	79.8	71.7	137.61	104.66	26.62
2	63.6	60.4	"	99.01	25.18
3	57.2	57.25	"	97.43	24.78
4	57.3	58.6	"	98.11	24.95
5	59.9	59.4	141.55	100.48	25.56
6	58.9	67.3	125.82	96.56	24.56
7	75.7	82.7	78.64	80.67	20.52
8	89.7	86.95	56.62	71.79	18.26
9	84.2	83.95	47.18	65.57	16.68
10	83.7	84.4	"	65.79	16.73
11	85.1	88.7	"	67.94	17.28
12	92.3	101.15	"	74.17	18.86
13	110.0	105.5	"	76.34	19.42
14	101.0	97.7	"	72.44	18.42
15	94.4	94.0	"	70.59	17.95
16	93.6	93.0	"	70.09	17.83
17	92.4	104.6	74.71	89.66	22.80
18	116.8	136.65	141.55	139.1	35.38
19	156.5	166.55	149.41	157.98	40.18
20	176.6	177.75	"	163.58	*41.60
21	178.9	175.95	141.55	158.75	40.38
22	173.0	150.65	137.61	144.13	36.66
23	128.3	109.7	"	123.66	31.45
24	91.1	85.45	"	111.53	28.37

* This percentage to contract kVA is calculated on the supposition that it is in inverse proportion to the load factor. Namely, 38%x163.58/149.41= 41.6%.

Table. A-4(2) Commercial/Public Load Curve in Summer

(Present Status in a Developed Country for Reference to Forecast Future Status in East Java)

time	Developed Country		East Java 1983/84	Halving of East Java & Developed country	
	% to ave. (integrated)	% to ave. (indicated)	% to ave. (do)	% to ave. (do)	% to contract (do)
1	36.1	36.0	78.09	57.0	11.51
2	35.9	34.7	"	56.35	11.38
3	33.5	33.05	"	55.57	11.22
4	32.6	32.55	72.89	52.22	10.54
5	32.5	32.45	"	52.67	10.64
6	32.4	35.65	78.09	56.87	11.48
7	38.9	49.15	"	63.62	12.85
8	59.4	82.55	93.71	88.13	17.80
9	105.7	129.1	104.12	116.61	23.55
12	152.5	159.5	98.92	129.21	26.09
11	166.5	168.9	"	133.91	27.04
12	171.3	170.5	93.71	132.11	26.68
13	169.7	173.25	98.92	136.09	27.48
14	176.8	176.65	104.12	140.39	28.35
15	176.5	176.5	93.71	135.11	27.28
16	"	173.7	"	133.71	27.00
17	170.9	159.7	119.74	139.72	28.21
18	148.5	136.25	150.98	143.62	*29.00
19	124.0	115.0	145.77	130.39	26.33
20	106.0	96.35	"	121.06	24.44
21	86.7	78.35	"	112.06	22.63
22	70.0	61.6	119.74	90.67	18.31
23	53.2	48.55	78.09	63.32	12.79
24	43.9	40.0	"	59.05	11.92

* Present value in East Java is applied.

Domestic Uses

Various uses other than minimum lighting, including television, refrigerator, cooking and air conditioning will grow remarkably; so it will bring more higher demand which accompanies people's activity and make the share in midnight lowered.

Commercial Uses

The demand for office building should be expected to make remarkable growth; so it will bring higher demand in the working hours of offices, consequently the share in the other hours will be lowered.

The load curves for residential or commercial/public uses in Dec. 2004 shown on Fig. A-4 using broken lines are obtained by halving present statuses for East Java and for KEPCO in Japan in summer. (Refer Table A-4(1),(2))
Consequently, those demand conversion factors at Dec. 2004 which contain no losses should be changed into the values which given in parentheses on the table mentioned.
For all of the other future time points, simple interpolation have been applied.

(4) Formulation of Distribution Loss Rate for Every Cabangs

According to PLN's data and targets of distribution line loss rate which obtained by the following expression,

$$\text{loss rate} = \frac{\text{Esub} - \text{Ecus}}{\text{Esub}} * 100 \quad (\%)$$

where Esub: energy sent out of substations
Ecus: energy supplied to customers,

it in general decreases monotonously year by year[1)] and approaches a final saturation value ten (10.0) percent. (Refer Table A-5)

A trend curve which called "modified exponential curve" and expressed by the formula shown on Table A-6 is adequate to express such trend.

Note 1) As a particular case, in Cabang Banyuwangi most of whose customers are supplied by tariff S1 at present, it is considered that the loss rate will increase year by year and will infinitely approach to ten (10.0) percent; because many S1 customers whose consumption time in a month is calculated but any measurement so long as five hundred (500) hours per month because of without meters.
This estimation results too much apparent energy sales and too less loss evaluation that is 8.31%, 1983/84.
On the other hand, the increase of number of customers with meter will lead to decrease of such an error; as the results the apparent loss rate will increase year by year in such a case.

The coefficients of the modified exponential functions which obtained by means of regressive analysis for each Cabang are shown on Table A-6.
These formulas are used when convert each demand into the one at substation.

Table. A-5 Target of Distribution Losses by Cabang [%]

Cabang \ F Y	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94
Surabaya Utara	15.93	15	14	13	12	11	10	10	10	10	10
Surabaya Selatan	20.97	19	17	15	13	12	11	10	10	10	10
Bojonegoro	40.05	20	18	16	13	12	11	10	10	10	10
Malang	21.87	19	17	15	13	12	11	10	10	10	10
Pasuruan	23.33	20	18	15	13	12	11	10	10	10	10
Kediri	19.03	17	16	14	13	12	11	10	10	10	10
Mojokerto	18.66	17	15	14	13	12	11	10	10	10	10
Madiun	16.71	15	14	13	12	11	10	10	10	10	10
Jember	16.09	15	14	13	12	11	10	10	10	10	10
Banyuwangi	8.31	9	10	10	10	10	10	10	10	10	10
Situbondo	17.28	16	15	14	13	12	11	10	10	10	10
Pamekasan	10.95	10	10	10	10	10	10	10	10	10	10

Table. A-6 Distribution Loss Formulas for Each Cabang

(loss rate) = K+S*(exp A)*(exp B)**t [%];

where k=10.0

S=-1 for Cabang Banyuwangi

S=+1 for all of the other Cabangs

t is expressed by dominical years considered t = 0.0 in Dec.1900.

The values of exp A and exp B are determined by applying regressive analysis to the data of PLN for each Cabang. Those results obtained are shown on the following table.

Constant / Cabang	K	S	A	B
Surabaya Utara	10.0	+ 1	27.04162	-0.3040436
Surabaya Selatan	10.0	+ 1	31.00065	-0.3443655
Bojonegoro	10.0	+ 1	49.48337	-0.5582369
Malang	10.0	+ 1	32.17167	-0.3579769
Pasuruan	10.0	+ 1	34.25163	-0.3815969
Kediri	10.0	+ 1	28.06051	-0.3116261
Mojokerto	10.0	+ 1	27.57348	-0.3064051
Madiun	10.0	+ 1	29.14473	-0.3285625
Jember	10.0	+ 1	27.47745	-0.3091248
Banynwangi	10.0	- 1	61.03855	-0.7307686
Situbondo	10.0	+ 1	24.25191	-0.2680974
Pamekasan	10.0	+ 1	59.77571	-0.7241021

A.4 Demand Forecast for Each Substation

In East Java, each Cabang is divided into ten(10) and less zones, and those locations are roughly shown on Table A-7.
If the demand at a specified time is forecasted for every zones by means of the procedure mentioned in the preceeding paragraph, the demand at a substation could be forecasted by combining these ones for all zones which fed from this substation.
The present supply areas of each substation in East Java have been estimated as a set of zones mentioned above with reference to maps which roughly show the locations of every substations and distribution lines and to the latest actual load of each substation and so on.
Further, for a zone which seems to be fed by several substations, the supply area has been set up as a combination of one tenth of a zone.
Next, considering the yearly increasing feature of the demand of each substation, alterations of supply area have been planned yearly so as to transfer demand from heavy loaded substations to newly installed or light loaded substations. These contents are shown on Table A-8.

(1) Computerized Calculation

Basing on the method mentioned in the preceeding paragraph, we have developed a computer program including vast itterative calculations of trend analysis and executed a series of computerized calculation which use a large sized computer.
A part of the many outcomes obtained will be described as an extraction.

a. Demand Conversion Factors.

Table A-9 shows the demand conversion factors which are used to convert contract kVA or weekday average demand into peak demand by year, by use category and by time (nineteen hours or fourteen hours).
The meanings of figures in the columns of M,K,L are as follows;

Table. A-7 Major Towns Included in Each Zone

(1/3)

Cabang	zone code	Major Towns/Villages
Surabaya	0 1	Genteng
	0 2	Bubutan, Tandes
	0 3	Pabean, Cantian
	0 4	Semampir, Simokerto, Tambaksari
	0 5	Sukolilo
	0 6	Gresik, Bungoh
	0 8	Krembangan
Surabaya Selatan	1 0	Krian, Wonoayu, Wringinanom
	1 1	Sawahan, Tegalsari
	1 2	Menganti, Kademean, Driyorejo, Karangpilang
	1 3	Wonokromo, Wonocolo
	1 4	Gubeng
	1 5	Rungkut, Waru
	1 6	Taman
	1 7	Lakor
	1 8	Sidoarjo, Tanggulangin, Krembung
Bojonegoro	1 1	Bojonegoro
	1 2	"
	1 3	"
	1 4	"
	1 5	"
	1 6	Tuban, Semanding, Tasikmadu
	1 7	Lamongan, Babad
	1 8	Tuban
Malang	1 1	North-East Part of Malang City
	1 2	East "
	1 3	North "
	1 4	North-West "
	1 5	South "
	1 6	West "
	1 7	Lawang, Bedali, Bululawang, Batu, Selekta
	1 8	Singosari, Tumpang, Poncokusumo
	1 9	Turen, Dampit, Sukorejo, Ngantang

Cabang	zone code	Major Towns/Villages
Pasuruan	1 0	Pasuruan, Plered
	1 1	Probolingo, Leces
	1 2	Kraksaan, Pajarakan
	1 3	Bangil, Beji
	1 4	Pandaan
	1 5	Tretes
	1 6	Porong, Gempol,
Kediri	1 0	Trenggalek, Pogalan
	1 1	South Part of Kediri City
	1 2	East "
	1 3	West "
	1 4	North "
	1 5	Blitar, Sanankulon,
	1 6	Tulungagung, Karangrejo, Gandekan
	1 7	Nganjuk, Berbek, Loceret, Sidokare, Sukomero
	1 8	Kertosono
	1 9	Pare, Kandangan
Mojokerto	1 1	South Part of Mojokerto City
	1 2	North "
	1 3	Bangsal, Dellangn, Pacet
	1 4	Jombang, Peterongan, Diwek
	1 5	Ngoro, Kandangan
	1 6	Ploso, Sentul, Tembelang
	1 7	Mojosari, Wonokusumo, Sidorejo
	1 8	Mojosari
Madiun	1 0	Caruban, Bancong
	1 1	North Part of Madiun City
	1 2	East "
	1 3	South "
	1 4	West "
	1 5	Dolopo, Ponorogo, Sarangan
	1 6	Magetan, Sarangan, Plaosan
	1 7	Ngawi, Geneng, Paron
	1 8	Maospati, Tebon
	1 9	Pacitan, Kebonagnng

Cabang	zone code	Major Towns/Villages
Jember	1 1	Jember City
	1 2	Lumajang, Sukodono
	1 3	Bondowoso, Wonosari
	1 4	Kalisat
	1 5	Kalisat
	1 7	Jember City
Banyuwangi	1 1	Banyuwangi City
	1 2	"
	1 6	Rogojampi, Kabat, Singojuruh
	1 7	Genteng
	1 8	Muncar
Situbondo	1 1	Situbondo City
	1 2	Panarukan
	1 3	Besuki
	1 4	Asembagus
Pamekasan	1 0	Kamal, Ambunten, Sepulu, Waru, Batu Marmer, Tanjung Bumi, Banyu Atas, Sapudi, Omben, Kwanyar
	1 1	Pamekasan City
	1 2	Gading, Guluk-Guluk, Sumenep
	1 3	Sampang
	1 4	Bangkalan
	1 5	Ketapang
	1 6	Pasongsongan
	1 7	Modung, Blega
	1 8	Pakong
	1 9	Prenduan

Table A-8 (1)

SUPPLY ZONE OF SUBSTATION

NO.	N A M E	YEAR	ZONE (NO. * RATIO)
1	SURABAYA UTARA		
1	UJUNG	1983/12	4*1.0,
2	KREMBANGAN:NEW PERAK	1983/12	8*1.0, 5*1.0,
2	KREMBANGAN:NEW PERAK	1997/ 3	8*1.0, 5*0.4,
3	SAWAHAN	1983/12	1*1.0, 3*0.5,
4	TANDES	1983/12	2*1.0, 3*0.5,
5	SEGOROMADU	1983/12	6*1.0,
5	SEGOROMADU	1993/ 3	6*0.6,
6	SIMOKERTO	1997/ 3	5*0.6,
7	BENOWO	1993/ 3	6*0.4,
2	SURABAYA SELATAN		
1	WARU	1983/12	13*1.0, 16*0.5, 17*1.0,
1	WARU	1987/ 3	13*0.6, 16*0.5,
2	SUKOLILO	1983/12	14*1.0, 15*0.9, 12*1.0,
2	SUKOLILO	1985/ 3	14*0.3, 15*0.3, 12*1.0,
2	SUKOLILO	1987/ 3	14*0.3, 15*0.3, 12*0.7,
2	SUKOLILO	1998/ 3	14*0.3, 12*0.7,
3	NGAGEL	1983/12	11*1.0,
3	NGAGEL	1985/ 3	11*0.5,
4	DRIYORE JO	1983/12	10*1.0, 16*0.5,
4	DRIYORE JO	1986/ 3	16*0.5,
4	DRIYORE JO	1988/ 3	16*0.3,
5	BUDURAN(SIDOARJO)	1983/12	18*1.0, 15*0.1,
5	BUDURAN(SIDOARJO)	1986/ 3	18*0.8,
6	KENJERAN	1985/ 3	14*0.7,
6	KENJERAN	1987/ 3	14*0.5,
7	RUNGKUT	1985/ 3	15*0.6, 11*0.5,
7	RUNGKUT	1991/ 3	15*0.3, 11*0.5,
7	RUNGKUT	1994/ 3	15*0.2, 11*0.5,
7	RUNGKUT	2004/ 3	15*0.2,
8	SIMPANG	1987/ 3	12*0.3, 13*0.2, 14*0.2,
9	DARMO GRAND	1987/ 3	17*1.0, 13*0.2,
9	DARMO GRAND	1990/ 3	17*0.5, 13*0.2,
10	BABATAN	1988/ 3	16*0.2,
10	BABATAN	1998/ 3	15*0.2,
11	KRIAN	1986/ 3	10*1.0, 18*0.2, 15*0.1,
11	KRIAN	1998/ 3	10*1.0, 18*0.2,
12	NGIWO	1998/ 3	15*0.2,
13	SEMANBUNG	1991/ 3	15*0.3,
13	SEMANBUNG	1999/ 3	15*0.2,
14	KALANG PILANG	1990/ 3	17*0.5,
15	KETINTANG	1994/ 3	15*0.2,
16	TROSOBO	1998/ 3	16*0.2,
17	SIDOSERMO	2004/ 3	11*0.5,

Table A-8 (2)

SUPPLY ZONE OF SUBSTATION

NO.	N A M E	YEAR	ZONE (NO. * RATIO)
3	BOJONEGORO		
1	BOJONEGORO	1983/12	11*1.0, 12*1.0, 13*1.0, 14*1.0, 15*1.0,
2	BABAT	1983/12	16*1.0, 18*1.0,
2	BABAT	1988/ 3	17*0.3, 16*0.6, 18*0.6,
3	LAMONGAN	1983/12	17*1.0,
3	LAMONGAN	1988/ 3	17*0.5,
4	TUBAN	1988/ 3	17*0.2, 16*0.4, 18*0.4,
4	MALANG		
1	KEBONAGUNG	1983/12	16*1.0, 15*1.0, 11*1.0,
2	POLEHAN	1983/12	12*1.0, 18*0.3,
3	BLIMBING	1983/12	13*1.0, 14*1.0,
3	BLIMBING	1986/ 3	13*1.0, 14*0.7,
4	SENGKALING	1983/12	17*0.4,
4	SENGKALING	1986/ 3	17*0.4, 14*0.3,
5	LAWANG	1983/12	17*0.3, 18*0.5,
6	SUKOREJO	1983/12	19*0.4,
7	TUREN	1983/12	19*0.4, 17*0.3,
7	TUREN	1991/ 3	19*0.2, 17*0.2,
8	SENGGURUH	1983/12	18*0.1,
9	KARANGKATES	1983/12	18*0.1,
10	PLTA SELOREJO	1983/12	19*0.2,
11	KEPANJEN	1991/ 3	19*0.2, 17*0.1,
5	PASURUAN		
1	PROBOLINGO	1983/12	11*0.4, 12*1.0, 10*0.6,
1	PROBOLINGO	1988/ 3	11*0.4, 10*0.6,
2	PLERED	1983/12	10*0.4,
3	BANGIL	1983/12	13*1.0,
4	PANDAAN	1983/12	14*1.0, 15*1.0,
5	PORONG	1983/12	16*1.0,
6	LECES	1983/12	11*0.6,
7	KRAKSAAN	1988/ 3	12*0.7,
8	PAITON	1988/ 3	12*0.3,
6	KEDIRI		
1	KEDIRI	1983/12	14*1.0, 12*1.0, 13*1.0, 19*1.0, 11*1.0,
2	TULUNGAGUNG	1983/12	16*1.0,
3	BLITAR	1983/12	15*0.6,
4	PLTA WLINGI	1983/12	15*0.4,
5	KERTOSONO	1983/12	18*1.0, 17*1.0,
5	KERTOSONO	1986/ 3	18*1.0, 17*0.7,
6	TRENGGALEK	1983/12	10*1.0,
7	NGANJUK	1986/ 3	17*0.3,

Table A-8 (3)

SUPPLY ZONE OF SUBSTATION

NO.	N A M E	YEAR	ZONE (NO. * RATIO)
7	MOJOKERTO		
1	MOJOKERTO	1983/12	11*1.0, 12*1.0, 13*1.0, 17*1.0, 18*1.0,
2	PLTA MENDALAN	1983/12	14*1.0, 15*1.0,
2	PLTA MENDALAN	1990/ 3	15*1.0,
2	PLTA MENDALAN	2004/ 3	15*0.7,
3	PLOSO	1983/12	16*1.0,
4	JOMBANG	1990/ 3	14*1.0,
4	JOMBANG	2004/ 3	14*1.0, 15*0.3,
8	MADIUN		
1	MANISREJO:NEW MADIUN	1983/12	11*1.0, 12*0.5, 13*0.5, 14*1.0, 16*1.0, 17*1.0, 18*1.0,
1	MANISREJO:NEW MADIUN	1988/ 3	11*1.0, 12*0.5, 13*0.5, 14*1.0, 16*1.0, 18*1.0,
1	MANISREJO:NEW MADIUN	1989/ 3	11*1.0, 12*0.5, 13*0.5, 14*1.0, 18*1.0,
2	CARUBAN	1983/12	10*1.0,
3	PONOROGO	1983/12	15*0.5,
4	PACITAN	1983/12	19*1.0,
5	DOLOPO	1983/12	15*0.5, 12*0.5, 13*0.5,
6	MAGETAN	1989/ 3	16*1.0,
7	NGAWI	1988/ 3	17*1.0,
9	JEMBER		
1	JEMBER	1983/12	11*1.0, 14*1.0, 15*1.0, 17*1.0, 13*1.0,
1	JEMBER	1986/ 3	11*1.0, 14*1.0, 15*1.0, 17*1.0,
1	JEMBER	1990/ 3	11*0.5, 14*1.0, 15*1.0, 17*1.0,
2	LUMAJANG	1983/12	12*1.0,
3	BONDOWOSO	1986/ 3	13*1.0,
4	TANGGUL	1990/ 3	11*0.5,
10	BANYUWANGI		
1	BANYUWANGI	1983/12	11*1.0, 12*1.0, 16*1.0, 17*1.0, 18*1.0,
1	BANYUWANGI	1990/ 3	11*1.0, 12*1.0, 16*1.0,
2	GENTENG	1990/ 3	17*1.0, 18*1.0,
11	SITUBONDO		
1	SITUBONDO	1983/12	11*1.0, 12*1.0, 13*1.0, 14*1.0,
1	SITUBONDO	2004/ 3	11*1.0, 12*1.0, 13*1.0,
2	ASEMBAGUS	2004/ 3	14*1.0,
12	PAMEKASAN		
1	CANDIH(GILI TIMUR)	1983/12	10*0.1,
2	BANGKALAN	1983/12	14*1.0, 10*0.2,
3	SAMPANG	1983/12	13*1.0, 15*1.0, 17*1.0, 10*0.3,
4	PAMEKASAN	1983/12	11*1.0, 19*1.0, 10*0.2,
5	SUMENEP	1983/12	12*1.0, 16*1.0, 10*0.2,

column M 1 : contract capacity
2 : weekday average demand

column K 1 : residential
2 : commercial/public
3 : industry (Low Volt.)
4 : industry (Medium Volt.)
5 : industry (High Volt.)

column L 1 : fourteen (14) hours on a weekday
2 : nineteen (19) hours on a weekday

b. Distribution Loss Rate

The distributon loss rates by year, by Cabang are shown on Table A-10.
The figures at the first column of the table mean the following Cabangs;

1 : Surabaya Utara	2 : Surabaya Selatan
3 : Bojonegoro	4 : Malang
5 : Pasuruan	6 : Kediri
7 : Mojokerto	8 : Madiun
9 : Jember	10 : Banyuwangi
11 : Situbondo	12 : Pamekasan

c. Editing of Input Data

In accordance with various purposes, it is easily possible to edit the input data mentioned or some files of output ; here, the results edited the historical input data by Cabang by category will be illustrated for Cabang 1 to 3 on Table A-11 as an example.
Besides, various historical statistics are available because the number of customers are also stored monthly. (Refer "Regional Load Forecast Programming" mentioned)

d. Establishment of Target Data

Based upon the manner described in the preceding paragraph, the following tables were obtained.

As for residential and commercial/public uses, the multipliers which obtained as the ratios of connected capacities at March in 1989,1994 and 2004 divided by the one at Mar.1983 were applied for each Cabang.

As for industrial uses, the trend analysis including some control technique was applied to the total connected capacities of I1,I2 and I3 by each Cabang at the first place. Then the results were divided into small industries(I1+I2) and medium industries(I3) under some adequate estimation concerning the component ratios of I3. And further, using the forecasted total energy sales shown on the table and the developed forecast by Cabang, the connected capacity of I4 was forecasted by Cabang.
The further mentions will be given in the item(3).

e. Forecasting Peak Hours Femand by Substations in a Time Series
The demand of each substation at the weekday peak hours which was obtained as a final output are shown on the Table.A-12(1)~(14) in the form of time series.

(2) Demand Forecasted by Substation at Nineteen (19) Hours in Mar.1994, 1999,2004

As for mentioned above, the results extracted from Table.A-12(1)~(14) are shown on Table.A-13(1)~(6) together with forecasted demand of big customers which supplied by 70 kV or 150 kV.

(3) Demand Forecast for High Voltage Big Customers

As for annual energy sales for big customers so called I4 are introduced as the energy sales of industry minus the sum of energy sales of I1~I3 for each Cabang.(Refer Table.A-14)

On this procedure, a minute modification was applied for some Cabangs so that it could obtain I4 energy stay in a reasonable range.
Next, referring this results and individual information which concern I4 customers, we established a long term demand forecast concerning big sustomers.(Refer Table.A-15(1)~(7))
In order to supplement the information deficiencies concerning remote future and to make total system demand reasonable, we temporarily assumed some unknown customers called X as if they are scheduled.
The results are shown on Table.A-13(1)~(6) together with demands of distribution transformers using double and single parentheses for 150 kV and 70kV customers respectively.

Table A-9 Demand Conversion Factor

M K L	DEMAND CONVERSION FACTOR (%)														
	1983/ 3	1983/ 4	1983/ 5	1983/ 6	1983/ 7	1983/ 8	1983/ 9	1983/10	1983/11	1983/12	1984/ 1	1984/ 2	1984/ 3	1984/ 4	1984/ 5
	1984/ 6	1985/ 3	1986/ 3	1987/ 3	1988/ 3	1989/ 3	1990/ 3	1991/ 3	1992/ 3	1993/ 3	1994/ 3	1995/ 3	1996/ 3	1997/ 3	1998/ 3
	1999/ 3	2004/ 3													
1 1 1	11.85	11.87	11.90	11.92	11.95	11.97	12.00	12.03	12.05	12.08	12.10	12.13	12.15	12.18	12.20
	12.23	12.45	12.76	13.06	13.36	13.66	13.96	14.27	14.57	14.87	15.17	15.47	15.78	16.08	16.38
	16.68	18.19													
1 1 2	37.95	37.96	37.97	37.97	37.98	37.99	38.00	38.01	38.02	38.03	38.03	38.04	38.05	38.06	38.07
	38.08	38.15	38.26	38.36	38.46	38.56	38.67	38.77	38.87	38.97	39.08	39.18	39.28	39.38	39.49
	39.59	40.10													
1 2 1	19.80	19.84	19.87	19.90	19.93	19.97	20.00	20.03	20.07	20.10	20.13	20.16	20.20	20.23	20.26
	20.29	20.59	20.98	21.38	21.77	22.16	22.55	22.95	23.34	23.73	24.13	24.52	24.91	25.30	25.70
	26.09	28.06													
1 2 2	28.04	28.03	28.03	28.02	28.01	28.01	28.00	27.99	27.99	27.98	27.97	27.97	27.96	27.95	27.95
	27.94	27.88	27.80	27.72	27.65	27.57	27.49	27.41	27.33	27.25	27.17	27.10	27.02	26.94	26.86
	26.78	26.39													
1 3 1	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00
	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00
	21.00	21.00													
1 3 2	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00
	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00
	13.00	13.00													
1 4 1	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50
	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50
	32.50	32.50													
1 4 2	28.50	28.50	28.50	28.50	28.50	28.50	28.50	28.50	28.50	28.50	28.50	28.50	28.50	28.50	28.50
	28.50	28.50	28.50	28.50	28.50	28.50	28.50	28.50	28.50	28.50	28.50	28.50	28.50	28.50	28.50
	28.50	28.50													
1 5 1	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
	60.00	60.00													
1 5 2	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
	60.00	60.00													
2 1 1	46.61	46.71	46.80	46.90	47.00	47.10	47.20	47.30	47.40	47.50	47.60	47.69	47.79	47.89	47.99
	48.09	48.98	50.17	51.35	52.54	53.73	54.91	56.10	57.29	58.47	59.66	60.85	62.04	63.22	64.41
	65.60	71.53													
2 1 2	149.20	149.23	149.27	149.30	149.33	149.37	149.40	149.43	149.47	149.50	149.53	149.57	149.60	149.64	149.67
	149.70	150.01	150.41	150.81	151.22	151.62	152.02	152.43	152.83	153.24	153.64	154.04	154.45	154.85	155.25
	155.66	157.68													
2 2 1	103.25	103.39	103.53	103.67	103.82	103.96	104.10	104.24	104.38	104.53	104.67	104.81	104.95	105.10	105.24
	105.38	106.66	108.37	110.08	111.79	113.50	115.21	116.92	118.63	120.34	122.05	123.76	125.47	127.18	128.89
	130.60	139.15													
2 2 2	146.16	146.10	146.04	145.98	145.92	145.86	145.80	145.74	145.68	145.62	145.56	145.50	145.44	145.38	145.32
	145.26	144.71	143.99	143.27	142.54	141.82	141.10	140.37	139.65	138.92	138.20	137.48	136.75	136.03	135.31
	134.58	130.96													
2 3 1	156.50	156.50	156.50	156.50	156.50	156.50	156.50	156.50	156.50	156.50	156.50	156.50	156.50	156.50	156.50
	156.50	156.50	156.50	156.50	156.50	156.50	156.50	156.50	156.50	156.50	156.50	156.50	156.50	156.50	156.50
	156.50	156.50													
2 3 2	96.90	96.90	96.90	96.90	96.90	96.90	96.90	96.90	96.90	96.90	96.90	96.90	96.90	96.90	96.90
	96.90	96.90	96.90	96.90	96.90	96.90	96.90	96.90	96.90	96.90	96.90	96.90	96.90	96.90	96.90
	96.90	96.90													
2 4 1	133.40	133.40	133.40	133.40	133.40	133.40	133.40	133.40	133.40	133.40	133.40	133.40	133.40	133.40	133.40
	133.40	133.40	133.40	133.40	133.40	133.40	133.40	133.40	133.40	133.40	133.40	133.40	133.40	133.40	133.40
	133.40	133.40													
2 4 2	117.00	117.00	117.00	117.00	117.00	117.00	117.00	117.00	117.00	117.00	117.00	117.00	117.00	117.00	117.00
	117.00	117.00	117.00	117.00	117.00	117.00	117.00	117.00	117.00	117.00	117.00	117.00	117.00	117.00	117.00
	117.00	117.00													
2 5 1	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	100.00	100.00													
2 5 2	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	100.00	100.00													

Table A-10 Distribution Loss Rate

	LOSS RATE														
	1983/ 3	1983/ 4	1983/ 5	1983/ 6	1983/ 7	1983/ 8	1983/ 9	1983/10	1983/11	1983/12	1984/ 1	1984/ 2	1984/ 3	1984/ 4	1984/ 5
	1984/ 6	1985/ 3	1986/ 3	1987/ 3	1988/ 3	1989/ 3	1990/ 3	1991/ 3	1992/ 3	1993/ 3	1994/ 3	1995/ 3	1996/ 3	1997/ 3	1998/ 3
	1999/ 3	2004/ 3													
1	17.64	17.45	17.27	17.09	16.91	16.74	16.57	16.40	16.24	16.09	15.93	15.79	15.64	15.50	15.36
	15.23	14.16	13.07	12.27	11.67	11.23	10.91	10.67	10.50	10.37	10.27	10.20	10.15	10.11	10.08
	10.06	10.01													
2	24.54	24.12	23.72	23.34	22.96	22.59	22.24	21.89	21.55	21.23	20.91	20.60	20.30	20.01	19.73
	19.45	17.30	15.17	13.67	12.60	11.84	11.30	10.92	10.66	10.46	10.33	10.23	10.17	10.12	10.08
	10.06	10.01													
3	45.46	43.85	42.31	40.84	39.44	38.10	36.82	35.60	34.44	33.33	32.27	31.26	30.29	29.37	28.49
	27.65	21.61	16.64	13.80	12.18	11.24	10.71	10.41	10.23	10.13	10.08	10.04	10.03	10.01	10.01
	10.00	10.00													
4	25.30	24.85	24.42	23.99	23.58	23.18	22.80	22.42	22.05	21.70	21.36	21.02	20.70	20.38	20.08
	19.78	17.48	15.23	13.66	12.56	11.79	11.25	10.87	10.61	10.43	10.30	10.21	10.15	10.10	10.07
	10.05	10.01													
5	27.55	27.00	26.47	25.96	25.46	24.97	24.50	24.05	23.61	23.19	22.77	22.37	21.99	21.61	21.25
	20.89	18.18	15.59	13.81	12.60	11.78	11.21	10.83	10.57	10.39	10.26	10.18	10.12	10.08	10.06
	10.04	10.01													
6	21.35	21.06	20.78	20.50	20.23	19.97	19.71	19.46	19.22	18.98	18.75	18.53	18.31	18.10	17.89
	17.69	16.09	14.46	13.26	12.39	11.75	11.28	10.94	10.69	10.50	10.37	10.27	10.20	10.14	10.11
	10.08	10.02													
7	20.72	20.45	20.18	19.93	19.67	19.43	19.19	18.96	18.74	18.52	18.30	18.09	17.89	17.69	17.49
	17.31	15.81	14.27	13.15	12.32	11.70	11.25	10.92	10.68	10.50	10.37	10.27	10.20	10.15	10.11
	10.08	10.02													
8	18.34	18.11	17.89	17.68	17.47	17.27	17.07	16.88	16.70	16.51	16.34	16.17	16.00	15.84	15.68
	15.53	14.32	13.11	12.24	11.61	11.16	10.84	10.60	10.43	10.31	10.22	10.16	10.12	10.08	10.06
	10.04	10.01													
9	17.78	17.59	17.39	17.20	17.02	16.84	16.67	16.50	16.33	16.17	16.02	15.86	15.71	15.57	15.43
	15.29	14.19	13.08	12.26	11.66	11.22	10.89	10.66	10.48	10.35	10.26	10.19	10.14	10.10	10.08
	10.06	10.01													
10	7.46	7.61	7.75	7.88	8.01	8.13	8.24	8.34	8.44	8.53	8.62	8.70	8.78	8.85	8.92
	8.98	9.41	9.72	9.86	9.93	9.97	9.98	9.99	10.00	10.00	10.00	10.00	10.00	10.00	10.00
	10.00	10.00													
11	19.03	18.83	18.64	18.45	18.26	18.08	17.90	17.73	17.55	17.39	17.22	17.06	16.91	16.76	16.61
	16.46	15.28	14.04	13.09	12.36	11.81	11.38	11.06	10.81	10.62	10.47	10.36	10.28	10.21	10.16
	10.12	10.03													
12	11.24	11.17	11.10	11.04	10.98	10.92	10.87	10.82	10.77	10.72	10.68	10.64	10.60	10.57	10.53
	10.50	10.29	10.14	10.07	10.03	10.02	10.01	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
	10.00	10.00													

Table A-11 (1)

HISTORICAL DATA FOR LOAD FORECAST BY USE CATEGORIES IN EACH CABANG

1 SURABAYA UTARA NUMBER OF ZONE: 7 1 - 8

YEAR	RESIDENT	COM/PU	IND. 1,2	IND. 3	TOTAL
CONNECTED CAPACITY		MVA			
1983/ 3	62.631	62.065	24.162	19.939	168.797
1983/ 4	63.184	62.608	24.527	19.939	170.258
1983/ 5	63.881	62.688	24.597	21.324	172.490
1983/ 6	64.061	63.700	25.165	21.324	174.250
1983/ 7	64.481	63.932	25.148	21.324	174.885
1983/ 8	64.764	63.781	25.538	21.324	175.407
1983/ 9	65.086	64.037	25.838	21.324	176.285
1983/10	65.484	64.202	25.929	21.324	176.939
1983/11	65.647	64.232	26.117	22.014	178.010
1983/12	65.952	64.330	26.136	22.914	179.332
1984/ 1	66.396	64.440	26.214	22.914	179.964
1984/ 2	68.004	64.665	26.131	22.914	181.714
1984/ 3	68.534	65.015	26.130	22.949	182.628
1984/ 4	68.458	65.379	26.348	22.949	183.134
1984/ 5	68.962	65.353	26.223	22.949	183.487
1984/ 6	70.354	66.662	25.910	23.554	186.480
AVERAGE DEMAND		MW			
1983/ 3	15.719	10.700	3.041	3.421	32.881
1983/ 4	15.455	10.821	2.996	3.103	32.374
1983/ 5	16.285	11.151	2.780	3.888	34.104
1983/ 6	16.610	11.178	2.716	3.109	33.613
1983/ 7	14.742	10.330	2.848	3.376	31.295
1983/ 8	15.103	8.677	2.552	2.822	29.154
1983/ 9	15.577	9.902	3.239	3.172	31.890
1983/10	15.810	10.425	2.940	3.238	32.413
1983/11	15.839	8.682	2.650	3.067	30.239
1983/12	14.514	8.984	3.010	3.603	30.111
1984/ 1	15.993	9.091	2.813	3.170	31.066
1984/ 2	16.673	8.906	3.121	3.111	31.812
1984/ 3	15.020	9.195	3.034	3.179	30.428
1984/ 4	15.051	9.723	3.025	3.313	31.113
1984/ 5	16.411	10.288	3.431	3.543	33.673
1984/ 6	17.492	9.067	2.981	3.741	33.282

Table A-11 (2)

HISTORICAL DATA FOR LOAD FORECAST BY USE CATEGORIES IN EACH CABANG

2 SURABAYA SELATAN NUMBER OF ZONE: 9 10 - 18

YEAR	RESIDENT	COM/PU	IND. 1,2	IND. 3	TOTAL
CONNECTED CAPACITY MVA					
1983/ 3	96.664	44.778	34.279	129.005	304.726
1983/ 4	97.411	46.072	34.815	129.960	308.258
1983/ 5	97.892	46.578	34.993	135.745	315.208
1983/ 6	98.429	46.701	35.045	135.745	315.920
1983/ 7	98.957	46.897	35.056	136.820	317.730
1983/ 8	99.382	45.777	35.541	145.375	326.075
1983/ 9	100.074	45.597	36.173	145.375	327.219
1983/10	100.786	47.257	36.343	145.375	329.761
1983/11	101.334	47.398	36.632	148.970	334.334
1983/12	102.116	47.458	36.655	150.780	337.009
1984/ 1	103.019	48.065	37.916	151.405	340.405
1984/ 2	105.106	48.387	38.313	153.685	345.491
1984/ 3	106.980	49.409	38.326	159.570	354.285
1984/ 4	108.258	48.844	38.815	160.205	356.122
1984/ 5	109.400	49.604	39.310	162.055	360.369
1984/ 6	111.028	49.367	39.533	162.090	362.018
AVERAGE DEMAND MW					
1983/ 3	21.120	8.157	4.247	32.022	65.546
1983/ 4	21.839	7.924	4.291	28.363	62.416
1983/ 5	21.231	9.063	4.048	28.094	62.437
1983/ 6	21.856	7.938	4.631	32.749	67.175
1983/ 7	20.559	7.882	3.013	24.331	55.785
1983/ 8	22.960	7.843	4.558	32.228	67.589
1983/ 9	22.936	8.306	4.576	34.515	70.332
1983/10	22.165	8.742	4.171	33.375	68.453
1983/11	22.271	8.532	4.914	36.107	71.823
1983/12	22.010	8.762	4.571	36.569	71.912
1984/ 1	24.403	8.219	5.586	36.060	74.268
1984/ 2	24.211	9.156	6.064	40.480	79.911
1984/ 3	22.880	7.494	4.130	42.494	76.998
1984/ 4	25.507	7.915	4.495	34.015	71.931
1984/ 5	26.743	9.257	4.502	37.829	78.331
1984/ 6	23.741	9.169	5.835	34.032	72.776

Table A-11 (3)

HISTORICAL DATA FOR LOAD FORECAST BY USE CATEGORIES IN EACH CABANG

3 BOJONEGORO NUMBER OF ZONE: 8 11 - 18

YEAR	RESIDENT	COM/PU	IND. 1,2	IND. 3	TOTAL
CONNECTED CAPACITY		MVA			
1983/ 3	7.255	2.178	0.403	0.0	9.836
1983/ 4	7.405	2.215	0.403	0.0	10.023
1983/ 5	7.580	2.298	0.409	0.0	10.287
1983/ 6	7.825	2.297	0.416	0.0	10.538
1983/ 7	7.877	2.295	0.416	0.0	10.588
1983/ 8	8.081	2.314	0.416	0.0	10.811
1983/ 9	8.265	2.386	0.424	0.0	11.075
1983/10	8.469	2.408	0.424	0.0	11.301
1983/11	8.577	2.424	0.416	0.0	11.417
1983/12	8.689	2.431	0.426	0.0	11.546
1984/ 1	8.876	2.440	0.449	0.0	11.765
1984/ 2	8.984	2.548	0.449	0.0	11.981
1984/ 3	9.067	2.598	0.449	0.0	12.114
1984/ 4	9.159	2.650	0.449	0.0	12.258
1984/ 5	9.526	2.664	0.449	2.180	14.819
1984/ 6	9.663	2.693	0.455	2.180	14.991
AVERAGE DEMAND		MW			
1983/ 3	1.860	0.538	0.034	0.0	2.432
1983/ 4	1.810	0.516	0.032	0.0	2.358
1983/ 5	1.764	0.515	0.032	0.0	2.311
1983/ 6	2.001	0.561	0.032	0.0	2.593
1983/ 7	1.808	0.507	0.031	0.0	2.346
1983/ 8	1.908	0.574	0.070	0.0	2.553
1983/ 9	2.069	0.627	0.048	0.0	2.745
1983/10	2.193	0.609	0.036	0.0	2.839
1983/11	2.028	0.574	0.117	0.0	2.718
1983/12	1.931	0.509	0.088	0.0	2.528
1984/ 1	1.926	0.520	0.101	0.0	2.546
1984/ 2	2.153	0.590	0.104	0.0	2.847
1984/ 3	1.987	0.522	0.034	0.0	2.543
1984/ 4	2.164	0.519	0.035	0.0	2.718
1984/ 5	2.128	0.526	0.042	0.0	2.696
1984/ 6	2.187	0.529	0.040	0.033	2.790

Table A-12(1)

SUMMARY OF SUBSTATION LOAD FORECAST MW

1 SURABAYA UTARA

	UJUNG		KREMBANGAN:NEW PERAK		SAWAHAN		TANDES		SEGOROMADU	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	3.53	6.66	7.11	13.61	14.83	22.45	10.14	14.32	5.18	7.19
1984/ 4	3.54	6.71	7.21	13.86	14.89	22.51	10.05	13.90	5.20	7.27
1984/ 5	3.56	6.74	7.25	13.95	14.89	22.50	10.04	13.92	5.17	7.23
1984/ 6	3.59	6.81	7.28	14.02	15.22	22.92	10.17	14.07	5.30	7.64
1985/ 3 **	3.92	7.31	8.01	15.18	16.81	24.86	11.25	15.30	6.07	8.89
1986/ 3	4.42	7.98	9.13	16.90	19.16	27.59	12.89	17.07	7.33	10.95
1987/ 3	4.96	8.70	10.40	18.81	21.73	30.43	14.73	18.96	8.89	13.57
1988/ 3	5.59	9.50	11.83	20.90	24.51	33.28	16.78	20.90	10.84	16.87
1989/ 3	6.29	10.39	13.43	23.17	27.53	36.25	19.03	22.86	13.20	20.84
1990/ 3	7.08	11.37	15.24	25.72	30.84	39.41	21.59	25.07	15.85	25.09
1991/ 3	7.96	12.45	17.28	28.58	34.45	42.79	24.50	27.54	18.81	29.61
1992/ 3	8.95	13.63	19.59	31.77	38.38	46.38	27.78	30.32	22.09	34.36
1993/ 3	10.04	14.93	22.19	35.35	42.62	50.17	31.49	33.43	15.43	23.59 *
1994/ 3	11.25	16.35	25.10	39.34	47.20	54.17	35.66	36.90	17.81	26.69
1995/ 3	12.59	17.89	28.37	43.78	52.13	58.38	40.34	40.78	20.42	29.87
1996/ 3	14.07	19.58	32.01	48.72	57.40	62.79	45.58	45.10	23.25	33.13
1997/ 3	15.69	21.40	18.36	26.26 *	63.02	67.42	51.40	49.89	26.31	36.43
1998/ 3	17.46	23.39	20.56	28.99	69.00	72.25	57.86	55.18	29.61	39.74
1999/ 3	19.38	25.53	22.97	32.01	75.34	77.29	64.98	61.01	33.12	43.04
2004/ 3	31.36	38.83	38.03	50.26	111.78	105.10	110.29	97.99	54.07	59.93

	SIMOKERTO		BENOWO		SURABAYA UTARA	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	0.0	0.0	0.0	0.0	40.78	64.24
1984/ 4	0.0	0.0	0.0	0.0	40.89	64.26
1984/ 5	0.0	0.0	0.0	0.0	40.91	64.35
1984/ 6	0.0	0.0	0.0	0.0	41.55	65.46
1985/ 3 **	0.0	0.0	0.0	0.0	46.07	71.54
1986/ 3	0.0	0.0	0.0	0.0	52.92	80.50
1987/ 3	0.0	0.0	0.0	0.0	60.73	90.46
1988/ 3	0.0	0.0	0.0	0.0	69.55	101.45
1989/ 3	0.0	0.0	0.0	0.0	79.48	113.51
1990/ 3	0.0	0.0	0.0	0.0	90.60	126.66
1991/ 3	0.0	0.0	0.0	0.0	103.00	140.97
1992/ 3	0.0	0.0	0.0	0.0	116.79	156.46
1993/ 3	0.0	0.0	10.28	15.73 *	132.05	173.20 *
1994/ 3	0.0	0.0	11.87	17.79	148.91	191.23
1995/ 3	0.0	0.0	13.61	19.91	167.46	210.61
1996/ 3	0.0	0.0	15.50	22.08	187.81	231.40
1997/ 3	17.71	27.96 *	17.54	24.29	210.05	253.64 *
1998/ 3	20.02	31.31	19.74	26.50	234.25	277.36
1999/ 3	22.59	35.02	22.08	28.69	260.46	302.59
2004/ 3	38.81	57.54	36.04	39.96	420.38	449.62

Table A-12(2)

SUMMARY OF SUBSTATION LOAD FORECAST MW

2 SURABAYA SELATAN

	WARU		SUKOLILO		NGAGEL		DRIYORE JO		BUDURAN(SIDOARJO)	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	26.06	36.00	51.37	62.16	7.66	13.20	6.98	7.31	11.92	13.05
1984/ 4	26.14	36.13	51.35	62.25	7.52	12.99	6.97	7.32	12.14	13.28
1984/ 5	25.96	36.02	52.32	63.20	7.73	13.24	6.78	7.16	12.26	13.42
1984/ 6	26.02	36.24	52.28	63.21	7.73	13.25	6.69	7.13	12.29	13.51
1985/ 3 **	28.12	39.05	22.64	27.89 *	4.18	7.04 *	7.43	8.32	13.44	14.93
1986/ 3	31.64	43.53	26.00	31.57	4.65	7.60	7.60	7.44 *	8.40	9.94 *
1987/ 3	16.43	23.67 *	27.82	32.80 *	5.20	8.25	8.75	8.74	9.64	11.64
1988/ 3	18.56	26.15	32.29	37.59	5.83	8.99	6.01	6.01 *	11.14	13.75
1989/ 3	20.96	28.84	37.55	43.17	6.54	9.81	6.86	6.81	12.96	16.36
1990/ 3	23.69	31.86	43.66	49.63	7.34	10.71	7.84	7.74	14.92	18.87
1991/ 3	26.78	35.25	50.70	57.04	8.23	11.71	8.98	8.81	17.02	21.26
1992/ 3	30.27	38.98	58.76	65.49	9.24	12.80	10.27	10.00	19.41	23.77
1993/ 3	34.23	43.11	67.89	75.04	10.36	13.99	11.76	11.34	22.10	26.40
1994/ 3	38.74	47.69	78.15	85.76	11.62	15.29	13.49	12.86	25.18	29.16
1995/ 3	43.91	52.82	89.58	97.71	13.02	16.72	15.51	14.60	28.69	32.09
1996/ 3	50.01	58.94	101.78	109.89	14.58	18.27	17.98	16.82	33.16	36.28
1997/ 3	57.08	65.91	115.00	123.01	16.32	19.98	20.90	19.43	38.37	41.04
1998/ 3	65.50	74.01	46.15	57.82 *	18.22	21.82	24.51	22.60	44.39	46.42
1999/ 3	75.29	83.34	52.84	64.72	20.30	23.82	28.81	26.35	51.42	52.74
2004/ 3	128.29	133.63	88.47	99.85	32.02	34.89	51.83	46.26	88.96	85.36

	KENJERAN		RUNGKUT		SIMPANG		DARMO GRAND		BABATAN	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984/ 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984/ 5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984/ 6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1985/ 3 **	9.86	15.73 *	29.35	32.38 *	0.0	0.0	0.0	0.0	0.0	0.0
1986/ 3	10.98	17.16	34.14	37.13	0.0	0.0	0.0	0.0	0.0	0.0
1987/ 3	8.79	13.45 *	39.92	42.87	8.30	13.54 *	16.88	20.29 *	0.0	0.0
1988/ 3	9.89	14.83	46.79	49.65	9.32	14.89	19.13	22.91	4.00	4.00 *
1989/ 3	11.15	16.40	54.85	57.59	10.51	16.43	21.66	25.61	4.57	4.54
1990/ 3	12.60	18.16	64.21	66.77	11.86	18.17	14.07	17.52 *	5.23	5.16
1991/ 3	14.27	20.16	41.59	44.50 *	13.41	20.13	15.99	19.56	5.98	5.87
1992/ 3	16.18	22.41	48.19	51.00	15.19	22.33	18.20	21.82	6.85	6.67
1993/ 3	18.40	24.97	55.57	58.26	17.23	24.82	20.76	24.32	7.84	7.56
1994/ 3	20.96	27.87	63.73	66.29	19.57	27.64	23.73	27.10	8.99	8.57
1995/ 3	23.93	31.17	72.63	75.05	22.28	30.82	27.18	30.21	10.34	9.73
1996/ 3	27.39	34.94	81.79	83.48	25.41	34.44	31.38	34.15	11.99	11.21
1997/ 3	31.39	39.23	91.38	92.18	29.01	38.55	36.30	38.69	13.94	12.96
1998/ 3	35.99	44.11	101.16	100.97	33.13	43.20	41.99	43.87	55.30	52.76 *
1999/ 3	41.25	49.63	80.88	81.26 *	37.63	47.96	48.59	49.88	60.57	57.44
2004/ 3	70.78	81.17	103.41	94.52 *	61.99	73.23	84.45	82.04	103.41	94.52

Table A-12(3)

SUMMARY OF SUBSTATION LOAD FORECAST MW

2 SURABAYA SELATAN

	KRIAN		NGIWO		SEMANBUNG		KALANG PILANG		KETINTANG	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984/ 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984/ 5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984/ 6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1985/ 3 **	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986/ 3	8.10	10.18 *	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1987/ 3	9.40	11.66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1988/ 3	11.07	13.75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1989/ 3	12.98	16.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990/ 3	15.16	18.56	0.0	0.0	0.0	0.0	10.53	11.20 *	0.0	0.0
1991/ 3	17.64	21.30	0.0	0.0	33.36	32.79 *	12.05	12.71	0.0	0.0
1992/ 3	20.42	24.25	0.0	0.0	38.95	38.20	13.82	14.38	0.0	0.0
1993/ 3	23.50	27.39	0.0	0.0	45.21	44.28	15.88	16.24	0.0	0.0
1994/ 3	26.90	30.71	0.0	0.0	52.12	51.00	18.31	18.34	0.0	0.0
1995/ 3	30.60	34.16	0.0	0.0	59.61	58.34	21.16	20.71	0.0	0.0
1996/ 3	34.77	38.18	0.0	0.0	67.21	65.20	24.70	23.85	0.0	0.0
1997/ 3	39.29	42.41	0.0	0.0	75.06	72.20	28.89	27.52	0.0	0.0
1998/ 3	16.45	20.43 *	55.30	52.76 *	82.94	79.15	33.77	31.76	0.0	0.0
1999/ 3	19.03	22.92	60.57	57.44	60.57	57.44 *	39.50	36.74	60.57	57.44 *
2004/ 3	35.06	37.35	103.41	94.52	103.41	94.52	70.48	63.20	103.41	94.52

	TROSOBO		SIDOSERMO		SURABAYA SELATAN	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	0.0	0.0	0.0	0.0	104.00	131.72
1984/ 4	0.0	0.0	0.0	0.0	104.11	131.97
1984/ 5	0.0	0.0	0.0	0.0	105.04	133.05
1984/ 6	0.0	0.0	0.0	0.0	105.00	133.34
1985/ 3 **	0.0	0.0	0.0	0.0	115.01	145.35 *
1986/ 3	0.0	0.0	0.0	0.0	131.53	164.55 *
1987/ 3	0.0	0.0	0.0	0.0	151.13	186.90 *
1988/ 3	0.0	0.0	0.0	0.0	174.04	212.52 *
1989/ 3	0.0	0.0	0.0	0.0	200.59	241.60
1990/ 3	0.0	0.0	0.0	0.0	231.11	274.36 *
1991/ 3	0.0	0.0	0.0	0.0	266.01	311.09 *
1992/ 3	0.0	0.0	0.0	0.0	305.73	352.10
1993/ 3	0.0	0.0	0.0	0.0	350.72	397.71
1994/ 3	0.0	0.0	0.0	0.0	401.48	448.27
1995/ 3	0.0	0.0	0.0	0.0	458.46	504.14
1996/ 3	0.0	0.0	0.0	0.0	522.14	565.65
1997/ 3	0.0	0.0	0.0	0.0	592.92	633.11
1998/ 3	16.34	15.06 *	0.0	0.0	671.15	706.74 *
1999/ 3	19.20	17.57	0.0	0.0	757.03	786.69 *
2004/ 3	34.56	30.84	32.02	34.89 *	1295.95	1275.33 *

Table A-12(4)

SUMMARY OF SUBSTATION LOAD FORECAST MW

3 BOJONEGORO

	BOJONEGORO		BABAT		LAMONGAN		TUBAN		BOJONEGORO	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	1.19	2.79	0.81	2.00	0.48	1.28	0.0	0.0	2.47	6.07
1984/ 4	1.19	2.79	0.80	1.99	0.48	1.28	0.0	0.0	2.47	6.06
1984/ 5	1.18	2.77	0.81	2.01	1.51	2.28	0.0	0.0	3.50	7.06
1984/ 6	1.18	2.76	0.80	2.00	1.52	2.31	0.0	0.0	3.50	7.06
1985/ 3 **	1.23	2.73	0.82	1.96	0.58	1.49	0.0	0.0	2.64	6.19
1986/ 3	1.40	2.84	0.89	1.97	0.70	1.70	0.0	0.0	2.98	6.51
1987/ 3	1.69	3.09	1.01	2.03	0.87	1.98	0.0	0.0	3.57	7.11
1988/ 3	2.14	3.48	1.05	2.01 *	0.52	1.11 *	0.70	1.34 *	4.41	7.94 *
1989/ 3	2.72	4.00	1.29	2.26	0.60	1.21	0.86	1.50	5.47	8.97
1990/ 3	3.35	4.57	1.54	2.53	0.69	1.30	1.02	1.68	6.60	10.08
1991/ 3	3.93	5.17	1.76	2.77	0.77	1.38	1.18	1.85	7.64	11.17
1992/ 3	4.40	5.72	1.96	3.01	0.85	1.46	1.30	2.01	8.51	12.20
1993/ 3	4.76	6.17	2.13	3.23	0.94	1.60	1.42	2.15	9.25	13.15
1994/ 3	5.06	6.61	2.27	3.44	1.05	1.73	1.52	2.30	9.90	14.08
1995/ 3	5.33	7.05	2.41	3.65	1.15	1.87	1.61	2.43	10.50	15.00
1996/ 3	5.59	7.51	2.55	3.85	1.26	2.00	1.70	2.56	11.09	15.93
1997/ 3	5.87	8.00	2.68	4.04	1.37	2.14	1.78	2.69	11.69	16.87
1998/ 3	6.15	8.53	2.80	4.22	1.48	2.27	1.87	2.81	12.30	17.84
1999/ 3	6.47	9.11	2.93	4.39	1.59	2.40	1.95	2.92	12.94	18.82
2004/ 3	8.54	12.90	3.42	4.87	2.11	2.85	2.28	3.25	16.35	23.87

Table A-12(5)

SUMMARY OF SUBSTATION LOAD FORECAST MW

4 MALANG

	KEBONAGUNG		POLEHAN		BLIMBING		SENGKALING		LAWANG	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	5.41	11.86	4.29	6.16	3.20	5.87	1.49	2.40	2.52	4.38
1984/ 4	5.42	11.87	4.29	6.18	3.23	5.93	1.51	2.45	2.56	4.45
1984/ 5	5.47	11.96	4.30	6.21	3.25	6.00	1.53	2.50	2.58	4.52
1984/ 6	5.52	12.05	4.31	6.25	3.29	6.13	1.54	2.53	2.61	4.58
1985/ 3 **	6.19	13.26	4.76	6.86	3.65	6.74	1.73	2.84	2.93	5.11
1986/ 3	7.15	14.92	5.45	7.76	3.80	6.82 *	2.46	4.24 *	3.43	5.96
1987/ 3	8.17	16.55	6.25	8.73	4.44	7.87	2.90	4.99	4.05	7.00
1988/ 3	9.21	18.03	7.16	9.77	5.19	9.12	3.44	5.90	4.79	8.26
1989/ 3	10.17	19.08	8.22	10.98	6.08	10.60	4.08	7.00	5.68	9.76
1990/ 3	11.25	20.46	9.45	12.38	7.13	12.33	4.74	7.97	6.66	11.30
1991/ 3	12.52	22.07	10.83	13.86	8.35	14.35	5.50	9.10	7.71	12.86
1992/ 3	13.88	23.78	12.36	15.44	9.79	16.72	6.35	10.32	8.84	14.44
1993/ 3	15.33	25.58	14.09	17.19	11.36	19.15	7.27	11.57	10.09	16.16
1994/ 3	16.88	27.46	16.05	19.15	12.93	21.37	8.31	12.97	11.51	18.06
1995/ 3	18.51	29.43	18.24	21.30	14.63	23.69	9.45	14.44	13.06	20.08
1996/ 3	20.24	31.46	20.68	23.64	16.47	26.10	10.70	15.99	14.75	22.19
1997/ 3	22.04	33.57	23.38	26.20	18.46	28.61	12.06	17.63	16.59	24.40
1998/ 3	23.92	35.75	26.36	28.97	20.59	31.20	13.55	19.34	18.57	26.71
1999/ 3	25.88	37.99	29.62	31.97	22.86	33.87	15.15	21.14	20.72	29.12
2004/ 3	36.74	50.26	50.24	50.40	36.21	48.08	24.97	31.20	33.66	42.45

	SUKOREJO		TUREN		SENGGURUH		KARANGKATES		PLTA SELOREJO	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	0.47	1.08	1.60	2.88	0.28	0.52	0.28	0.52	0.24	0.54
1984/ 4	0.49	1.09	1.62	2.93	0.28	0.52	0.28	0.52	0.25	0.55
1984/ 5	0.50	1.11	1.64	2.99	0.29	0.53	0.29	0.53	0.25	0.56
1984/ 6	0.50	1.13	1.66	3.03	0.29	0.54	0.29	0.54	0.25	0.57
1985/ 3 **	0.57	1.26	1.86	3.39	0.33	0.60	0.33	0.60	0.28	0.63
1986/ 3	0.67	1.48	2.19	3.97	0.38	0.69	0.38	0.69	0.33	0.74
1987/ 3	0.79	1.74	2.59	4.69	0.45	0.81	0.45	0.81	0.40	0.87
1988/ 3	0.94	2.06	3.07	5.57	0.53	0.95	0.53	0.95	0.47	1.03
1989/ 3	1.13	2.44	3.66	6.63	0.63	1.11	0.63	1.11	0.56	1.22
1990/ 3	1.34	2.86	4.28	7.61	0.74	1.31	0.74	1.31	0.67	1.43
1991/ 3	1.53	3.22	3.03	5.20 *	0.86	1.49	0.86	1.49	0.77	1.61
1992/ 3	1.74	3.58	3.48	5.84	0.99	1.67	0.99	1.67	0.87	1.79
1993/ 3	1.96	3.97	3.97	6.54	1.12	1.86	1.12	1.86	0.98	1.99
1994/ 3	2.21	4.40	4.54	7.32	1.27	2.08	1.27	2.08	1.10	2.20
1995/ 3	2.47	4.84	5.16	8.14	1.43	2.30	1.43	2.30	1.23	2.42
1996/ 3	2.74	5.28	5.83	9.01	1.61	2.53	1.61	2.53	1.37	2.64
1997/ 3	3.03	5.72	6.57	9.91	1.80	2.77	1.80	2.77	1.51	2.86
1998/ 3	3.32	6.17	7.37	10.86	2.00	3.01	2.00	3.01	1.66	3.08
1999/ 3	3.62	6.61	8.23	11.84	2.22	3.26	2.22	3.26	1.81	3.30
2004/ 3	5.19	8.64	13.44	17.29	3.48	4.60	3.48	4.60	2.59	4.32

Table A-12(6)

SUMMARY OF SUBSTATION LOAD FORECAST MW

4 MALANG

	KEPANJEN		MALANG	
	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	0.0	0.0	19.79	36.19
1984/ 4	0.0	0.0	19.95	36.50
1984/ 5	0.0	0.0	20.10	36.89
1984/ 6	0.0	0.0	20.28	37.34
1985/ 3 **	0.0	0.0	22.61	41.29
1986/ 3	0.0	0.0	26.25	47.28 *
1987/ 3	0.0	0.0	30.49	54.07
1988/ 3	0.0	0.0	35.34	61.63
1989/ 3	0.0	0.0	40.84	69.93
1990/ 3	0.0	0.0	47.00	78.95
1991/ 3	1.90	3.41 *	53.86	88.67 *
1992/ 3	2.17	3.82	61.44	99.07
1993/ 3	2.48	4.26	69.77	110.13
1994/ 3	2.82	4.76	78.89	121.85
1995/ 3	3.20	5.28	88.82	134.21
1996/ 3	3.60	5.82	99.61	147.20
1997/ 3	4.04	6.39	111.28	160.82
1998/ 3	4.51	6.97	123.85	175.08
1999/ 3	5.02	7.57	137.35	189.94
2004/ 3	8.01	10.80	218.02	272.64

Table A-12(7)

SUMMARY OF SUBSTATION LOAD FORECAST MW

5 PASURUAN

	PROBOLINGO		PLERED		BANGIL		PANDAAN		PORONG	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	4.96	6.64	1.44	2.03	0.77	1.35	2.85	3.65	0.85	1.36
1984/ 4	4.96	6.68	1.44	2.05	0.78	1.37	2.85	3.67	0.86	1.37
1984/ 5	4.96	6.70	1.44	2.06	0.79	1.38	2.84	3.67	0.86	1.38
1984/ 6	4.99	6.81	1.46	2.12	0.78	1.38	2.84	3.68	0.90	1.41
1985/ 3 **	5.53	7.53	1.63	2.36	0.87	1.51	3.13	4.05	1.01	1.58
1986/ 3	6.41	8.68	1.90	2.74	1.00	1.71	3.63	4.65	1.19	1.84
1987/ 3	7.49	10.05	2.23	3.19	1.16	1.95	4.22	5.38	1.41	2.15
1988/ 3	6.39	9.06 *	2.62	3.70	1.36	2.24	4.94	6.24	1.67	2.51
1989/ 3	7.47	10.48	3.07	4.28	1.59	2.58	5.77	7.24	1.97	2.91
1990/ 3	8.72	12.05	3.59	4.93	1.86	2.97	6.74	8.38	2.30	3.35
1991/ 3	10.13	13.79	4.17	5.64	2.17	3.42	7.86	9.68	2.68	3.83
1992/ 3	11.73	15.71	4.83	6.42	2.53	3.93	9.12	11.08	3.10	4.35
1993/ 3	13.51	17.80	5.56	7.27	2.94	4.52	10.53	12.62	3.57	4.92
1994/ 3	15.48	20.06	6.36	8.19	3.40	5.16	12.12	14.32	4.08	5.52
1995/ 3	17.67	22.52	7.26	9.19	3.88	5.78	13.90	16.19	4.64	6.17
1996/ 3	20.08	25.15	8.23	10.25	4.40	6.45	15.87	18.22	5.25	6.85
1997/ 3	22.70	27.95	9.30	11.37	4.98	7.15	18.05	20.42	5.90	7.57
1998/ 3	25.54	30.92	10.45	12.55	5.59	7.88	20.43	22.79	6.59	8.31
1999/ 3	28.61	34.04	11.68	13.80	6.26	8.65	23.02	25.32	7.34	9.08
2004/ 3	46.91	51.46	19.01	20.69	10.18	12.87	38.93	40.13	11.61	13.18

	LECES		KRAKSAAN		PAITON		PASURUAN	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	2.08	3.01	0.0	0.0	0.0	0.0	12.95	18.03
1984/ 4	2.08	3.04	0.0	0.0	0.0	0.0	12.97	18.18
1984/ 5	2.09	3.05	0.0	0.0	0.0	0.0	12.98	18.25
1984/ 6	2.09	3.07	0.0	0.0	0.0	0.0	13.06	18.48
1985/ 3 **	2.32	3.40	0.0	0.0	0.0	0.0	14.48	20.43
1986/ 3	2.69	3.93	0.0	0.0	0.0	0.0	16.83	23.55
1987/ 3	3.14	4.55	0.0	0.0	0.0	0.0	19.67	27.27
1988/ 3	3.68	5.26	1.66	1.80 *	0.71	0.77 *	23.02	31.59 *
1989/ 3	4.30	6.08	1.93	2.07	0.83	0.89	26.94	36.52
1990/ 3	5.01	6.99	2.25	2.39	0.97	1.02	31.44	42.08
1991/ 3	5.82	7.99	2.62	2.75	1.12	1.18	36.58	48.28
1992/ 3	6.73	9.11	3.05	3.17	1.31	1.36	42.39	55.14
1993/ 3	7.76	10.34	3.53	3.64	1.51	1.56	48.91	62.67
1994/ 3	8.91	11.66	4.08	4.17	1.75	1.79	56.18	70.88
1995/ 3	10.18	13.12	4.71	4.76	2.02	2.04	64.25	79.77
1996/ 3	11.59	14.68	5.41	5.43	2.32	2.33	73.14	89.35
1997/ 3	13.13	16.35	6.19	6.17	2.65	2.64	82.88	99.62
1998/ 3	14.81	18.13	7.06	6.99	3.02	2.99	93.49	110.56
1999/ 3	16.62	20.01	8.01	7.88	3.43	3.38	104.98	122.16
2004/ 3	27.58	30.64	14.10	13.58	6.04	5.82	174.36	188.37

Table A-12(8)

SUMMARY OF SUBSTATION LOAD FORECAST MW

6 KEDIRI

	KEDIRI		TULUNGAGUNG		BLITAR		PLTA WLINGI		KERTOSONO	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	3.66	6.65	1.68	2.98	0.65	1.24	0.43	0.82	0.99	2.22
1984/ 4	3.69	6.71	1.67	2.97	0.65	1.25	0.44	0.83	1.00	2.24
1984/ 5	3.71	6.80	1.71	3.05	0.67	1.29	0.45	0.86	1.02	2.29
1984/ 6	3.76	6.84	1.73	3.07	0.68	1.30	0.45	0.87	1.03	2.31
1985/ 3 **	4.25	7.63	2.04	3.68	0.79	1.51	0.52	1.01	1.16	2.53
1986/ 3	4.99	8.76	2.56	4.72	0.96	1.84	0.64	1.22	1.10	2.36 *
1987/ 3	5.85	10.02	3.23	6.08	1.18	2.24	0.78	1.50	1.26	2.61
1988/ 3	6.86	11.47	4.01	7.61	1.44	2.74	0.96	1.83	1.44	2.87
1989/ 3	8.04	13.17	4.87	9.21	1.76	3.34	1.17	2.23	1.64	3.16
1990/ 3	9.38	15.03	5.83	10.93	2.14	4.08	1.43	2.72	1.86	3.47
1991/ 3	10.91	17.13	6.85	12.65	2.61	4.97	1.74	3.32	2.11	3.82
1992/ 3	12.64	19.49	7.92	14.32	3.16	6.04	2.11	4.03	2.39	4.20
1993/ 3	14.64	22.23	9.22	16.44	3.66	6.90	2.44	4.60	2.69	4.63
1994/ 3	16.91	25.35	10.63	18.62	4.19	7.78	2.79	5.18	3.03	5.09
1995/ 3	19.46	28.84	12.12	20.81	4.72	8.63	3.15	5.75	3.45	5.65
1996/ 3	22.05	32.08	13.83	23.40	5.33	9.62	3.56	6.42	3.92	6.28
1997/ 3	24.80	35.41	15.72	26.14	5.97	10.64	3.98	7.09	4.46	6.99
1998/ 3	27.74	38.88	17.77	29.02	6.62	11.64	4.41	7.76	5.06	7.78
1999/ 3	30.83	42.43	19.99	32.00	7.27	12.63	4.85	8.42	5.73	8.67
2004/ 3	47.61	60.32	33.33	47.65	10.14	16.66	6.76	11.10	10.78	15.15

	TRENGGALEK		NGANJUK		KEDIRI	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	0.66	1.72	0.0	0.0	8.07	15.64
1984/ 4	0.66	1.73	0.0	0.0	8.11	15.73
1984/ 5	0.66	1.74	0.0	0.0	8.23	16.03
1984/ 6	0.67	1.74	0.0	0.0	8.31	16.13
1985/ 3 **	0.74	1.88	0.0	0.0	9.49	18.23
1986/ 3	0.84	2.05	0.24	0.47 *	11.33	21.42 *
1987/ 3	0.91	2.14	0.28	0.54	13.50	25.12
1988/ 3	0.99	2.20	0.33	0.62	16.03	29.33
1989/ 3	1.07	2.28	0.39	0.71	18.94	34.09
1990/ 3	1.16	2.37	0.45	0.81	22.26	39.40
1991/ 3	1.27	2.46	0.52	0.92	26.00	45.27
1992/ 3	1.38	2.57	0.61	1.05	30.20	51.70
1993/ 3	1.51	2.68	0.70	1.20	34.86	58.68
1994/ 3	1.63	2.80	0.80	1.36	39.99	66.18
1995/ 3	1.77	2.91	0.94	1.57	45.61	74.17
1996/ 3	1.91	3.03	1.10	1.80	51.70	82.63
1997/ 3	2.05	3.14	1.28	2.07	58.27	91.49
1998/ 3	2.18	3.25	1.49	2.37	65.28	100.70
1999/ 3	2.31	3.34	1.74	2.72	72.73	110.21
2004/ 3	2.71	3.51	3.63	5.28	114.96	159.68

Table A-12(9)

SUMMARY OF SUBSTATION LOAD FORECAST MW

7 MOJOKERTO

	MOJOKERTO		PLTA MENDALAN		PLOSO		JOMBANG		MOJOKERTO	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	4.92	7.03	1.25	2.57	0.09	0.23	0.0	0.0	6.26	9.83
1984/ 4	4.96	7.16	1.25	2.57	0.09	0.23	0.0	0.0	6.30	9.96
1984/ 5	4.98	7.22	1.28	2.64	0.09	0.24	0.0	0.0	6.35	10.10
1984/ 6	4.99	7.27	1.30	2.67	0.10	0.24	0.0	0.0	6.39	10.18
1985/ 3 **	5.72	8.48	1.42	2.79	0.10	0.25	0.0	0.0	7.24	11.52
1986/ 3	6.86	10.35	1.58	2.95	0.11	0.26	0.0	0.0	8.56	13.55
1987/ 3	8.21	12.52	1.77	3.12	0.12	0.27	0.0	0.0	10.10	15.91
1988/ 3	9.77	15.01	1.98	3.31	0.13	0.28	0.0	0.0	11.89	18.60
1989/ 3	11.55	17.81	2.21	3.51	0.14	0.29	0.0	0.0	13.91	21.60
1990/ 3	13.55	20.90	0.39	0.75 *	0.15	0.29	2.05	2.95 *	16.14	24.90 *
1991/ 3	15.75	24.28	0.46	0.82	0.16	0.30	2.18	3.03	18.55	28.43
1992/ 3	18.22	28.05	0.55	0.91	0.16	0.30	2.28	3.08	21.21	32.33
1993/ 3	21.03	32.23	0.66	1.03	0.16	0.30	2.40	3.13	24.25	36.69
1994/ 3	24.21	36.85	0.80	1.17	0.17	0.29	2.53	3.20	27.70	41.52
1995/ 3	27.76	41.91	0.99	1.36	0.17	0.30	2.67	3.28	31.59	46.85
1996/ 3	31.73	47.41	1.22	1.59	0.17	0.30	2.84	3.37	35.96	52.67
1997/ 3	36.11	53.32	1.52	1.89	0.17	0.30	3.03	3.47	40.83	58.98
1998/ 3	40.92	59.65	1.90	2.25	0.18	0.30	3.27	3.64	46.26	65.84
1999/ 3	46.21	66.43	2.37	2.70	0.18	0.31	3.63	3.91	52.39	73.34
2004/ 3	78.39	104.25	4.71	4.62 *	0.24	0.35	7.56	7.20 *	90.90	116.42 *

Table A-12(10)

SUMMARY OF SUBSTATION LOAD FORECAST MW

8 MADIUN

	MANISREJO:NEW MADIUN		CARUBAN		PONOROGO		PACITAN		DOLOPO	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	5.81	9.86	0.17	0.42	0.48	1.06	0.20	0.51	1.09	2.47
1984/ 4	5.86	9.97	0.17	0.43	0.49	1.10	0.20	0.53	1.12	2.55
1984/ 5	5.91	10.11	0.18	0.44	0.50	1.12	0.20	0.54	1.14	2.60
1984/ 6	5.96	10.25	0.19	0.46	0.51	1.13	0.21	0.55	1.15	2.64
1985/ 3 **	6.64	11.20	0.21	0.51	0.57	1.26	0.24	0.61	1.31	2.94
1986/ 3	7.66	12.57	0.25	0.59	0.67	1.46	0.28	0.71	1.56	3.42
1987/ 3	8.80	14.04	0.30	0.69	0.78	1.69	0.34	0.82	1.86	4.00
1988/ 3	9.34	14.06 *	0.35	0.80	0.91	1.95	0.40	0.96	2.22	4.65
1989/ 3	9.72	13.68 *	0.41	0.92	1.04	2.23	0.46	1.10	2.61	5.35
1990/ 3	11.17	15.42	0.47	1.04	1.19	2.53	0.53	1.25	3.05	6.11
1991/ 3	12.80	17.32	0.54	1.17	1.35	2.84	0.61	1.41	3.52	6.91
1992/ 3	14.61	19.37	0.61	1.31	1.51	3.15	0.69	1.57	4.02	7.73
1993/ 3	16.61	21.58	0.69	1.44	1.68	3.47	0.78	1.73	4.55	8.56
1994/ 3	18.77	23.92	0.76	1.57	1.88	3.82	0.86	1.89	5.13	9.43
1995/ 3	21.13	26.42	0.83	1.69	2.10	4.17	0.94	2.04	5.75	10.31
1996/ 3	23.71	29.08	0.90	1.81	2.33	4.52	1.02	2.18	6.40	11.18
1997/ 3	26.51	31.93	0.96	1.91	2.57	4.87	1.10	2.32	7.08	12.03
1998/ 3	29.53	34.95	1.02	2.01	2.87	5.24	1.17	2.43	7.72	12.83
1999/ 3	32.78	38.18	1.07	2.09	3.19	5.59	1.23	2.53	8.36	13.56
2004/ 3	52.74	56.70	1.33	2.47	4.66	6.89	1.51	2.98	11.36	16.65

	MAGETAN		NGAWI		MADIUN	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	0.0	0.0	0.0	0.0	7.75	14.32
1984/ 4	0.0	0.0	0.0	0.0	7.84	14.57
1984/ 5	0.0	0.0	0.0	0.0	7.93	14.81
1984/ 6	0.0	0.0	0.0	0.0	8.01	15.03
1985/ 3 **	0.0	0.0	0.0	0.0	8.96	16.51
1986/ 3	0.0	0.0	0.0	0.0	10.42	18.75
1987/ 3	0.0	0.0	0.0	0.0	12.08	21.25
1988/ 3	0.0	0.0	0.74	1.57 *	13.95	23.98 *
1989/ 3	0.98	2.05 *	0.79	1.62	16.03	26.95 *
1990/ 3	1.04	2.11	0.86	1.67	18.32	30.14
1991/ 3	1.10	2.16	0.92	1.73	20.84	33.54
1992/ 3	1.15	2.21	0.98	1.78	23.58	37.12
1993/ 3	1.20	2.25	1.05	1.84	26.55	40.88
1994/ 3	1.25	2.29	1.11	1.89	29.77	44.80
1995/ 3	1.30	2.32	1.17	1.93	33.22	48.88
1996/ 3	1.34	2.35	1.22	1.96	36.92	53.08
1997/ 3	1.38	2.37	1.26	1.98	40.88	57.41
1998/ 3	1.47	2.42	1.30	2.00	45.08	61.87
1999/ 3	1.59	2.48	1.32	2.00	49.54	66.43
2004/ 3	2.37	2.93	1.44	2.04	75.41	90.67

Table A-12(11)

SUMMARY OF SUBSTATION LOAD FORECAST MW

9 JEMBER

	JEMBER		LUMAJANG		BONDOWOSO		TANGGUL		JEMBER	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	3.25	7.08	1.06	2.21	0.0	0.0	0.0	0.0	4.32	9.29
1984/ 4	3.30	7.19	1.07	2.24	0.0	0.0	0.0	0.0	4.38	9.44
1984/ 5	3.36	7.32	1.10	2.32	0.0	0.0	0.0	0.0	4.46	9.64
1984/ 6	3.47	7.48	1.12	2.36	0.0	0.0	0.0	0.0	4.59	9.84
1985/ 3 **	3.86	8.10	1.22	2.54	0.0	0.0	0.0	0.0	5.08	10.65
1986/ 3	3.61	7.35 *	1.43	2.87	0.80	1.67 *	0.0	0.0	5.85	11.90 *
1987/ 3	4.13	8.19	1.66	3.22	0.95	1.91	0.0	0.0	6.73	13.32
1988/ 3	4.71	9.12	1.91	3.61	1.13	2.19	0.0	0.0	7.76	14.93
1989/ 3	5.37	10.15	2.21	4.04	1.35	2.52	0.0	0.0	8.93	16.72
1990/ 3	3.40	6.32 *	2.54	4.53	1.62	2.90	2.71	4.96 *	10.26	18.71 *
1991/ 3	3.84	7.00	2.93	5.08	1.94	3.35	3.07	5.49	11.78	20.93
1992/ 3	4.33	7.73	3.39	5.70	2.33	3.87	3.46	6.07	13.50	23.38
1993/ 3	4.85	8.50	3.91	6.40	2.81	4.48	3.88	6.68	15.45	26.06
1994/ 3	5.39	9.31	4.52	7.18	3.38	5.19	4.33	7.33	17.63	29.01
1995/ 3	5.97	10.14	5.22	8.06	4.07	6.03	4.81	8.00	20.08	32.23
1996/ 3	6.57	11.03	6.03	9.04	4.90	6.95	5.31	8.72	22.82	35.74
1997/ 3	7.25	12.00	6.97	10.14	5.78	7.91	5.88	9.50	25.89	39.55
1998/ 3	8.02	13.05	8.05	11.36	6.71	8.90	6.53	10.36	29.31	43.67
1999/ 3	8.88	14.20	9.29	12.73	7.68	9.90	7.26	11.30	33.11	48.13
2004/ 3	15.06	21.51	18.88	22.42	12.92	14.97	12.61	17.40	59.47	76.30

Table A-12(12)

SUMMARY OF SUBSTATION LOAD FORECAST MW

10 BANYUWANGI

	BANYUWANGI		GENTENG		BANYUWANGI	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	1.68	3.86	0.0	0.0	1.68	3.86
1984/ 4	1.71	3.94	0.0	0.0	1.71	3.94
1984/ 5	1.75	4.04	0.0	0.0	1.75	4.04
1984/ 6	1.83	4.18	0.0	0.0	1.83	4.18
1985/ 3 **	2.11	4.66	0.0	0.0	2.11	4.66
1986/ 3	2.56	5.38	0.0	0.0	2.56	5.38
1987/ 3	3.12	6.24	0.0	0.0	3.12	6.24
1988/ 3	3.85	7.25	0.0	0.0	3.85	7.25
1989/ 3	4.80	8.48	0.0	0.0	4.80	8.48
1990/ 3	4.29	7.25 *	1.76	2.73 *	6.05	9.99 *
1991/ 3	5.30	8.37	2.40	3.47	7.70	11.84
1992/ 3	6.61	9.72	3.25	4.42	9.86	14.14
1993/ 3	8.28	11.35	4.39	5.62	12.67	16.98
1994/ 3	10.38	13.31	5.87	7.13	16.25	20.44
1995/ 3	13.00	15.65	7.74	8.99	20.73	24.64
1996/ 3	16.17	18.41	10.06	11.23	26.23	29.63
1997/ 3	19.95	21.63	12.83	13.83	32.78	35.46
1998/ 3	24.34	25.33	16.02	16.78	40.36	42.11
1999/ 3	29.25	29.43	19.60	20.05	48.86	49.48
2004/ 3	56.45	52.62	41.11	39.52	97.56	92.14

Table A-12(13)

SUMMARY OF SUBSTATION LOAD FORECAST MW

11 SITUBONDO

	SITUBONDO		ASEMBAGUS		SITUBONDO	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	0.86	2.06	0.0	0.0	0.86	2.06
1984/ 4	0.87	2.09	0.0	0.0	0.87	2.09
1984/ 5	0.90	2.16	0.0	0.0	0.90	2.16
1984/ 6	0.92	2.22	0.0	0.0	0.92	2.22
1985/ 3 **	0.98	2.32	0.0	0.0	0.98	2.32
1986/ 3	1.08	2.50	0.0	0.0	1.08	2.50
1987/ 3	1.20	2.69	0.0	0.0	1.20	2.69
1988/ 3	1.32	2.90	0.0	0.0	1.32	2.90
1989/ 3	1.46	3.14	0.0	0.0	1.46	3.14
1990/ 3	1.62	3.39	0.0	0.0	1.62	3.39
1991/ 3	1.79	3.67	0.0	0.0	1.79	3.67
1992/ 3	1.99	3.97	0.0	0.0	1.99	3.97
1993/ 3	2.20	4.29	0.0	0.0	2.20	4.29
1994/ 3	2.43	4.64	0.0	0.0	2.43	4.64
1995/ 3	2.68	5.01	0.0	0.0	2.68	5.01
1996/ 3	2.95	5.40	0.0	0.0	2.95	5.40
1997/ 3	3.24	5.81	0.0	0.0	3.24	5.81
1998/ 3	3.54	6.25	0.0	0.0	3.54	6.25
1999/ 3	3.87	6.71	0.0	0.0	3.87	6.71
2004/ 3	5.48	8.87 *	0.26	0.40 *	5.74	9.27 *

Table A-12(14)

SUMMARY OF SUBSTATION LOAD FORECAST MW

12 PAMEKASAN

	CANDIH(GILI TIMUR)		BANGKALAN		SAMPANG		PAMEKASAN		SUMENEP	
	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING
1984/ 3	0.02	0.07	0.35	0.76	0.28	0.69	0.61	1.23	0.46	1.03
1984/ 4	0.03	0.07	0.35	0.76	0.29	0.71	0.63	1.28	0.48	1.08
1984/ 5	0.03	0.08	0.36	0.77	0.30	0.73	0.63	1.30	0.49	1.09
1984/ 6	0.03	0.08	0.36	0.79	0.30	0.75	0.64	1.31	0.49	1.10
1985/ 3 **	0.03	0.09	0.41	0.88	0.35	0.85	0.72	1.47	0.56	1.23
1986/ 3	0.04	0.11	0.48	1.02	0.43	1.01	0.85	1.70	0.66	1.43
1987/ 3	0.05	0.13	0.57	1.18	0.53	1.19	1.00	1.96	0.78	1.64
1988/ 3	0.06	0.16	0.67	1.36	0.64	1.41	1.17	2.24	0.91	1.89
1989/ 3	0.07	0.19	0.78	1.55	0.77	1.67	1.36	2.55	1.06	2.15
1990/ 3	0.09	0.22	0.90	1.76	0.94	1.98	1.57	2.88	1.23	2.44
1991/ 3	0.10	0.26	1.04	1.99	1.13	2.33	1.79	3.24	1.43	2.77
1992/ 3	0.13	0.32	1.18	2.22	1.36	2.73	2.04	3.60	1.65	3.15
1993/ 3	0.15	0.38	1.34	2.47	1.62	3.16	2.31	3.99	1.90	3.57
1994/ 3	0.19	0.45	1.52	2.76	1.89	3.58	2.61	4.41	2.19	4.04
1995/ 3	0.22	0.53	1.72	3.07	2.17	3.97	2.94	4.87	2.52	4.58
1996/ 3	0.27	0.63	1.95	3.44	2.42	4.30	3.30	5.37	2.88	5.19
1997/ 3	0.32	0.73	2.19	3.80	2.71	4.71	3.68	5.88	3.29	5.82
1998/ 3	0.36	0.82	2.44	4.16	3.04	5.19	4.08	6.38	3.71	6.49
1999/ 3	0.41	0.91	2.71	4.54	3.37	5.67	4.50	6.90	4.17	7.21
2004/ 3	0.65	1.34	4.25	6.54	5.11	7.96	6.87	9.53	7.08	11.62

	PAMEKASAN	
	DAYTIME	EVENING
1984/ 3	1.73	3.78
1984/ 4	1.77	3.91
1984/ 5	1.80	3.97
1984/ 6	1.82	4.02
1985/ 3 **	2.08	4.53
1986/ 3	2.47	5.27
1987/ 3	2.92	6.11
1988/ 3	3.44	7.05
1989/ 3	4.04	8.11
1990/ 3	4.72	9.29
1991/ 3	5.50	10.60
1992/ 3	6.36	12.02
1993/ 3	7.32	13.57
1994/ 3	8.40	15.24
1995/ 3	9.57	17.02
1996/ 3	10.83	18.93
1997/ 3	12.19	20.94
1998/ 3	13.64	23.04
1999/ 3	15.17	25.22
2004/ 3	23.96	36.99

Table. A-13(1) Long Term Demand Forecast of Distribution Substations

Cabaugs	Sudstations	Ordinary Peak Demand on Weekdays (MW)			
		1989/3	1994/3	1999/3	2004/3
Surabaya Utara & Selatan	Ujung	(8.4) 10.4	(8.4) 16.4	(8.4) 25.5	(8.4) 38.8
	Krembangan	23.2	39.3	32.0	50.3
	Sawahan	36.3	54.2	(10.5) 77.8	(10.5) 105.1
	Tandes	22.9	36.9	(18.0) 61.0	(18.0) 98.0
	Segoromadu	((21.0)) (21.0) 20.8	((27.3)) (28.5) 26.7	((27.3)) (31.5) 43.0	((27.3)) (31.5) 59.9
	Simokerto			35.0	57.5
	Benowo		17.8	28.7	40.0
	PLTU Gresik			((22.8))	((97.6))
	Simpang	16.4	27.6	48.0	73.2
	Waru	(34.5) 28.8	(51.3) 47.7	(51.3) 83.3	(51.3) 133.6
	Sukolilo	43.2	85.8	64.7	99.9
	Ngagel	9.8	15.3	23.8	34.9
	Driyore jo	6.8	12.9	26.4	46.3
	Buduran	16.4	29.2	52.7	85.4
	Kenjeran	16.4	27.9	49.6	81.2
	Rungkut	57.6	66.3	81.3	94.5
	Darmo Grand	25.6	27.1	49.9	82.0

Table. A-13(2) Long Term Demand Forecast of Distribution Substations

Cabangs	Substations	Ordinary Peak Demand on Weekdays (MW)			
		1989/3	1994/3	1999/3	2004/3
	Babatan	4.5	8.6	66.2	110.0
	Krian	((3.5))	((47.2))	((151.1))	((382.5))
		16.0	30.7	22.9	37.4
	Ngiwo			57.4	94.5
	Semanbung		51.0	57.4	94.5
	Kalang Pilang		18.3	36.7	63.2
	Ketintang			57.4	94.5
	Trosobo			17.6	30.8
	Sidosermo				34.9
Bojonegoro	Bojonegoro	4.0	6.6	9.1	12.9
	Babat	((18.0))	((18.0))	((18.0))	((18.0))
		2.3	3.4	4.4	4.9
	Lamongan	((13.9))	((23.4))	((23.4))	((23.4))
		1.2	1.7	2.4	2.9
	Tuban	1.5	2.3	2.9	3.3
Malang	Kebonagung	19.1	27.5	38.0	50.3
	Polehan	11.0	19.2	32.0	50.4
	Blimbing	10.6	21.4	33.9	48.1
	Sengkaling	7.0	13.0	21.1	31.2
	Lawang	9.8	18.1	29.1	42.5

Table. A-13(3) Long Term Demand Forecast of Distribution Substations

Cabangs	Substations	Ordinary Peak Demand on Weekdays (MW)			
		1989/3	1994/3	1999/3	2004/3
	Sukorejo	2.4	4.4	6.6	8.6
	Turen	6.6	7.3	11.8	17.3
	Sengguruh	1.1	2.1	3.3	4.6
	Karangkates	1.1	2.1	3.3	4.6
	PLTA Selorejo	1.2	2.2	3.2	4.3
	Kepanjen		4.8	7.6	10.8
Pasuruan	Probolingo	10.5	20.1	34.0	51.5
	Plered	4.3	8.2	13.8	20.7
	Bangil	2.6	5.2	8.7	12.9
	Pandaan	7.2	14.3	25.3	40.1
	Porong	2.9	5.5	9.1	13.2
	Leces	6.1	11.7	20.0	30.6
	Kralsaan	2.1	4.2	7.9	13.6
	Paiton	(1.8) 0.9	1.8	3.4	5.8
Kediri	Kediri	(9.1) 13.2	(20.7) 25.4	((15.4)) (21.6) 42.4	((44.1)) (21.6) 60.3
	Tulungagung	9.2	18.6	32.0	47.7
	Blitar	3.3	7.8	12.6	16.7

Table. A-13(4) Long Term Demand Forecast of Distribution Substations

Cabangs	Substations	Ordinary Peak Demand on Weekdays (MW)			
		1989/3	1994/3	1999/3	2004/3
	PLTA Wlingi	2.2	5.2	8.4	11.1
	Kertosono	3.2	5.1	8.7	15.2
	Trenggalek	2.3	2.8	3.3	3.5
	Nganjük	0.7	1.4	2.7	5.3
Mojokerto	Mojokerto	(7.5) 17.8	((10.5)) (12.0) 36.9	((41.9)) (12.0) 66.4	((105.8)) (12.0) 104.3
	PLTA Mendalan	3.5	1.2	2.7	4.6
	Ploso	0.3	0.3	0.3	0.4
	Jombang	0	3.2	3.9	7.2
Madiun	Manisrejo	13.7	23.9	38.2	56.7
	Caruban	0.9	1.6	2.1	2.5
	Ponorogo	2.2	3.8	5.6	6.9
	Pacitan	1.1	1.9	2.5	3.0
	Dolopo	5,4	9.4	13.6	16.7
	Magetan	2.1	2.3	2.5	2.9
	Ngawi	1.6	1.9	2.0	2.0

Table. A-13(5) Long Term Demand Forecast of Distribution Substations

Cabangs	Substations	Ordirary Peak Demand on Weekdays (MW)			
		1989/3	1994/3	1999/3	2004/3
Jember	Jember	((13.7)) 10.2	((25.3)) 9.3	((38.2)) 14.2	((69.3)) 21.5
	Lumajang	4.0	7.2	12.7	22.4
	Bondowoso	2.5	5.2	9.9	15.0
	Tanggul		7.3	11.3	17.4
Banyu-wangi	Banyuwangi	8.5	13.3	29.4	52.6
	Genteng		7.1	20.1	39.5
Situbondo	Situbondo	3.1	4.6	6.7	9.3
	Asembagus				0.4
Pamekasan	Candih	((36.0)) 0.2	((36.0)) 0.5	((36.0)) 0.9	((36.0)) 1.3
	Bangkalan	1.6	2.8	4.5	6.5
	Sampang	1.7	3.6	5.7	8.0
	Pamekasan	2.6	4.4	6.9	9.5
	Sumenep	2.2	4.0	7.2	11.6

Note: o Each figure means forecasted average demand at 19:00 hours on weekdays.

o Double parenthesized figures mean big customers demand fed by 150kV.

o Single parenthesized ones mean those of 70kV or special use for construction (Paiton).

o The rest mean those of distribution transformers.

Table. A-14 Forecast of I4 Energy Sales by Cabang

Cabang	loss rate	(I1+I2) MW sub	(I1+I2) GWh cus	(I3) MW sub	(I3) GWh cus	(I1+I2+I3) GWh cus	Total GWh cus	I4 GWh cus
01 Surabaya Utara	0.1123	11.84	56.03	19.52	108.37	164.40	592.7	428.3
	0.1027	22.60	108.11	44.33	248.77	356.88	930.2	573.3
	0.1006	40.25	192.98	95.48	537.06	730.04	1,719.0	989.0
	0.1001	63.94	306.74	183.54	1,032.96	1,339.70	2,952.6	1,612.9
02 Surabaya Selatan	0.1184	18.70	87.88	126.47	697.30	785.18	1,102.3	317.1
	0.1033	37.24	178.02	266.59	1,495.03	1,673.05	2,494.7	821.6
	0.1006	71.47	342.67	533.51	3,000.92	3,343.59	5,031.9	1,688.3
	0.1001	126.55	607.10	955.20	5,375.85	5,982.95	9,602.4	3,619.4
03 Bojonegoro	0.1124	2.17	10.27	16.53	91.76	102.03	367.8	265.8
	0.1008	4.54	21.76	34.39	193.40	215.16	560.8	345.6
	0.1000	4.74	22.74	35.82	201.62	224.36	570.0	345.6
	0.1000	4.75	22.79	35.89	202.01	224.80	570.4	345.6
04 Malang	0.1179	6.70	31.51	7.49	41.32	72.83	92.6	19.8
	0.1030	13.03	62.31	17.00	95.37	157.68	220.9	63.2
	0.1005	23.76	113.93	37.05	208.42	322.35	452.3	129.9
	0.1001	38.53	184.84	72.82	409.83	594.67	854.4	259.7
05 Pasuruan	0.1178	3.86	18.15	11.98	66.10	84.25	110.3	26.0
	0.1026	7.70	36.84	25.51	143.17	180.01	222.0	42.0
	0.1004	14.75	70.74	51.59	290.25	360.99	413.4	52.4
	0.1001	25.80	123.77	93.09	523.91	647.68	735.0	87.3
06 Kediri	0.1175	2.23	10.49	2.24	12.36	22.85	36.9	14.0
	0.1037	4.22	20.16	5.38	30.16	50.32	70.0	19.7
	0.1008	7.56	36.24	12.08	67.93	104.17	122.6	18.4
	0.1002	12.31	59.05	23.28	131.01	190.06	204.2	14.1
07 Mojokerto	0.1170	1.19	5.60	5.47	30.21	35.81	101.4	65.6
	0.1037	2.35	11.23	11.58	64.91	76.14	264.2	188.1
	0.1008	4.46	21.38	23.32	131.14	152.52	602.3	449.8
	0.1002	7.72	37.03	42.32	238.15	275.18	1,257.7	982.5
08 Madiun	0.1116	1.07	5.07	4.46	24.78	29.85	49.4	19.5
	0.1022	2.15	10.29	9.48	53.23	63.52	119.8	56.3
	0.1004	4.11	19.71	19.12	107.57	127.28	235.6	108.3
	0.1001	7.08	33.96	34.71	195.35	229.31	416.1	186.8
09 Jember	0.1122	0.79	3.74	0.64	3.55	7.29	91.4	84.1
	0.1026	1.83	8.75	1.93	10.83	19.58	158.3	138.7
	0.1006	4.18	20.04	5.46	30.71	50.75	268.7	217.9
	0.1001	9.26	44.42	14.32	80.59	125.01	450.8	325.8
10 Banyuwangi	0.0997	0.90	4.32	0.52	2.93	7.25	37.5	30.2
	0.1000	4.68	22.45	4.99	28.09	50.54	122.8	72.3
	0.1000	17.09	81.99	20.30	114.26	196.25	307.8	111.5
	0.1000	31.44	150.84	48.63	273.72	424.56	677.9	253.3
11 Situbondo	0.1181	0.06	0.28	0.02	0.11	0.39	0.3	△ 0.1
	0.1047	0.09	0.43	0.09	0.53	0.96	0.7	△ 0.3
	0.1012	0.15	0.72	0.23	1.29	2.01	1.3	△ 0.7
	0.1003	0.26	1.25	0.40	2.25	3.50	2.3	△ 1.2
12 Pamekasan	0.1002	0.44	2.11	0.18	1.01	3.12	339.8	300.3
	0.1000	0.75	3.60	0.86	4.84	8.44	371.3	300.3
	0.1000	1.27	6.09	2.05	11.54	17.63	424.9	300.3
	0.1000	2.14	10.27	3.34	18.80	29.07	515.4	300.3

Note
- Multilayered figures mean of March 1989, 1994, 1999 and 2004 respectively.
- MW means demand at daytime, and GWh means annual energy.
- Demand Conversion Factor is 1.565 for I1+I2 and 1.334 for I3.
- For I4 of Pamekasan, just Madura Cement is forecasted.

Table. A-15(1) Long Term Demand Forecast of Big Customers (I4)

Cabang	Customer	Substation (kV) /Voltage	Demand Forecast (MW)			
			1989/3	1994/3	1999/3	2004/3
Surabaya Utara	Retrokimia Gresik	Segoromadu 150kV	21.0	"	"	"
	Kunci Kedamean	"	-	6.3	"	"
		Segoromadu 150kV	21.0	27.3	"	"
	Semen Gresik	Segoromadu 70kV	18.0	"	"	"
	Barata	"	3.0	"	"	"
	Carbide Factory Gresik	"	-	7.5	"	"
	Parama Arta	"	-	-	3.0	"
		Segoromadu 70kV	21.0	28.5	31.5	"
	PT PAL	Ujung 70kV	8.4	"	"	"
	Jaya Pari Steel	Tandes 70kV	-	-	18.0	"
	Sawahan X	Sawahan 70kV	-	-	10.5	"
	Total		50.4	64.2	95.7	"
	X - SV	Gresik 150kV	-	-	22.8	97.6
Target		Annual Energy	428.3GWh	573.3GWh	989.0GWh	1,612.9GWh
		Peak Demand	51.3MW	68.7MW	118.5MW	193.3MW

Table. A-15(2) Long Term Demand Forecast of Big Customers (I4)

Cabang	Customer	Substation (kV) /Voltage	Demand Forecast (MW)			
			1989/3	1994/3	1999/3	2004/3
Surabaya Selatan	Ispat Indo	Waru 70kV	19.2	"	"	"
	"	"	4.8	"	"	"
	Soda Waru	"	10.5	"	"	"
	Jatim Utama Steel	"	-	16.8	"	"
	Maspion	Waru 70kV	34.5	51.3	"	"
		Krian150kV	3.5	47.2	151.1	382.5
	X - SS (Include Tsarin Manunggal 30.0MW)					
Target		Annual Energy	317.1GWh	821.6GWh	1,688.3GWh	3,619.4GWh
		Peak Demand	38.0MW	98.5MW	202.4MW	433.8MW

Table. A-15(3) Long Term Demand Forecast of Big Customers (I4)

Cabang	Customer	Substation (kV) /Voltage	Demand Forecast (MW)			
			1989/3	1994/3	1999/3	2004/3
Bojonegoro	Dwima Agung Cement	Babat 150kV	18.0	"	"	"
	X - BJ (Include Carbide Factory Lamongan 9.0)	Lamongan 150kV	13.9	23.4	"	"
Target		Annual Energy	265.8GWh	345.6GWh	345.6GWh	345.6GWh
		Peak Demand	31.9MW	41.4MW	41.4MW	41.4MW

Table. A-15(4) Long Term Demand Forecast of Big Customers (I4)

Cabang	Customer	Substation (kV) /Voltage	Demand Forecast (MW)			
			1989/3	1994/3	1999/3	2004/3
Kediri + Malang + Madiun + Pasuruan	Gudang Garam	Kediri 70kV	9.1	20.7	21.6	"
	X - KD	Kediri 150kV	-	-	15.4	44.1
Target	Annial Energy		19.8+14.0 +19.5+26.0 =79.3	63.2+19.7 +56.3+42.0 =181.2	129.9+18.4 +108.3+52.4 =309.0	259.7+14.7 +186.8+87.3 =547.9
	Peak Demand		9.5MW	21.7MW	37.0MW	65.7MW

Table. A-15(5) Long Term Demand Forecast of Big Customers (I4)

Cabang	Customer	Substation (kV) /Voltage	Demand Forecast (MW)			
			1989/3	1994/3	1999/3	2004/3
Mojokerto	Pakerin	Mojokerto 70kV	6.0	"	"	"
	Ciwikimia	"	1.5	6.0	"	"
		sub total	7.5	12.0	"	"
	X - MJ	Mojokerto 150kV	-	10.5	41.9	105.8
Target		Annual Energy	65.6GWh	188.1GWh	449.8GWh	982.5GWh
		Peak Demand	7.9MW	22.5MW	53.9MW	117.8MW

Table. A-15(6) Long Term Demand Forecast of Big Customers (I4)

Cabang	Customer	Substation (kV) /Voltage	Demand Forecast (MW)			
			1989/3	1994/3	1999/3	2004/3
Jember + Banyn wangi + Situ-bordo	X - JB	Jember 150kV	13.7	25.3	38.2	69.3
Target	Annual Energy		84.1+30.2 -0.1 =114.2	138.7+72.3 -0.7 =210.7	207.9+111.5 -0.7 =318.7	325.8+253.3 -1.2 =577.9
	Peak Demand		13.7MW	25.3MW	38.2MW	69.3MW

Table. A-15(7) Long Term Demand Forecast of Big Customers (I4)

Cabang	Customer	Substation (kV) /Voltage		Demand Forecast (MW)			
				1989/3	1994/3	1999/3	2004/3
Pameka-san	Madura Cement Factory	Candih (Giri Timur) 150kV		36.0	36.0	36.0	36.0
Target			Annual Energy	300.3GWh	300.3GWh	300.3GWh	300.3GWh
			Peak Demand	36.0MW	36.0MW	36.0MW	36.0MW

REGIONAL DEMAND FORECAST 1980/ 3 - 2004/ 3 CONNECTED CAPACITY UNIT: MVA

CABANG	1980/ 3	1981/ 3	1982/ 3	1983/ 3	1989/ 3	1994/ 3	1999/ 3	2004/ 3
RESIDENTIAL								
SURABAYA UTARA	42.083	53.296	63.656	72.944	139.908	219.022	310.037	394.013
SURABAYA SELATAN	61.844	75.207	91.444	103.182	218.322	354.766	512.259	659.653
MALANG	24.641	32.962	39.782	55.155	126.472	213.587	310.791	394.250
PASURUAN	8.404	10.899	13.493	19.600	49.212	89.139	138.216	184.912
KEDIRI	9.384	13.162	16.435	19.983	55.443	106.095	171.409	235.770
MOJOKERTO	5.303	7.186	8.470	11.045	32.148	65.286	111.879	162.810
MADIUN	7.947	10.688	14.140	17.248	40.359	64.686	87.267	101.302
JEMBER	7.700	8.755	9.799	13.096	27.791	48.514	75.955	105.218
BANYUWANGI	3.077	3.586	3.785	6.016	13.766	25.207	40.285	55.976
SITUBONDO	1.845	2.087	2.307	2.785	5.242	8.362	12.106	15.674
PAMEKASAN	4.204	4.697	5.606	6.670	15.164	27.492	44.474	63.398
EAST JAVA	176.432	222.525	268.917	327.724	723.827	1222.156	1814.679	2372.975
COMMERCIAL								
SURABAYA UTARA	18.118	31.780	34.223	34.491	66.155	103.563	146.599	186.306
SURABAYA SELATAN	12.122	18.279	20.384	19.441	41.135	66.843	96.517	124.288
MALANG	5.282	5.950	6.826	6.930	15.891	26.836	39.050	49.536
PASURUAN	2.320	2.544	2.822	2.755	6.917	12.530	19.428	25.991
KEDIRI	3.643	4.224	4.768	4.982	13.823	26.451	42.734	58.780
MOJOKERTO	1.610	1.763	1.849	2.035	5.923	12.029	20.613	29.997
MADIUN	1.830	2.695	3.032	3.198	7.483	11.994	16.180	18.783
JEMBER	2.251	2.392	2.748	3.075	6.525	11.391	17.835	24.706
BANYUWANGI	0.887	0.953	1.012	1.357	3.105	5.686	9.087	12.626
SITUBONDO	0.473	0.497	0.509	0.638	1.201	1.916	2.773	3.591
PAMEKASAN	0.840	0.863	1.003	1.072	2.437	4.419	7.148	10.189
EAST JAVA	49.376	71.940	79.176	79.974	170.595	283.656	417.964	544.793
PUBLIC								
SURABAYA UTARA	4.063	18.753	18.827	25.552	49.009	76.722	108.605	138.021
SURABAYA SELATAN	5.575	16.447	18.229	19.095	40.403	65.653	94.799	122.076
MALANG	2.959	5.698	4.781	6.022	13.809	23.320	33.933	43.046
PASURUAN	0.992	1.795	2.360	4.125	10.357	18.760	29.089	38.916
KEDIRI	1.664	2.211	2.945	3.113	8.637	16.528	26.703	36.729
MOJOKERTO	0.968	1.828	1.947	2.023	5.888	11.958	20.492	29.820
MADIUN	1.452	4.060	4.473	3.611	8.450	13.542	18.270	21.208
JEMBER	1.499	2.304	2.588	2.709	5.749	10.036	15.712	21.765
BANYUWANGI	0.605	0.721	0.745	0.806	1.844	3.377	5.397	7.499
SITUBONDO	0.375	0.393	0.421	0.491	0.924	1.474	2.134	2.763
PAMEKASAN	0.623	0.622	0.806	0.970	2.205	3.998	6.468	9.220
EAST JAVA	20.775	54.832	58.122	68.517	147.275	245.369	361.602	471.064

REGIONAL DEMAND FORECAST 1980/ 3 - 2004/ 3 SEP. 5,1984

ITEM	UNIT	1980/ 3	1981/ 3	1982/ 3	1983/ 3	1989/ 3	1994/ 3	1999/ 3	2004/ 3
EAST JAVA									
POPULATION	TPSN	25799.0	26175.8	27010.9	27455.0	31509.2	35414.7	39882.3	45005.1
NOS OF HOUSEHOLD	TFML	5739.4	5817.6	6001.1	6101.0	7002.0	7869.9	8862.7	10001.1
NOS OF PERSON PER HH	PSNS	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
RESIDENTIAL									
ENERGY SALES	GWH	410.7	482.0	582.1	670.7	1490.9	2531.8	3778.3	4960.2
NOS OF CONSUMER	TPCS	370.6	449.9	524.3	624.0	1408.9	2411.7	3614.2	4752.1
G.R. OF CONSUMER	%	**********	21.399	16.558	18.999	14.539	11.349	8.427	5.627
E.S. PER CONSUMER	MWH	1.108	1.071	1.110	1.075	1.058	1.050	1.045	1.044
CONNECTED CAPACITY	MVA	176.4	222.5	268.9	327.7	723.8	1222.2	1814.7	2373.0
C.C. PER CONSUMER	KVA	0.476	0.495	0.513	0.525	0.514	0.507	0.502	0.499
COMMERCIAL									
ENERGY SALES	GWH	76.4	103.2	115.4	105.1	225.8	377.4	558.5	730.1
NOS OF CONSUMER	TPCS	23.3	26.1	28.0	30.5	68.8	118.4	178.9	237.0
G.R. OF CONSUMER	%	**********	12.036	7.114	9.008	14.495	11.480	8.602	5.790
E.S. PER CONSUMER	MWH	3.275	3.947	4.122	3.442	3.283	3.187	3.122	3.080
CONNECTED CAPACITY	MVA	49.4	71.9	79.2	80.0	170.6	283.7	418.0	544.8
C.C. PER CONSUMER	KVA	2.116	2.751	2.827	2.620	2.480	2.395	2.336	2.298
PUBLIC									
ENERGY SALES	GWH	59.8	110.2	124.3	144.0	312.2	521.6	768.7	999.7
NOS OF CONSUMER	TPCS	3.8	4.7	5.1	5.6	13.1	23.0	35.1	46.9
G.R. OF CONSUMER	%	**********	22.808	9.361	9.615	15.173	11.909	8.873	5.955
E.S. PER CONSUMER	MWH	15.703	23.550	24.285	25.675	23.847	22.700	21.869	21.299
CONNECTED CAPACITY	MVA	20.8	54.8	58.1	68.5	147.3	245.4	361.6	471.1
C.C. PER CONSUMER	KVA	5.453	11.719	11.359	12.216	11.250	10.678	10.288	10.036
EXC.INDUSTRY									
ENERGY SALES	GWH	547.0	695.4	821.9	919.8	2028.9	3430.8	5105.5	6690.1
NOS OF CONSUMER	TPCS	397.7	480.7	557.5	660.1	1490.8	2553.1	3828.2	5036.0
G.R. OF CONSUMER	%	**********	20.863	15.975	18.411	14.543	11.360	8.439	5.638
E.S. PER CONSUMER	MWH	1.375	1.447	1.474	1.393	1.361	1.344	1.334	1.328
CONNECTED CAPACITY	MVA	246.6	349.3	406.2	476.2	1041.7	1751.2	2594.2	3388.8
C.C. PER CONSUMER	KVA	0.620	0.727	0.729	0.721	0.699	0.686	0.678	0.673
INDUSTRY									
ENERGY SALES	GWH	474.1	481.0	658.6	877.9	2622.1	5235.2	9849.5	17938.9
TOTAL									
ENERGY SALES	GWH	1021.1	1176.4	1480.4	1797.7	4651.0	8666.0	14955.0	24629.0
G.R. OF ENERGY SALES	%	**********	15.2	25.8	21.4	17.2	13.3	11.5	10.5
ELECTRIFICATION RAT.	%	6.456	7.733	8.737	10.227	20.121	30.644	40.779	47.515
CONSUMER RATIO C/R	%	6.298	5.812	5.341	4.893	4.882	4.910	4.950	4.988
CONSUMER RATIO P/R	%	1.028	1.040	0.976	0.899	0.929	0.953	0.973	0.988

APPENDIX - B

REPORT ON FIELD INVESTIGATION

APPENDIX - B

The site surveys of main transmission lines and substations to be included in the Short-term Implementation Program were carried out in Surabaya City, Madura Island, Paiton and etc.

The following is the details of field investigation:

1. Surabaya City and Its Surrounding Area

1.1. Krian Substation

The construction works are now being executed toward the completion time in 1985 as the substation for 500 kV transmission line.

At present, the construction of access road to the site from the Surabaya - Krian truck road and preparatory work of substation site are in progress.

The substation site is located on the gently-sloping hill and the excavation and compaction works up to design level have been carried out there. The transmission lines for Babatan New Substation in Surabaya City and for Gresik Power station will lead from 150 kV side of this substation.

1.2. Krian - Trosobo - Babatan Transmission Line (11.6 km)

As a village located at just South side of Krian S/S, the transmission line is coursed around.

The route is almost rice field and crosses 150 kV and 70 kV T/L and furthermore crosses Surabaya River, and reaches Trosobo S/S, although the span length is 400 m in crossing the Surabaya River, particular tall tower is to be erected.

Trosobo - Babatan transmission line route is also disturbed by a village and takes a roundabout course. The route also traverses rice field, sugarcane field and railway crossing. The length of Krian - Babatan line will be 11.6 km instead of 9 km previously planned because of the course avoiding the village.

1.3. Trosobo Substation (Future Plan)

It is assumed to construct the substation at the sugarcane plantation area where the canal is passing through at an east side and located at the north side of principal road (Waru - Krian) in future. As the ground level is low in these area, levelling works of the ground way take a lot of time. It is really rare to have an environmental problem for big villages do not exist nearby.

1.4. Babatan Substation

The substation site will be determined at the location between the irrigation canals and along the road branched southward from the principal road (Waru - Krian).

The ground and the surrounding conditions are quite good comparing with Trosobo S/S site although there is now sugarcane plantation.

1.5. Waru - Sawahan Line (Rehabilitation - 10.6 km)

This is the rehabilitation works for 70 kV transmission line using presently 50 mm^2 H.D.C.C. (current capacity 260A) to ACSR 300 MCM (current capacity 440A) for the countermeasures to load increase.

The tower type is the same as the one for Waru - Bangil line, and regarding to Waru - Bangil line, the same rehabilitation

plan has been made under Surabaya City Power Distribution Project. The strength of tower structure has already been studied.

However, as the construction of the towers is really in old time and the condition of their foundations is not clear, the strength test for tower materials, bolts and etc. will be necessary, and also the checking of the size of foundations and condition of concrete by means of test excavation will be needed.

In peak load hours of Sawahan S/S, the load on each of double circuit reaches 180A. Assuming the case that one of double circuit line is failure, it should be reinforced.

This line has to cross over a railway and pass beneath three 150 kV lines, however, these would not pose so serious problem in the execution of the work.

1.6. Sukolilo - Kenjeran Line (4.5 km)

Kenjeran S/S to be constructed in the Surabaya City Power Distribution Project is connected by single circuit line. The conversion to double circuit line will increase the reliability.

Substation will be constructed inside a rice field area at 450 m distance from road.

For this additional stringing work, the same towers of Sukolilo - Ujung Line are used in a section from the Sukolilo outgoing to No.14 tower.

In stringing on upper part of the towers, a careful working plan has to be set up.

1.7. Rungkut S/S

At present Waru - Sukolilo Line is a single circuit line, but this is scheduled to become double circuit line in the Surabaya City Power Distribution Project.

In the intermediate point of the line Rungkut S/S is established newly and double circuit line is taken in by π branch.

The substation is planed to be constructed at the plain grass-land, but the geological condition is quite bad due to the swamp located nearby the site and the access to the transportation of equipments will not be favoured.

2. Madura Island

Madura is a long and narrow island extending over 163 km from east to west and 38 km from south to north, and with an area of 5,593 km^2.

It has a population of about 2.7 million.

There is one PLN branch office in Pamekasan and the branch office operates generating facilities and distribution facilities divided into four zones.

As of today, the electrification ratio is still only 3%, and there are no large enterprises nor factories. Other major power demand are the load from pumps for irrigation and town water supply, drying up facilities for tobacco and salt factries.

In recent years, the submarine cable project for interconnection between the Madura island and Java island has become formed up and, the positive introduction of a cement factory is to be set up in Madura.

Besides, 150 kV transmission line project that will cross over the island from west to east has be formulated to supply the power to sustain its regional development and up-bringing of electrification. During the site survey, the team encountered the ongoing distribution expansion work and felt the projects are in progress.

2.1. Gili Timur S/S

The submarine cable from Gresik P/S is now being prepared for construction.

The project is to connect submarine cable to Gili Timur S/S which supplies the loads of both Labang (clincher plant) and Sekar Bungu (grinder plant) cement plants.

Gili Timur S/S is the origin of 150 kV transmission line running through the Madura island. The site is located at the crop field about 800 m distant from the main road (Kamal - Bangkalan).

The ground level is higher than the access road and it is considered that the drainage condition is good. The ground is covered with an organic surface soil including red clay.

2.2. Bangkalan P/S

There are 4 diesel power stations in the Madura island Among others, Bangkalan Power Station has been surveyed at this time.

One of five generators in the station is manufactured by AEG, West Germany in 1959 and the other four units added after 1973 are made in Holland.

The capacities of the generators varies such as 400 KVA, 420 KVA x 2 units, 670 KVA and 1,000 KVA. Distribution panel includes operation panel by each generator and also parallel operation panel, and the parallel operation of generators is being made. It is connected to the distribution facilities outside by 6 KV cable.

The operation office of power station is located at the same compound as of PLN Branch Office in Madura.

2.3. Gili Timur - Bangkalan Line (15.5 km)

This line reaches to Bangkalan S/S running along the principal road (Kamal - Bangkalan) in north direction right after Gili Timur S/S.

The route is fairly taking a longer course because the industry sites and the quarry sites have been avoided.

2.4. Bangkalan S/S

This substation is planned to be established at the site facing with the principal road (Bangkalan - Sampang). The ground surface is covered by the grasses and there is no problem for site preparation and transportation of equipment and materials.

However the site is about 4 km distant from the center of Bangkalan town.

2.5. Bangkalan - Sampang Line (57.9 km)

Except the route section of the transmission line nearly Bangkalan S/S to keep away from the villages, transmission line is almost running along the principal road.

Therefore there is no problem for construction and maintenance.

Although the route is plain field, grassland and rice field, only 9 km of the middle portion runs through the hill of mountain base.

After passing this parts, the route passes nearby swamp place in a section of about 3 km and again passes the base of mountain, and reaches to Sampang S/S.

The demand in future is expected in nearby Sampang as there are some fish ponds and salt fields.

2.6. Sampang S/S

As sampang S/S site is facing on the principal road from south to north starting from Sampang and is plain fields, there are no difficulties in construction. And it is suitable for distribution of load as it is located near by downtown of Sampang.

2.7. Sampang - Pamekasan Line (25.3 km)

The route is planned along the Sampang - Pamekasan bypass road located at further inside of the south coast road.

The terrain of the route is generally flat, farm land, grassland, and rice fields with sparse inhabitants. No difficulty is expected in construction and maintenance as well.

The route is almost running along the road but most of the route is taken straight.

2.8. Pamekasan Substation

The site is located at the side of the bypass road for Sampang and about 4 km away from Sampang town center. At present, the place is a grassland with no resident nearby, but due to the distant location from the load center, distribution plan should need careful considerations.

2.9. Pamekasan - PLN Cabang

Inside Pamekasan, which is the center of the island, PLN has a branch office and this office administer four zones. The survey team inspected one city water supply pumping station adjacent to PLN office. The station is to pump up water from deep well to store it in the about 20 m high tank. Their contracted kVA is 200 kVA and uses four (4) units of pump for supplying water to approx. 2,000 residents at 114 l/sec.
This would be probably one of the largest load.

2.10. Others

Due to the limited times, the route in the section Pamekasan - Sumenep (51.2 km) and the site for Sumenep Substation have to remain unsurveyed. It is foreseen from the data check that any particular problem will hardly occur.

As a general view, the construction of transmission facilities on the island of Madura would not present difficulties in selection of the site and the work execution as well, because the island is rather flat terrain throughout with generally solid ground conditions and favoured by fairly developed road network. However, since this is the first introduction of large transmission facilities into the island, geologic investigations are to be conducted and the results should be reflected on the determination of foundation design parameters.

As to the transmission line, the route has selected mainly along the existing roads due to putting a major consideration on the maintenance, however, more studies also be given in a direction to select economical line routes.

* P.S. : Afterward, a re-examination took place at PLN on Pamekasan - Sumenep route, and a short-cut route came to be adopted, which results as follows;

	Route Length
Old route	51.2 KM
New route	45.6 KM

The Route Length has become shorter by 5.6 KM.

3. Paiton

3.1. Paiton Power Station

The paiton Coal Fired Steam Power Plant Project # 1 and # 2 is scheduled for completion in 1989. For construction power supply, a transmission line of 150 kV double circuit is expected to be erected in 1986 between Probolinggo and the Site.
The switch yard site of Paiton Project is located on a hill land facing to the power station site.
The ground level is EL. 84 m.
The 150 kV outgoing facilities are planned to be constructed in the east side of 500 kV switching equipment.

3.2. Paiton - Kraksaan Line (19.7 km)

The outgoing line will traverse on the west hilly land until it reaches a plain.
The route up to Kraksaan takes a round about courses in the middle of plain in order to avoid villages along the trunk road.
The route passes through a flat land consisted of rice fields, sugar cane plantation, corn farm land, except the hilly portion at the outgoing.
No serious problems are foreseen in the construction, but the hauling of construction materials and time duration of the work should be planned out minutely since the route is apart from the main road.

3.3. Kraksaan Substation

The proposed site is located at one street behind southward of the main traffic road.
Final location of whether to be south side or north side of the street has not yet been decided.
The north area is a grassland and the other is a ricefield, both of which do not pose any problem in construction.

3.4. Kraksaan - Probolinggo (31.5 km)

Like the above mentioned transmission line, the presently proposed route is taken to avoid the villages along the trunk road. Especially, the incoming portion to Probolinggo is southward aligned apart from a dense residencial area. All the way through the route would not involve any serious construction problem. Only the place which needs a careful consideration and construction program is the crossing section of two 150 kV lines nearby Probolinggo outgoing bay.

3.5. Probolinggo Substation

At present, this substation receives the power supply from Bangil Substation through 70 kV line and transmit toward Jember area after the step-up to 150 kV. In the Acceleration Project, a new 150 kV line from Bangil is connected to this substation for Surabaya - Bali 150 kV interconnection.

As mentioned before, a 150 kV transmission line for con - struction power supply to the Paiton Project will take off from Probolinggo Substation.

With the completion of this line, this substation will have a complete 150 kV facilities and the yard could be neatly rearranged owing to removal of 30 kV bay equipment for Leces and step-up transformer.

4. Bojonegoro

Due to the heavy rainfall during the rainy season, the team has met flooding over the roads at many places. Therefore, the survey of substation sites and transmission line route could not be done. As far as the relevant data reveal, it seems that both substation (Ngawl and Tuban) sites and transmission route would not pose difficulties in construction as well as selection. However, the area for Tuban substation may be suffered by rainwater during the rainy season. Then, ground conditions of the sites should be investigated sufficient enough to ensure the safety of equipment.

Route Length

Feb. 28, JICA

	Planning length	Real length
Sukolilo - Kenjeran	6 Km	4.5 Km
Krian - Babatan	9 Km	11.6 Km
Waru - Sawahan	11 Km	10.6 Km
Probolinggo - Kraksaan	30 Km	31.5 Km
Ngawi incomer	10 Km	2 cct x 5 km
Kraksaan - Paiton	30 Km	19.7 Km
Babat - Tuban	40 Km	30.9 Km
Gili Timur - Bangkalan	160 Km	15.5
Bangkalan - Sampang		57.9
Sampang - Pamekasan		25.3
Pamekasan - Sumenep		51.2
		149.9 Km

APPENDIX - C

SUBREPORT ON LAMP FLICKER

Appendix-C Subreport on Lamp Flicker

C.1. A historical change on the problem of lamp flicker by arc furnace in Japan.

The problem of lamp flicker by arc furnace has been treated since around 1955 in Japan.

It was not until 1964 that the following concepts on flicker were established:

- Sensitivity coefficients
- V_{10}
- Perception ratio, etc.

Each power corporation, however, did not come to an agreement on the actual application of them. Besides, few arc furnace users were interested in lamp flicker, and electric machine makers were not so aggressive to produce flicker reducing devices on a commercial basis.

After that, study of estimating method on flicker had been developed respectively to establish Guide-lines by each power corporation. But it was impossible to find effective countermeasures. There was nothing but one case of power supply by installing an exclusive transformer.

With the popularization of color television (no voltage stabilizer was included in early color TV), considerable complaints about flicker were occasioned one after another in around 1967. To cope with this problem, each power corporation raised the level of their own Guide-lines respectively, and explained effectiveness of some concrete countermeasures on flicker at the research meeting composed

of power corporation, arc furnace users and electric machine makers. As the result of patient negotiation with arc furnace users, saturable shunt reactor or synchronous condenser had come to be adopted for the countermeasures by each arc furnace user during 1971 to 1972.

However, considerable complaints on flicker occasioned subsequently by the following reasons:

. Capacity increasing and productivity progress of arc furnace
. A change of power supply system
. Fault of estimating procedure, etc.

Consequently, the level of Guide-lines was raised again in 1972.

As thyristor Q (reactive power) compensator (Example: TQC) was realized for practical application in 1973, some countermeasures on flicker were taken whenever the capacity of arc furnace was increased by the users.

As the result of development of ΔV_{10} calculation method using digital computer in 1976, the following studies were advanced:

. Comparative research between digital ΔV_{10} calculation method and analogue ΔV_{10} measurement method adopted by each power corporation

. Analysis method using statistical mathematics

In 1979, with the progress of the studies above, the relation between ΔVmax and ΔV_{10} max concerning flicker was clarified, and each power corporation reached a consensus to adopt the predict method by ΔV_{10} max.

Since it requires a large investment for countermeasures on flicker, the economic burden of arc furnace user is considered to be much.

However, the supply voltage to general consumer, one factor of the quality of electricity, is disturbed by flicker.

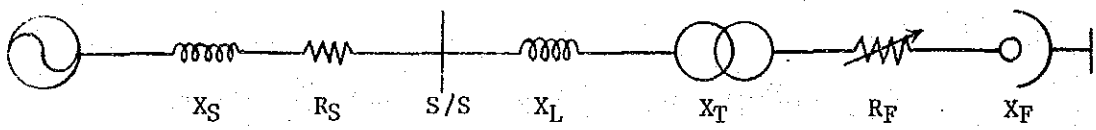
In Japan, it is regulated to maintain the quality of electricity by the Rules and Rates for Electric Service. The experience in Japan having solved the problem tells that it is very important for power corporation to cope with arc furnace users fairly and impartially by arranging and standardizing the following theoretical systems about flicker:

. Calculation method
. Measurement method
. Allowable level
. Effectiveness evaluation of reducing device

C.2. Mutual relation between voltage fluctuation and V_{10}

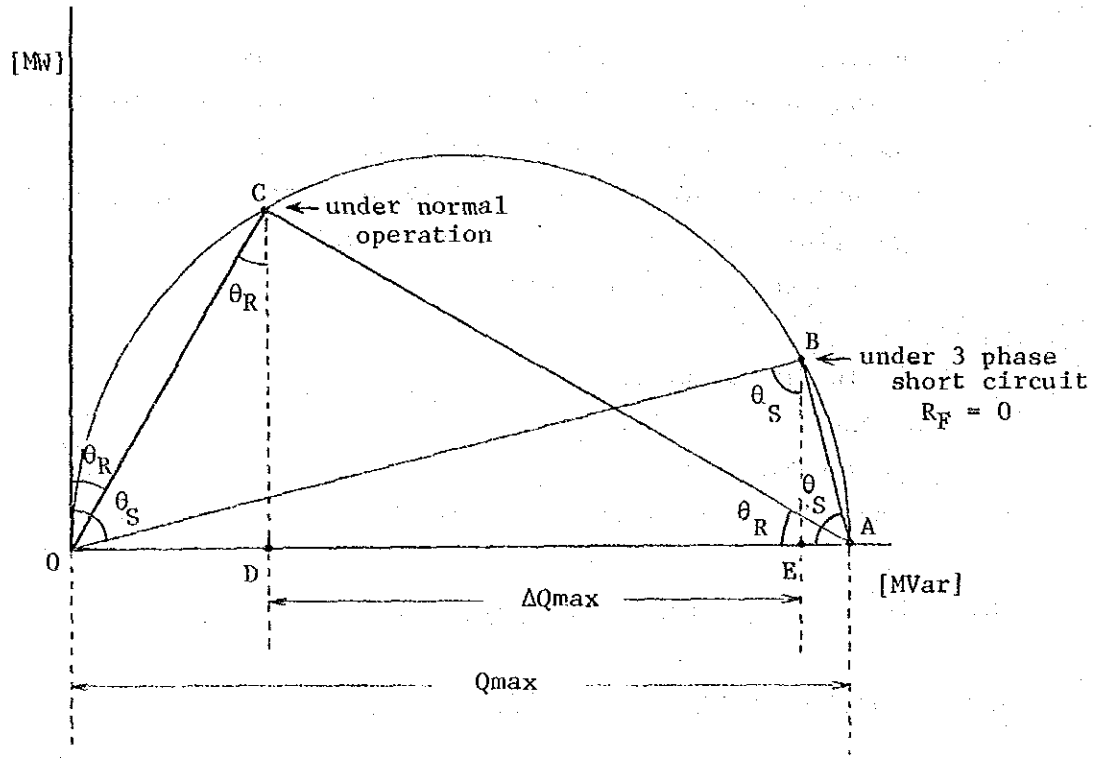
C.2.1. Calculation of Voltage Fluctuation

C.2.1.1. Schematic diagram of model power system



$$X_0 \equiv X_S + X_L + X_T + X_F \quad (\%) \ \ldots \ 10 \text{ MVA Base}$$

C.2.1.2. Electric power circle diagram and reactive power fluctuation in arc furnace



$\sin \theta_S \fallingdotseq 1$

$\cos \theta_R \fallingdotseq 0.85$

$$Q_{max} = \overline{OA} = \frac{100}{X_S + X_L + X_T + X_F} \times 10 = \frac{100}{X_0} \quad (MVar)$$

$\overline{OE} = \overline{OB} \sin \theta_S$, $\overline{OB} = \overline{OA} \sin \theta_S$

$\therefore \overline{OE} = \overline{OA} \sin^2 \theta_S$

$\overline{OD} = \overline{OC} \sin \theta_R$, $\overline{OC} = \overline{OA} \sin \theta_R$

$\therefore \overline{OD} = \overline{OA} \sin^2 \theta_R$

$$\Delta Q_{max} = \overline{OE} - \overline{OD} = \overline{OA} \sin^2 \theta - \overline{OA} \sin^2 \theta_R$$

$$= Q_{max} (\sin^2 \theta_S - \sin^2 \theta_R)$$

$$= Q_{max} (\sin^2 \theta_S - 1 + \cos^2 \theta_R)$$

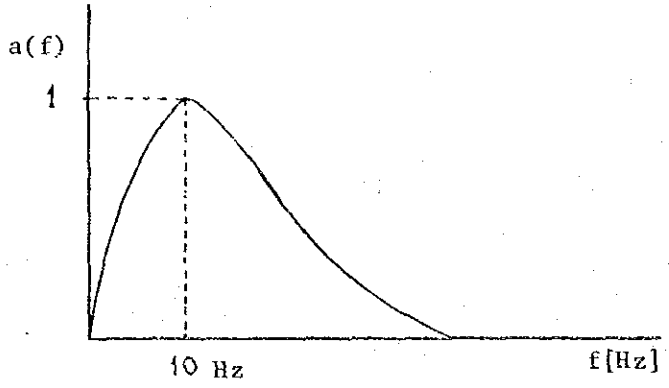
$$\fallingdotseq Q_{max} \cos^2 \theta_R \qquad \text{(MVar)}$$

C.2.1.3. Voltage fluctuation (at S/S Bus)

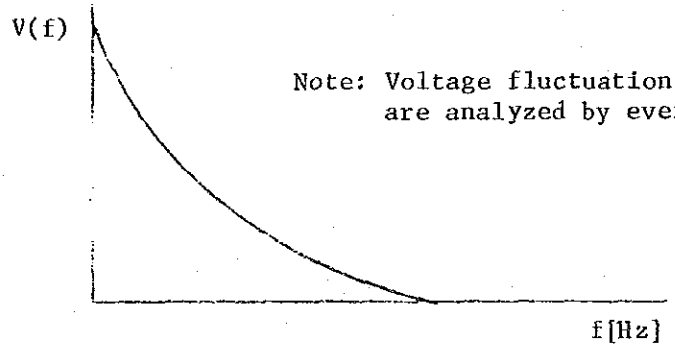
$$\Delta V_{max} \fallingdotseq Q_{max} \times \frac{X_S}{10} \quad \ldots\ldots \text{100V Base} \qquad \text{(V)}$$

C.2.2. A concept of ΔV_{10}

C.2.2.1. Sensitivity coefficients ..... a(f)

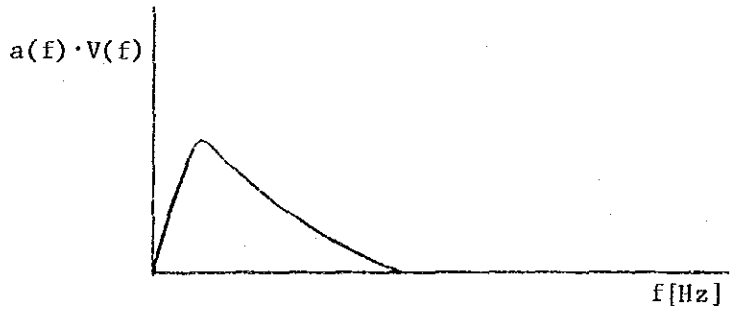


C.2.2.2. Spectra of flicker in arc furnace ... V(f)



Note: Voltage fluctuation data of 100V Base are analyzed by every 1 minute.

C.2.2.3. a(f) x V(f)



C.2.2.4. A definition of ΔV_{10}

$$V_{10} = \sqrt{\sum_{f}^{\infty} [a(f) \cdot V(f)]^2}$$

Note: One ΔV_{10} can be obtained by every 1 minute.

C.2.2.5. A definition of $\Delta V_{10\ max}$

After measuring for several hours, choose the one hour for which ΔV_{10} is largest.

Determine mean (m) and standard deviation (σ) calculating 60 pieces of ΔV_{10}, and definite $\Delta V_{10\ max}$ by the following formula:

$$\Delta V_{10\ max} = m + 1.65\sigma \quad \ldots \text{ 100V Base} \qquad (V)$$

Note: The probability that values larger than $\Delta V_{10\ max}$ appeare is 5% when ΔV_{10} are shown in the normal distribution.

Namely, 60 pieces x 0.05 = 3 pieces
then, $\Delta V_{10\ max}$ is the fourth value from the biggest in 60 pieces of ΔV_{10}.

C.2.3. Mutual Relation

The following formula is used empirically.

$$\Delta V_{10\ max} = \frac{1}{3.6}\Delta V_{max}$$

$$= \frac{1}{3.6}\Delta Q_{max} \times \frac{X_S}{10}$$

$$= \frac{1}{3.6}\ Q_{max} \cos^2 \theta_R \times \frac{X_S}{10}$$

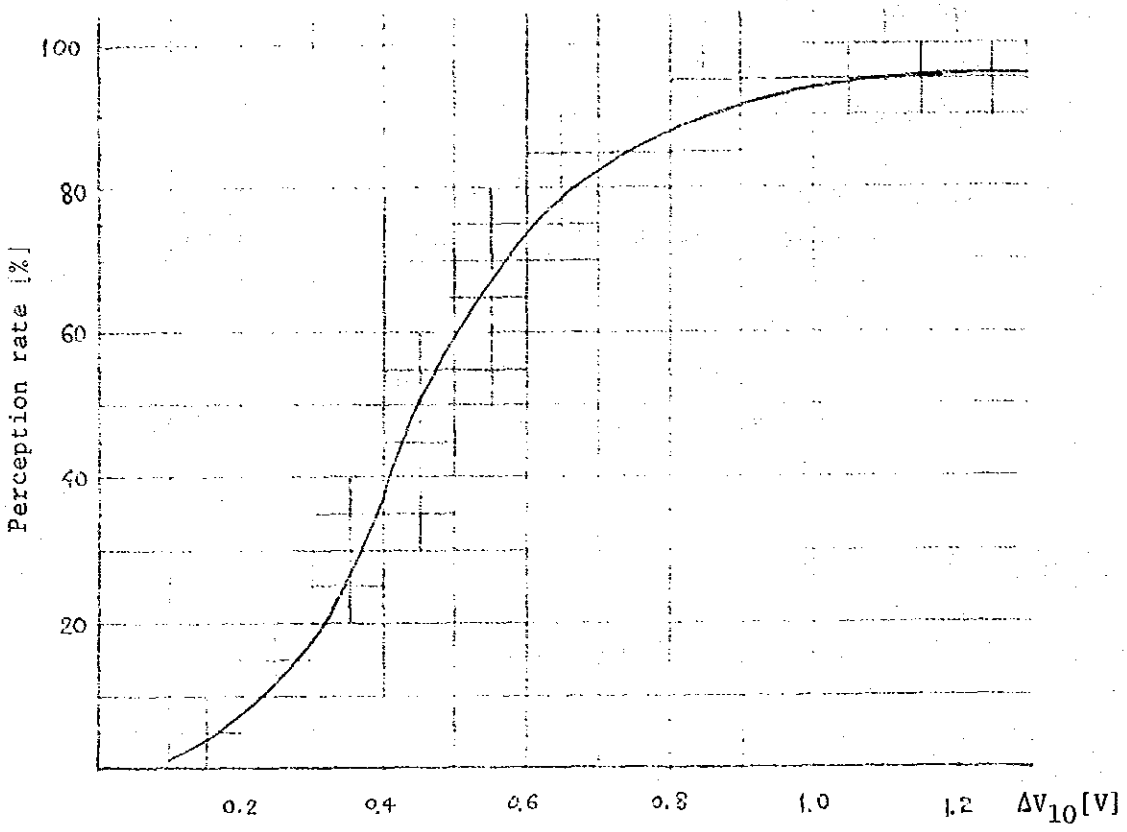
$$= \frac{1}{3.6} \cdot \frac{100 \times (0.85)^2}{X_S + X_L + X_T + X_F} \times X_S$$

$$= 20.07\ \frac{X_S}{X_0} \quad \ldots\ \text{100V Base} \qquad (V)$$

C.3. Allowable Level and Countermeasures on Flicker by $\Delta V_{10\ max}$

C.3.1. Allowable Level

C.3.1.1. The relation between ΔV_{10} and perception ratio



$$\text{Perception ratio} = \frac{B + C + D}{A + B + C + D} \times 100 \quad (\%)$$

A : number of subjects who don't feel flicker at all

B : number of subjects who don't feel flicker so much

C : number of subjects who feel flicker

D : number of subjects who feel flicker nervously

C.3.1.2. Maximum Allowable level

Determine perception ratio 50%: $\Delta V_{10\ max}$ = 0.45V for maximum allowable (control) limit.

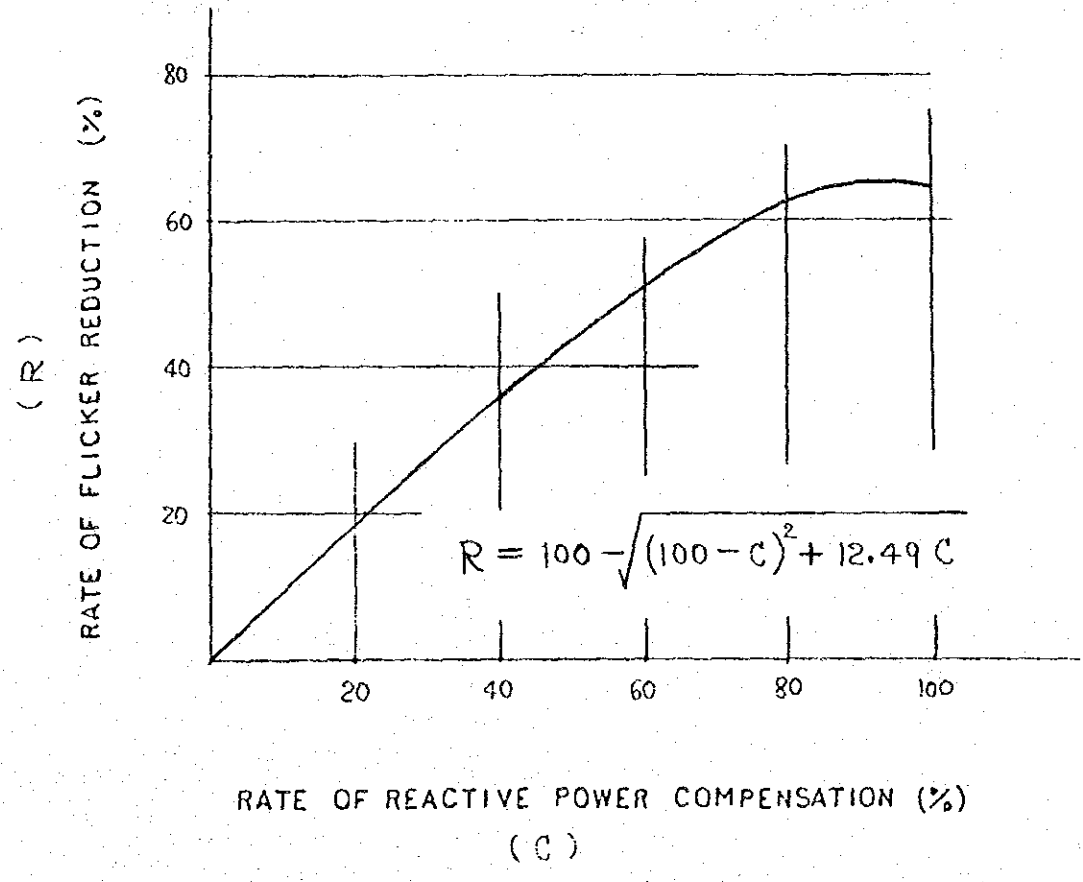
C.3.2. Countermeasures on Flicker

C.3.2.1. The relation between rate of flicker reduction (R) and rate of reactive power compensation (C) of TQC

$$R = \frac{\Delta V_{10\ max}\ \text{without TQC} - \Delta V_{10\ max}\ \text{with TQC}}{\Delta V_{10\ max}\ \text{without TQC}} \times 100\ (\%)$$

$$C = \frac{\text{TQC capacity}}{Q_{max}} \times 100 \qquad (\%)$$

Improvement characteristic of TQC is as follows:



FLICKER REDUCTION CHARACTERISTICS

C.3.2.2. Required capacity of TQC

Arc furnace users set up TQC or something like that to make $\Delta V_{10\ max}$ not exceeding 0.45V when $\Delta V_{10\ max}$ is more than 0.45 V.

(Example)

In case that present ΔV_{10max} = 1.0 V is expected to be reduced to maximum allowable (control) limit ($\Delta V_{10\ max}$ = 0.45V):

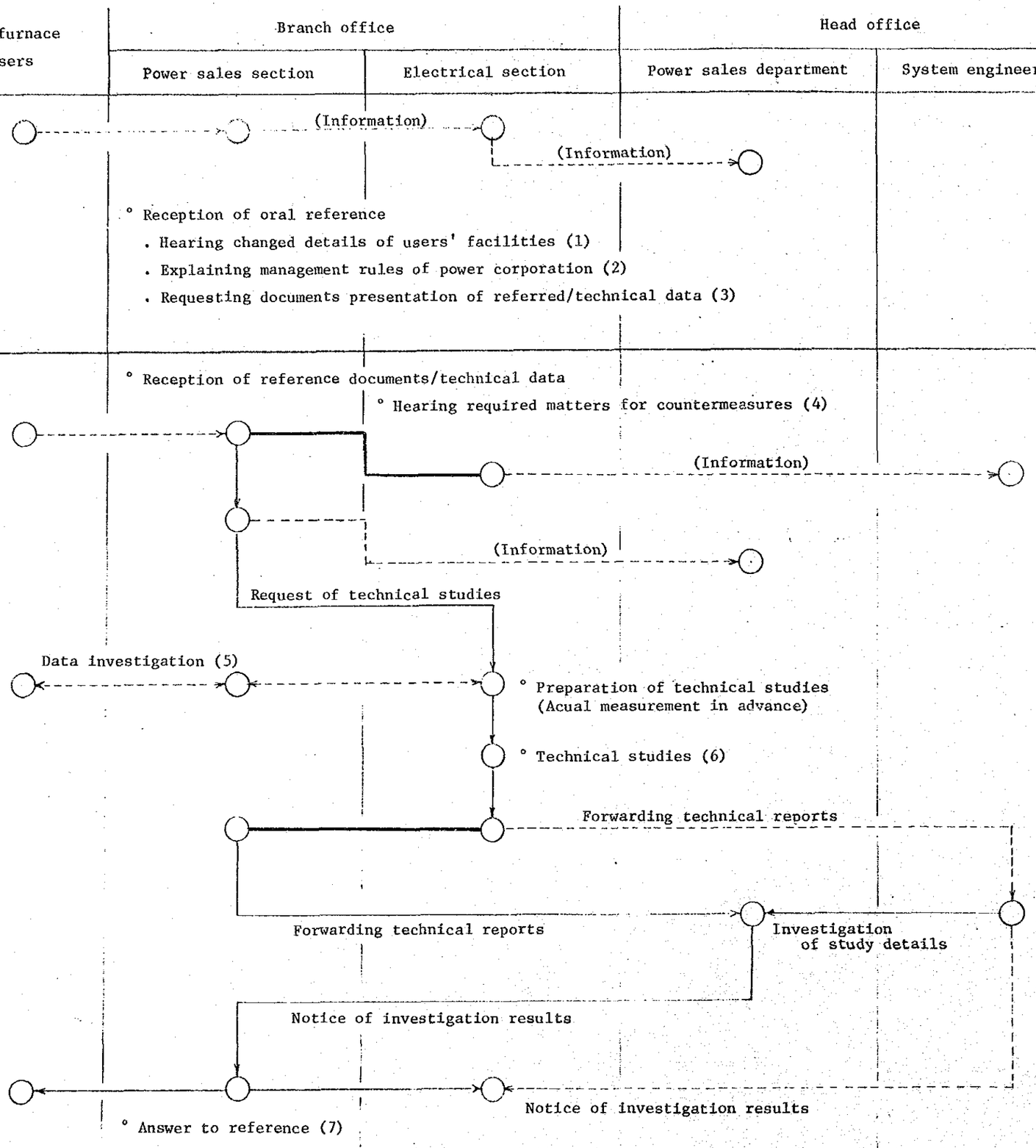
$$R = \frac{1.0 - 0.45}{1.0} \times 100 = 55 \quad (\%)$$

$$C \doteqdot 65.3 \quad (\%)$$

Required capacity of TQC = $0.653\ Q_{max}$

$$= 0.653\ \frac{100}{X_0} = 65.3 \cdot X_0^{-1} \quad (MVar)$$

C.4 Operative flow of power supply to arc furnace users (Example)



Remarks

(1) Scheduled date of completion, contracted power and details of arc furnace facilities etc.

(2) Explaining considerable expense and a number of days is also required for countermeasures on flicker

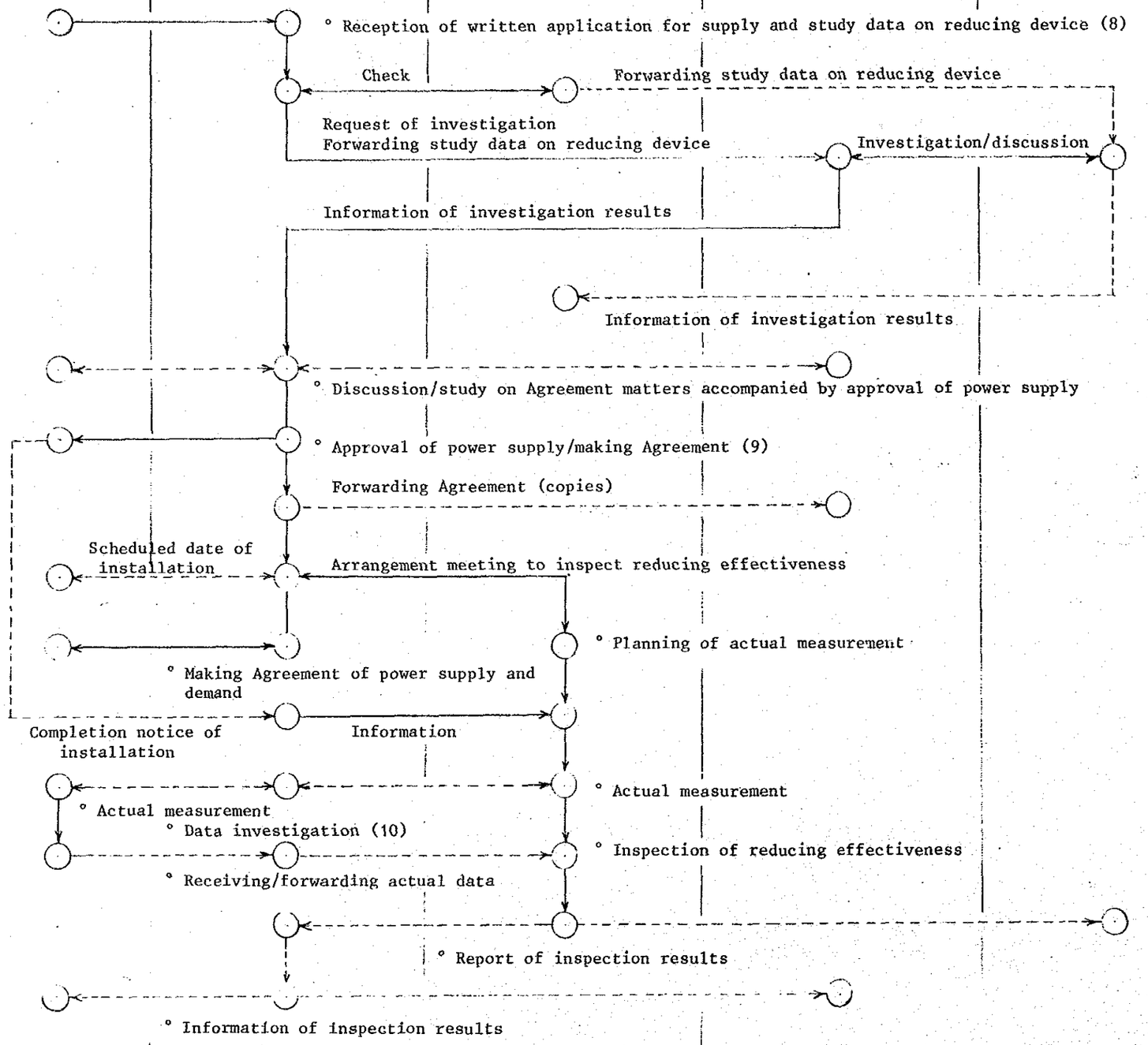
(3) Main circuit skeleton diagram, arc furnace impedance

(4) Kind and maker of reducing device

(5) Investigating the present condition of all arc furnace users within the same power system
- . Operating condition of arc furnace
- . Main circuit skeleton diagram
- . Arc furnace impedance

(6) . Various data of ΔV_{10}: estimated value, actual measured value at present, estimated value after newly/additional installation
- . Required rate of flicker reduction
- . Rate of flicker reduction with TQC
- . Rate of reactive power compensation and required capacity of TQC etc.

(7) Conditions of power supply system (impedance map), critical bus, required rate of flicker reduction etc.



Remarks

(8) Kind of reducing device and scheduled date of installation etc.

(9) Contracted power quantity, scheduled date of supplying commencement, estimated allocation for construction costs, supplying method, arc furnace facilities, required reduction value, reducing device and partnership for complaints etc.

(10) Concerning all arc furnace users within the same power system
. Operating condition of arc furnace
. Main circuit skeleton diagram
. Arc furnace impedance

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